

Technical Manual

Boxster

Technical Information

Repair

Contents:

Group 3

Transmission, manual transmission

Foreword

The workshop documentation for the Boxster model has the designation "**Boxster**" **Technical Manual** and contains **Technical Information** as well as instructions on **Repairs**.

The integration of the technical information published in the "Boxster" Technical Manual with the descriptive matter on repairs provides the user with a complex reference work that combines into one book associated or cross-referenced material of relevance to workshops and originating from various information media.

The "Boxster" Technical Manual consists of 15 folders, subdivided into the following Groups

0	Entire vehicle – General
0	Diagnosis, part 1 (up to Repair Group 45) * ¹
0	Diagnosis, part 2 (as of Repair Group 69) * ²
1	Engine, part 1 (up to Repair Group 13) * ³
1	Engine, part 2 (as of Repair Group 15) * ⁴
2	Fuel, exhaust, engine electronics
3	Transmission, manual transmission
3	Transmission, automatic transmission
4	Running gear
5	Body
6	Body equipment, exterior
7	Body equipment, interior
8 / 9	Air conditioning / Electrics
9	Circuit diagrams, part 1 (up to and including the '99 model) * ⁵
9	Circuit diagrams, part 2 (as of the '00 model) * ⁶

- *¹ The two folders with Group 0 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 0 – Diagnosis, part 1" (**up to Repair Group 45**).
- *² The **second folder** "Group 0 – Diagnosis, part 2" (**as of Repair Group 69**) includes the further Repair Groups belonging to Group 0.
- *³ The two folders with Group 1 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 1 – Engine, part 1" (**up to Repair Group 13**).
- *⁴ The **second folder** "Group 1 – Engine, part 2" (**as of Repair Group 15**) includes the further Repair Groups belonging to Group 1.

- | *5 The two folders with Group 9 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 9 – Circuit diagrams, part 1" (**up to the '99 model**).
- *6 The **second folder** "Group 9 – Circuit diagrams, part 2" (**as of the '00 model**) includes the further circuit diagrams belonging to Group 9.

The "Boxster" Technical Manual has the same structure in each folder, with the following breakdown for all Groups:

Title page, "Boxster" Technical Manual

> Foreword

Title page: "Technical Information"

> Table of Contents, Technical information
> Technical information

Title page: "Repair"

> Repair Groups: overview
> Table of Contents, repairs
> General / technical data
> Instructions on repairs

As can be seen from the breakdown, the published Technical Information is in the front part of each folder – numbered according to the Groups. The Table of Contents assigned to each Group will be periodically updated.

Following the Technical Information, separated by a title page, the instructions on repairs – assigned according to the Groups or broken down into Repair Groups – are included in the folder.

The instructions on repairs will be extended and updated by means of supplements.

Note

Sheets that already exist in the "Boxster" Technical Manual and are updated or revised and thereby exchanged by a supplement are designated "Replacement sheet". Revisions or technical modifications on pages of these replacement sheets are identified for the user with a vertical bar at the margin.

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3 Transmission, manual transmission**3 Power transmission**

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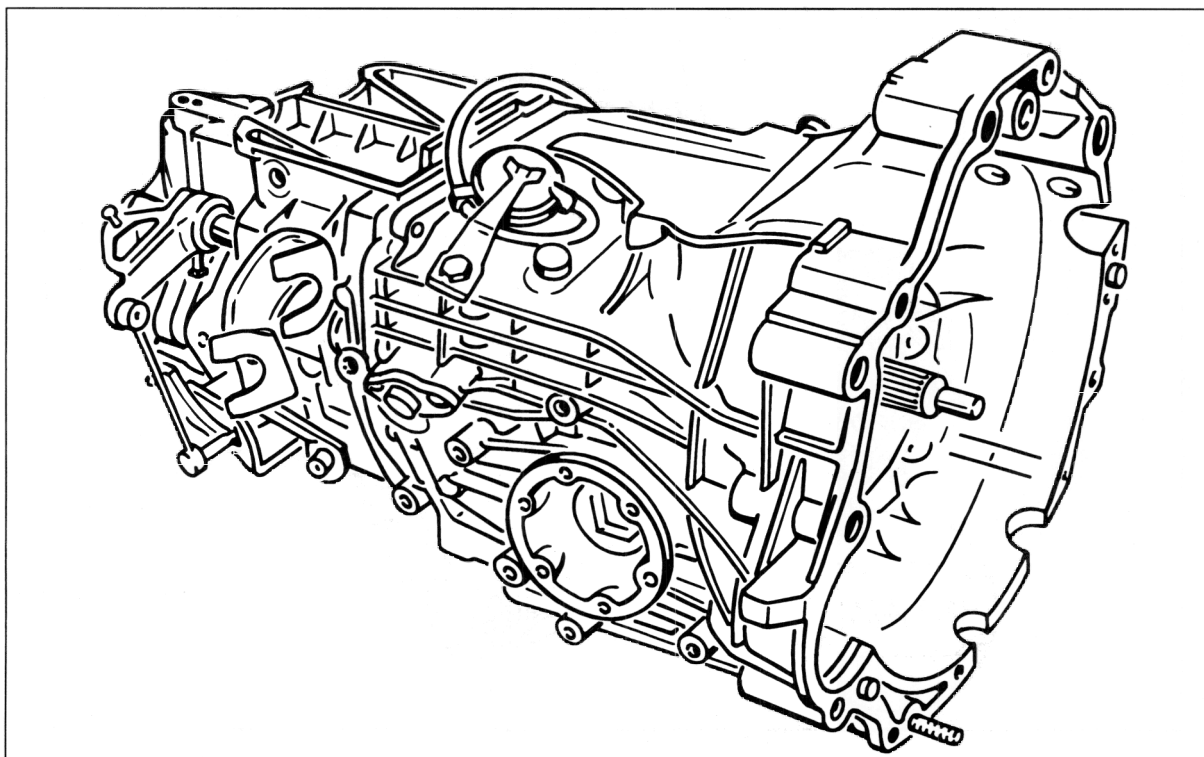
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3 Technical data (transmission G 86)

5-speed manual transmission G 86

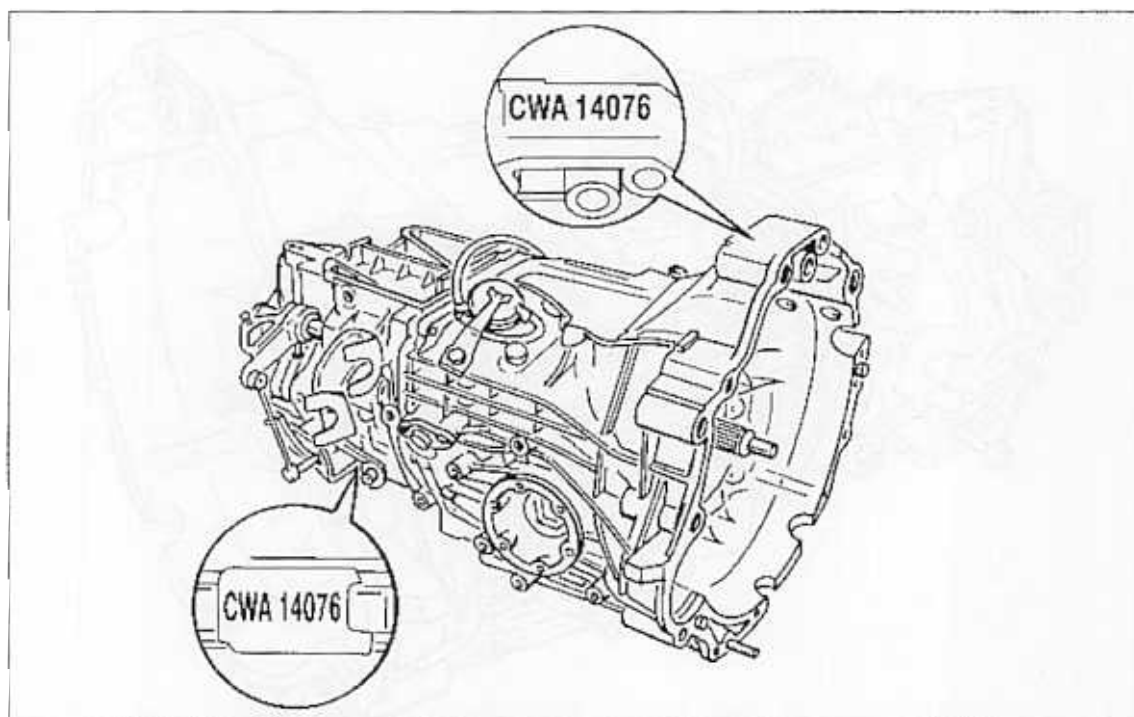


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Type	Code letter	Equipment	Installed in	Model year
G 86/00	CWA	5-speed	Boxster	97/98
G 86/00	DVY	5-speed	Boxster	99
G 86/01	EFD	5-speed	Boxster	00

Technical data (transmission G 86)

Identification of the transmission G 86



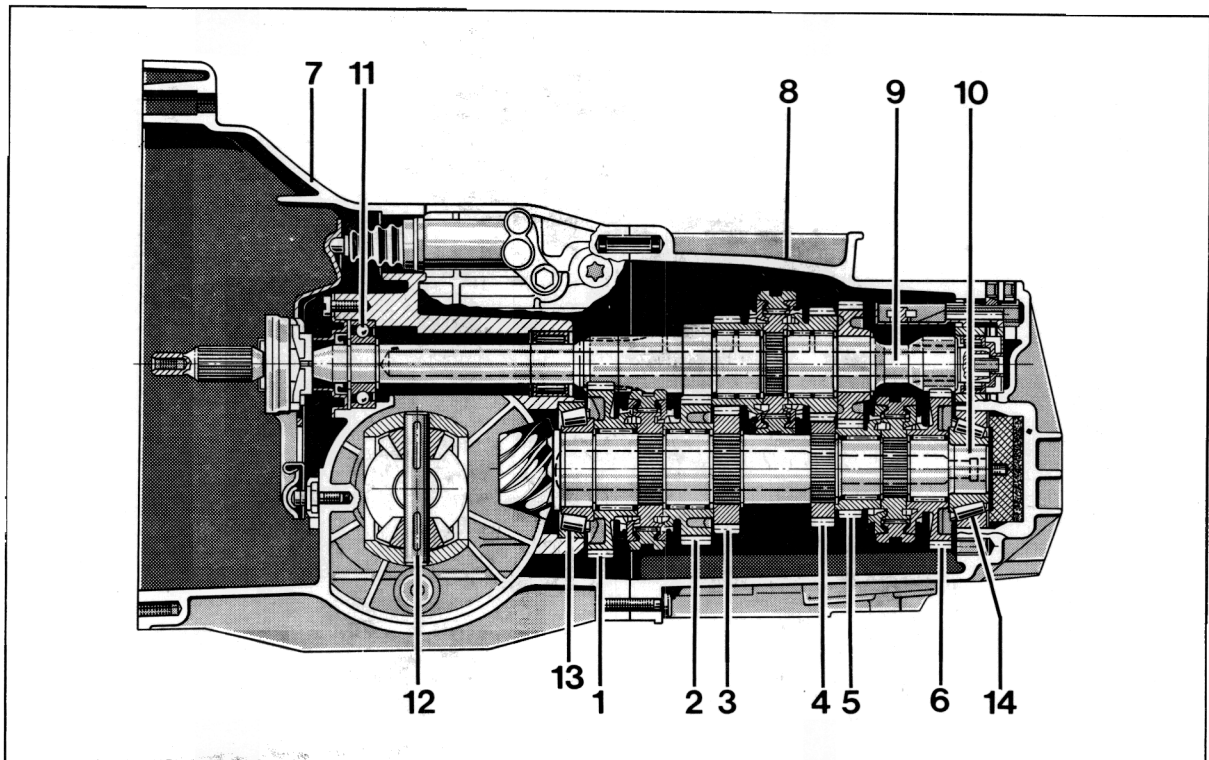
171_g 96

Identification and construction date of the transmission:

Example: CWA 14 07 6

CWA	=	Code letter
14	=	Day
07	=	Month (July)
6	=	Year (1996) of manufacture

Technical data (transmission G 86)



- | | |
|--------------------------|-----------------------------|
| 1st gear | 8 - Transmission case cover |
| 2 - 2nd gear | 9 - Input shaft |
| 3 - 3rd gear | 10 - Output shaft |
| 4 - 4th gear | 11 - Ball bearing |
| 5 - 5th gear | 12 - Differential |
| 6 - Reverse gear | 13 - Tapered roller bearing |
| 7 - Transmission housing | 14 - Tapered roller bearing |

Technical data (transmission G 86/00/01)**Manual transmission**

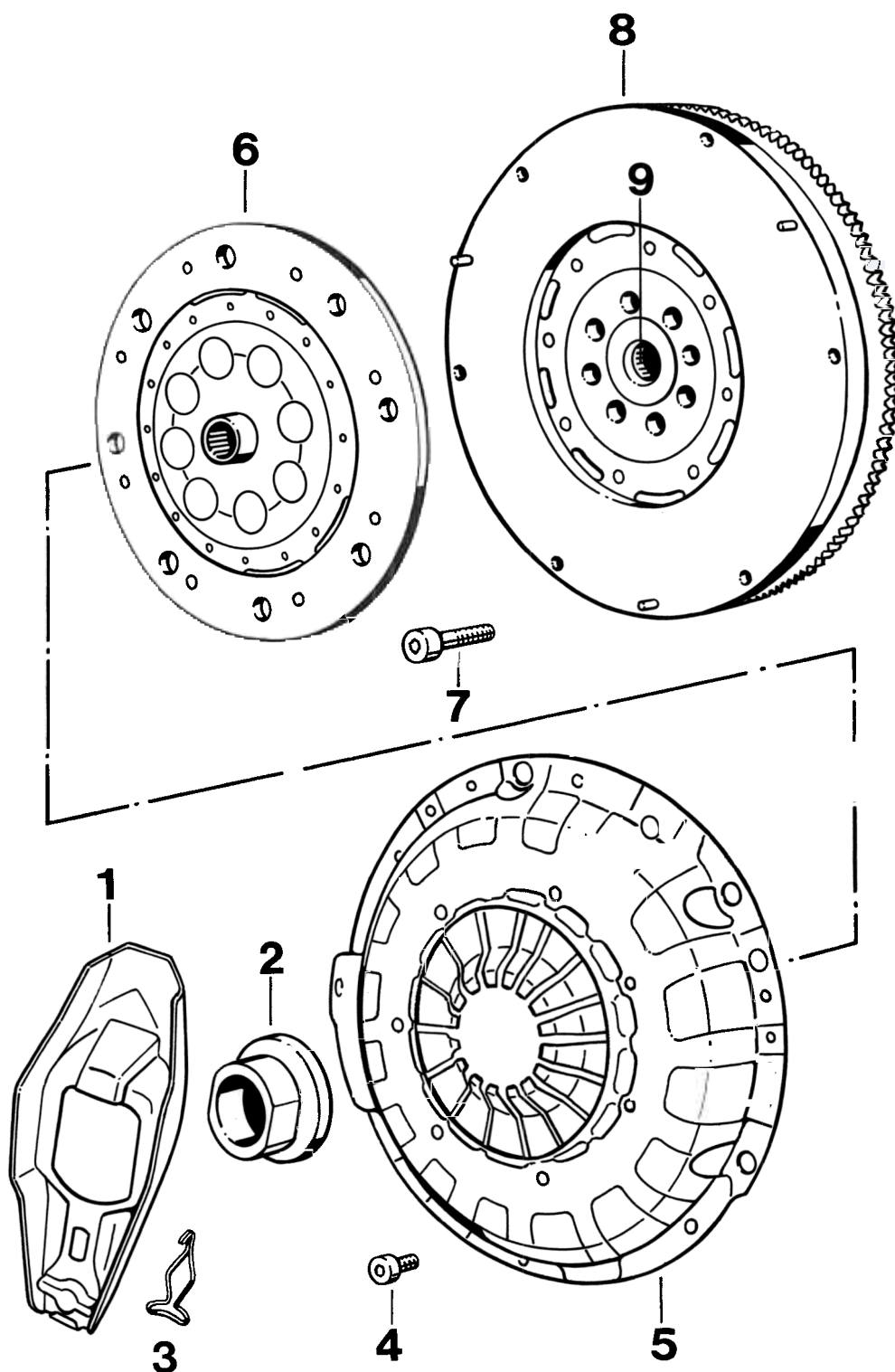
General data	Manual transmission G 86/00	Manual transmission G 86 01
Transmission ratios	$Z_1:Z_2=Z_2:Z_1$	$Z_1:Z_2=Z_2:Z_1$
1st gear	10:35=3.500	10:35=3.500
2nd gear	17:36=2.117	17:36=2.117
3rd gear	28:40=1.428	28:40=1.428
4th gear	34:35=1.029	33:36=1.090
5th gear	38:30=0.789	37:31=0.837
Reverse gear	9:31=3.444	9:31=3.444
Final drive	hypoid bevel gear drive with 12 mm offset	
Transmission ratio, final drive	9:35=3.889	9:32=3.555
Filling capacity	2.25 l transmission oil	2.25 l transmission oil

Technical data (transmission G 86)**Tightening torques**

Location	Thread	Tightening torque Nm (ftlb.)
Screw plug, oil drainage and oil filling	M24	25 (18)
Guide sleeve for release bearing on transmission housing	M8	35 (26)
Retaining plate, reversing light switch on transmission housing	M8	25 (18)
Plug, reversing light switch on transmission housing	M8	10 (7)
Transmission case cover on transmission housing	M8	25 (18)
Switch interlock on transmission housing	M8	25 (18)
Screws for relay shaft on transmission housing	M22 M26	40 (29) 40 (29)
Torx screw for reverse idler shaft	M8	35 (26)
Cover for interior shift rod on transmission housing	M8	20 (15)
Interlock (5th and reverse gears) on transmission housing	M8	10 (7)
Ball journal for release lever on transmission housing	M8	25 (18)
Cover for final drive on transmission housing	M8	25 (18)
Crown wheel on differential housing	M10	60 (45) + 45° rotary angle

Location	Thread	Tightening torque Nm (ftlb.)
Bracket for shift cables on transmission housing	M10	45 (33)
Rocker holder on transmission housing	M8	23 (17)
Gearshift lever on interior shift rod	M6	23 (17)
Transmission on engine	M12	85 (63)
	M10	45 (33)
Transmission support on transmission housing	M10	65 (48)
Hydraulic mount on support side part	M8	25 (18)
Drive shaft on transmission flange	M8	39 (29)
Clutch slave cylinder on transmission	M8	23 (17)

Disassembling and assembling clutch



No.	Designation	Qty.	Removal	Note:	
				Installation	
1	Release lever	1			
2	Release bearing	1			Do not wash out bearings. Replace noisy bearings. Do not grease sliding surface of release bearing or guide tube
3	Retainer spring				
4	Cylinder-head bolt	6		Note The bolts always must be tightened and loosened in several steps and crosswise in order to prevent deformation of the thrust-plate housing	
5	Thrust plate				
6	Drive plate	1			Centre with mandrel, VW special tool 3176
7	Pan-head screw M10 x 1 x 50	8			Initial torque 25 Nm (18 ftlb.) Final torque 90°
8	Double-mass flywheel	1			Ensure the centring pin is seated firmly
9	Needle bush				

30 01 07 Bleeding the clutch system

Important notes

The clutch hydraulics must always be filled or bled using a pressure filling and bleeding device. Furthermore, the bleeder valve must be opened sufficiently and the gauge pressure must be approx. 1.5 bar.

Before the system is filled or bled, the clutch pedal must be in the **"pedal fully depressed"** position.

Important: As there is no system pressure, servo kinematic effects will cause the clutch pedal to move forward abruptly. In order to avoid damage, the pedal must be guided manually.

Bleed the system until no more bubbles appear at the bleeder valve (use a collecting bottle with transparent hose).

If the system was open previously (e.g. for component replacement), the **minimum filling or bleeding time must be 30 seconds**.

Filling/bleeding

1. Fill the fluid reservoir up to the upper edge with new brake fluid.

Connect bleeding device to the fluid reservoir.

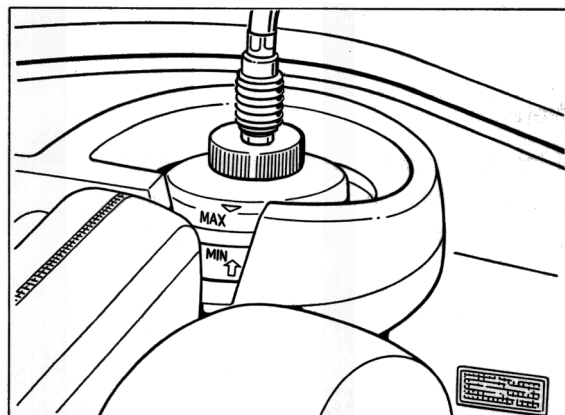
Note

Use only new DOT 4 brake fluid.

This brake fluid is available under the **following part number:**

Container quantity 1 litre = 000.043.203.66

Container quantity 30 litres = 000.043.203.67

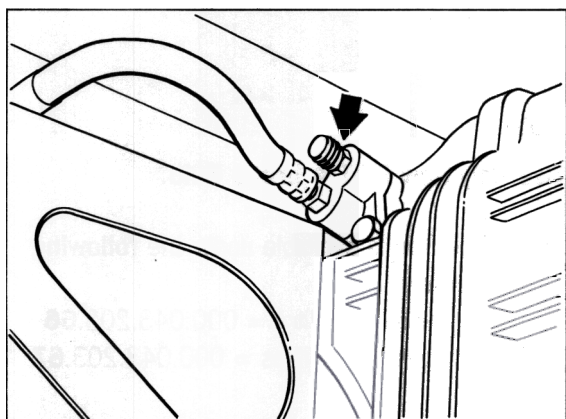


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2. Move pedal to the fully depressed position. When doing so, guide the pedal by hand so that it does not move forward abruptly.
3. Switch on the bleeding device. Bleeding pressure approx. 1.5 bar.

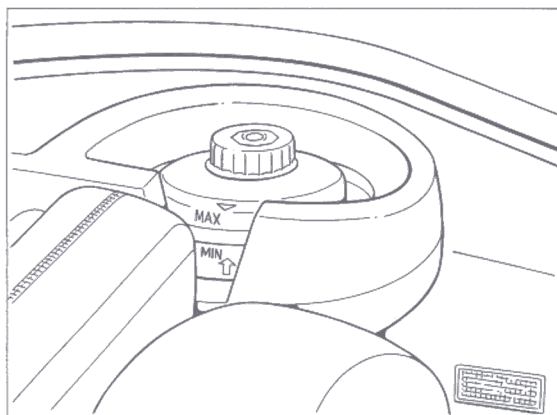
4. The bleeder valve on the clutch slave cylinder must be opened until clear, bubble-free brake fluid emerges.

Use a collecting bottle for precise examination of the emerging brake fluid for cleanliness and freedom from bubbles.



690/1 - 96

5. Switch off and disconnect the bleeding device. Correct the brake fluid level if necessary.



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Note

If the system was open previously (e.g. for component replacement), the minimum filling or bleeding time must be 30 seconds.

30 05 19 Removing and installing the clutch pedal

Important notes

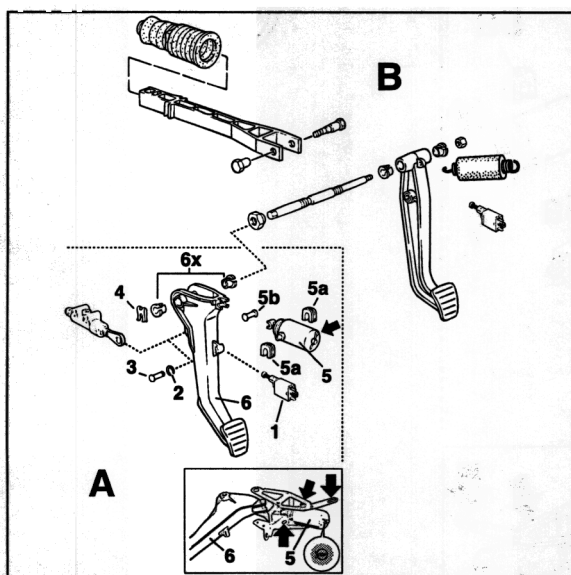
The description below applies to left-hand drive vehicles.

On right-hand drive vehicles, the clutch pedal lever is located directly next to the brake pedal (separated by the steering outer tube in the case of left-hand drive vehicles).

Assembly/disassembly for right-hand drive vehicles is similar to the procedure for left-hand drive vehicles.

Before the start of disassembly work on the pedals, the clutch boost spring must be fixed with a cotter pin (arrow at No. 5).

Important: secure the cotter pin (bend it over).



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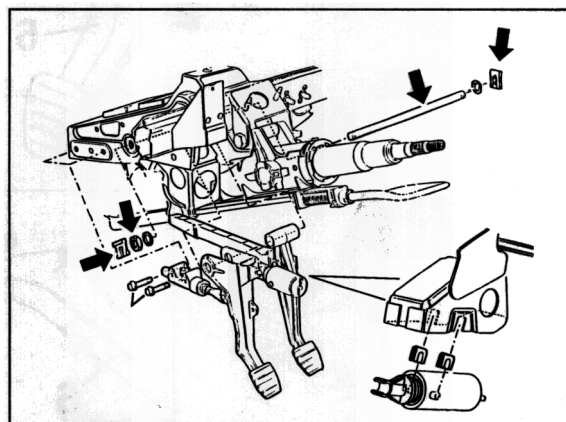
Pedal-group versions (distinction)

1. The pedals of Boxster vehicles **as of** Mod. '98 (as of Mod. W) are identical to the 996 pedals, with the exception of the boost spring and boost-spring bracket.
2. The Boxster pedals **before** Mod. '98 (before Mod. W) differ from the pedals **as of Mod. '98** in the following respects:

Bracket for clutch boost spring cannot be unscrewed. Consequently, the boost-spring bracket cannot and need not be adjusted. Furthermore, the distance between the bearing pins of the boost spring is 3 mm less.

Pedal bearing axle with different fastening method **>arrows<** (clamping of the steering outer tube and fixing of the pedal-bearing axle)

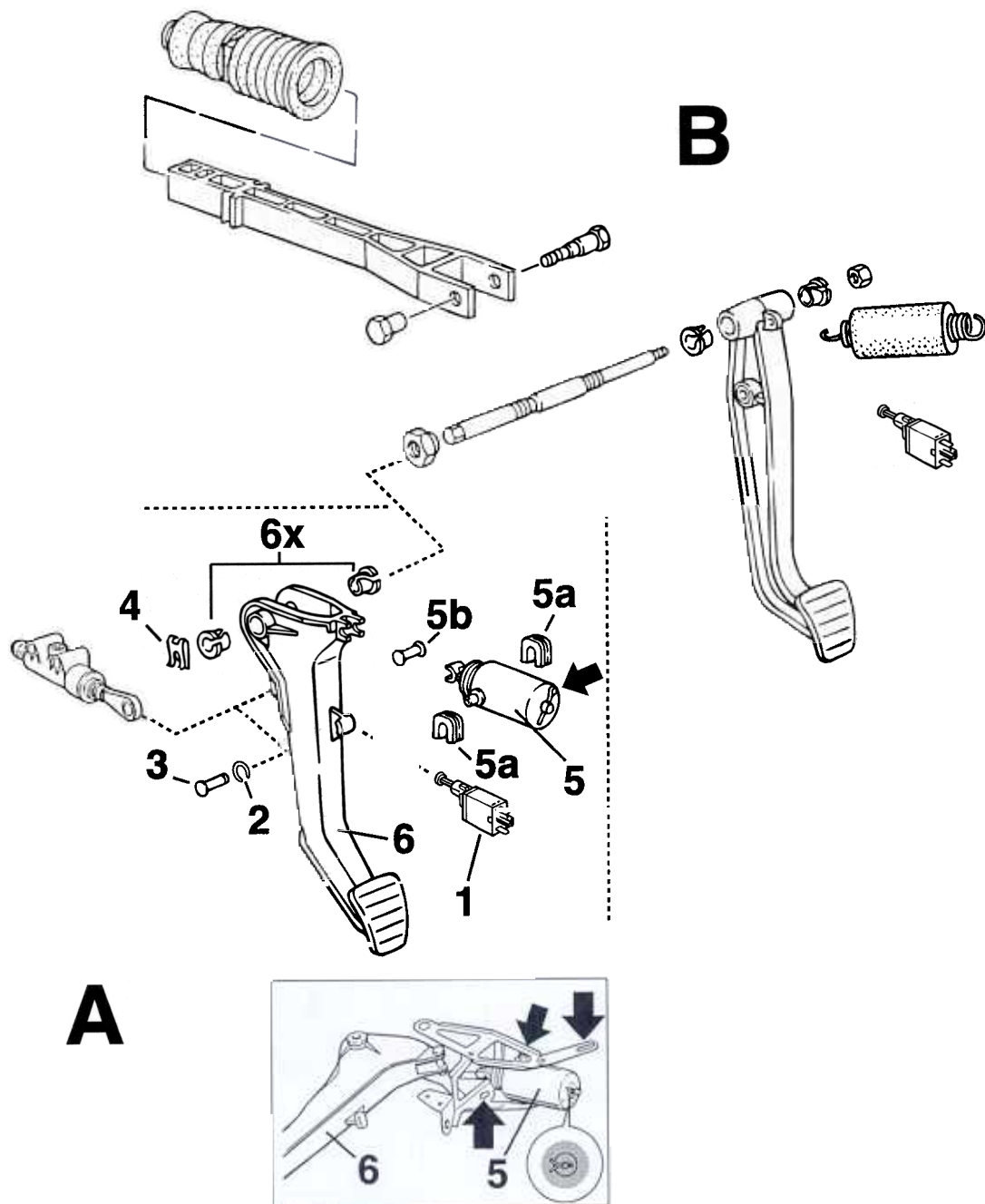
No return spring on the brake pedal



32_1_98

Boxster pedals before Mod. '98

Removing and installing the clutch pedal



465_98

A = Clutch pedal area
B = Brake pedal area

A = Clutch pedal area

No.	Designation	Qty.	Removal	Note:
				Installation
1	Switch	1	Release by turning 90°, and pull out of the installation opening	Before installation, pull operating plunger out of the switch as far as it will go
2	Retaining clip	1		Replace if necessary
3	Pin	1		
4	Clamp	1		Replace
5	Boost spring with bracket (bracket cannot be removed before Mod. '98)			
1			Secure boost spring with cotter pin (arrow at No. 5) Insert the cotter pin (ø 3 mm) into the assembly bore and bend over ends. Then undo the three fastening nuts of the bracket (arrows) and remove the boost spring together with bracket and clutch pedal lever (No. 6)	Install the assembly consisting of bracket, boost spring and clutch pedal lever. Observe proper allocation when replacing the boost spring.** Observe assembly and adjustment specification for the bracket (assembly instructions under Installation, step 3)
5a	Boost spring bearing	2		Replace if necessary. Always observe note with regard to greasing**
5b	Pin	1		Always observe note with regard to greasing**
6	Clutch pedal lever	1	Remove together with boost spring No. 5 and bracket	
6X	Bushings	2	Remain in the clutch pedal lever	Check, replace if necessary. Lubricate. Use grease specified*

Lubricate the bushings of the clutch and brake pedals (6X and 14X) with "Optimol, Optitemp LG 2" grease, part No.: 000.043.203.37 (delivery quantity: 80 g tube).

*Information can be found in Repair Group 30 – Serv. No. 30 Clutch boost spring: allocation and grease specification. In the case where lubricating the boost spring bearing surfaces is not permissible, the assembly instructions under Installation, steps 2.1 and 2.2 can also be followed.

Notes on removal and installation

Removal



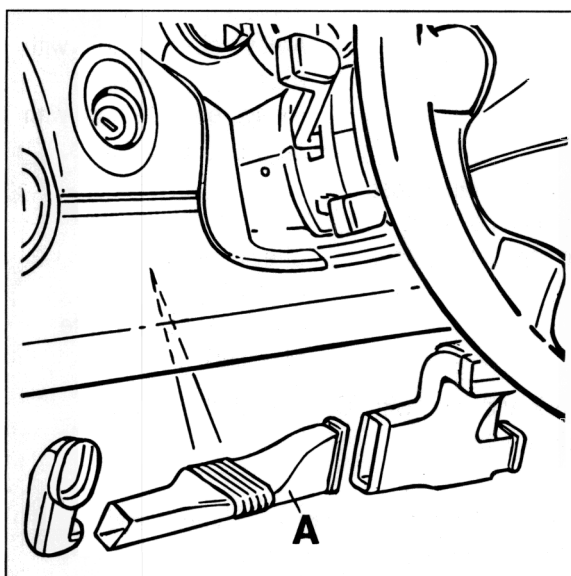
Warning

Danger of injury and damage during disassembly and assembly work!

Clutch boost spring can disassemble automatically!

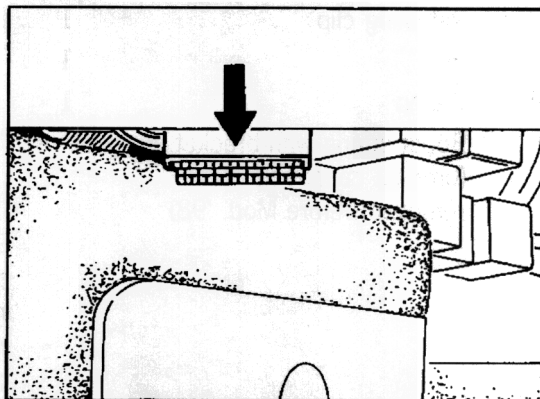
Before the start of disassembly work in the area of the clutch pedal lever (exception: clutch pedal switch), the clutch boost spring must be fixed with a cotter pin (Fig. 478_98).

1. Disconnect battery ground cable.
2. Remove driver's seat (to facilitate work).
3. Remove air duct (A).
The air duct is plugged in.



