PORSCHE

968

Repair Manual

Supplement 5

Supplement - Contents

Important note

For Volume 1

For Volume 2

[illegible] = Replacement sheets

Please file the supplement in the usual manner in the appropriate groups of the Repair Manual and exchange existing sheets for replacement sheets.

Supplement - Contents

Important Note

For Volume 2, continued

For Volume 3

= Replacement sheets

Please file the supplement in the usual manner in the appropriate groups of the Repair Manual and exchange existing sheets for replacement sheets.

page

General

Maintenance, Self-diagnosis general

Engine, Crankcase, Engine Mounts

Engine, Crankshaft, Pistons

Engine, Cylinder Head, Valve Drive

Engine, Lubrication

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page

Engine, Cooling

Fuel Supply

Fuel System - Electronic Injection

Ignition system

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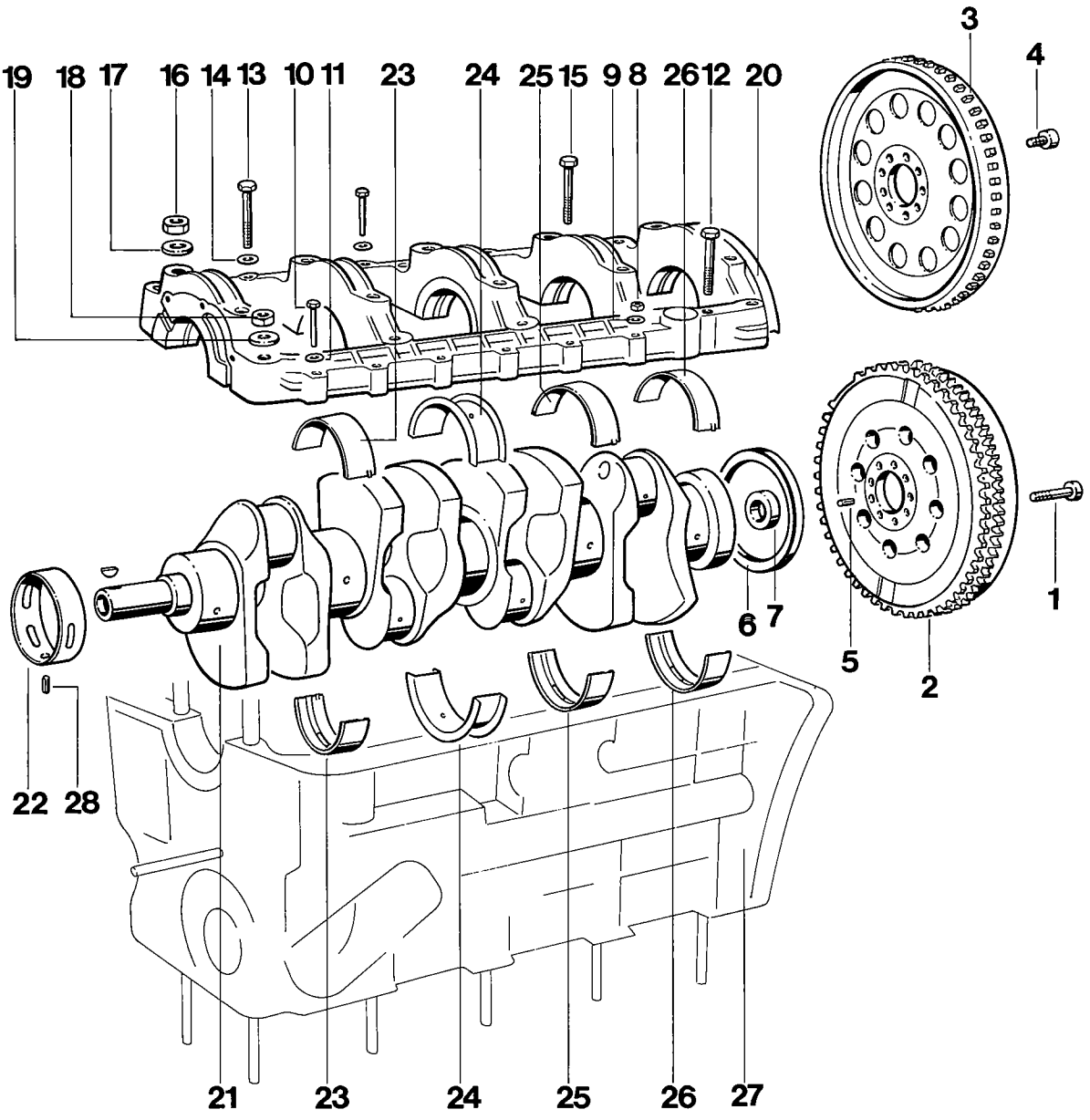
Dismantling and assembling crankcase, crankshaft



1227-13

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No.	Designation	Qty.	Note: Removal	Note: 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

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No.	Designation	Qty.	Note: Removal	Note: 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

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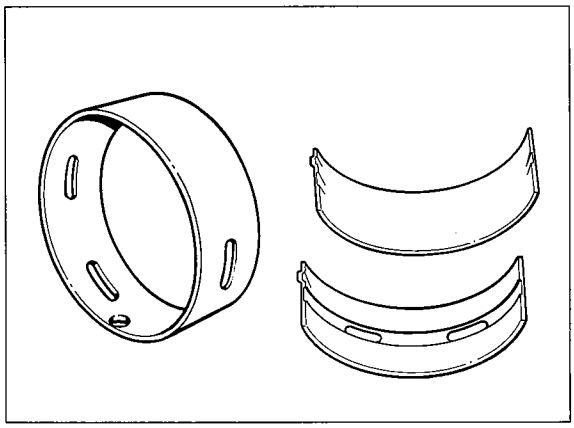
Dismantling and assembling crankcase and crankshaft

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.



1231-13

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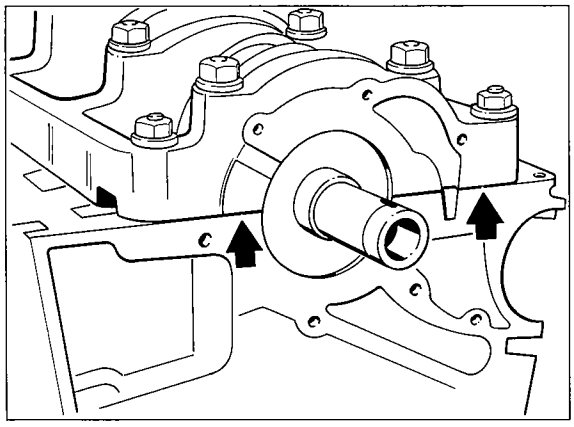
Aligning the upper and lower parts of the crankcase

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).



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

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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.

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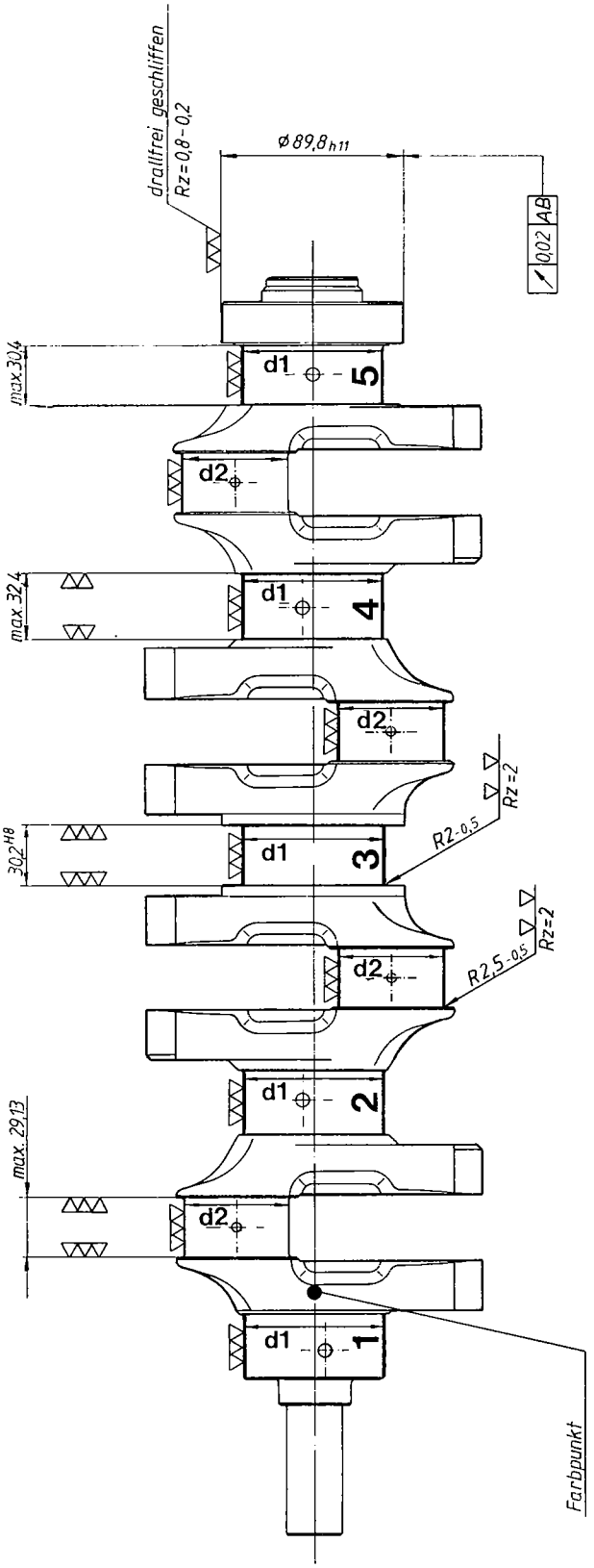

Grind bearing surface for oil seals to dimension 89.8 only if score marks are too deep. In other cases, repolish if required R_t = 0.8...2.

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

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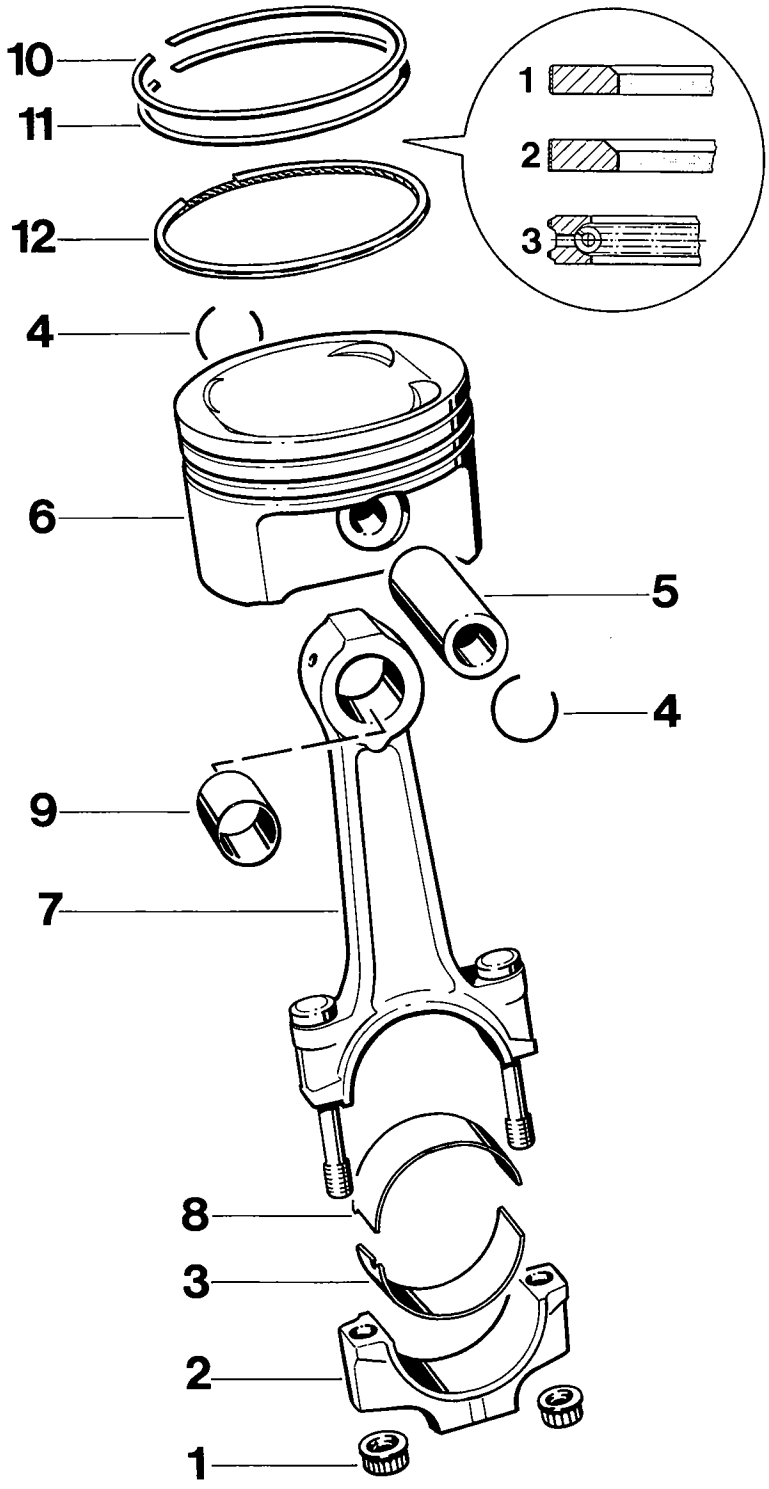
Dismantling and assembling pistons, connecting rod



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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 connecting 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

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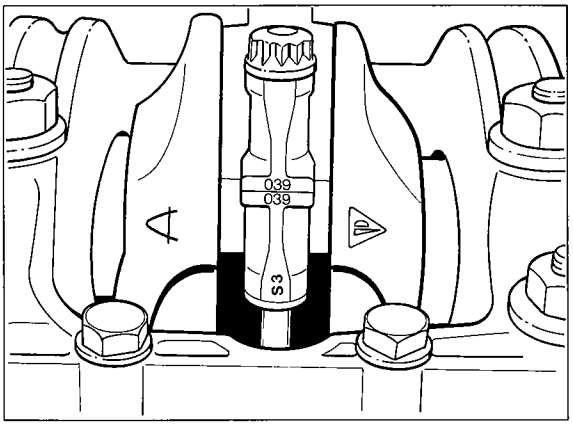
Assembly notes

Connecting rods - Installation position

The matching numbers must always face each other so that they remain legible in pairs.

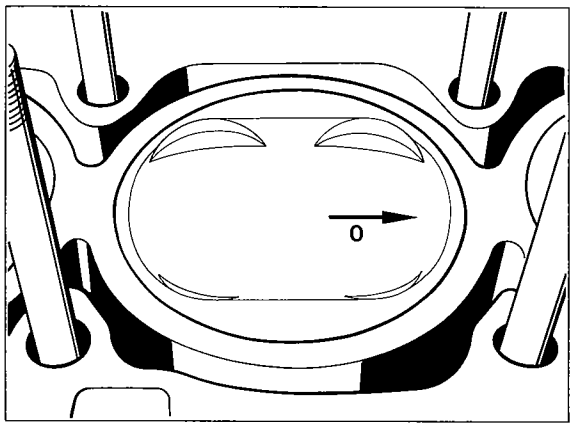
When fitting the connecting rods, the matching numbers of the four connecting rods must be on the same side throughout.



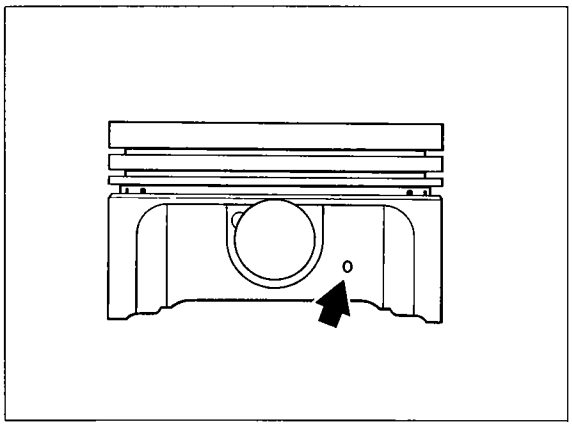
1229-13

Pistons - Installation position

Arrow (rubber stamp) points towards pulley. If arrow is not discernible anymore, refer to the tolerance group mark that also points towards the pulley.



1232-13



1230-13B

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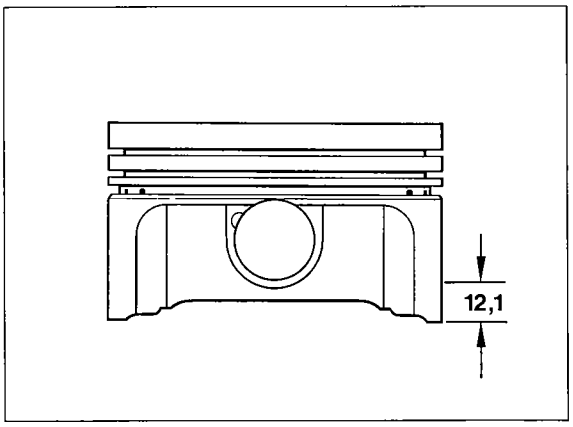
Checking piston and cylinder bore

Engine type M 44.43/44

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

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°.



1230-13A

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.

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.

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The Repair Manual 968, Vol. II, "Transmission", covers manual and Tiptronic transmissions. The description of Tiptronic transmission repairs is found after the section covering the manual transmission. A yellow page is inserted for separation. For further differentiation, the page numbers after the separation page start with 200.

page

General

Clutch, operation

Manual Transmission, Operation, Housing

Manual Transmission, Gears, Shafts

Differential / Transaxle System

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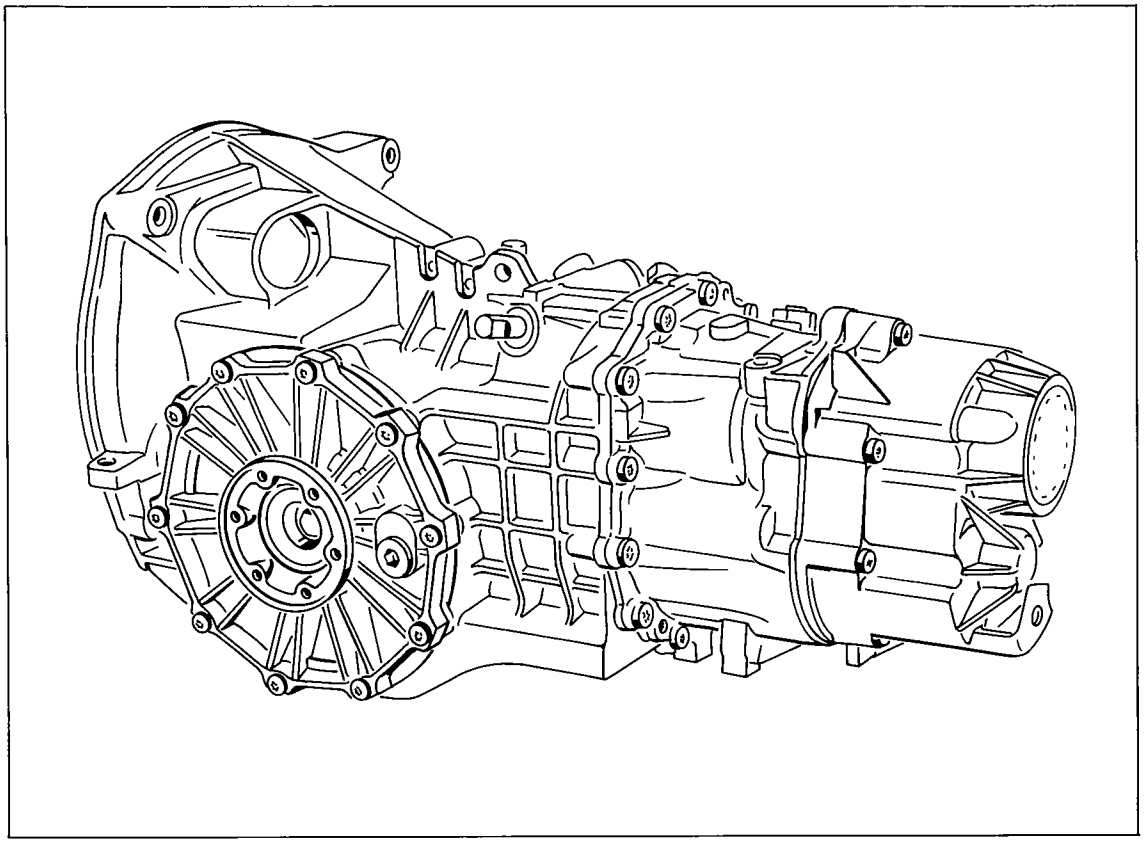
Technical data

6-speed manual transmission G 44



Model	Code letter	Equipment	Installed in:	Model year
G 44/00		6-speed	968 worldwide	'92

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Technical data

General data	Manual transmission G 44
Transmission ratios $Z_2 : Z_1 = i$	
1st gear	35 : 11 = 3.182
2nd gear	38 : 19 = 2.000
3rd gear	33 : 23 = 1.435
4th gear	30 : 27 = 1.111
5th gear	31 : 34 = 0.912
6th gear	28 : 36 = 0.778
Reverse	38 : 11 = 3,455
Final drive	Hypoid bevel-gear drive with 12 mm offset
Transmission ratio Final drive	34 : 9 = 3.778
Filling capacity	approx. 2.75 liter hypoid oil SAE 75 W 90 or API classification GL5 (or MIL-L 2105 B)

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Removing and installing transmission, Model G 44

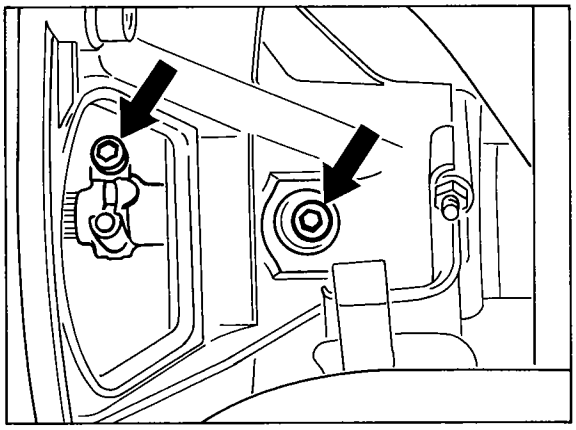
Removal

1. Undo drive shafts at transmission end and suspend horizontally on vehicle.

2. Disconnect connector for reverse light switch.

3. Push shift rod bellows to the rear and unscrew clamping screw. Disconnect shift rod from intermediate lever.

4. Unscrew pan head screws of clamping sleeve across inspection holes and push clamping sleeve towards transmission.



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Note

To fit the pan head screw into the central tube housing, use an extension with swivel joint (16° angle).
Order No. SXW 10

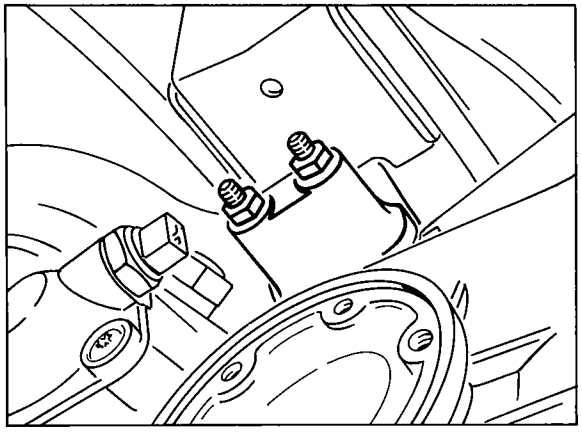
Supplier's address:
Snap-on Tools GmbH
Rudolph Diesel Strasse 6
D-7104 Obersulm-Willsbach
Phone 07134/3054

or any other Snap-on distributor worldwide.

5. Locate transmission complete with central tube in installation position, placing a suitable wooden block between the crosstube and the central tube.

6. Place a general-purpose transmission jack below the transmission and secure with a retaining strap.

7. Remove fastening bolts for transmission mounting.



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8. Remove transmission/central tube fastening bolts.

9. Pull transmission to the rear and lower carefully towards bottom.

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Installation

1. Fit transmission with general-purpose transmission jack.

2. Engage transmission and fit flange bolts. Tighten all fastening bolts to the specified torque.

3. Retain transmission in installation position and fit transmission mount.

4. Fit connectors for reverse light switch, shift rod and drive shafts.

Tightening torques:

Transmission to central tube	M 12	85 Nm (63 ftlb)
	M 10	42 Nm (31 ftlb)
Shift rod	M 8	21 Nm (15 ftlb)
Mounting bracket to transmission	M 8	23 Nm (17 ftlb)
Drive shafts	M 8	42 Nm (31 ftlb)

Order of assembly of the clamping sleeve:

Start by fitting one bolt each on left and right-hand side and tightening to 10 ±5 Nm (7 ±4 ftlb). Fit opposite bolts and tighten to 80 Nm (59 ftlb). Re-tighten the bolts fitted initially to 80 Nm (59 ftlb).

