Workshop Manual

911

Carrera 4

Dr. Ing. h.c. F. Porsche Aktiengesellschaft

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Survey of Information Published in Technical Manual beginning in 1985

6 Cyl. 3

	TI/ QI		No.	911 C2/C4	911		911 Turbo	Remarks, Model, Also refer to...	Date
1985									
– Drive Shaft seal and Guide Tube	T		1/85		●			New seal	25.03.85
– Manual Transmission / Shift	Q		1/85		●			1985 Model/reverse gear	06.09.85
– Manual Transmission /Shift Seizure	Q		2/85		●			5th gear	06.09.85
1986									
– Transmission Shift Shift Rod Clatter	Q	♦	1/86		●			1987 Model/...QI 1/87	30.12.86
1987									
– Transmission/Shift Mechanism Rattling Shift Rods	Q		1/87		●			Seal	22.05.87
– Manual Transmission "Gear Jumper"	Q		2/87		●			1987 Model/4th gear ...QI-1/88	18.06.87
– Hydraulic Clutch Release Fork	Q		3/87		●			1987 Model/noise	17.07.87
– Transmission Shifting Shift Rod Rattling	Q	⊕	1/87		●			Supporting strut	16.10.87
– Hydraulic Clutch Release Fork	Q	⊕	3/87		●			Pedal assy/adjustment	24.11.87
– Manual Transmission Drive Pinion	Q		4/87		●			1987 Model/thrust washer 2.8 mm	24.11.87
– Manual Transmission Shifting Problems	Q		5/87				●	Reverse gear operating lever	30.12.87
– Transmission Shifts Shift Rods Rattling	Q	♦	1/87		●			Rubber ring	30.12.87
1988									
– Manual Transmission "Gear Jumping"	Q		1/88		●			1st and 2nd gears	19.02.88
– Shift Lever Shift Noise	Q		2/88		●			Lubricating shift base	19.02.88
– Manual Transmission "Transmission Noise"	Q		3/88		●			Engine carrier/console	19.02.88
– RHD Models/Pedals	Q		4/88		●			5 mm Diameter Pin	30.05.88
– Manual Transmission Selector Rod Seal	Q	♦	5/88		●			New Seal	22.07.88
– Clutch Operation	Q		6/88		●		●	Olista Longtime 3 EP	22.07.88

♦ = Conversion instructions or workshop campaign
∇ = Brochure
⊕ = Supplement or change for TI/QI

SERVICE

Date 30.04.90 VKQPI

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Survey of Information Published in Technical Manual beginning in 1985

6 Cyl. 3

	TI/ QI		No.	911 C2-C4	911		911 turbo	Remarks, Model, Also refer to...	Date
– RHD Cars Clutch Hose	Q		7/88		●			Spiral shaped line RHD	30.12.88
1989									
– Optimized Clutch Slave Cylinder	T		1/89	●			●	Clutch actuated hydraulically.	03.03.89
– Modified Multi-plate Package for Transverse Lock	T		2/89				●	Model 959	15.06.89
– New Transmission Carrier (Noise Uncoupled)	T		3/89	●				1987 (H) to 1989 (K)-Model	31.08.89
– Modified Release Lever Bearing	T		4/89	●				1987 (H) to 1989 (K)-Model	31.08.89
– Manual Transmission/2nd Gear/Loose Gear with Needle Roller Assemby	T		5/89	●				Loose whed with coloured dot marking.	21.11.89
1990									
– Porsche Tiptronic drive system	T	∇	1/90	●				WKD 496 920	22.02.90
– "Clutch does not disengage sufficiently"	T		2/90	●				Bleeding hydraulic-system. Testing pedal travel	24.09.90
– Assessing the Clutch and Double Mass Flywheel	T		3/90	●				from M'90 (L)	11.12.90

♦ = Conversion instructions or workshop campaign
∇ = Brochure
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Date 30.04.90 | 31.12.90 VKQPI

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The workshop manual of the Carrera 4 also includes that for the Carrera 2.
The Carrera 4 acts as the basis for description of the repairs in the manual.
“Carrera 4" also appears on every page in the header line.

Deviating descriptions for repairs on the Carrera 2 follow those of the Carrera 4. These repair descriptions for both models are separated by a yellow sheet.
“Carrera 2" appears on all pages in the header line after the separating sheet. The page number starts with 200 as an additional distinction.

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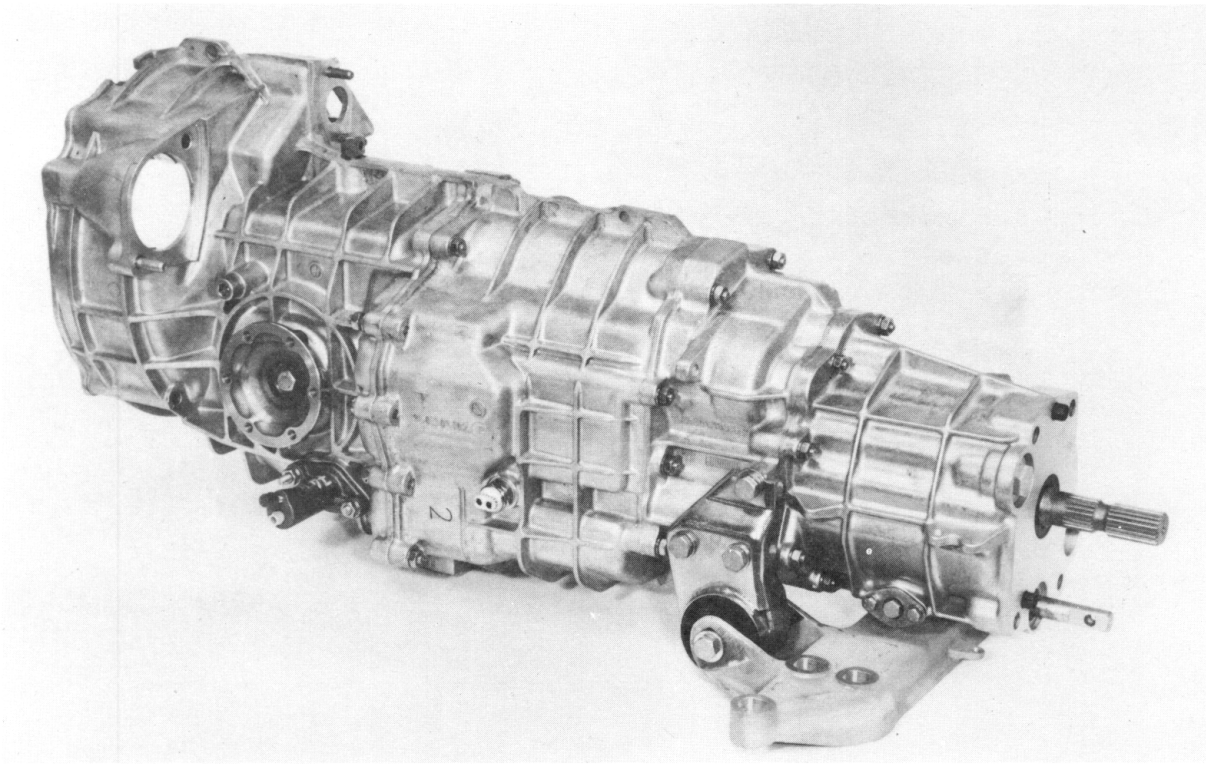
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General data

5-speed manual transmission G 64



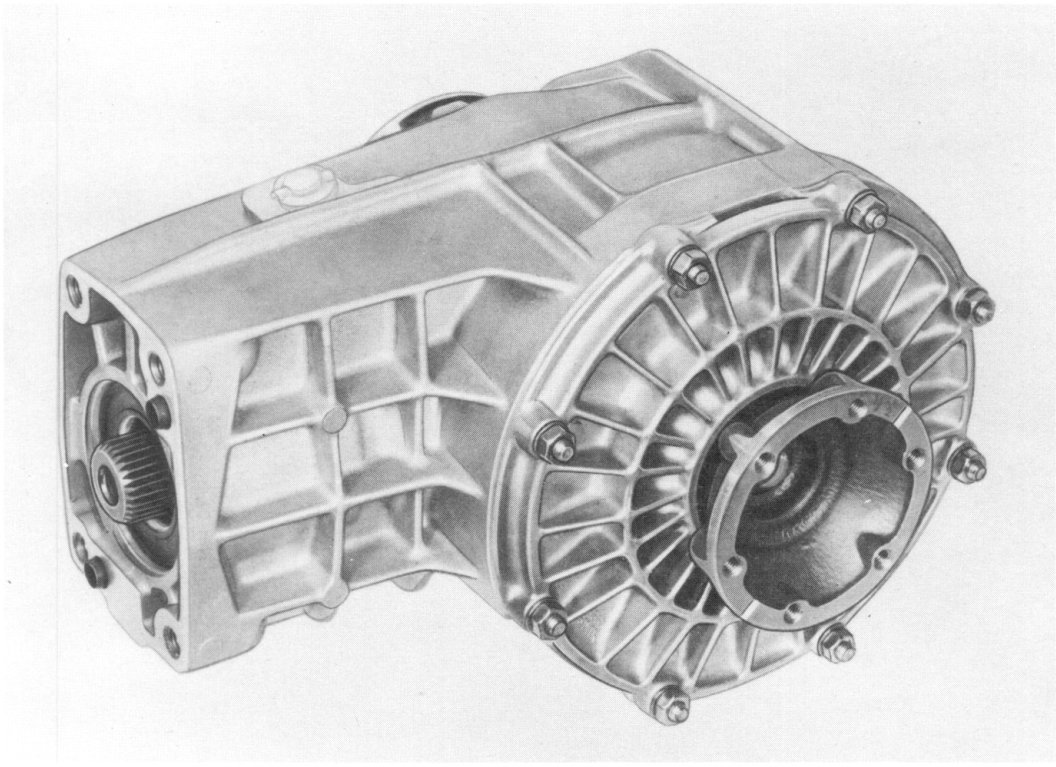
88/487

Model	Code letter	Equipment	Installed in	Model year
G64/00	-	5 speed	911 Carrera 4 worldwide	Model 1989 onward
G64/01	-	5 speed	911 Carrera 4 Switzerland	Model 1989 onward

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General data

Front axle final drive Z64



88/379

Model	Code letter	Equipment	Installed in	Model year
Z64/00	-	-	911 Carrera 4 worldwide	Model 1989 onward

General data	Front axle final drive Z64/00
Transmission ratio Final drive ($Z_2 : Z_1 = i$)	31 : 9 = 3.444
Final drive	Hypoid bevel-gear drive with 10 mm offset
Filling capacity	approx. 1.2 liter hypoid oil 75 W 90 of API classification GL 5 (or MIL-L 2105 B)

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General data

Structure of transmission numbers



Transmission Type

Index for variants within the assembly number

1 = normal differential
3 = limited-slip differential

Model Year

K = 1989
L = 1990
M = 1991

Serial number
z.B. 00903

Note

The model letter is omitted as of MY '92.

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General data

General data	Manual transmission G64/00 - G64/01	
Transmission ratios $Z_2:Z_1 = i$	**G64/00**	**G64/01**
1st gear	42:12 = 3.500	41 : 13 = 3.154
2nd gear	36:17 = 2.118	36 : 19 = 1.895
3rd gear	39:27 = 1.444	36 : 27 = 1.333
4th gear	38:35 = 1.086	36 : 35 = 1.029
5th gear	33:38 = 0.868	33 : 38 = 0.868
Rev. gear	40:14 = 2.857	40 : 14 = 2.857
Final drive	Hypoid bevel-gear drive with 16 mm offset	
Transmission ratio Final drive	31:9 = 3.444	31:9 = 3.444
Filling capacity	approx. 3.8 liter hypoid oil SAE 75 W 90 of API classification GL 5 (or MIL-L 2105 B)	

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Tightening torques for manual transmission G 64

Location	Thread	Tightening torque Nm (ft.lb)
Oil drain plug and oil filler plug	M 22 x 1.5	30 (22)
Hexagon nut for gear and transmission cases, side transmission cover, transfer case, intermediate case, tensioning plate	M 8	23 (17)
Clamp plate to transfer case	M 6	10 (7.5)
Lock nut / driver carrier	M 24 x 1.5	240 (177)
Lock nut / bearing carrier	M 42 x 1.25	300 (221.5)
Hexagon head screw / shift fork	M 8	23 (17)
Collar nut / input shaft	M 14 x 1.5	140 (103)
Reversing-light switch to gearbox	M 18 x 1.5	35 (26)
Guide tube to transmission case	M 6	10 (7.5)
Shift gate to tensioning plate	M 6	10 (7.5)
Mating bearing screw / engaging forks (interaxle lock)	M 30 x 1.5	80 (50)
Collar screw / reverse idler gear II	M 8	35 (26) (and Loctite 270)
Bleeder in transmission case	M 14 x 1.5	35 (26)
Mating bearing screw / engaging fork (rear-axle lock)	M 12 x 1.5	65 (48)
Collar nut / input shaft	M 30 x 1.5	250 (184.5)
Lock nut / drive pinion	M 40 x 1.25	240 (177)
Hexagon head screw / halfshaft flange	M 10	44 (32.5)

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Location	Thread	Tightening torque Nm (ft.lb.)
Tension spring / tachometer sensor	M 6	10 (7.5)
Crown wheel to differential housing (hex bolt with tab washer)	M 12 x 1.25	150 (112)
Crown wheel to differential housing (Verbus-Ripp bolt **without** tab washer)	M 12 x 1,25	200 (147)
Cover on differential housing	M 6	15 (11)

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Tightening torques for front axle final drive Z 64

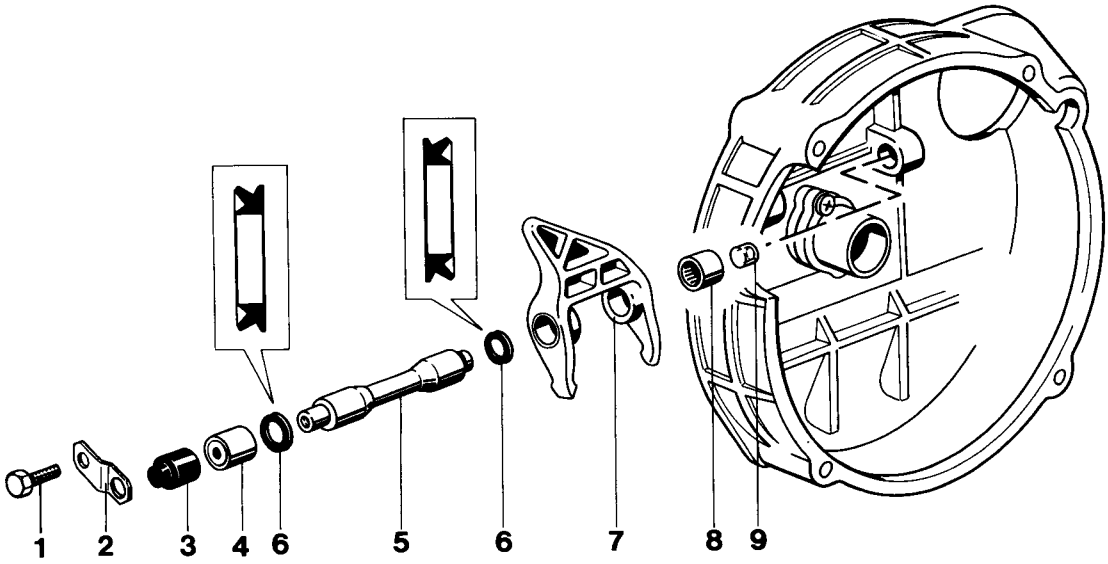
Location	Thread	Tightening torque Nm (ft.lb.)
Oil drain plug and oil filler plug	M 22 x 1.5	30 (22)
Hexagon head screw / joint flange	M 10	44 (32.5)
Side transmission cover to housing	M 8	23 (17)
Lock screw / lock nut	M 5	6 (4.5)
Lock nut / drive pinion	M 33 x 1.5	230 (170)
Crown wheel to differential housing (hex bolt with tab washer)	M 12 x 1.25	150 (111)
Crown wheel to differential housing (Verbus-Ripp bolt **without** tab washer)	M 12 x 1,25	200 (147)

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Clutch control, disassembling and assembling

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Clutch control, disassembling and assembling



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No.	Description	Qty.	Note when: Removing	Installing
1	Hexagon head screw M6 x 16	1		
2	Holder	1		
3	Bearing cover	1		Pack with grease (Use Olista Longtime 3 EP)
4	Needle bearing with assembly hole	1		Install in correct position, assembly hole points outwards
5	Release lever shaft	1	Pull out with hexagon head screw M6 x 40	
6	Sealing ring	2		Check, replace if necessary, install in correct position
7	Release lever	1		
8	Needle bearing without assembly hole	1		
9	Plastic sleeve	1		Install in correct position, closed side points towards the needle bearing, sleeve not required for transmissions with through bore

Note

Lubricate all sliding surfaces of the clutch release mechanism with Olista Longtime 3EP
Part number 000.043.024.00

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Checking clutch drive plate for wear

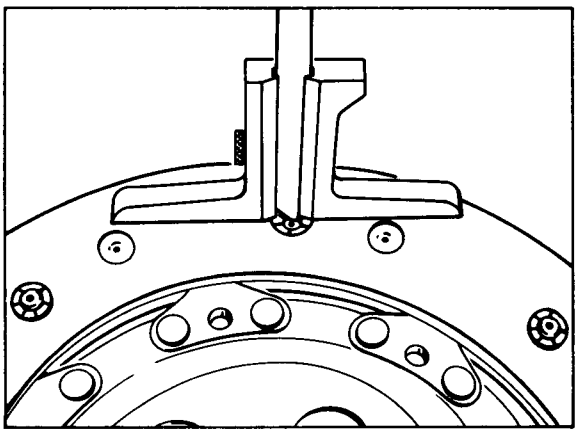
(clutch drive plate removed)

Checking:

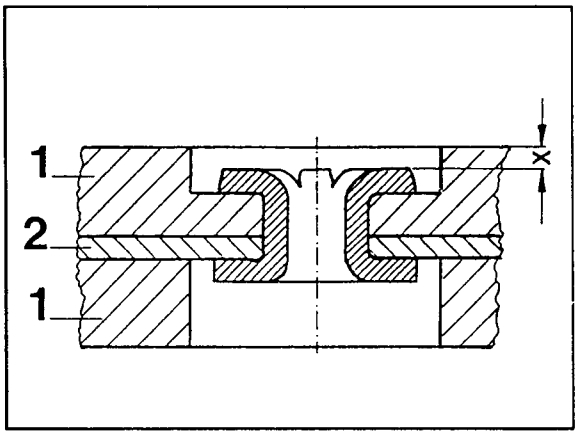
Using a depth gage or sliding calipers, measure distance X from surface of lining to rivet head.

Note

Measure only at the beaded-over side of the rivet head.



645-30



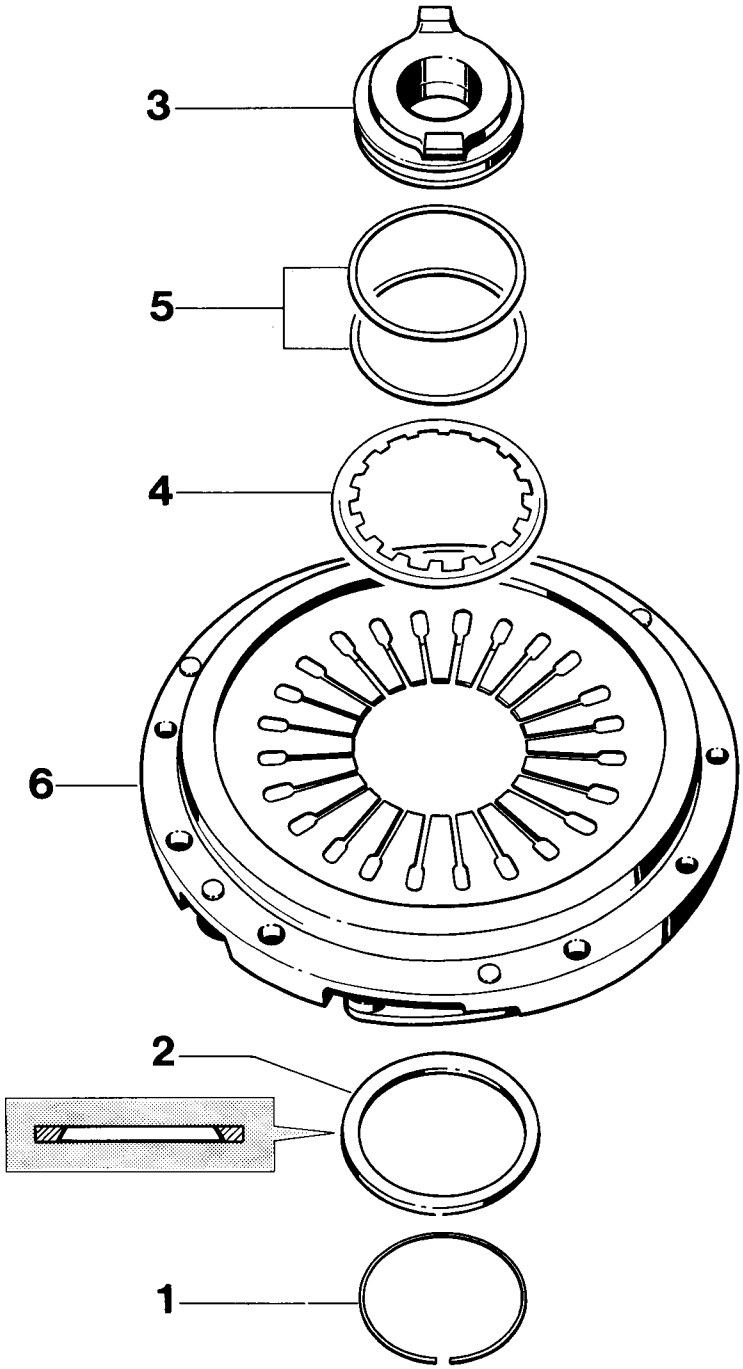
646-30

1 - Lining
2 - Drive plate/lining spring

Wear limit X is **0.3 mm** (see drawing).
When the drive plate is new, this dimension is approx. 1.0 mm.
Note that **lining wear** is **not linear**, i.e. not at a steady rate throughout the clutch's operating life. The way in which the lining material beds down and is compressed initially suggests that greater lining wear is taking place, but as the car is driven further, the rate of wear declines considerably.

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Removing and installing release bearing



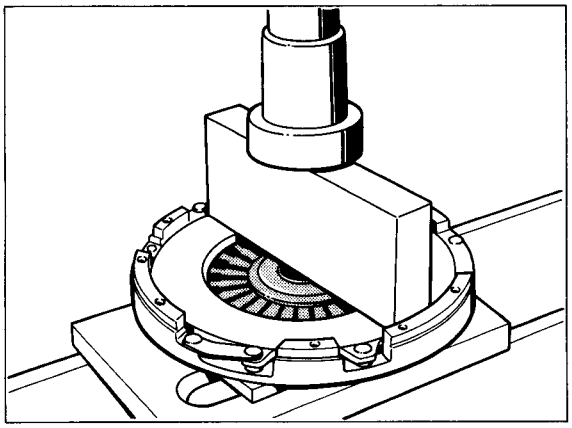
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No.	Designation	Qty.	Note: Removal	Installation
1	Snap ring	1	use pointed pliers to remove, pressing down thrust plate in a press	observe correct seating of snap ring
2	Thrust washer	1		groove must face snap ring
3	Release bearing	1	check, do not wash out, just wipe with a dry cloth	
4	Spring washer	1	install in correct position	
5	Spacer	2		**always insert 2 spacers (1 spacer for 911 turbo)**
6	Thrust plate	1		check for wear, replace if required

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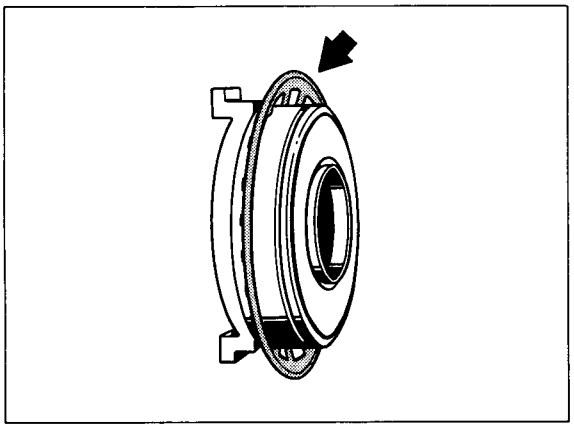
Assembly notes

1. To fit the snap ring, a shop press is required. Use a wooden block as a pressure piece.



1000-30

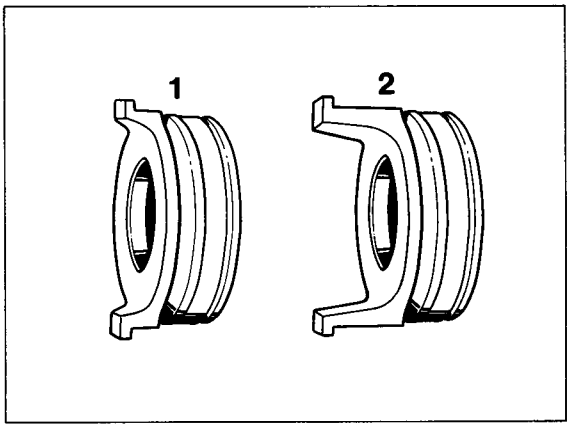
2. Install spring washer in correct position.



1001-30

Usage of release bearings

1	2
911 Carrera 2/4 911 Turbo 911 RS with double-mass flywheel	911 RS without double-mass flywheel 968

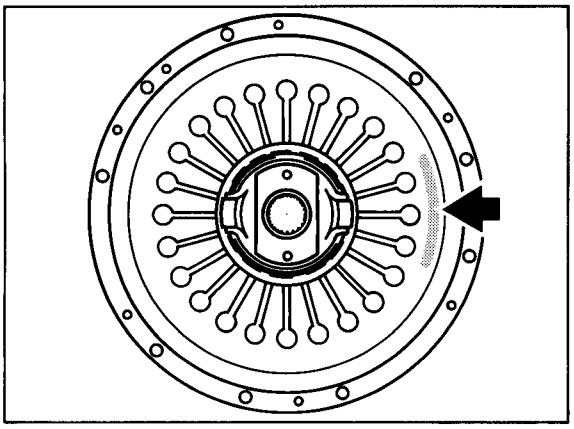


1002-30

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Identification of clutch pressure plates

To avoid confusion, the pressure plates are color-marked for positive identification.



836-30

Color marking:

968	Green
911 Carrera 2/4	Blue
911 Carrera (993)	No mark
911 Turbo 3.6	Red

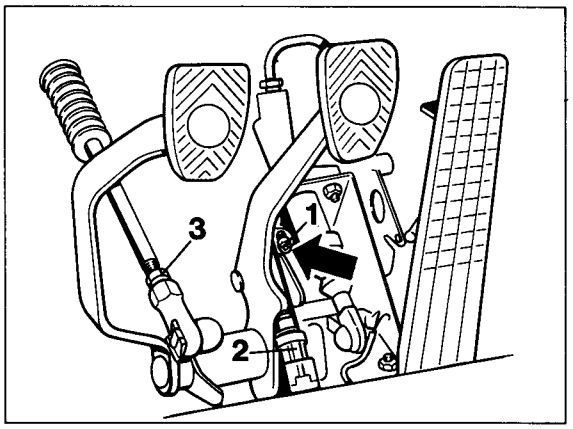
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Adjusting the clutch pedal

Note

The following items are essential **requirements** for smooth clutch operation and must therefore be observed whenever the pedal is adjusted:

- Correct bleeding of clutch hydraulics.
- Tightness of hydraulic system.
- Correct setting of boost spring.
- Pedal travel limited by correctly set floorboard stop.
- Fitting position of pedals according to standard specification.



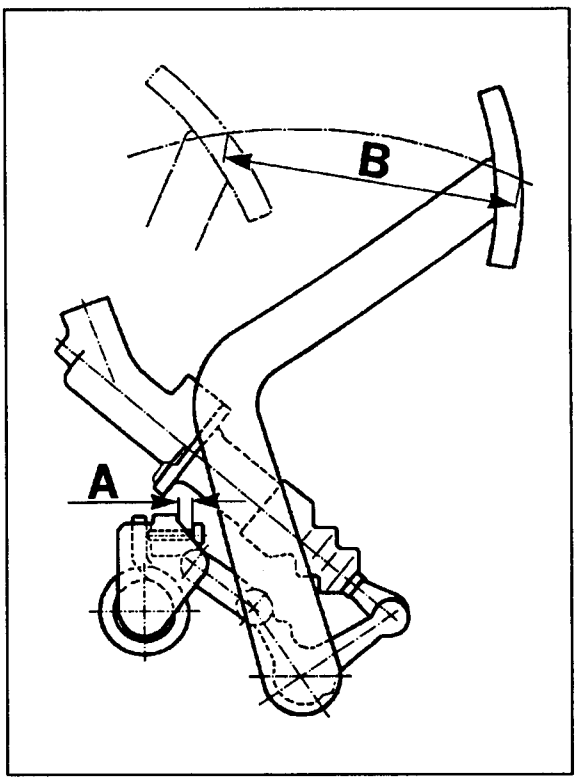
1097-30

Checking and adjustment procedures

1. **Checking the pedal return (return force).**
   With the pedal in home position, pull pedal back with a force of 30 N min. (using a spring balance). The pedal must not yield. If it does (= return force insufficient), the boost spring preload must be reduced or set to a dimension of 6 mm, respectively (refer to item 2.).

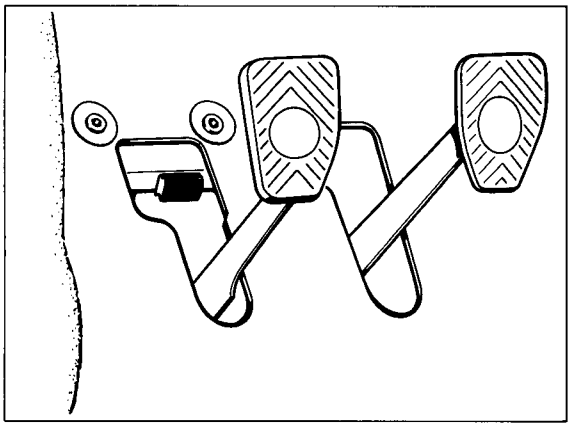
2. **Adjusting the boost spring (dimension A = 6 mm).**
   Adjustment is made by rotating the hex socket head bolt (drawing 1097-30/arrow 1). The clearance between screw and pivot must be 6 mm.

3. **Checking the pedal travel (dimension B = 145 mm).**
   When measured in the center of the pedal, the pedal travel must be **145 mm + 10**. If required, adjust or limit the pedal travel at the floorboard stop (refer to drawing 1098-30 on page 30 - 10).



1113-30

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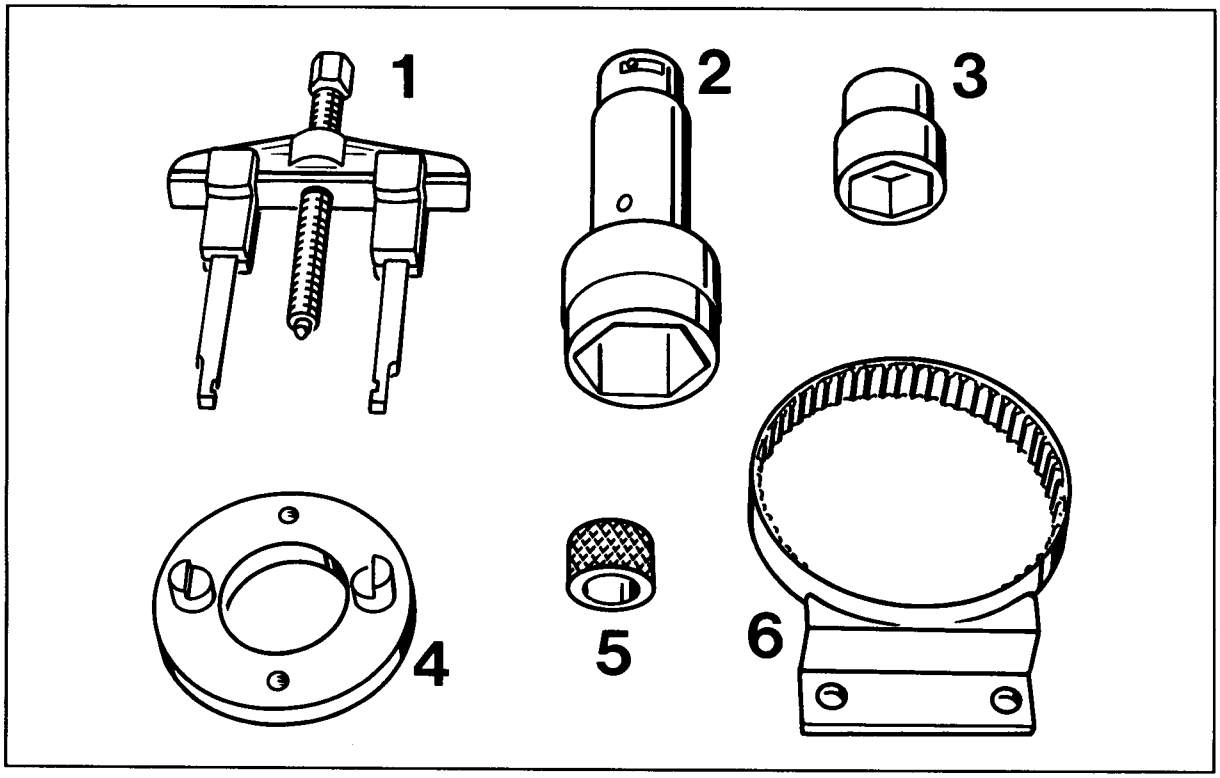
1098-30

4. Clutch free play.

The clutch master cylinder is provided with an internal stop. The boost spring always forces the pushrod and, hence, the clutch pedal against this stop. Due to the fact that any free play is automatically taken up hydraulically, the free play of the clutch cannot be checked at the clutch pedal.

Disassembling and assembling gearbox

Tools

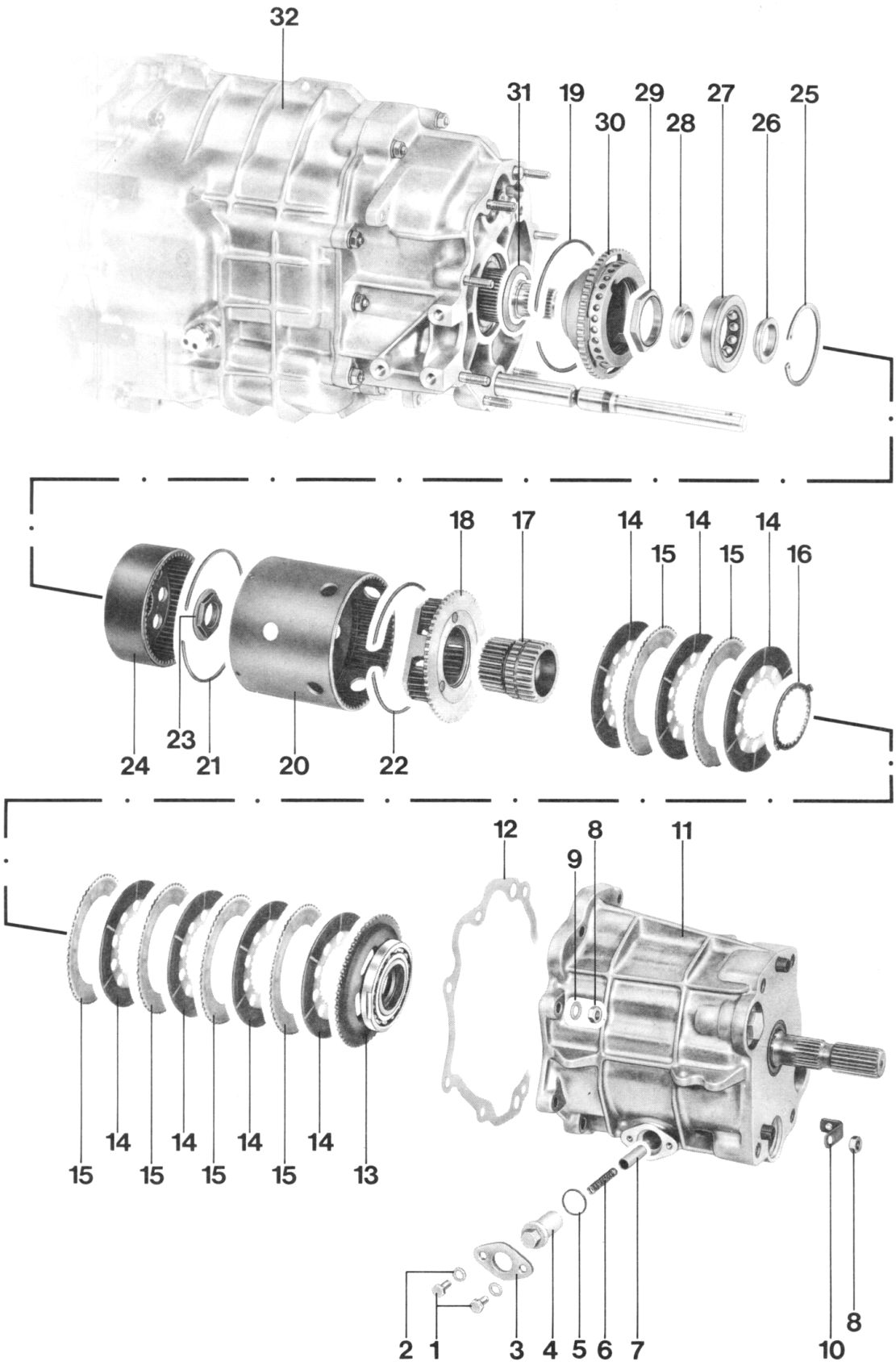


194-34

No.	Description	Special Tool	Order number	Remarks
1	Extraction arms for Kukko puller 20-2	9278	000.721.927.80	
2	Socket wrench	9277	000.721.927.70	
3	Socket wrench	9280	000.721.928.00	
4	Holding device	9275	000.721.927.50	
5	Centering component	9294	000.721.929.40	
6	Holding device	9276	000.721.927.60	

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Disassembling and assembling gearbox



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No.	Designation	Qty.	Note: Removal	Installation
1	Hex bolt	2		Tighten to 10 Nm (7 ftlb) torque
2	Washer	2		
3	Tensioning plate	1		
4	Eccentric bushing	1		Adjust
5	Sealing ring	1		Renew
6	Coil spring	1		
7	Locking bushing	1		
8	Hex nut	8		Tighten to 23 Nm (17 ftlb) torque
9	Washer	7		
10	Holder	1		
11	Transfer box	1		
12	Gasket	1		Renew
13	Press. plate with bearing	1		
14	Inner plate*	7		Oil lightly, install in correct position
15	Outer plate (1.3 mm thick)*	6		Oil lightly
16	Circlip	1		Install in correct position between 3rd and 4th inner plates
17	Sun wheel	1		
18	Planet wheel carrier	1		
19	Snap ring	1	Remove through assembly holes in clutch sleeve	
20	Clutch sleeve	1		
21	Snap ring	1		
22	Snap ring	1		

* From 1991 model on, determine thickness of plate cluster and adjust counter-bearing screw (see Page 34-8a).

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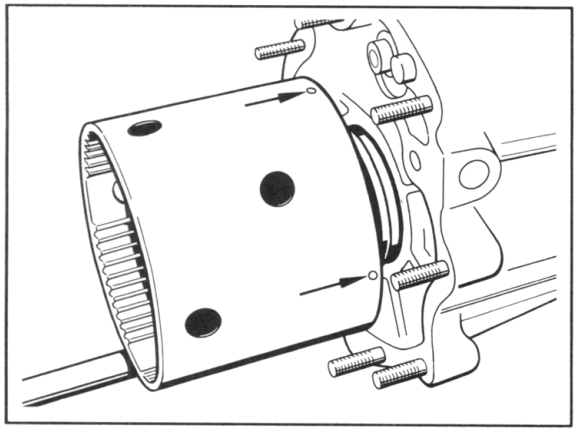
No.	Description	Qty.	Note when: Removing	Installing
23	Lock nut	1	Remove using Special Tools 9275, 9276 and 9280	Tighten with 240 Nm (177 ft.lb.), notch collar to secure
24	Driving carrier with hollow gear	1		
25	Circlip	X	Make a note of the thickness for refitting	Determine thickness again if necessary. Select the thickest possible ring which may be used
26	Inner bearing race	1	Remove using Special Tools 9294 and 9278	Heat up to approx. 120 °C (248 °F)
27	Four-point bearing	1		
28	Inner bearing race	1	Undo lock nut and pull out using suitable two-claw puller	Heat up to approx. 120 °C (248 °F)
29	Lock nut	1	Remove using Special Tools 9276 and 9277	Tighten with 300 Nm (221 ft.lb.), notch collar to secure
30	Bearing carrier	1		
31	Shim "S"	X	Make a note of the thickness for refitting	Determine again if necessary (refer to Page 35 - 25)
32	Transmission	1		

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Notes on disassembly and assembly

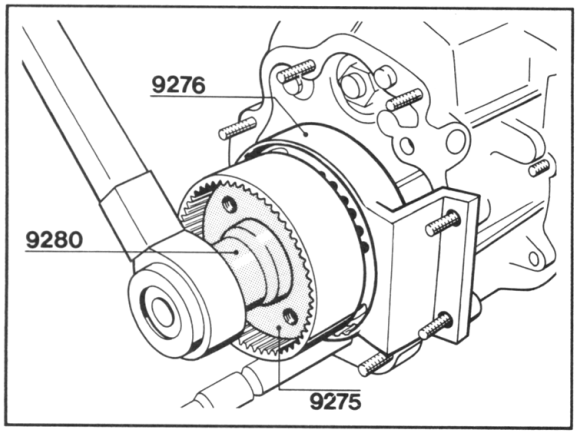
Disassembly

1. Remove snap ring (No. 19) through the assembly holes in the clutch sleeve with a suitable tool.



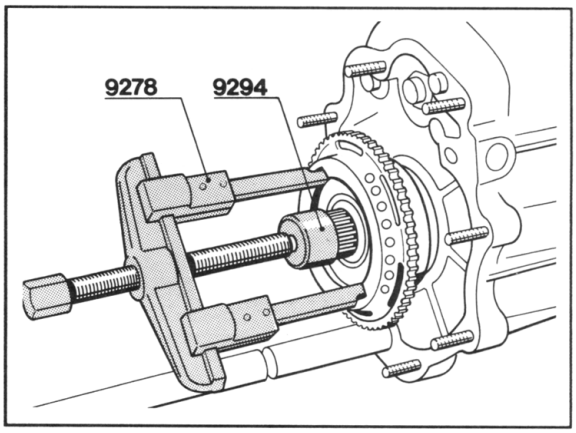
180 - 34

2. Remove collar nut (No. 23) with Special Tools 9275, 9276 and 9280.



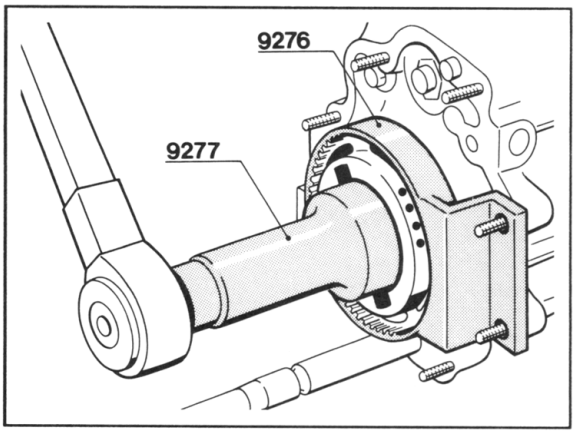
178 - 34

3. Remove inner bearing race (No. 26) with Special Tools 9278 and 9294.



181 - 34

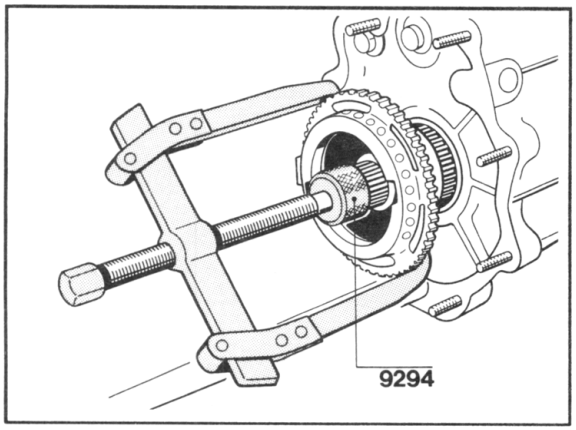
4. Remove lock nut (No. 29) with Special Tools 9276 and 9277.



176-34

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5. Pull out inner bearing race (No. 28) over the bearing carrier with Special Tool 9294 and a suitable puller.



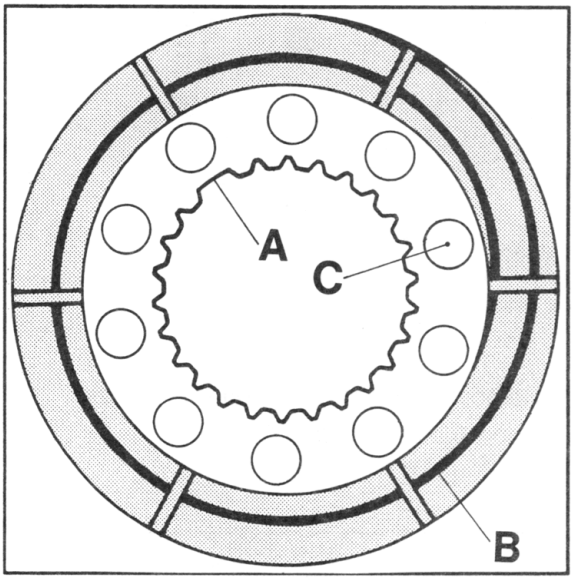
182 - 34

Note

Counternut (No. 29) must be unscrewed beforehand.

Assembly

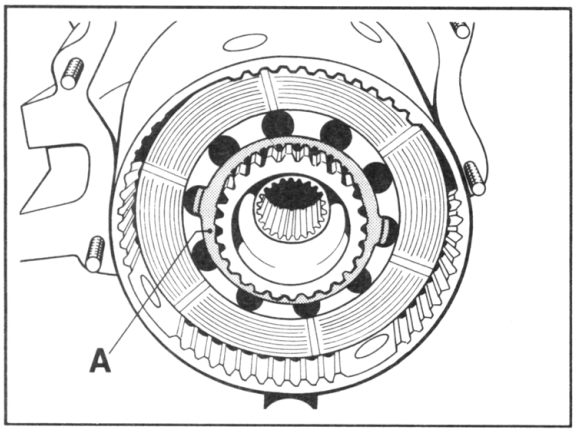
1. Apply a film of transmission oil to inner plates and assemble so that the spiral groove for the oil supply runs counterclockwise from inside to outside when looking at the clutch sleeve (direction of assembly) (refer to the simplified sketch). Apart from this, the oil holes in the carrier plate must be in line with one another. Assembly is easier if a tooth is missing from the carrier plate.



207 - 34

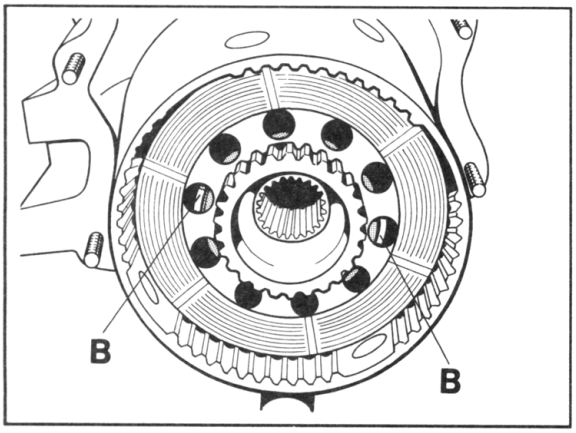
A = Missing tooth
B = Spiral groove
C = Oil hole

2. Insert tab washer (A) between 3rd and 4th inner plate so that the lugs (B) project through two oil holes in the carrier plate.



177 - 34

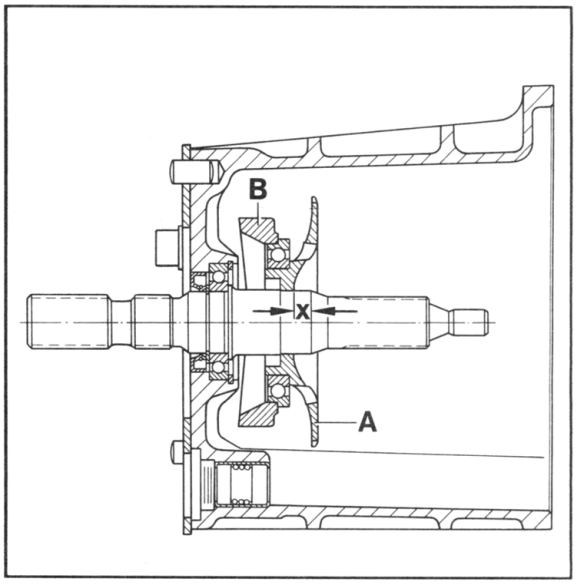
A = Tab washer



179 - 34

B = Lugs of tab washer

3. Insert pressure plate (No. 13) into transfer case in correct position (recesses on bearing must latch into the driving journals of the engaging fork).



208 - 34

A = Pressure plate
B = Engaging fork
X = approx. 8 mm

Note

The pressure plate is in the correct position if dimension "X" is approx. 8 mm.

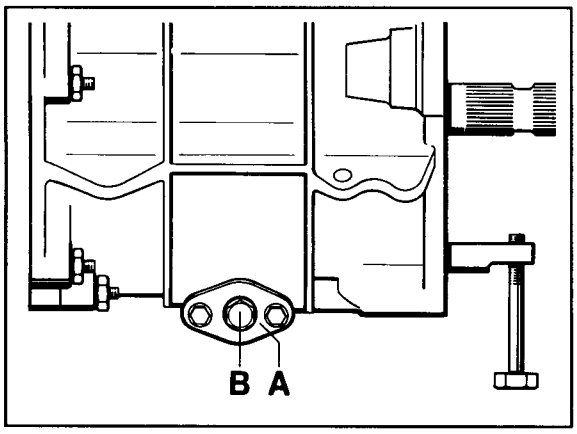
4. Mount transfer case and pressure plate carefully. Turn input shaft so that the teeth on the pressure plate engage with the teeth of the clutch sleeve.

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Note

The transfer case is in the correct position if it can be slid up completely **by hand**.
If there is a gap of approx. 6 mm between transfer case and intermediate housing, the teeth of the pressure plate have not engaged into those of the coupling sleeve.

5. Adjust the inner shift rod with eccentric bush (No. 4) in such a way that it is possible to preselect all gears without resistance. For this, undo hexagon head screws holding the tensioning plate and turn the eccentric bush.



209 - 34

A = Tensioning plate
B = Eccentric bush

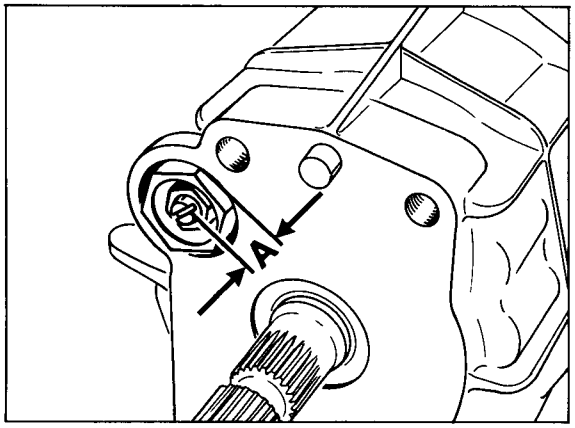
6. Change through all gears by way of a check. For this, fit long M 8 screws into the inner shift rod.

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Modifications from 1991 model on

Note

Before dismantling the transmission always check the amount of wear on the front-rear locking plates (see Vol. IV, Page D39/45-21). If plates are re-used after having been operated for a period, the bearing pin of the counter-bearing bolt must remain in the same position as before. If it has to be reset or if the counter-bearing bolt has to be removed (for instance to rectify a leak), the correct position for re-installing must first be determined.



587-34

A = Installed position

Determining thickness of plate cluster (with Gylon discs)

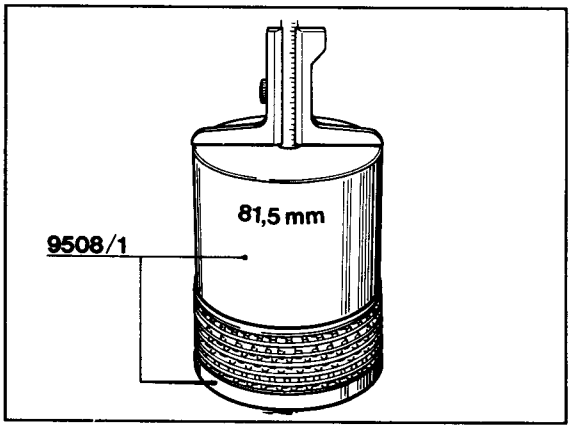
If the plates for the front-rear lock are renewed, the plate cluster thickness must be determined.

Adjustment value (new)	= 26 - 0.2 mm
Wear limit	= 23 mm

Note

If the wear limit is reached, replace all inner discs.

Measure entire disc pack.



184-39

Example I

Measured value	106.90 mm
Height of special tool*	– 81.50 mm
Plate cluster thickness	25.40 mm

* Marked on tool

Adjustment value	26.00 mm
Plate cluster thickness	– 25.40 mm
Adjusting plate	0.60 mm

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Example II

Measured value	106.00 mm
Height of special tool*	– 81.50 mm
Plate cluster thickness	24.50 mm

* Marked on tool

Adjustment value	26.00 mm
Plate cluster thickness	– 24.50 mm
Adjusting plate	1.50 mm

Note

Do not install any outer adjusting plates thinner than 1.3 mm.
In Example I, one of the six 1.3 mm thick outer plates must be increased in thickness by 0.6 mm (to 1.9 mm).
In Example II, an additional outer plate 1.5 mm thick must be inserted between the inner plate and the pressure plate.

Adjusting counter-bearing for front-rear lock

Note

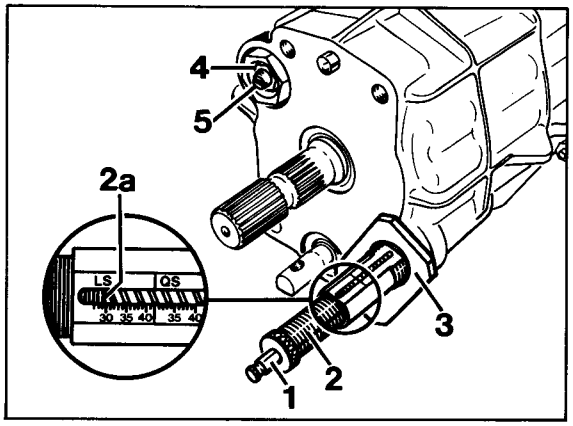
Adjustment is possible only with the measuring cylinder (special tool 9514), and is only necessary if the plates are renewed.

1. The flexible gaiter for the slave cylinder must be installed.

2. Slacken off the measuring cylinder adjusting screw as far as possible (to make it easier to install the measuring cylinder).

3. Attach the measuring cylinder to the transmission.

4. Use the adjusting screw to set the measuring cylinder to 29.5 mm (in the front-rear differential lock measuring range).
   LS = Front-rear diff. lock measuring range
   QS = Lateral diff. lock measuring range



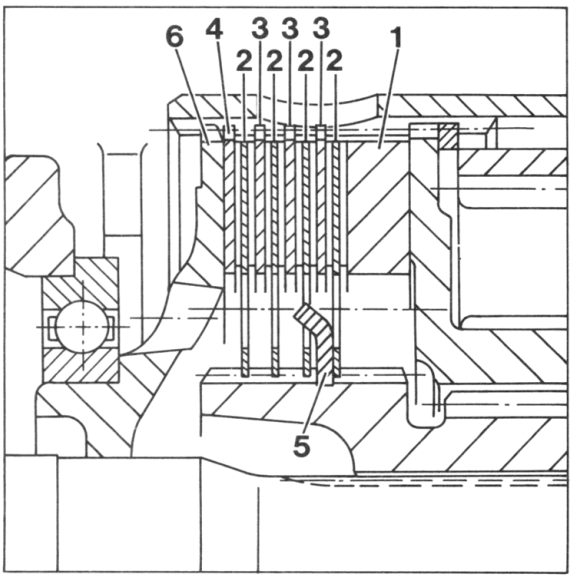
588-34

1 – Spacing plunger
2 – Adjusting screw
2a – Measuring groove on adjusting screw
3 – Special tool 9514/1
4 – Locknut (seal with Loctite 222)
5 – Bearing pin (counter-bearing)

5. Screw in the bearing pin until there is no more endplay at the measuring cylinder spacing plunger. In this position, lock the bearing pin with the hex nut (tightening torque 40 Nm) (30 ftlb).

Modifications to the longitudinal lock

Following introduction of the Valeo inner discs, the number of discs and the stacking of the disc pack have been modified.



1358-34

1 = Wave disc
2 = Valeo inner disc
3 = Outer disc (1.3 mm thick)
4 = Outer adjusting disc
5 = Snap ring
6 = Thrust plate

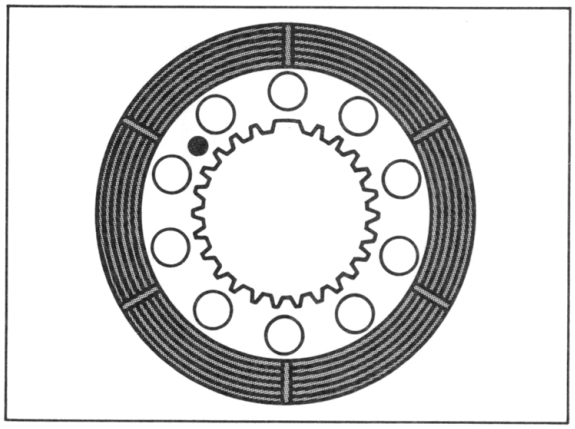
Note

Due to the fact that supply of the Gylon inner discs will be stopped in the foreseeable future, the longitudinal lock must be fitted with Valeo friction discs if repairs are required. To do so, replace all friction discs as well as the wave disc and adjust the pack thickness to the specified dimension (26 mm). Combining Gylon and Valeo inner discs is not permissible.

Determining disc pack thickness (with Valeo inner discs)

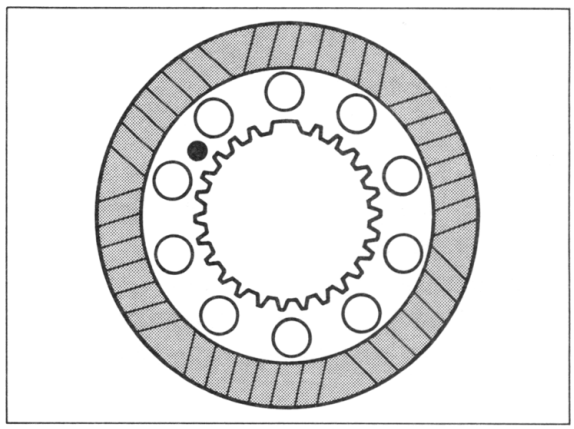
Note

Due to the transition from Gylon to Valeo inner discs, the stacking of the disc pack has been modified.



288-39

Former Gylon disc



1311-39

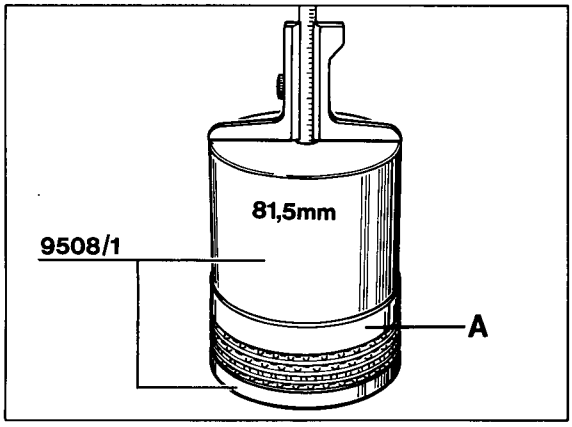
New Valeo disc

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1. Determine thickness of disc pack.

– Pack thickness (new) = 26.0 – 0.2 mm
  Wear limit = 25.2 mm

– Measure entire disc pack with wave disc.