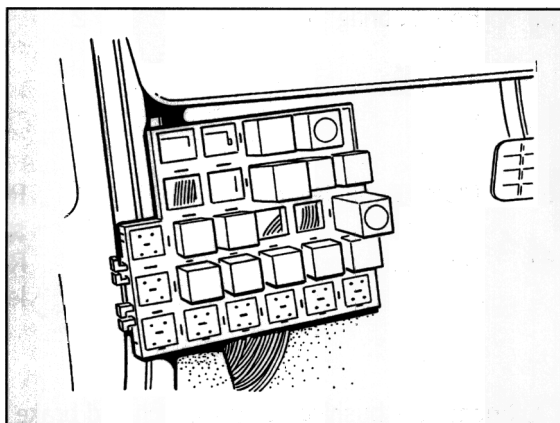
290_1_97

4. Detach diagnostic socket.



12_96

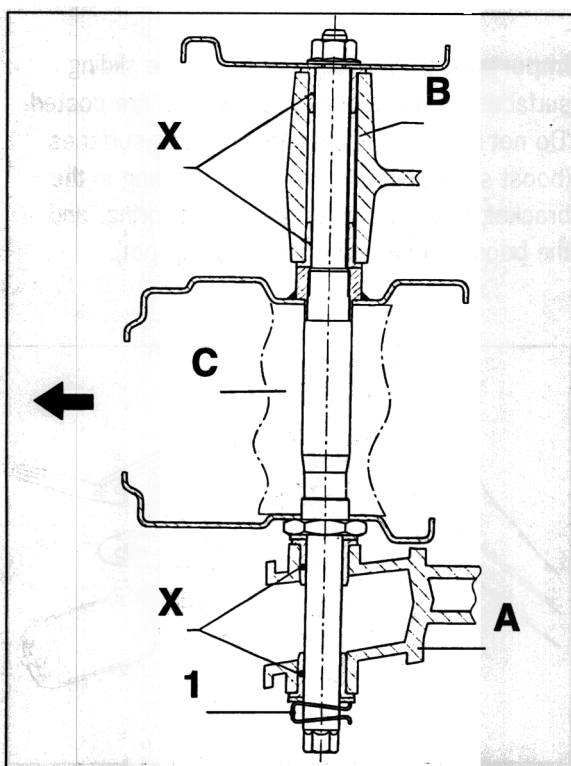
5. Detach relay carrier, unclip and lower into the footwell.



86_98

6. Release clutch pedal switch by turning it 90° and pull it out of the installation opening.

7. There is an assembly bore in the guide rod for the clutch boost spring. Insert a 3 mm \varnothing cotter pin in this bore, and bend over the ends (securing: refer to Fig. 478_98).
8. Remove pin between the clutch push rod and clutch pedal lever.
9. Remove retainer (1) on the pedal bearing axle.



A – Clutch pedal lever
B – Brake pedal
C – Steering outer tube
X – Bearing bushings

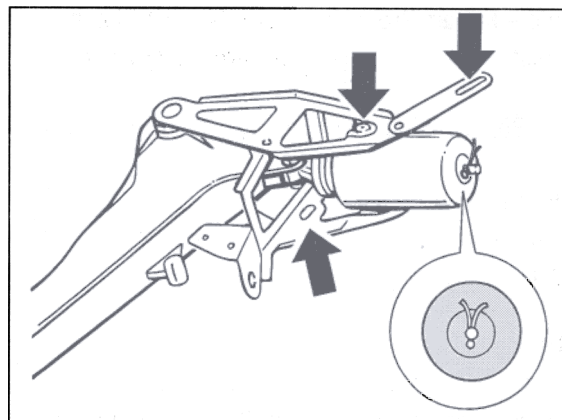
1 – Retainer

466_98

10. Undo fastening nuts from boost spring bracket (arrows).

Requirement: Boost spring secured with a cotter pin.

Remove clutch pedal lever together with boost spring and bracket. The bracket is not removable on the Boxster before Mod. '98.



478_98

Installation

1. Inspect all bearing bushings X for clutch pedal lever and replace them if necessary. Lubricate sliding surfaces of the bearing bushings X (Fig. 466_98) and the pedal bearing axle with Optimol, Optitemp LG 2, part No. 000.043.203.37.
2. Assemble boost spring, bracket and clutch pedal lever.
Description in 2.1 or 2.2.
2.1 Boxster Mod. '98 / partly Mod. '99
2.2 Boxster from current Mod. '99

Note

Different types of boost springs can be fitted in the Boxster.

Observe proper allocation when replacing the boost spring and/or the bracket.

In some cases, a modified (optimised) clutch pedal must also be used when replacing the boost spring.

Lubricating the boost spring bearing surfaces is sometimes necessary and sometimes prohibited (according to boost spring version).

Information can be found in the Technical Manual – Repair Group 30, Serv. No. 30 Clutch boost spring: allocation and grease specification.

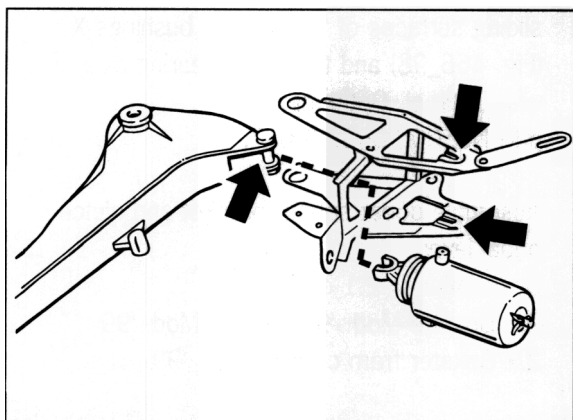
2.1 Boxster Mod. '98 / partly Mod. '99

Identification/distinction:

Boost-spring push rod open on one side, boost spring components not coated.

Grease pin for boost spring (arrow) with mating bearing on the boost spring push rod, the boost spring bearing (arrows) and the bearing pins on the boost spring with Optimol, Optitemp LG 2; part No. 000.043.203.37.

First remove old grease with solvent naphtha.



Lubrication necessary (arrows)

31_1_98

2.2 Boxster from current Mod. '99

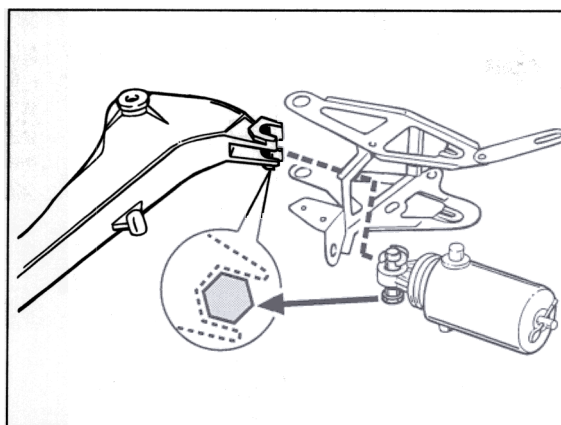
Identification/distinction:

Push rod closed / boost spring components coated.

The date of introduction for this boost spring is contained in the Parts Catalogue.

Engage the hexagon-socket bolts of the boost spring into the hexagon on the clutch pedal (arrow).

Important: Do not lubricate since the sliding surfaces of this boost spring version are coated. 'Do not lubricate' applies to all sliding surfaces (boost spring pins, boost spring bearing in the bracket, bearing pins on the boost spring, and the boost spring in the boost spring pot).



Do not lubricate (prohibited)

467_98

Note

Silver bracket (986.423.571.00) and boost spring with white marking (986.423.081.08 Mod. '98 / partly Mod. '99 or 986.423.081.11 from current Mod. '99) must be used only in this combination and installed only in the Boxster.

3. Installation and adjustment specification for boost spring bracket.
 Install preassembled boost spring bracket with clutch pedal lever.
 Not valid for Boxster vehicles before Mod. '98 (bracket cannot be unscrewed or adjusted).

To do this:

Step 1:

Tighten the three fastening nuts (arrows) only slightly (the bracket must still be movable).

Step 2:

Tighten the clutch master cylinder to 10 Nm (7.5 ftlb.) (if the clutch master cylinder was detached).

Step 3:

Press the clutch pedal against the direction of travel until the pull stop in the clutch master cylinder is reached.

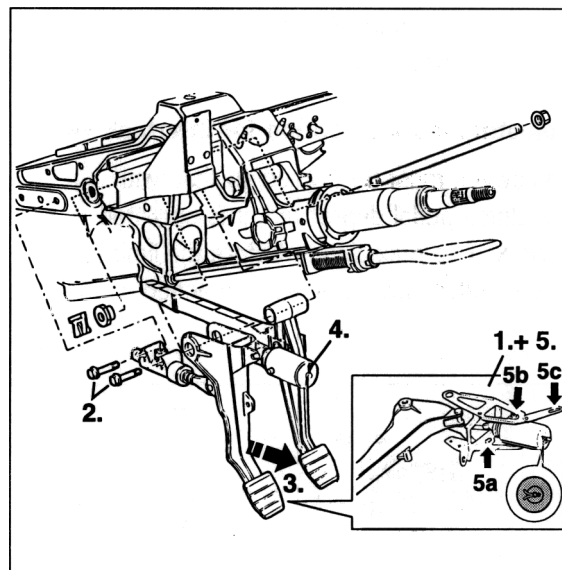
Step 4:

Remove cotter pin (retaining pin) on the spring cup so that the clutch pedal is pressed against the rubber stop in the boost spring bracket.

Step 5:

The bracket is screwed down with the clutch pedal pressed back (to make full use of the slots). Tighten hexagon nuts (arrows) in the prescribed sequence. Tightening torque: 7.5 Nm (5.5 ftlb.).

Sequence: 5a / 5b / 5c



32_98

Note

The push rod of the clutch save cylinder should **not** be lubricated in general (for all versions).

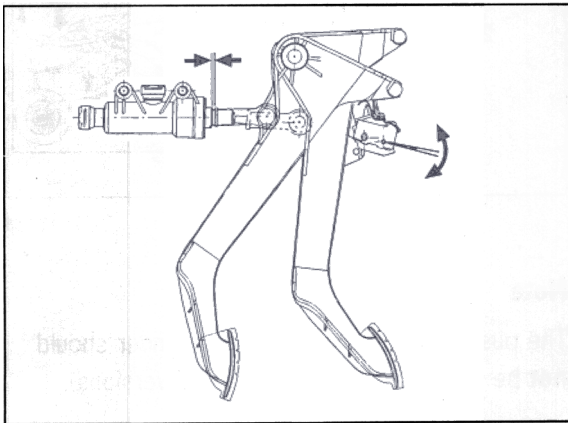
4. Fit new retainer on the pedal bearing axle.
 On vehicles as of Mod. '98, subsequently secure the retainer by wedging it with a mandrel.

5. Install clutch pedal switch.
 First pull operating plunger out of the switch as far as it will go.
 By means of its self-adjustment function, the switch then compensates for tolerances in the pedals.

6. Check the interlock switch adjustment on vehicles with interlock.

Adjustment specification for interlock switch:

The switch must be aligned so that, with the clutch pedal depressed, it is operated approx. 1 to max. 2 mm before the limit stop of the clutch slave cylinder is reached.



49_98

7. Install relay carrier, diagnostic socket and air duct.
8. Perform a function test on clutch and brake operation.

30 Clutch boost spring: allocation and grease specification

1. Boost spring bracket allocation

1.1 Boxster before Mod. '98

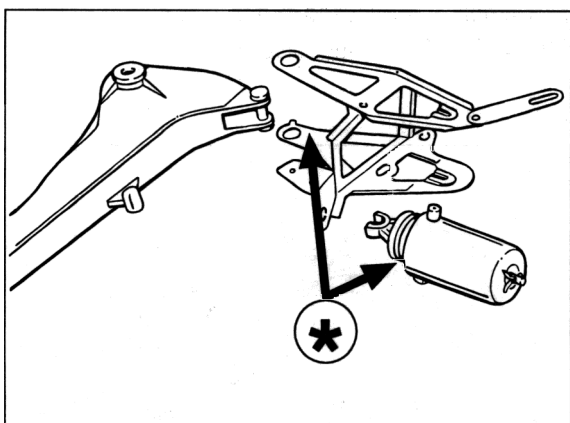
The bracket for the boost spring **cannot** be unscrewed.

1.2 Boxster as of Mod. '98

Silver bracket (986.423.571.00) and boost spring with **white** marking (986.423.081.08 or 986.423.081.11 / see boost spring allocation) must be used only in this combination and installed only in the Boxster.

Note

The gold-coloured bracket (996.423.571.00) and boost spring with purple marking (996.423.081.09 or 996.423.081.11) are assigned to the 911 Carrera (996) and must **not** be installed in the Boxster.



31_98

* Distinction/identification

2. Standard boost spring allocation

2.1 Boxster up to Mod. '98 (boost spring bracket cannot be unscrewed)

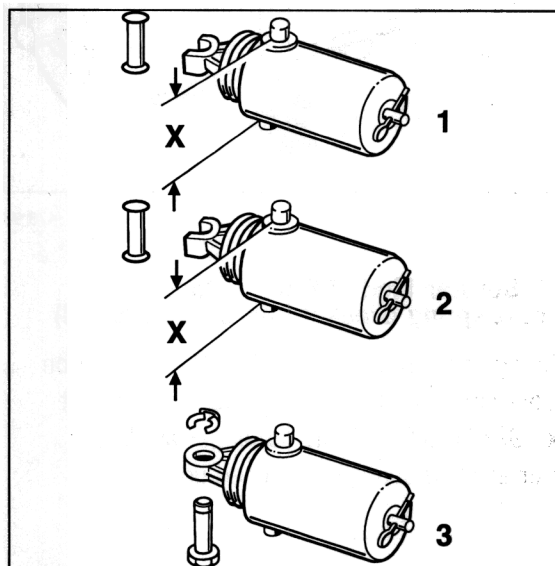
Boost spring **No. 1**. Dimension X approx. 39 mm. Boost-spring push rod open on one side. Observe replacement procedure and grease specification.

2.2 Boxster Mod. '98 partly Mod. '99 (boost spring bracket can be unscrewed)

Boost spring **No. 2**. Dimension X approx. 42 mm. Boost-spring push rod open on one side. Boost spring with **white** marking. Observe replacement procedure and grease specification.

2.3 Boxster from current Mod. '99 (boost spring bracket can be unscrewed)

Boost spring **No.3**. Boost-spring push rod of closed. Boost spring with **white** marking. Observe grease specification (do not lubricate boost spring).

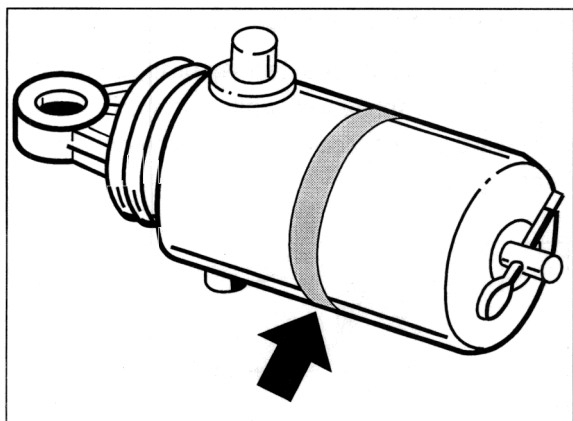


469_98

3. Boost spring: Replacement procedure

3.1 Boxster before Mod. '98 (boost spring bracket cannot be unscrewed)

The standard boost spring **Nr.1** (Fig. 469_98) Spare Part No. 986.423.081.07 is no longer available after existing supplies are used up. The boost spring 986.423.081.12 will be used as a replacement. This boost spring has a closed push rod and should **not be lubricated**. Identifying feature: All-round green ring on the boost spring housing (arrow). The bolt 999.423.315.06 and the fuse 999.166.075.02 for connection to the *previous* clutch pedal are included in the scope of delivery of the boost spring.



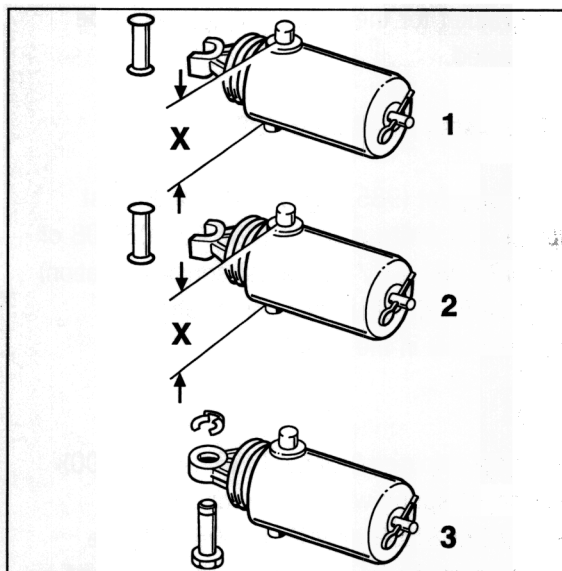
470_98

3.2 Boxster Mod. '98 partly Mod. '99 (boost spring bracket can be unscrewed)

The standard boost spring **No. 2** (push rod on boost spring is open on one side) Spare Part No. 986.423.081.08 is no longer available after existing supplies are used up.

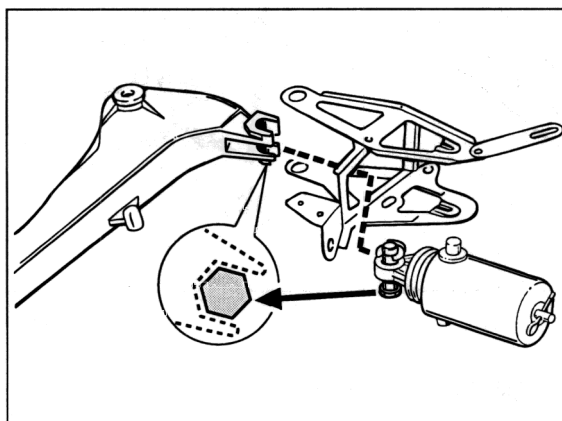
The boost spring **No.3** 986.423.081.11 will be used as a replacement (closed push rod / boost spring painted **white**).

This boost spring should **not be lubricated**.



469_98

When the boost spring No. 3 is installed for the first time, the optimised clutch pedal 996.423.139.09 must also be used.



467_98

Note

The hexagon bolt 999.423.315.06 and the fuse 999.166.022.02 for connection to the optimised clutch pedal are included in the scope of delivery of the boost spring.

This corresponds to the same scope as for the boost spring version No. 3 (from current Mod. '99).

3.3 Boxster from current Mod. '99 (boost spring bracket can be unscrewed)

The boost spring No. 3 (Fig. 469_98) is used as standard and in the event of replacement.

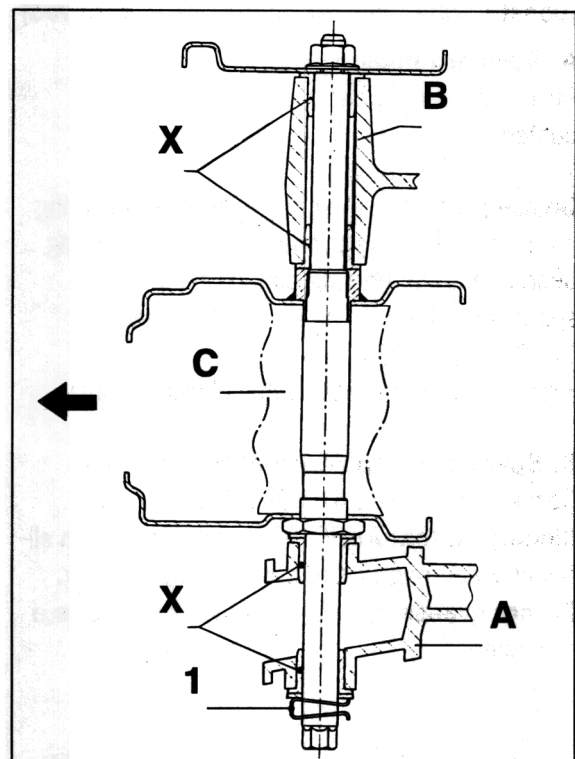
4. Grease specification

It is essential to observe the following grease specification during assembly work on the pedals.

4.1 Pedal bearing axle

Lubrication required in most cases.

Grease the bearing bushings marked X and the pedal bearing axle with Optimol, Optitemp LG 2, Part No. 000.043.203.37.



A – Clutch pedal lever
B – Brake pedal
C – Steering outer tube
X – Bearing bushings

1 – Retainer

466_98

4.2 Push rod of clutch master cylinder

Do not grease, as this could cause damage.

4.3 Spring boost area

Lubrication may be required **or** prohibited, according to the spring boost version.

In general, the following applies: **Do not grease** coated components, as this erodes the coating.

4.3.1 Boxster up to Mod. '98 (boost spring bracket cannot be unscrewed)

A. Standard boost spring:

Push rod open on one side. Component not coated.

Grease pin for boost spring with mating bearing on the boost spring push rod, the boost spring bearing and the bearing pins on the boost spring with Optimol, Optitemp LG 2, part No. 000.043.203.37.

First remove old grease with solvent naphtha.

B. Spare part replacement boost spring

Spare part No. 986.423.081.12.

Identifying feature: Closed push rod and an all-round green ring on the boost spring housing.

Do not grease any areas as the components are coated.

4.3.2 Boxster Mod. '98 partly Mod. '99 (boost spring bracket can be unscrewed)

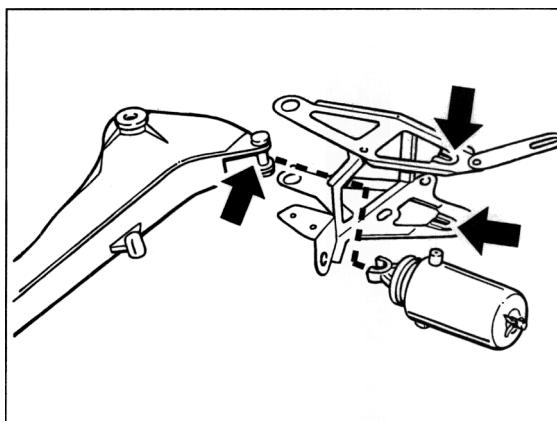
A. Standard boost spring:

Push rod open on one side. Component not coated.

Grease pin for boost spring (arrow) with mating bearing on the boost spring push rod, the boost spring bearing (arrows) and the bearing pins on the boost spring with Optimol, Optitemp LG 2, part No. 000.043.203.37.

First remove old grease with solvent naphtha.

The boost spring and the boost spring housing are greased with a special grease on the inside. This grease is not available as a spare part. Replace the entire boost spring (with boost spring housing) if necessary.



31_1_98

B. Spare part replacement boost spring

Spare part No. 986.423.081.11 (version as from current Model '99 / Figure 467_98).

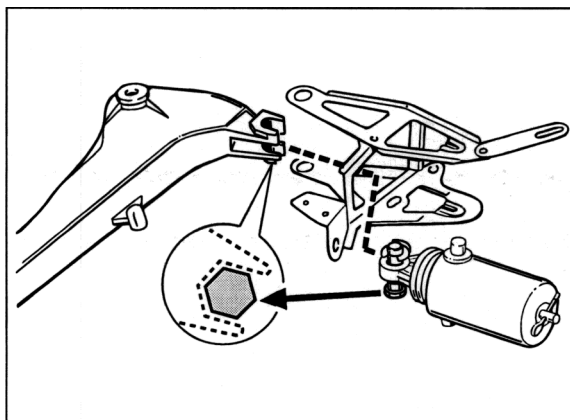
Identifying feature: closed push rod and hexagon nuts for connection to the clutch pedal.

Do not grease any areas as the components are coated.

4.3.3 Boxster from current Mod. '99 (boost spring bracket can be unscrewed)

Push rod closed / connection to clutch pedal
with a hexagon bolt.

Do not grease any areas as the components
are coated.



467_98

34 01 55 Changing and checking transmission oil (transmission G 86)

Filling capacity: 2.25

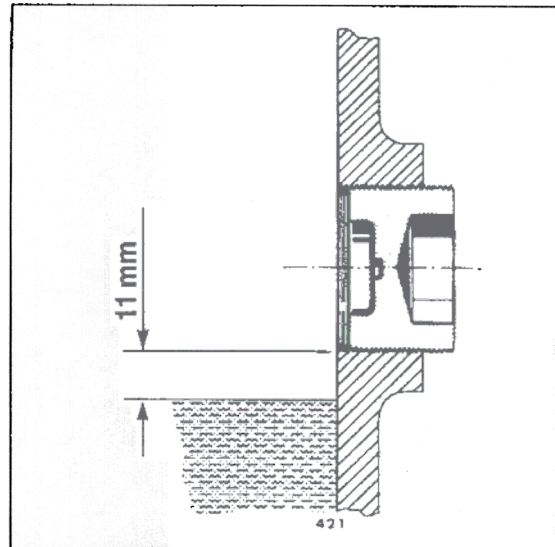
Note

Use only transmission oil approved by Porsche.
Refer to Parts Catalogue!

1. Remove transverse strut member.
2. Unscrew the oil drain plug with a socket wrench insert (Refer to Workshop Equipment Manual, Chapter 2.4, No. 33) and drain oil with the vehicle horizontal.
3. Clean the drain and filler screw.
4. Fill in 2.25 l transmission oil with the vehicle horizontal.

Note

At 2.25 l, the oil level is 11 mm below the filler opening.
Use a bent wire hook (shop-made) to check the level.

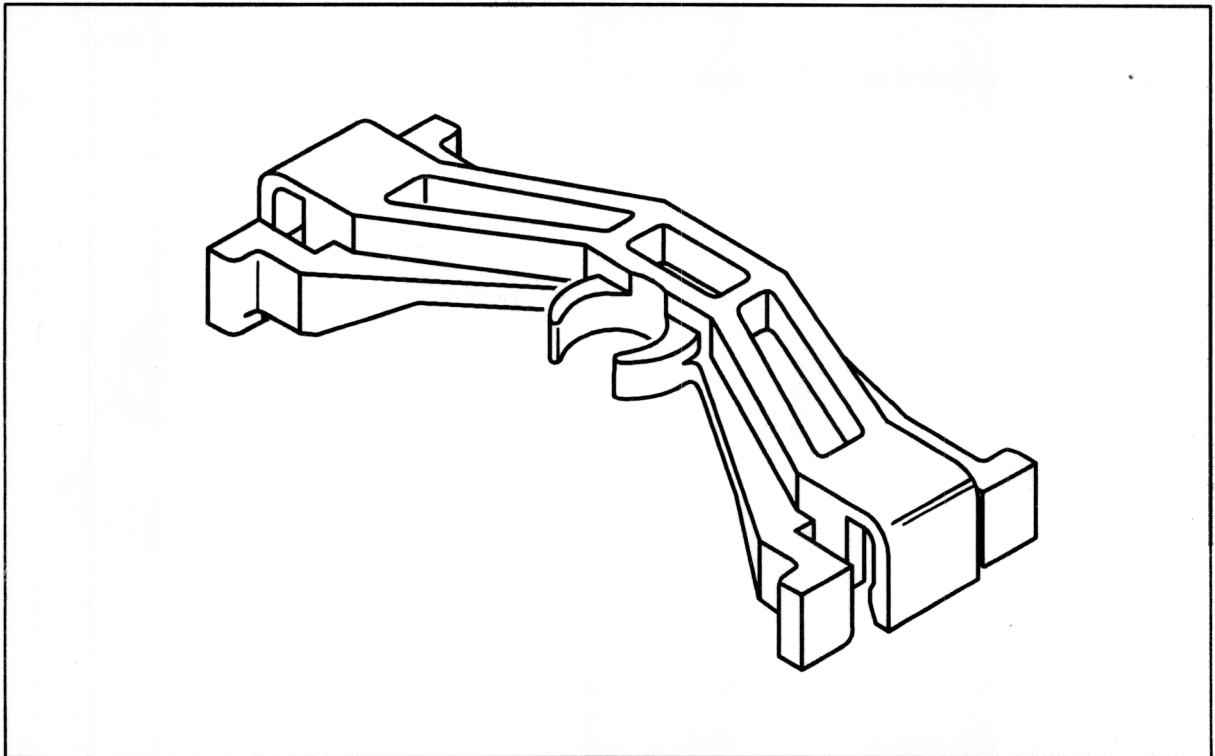


190-96

5. Tighten the drain and filler screw with **25 Nm** (18 ftlb.).

34 08 19 Removing and installing shift console

Tools

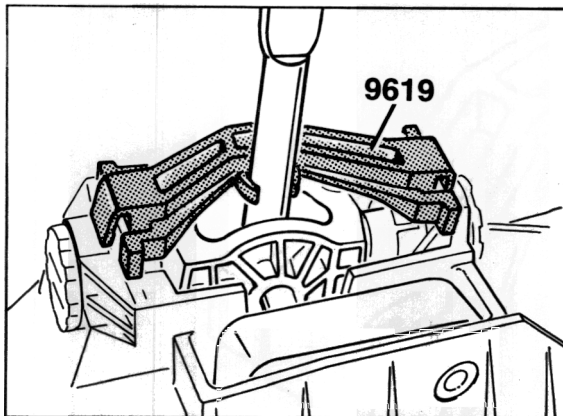


No.	Designation	Special tool	Explanation
	Locking bridge	9619	

Removing and installing shift console

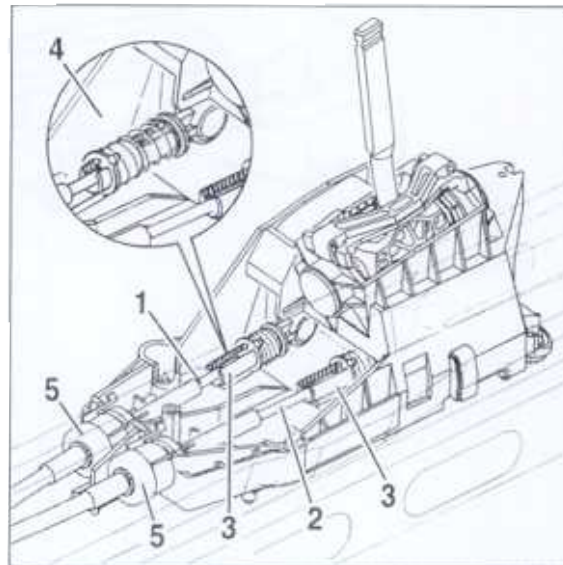
Removal

1. Remove centre console (see Group 68, Interior equipment).
2. Shift transmission to neutral and fix shift lever with special tool 9619.
4. Disengage the selector and shift cables on the shift console. To do this, slide the locking sleeve forward as far as it will go and turn it clockwise to removal position.



602 - 96

3. Remove shift console cover.



- 1 - Selector cable (blue)
- 2 - Shift cable (black)
- 3 - Adjuster open
- 4 - Adjuster closed
- 5 - Support bracket

603 - 96

5. Disengage support bracket sleeves (5) on the shift console. To do this, release the support bracket sleeves and carefully pull out of the support bracket.
6. Unscrew fastening nuts for the shift console and remove the shift console.

Installation

Note

The shifting element is designed so that installation and adjustment are a single work step.

Preconditions for this are:

Special tool 9619 must be fitted to fix the shift lever.

The transmission must be in neutral.

1. Install the shift console and tighten the fastening nuts with **10 Nm (7.5 ftlb.)**.

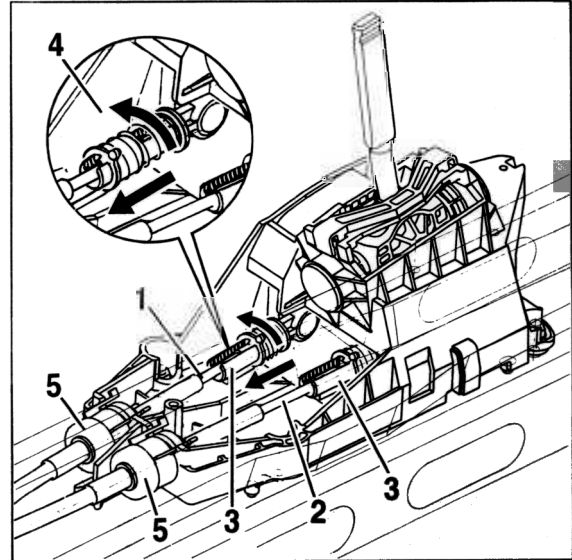
Note

The shift and selector cables must not be excessively bent or kinked.

2. Fasten selector and shift cables on the shift console:

Fit support bracket sleeves (5) in the correct position. It must be possible to hear and feel them engage.

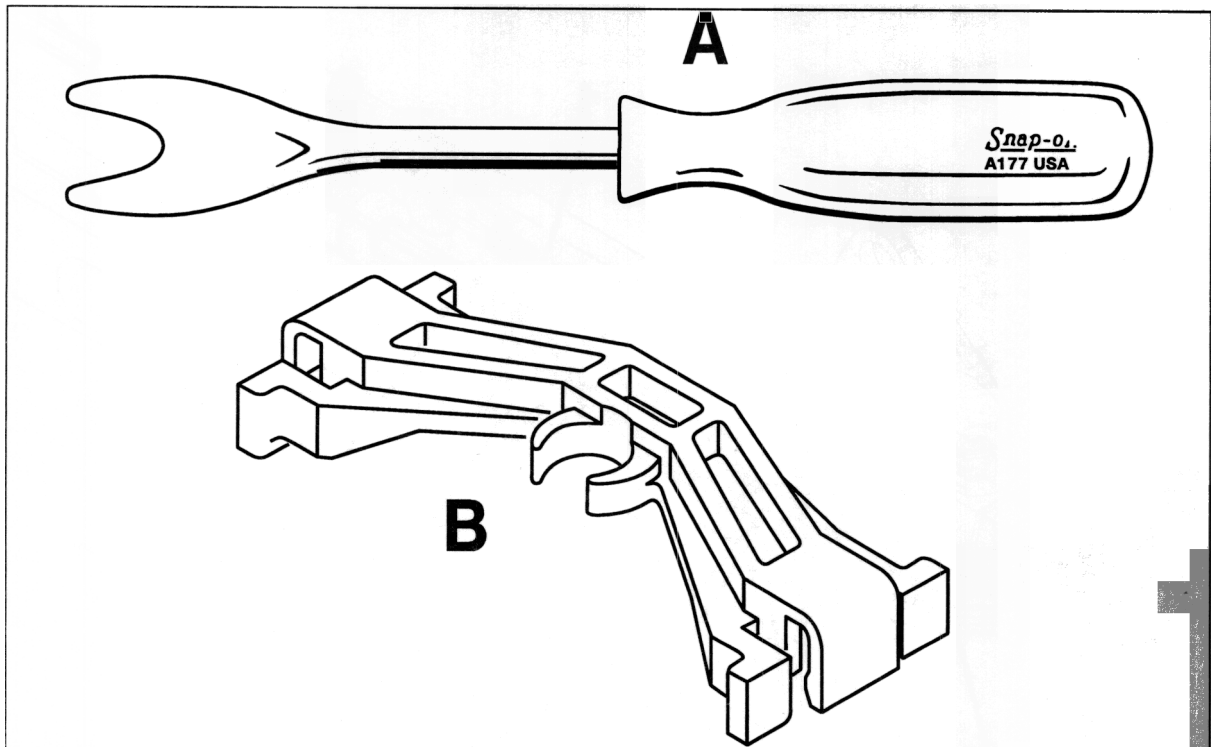
Engage shift and selector cables in the adjusters (3) without tension and close the adjusters (see enlarged view).