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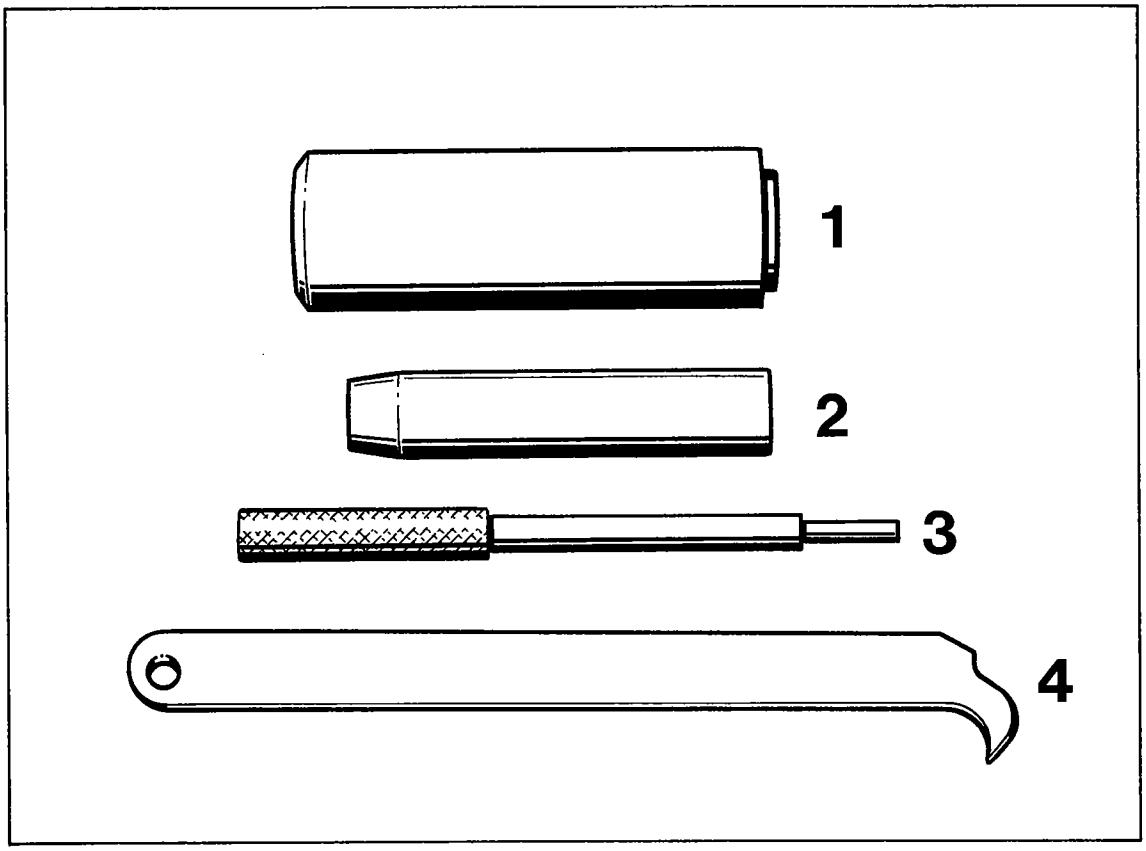
Removing and installing gear set

Tools



No.	Designation	Special tool	Order number	Explanation
1	Drift	9256	000.721.925.60	
2	Assembly sleeve	9255	000.721.925.50	
3	Drift	9532	000.721.953.20	
4	Hook	VW 681	–	VW Special Tool

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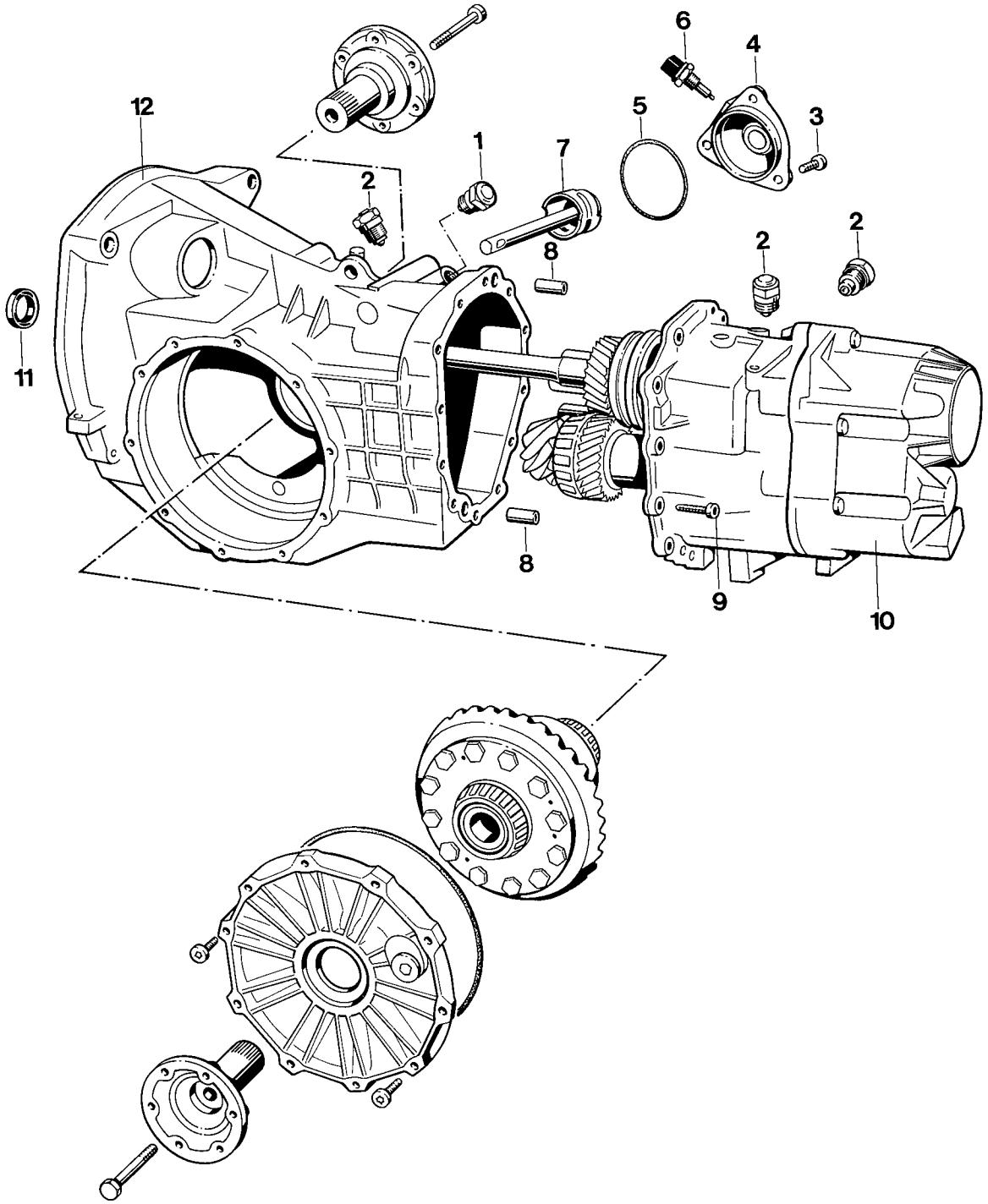
Removing and installing gear set



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No.	Designation	Qty.	Note: Removal	Note: Installation
1	Shift catch (black)	1		Do not confuse with shift catch (No. 2) Tightening torque 70 Nm (52 ftlb)
2	Shift catch (light)	3		Do not confuse with shift catch (No. 1) Tightening torque 70 Nm (52 ftlb)
3	Bolt M 8 x 22	3		Insert with Loctite 573 and tighten to 25 Nm (18 ftlb)
4	Cover	1		
5	Sealing ring	1		Replace
6	Reverse light switch	1		Tighten to 20 Nm (15 ftlb)
7	Selector shaft with shift cylinder	1		
8	Adapter sleeves	2	Use Special Tool 9532 to drive out	
9	Bolt M 8 x 36	12		Tighten to 25 Nm (18 ftlb)
10	Full gear set	1		
11	Shaft seal	1	May be replaced without dismantling the transmission (refer to page 34 - 7)	Replace, fit only after gear set has been installed as it may otherwise be damaged. Pack space between sealing lip and dust lip with multi-purpose grease
12	Transmission housing			

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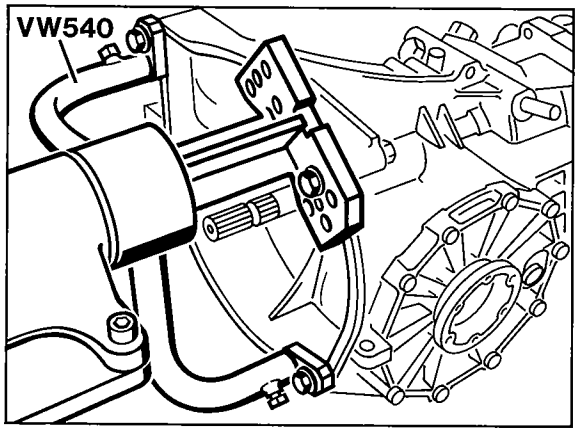
Removal and installation notes

Removal

Note

When working on the gear set, it is not necessary to remove the differential.

1. Clamp transmission with Special Tool VW 540 into assembly stand and drain transmission oil.



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Installation

Note

To avoid damaging the seal, install drive shaft seal only after the gear set has been installed.

1. Coat end shield/transmission housing sealing surface with sealant (Loctite 573) and place full gear set carefully into transmission housing.

2. Drive adapter sleeves into position and tighten mounting screws to 25 Nm (18 ftlb)

3. Fit seal for drive shaft (refer to page 34 - 7).

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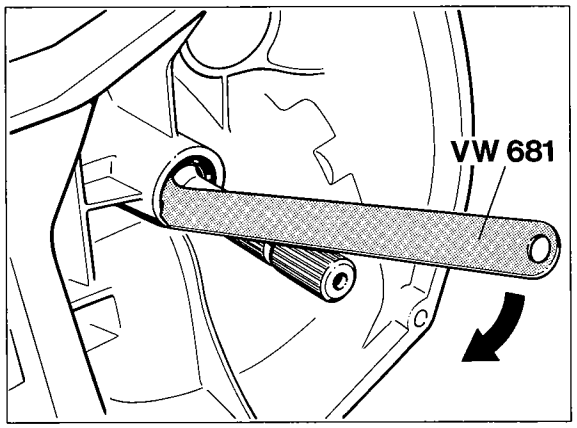
Removing and installing drive shaft seal if transm. has not been dismantled

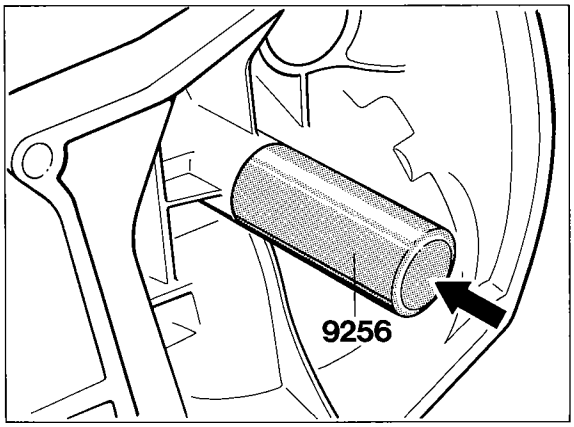
Removal

1. Remove transmission.

2. Lever out seal carefully, using hook VW 681.



1208-34



1209-34

Note

Make sure the sealing surfaces for the seal are not damaged.

Installation

1. Push assembly sleeve 9255 onto drive shaft splines.

2. Pack seal space between dust lip and sealing lip with multi-purpose grease.

3. Push seal into place using Special Tool 9256 until it is seated at the stop.

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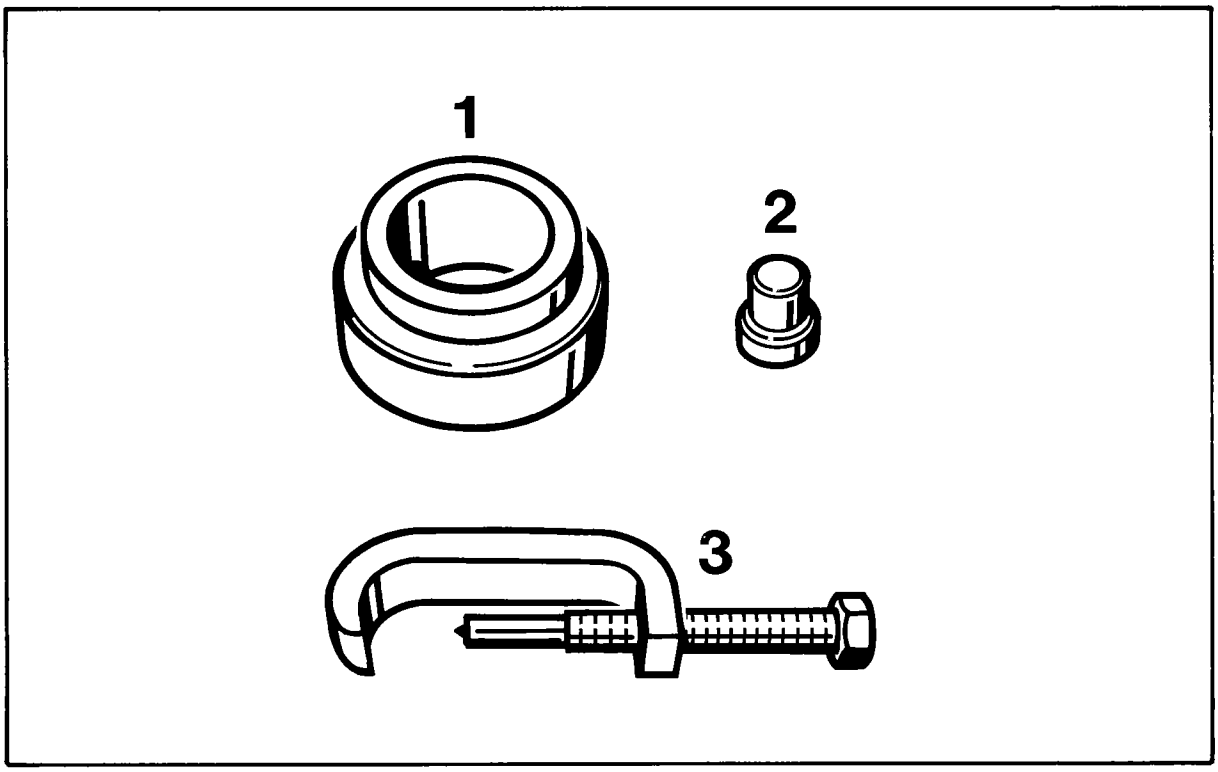
Removing and installing 5th and 6th gear

Tools



1201-34

No.	Designation	Special Tool	Order number	Explanation
1	Thrust piece	9530	000.721.953.00	
2	Thrust piece	9536	000.721.953.60	
3	Pressing device	3276	–	VW Special Tool

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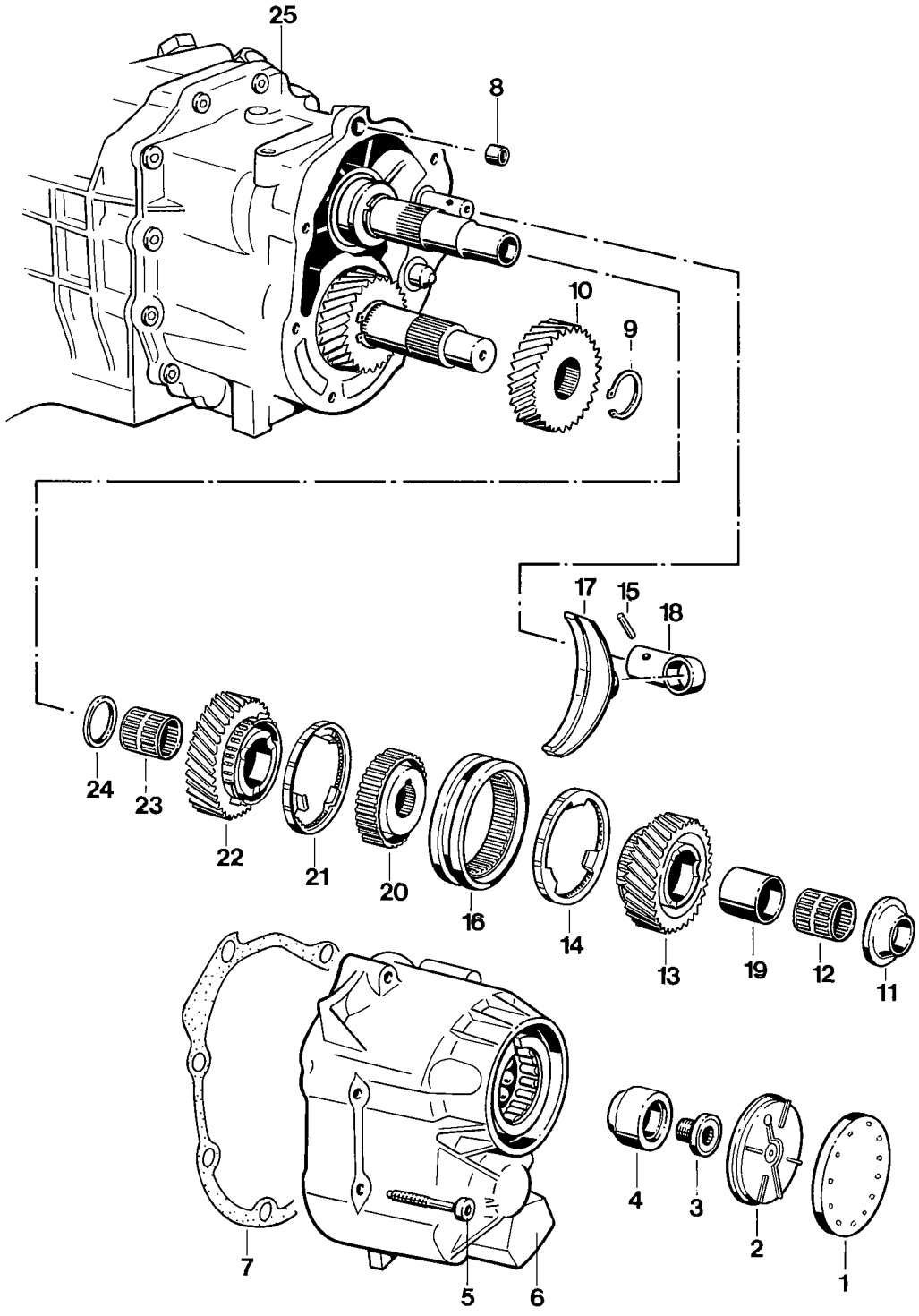
Removing and installing 5th and 6th gear



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No.	Designation	Qty.	Note: Removal	Installation
1	Cover	1	Use a large screwdriver to lever out. The oil catcher is damaged in the process	Replace
2	Oil catcher	1	Lever out at bore using a screwdriver	Replace. Observe installation position
3	Bolt	1	Lock drive shaft, removing shift cylinder and engaging two gears	Tighten to 150 Nm (111 ftlb)
4	Four-point bearing inner race	1	Pull out using thrust piece 9530 and internal puller 30...37 mm (e.g. Kukko 21/5)	Heat to approx. 100°C and drive into place
5	Bolt M 8 x 60*	7		Tighten to 25 Nm (18 ftlb)
6	End cap	1		
7	Gasket	1		Replace
8	Adapter sleeve	2		
9	Lock ring	1		
10	Fixed gear, 5th gear	1	Engage 2 gears and pull off using two-way puller	Heat to approx. 120°C and drive in to stop, observing correct installation position. Installation position: Flange towards gearwheel for 6th gear
11	Four-point bearing inner race	1	Pull off across 5th gear loose gearwheel (No. 13), using thrust piece 9536 and two-way puller	Heat to approx. 100°C and drive in to stop
12	Needle-roller bearing	1	Mark for reinstallation	Oil with transmission oil. Fit with the same gearwheel as before
13	5th gear loose gearwheel with spring	1		
14	Synchronizing ring	1	Mark for reinstallation	Check for wear. Fit with same gearwheel as before.

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No.	Designation	Qty.	Note: Removal	Installation
15	Spiral pin	1	Press out only with Special Tool 3276	Press in only with Special Tool 3276
16	Selector sleeve	1	Mark for reinstallation along with synchronzier hub. Pull off shift rod along with shift fork and dog	Marks on synchronizer hub and selector sleeve must match
17	Shift fork	1		
18	Driver	1		Replace only complete with shift rod for 5th and 6th gear
19	Bearing inner race	1	Pull off across 6th gear loose gearwheel (No. 22) using thrust piece 9536 and two-way puller	Heat to approx. 100°C and drive in until it is seated at the stop
20	Synchronizer hub	1	Pull off along with bearing inner race (No. 19)	Heat to approx. 100°C and press in to stop, observing correct position
21	Synchronizing ring	1	Mark for reinstallation	Check for wear, fit with the same gearwheel as before
22	6th gear loose gearwheel with spring	1		
23	Needle-roller bearing	1	Mark for reinstallation	Oil with transmission oil. Fit with the same gearwheel as before
24	Thrust washer	1		Cutout points towards snap ring
25	End shield	1		

*** Note**

If the height of the lug (approx. 35 mm) at the end cap is insufficient, a washer must be inserted at both of the lowermost bolts (No. 5).

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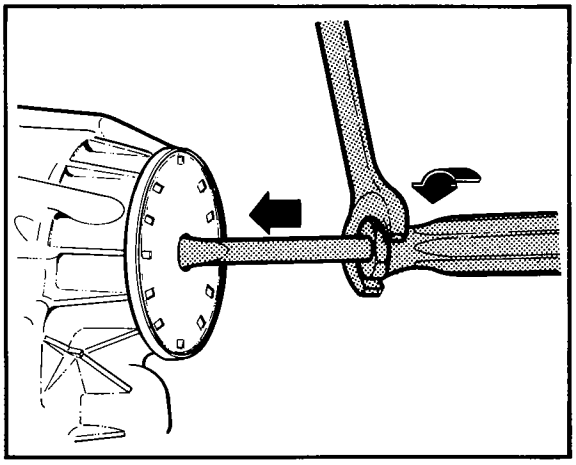
Removal and assembly notes

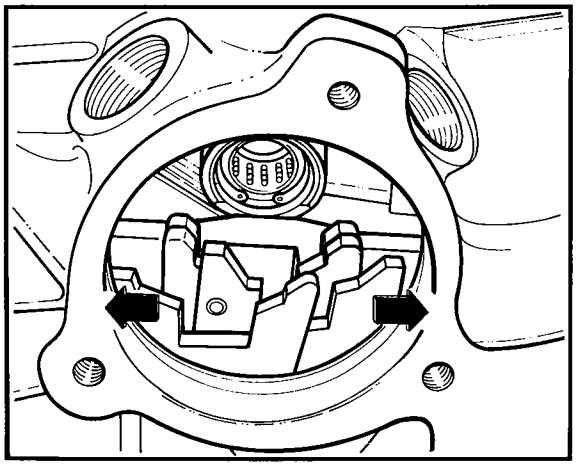
Removal

1. Remove end cap, piercing center of rubber with a large screwdriver. Push in screwdriver laterally between cap and oil catcher and twist screwdriver to lever off the cap.



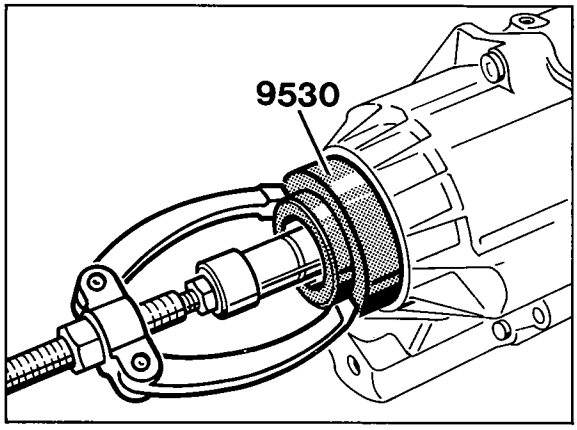
1159-34

2. To undo the bolt (No. 3), the drive shaft must be locked. To do so, remove the shift cylinder and engage two gears.



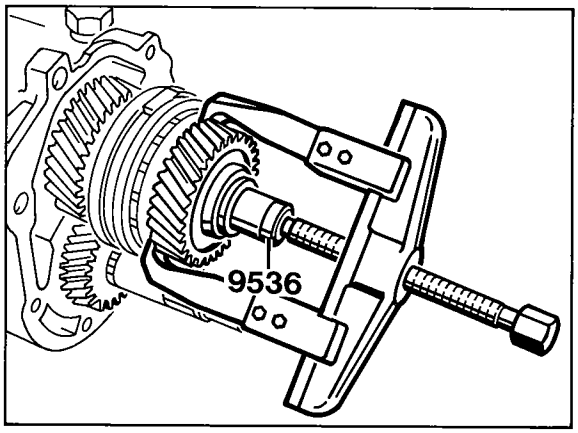
1160-34

3. Pull out four-point bearing inner race with thrust piece 9530, internal puller 30...37 mm (e.g. Kukko 21/5) and support.
Make sure the internal puller engages into the circumferential groove in the inner race.



1150-34

4. Pull off four-point bearing inner race using thrust piece 9536 and two-way puller.



1149-34

5. Push out spiral pin for driver, using Special Tool 3276.

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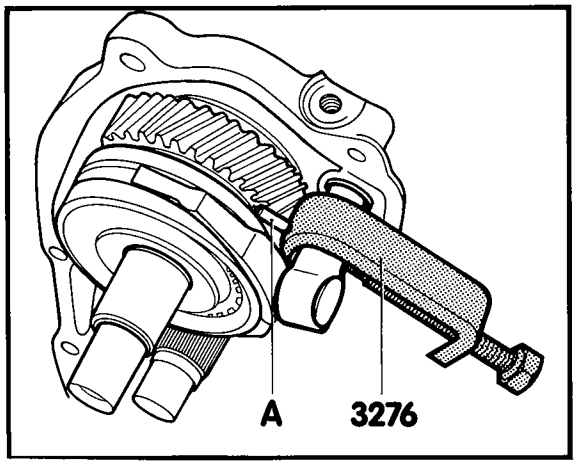
Note

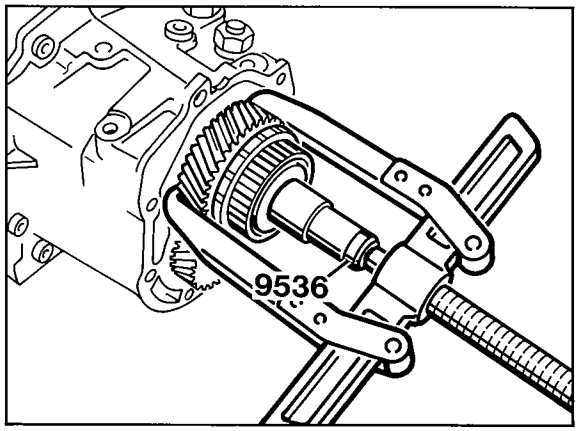
The spiral pin must not be driven out as this will damage the mountings of the shift rod.



1161-34

A = Spiral pin

6. Pull off bearing inner race and synchronizer hub with thrust piece 9536 and two-way puller.



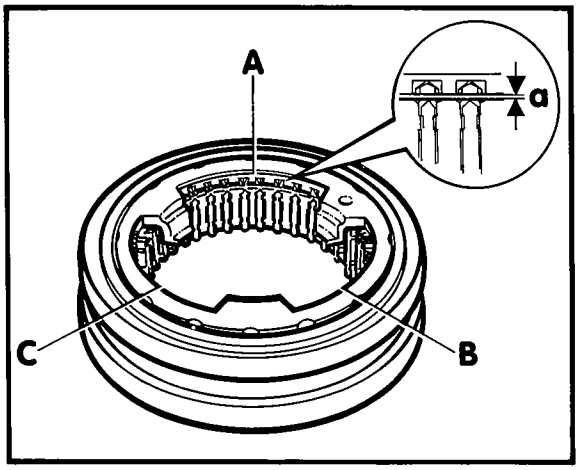
1151-34

Note

The 6th gear fixed gearwheel can only be replaced if the end shield has been removed (refer to page 34 - 21).