1361-34

A = Wave disc

Example

Measurement	106.60 mm
Special Tool height*	– 81.50 mm
Pack thickness	25.10 mm

* Engraved on tool

Note

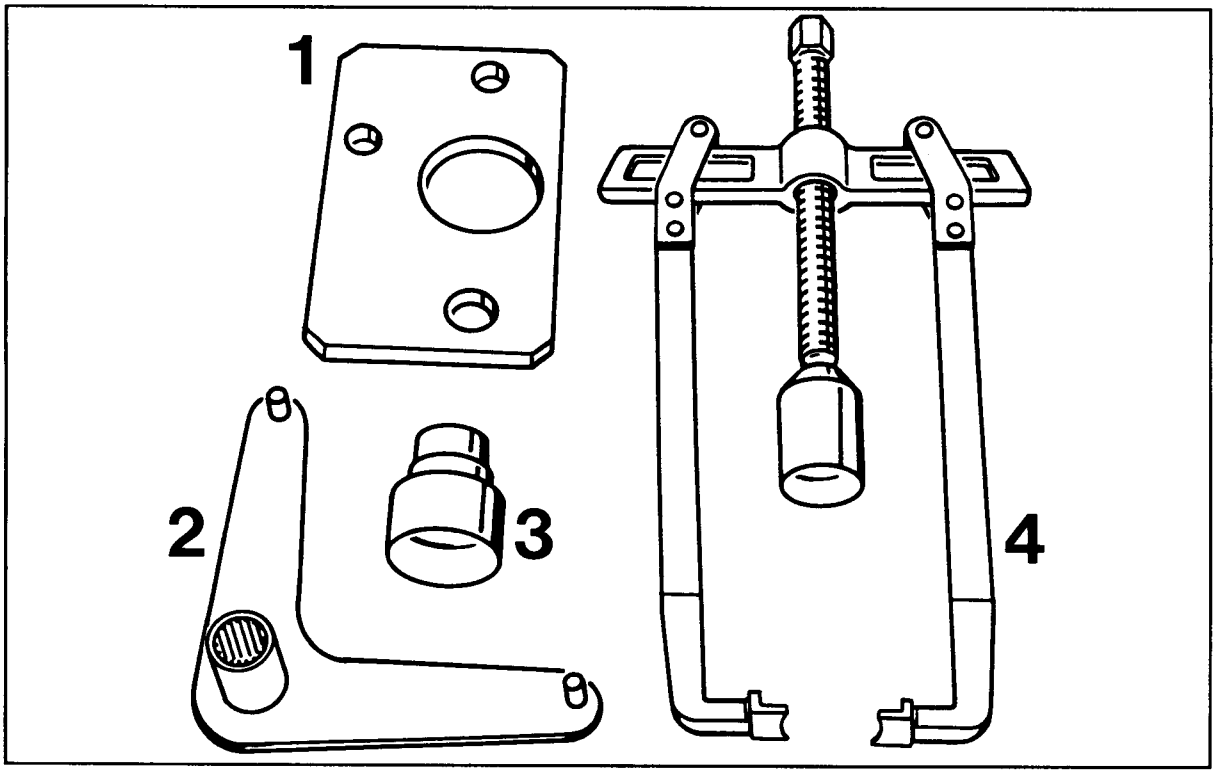
If the wear limit has been reached, all inner discs must be replaced.
Adjust to specified pack thickness (26.0 - 0.2 mm) at the thrust plate, using the outer adjusting disc (refer to page 34 - 8c).

2. Apply a thin coat of transmission oil to discs before fitting them.

3. Oil bores in carrier plate of inner discs must line up exactly.

Disassembling and assembling gearbox

Tools

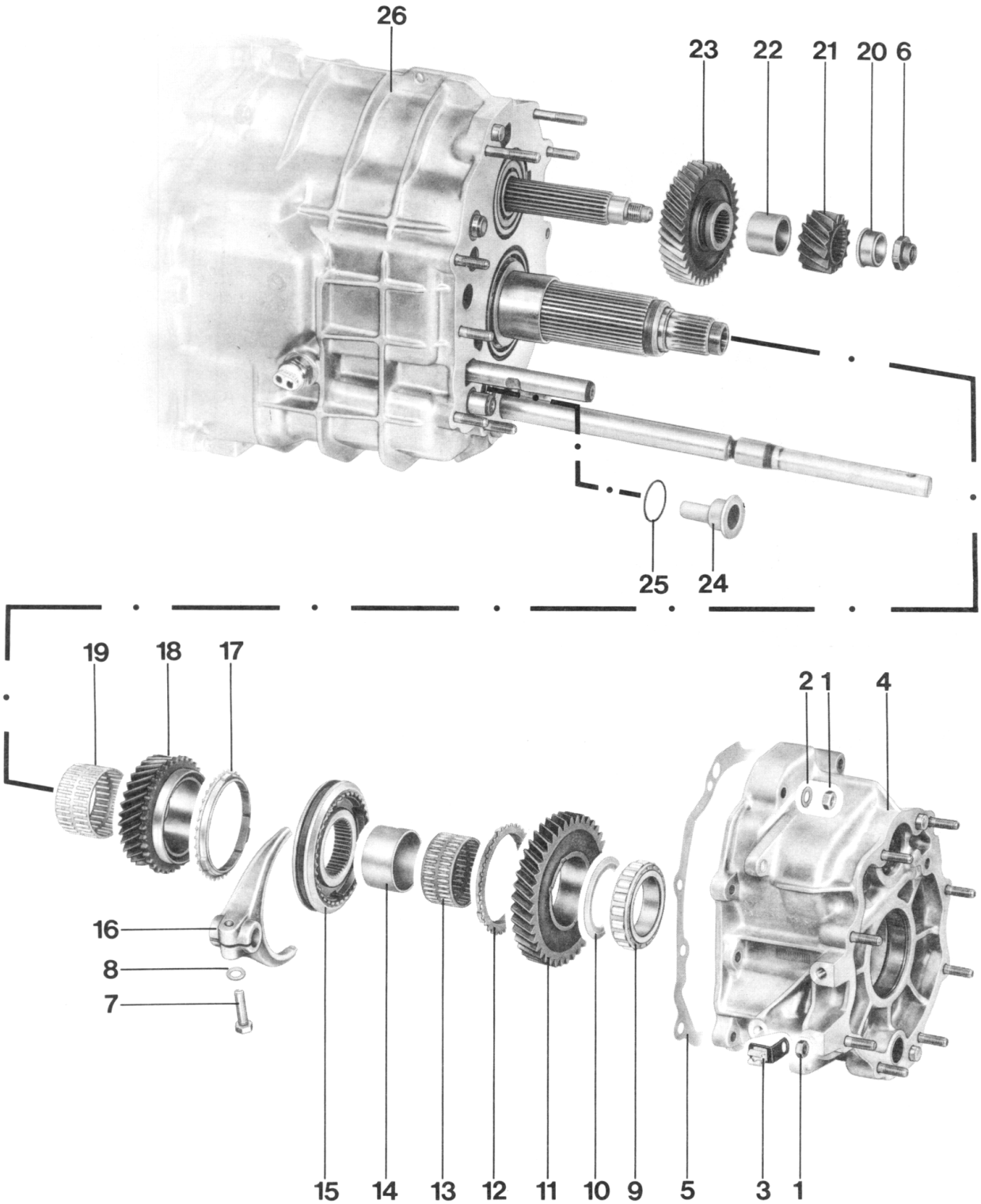


195 - 34

No.	Description	Special Tool	Order number	Remarks
1	Retainer plate	9286	000.721.928.60	
-	Retainer plate	9286/1	000.721.928.61	not illustrated
2	Bracket	9253	000.721.925.30	
3	Assembly bush	9283	000.721.928.30	
4	Puller	9284	000.721.928.40	

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Disassembling and assembling gearbox



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No.	Description	Qty.	Note when: Removing	Installing
1	Hexagon nut	10		Tighten with 23 Nm (17 ft.lb.)
2	Washer	9		
3	Holder	1		
4	Intermediate case	1		
5	Seal	1		Replace
6	Collar nut	1	Select 5th gear, block input shaft with Special Tool 9253	Tighten with 140 Nm (103 ft.lb.) (and notch the collar to secure)
7	Hexagon head screw	1		Tighten with 23 Nm (17 ft.lb.)
8	Washer	1		
9	Cylindrical-roller bearing	1	Pull out with Special Tool 9284	Heat up to approx. 120 °C (248 °F)
10	Friction washer	1		Mount in correct position. The large flat-ground side points towards needle bearing (No. 13)
11	Loose gear, reverse gear	1		Only replace in sets
12	Synchronizing disk	1	Mark for refitting	Check for wear, assemble with the same gear wheel. (Cogs towards driver dogs)
13	Needle cage	1	Mark for refitting	Assemble with the same gear wheel
14	Sleeve	1	Mark for refitting	Assemble with the same gear wheel
15	Guide sleeve with gear shift sleeve and synchronizing components	1	Remove together with shift fork	Gear shift sleeve and guide sleeve are matched
16	Shift fork	1	Remove together with gear shift sleeve and guide sleeve	Adjust with Special Tool 9286 and/or 9286/1

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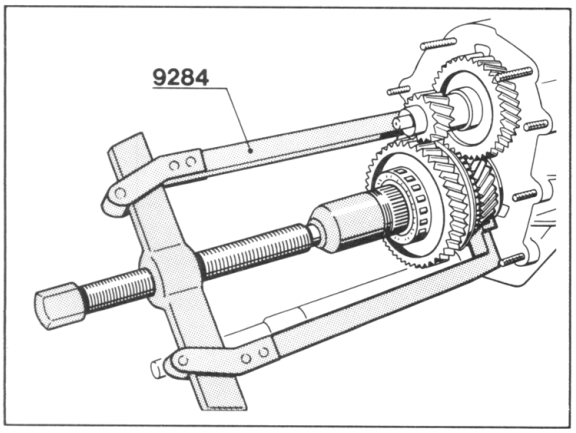
No.	Description	Qty.	Note when: Removing	Installing
17	Synchronizing disk	1	Mark for refitting	Check for wear, assemble with the same gear wheel (cogs towards driver dogs)
18	Loose gear - 5th gear	1		Only replace in pairs
19	Needle cage	1	Mark for refitting	Assemble with the same gear wheel
20	Inner bearing race	1	Pull out with suitable claw puller	Heat up to approx. 120 °C (248 °F)
21	Fixed gear - reverse gear	1		Only replace in sets
22	Spacer	1		
23	Fixed gear - 5th gear	1		Only replace in pairs
24	Oil guide tube	1		
25	O-ring			Replace
26	Transmission	1		

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Notes on disassembling and assembling

Disassembling

1. Pull cylindrical-roller bearing and needle-bearing sleeve from the hollow shaft with Special Tool 9284.



175-34

Note

Always use Special Tool 9284. If the drive pinion is used as a support, this may cause damage to the gear wheels in the transmission.

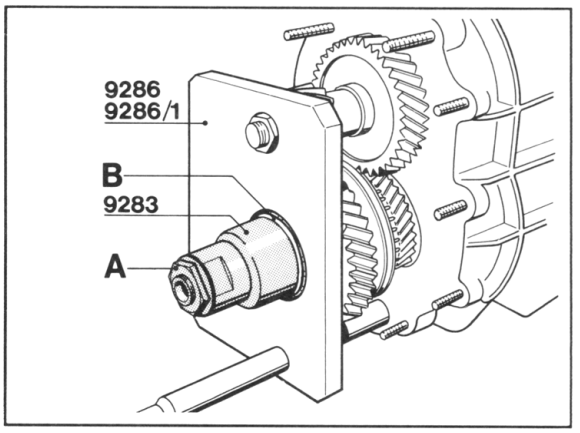
Assembly

1. Adjust shift fork for 5th and reverse gear:

- Secure hollow shaft with Special Tool 9286 and/or 9286/1.

- Insert shim "s" and counter Special Tool 9285 hand tight.

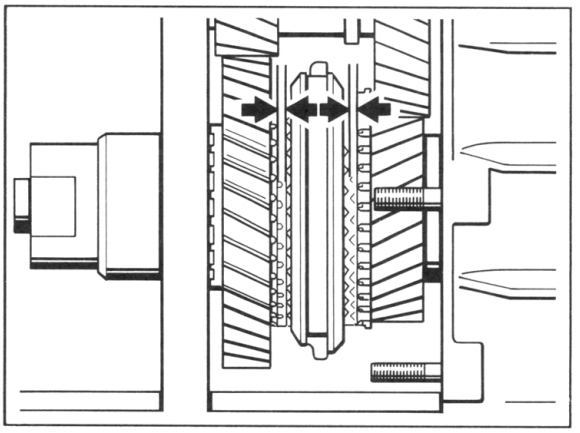
- Tighten lock nut.



183-34

A = Lock nut
B = Shim "s"

- Adjust gear shift sleeve with the gear fork in such a way that it is exactly centrally located in idle position.



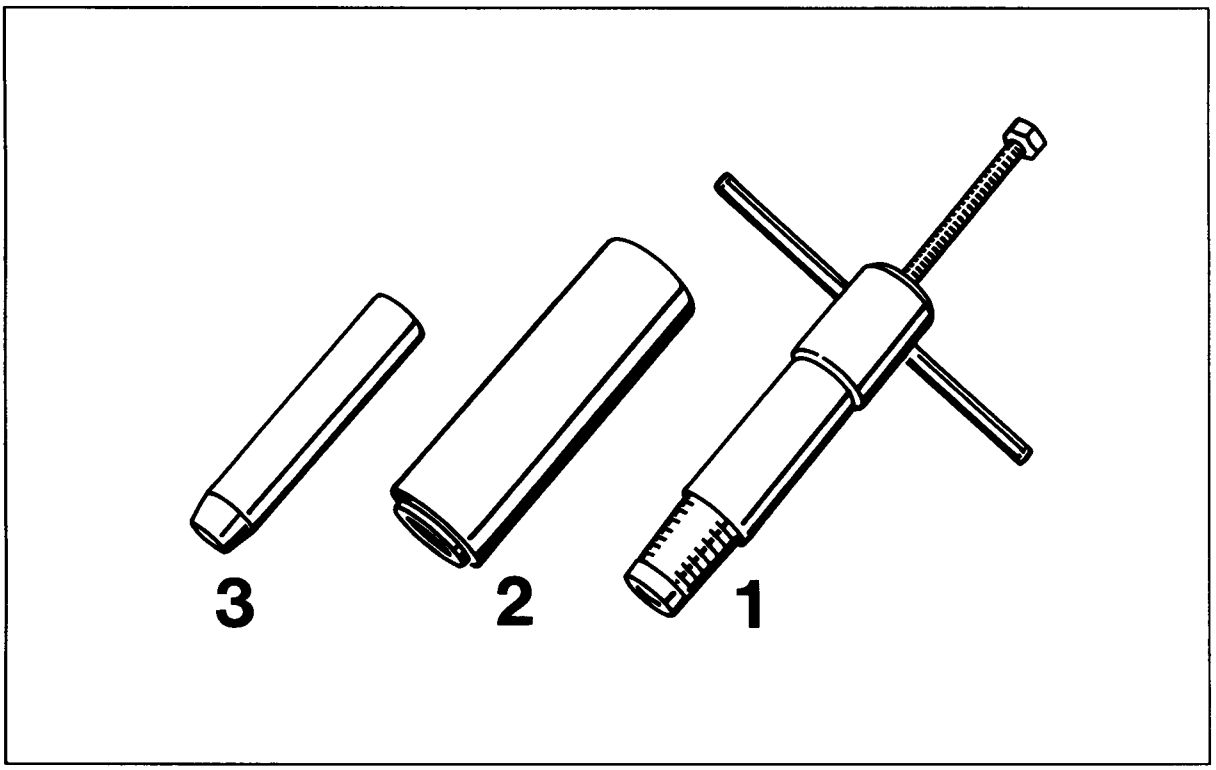
186-34

- Tighten hexagon head screws for shift fork with 23 Nm (17 ft.lb.).

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Disassembling and assembling gearbox

Tools

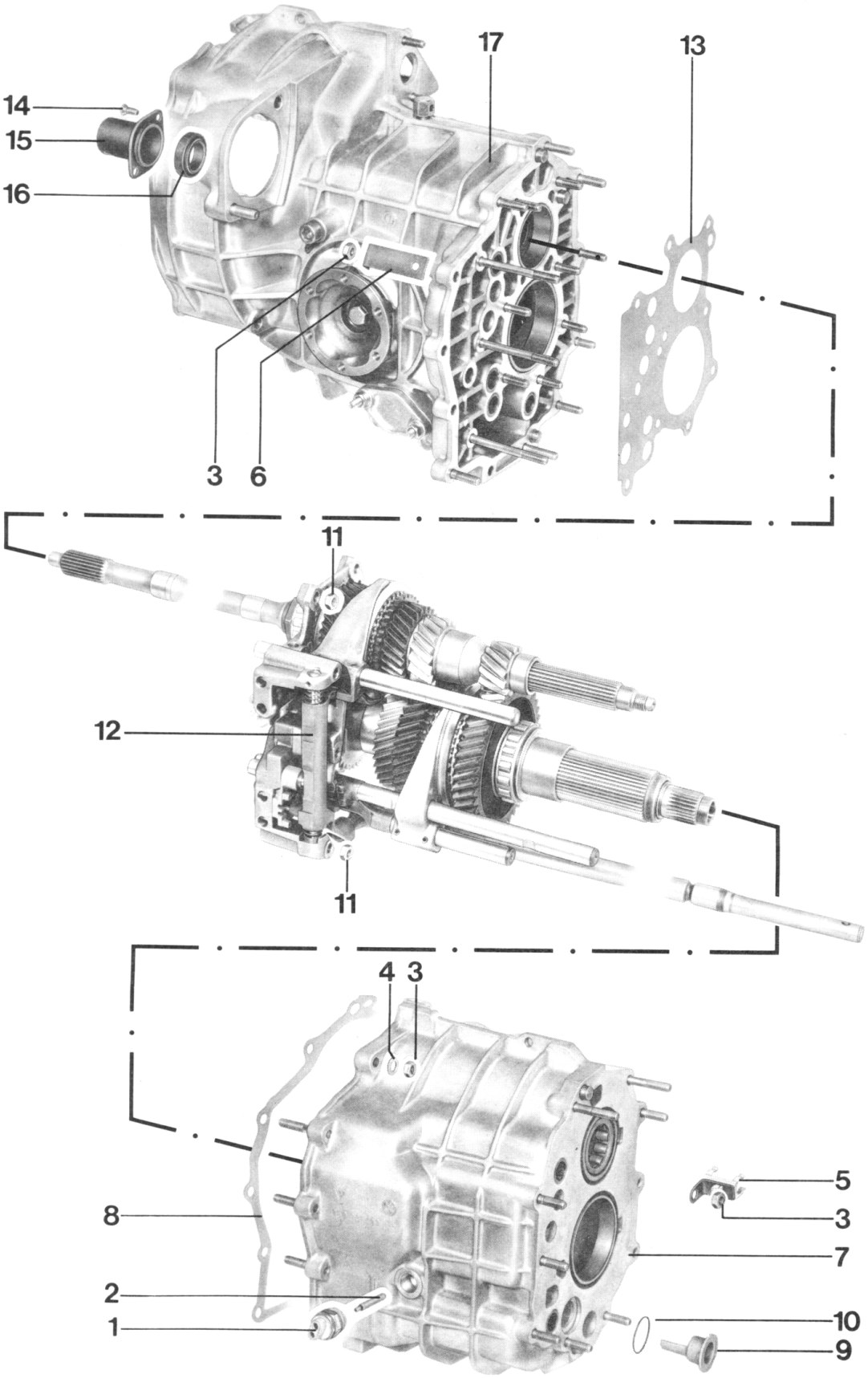


193 - 34

No.	Description	Special Tool	Order Number	Remarks
1	Puller	9251	000.721.925.10	
2	Pressing tool	9256	000.721.925.60	
3	Sleeve	9255	000.721.925.50	

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Disassembling and assembling gearbox



Printed in Germany – III, 1989

No.	Description	Qty.	Note when: Removing	Installing
1	Reversing-light switch	1		Tighten with 35 Nm (26 ft.lb.)
2	Plunger	1		Offset side points towards switch
3	Hexagon nut	12		Tighten with 23 Nm (17 ft.lb.)
4	Washer	10		
5	Holder	1		
6	Holder	1		
7	Gear housing	1		
8	Seal	1		Replace
9	Oil guide pipe	1		Insert in correct position
10	O-ring	1		Replace
11	Hexagon nut	10		Tighten with 23 Nm (17 ft.lb.)
12	Gear set (complete)	1		Insert complete gear set with inner shift rod
13	Shim "S3"	X	Make a note of number and thickness for refitting	Determine again if necessary
14	Oval-head screw	2		Tighten with 10 Nm (7.5 ft.lb.)
15	Guide tube	1		
16	Shaft seal	1	Refer to Page 34 - 18	Only install after assembling the gear set (refer to Page 34 - 18)
17	Transmission case	1		

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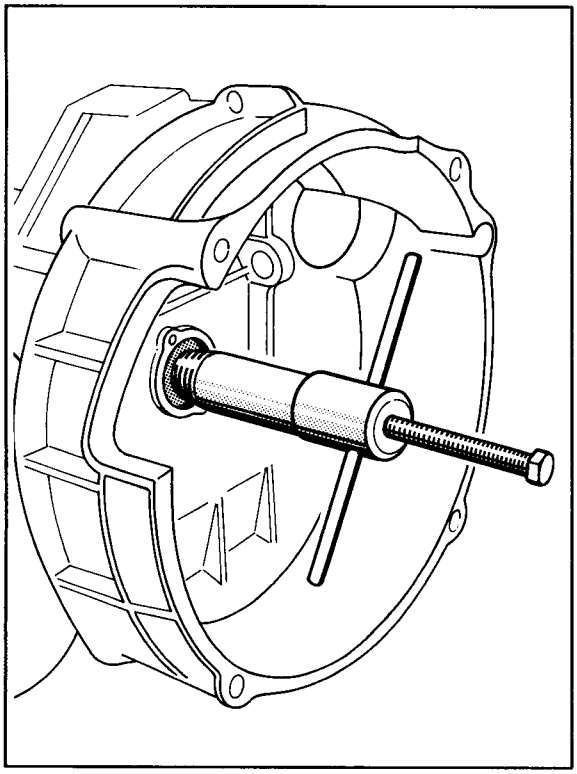
Removing and installing input shaft seal

Removing

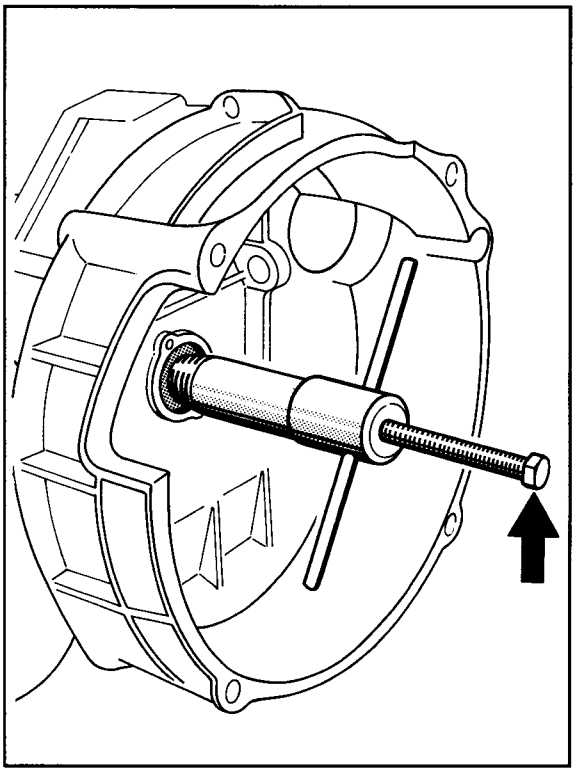
1. Remove engine/gearbox assembly and disconnect transmission.

2. Remove release-bearing guide tube.

3. Screw Special Tool 9251 firmly into the seal.



4. Pull out seal by screwing in the hexagon head screw.



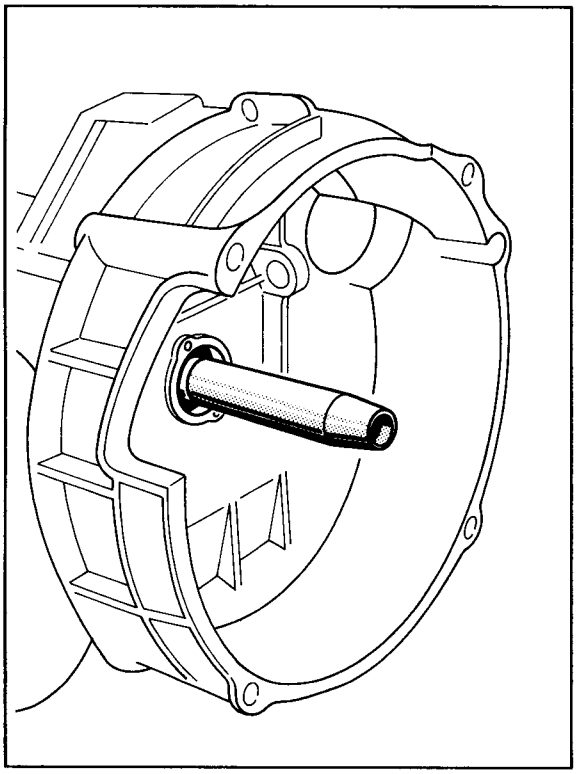
Note

If the helical tension spring jumps out when removing the seal, pull from the input shaft using a wire hook.

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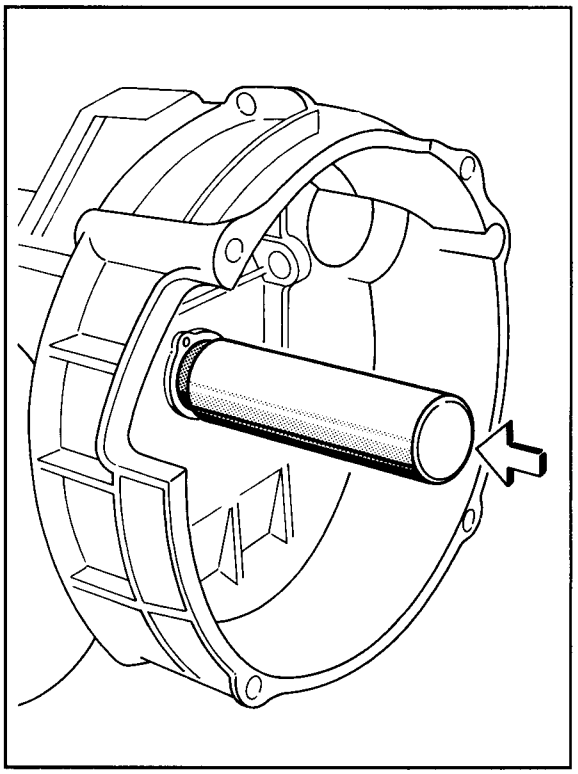
Installing

1. Slide assembly sleeve 9255 over the input shaft gearing.



2. Fill the area between sealing lips with grease (e.g. Olista Longtime 3 EP)

3. Drive seal into place with Special Tool 9256.



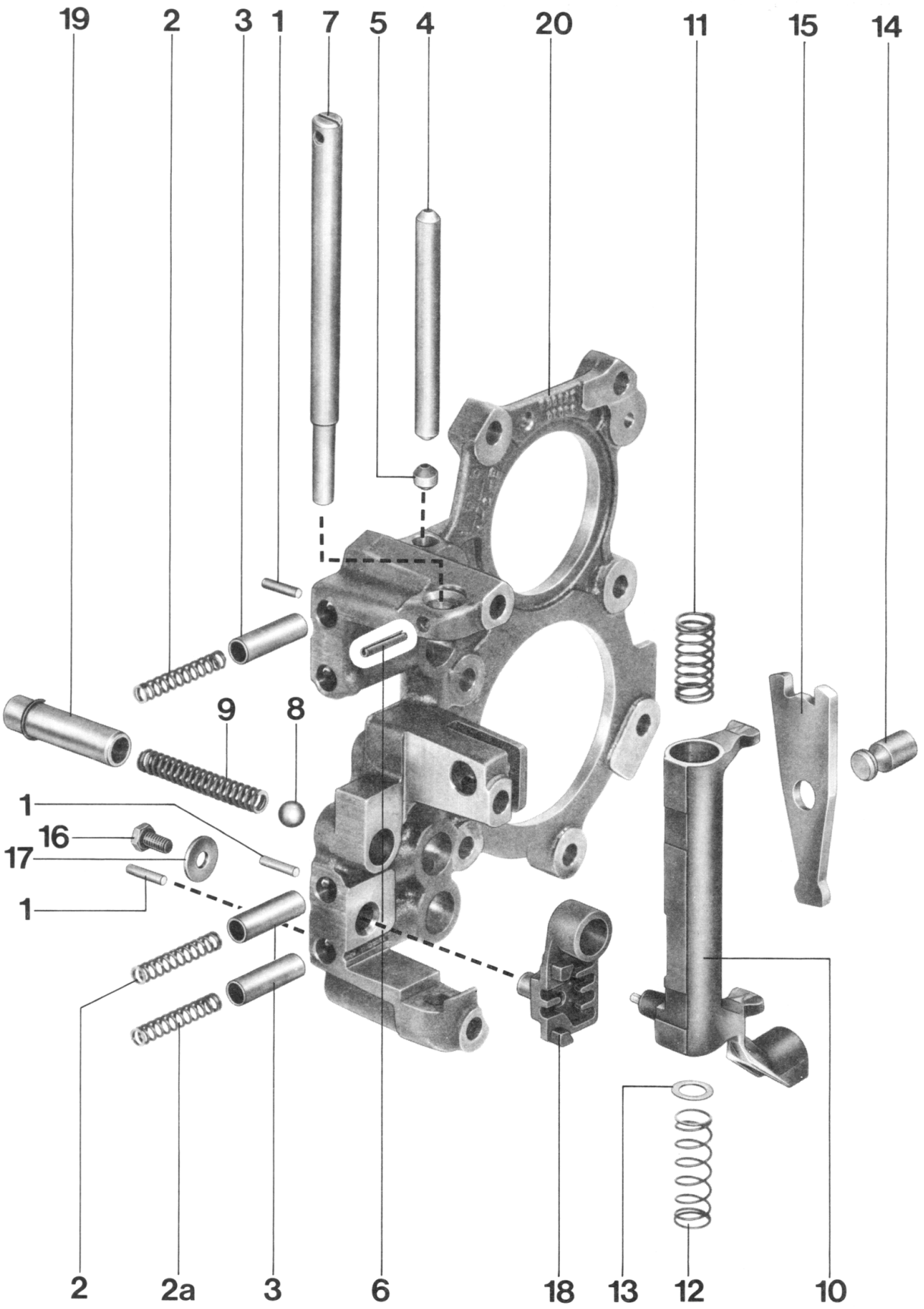
4. Install guide tube and tighten fastening screws with **10 Nm (7.5 ft.lb.)**

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Disassembling and assembling tensioning plate

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Disassembling and assembling tensioning plate



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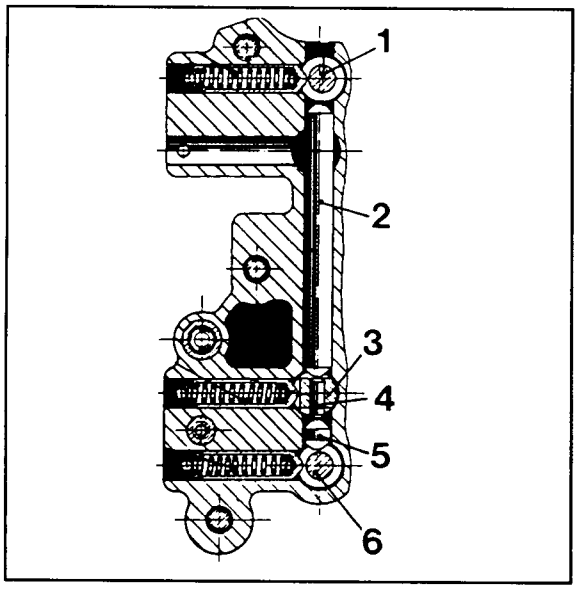
No.	Description	Qty.	Note when: Removing	Installing
1	Parallel pin	3	Springs (No. 2) are under tension when shift rods installed	
2	Compression spring	3		
3	Locking bush *	3		
4	Lock*	1		
5	Lock*	1		
6	Dowel pin	1		
7	Pivot shaft	1		Insert in correct position, secure to tensioning plate hole with mandrel dia. 8 mm
8	Ball	1		
9	Compression spring	1		
10	Deflection lever	1		
11	Compression spring**	1	Mark for refitting	Relaxed length = 33.9 + 0.5 mm, wire thickness = 1.6 mm. Do not confuse with spring No. 12
12	Compression spring	1	Mark for refitting	Relaxed length = 55.2 + 0.5 mm, wire thickness = 1.5 mm. Do not confuse with spring No. 11
13	Shim	1		

* Observe installation position of locks

** New spring as of Feb., 1991. Free length 63 + 0,5 mm, wire thickness 1.6 mm

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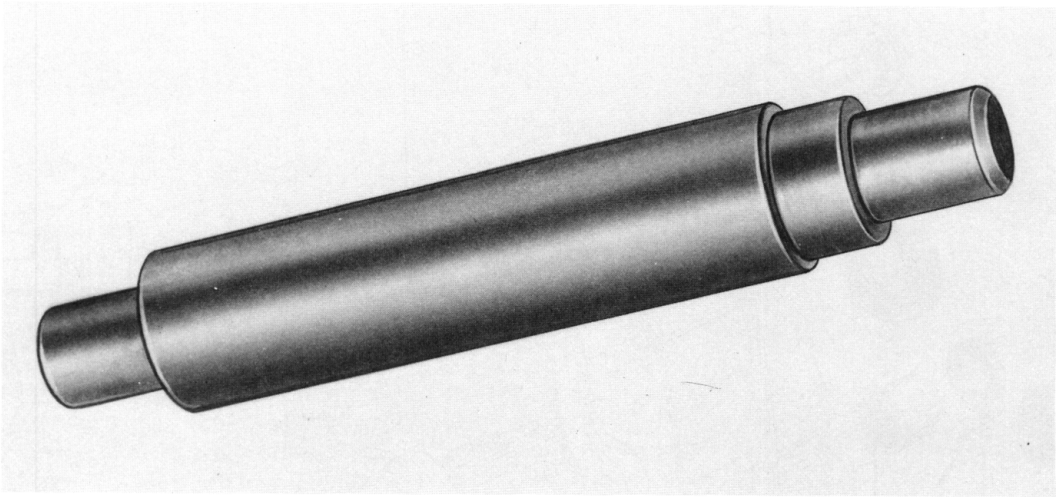
No.	Description	Qty.	Note when: Removing	Installing
14	Bolt	1		Insert in correct position, secure to tensioning plate hole with mandrel Ø 8 mm
15	Deflection lever	1		
16	Hexagon head screw	1		Tighten with 10 Nm (7.5 ft.lb.)
17	Washer	1		
18	Shift gate	1		
19	Adapter sleeve with snap ring	1	Press out with suitable mandrel	Press in to position with suitable mandrel
20	Tensioning plate	1		



160-35

Transfer case, disassembling and assembling

Tools

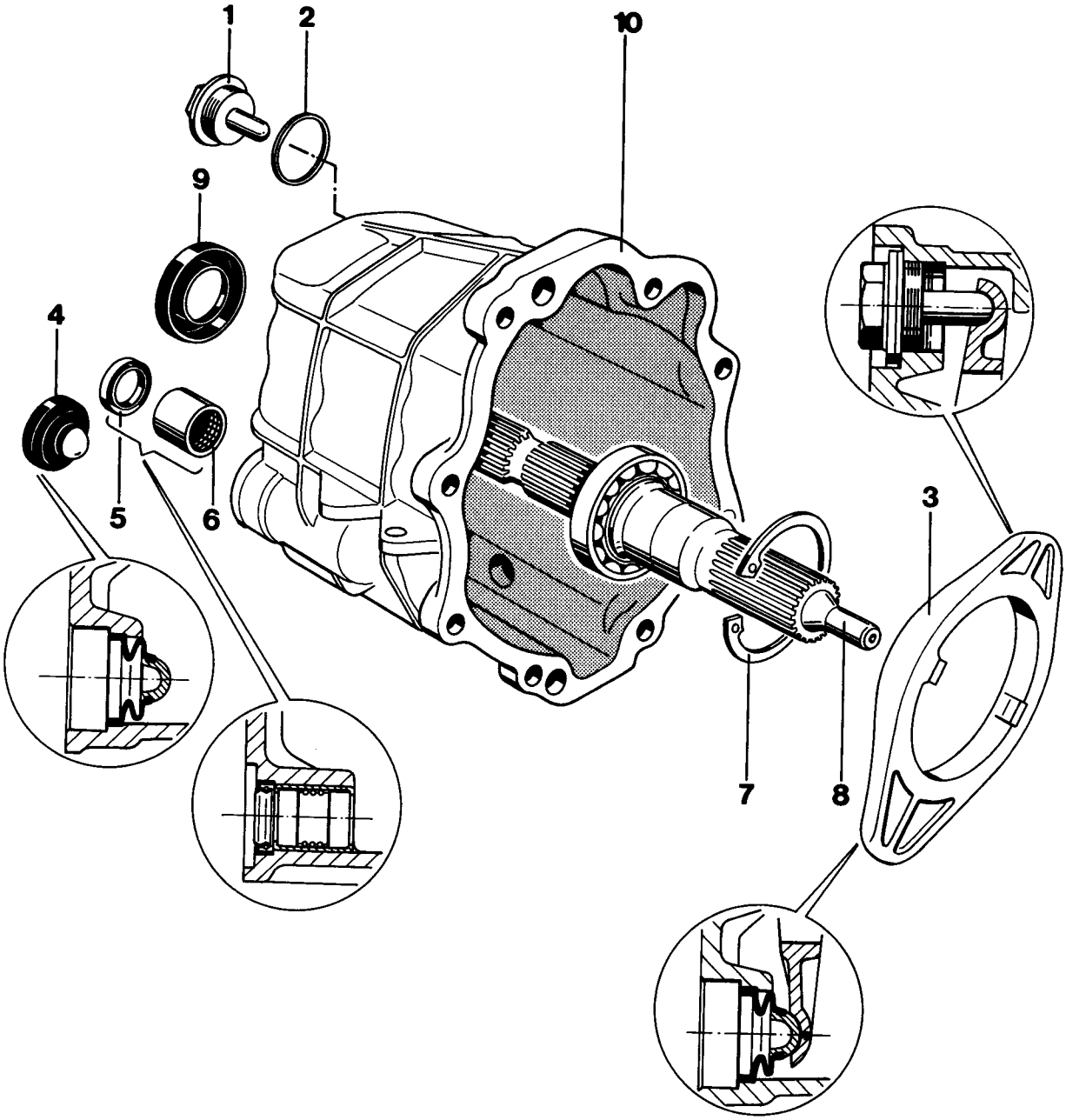


86/856

No.	Description	Special Tool	Order number	Remarks
	Mandrel	9254	000.721.925.40	

Printed in Germany – II, 1989

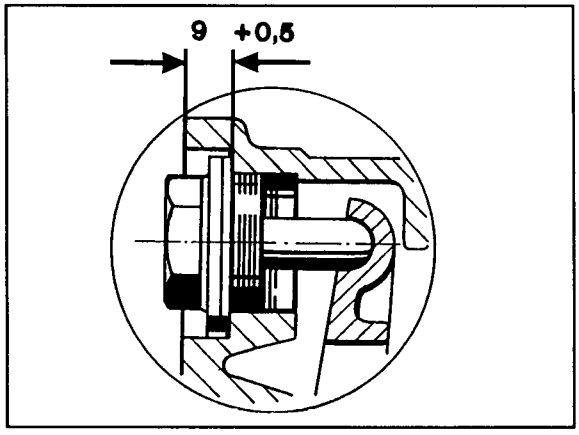
Transfer case, disassembling and assembling



Printed in Germany – II, 1989

No.	Designation	Qty.	Note: Removal	Installation
1	Counter-bearing bolt	1		Tighten to 80 Nm (59 ftlb) torque
2	Sealing ring	1		Renew
3	Engagement lever	1		Install in correct position
4	Sealing gaiter**	1	Remove from the inside outwards	Oil lightly and press in with a suitable tube (e.g. VW 418 A), noting correct position
5	Shaft sealing ring	1	Lever out with screwdriver	Press in with special tool 9254, noting correct position
6	Ball sleeve	1	Pull out with a suitable internal-arm puller (e.g. 14 - 20, manufacturer Schrem)	Press in with special tool 9254, noting correct position
7	Circlip	1		
8	Output shaft	1	Press out	Press in
9	Shaft sealing ring	1		Install only after assembly of the output shaft. Oil the sealing lip lightly and press in flush with a suitable tube
10	Housing*	1		

* As a result of overlapping tolerances, the 9 +0.5 mm dimension on some transfer box housings has proved to be up to 0.5 mm too deep. To avoid the risk of front-rear differential lock malfunction, an additional washer 1 mm thick has been placed under the counter-bearing bolt

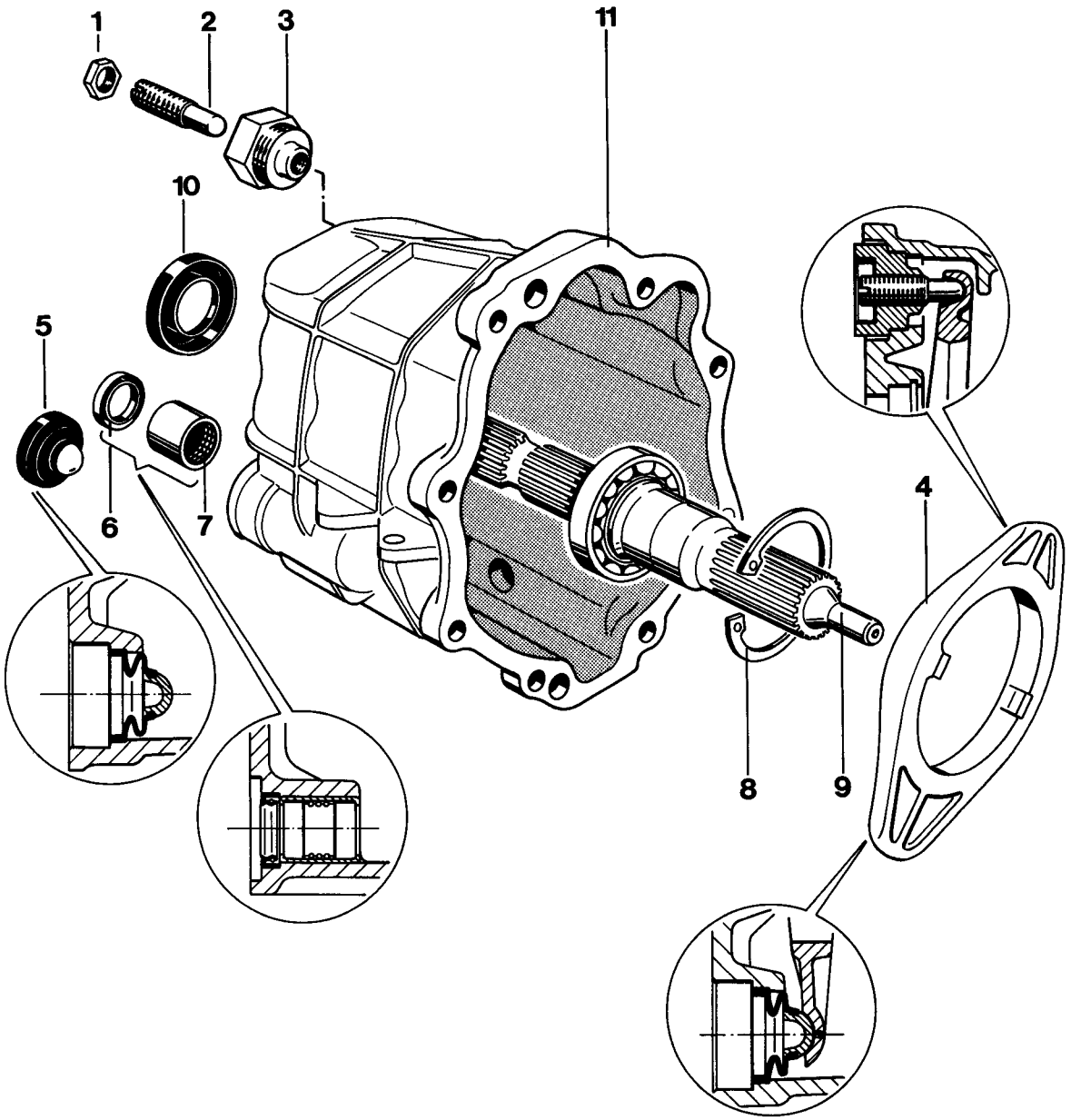


589-34

** If the sealing gaiter is leaking, always renew the slave cylinder.

Printed in Germany – X, 1990

Dismantling and assembling the transfer box housing (from 1991 model on)



590-34

Printed in Germany – X, 1990

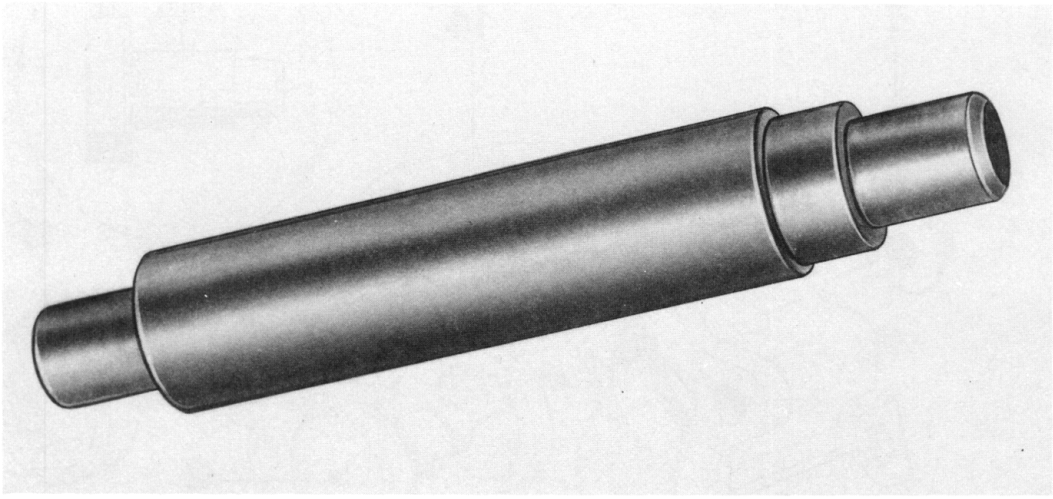
No.	Designation	Qty.	Note: Removal	Installation
1	Hex nut	1		Seal with Loctite 222 and tighten to 40 Nm (30 ftlb) torque
2	Bearing pin	1	Do not alter the setting of this pin or remove it unless renewing the plates or the front-rear differential lock.	Adjust; see Page 34 - 8b
3	Counter-bearing screw	1		Seal with Loctite 222 and tighten to 80 Nm (59 ftlb) torque
4	Engagement lever	1		Install in correct position
5	Sealing gaiter*	1	Remove from the inside outwards	Oil lightly and press in with a suitable tube (e.g. VW 418 A), making sure that the position is correct
6	Shaft sealing ring	1	Lever out with screwdriver	Press in with special tool 9254, making sure that position is correct
7	Ball sleeve	1	Pull out with a suitable internal-arm puller (e.g. 14 - 20, manufacturer Schrem)	Press in with special tool 9254, making sure that position is correct
8	Circlip	1		
9	Output shaft	1	Press out	Press in
10	Shaft sealing ring	1		Install only after assembly of the output shaft. Oil the sealing lip lightly and press in flush with a suitable tube.
11	Housing	1		

* If the sealing gaiter is leaking, always renew the slave cylinder as well.

Printed in Germany – X, 1990

Intermediate case, disassembling and assembling

Tools

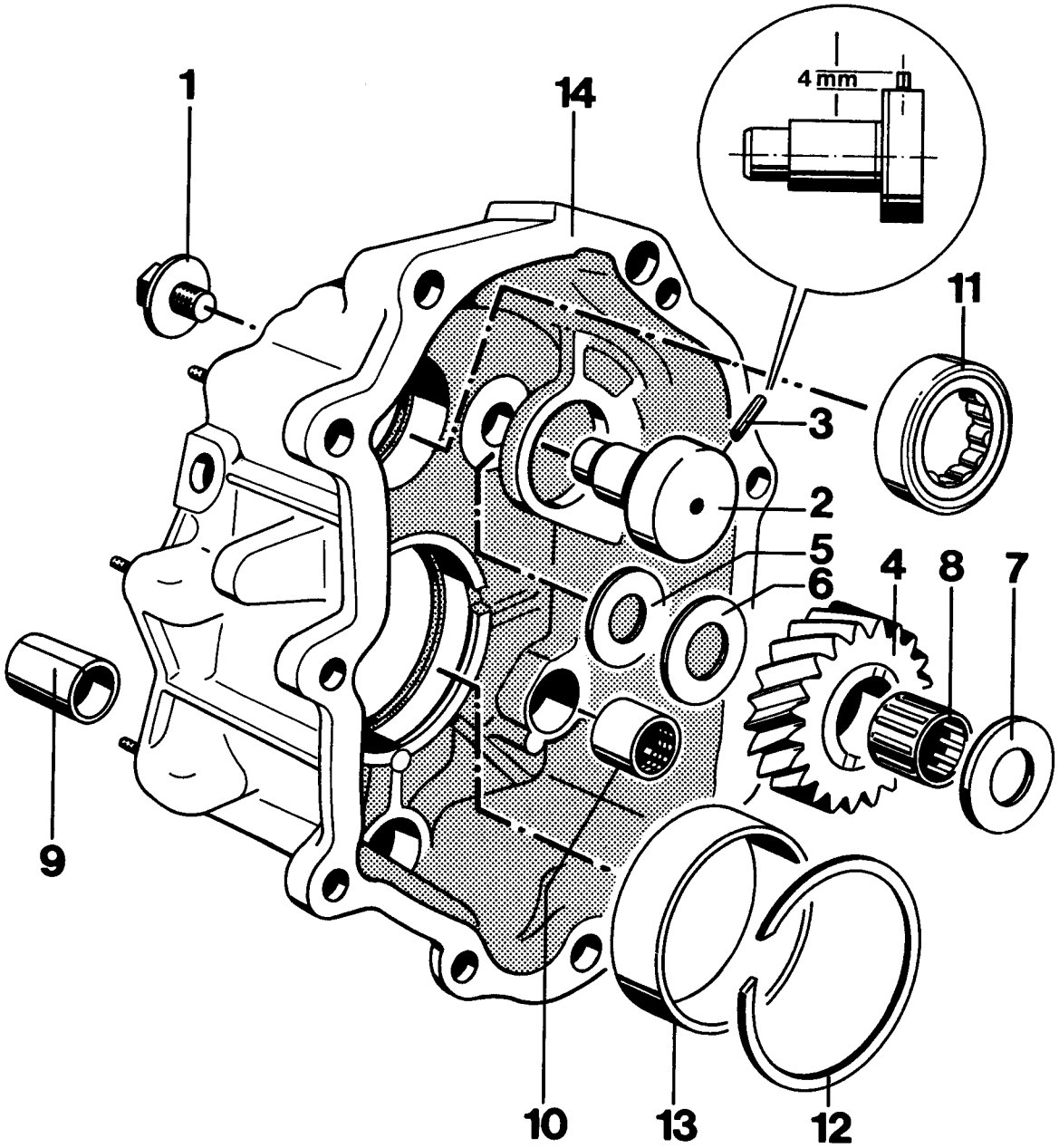


86/856

No.	Description	Special Tool	Order number	Remarks
	Mandrel	9254	000.721.925.40	

Printed in Germany – II, 1989

Intermediate case, disassembling and assembling



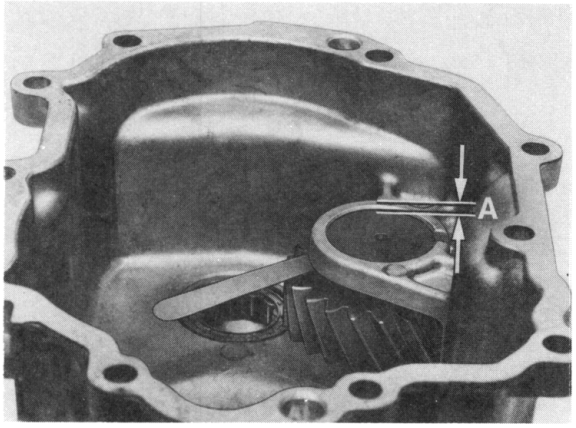
Printed in Germany – II, 1989

No.	Description	Qty.	Note when: Removing	Installing
1	Hexagon head screw	1		Apply film of Loctite 270 and tighten with 35 Nm (26 ft.lb.)
2	Bolt	1		
3	Dowel pin	1		Drive into correct pos.
4	Reverse idler gear	1		
5	Friction washer (2.0 mm thick)	1		
6	Friction washer (1.5 mm thick)	1		Do not confuse with washer No. 5
7	Friction washer (1.5 mm thick)	1		Do not confuse with washer No. 5
8	Needle-roller assembly	1		
9	Sleeve	1	Pull out with suitable internal puller (e.g. Schrem 14-20)	Press in level from outside using Special Tool 9254
10	Spherical sleeve	1	Pull out using suitable internal puller (e.g. Schrem 14 - 20)	Press in level from inside using Special Tool 9254
11	Cylindrical-roller bearing	1	Heat housing up to approx. 120 °C (248 °F) and drive inside from outside using a suitable mandrel	Heat housing up to approx. 120°C (248 °F) and insert using a suitable piece of tubing (e.g. VW 484). Press in again following heat exchange
12	Circlip	1		
13	Outer bearing race	1	Heat housing up to approx. 120 °C (248 °F) and drive inside from outside using a suitable mandrel.	Heat housing up to approx. 120 °C (248 °F) and insert using suitable piece of tubing (e.g. VW 472/1). Press in further following heat exchange
14	Housing	1		

Printed in Germany – II, 1989

Notes on assembly

Mount reverse idler gear with friction washers and bolt in the correct position (refer to explosion drawing). If friction washers and bolts are in the correct position, the front surface of the bolt is approx. 1.5 mm lower than the case casting and the reverse idler gear has an axial play of 0.15...0.35 mm.

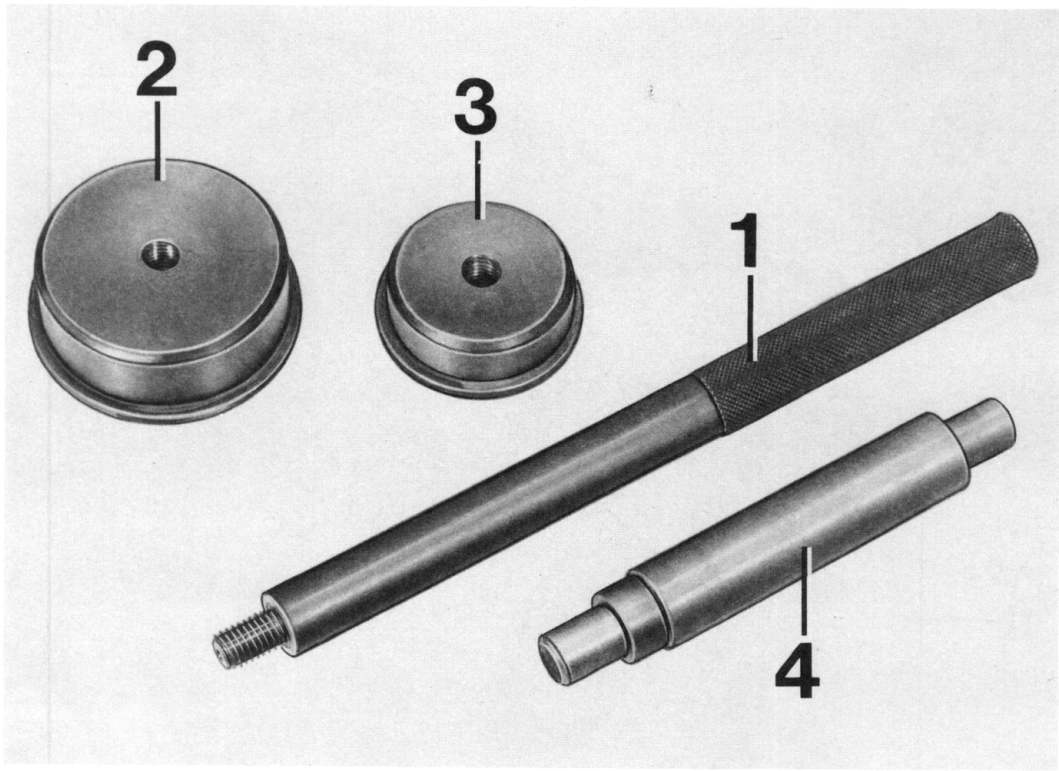


A = approx. 1.5 mm 88/340

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Gear housing, disassembling and assembling

Tools

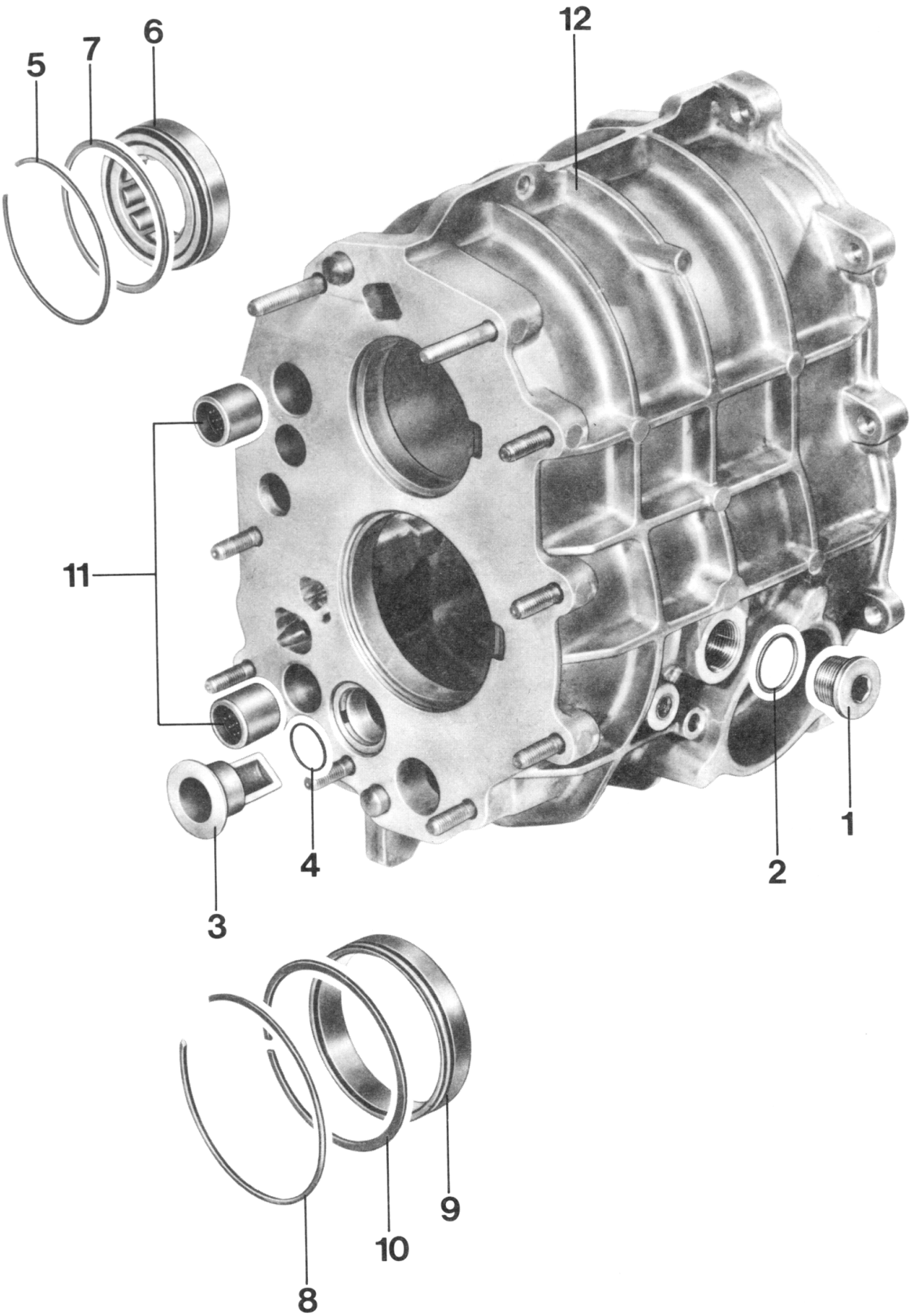


86/854

No.	Description	Special Tool	Order number	Remarks
1	Mandrel	P 254	000.721.254.00	
2	Pressing tool	P 254 a	000.721.254.10	
3	Pressing tool	P 254 b	000.721.254.20	
4	Mandrel	9254	000.721.925.40	

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Gear housing, disassembling and assembling



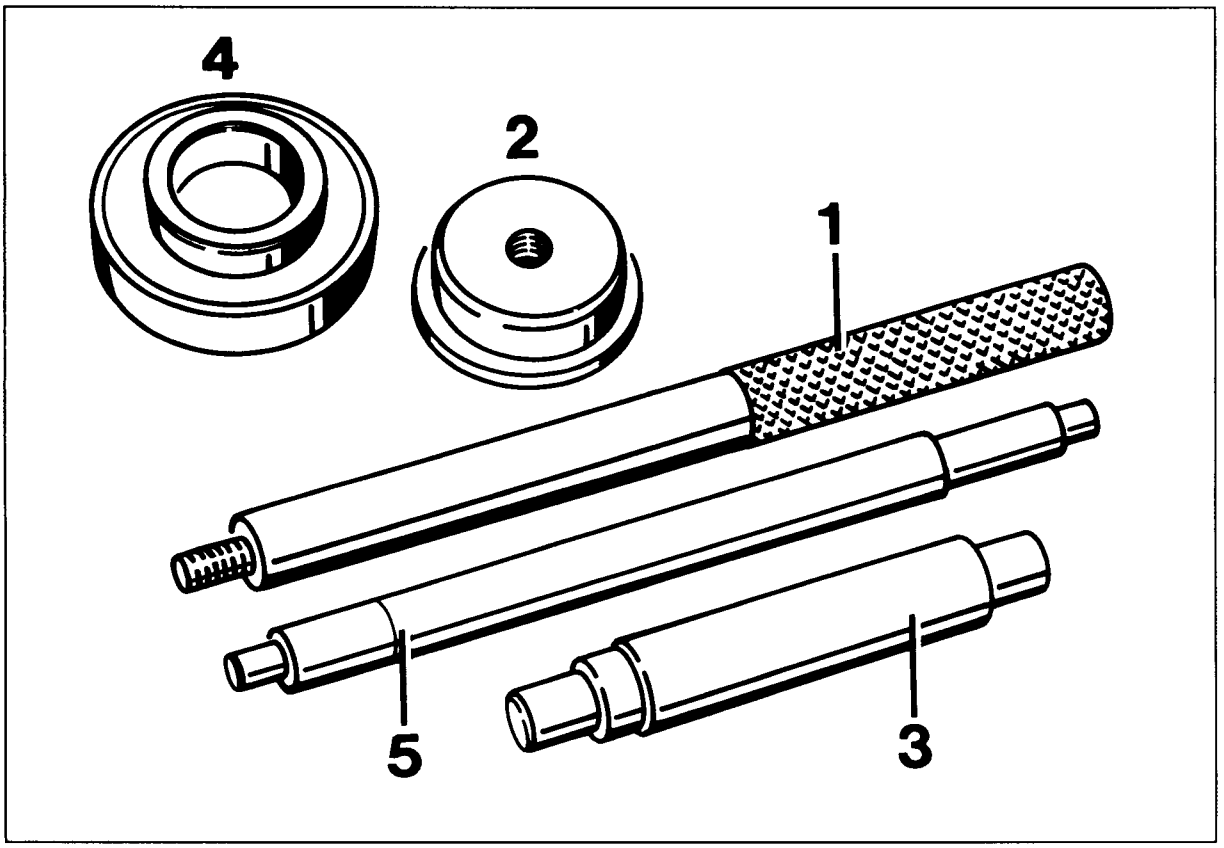
Printed in Germany – II, 1989

No.	Description	Qty.	Note when: Removing	Installing
1	Plug	1		Tighten with 30 Nm (22 ft.lb.)
2	Seal	1		Replace
3	Oil guide tube	1		Insert in correct position
4	O-ring	1		Replace
5	Circlip	1	Take out using suitable screwdriver	
6	Cylindrical-roller bearing	1	Heat gear housing up to approx. 120 °C (248 °F) and press outside from inside over the outer ring using Special Tools P 254 and P 254 b	Heat gear housing up to approx. 120 °C (248 °F) and press in over the outer ring using Special Tools P 254 and P 254 b.
7	Snap ring	1		
8	Circlip	1	Remove using suitable screwdriver	
9	Outer bearing race	1	Press outside from inside using Special Tools P 254 and P 254 a	Press in using Special Tools P 254 and P 254 a
10	Snap ring	1		
11	Spherical sleeve	2	Press out using suitable mandrel	Press in level from outside using Special Tool 9254
12	Gear housing	1		

Printed in Germany – II, 1989

Disassembling and assembling transmission case

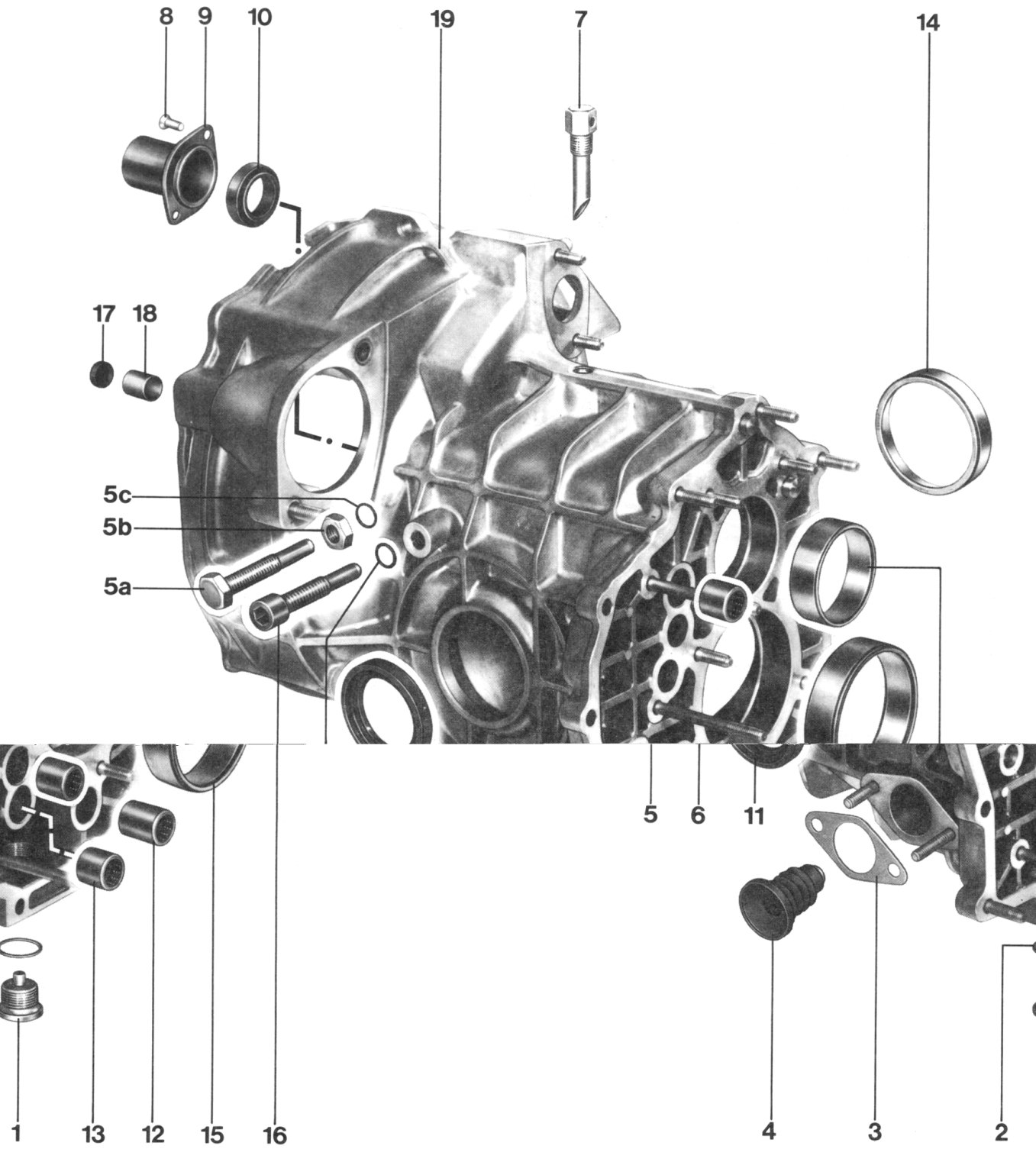
Tools



No.	Description	Special Tools	Order number	Remarks
1	Mandrel	P 254	000.721.254.00	
2	Pressure piece	P 254 b	000.721.254.20	
3	Mandrel	9254	000.721.925.40	
4	Pressure piece	9252	000.721.925.20	
5	Mandrel	9515	000.721.951.50	

Printed in Germany – X, 1990

Disassembling and assembling gearbox



Printed in Germany – X, 1990

No.	Description	Qty.	Note when: Removing	Installing
1	Plug	1		Clean, tighten with 30 Nm (22 ft.lb.)
2	Seal	1		Replace
3	Seal	1		Replace
4	Boot	1		Apply light film of oil and press into position using suitable piece of tubing (e.g. VW 418 a)
5	Fillister-head screw	1		Tighten with 65 Nm (48 ft.lb.)
5a	Counter-bearing*	1	Adjust or remove only if lateral differential lock plates are renewed	Re-adjust if necessary and lock with hex nut
5b	Hex nut	1		Seal with Loctite 222, tightening torque 85 Nm
5c	Sealing ring**			Renew
6	Disk	1		
7	Bleeder	1		Tighten with 35 Nm (26 ft.lb.). Observe installation position.
8	Oval-head screw	2		Tighten with 10 Nm (7.5 ft.lb.)
9	Guide tube	1		
10	Shaft seal	1		Only install after fitting the gear set (also refer to Page 34 - 18)
11	Shaft seal	1		Drive into position with Special Tool 9252. Pack area between sealing lips with Silubrin grease S from Klüber

* From 1991 model on, starter motor with external bearing

** As of March 1991, the sealing ring at the adjustable mating bearing screw is omitted. To seal, Loctite 222 is applied.