- 1 – Selector cable (blue)
- 2 – Shift cable (black)
- 3 – Adjuster open
- 4 – Adjuster closed
- 5 – Support bracket

603/1 - 96

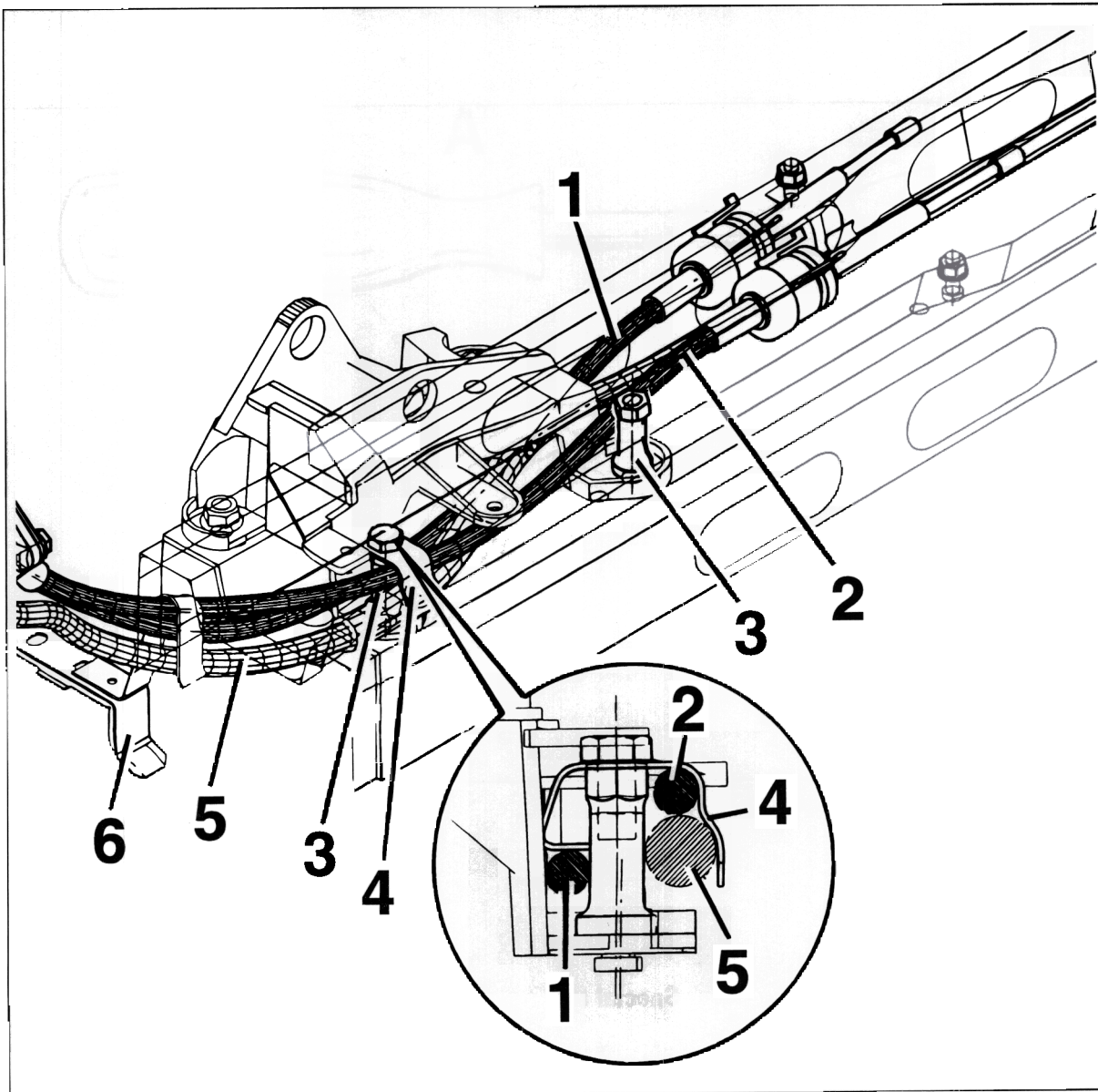
3. Remove special tool 9619 and shift through all gears as a test.
4. Clip in shift console cover.
5. Install centre console.

34 12 19 Removing and installing shift and selector cables**Tools**

45997

Item	Designation	Special tool	Explanation
A	Removal tool		Commercially available (refer to Workshop Equipment Manual, Chapter 2.4, No. 21)
B	Locking bridge	9619	

Removing and installing shift and selector cables



59596

- 1 - Selector cable (blue)
- 2 - Shift cable (black)
- 3 - Spacer nut
- 4 - Holder
- 5 - B+ wire
- 6 - Holder

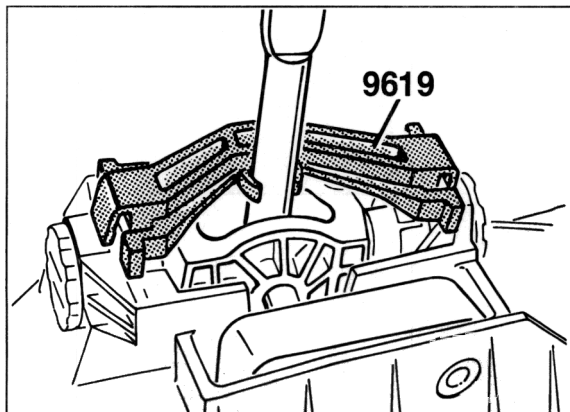
Removing and installing shift and selector cables

Removal

Note

The shift cable and selector cable can be exchanged only together, as they possess a common locking piece.

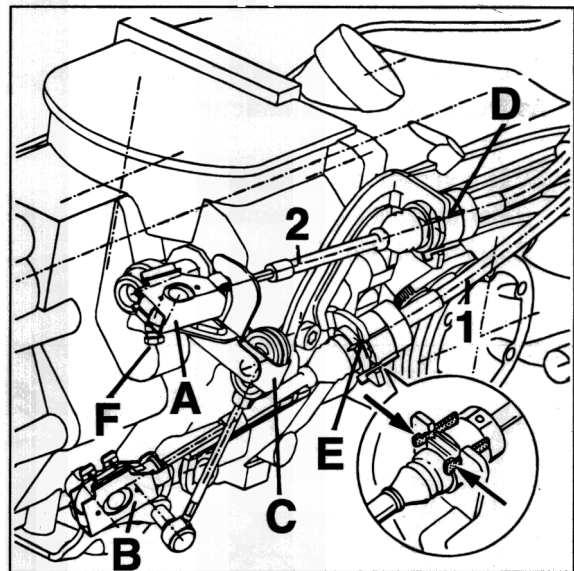
1. Remove centre console (see Group 68, Interior equipment).
2. Shift transmission to neutral and fix shift lever with special tool 9619.



602-96

3. Disengage shift and selector cables on the transmission.

Until date of manufacture 21.4.97



- 1 – Selector cable (blue)
2 – Shift cable (black)

671-1-96

Note

The shift and selector cables must not be excessively bent or kinked.

Remove cotter pins for retaining clips (A/B), remove clips and pull shift and selector cables off the ball head.

Note

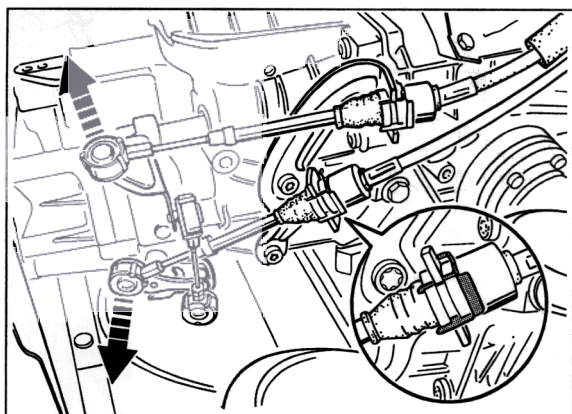
The transmission shift lever must be removed so that retaining clip "A" can be removed. To do this, remove retaining clip "C", unclip joint rod at the top and unscrew securing screw "F".

Disengage support bracket sleeves "D" and "E" on the support bracket. To do this, release the support bracket sleeves (press tabs in the direction indicated by the arrow) and carefully pull out of the support bracket.

4. Disengage shift cables on the transmission.

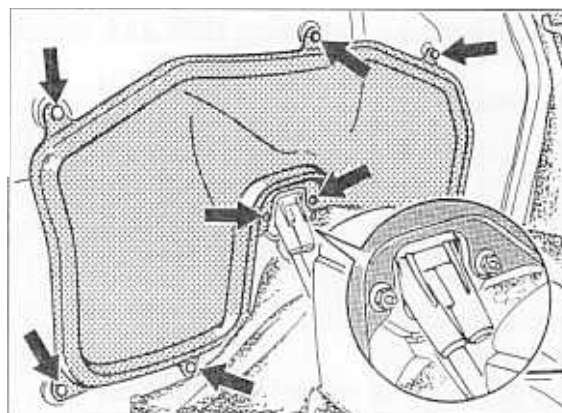
As from date of manufacture 22.4.97

Use commercially available removal tool (refer to Workshop Equipment Manual, Chapter 2.4, No. 21)



462-97

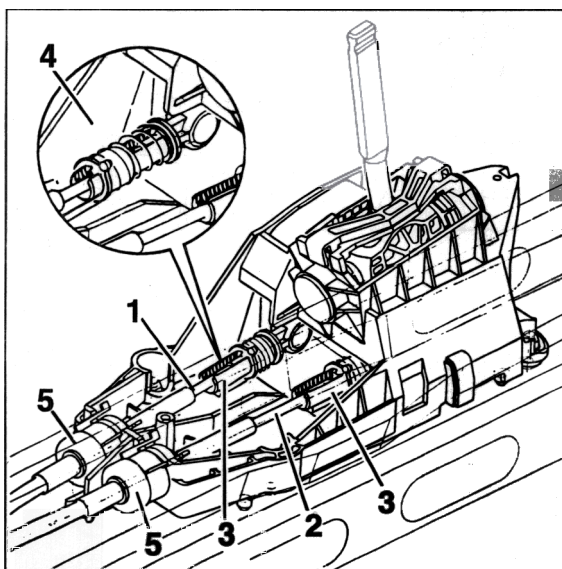
5. Remove rear wall cover.



414-97

6. Lift shift console cover up and off.

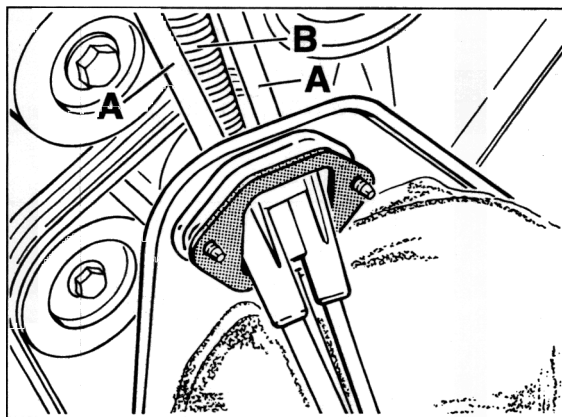
7. Disengage shift and selector cables on the shift console. To do this, slide the locking sleeve forward as far as it will go and turn it clockwise to removal position.



603-96

- 1 – Selector cable (blue)
- 2 – Shift cable (black)
- 3 – Adjuster open
- 4 – Adjuster closed
- 5 – Support bracket

8. Disengage support bracket sleeves (5) on the shift console. To do this, release the support bracket sleeves and carefully pull out of the support bracket.
9. Relieve parking brake cable, unscrew fastening nuts for parking brake lever support, and lift the support only far enough so that the selector cable can be removed from the side.
10. Remove locking piece from the rear wall and take out shift and selector cables. Take care not to soil the passenger compartment.



604_96

The transmission must be in neutral.

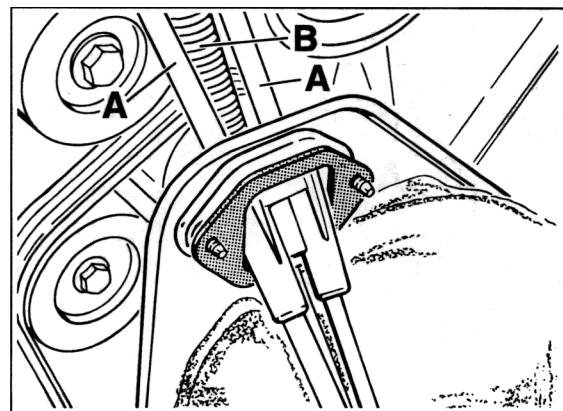
Note

Shift and selector cables must not be excessively bent or kinked.

1. Guide shift and selector cables from the passenger compartment, through the rear wall and to the transmission.

Note

Always make sure that the B+ wire is routed **between** the shift and selector cables (A).



A – Shift and selector cables
B – B+ wire

604_96

Installation

The shift and selector cables are designed so that installation and adjustment are a single work step.

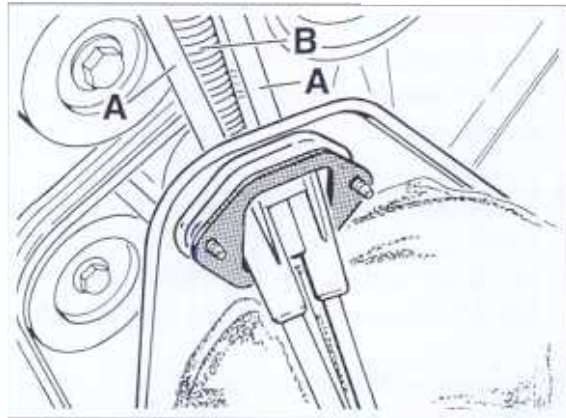
Preconditions for this are:

Special tool **9619** must be fitted to fix the shift lever.

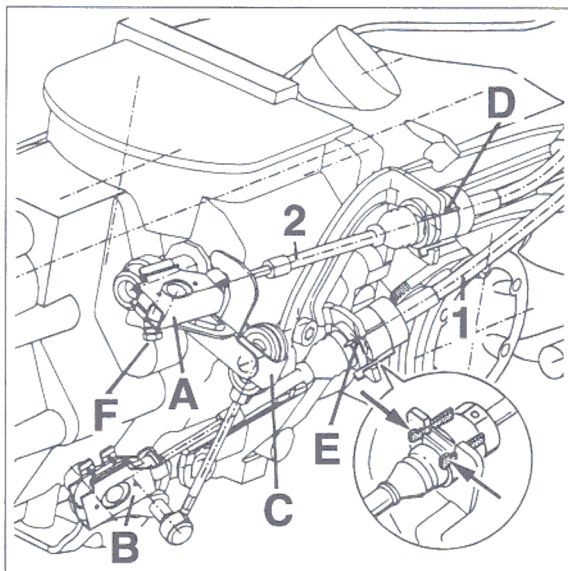
2. Fasten shift and selector cables on the transmission. The end pieces and support brackets of the shift and selector cables must be heard and felt to engage and, on the version with tab washer, the cotter-pin heads on the retaining clip "A" must face down.

Note

Always replace micro-encapsulated securing screw "F" and tighten to **23 Nm (17 ftlb.)**.

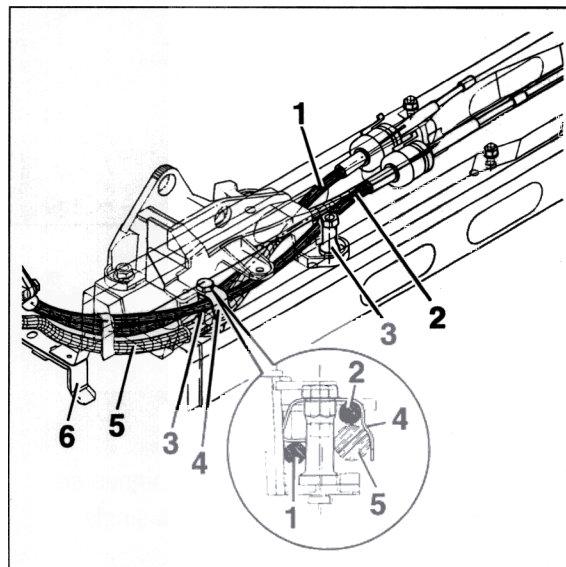


604_96



671-1-96

3. Insert locking piece in the rear wall and fit rear wall cover.



- 1 – Selector cable (blue)
- 2 – Shift cable (black)
- 3 – Spacer nut
- 4 – Holder
- 5 – B+ cable
- 6 – Holder

595-96

Note

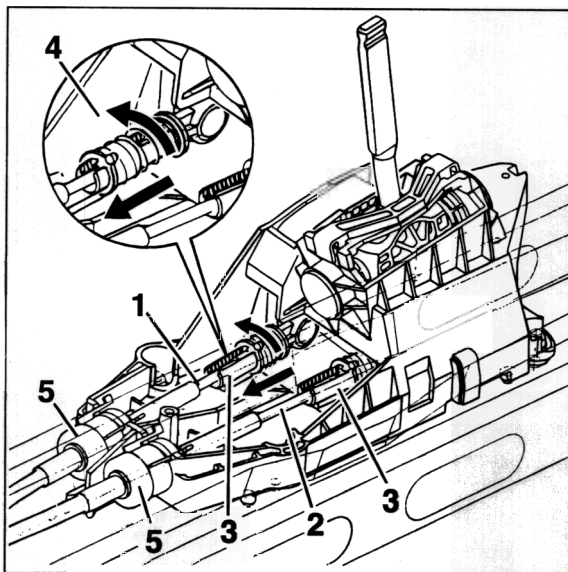
Correct routing of the shift and selector cables is a prerequisite for precise shifting.

5. Fasten shift and selector cables on the shift console:

Fit support bracket sleeves (5) in the correct position. It must be possible to hear and feel them engage.

Engage shift and selector cables in the adjusters (3) without tension and close the adjusters (see enlarged view).

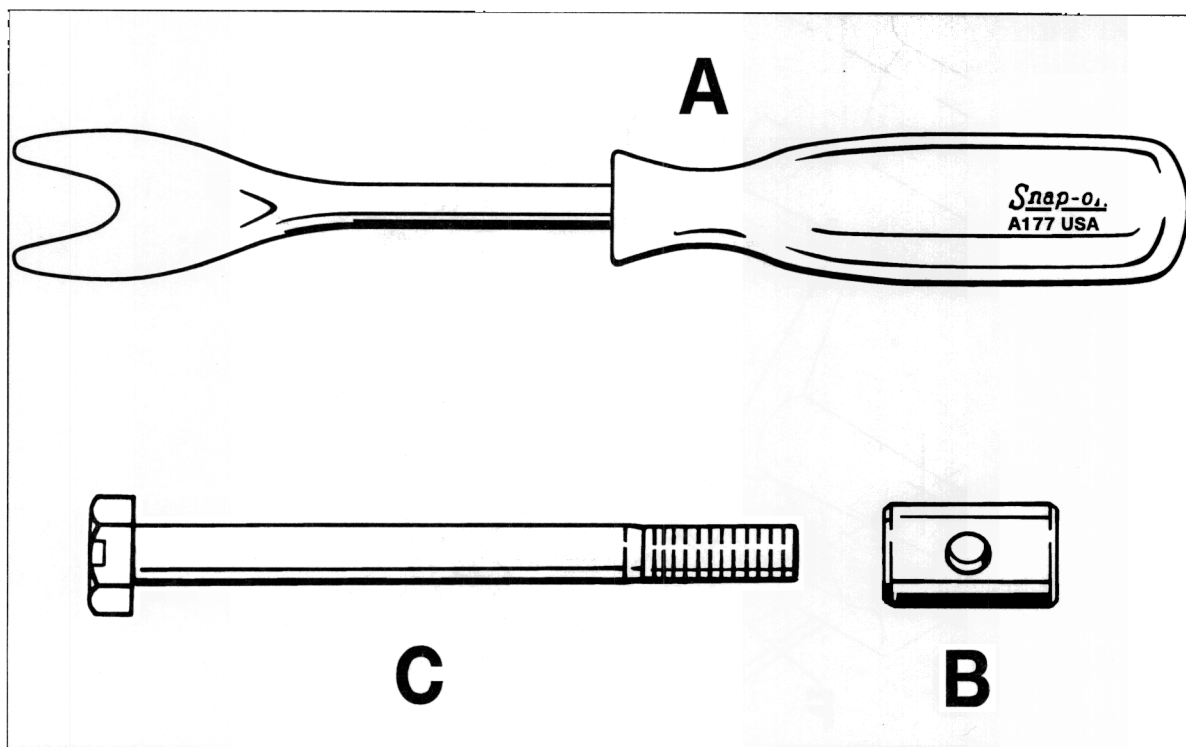
8. Adjust parking brake and install centre console.



- 1 – Selector cable (blue)
2 – Shift cable (black)
3 – Adjuster (open)
4 – Adjuster (closed)
5 – Support bracket

603-196

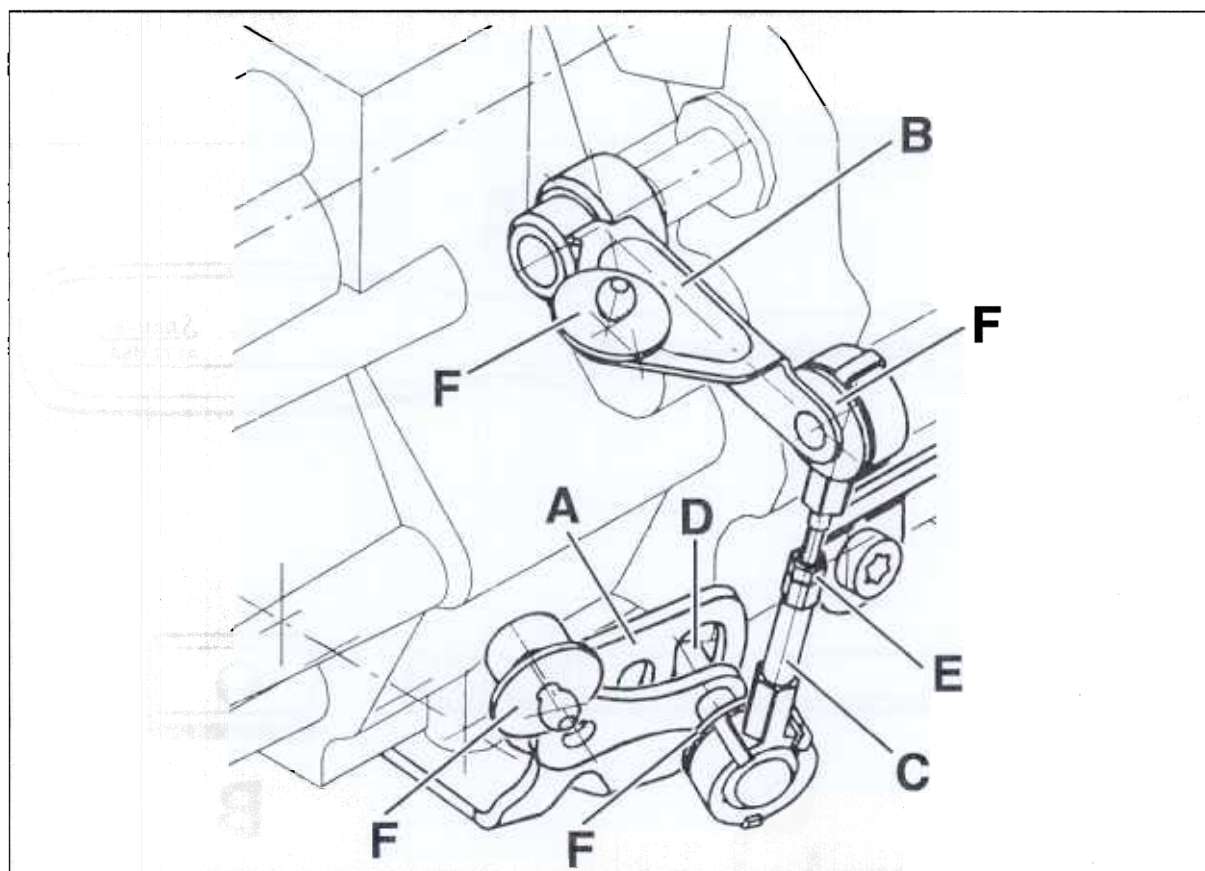
6. Remove special tool **9619** and shift through all gears as a test.
7. Clip in shift console cover.

34 33 15 Adjusting intermediate lever (transmission connection)**Tools**

477.97

Item	Designation	Special tool	Explanation
A	Removal tool		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 21)
B	Threaded piece	WV 771/15	
C	Hexagon-head bolt M10 x 110		Commercially available; make a 5mm wide and 3 mm deep groove in the head.

Adjusting intermediate lever (transmission connection)



461-97

Transmission connection:

- A – Relay shaft
- B – Shift lever
- C – Intermediate lever
- D – Stop cap
- E – Lock nut
- F – Rubber washer (as of date of manufacture 22.4.97)

Adjusting intermediate lever (transmission connection)**Note**

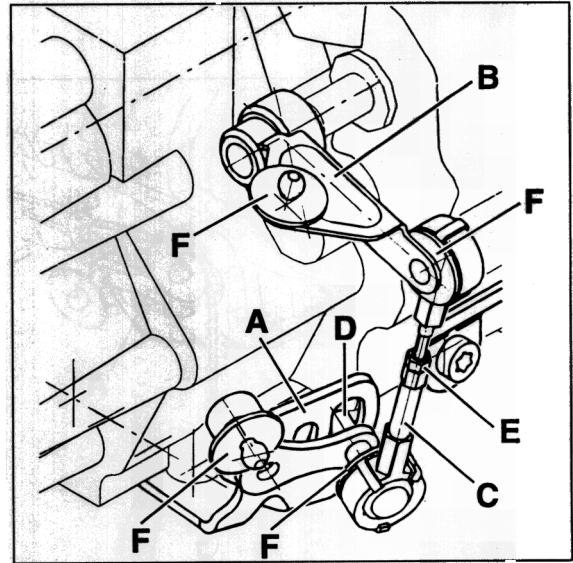
The intermediate lever is machine-caulked as standard after adjustment of the shift mechanism.

If the transmission connection or parts of the transmission connection are replaced during repairs, the caulked intermediate lever must be exchanged for an adjustable intermediate lever and readjusted.

A misadjustment of the intermediate lever can result in the following problems:

higher shifting friction.

1st, 2nd, 5th or reverse gear cannot be engaged.



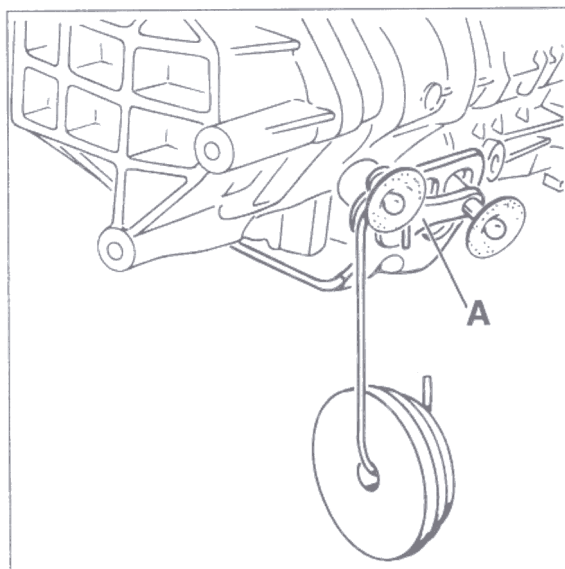
461-97

1. Move shift lever to neutral position and disengage shift cables on the transmission. Use a commercially available removal tool for this purpose (refer to Workshop Equipment Manual, Chapter 2.4, No. 21)
2. Disengage end piece of intermediate lever at shift lever "B".

Transmission connection

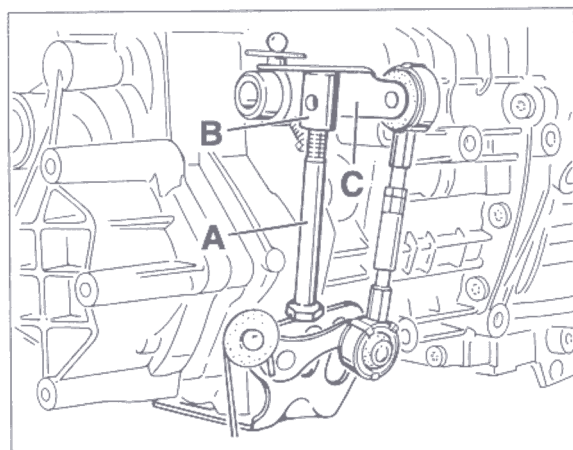
- A – Relay shaft
- B – Shift lever
- C – Intermediate lever
- D – Stop cap
- E – Lock nut
- F – Rubber washer (as of date of manufacture 22.4.97)

3. Turn relay shaft "A" counterclockwise to push it to the upper stop and fix it with a suitable weight (e.g. special tool 9350).



484-97

4. Turn shift lever "C" counterclockwise to the upper stop (shift gate 1/2) and fix with shop-made tool.



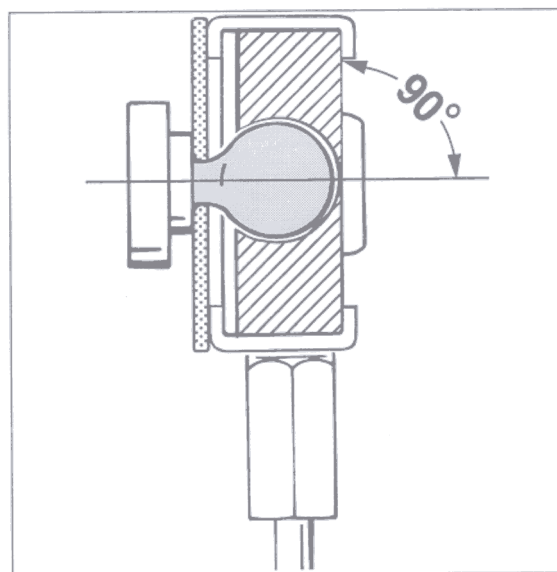
A – Hexagon-head bolt
B – Threaded piece VW 771/15

482-97

5. Adjust the length of the intermediate lever by means of the thread until the end piece can be pressed onto the upper ball pin without tension.

Note

The face sides of the intermediate lever end pieces must be at right angles to the centre axis of the ball pins.



478-97

6. Tighten lock nut.
7. Press shift cables onto the ball pins and check shifting function.

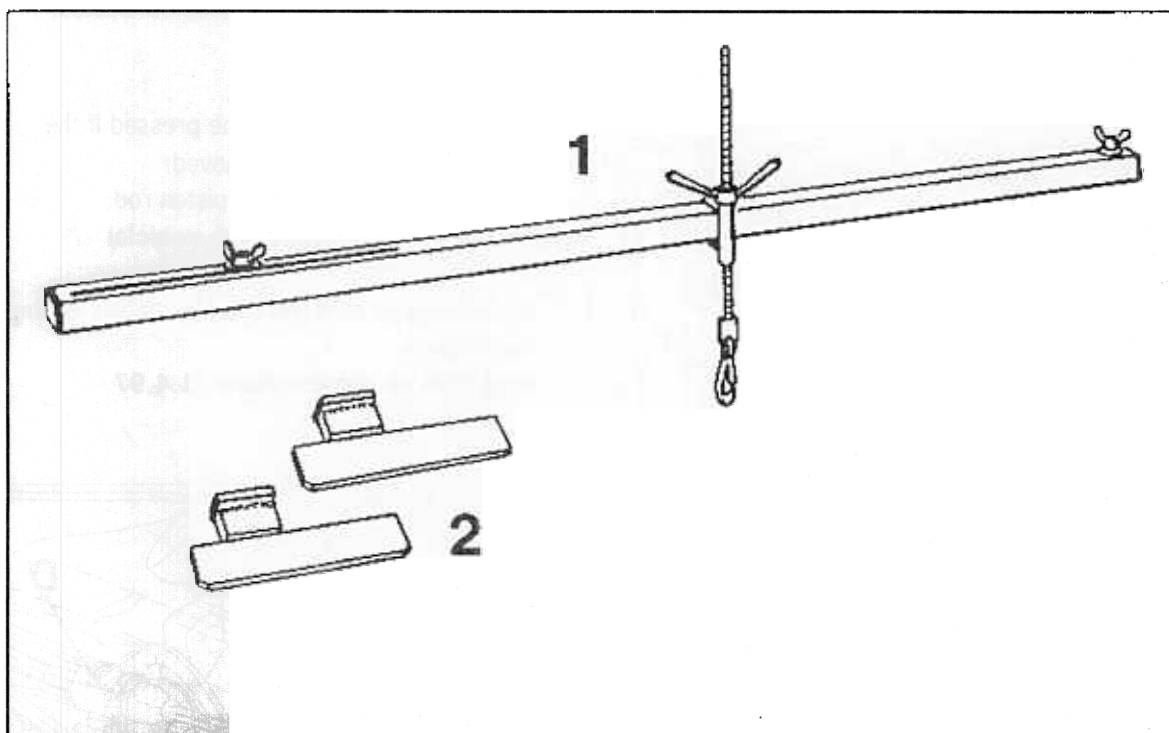
Note

Ball socket and ball pin versions **with retaining clips** must be lubricated with a light coat of Universal low-temperature grease.

Do **not** grease ball socket and ball pin versions **without retaining clips** (as of date of manufacture 22.4.97).