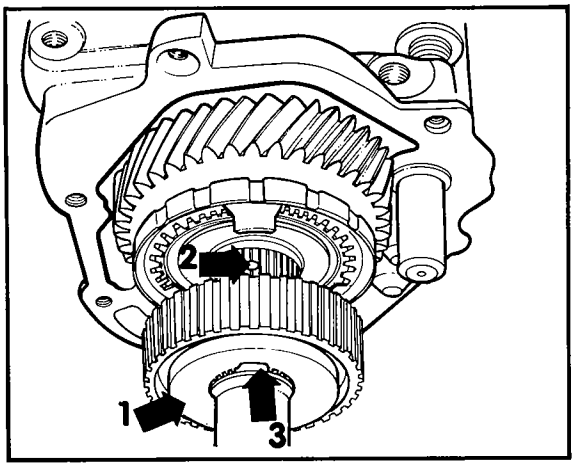
Installation

1. Check synchronizing ring for wear, pressing the synchronizing ring into the sliding sleeve and measuring gap „a" in three places (A, B and C) using a feeler gauge. Add the measured values and divide by 3. The result must not be less than 0.5 mm.



1162-34

2. Heat synchronizer hub to approx. 100°C and press in to stop, observing correct position. Installation position: The protruding front area (arrow 1) points towards the gearwheel for 5th gear and the oil groove (arrow 3) must line up with the oil bore (arrow 2).



1163-34

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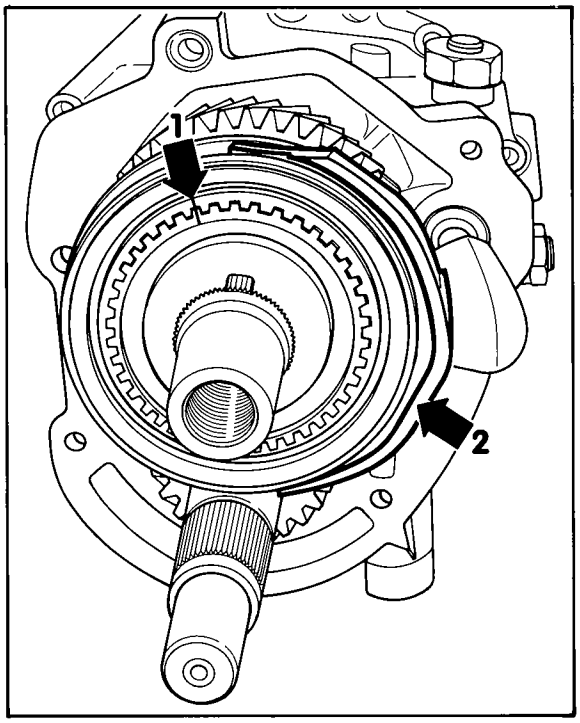
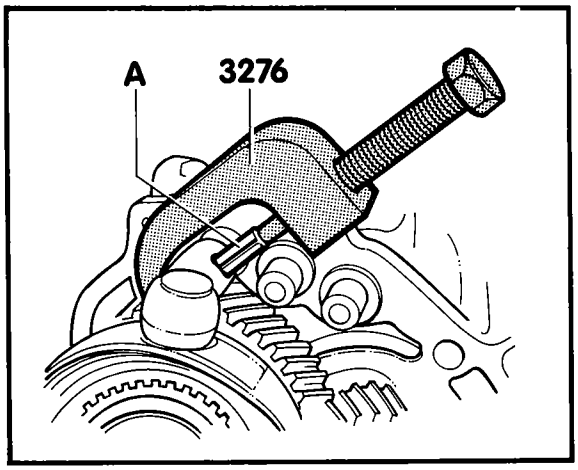
3. Install sliding sleeve for 5th and 6th gear complete with shift fork and driver, observing correct position. Installation position: Marks on synchromesh hub and sliding sleeve must line up.



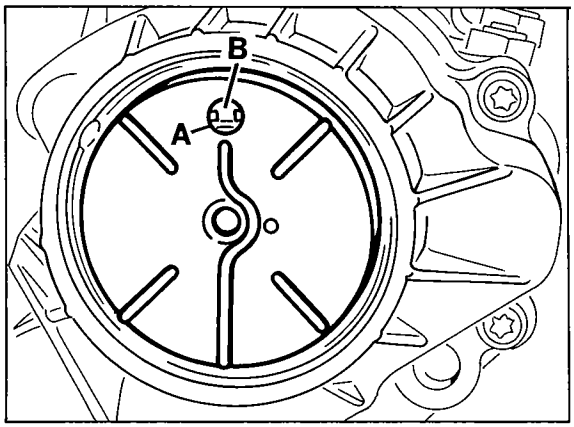
4. Press in roll pin, using Special Tool 3276.



1165-34

A = Roll pin

5. Install oil catcher in correct position. Installation position: Large oil bore must line up with the groove in the cover.



1166-34

A = Large oil bore
B = Groove in cover

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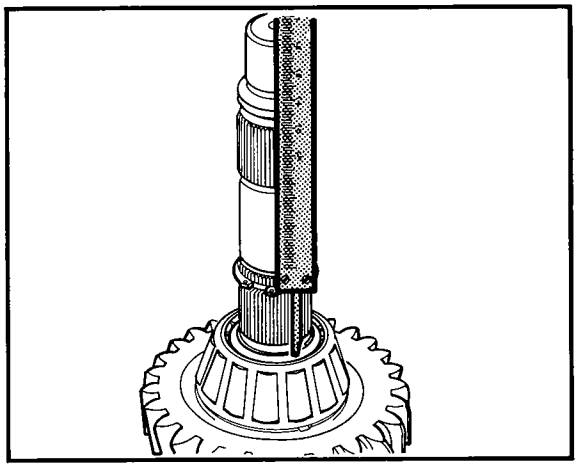
Determining snap rings for tapered roller bearing and 6th gear gearwheel

Tapered roller bearing

Press on tapered roller bearing until it is seated against the stop.

Determine dimension between tapered roller bearing inner race and installed snap ring (push up), using a depth gauge, and determine ring thickness according to table.

Measuring range (mm)	Snap ring Thickness (mm)
32.44...32.53	1.66
32.54...32.62	1.75
32.63...32.71	1.84
32.72...32.80	1.93
32.81...32.89	2.02
32.90...32.98	2.11
32.99...33.07	2.20
33.08...33.16	2.29



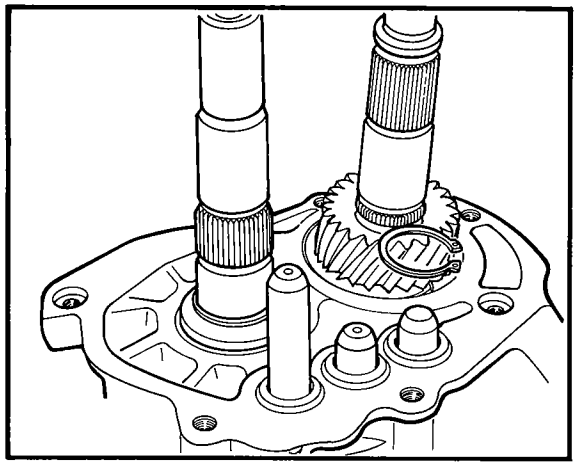
1186-34

6th gear gearwheel

Press on 6th gear gearwheel until it is seated against the stop.

Determine the thickest snap ring that can barely be inserted and install snap ring.
End play must not be more than 0.05 mm.

The following snap rings are available as spare parts:
Thickness in mm
2.11 - 2.14 - 2.17 - 2.20 - 2.23 - 2.26 - 2.29



1185-34

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Removing and installing drive pinion and drive shaft

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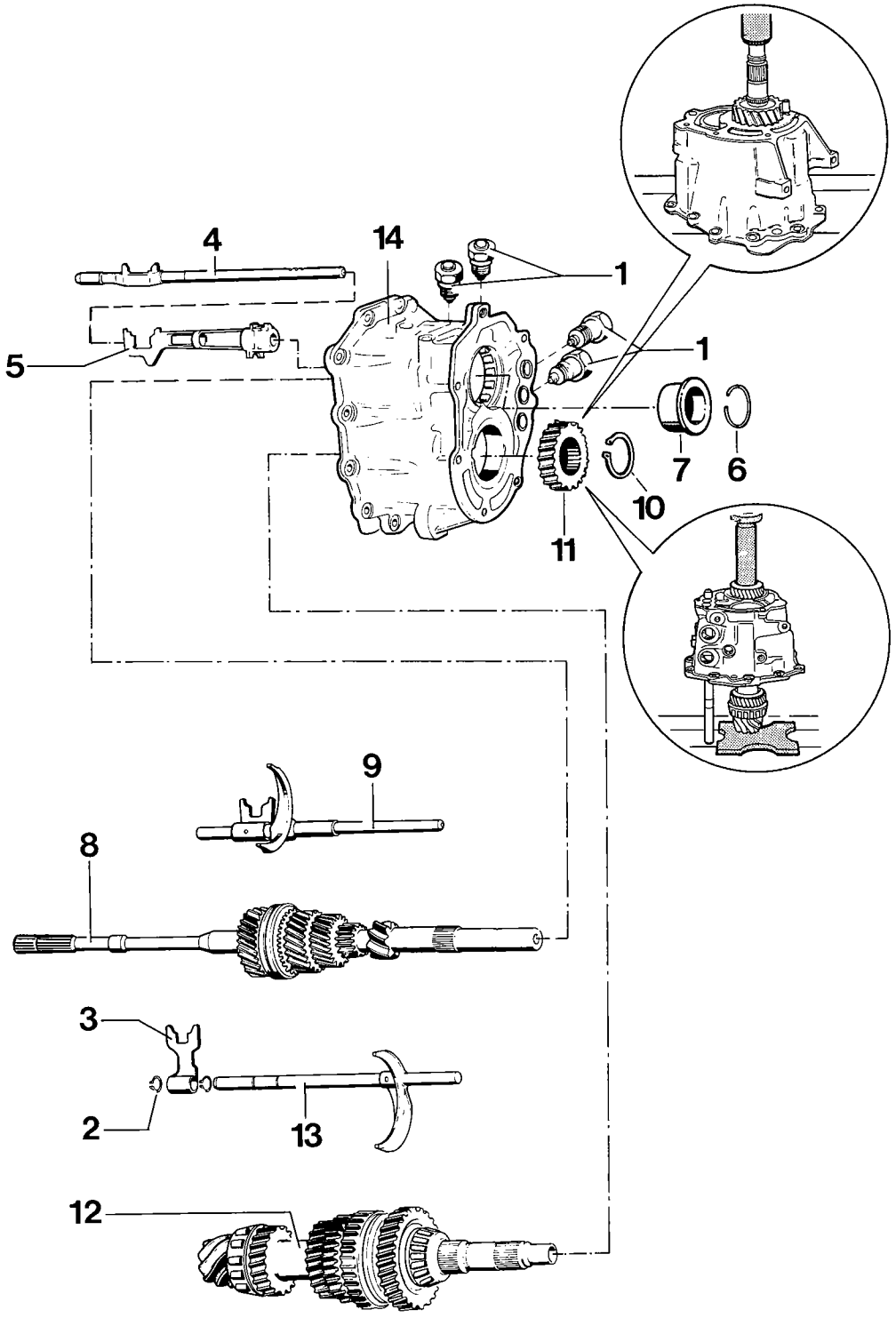
Removing and installing drive pinion and drive shaft



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No.	Designation	Qty.	Note: Removal	Installation
1	Shift catch (light)	4		Do not confuse with catch No. 1 on page 34 - 5. Tighten to 70 Nm (52 ftlb)
2	Snap ring	1		
3	Driver (1st and 2nd gear)	1		
4	Shift rod (5th and 6th gear)	1		Replace only as a unit with driver for 5th and 6th gears (also refer to page 34 - 12)
5	Reverse driver	1		Cutout must engage into reverse gear return lever
6	Snap ring	1		
7	Cylinder roller bearing inner-race	1	Pull off manually	
8	Drive shaft	1	Take out along with shift rod (No. 9)	
9	Shift rod (3rd and 4th gear) with shift lever	1		Replace only as a unit with driver for 3rd and 4th gear
10	Snap ring	1	Note thickness for reinstallation	If required, redetermine thickness (refer to page 34 - 17)
11	6th gear fixed gearwheel	1	Replacement is only possible if end shield has been removed. Press off using a suitable shop press	Heat to approx. 120°C and press on to stop using a shop press Installation position: Flange must face tapered roller bearing
12	Drive pinion	1		
13	Shift rod (1st and 2nd gear)	1		Replace only complete with pin-locked shift fork
14	End shield	1		

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Removal and installation notes

Removal

Note

If repairs are limited to the drive pinion and drive shaft, it is not required to remove reverse gear.

Installation

1. Determine snap rings for tapered roller bearings and 6th gear gearwheel (refer to page 34 - 17).

2. Install drive pinion with shift fork and shift rod for 1st/3nd gear without driver into end shield.

3. Heat 6th gear gearwheel to approx. 120°C and press on.
   Installation position: Flange must face tapered roller bearing

4. Fit snap ring.

5. Insert drive shaft complete with shift fork and 3rd/4th gear shift rod obliquely into the end shield. Observe correct installation position of shift fork.

6. Install inner race of cylinder roller bearing and fit snap ring.

7. Install driver for reverse, allowing the cutout to engage into the return lever, and slide 5th/6th gear shift rod across the driver.

8. Push 1st/2nd gear driver onto the shift rod and fit snap ring.

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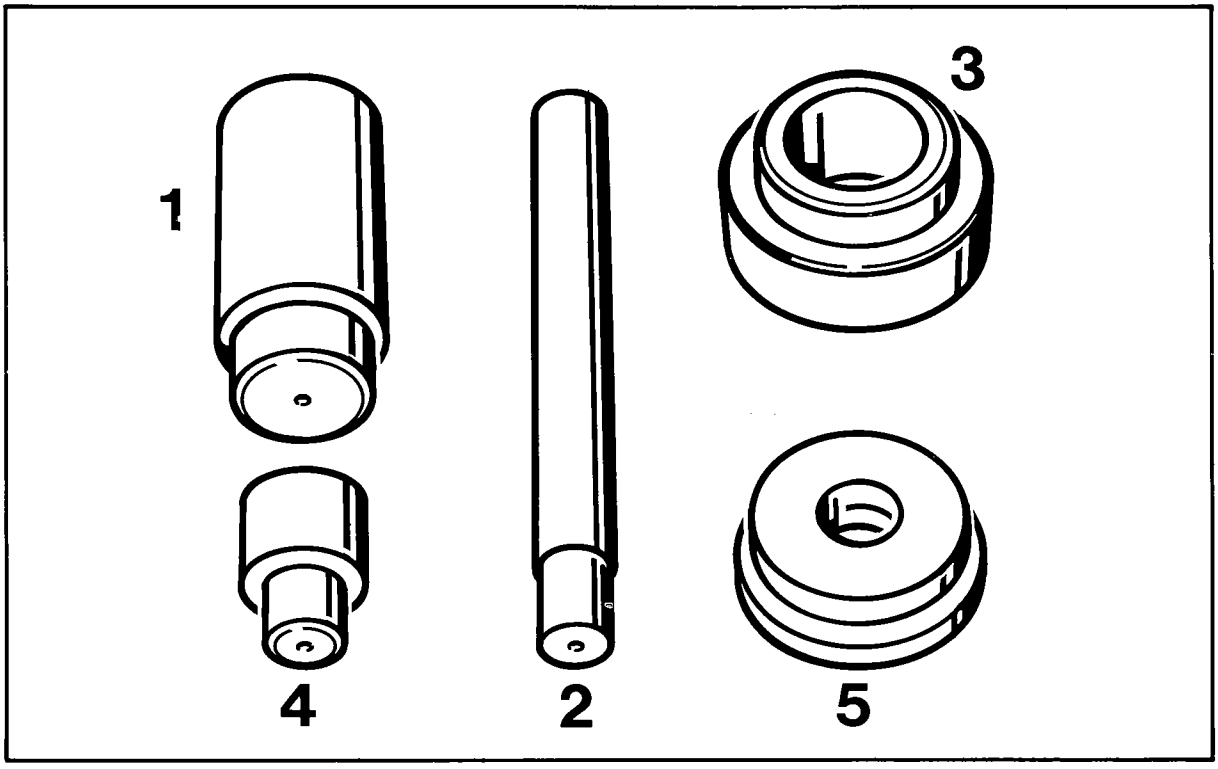
Dismantling and assembling end cover

Tools



1196-34

No.	Designation	Special tool	Order number	Explanation
1	Thrust piece	VW 432	–	VW Special Tool
2	Drift	P 375	000.721.375.00	
3	Thrust piece	9530	000.721.953.00	
4	Thrust piece	VW 295 A	–	VW Special Tool
5	Thrust piece	30 - 205	–	VW Special Tool

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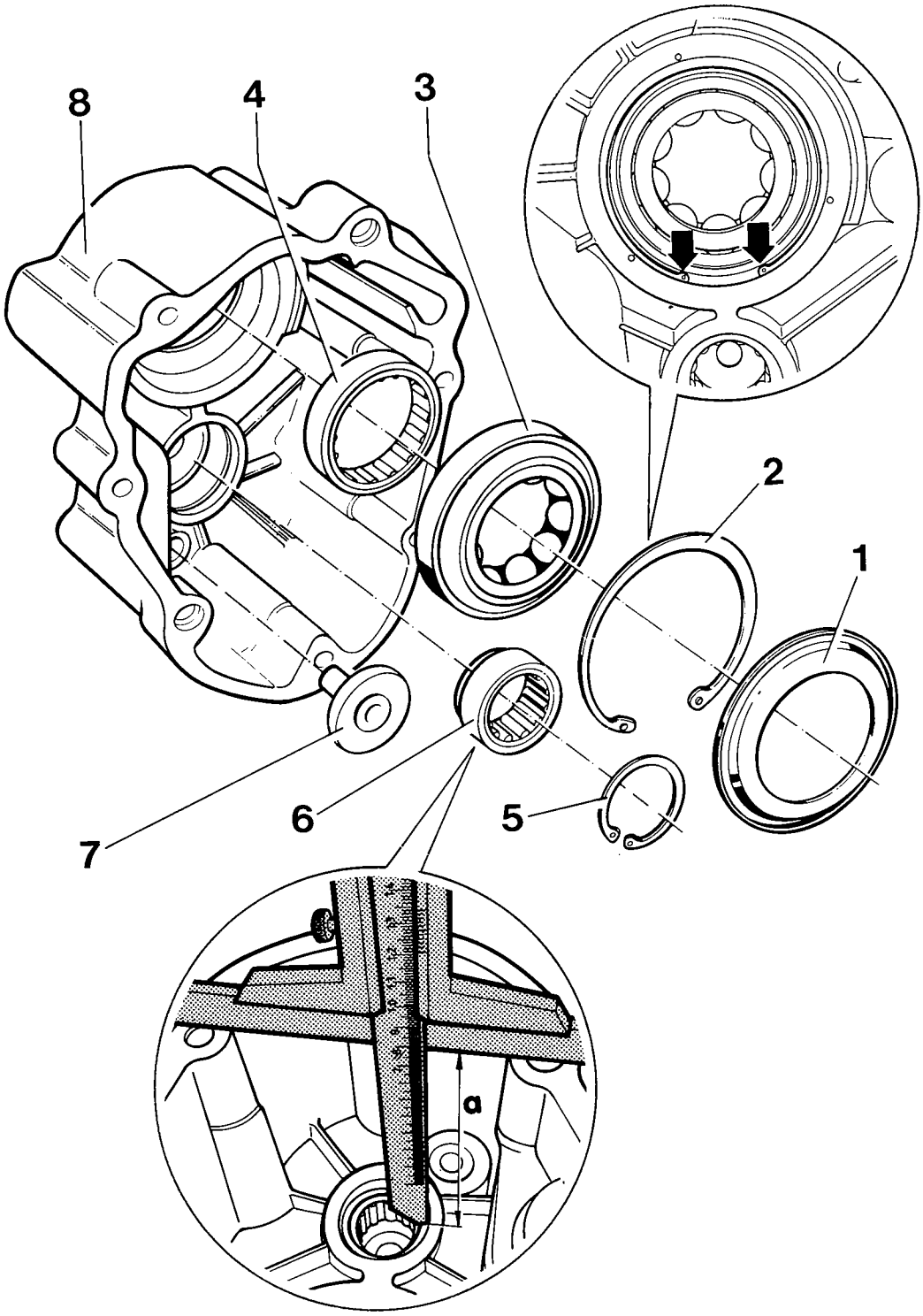
Dismantling and assembling end cover



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No.	Designation	Qty.	Note: Removal	Installation
1	Baffle plate	1	Lever out (e.g. using arm of puller 9884)	Replace, lock in three places
2	Snap ring	1	Note thickness for reinstallation	When replacing bearing and end cover, recalculate thickness. Make sure it is seated correctly in the correct position.
3	Four-point bearing outer race	1	Take out, remove upsetting marks if required	
4	Cylindrical roller bearing outer race	1	Press out (e.g. with VW 432)	Using Tool 30-205, press in to stop, inserting Special Tool 9530 at collar/stop to support cylindrical roller bearing.
5	Snap ring	1		Check for correct seating
6	Cylindrical roller bearing outer race	1	Pull out using internal puller 23.5...30 mm (e.g. Kukko 21/4)	Removal damages the bearing, i.e. the bearing must always be replaced. Use VW 295A to drive in to correct position (a = 98.6 mm)
7	Magnet with bushing	1	Remains in end cover	Drive in (e.g. using P 375)
8	End cover	1		

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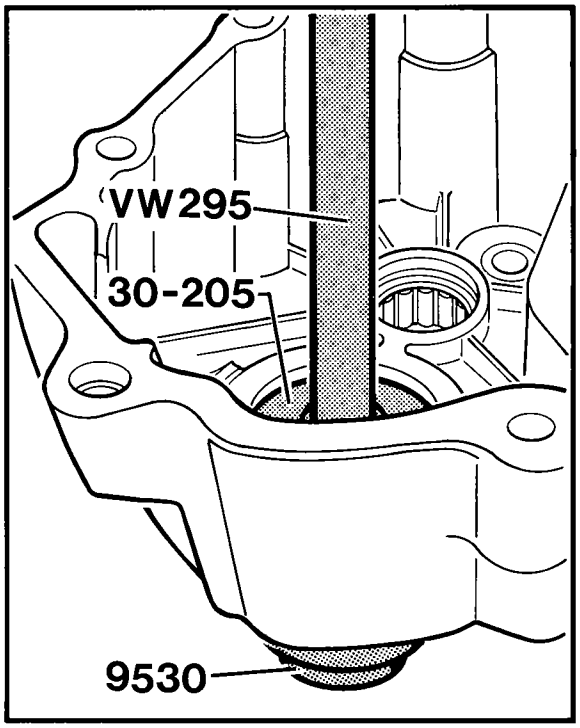
Assembly notes

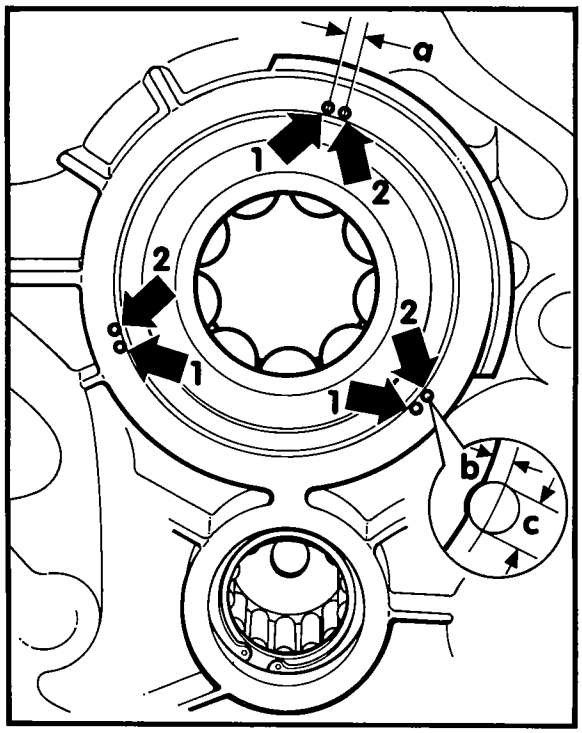
1. Using Tool 30-205, drive in cylindrical roller bearing outer race for drive pinion until it is seated against the stop.
   Be sure to use Special Tool 9530 as a support for the collar/stop of the cylindrical roller bearing.



2. Determining snap ring for four-point bearing:

- Press in outer race of four-point bearing until it is seated against the stop.
- Determine the thickest snap ring that can just about be inserted.
- End play must not be more than 0.08 mm.

3. When replacing the bearing races, upset the edge of the baffle plate.
   Insert baffle plate and use a drift (ball dia. = 5 mm) to apply new upsetting marks (arrow 2) at a distance of "a" = 5 mm to the initial upsetting marks (arrow 1).
   "b" = 2 mm
   "c" = 3 mm



4. Upset baffle plate when replacing the end cover.

- Reinstall baffle plate.
- First upsetting mark (large arrow) must be at a distance of "d" = 10 mm to the connecting line of the shaft center.