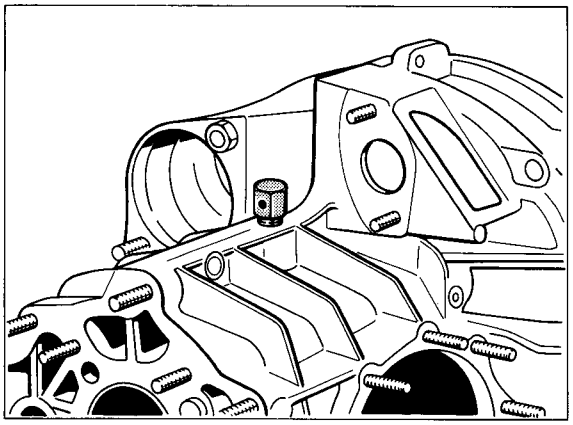
Printed in Germany – XI, 1991

No.	Description	Qty.	Note when: Removing	Installing
12	Spherical sleeve	1	Pull out with suitable internal puller (e.g. Schrem 14-20)	Press in level with Special Tool 9254
13	Spherical sleeve	3	Pull out with suitable internal puller (e.g. Schrem 14-20)	Press in level with Special Tool 9254
14	Outer bearing race	1	Heat transmission case up to approx. 120 °C (248 °F) and press in using suitable pressing tool	
15	Outer bearing race	1	Heat transmission case up to approx. 120 °C (248 °F) and drive out using suitable mandrel	Heat transmission case up to approx. 120 °C (248 °F) and press into position using suitable pressing tool (e.g. VW 204 b)
16	Outer bearing race	1	Heat transmission case up to approx. 120 °C (248 °F) and pull out using suitable internal puller (e.g. Schrem 50-60)	Heat transmission case up to approx. 120 °C (248 °F) and press into position using Special Tools P 254 and 254 b
17	End cover**	1		
18	Bushing**	1	Drive out from the inside with arbor 9515	Do not grease or oil; do not clean with solvents (e.g. white spirit. Drive in fully from the inside with arbor 9515
19	Transmission case	1		

** From 1990 model on, starter motor with external bearing

Assembly notes

1. Fit bleeder in correct position and tighten with **35 Nm (26 ft.lb.)**.

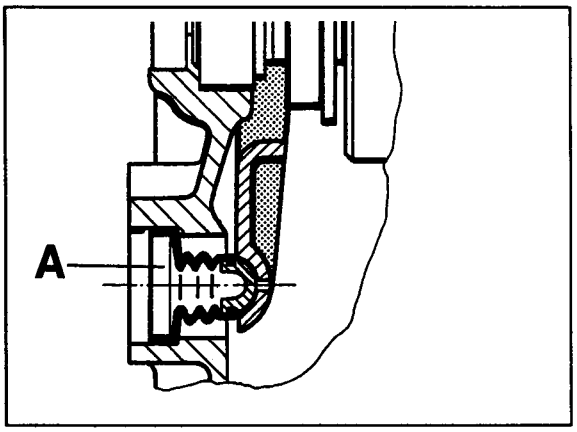


86 - 824

Note:

The hole in the hexagon head of the bleeder must point towards the front viewed from the driving seat (towards the intermediate case).

2. Apply light film of oil to the boot and press into position with suitable piece of tubing (e.g. VW 418 a).



A = Boot

210-34

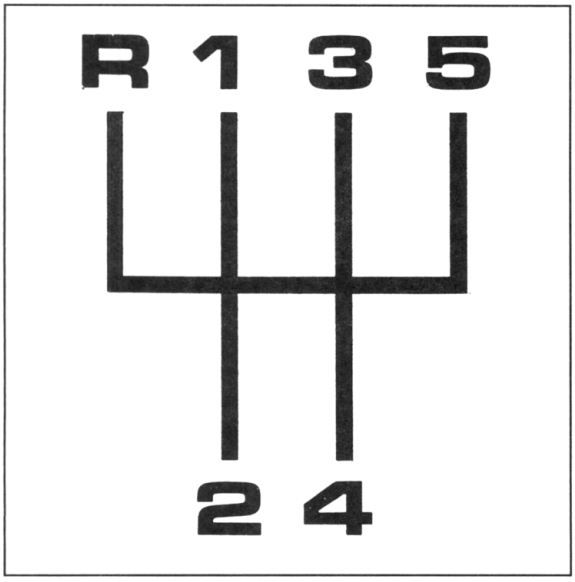
Note

If the sealing gaiter is leaking, always renew the slave cylinder.

Printed in Germany – X, 1990

Adjusting the gearshift assembly

1. Set shift lever to neutral. The shift lever will automatically move into the 3rd and 4th gear shift plane (no adjustment possible).



2049-34

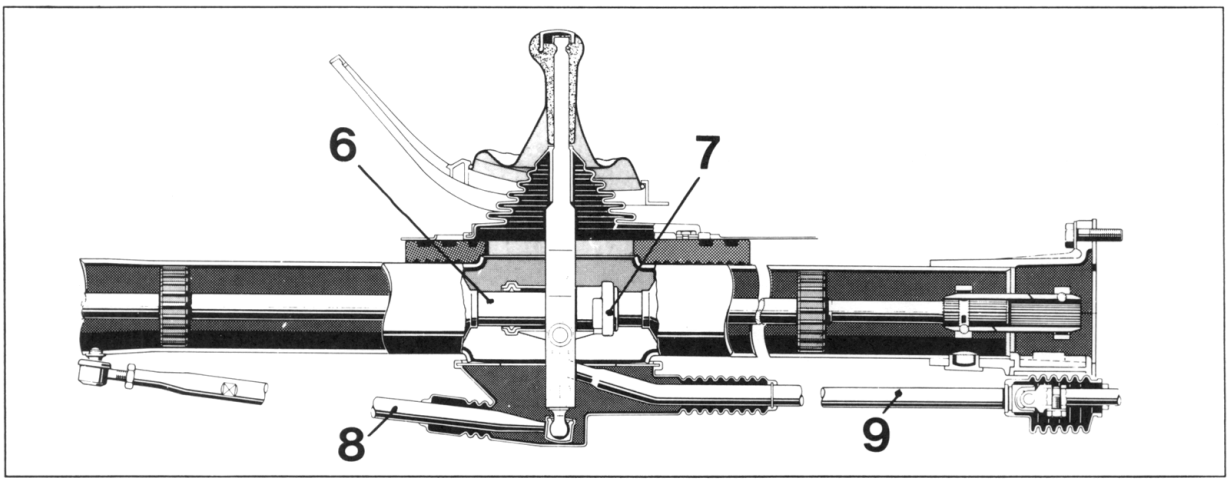
2. When the gearshift is adjusted correctly, the underside of the shift lever is not inclined in a longitudinal direction. This means that the lower section is at a 90° angle to the central tube and the frame tunnel, respectively.

Note

The upper part of the shift lever is slightly inclined towards the rear since only the lower part of the shift lever is straight (not evident from drawing No. 644).

3. Checking the adjustment: Shift through all gears. The clearance between the front and rear of the console must be approximately the same in all gears.

4. If required, correct adjustment at the adjustable guide tube (No. 8).
One turn of the ball joint corresponds to a change of inclination of approx. 3 to 5 mm at the shift lever.
Caution: When tightening the lock nut, make sure the ball joints are **not** twisted with regard to each other.

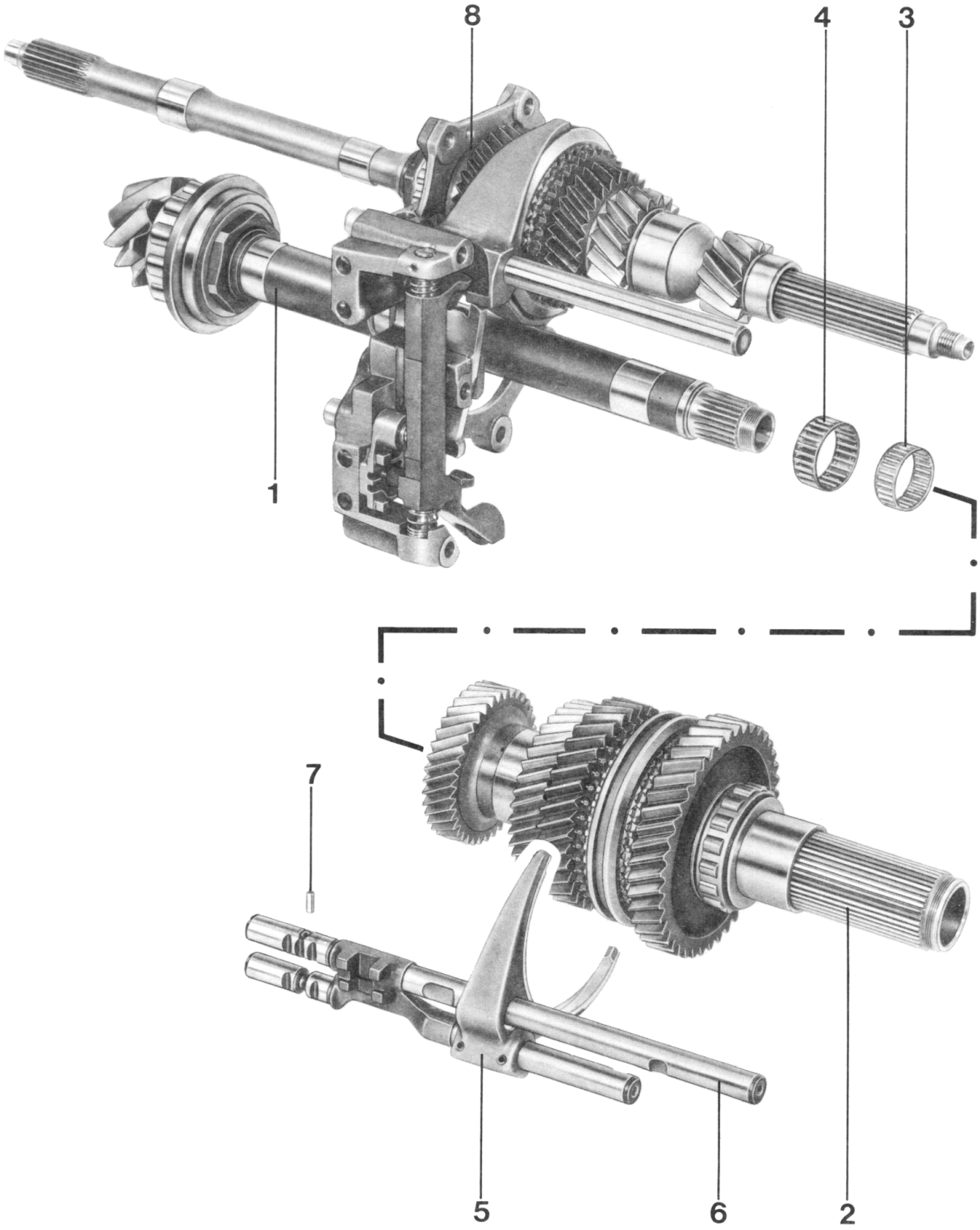


Printed in Germany XXII 1994

Partially disassembling the gear set

Printed in Germany – II, 1989

Partially disassembling the gear set



Printed in Germany – II, 1989

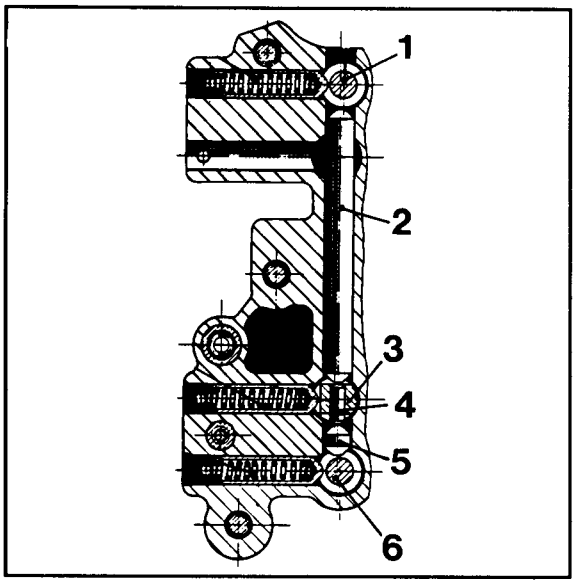
No.	Discription	Qty.	Note when: Removing	Installing
1	Drive pinion	1		
2	Hollow shaft	1		
3	Needle-roller assembly	1		
4	Needle-roller assembly	1		
5	Shift rod with gearshift fork (1st and 2nd gear)			Observe position of locks
6	Shift rod (5th and reverse gears)	1		Observe position of locks
7	Locking pin	1		Insert into shift rod (5th and reverse gears) with grease
8	Tensioning plate with internal shaft	1		

Printed in Germany – II, 1989

Notes on assembly

Assembling

1. Observe installation position of locks.



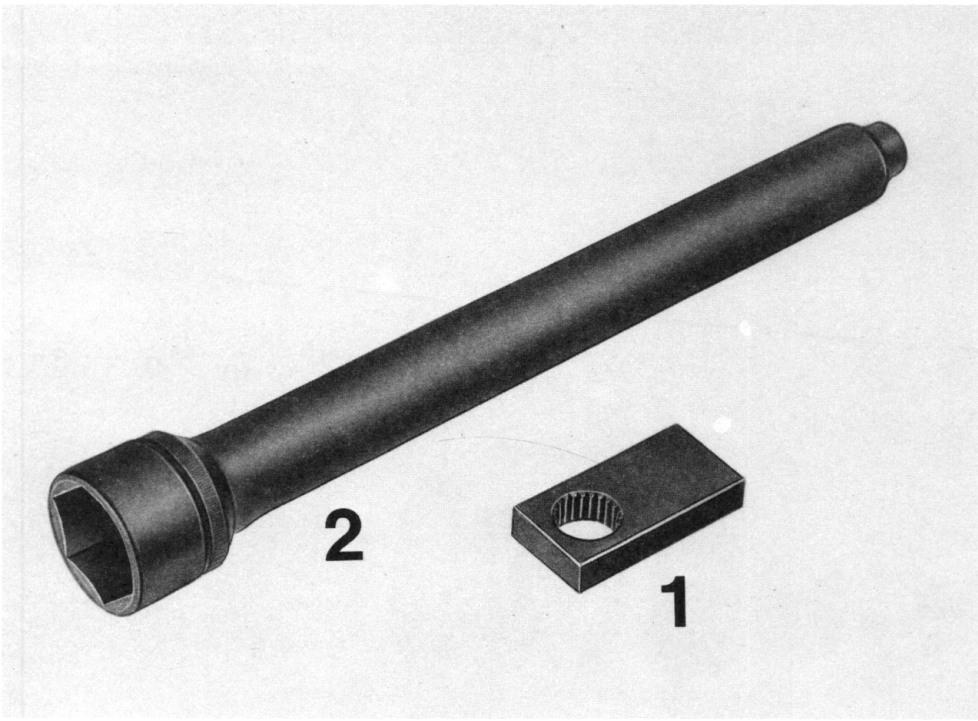
160-35

1 = Shift rod 3/4
2 = Lock
3 = Shift rod 5/R
4 = Locking pin
5 = Lock
6 = Shift rod 1/2

Printed in Germany – II, 1989

Disassembling and assembling input shaft

Tools

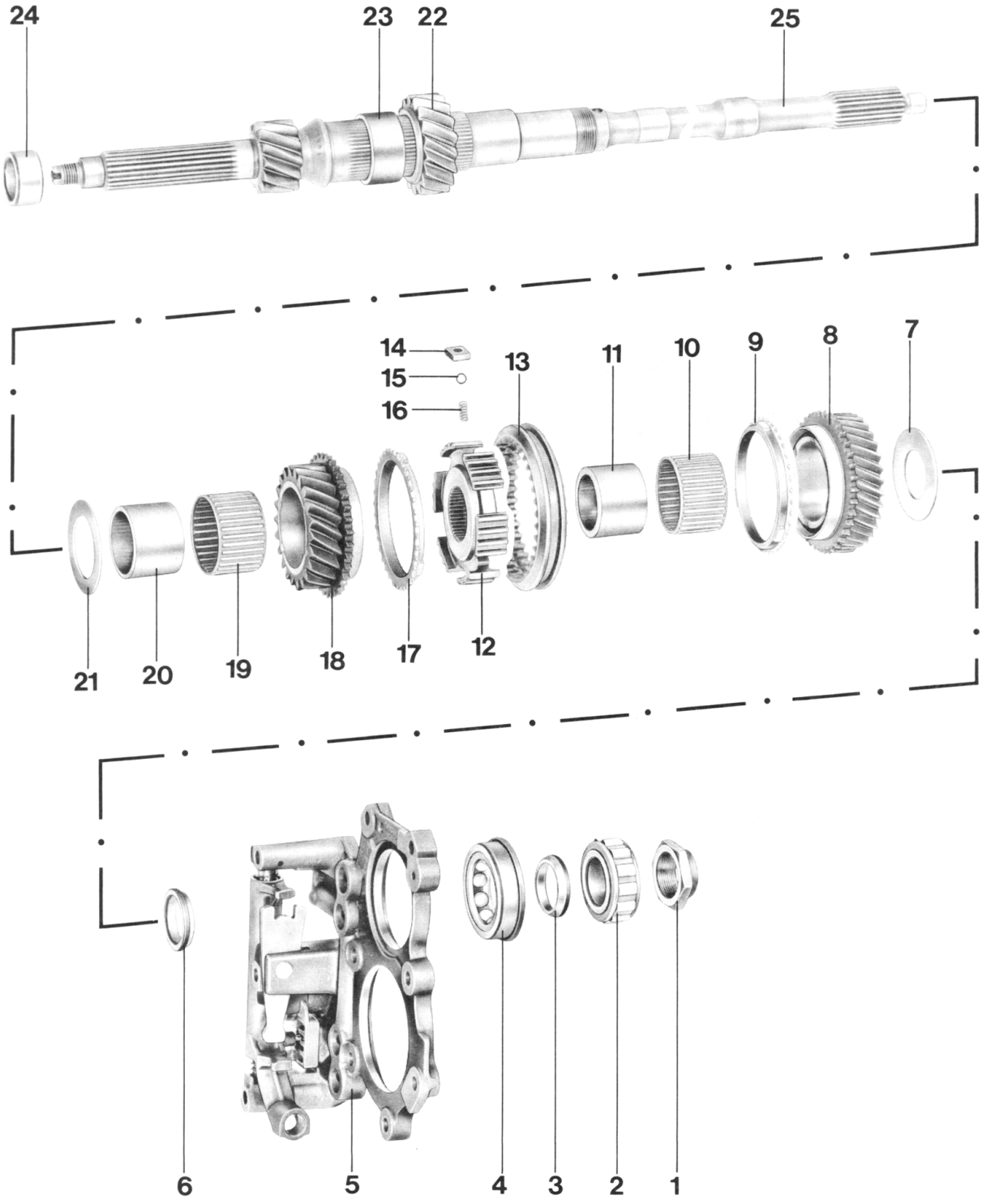


86/907

No.	Description	Special Tool	Order number	Remarks
1	Retainer plate	9177	000.721.917.70	
2	Socket wrench	9105	000.721.910.50	

Printed in Germany – II, 1989

Disassembling and assembling input shaft



Printed in Germany – II, 1989

No.	Description	Qty.	Note when: Removing	Installing
1	Collar nut	1	Undo with Special Tools 9177 and 9105	Use Special Tools 9177 and 9105, tighten with 250 Nm (184.5 ft.lb.). Notch the collar to secure
2	Cylindrical-roller bearing		Press off using suitable separating device (e.g. Kukko 17-1)	Heat up to approx. 120 °C (248 °F) and press into position with suitable piece of tubing
3	Inner bearing race	1	Press off using suitable separating device (e.g. Kukko 17-1)	Heat up to approx. 120 °C (248 °F) and press into position with suitable piece of tubing
4	Four-point bearing	1		
5	Tensioning plate	1		Clamp in the vice (use protective jaws). Select 5th gear, use input shaft with pin-secured shift rod / shift fork together. Observe pos. of locks (refer to Page 35-12)
6	Inner bearing race	1	Press off using suitable separating vice (e.g. Kukko 17-1)	Heat up to approx. 120°C (248 °F) and press into position using suitable piece of tubing
7	Friction washer	1		Large flat-ground side points towards needle-roller assembly
8	Loose gear (4th gear)	1		Only replace in pairs
9	Synchronizing disk	1	Mark for refitting	Check for wear, assemble in correct position with the same gear wheel (cogs towards driver dogs)
10	Needle-roller bearing	1	Mark	Assemble with the same gear wheel

Printed in Germany – II, 1989

No.	Description	Qty.	Note when: Removing	Installing
11	Inner race	1		Heat up to approx. 120°C (248 °F) and press into position
12	Guide sleeve	1	Remove with gearshift sleeve	Gearshift sleeve and guide sleeve are matched, fit together with gearshift sleeve and synchronizing compon.
13	Gearshift sleeve (3rd and 4th gear)	1	Spring-loaded synchronizing components may jump out. Mark for refitting	Observe inst. position, mount together with guide sleeve and synchronizing components. Only replace in pairs
14	Driver dogs	3		Insert in correct position
15	Ball	3		
16	Spring	3		Relaxed length = 11.8 + 0.3 mm, wire thickness = 0.8 mm. Do not confuse with springs for 1st and 2nd gears
17	Synchronizing disk	1	Mark for refitting	Check for wear, assemble in correct position with the same gear wheel (cogs toward driver dogs)
18	Loose gear (3rd gear)	1		Only replace in pairs
19	Needle-roller assembly	1	Mark for refitting	Assemble with the same gear wheel
20	Inner race	1		Heat up to approx. 120°C (248 °F) and press into position
21	Friction washer (1.85 mm thick)	1		
22	Fixed gear (2nd gear)	1		Only replace in pairs. Collar points towards spacer

Printed in Germany – II, 1989

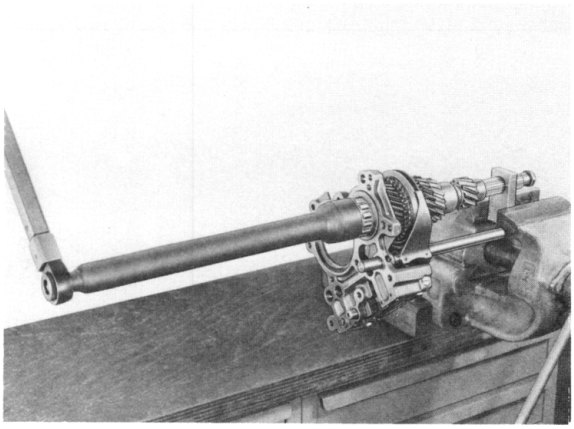
No.	Description	Qty.	Note when: Removing	Installing
23	Spacer	1		
24	Cylindrical-roller bearing - inner race	1	Press off using suitable separating device (e.g. Kukko 17- 0)	Heat up to approx. 120°C (248 °F) and press into position
25	Input shaft	1		

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Notes on disassembling and assembling

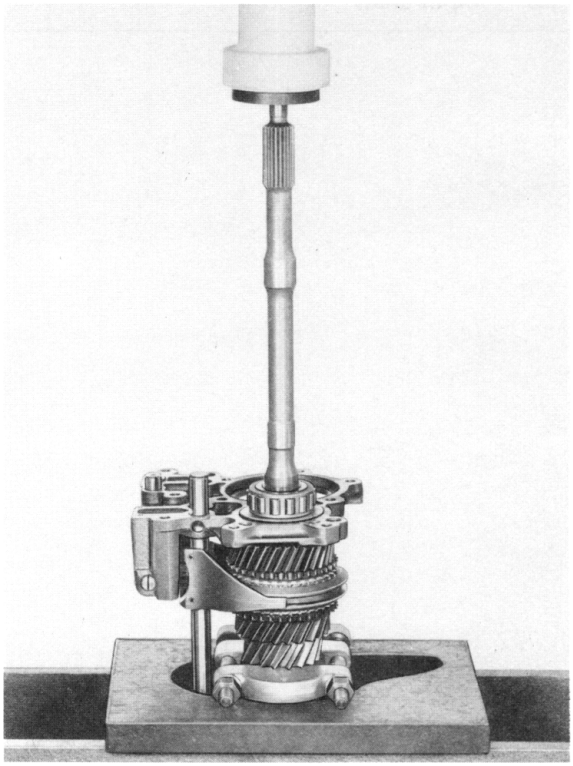
Disassembling

1. Clamp retaining plate 9177 in the vice, insert input shaft and undo collar nut with Special Tool 9105.



86/687

2. Remove all parts from the input shaft by pressing off with suitable separating device (e.g. Kukko 17-1).



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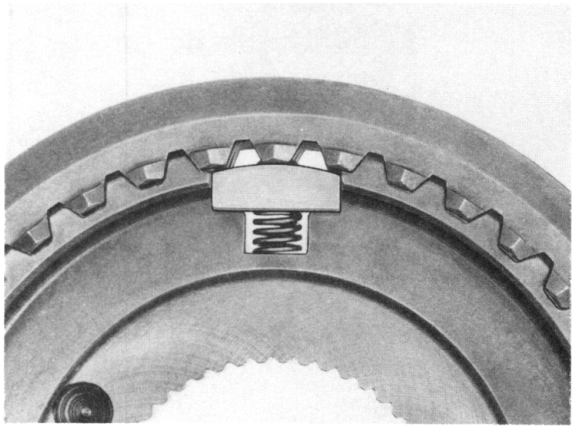
Printed in Germany – II, 1989

Assembling

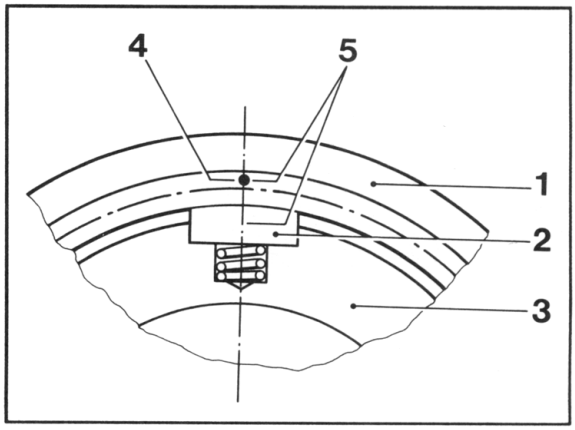
Note

All components must be fitted onto the input shaft dry to ensure that no oil penetrates between the contact surfaces.

1. Fit driver dogs for synchronization in correct position (curved side towards gear shift sleeve).



2. Installation position of gearshift sleeve. The dotting mark must be fitted centrally in relation to the driver dogs.



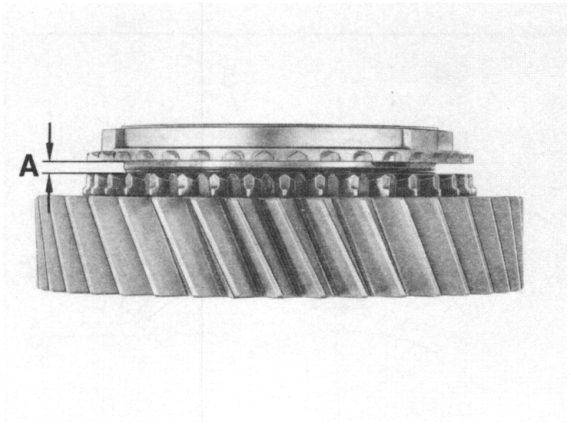
55-35

1 = Gearshift sleeve
2 = Driver dog
3 = Guide sleeve
4 = dotting mark
5 = Installation position

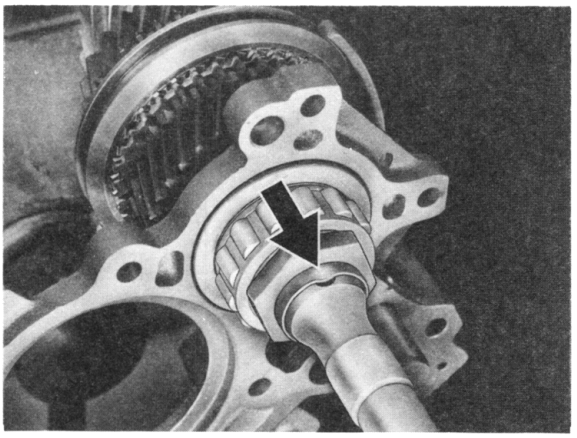
Printed in Germany – II, 1989

3. Check synchronizing disks by pressing onto the cones of the gear wheels and measuring gap "A" with a feeler gauge.

Installation dimension (new) = min. 0.9 mm
Wear limit = 0.6...0.7 mm

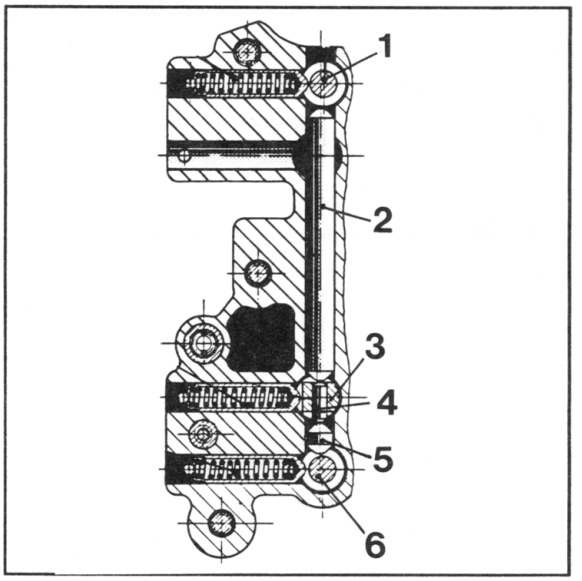


4. Tighten collar nut with 250 Nm (184.5 ft.lb.) and notch collar to secure.



86/681

5. Observe installation position of locks.



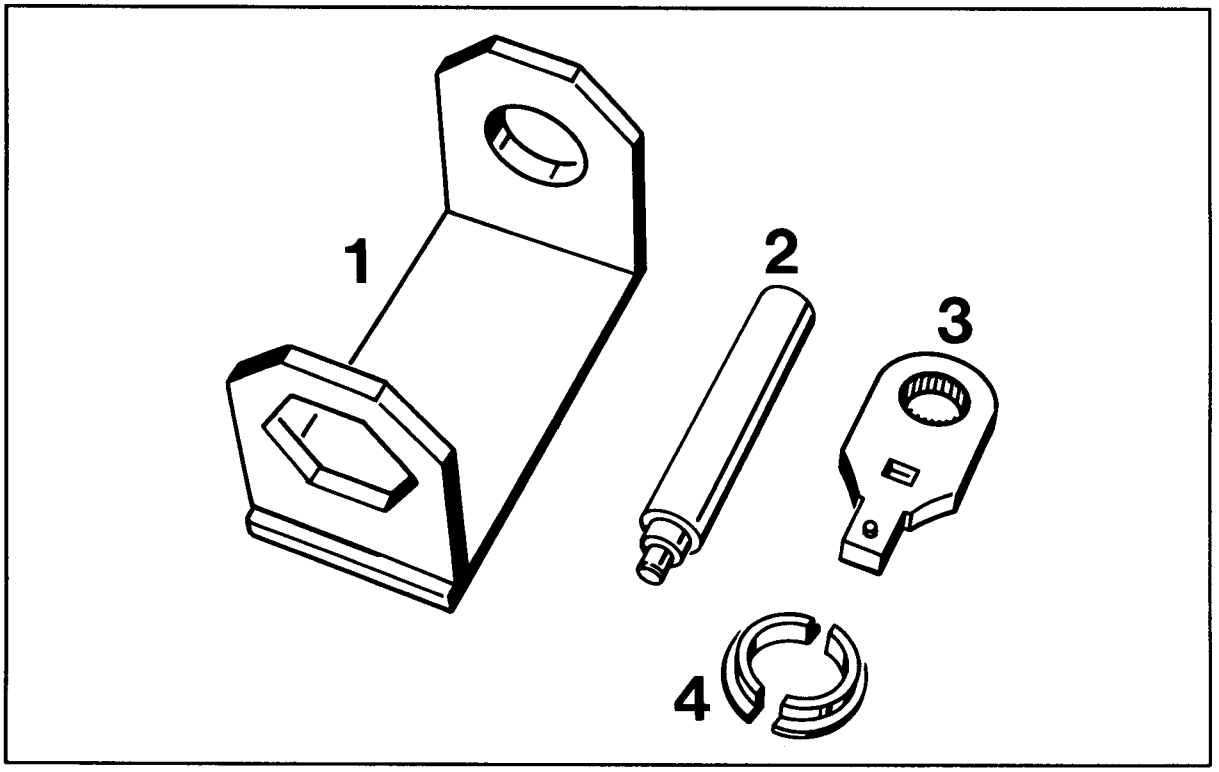
160-35

1 = Shift rod 3/4
2 = Lock
3 = Shift rod 5/R
4 = Locking pin
5 = Lock
6 = Shift rod 1/2

Printed in Germany – II, 1989

Disassembling and assembling drive pinion

Tools

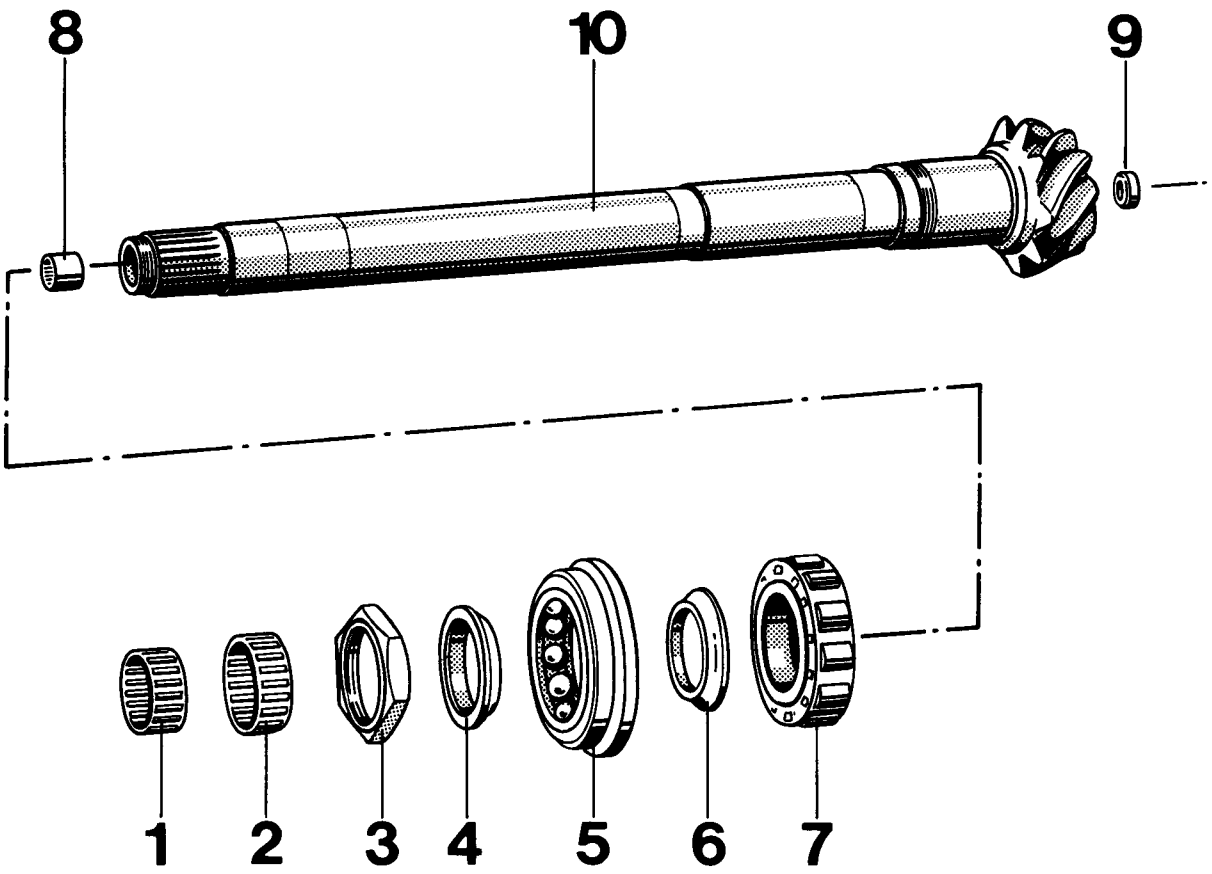


192-35

No.	Description	Special Tools	Order number	Remarks
1	Bracket	9142	000.721.914.20	
2	Pressing tool	9298	000.721.929.80	
3	Insert	9282	000.721.928.20	
4	Half shells	9142/1	000.721.914.21	

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Disassembling and assembling drive pinion



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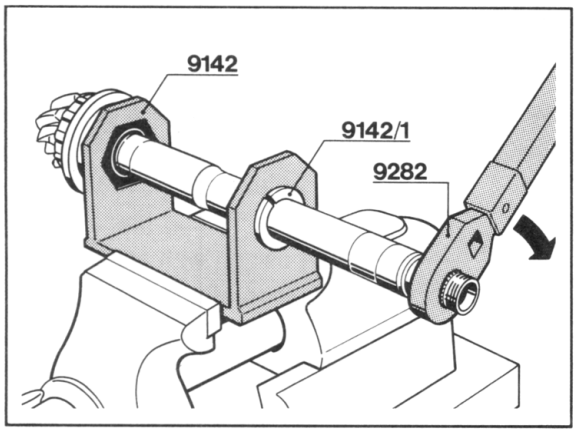
No.	Description	Qty.	Note when: Removing	Installing
1	Needle cage	1		
2	Needle cage	1		
3	Lock nut	1	Remove with Special Tools 9142, 9142/1 and 9282	Tighten with 240 Nm (177 ft.lb.) and secure by notch collar
4	Inner bearing race	1	Press out with suitable separating device (e.g. Kukko 15-17)	Do not confuse with inner race No. 6, heat up to approx. 120 °C (248 °F) and press into position with suitable piece of tubing (e.g. VW 519)
5	Four-point bearing	1		
6	Inner bearing race	1	Press out with suitable separating device (e.g. Kukko 15-17)	Do not confuse with inner race No. 4, heat up to approx. 120 °C (248 °F) and press into position with suitable piece of tubing (e.g. VW 519)
7	Cylindrical-roller bearing	1	Press out with suitable separating device (e.g. Kukko 15-17)	Heat up to approx. 120°C (248 °F) and press in to correct position
8	Needle bush	1	Press out with suitable internal puller (e.g. Schrem 10-14) and VW 771	Replace, press into position with Special Tool 9298
9	Ring	1	Pull out with suitable internal puller (e.g. Schrem 10-14) and VW 771	Press in to correct position (with crowned side outwards)
10	Drive pinion	1		Observe matching number, adjust again if necessary

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Notes on disassembly and assembly

Disassembling

1. Remove lock nut with Special Tools 9142, 9142/1 and 9282.



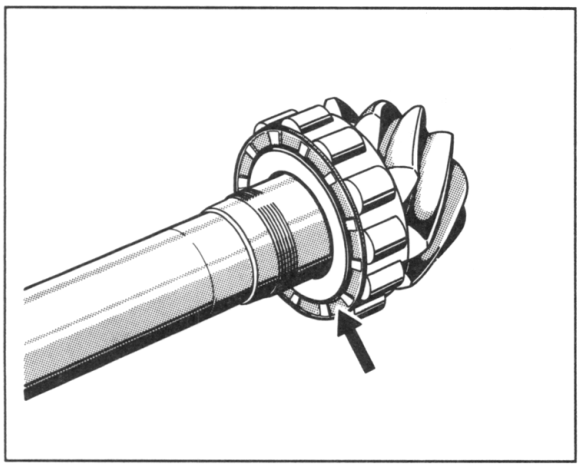
211 - 35

Assembling

1. Heat cylindrical-roller bearing up to approx. 120 °C (248 °F) and press into correct position.

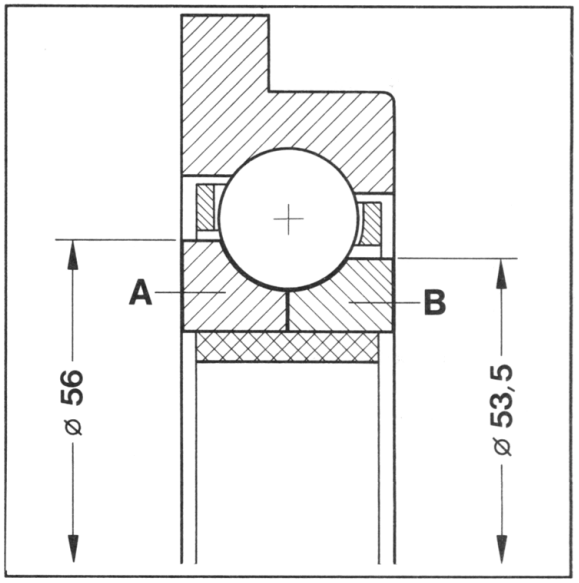
Note

Fit the bearing in such a way that the collar of the roller cage points towards the four-point bearing.



120-35

2. Heat inner bearing rings for four-point bearing up to approx. 120 °C (248 °F) and press into correct position.



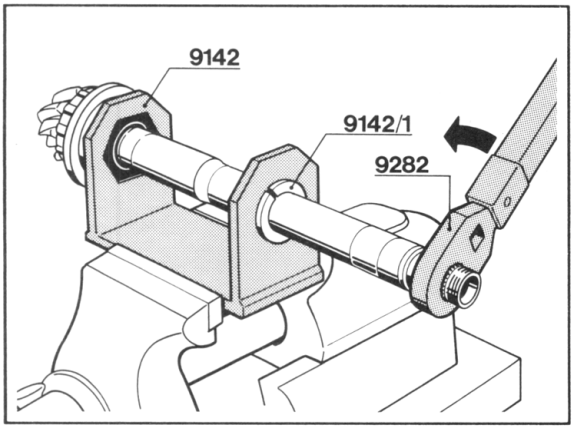
187-35

A = larger inner race (outer diameter 56 mm), points towards pinion head when installed

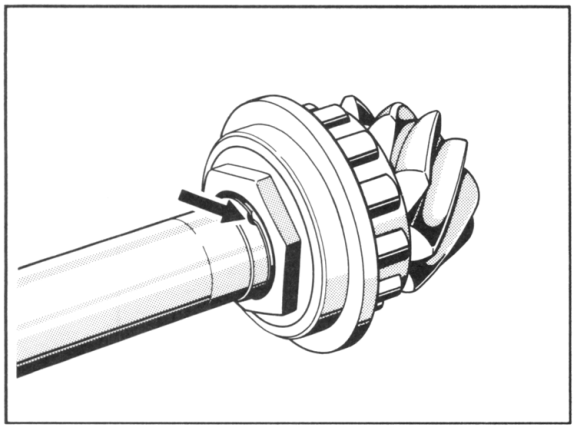
B = smaller inner race (outer diameter 53.5 mm), points towards fixed gear - 4th gear when installed

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3. Tighten lock nut with 240 Nm (177 ft.lb.) and recess a collar to secure



211 - 35

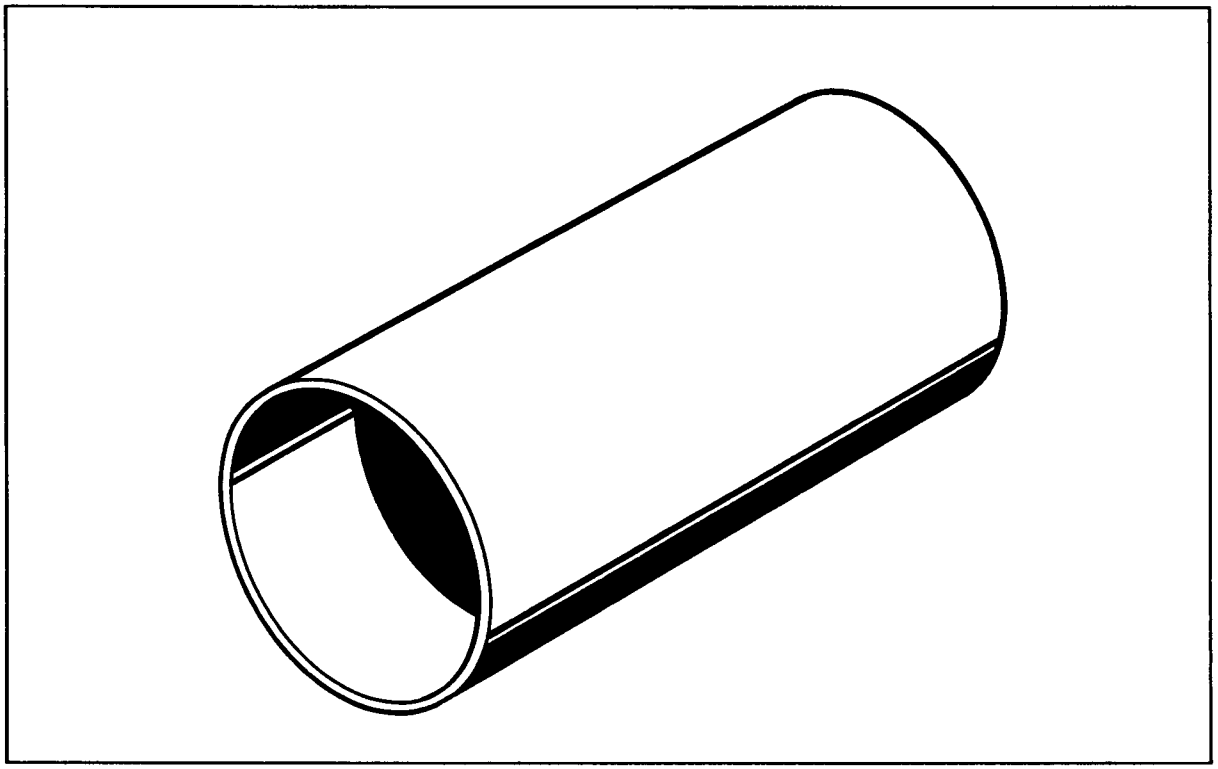


119 - 35

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Disassembling and assembling hollow shaft

Tools

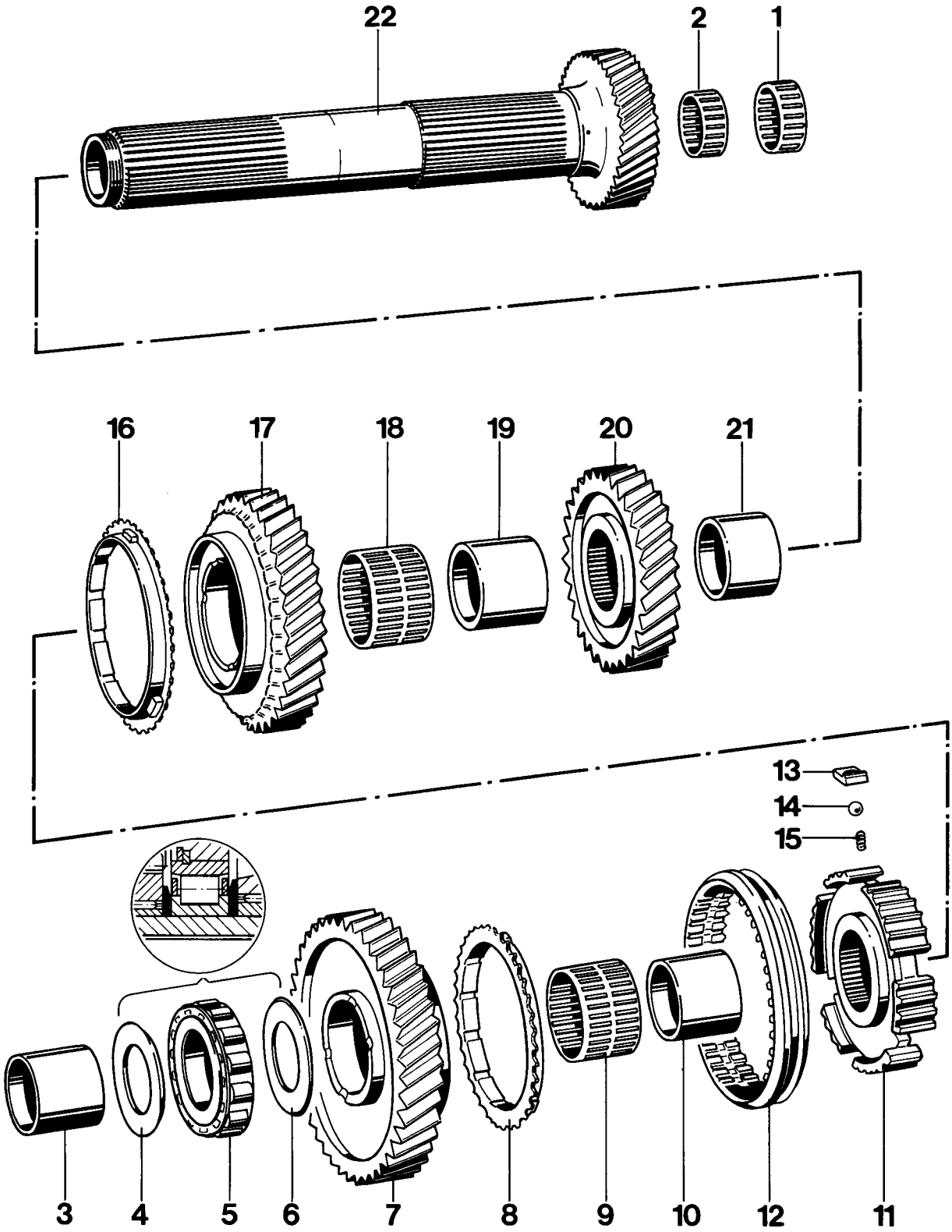


232-35

No.	Description	Special Tools	Order number	Remarks
	Spacer sleeve	9279	000.721.927.90	

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Disassembling and assembling hollow shaft



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No.	Description	Qty.	Note when: Removing	Installing
1	Needle-roller assembly	1		
2	Needle-roller assembly	1		
3	Inner race	1	Mark for refitting	Assemble with same gear wheel
4	Friction washer (outer diameter 64 mm, 2.8 mm thick)			Do not confuse with washer No. 6, flat-ground side points towards needle bearing
5	Cylindrical-roller bearing	1		Heat up to approx. 120 °C (248 °F)
6	Friction washer (outer diameter 69 mm, 2.8 mm thick)			Do not confuse with washer No. 4, flat-ground side points towards needle bearing
7	Loose gear (1st gear)	1		Only replace in pairs
8	Synchronizing disk	1	Mark for refitting	Check for wear, mount in correct position with same gear wheel (cogs toward driver dogs)
9	Needle-roller assembly	1	Mark for refitting	Assemble with same gear wheel
10	Inner race	1	Mark for refitting	Assemble with same gear wheel. Heat up to approx. 120 °C (248 °F).
11	Guide sleeve	1	Remove with gearshift sleeve	Only replace in pairs, fit together with gearshift sleeve and synchronizing components
12	Gearshift sleeve (1st + 2nd gear)	1	Spring-loaded synchronizing components may spring out	Only replace in pairs, fit together with guide sleeve and synchronizing components
13	Diver dog (with guide lug)	3		Do not confuse with dogs for 3rd to 5th and rev. gear

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No.	Description	Qty.	Note when: Removing	Installing
14	Ball	3		
15	Spring	3	Mark for refitting	Relaxed length 10.7 ±0.2 mm, wire thickness 0.9 mm. Do not confuse with springs for 3rd to 5th and rev. gear
16	Synchronizing disk	1	Mark for refitting	Check for wear, assemble in correct position with same gear wheel (cogs to driver dogs)
17	Loose gear (2nd gear)	1		Only replace in pairs
18	Needle-roller assembly	1	Mark for refitting	Assemble with same gear wheel
19	Inner race	1	Mark for refitting	Assemble with same gear wheel
20	Fixed gear (3rd gear)	1		Only replace in pairs. Large collar points towards friction washer
21	Spacer bush	1		
22	Hollow shaft	1		

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Notes on disassembling and assembling

Disassembling

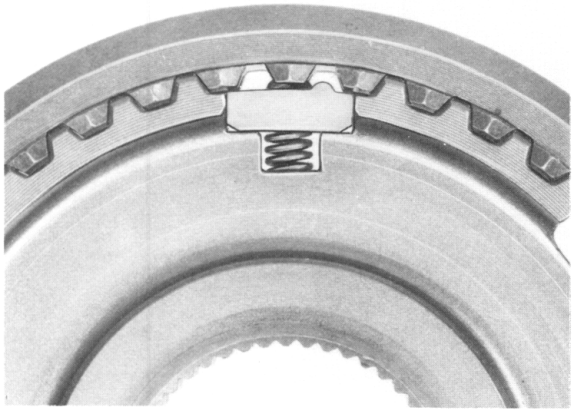
1. Remove all components (No. 3 to 20) from hollow shaft by pressing off with suitable separating device (e.g. Kukko 15-17).

Assembling

Note

All components must be fitted onto hollow shaft dry to ensure that no oil penetrates between the contact surfaces.

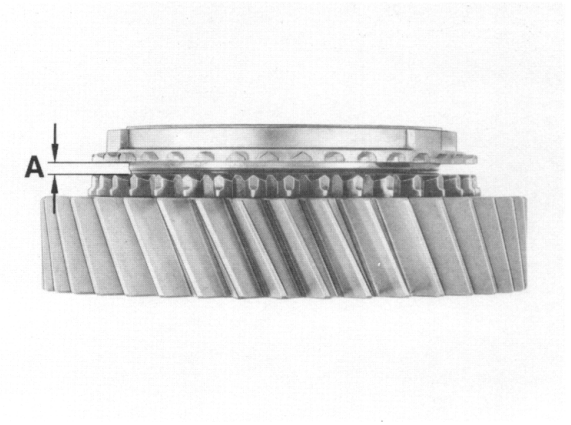
1. Fit driver dogs for synchronization with the lug pointing towards gearshift sleeve. It does not matter whether the lug points to the left or right.