34 35 19 Removing and installing transmission G 86

Tools



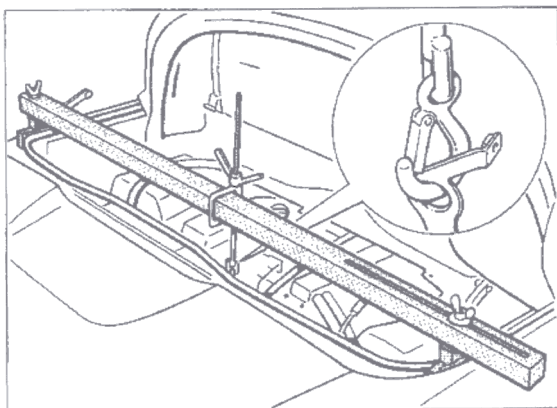
23396g

Item	Designation	Special tools	Explanation
	Supporting bridge	10 - 222 A	
2	Support feet	9591/1	

Removing and installing transmission G 86

Removal

1. Secure engine in installation position on the transport carrier with special tools 10 - 222 A and 9591/1.



194-96

2. Remove the diagonal braces and transverse strut member.
 3. Remove stabilizer bar.
 4. Remove silencer with catalytic converters (see Group 10 - Removing and installing engine).
 5. Remove the rear cross member (V-strut).
 6. Unscrew mount for silencer on the transmission.
- Remove drive shafts at the transmission and protect the shafts against damage (use scrap pieces of hose with a diameter of 30 mm).
8. Undo the plug connection for the reversing light switch.
 9. Unscrew the clutch slave cylinder and hang up at the side with the hose connected.

Note

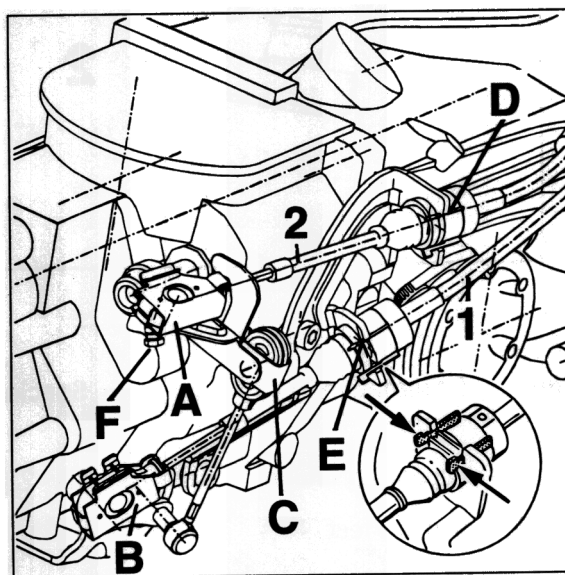
The clutch pedal must **not** be pressed if the slave cylinder has been removed.

Danger of injury from flying piston rod.

Affix a warning note in the vehicle!

10. Disengage shift and selector cables on the transmission.

Until date of manufacture 21.4.97



671-1-96

1 - Selector cable (blue)

2 - Shift cable (black)

Note

The shift and selector cables must not be excessively bent or kinked.

Remove cotter pins for retaining clips (A/B), pull off clips and pull shift and selector cables off the ball head.

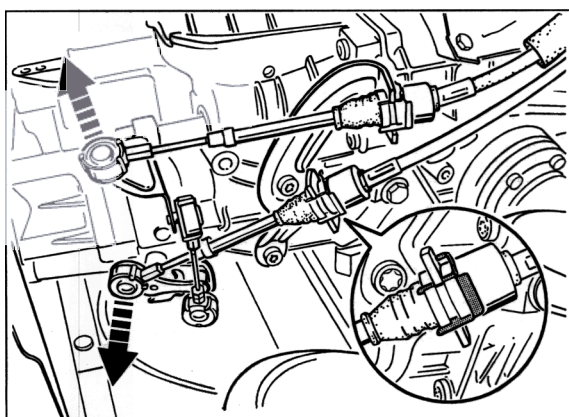
The transmission shift lever must be removed before retaining clip "A" can be removed. To do this, remove retaining clip "C", unclip the joint rod at the top and unscrew securing screw "F".

Disengage support bracket sleeves "D" and "E" on the support bracket. To do this, release the support bracket sleeves (press tabs in the direction indicated by the arrow) and carefully pull them out of the support bracket.

11. Disengage shift cables on the transmission.

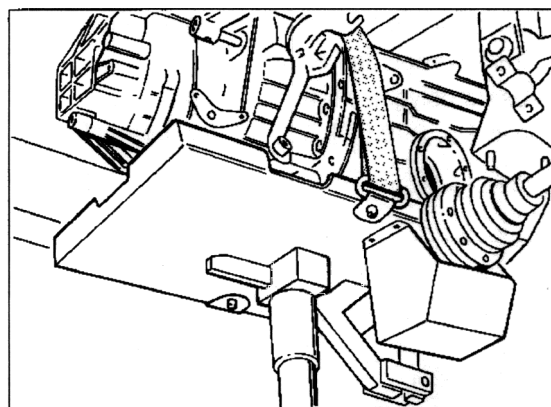
As from date of manufacture 22.4.1997

Use commercially available removal tool (refer to Workshop Equipment Manual, Chapter 2.4, No. 21).



462-97

12. Place a transmission jack underneath the transmission and secure the retaining strap.

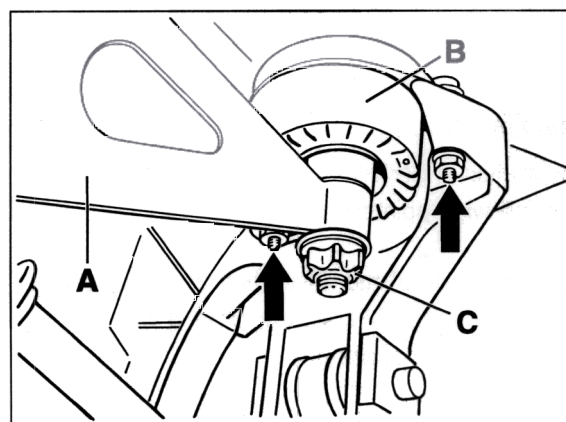


396-96

13. Remove transmission support **with hydraulic mounts** on the left and right-hand sides.

Note

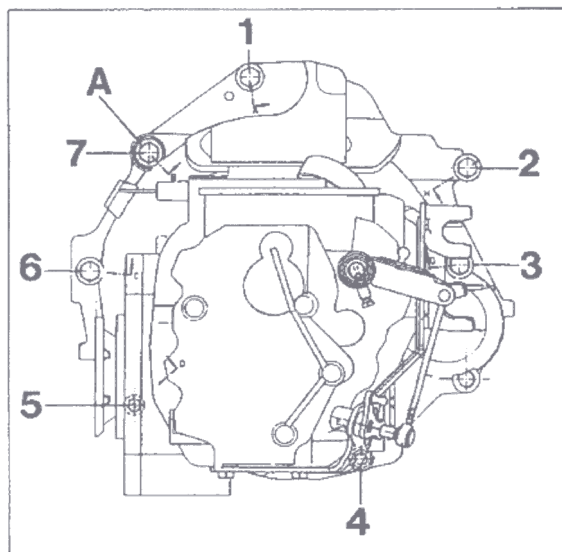
Fastening nut "C" (M12) must not be undone. The transmission prop will otherwise be damaged.



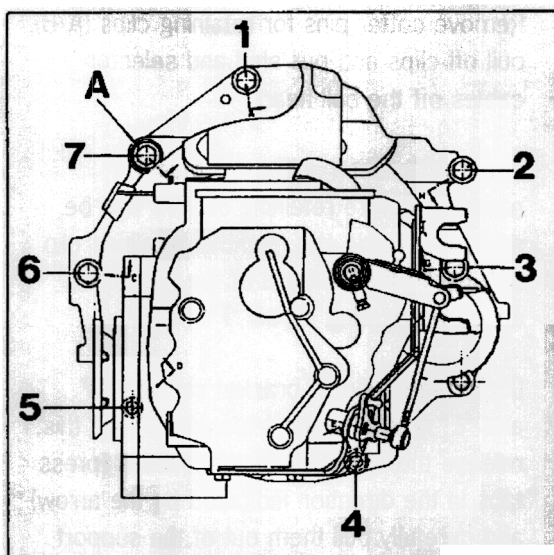
435-97

A = Transmission support
B = Hydraulic mount
C = M12 Fastening nut

14. Unscrew the fastening screws between the transmission and engine.
Use a polygon wrench (10 mm, part No. 999.571.052.02) for screw No. 5.



193-96



193-96

A = Washer

15. Pull the transmission to the rear and lower it carefully.

Installation

Installation is performed in reverse order, taking the following points into account.

1. Clean teeth of the drive shaft and grease with a thin coat of **Olista Longtime 3 EP** (available as spare part).
2. Make sure that the dowel sleeves are properly seated in the crankcase.
3. Carefully slide in the transmission, and properly secure it to the engine.

No.	Screw/nut	Nm (ftlb.)
1	M12 x 70	85 (63)
2	M12 x 90	85 (63)
3	M12 x 90	85 (63)
4 *	M10	45 (33)
5 **	M10 x 35	45 (33)
6	M12 x 90	85 (63)
7	M12 x 100	85 (63)

Hexagon nut

Multiple-tooth nut

4. Fit the clutch slave cylinder and tighten fastening screw to **23 Nm (17 ftlb.)**.

Note

If the piston rod cannot be pushed back manually when the clutch slave cylinder is fitted, the bleeder valve must be opened. Connect a collection bottle with hose for this purpose.

5. Bleed the clutch system

Tightening torques (transmission G 86):

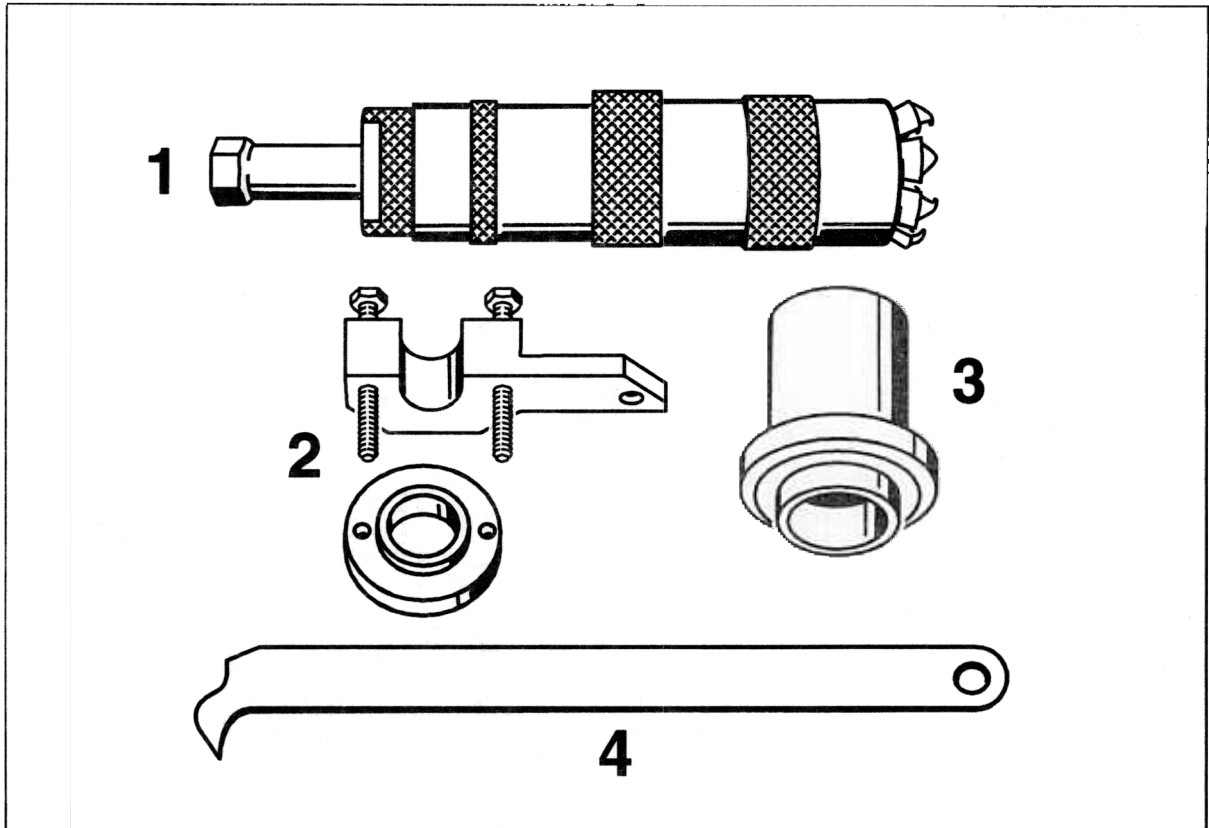
Diagonal brace to carrier side member and body (M10)	=	65 Nm (48 ftlb.)
Rear cross member (V-strut) to transverse strut member and body (M10)		65 Nm (48 ftlb.)
Stabilizer bar to carrier side member (M8)	=	23 Nm (17 ftlb.)
Stabilizer mount to stabilizer bar (M10)		46 Nm (34 ftlb.)
Drive shaft to transmission flange (M8)	=	39 Nm (29 ftlb.)
Transmission prop to transmission (M10)	=	65 Nm (48 ftlb.)
Hydraulic mounts to carrier side part (M8)	=	23 Nm (17 ftlb.)
Clutch slave cylinder to transmission (M8)		23 Nm (17 ftlb.)
Gearshift lever on interior shift rod (M8)*	=	23 Nm (17 ftlb.)

*** Note**

Always replace micro-encapsulated screw.

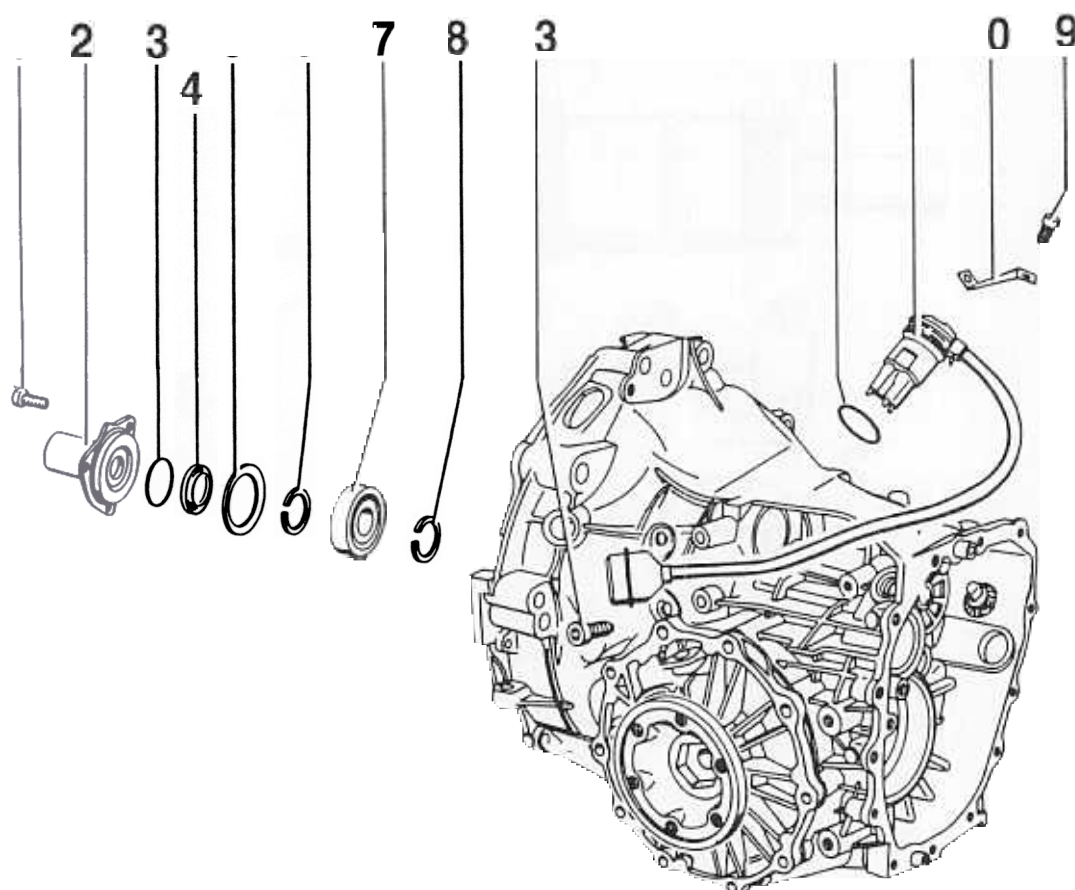
34 35 37 Disassembling and assembling transmission G 86

Tools

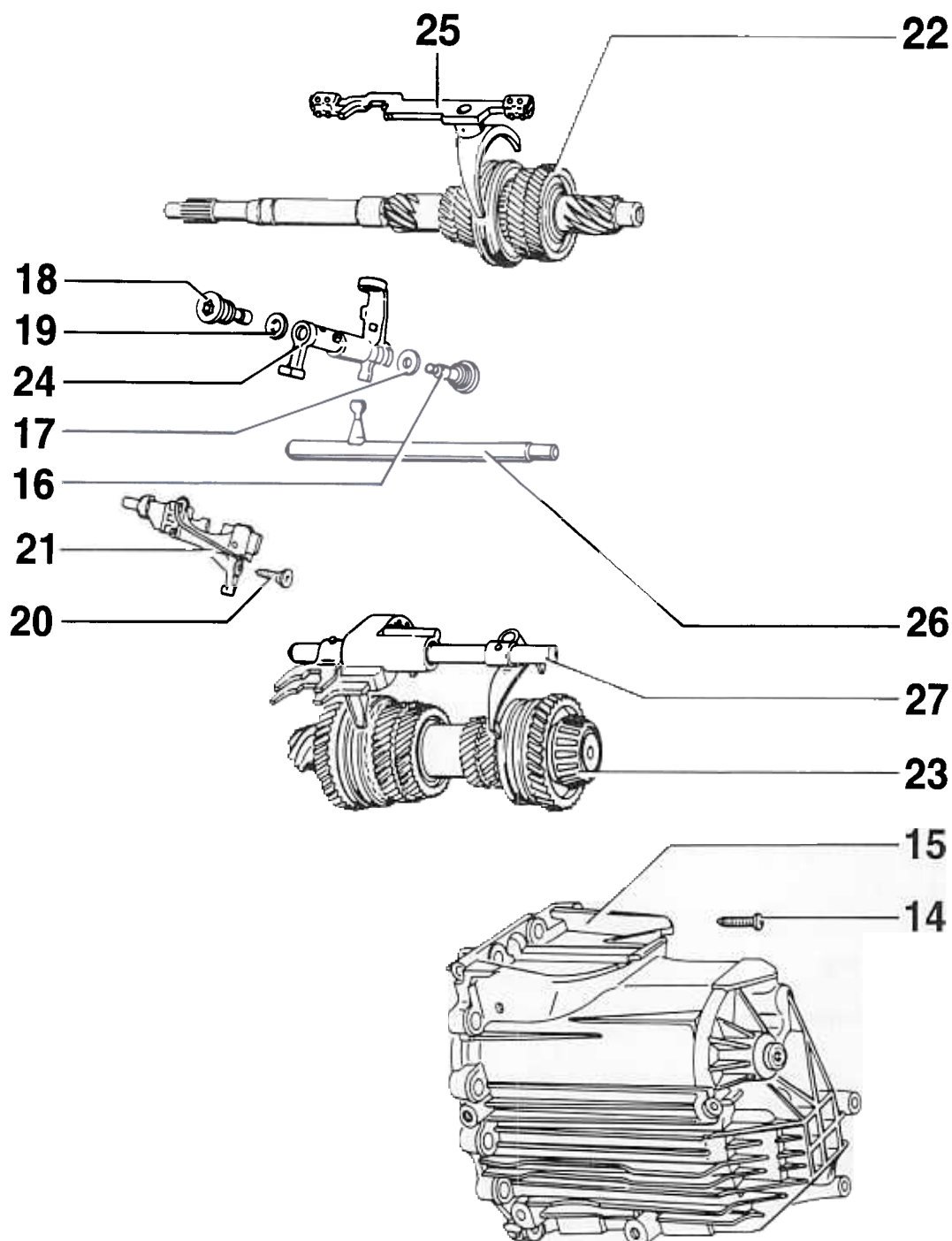


No.	Designation	Special tool	Explanation
1	Puller with grip	V.A.G. 1582 V.A.G. 1582/2	
2	Press-in fixture	3235	
3	Driver sleeve	VW 192	
4	Hook	VW 681	

Disassembling and assembling transmission 86



Disassembling and assembling transmission G 86



Note

If the 5th and reverse gears stick or catch after adjustment of the gear changing mechanism, before removing and disassembling the transmission first remove the lock for the 5th and reverse gears, inspect it and, if necessary, replace it (see Page 34 - 32)

No.	Designation	Qty.	Removal	Note:	Installation
	Torx screw	2			Always replace, tightening torque 35 Nm (26 ftlb.)
2	Guide sleeve	1			
3	Toroidal sealing ring	1			Always replace
4	Shaft seal	1	Remove with special tool VW 681		Lightly coat the sealing lip with multi-purpose grease and drive it in as far as it will go using the special tool VW 192
5	Cup spring	1			Small diameter (curved side) to the guide sleeve
6	Snap ring	1			Note the thickness for re-fitting (must not be mixed up). If ball bearings No. 7, the input shaft or the transmission housing are replaced, the thickness must be remeasured (see Page 35 - 9).
7	Ball bearing	1	Remove with special tools V.A.G. 1581 and V.A.G. 1582/2		Press in with special tool 3225. The open side of the plastic retainer faces the guide sleeve
8	Snap ring	1			As for No. 6
9	Hexagon-head bolt	1			Tightening torque 25 Nm (18 ftlb.)
10	Tab washer				
11	Reversing light switch	1			Insert in correct position



No.	Designation	Qty.	Removal	Note:	Installation
12	Toroidal sealing ring	1			Always replace and lightly grease
13	Torx screw	1			Tightening torque 10 Nm (7 ftlb.)
14	Torx screw				Tightening torque 25 Nm (18 ftlb.)
15	Transmission case cover	1,			Seal with Loctite 574
16	Torx screw	1			Tightening torque 40 Nm (29 ftlb.)
17	Spacer	1			
18	Torx screw	1			Tightening torque 40 Nm (29 ftlb.)
19	Spacer				
20	Torx screw with collar	1			Tightening torque 25 Nm (18 ftlb.)
21	Switch interlock	1			
22	Input shaft				
23	Output shaft				
24	Relay shaft	1			
25	Shift rod and shift fork, 3rd and 4th gears				
26	Interior shift rod	1			
27	Shift rod with shift fork for 1st / 2nd / 5th and reverse gears	1			Replace the shift rod for 5th and reverse gears only as a complete assembly with shift fork and driver

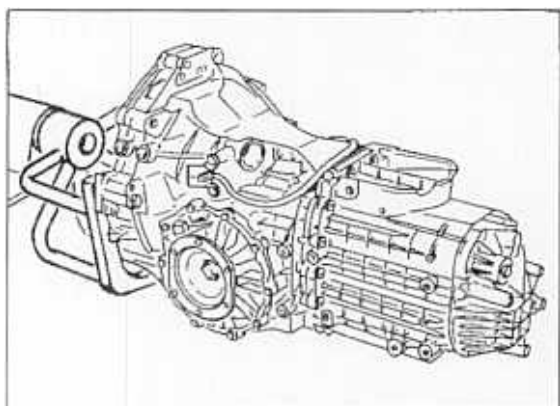
Instructions for disassembly and assembly

Disassembly

Note

The differential does not have to be removed in order to take out the gear set. Removal is necessary only in order to determine which deviation "r" is given on the crown wheel. This deviation is necessary if the transmission housing or tapered roller bearing for the output shaft is replaced.

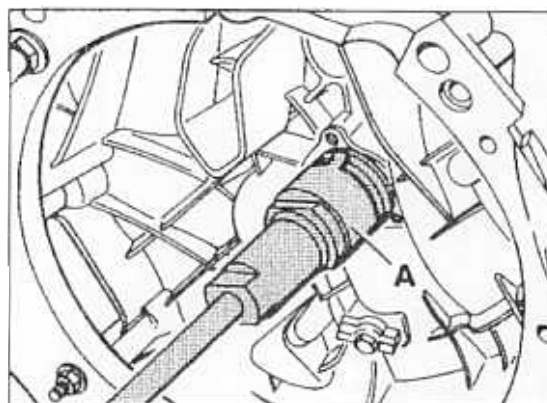
1. Clamp the transmission in the assembly support using the special tool 9589 or VW 540 and drain off the gear oil.



42-96

2. Pull the clutch release lever off the ball journal and remove with the release bearing.

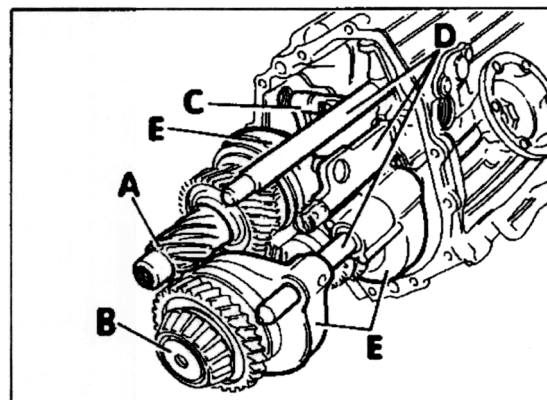
3. Pull the ball bearing for the input shaft out of the transmission housing using the special tools V.A.G. 1582 and V.A.G. 1582/2.



43-96

A = Puller with grip

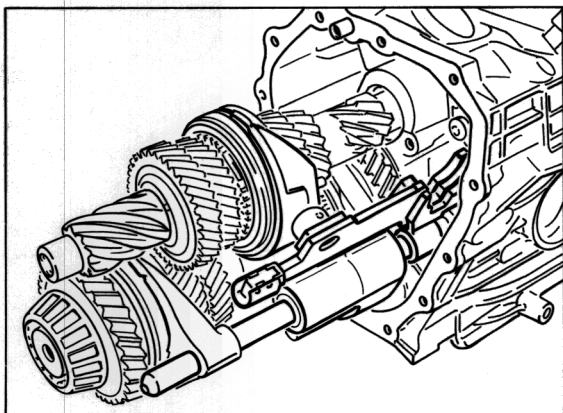
4. Take out the input shaft "A", the output shaft "B", the relay shaft "C", the shift rods "D" and the shift forks "E" together.



44-96

Assembly

1. Assemble the input and output shafts with the shift rods and install them together in the transmission housing.



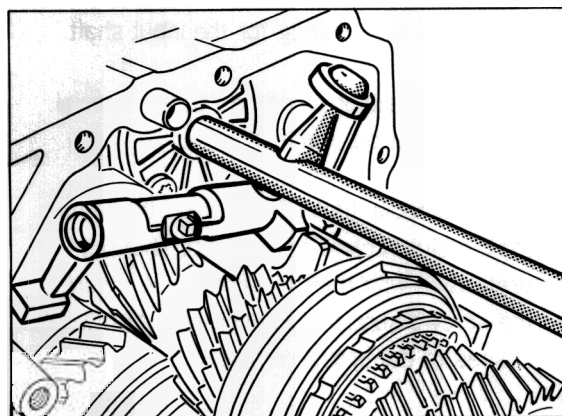
45 - 96

2. Insert the relay shaft and the interior shift rod.

Engage 3rd gear.

Insert the relay shaft.

Position the interior shift rod next to the guide hole of the bearing cover, push the shift finger into the driver of the relay shaft and, by turning the interior shift rod, carefully swivel the latter into the guide hole.



46 - 96

3. Install the switch interlock.

Push the locking slide to the center position and ensure that no gear is engaged.

Insert the switch interlock.

Guide the relay shaft into the switch interlock.

Tighten the switch interlock with the stipulated tightening torque.

4. Insert the bolts for the relay shaft and tighten them with the stipulated tightening torque.
5. Seal and fit the transmission case cover. When doing so, pay attention to the installation position of the dowel sleeves in the transmission housing (see Page 34 - 27).

6. Press in the ball bearing for the input shaft.

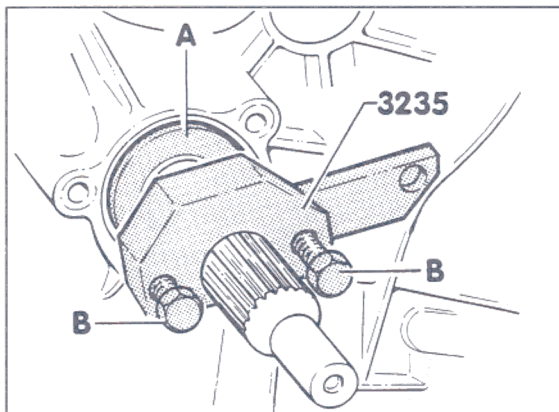
Place the pressure disc - A - of the special tool onto the ball bearing.

Put the special tool 3235 behind the teeth for the clutch plate on the input shaft and pretension with the two screws - B -. Here, the screws support themselves in the two recesses of the pressure disc.

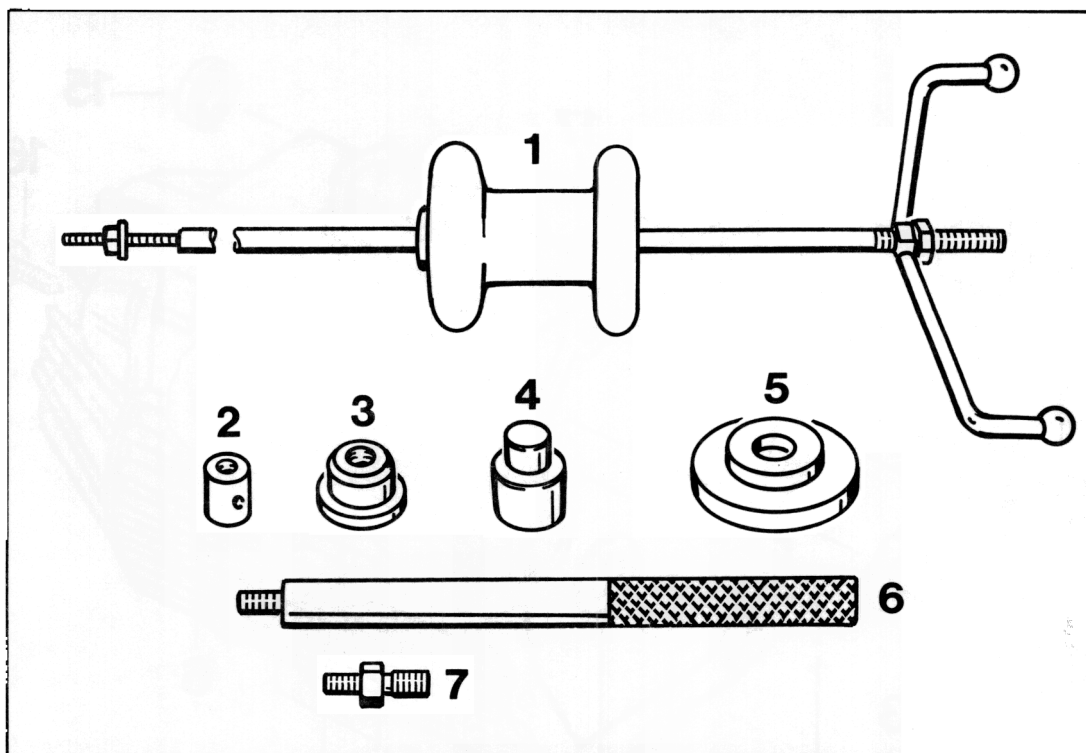
Press in the ball bearing as far as it will go by alternately tightening the two screws.

Note

Tighten the screws - B - only by 1/2 of a turn each so that the ball bearing is not tilted and thereby damaged.