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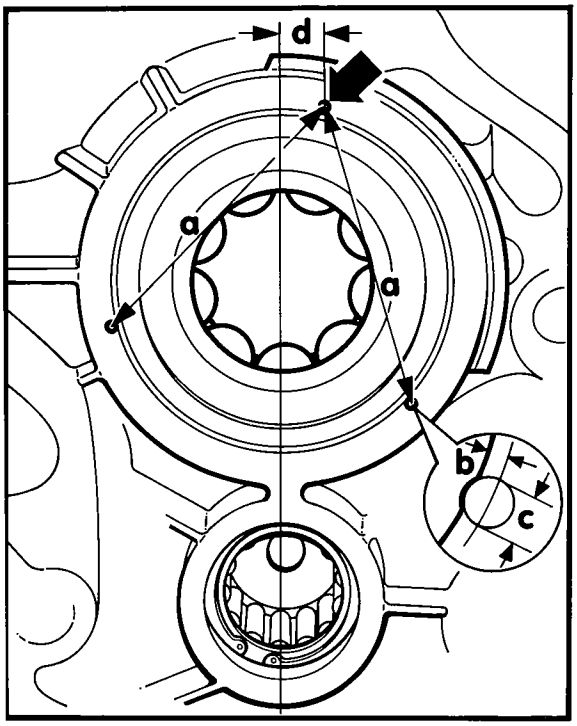
– Also apply second and third upsetting marks at a distance of "a" = 70 mm using a drift (ball dia. = 5 mm).
"b" = 2 mm
"c" = 3 mm



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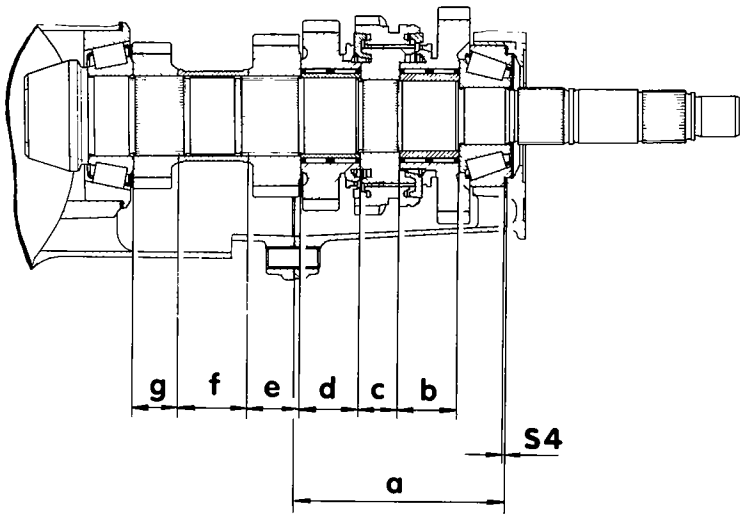
Recalculating adjusting shim „S4"

This adjustment is required if end shield, needle-roller bearing inner race for 1st gear loose gearwheel, synchronizer hub for 1st and 2nd gear, needle-roller bearing inner race for 2nd gear loose gearwheel, gearwheel for 3rd gear, spacer sleeve and gearwheel for 4th gear have been replaced.

This adjustment allows the preload of the tapered roller bearings for the drive pinion to be reset.



1187-34

Dim. „a" = Housing depth of the end shield

Dim. „b" = Length of inner race/needle roller bearing for 1st gear loose gearwheel

Dim. „c" = Length of hub of synchronizer hub for 1st and 2nd gear

Dim. „d" = Length of inner race/needle roller bearing for 2nd gear loose gearwheel

Dim. „e" = Length of 3rd gear gearwheel

Dim. „f" = Length of spacer sleeve

Dim. „g" = Length of 4th gear gearwheel

Dim. „S4" = Thickness of adjusting shim S4

1 - End shield
2 - Shim „S4"
3 - Needle roller bearing inner race for gearwheel of 1st gear
4 - Synchronizer hub for 1st and 2nd gear
5 - Needle roller bearing inner race for gearwheel of 2nd gear
6 - Gearwheel for 3rd gear
7 - Spacer sleeve
8 - Gearwheel for 4th gear
9 - Drive pinion

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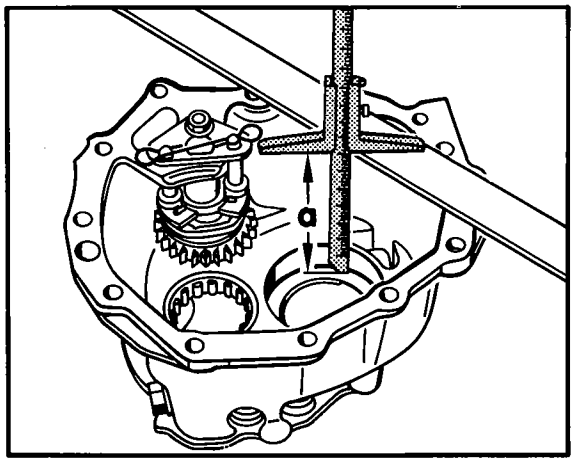
A - Replacing the end shield

- Measure housing depth "a" of old and new end shield and determine difference



1188-34

Example:
Old end shield
Housing depth „a" = 118.40 mm
New end shield
Housing depth "a" = 118.65 mm

Difference = 0.25 mm

If the **new** end shield is deeper - fit **thicker** „S4".

If the **old** end shield is deeper - fit **thinner** „S4".

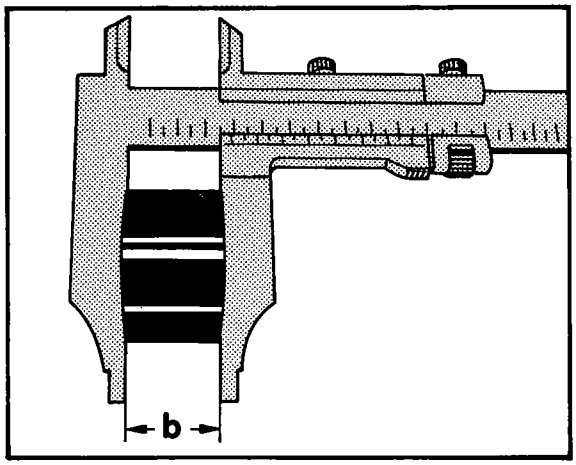
Example:
Old shim 0.95 mm
Difference + 0.25 mm

New adjusting shim "S4" 1.20 mm

The following shims are available as spare parts: Thickness in mm
0.45 - 0.50 - 0.55 - 0.60 - 0.65 - 0.70 - 0.75 - 0.80 - 0.85 - 1.25

B - Replacing needle roller bearing for 1st gear

Calculate length "b" of the inner race of the old and new needle roller bearings and determine thickness



1189-34

Example:
Old inner race: "b" = 33.35 mm
New inner race: "b" = 33.40 mm

Difference = 0.05 mm

If the **new** inner race is longer - fit correspondingly **thinner** shim „S4".

If the **old** inner race is longer - fit correspondingly **thicker** shim „S4".

C - Replacement of parts 4 to 8 - pages 34 - 29

Determine difference of dimensions between old and new parts in the same manner for dimensions "c" to "g" - pages 34 - 29 and determine required adjusting shim "S4".

D - Replacing only drive set refer to page 39 - 17.

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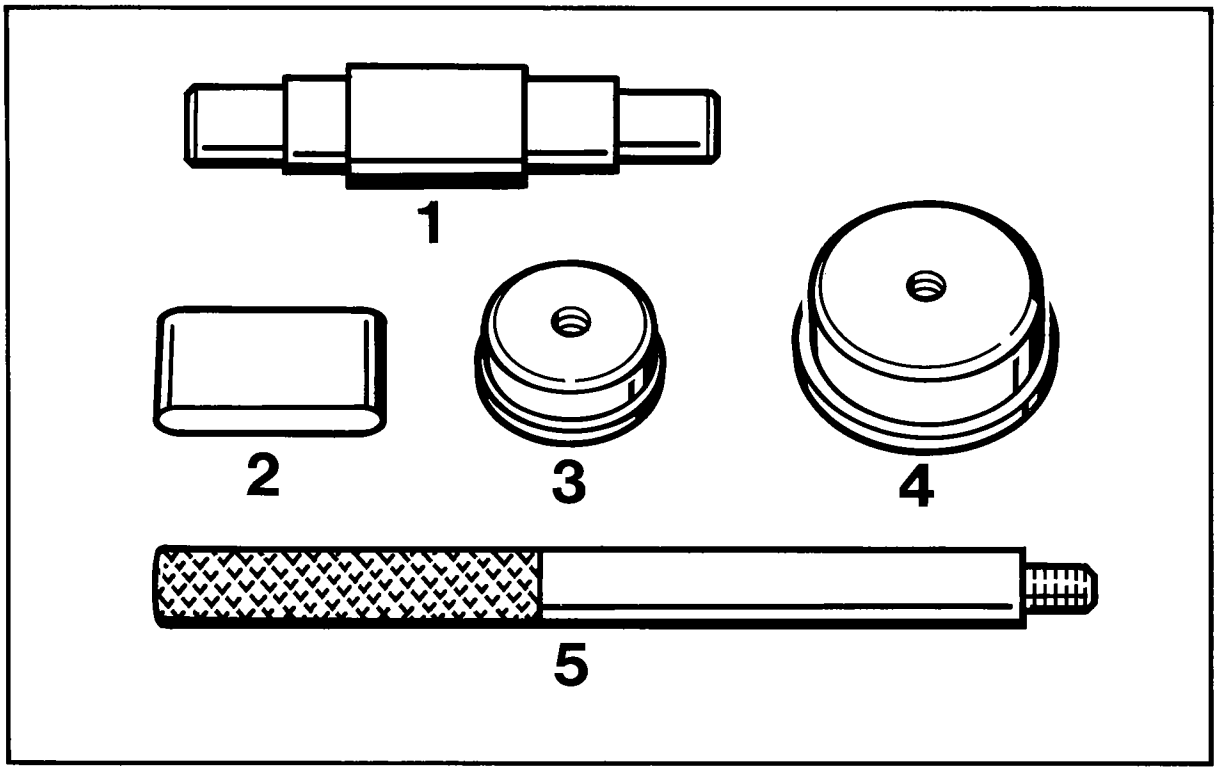
Dismantling and assembling end shield

Tools



1197 - 34

No.	Designation	Special tool	Order number	Explanation
1	Drift	9223	000.721.922.30	
2	Thrust piece	9533	000.721.953.30	
3	Thrust piece	P 254 b	000.721.254.20	
4	Thrust piece	P 254 a	000.721.254.10	
5	Threaded stud	P 254	000.721.254.00	

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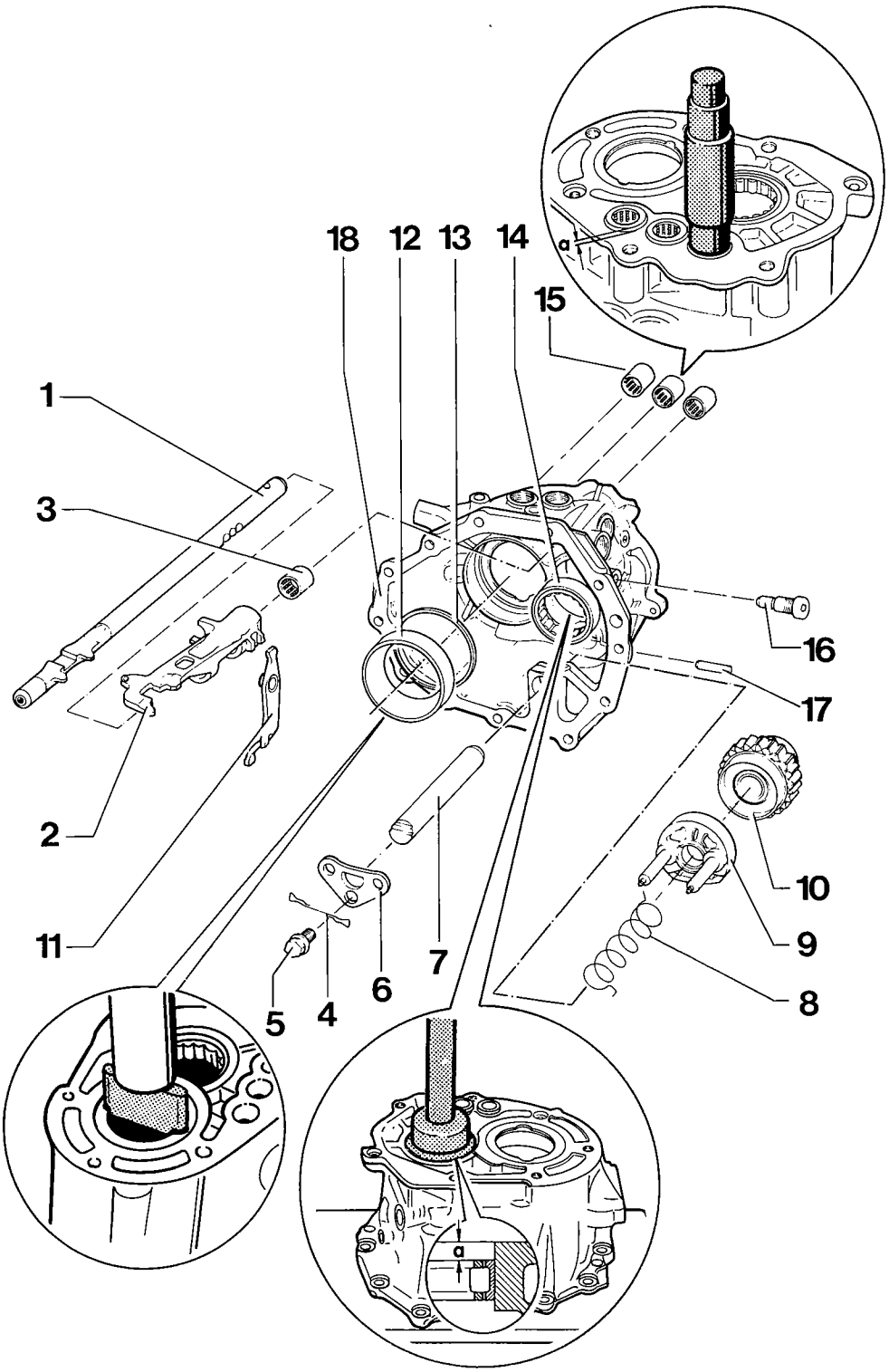
Dismantling and assembling end shield



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No.	Designation	Qty.	Note: Removal	Installation
1	Shift rod (5th and 6th gear)	1	Refer to page 34 - 22	
2	Driver for reverse	1	Refer to page 34 - 22	
3	Ball sleeve	1	Pull out using internal puller 14.5...18.5 (e.g. Kukko 21/2) and counter-support	Replace, drive in flush using Special Tool 9223
4	Spring clamp	1		
5	Bolt with collar (micro-sealed)	1		Always replace with new bolt, tighten to 25 Nm (18 ftlb)
6	Retainer plate	1		Observe installation pos.
7	Axle	1	Pull out	
8	Thrust spring	1		Observe installation pos.
9	Synchronizing ring	1		Check for wear. Observe installation pos.
10	Return gear	1		
11	Deflection lever	1		
12	Tapered roller bearing outer race	1	Press out with Special Tool 9533	Press in with P 254 A and P 254. Place with larger diameter onto the outer race
13	Adjustment shim „S4"	X	Note thickness for reinstallation	If required, determine new thickness (refer to page 34 - 29)
14	Cylindrical roller bearing outer race	1	Press out with P 254 B and P 254. Place with larger diameter onto the outer race	Press in with P 254 B and P 254, observing correct position. Installation pos.: „a" = 9 mm
15	Needle sleeve	3	Drive out (e.g. using 9223)	Replace, press in with Special Tool 9223. Install. pos.: „a" = 2.5 mm
16	Bolt for deflection lever	1		Tighten to 35 Nm (26 ftlb)
17	Cylindrical pin	1		
18	End shield	1		Replacement note: Redetermine thickness of shim „S4" (refer to page 34 - 29)

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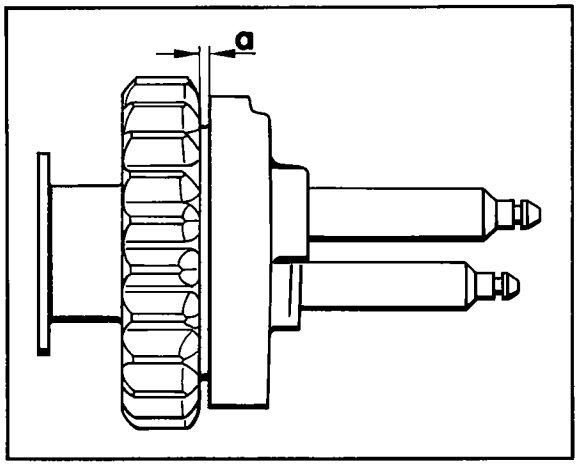
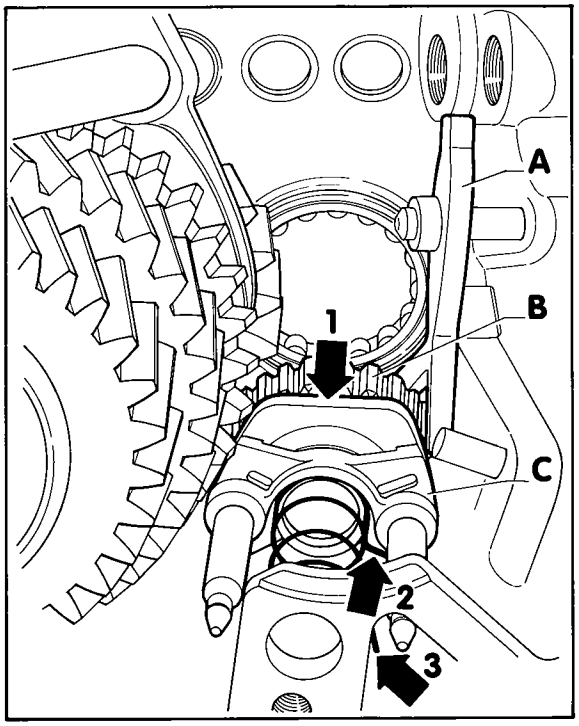
Assembly notes

1. Check synchronizing ring, pressing the ring onto the taper of the gearwheel and measuring gap „a“ using a feeler gauge.

   Gap “a“
   Installation dimension (new) = 0.75...2.3 mm
   Wear limit = 0.2 mm



1172-34



1173-34

2. Fit return gear with synchronizing ring.

- Fit return lever „A“ and return gear “B“, making sure the deflection lever engages into the driver of the return gear.

- Install synchronizing ring, observing correct position.
  Installation position: Chamfer (arrow 1) faces drive shaft.

- Install thrust spring into correct position.
  Installation position: Hook single-hook end into cutout in the synchronizing ring (arrow 2) and double-hook end into aperture at end shield (arrow 3).

- Push in axle „C“, ensuring it is seated in correct position.

- Place retainer plate „A“ into position.
  Installation position: The radii of the bores for the lock pins of the synchronizing ring face the end shield.

- Place spring clamp „B“ into position.

- Always replace screw „D“ (micro-sealed screw) and tighten to 25 Nm (18 ftlb).

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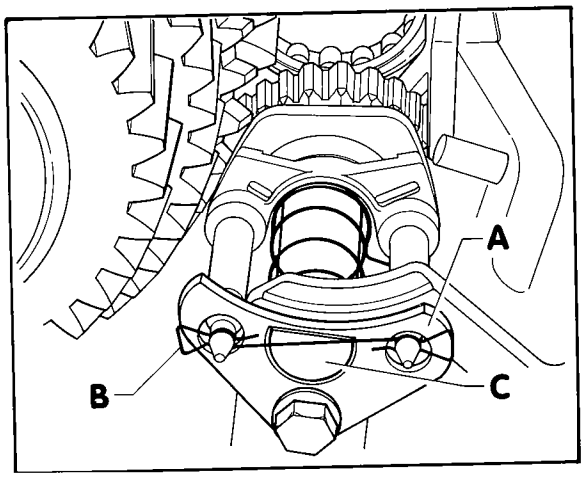

1174-34

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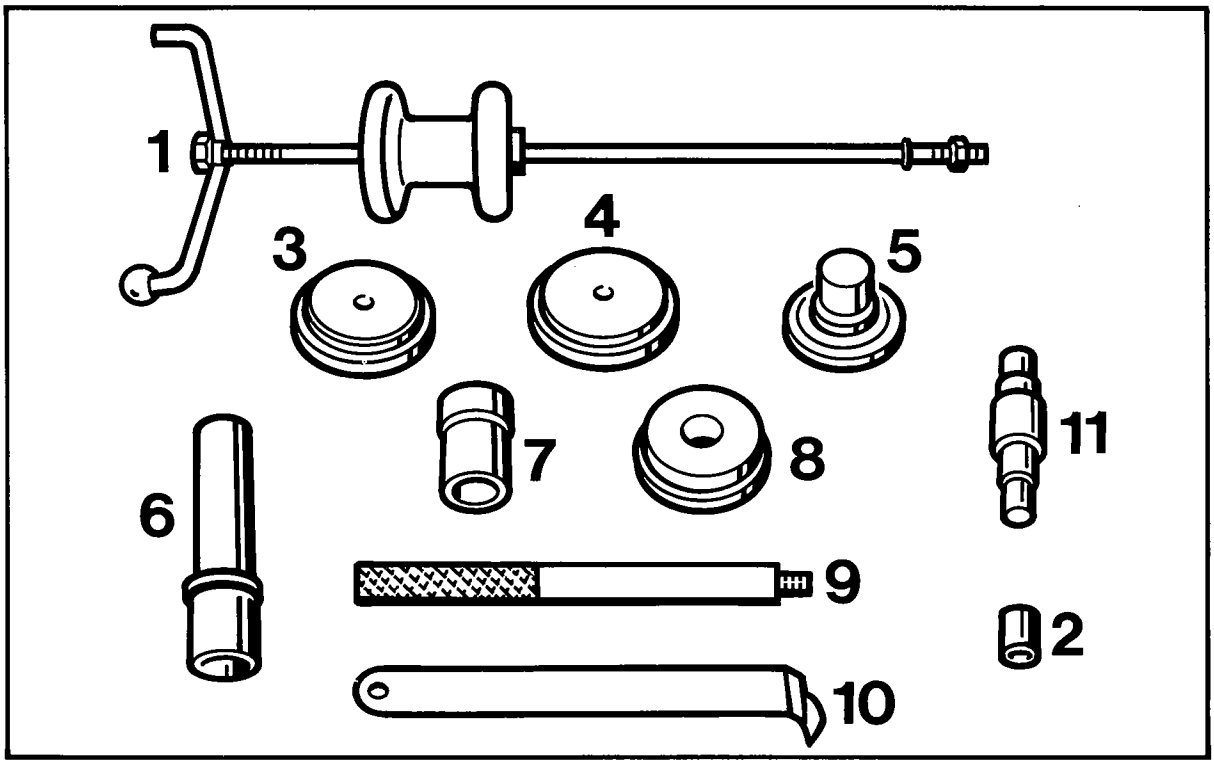
Dismantling and assembling transmission housing

Tools



1198-34

No.	Designation	Special tool	Order number	Explanation
1	Punch	VW 771/1	–	VW Special Tool
2	Threaded sleeve	VW 771/15	–	VW Special Tool
3	Thrust piece	9247/4	000.721.924.70	
4	Thrust piece	9247/3	000.721.924.70	
5	Thrust piece	9534	000.721.953.40	
6	Drift	P 381	000.721.381.00	
7	Thrust piece	VW 454	–	VW Special Tool
8	Thrust piece	2050	–	VW Special Tool
9	Threaded stud	P 254	000.721.254.00	
10	Push-out lever	VW 681	–	VW Special Tool
11	Drift	9223	000.721.922.30	

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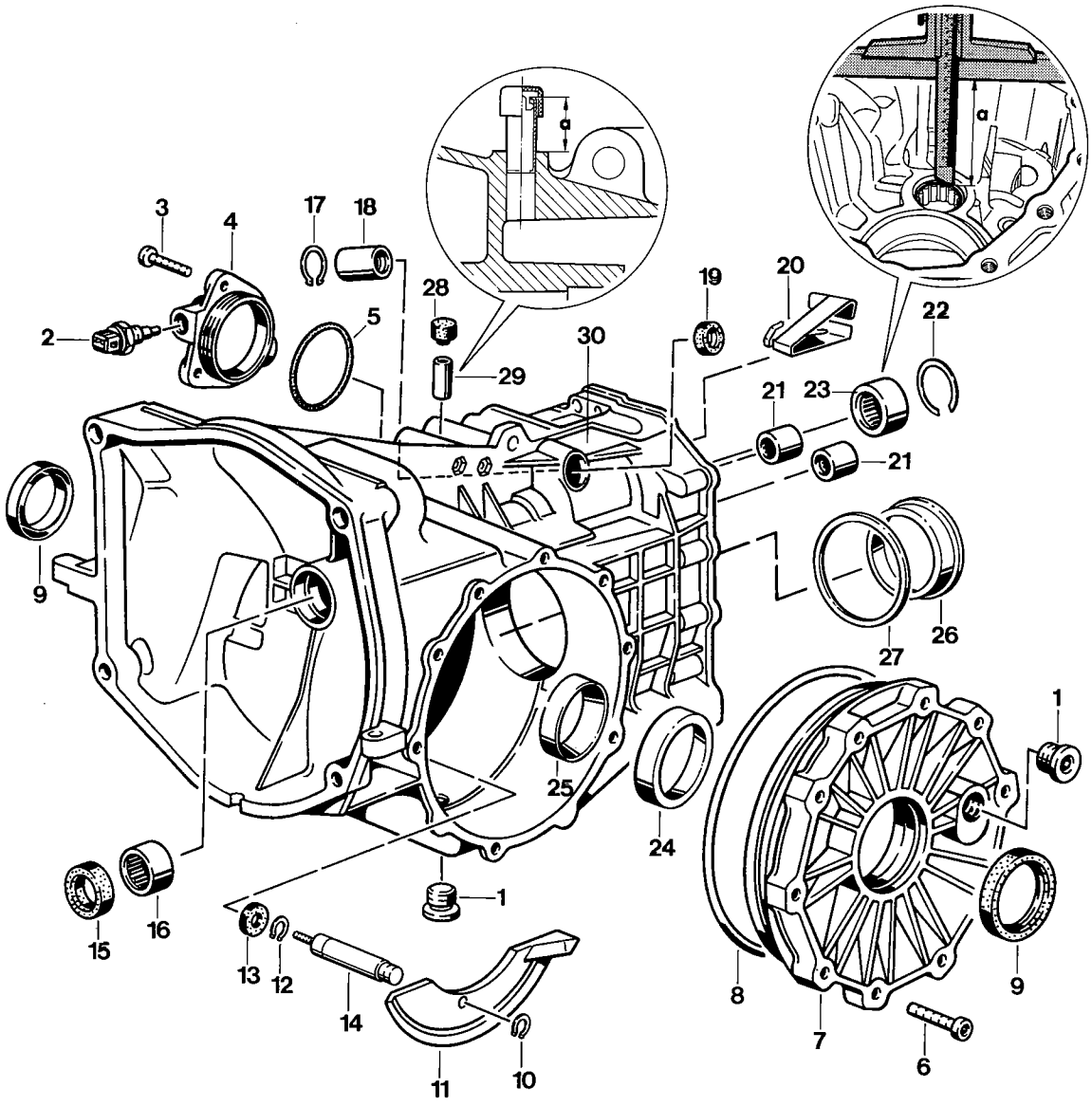
Dismantling and assembling transmission housing



1139-34

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No.	Designation	Qty.	Note: Removal	Note: Installation
1	Plug	2		Tighten to 35 Nm (26 ftlb)
2	Reverse light switch	1		Tighten to 20 Nm (15 ftlb)
3	Pan head screw	3		Tighten to 25 Nm (18 ftlb)
4	Cover	1		
5	Sealing ring	1		Replace
6	Pan head screw	10		Tighten to 25 Nm (18 ftlb)
7	Transmission side cover	1		When replacing cover, adjust ring gear
8	Sealing ring	1		Replace
9	Shaft seal	2		Pack space between sealing lip and dust lip with multi-purpose grease. Use Special Tool 9534 to drive in to stop
10	Snap ring	1		
11	Shroud	1		
12	Snap ring	1		
13	Form magneto	1		
14	Threaded flange	1		Before screwing in, coat with Loctite 271. Tightening torque 10 Nm (7 ftlb)
15	Shaft seal	1	May also be replaced if transmission has not been dismantled.	Do not fit until gear set has been installed (refer to page 34 - 7). Pack space between dust lip and sealing lip with multipurpose grease
16	Needle roller bearing	1	Pull out with internal puller 30 - 37 mm (e.g. Kukko 21/5), VW 771/15 and VW 771/1	Press in to stop (e.g. with P 381). The lettering on the bearing must face the thrust piece

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No.	Designation	Qty.	Note: Removal	Installation
17	Snap ring	1		
18	Ball sleeve	1	Pull out with internal puller 14...20 mm (e.g. Kukko 21/2), VW 771/15 and 771/1	Replace, use Special Tool 9223 to drive in to stop
19	Shaft seal	1	Pull out with VW 681. May also be replaced if transmission has not been dismantled	Pack space between dust lip and sealing lip with multipurpose grease. Drive in to stop using Special Tool 9223
20	Cover plate	1	Press retaining lug down, inserting a small screwdriver through the breather tube, and pull out	Engage retaining lug into breather tube
21	Ball sleeve	2	Pull out with internal puller 14...20 mm (e.g. Kukko 21/2), VW 771/1 and VW 771/15	Replace, drive in with Special Tool 9223
22	Snap ring	1	Lever out with two screwdrivers	Check for correct seating
23	Needle roller bearing	1	Pull out with internal puller 30...37 mm (e.g. Kukko 21/5), VW 771/1 and VW 771/15	Press into correct pos. (e.g. with VW 454). Make sure the lettering on the bearing faces the thrust piece „a“ = 105 mm
24	Tapered roller bearing outer race	1	Pull out with internal puller 71...100 mm (e.g. Kukko 21/9) and countersupport	Press in to stop (e.g. with Special Tool 9247/4), supporting cover at the aperture for the joint flange. When replacing, readjust ring gear.
25	Tapered roller bearing outer race	1	Pull out with internal puller 50...70 mm (e.g. Kukko 21/8) and countersupport	Press in to stop (e.g. with Special Tool 2050). The large diameter must face the outer race. When replacing, readjust ring gear.