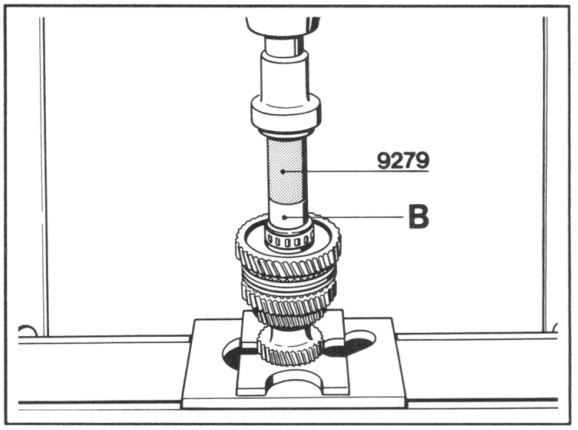
86/862

2. Check synchronizing disks by pressing onto the cones of the gear wheels and measuring gap "A" with a feeler gauge.

   Installation dimension (new) = min. 1.1 mm
   Wear limit = 0.6 ... 0.7 mm



3. Preload gear block onto the shaft with 5 t. Use Special Tool 9279 for this.



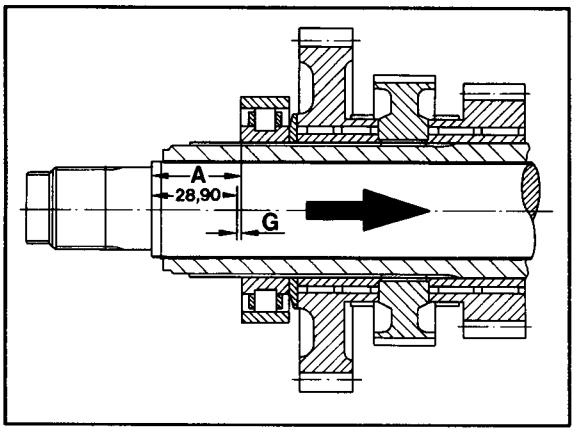
A = Special Tool 9279
B = Inner bearing race

169-35

Printed in Germany – II, 1989

Determining size of shim "s" for hollow shaft

1. Determine basic value "G":



228 - 35

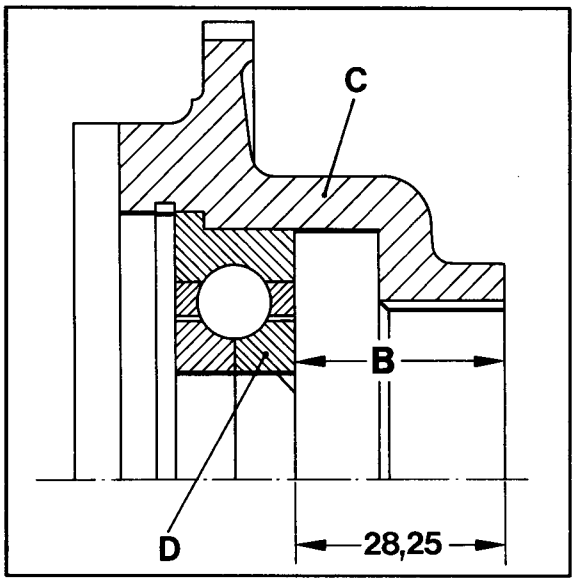
28.90 = Constant value
A = Measured value
G = Basic value

- Slide hollow shaft in direction of arrow to the stop (facing surface of hollow shaft level with outer race of four-point bearing).
- Measure distance between collar of output shaft and inner race of cylindrical-roller bearing (dimension "A").
- Measured value "A" minus constant value 28.90 mm = Basic value "G".

Example

Measured value "A"	30.13 mm
Constant value	- 28.90 mm
Basic value "G"	1.23 mm

2. Determine correction value "K":

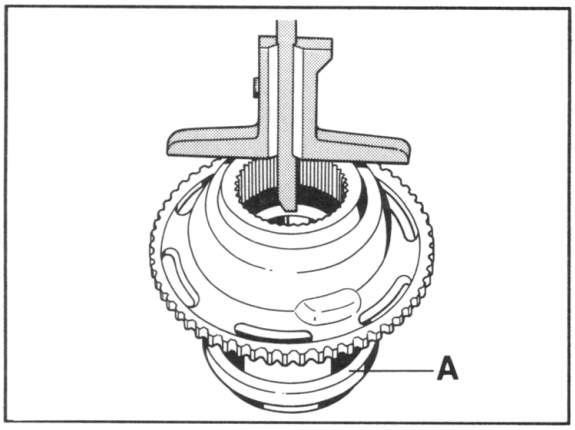


229 - 35

28.25 = Constant value
B = Measured value
C = Bearing carrier
D = Inner bearing race

- Measure distance between inner race and end of bearing carrier (dimension "B"). For this, insert four-point bearing with inner race into bearing carrier and hold in position with suitable pressing tool.

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230 - 35

A = Pressure piece (e.g. VW 472/1)

- Deviations from the constant value 28.25 mm gives the correction value "K"".

Note

If the measured value "B" is less than 28.25 mm, the deviation must be added to basic value "G", if greater, the deviation must be subtracted from basic value "G".

3. Determine thickness of shim "s":

- Basic value "G", plus or minus correction value "K" gives the thickness of shim "s"

Example I

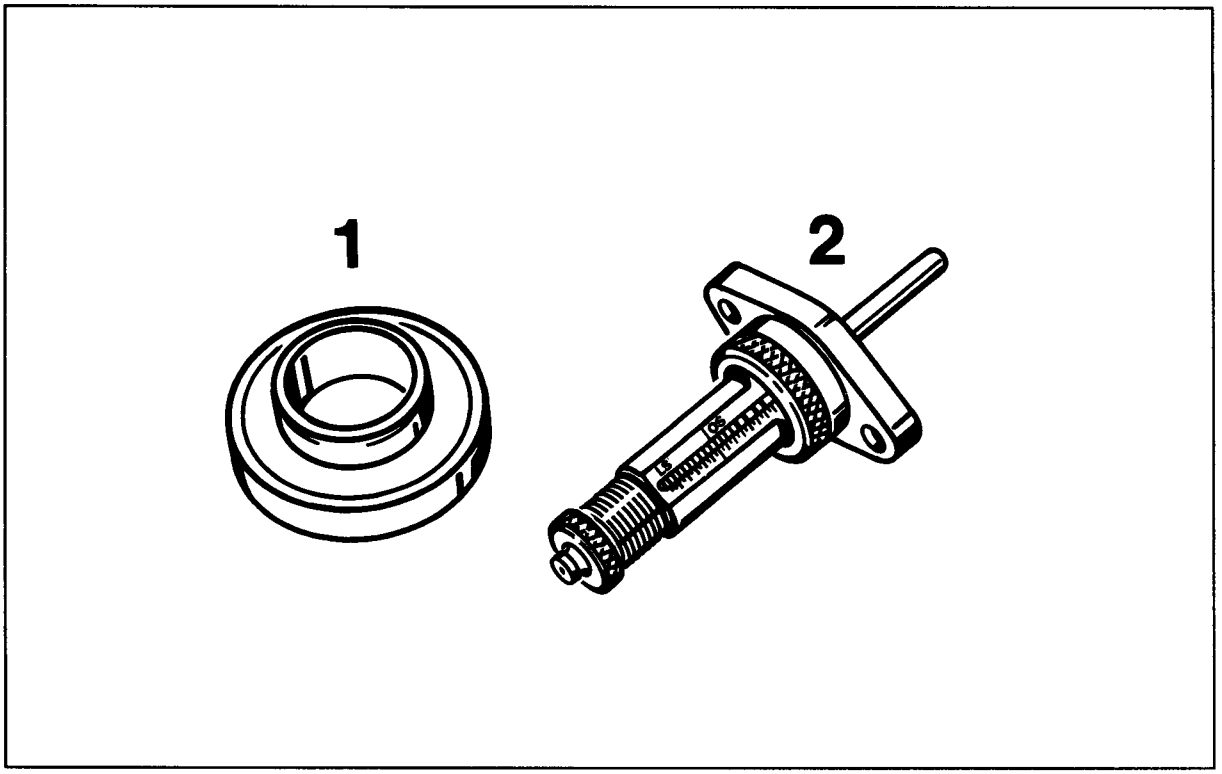
Basic value "G"	1.23 mm
Correction value "K"	+ 0.12 mm
Thickness of shim "s"	1.35 mm

Example II

Basic value "G"	1.20 mm
Correction value "K"	- 0.10 mm
Thickness of shim "s"	1.10 mm

Removing and installing limited slip differential

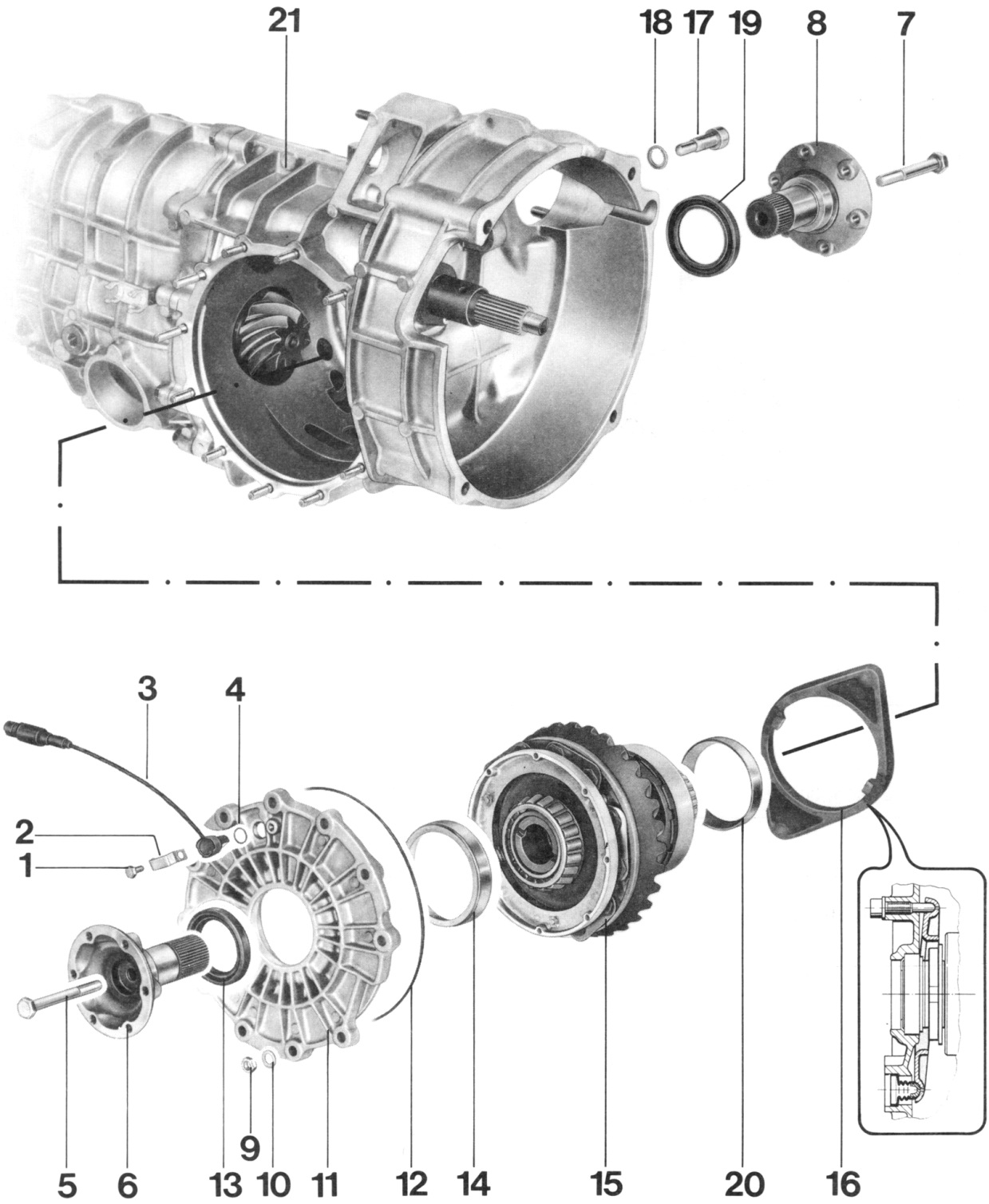
Tools



No.	Description	Special Tool	Order number	Remarks
1	Pressing	9252	000.721.925.20	
2	Measuring cylinder	9514	000.721.951.40	

Printed in Germany – X, 1990

Removing and installing limited slip differential



Printed in Germany – X, 1990

No.	Description	Qty.	Note when: Removing	Installing
1	Hexagon head screw*	1		Tighten with 10 Nm (7.5 ft.lb.)
2	Bracket*	1		
3	Reed contact*	1		
4	O-ring*	1		Replace, apply light film of oil
5	Hexagon head screw 10 x 90	1		Tighten with 44 Nm (32.5 ft.lb.)
6	Halfshaft flange, right	1		
7	Hexagon head screw 10 x 80	1		Tighten with 44 Nm (32.5 ft.lb.)
8	Halfshaft flange, left	1		
9	Hexagon nut	11		Tighten with 23 Nm (17 ft.lb.)
10	Washer	11		
11	Cover	1		
12	O-ring	1		Replace, apply light film of oil
13	Shaft seal	1		Pack area between sealing lips with grease (e.g. Olista Longtime 3EP). Press into position with pressing tool 9252
14	Outer bearing race	1	Heat transmission case up to approx. 120 °C (248 °F) and drive out with suitable mandrel	Heat transmission case up to approx. 120 °C (248 °F) and press in with suitable pressing tool
15	Differential with rear-axle lock	1		The recesses in the release bearing must engage into the driving cogs of the engaging fork
16	Engaging fork	1		Insert in correct position

* Deleted from 1991 model on

Printed in Germany – X, 1990

No.	Description	Qty.	Note when: Removing	Installing
17	Screw**	1		Tighten with 65 Nm (48 ft.lb.)
18	Disk	1		
19	Shaft seal	1		As seal No. 13
20	Outer bearing race	1	Heat transmission case up to approx. 120 °C (248 °F) and drive out with suitable mandrel	Heat up to approx. 120°C (248 °F) and press in with suitable pressing tool
21	Transmission case	1		

* Deleted from 1991 model on

** Adjustable from 1991 model on

Printed in Germany – X, 1990

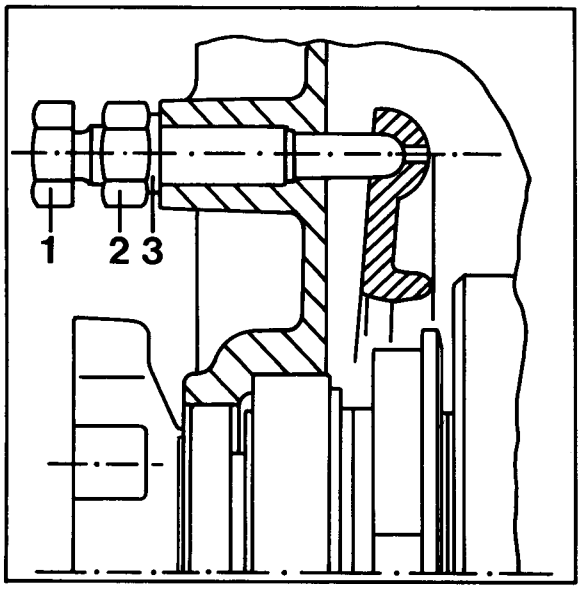
Removing and installing contr. limited-slip differential (from 1991 model on)

Assembly instructions for removing and installing

Removing

Note

From the 1991 model on, the counter-bearing on the lateral limited-slip differential is adjustable.



592-39

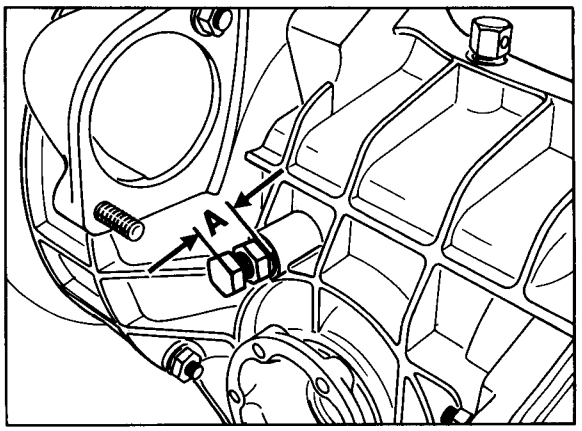
1 = Counter-bearing

2 = Hex nut (tightening torque 85 Nm (63 ftlb) / seal with Loctite 222)

3 = Sealing ring (omitted as of March 1991)

Note

Before removing the limited-slip differential, always check the amount of wear at the plates (see Vol. IV, Page D39/45 - 21). If plates are re-used after a period of operation, the position of the counter-bearing (No. 1) must not be altered. If repositioning or removal of the counter-bearing is unavoidable (for instance to rectify a leak), always measure the installed position of the counter-bearing before removing it, so that it can be installed again in the same position.



593-39

A = Installed position

Installing

Note

If the sealing gaiter is leaking, always renew the slave cylinder.

1. Adjusting the counter-bearing (only necessary if the plates have been renewed):

- The basic locking moment and the final drive set must be adjusted.

Printed in Germany – XI, 1991

- The flexible gaiter for the slave cylinder must be installed.

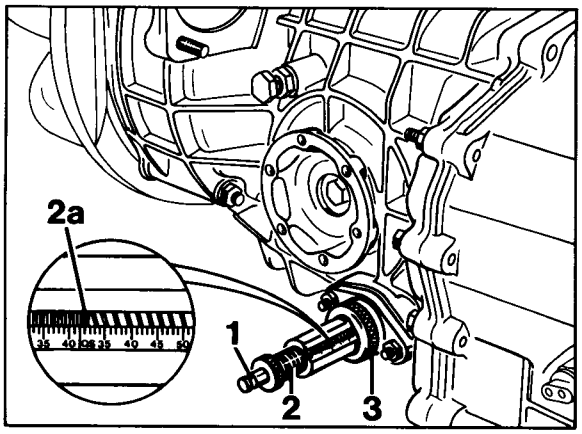
- Slacken off the measuring cylinder adjusting screw as far as possible (to make it easier to install the measuring cylinder).

- Install the measuring cylinder (special tool 9514) on the transmission and tighten the knurled nut.

- Adjust to a dimension of 31 mm (in the lateral locking (QS) range) with the adjusting screw on the measuring cylinder.

LS = Front-rear diff. lock measuring range

QS = Lateral differential lock measuring range



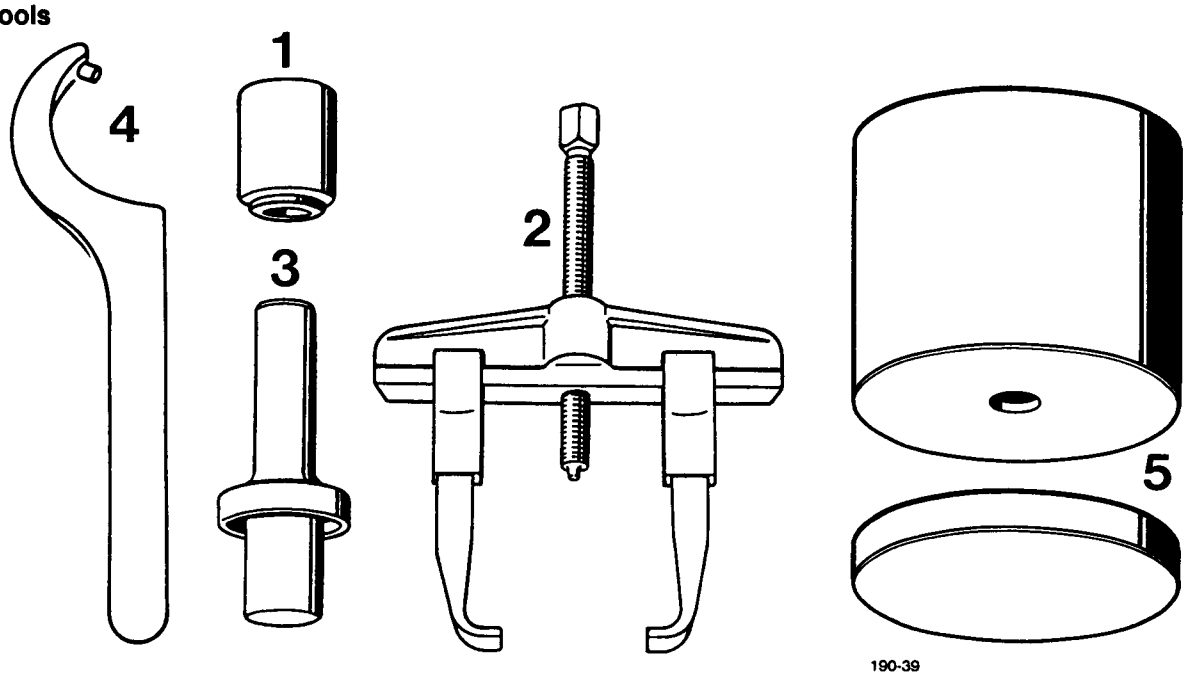
594-39

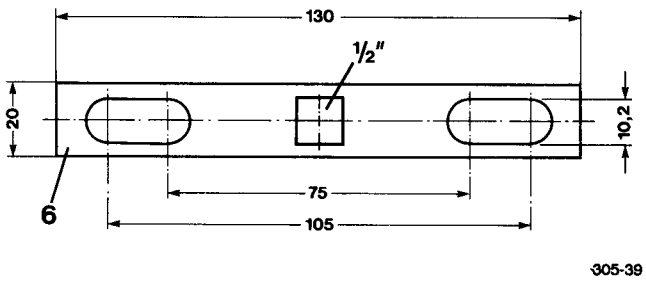
1 – Spacing plunger
2 – Adjusting screw
2a – Measuring groove on adjusting screw
3 – Knurled nut
4 – Counter-bearing
5 – Hex nut
6 – Sealing ring

- Screw in the counter-bearing until there is no more endplay at the measuring cylinder's spacing plunger.

Disassembling and assembling limited slip differential

Tools

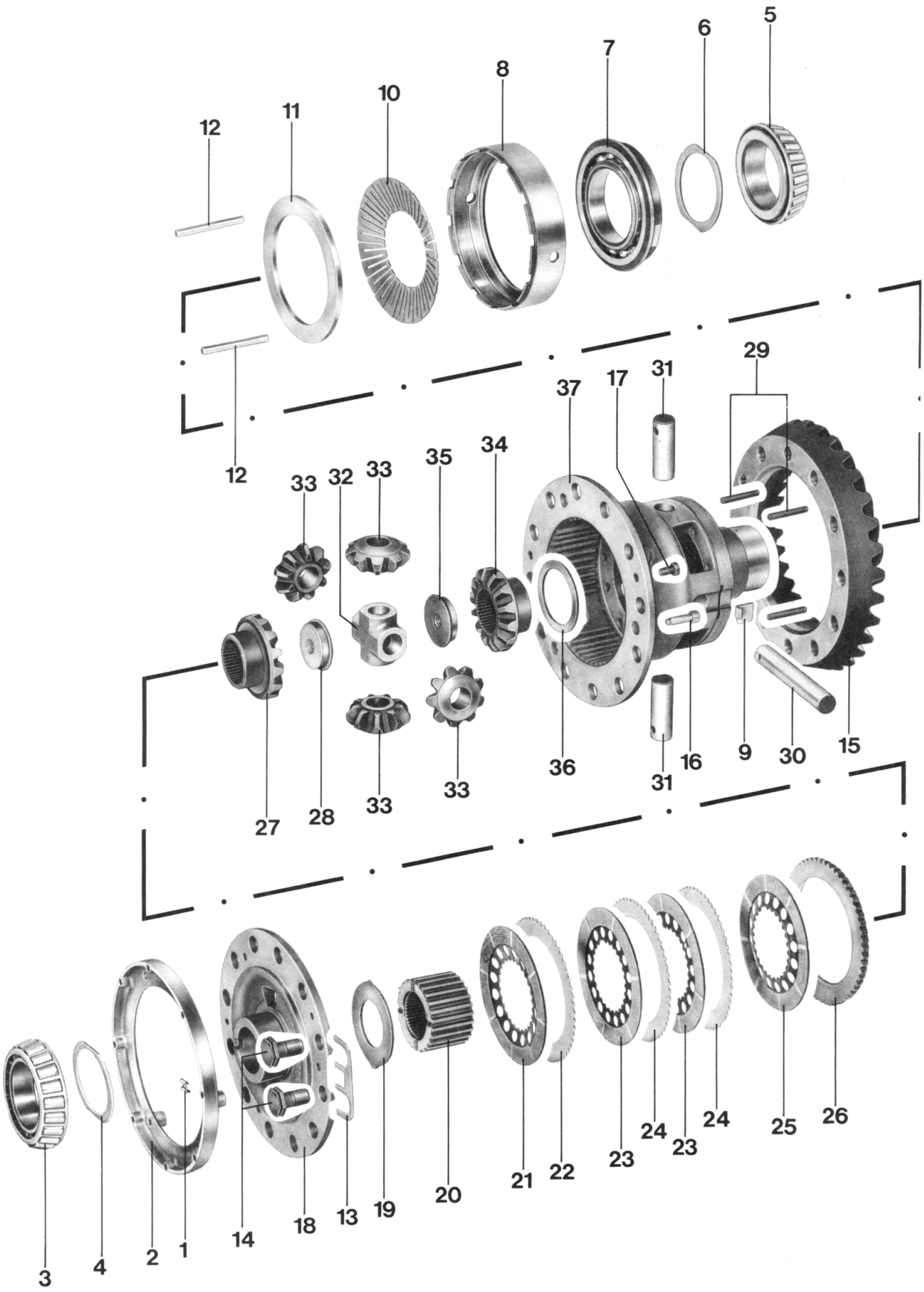




No.	Description	Special Tool	Order number	Remarks
1	Pressing tool	P 263	000.721.263.00	
2	Puller	-	-	standard
3	Pressing tool	P 264 b	000.721.264.20	
4	Hook wrench	-	-	standard
5	Measuring device	9508/1	000.721.950.81	2-part
6	Connector	-	-	Produced locally (flat steel 10 x 20)

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Disassembling and assembling limited slip differential



Printed in Germany – III, 1989

No.	Description	Qty.	Note when: Removing	Installing
1	Safeguard*	3		
2	Magnet-carrying disk*	1		
3	Taper roller bearing-outer race	1	Press out with two suitable levers	Press into position with suitable piece of tubing (e.g. VW 415)
4	Shim "S1"	X	Make a note of thickness for refitting	Determine thickness again if necessary
5	Tapered roller bearing-outer race	1	Remove with suitable puller and P 263	Press into position with Special Tool P 264 b
6	Shim "S2"	X	Make a note of thickness for refitting	Determine thickness again if necessary
7	Deep-groove ball-bearing	1		
8	Ring nut	1		Secure with tab washer
9	Tab washer	1		Replace
10	Lever spring	1		
11	Pressure ring	1		Flat side towards pressure pins
12	Pressure pin	8		Replace in sets only
13	Tab washer (omitted for Verbus-Ripp bolts)	6		Replace. Slide into the groove in the hexagon-head screw, pull together at front with pliers (to ensure that the tab washer is firmly linked to the hexagon head screw) and secure downwards via a hexagonal surface.
14	Hexagon head bolt (with tab washer)	12		Thread must be dry and free of grease. Tighten with 150 Nm (110 ftlb).

* omitted as of MY '91

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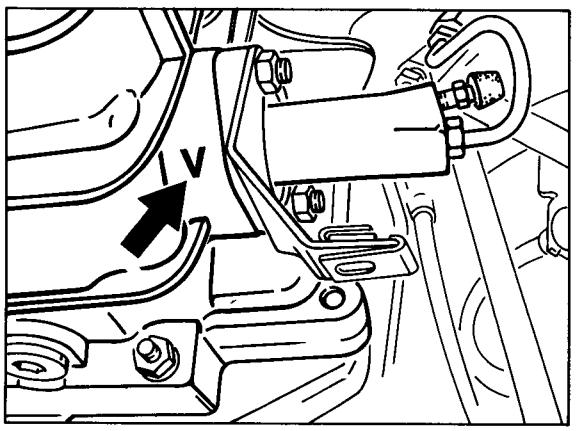
No.	Description	Qty.	Note when: Removing	Installing
–	Verbus-Ripp bolt (**without** tab washer)	12		Must always be replaced. Threads must be dry and grease-free. Tighten to 200 Nm (148 ftlb).
15	Ring gear	1		Heat up to approx. 120° C (248 °F), the threads of ring-gear screws must be dry and free of grease. Observe matched numbers. Adjust again if necessary.
16	Bolt*	3		
17	Screw	2		Tighten with 15 Nm (11 ftlb)
18	Cover	1		
19	Friction washer	X	Make a note of thickness for refitting	Determine again if necessary
20	Plate carrier	1		
21	Inner plate (bent)	1	Do not confuse with bent inner plate No. 25	Observe installation position, bent side points towards inside to block of plates
22	Adjusting plate	X	Make a note of thickness for refitting	Remeasure thickness if necessary
23	Inner plate	8		Observe installation position
24	Outer plate (1.3 mm thick	8		
25	Inner plate (cranked)	1	Do not confuse with cranked inner plate No. 21	Observe installation position, cranked side points inside towards block of plates
26	Pressure ring	1		Large, flat side points towards block of plates

* omitted as of MY '91

No.	Description	Qty.	Note when: Removing	Installing
27	Shaft bevel gear	1		Replace only as a set complete with bevel pinions
28	Threaded fitting	1		
29	Spring pin	3		
30	Bolt	1		
31	Bolt	2		
32	Cross fitting	1		
33	Bevel pinion	4		Replace only as a set complete with shaft bevel gears
34	Shaft bevel gear	1		Replace only as a set complete with bevel pinions
35	Threaded fitting	1		
36	Friction washer	X	Make a note of thickness for refitting	Remeasure thickness if necessary
37	Housing	1		

Note

As soon as the stocks of Gylon inner discs are exhausted, the limited-slip differential must be modified to accept Valeo inner discs when repairs are required. To do so, fit all inner and outer discs, cup spring and thrust ring and adjust pack thickness to specified value of 37.9 ± 0.1 mm (refer to p. 39 - 12a to 39 - 12d). Also mark the modified transmissions for identification (to highlight different wear limits) by stamping a large "V" into the transmission housing (below the lock cylinder). Also refer to Vol. IV, page D39/45-23.

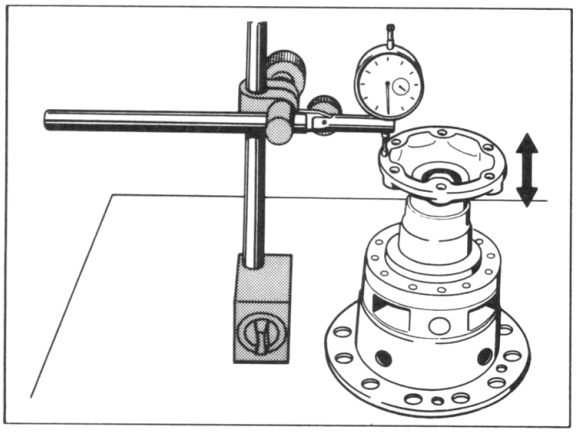


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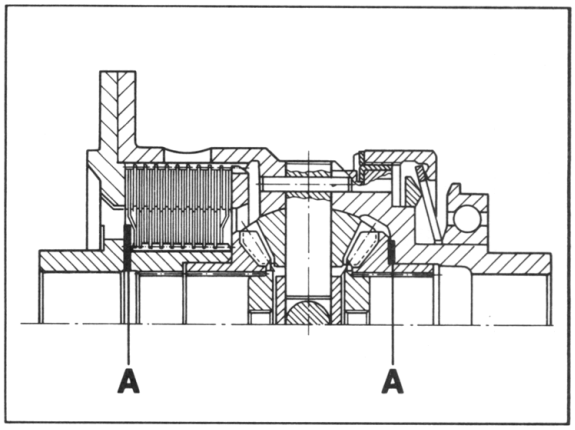
Notes on assembly

Assembling

1. Determine axial play of differential bevel gears and adjust to 0.05...0.15 mm by inserting appropriate friction washers (A).



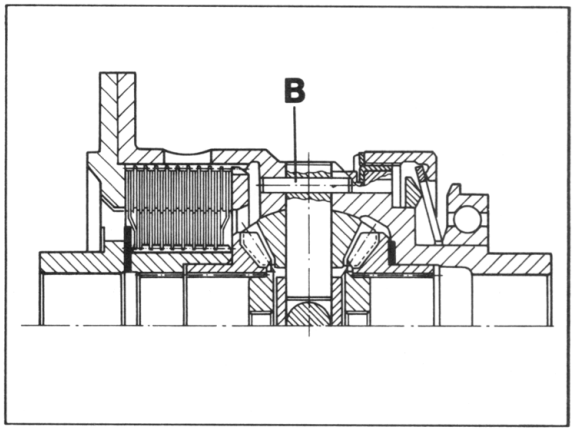
197-39



A = Friction washers

186-39

2. Drive in dowel pins for bevel-gear axles in correct position.



B = Dowel pin

186 - 39

Note

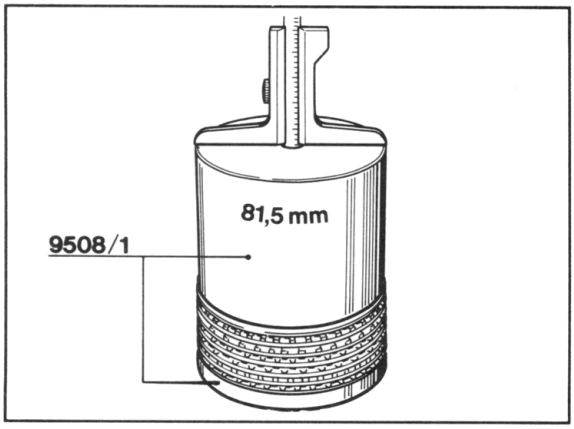
If components have been replaced (e.g. differential housing or bevel gears), the thinnest friction washers must be installed for measurement.

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3. Determine thickness of block of plates:

- Block thickness (new) = 36.7 ± 0.1 mm
  Wear limit = 34.2 mm

- Measure complete block of plates (without pressure ring) with Special Tool 9508/1 and adjust to prescribed size with adjusting plate (No. 22) if necessary.



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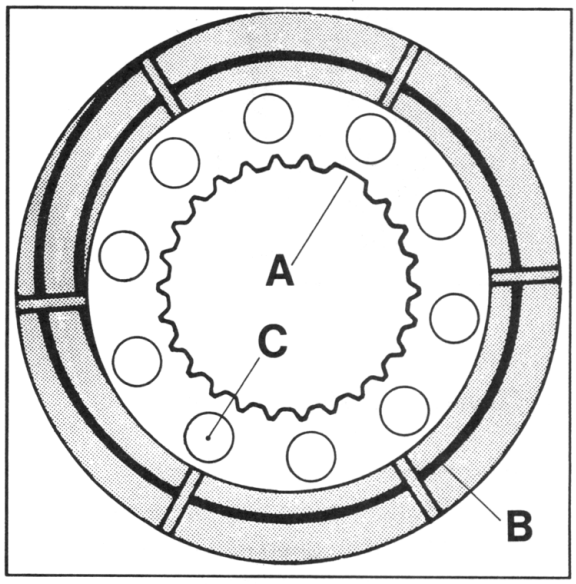
Example:

Measured value		117.80 mm
Height of special Tool*	-	81.50 mm
Thickness of block		36.30 mm

* Embossed on tool

- Adjusting plate must be selected which is 0.4 mm thicker.

4. Apply film of transmission oil to inner plate and assemble in such a way that the spiral groove for the oil supply runs clockwise from inside to outside when looking at the block of plates (direction of assembly) (refer to simplified sketch). Apart from this, the oil holes in the carrier sheet must be exactly in line with one another. Assembly is easier if a tooth is missing from the carrier plate.



207-39

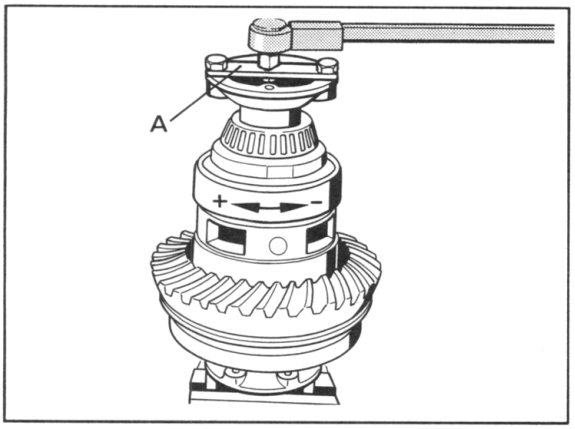
A = Missing tooth
B = Spiral groove
C = Oil hole

5. Adjust basic locking moment:

- Differential lock completely assembled (with deep-groove ball-bearing and tapered-roller bearing - inner races)

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- Measure breakaway torque with one bevel gear held fast and one driven. For this, clamp a flange with two screws into the vice and measure the torque at the other flange.

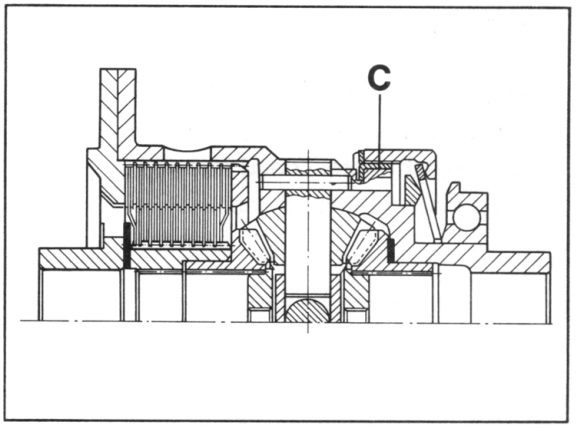


213-39

A = Connector (produced locally)

- Adjust breakaway torque with hook wrench by turning the ring nut to 100 Nm (73.75 ft.lb.), then undo ring nut as far as the safety groove at which the breakaway torque is less than 20 Nm (15 ft.lb.).

- Secure ring nut with tab washer

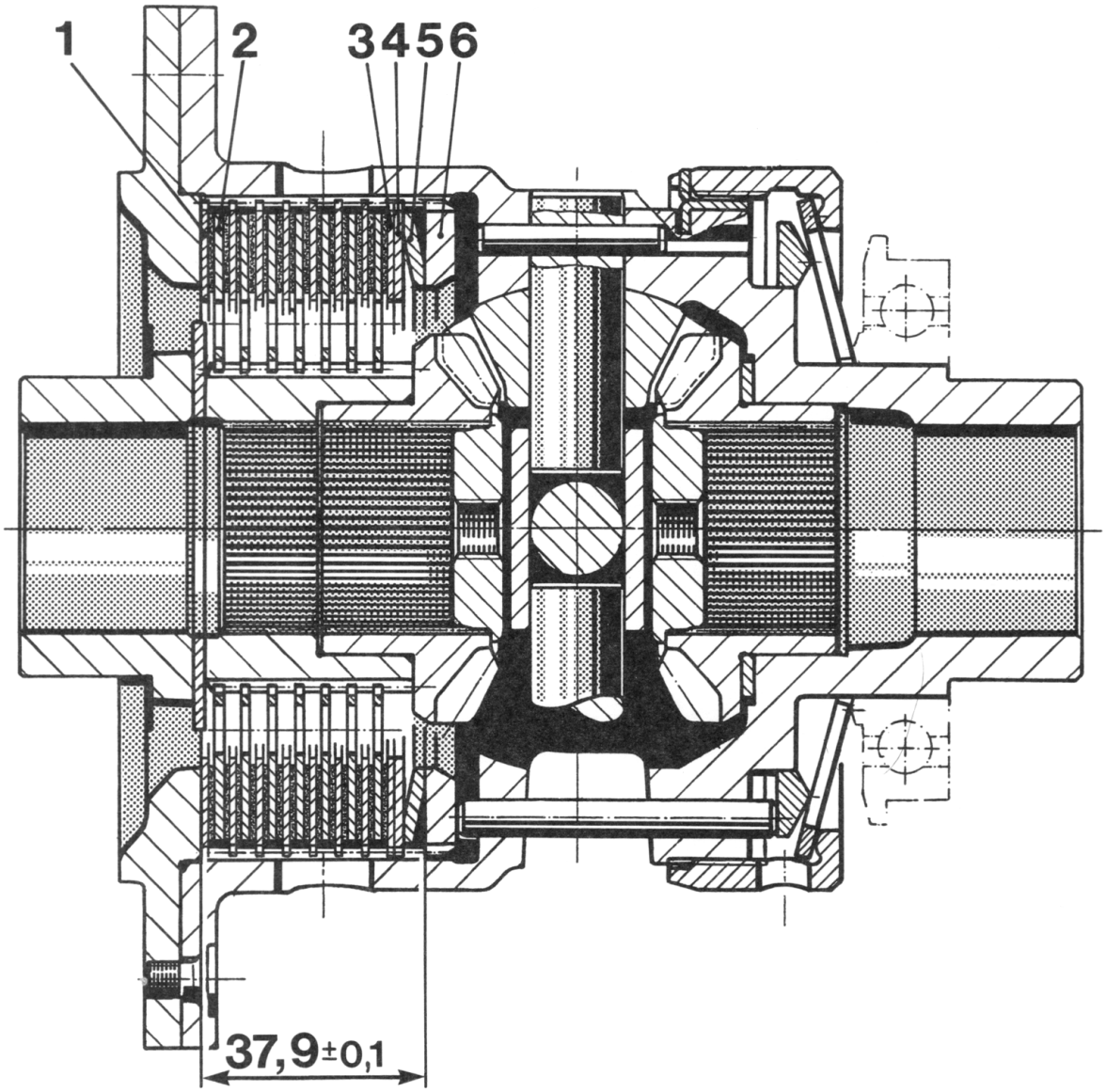


C = Tab washer

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Dismantling and assembling limited slip differential with Valeo friction linings



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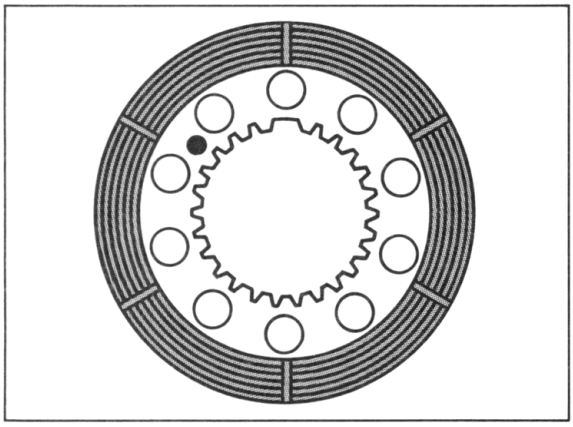
No.	Designation	Qty.	Note: Removal	Installation
1	Outer disc, 1.2 mm thick	7		
2	Inner disc with Valeo lining	7		
3	Outer disc (adjusting disc)	1	Mark for reinstallation. Must be refitted in the same place	
4	Outer disc (adjusting disc)	1	Mark for reinstallation. Must be refitted in the same place.	Minimum thickness must be 1.5 mm
5	Cup spring	1		Observe installation position
6	Thrust ring	1		Observe installation position

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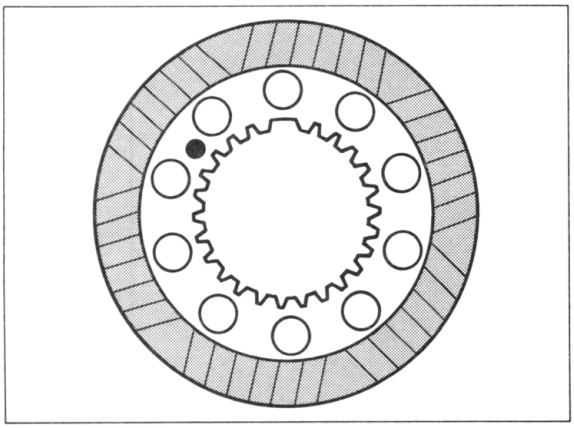
Dismantling and assembly notes

Note

Following the change of the inner discs from Gylon to Valeo, stacking, adjustment and wear limit specifications of the disc pack have been modified (also refer to page D 39/45-23).



Former Gylon disc 288-39

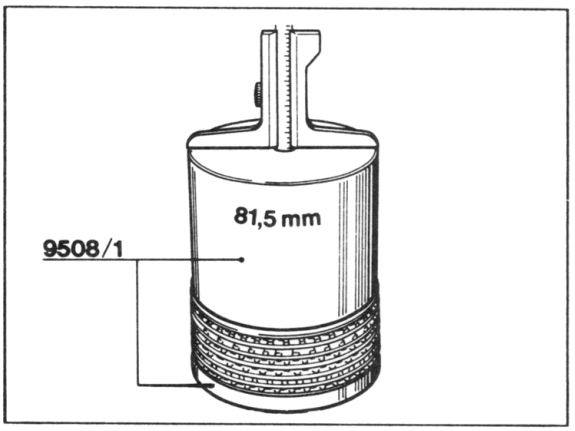


New Valeo disc 1311-39

1. Determine thickness of disc pack.

- Pack thickness (new) = 37.9 ±0.1 mm
  Wear limit = 36.5 mm

- Measure entire disc pack with cup spring (but without thrust ring).



184-39

Example

Measurement	= 117.90 mm
Special Tool height*	= 81.50 mm
Pack thickness	36.40 mm

* Engraved on tool

Note

If the wear limit has been reached, all inner discs must be replaced and the disc pack must be packed with the outer discs towards the cup spring to give a pack thickness of 37.9 ±0.1 mm.
A maximum of two outer discs may be fitted at the cup spring. The outer disc in contact with the cup spring must have a minimum thickness of 1.5 mm.

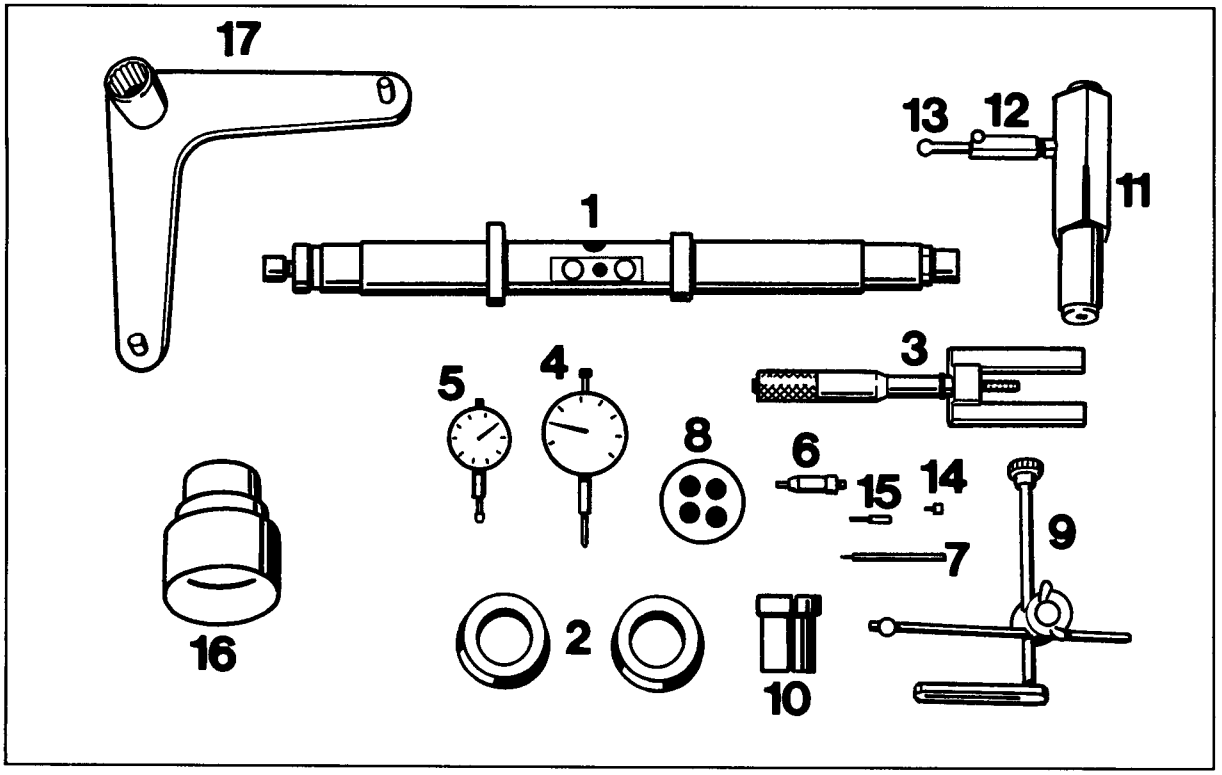
2. Coat discs with transmission oil before fitting them.

3. Oil bores in carrier plate of inner discs must line up exactly.

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Adjust drive set (rear-axle drive)

Tools



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Adjust drive set (rear-axle drive)

Tools

No.	Description	Special Tools	Order number	Remarks
1	Measuring mandrel	VW 385/1		
2	Centering disks	9109	000.721.910.90	
3	Universal gauge	VW 385/30		
4	Dial gauge	-		standard
5	Dial gauge	-		standard, measuringrange 3mm
6	Plunger	VW 385/14		
7	Dial gauge extension	VW 385/56		30 mm long
8	Final measuring plate	9281	000.721.928.10	
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	Plunger	VW 388		
14	Dial-gauge extension	VW 382/10		6.0 mm long
15	Dial-gauge extension	VW 385/15		9.3 mm long
16	Assembly sleeve	9283	000.721.928.30	
17	Holding device	9253	000.721.925.30	

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Practical procedure when readjusting the drive set

If it is necessary to adjust drive pinion and ring gear, following this sequence will ensure an efficient working procedure:

1. Determine the total thickness of shims "S_{tot} (S_1 plus S_2). For the specified pretension on tapered roller bearing/differential.

2. Determine the thickness of shim "S_3".

3. Split the total thickness "Stot" into S_1 and S_2 so that the specified circumferential backlash is given between ring gear and drive pinion.

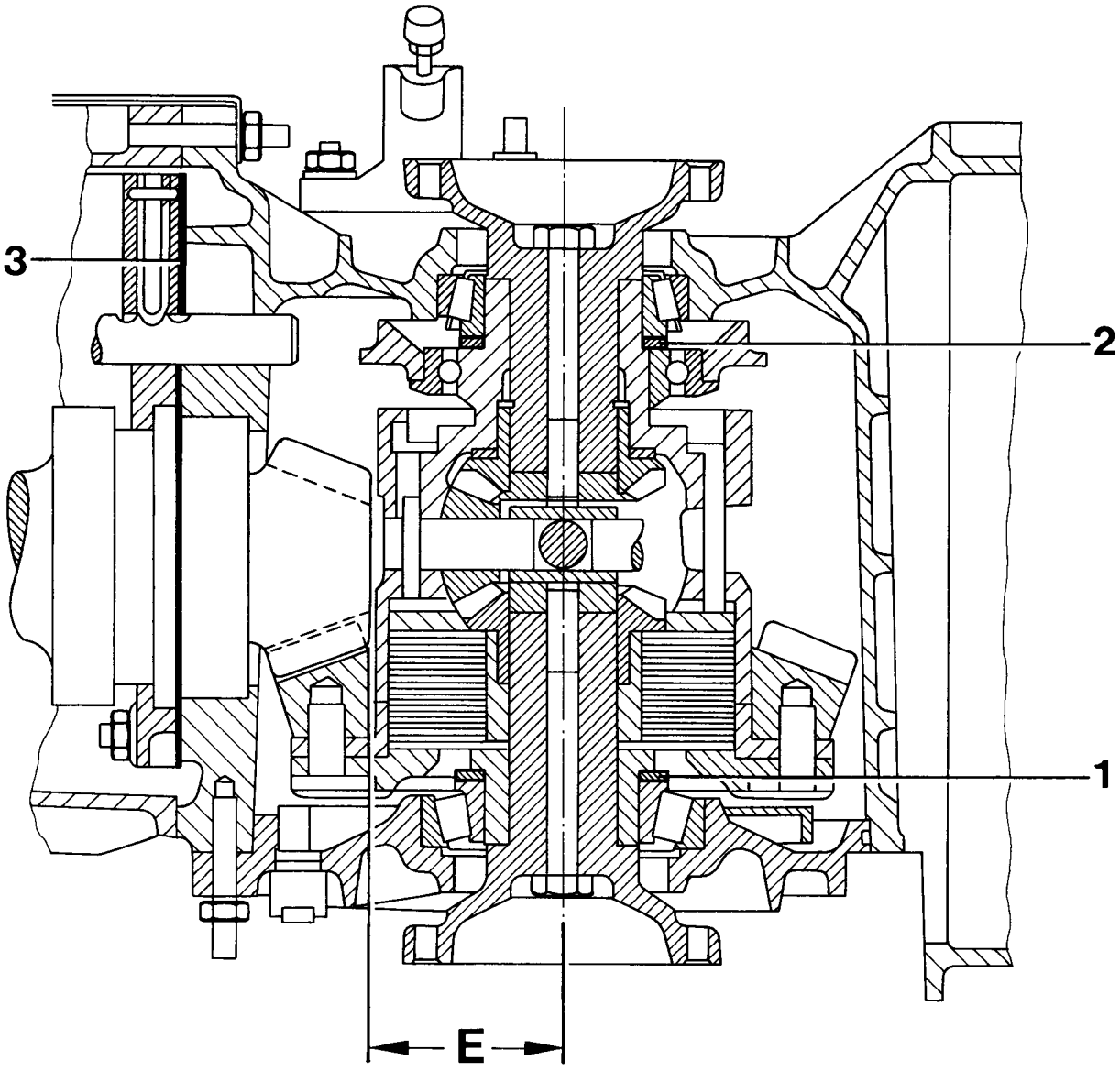
The aim of this adjustment is to restore the smoothest running position which can be achieved on test equipment in the production line.

Greatest possible cleanliness when performing all assembly work and measuring procedures are pre-requisites for a correct result.

When carrying out assembly work on the final drive assembly, it is only necessary to readjust drive pinion and ring gear or drive set if components have been replaced which have a direct influence on the adjustment. Refer to the following table to avoid unnecessary adjustment work.

Adjust: / Replaced component	Ring gear (S_1 + S_2)	Drive pinion (S_3)
Transmission case	x	x
Side transmission cover	x	
Large cylindrical-roller bearing and four-point bearing for drive pinion	x	x
Drive set	x	x
Differential housing	x	
Tapered roller bearing for differential	X	

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1 – Shim S_1
2 – Shim S_2
3 – Shim S_3
E – Adjustment dimension

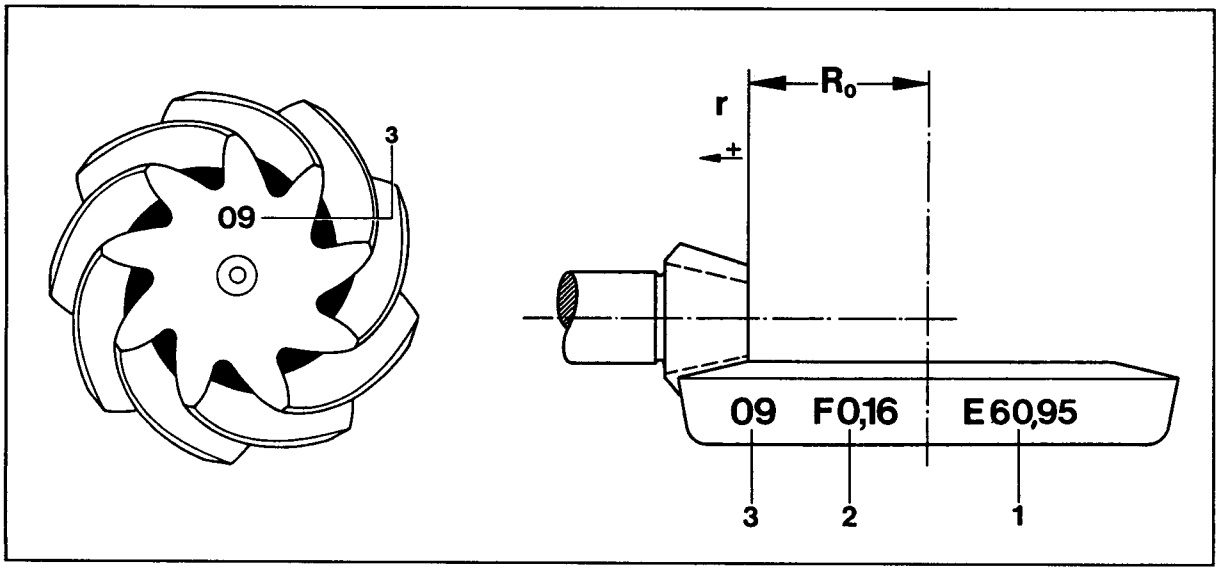
Correct results may only be achieved if assembly work and measuring procedures are carried out conscientiously observing cleanliness.

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Adjusting drive set (rear-axle drive)

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 were therefore matched during production which have been checked for good surface appearance and low noise in both directions of rotation on special test equipment. The position at which smoothest running can be achieved is determined by shifting the drive pinion axially, whereby the ring gear is kept within the tolerance of the prescribed tooth-flank backlash. Deviation "r" from the specified design dimension "Ro" is measured, added to design dimension "Ro" and embossed on the ring gear as setting value "E".



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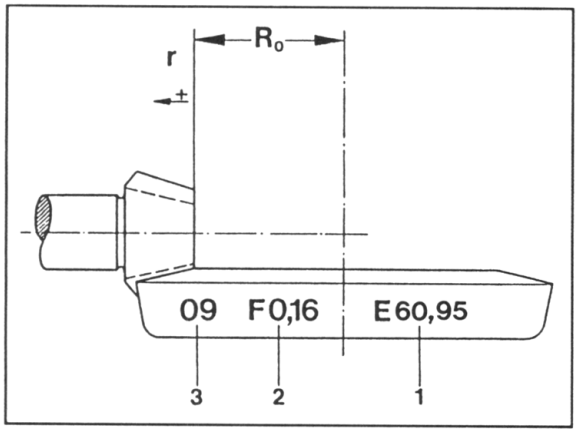
- R_o = Design dimension
  r = Deviation r
  1 = Adjustment dimension (Ro + r), e.g. E 60.95
  2 = Flank backlash, e.g. F 0.16
  3 = Matching number

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Adjust drive pinion (rear-axle drive)

Note

The setting dimension "E" is given on the ring gear.

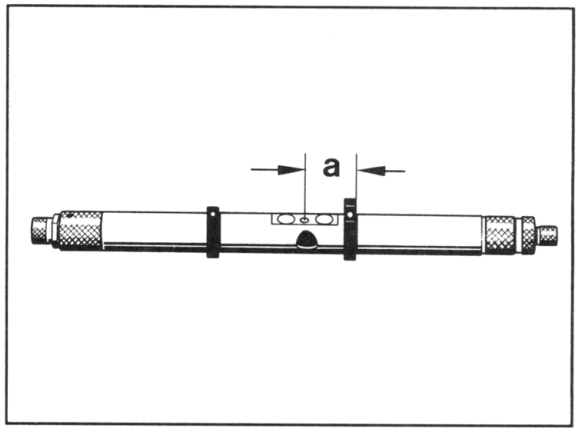


217-39

1 = Setting dimension "E"

1. Install complete gear set without "S_3" shims and tighten all hexagon nuts for tensioning plate with 23 Nm (17 ft.lb.).

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

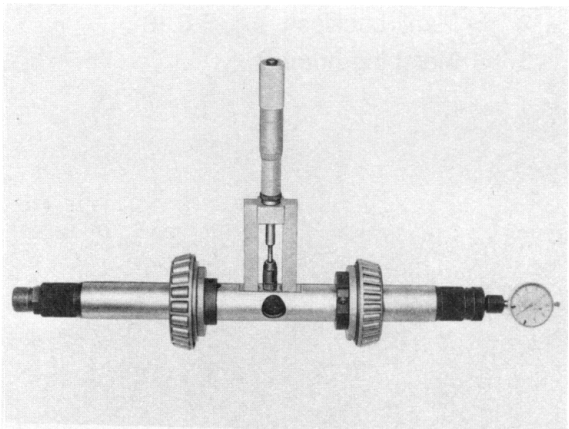


223-39

a = approx. 65 mm

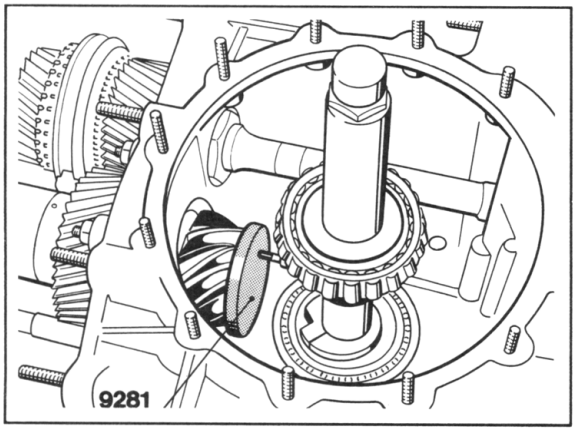
3. Assemble measuring mandrel with centering disk 9109, tapered-roller bearings, plunger VW 385/14 and dial-gauge extension VW 385/15.

4. Set measuring mandrel with adjuster 385/30 to adjusting dimension (60.95 mm in the example). Set dial gauge (3 mm measuring range) to 0 with 1 mm pretension.



5. Block input shaft with Special Tool 9253, select 4th gear and screw Special Tool 9283 onto hollow shaft hand tight.

6. Apply final dimension plate 9281 to drive pinion head and insert measuring mandrel into transmission case. Dial-gauge extension located in the area of the final dimension plate.



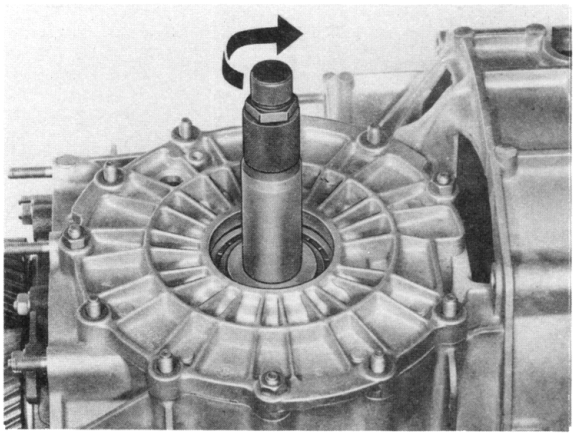
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7. Fit side transmission cover without O-ring and fasten cross-wise with 4 nuts.