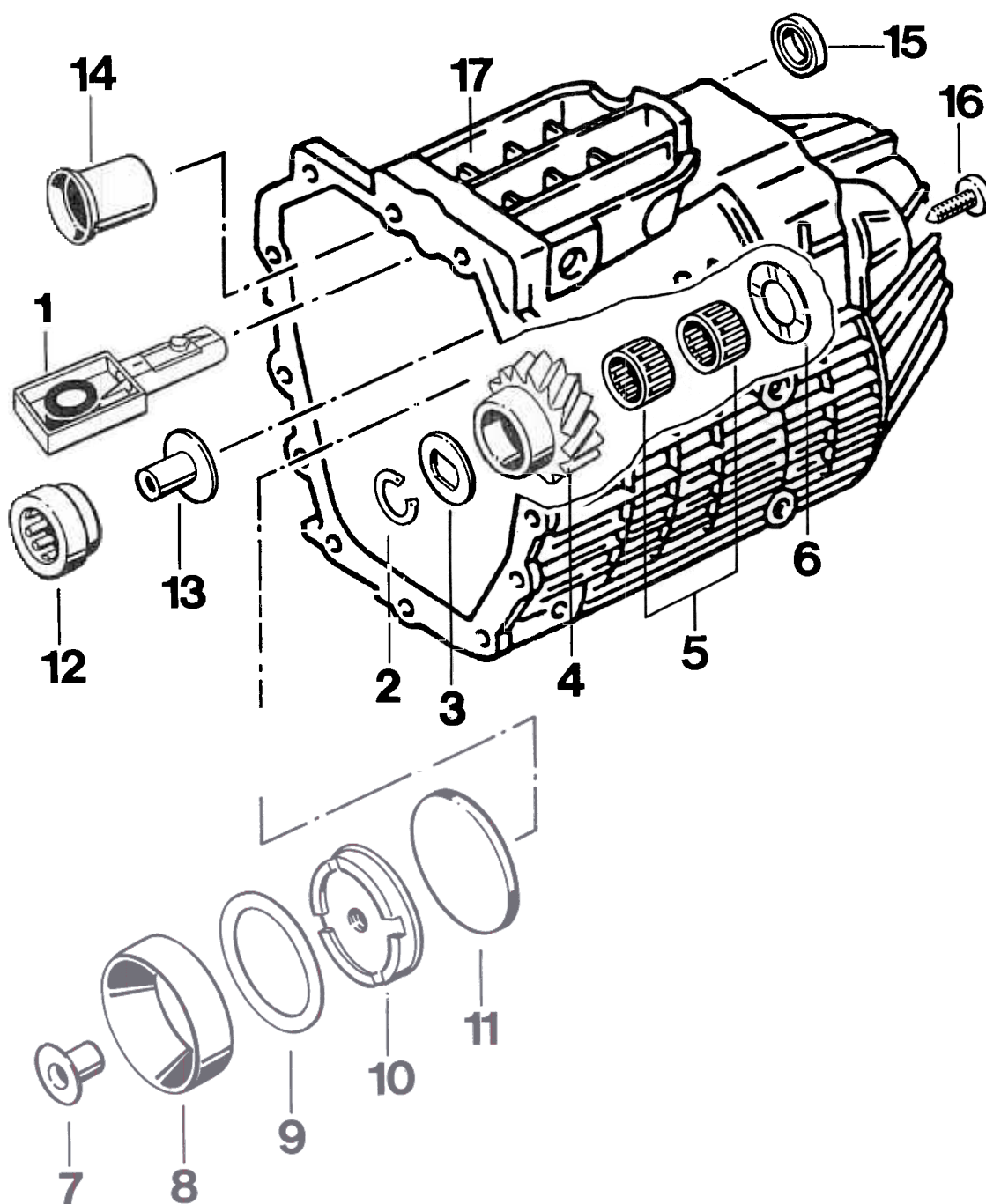


47 - 96

34 55 37 Disassembling and assembling transmission case cover (transmission G 86)**Tools**

No.	Designation	Special tool	Explanation
1	Striking tool	VW 771	
2	Threaded piece	VW 771/15	
3	Pressure piece	9247/1	
4	Pressure piece	VW 295 a	
5	Pressure piece	3005	
6	Pull-in tool and extractor	P 254	
7	Threaded adapter (M10/M8)		Standard (e.g. Messrs. Kukko 18 - 008 A)

Disassembling and assembling transmission case cover (transmission G 86)



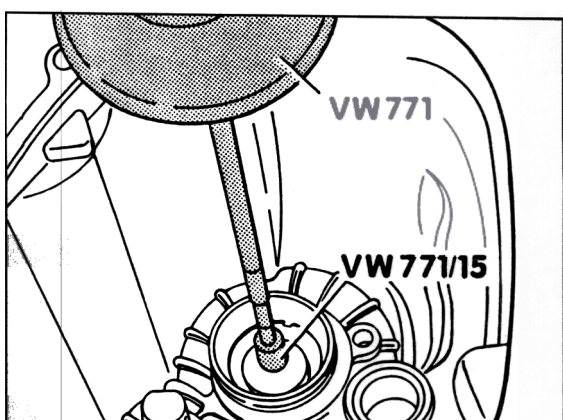
No.	Designation	Qty.	Removal	Note:	Installation
	Oil collecting vessel	1			Push in until the lock engages in the transmission case cover hole. The collecting vessel must face upwards.
2	Snap ring	1			
3	Washer	1			
4	Reverse idler gear	1			
	Needle roller bearing	2			
6	Thrust washer	1			
7	Retaining sleeve	1	Force out with a suitable internal puller and special tool VW 771		Do not reinstall (required only during manufacture in Production)
8	Tapered roller bearing outer race	1	Remove with the special tools VW 771, VW 771/15 and standard threaded adapter		Press in with the special tool 3005 and a suitable plunger (e.g. special tool VW 407)
9	Adjusting shim "S4"	X	Note the thickness for refitting		Measure again if necessary (see Page 39 - 15 and 39 - 25)
10	Pressure plate	1			
11	Rubber disc	1	If necessary, drill a hole in the disc and pull out with a sheetmetal screw		Replace if necessary

No.	Designation	Qty.	Removal	Note:
				Installation
12	Needle roller bearing	1	Remove with the special tools VW 771, VW 771/15 and a suitable internal puller (e.g. Kukko 21/4, 22 - 28 mm). Destroy the plastic sleeve No. 13 before fitting the puller.	Always replace. Press in in the correct position using the special tool VW 295 a and a suitable tubular piece (e.g. special tool VW 420). The large collar of the special tool VW 295 a faces the needle roller bearing
13	Plastic sleeve	1	Is destroyed during removal	Always replace
14	Bushing	1	Remove with the special tools VW 771, VW 771/15 and a suitable internal puller (e.g. Kukko 21/4, 23.5 - 30 mm)	Press in with the special tools 9247/1 and P 254
15	Shaft seal	1	Lever out	Fill the chamber between the dust lip and sealing lip with multi-purpose grease and drive in with a suitable tubular piece (e.g. special tool VW 423)
16	Torx screw	1	Must be removed only if the reverse idler shaft is replaced	Tightening torque 35 Nm (26 ftlb.)
17	Transmission case cover	1		If the cover is replaced, remeasure the adjusting shim "S4" (see Page 39 - 25). Seal with Loctite 574

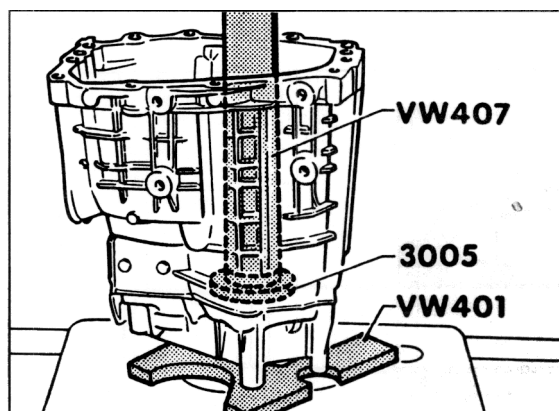
Instructions for disassembly and assembly

Disassembly

1. Remove the outer race for the small tapered roller bearing using special tools VW 771, VW 771/15 and a commercially available threaded adapter (M10/M8).



56 - 96

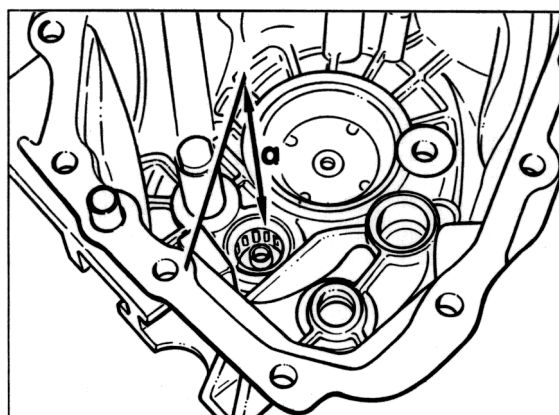


57 - 96

2. Press in the needle roller bearing for the input shaft in the correct position with special tool VW 295 a. Measure the installation dimension from the cover upper edge to the bearing upper edge.

Assembly

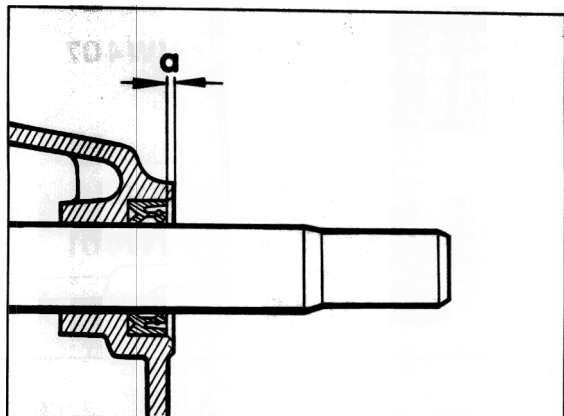
1. Press in the outer race for the small tapered roller bearing using special tool 3005.



"a" = 216 mm

58 - 96

3. Drive in the sealing ring for the interior shift rod.

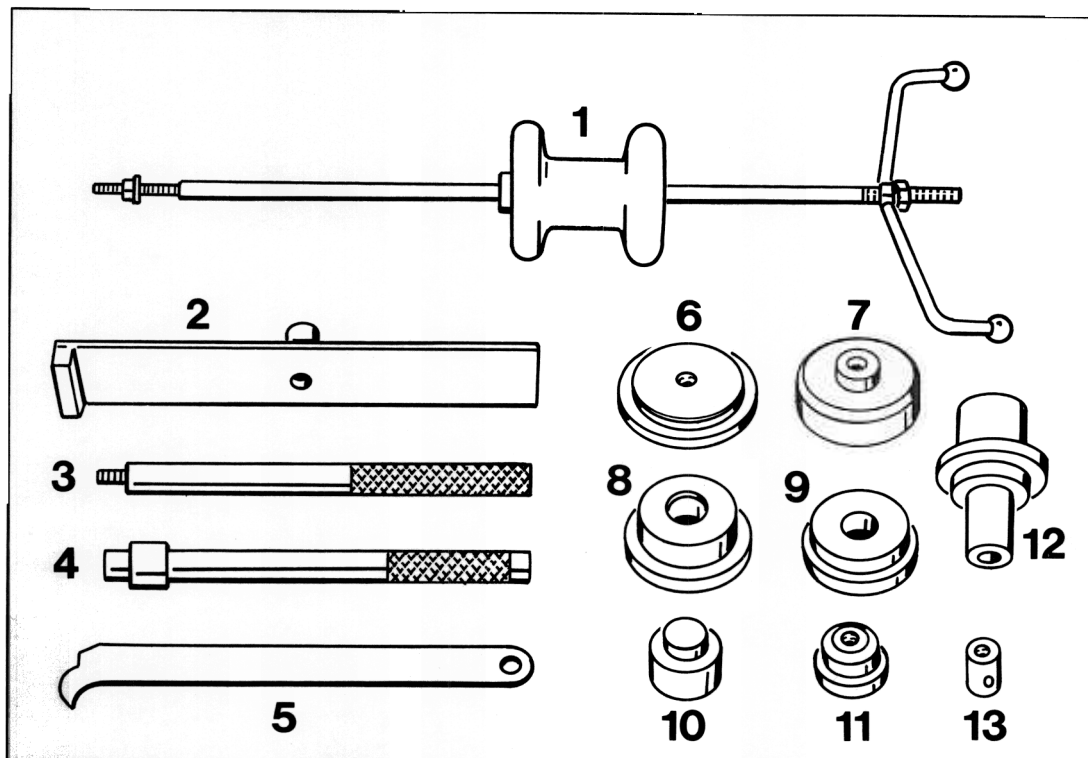


"a" = 1 mm

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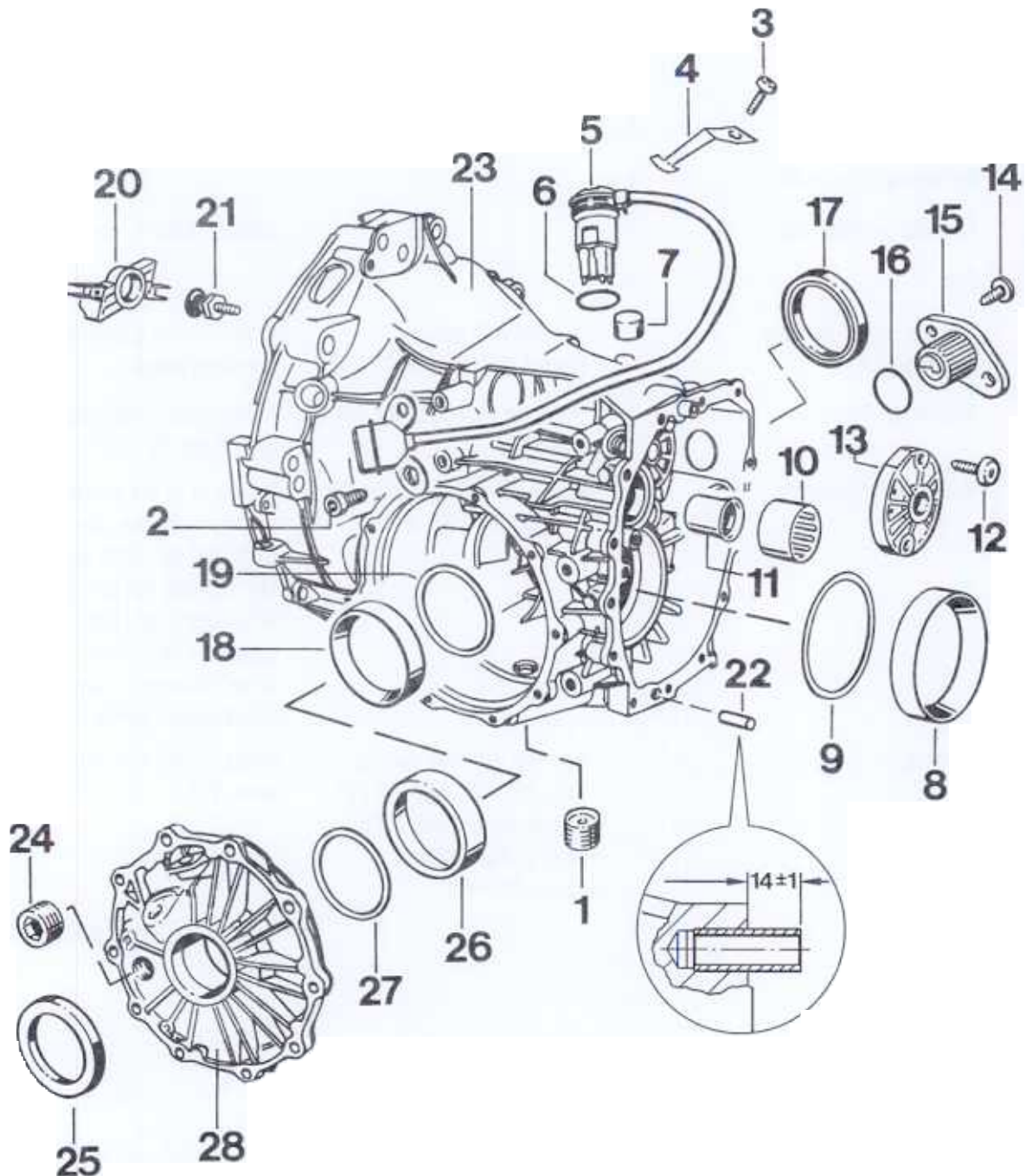
34 37 37 Disassembling and assembling the transmission housing (transmission G 86)

Tools



No.	Designation	Special tool	Explanation
1	Striking tool	VW 771	
2	Bridge	VW 771/29	
3	Pull-in tool and extractor	P 254	
4	Drive-in mandrel	VW 295	
5	Hook	VW 681	
6	Pressure piece	9247/4	
7	Pressure piece	3128	
8	Pressure disc	VW 511	
9	Pressure piece	30 - 205	
10	Pressure piece	40 - 202	
	Pressure piece	9247/1	
12	Drive-in mandrel	VW 195	
13	Threaded piece	VW 771/15	

Disassembling and assembling the transmission housing (transmission G 86)



No.	Designation	Qty.	Removal	Note:	Installation
1	Oil drain plug	1	See Page 34 - 1		Tightening torque 25 Nm (18 ftlb.)
2	Torx screw	2			Tightening torque 10 Nm (7 ftlb.)
3	Torx screw	1			Tightening torque 25 Nm (18 ftlb.)
4	Tab washer				
5	Reversing light switch	1			
6	Toroidal sealing ring	1			Always replace, lightly oil
7	Cap				
8	Tapered roller bearing outer race *	1	Pull out with special tools 3128 and VW 771/29		Press in with a suitable pressure piece
9	Adjusting shim "S3"	X	Note the thickness for reinstallation		Remeasure if necessary (see Page 39 - 19)
10	Needle roller bearing	1	Press out with special tools VW 295 and 40 - 202		Press in in the correct position with the special tools VW 40 - 202 and VW 295 (do not strike). When doing so, the labelled side (greater sheet thickness) faces the pressure piece
11	Bushing	1	Remove with the special tools VW 771, VW 771/15 and a suitable internal puller (e.g. Kukko 21/4, 23.5...30 mm)		Press in with the special tools 9247/1 and P 254
12	Torx screw	2			Tightening torque 20 Nm (15 ftlb.)

No.	Designation	Qty.	Removal	Note:	Installation
13	Cover	1	Remove with the special tools VW 771, VW 771/15 and a suitable internal puller (e.g. Kukko 21/3, 18.5...23.5 mm)		
14	Torx screw	1			Tightening torque 10 Nm (7.5 ftlb.)
15	Lock (5th and reverse gear)				
16	Toroidal sealing ring	1			Always replace, lightly oil
17	Shaft seal	1	Pull out with the special tool VW 681 (also possible with transmission installed)		Fill the chamber between the dust lip and sealing lip with multi-purpose grease. Drive in in the correct position using the special tool VW 195 (5.5 mm under the upper edge of the cover)
18	Tapered roller bearing outer race (small) *	1	Drive out with a suitable aluminium or copper mandrel (ø6...8 mm)		Press in with the special tools 30 - 205 and VW 295
19	Adjusting shim "S2"	X	Note the thickness for reinstallation		Remeasure the thickness if necessary
20	Adapter				
21	Ball journal	1			Tightening torque 25 Nm (18 ftlb.)
22	Sleeve	2			Press in in the correct position
23	Transmission housing				
24	Oil filler screw	1			Tightening torque 25 Nm (18 ftlb.)
25	Shaft seal	1	Same as No. 17		same as No. 17
26	Tapered roller bearing outer race (large) *	1	Same as No. 18		Press in with the special tools VW 511 and VW 295

No.	Designation	Qty.	Removal	Note:	Installation
27	Adjusting shim "S1"	X	Same as No. 19		Same as No. 19
28	Cover for final drive *	1			Seal with Loctite 574

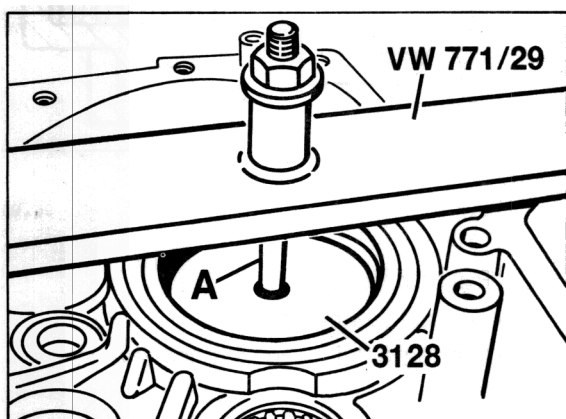
Note

If the parts marked with an * (asterisk) are replaced, readjustment is necessary (see Page 39 - 11).

Instructions for disassembly and assembly (transmission G 86)

Disassembly

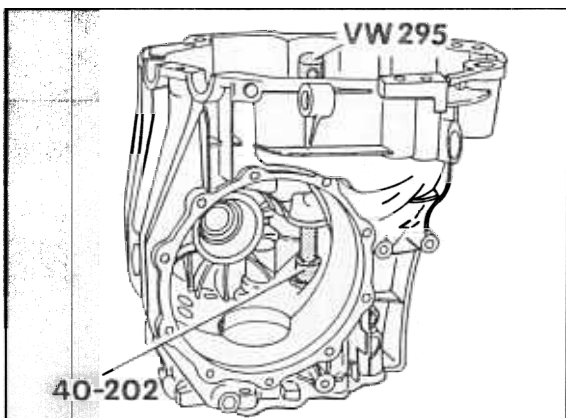
1. Pull out the tapered roller bearing outer race with the special tools 3128 and VW 771/29.



A = screw M10 x 135

92 - 96

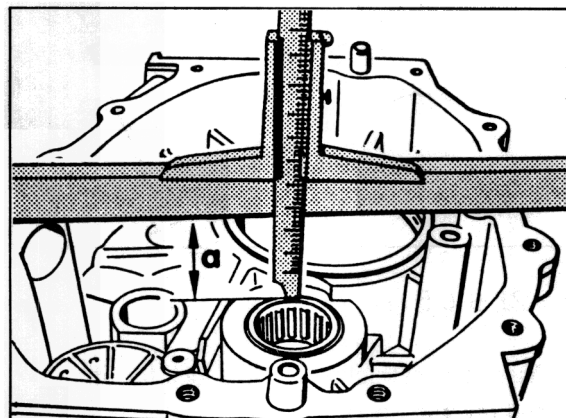
2. Press out the needle roller bearing for the input shaft with the special tools VW 295 and 40 - 202.



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Assembly

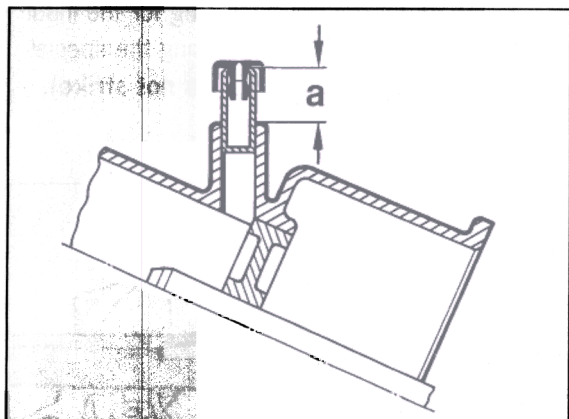
1. Press in the needle roller bearing for the input shaft in the correct position, using the special tools VW 295 and 40 - 202 (**do not strike**).



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Dimension "a" from the bottom edge of the rule to the upper edge of the needle roller bearing 39.5 ± 0.3 mm.

2. Press-in depth of the sleeve for transmission venting.

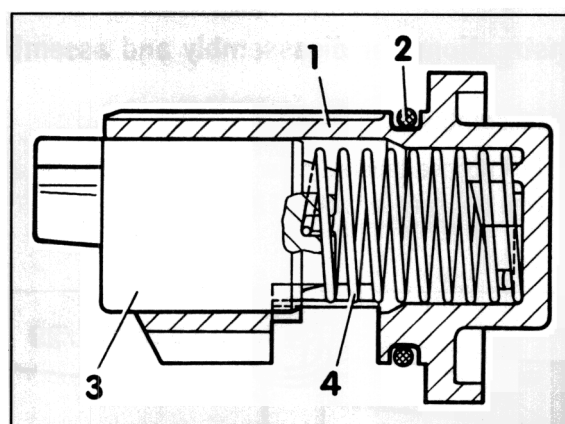


$$a = 21 \pm 0,5 \text{ mm}$$

95 - 96

3. Assembly instructions for the lock for 5th and reverse gears

Insert the spring "4" into the plastic bushing "1" and turn it counterclockwise under slight pressure until the spring engages at the base of the plastic part. Position the bushing "3" onto the spring so that the bent spring end lies in the groove provided for that purpose. Press the spring together with the bushing "3", tighten by approx. 1 turn counterclockwise (to the left) until the lug of the bushing "3" is above the groove in the plastic bushing. Press the lug of the bushing "3" into the groove of the plastic bushing "1" as far as the stop surface. Turn the bushing "3" clockwise (to the right) and release it. The bushing "3" springs into the assembly end position.

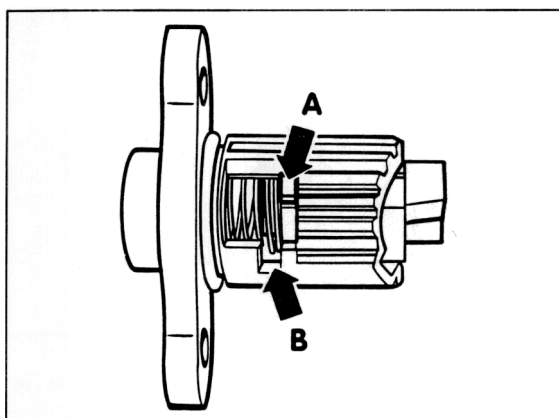


96 - 96

- 1 - Plastic bushing
- 2 - Toroidal sealing ring
- 3 - Bushing with lock for 5th and reverse gears
- 4 - Spring

4. Assembly end position of the lock for 5th and reverse gears.

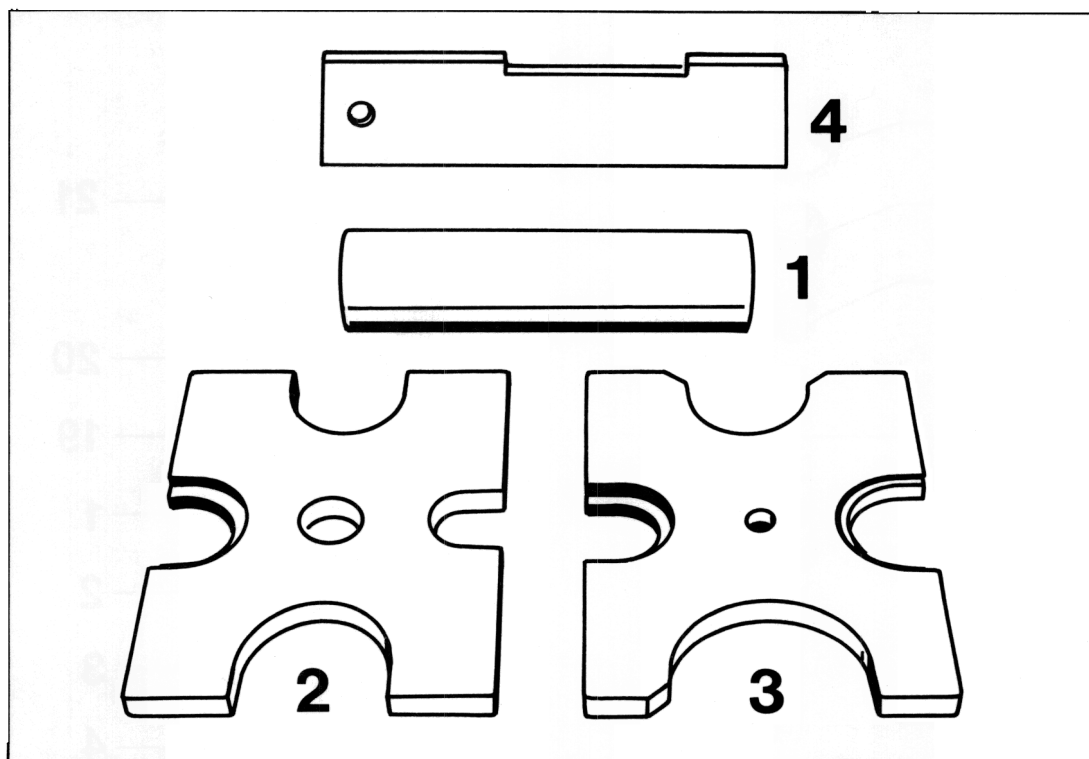
The lug (arrow A) of the bushing for 5th and reverse gears must always come to the stop opposite to the groove (arrow B) of the plastic bushing.



97 - 96

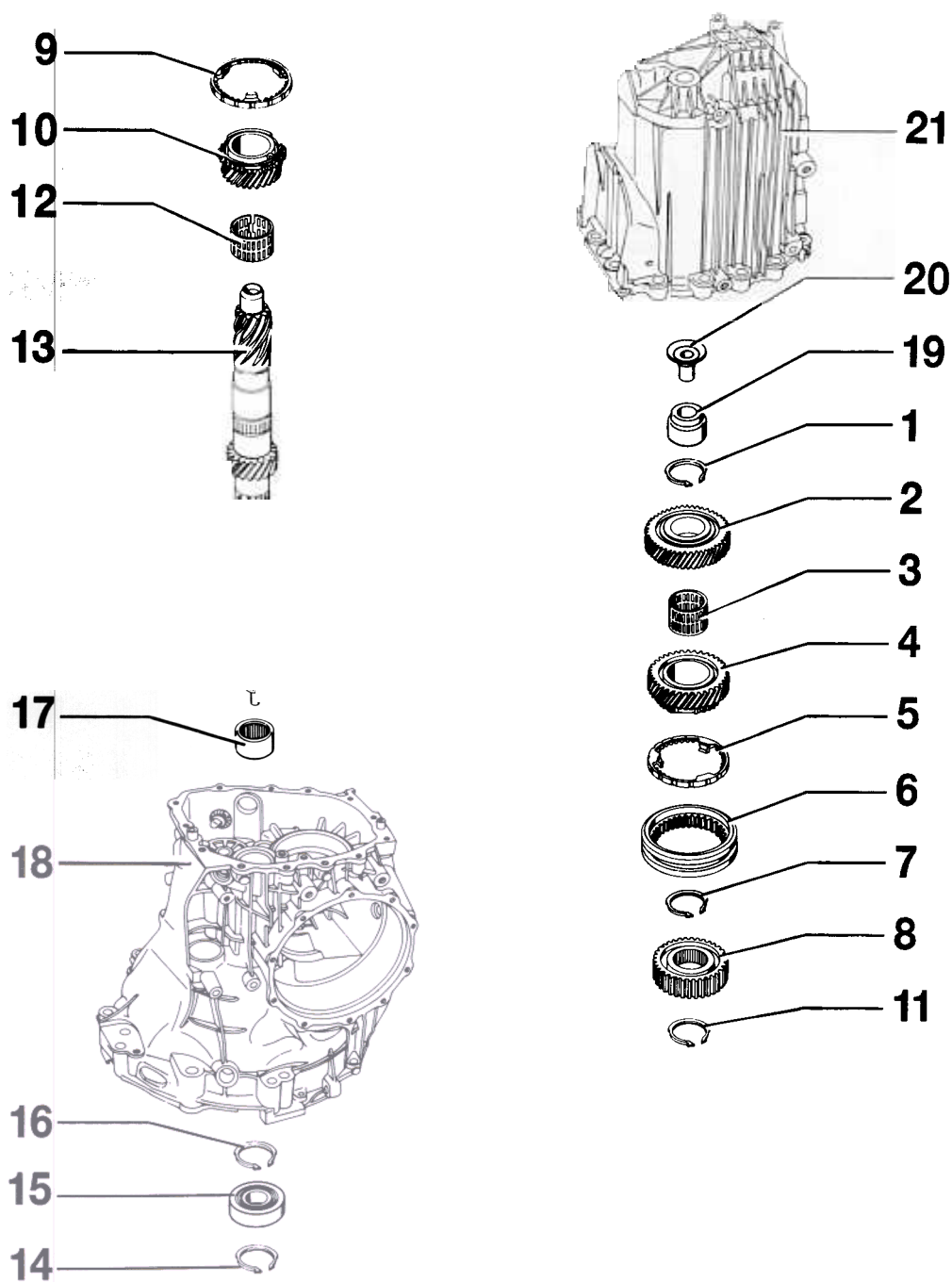
35 40 37 Disassembling and assembling the input shaft (transmission G 86)

Tools



No.	Designation	Special tool	Explanation
1	Tubular piece	9238	
2	Pressure plate	VW 401	
3	Pressure plate	VW 402	
4	Measuring bridge	3167	

Disassembling and assembling the input shaft (transmission G 86)



No.	Designation	Qty.	Removal	Note:	
					Installation
1	Snap ring	1	Mark for refitting		Remeasure the snap ring if the input shaft and 5th gear fixed gear wheel are to be replaced
2	5th gear fixed gear wheel	1	Press off above the 4th gear loose gear wheel		Heat up to approx. 100 °C and press on in the correct position
3	Needle-roller bearing	1	Mark for refitting		Fit with the same gear wheel
4	4th gear loose gear wheel	1			Insert spring before assembly
5	4th gear synchronizing ring	1	Mark for refitting		Check for wear. Fit with the same gear wheel
6	Selector sleeve	1			Pay attention to the installation position
7	Snap ring (color blue)	1	Mark for refitting		Remeasure the snap ring if the input shaft and synchronizing element No. 8 are to be replaced
8	Synchronizing element	1	Press off		Heat up to approx. 100 °C and press on (high collar faces the 3rd gear loose gear wheel)
9	3rd gear synchronizing ring	1	Same as No. 5		Same as No. 5
10	3rd gear loose gear wheel	1			Same as No. 4
11	Snap ring (color brown)	1	Mark for refitting		Always the same thickness
12	Needle-roller bearing	1	Same as No. 3		Same as No. 3

No.	Designation	Qty.	Removal	Note:	Installation
13	Input shaft	1			If the input shaft and ball bearing No. 15 are to be replaced, the snap rings No. 14 and No. 16 must be remeasured (see Page 35 - 9)
14	Snap ring	1	Mark for refitting		Remeasure the thickness if necessary (see Page 35 - 9)
15	Ball bearing	1	See Page 34 - 14		See Page 34 - 14
16	Snap ring	1	Same as No. 14		Same as No. 14
17	Needle-roller bearing	1	See Page 34 - 28		See Page 34 - 28
18	Transmission housing				
19	Needle-roller bearing	1	See Page 34 - 22		See Page 34 - 22
20	Plastic sleeve	1	See Page 34 - 22		See Page 34 - 22
21	Transmission case cover	1			

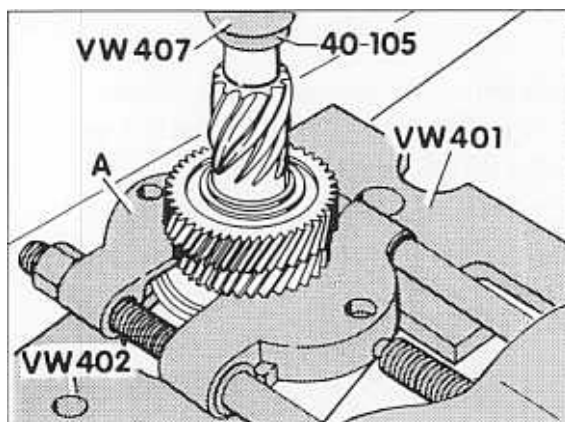
Instructions for disassembly and assembly (transmission G 86)

Disassembly

Note

Since snap rings of different sizes and thicknesses are used, the individual snap rings must be identified (e.g. with numbers). The thickness of the individual snap ring must be determined again if a directly affected component is replaced.

1. Press off the 5th gear fixed gear wheel using a suitable separating device (e.g. Kukko 17/2, 22...115 mm).



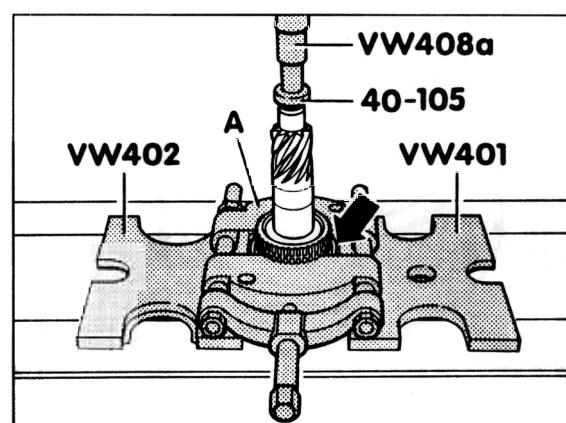
A = Separating device

88 - 96

2. Press off the synchronizing elements for the 3rd and 4th gears using a suitable separating device (e.g. Kukko 17/2, 22...115 mm).

Note

Before fitting the separating device, press the synchronizing ring for the 3rd gear (arrow) to the loose gear wheel for the 3rd gear.