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No.	Designation	Qty.	Note: Removal	Installation
26	Tapered roller bearing outer race	1	Drive out using Special Tool 9247/4 and VW 771/1	Heat transmission housing to approx. 120°C and press in with Special Tool 9247/3 and P 254, using a shop press. Continue pressing for 1 to 2 minutes until heat exchange has occurred
27	Adjusting shim „S3"	X	Note thickness for reinstallation	If required, recalculate thickness (refer to page 39 - 17)
28	Cap	1	Pull off manually	
29	Bleeder tube	1		Observe correct pressing depth. „a" = 21 mm
30	Transmission housing	1		

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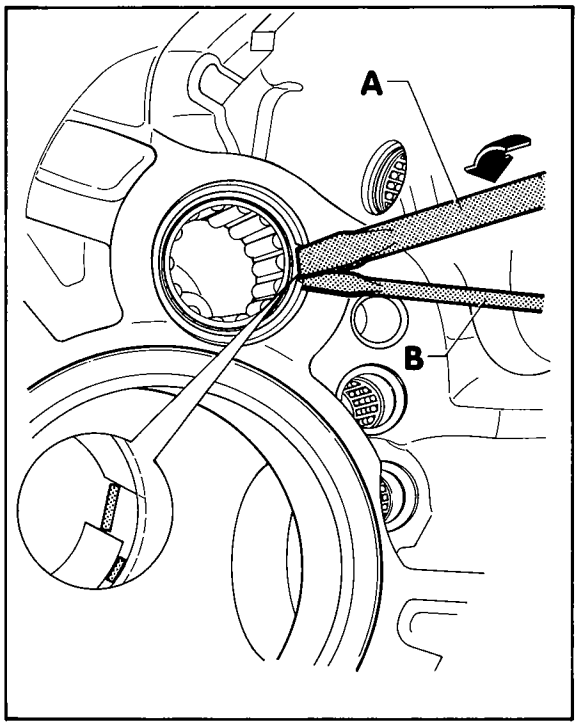
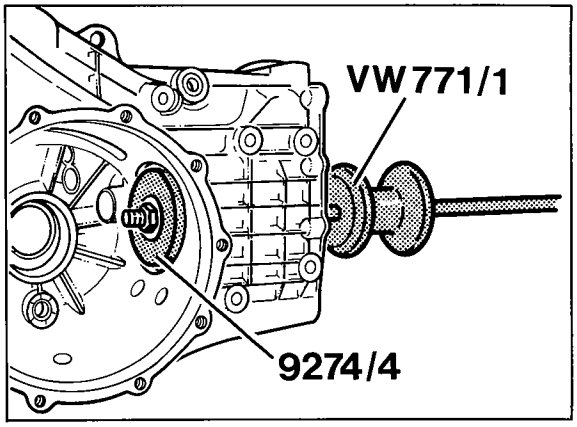
Dismantling and assembly notes

Dismantling

1. Remove snap ring (No. 22), disengaging one end of the snap ring from the groove by turning with screwdriver „A".
   Secure disengaged end with screwdriver "B".
   Continue levering out ring with screwdriver „A".



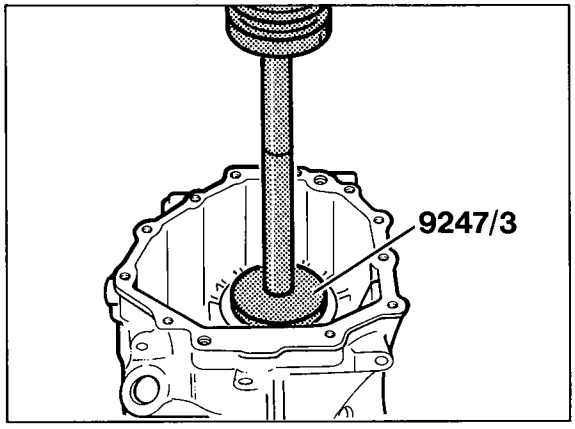
2. Drive out tapered roller bearing for drive pinion with Special Tool 9247/4 and punch tool VW 771/1.



1176-34

Assembly

1. Place tapered roller bearing outer race for drive pinion into heated transmission housing. Always fit with a shop press as the bearing race might otherwise be tilted in the bore and get stuck.
   Use Special Tool 9247/3 and pin P 254.
   Keep up preload under the press for approx. two more minutes until heat exchange has occurred.



1177-34

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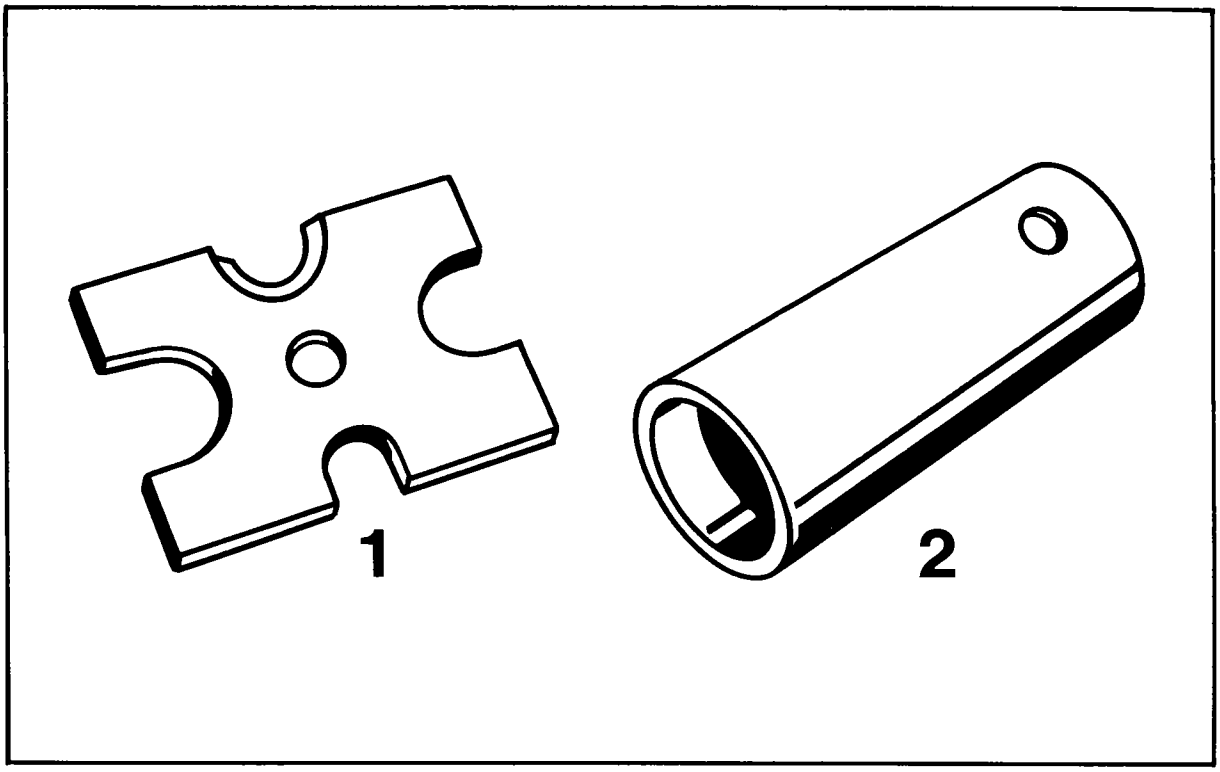
Dismantling and assembling drive shaft

Tools



1199-35

No.	Designation	Special tool	Order number	Explanation
1	Thrust plate	VW 401	–	VW Special Tool
2	Pipe section	VW 519	–	VW Special Tool

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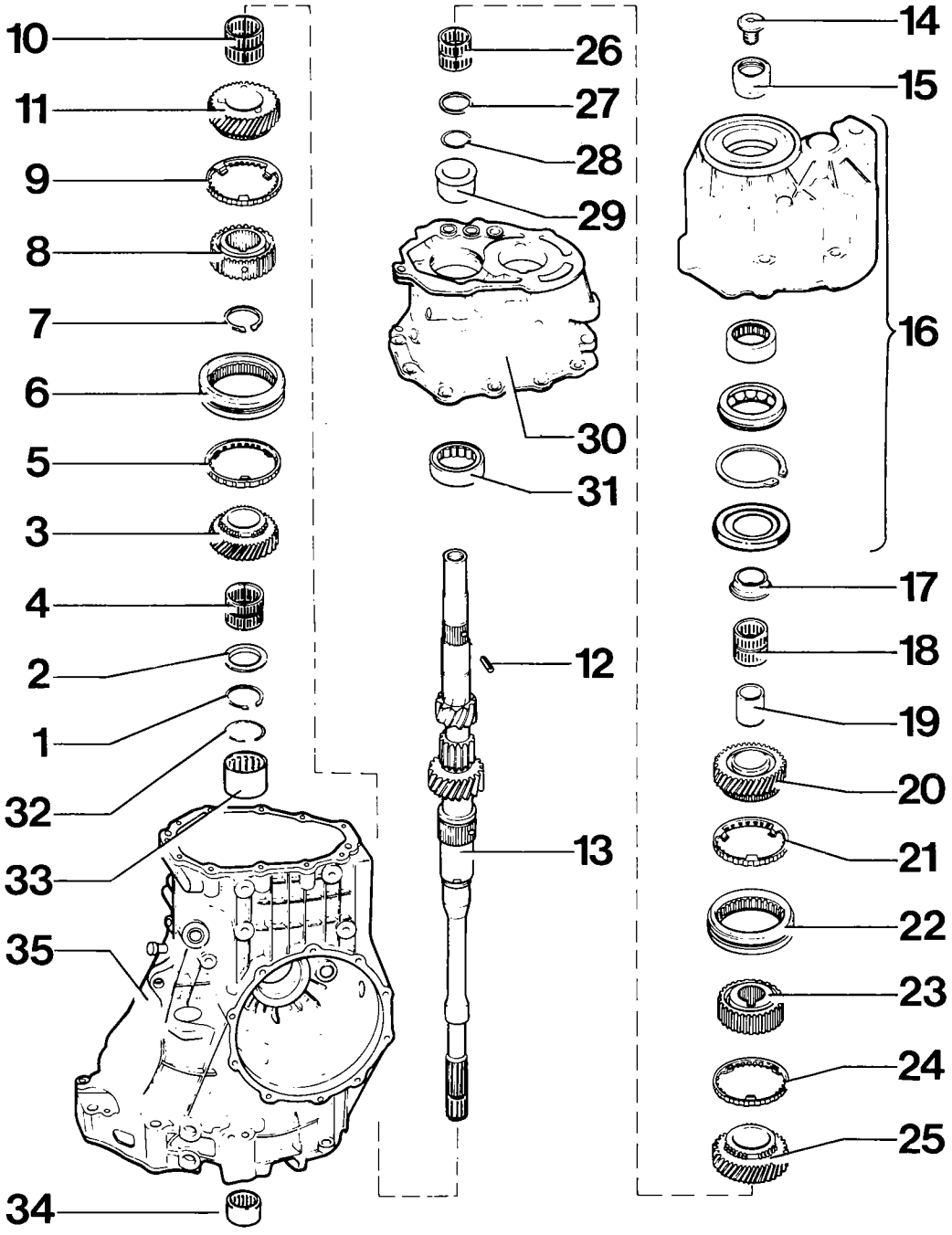
Dismantling and assembling drive shaft



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No.	Designation	Qty.	Note: Removal	installation
1	Snap ring	1		
2	Thrust washer	1		
3	4th gear loose gearwheel with spring	1		Insert spring before installing gearwheel
4	Needle roller bearing	1	Mark for reinstallation	Oil with transmission oil. Fit with the same gearwheel as before.
5	Synchronizing ring	1	Mark for reinstallation	Check for wear. Fit with the same gearwheel as before.
6	Sliding sleeve	1		
7	Snap ring	1	Note thickness for reinstallation	When replacing the synchronizer hub (No. 8), redetermine thickness
8	Synchroninzer hub	1	Press off with tools VW 412 and VW 401	Heat to approx. 100°C and press on, observing correct position
9	3rd gear synchronizing ring (molybdenium-coated)	1	Mark for reinstallation	Check for wear. Fit with the same gearwheel as before.
10	Needle roller bearing	1	Mark for reinstallation	Oil with transmission oil and fit with the same gearwheel as before.
11	3rd gear loose gearwheel with spring	1		Insert spring before installing gearwheel.
12	Clamping sleeve	1	Remains on drive shaft	When replacing the drive shaft, drive in sleeve until it is seated in the correct position
13	Drive shaft	1		
14	Screw	1	Page 34 - 10	
15	Four-point bearing inner race	1	Page 34 - 10	
16	End cover assy.	1	Page 34 - 10	

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No.	Designation	Qty.	Note: Removal	Installation
17	Four-point bearing inner race	1	Page 34 - 10	
18	Needle roller bearing	1	Page 34 - 10	
19	Bearing inner race	1	Page 34 - 10	
20	5th gear loose gearwheel	1	Page 34 - 10	
21	Synchronizing ring	1	Page 34 - 10	
22	Selector sleeve	1	Page 34 - 10	
23	Synchronizer hub	1	Page 34 - 10	
24	Synchronizing ring		Page 34 - 10	
25	6th gear loose gearwheel	1	Page 34 - 10	
26	Needle roller bearing	1	Page 34 - 10	
27	Thrust washer	1	Page 34 - 10	
28	Snap ring	1	Page 34 - 20	
29	Cylindrical roller bearing inner race	1	Page 34 - 20	
30	End shield	1	Page 34 - 20	
31	Cylindrical roller bearing outer race	1	Page 34 - 32	
32	Snap ring	1	Page 34 - 38	
33	Needle roller bearing	1	Page 34 - 38	
34	Needle roller bearing	1	Page 34 - 38	
35	Transmission housing	1	Page 34 - 38	

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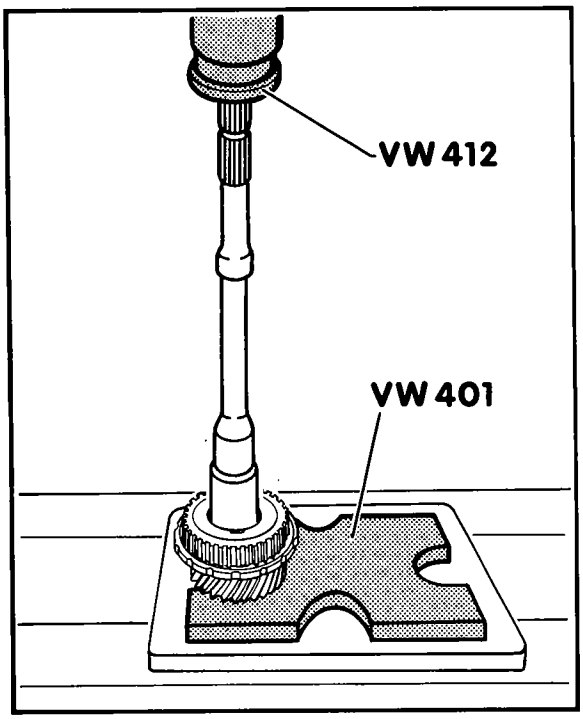
Dismantling and assembly notes

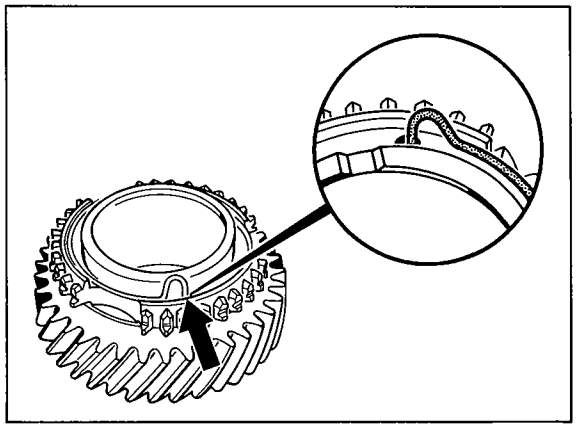
Dismantling

1. Press off synchronizer hub for 3rd and 4th gear.



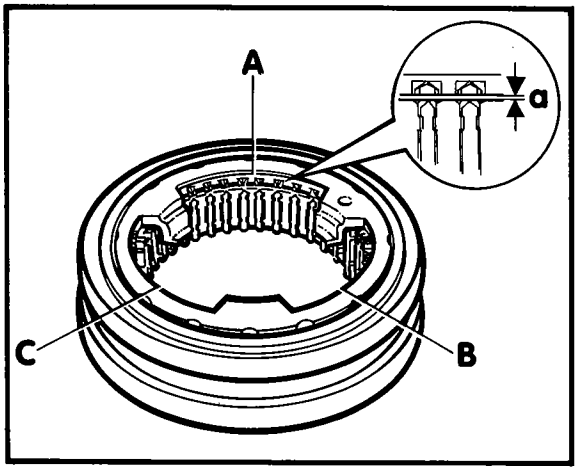
Assembly

1. Insert spring into loose gearwheel, engaging the hooked end into the bore.



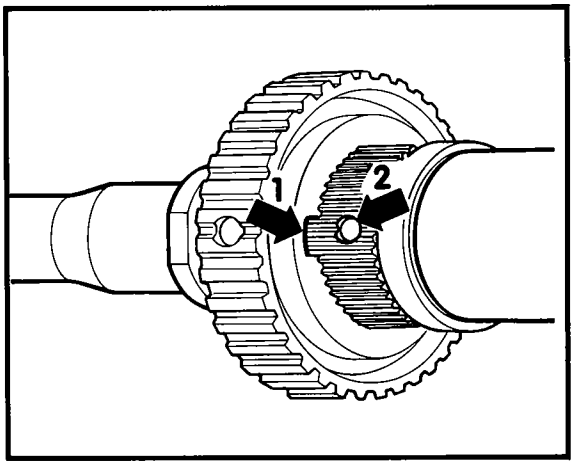
1179-35

2. Check synchronizing ring for wear, pushing synchronizing ring into the sliding sleeve and measuring gap "a" in three places (A, B and C) using a feeler gauge. Add measured values and divide by 3. The resulting value must not be less than 0.5 mm.



1162-34

3. Heat synchronizing body to approx. 100°C and press into place, observing correct position. Make sure the oil groove (arrow 1) lines up with the oil bore (arrow 2) in the drive shaft.



1180-35

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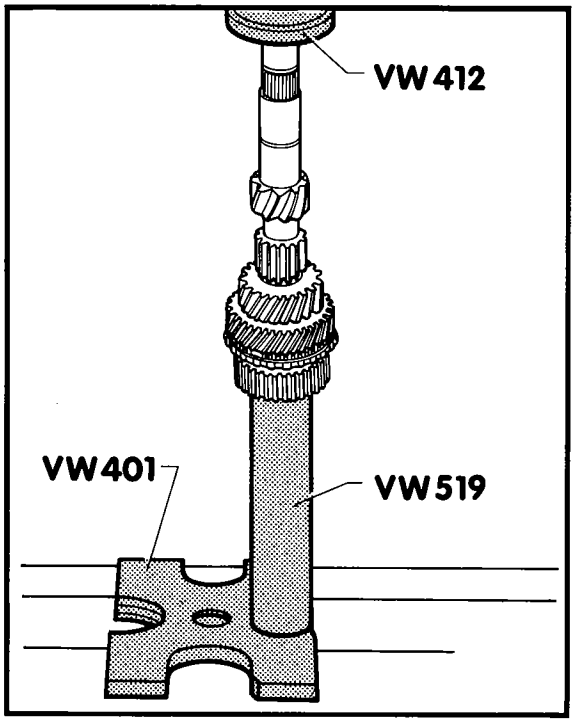
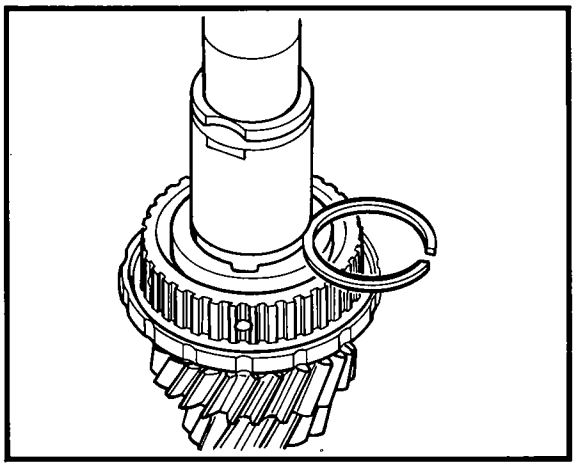


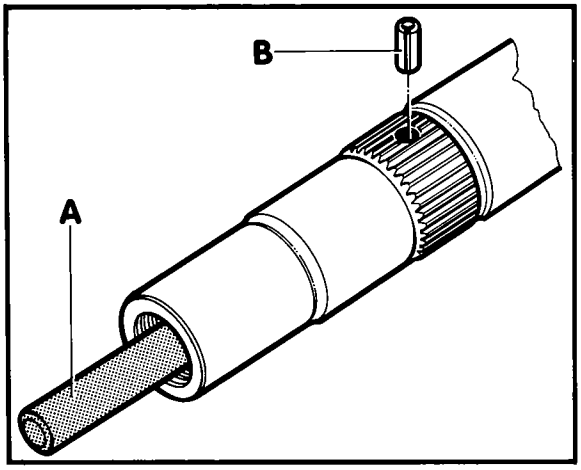
4. Redetermine thickness of snap ring on the synchronizer hub.

- Press synchronizer hub up to the stop, observing correct position.

- Determine the thickest snap ring that can just barely be inserted and insert snap ring. Make sure the opening lines up with the oil groove of the synchronizer hub.



5. Drive clamping sleeve into the drive shaft, inserting 9 mm dia. drift "A" into the oil bore and driving in clamping sleeve "B" until it rests on the drift stop.