Note

Do not use a hammer when fitting the side transmission cover (the magnet- fitted final dimension plate may fall). Settle cover in installation position by tightening the nuts uniformly.

8. Pull second centering disk with spindle towards the outside until the measuring mandrel can still just be turned by hand.



9. Turn measuring mandrel carefully until the dial-gauge extension is vertical to the facing edge of the drive-pinion head. At this point, the pointer of the dial gauge reaches max. deflection (reverse point), and the dial gauge must be read.

Note

The measured value always deviates from the set dimension clockwise (the smaller pointer on the dial gauge is between 1 and 2), i.e. if the dial gauge is set with 1 mm preload, the value deviating from 1 is taken as shim thickness "S_3".

Example:

If the small pointer on the dial gauge indicates between 1 and 2 and the large pointer indicates 0.37 mm, then take 0.37 mm as being the shim thickness (with 1 mm gauge preload). Always round up or down to the nearest 0.05 mm. (e.g. 0.37 mm to 0.35 mm).

10. After providing the necessary shims, check setting value "E" again.
A deviation ± 0.03 mm is permissible.

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Adjusting ring gear (rear-axle drive)

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

The ring gear must be adjusted if the transmission case,

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

Note

The drive pinion must be removed to determine the preload of tapered-roller bearing on the differential.

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

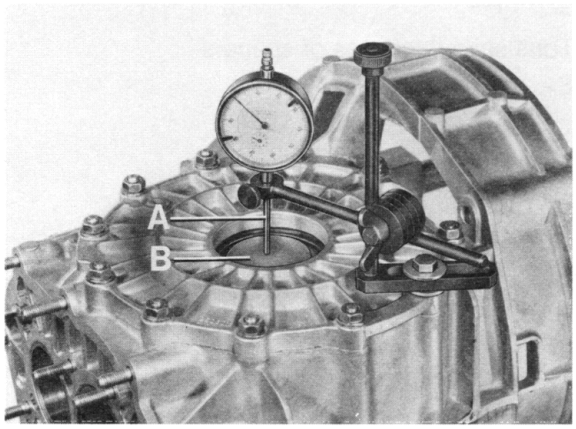
2. Fit one spacer ring, 2.5 mm thick, on the ring gear side and opposite side of the differential to be used.

3. Insert differential into transmission case and crank several times.

4. Fit side transmission cover without seal and tighten all hexagon nuts with 23 Nm (17 ft.lb.).

5. Lay final dimension 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 case and set to 0 with 2 mm preload.



A = Dial-gauge extension (approx. 30...40 mm long)

B = Final dimension 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 falsify the measuring result.

8. Calculate "S tot."
   "S"tot." = Fitted shim thickness
   + measured value
   + pressure of the tapered-roller bearing

Example

Shim thickness provided	5.00 mm
Measured value	0.75 mm
Pressing (constant value)	0.40 mm
"S tot."	6.15 mm

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9. Remove differential, pull off both tapered roller bearings and split calculated shim thickness "S tot." as follows.
   Select spacer S_1 0.70 mm thinner and S_2 0.7 mm thicker as a starting point for subsequent adjustment of the flank backlash.

Example

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

Thickness of spacer S_1

$$\frac{6.15 \text{ mm}}{2} = 3{,}075 \text{ mm}$$
$$- 0{,}700 \text{ mm}$$
$$= 2{,}375 \text{ mm}$$

Thickness of spacer S_2

$$\frac{6.15 \text{ mm}}{2} = 3{,}075 \text{ mm}$$
$$+ 0{,}700 \text{ mm}$$
$$= 3{,}775 \text{ mm}$$

Note

Spacers are available in thickness 1.6...3.1 mm in increments of 0.10 mm.

A 0.25 mm thick shim makes it possible to graduate shim thicknesses in increments of 0.05 mm.

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

Example:

Calculated thickness

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

Rounded off thicknesses

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

Measure shims with a micrometer in several places. Permissible deviation 0.02 mm. Also check shims for burrs and damage.

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Adjust circumferential backlash (rear-axle drive)

Note

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

1. Mount gear set using shims "S_3" determined while adjusting the drive pinion.

2. Insert differential with tapered roller bearing and shims (S_1 + S_2) into the housing.

3. Fit side transmission cover and tighten all hexagon nuts with 23 Nm (17 ft.lb.).

Note

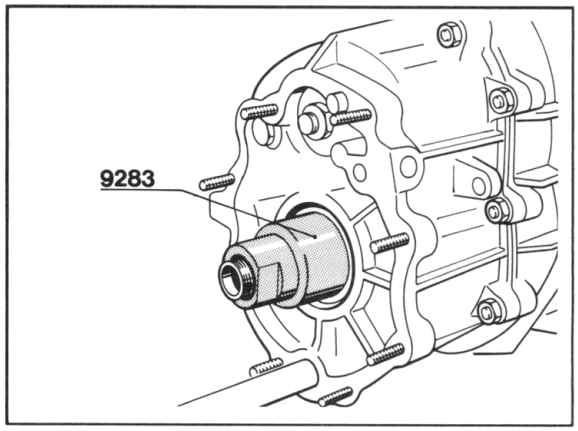
Always make sure that there is a certain amount of flank backlash when tightening the nuts. Never allow the drive pinion to seize.

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 picture.

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

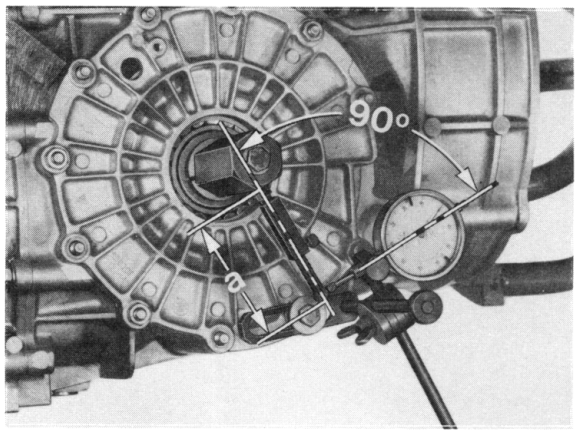
6. Crank differential in both directions several times to settle the tapered roller bearing.

7. Screw Special Tool 9283 (without shim "S") onto the hollow shaft **hand tight**.



231-39

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



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Dimension "a" = approx. 80 mm

9. Turn ring gear carefully at the clamping screw of the adjusting device as far as the stop and set the dial gauge to 0. Turn back ring gear and read off circumferential backlash. Make a note of the value.

10. After turning the ring gear a further 90°, repeat measuring procedure three times. The measured values must not deviate from one another by more than 0.05 mm.

Note

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

11. If it is not possible to obtain the prescribed flank play, replace spacers (S_1 + S_2) again. The total shim thickness ($S_{tot.}$) must not alter however.

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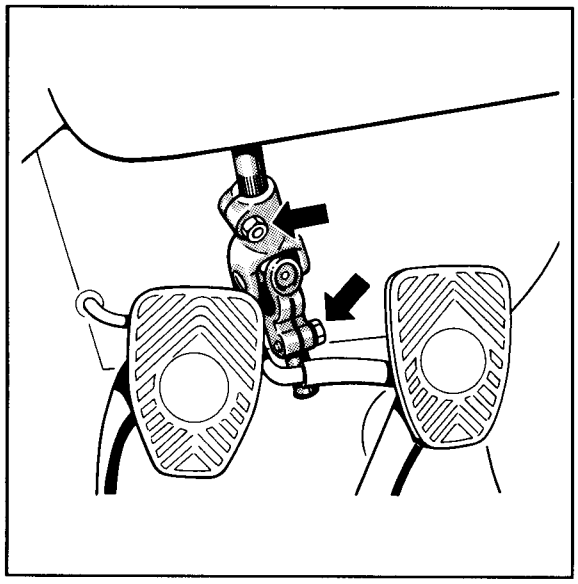
Removing and installing front-axle final drive

Removing

1. Raise vehicle at jacking points.

2. Remove floor panel from pedal assembly.

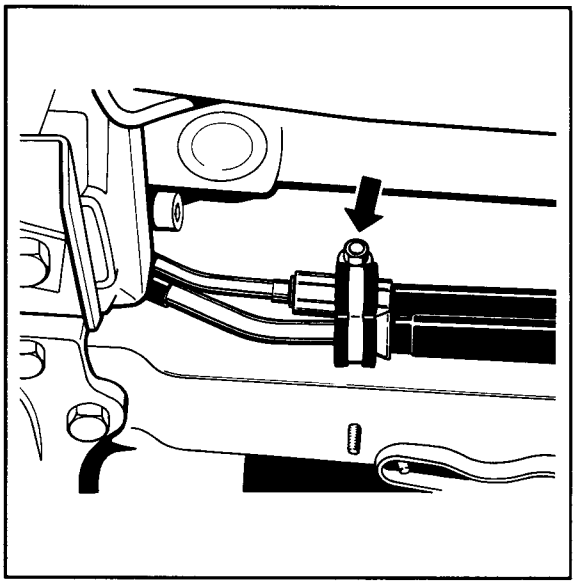
3. Remove both universal-joint clamping screws between steering gear and steering shaft and pull joint upwards.



244-39

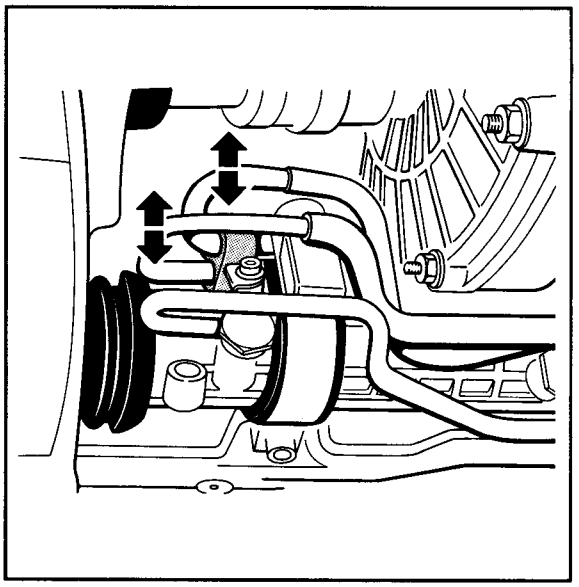
4. Remove front and middle floor panels.

5. Remove retaining clamp from power-steering lines.



245-39

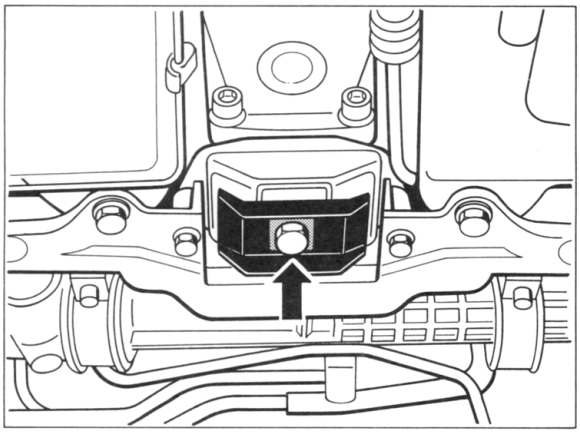
6. Unclip power-steering lines from holder.



246-39

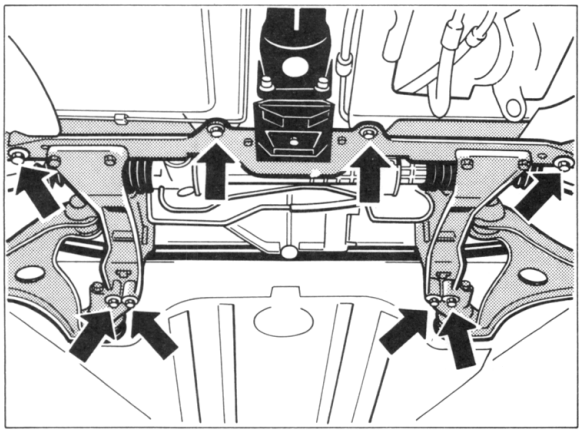
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7. Undo transmission-bearing screw.



247-39

8. Undo hexagon head screws from front-axle cross members and side members and drop front axle.



248-39

9. Remove stabilizer.

10. Undo drive shaft at flange from front-axle final drive.

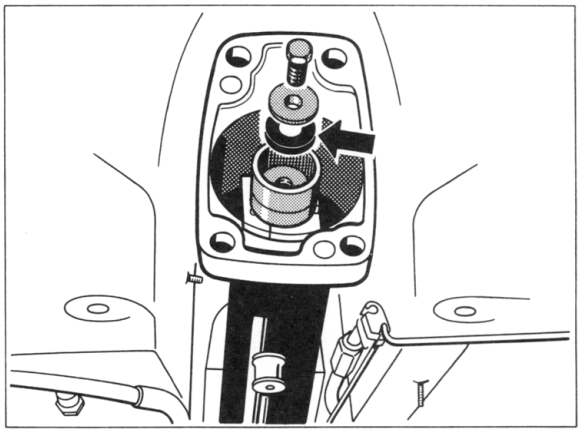
11. Undo Allen screw from front central-shaft clamping sleeve and slide clamping sleeve along central shaft to the rear.

12. Undo upper fastening screws for central tube - front-axle final drive - by pressing central pipe to one side with a suitable tool. (Do not damage lines).

13. Position gearbox lever underneath, undo central pipe fastening screws and remove transmission.

Installing

1. The rubber seal (arrow) must be replaced on the facing surface of the central shaft before installing the front-axle final drive. Apply glycerine to sealing disk before assembly. Tightening torque for hexagon head screws (M 6 x 12) 10 Nm (7.5 ft.lb.)



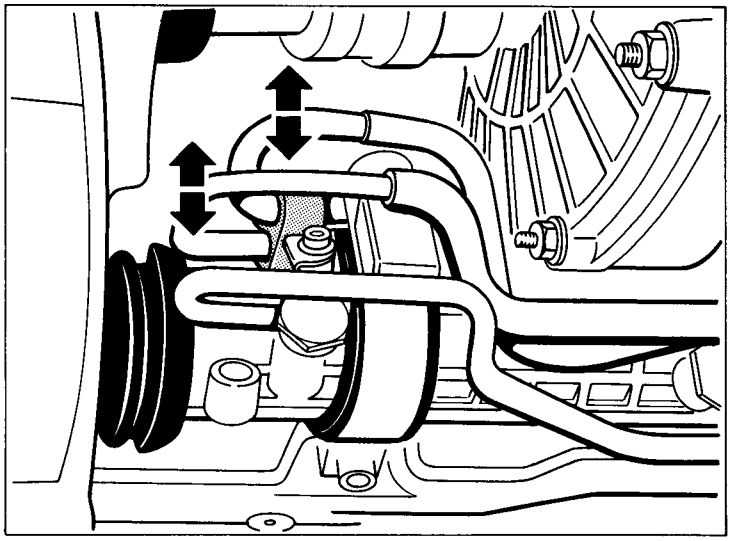
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2. Check transmission oil and fill up if necess.

3. Clip lines into holder.

4. Align front axle.



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Tightening torques: Removing and installing front-axle final drive

Location	Thread	Tightening torque Nm (ft.lb.)
Rubber sealing disk (in area of clamping sleeve)	M 6	10 (7.5)
Central pipe to transmission	M 12	85 (62.5)
Clamping sleeve to central shaft	M 10	75 (55)
Drive shaft to transmission	M 8	42 (31)
Stabilizer to side member	M 8	23 (17)
Stabilizer to stabilizer mounting	M 10	46 (34)
Cross member to chassis outside inside	 M 12 M 10	 85 (62.5) 46 (34)
Trailing arm to chassis (front)	M 12	85 (62.5)
Universal joint to steering gear and steering shaft	M 8	23 (17)
Wheel to hub	M 14	130 (96)

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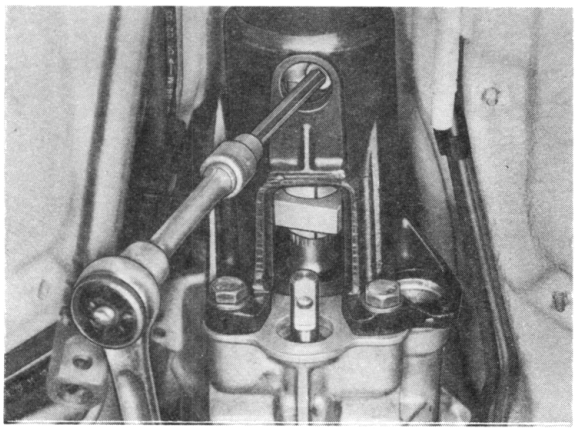
Removing and installing central pipe

1. Remove front-axle final drive, refer to Page 39 - 25.

2. Remove transmission shield.

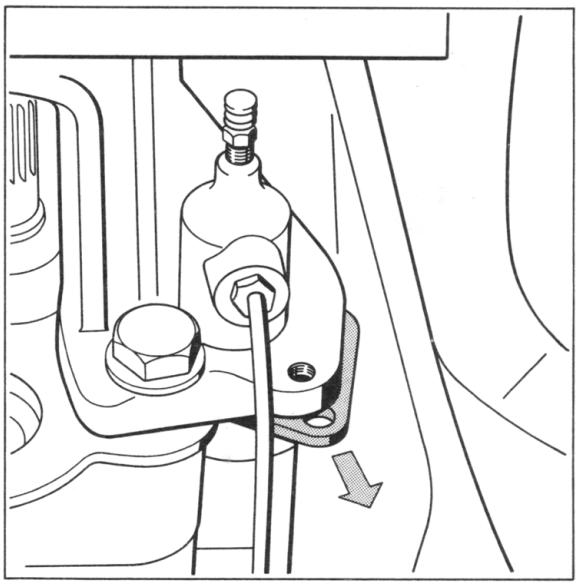
3. Pull rubber boot forward over gearshift rod coupling and undo fit bolt.

4. Undo both Allen screws from clamping sleeve and slide sleeve along central shaft to the front.



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5. Undo Allen screws from interaxle-lock slave cylinder and remove safeguard. Do not undo line.



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6. Unclip connection line to transmission and suspend interaxle cylinder with connected line on one side.

7. Unclip control cable for throttle flap on deflection lever of pedal box and remove bolt pin.

8. Remove lever knob from gear lever.

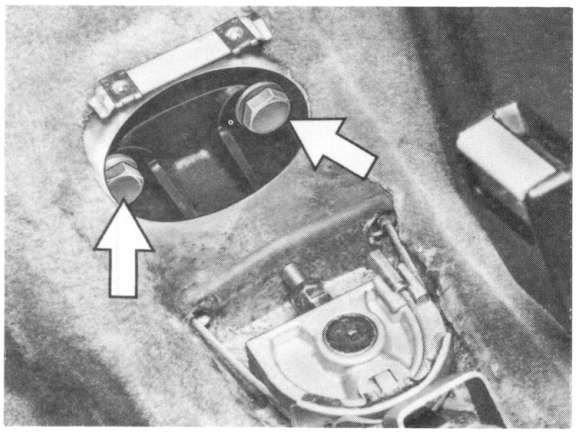
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9. Undo upper fastening screws from transmission central pipe; for this, remove rear shelf from central console. Remove PVC layer and take off cover.

Note

The cover can also be pushed out from below.

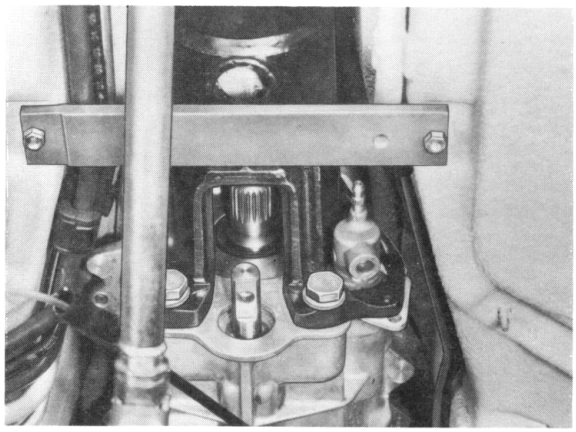
Illustration shows cutout without console



88-511

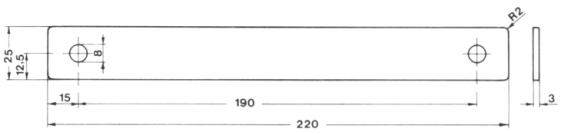
10. Pull throttle-flap withdrawal cable out of guide tube for floor group.

11. Fit own-construction tool - flat iron - front and rear. (To support central pipe when disconnecting).



88-514

Sketch of own-construction tool



156-10

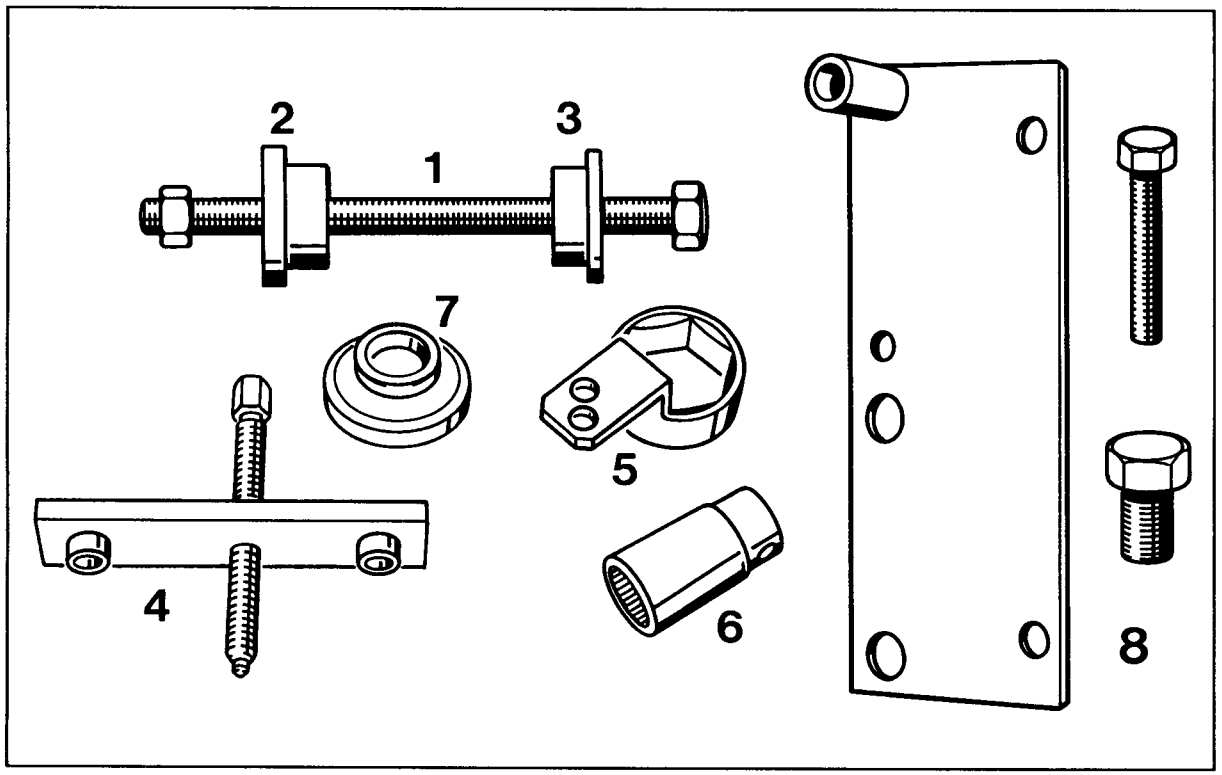
Installing

When installing, make sure that the aluminium plate between central pipe and rear-axle transmission is fitted correctly.

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Disassembling and assembling front-axle final drive

Tools

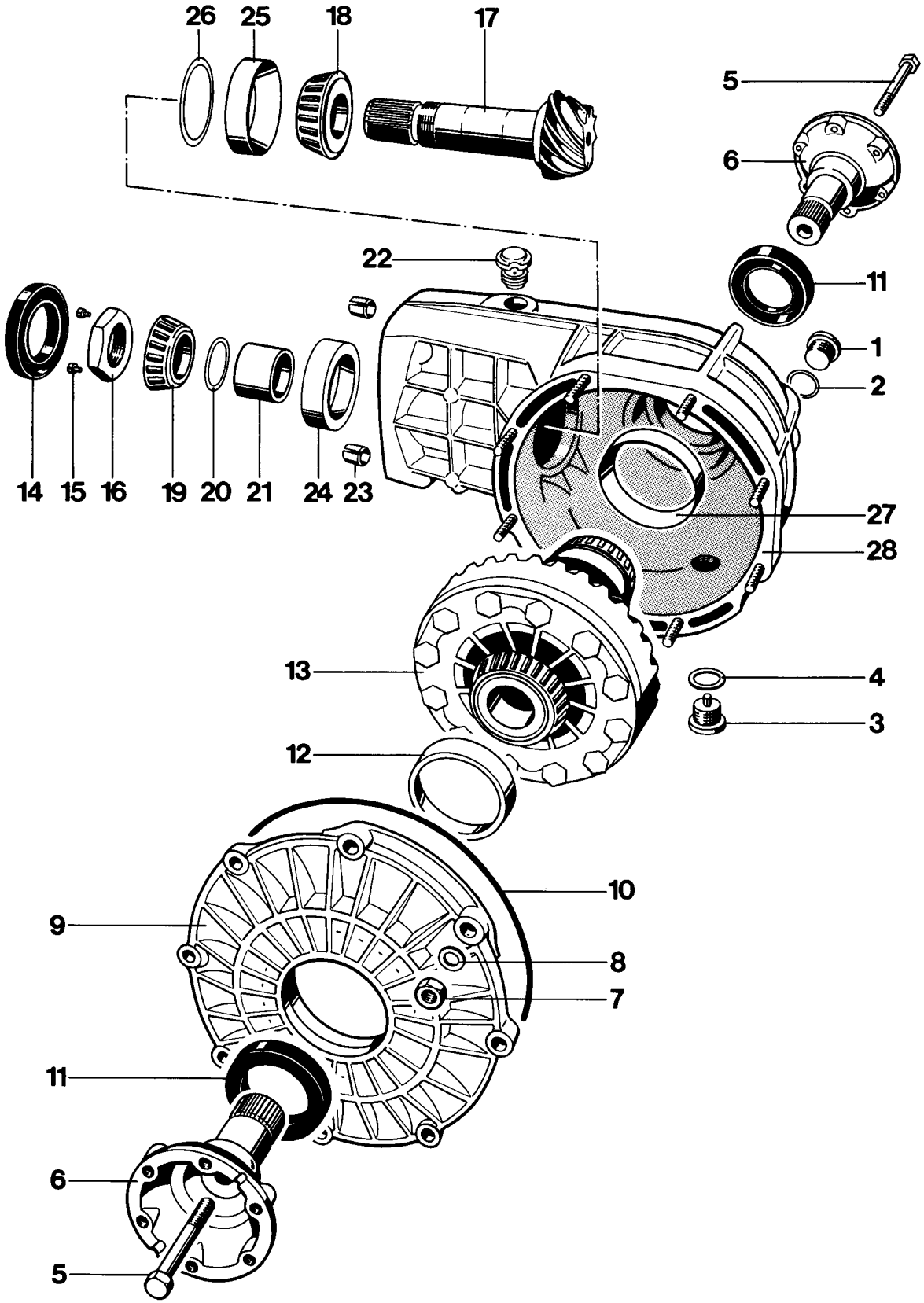


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No.	Description	Special Tools	Order number	Remarks
1	Threaded spindle	VW 517		
2	Pressing tool	VW 511		
3	Pressing tool	9502	000.721.950.20	
4	Retainer plate	9504	000.721.950.40	with standard threaded spindle (e.g. Kukko 20/1)
5	Holding device	9503	000.721.950.30	
6	Socket wrench	9505	000.721.950.50	
7	Pressing tool	9252	000.721.925.20	
8	Retainer plate	9296	000.721.929.60	

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Disassembling and assembling front-axle final drive



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No.	Description	Qty.	Note when: Removing	Installing
1	Plug	1		Tighten with 30 Nm (22 ft.lb.)
2	Seal	1		Replace
3	Plug with magnet	1		Tighten with 30 Nm (22 ft.lb.)
4	Seal	1		Replace
5	Hexagon head screw	2		Tighten with 44 Nm (32.5 ft.lb.)
6	Joint flange	2		
7	Hexagon nut	8		Tighten with 23 Nm (17 ft.lb.)
8	Washer	8		
9	Cover	1		
10	O-ring	1		Replace, apply light film of oil
11	Shaft seal	2		Pack area between sealing lips with grease (e.g. Olista Longtime 3 EP). Drive into position with Special Tool 9252.
12	Outer bearing race	1	Heat cover up to approx. 120 °C (248 °F)	
13	Differential	1		Readjust if necessary
14	Shaft seal	1		Pack area between sealing lips with grease (Olista Longtime 3 EP).
15	Screw	2		Tighten with 6 Nm (4.5 ft.lb.)
16	Lock nut	1	Remove with Special Tools 9503 and 9505	Tighten with 230 Nm (170 ft.lb.) and secure with screws (No. 15)
17	Drive pinion	1	Press out with Special Tool 9504	Observe matching number, readjust i. n.

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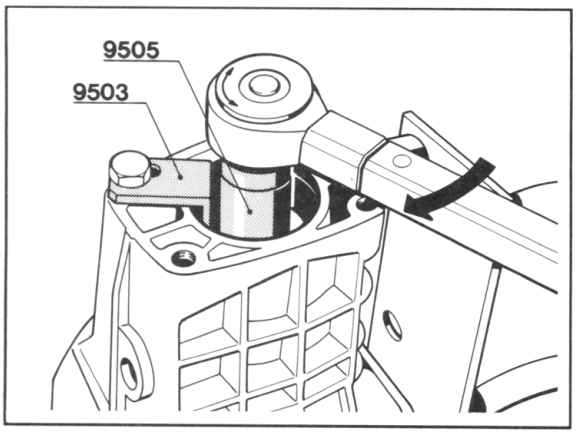
No.	Description	Qty.	Note when: Removing	Installing
18	Inner bearing race	1	Press off with suitable separating device (e.g. Kukko 17-1)	Heat up to approx. 120 °C (248 °F)
19	Inner bearing race	1	Heat up to approx. 120 °C (248 °F)	
20	Shim "S4"	X	Make a note of thickness for refitting	Measure again if necessary
21	Spacer	1		
22	Bleeder	1		
23	Clamping sleeve	2		
24	Outer bearing race	1	Heat housing up to approx. 120 °C (248 °F)	Heat housing up to approx. 120 °C (248 °F) and pull in with Special Tools VW 517, VW 511 and 9502
25	Outer bearing race	1	Heat housing up to approx. 120 °C (248 °F)	Heat housing up to approx. 120 °C (248 °F) and pull in with Special Tools VW 517, VW 511 and 9502
26	Shim "S3"	X	Make a note of thickness for refitting	Measure again i. n.
27	Inner bearing race	1	Heat housing up to approx. 120 °C (248 °F)	Heat housing up to approx. 120 °C (248 °F)
28	Housing	1		

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Notes on disassembling and assembling

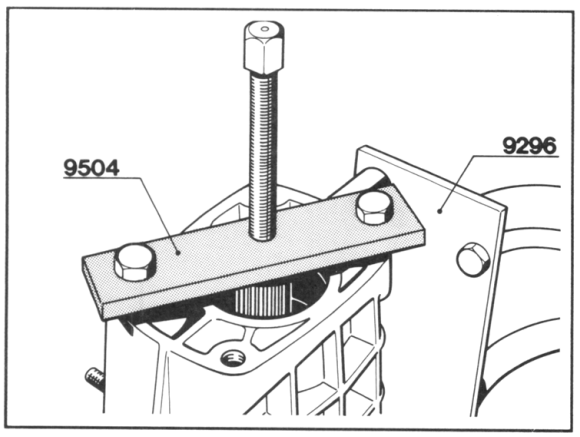
Disassembling

1. Remove lock nut with Special Tools 9505 and 9503.



166-39

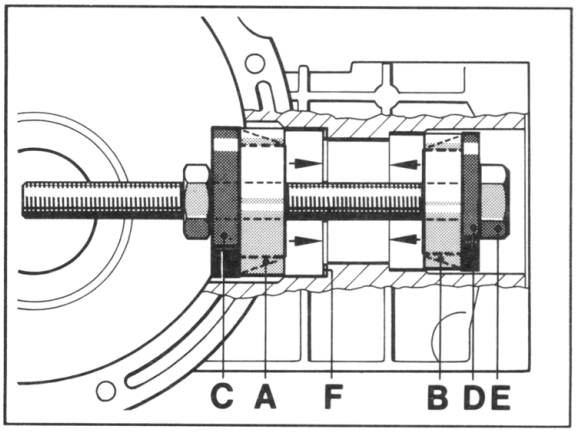
2. Press out drive pinion with Special Tool 9504 and standard spindle M 14 x 1.5 (e.g. Kukko 20/1).



170-39

Assembling

1. Heat housing up to approx. 120 °C (248 °F) and pull in outer bearing races with Special Tools VW 517, VW 511 and 9502.



168-39

A = Outer bearing race

B = Outer bearing race

C = Pressing tool VW 511

D = Pressing tool 9502

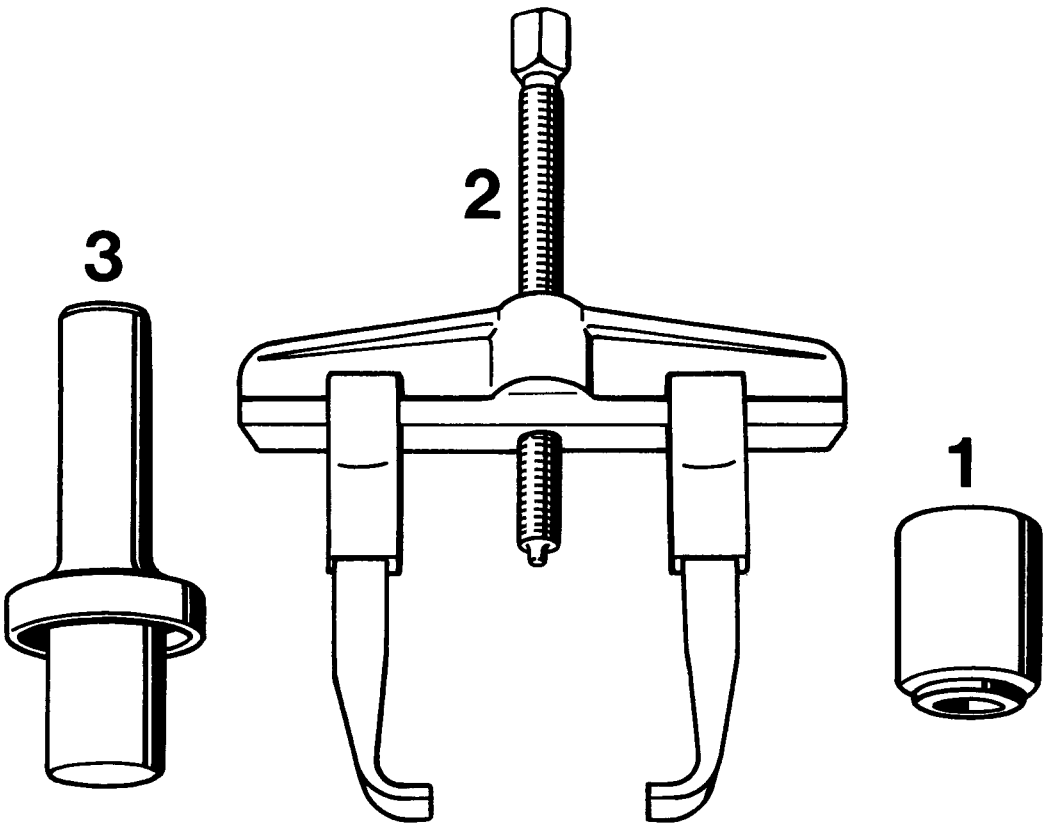
E = Threaded spindle VW 517

F = Shim "S3"

2. Only fill with transmission oil after gearbox has been installed and central pipe fitted.

Disassembling and assembling differential (front-axle drive)

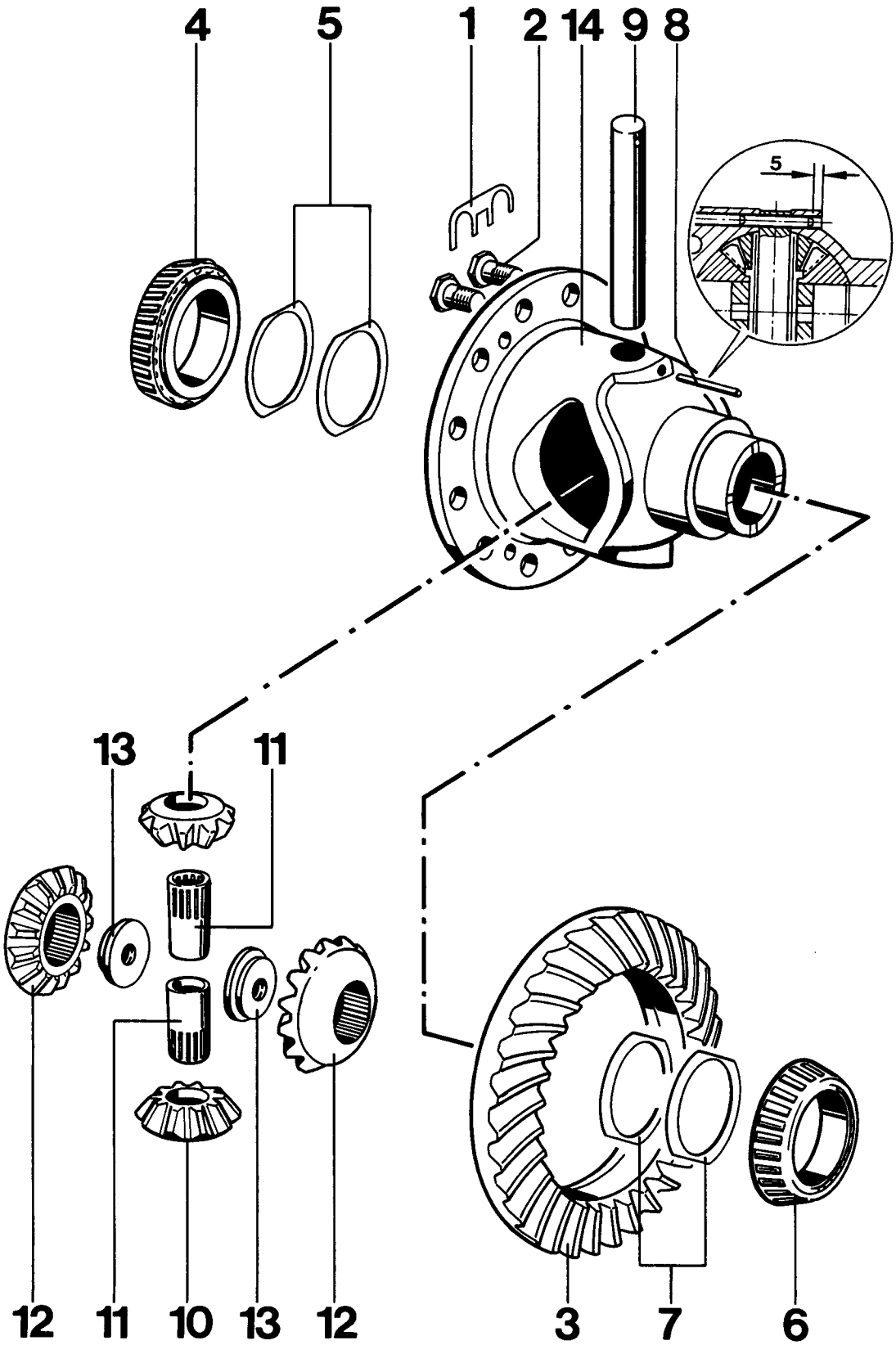
Tools



No.	Description	Special Tools	Order number	Remarks
1	Pressing tool	P 263	000.721.263.00	
2	Puller	-	-	standard
3	Pressing tool	P 264 b	000.721.264.20	

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Disassembling and assembling differential (front-axle drive)



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No.	Description	Qty.	Note when: Removing	Installing
1	Tab washer (omitted for Verbus-Ripp bolts)	6		Replace. Slide into groove of hexagon head screw, pull together at front with pliers (to ensure that tab washer is firmly linked to hexagon head screw) and secure below over a hexagonal surface.
2	Hexagon head screw (with tab washer)	12		Thread must be dry and free of grease. Tighten with 150 Nm (110.5 ft.lb.).
–	Verbus-Ripp bolt (**without** tab washer)	1		Must always be replaced. Threads must be dry and grease-free. Tighten to 200 Nm (148 ftlb).
3	Ring gear	1		Threaded holes for ring-gear screws must be dry and free of grease. Observe matching numbers. Readjust if necessary.
4	Tapered roller bearing - inner race	1	Remove with suitable puller and P 263	Press on with P 264 b
5	Shim "S_1"	X	Mark for refitting	Measure thickness again if necessary
6	Tapered roller bearing - inner race	1	Pull out with suitable puller and P 263	Press into place with P 264 b
7	Shim "S_2"	X	Mark for refitting	Remeasure thickness if necessary
8	Spiral pin	1		Drive into correct position
9	Bolt	1		

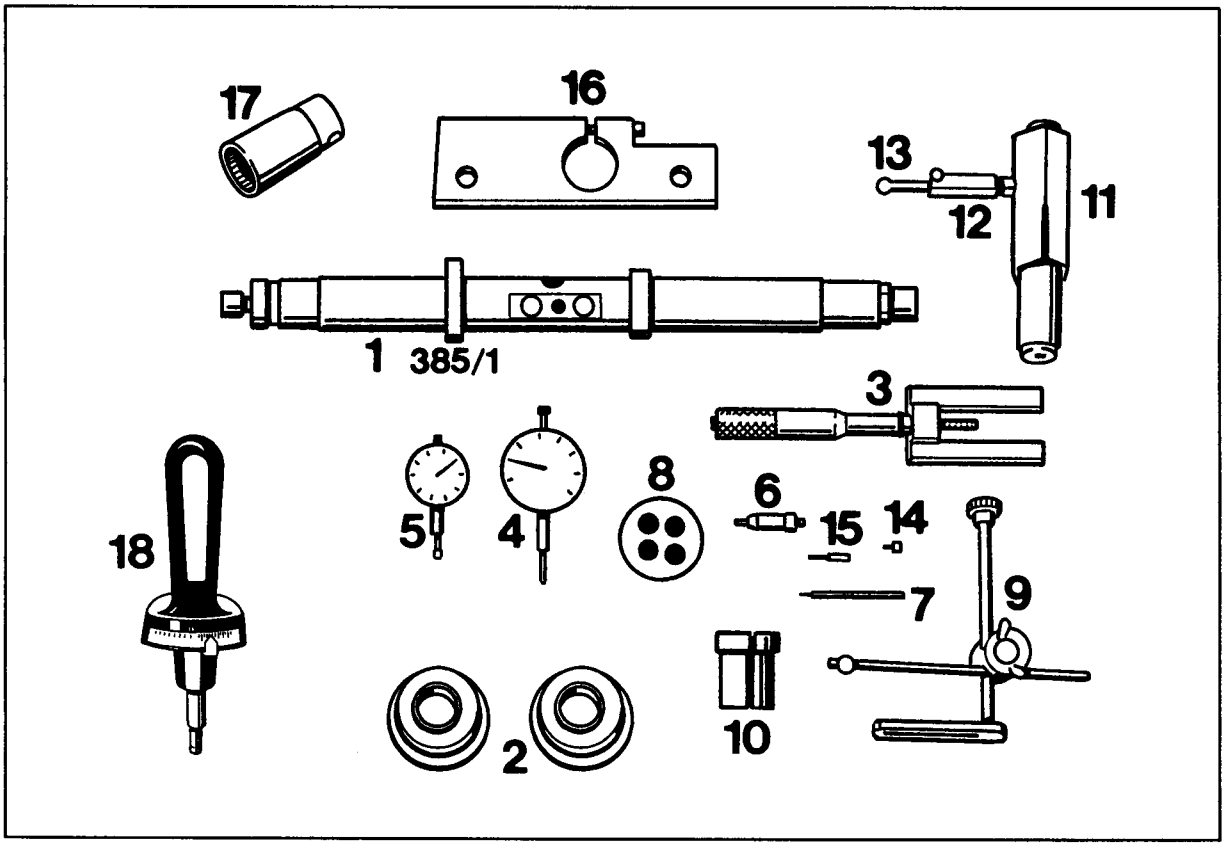
Printed in Germany – XVIII, 1992

No.	Description	Qty.	Note when: Removing	Installing
10	Bevel pinion	2		Apply code of MOS2 paste to convex surface. Replace only as a set complete with shaft bevel gears
11	Needle sleeve	2		
12	Shaft bevel gear	2		Apply film of MOS2 paste to convex surface. Replace only as a set complete with bevel pinions
13	Threaded fitting	2		
14	Housing	1		

Printed in Germany – XVIII, 1992

Adjusting drive set (front-axle drive)

Tools



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Printed in Germany – II, 1989

Adjusting drive set (front-axle drive)

Tools

No.	Description	Special Tools	Order number	Remarks
1	Measuring mandrel	VW 385/1		
2	Centering disks	VW 385/4		
3	Universal gauge	VW 385/30		
4	Dial gauge	-		standard
5	Dial gauge	-		standard Measuring range 3 mm
6	Plunger	VW 385/14		
7	Dial-gauge extension	VW 385/56		
8	Final dimension plate	9281	000.721.928.10	
9	Dial-gauge holder	VW 387		
10	Clamping sleeve	9145	000.721.914.50	
11	Adjusting device	VW 521/4		
12	Measuring lever	VW 388		
13	Plunger	VW 388		
14	Dial-gauge extension	VW 382/10		6.0 mm long
15	Dial-gauge extension	VW 385/15		9.3 mm lang
16	Retainer plate	9506	000.721.950.60	
17	Socket wrench	9505	000.721.950.50	
18	Torque gauge	-		standard

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Adjusting drive set (front-axle drive)

Practical procedure when readjusting the drive set

If it is necessary to adjust drive pinion and ring gear, following this sequence will ensure an efficient working procedure:

1. Determine total shim thickness "S_{tot}" (S_1 plus S_2) for specified preload of tapered-roller bearing/differential.
2. Determine shim thickness "S_3".
3. Determine bearing pressure "S_4".
4. Split total shim thickness "S_{tot}" into S_1 and S_2 so that there is the specified circumferential backlash between ring gear and drive pinion.

The aim of this adjustment is to once again achieve the position of smoothest running which was obtained on test equipment in the production line.

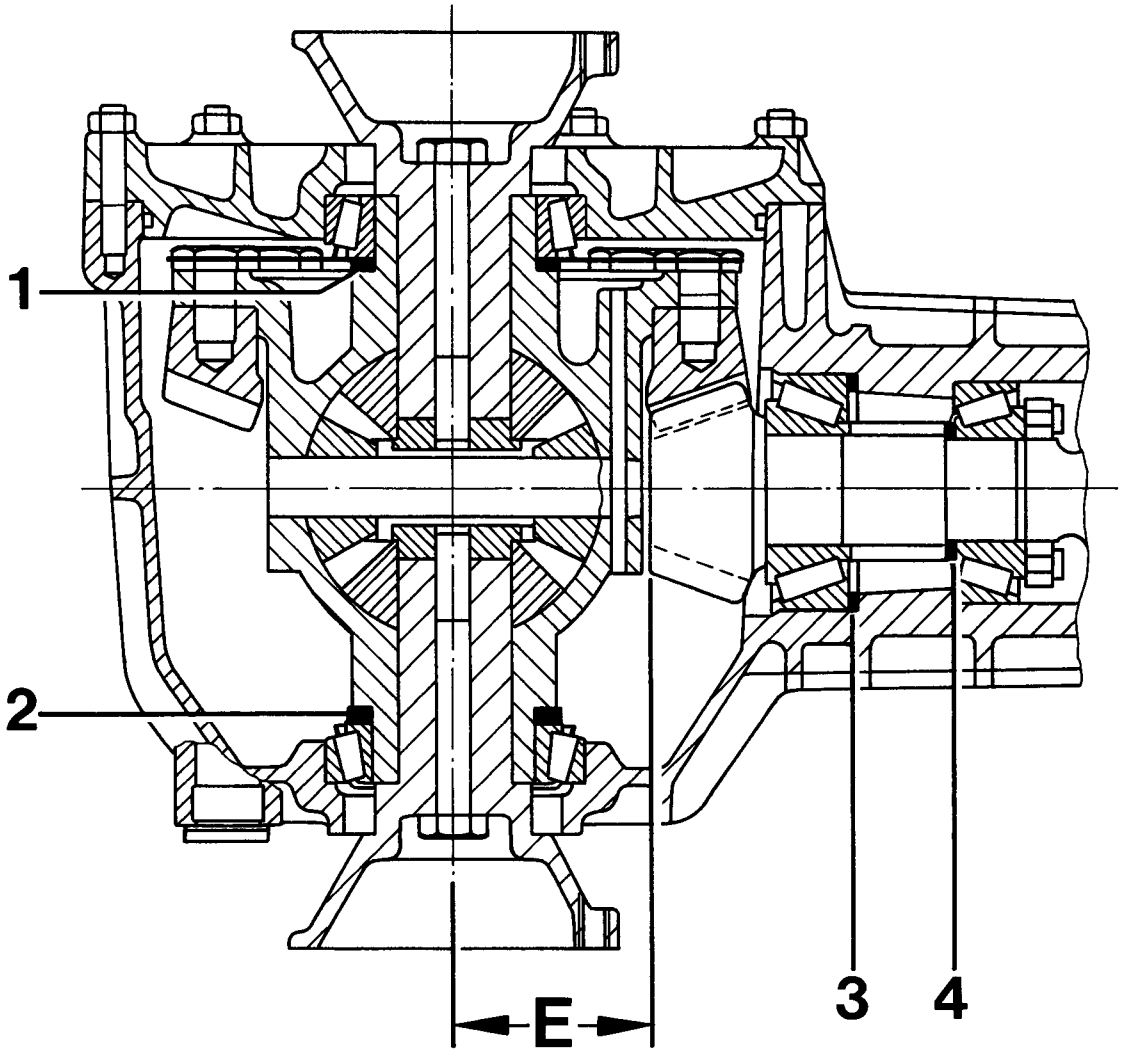
A correct result presupposes greatest possible degree of cleanliness during all assembly work and measuring procedures.

It is only necessary to adjust drive pinion and ring gear or drive set when working on the final drive assembly if parts have been replaced which have direct influence on the adjustment. Refer to the following table in order to avoid unnecessary adjusting procedures.

Adjust is: / Replace component	Ring gear (S_1 + S_2)	Drive pinion (S_3)	Bearing pressure (S_4)
Transmission case	X	X	X
Side transmission cover	X		
Drive set	X	X	X
Differential housing	X		
Tapered roller bearing for differential	X		
Tapered roller bearing for drive pinion		X	X

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Adjusting drive set (front-axle drive)



1 - Spacer S_1
2 - Spacer S_2
3 - Shim S_3
4 - Shim S_4
E - Adjustment dimension

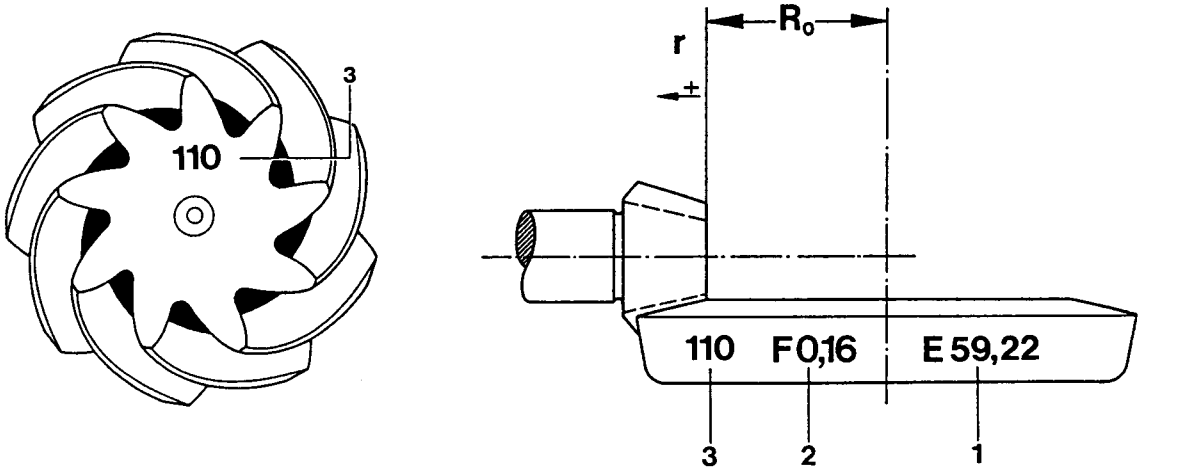
A correct result presupposes cleanliness and conscientiousness for all assembly operations and measuring procedures.

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Adjusting drive set (front-axle drive)

General

The setting of drive pinion, ring gear and bearing pressure of both tapered roller bearings on the drive pinion are determining factors for the service life and smooth running of the front-axle final drive. Drive pinion and ring gear are therefore already matched during production, which are checked for good surface appearance and low noise factor in both directions of rotation on special test equipment. The position where smoothest running is achieved is determined by shifting the drive pinion axially, whereby the ring gear is kept within the tolerance of specified backlash. Deviation "r" from the specified design dimension "R_Q" is determined, added to design dimension "R_o" and embossed on the ring gear as setting value "E".



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R_o = Design dimension

r = Deviation r

1 = Setting value (R_o + r) e.g. 59.22

2 = Backlash, e.g. F 0.16

3 = Matching number

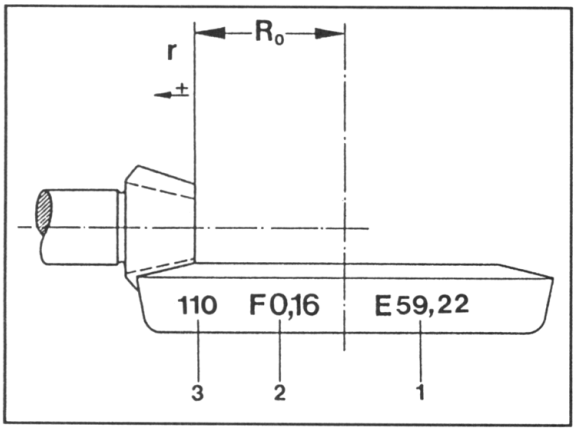
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Adjusting drive set (front-axle drive)

Adjusting drive pinion (shim S_3)

Note

The setting value "E" is given on the ring gear.



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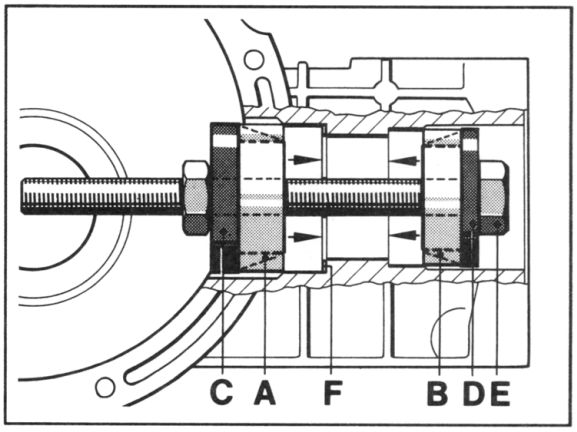
1 = Setting value "E"

Note

Use shims which are 2.0 mm thick as shim thickness "S_3" between front outer bearing race and housing as a starting point for the adjustment of the drive-pinion bearing.

1. Heat front drive-pinion bearing up to approx. 120 °C (248 °F) and press onto the drive pinion in the correct position.

2. Heat housing up to approx. 120 °C (248 °F) and pull in outer bearing races with Special Tools VW 517, VW 511 and 9502.



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A = Outer bearing race

B = Outer bearing race

C = Pressing tool VW 511

D = Pressing tool 9502

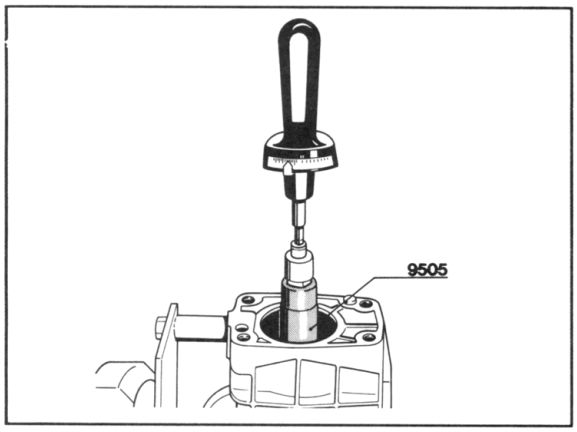
E = Threaded spindle VW 517

F = Shim "S_3"

3. Insert drive pinion with spacer sleeve, heat rear drive-pinion bearing up to approx. 120°C (248 °F) and mount onto the drive pinion without shim "S_4".

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4. Tighten the lock nuts of drive pinion carefully up to a maximum of 100 Nm (74 ft.lb.) using Special Tools 9503 and 9505 until you reach a drag moment of 270...350 Ncm.

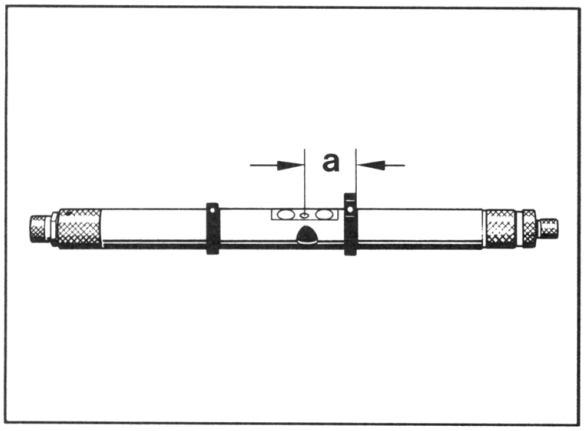


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Note

Check the moment of drag from time to time while tightening the nuts.

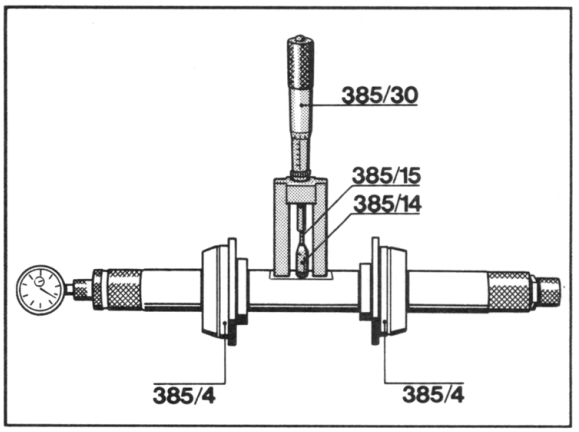
5. Set the adjusting ring of measuring mandrel VW 385/1 to dimension "a".



"a" = ca. 55 mm

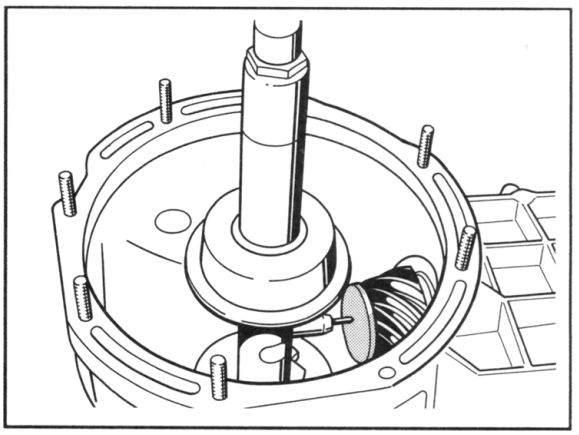
223-39

6. Assemble measuring mandrel with centering disk VW 385/4, plunger VW 385/14 and dial-gauge extension VW 385/15.



7. Set measuring mandrel with gauge 385/30 to setting value (59.22 mm in the example). Set dial gauge (3 mm measuring range) to zero with 1 mm preload.

8. Place final dimension plate 9281 onto the drive-pinion head and insert measuring mandrel into transmission case. Dial-gauge extension located in the area of the final dimension plate.



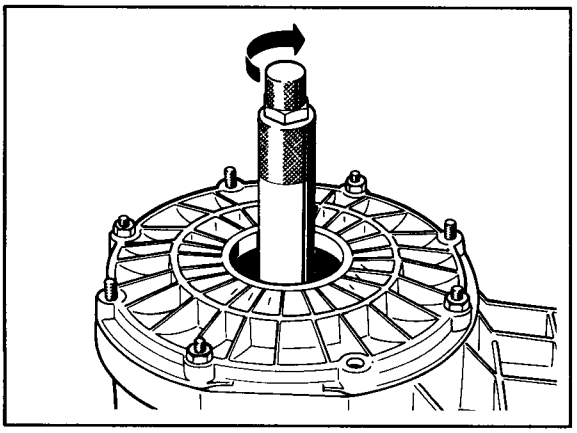
221-39

9. Fit side transmission cover without O-ring and fasten cross-wise with 4 nuts.

Note

Do not use a hammer when fitting the side transmission cover (the magnet-fitted final dimension plate may fall). Settle the cover in its installation position by tightening the nuts uniformly.

10. Pull second centering disk with spindle far enough outwards that it is just still possible to turn the measuring mandrel by hand.



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11. Turn measuring mandrel carefully until the dial-gauge extension is vertical to the facing surface of the drive-pinion head. At this point, the pointer of the dial gauge reaches maximum deflection (reversing point), at which point the dial gauge should be read.

Note

If the measured value deviates from the setting value "E" clockwise (59.22 mm in the example) then the dimension is less than 59.22 mm; that means that the value deviating from zero must be subtracted from dimension 59.22.