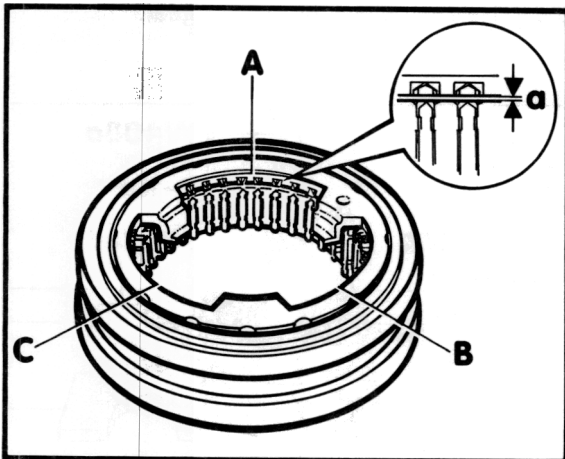


A = Separating device

89 - 96

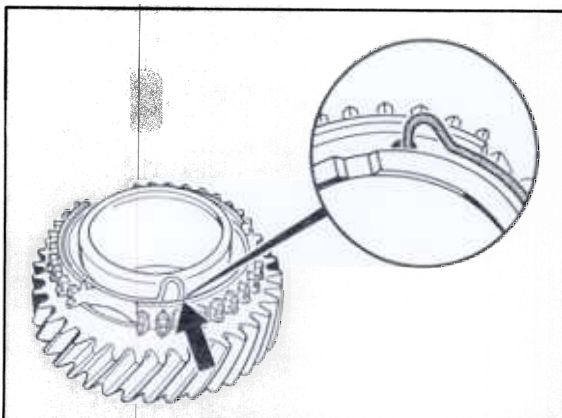
Assembly

1. Check the synchronizing rings for wear.
To do this, press the ring into the shift sleeve and measure the gap dimension "a" with a feeler gauge in positions A, B and C.
Add up the measured values and divide by 3.
The value obtained must not be below 0.5 mm.



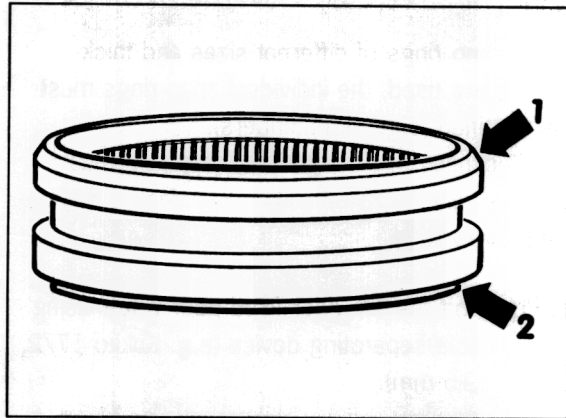
1162 - 35

2. Insert the spring into the loose gear wheel so that the angled end engages in the hole.



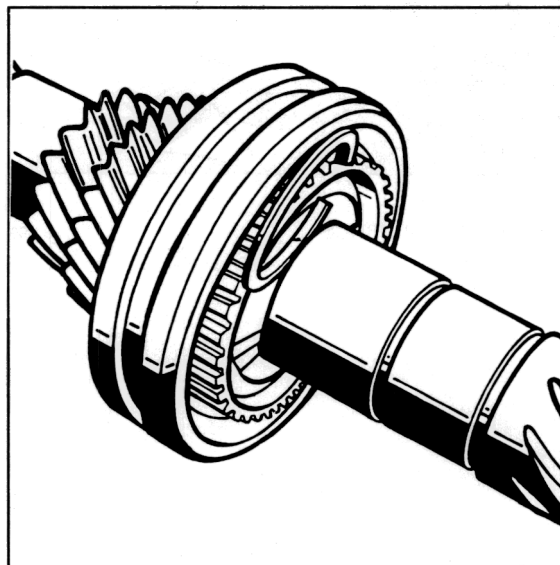
1179 - 35

3. Install the selector sleeve so that the slant (arrow 1) faces the 4th gear and the offset side (arrow 2) faces the 3rd gear.



83 - 96

4. Determine the snap ring for the 4th gear.
To do this, determine the thickest ring which can still just be used.

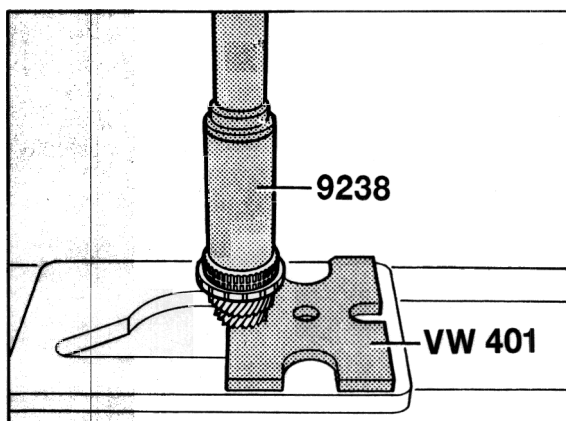


85 - 96

Note

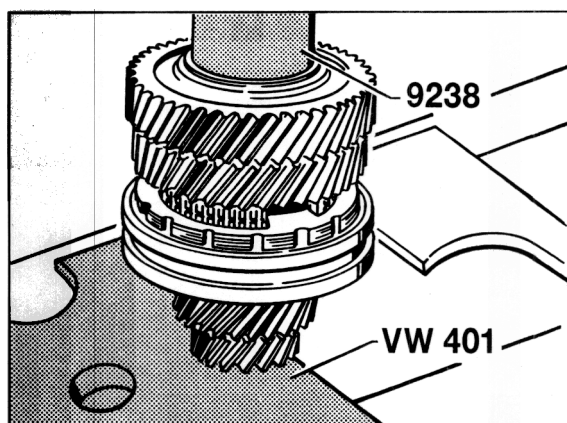
Determine the snap ring for the 5th gear in exactly the same way.

5. Heat the synchronizing elements for the 3rd and 4th gears to approx. 100 °C and press on (high collar facing the 3rd gear loose gear wheel).



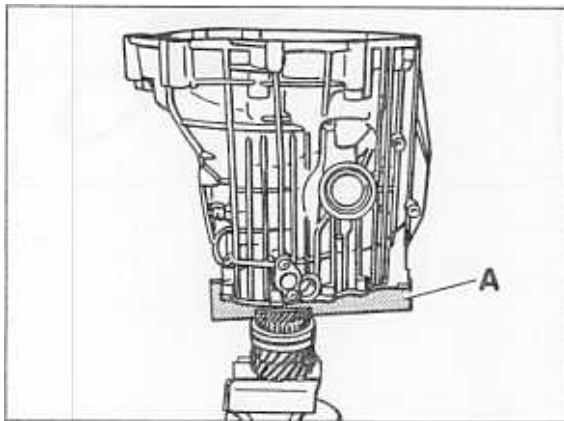
01 - 90

6. Heat the fixed gear wheel for the 5th gear to approx. 100 °C and press on (high collar to the reverse gear and the oil pockets to the 4th gear).



35 40 15 Adjusting the input shaft (transmission G 86)

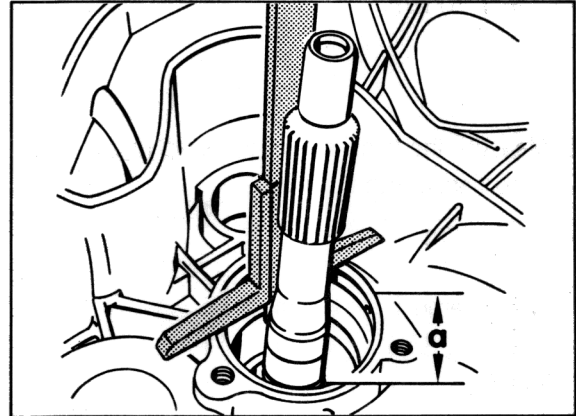
1. Clamp the input shaft in the vise with protective jaws.
2. Put the special tool 3167 onto the 3rd gear and position the transmission housing onto the special tool via the input shaft.



A = Special tool 3167

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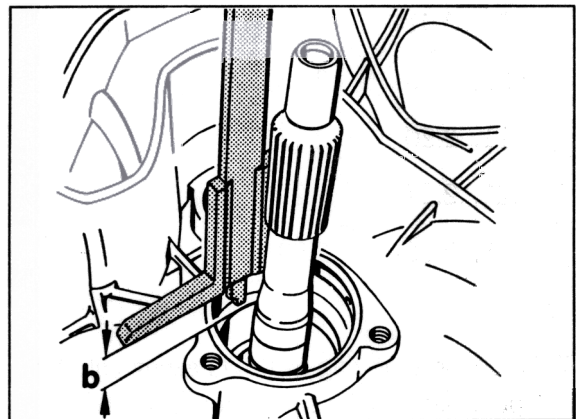
3. With a depth gauge, measure from the housing to the lower input shaft groove.



Dimension "a" = 28.5 mm

64 - 96

4. With a depth gauge, measure from the housing to the bearing surface of the ball bearing.



Dimension "b" = 26.8 mm

63 - 96

5. Measure the thickness of the lower snap ring (No. 8, Page 34 - 14):

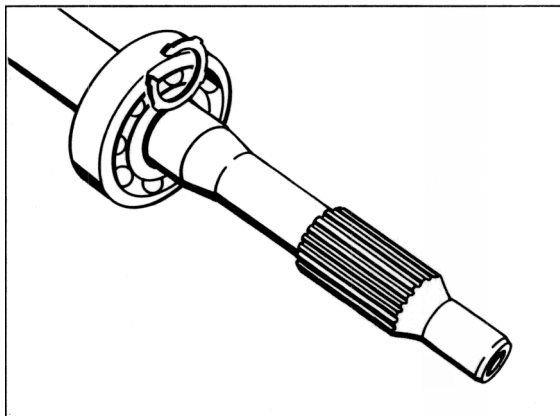
Dimension "x"

$$\begin{aligned} x &= a - b \\ &= 28.5 - 26.8 \text{ mm} \\ &= 1.70 \text{ mm} \end{aligned}$$

6. Measure the thickness of the snap ring in accordance with the table:

Measurement result (mm)	thickness (mm)
1.48...1.56	1.54
1.57...1.65	1.63
1.66...1.74	1.72
1.75...1.83	1.81
1.84...1.92	1.80
1.93...2.01	1.99
2.02...2.10	2.08
2.11...2.20	2.17
2.21...2.27	2.25
2.28...2.35	2.33

8. Determine the thickest snap ring which can still just be used.

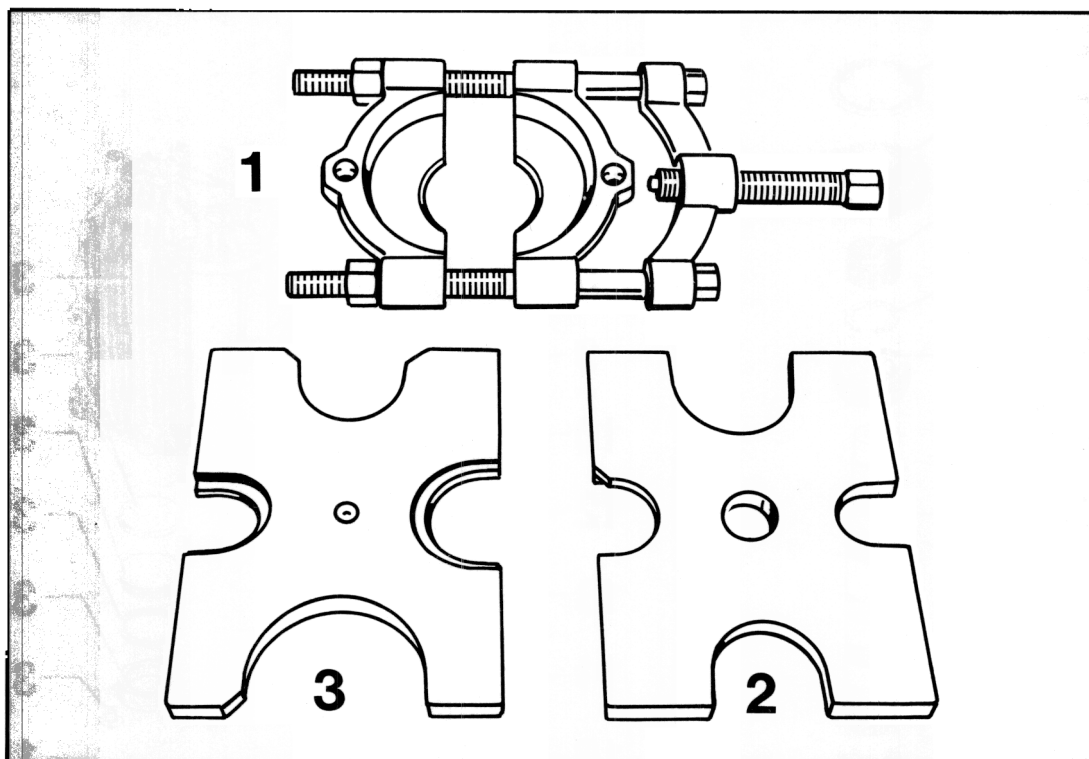


65 - 96

7. Force the snap ring and ball bearing onto the input shaft with the special tool 30 - 100.

35 59 37 Disassembling and assembling the output shaft (transmission G 86)

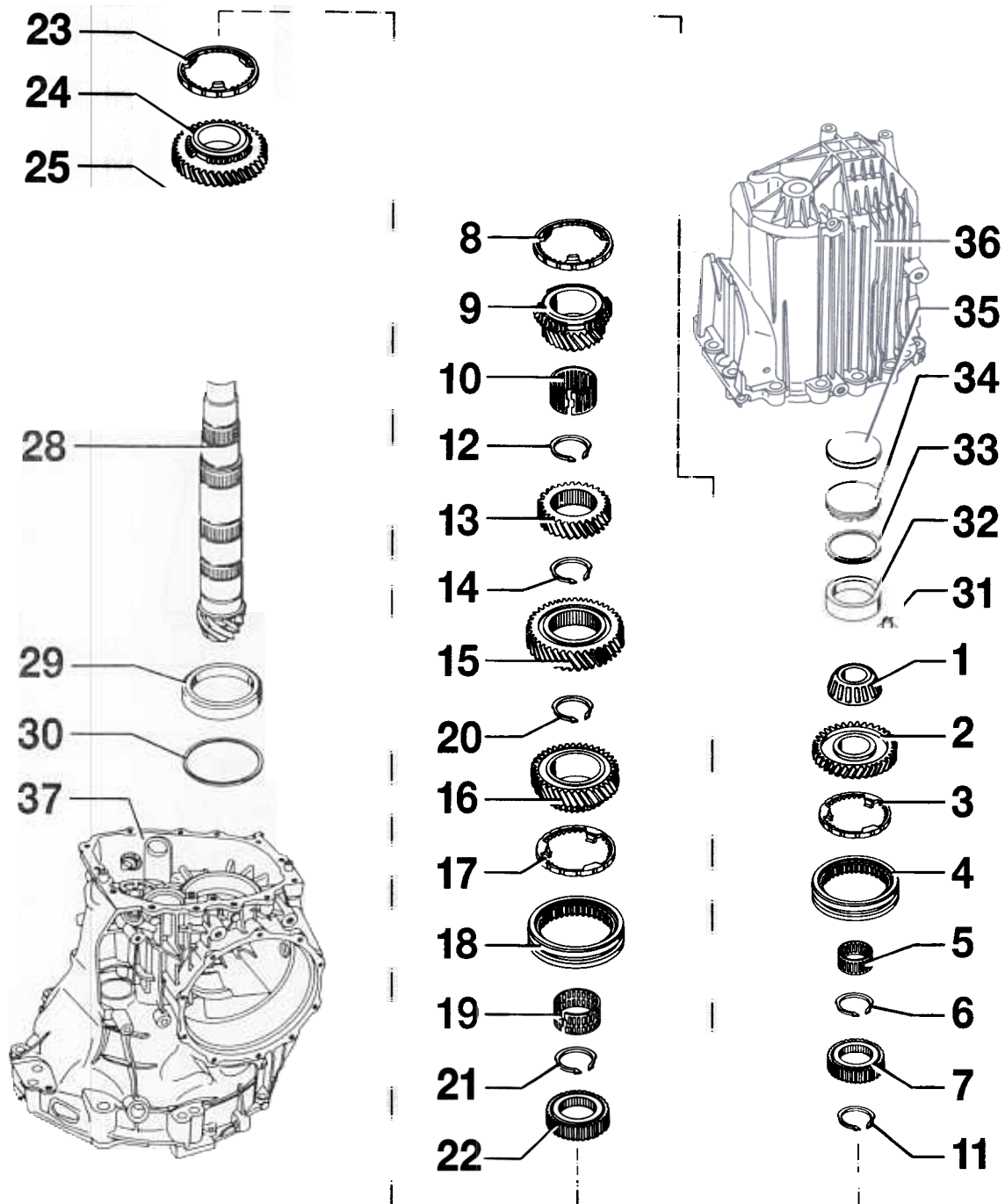
Tools



100 - 96

No.	Designation	Special tool	Explanation
	Separating device		e.g. Kukko 17/2
2	Pressure plate	VW 401	
3	Pressure plate	VW 402	

Disassembling and assembling the output shaft (transmission G 86)



No.	Designation	Qty.	Removal	Note:
				Installation
1	Tapered roller bearing inner race	1	Using a suitable separating device (e.g. Kukko 17/2), press off via the reverse gear wheel	Heat to approx. 100° C and press on with a suitable tubular piece (e.g. special tool 30 - 100). Press again after heat exchange
2	Reverse gear loose gear wheel	1		Insert spring before assembly
3	Reverse gear synchronising ring	1	Mark for refitting	Check for wear. Fit with the same gear wheel (see Page 35 - 16).
4	Selector sleeve	1		The slant must face the reverse gear (see Page 35 - 17).
5	Needle-roller bearing	1	Mark for refitting	Fit with the same gear wheel
6	Snap ring * (colour blue)	1	Mark for refitting	Remeasure if necessary
	Synchronising element	1	Using a suitable separating device (e.g. Kukko 17/2), press off together with the 5th gear loose gear wheel	Heat to approx. 100° C and press on (high collar facing the 5th gear loose gear wheel)
8	5th gear synchronising ring	1	Same as No. 3	Same as No. 3
9	5th gear loose gear wheel**	1		Same as No. 2
10	Needle-roller bearing**	1	Same as No. 5	Same as No. 5
11	Snap ring * (colour brown)	1	Same as No. 6	Always 2.00 mm thick
12	Snap ring**	1	Same as No. 6	Same as No. 6

No.	Designation	Qty.	Removal	Note:	
				Installation	
13	4th gear fixed gear wheel**	1	Press off with special tool VW 402	Heat up to approx. 100°C and press on in the correct position (groove or high collar faces 3rd gear)	
14	Snap ring *	1	Same as No. 3	Same as No. 3	
15	3rd gear fixed gear wheel	1	Same as No. 13	Same as No. 13, groove faces 4th gear	
16	2nd gear loose gear wheel	1		Same as No. 2	
17	2nd gear synchronising ring	1	Same as No. 3	Same as No. 3	
18	Selector sleeve	1		Slant faces 2nd gear (see Page 35 - 17).	
19	Needle-roller bearing	1	Same as No. 5	Same as No. 5	
20	Snap ring * (colour blue)	1	Same as No. 6	Always 2.5 mm thick	
21	Snap ring * (colour blue)	1	Same as No. 6	Same as No. 6	
22	Synchronising element	1	same as No. 7, press off with 1st gear loose gear wheel	Heat to approx. 100°C and press on (high collar faces 2nd gear)	
23	1st gear synchronising ring	1	Same as No. 3	Same as No. 3	
24	1st gear loose gear wheel	1		Same as No. 2	
25	Needle-roller bearing	1	Same as No. 5	Same as No. 5	
26	Snap ring *	1	Same as No. 6	Same as No. 6	
27	Tapered roller bearing inner race	1	Press off with tapered roller bearing outer race and special tools VW 401 and VW 402	Heat to approx. 100 °C and press on with a suitable tubular piece (e.g. special tool VW 415 a). Press again after heat exchange	

No.	Designation	Qty.	Removal	Note:
				Installation
28	Output shaft**	1		This is paired with the crown wheel (drive set). Readjust if replaced (see Page 39 - 13).
29	Tapered roller bearing outer race	1	See Page 34 - 30	
30	Adjusting shim "S3"	X	See Page 34 - 30	
31	Retaining sleeve	1	See Page 34 - 21	
32	Tapered roller bearing outer race	1	See Page 34 - 21	
33	Adjusting shim "S4"	X	See Page 34 - 21	
34	Pressure plate	1	See Page 34 - 21	
35	Rubber washer	1	See Page 34 - 21	
36	Transmission cover	1	See Page 34 - 22	
37	Transmission housing	1	See Page 34 - 25	

*** Note**

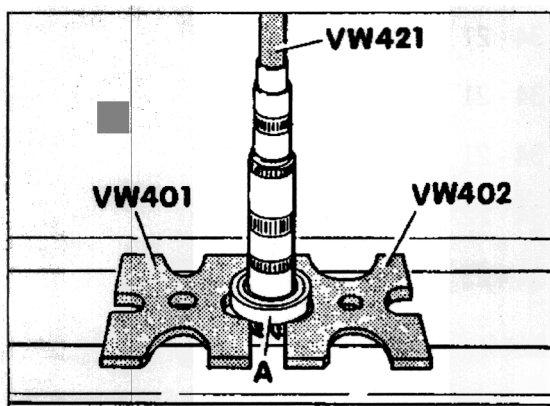
Since snap rings of different sizes and thicknesses are used, the individual snap rings must be identified (e.g. with numbers). The thickness of the individual snap ring must be determined again if a directly affected component is replaced.

** Changed components on the transmission **DVY**. Observe allocation in the case of repairs (see Parts Catalogue).

Instructions for disassembly and assembly (transmission G 86)**Disassembly****Note**

When replacing the tapered roller bearings (No. 1 and No. 27), determine the installation position before removing the output shaft (see Actual Measurement on Page 39 - 17).

1. Press off the tapered roller bearing inner race.
The outer race must be used for this purpose.

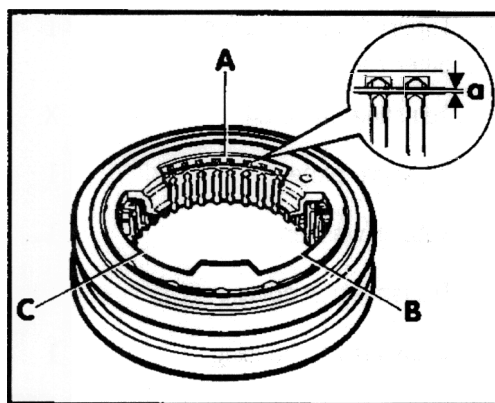


A = Tapered roller bearing outer race

116_96

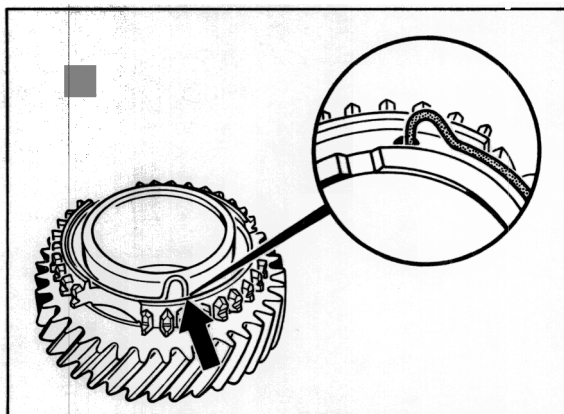
Assembly

1. Check the synchronising rings for wear.
To do this, press the ring into the shift sleeve and measure the gap dimension "a" with a feeler gauge in positions A, B and C. Add up the measured values and divide by 3. The value obtained must not be below 0.5 mm.



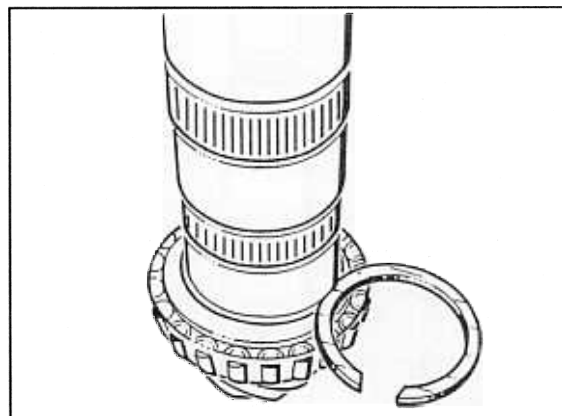
1162_35

2. Insert the spring into the loose gear wheel so that the angled end engages in the hole.

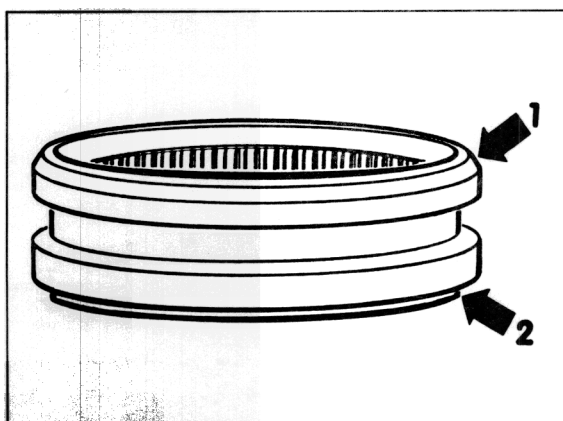


Note

Determine the snap rings of the synchronizing elements and of the 3rd and 4th gears in exactly the same way.



3. Install the selector sleeves in the correct position. The slanted side (arrow 1) faces the reverse gear loose gear wheel (No. 2) in the case of the 5th and reverse gear selector sleeve, and it faces the 2nd gear loose gear wheel (No. 16) in the case of the 1st and 2nd gear selector sleeve.



4. Determine the snap ring for the tapered roller bearing.
To do this, determine the thickest ring which can still just be used.

[illegible]

Purchased from www.WorkshopManuals.co.uk

No.	Designation	Qty.	Removal	Note:
				Installation
	Flanged shaft	2	See Assembly instructions	Grease the snap ring and drive it in with a suitable mandrel (e.g. special tool VW 295)
2	Snap ring	2	See Assembly instructions	Always replace
3	Torx screw	10		Tightening torque 25 Nm (19 ftlb.)
4	Cover for final drive	1		Seal with Loctite 574
5	Differential	1	Can also be removed without removing the transmission	
6	Speedometer-drive gear	1		
7	Tachometer sensor	1		
8	Toroidal sealing ring	1		Always replace, lightly oil
9	Transmission housing	1		

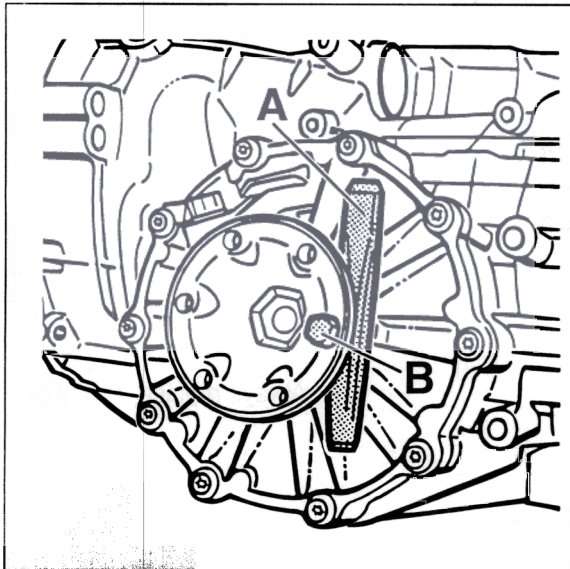
*** Note**

In this transmission, the speedometer-drive gear and tachometer sensor have no function.

Instructions for removal and installation (transmission G 86)**Removal**

1. Remove the flanged shaft.

To do this, place a chisel or spacer "A" under the flanged shaft and pull out the flanged shaft by turning the screw "B".

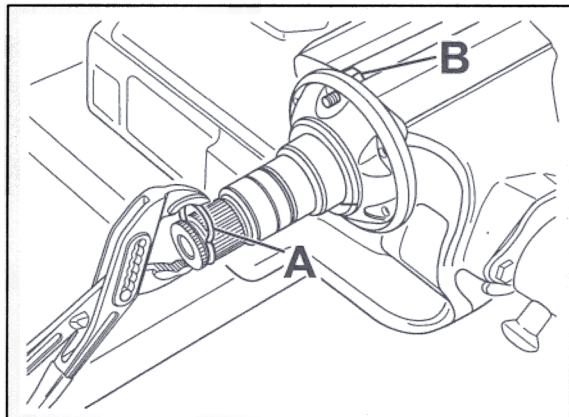


39250001

Installation**Note**

The flanged shafts are installed with polygonal bearings. **The rough running of these bearings when the flanged shafts are not installed does not indicate that the bearings are faulty.** The polygonal bearings can be replaced only with the flanged shaft.

1. Always replace the snap ring for the halfshaft flange. To do this, clamp the flange with protective jaws and press out the snap ring with the new snap ring "A".



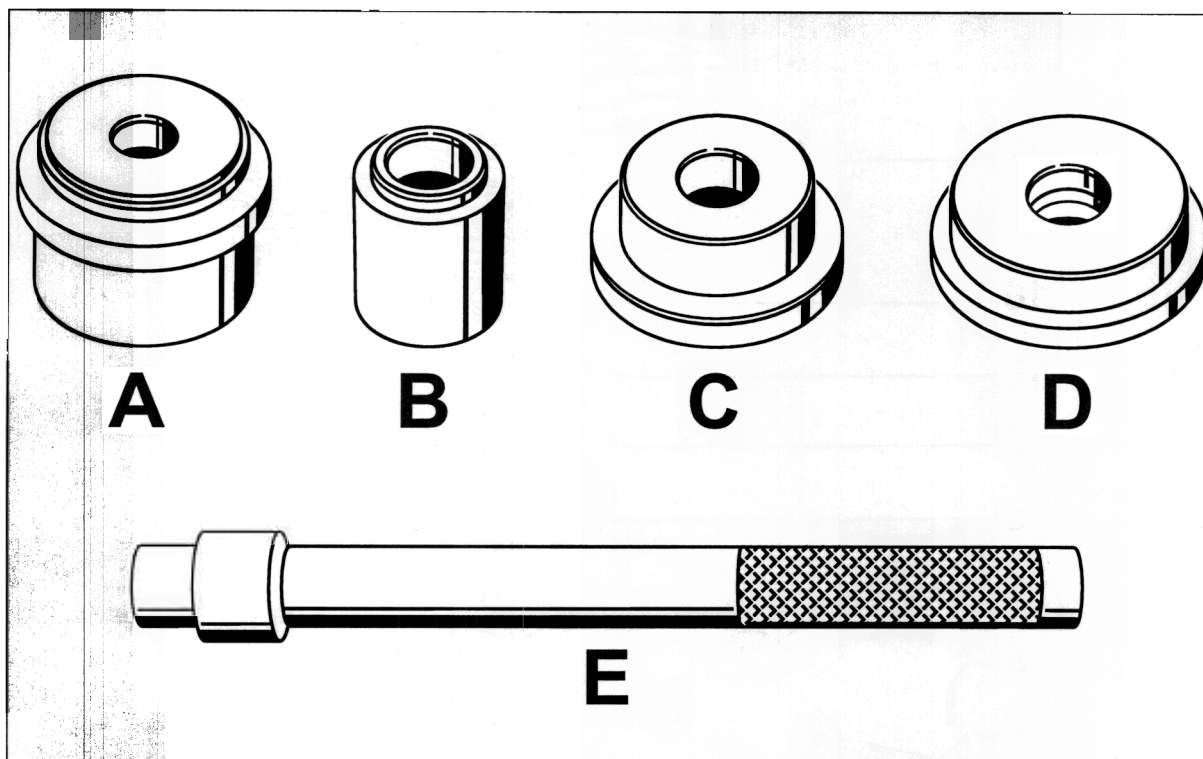
A=New snap ring
B=Hexagon-head bolt

39250002

2. Grease the snap ring thoroughly and drive in the halfshaft flange.

39 09 37 Disassembling and assembling the differential (transmission G 86)

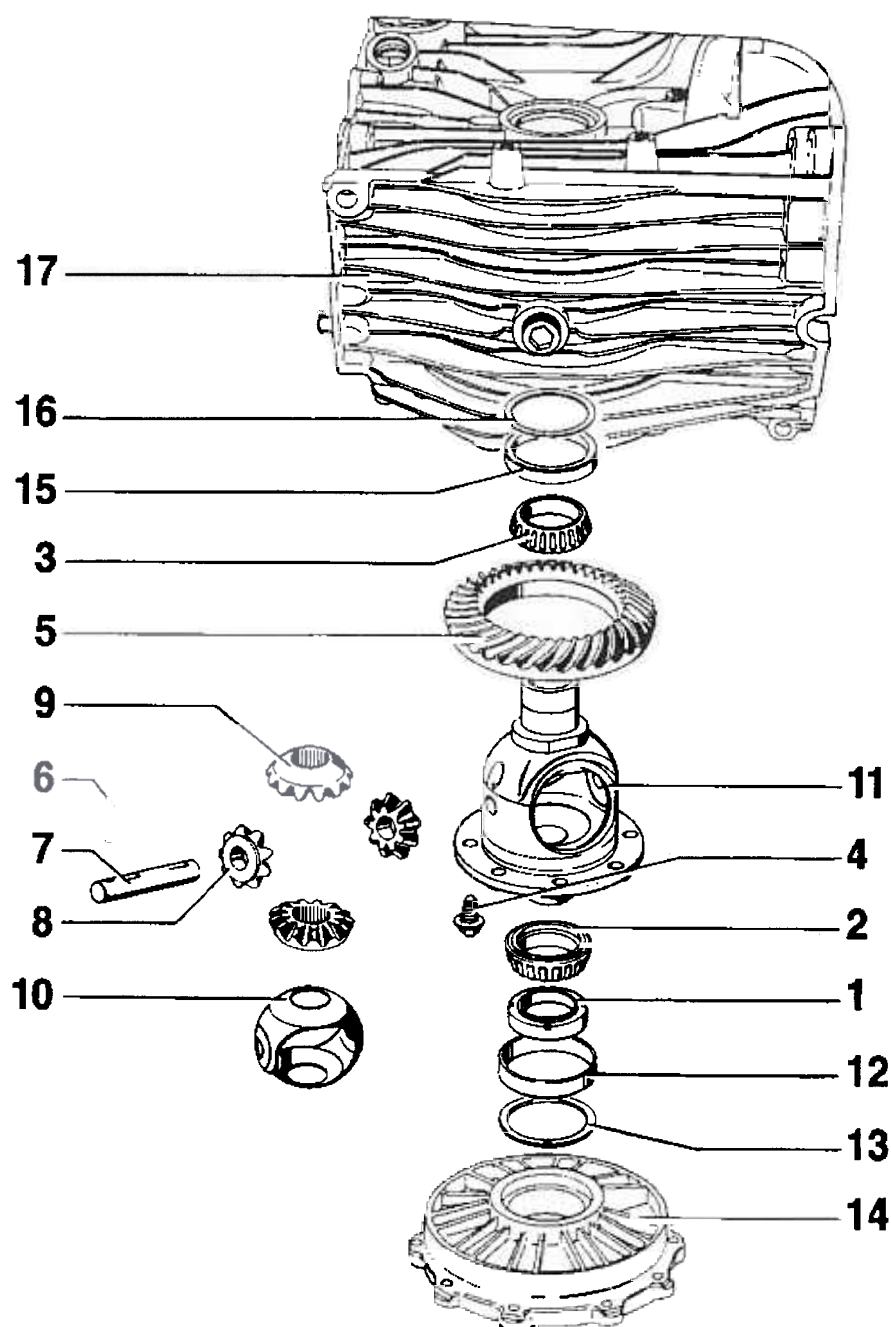
Tools



39090001

Item	Designation	Special tool	Explanation
A	Pressure piece	VW 472/1	
B	Pressure piece	P263	
C	Pressure disc	VW 511	
D	Pressure piece	2050	
E	Drive-in mandrel	VW 295	

Disassembling and assembling the differential (transmission G 86)



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No.	Designation	Qty.	Removal	Note:
				Installation
1	Speedometer-drive gear	1		
2	Tapered roller bearing inner race *	1	Remove with commercially available two-arm puller and special tool P 263	Heat to approx. 100° C, put into position and press again after heat exchange
3	Tapered roller bearing inner race *	1	Same as No. 2	Same as No. 2
4	Crown wheel screw	10		Always replace. The thread must be dry and grease-free. Tighten crosswise with 60 Nm (44 ftlb.) and then continue turning with a rotational angle of 45°.
5	Crown wheel *	1	Force off with a mandrel through the threaded holes	If required, heat up to approx. 100° C
6	Dowel pin	1		Drive in in the correct position
7	Axle	1		
8	Differential bevel gear (small)	2		
9	Differential bevel gear (large)	2		
10	Thrust washer assembly	1		Insert with gear oil
	Differential housing *	1		
12	Tapered roller bearing outer race	1	Drive out using a suitable aluminium or copper mandrel (ø6...8 mm)	Press in with special tools VW 511 (or 2050) and VW 295
13	Adjusting shim "S ₁ "	X	Note the thickness for installation	Remeasure the thickness if necessary
14	Cover for final drive *	1		Seal with Loctite 574

No.	Designation	Qty.	Removal	Note: Installation
15	Tapered roller bearing outer race	1	Same as No. 12	Drive in with special tool VW 472/1
16	Adjusting shim "S2"	X	Same as No. 13	Same as No. 13
17	Transmission housing *	1		

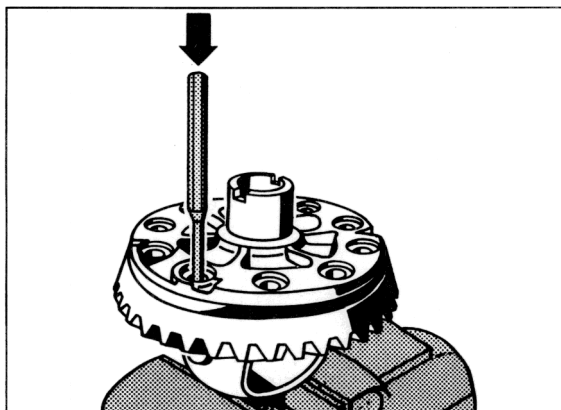
*** Note**

If the parts marked with an * (asterisk) are replaced, readjustment is necessary (see Page 39 - 13).