1183-35

A = Drift, 9 mm dia.
B = Clamping sleeve

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Dismantling and assembling drive pinion

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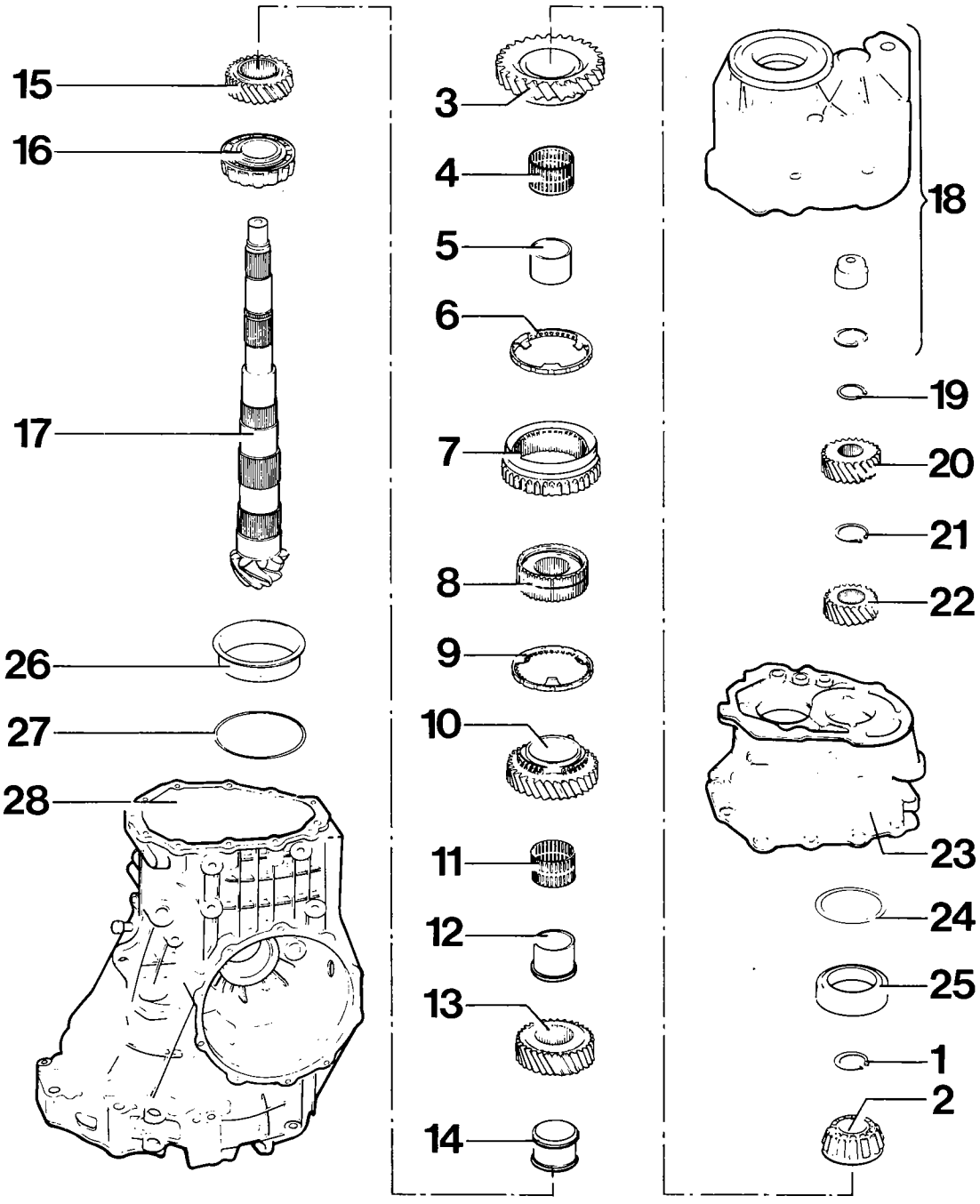
Dismantling and assembling drive pinion



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No.	Designation	Qty.	Note: Removal	Installation
1	Snap ring	1	Note thickness for reinstallation	Redetermine thickness if required (refer to page 34 - 17)
2	Tapered roller bearing inner race	1	Press off across 1st gear loose gearwheel (No. 3) using a suitable sep. tool (e.g. Kukko 15-17 size 2)	Heat to approx. 100°C and press on
3	1st gear loose gearwheel	1		Insert spring before fitting the gearwheel
4	Needle roller bearing	1	Mark for reinstallation	Fit with the same gearwheel as before. Oil with transmission oil before fitting
5	Bearing inner race	1	Press off across 2nd gear loose gearwheel (No. 10) using a suitable separating tool (e.g. Kukko 15-17 size 2). Mark for reinstall.	Heat to approx. 100°C and press on
6	1st gear synchronizing ring	1	Mark for reinstallation	Check for wear. Fit with the same gearwheel as bef. (Ref. to page 35 - 5)
7	Sliding sleeve	1		Install in correct position. Groove for shift fork faces 1st gear
8	Synchronizer hub	1	Press off across 2nd gear loose gearwheel (No. 10)	Heat to approx. 100°C and press on, observing correct position
9	2nd gear synchronizing ring (molybdenium-coated)	1	Mark for reinstallation	Check for wear. Fit with the same gearwheel as before (Refer to page 35 - 5)
10	2nd gear loose gearwheel	1		Insert spring before fitting gearwheel
11	Needle roller bearing	1	Mark for reinstallation	Fit with the same gearwheel as before. Oil with transmission oil before fitting
12	Bearing inner race	1	Press off across 3rd gear fixed gearwheel (No. 13), using a suitable sep. dev. (e.g. Kukko 15-17, size 2).	Heat to approx. 100°C and press on, making sure the collar faces 3rd gear fixed gearwheel

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No.	Designation	Qty.	Note: Removal	Installation
13	3rd gear fixed gearwheel	1	Press off as for bearing inner race (No. 12)	Heat to approx. 100°C and press on, making sure the collar faces the gearwheel for 4th gear
14	Spacer sleeve	1		
15	4th gear fixed gearwheel	1	Press off with separating device (e.g. Kukko 15-17, size 2)	Heat to approx. 100°C and press on, making sure the collar faces the gearwheel for 3rd gear
16	Tapered roller bearing inner race	1	Press off with suitable separating device (e.g. Kukko 15-17, size 2)	Heat to approx. 100°C and press on
17	Drive pinion	1		Supplied in matched pairs with ring gear (drive set). When repl. the pinion, adjust drive pinion/ring gear (Refer to page 39 - 13)
18	End cover	1	Page 34 - 10	
19	Snap ring	1	Page 34 - 10	
20	5th gear fixed gearwheel	1	Page 34 - 10	
21	Snap ring	1	Page 34 - 21	
22	6th gear fixed gearwheel	1	Page 34 - 21	
23	End shield	1	Page 34 - 21	
24	Adjusting shim "S4"	X	Page 34 - 32	
25	Tapered roller bearing outer race	1	Page 34 - 32	
26	Tapered roller bearing outer race	1	Page 34 - 38	
27	Adjusting shim "S3'"	X	Page 34 - 38	
28	Transmission housing	1	Page 34 - 38	

Note

If components No. 4, 5, 8, 11, 12, 13, 14 and 15 have been replaced, the thickness of shim "S4" must be recalculated (Refer to page 34 - 29)

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Removing and installing differential

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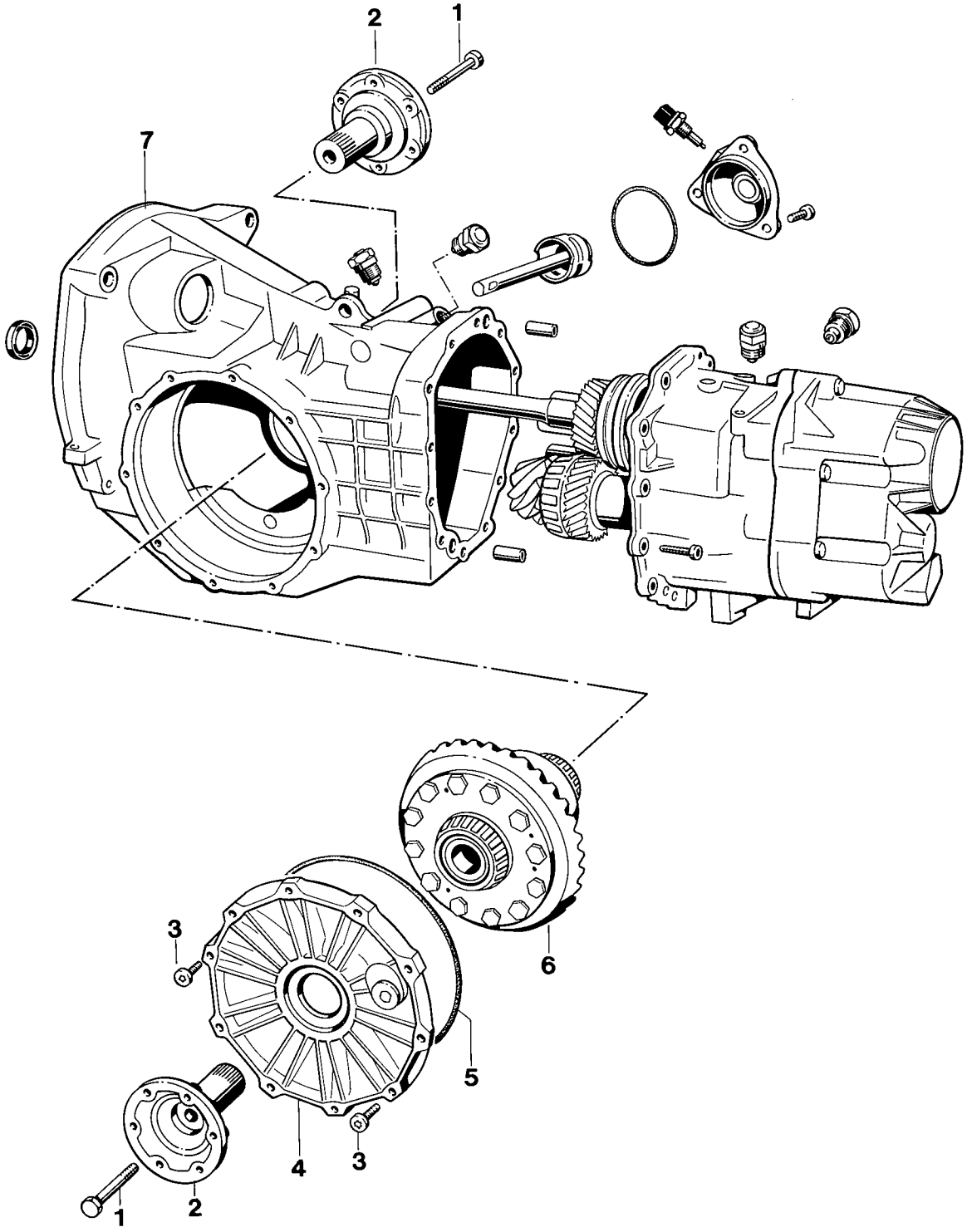
Removing and installing differential



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No.	Designation	Qty.	Note: Removal	Note: Installation
1	Hexagon head bolt	2		44 Nm (32 ftlb)
2	Joint flange	2		
3	Bolt	10		Tighten to 25 Nm (18 ftlb)
4	Cover	1		
5	Sealing ring	1		Replace
6	Differential	1		Readjust if required (refer to page 39 - 21)
7	Transmission housing	1		

Note

The differential may be removed and installed without removing the gearshift shaft and gear set

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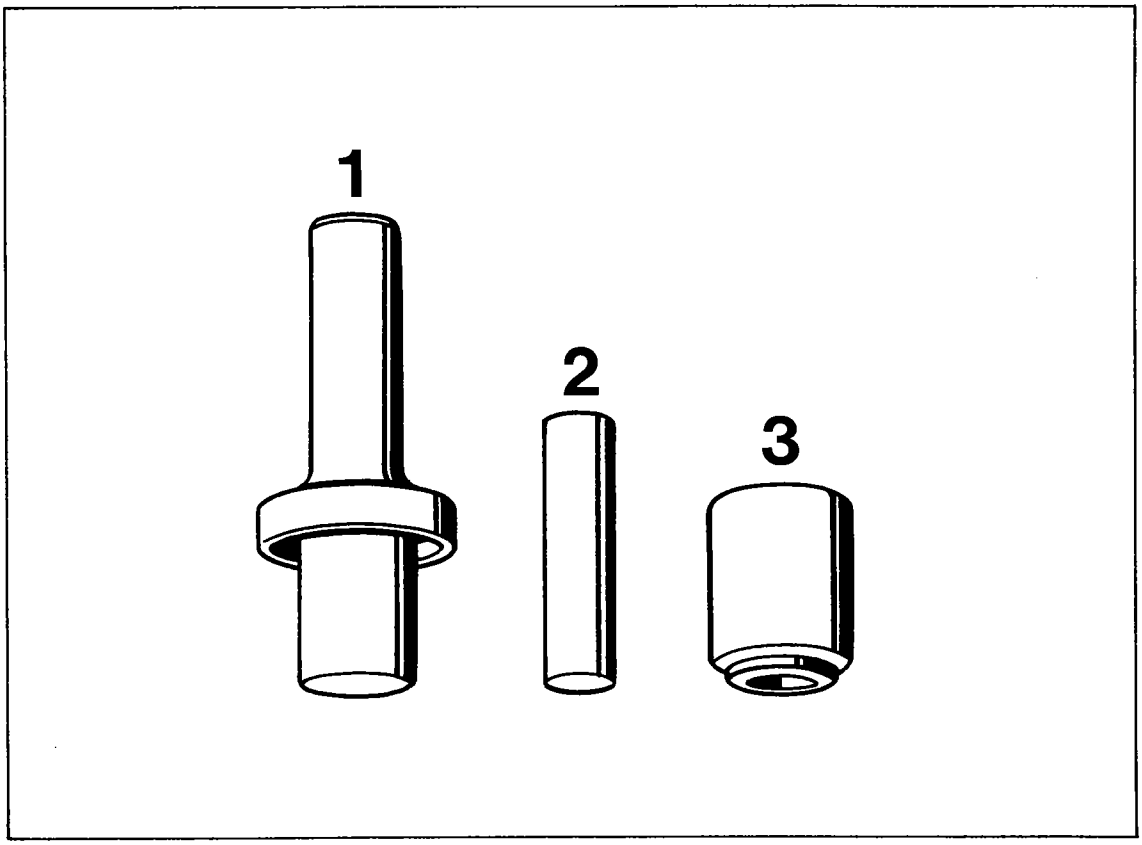
Dismantling and assembling differential



No.	Designation	Special tool	Order number	Explanation
1	Thrust piece	P 264 b	000.721.264.20	
2	Centering mandrel	9289	000.721.928.90	
3	Thrust piece	P 263	000.721.263.00	

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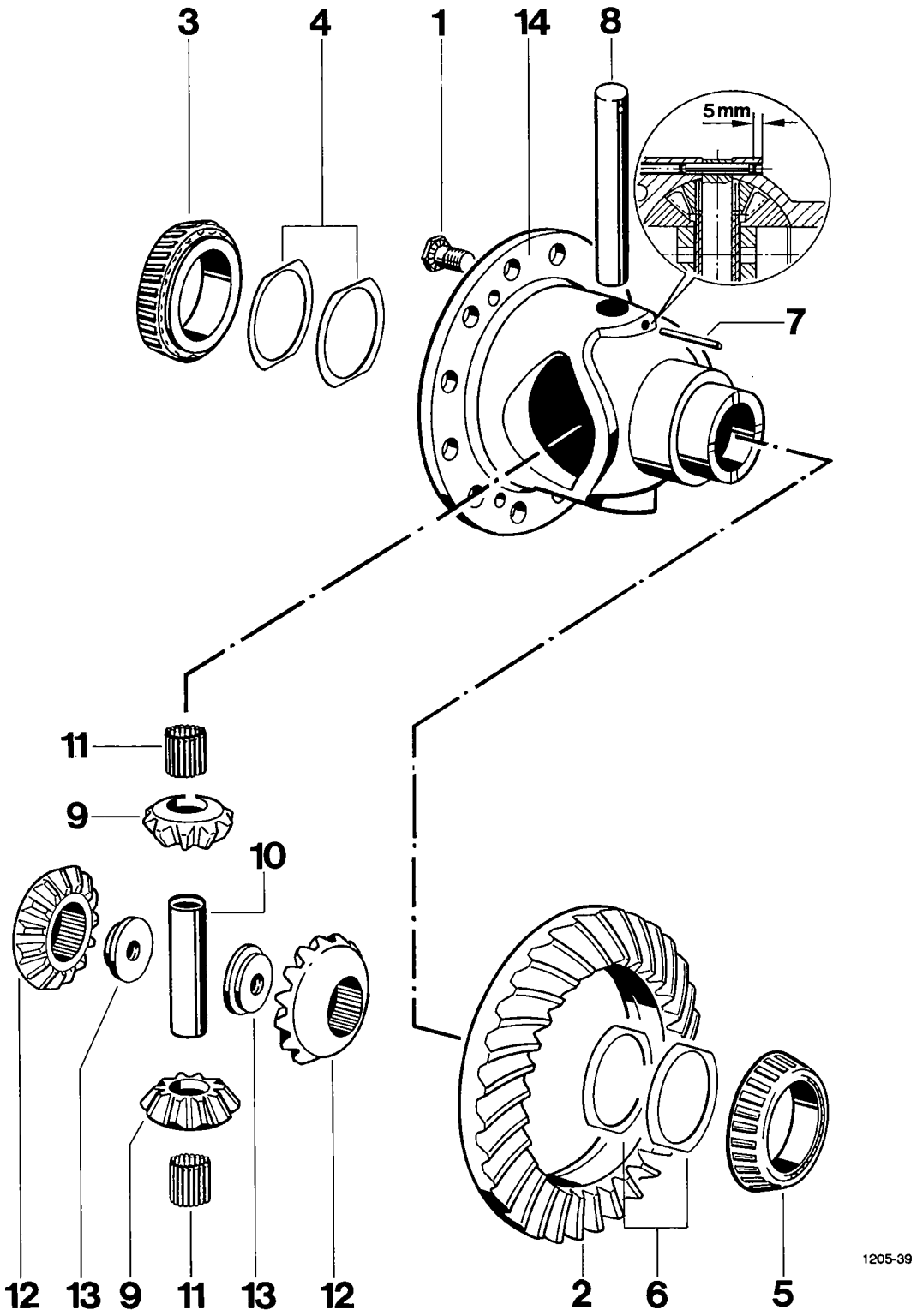
Dismantling and assembling differential



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No.	Designation	Qty.	Note: Removal	Installation
1	Ring gear bolt (Verbus Ripp bolt)	12		Always replace with new bolt. Threads must be dry and free from grease. Tighten to 200 Nm (148 ftlb)
2	Ring gear	1		Threaded holes for ring gear bolts must be dry and free from grease. Observe matching number. Readjust if required
3	Tapered roller bearing inner race	1	Pull off with suitable puller and P 263	Press on with P 264 b
4	Adjusting shim	X	Mark for reinstallation	Redetermine thickness if required
5	Tapered roller bearing inner race	1	Pull off with suitable puller and P 263	Press on with P 264 b
6	Adjusting shim	X	Mark for reinstallation	Redetermine thickness if required
7	Spiral pin	1		Drive in to correct position
8	Pin	1		
9	Small differential gear	2		Coat semi-circular surface with MoS2 paste. Replace only as a set (with large differential gears)
10	Spacer sleeve	1		
11	Roller insert (31 individual needle rollers each)	2	Be careful not to lose any needle rollers	Insert with stiff grease
12	Large differential gear	2		Coat semi-circular surface with MoS2 paste. Replace only as a set (with small differential gears)
13	Threaded insert	2		
14	Housing	1		

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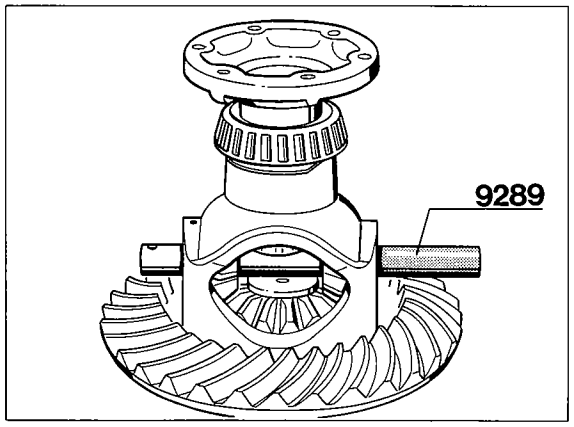
Dismantling and assembly notes

Note

The small differential gears are supported by two roller inserts consisting of 31 individual needle rollers each.

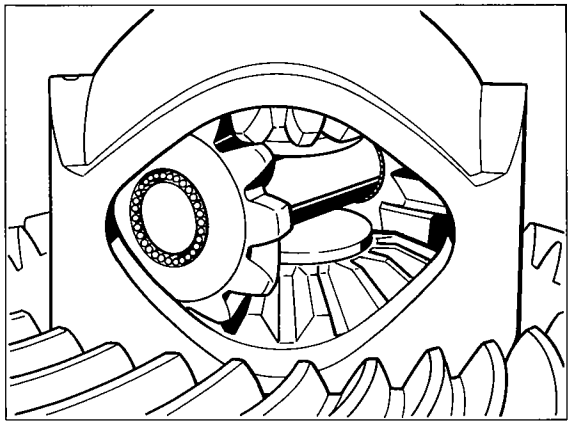
Dismantling

1. Press out pin with centering mandrel **9289**.



539-39

2. Use centering mandrel to turn small differential gears towards the housing openings and take them out carefully. Be careful not to lose any needle rollers.

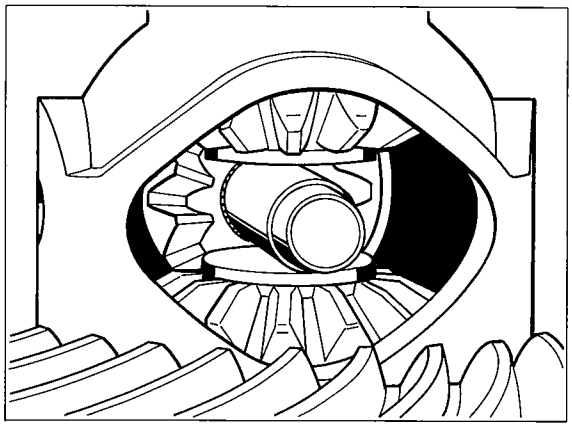


540-39

Assembly

1. Insert large differential gears with pressed-in threaded washers across the large aperture in the differential housing and locate them with the joint flanges.

2. Preassemble a small differential gear with 31 needle rollers, centering mandrel **9289** as well as the spacer sleeve and insert across one of the openings in the housing.



541-39

3. Assemble second differential gear with 31 needle rollers and push carefully onto the centering mandrel. Be careful not to lose any needle rollers.

Note

To facilitate assembly, apply stiff grease to needle rollers prior to inserting them.

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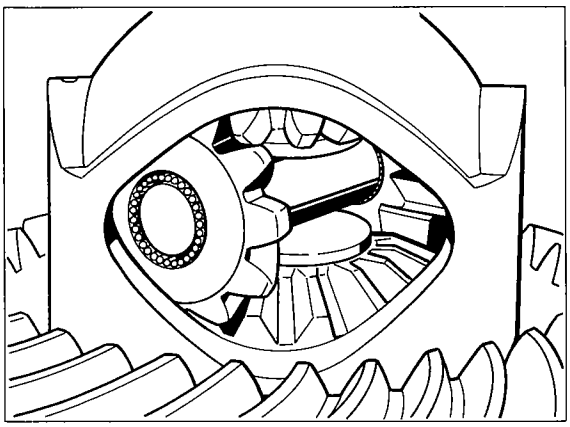
4. Turn small differential gears with centering mandrel until the bores in the housing line up.



540-39

5. Press in differential pin until it is seated in correct position, take off centering mandrel and lock pin according to specifications.

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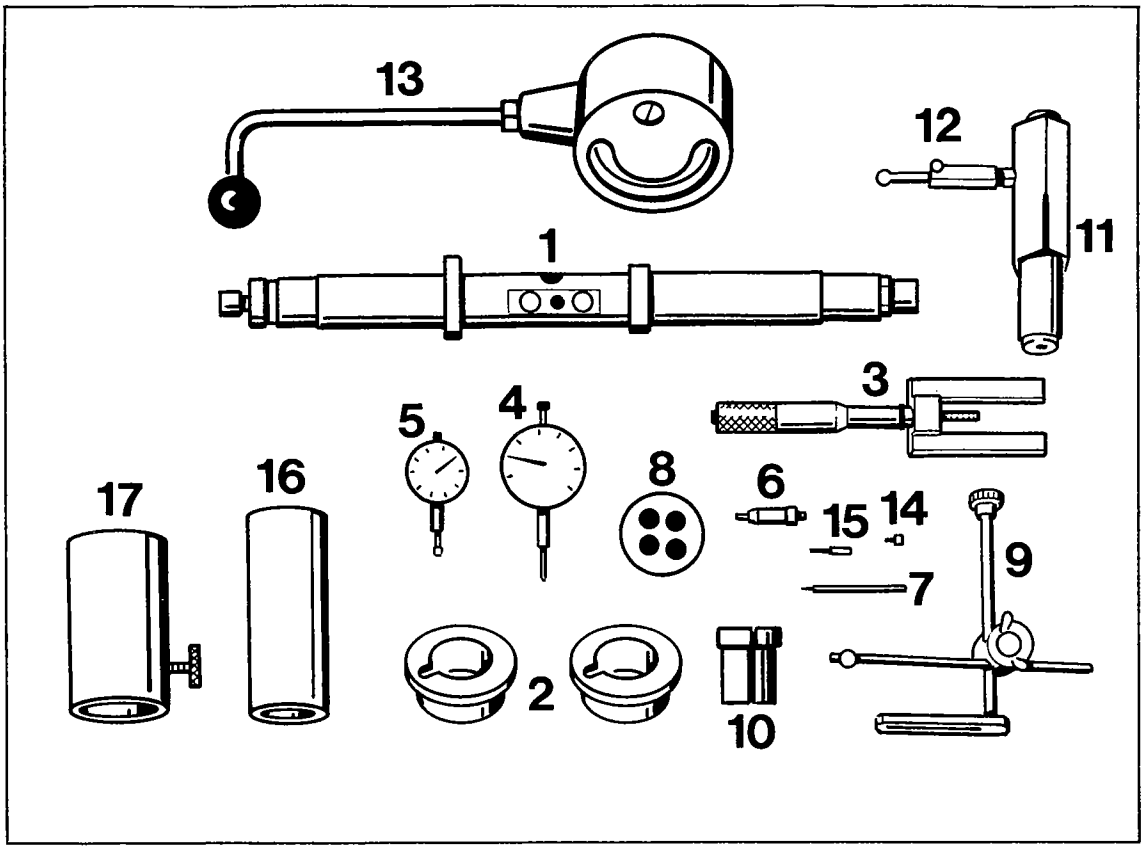
Adjusting drive set

Tools



1222-39

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Adjusting drive set

Tools

No.	Designation	Special tool	Order number	Explanation
1	Measuring mandrel	VW 385/1		
2	Centering sleeves	9109	000.721.910.90	
3	Master gauge	VW 385/30		
4	Dial gauge	-		commercially available
5	Dial gauge	-		commercially available, measuring range 3 mm
6	Gauge plunger	VW 385/14		
7	Dial gauge extension	VW 385/56		Length 30 mm
8	Gauge block plate	VW 385/17		
9	Dial gauge bracket	VW 387		
10	Clamping sleeve	9145		000.721.914.50
11	Adjusting device	VW 521/4		
12	Measuring lever	VW 388		
13	Torque gauge	-		commercially available 0...600 Ncm
14	Dial gauge extension	VW 382/10		Length 6.0 mm
15	Dial gauge extension	9150	000.721.915.00	Length 20 mm
16	Pipe section	VW 418a		
17	Clamping device	VW 548		

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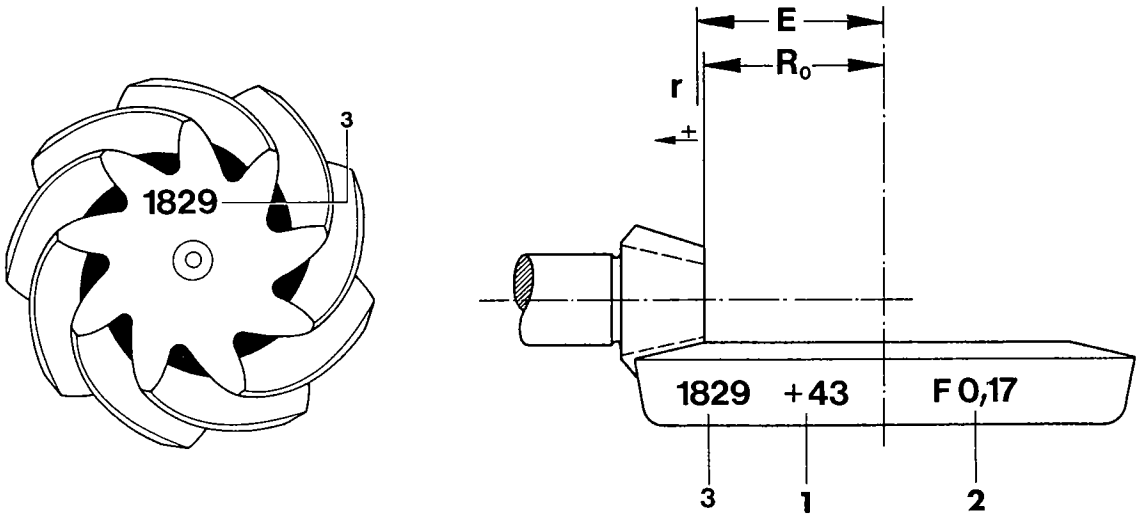
Adjusting drive set

General

The setting of drive pinion and ring gear is a determining factor for the service life and smooth running of the rear-axle drive. Drive pinions and ring gears that have been checked for good tooth contact pattern and low noise in both directions of rotation on special test equipment are therefore matched during production. The position at which smoothest running can be achieved is determined by shifting the drive pinion axially, with the ring gear being kept within the tolerance of the prescribed tooth backlash. The deviation „r" from the specified design dimension "Ro" is determined and is engraved on the outer circumference of the ring gear. Ring gear and drive pinion have been designed in such a manner that the deviation „r" always adds to the design dimension "Ro", i.e. it has a positive sign.