Example:

The small pointer on the dial gauge is pointing between 1 and 2, the large pointer indicates 0.15 mm.

Dial-gauge setting	59.22 mm
Measured value	- 0.15 mm
Value towards drive pinions facing	59.07 mm
Setting value "E" (e.g.)	59.22 mm
Value towards drive-pinion facing	- 59.07 mm
Deviation	0.15 mm

The drive pinion must therefore be shifted a further 0.15 mm away from the middle of the ring gear.

This is achieved by using a shim "S_3" which is 0.15 mm thinner. At the same time, round up or down to the nearest 0.05 mm.

If the measured value deviates from setting value "E" counterclockwise (59.22 mm in the example) then the dimension is greater than 59.22 mm; that means that the value deviating from 0 must be added to dimension 59.22.

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Example:

The small pointer of the dial gauge indicates between 1 and 0, the large pointer indicates 0.08 mm.

Dial-gauge setting		59.22 mm
Measured value	+	0.08 mm
Value towards drive-pinion facing		59.30 mm
Value towards drive-pinion facing		59.30 mm
Setting dimension "E"(e.g.)	-	59.22 mm
Deviation		0.08 mm

The drive pinion must therefore be shifted nearer to the middle of the ring gear by a further 0.08 mm.

This is achieved by using shim "S_3" which is thicker by 0.08 mm.

At the same time, round up or down to the nearest 0.05 mm.

12. After altering shim "S_3" check setting value "E" once again. A deviation of ± 0.03 mm is permitted.

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Adjusting drive set (front-axle drive)

Adjusting ring gear

Determine total shim "S $_{tot.}$" ($S_1 + S_2$).

The ring gear must be readjusted if transmission case, side transmission

cover, tapered roller bearing for differential, differential housing or drive set have been replaced.

Note

The drive pinion must be removed to determine the preload of tapered roller bearing on the differential.

1. Make sure that the outer bearing races of the tapered roller bearing are firmly secured in transmission case or side transmission cover.

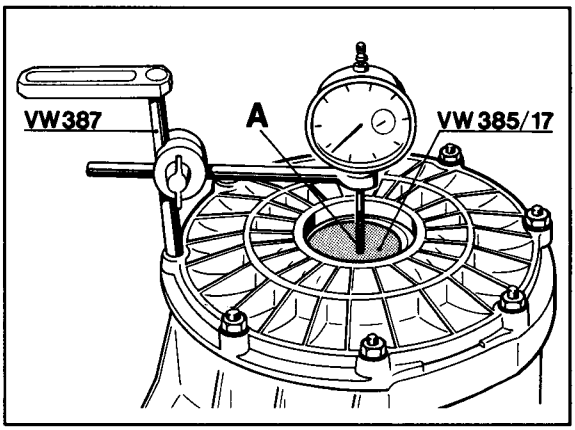
2. Fit a spacer, 2 mm thick, on ring-gear side and opposite side of differential to be used.

3. Insert differential into transmission case and crank several times.

4. Install side transmission cover without seal and tighten all hexagon nuts with 23 Nm (17 ft.lb).

5. Place final dimension 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.



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A = Dial-gauge extension (approx. 30...40 mm long)

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

Note

Do not turn differential while measuring backlash as this will falsify the measuring result.

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8. Calculate "$S_{tot.}$".
   "$S_{tot.}$" = Thickness of shim provided + measured value + Pressure of tapered roller bearing

Example:

Thickness of shim provided	4.00 mm
Measured value	0.80 mm
Pressure (constant value)	0.30 mm
"$S_{tot.}$"	5.10 mm

9. Remove differential, pull off both tapered roller bearings and split the calculated thickness of shims "$S_{tot.}$" as follows.

Select a spacer S_1 which is 0.70 mm thinner and S2 which is 0.70 mm thicker as a starting point for subsequent adjustment of the backlash.

Example:

Total thickness of spacers
$S_1 + S_2 = 5.10$ mm

Thickness of spacer S_1 =

$$\frac{5.10 \text{ mm}}{2} = 2{,}55 \text{ mm} - 0{,}70 \text{ mm} = 1{,}85 \text{ mm}$$

Thickness of spacer S_2 =

$$\frac{5.10 \text{ mm}}{2} = 2{,}55 \text{ mm} + 0{,}70 \text{ mm} = 3{,}25 \text{ mm}$$

Note

Spacers are available in thicknesses from 1.6...3.1 mm in increments of 0.10 mm.

A 0.25 mm thick shim is provided to enable the spacer thicknesses to be graded into increments of 0.05 mm.

The calculated spacer thicknesses must therefore be rounded up or down to feasible values in such a way that the total shim thickness S_1 and S_2 is not altered.

Measure shims with a micrometer in several places. Permitted deviation 0.02 mm. Also check shims for burrs and damage.

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Adjusting drive set (front-axle drive)

Determine bearing pressure of tapered roller bearing on drive pinion (S_4)

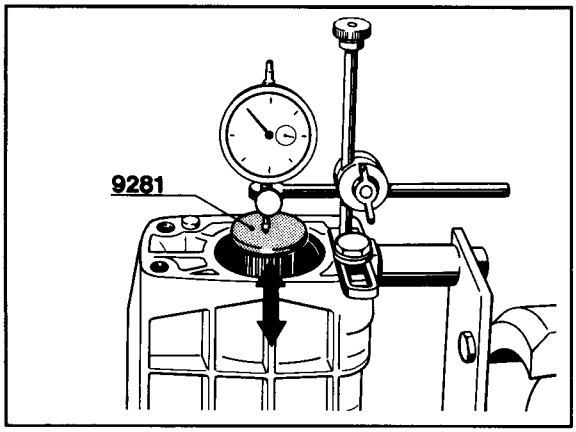
Note

The setting value "E" must be within the tolerance of ±0.03 mm in order to determine the bearing pressure.

1. Fit drive pinion with 2.5 mm thick shim "S4", heat rear drive-pinion bearing up to approx. 120 °C (248 °F) and install.

2. Tighten lock nut with 230 Nm (169.5 ft.lb.) using Special Tools 9503 and 9505.

3. Fasten universal dial-gauge holder VW 387 to the housing and set dial gauge to 0 with 2 mm preload.



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4. Move drive pinion in axial direction and measure backlash on dial gauge, noting the value.

Note

Do not turn drive pinion while measuring backlash as this will falsify the measured result.

5. Calculate bearing pressure.

Example:

Inserted shims	2.50 mm
Measured backlash	- 0.95 mm
Axial preload (constant value	- 0.15 mm
Shim "S_4"	1.40 mm

6. Remove drive pinion and alter shim "S_4" to the calculated value.

7. Tighten lock nut with 230 Nm (169.5 ft.lb.), check setting value "E" and moment of drag (270...350 Ncm) several times.

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Adjusting drive set (front-axle drive)

Adjusting circumferential backlash

Note

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

1. Install drive pinion using shims "S_3" and "S_4" determined while adjusting the drive pinion.

Note

The collar nut for the drive pinion must always be tightened with 230 Nm (169.5 ft.lb.) before measurement.

2. Fit differential with tapered roller bearing and calculated spacers (S_1 + S_2) into housing.

3. Fit side transmission cover and tighten all hexagon nuts with 23 Nm (17 ft.lb.).

Note

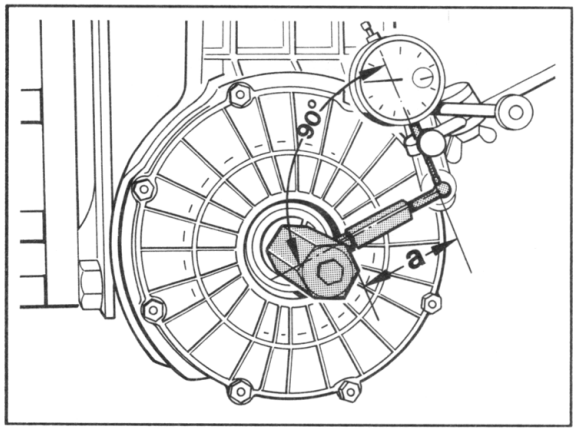
Always bear in mind that there is a certain amount of backlash when tightening the nuts. Under no circumstances may the drive pinion seize.

4. Attach measuring lever VW 388 to adjusting device VW 521/4 and set lever length to 75 mm with plunger over the large hexagon surface (refer to dimension "a" in the figure).

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

6. Crank differential in both directions several times to settle the tapered roller bearing.

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



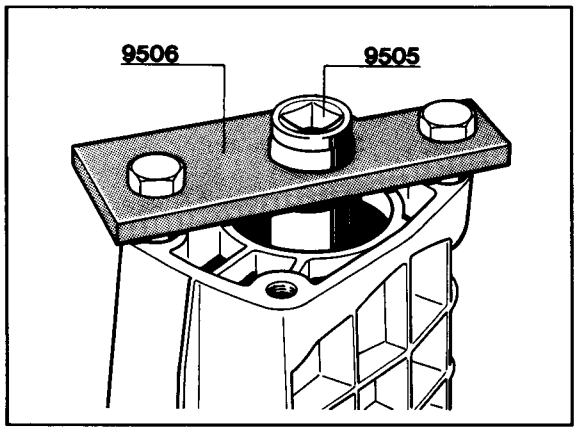
Dimension "a" = approx. 75 mm 224 - 39

8. Turn ring gear carefully with the hexagon of the adjusting device as far as the stop and set dial gauge to zero. Turn back ring gear and read off circumferential backlash. Make a note of the value.

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Note

Always hold the drive pinion with Special Tools 9505 and 9506 when measuring.



220-39

9. Repeat measuring procedure another three times, turning the ring gear a further 90° in each case. The measured values may not deviate from one another by more than 0.05 mm.

Note

The backlash to be set is given on the ring gear. The actual value may be less than this value by 0.05 mm. Under no circumstances may the backlash be greater than this value.

10. If it is not possible to achieve the prescribed backlash, then the spacers (S_1 + S_2) must be replaced again. At the same time, the total thickness of shim ($S_{tot.}$) must not be altered.

PDAS – Diagnosis (Survey)

PDAS (Porsche Dynamic All Wheel Drive Control) works in conjunction with ABS (Antiblock System). Consequently there will be overlapping in diagnosing / troubleshooting. PDAS diagnosis is filed at the end of Repair Group 45 (from page D 39/45 - 1 on) for this reason.
The "D" preceding the repair group page number stands for diagnosis. Normally all D-marked pages will be filed at the end of a corresponding Repair Group.

Survey* of Diagnosing and Installing Jobs on PDAS / ABS

–	**Diagnosing / Troubleshooting / Installing**	**Rep. Gr.**
–	Axial and lateral acceleration sensors	45
–	PDAS diagnosis	45
–	Hydraulics for lock operation and brake booster	47

* Operations not listed here will be included in future supplements.

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Carrera 2

page

Clutch, Controls

Technical data . . . . . 30 - 0201

Manual transmission, controls, case

Dismantling and assembling transmission . . . . . 34 - 201
Removing and installing input shaft oil seal . . . . . 34 -209
Dismantling and assembling tensioning plate . . . . . 34 - 211
Dismantling and assembling front transmission cover . . . . . 34 - 215
Dismantling and assembling gear housing . . . . . 34 - 219
Dismantling and assembling transmission case . . . . . 34 - 223

Manual transmission - gears, shafts

Dismantling and assembling input shaft . . . . . 35 - 201
Dismantling and assembling drive pinion . . . . . 35 - 209

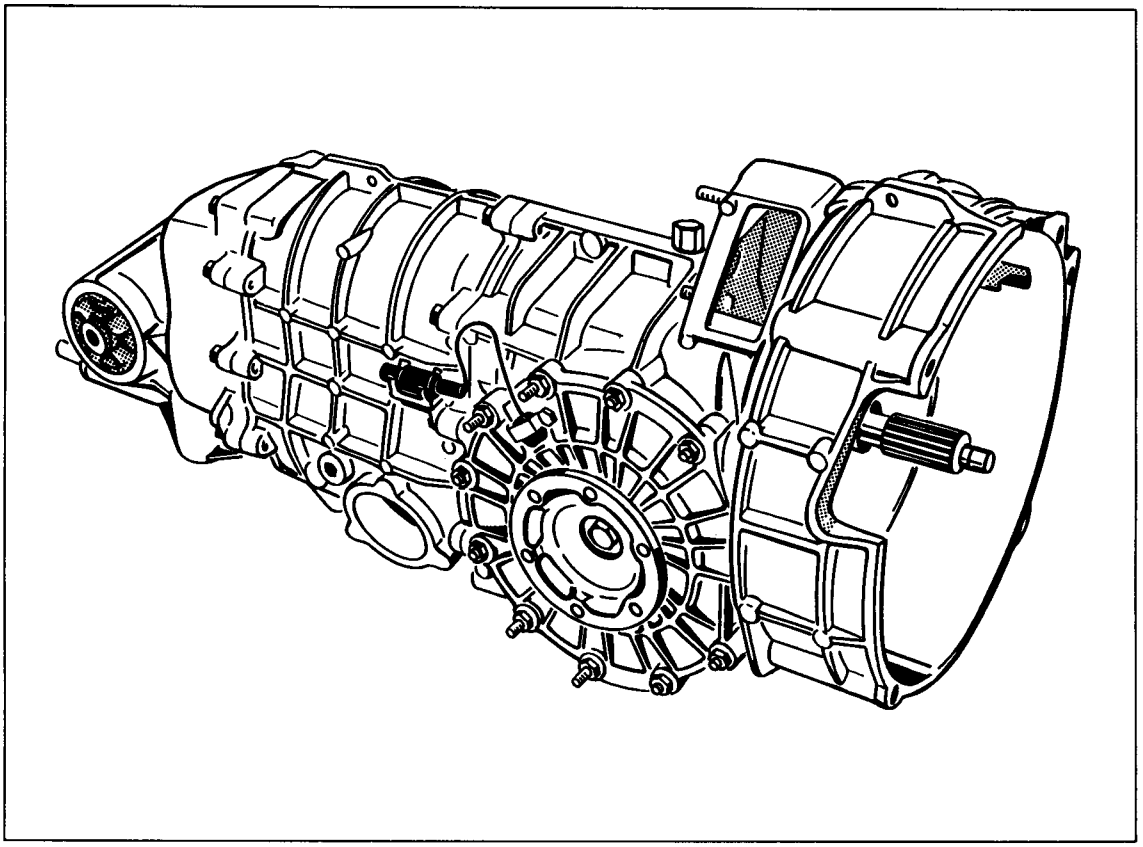
Final drive, differential

Removing and installing differential . . . . . 39 - 201
Dismantling and assembling differential . . . . . 39 - 205
Dismantling and assembling drivetorque controlled limited slip differential for Carrera RS . . . . . 39 - 210a
Dismantling and assembling limited-slip differential (locking value 40%) . . . . . 39 - 210i
Adjusting drive set . . . . . 39 - 211

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Technical data

5 speed manual transmission (Typ G 50)



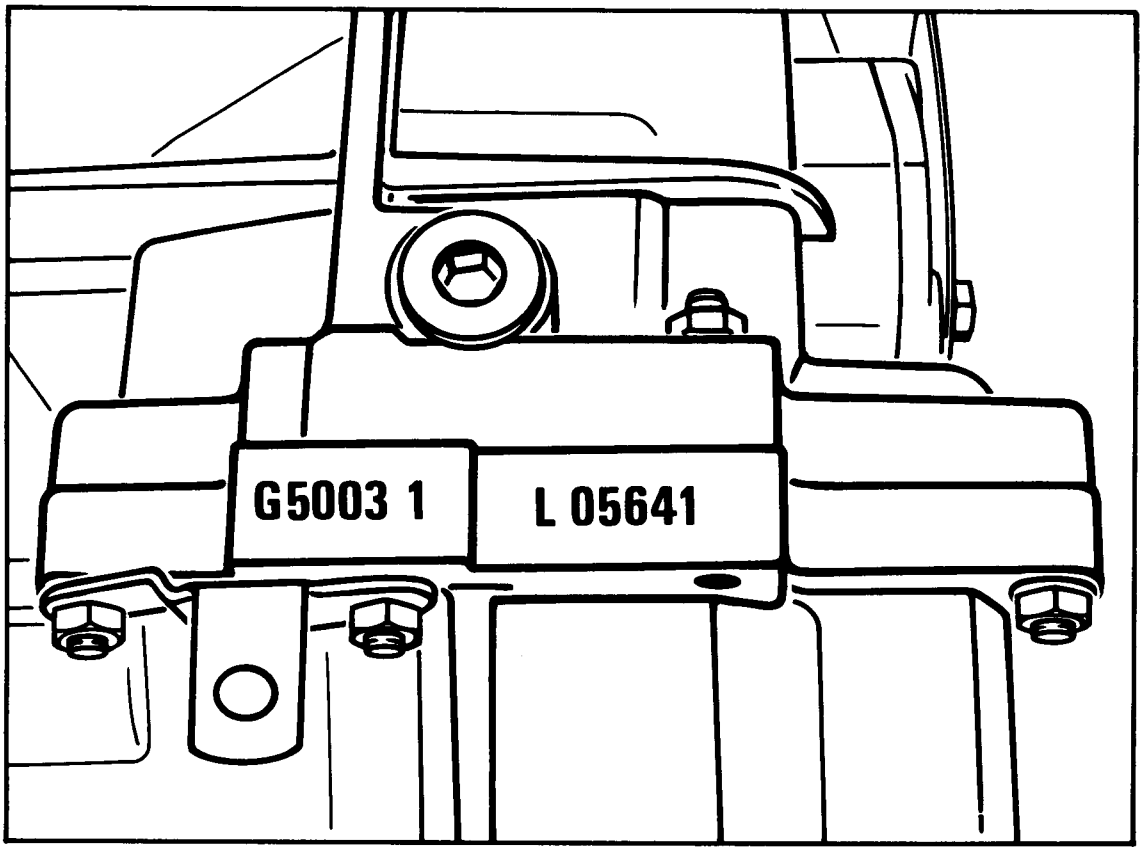
Type	Key letter	Equipment	installed in:	Model year
G 50/03	-	5 Speed	911 Carrera 2 worldwide except Switzerland	from '90 Model
G 50/04	-	5 Speed	911 Carrera 2 Switzerland	from '90 Model
G 50/05	–	5 Speed	911 Carrera 2 USA 911 RS America	from '92 Model from '92 Model
G 50/10	–	5 Speed with limited slip differential	911 Carrera RS	from '92 Model

Printed in Germany – XVIII, 1992

Technical data

Structure of transmission numbers

G5003	1	L	05641
transmission type	**index of variations within the assembly no.** 1 = normal differential 2 = ZF slip differential	**model year** L = 1990 M = 1991	**serial no.** e.g. 05641



502-30

Note

The model letter is omitted as of MY '92.

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Technical data

General data	Manual transmission G 50 / 03 / 04 / 05 / 10			
Transmission ratios $Z_2 : Z_1 = i$	G50/03	G50/04	G50/05	G50/10
1st gear	42 : 12 = 3.500	41 : 13 = 3.154	42 : 12 = 3.500	41 : 13 = 3.154
2nd gear	35 : 17 = 2.059	36 : 19 = 1.895	35 : 17 = 2.059	36 : 19 = 1.895
3rd gear	38 : 27 = 1.407	36 : 27 = 1.333	38 : 27 = 1.407	38 : 27 = 1.407
4th gear	38 : 35 = 1.086	36 : 35 = 1.029	38 : 35 = 1.086	38 : 35 = 1.086
5th gear	33 : 38 = 0.868	33 : 38 = 0.868	33 : 38 = 0.868	33 : 38 = 0.868
Rev.gear	40 : 14 = 2.857	40 : 14 = 2.857	40 : 14 = 2.857	40 : 14 = 2.857
Final drive	Hypoid bevel-gear drive with 16 mm offset			
Transmission ratio Final drive	31 : 9 = 3.444	31 : 9 = 3.4444	30 : 9 = 3.333	31 : 9 = 3.444
Capacity	approx. 3.6 liter multigrade gear oil SAE 75 W 90 of API classification GL 5 (or MIL-L 2105 B)			

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Technical data

Tightening torques for manual transmission

Location	Thread	Tightening torques Nm
Oil drain and oil filler plug	M 22 x 1.5	30 (22 ft.lb)
Hex nut for gear housing and transmission case, side cover tensioning plate	M 8	23 (17 ft.lb)
Clamping plate at front transmission cover	M 6	10 (7.3 ft.lb)
Collar nut / input shaft	M 14 x 1.5	140 (103 ft.lb)
Collar nut / drive pinion	M 30 x 1.5	250 (184 ft.lb)
Hex bolt / selector fork	M 8	23 (17 ft.lb)
Backup light switch to gearbox	M 18 x 1.5	35 (26 ft.lb)
Guide tube to transmission case	M 6	10 (7.3 ft.lb)
Shift gate to tensioning plate	M 6	10 (7.3 ft.lb)
Collar bolt / reverse idler gear II	M 8	35 (26 ft.lb)
Breather at transmission case	M 14 x 1.5	35 (26 ft.lb)
Collar nut/ input shaft	M 30 x 1.5	250 (184 ft.lb)
Hex bolt / halfshaft flange	M 10	44 (32.5 ft.lb)

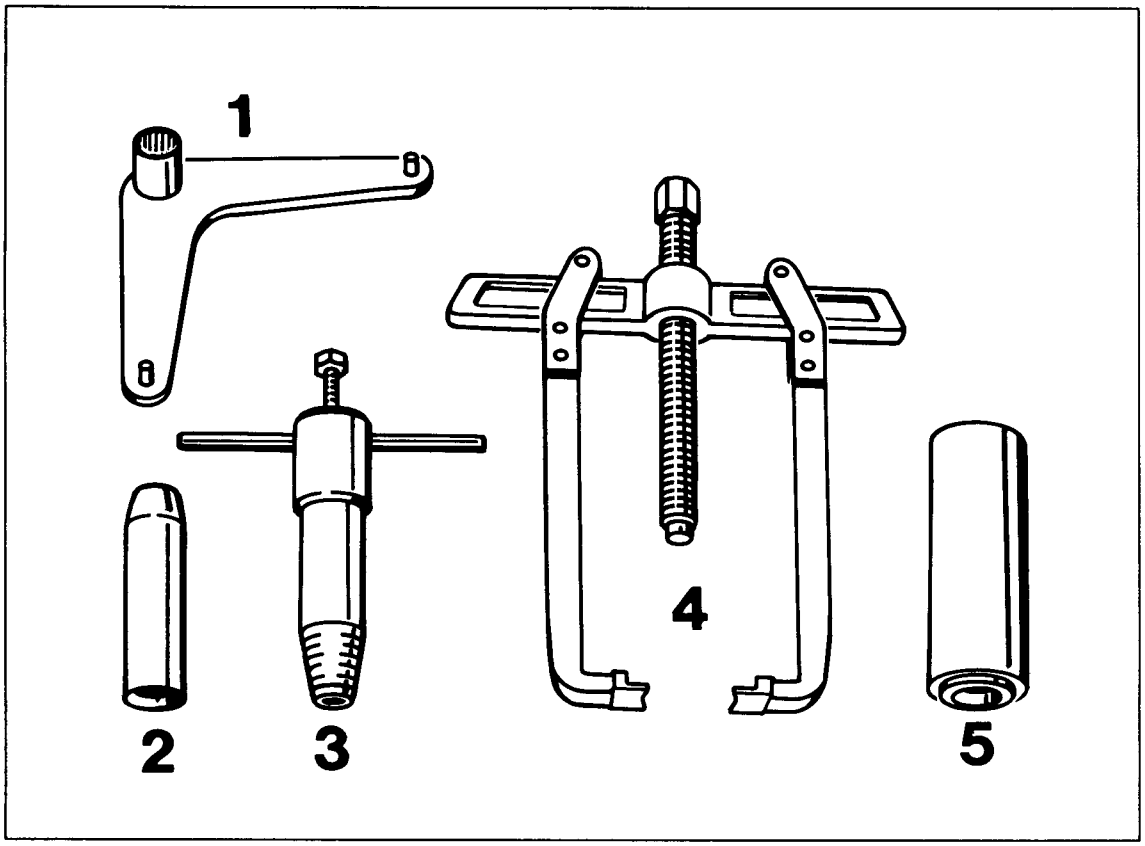
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Location	Thread	Tightening torques Nm
Tension spring / speedometer sensor	M 6	10 (7.3 ft.lb)
Ring gear in differential housing (hexagon head bolt with tab washer)	M 12 x 1.25	150 (111 ft.lb)
Ring gear in differential housing (Verbusrip bolt without tab washer)	M 12 x 1.25	200 (147 ft.lb)
Cover / transmission case	M 8 x 30	23 (17 ft.lb)

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Dismantling and assembling transmission

Tools

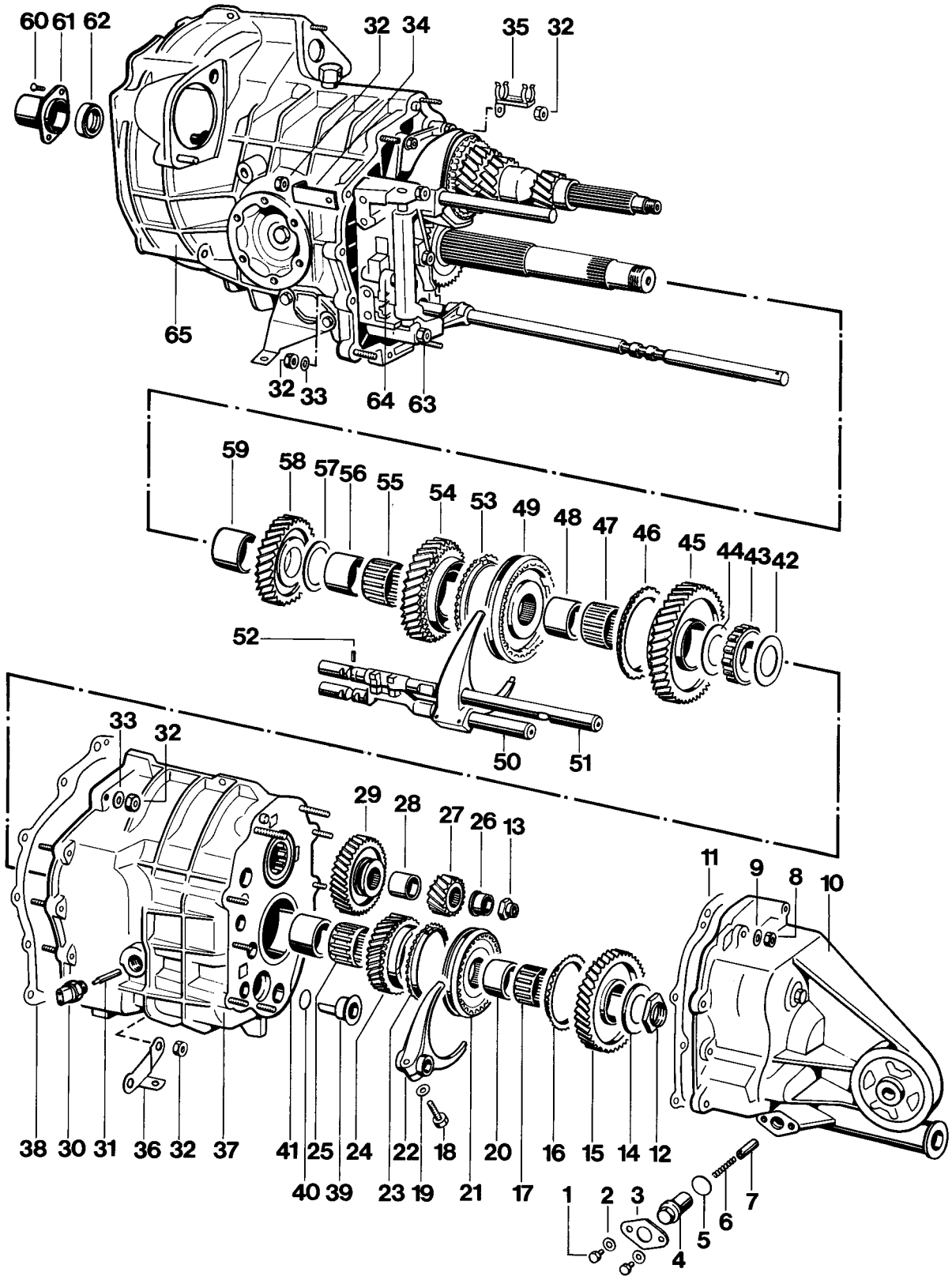


517-34

No.	Designation	Special tool	Order number	Explanation
1	Bracket	9253	000.721.925.30	
2	Assembling sleeve	9255	000.721.925.50	
3	Puller set	9251	000.721.925.10	
4	Puller	-	-	use arms of puller 9284
5	Drift	9256	000.721.925.60	

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Dismantling and assembling transmission



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No.	Designation	Qty.	Note: Removal	Installation
1	Hex screw	2		Torque: 10 Nm (7.3 ft.lb)
2	Washer	2		
3	Clamping plate	1		
4	Eccentric bush	1		Adjust
5	Seal	1		Replace
6	Pressure spring	1		
7	Locking bush	1		
8	Hex nut	10		Torque: 23 Nm (16.9 ft.lb)
9	Washer	10		
10	Front transmission cover	1		
11	Gasket	1		Replace
12	Collar nut	1	Block drive shaft with Special Tool 9253 and engage 5th gear	Torque: 250 Nm (183.25 ft.lb). Punch collar to lock
13	Collar nut	1	Block drive shaft with Special Tool 9253 and engage 5th gear	Torque: 140 Nm (102.6 ft.lb). Punch collar to lock
14	Thrust washer	1		
15	Loose gear, reverse gear	1		Always replace as a set
16	Synchronizing ring	1	Mark for refitting	Check for wear, reassemble in correct position with the same gearwheel (cogs towards driver dogs)
17	Needle cage	1		
18	Hex bolt	1		Torque: 23 Nm (16.9 ft.lb)
19	Washer	1		
20	Bushing	1		Heat to approx. 120° C
21	Guide sleeve with selector sleeve and synchronizing parts	1	Remove together with selector fork, mark for refitting	Selector sleeve and guide sleeve are matched

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No.	Designation	Qty.	Note: Removal	Installation
22	Selector fork	1	Remove together with selector sleeve and guide sleeve	Adjust
23	Synchronizing ring	1	Mark for refitting	Check for wear, assemble in correct position with the same gearwheel (cogs towards driver dogs)
24	Loose gear, 5th gear	1		Always replace in pairs
25	Needle cage	1	Mark for refitting	Assemble with the same gearwheel
26	Bearing inner race	1	Pull off with suitable claw puller	Heat to approx. 120° C
27	Fixed gear, reverse gear	1		Always replace as a set
28	Spacer	1		
29	Fixed gear (5th gear)			Always replace in pairs
30	Backup light switch	1		Torque: 35 Nm (25.7 ft.lb)
31	Plunger	1		Stepped end faces switch
32	Hex nut	12		Torque: 23 Nm (16.9 ft.lb)
33	Washer	8		
34	Bracket	1		
35	Bracket	1		
36	Bracket	1		
37	Gear housing	1		
38	Gasket	1		Replace
39	Oil delivery tube	1		Install in correct position
40	O-ring	1		Replace
41	Sleeve	1	Mark for refitting	Heat to approx. 120° C, assemble with the same gearwheel

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No.	Designation	Qty.	Note: Removal	Installation
42	Thrust washer (2.8 mm)	1		
43	Cylindrical roller bearing	1	Pull off with suitable claw bearing puller over 1st gear loose gear	Heat to approx. 120° C
44	Thrust washer (2.8 mm)	1		
45	Loose gear, 1st gear	1		Always replace in pairs
46	Synchronizing ring	1	Mark for refitting	Check for wear, reassemble in correct position with the same gearwheel (cogs towards driver dogs)
47	Needle roller bearing	1	Mark for refitting	Assemble with the same gearwheel
48	Sleeve	1	Mark for refitting, pull off with suitable claw puller over 2nd gear loose gear	Heat to approx. 120° C, reassemble with the same gear wheel
49	Guide sleeve with selector sleeve and synchronizing parts (1st and 2nd gear)	1	Remove together with selector fork and selector rod	Always replace in pairs
50	Selector fork with selector rod	1	Selector rod in idle position, remove together with selector sleeve and guide sleeve	
51	Selector rod for 5th and reverse gear	1		
52	Locking dowel	1		Grease lightly and insert in selector rod

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No.	Designation	Qty.	Note: Removal	Installation
53	Synchronizing ring	1	Mark for refitting	Check for wear, reassemble in correct position with the same gearwheel (cogs towards driver dogs)
54	Loose gear, 2nd gear	1		Always replace in pairs
55	Needle roller bearing	1	Mark for refitting	Reassemble with the same gearwheel
56	Sleeve	1	Mark for refitting, pull off with suitable claw puller over 3rd gear loose gear	Heat to approx. 120° C, reassemble with the same gearwheel
57	Thrust washer (1.4 mm)	1		
58	Fixed gear, 3rd gear			Always replace in pairs, large collar faces thrust washer no. 57
59	Spacer	1		
60	Raised countersunk head screw	2		Torque: 10 Nm (7.3 ft.lb)
61	Guide tube	1		
62	Oil seal	1		Drive in to correct position using assembly sleeve 9255 and drift 9256 once gears have been fully assembled (see also page 34 - 209)
63	Hex nut	10		Torque: 23 Nm (16.9 ft.lb)
64	Tensioning plate with drive pinion and input shaft	1		
65	Transmission case	1		

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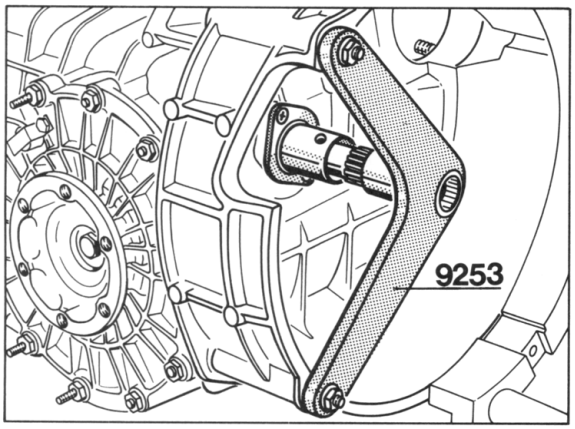
Notes on dismantling and assembling

Dismantling

Note

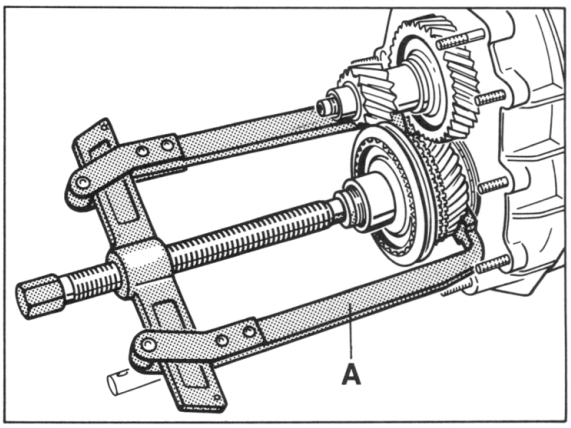
To facilitate assembly, the gearwheel set is not removed completely but the drive pinion is partially dismantled before removal.

1. 5. Engage 5th gear, block input shaft with Special Tool **9253** and unscrew collar nut for drive pinion and input shaft.



503-34

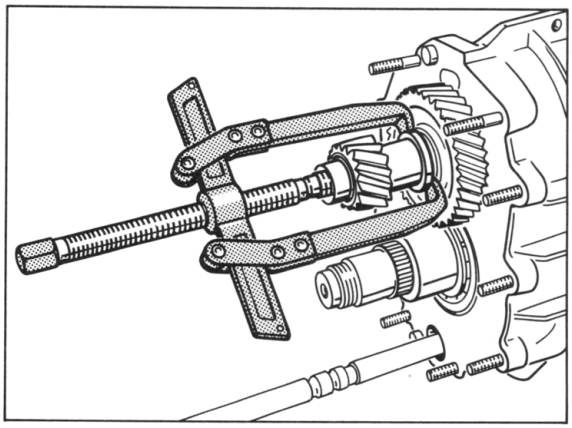
2. Pull off sleeve for reverse gear needle roller bearing.



504-34

A = Arms of puller 9284

3. Pull off bearing inner race of the input shaft cylindrical roller bearing.

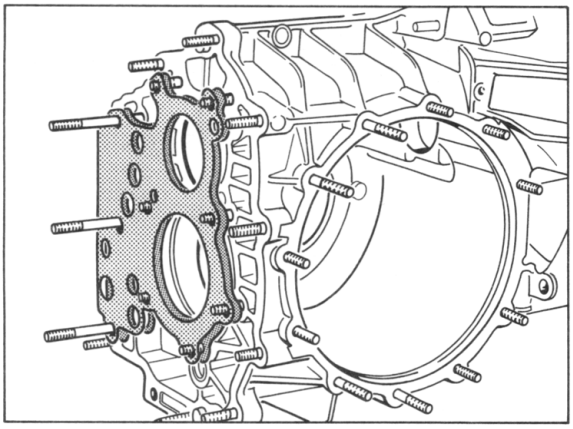


505-34

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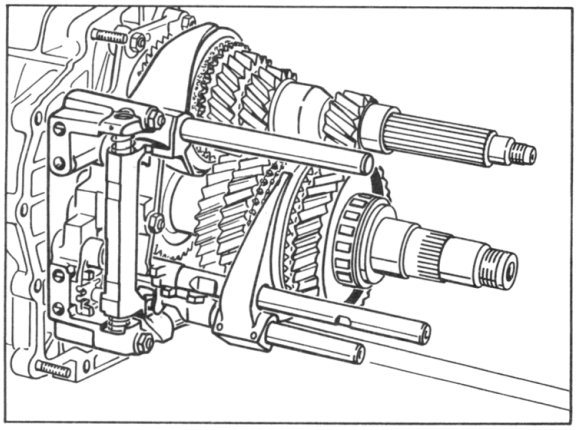
Assembling

1. Put the number of shims "S3" noted during disassembly or the number of shims calculated when adjusting the drive pinion on the case studs to achieve the corresponding thickness of shims.



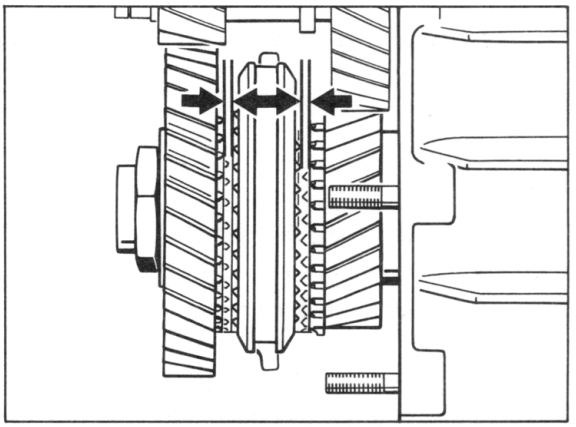
506-34

2. Install the preassembled gear set with the internal selector rod and tighten the tensioning plate mounting nuts to **23 Nm** (17 ft.lb).



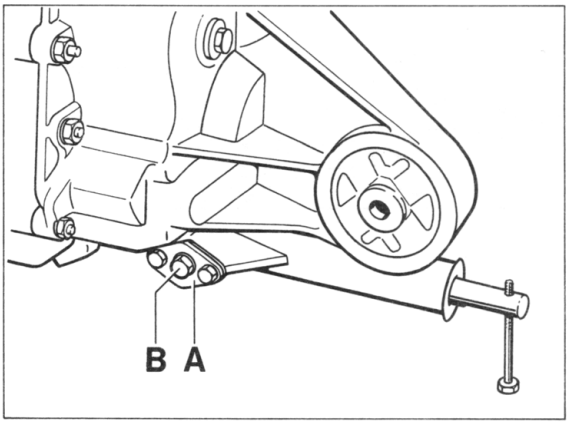
507-34

3. Adjust the selector fork for 5th and reverse gear. Adjust the selector sleeve over the selector fork 5/R so that it remains centered in idle position.



508-34

4. Adjust the internal selector rod with eccentric bush (no. 4) by undoing the clamping plate hex screws and turning the eccentric bush so that all gears may be preselected freely without binding.



527-34

A = Clamping plate
B = Eccentric bush

5. To check gear selection, engage all gears one after another. To facilitate this check, screw a long M 8 into the internal selector rod.

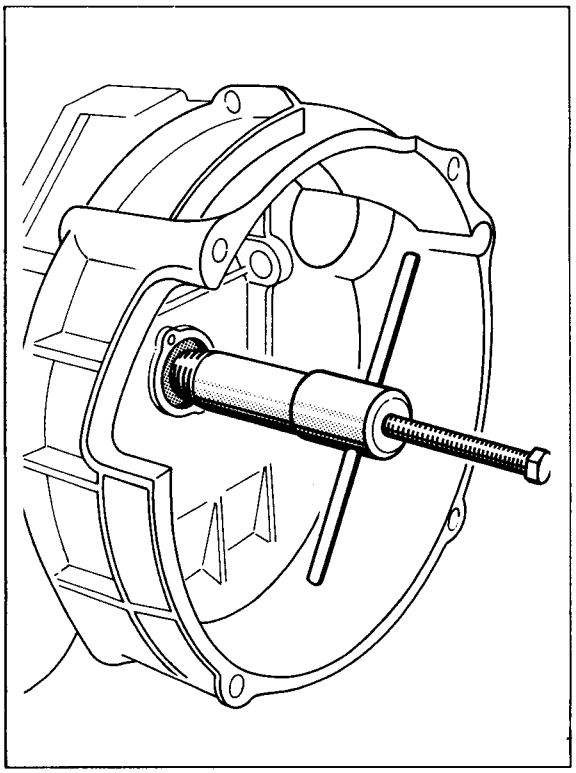
Removing and installing input shaft oil seal

Removing

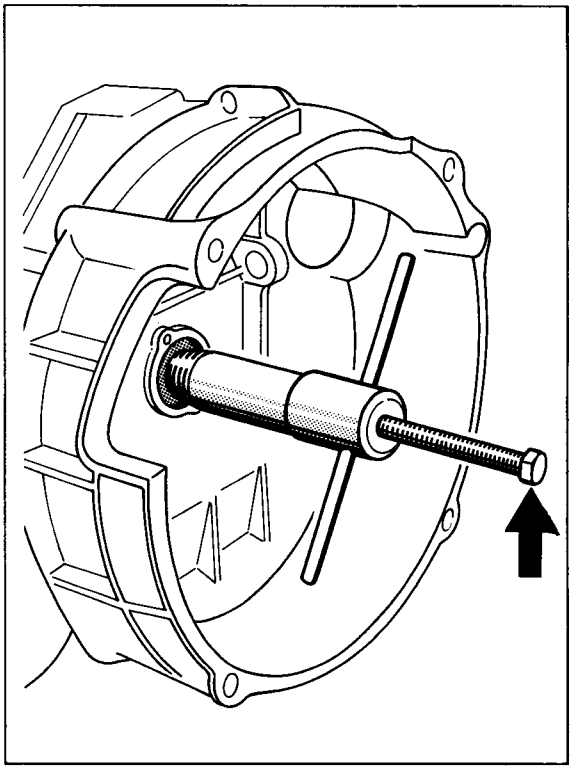
1. Remove engine/transmission assembly and separate transmission from engine.

2. Remove release bearing guide tube.

3. Screw Special Tool **9251** firmly into the oil seal.



4. Screw in the hex bolt and pull out oil seal.



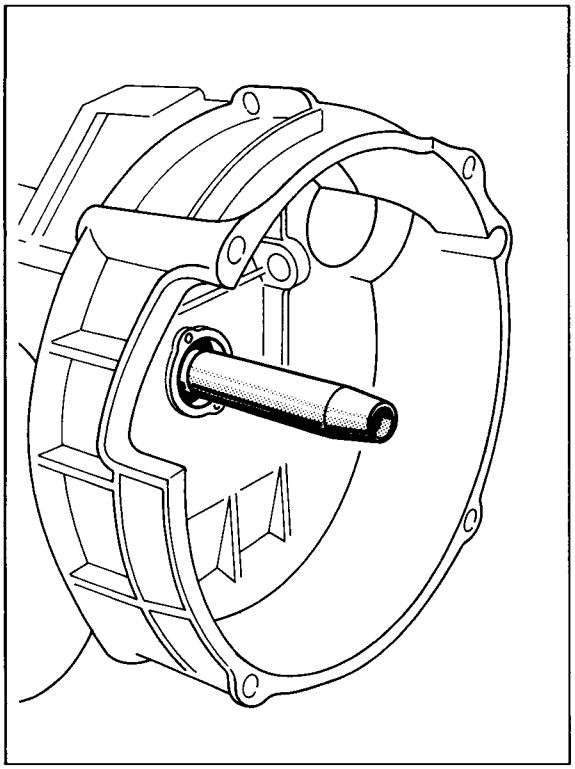
Note

If the helical tension spring jumps out when removing the seal, use a wire hook to pull it off the input shaft.

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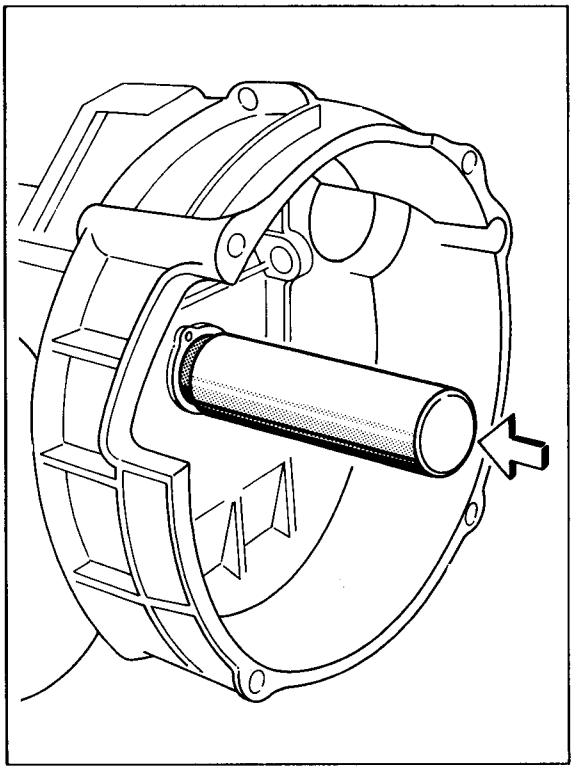
Installing

1. Push assembling sleeve **9255** onto the input shaft splines.



2. Pack the oil seal area between dust lip and sealing lip with grease (e.g. Silubrin Grease S manufactured by Klüber).

3. Use Special Tool **9256** to drive the oil into place.



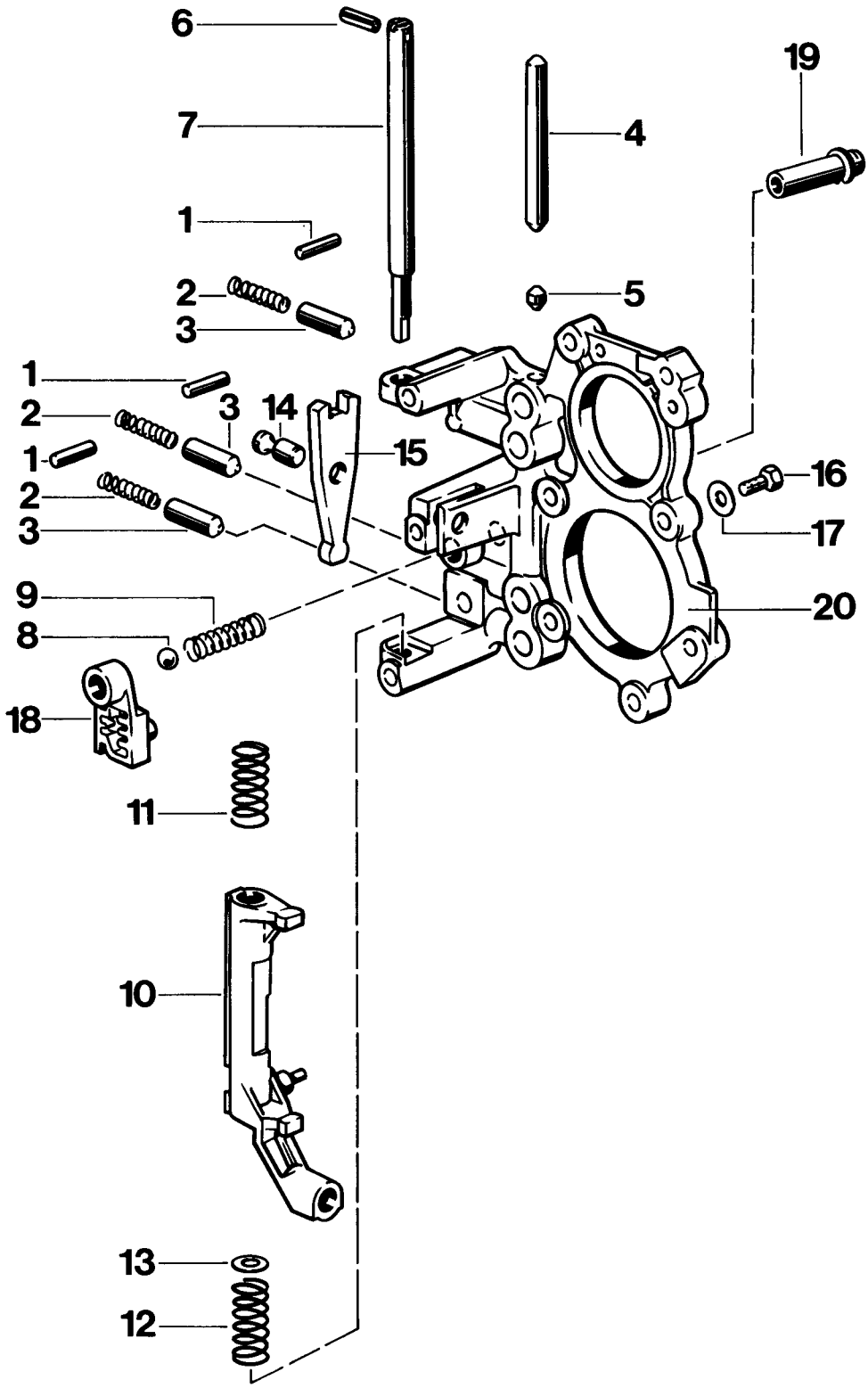
4. Install guide tube and tighten mounting screws to **10 Nm** (7.3 ft.lb).

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Dismantling and assembling tensioning plate

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Dismantling and assembling tensioning plate



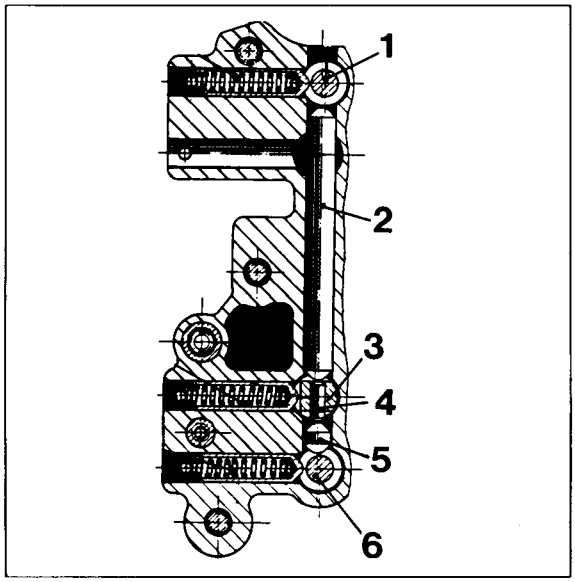
522-34

No.	Designation	Qty.	Note: Removal	Installation
1	Parallel pin	3	When the selector rods are installed, springs (No.2) are under tension	
2	Compression spring	3		
3	Locking sleeve	3		
4	Lock	1		
5	Lock	1		
6	Dowel pin	1		
7	Bearing shaft	1		Install in correct position, use mandrel (dia. 8 mm) to secure to tensioning plate bore
8	Ball	1		
9	Compression spring	1		
10	Reversing lever	1		
11	Compression spring	1	Mark for refitting	Free length = 33.9 + 0.5 mm, wire thickness = 1.6 mm. Do not confuse with spring no. 12
12	Pressure spring	1	Mark for refitting	Free length = 55.2 + 0.5 mm, wire thickness = 1.5 mm. Do not confuse with spring no. 11
13	Shim	1		
14	Bolt	1		Install in correct position, use mandrel (dia. 8 mm) to secure to tensioning plate bore
15	Reversing lever	1		
16	Hex bolt	1		Torque: 10 Nm (7.3 ft.lb)

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No.	Designation	Qty.	Note: Removal	Installation
17	Washer	1		
18	Selector gate	1		
19	Sleeve with snap ring	1	Press out with suitable drift	Press in to stop with suitable drift
20	Tensioning plate	1		

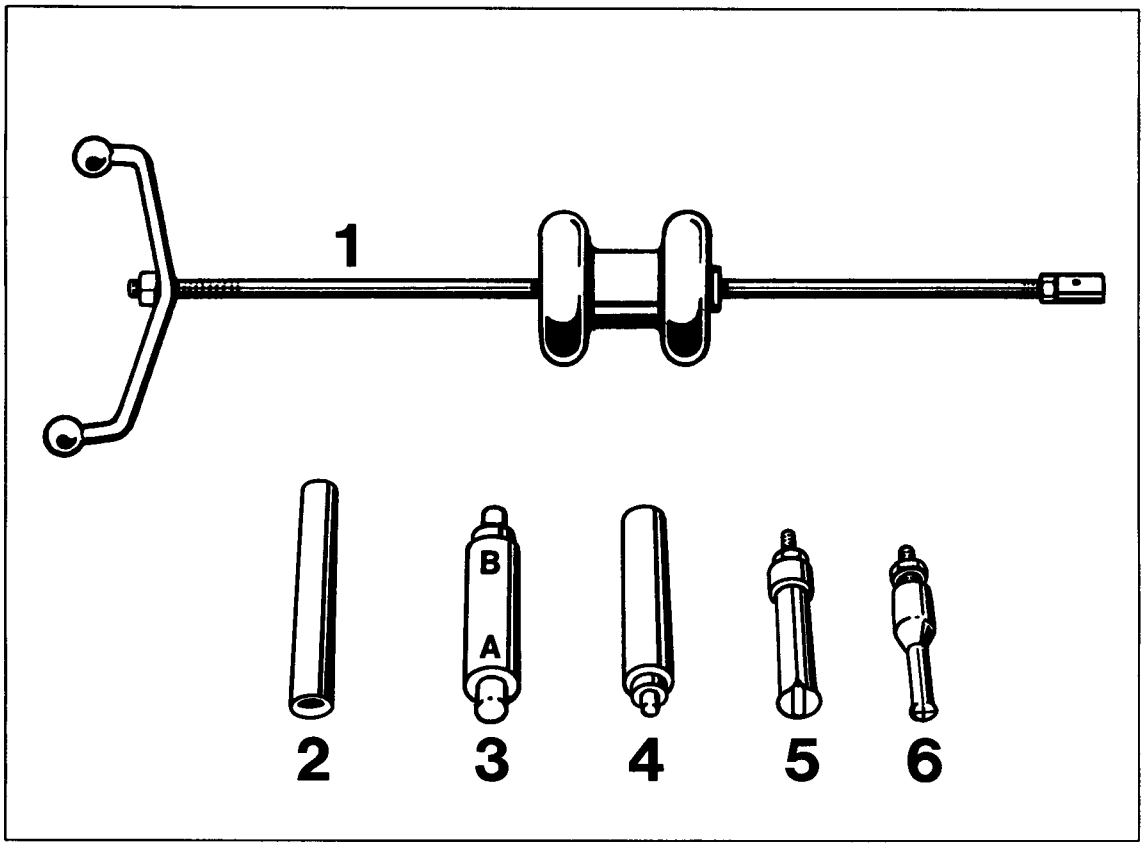
Installation position of the locks



160-35

Dismantling and assembling front transmission cover

Tools

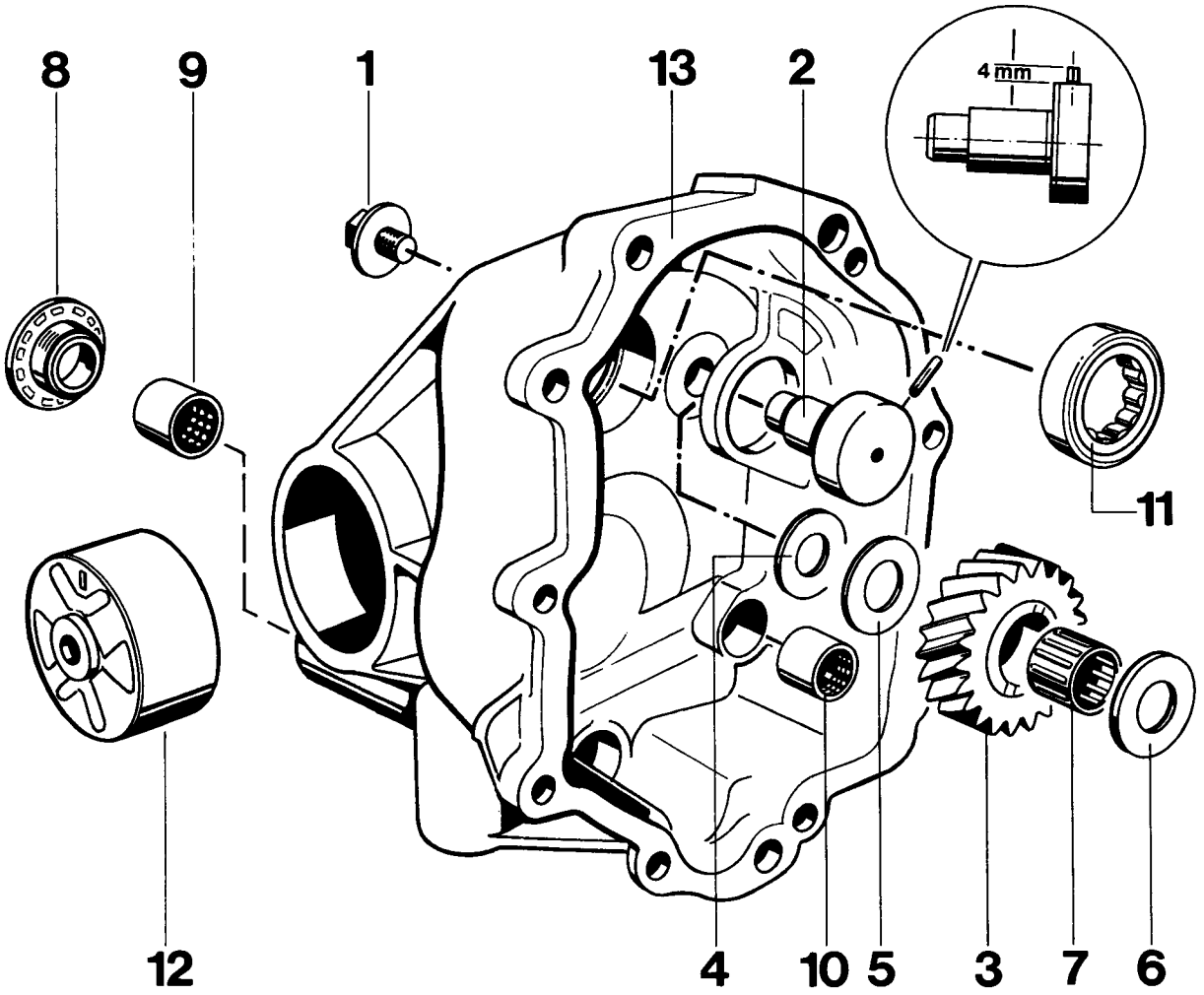


534-34

No.	Designation	Special tool	Order number	Explanation
1	Punch	VW 781		
2	Pipe section	VW 423		
3	Drift	9254	000.721.925.40	
4	Drift	9298	000.721.929.80	
5	Internal puller	-	-	Standard (e.g. Kukko 21/4)
6	Internal puller	-	-	Standard (e.g. Schrem 14 - 20)

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Dismantling and assembling front transmission cover



521-34

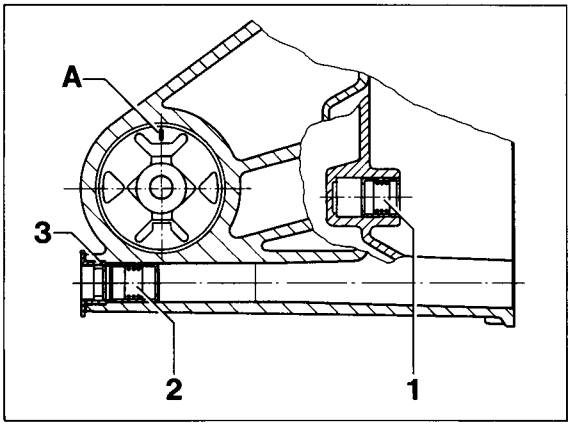
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No.	Designation	Qty.	Note: Removal	Installation
1	Hex bolt	1		Torque: 35 Nm (25.7 ft.lb)
2	Bolt with pin	1		Insert in correct position
3	Reverse idler gear	1		
4	Thrust washer (2.0 mm)	1		
5	Thrust washer (1.5 mm)	1		Do not confuse with washer no. 4
6	Thrust washer (1.5 mm)	1		Do not confuse with washer no. 4
7	Needle-roller assembly	1		
8	Oil seal	1		Pack the area between dust lip and sealing lip with grease (e.g. Silubrin Grease S manufactured by Klüber); press in to stop with drift 9254 (page A)
9	Ball sleeve (long)	1	Press out from the inside, using a suitable pipe section (e.g. VW 423) and drift 9298	Press in to stop with Special Tool 9254 (page B)
10	Ball sleeve (short)	1	Pull out with a suitable internal puller (e.g. Schrem 14 - 20) and punch VW 771	Press in to stop with Special Tool 9254 (page A)
11	Cylindrical roller bearing	1	Pull out with suitable internal puller (e.g. Kukko 21/4) and punch VW 771	
12	Transmission bearing	1	Press out with suitable pipe section	Press in to correct position
13	Front transmission cover	1		

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Notes on assembly

1. Press in ball sleeves, oil seal and transmission bearing to correct position.



526-34

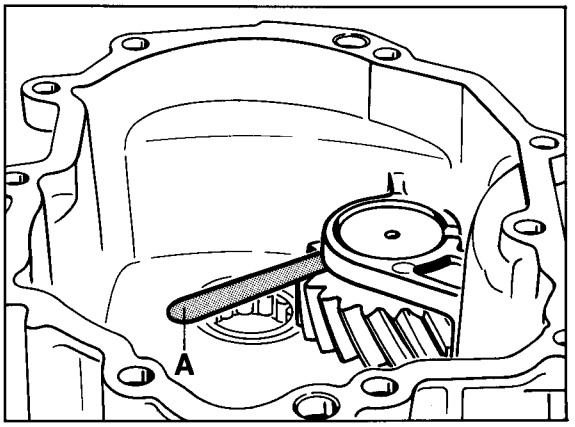
1 - Short ball sleeve (press in flush)

2 - Long ball sleeve (press in to correct position)

3 - Oil seal

A - Assembly mark (must point upwards)

2. Reassemble reverse idler gear with thrust washers and bolt in correct position (refer to exploded view). With thrust washers and bolt located correctly, the axial end play of the reverse idler gear is 0.15 to 0.35 mm.