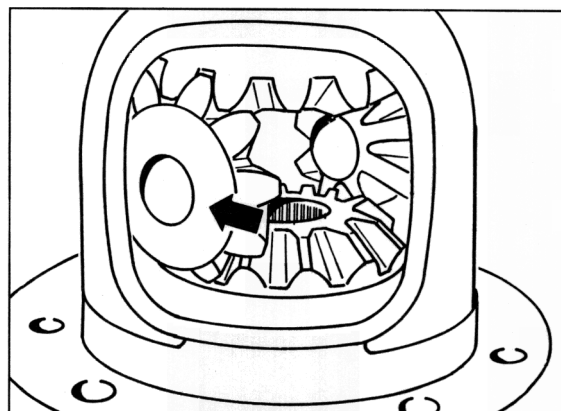
Instructions for disassembly and assembly (transmission G 86)

Disassembly

1. Force the crown wheel off the housing.



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2. Heat up the crown wheel to approx. 100 °C and put it into position.

Assembly

1. Install the differential bevel gears.

Insert the thrust washer assembly with hypoid gear oil (Burmah-Oil TAF 21).

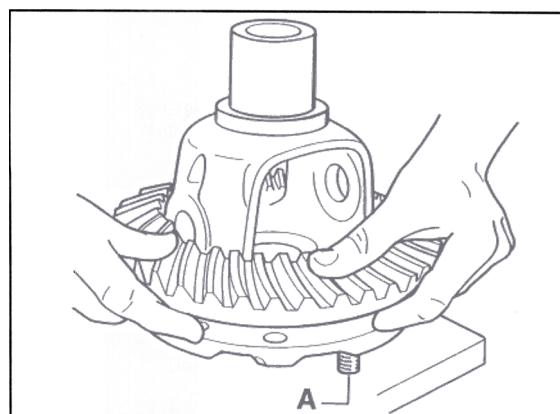
Oil the differential bevel gears thoroughly.

Insert large differential bevel gears and fix them with the flanged shafts (without snap ring).

Insert the small differential bevel gears offset by 180° and swivel them in by turning the flange shafts.

Align the thrust washer assembly and small differential bevel gears.

Insert the axle and secure with a dowel pin.



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A = Use centering pins (shop-made) for guidance.

Adjusting the drive set (transmission G 86)**Tools**

No.	Designation	Special tool	Explanation
1	Centring disc	VW 385/4	
2	Centring disc	VW 385/3	
3	Universal master gauge	VW 385/30	
4	Dial gauge		Commercially available (see Workshop Equipment Manual)
5	Dial gauge		Commercially available, measuring range 3 mm (see Workshop Equipment Manual)
6	Gauge plunger	VW 385/14	
7	Dial gauge extension	VW 385/56	30 mm long
8	End plate	VW 385/17	
9	Gauge holder	VW 387	
10	Clamping sleeve	VW 521/12	
11	Adjustment device	VW 521/4	
12	Measuring lever	VW 388	
13	Torque gauge		Commercially available 0...600 Ncm (see Workshop Equipment Manual)
14	Dial gauge extension	VW 382/10	6.0 mm long
15	Dial gauge extension	VW 385/15	9.3 mm long
16	Measuring mandrel	VW 385/1	
17	Holder	VW 792/1	
18	Holder	3177	
19	End plate	VW 385/33	
20	Lever	VW 296	

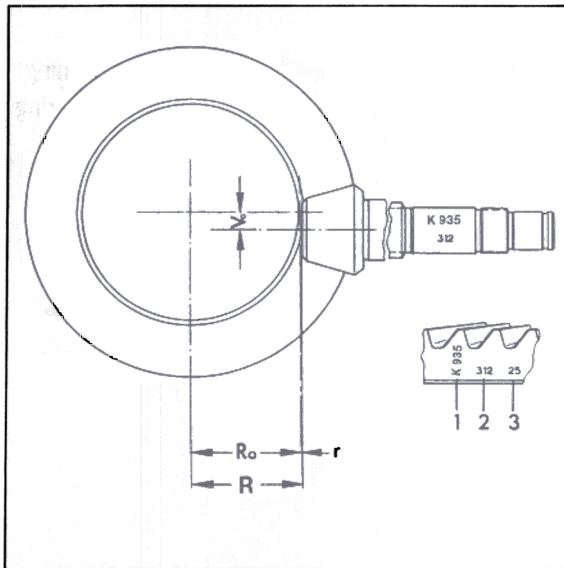
Adjusting the drive set (transmission G 86)

General

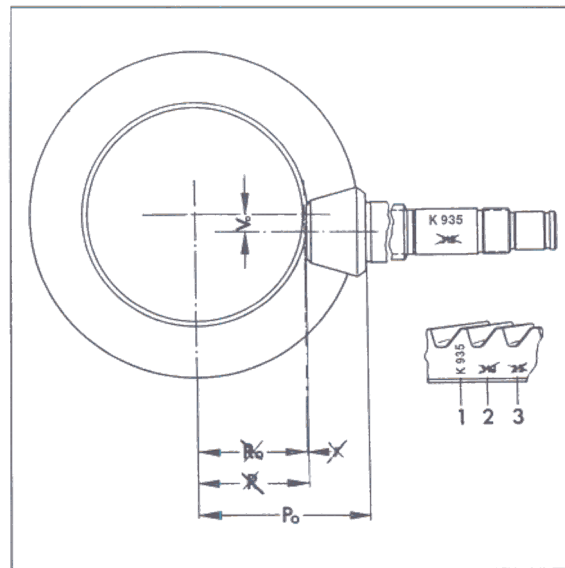
Careful adjustment of the output shaft and crown wheel are crucial to the service life and smooth running of the final drive. Therefore, output shafts and crown wheels are paired with each other as early as during manufacture and are checked by special inspection machines to ensure that the tooth bearing is in a good position and that there is low noise in both rotation directions.

The deviation "r" referred to the master gauge "R₀" is measured for the drive sets supplied as spare parts and is recorded on the outer circumference of the crown wheel. Every drive set (output shaft and crown wheel) must be replaced only together.

Adjustment and labelling of the drive sets (transmission G 86)



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KD drive sets

- 1 – Identification "0937" means Oerlikon drive set with the transmission ratio of 35 : 9.
- 2 – Pairing number (312) of the drive set.
- 3 – Deviation "r" referred to the master gauge of the special inspection machine used in production. The deviation "r" is always stated in 1/100 mm.
Example: "25" means $r = 0.25$ mm

R_0 – Length of the used master gauge of the special inspection machine.
" R_0 " = 59.65 mm

R – Actual dimension between the crown wheel axis and the front side of the output shaft at the point of maximum smooth running for this one drive set.

V_0 – Hypoid offset

Drive set in the series

Note

In the series, the position of the output shaft is determined by the dimension P_0 (center of the crown wheel to the rear of the output shaft head). The labellings of the deviation "r" on the crown wheel and the pairing number are not present. Due to the deviation "r" not being given, it is necessary that, before the output shaft is replaced, to carry out an actual measurement if parts are being replaced which directly influence the installation position of the output shaft (see Page 39 - 17).

X – These details are not required in the series.

P_0 – Adjustment dimension for the series.

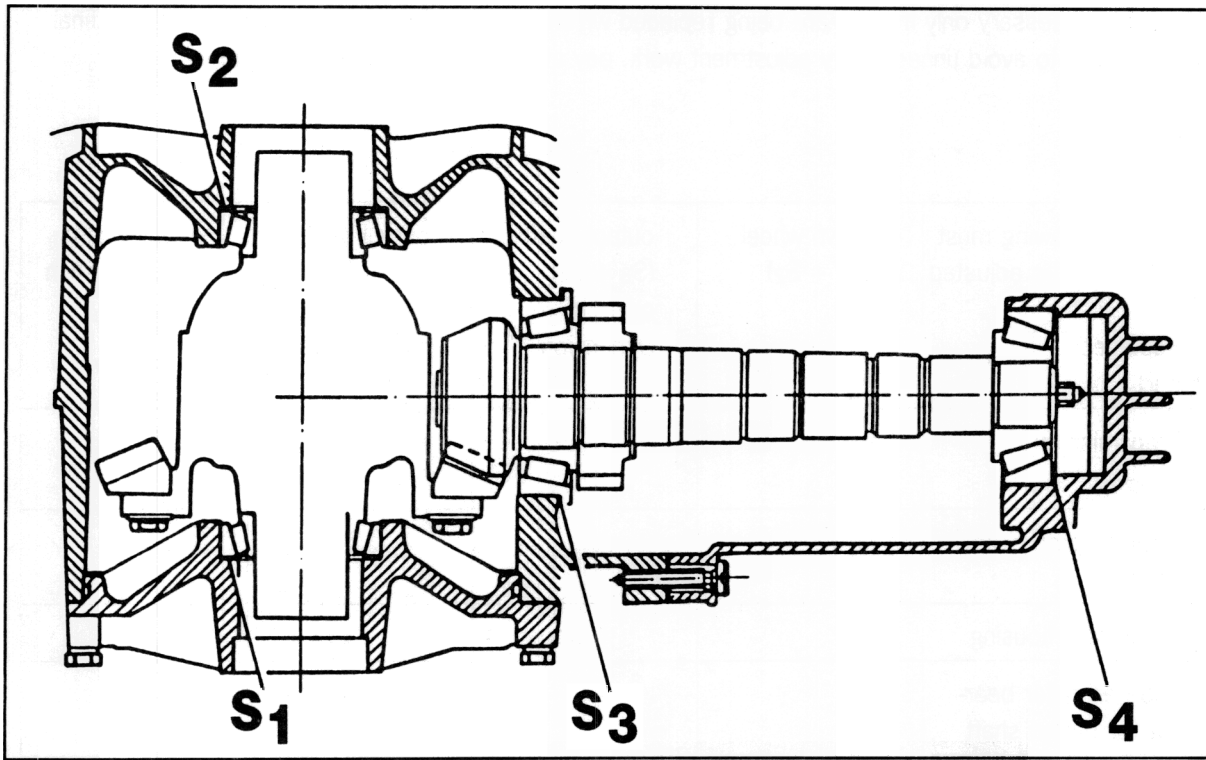
Adjustment overview (transmission G 86)

When carrying out assembly work on the final drive, readjustment of the output shaft and crown wheel or drive set is necessary only if parts are being replaced which directly influence the adjustment of the final drive. In order to avoid unnecessary adjustment work, pay attention to the following table:

The following must be adjusted Replaced part	crown wheel (S ₁ + S ₂)	output shaft (S ₃ + S ₄) over Dimension "r"	output shaft (S ₃ + S ₄) over actual measurement	output shafts adjusting shim only S ₄
Transmission housing *	X		X	
Transmission case cover				X
Differential housing	X			
Tapered roller bearing for output shaft			X	
Tapered roller bearing for differential	X			
Drive set	X	X		
Cover for final drive	X			

If the transmission housing is replaced, it is also necessary to adjust the input shaft (see Page 35 - 9).

Appropriate sequence for readjusting the drive set (transmission G 86)



154 - 96

S1 = Adjusting shim for crown wheel
S2 = Adjusting shim for crown wheel

S3 = Adjusting shim for drive pinion
S4 = Adjustment shim for drive pinion

If the output shaft and crown wheel have to be adjusted, it is best to follow the sequence below in the interest of rational working:

1. Determine the total disc thickness "Stot" (S1 plus S2) for the correct preload of the tapered roller bearings/differentials.
2. Determine the total disc thickness "Stot" (S3 plus S4) for the correct preload of the tapered roller bearings/output shaft.

3. Divide up the total disc thickness "Stot" in S3 and S4 so that the measurement from the crown wheel center to the front of the drive pinion corresponds to the installation dimension "R" measured during production.
4. Divide up the total disc thickness "Stot" in S1 and S2 so that the stipulated circumferential backlash is present between the crown wheel and output shaft.

The aim of the adjustment is to again achieve the position of maximum smooth running which was determined in production on the testing machine.

The greatest possible care and cleanliness during all assembly work and measuring procedures are essential requirements for a perfect result.

Determining the installation position of the output shaft (actual measurement)

This work must be carried out only if the deviation "r" is not given on the crown wheel and if parts are to be replaced which directly influence the output shaft position. These are: Both tapered roller bearings for the drive pinion and the transmission housing.

Remove the differential.

Complete the universal measuring mandrel, as described on Page 39 - 22. Insert it into the transmission housing and measure the difference to "R₀" (max. deflection/reversing point). The measured value corresponds to the deviation "r". Note the value.

After replacing the parts, adjust the output shaft as described. When doing so, use the deviation "r" determined when measuring the adjusting shim "S₃".

Adjusting the output shaft (transmission G 86)

Readjustment of the output shaft in accordance with the instructions below is necessary only if the drive set is replaced. If other parts which also influence the output shaft position are changed, make the adjustment via the previously determined installation position.

(See Page 39 - 17 for actual measurement).

1. Total disc thickness Stot. ($S_3 + S_4$).

Preload of the tapered roller bearings/output shaft

Install the outer races for the tapered roller bearings without adjusting shims in the transmission housing or in the transmission case cover. Always use rubber washer and pressure plate for measuring the disc thickness and for measuring the S_4 disc.

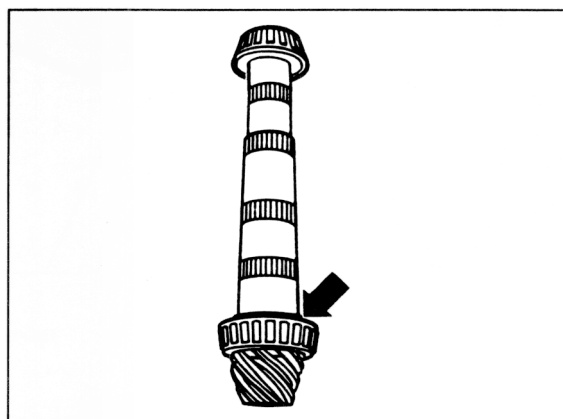
Note

Pressure plates of various thicknesses can be installed.

Fit the inner races for the tapered roller bearings

(see Rep. Gr. 35, Disassembling and assembling the output shaft).

Secure the lower tapered roller bearing (arrow).



172 - 96

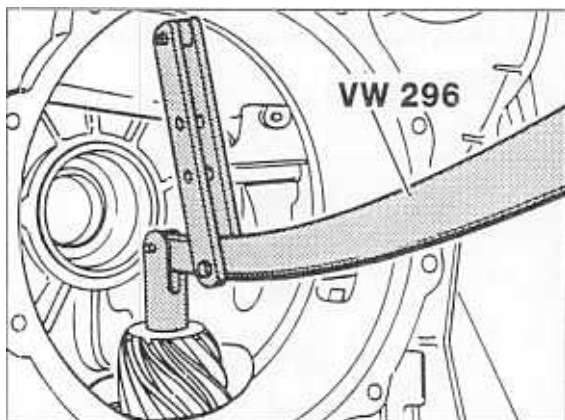
Place the transmission housing on the workbench.

Put the output shaft into the transmission housing.

Put on the transmission case cover and tighten the screws with 25 Nm (18 ftlb).

Turn the gears so that the transmission case housing faces downwards.

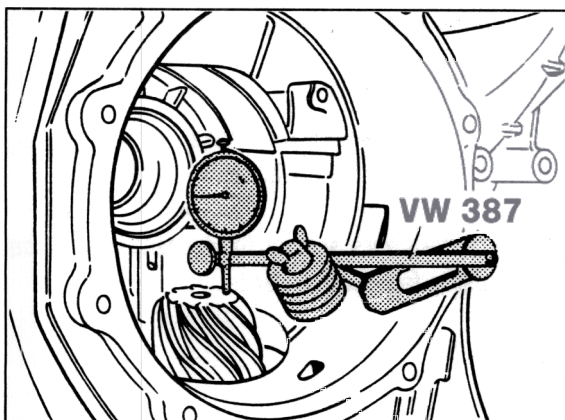
Using the special tool VW 296, press on the output shaft head until the tapered roller bearing outer race fits closely in the transmission case cover.



156 - 96

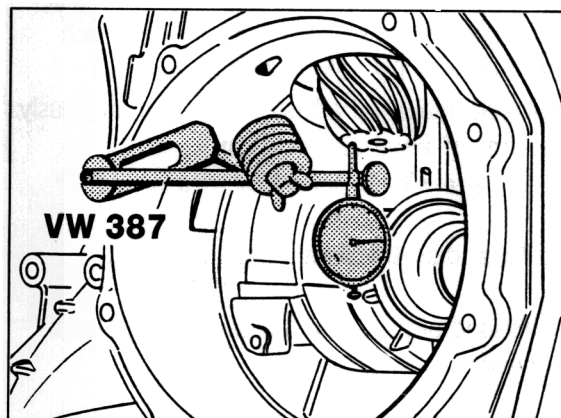
Turn the output shaft manually until the tapered roller bearing settles.

Assemble the measuring tool and set the dial gauge with 1 mm preload to "0".



157 - 96

Turn the transmission through 180° so that the transmission case cover faces upwards.



158 - 96

Turn the output shaft manually so that the tapered roller bearing settles.

Read off the measurement result on the dial gauge (e. g. 1.45 mm).

Measure the total disc thickness "Stot."
(S₃ + S₄)

Stot.	=	Measurement result
		+ pressing
Pressing		0.15 mm
(constant value)		
Measurement result		+ <u>1.45 mm</u>
Stot.		1.60 mm

2. Checking the preload of the tapered roller bearings for the output shaft.

Install the measured total disc thickness (example 1.60 mm) behind the tapered roller bearing outer race of the transmission case cover (S4 side).

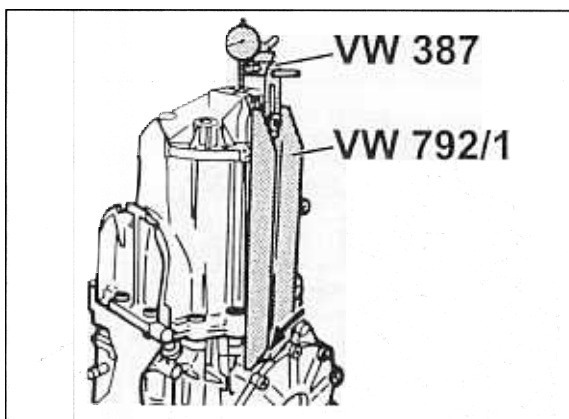
Put on the transmission case cover and tighten the fastening screws with 25 Nm (19 ftlb.).

Turn the output shaft a few times so that the tapered roller bearings settle.

Note

Screw the screw into the shaft head in order to turn the output shaft.

Fit the measuring tools.



39080001

Set the dial gauge (3 mm measurement range) with 1 mm preload to "0".

Undo the screws of the transmission case cover and read off the dial gauge.

Note

The dial gauge may now display a value of **0.08 mm to 0.15 mm** with correctly selected adjusting shims.

3. Determining the dimension "e"

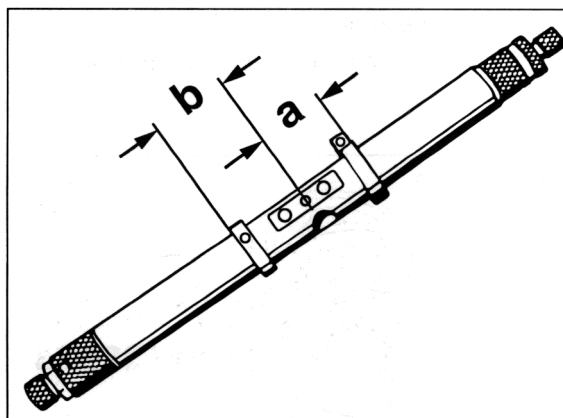
Allow the measured total disc thickness (in the example 1.60 mm) into the tapered roller bearing outer race in the transmission case cover (S4 side).

Refit the transmission case cover.

Turn the output shaft a few times so that the tapered roller bearings settle.

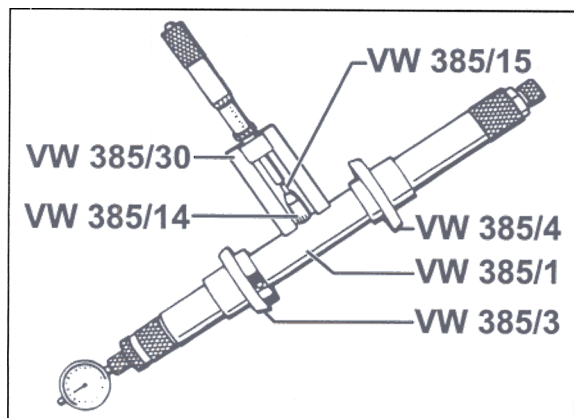
Adjust the setting collar of the special tool VW 385/1 to the dimension "a" = 35 mm."

Adjust the movable setting collar to the dimension "b" = 65 mm.



39080002

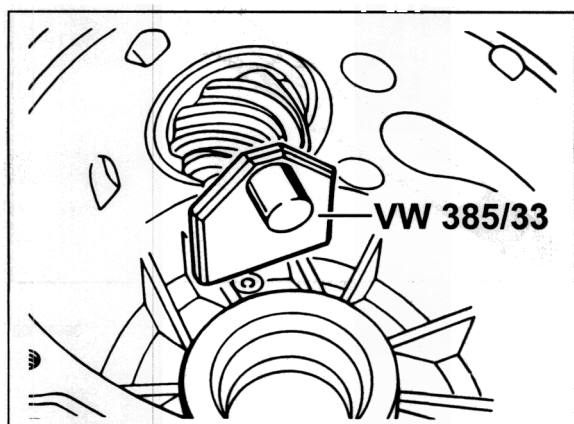
Complete the universal measuring mandrel as shown in the illustration.



39080003

Set the master gauge, special tool 385/30, to the dimension $R_0 = 59.65 \text{ mm}$ and place on the measuring mandrel. Set the dial gauge (3 mm measurement range) with 1 mm preload to "0".

Place the end plate, special tool VW 385/33, onto the output shaft head.



39080004

Remove the master gauge and insert the measuring mandrel with the dial gauge downwards into the housing.

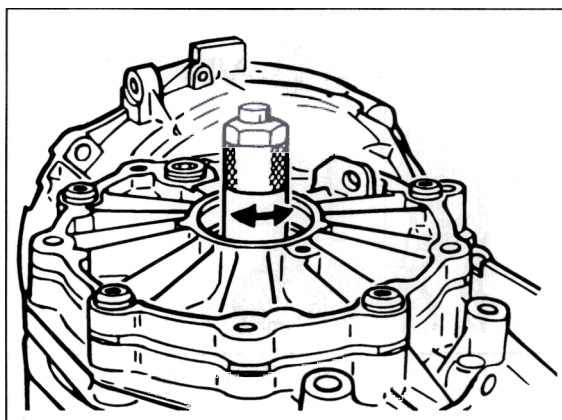
Put on the cover for the final drive and secure it with 4 screws.

Pull out the 2nd centring disc via the movable setting collar far enough so that the measuring mandrel can still just be turned manually.

Measure dimension "e".

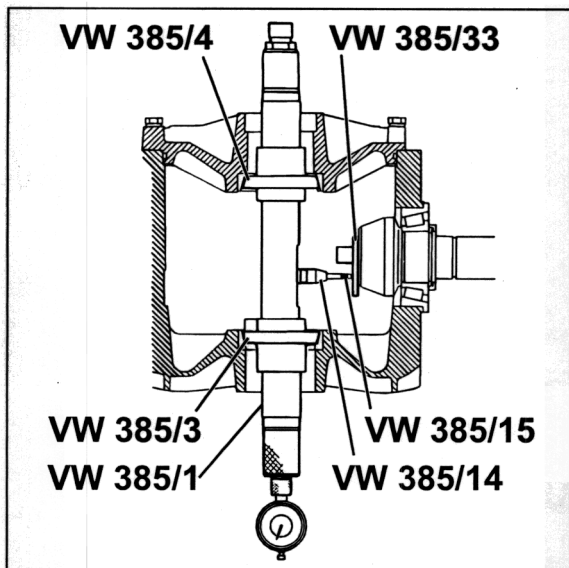
Turn the measuring mandrel until the dial gauge tip touches the end plate on the output shaft head and displays the max. deflection (reversing point). The measured value is the dimension "e" (black number range).

Example 0.46 mm



39080005

Arrangement of the measuring tools for determining dimension "e".



39080006

4. Determining the thickness of the adjusting shim "S₃"

$$S_3 = e + r$$

e = Measured value (max. deflection)

= Deviation (given in 1/100 mm on the crown wheel or is determined in the actual measurement)

Example

Value "e" read off on the dial gauge 0.46 mm
Deviation "r" written on the crown wheel +0.18 mm
Disc thickness "S₃" = 0.64 mm

Discs of 0.55 mm...1.05 mm thickness are available (0.05 mm increments).
Different tolerances allow the required disc thickness to be measured exactly.

5. Determining the thickness of the adjusting shim "S₄"

$$S_4 = S_{\text{tot.}} - S_3$$

Example

Total disc thickness 1.60 mm
Disc thickness "S₃" 0.64 mm
Disc thickness "S₄" = 0.96 mm

Note

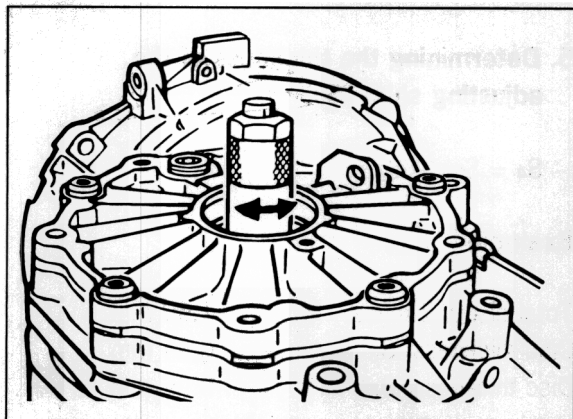
Pressure plates of 14.8 mm or 15.3 mm can be installed.

Discs of 0.45 mm...1.49 mm thickness are available (0.04 mm increments).
Different tolerances allow the required disc thickness to be measured exactly.

6. Performing a check measurement (checking dimension "r").

Install the output shaft with the measured adjusting shims S₃ and S₄ and turn several times in both directions.

Insert a universal measuring mandrel (special tool) and carry out a check measurement.



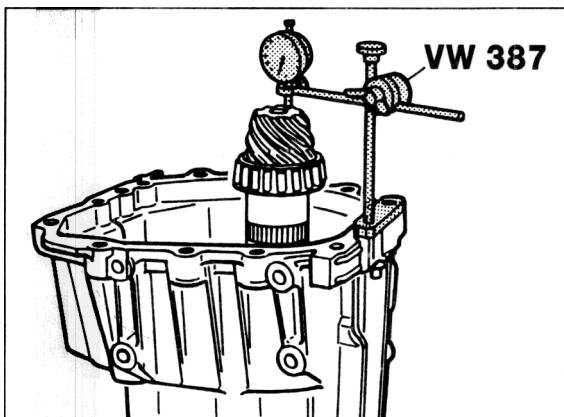
39080005

If the selected adjusting shims are the correct ones, the dial gauge must display the value of the written deviation "r" (in the example 0.18 mm) with a tolerance of ± 0.04 mm when read off counterclockwise (red number range).

Determining "S4" again (transmission G 86)**Note**

If only the transmission case cover is replaced, only the adjusting shim "S4" must be measured again.

1. Clean the housing mating face.
2. Place the output shaft in the transmission case cover and turn so that the tapered roller bearing settles.
3. Assemble the measuring tools.



165 - 96

4. Set the dial gauge (3 mm measuring range) to "0" with 1 mm preload.
5. Carefully remove the special tool VW 387 with the dial gauge.

Note

Handle the holder and dial gauge with care so that they do not become misadjusted.

6. Remove the output shaft and outer race of the tapered roller bearing with the pressure plate, adjusting shim and rubber washer, and install them in the new transmission case cover (see Page 34 - 20).

7. Place the dial gauge on the new transmission case cover with the special tool VW 387 as shown in Figure 165 - 96 and read off the value on the dial gauge (in the example 0.88 mm).

Example

Preload	1.00 mm
Read-off value	<u>0.88 mm</u>
X	= 0.12 mm

Adjusting shim S4	0.77 mm
Value X	+ <u>0.12 mm</u>
New shim thickness S4	= 0.89 mm

Note

If the read-off value on the dial gauge is greater than 1.00 mm, the thickness of the adjusting shim "S4" must be reduced by the value X.

8. Fit the transmission case cover and check the preload of the tapered roller bearings for the output shaft (see Page 39 - 21).

Adjusting the crown wheel (transmission G 86)

Determining the total disc thickness "Stot." (S1 + S2).

Readjustment of the crown wheel is necessary if

the transmission housing,
the cover for the final drive,
the tapered roller bearings for the
differential, (the differential housing)
or the drive set

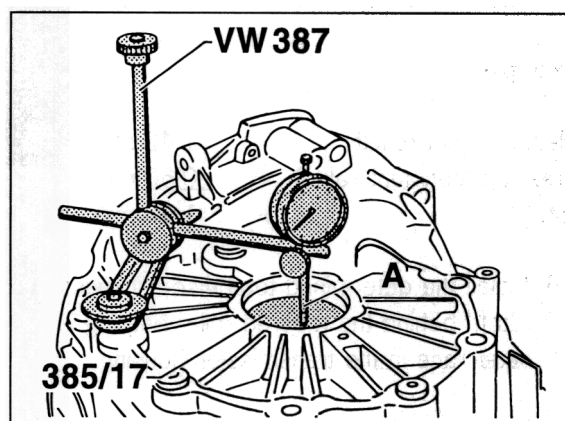
are replaced.

Note

The output shaft must be removed in order to determine the preload of the tapered roller bearings on the differential.

1. Remove the sealing rings and tapered roller bearing outer races for the differential and take out the adjusting shims (see Page 34 - 27).
2. Install the tapered roller bearing outer races **without** adjusting shims (see Page 34 - 27).
3. Put the differential without the speedometer-drive gear into the housing, put on the cover and tighten all screws with the stipulated tightening torque.
4. Fit the special tools 521/4 and 521/12.
5. Place the special tool VW 385/17 onto the collar of the differential.

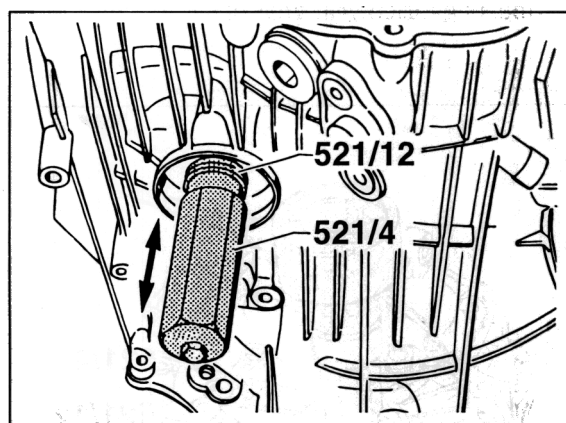
6. Secure the special tool VW 387 with the dial gauge and extension to the housing, and set to "0" with 1 mm preload.