215-39

Ro = Design dimension (69.65 mm)
r = Deviation „r"
1 = Deviation "r" (is always indicated in 1/100 mm. Example: +43 means „r" =0.43 mm)
2 = Tooth backlash (e.g. 0.17 mm)
3 = Matching number
E = Setting (actual dimension between ring gear axis and face of the drive pinion at the point of smoothest running for this particular drive set) E = Ro + r

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Adjustment overview

When assembling the transmission, the drive pinion and ring gear or drive set only require adjustment if parts have been replaced which have a direct influence on the setting of the final drive. Refer to the following table to avoid unnecessary adjustment procedures:

Adjust: / Replaced component:	Ring gear (S1 + S2)	Drive pinion via deviation „r“	Drive pinion adjusting shim “S4”
Transmission housing	X	X	
End shield			X
Differential housing	X		
Tapered roller bearing for drive pinion		X	
Tapered roller bearing for differential	X		
Drive set	X	X	
Cover for final drive	X		
Needle roller bearing for 1st gear			X
Synchronizer hub for 1st and 2nd gear			X
Needle roller bearing for 2nd gear			X
3rd gear gearwheel			X
Spacer sleeve			X
4th gear gearwheel			X

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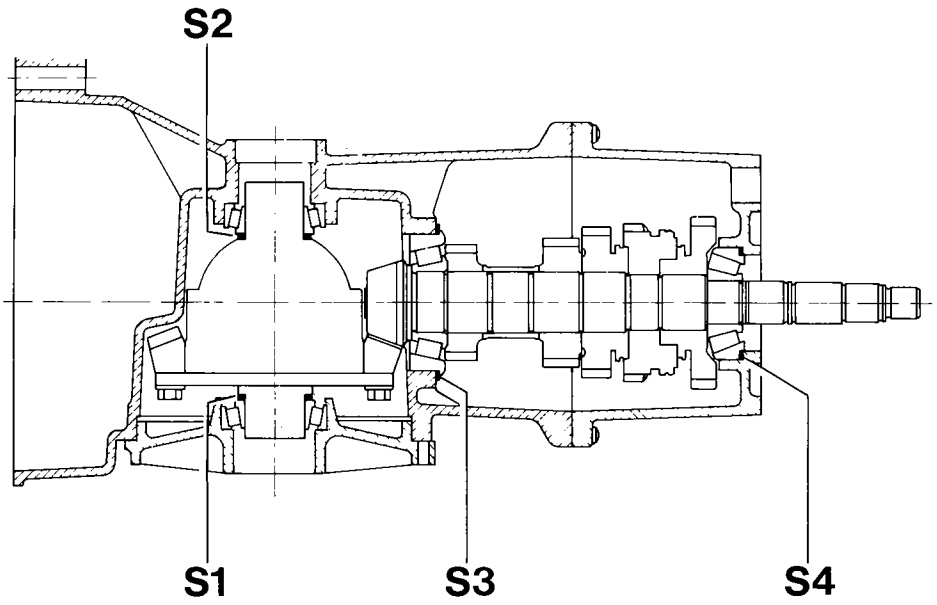
Practical procedure when readjusting the drive set



1206-39

S1 = Ring gear adjustment shim

S2 = Ring gear adjustment shim

S3 = Drive pinion adjustment shim

S4 = Drive pinion adjustment shim

If it becomes necessary to adjust drive pinion and ring gear, follow the below sequence to ensure an efficient working procedure:

1. Determine the total shim thickness "Stot" (S1 plus S2) for the specified preload on the tapered roller bearings/differential.

2. Determine the total shim thickness "Stot" (S3 plus S4) for the specified preload of the tapered roller bearings/drive pinion.

3. Split total shim thickness "Stot" into S3 and S4 in such a manner that the dimension from the center of the ring gear to the face of the drive pinion corresponds to the installation dimension "E" determined during manufacture.

4. Split total shim thickness "Stot" into S1 and S2 so that the specified circumferential backlash is present between ring gear and drive pinion.

The aim of this adjustment is to restore the smoothest running position which has been achieved on test equipment in the production line.

To achieve correct results, greatest possible cleanliness for all assembly work and measuring procedures is essential.

Adjusting drive pinion

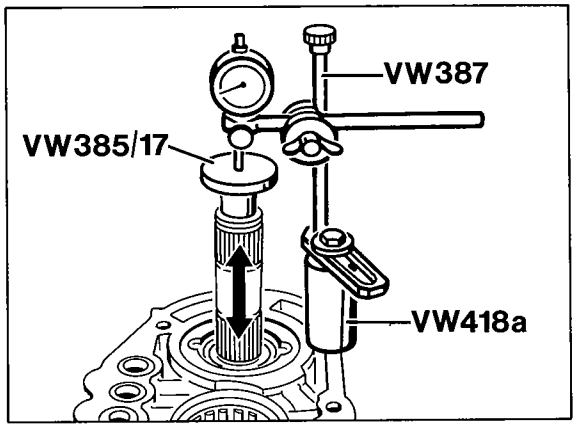
Determining total shim thickness „Stot" (S3 plus S4)

(Adjusting preload of tapered roller bearings/drive pinion).

1. Fit tapered roller bearing outer races **without** adjustment shims into the transm. housing and into the end shield, respectively.

2. Insert fully assembled drive pinion. Place end shield into position and tighten bolts to 25 Nm (18 ftlb).

3. Fit measuring tools. Set dial gauge (3 mm measuring range) to zero at a preload of 1 mm. Length of dial gauge extension is approx. 30 mm.



1193-39

Note

Before carrying out measurements, rotate drive pinion in both directions to allow the tapered roller bearings to settle.

4. Move drive pinion up and down. Read off backlash at dial gauge and record backlash. Do not rotate the drive when moving it up and down as this may give faulty readings. Example: 1.40 mm.

5. Remove end shield again.

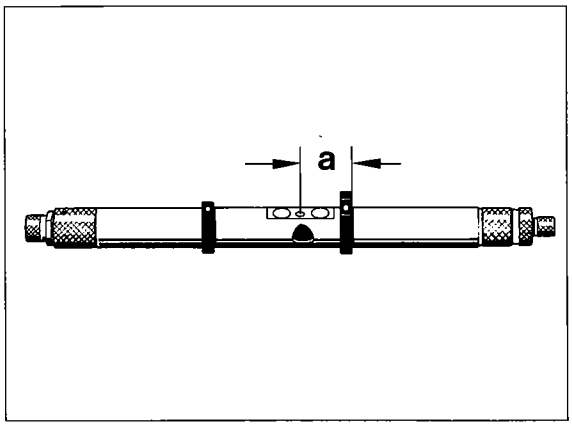
Determining total shim thickness "Stot" (S3 plus S4)

Stot	= Measuring dimension + Pressure
Pressure	= 0.20 mm (constant value)
Measuring value	= 1.40 mm (Example)
Stot	1.60 mm

Determining dimension "e"

1. Insert shims to the determined total shim thickness (1.60 mm for our example) behind the tapered roller bearing outer race into end shield (S4 side). Refit end shield again, tighten bolts and rotate drive pinion into both directions to allow the tapered roller bearings to settle.

2. Set adjustment ring of measuring mandrel VW 385/1 to dimension "a".



223-39

A = approx. 68 mm

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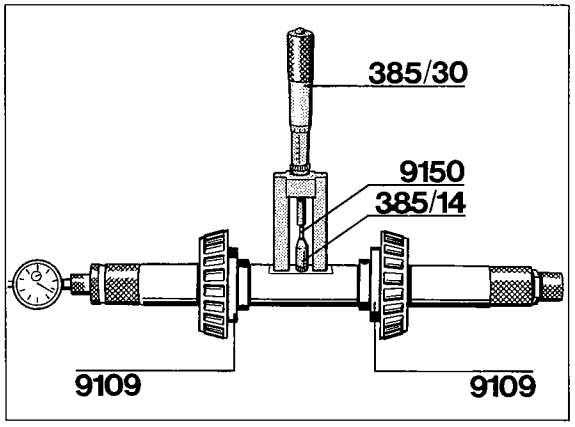
3. Assemble measuring mandrel acc. to figure.



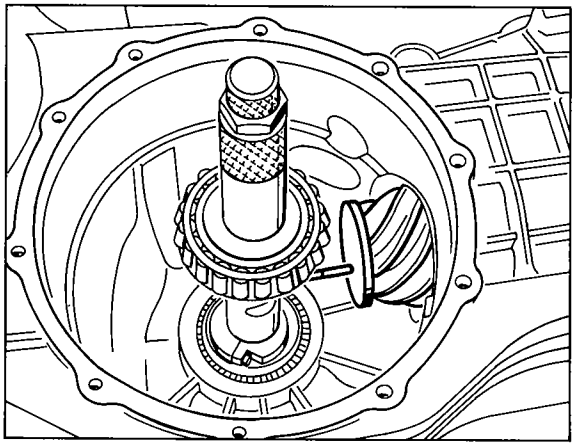
543-39

4. Use dial gauge extension 9150 = 20 mm length.

5. Set master gauge to dimension
Ro = 69.65 mm
and place onto measuring mandrel. Set dial gauge (3 mm measuring range) to zero at a preload of 1 mm.

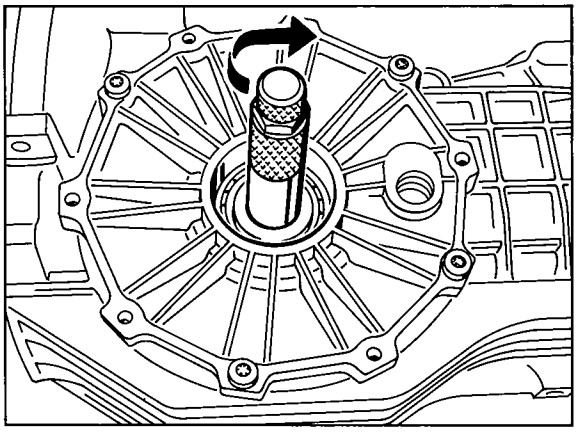
6. Turn back moving adjustment ring until it is seated against the stop.

7. Place gauge block plate VW 385/17 onto drive pinion head and insert measuring mandrel into transmission housing. Dial gauge extension rests in the gauge block plate area.



9. Fit final drive cover carefully (do not tap as this may cause the gauge block plate to slide off) and tighten with 4 bolts.

10. Pull second centering sleeve outwards across moving adjustment ring until the measuring mandrel can just about be turned.



1203-39

11. Turn measuring mandrel carefully until the dial gauge extension is vertical to the face of the drive pinion head. At this point, the pointer of the dial gauge is at its maximum deflection (reversing point) and the dial gauge must now be read.
The measured value corresponds to dimension „e".
Example: 0.46 mm

Determ. thickness of adjustment shim „S3"

S3 = e + r

e = Determined value
(max. dial gauge deflection)

r = Deviation (indicated in 1/100 mm on the ring gear, e.g. 43)

Example:

Value read off on dial gauge „e“	0.46 mm
Deviation “r“ indicated on ring gear:	+ 0.43 mm
Shim thickness „S3“	0.89 mm

Shims S3 available as spare parts:
Thickness in mm
0.45 - 0.50 - 0.55 - 0.60 - 0.65 - 0.70 - 0.75 - 0.85

Note

The tolerances of the adjustment shims allow any thickness to be measured for „S3“. Measure shims in several places using a micrometer. Also check shims for burrs or damage.

Fit only shims in perfect condition!

Determining thickness of adjustment shims „S4“

S4 = Stot - „S3“

Example:

Total shim thickness	1.60 mm
Shim thickness S3	- 0.89 mm
Shim thickness S4	0.71 mm

Shims S4 available as spare parts:
Thickness in mm
0.45 - 0.50 - 0.55 - 0.60 - 0.65 - 0.70 - 0.75 - 0.80 - 0.85 - 1.25

Measure adjustment shims in several places using a micrometer. Check shims for burrs or damage.

Fit only shims in perfect condition!

Checking dimension „E“

1. Fit drive pinion with measured adjustment shims „S3“ and “S4“ and rotate several times in both directions.

2. Place measuring mandrel into position and measure again to check.

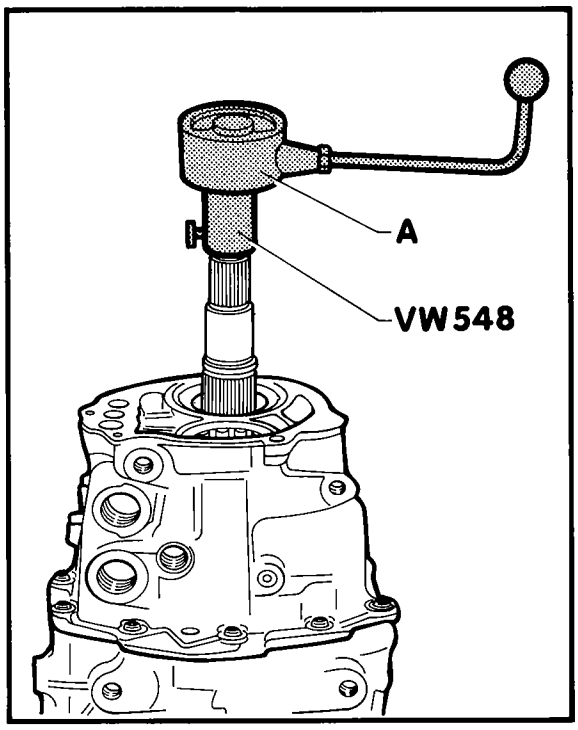
3. If the shims have been selected correctly, the dial gauge must indicate the value of the recorded deviation „r“ with a tolerance of ± 0.04 mm when it is read off in counterclockwise direction.

Checking preload of tapered roller bearings on drive pinion

Note

Oil bearings with hypoid transmission oil.

The preload must be 200...400 Ncm for new bearings and 50...60 Ncm for used bearings.



A - Torque gauge, commercially available 0...600 Ncm

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Adjusting ring gear

Determine total shim thickness "S tot" ($S_1 + S_2$).

The ring gear must be readjusted if the

transmission housing,
transmission side cover,
tapered roller bearings for differential,
differential housing or drive set
have been replaced.

Note

The drive pinion must be removed in order to determine the preload of the differential tapered roller bearings.

1. Make sure the bearing outer races of the tapered roller bearings are well seated in the transmission housing or transmission side cover, respectively.

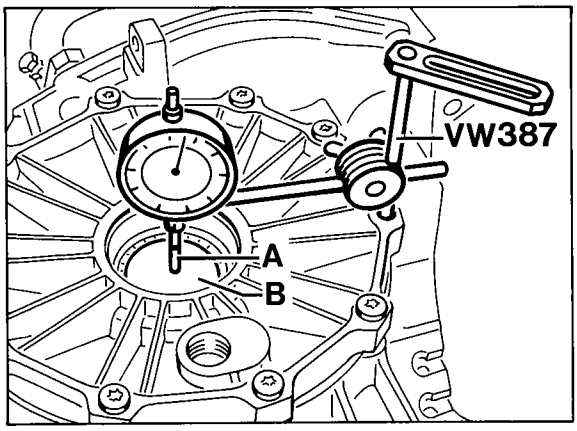
2. Fit one 2.5 mm spacer both on the ring gear side of the differntial to be used as well as on the opposite side.

3. Place differential into transmission housing and rotate repeatedly.

4. Fit transmission side cover without seal and tighten all bolts to 25 Nm.

5. Place gauge block plate **VW 385/17** on the collar of the differential.

6. Fasten universal dial gauge holder **VW 387** with dial gauge and extension to the housing and set to zero with 2 mm preload.



1192-39

A = Dial gauge extension (approx. 30...40 mm long)
B = Gauge block plate VW 385/17

7. Move differential up and down. Read off backlash on the dial gauge and note.

Note

Do not turn differential while measuring backlash as this will give an incorrect reading.

8. Calculate "S tot".
   "S tot" = thickness of inserted shims
   + measured value
   + pressure fit of tapered roller bearings

Example

Thickness of inserted shims	5.00 mm
Measured value	0.90 mm
Pressure fit (constant value)	0.25 mm
"S tot"	6.15 mm

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9. Remove differential, pull off both tapered roller bearings and distribute calculated shim thickness "S tot" as follows.
   As a start for backlash adjustment, the thickness of spacer S_1 is reduced by 0.70 mm while the thickness of spacer S_2 is increased by 0.70 mm.

Example

Total shim thickness of spacers
$S_1 + S_2 = 6.15$ mm

Thickness of spacer S_1

6.15 mm / 2	=	3.075 mm
		− 0.700 mm
		2.375 mm

Thickness of spacer S_2

6.15 mm / 2	=	3.075 mm
		+ 0.700 mm
		3.775 mm

Note

The spacers are available in thicknesses of 1.6...3.1 mm in increments of 0.10 mm.

A 0.25 mm shim allows the ring thicknesses to be selected in increments of 0.05 mm.

The shim thicknesses calculated must be rounded up or down for plausible dimensions that will not alter the total shim thicknesses S_1 and S_2.

Example:

Calculated ring thicknesses

$S_1 + S_2 = 2.375 + 3.775 = 6.15$ mm

Rounded down ring thicknesses

$S_1 + S_2 = 2.35 + 3.80 = 6.15$ mm

Measure shims in several places using a micrometer. Admissible deviation is 0.02 mm. Also check shims for burrs and damage.

Adjusting circumferential backlash

Note

The backlash to be set is engraved on the ring gear.

1. Fit drive pinion using shims „S3" and "S4".

2. Fit differential with tapered roller bearings into housing, inserting the spacers (S_1 + S_2) determined before.

3. Fit transmission side cover and tighten all mounting bolts to **25 Nm**.

Note

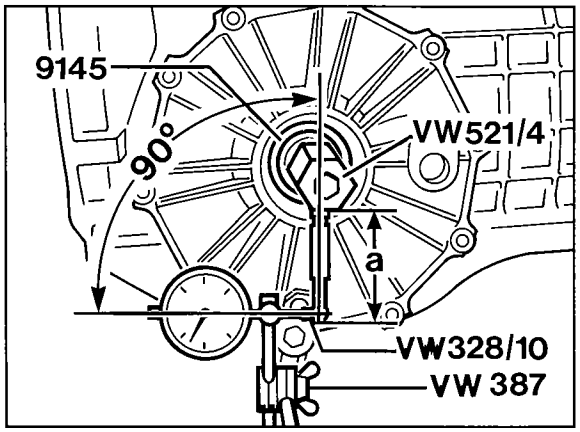
Always make sure that there is a certain amount of backlash when tightening the bolts. Never allow the drive pinion to bind.

4. Assemble measuring lever **VW 388** and adjusting device VW 521/4 and adjust lever length to 80 mm with the plunger. Refer to dimension "a" in the figure.

5. Insert adjusting device with clamping sleeve (Special Tool 9145) into the differential and clamp firmly.

6. Rotate differential in both directions several times to allow the tapered roller bearings to settle.

7. Fit universal dial gauge holder with flat extension in such a way as to produce a right angle between dial gauge axis and lever.



1202-39

Dimension "a" = approx. 80 mm

8. Turn ring gear carefully at the clamping screw of the adjusting device up to the stop and set the dial gauge to zero. Turn back ring gear and read off circumferential backlash. Note the reading.

9. After turning the ring gear another 90° each, repeat measuring procedures three times. The measured values must not deviate from one another by more than 0.05 mm.

Note

The backlash to be adjusted is engraved on the ring gear. The actual value may be less than the specified value by - 0.05 mm. Under no circumstances must the backlash be greater than the specified value.

10. If the required backlash cannot be obtained, replace spacers (S_1 + S_2) again. The total shim thickness (S tot) must not be altered, however.

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page

Automatic Transmission, Operation, Housing

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Removing and installing transmission - Model A 44

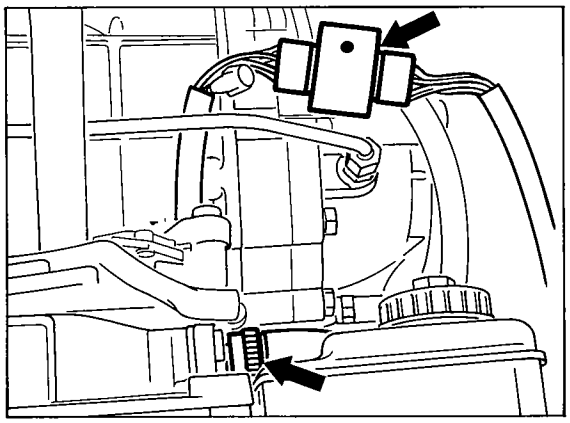
Removal

1. Remove rear muffler and heat shield.

2. Unbolt drive shafts on transmission side and suspend horizontally on vehicle.

3. Pull off reverse light switch connector and unclip wire from transmission housing. On USA vehicles, remove support at rear transmission cover.

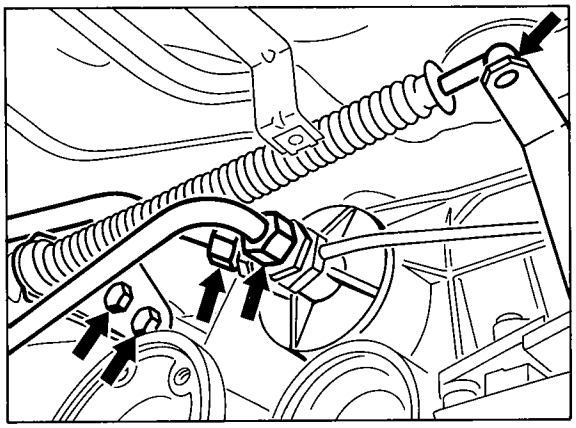
4. Disconnect wiring connectors at transmission.



1144-37

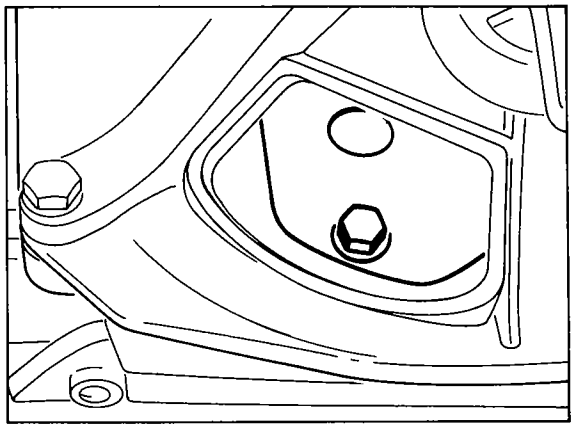
5. Disconnect ATF lines from transmission housing, using a second open-ended wrench to lock. Plug oil bores to avoid ingress of dirt.

6. Disconnect selector lever cable from lever and bracket from transmission. The ball socket keeps the cable from jumping out of position.



1145-37

7. Remove cover for service hole and undo torque converter fastening bolts. If required, lock pulley to keep assembly from turning.



1146-37

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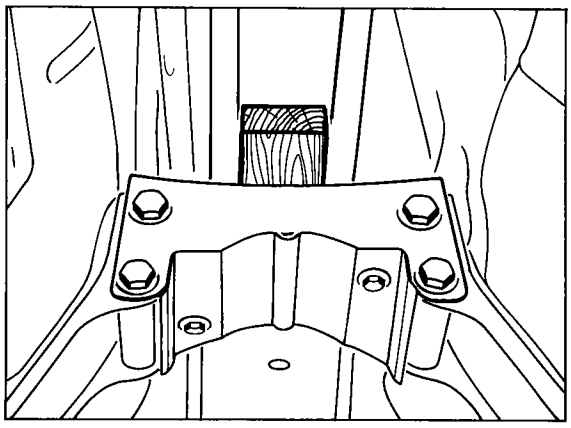
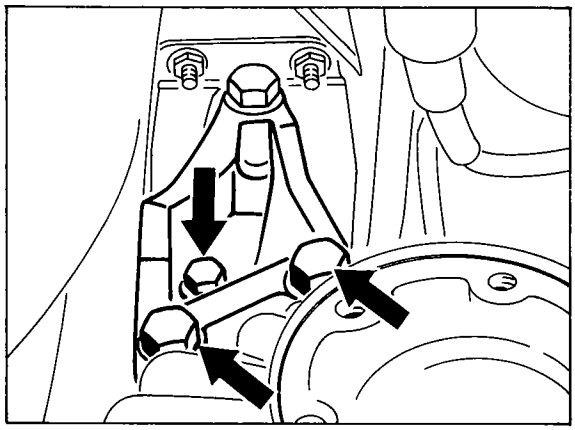
8. Keep transmission complete with central tube in installation position, placing a suitable wooden block between crosslink and central tube. Make sure the oil lines have enough clearance.



1147-37

9. Place transmission jack below transmission and secure with mounting strap.

10. Remove fastening bolts for transmission mounts.



1148-37

11. Remove fastening bolts for transmis sion/central tube housing. Pull back transmission with torque converter and extract carefully towards bottom. Secure torque converter against dropping out.

Installation

1. Fit transmission using the transmission jack. Apply a light coat of multipurpose grease to the lug at the torque converter and guide in the driver plate.

2. Put transmission into place and fit flange bolts. Tighten all fastening bolts to the specified torque.

3. Retain transmission in installation position and fit transmission mount.

4. Tighten ATF lines to the transmission, fitting new seals.

5. Fit bracket to transmission and engage selector lever cable in D position. The selector lever must engage into the D and M positions by itself.

6. Check adjustment. Select all gears and check if the respective gears are indicated on the speedometer. Also check gate change from „D" to „M". A straight movement must be possible without binding of the lever.