520-34

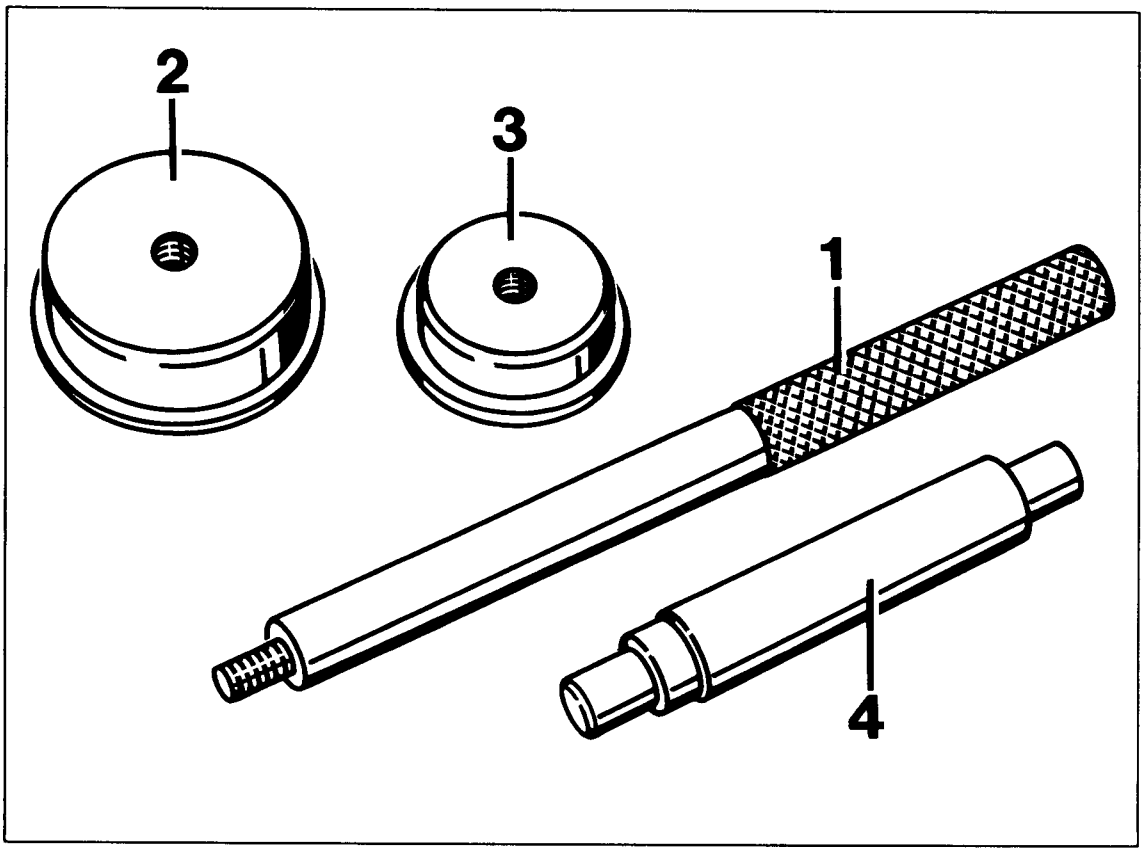
A = Feeler gauge

3. Check axial play of reverse idler gear with feeler gauge.

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Dismantling and assembling gear housing

Tools

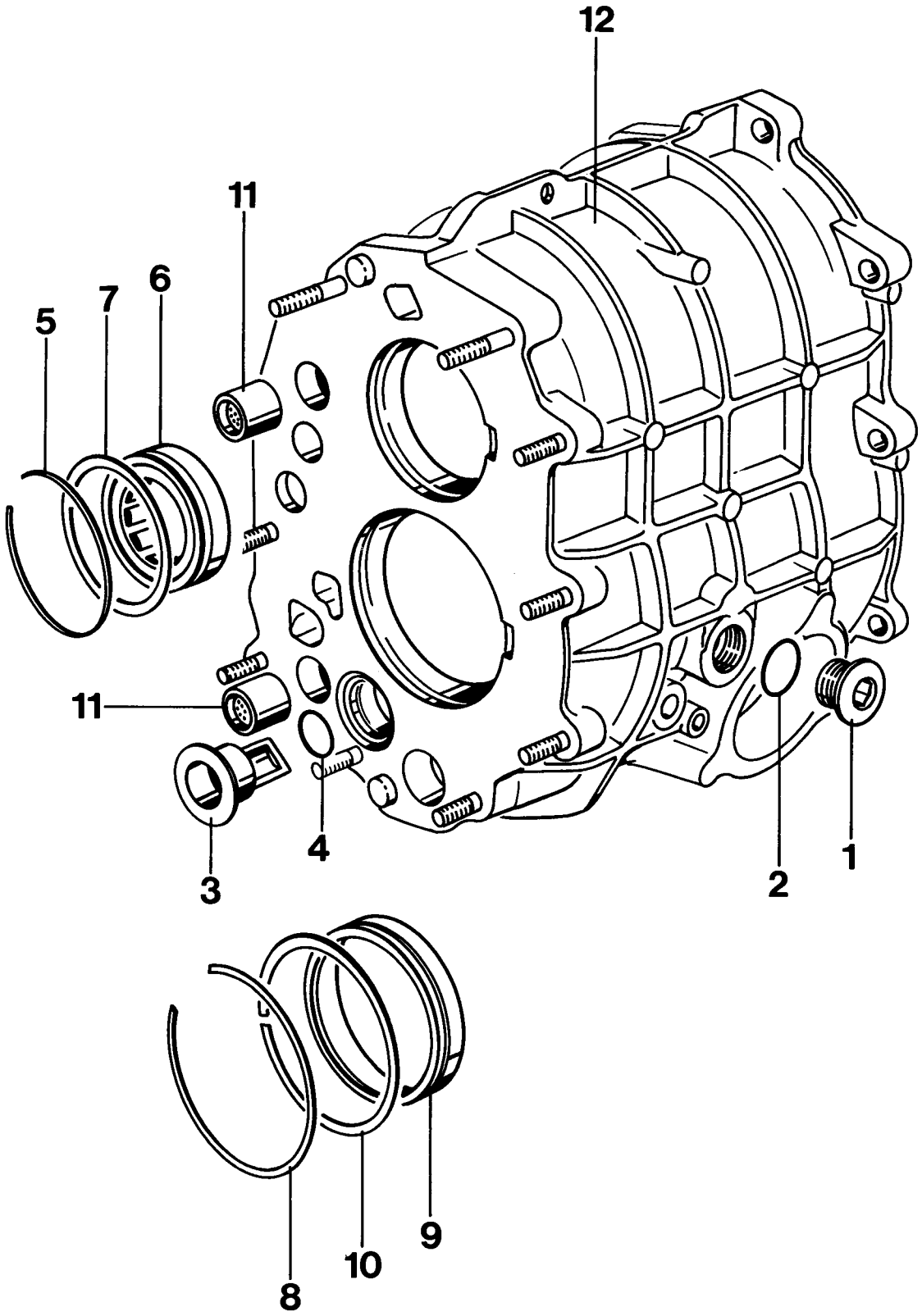


512-34

No.	Designation	Special tool	Order number	Explanation
1	Mandrel	P 254	000.721.254.00	
2	Thrust piece	P 254 a	000.721.254.10	
3	Thrust piece	P 254 b	000.721.254.20	
4	Drift	9254	000.721.925.40	

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Dismantling and assembling gear housing



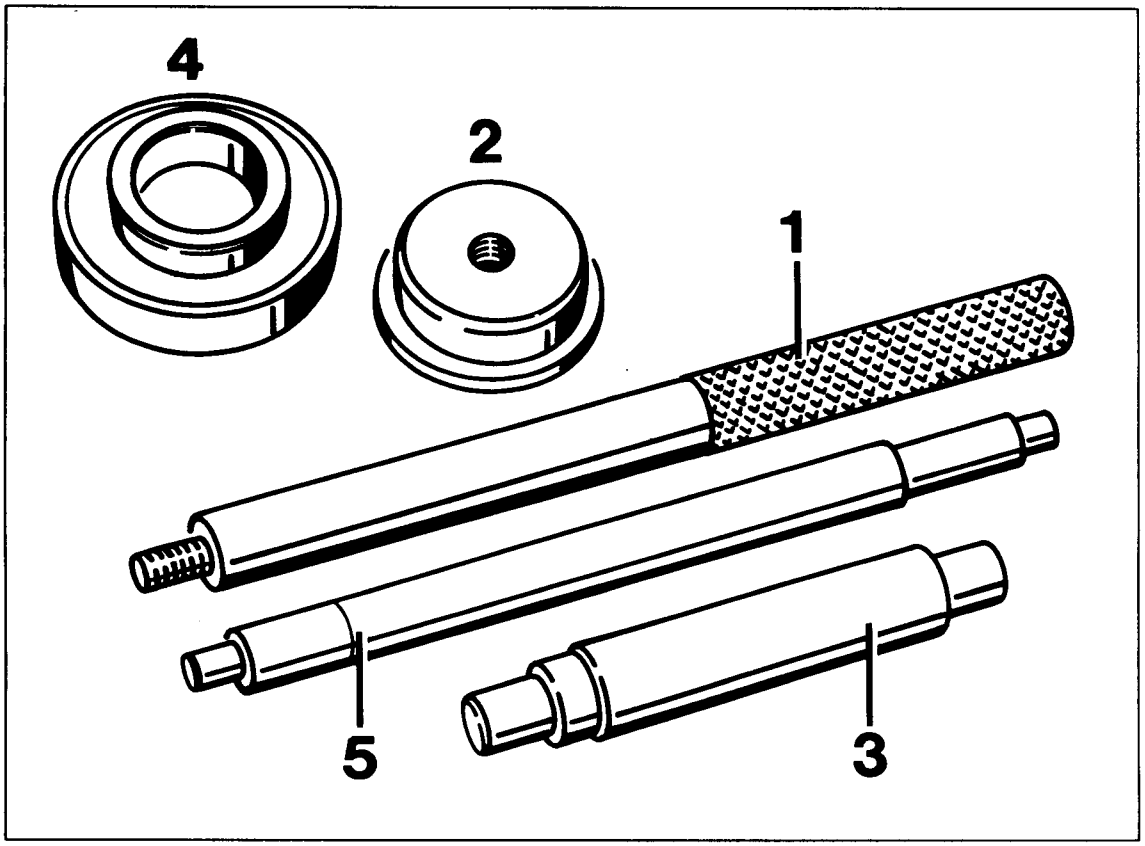
513-34

No.	Designation	Qty.	Note: Removal	Installation
1	Plug	1		Torque: 30 Nm (22 ft.lb)
2	Seal	1		Replace
3	Oil delivery tube	1		Insert in correct position
4	O-ring	1	Replace	
5	Retaining ring	1	Remove with a suitable screwdriver	
6	Cylindrical roller bearing	1	Use Special Tools P 254 and 254 b to press out bearing from inside over the outer race	Heat gearbox to approx. 120 °C and use Special Tools P 254 and P 254 b to press in bearing over the outer race
7	Snap ring	1		
8	Retaining ring	1	Remove with suitable screwdriver	
9	Bearing outer race	1	Working from inside, press out with Special Tools P 254 and P 254 a	Press in with Special Tools P 254 and P 254 a
10	Snap ring	1		
11	Ball sleeve	2	Press out with suitable mandrel	Press in flush with Special Tool 9254
12	Gear housing	1		

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Dismantling and assembling transmission case

Tools

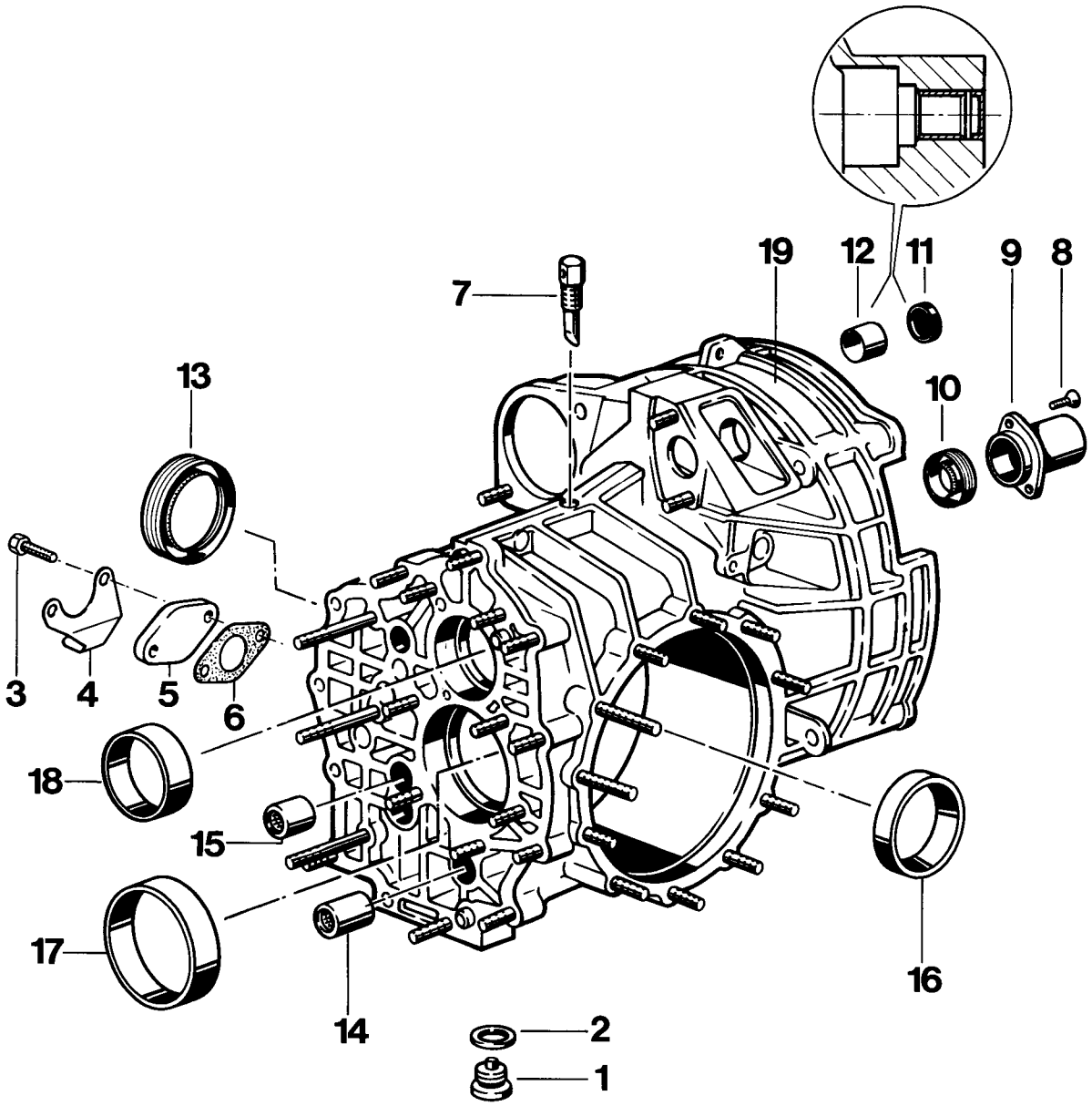


514-34

No.	Designation	Special tool	Order number	Explanation
1	Mandrel	P 254	000.721.254.00	
2	Thrust piece	P 254 b	000.721.254.20	
3	Drift	9254	000.721.925.40	
4	Thrust piece	9252	000.721.925.20	
5	Drift	9515	000.721.951.50	

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Dismantling and assembling transmission case



525-34

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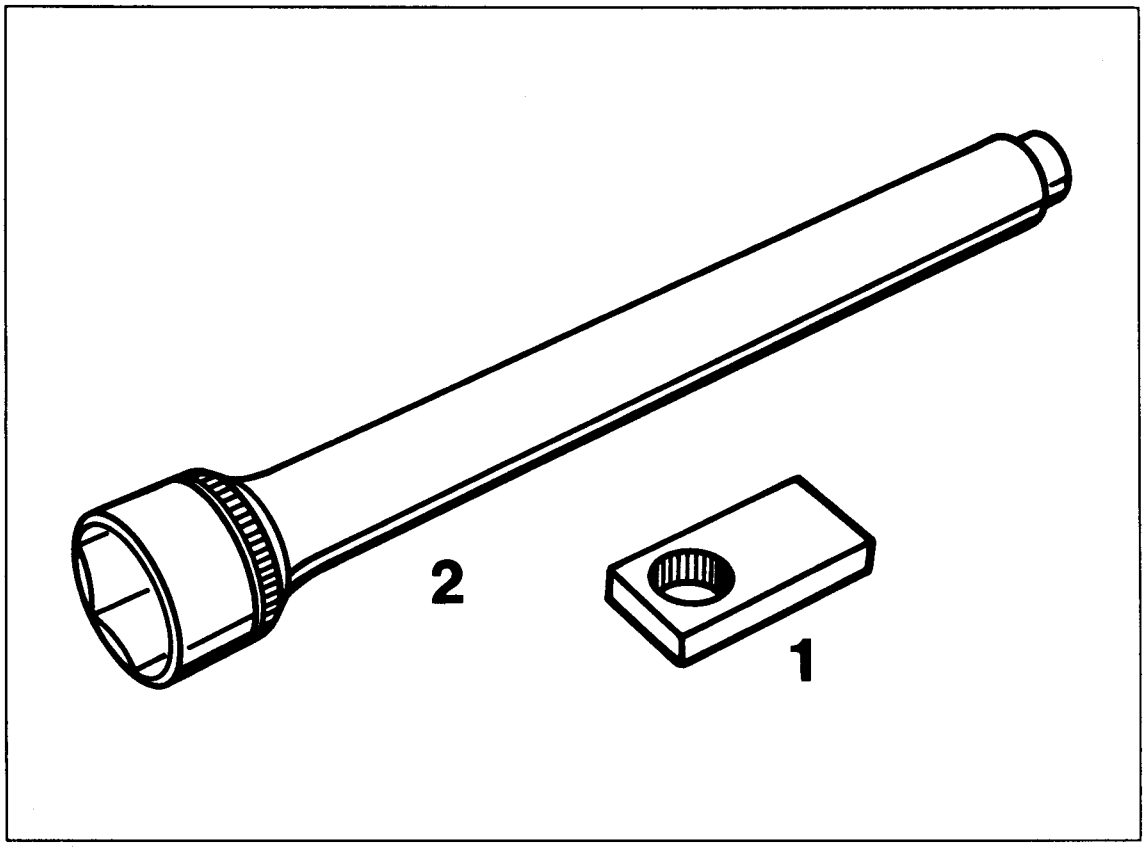
No.	Designation	Qty.	Note: Removal	Installation
1	Plug	1		Clean, tighten to 30 Nm (22 ft.lb)
2	Seal	1		Replace
3	Hex screw	2		Torque: 23 Nm (16.9 ft.lb)
4	Bracket	1		
5	Flange	1		
6	Gasket (or Loctite 573)	1		Replace
7	Breather	1		Torque: 35 Nm (25.7 ft.lb). The bore in the hex head must face the front transmission cover
8	Oval head screw	2		Torque: 10 Nm (7.3 ft.lb)
9	Guide tube	1		
10	Oil seal	1		Do not install until after fitting the gear set (refer to page 34-209)
11	Cover plate	1		
12	Bushing	1	Working from inside, press out with drift 9515	Do not grease or oil and do not clean with solvents (e.g. naphtha). Use drift 9515 to press in to stop from inside.
13	Oil seal	1		Use Special Tool 9252 to press in to stop. Pack area between dust lip and sealing lip with grease (e.g. Silubrin Grease S manufactured by Klüber)
14	Ball sleeve (long)	1	Pull out with suitable internal puller (e.g. Schrem 14-20)	Press in flush with Special Tool 9254

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No.	Designation	Qty.	Note: Removal	Installation
15	Ball sleeve (short)	3	Pull out with suitable internal puller (e.g Schrem 14-20)	Press in flush with Special Tool 9254
16	Bearing outer race	1	Heat transmission case to approx. 120° C and drive out with suitable drift	Heat transmission case to approx. 120° C and press in with suitable thrust piece
17	Bearing outer race	1	Heat transmission case to approx. 120° C and drive out with suitable drift	Heat transmission case to approx. 120° C and use suitable thrust piece (e.g. VW 204 b) to press in to stop
18	Bearing outer race	1	Heat transmission case to approx. 120° C and pull out with suitable internal puller (e.g. Schrem 50-60)	Heat transmission case to approx. 120° C and use Special Tools P 254 and 254 b to press in to stop
19	Transmission case	1		

Dismantling and assembling input shaft

Tools

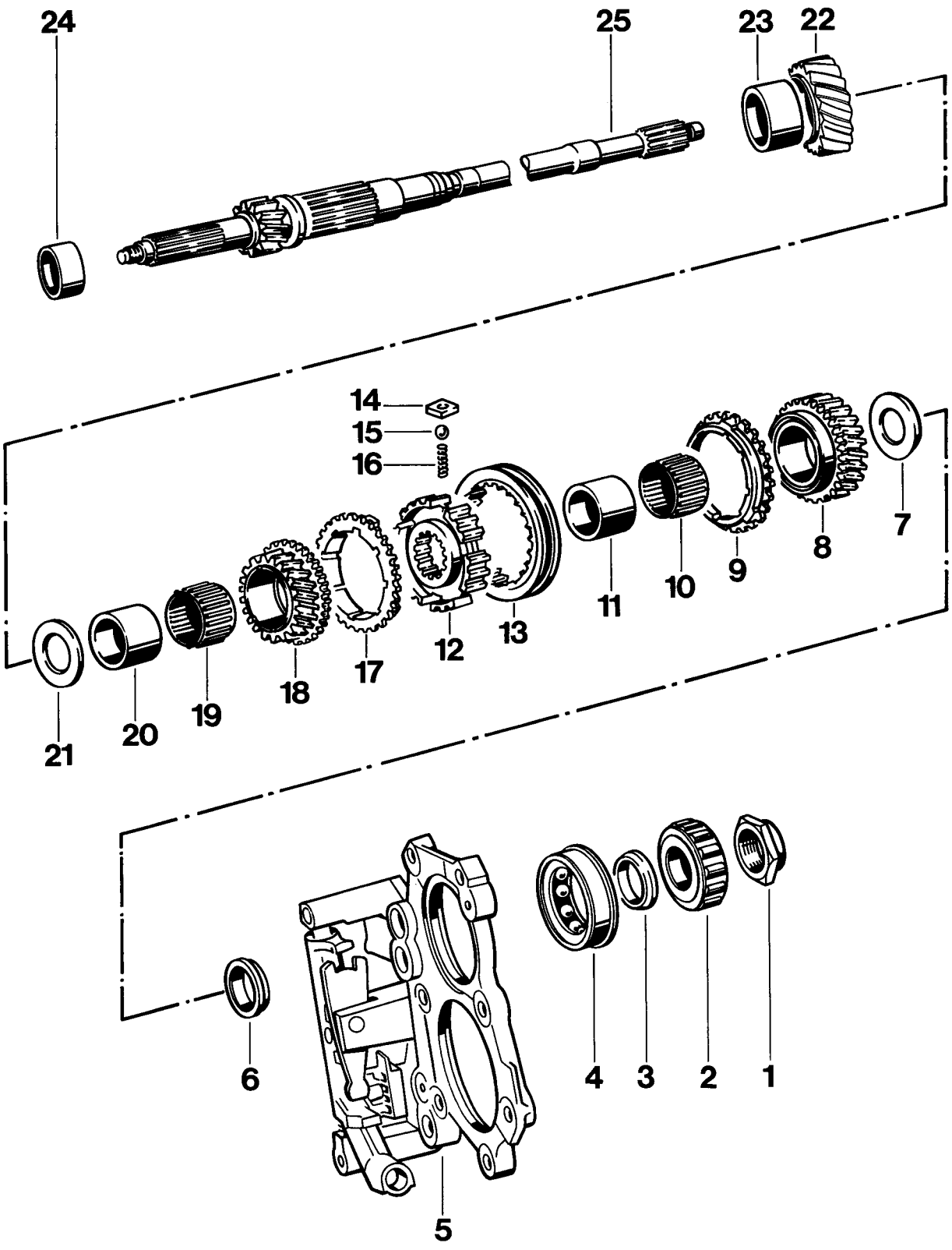


516-35

No.	Designation	Special tool	Order number	Explanation
1	Retainer plate	9177	000.721.917.70	
2	Socket	9105	000.721.910.50	

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Dismantling and assembling input shaft



524-35

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No.	Designation	Qty.	Note: Removal	Installation
1	Collar nut	1	Undo with Special Tools 9177 and 9105	Use Special Tools 9177 and 9105. Torque: 250 Nm (183.25 ft.lb). Punch collar to lock
2	Cylindrical roller bearing	1	Press off with suitable tool (e.g. Kukko 17-1) over 2nd gear fixed wheel	Heat to approx. 120° C and press on with suitable pipe section
3	Bearing inner race	1	Press off with suitable tool (e.g. Kukko 17-1) over 2nd gear fixed wheel	Heat to approx. 120° C and press on with suitable pipe section
4	Four-point bearing	1		
5	Tensioning plate	1		Mount in vice (fit protective jaws), engage 5th gear, insert input shaft in selector rod / fork with dowels in place. Observe position of locks (refer to page 35 - 207)
6	Bearing inner race	1	Press off with suitable tool (e.g. Kukko 17-1)	Heat to approx. 120° C and press on with suitable pipe section
7	Thrust washer	1		Large, flat-ground side faces needle cage
8	Loose gear (4th gear)	1		Always replace as a pair
9	Synchronizing ring	1	Mark for refitting	Inspect for wear, assemble in correct position with the same gearwheel (cogs towards driver dogs)
10	Needle cage	1	Mark for refitting	Assemble with the same gearwheel

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No.	Designation	Qty.	Note: Remove	Installation
11	Inner race	1		Heat to approx. 120° C and press into position
12	Guide sleeve	1	Remove together with selector sleeve	Selector sleeve and guide sleeve are matched, install together with selector sleeve and synchronizing parts
13	Selector sleeve (3rd and 4th gear)	1	Spring-loaded synchronizing parts may jump out. Mark for refitting	Observe assembly position, install together with guide sleeve and synchronizing parts. Always replace in pairs
14	Driver dogs	3		Install in correct position, domed side faces selector sleeve
15	Ball	3		
16	Spring	3		Free length = 11.8 + 0.3 mm, wire thickness = 0.8 mm. Do not confuse with springs for 1st and 2nd gears
17	Synchronizing ring	1	Mark for refitting	Inspect for wear, assemble in correct position with the same gearwheel (cogs towards driver dogs)
18	Loose gear (3rd gear)	1		Always replace in pairs
19	Needle cage	1	Mark for refitting	Assemble with the same gearwheel
20	Inner race	1		Heat to approx. 120° C and press into position
21	Thrust washer (1.85 mm)	1		

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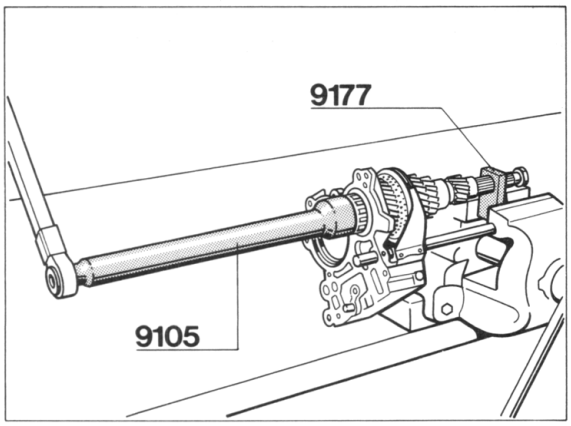
No.	Designation	Qty.	Note: Remove	Installation
22	Fixed gear (2nd gear)	1		Always replace in pairs. Collar faces spacer
23	Spacer	1		
24	Cylindrical roller bearing inner race	1	Press off with suitable tool (e.g. Kukko 17-0)	Heat to approx. 120° C and press into position
25	Input shaft	1		

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Notes on dismantling and assembling

Dismantling

1. Mount retaining plate **9177** in vice, fit input shaft and undo collar nut with Special Tool **9105**.

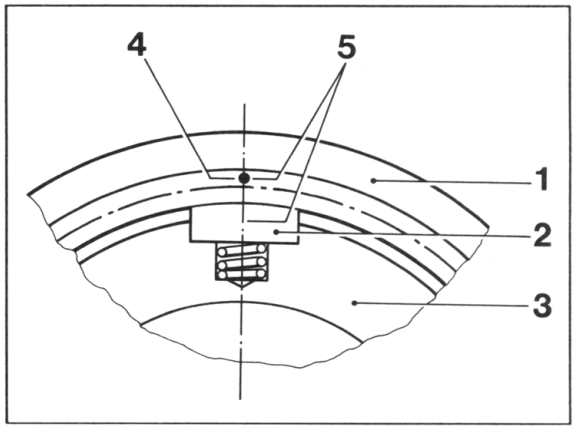


535-35

2. Use a suitable tool (e.g. Kukko 17 - 1) to press all parts off the input shaft over the 2nd gear wheel.

Assembling

1. Observe assembly position of selector sleeve. When assembling, the punch mark must be centered in relation to the driver dogs.



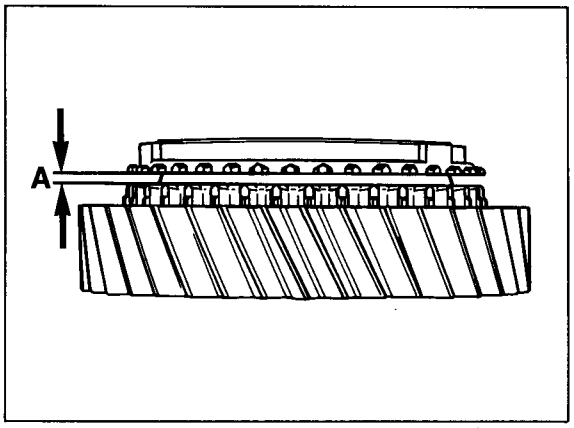
55-35

1 = Selector sleeve
2 = Driver dog
3 = Guide sleeve
4 = Punch mark
5 = Assembly position

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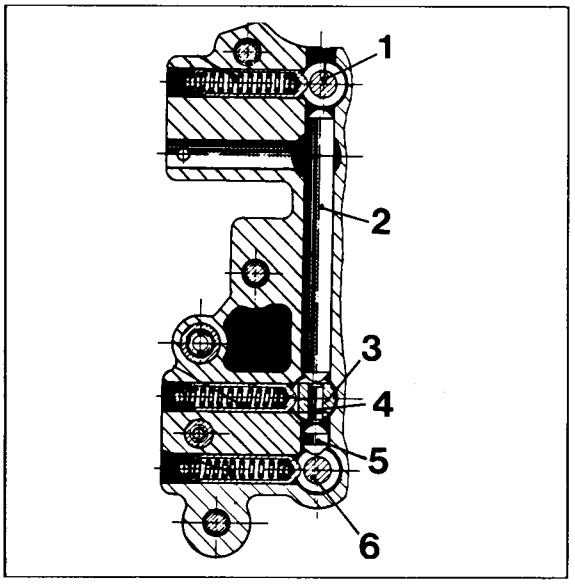
2. To inspect the synchronizing rings, press rings onto the gear wheel cones and use a feeler gauge to measure gap "A".

Assembly dimension (new) = 0.9 mm min.
Wear limit = 0.6 to 0.7 mm



518-35

3. Observe assembly position of locks.



160-35

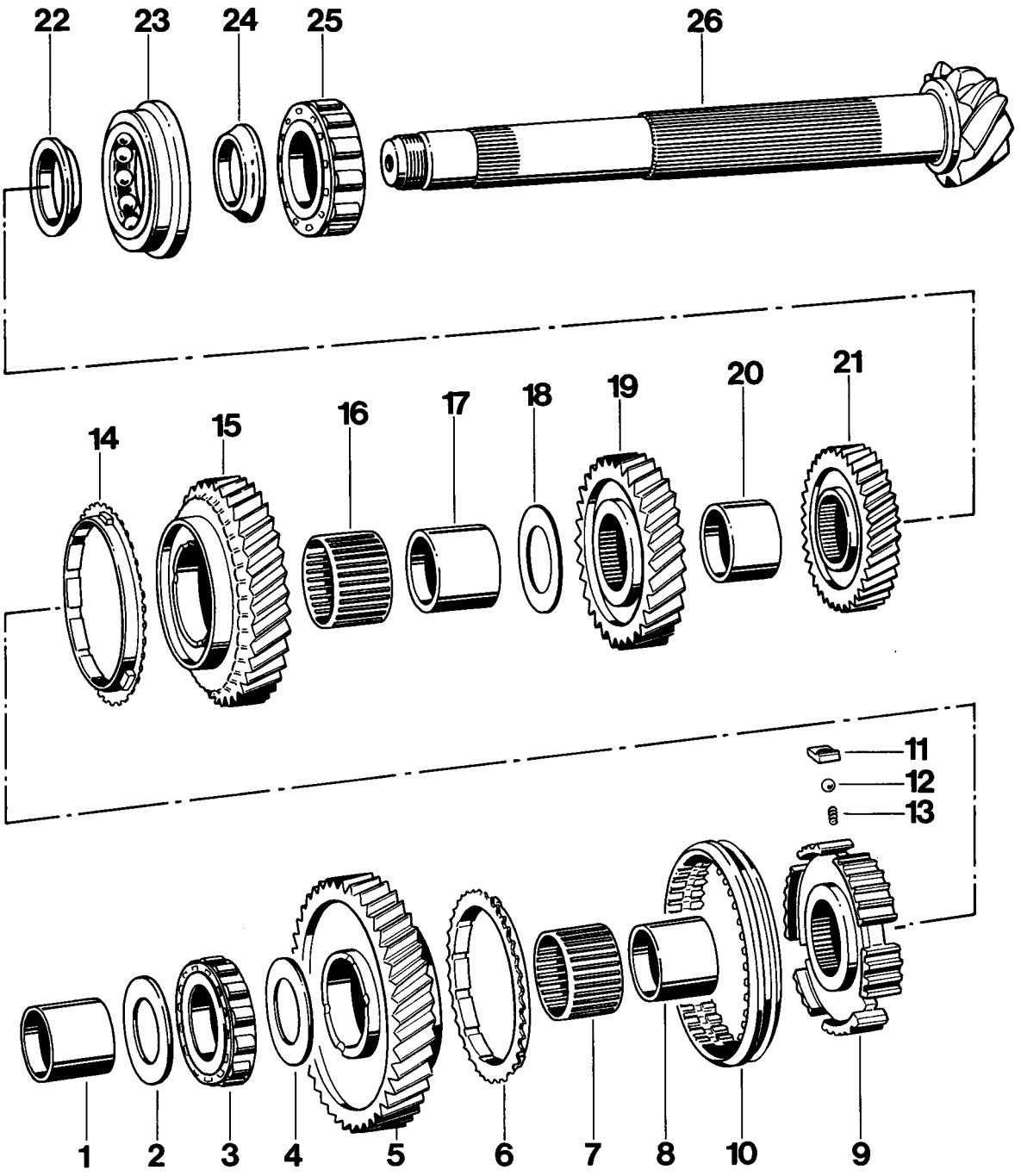
1 = Selector rod 3rd/4th
2 = Lock
3 = Selector rod 5th/R
4 = Lock
5 = Lock
6 = Selector rod 1/2

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Dismantling and assembling drive pinion

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Dismantling and assembling drive pinion



523-35

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No.	Designation	Qty.	Note: Removal	Installation
1	Inner race	1	Mark for refitting	Assemble with the same gearwheel. Heat to approx. 120° C
2	Thrust washer (2.8 mm)	1		
3	Cylindrical roller bearing	1		Heat to approx. 120° C
4	Thrust washer (2.8 mm)	1		
5	Loose gear (1st gear)	1		Always replace in pairs
6	Synchronizing ring	1	Mark for refitting	Check for wear, assemble in correct position with the same gearwheel (cogs towards driver dogs)
7	Needle cage	1	Mark for refitting	Reassemble with the same gearwheel
8	Inner race	1	Mark for refitting	Reassemble with the same gearwheel. Heat to approx. 120° C
9	Guide sleeve	1	Remove with selector sleeve	Always replace in pairs. Install together with selector sleeve and synchronizing parts
10	Selector sleeve (1st and 2nd gear)	1	Spring-loaded synchronizing parts may jump out	Always replace in pairs. Install together with guide sleeve and synchronizing parts
11	Driver dog (with guide nose)	3		Do not confuse with dog for 3rd to 5th and reverse gears
12	Ball	3		

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No.	Designation	Qty.	Note: Remove	Installation
13	Spring	3	Mark for refitting	Free length 10.7 ± 0.2 mm, wire thickness 0,9 mm. Do not confuse with springs for 3rd to 5th and reverse gears
14	Synchronizing ring	1	Mark for refitting	Check for wear, reassemble in correct position with the same gearwheel (cogs towards driver dogs)
15	Loose gear (2nd gear)	1		Always replace in pairs
16	Needle cage	1	Mark for refitting	Reassemble with the same gearwheel
17	Inner race	1	Mark for refitting	Reassemble with the same gearwheel
18	Thrust washer (1.4 mm)	1		
19	Fixed gear (3rd gear)	1		Always replace in pairs. Larger collar faces thrust washer
20	Spacer	1		
21	Fixed gear (4th gear)	1		Always replace in pairs. Larger collar faces four-point bearing
22	Bearing inner race	1	Mark for refitting. Press off with suitable tool (e.g. Kukko 15 - 17)	Do not confuse with inner race no. 24. Heat to approx. 120° C and press into position
23	Four-point bearing	1		
24	Bearing inner race	1	Mark for refitting. Press off with suitable tool (e.g. Kukko 15 - 17)	Do not confuse with inner race no. 22. Heat to approx. 120° C and press into position

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No	Designation	Qty.	Note: Removal	Installation
25	Cylindrical roller bearing	1	Press off with suitable tool (e.g. Kukko 15 - 17)	Heat to approx. 120° C and use a suitable pipe section (e.g. VW 519) to press into correct position
26	Drive pinion	1		Observe matching number. Readjust if necessary

Note

Items 1 through 20 are removed without removing the drive pinion.

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Notes on dismantling and assembling

Dismantling

Note

To facilitate reassembly, the drive pinion remains installed for part of the dismantling steps (refer to Dismantling and assembling transmission, on page 34 - 201)

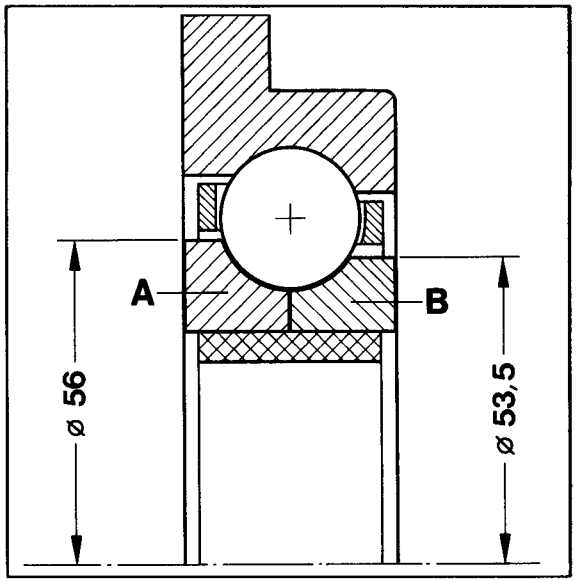
Assembling

1. Mount tensioning plate with input shaft in vice (fit protective jaws) and reassemble drive pinion.

Note

All parts of the drive pinion must be assembled dry to ensure that no oil penetrated between the mating faces.
Check matching numbers on drive pinion and ring gear for reassembly. Both numbers must be identical.

2. Heat bearing inner race of four-point bearing to approx. 120° C and press into correct position.

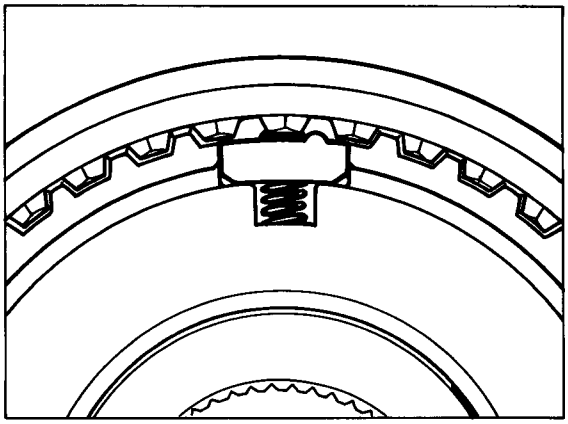


A = Large inner race (Outside diameter 56 mm), pointing towards pinion head when installed

B = Small inner race (outside diameter 53.5 mm), pointing towards 4th gear fixed gear.

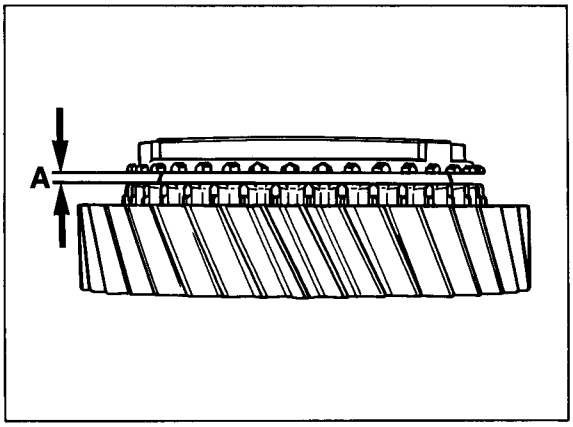
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3. When installing the synchronizer driver dogs, the guide nose must face the selector sleeve. The nose may point either to the left or the right.



519-35

4. To check the synchronizer rings, press rings onto the gear cones and use a feeler gauge to measure gap "A".



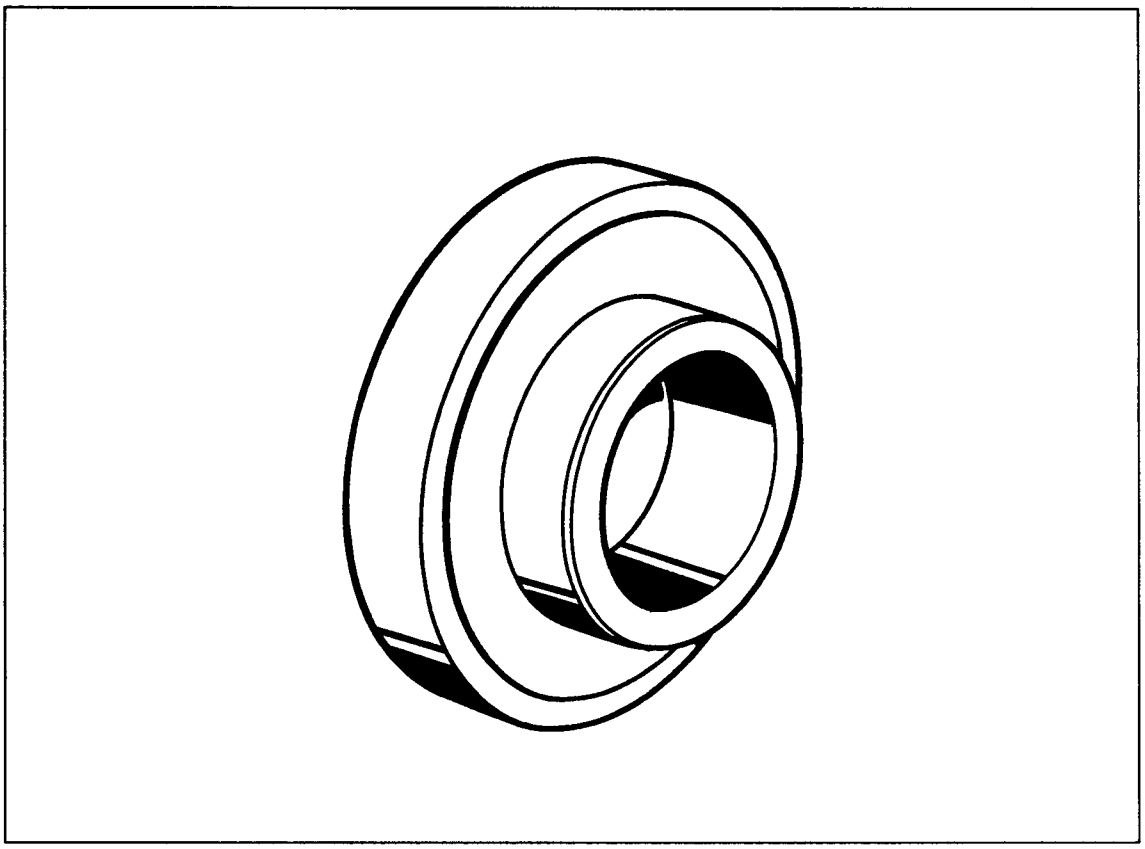
518-35

Assembly dimension (new) = 1.1 mm min.
Wear limit = 0.6 to 0.7 mm

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Removing and installing differential

Tool

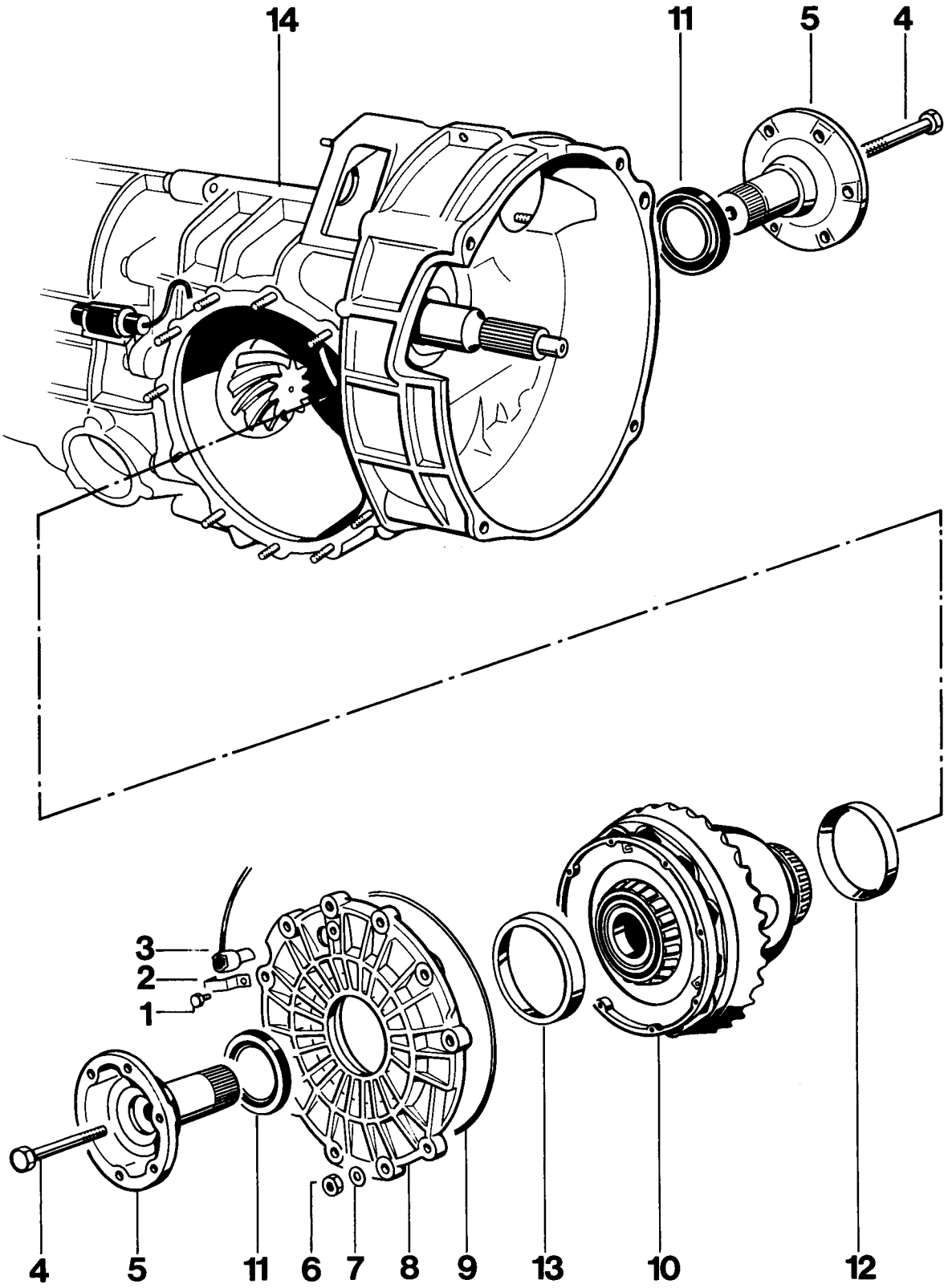


536-39

No.	Designation	Special tool	Order number	Explanation
	Thrust piece	9252	000.721.925.20	

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Removing and installing differential



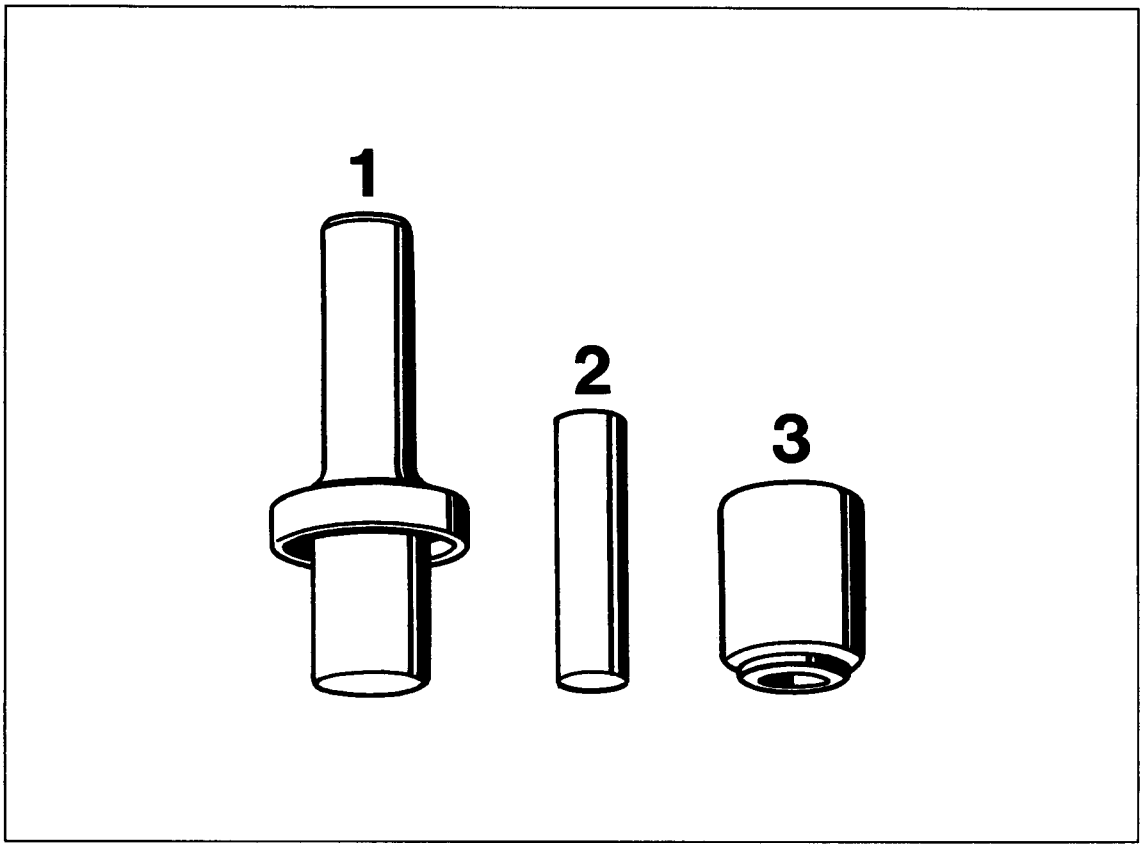
537-39

No.	Designation	Qty.	Note: Removal	Installation
1	Hex screw	1		Torque: 10 Nm (7.3 ft.lb)
2	Bracket	1		
3	Reed contact	1		
4	Hex screw	2		Torque: 44 Nm (32.3 ft.lb)
5	Halfshaft flange	2		
6	Hex nut	11		Torque: 23 Nm (16.9 ft.lb)
7	Washer	11		
8	Cover	1		
9	O-ring	1		Fit replacement, oil lightly
10	Differential or limited slip differential	1		Adjust if necessary
11	Oil seal	2		Pack area between dust lip and sealing lip with grease (e.g. Silubrin Grease S manufactured by Klüber). Drive in with thrust piece 9252 until seated
12	Bearing outer race	1	Heat transmission case to approx. 120° C and drive out with suitable drift	Heat transmission case to approx. 120° C and press in with suitable thrust piece
13	Bearing outer race	1	Heat transmission cover to approx. 120° C and remove with suitable internal puller (e.g. Kukko 21-9)	Heat transmission side cover to approx. 120° C and press in with suitable thrust piece
14	Transmission case			

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Dismantling and assembling differential

Tools

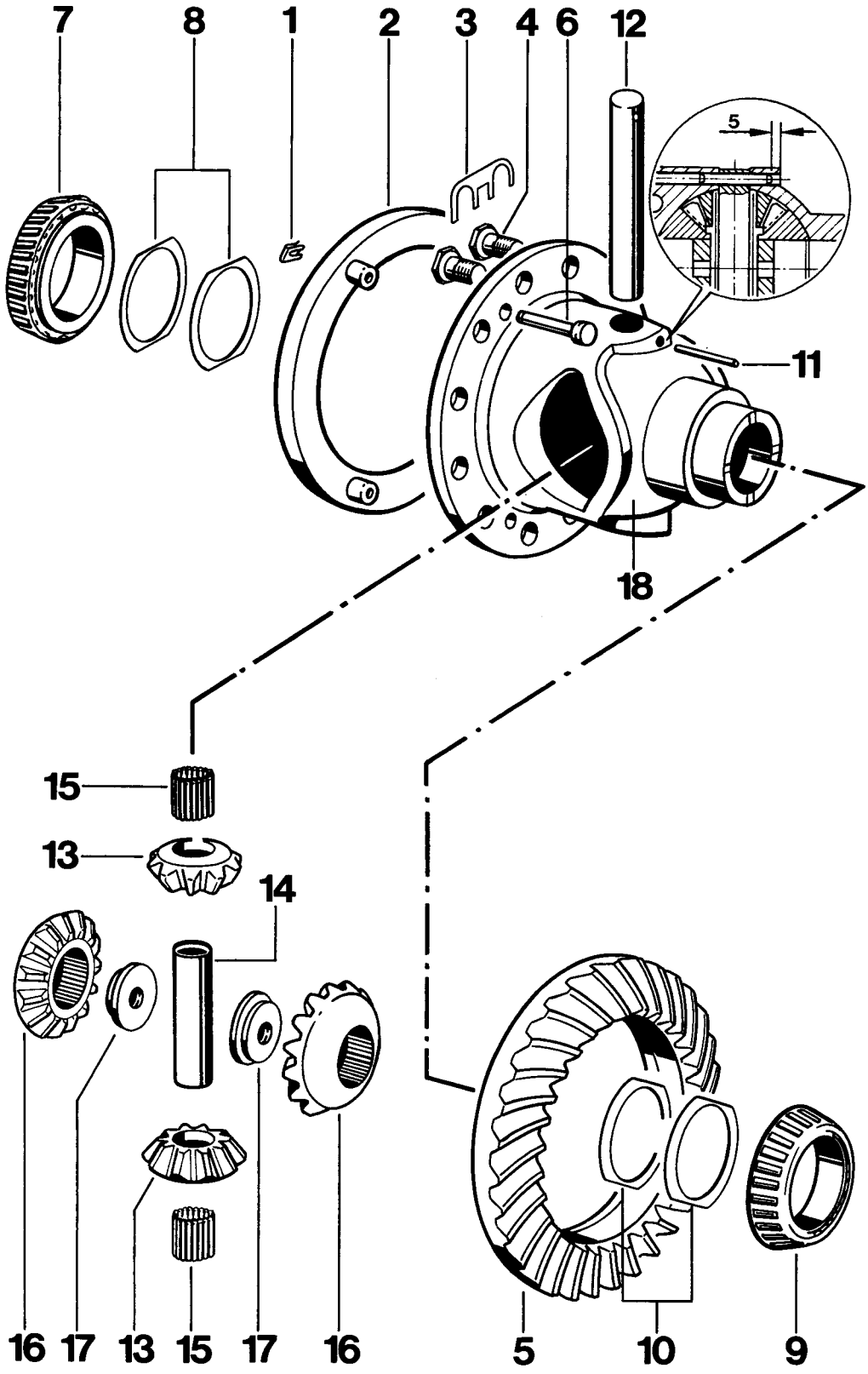


538-39

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



528-39

No.	Designation	Qty.	Note: Removal	Installation
1	Retainer	3		
2	Magnet carrier plate	1		
3	Tab washer	6		Fit replacement. Push into groove of adjacent bolts, pinch tabs with pliers (to lock plate around bolt) and bend down on a hexagon flat
4	Hex bolt	12		Threads must be dry and free of grease. Torque: 150 Nm (110 ft.lb).
5	Ring gear	1		Threaded holes for ring gear bolts must be dry and free of grease. Note matching numbers. Read-just if necessary.
6	Pin	3		
7	Taper roller bearing inner race	1	Pull of with suitable puller and P 263	Press on with P 264 b
8	Shim	X	Mark for refitting	Redetermine thickness if necessary
9	Taper roller bearing inner race	1	Pull off with suitable puller and P 263	Press on with P 264 b
10	Shim	X	Mark for refitting	Redetermine thickness if necessary
11	Spiral pin	1		Drive in observing correct position
12	Pin	1		

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No.	Designation	Qty.	Note: Removal	Installation
13	Small differential bevel gear	2		Apply MoS2 paste to curved surface. Always replace as a set (with large differential bevel gears)
14	Spacer	1		
15	Needle roller sleeve (31 seperate needle rollers each)	2	Do not lose any needle rollers	To insert, coat with stiff grease
16	Large differential bevel gear	2		Apply MoS2 paste to curved surface. Always replace as a set (with small differential bevel gears)
17	Threaded fitting	2		
18	Case	1		

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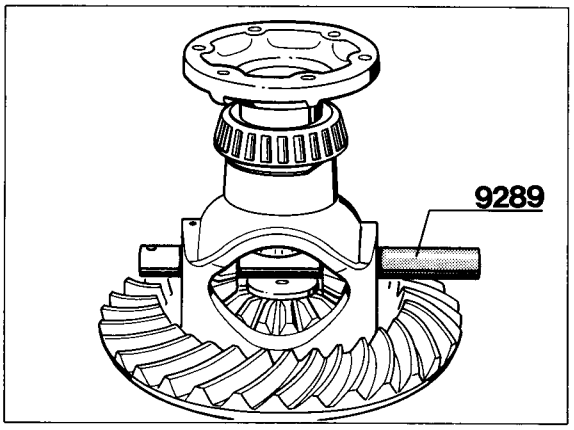
Notes on dismantling and assembling

Note

The small differential bevel gears run on two needle roller bearing sleeves that comprise 31 separate needle rollers each.

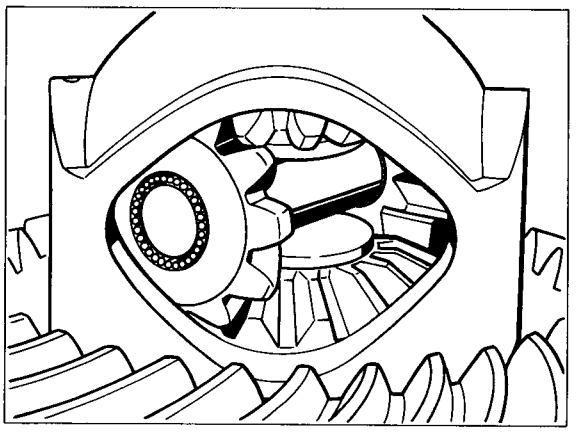
Dismantling

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



539-39

2. Turn small differential bevel gears until centering mandrel faces the case cutouts and carefully take out the differential bevel gears. Be careful not to drop any needle rollers.

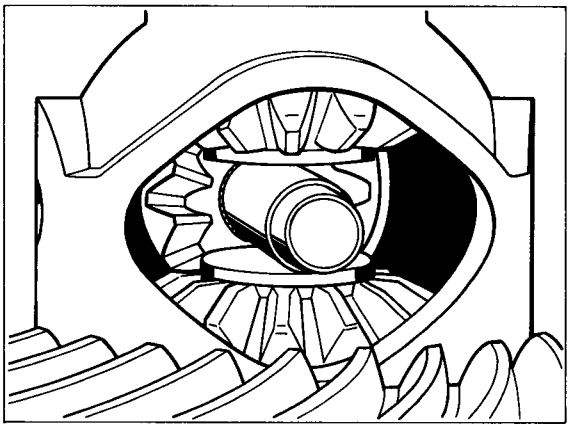


540-39

Reassembling

1. Install large differential bevel gears with pressed in threaded disks through the large differential case cutout and assemble with the halfshaft flanges.

2. Preassemble 31 needle rollers, centering mandrel **9289** and spacer on a small differential bevel gear and install through one of the case cutouts.



541-39

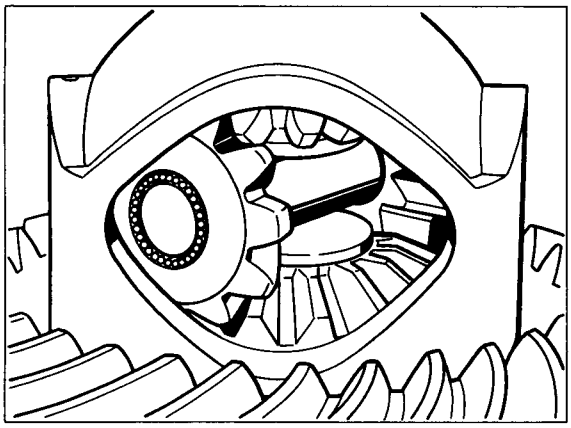
3. Assemble the other differential bevel gear with 31 needle rollers and carefully locate it on the centering mandrel. Be careful not to drop any needle rollers.

Note

To facilitate assembly, insert needle rollers coated with stiff grease.

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4. Use centering mandrel to turn small differential bevel gears until the case bores line up.



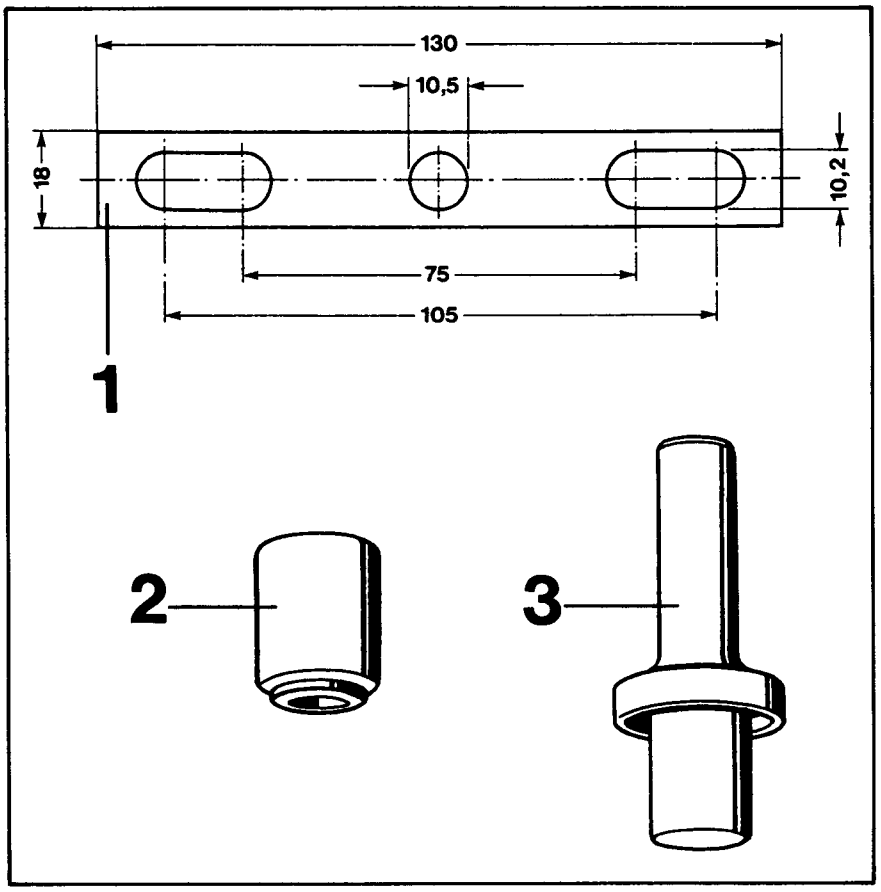
540-38

5. Press in differential pin observing correct position, take off centering mandrel and lock pin according to specifications.

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Dismantling and assembling drive torque-controlled limited slip differential for Carrera RS

Tools

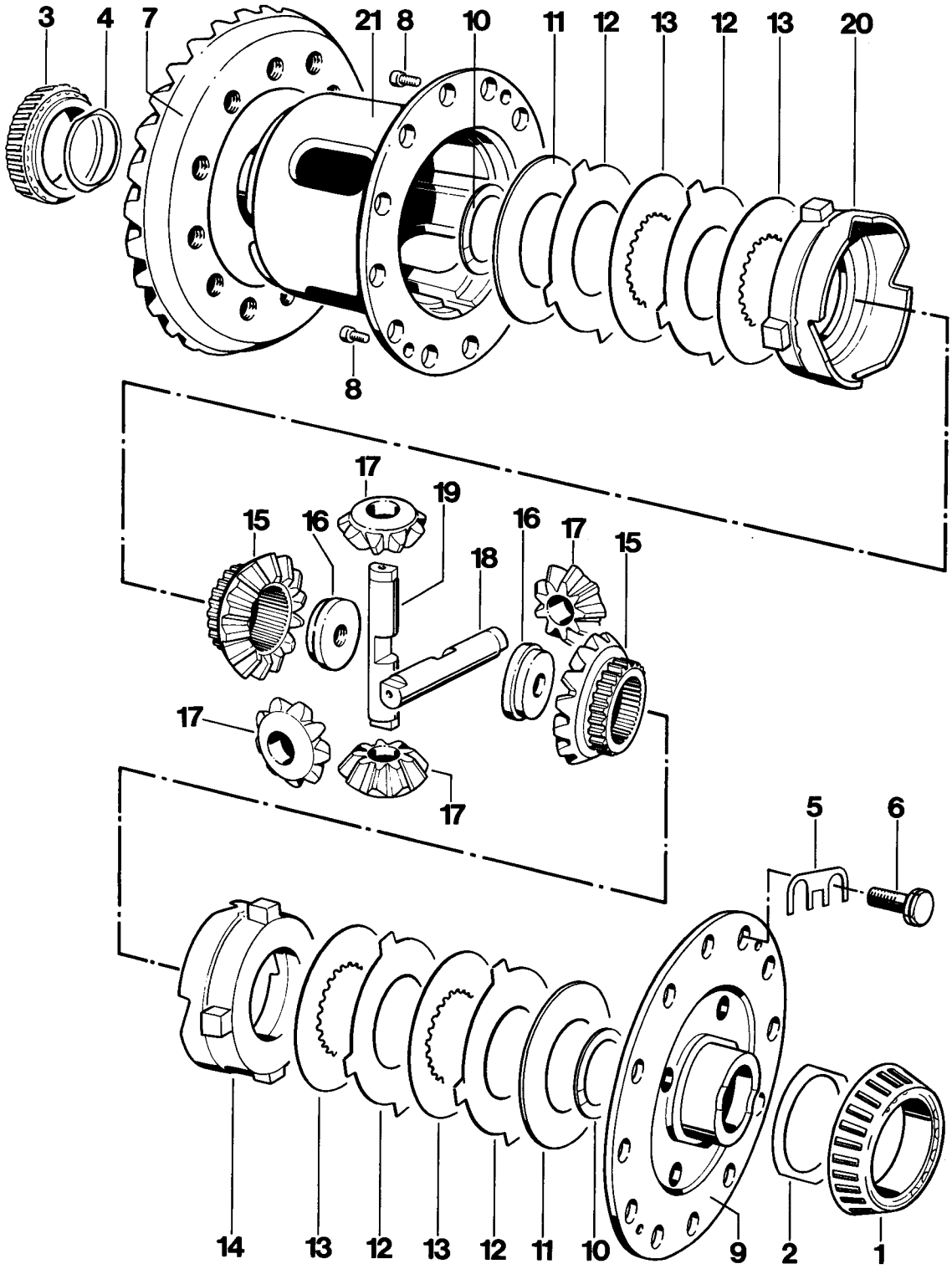


672-39

No.	Designation	Special tool	Order number	Explanation
1	Connecting piece			Shop-made tool The connecting piece for the halfshaft flange may be made of 6 x 18 flat steel.
2	Pressure piece	P 263	000.721.263.00	
3	Pressure piece	P 264 b	000.721.264.20	

Printed in Germany – XVIII, 1992

Dismantling and assembling drive torque-controlled limited slip differential for Carrera RS



Printed in Germany – XVIII, 1992

No.	Designation	Qty.	Note: Removal	Installation
1	Large inner race of tapered roller bearing	1	Pull off with suitable puller and P 263	Press on with P 264 b
2	Adjusting shim	X	Mark for refitting	Redetermine thickness if necessary
3	Small inner race of tapered roller bearing	1	Pull off with suitable puller and P 263	Press on with P 264 b
4	Adjusting shim	X	Mark for refitting	Redetermine thickness if necessary
5	Tab washer (omitted for Verbus-Ripp bolts)	6		Replace. Slide into the groove of the hex screws, pull together at front with pliers (to ensure that the tab washer is firmly locked with the hexagon head screw) and secure at bottom by bending over one of the hex flats
6	Hexagon head screws (with tab washer)	12		Threads must be dry and free of grease. Tighten with 150 Nm (111 ftlb)
–	Verbus-Ripp bolt (**without** tab washer)			Must always be replaced. Threads must be dry and grease-free. Tighten to 200 Nm (148 ftlb.)
7	Ring gear	1		Threaded holes must be dry and free of grease. Note matching numbers. Readjust if necessary.
8	Screw (M6 x 10)	2		Tight. with 14 Nm (10 ftlb)
9	Cover	1		
10	Thrust washer	2		Fit in place with some grease
11	Cup washer	2		Install in correct position. Apply some stiff grease to the cover side to keep the cover in place
12	Outer disc	4		

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No.	Designation	Qty.	Note: Removal	Instalation
13	Inner disc (with molybdenium coating)	4		
14	Thrust ring	1	Mark for refitting	Do not confuse with thrust ring no. 20. Install in correct position
15	Shaft bevel gear	2		Replace only as a set (with bevel pinion)
16	Threaded washer	2		
17	Bevel pinion	4		Replace only as a set (with shaft bevel gears)
18	Shaft	1	Mark for refitting	Do not confuse with shaft no. 19, insert in correct position
19	Shaft	1	Mark for refitting	Do not confuse with shaft no. 18, insert in correct position
20	Thrust ring	1	Mark for refitting	Do not confuse with thrust ring no. 14, insert in correct position
21	Housing	1		

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Notes on dismantling and assembling

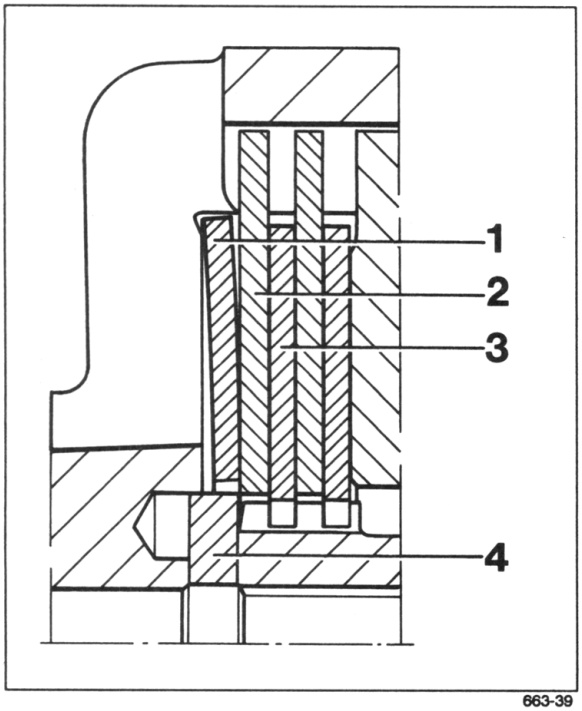
Dismantling

Remove pan head screws (no. 8) from case cover, remove cover and take out all internal components.
Mark all thrust rings and differential shafts for reassembly.

Assembling

1. Oil all sliding surfaces of the discs, thrust rings and differential shafts with transmission oil.

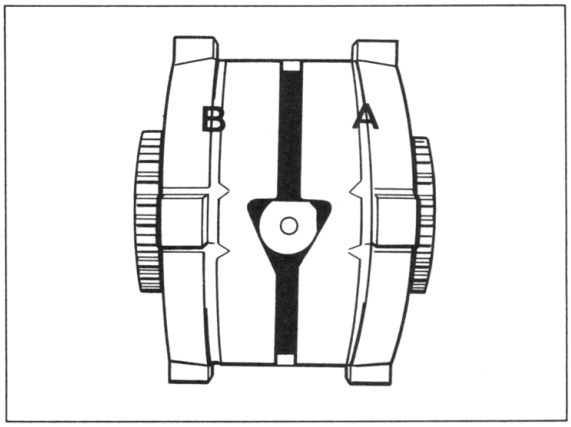
2. Install cup washers in such a way that the domed surface points towards the inside (towards the disc package).



663-39

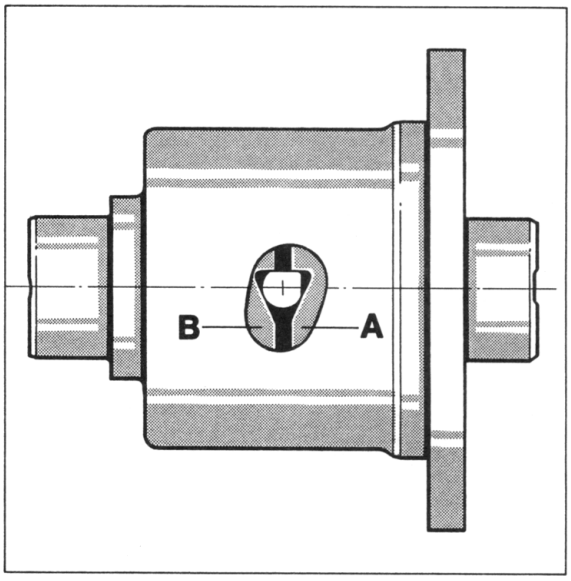
1 - Cup spring
2 - Outer disc
3 - Inner disc
4 - Thrust washer

3. Install thrust rings and differential shafts in correct position.



665-39

A = Thrust ring (cover side)
B = Thrust ring (case side)

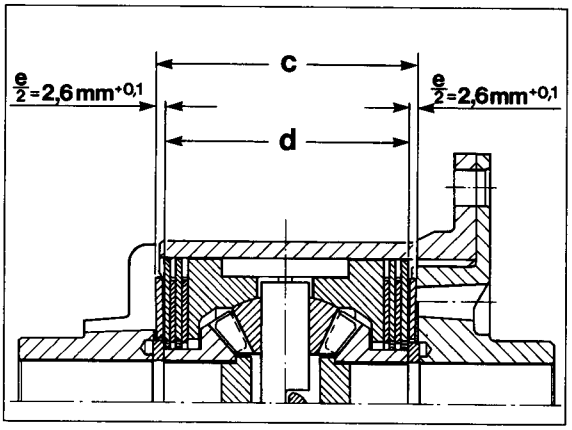


666-39

A = Thrust ring (cover side)
B = Thrust ring (case side)

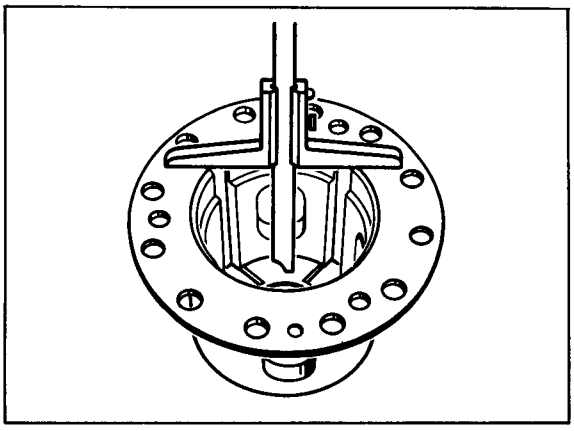
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4. Determine thickness of disc package “d” (only required if components are to be replaced).



667-39

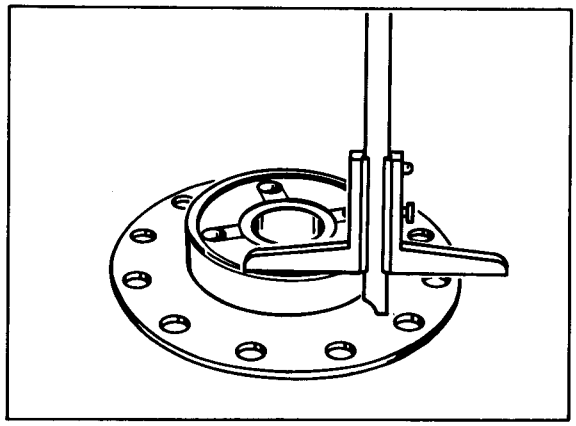
– Determine case depth, dimension “a” Example: a = 106. 35



668-39

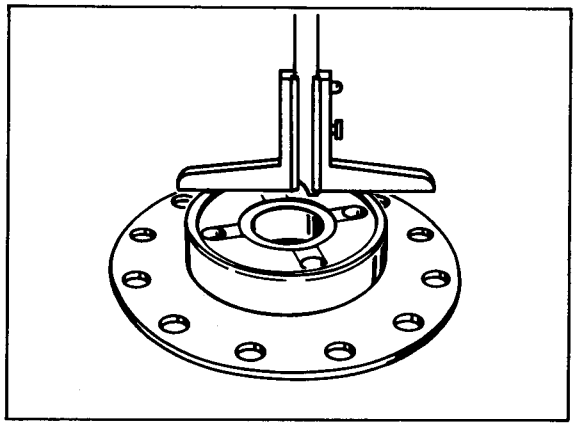
– Determine dimension “b” of cover. Two measurements are required to determine this dimension.

Measurement I = e. g. 20.95 mm



669-39

Measurement II = e.g. 1.30 mm



670-39

– **b = Measurement I - Measurement II**

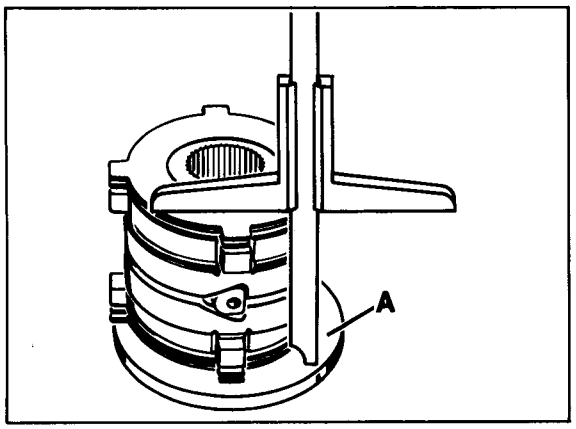
I = 20.95 mm
II = 1.30 mm
b = 19.65 mm

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– Calculate clearance "c" inside casing.
c = a – b

Example:
a = 106.35 mm
b = 19.65 mm
c = 86.70 mm

– Determine dimension "d"
(disc package with 2.0 mm outer discs and inner discs but without cup springs).
Example: d = 81.50 mm

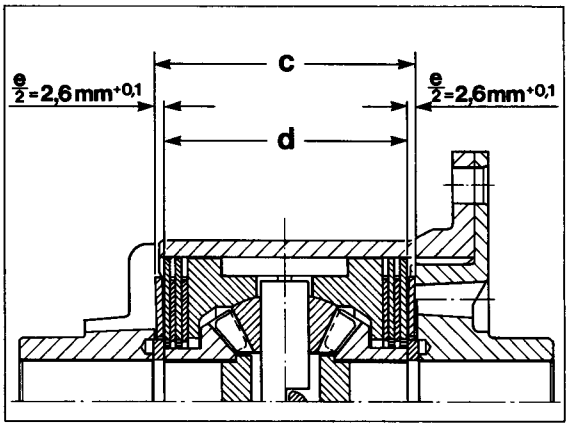


671-39

A = Plate of Special Tool 9508/1

– Determine dimension "e"
(must be 5.20 mm).

e = c – d
Example:
c = 86.70 mm
d = 81.50 mm
e = 5.20 mm



667-39

$\frac{e}{2} + \frac{e}{2}$ = e = 5,2 mm

Note

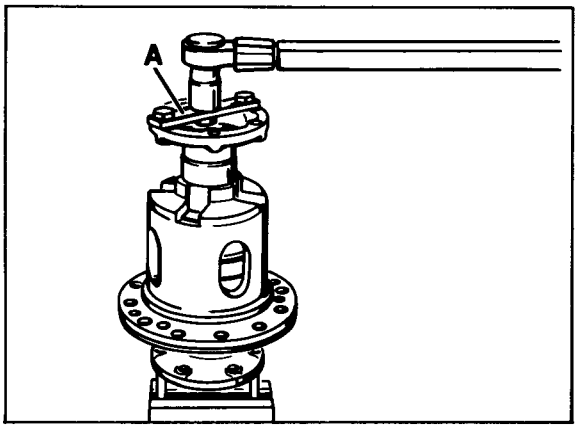
If dimension "e" is exceeded or if the dimension remains below this value, fit thicker or thinner outer discs.

"e" below 5.20 mm - install thinner discs
"e" above 5.20 mm - install thicker discs

Outer discs are available in a thickness of 1.9 mm, 2.0 mm and 2.1 mm.

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5. Following assembly, measure spinning torque with one fixed shaft bevel gear and one driven shaft bevel gear. For this purpose, fit one flange with two bolts in a vise and position differential. Insert other flange with shop-made connecting piece and rotate differential with a torque wrench.
A torque of 20...50 Nm (15...37 ftlb) must be attained.



674-39

A = Connecting piece (shop-made)

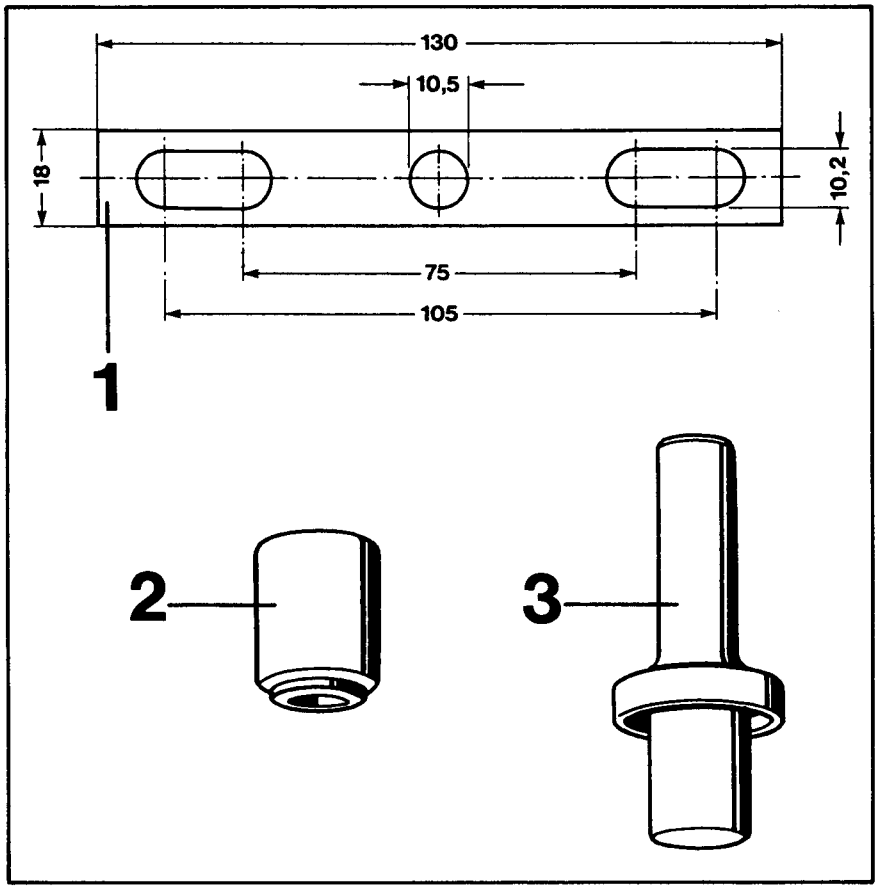
Note

If the prescribed torque is not attained when the thickest outer discs are fitted, all discs are worn and must be replaced.

Printed in Germany – XVIII, 1992

Dismantling and assembling limited-slip differential (locking value 40%)

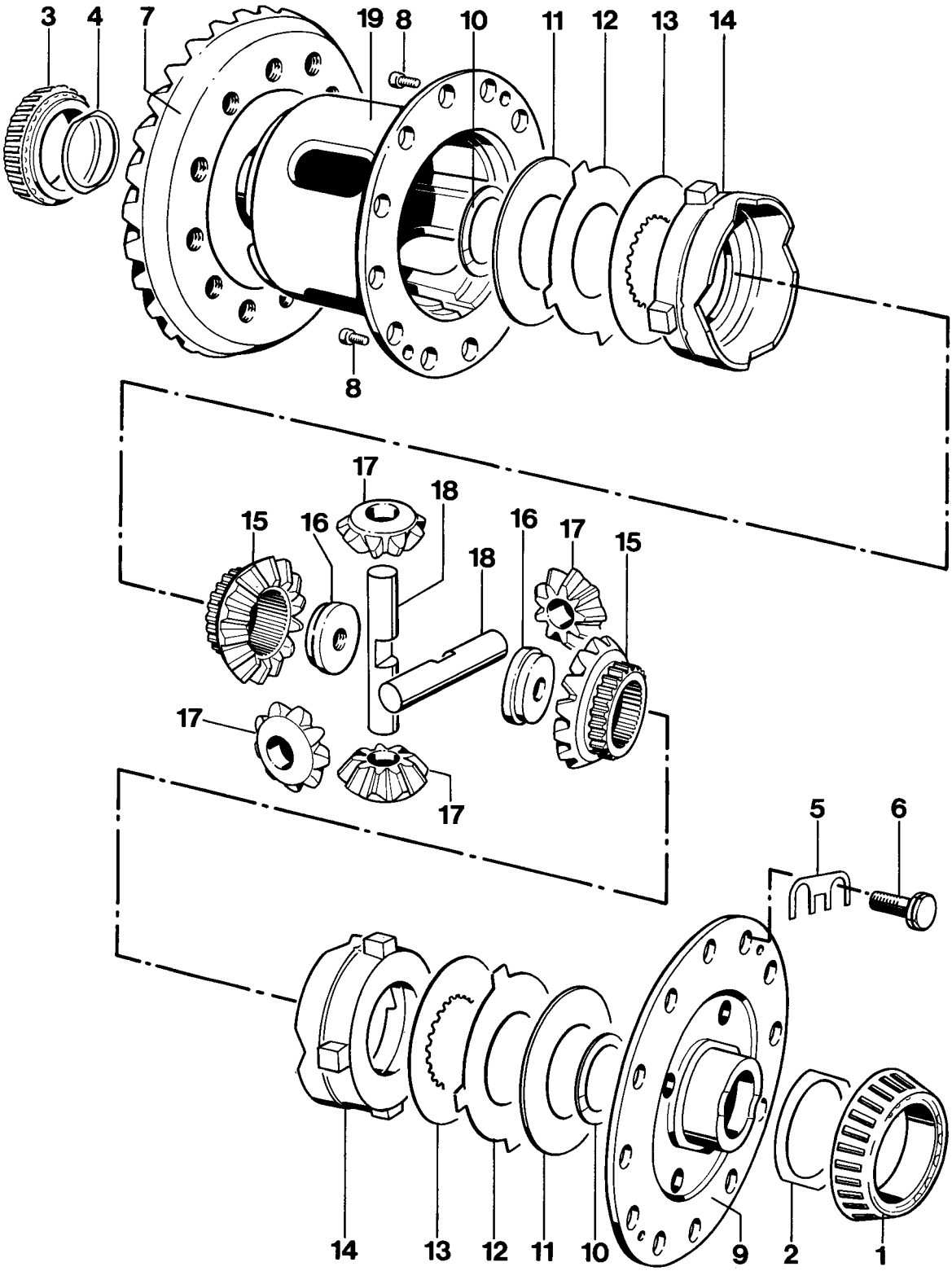
Tools



No.	Designation	Special tool	Order number	Explanation
1	Connecting piece			Shop-made tool. The connecting piece for the halfshaft flange may be made of 6 x 18 flat steel.
2	Pressure piece	P 263	000.721.263.00	
3	Pressure piece	P 264 b	000.721.264.20	

Printed in Germany – XX, 1993

Dismantling and assembling limited-slip differential (locking value 40%)



Printed in Germany – XX, 1993

No.	Designation	Qty.	Note: Removal	Installation
1	Large inner race of tapered roller bearing	1	Pull off with suitable puller and P 263	Press on with P 264 b
2	Adjusting shim	X	Mark for refitting	Redetermine thickness if necessary
3	Small inner race of tapered roller bearing	1	Pull off with suitable puller and P 263	Press on with P 264 b
4	Adjusting shim	X	Mark for refitting	Redetermine thickness if necessary
5	Tab washer (omitted for Verbus-Ripp bolts)	6		Replace. Slide into the groove of the hex screws, pull together at front with pliers (to ensure that the tab washer is firmly locked with the hexagon head screw) and secure at bottom by bending over one of the hex flats
6	Hexagon head screws (with tab washer)	12		Threads must be dry and free of grease. Tighten with **150 Nm** (111 ftlb)
–	Verbus-Ripp bolt (**without** tab washer)	12		Must always be replaced. Threads must be dry and grease-free. Tighten to **200 Nm** (148 ftlb.)
7	Ring gear	1		Threaded holes must be dry and free of grease. Note matching numbers. Readjust if necessary.
8	Screw (M6 x 10)	2		Tight. with 14 Nm (10 ftlb)
9	Cover	1		
10	Thrust washer	2		Fit in place with some grease
11	Cup washer	2		Place into correct position
12	Outer disc	2		Redet. thickness if nece.

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No.	Designation	Qty.	Note: Removal	Instalation
13	Inner disc (with molybdenium coating)	2		
14	Thrust ring	2		
15	Shaft bevel gear	2		Replace only as a set (with bevel pinion)
16	Threaded washer	2		
17	Bevel pinion	4		Replace only as a set (with shaft bevel gears)
18	Shaft	2		
19	Housing	1		

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Notes on dismantling and assembling

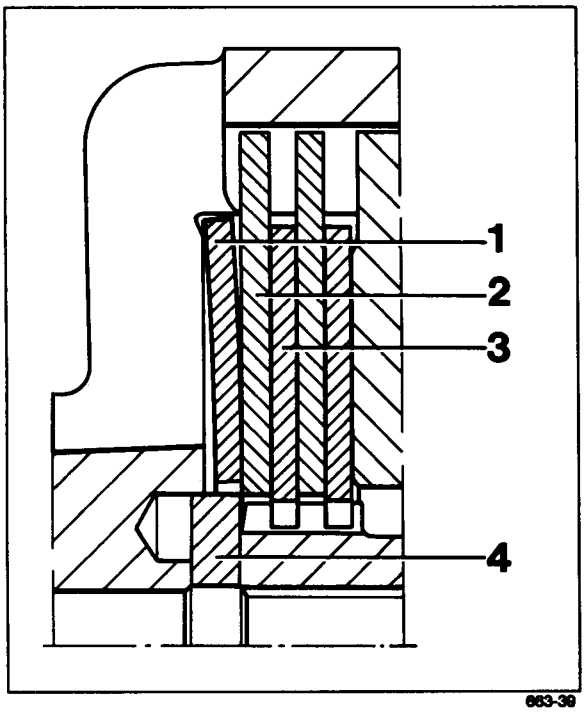
Dismantling

Remove pan head screws (no. 8) from case cover, remove cover and take out all internal components.
Mark all thrust rings and differential shafts for reassembly.

Assembling

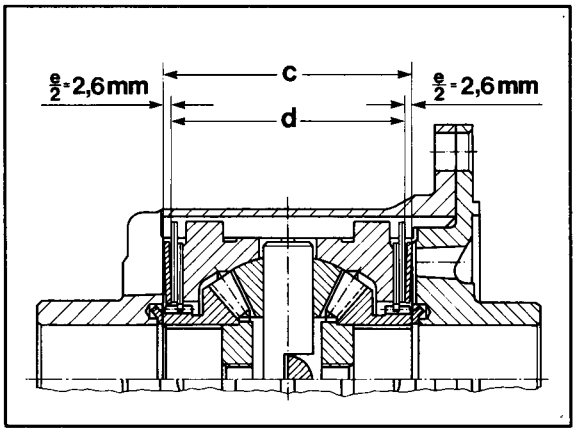
1. Oil all sliding surfaces of the discs, thrust rings and differential shafts with transmission oil.

2. Install cup washers in such a way that the domed surface points towards the inside (towards the disc package).

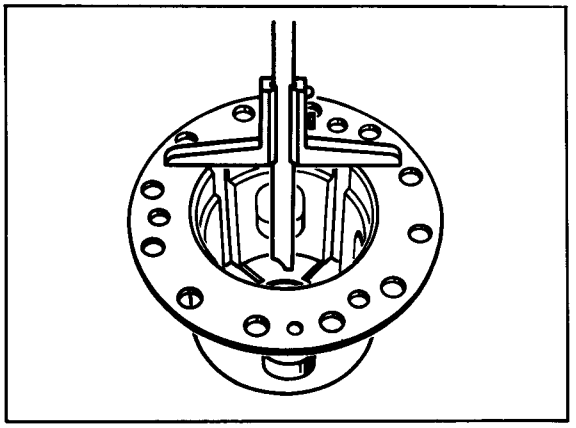


1 - Cup spring
2 - Outer disc
3 - Inner disc
4 - Thrust washer

3. Determine thickness of disc package "d" (only required if components are to be replaced).

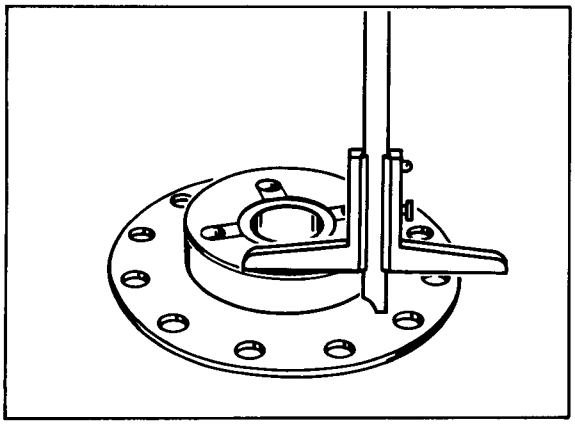


– Determine case depth, dimension "a"
Example: a = 95.50



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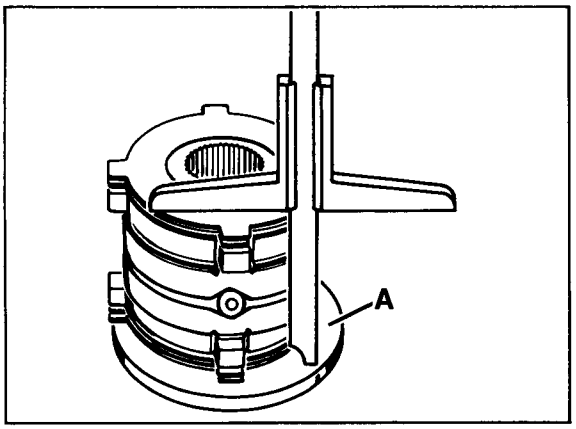
– Determine dimension "b" of cover.
Example: b = 13.8 mm



– Calculate clearance "c" inside casing.
c = a – b

Example:
a = 95.5 mm
b = 13.8 mm
c = 81.7 mm

– Determine dimension "d"
(disc package with 2.0 mm outer discs and inner discs but without cup springs).
Example: d = 76.50 mm

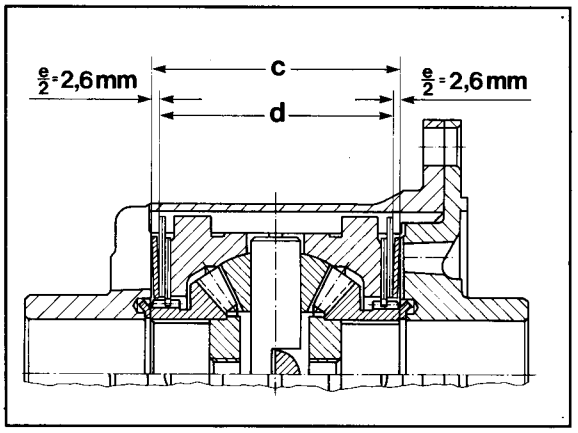


671-39

A = Plate of Special Tool 9508/1

– Determine dimension "e"
(must be 5.20 mm).

e = c – d
Example:
c = 81.70 mm
d = 76.50 mm
e = 5.20 mm



$\frac{e}{2} + \frac{e}{2} = e = 5.2$ mm

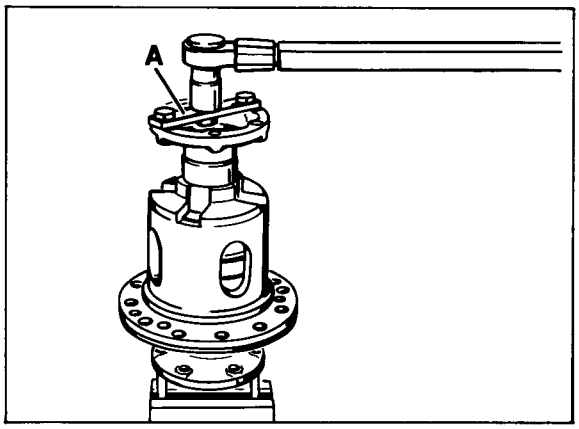
Note

If dimension "e" is exceeded or if the dimension remains below this value, fit thicker or thinner outer discs.

"e" below 5.20 mm - install thinner discs
"e" above 5.20 mm - install thicker discs

Outer discs are available in a thickness of 1.9 mm, 2.0 mm and 2.1 mm.

4. Following assembly, measure spinning torque with one fixed shaft bevel gear and one driven shaft bevel gear. For this purpose, fit one flange with two bolts in a vise and position differential. Insert other flange with shop-made connecting piece and rotate differential with a torque wrench.
A torque of 10...35 Nm (7.5...26 ftlb) must be attained.



A = Connecting piece (shop-made)

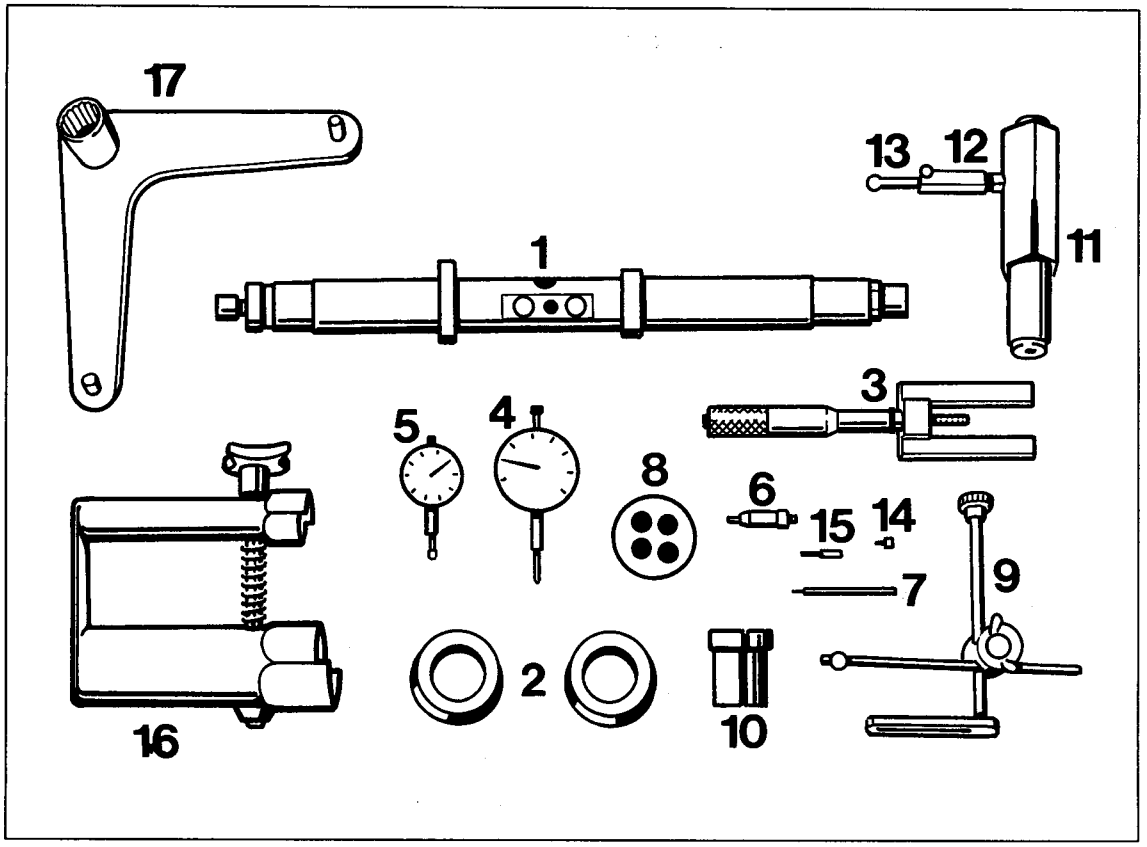
Note

If the prescribed torque is not attained when the thickest outer discs are fitted, all discs are worn and must be replaced.

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Adjusting drive set

Tools



542-39

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Adjusting drive set

Tools

No.	Designation	Special tool	Order number	Explanation
1	Measuring mandrel	VW 385/1		
2	Centering disks	9109	000.721.910.90	
3	Master gauge	VW 385/30		
4	Dial gauge	-		Standard
5	Dial gauge	-		Standard, measuring range 3 mm
6	Gauge plunger	VW 385/14		
7	Dial gauge extension	VW 385/56		30 mm long
8	Gauge block plate	9281	000.721.928.10	
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	Gauge plunger	VW 388	000.721.919.60	
14	Dial gauge extension	VW 382/10		6.0 mm long
15	Dial gauge extension	VW 385/15		9.3 mm long
16	Clamping device	9260	000.721.926.00	
17	Holder	9253	000.721.925.30	

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Practical procedure when readjusting the drive set

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

1. Determine the total thickness of shims "Stot" (S_1 plus S_2) for the specified preload on the taper roller bearings/differential.

2. Determine the thickness of shim "S_3".

3. Split the total shim thickness "Stot" into S_1 and S_2 so that the specified circumferential backlash is present between ring gear and drive pinion.

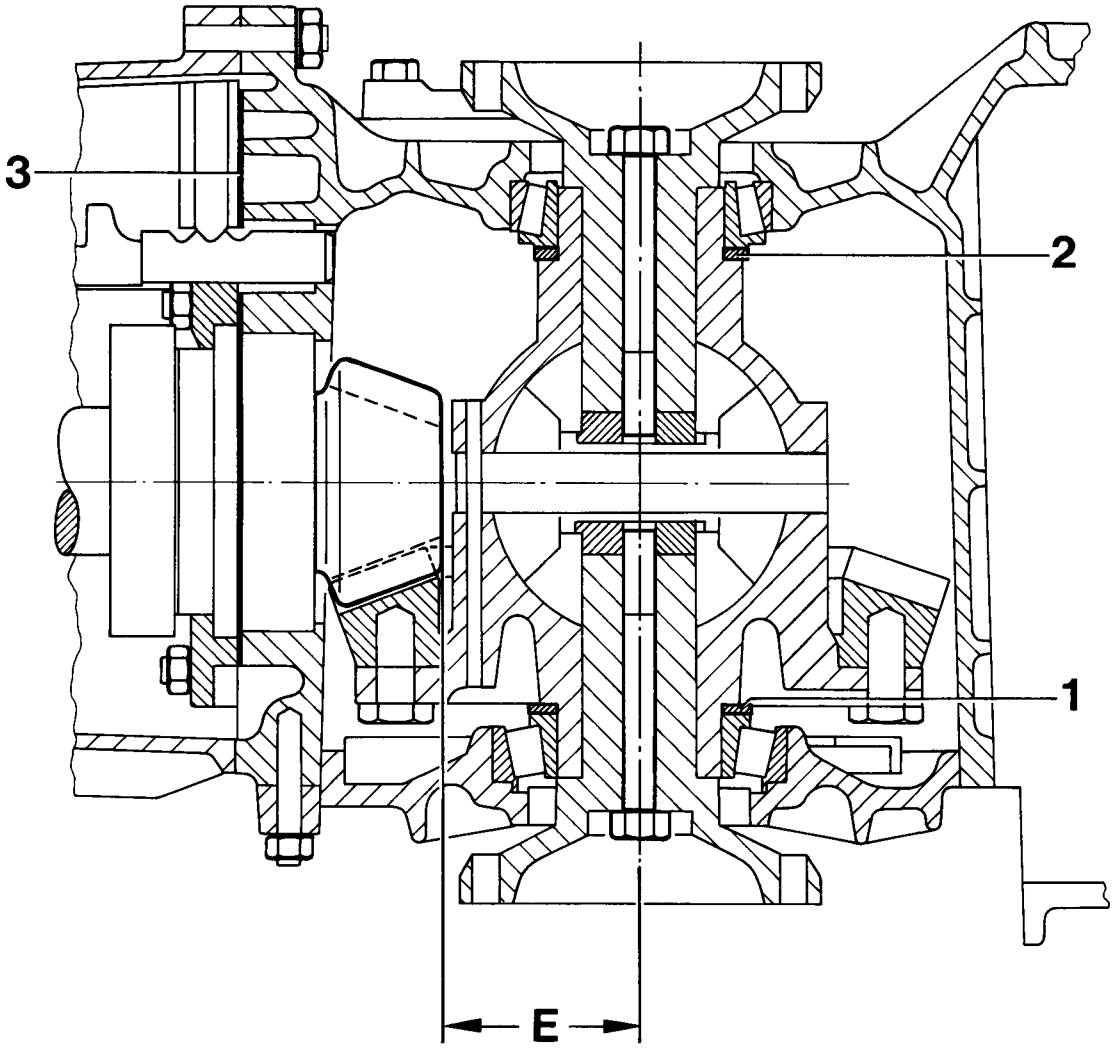
The aim of this adjustment is to restore the smoothest running position which has been achieved on test equipment in the production line.

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

When assembling the final drive assembly, it is only necessary to readjust drive pinion and ring gear or drive set if components have been replaced which have a direct influence on the adjustment. Refer to the following table to avoid unnecessary adjustment procedures.

Adjust:: / Replaced component	Ring gear (S_1 + S_2)	Drive pinion (S_3)
Transmission case	x	x
Side transmission cover	x	
Large cylindrical roller bearing and four-point bearing for drive pinion	x	x
Drive set	x	x
Differential housing	x	
Taper roller bearing for differential	x	

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1 – Shim S_1
2 – Shim S_2
3 – Adjusting shim S_3
E – Adjustment dimension

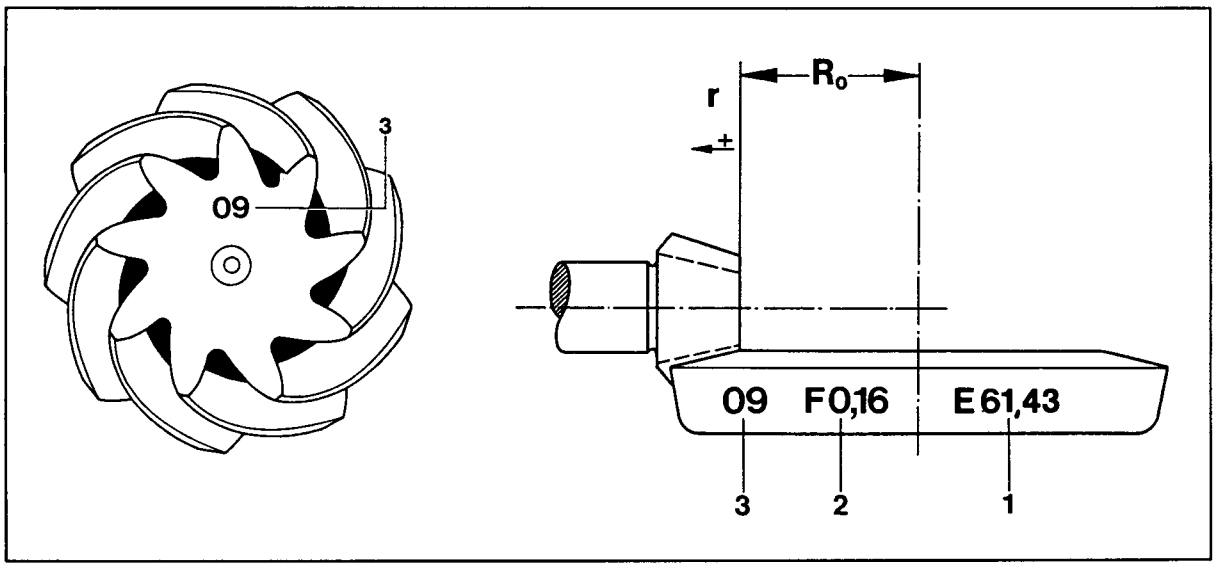
Correct results may only be achieved if assembly work and measuring procedures are carried out carefully and with maximum cleanliness.

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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, whereby the ring gear is kept within the tolerance of the prescribed tooth backlash. Deviation "r" from the specified design dimension "Ro" is measured, added to the design dimension "Ro" and embossed on the ring gear as setting value "E".



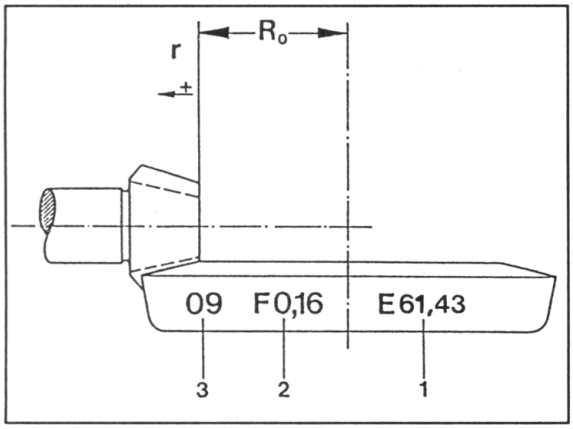
R_o = Design dimension (61.00 mm) 215-39
r = Deviation r
1 = Setting value (Ro + r), e.g. E 61.43
2 = Backlash, e.g. F 0.16
3 = Matching number

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Adjust drive pinion

Note

The setting value "E" is indicated on the ring gear.



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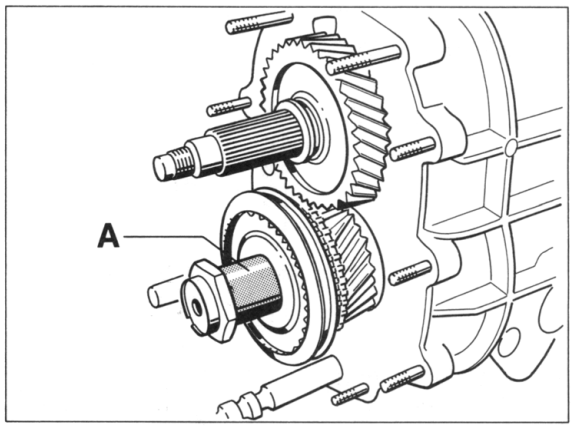
1 = Setting value "E"

1. Install complete gear set without "S_3" shims and tighten all tensioning plate hex nuts to **23 Nm** (16.9 ft.lb).

2. Fit gear housing and locate with three nuts.

3. Install and engage fifth gear.

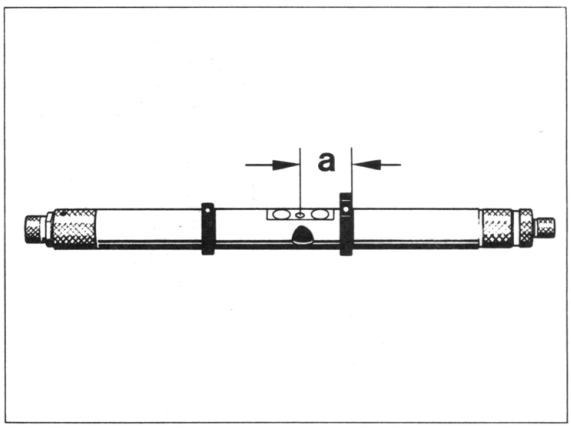
4. Block input shaft with special tool 9253 and tighten drive pinion collar nut to 250 Nm (183.25 ft.lb).



547-39

A = Suitable pipe section or old bushing removed from 5th gear needle roller bearing

5. Set adjustig ring of measuring mandrel **VW 385/1** to dimension "a".



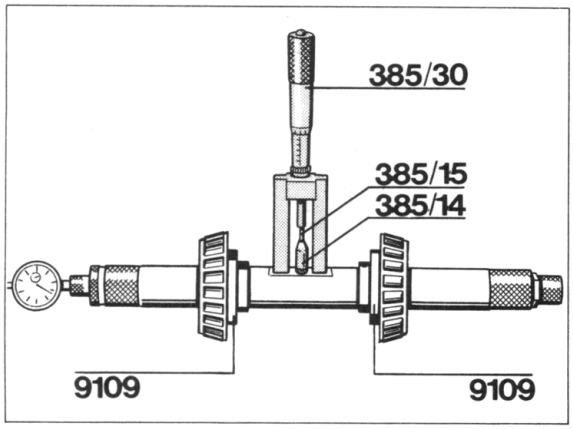
223-39

a = Approx. 65 mm

6. Assemble measuring mandrel with centering disks **9109**, tapered roller bearings, plunger **VW 385 /14** and dial gauge extension **VW 385/15**.

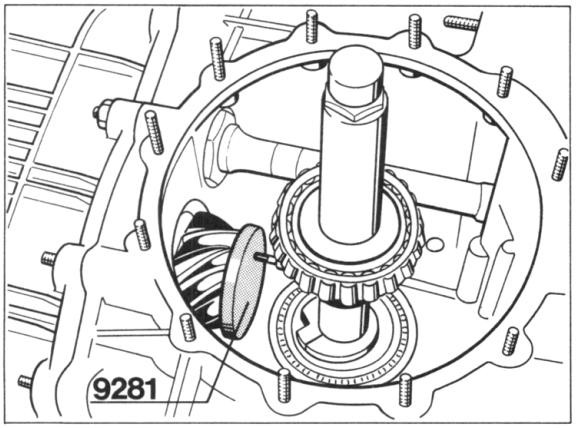
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7. Set measuring mandrel with master gauge **385/30** to adjusting dimension (61.43 mm in the example). Set dial gauge (3 mm measuring range) to zero with 1 mm preload.



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8. Put gauge block plate **9281** on drive pinion head and insert measuring mandrill into transmission case. Dial gauge extension is located in the area of the gauge block plate.



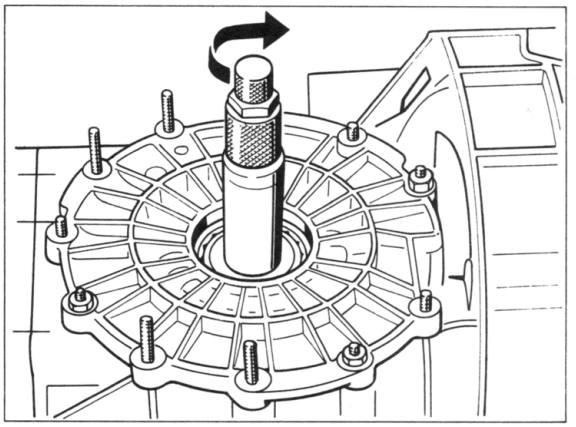
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9. Fit side transmission cover without O-ring and tighten crosswise with 4 nuts.

Note

Do not use a hammer when fitting the side transmission cover (the gauge block plate held by magnets might fall off). Fit cover in installation position only by tightening the nuts uniformly.

10. Pull second centering disk with spindle towards the outside until the measuring mandrel can just be turned by hand.



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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 reaches maximum deflection (reverse point) and the dial gauge must be read.

Note

The measured value always deviates from the set dimension clockwise (the smaller pointer on the dial gauge is between 1 and 2), i.e. if the dial gauge is set with a preload of 1 mm, the value deviating from 1 is taken as shim thickness "S_3".

Example:

If the small pointer on the dial gauge is between 1 and 2 and the large pointer indicates 0.37 mm, then 0.37 mm is the shim thickness (with 1 mm gage preload) to be inserted. Always round up or down to the nearest 0.05 mm (e.g. 0.37 mm to 0.35 mm).

12. After inserting the necessary shims, check the setting value "E" again. A deviation of ± 0.03 mm is permissible.

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Adjusting ring gear

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

The ring gear must be adjusted if the

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

Note

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

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

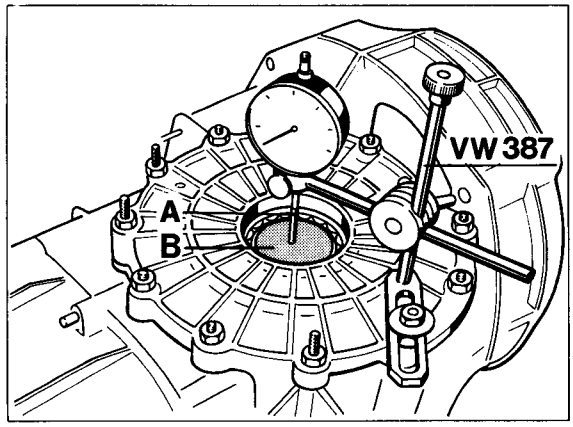
2. Fit one spacer ring (2.5 mm thick) on the ring gear side and opposite side of the differential to be used.

3. Insert differential into transmission case and rotate several times.

4. Fit side transmission cover without seal and tighten all hex nuts to 23 Nm (16.9 ft.lb).

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

6. Fasten universal dial gage holder **VW 387** with dial gauge and extension to the case and set to 0 with 2 mm preload.



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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." = Fitted shim thickness
   + measure value
   + pressure fit of the tapered roller bearing

Example

Thickness of shims inserted	5.00 mm
Measured value	0.75 mm
Pressing (constant value)	0.40 mm
"S tot."	6.15 mm

9. Remove differential, pull off both tapered roller bearings and split calculated shim thickness "S tot." as follows.
Select spacer S_1 0.70 mm thinner and S_2 0.70 mm thicker as a starting point for subsequent adjustment of the backlash.

Example

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

Thickness of spacer S_1

$$\frac{6.15 \text{ mm}}{2} = 3.075 \text{ mm}$$
$$- 0.700 \text{ mm}$$
$$2.375 \text{ mm}$$

Thickness of spacer S_2

$$\frac{6.15 \text{ mm}}{2} = 3.075 \text{ mm}$$
$$+ 0.700 \text{ mm}$$
$$3.775 \text{ mm}$$

Note

Spacers are available in thicknesses of 1.6 to 3.1 mm in increments of 0.10 mm.

By using a 0.25 mm shim the shim thicknesses may graduated in increments of 0.05 mm.

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

Example:

Calculated thicknesses

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

Rounded down ring thickness

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

Measure shims with a micrometer in several places. Permissible deviation 0.02 mm. Also check shims for burrs and damage.

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Adjusting circumferential backlash

Note

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

1. Mount gear set using shims "S_3" determined while adjusting the drive pinion.

Note

Make sure that the collar nut of the drive pinion is tightened to **250 Nm** (183.25 ft.lb) before measuring backlash.

2. Insert differential with tapered roller bearing and shims (S_1 + S_2) into the housing.

3. Fit side transmission cover and tighten all hex nuts to **23 Nm** (16.9 ft.lb).

Note

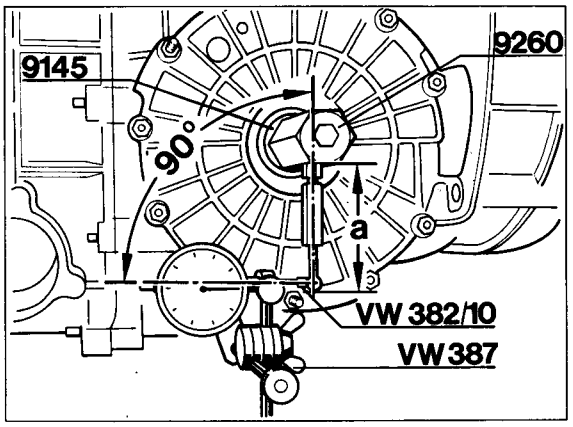
Always make sure that there is a certain amount of backlash when tightening the nuts. Never allow the drive pinion to seize.

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 picture.

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 settle the tapered roller bearings.

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.



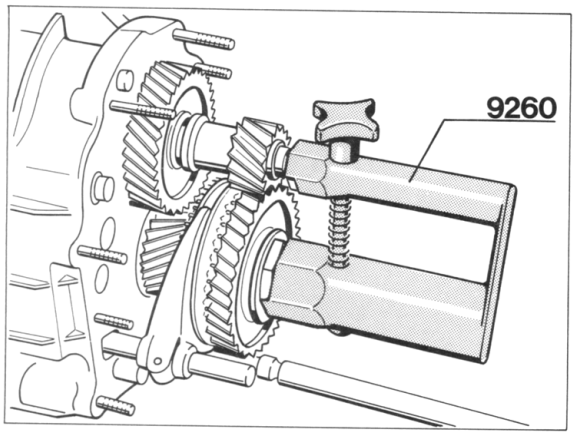
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Dimension "a" = Approx. 80 mm

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

Note

When carrying out measurements, the drive pinion must be blocked with Special Tool 9260.



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9. After turning the ring gear a further 90°, 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 embossed on the ring gear. The actual value may be less than the specified value by 0.05 mm. Under no circumstances may 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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