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7. Refit wiring connectors, drive shafts, driver plate and exhaust system.

Tightening torques:

Transmission to central tube	M 10	42 Nm (31 ftlb)
Driver plate to torque converter	M 10	76 Nm (56 ftlb)
Screw fitting of oil line to adapter		24 Nm (18 ftlb)
Bracket on transmission	M 8	23 Nm (17 ftlb)
Drive shafts	M 8	42 Nm (31 ftlb)

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page

Front wheel suspension

Rear wheel suspension, drive shaft

Wheels, tires, alignment

Brakes, mechanical

Brake, hydraulics, regulator, booster

Steering

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page

Body, general

Doors

Convertible top

Bumpers

Glasses, window control

Exterior equipment

Interior equipment / Airbag

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Dismantling and assembling suspension

Tools

No.	Designation	Special tool	Order number	Explanation
–	Tie rod extractor			Commercially available, e.g. Nexus 168 - 1

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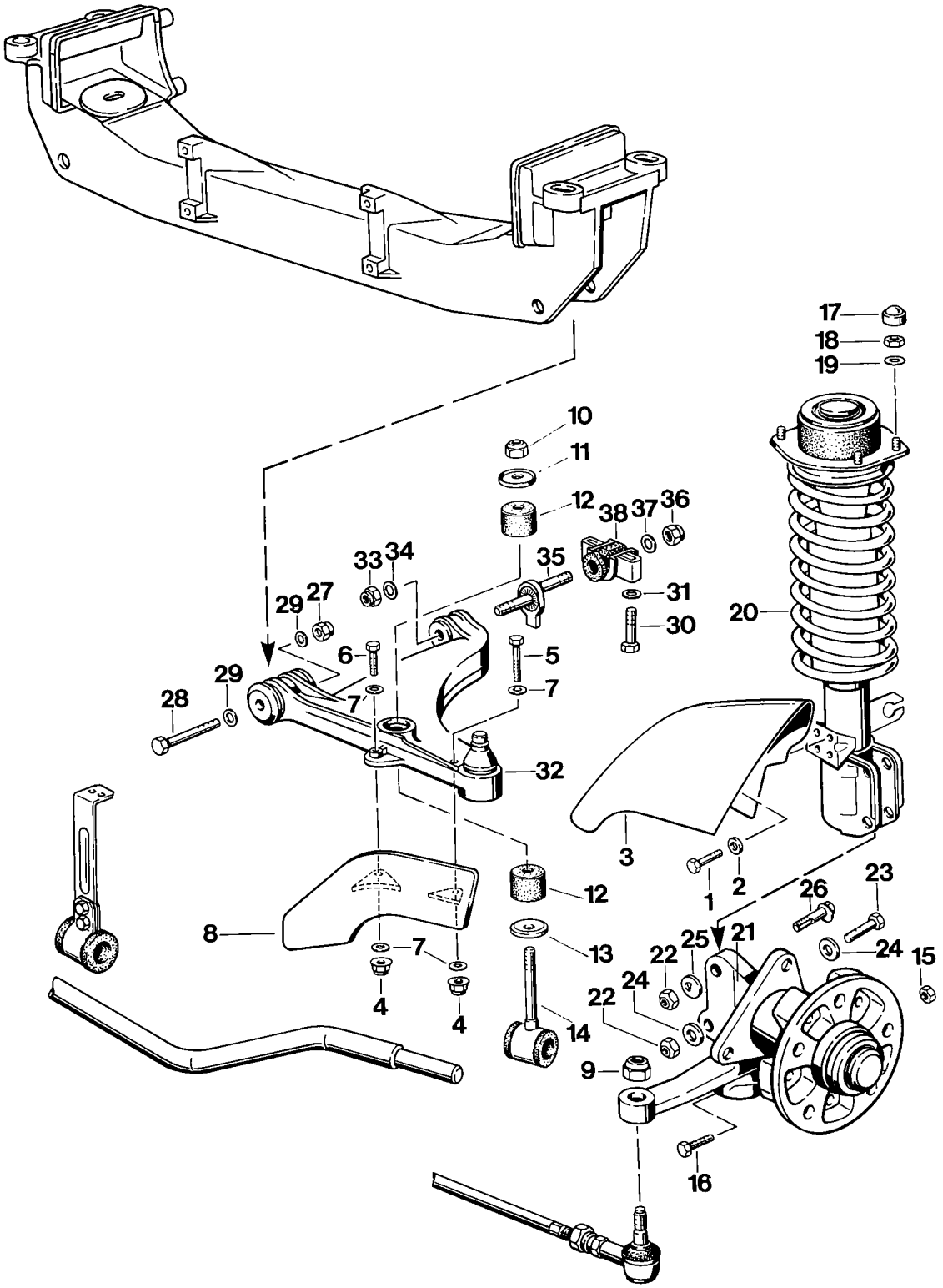
Dismantling and assembling suspension



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No.	Designation	Qty.	Note: Removal	Note: Installation
1	Hexagon head bolt M 6 x 20	2		Tighten to 10 Nm (7 ftlb)
2	Washer	2		
3	Cooling air duct	1		
4	Hexagon head bolt	2		Tighten to 10 Nm (7 ftlb)
5	Hexagon head bolt M 6 x 45	1		
6	Hexagon head bolt M 6 x 35	1		
7	Washer	4		
8	Cooling air duct	1		
9	Lock nut	1		Replace. Taper of ball joint and operating lever must be gree from grease. Tighten to 50 Nm (37 ftlb)
10	Lock nut	1		Replace. Tighten to 25 Nm (18 ftlb)
11	Cup washer	1		Identical to No. 13
12	Rubber mount	2		
13	Cup washer	1		Identical to No. 11
14	Stabilizer bar link	1		
15	Lock nut	1		Replace. Tighten to 50 Nm (37 ftlb)
16	Hexagon head bolt	1		Grease stem and threads with Optimoly HT. Coat stem of ball joint of axle strut with Tectyl (underbody wax)
17	Cap	4		
18	Hexagon head nut	4		Tighten to 25 Nm (18 ftlb)
19	Washer	4		

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No.	Designation	Qty.	Note: Removal	Installation
20	Spring strut	1	To remove the strut, the steering knuckle and the subsequent parts (Nos. 22 to 26) do not have to be removed	
21	Steering knuckle	1		If the steering knuckle has been separated from the strut, the wheel alignment must be checked and/or corrected
22	Lock nut	2		Replace. Tighten to 120 Nm (88 ftlb)
23	Hexagon head bolt	1		Replace. Use only genuine bolt. Coat threads with Optimoly HT
24	Washer	2		Replace
25	Eccentric washer	1		
26	Eccentric bolt	1		Coat threads with Optimoly HT
27	Lock nut	1		Replace. Tighten to 65 Nm (48 ftlb)
28	Hexagon head bolt M 12	1		Coat threads and stem with Optimoly **TA**
29	Washer	2		
30	Hexagon head bolt M 10	2		Coat threads with Optimoly HT. Tighten to 46 Nm (34 ftlb)
31	Washer	2		

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No.	Designation	Qty.	Note: Removal	Installation
32	A-arm	1		No welding or straightening is permissible on the A-arm. Coat stem of ball joint with Tectyl (underbody wax by Valvoline)
33	Lock nut	1	Undo only if A-arm or caster eccentric is to be replaced	Replace after removal. Tighten to 100 Nm (73 ftlb)
34	Washer	1		
35	Caster eccentric	1		Fit only new version (with serrations at A-arm end). Do not exceed specified caster setting. For caster adjustment, refer to page 44 - 9
36	Lock nut	1	Undo only if caster eccentric or rubber mount (No. 37) is to be replaced	Replace after removal. Tighten to 100 Nm (73 ftlb)
37	Washer	1		
38	Rubber mount	1		Replace if required

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Dismantling and assembly notes

Dismantling

1. Remove front wheel.

2. Open combination plug at A-arm and pull out connector. Unclip wiring at spring strut.

3. Remove brake caliper from steering knuckle and suspend at a suitable location.

4. Remove brake cooling air duct from A-arm and spring strut.

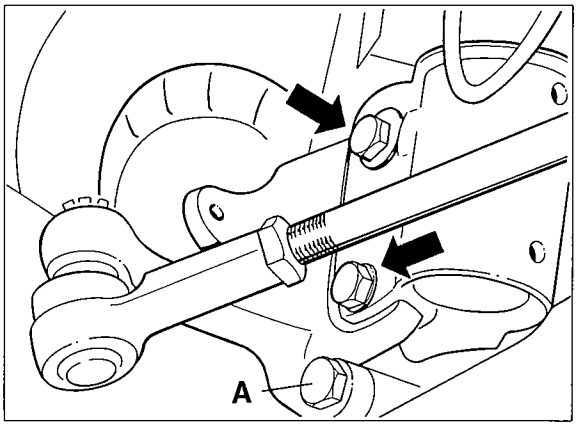
5. Separate tie-rod ball joint from operating lever. Use a suitable separator, e.g. Nexus 168 - 1.

6. Undo stabilizer mount at stabilizer bar and A-arm.

7. Separate A-arm (ball joint) from steering knuckle (A). Undo strut at body. Remove strut and steering knuckle.

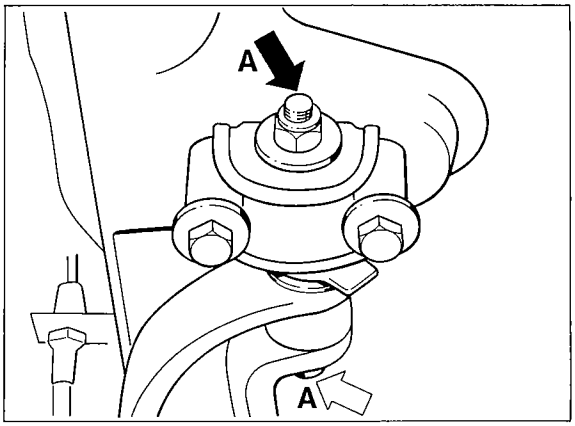
Note

Undo bolt unions (arrows) of strut and steering knuckle (camber adjustment) only if components are to be replaced.



1108A - 40

8. When removing the A-arm, undo bolt union (A) – caster eccentric to A-arm mount or A-arm (caster adjustment) – only if the A-arm or A-arm mount is to be replaced.



1107A - 40

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Assembly

1. Assemble in reverse order.
   No welding or straightening is permissible on suspension components.
   Use specified assembly pastes. Observe correct tightening torques.

2. When carrying out assembly operations affecting ride level height or wheel adjustment settings, the suspension alignment must be checked.

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Dismantling and assembling suspension

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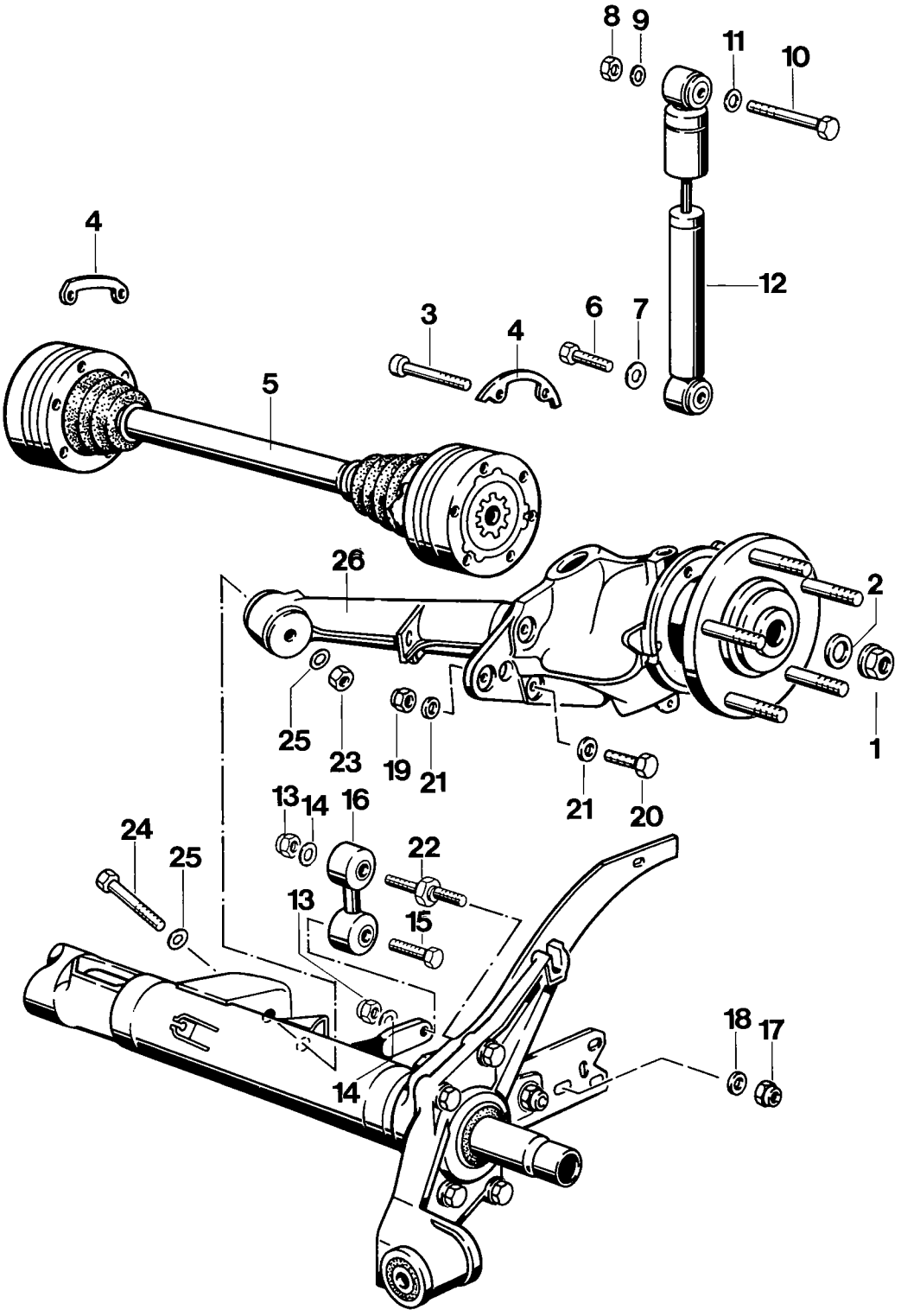
Dismantling and assembling suspension



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No	Designation	Qty.	Note: Removal	Installation
1	Lock nut	1	Undo only if rear-axle trailing arm, wheel bearing or wheel hub is to be replaced. Loosen nut before raising the vehicle. Actuate brakes when undoing the nut.	Replace after each removal. Coat threads with Optimoly HT. Tighten to 500 Nm (369 ftlb)
2	Washer	1		
3	Pan head screw	2 x 6		Tighten to 42 Nm (31 ftlb)
4	Support plate on transmission side on wheel side	 3 3		2 versions (transmission side and wheel side)
5	Drive shaft	1		
6	Hexagon head bolt	1	Raise trailing arm, e.g. with tensioning device VW 655/3 (to unload bolt)	Coat threads with Optimoly HT. Tighten to 123 Nm (91 ftlb)
7	Washer	1		
8	Hexagon head nut	1		Tighten to 61 Nm (45 ftlb)
9	Washer	1		
10	Hexagon head bolt	1		Coat threads and bolt stem with multipurpose grease.
11	Washer	1		
12	Vibration damper	1		
13	Lock nut	2		Tighten to 46 Nm (34 ftlb)
14	Washer	2		
15	Hexagon head bolt	1		
16	Stabilizer mount	1		
17	Lock nut	1		Replace, tighten to 90 Nm (66 ftlb)
18	Washer	1		

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No.	Designation	Qty.	Note: Removal	Note: Installation
19	Lock nut	2		Replace, tighten to 103 Nm (76 ftlb)
20	Hexagon head bolt	2		Check threads, replace bolt(s) if required.
21	Washer	4		
22	Camber eccentric	1		
23	Lock nut	1		Replace, tighten to 61 Nm (45 ftlb). Do not tighten to final specifications until the vehicle is back on its wheels
24	Hexagon head bolt	1		
25	Washer	2		
26	Trailing arm	1	Mark position of arm flange with regard to spring brace for reinstallation	No welding and straightening is permissible on the arm. Carry out suspension alignment.

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Dismantling and assembly notes

Dismantling

1. If the trailing arm, the wheel bearing or the wheel hub is to be replaced, undo drive shaft nuts (M 18 lock nut on wheel hub) before raising the vehicle. Apply brakes at the same time.

2. Remove rear wheel.

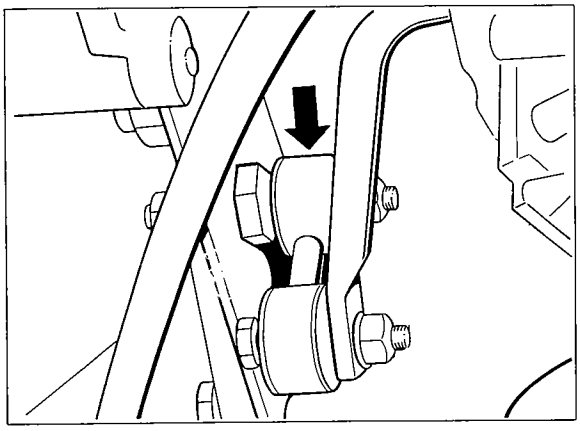
3. Open combination plug at trailing arm and pull out connectors.
   Unclip or extend wire at trailing arm.

4. Disconnect brake pipe from brake hose at trailing arm and remove brake caliper. Before disconnecting the pipe, press down brake pedal with pedal retainer to keep brake fluid from flowing down from the reservoir.

5. Remove parking brake assembly from rear-axle trailing arm.

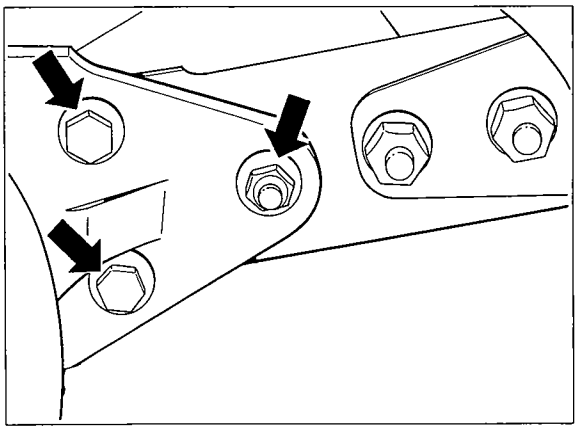
6. Undo pan head screws for constant velocity joint. If the drive shaft is undone on the wheel side or transmission side only, respectively, suspend drive shaft in horizontal position.

7. Undo shock absorbers at trailing arm. Remove stabilizer mount (arrow). Raise trailing arm somewhat for both assembly operations.



1105A-44

8. Undo spring brace/trailing arm union. Mark position of trailing arm before undoing the bolt union.



1104A-44

9. Separate trailing arm from rear-axle crosstube and remove trailing arm.

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Assembly

1. Assemble in reverse order.
   No welding and straightening operations are permissible on suspension components.
   Use specified assembly pastes. Observe correct tightening torques.

2. Tighten trailing arm to rear-axle crosstube mounting bolt only when the vehicle is back on its wheels.

3. Adjust parking brake. Bleed rear brake circuit.

4. If assembly operations affecting the vehicle ride height have been performed, the suspension alignment (vehicle height and wheel alignment settings) must be adjusted as required.
   When replacing components or undoing bolt unions that affect the wheel alignment, check and/or adjust the wheel alignment.

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Changing the brake fluid / bleeding the brakes

Important Notes

Use only new DOT brake fluid. **Observe change intervals and brake fluid grade.** Total brake fluid quantity for fluid change: **approx. 1 liter.**

On vehicles up to MY '92, the brake fluid must be replaced **every 2 years** as a minimum.

As of MY '93, the brake fluid change interval has been increased to **3 years** - along with the use of special DOT 4 brake fluid.

The 3-year change interval is valid as of MY '93, but only in conjunction with the use of the special Porsche brake fluid. The brake fluid is available under Part No. 000.043.202.04.
Container contents: 5 liters (as of May, 1992).

This special brake fluid may also be used on pre-MY '93 vehicles. However, the **two-year** fluid change interval will remain valid for those vehicles.

Brake fluid

The new brake fluid - Part No. 000.043.202.04 - offers superior properties. Compared to the brake fluid specified previously, its main features are **further reduction of water absorption and increased wet and dry boiling points.**
Notes on water absorption: Water contents of only 2 % in the brake fluid will cause the boiling point to drop by approx. 60°C.

As of MY '93, only the new brake fluid must be used when topping up the reservoir. Any mixture of former brake fluid with the new brake fluid causes the safety margin of the fluid to be narrowed down unnecessarily. Both the former and the new brake fluid are of amber color.

Sequence of operation for bleeding and brake fluid change

- Fill reservoir with new brake fluid up to the upper edge. **Connect bleeding device to expansion tank.**
  Turn bleeding device on. Bleeding pressure approx. 1,5 bar.

- Continue bleeding or changing the brake fluid, respectively, on the other brake calipers (no special sequence to be observed).
  Open each bleeder valve until clear brake fluid or until the corresponding brake fluid change quantity per caliper (approx. 250 cm^3) is reached. note that each four-piston fixed caliper must be bled at both bleeder valves.

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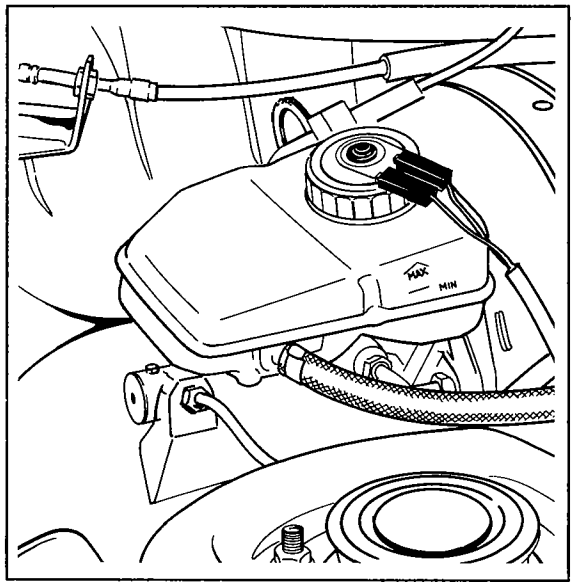
- To check that escaping brake fluid is clean and free from air bubbles, and to determine the brake fluid quantity used, use a suitable receiver bottle.

- After fitting a new brake master cylinder, depress brake pedal fully several times with the bleeder valves open during the bleeding operation. This allows trapped air to escape from the brake master cylinder.

- When changing the brake fluid, also drain some brake fluid from the clutch slave cylinder.

- **Turn off and disconnect bleeding device.**
  If required, top up with fresh brake fluid.



BA-03

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Safety notes

Observe the following safety notes when performing body repairs:

- Removal of components may change the gravity center of the vehicle.
  The vehicle may therefore have to be tied down by additional measures on the lifting platform.

- Rooms designated for body repairs may not be used to stock other vehicles without protection (risk of fire damage due to sparks, battery, paint and body glass damage).

- Be extremely careful when grinding or welding in the vicinity of the fuel tank and other parts of the fuel system. If necessary, remove any components affected.

- Do not weld, braze or solder any parts of the filled air conditioning system. This also applies to welding, brazing or soldering operations on the vehicle that may result in the risk of components of the air conditioning system warming up.

- When drying the vehicle following a respray, do not expose the vehicle to temperatures of max. 80°C for more than 2 hours.

To protect electronic control units against excessive voltage when using electric welding equipment, observe the following safety measures:

- Disconnect clamp from negative battery terminal and cover negative battery terminal.

- Connect ground clamp of the electric welding equipment directly and as closely as possible to the component to be welded. Make sure no electrically insulated parts are located between the ground clamp and the welding location.

- Do not touch electronic control units and electric lines with the ground clamp or with the welding electrode.

Safety precautions for **operations involving open flames or spark generation** (welding, grinding) in the vicinity of the **battery** or near the location of the **battery vent hose:**

- Remove battery and store it in a safe place.

- Blow through vent hose using compressed air. Plug hose ends. (The vent hose is routed into the right water reservoir affluent behind battery)

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Treatment of electronic control units following accident repairs

Following an accident, electronic control units have to be replaced only if at least one of the following conditions is met:

- The housing is visibly deformed or damaged.
- The support area and/or console is deformed (no outside damage evident on the unit).
- The connector is damaged or corroded due to moisture.
- Operation check and/or self-diagnosis of the units reveals the following fault:
  "Control unit faulty ".

If electronic components, e.g. the ABS control unit, have to be removed to allow repair operations to be performed and if they are to be reused afterwards, they must be checked for proper operation according to specifications after they have been refitted.

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1. Fault memory

Fault code table

Fault code	Designation of fault	
10	Ignition circuits	– closed once
		– closed several times
		– permanently closed
		– contact resistance to U_B
		– contact resistance to ground
		– coupled 1/3 or 2/3
11	Left front sensor	– resistance too high
12	Right front sensor	– resistance too high
21	Ignition pill circuit 1	– resistance too high / too low
22	Ignition pill circuit 2	– resistance too high / too low
23	Ignition pill circuit 3	– resistance too high / too low
30	Warning light airbag	– Signal implausible
31		– Control unit defective
40 to 47		– Control unit defective
50 to 54		– Control unit defective
60 to 62		– Control unit defective
70	Crash entry	– only if airbag has been triggered

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Fault, Fault Code	Possible Causes, Elimination, Remarks

Note

After an airbag system fault has been detected and rectified, the fault memory **must** be erased.

Test point 1

Ignition circuits
closed once
Fault code 10

- Replace both front impact sensors.
- Check wiring harness for squeezed sections or chafing and replace if required.

Test point 2

Ignition circuits
closed several times
Fault code 10

- Refer to test point 1.

Test point 3

Ignition circuits
closed permanently
Fault code 10

- Refer to test point 1.

Test point 4

Ignition circuits
Contact resistance
to U_B
Fault code 10

- Check wiring harness to front impact sensors and ignition pills for squeezed sections and chafing. Replace if required.
- Using Special Tool 9541, check wiring to front impact sensors for short to positive terminal, replace if required.
- Check front impact sensors for short to positive terminal.
- If no fault can be detected at the front impact sensors and at the wiring, the control unit must be replaced.

Test point 5

Ignition circuits
Contact resistance
to ground
Fault code 10

- Check wiring harness to front impact sensors and ignition pills for squeezed sections and chafing. Replace if required.
- Using Special Tool 9541, check wiring harness to front impact sensors for short to ground.
- Check front impact sensors for short to ground.
- If no fault can be detected at the front impact sensors and at the wiring harness, replace the control unit.

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