A = Dial gauge extension,
approx. 30...40 mm long

182_99

7. Move the differential up and down. Read off and note the play at the dial gauge.
Example: 1.42 mm



99

Note

When measuring the play, do not turn the differential, otherwise the measurement result will be corrupted.

8. Calculate "Stot."

"Stot." = measurement result + pressing.

Example:

Measurement result	1.42 mm
Pressing (constant value) +	<u>0.50 mm</u>
"Stot." =	1.92 mm

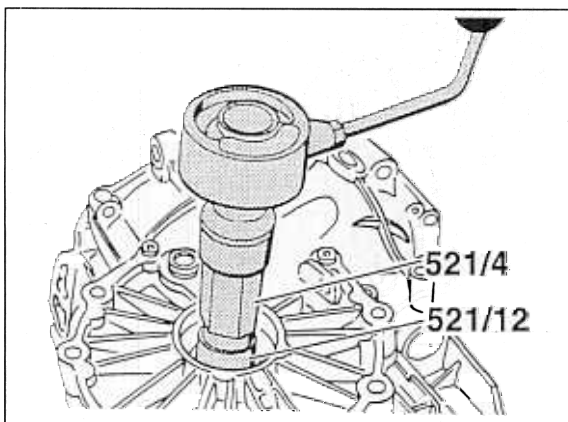
Note

When readjusting the drive set, also adjust the output shaft and perform a check (see Page 39 - 19).

9. Install the determined total disc thickness

"Stot." behind the tapered roller bearing outer race in the transmission housing.

10. Measure the friction torque with a commercially available torque gauge (0...600 Ncm (0... 53 inlb.)).
It must be 250...350 Ncm (22...31 inlb.) in the case of new tapered roller bearings and it must be 30...60 Ncm (2.6...5.3 inlb.) in the case of run-in tapered roller bearings (bearings filled with gear oil).



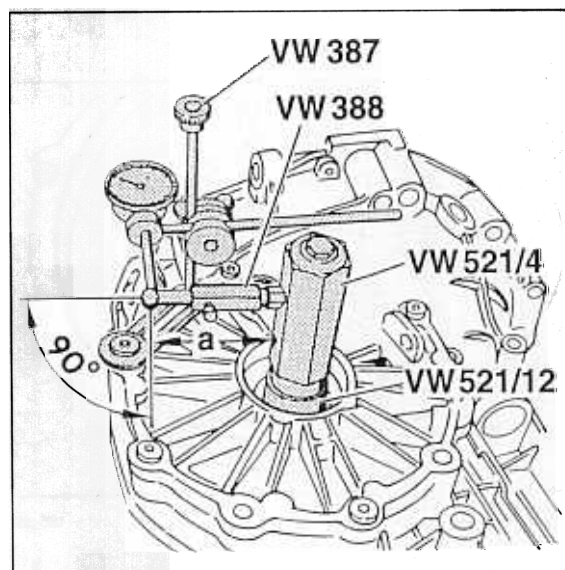
A = Torque gauge

183_99

Adjusting the circumferential backlash (transmission G 86)

The circumferential backlash must be 0.12 mm... 0.22 mm.

1. Install the output shaft with the adjusting shims "S3" and "S4".
2. Insert the differential, fit the cover and tighten all fastening screws with the stipulated tightening torque.
3. Screw the special tool VW 388 to the special tool VW 521/4 and adjust the lever length to 72 mm with the gauge plunger (see Figure, dimension "a").
4. Insert the adjustment device with the special tool VW 521/12 into the differential and clamp it securely.
5. Turn the differential several times in both directions so that the tapered roller bearings settle.
6. Fit the dial gauge holder with the dial gauge so that a right angle is produced between the dial gauge axis and the lever.



Dimension "a" = approx. 72 mm

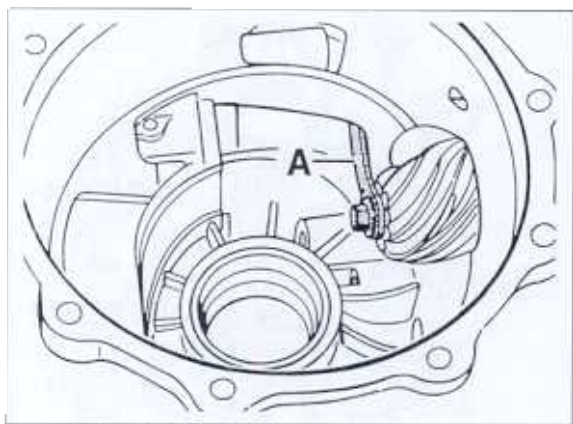
184_99

7. Carefully turn the crown wheel as far as it will go via the clamping screw of the adjustment device and set the dial gauge to zero. Next, turn the crown wheel back and read off the circumferential backlash. Note the value.

Note

If the friction coefficient of the output shaft is too low, the special tool 3177 must be fitted so that an exact circumferential backlash can be measured.

The differential can then only be inserted in such a way that the aperture of the bevel gears faces the output shaft.



A = Holder 3177

185.99

8. Repeat the measuring procedure another three times after continuing to turn the crown wheel through 90° in each case. Add up the measured values and calculate the average circumferential backlash.

With the assembled special tool 3177, install the differential offset by 180° and repeat the measuring procedure.

Note

If the individual measured values deviate from each other by more than 0.06 mm during this measurement, installation of the crown wheel or the drive set itself is not in order. Inspect the assembly work and replace the drive set if necessary.

9. Determine the average circumferential backlash.

Example:

1st measurement	0.84 mm
2nd measurement	0.85 mm
3rd measurement	0.84 mm
4th measurement	+ 0.83 mm
Total	3.36 mm

Average circumferential backlash:

$$3.36 : 4 = 0.84 \text{ mm}$$

**10. Determining the disc thickness "S₂"
(with respect to the crown wheel)**

$$S_2 = \text{Stot.} \\ - \text{Average circumferential backlash} \\ + \text{Take-off (constant value)}$$

$$\text{Take-off} = 0.15 \text{ mm}$$

Example:

Stot.	1.92 mm
Average circumferential backlash	0.84 mm
	1.08 mm
Take-off (constant value) +	0.15 mm
S ₂	1.23 mm

Note

Discs of 0.45 mm...1.00 mm thickness are available (0.05 mm increments). Different tolerances allow the required disc thickness to be measured exactly.

**11. Determining the disc thickness "S₁"
(crown wheel side)**

$$S_1 = \text{Stot.} - S_2$$

Example:

Stot.	1.92 mm
S ₂	<u>1.23 mm</u>
S ₁	0.69 mm

Note

Discs of 0.45 mm...1.00 mm thickness are available (0.05 mm increments).

Different tolerances allow the required disc thickness to be measured exactly.

12. Install determined adjusting shims "S₁" on the crown wheel side and "S₂" opposite the crown wheel.

13. Carry out a check measurement. When doing so, measure the circumferential backlash four times around the circumference.
It must be 0.12...0.22 mm.

Note

The individual measurement results may deviate from each other by max. 0.05 mm.

PORSCHE

Technical Manual

Boxster S

Repair

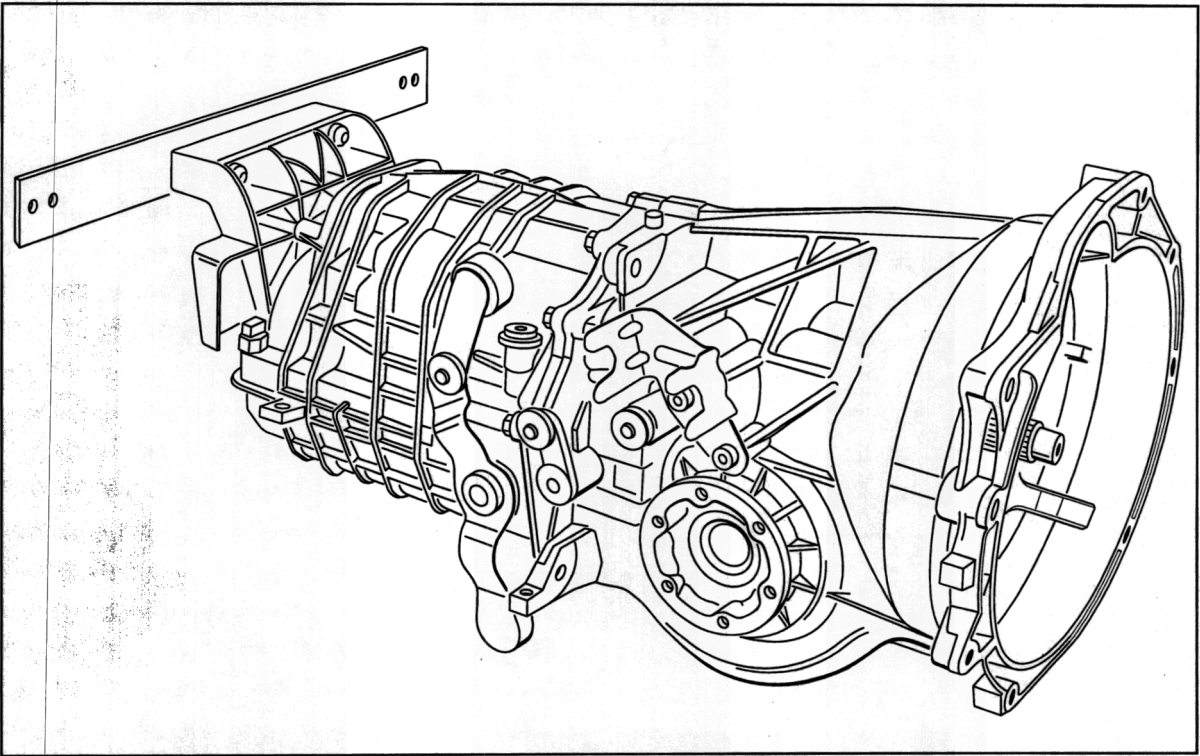
Group 3

Transmission, manual transmission

3	Transmission, manual transmission (Boxster S)	
3	Transmission	
3	Technical data	3 - 101
34	Manual transmission – Actuation, housing	
34 35 19	Removing and installing transmission	34 - 101
34 49 19	Removing and installing closure cap for selector force mechanism	34 - 107
35	Manual transmission – Gears, shafts, int. gearsh.	
35 50 19	Removing and installing sealing ring for input shaft . .	35 - 101
39	Final drive – Differential, differential lock	
39 22 19	Removing and installing sealing ring for halfshaft flange . .	39 - 101

3 Technical data (Boxster S)

6-speed manual transmission G86/20

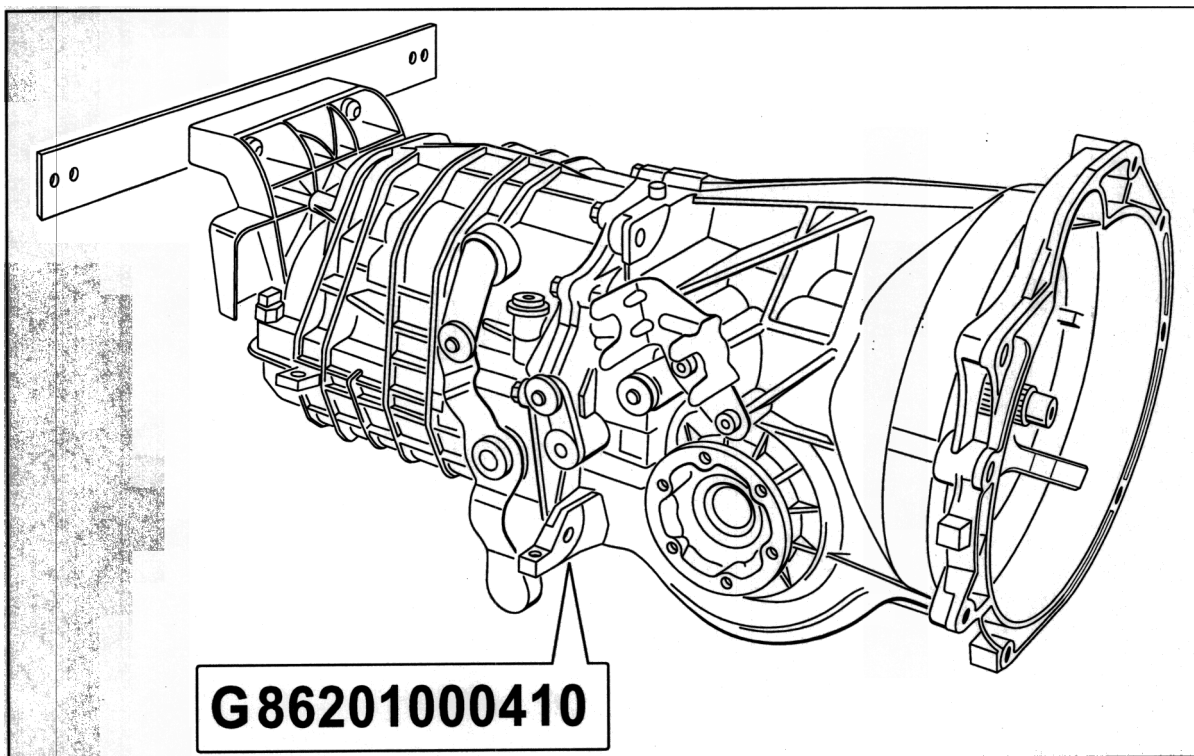


34350002

Type	Code letter	Equipment	Installed in	Model year
G 86/20		6-speed	Boxster S	00

3 Technical data (Boxster S)

Key to transmission numbers



34350005

G8620

Transmission type

1

Index for version
within transmission number

000410

Serial number

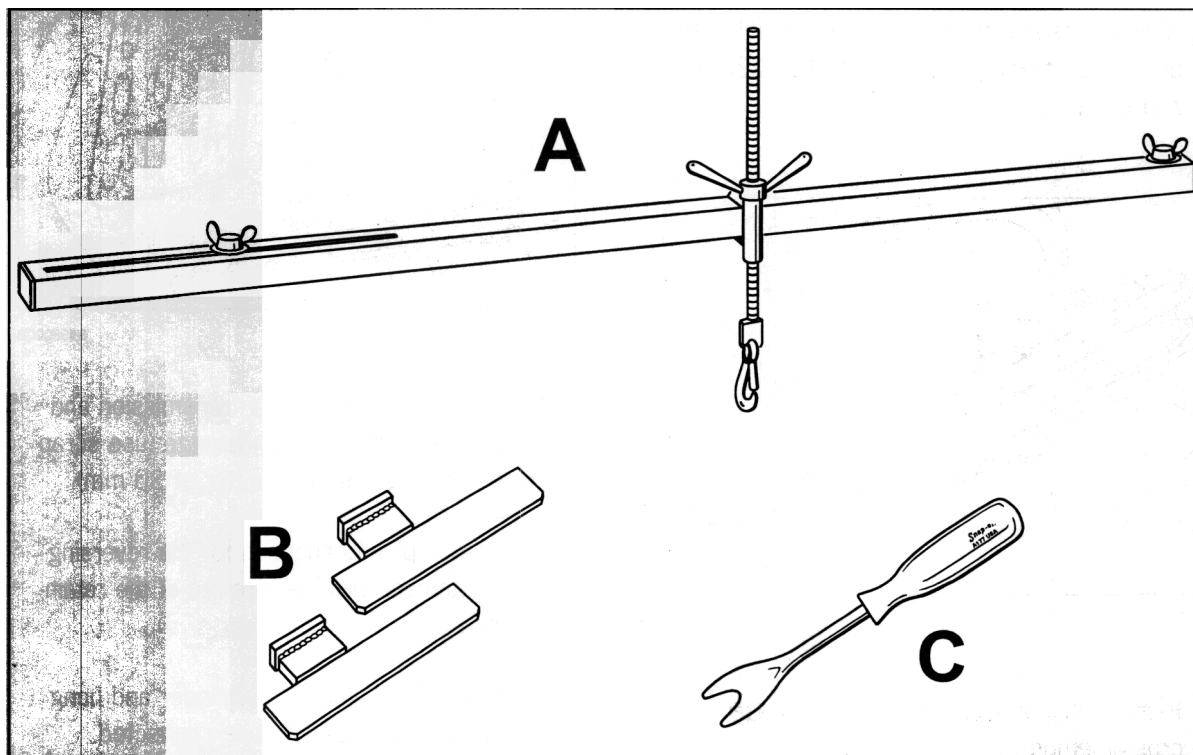
= normal differential

Technical data (Boxster S)**Manual transmission G86/20**

General data	Manual transmission G86/20
Transmission ratios	G86/20 $Z_1 : Z_2 = Z_2 : Z_1$
1st gear	$11 : 42 = 3.82$
2nd gear	$20 : 44 = 2.20$
3rd gear	$31 : 47 = 1.52$
4th gear	$37 : 45 = 1.22$
5th gear	$41 : 42 = 1.02$
6th gear	$44 : 37 = 0.84$
Reverse gear	$11 : 39 = 3.55$
Final drive	hypoid bevel gear drive with 12 mm offset
Transmission ratio final drive	$9 : 31 = 3.44$
Filling capacity	2.8 l

Technical data (Boxster S)**Tightening torques (transmission G86/20)**

Location	Thread	Tightening torque Nm (ftlb.)
Screw plug, oil drainage and oil filling	M22	30 (22)
Drive shaft on transmission flange	M10	81 (60)
Clutch slave cylinder on transmission	M8	23 (17)
Guide tube for release bearing on transmission	M8	24 (18)
Ball journal for release lever on transmission	M8	25 (19)
Cover for final drive on transmission	M8	25 (19)
Transmission on engine	M12 M10	85 (63) 45 (33)
Reversing light switch on transmission	M12	15 (11.0)
Bracket for shift cables on transmission	M10	45 (33)

34 35 19 Removing and installing transmission – Boxster S**Tools**

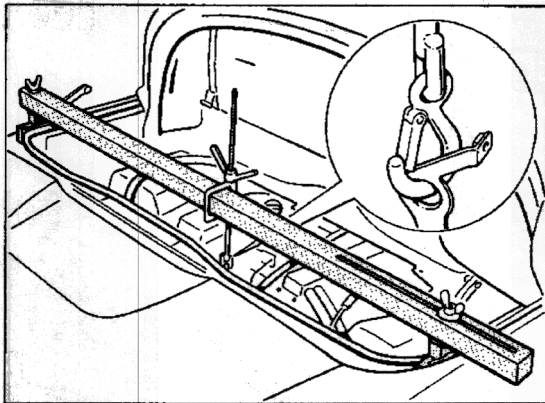
34350004

Item	Designation	Special tool	Explanation
A	Support beam	10 - 222 A	
B	Support feet	9591/1	
C	Removal tool		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 21)

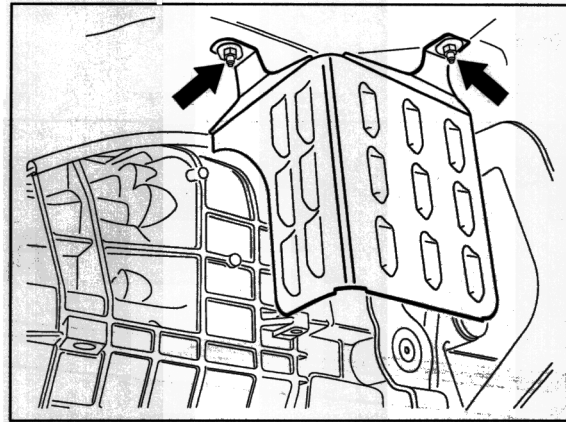
Removing and installing transmission

Removal

1. Remove muffler for intake system.
2. Hold engine in installation position at the transport bracket using special tools 10 - 222 A and 9591/1.



194_96



34350006

3. Remove diagonal braces and sheetmetal cross member.
4. Remove stabilizer.
5. Remove rear muffler (see serv. No. 26 33 19).
6. Remove rear cross member (V strut).
7. Remove heat shield.
8. Remove drive shafts at the transmission and protect the shafts against damage (use scrap pieces of hose with a diameter of 30 mm).
9. Disconnect plug connection for the reversing-light switch and pull the wire out of the retaining clips.
10. Unscrew the clutch slave cylinder and hang up at the side with the hose connected.

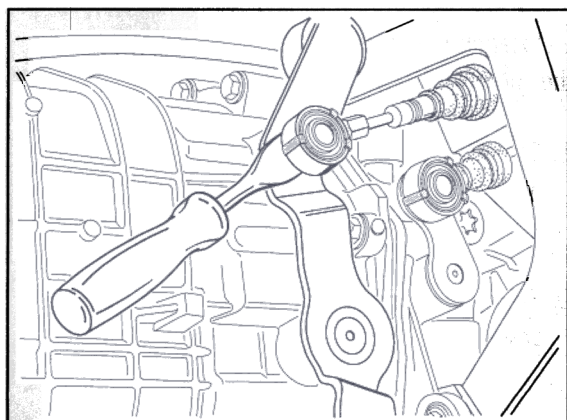


Warning!

The clutch pedal must not be pressed if the slave cylinder has been removed.
Danger of injury from flying piston rod.

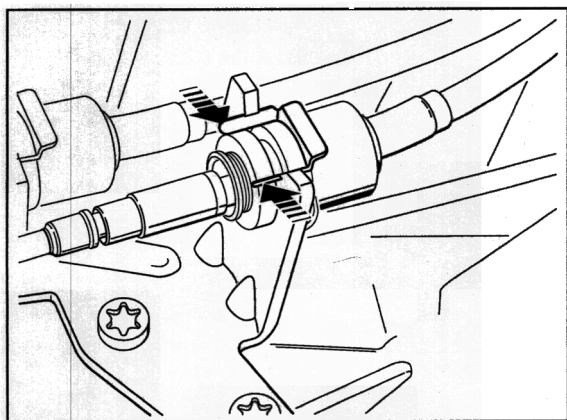
> Affix a warning note where it can be seen in the vehicle!

Lever off shift cables on transmission lever using a commercially available removal tool (refer to Technical Equipment Manual, Chapter 2.4, No. 21).



34120001

12. Release the support bracket sleeves (press tabs in the direction indicated by the arrow) and carefully pull them out of the bracket.



34120002

Note

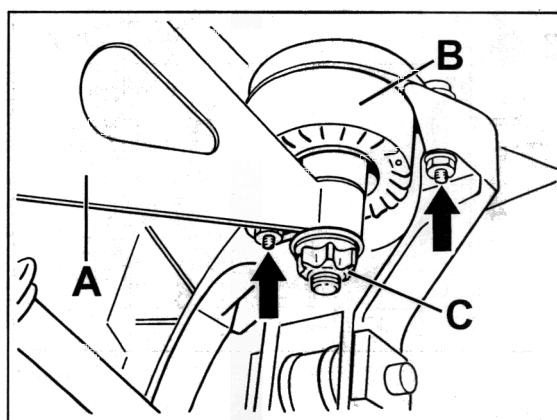
The shift and cables must not be excessively bent or kinked.

13. Place transmission jack under the transmission and fasten fixing strap.

14. Remove transmission support **with** left and right **hydraulic mounts**.

Note

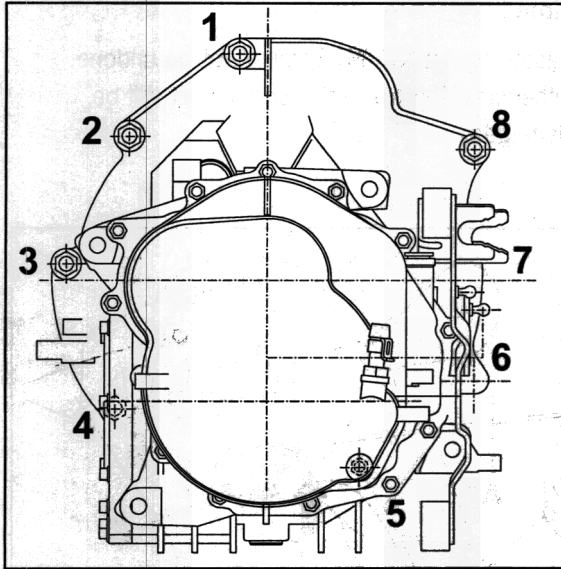
Fastening nut "C" (M12) must not be undone. Otherwise, the transmission support will be damaged.



34380001

A = Transmission support
B = Hydraulic mount
C = M12 fastening nut

15. Unscrew transmission/engine fastening screws.
Use a polygon wrench (10 mm, part No. 999.571.052.02) for screw No. 4.



34350003

16. Pull transmission to the rear and lower it carefully.

Installation

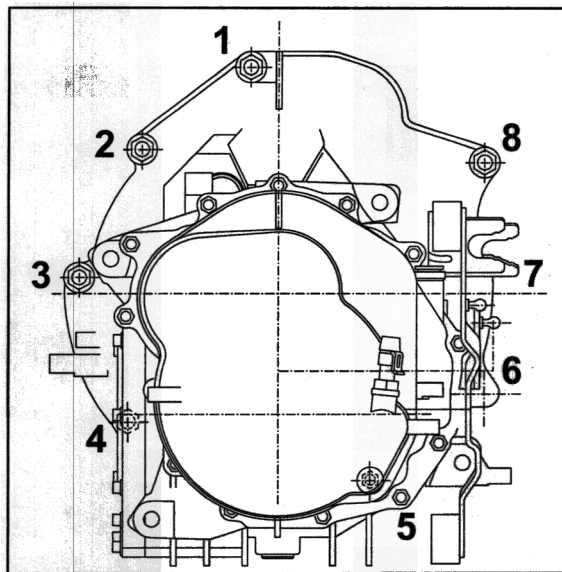
Note

The rear cross member (V strut) cannot be fitted if the rear muffler is installed.

Installation is performed in reverse order, taking the following points into account.

1. Clean teeth of the drive shaft and grease with a thin coat of **Olista Longtime 3 EP** (available as spare part).
2. Ensure perfect seating of dowel sleeves in crankcase.

3. Carefully move transmission in and properly fasten to engine.



34350003

No.	Screw/nut	Nm (ftlb.)
1	M12 x 70	85 (63)
2	M12 x 100	85 (63)
3	M12 x 100	85 (63)
4 *	M10 x 50	45 (33)
5	M10 x 50	45 (33)
6	M12 x 50	85 (63)
7	M12 x 70	85 (63)
8	M12 x 70	85 (63)

Multiple-tooth nut

4. Fit the clutch slave cylinder and tighten fastening screw to **23 Nm (17 ftlb.)**.

Note

The bleeder valve must be opened if the piston rod cannot be pushed back manually when the clutch slave cylinder is being installed. Connect a collecting bottle with hose for this purpose.

5. Bleed the clutch system.

Tightening torques (transmission G 86/20)

Diagonal brace on carrier side section and body (M10) = 65 Nm (48 ftlb.)

Rear cross member (V strut) on sheetmetal cross member and body (M10) = 65 Nm (48 ftlb.)

Stabiliser on carrier side section (M8) = 23 Nm (17 ftlb.)

Stabilizer mount on stabilizer (M10) = 46 Nm (34 ftlb.)

Drive shaft on transmission flange (M10) = 81Nm (60 ftlb.)

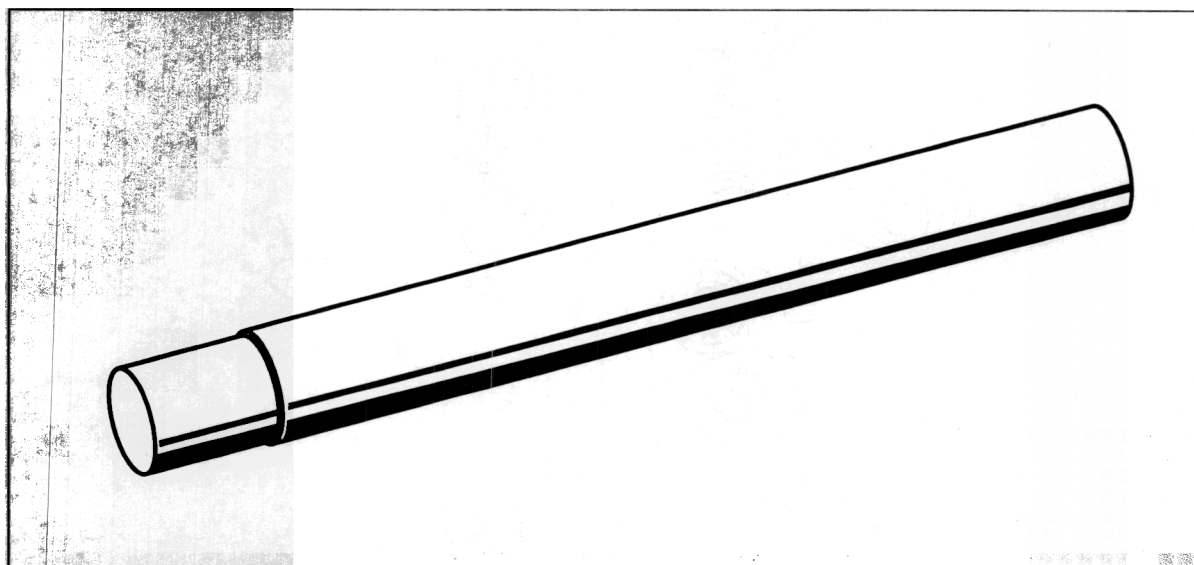
Transmission support on transmission (M12) = 85 Nm (63 ftlb.)

Hydraulic mount on carrier side section (M8) = 23 Nm (17 ftlb.)

Clutch slave cylinder on transmission (M8) = 23 Nm (17 ftlb.)

34 49 19 Removing and installing cap for selector force mechanism – Boxster S

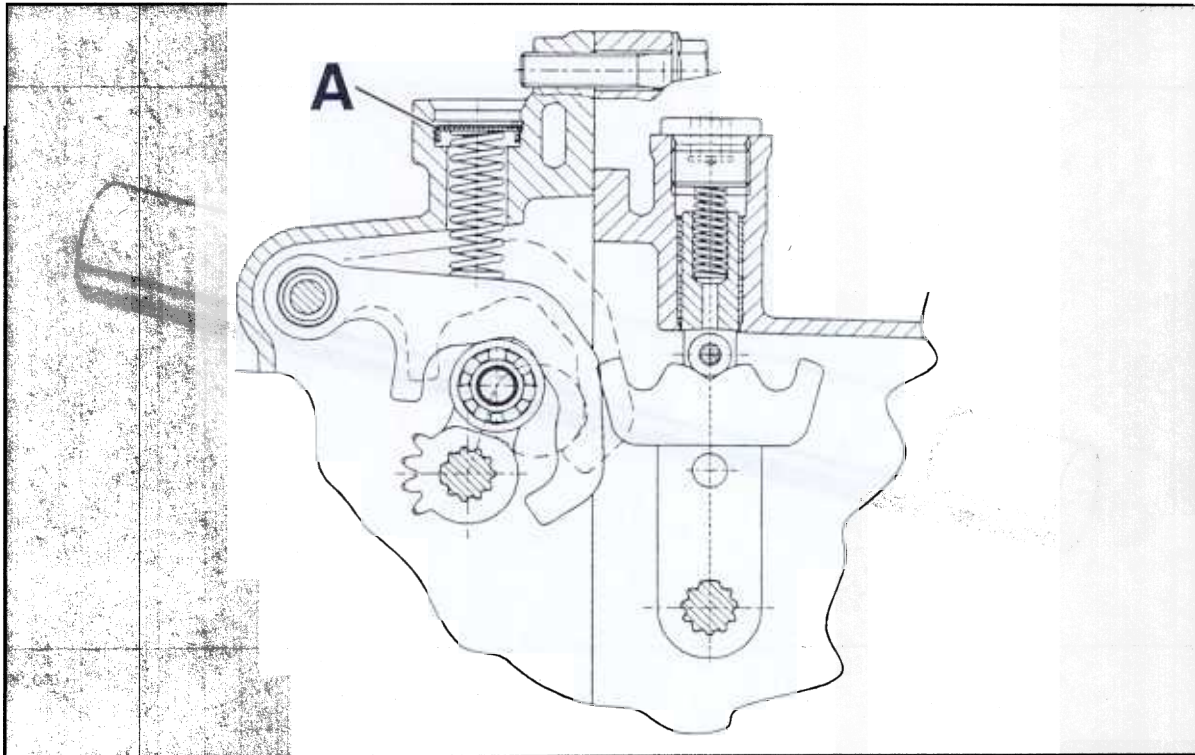
Tools



500_98

Item	Designation	Special tool	Explanation
	Mandrel	P 375	

Removing and installing cap for selector force mechanism



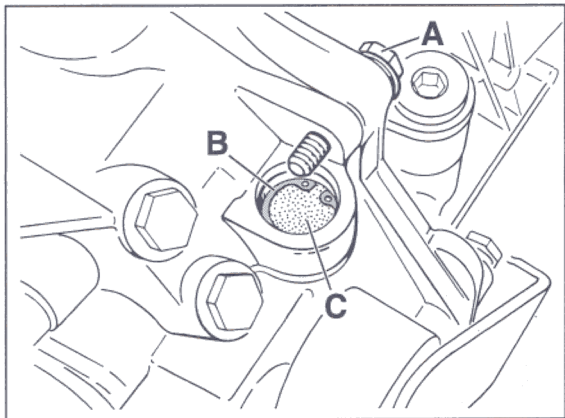
075_98

A – Closure cap

Removing and installing cap for selector force mechanism

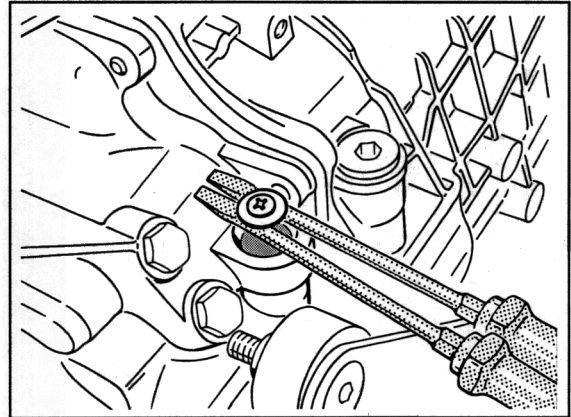
Removal

1. Remove transmission.
2. Shift transmission to neutral, unscrew fastening screw "A" and remove snap ring "B".



A – Fastening screw
B – Snap ring
C – Closure cap

076_98



484_98

Installation

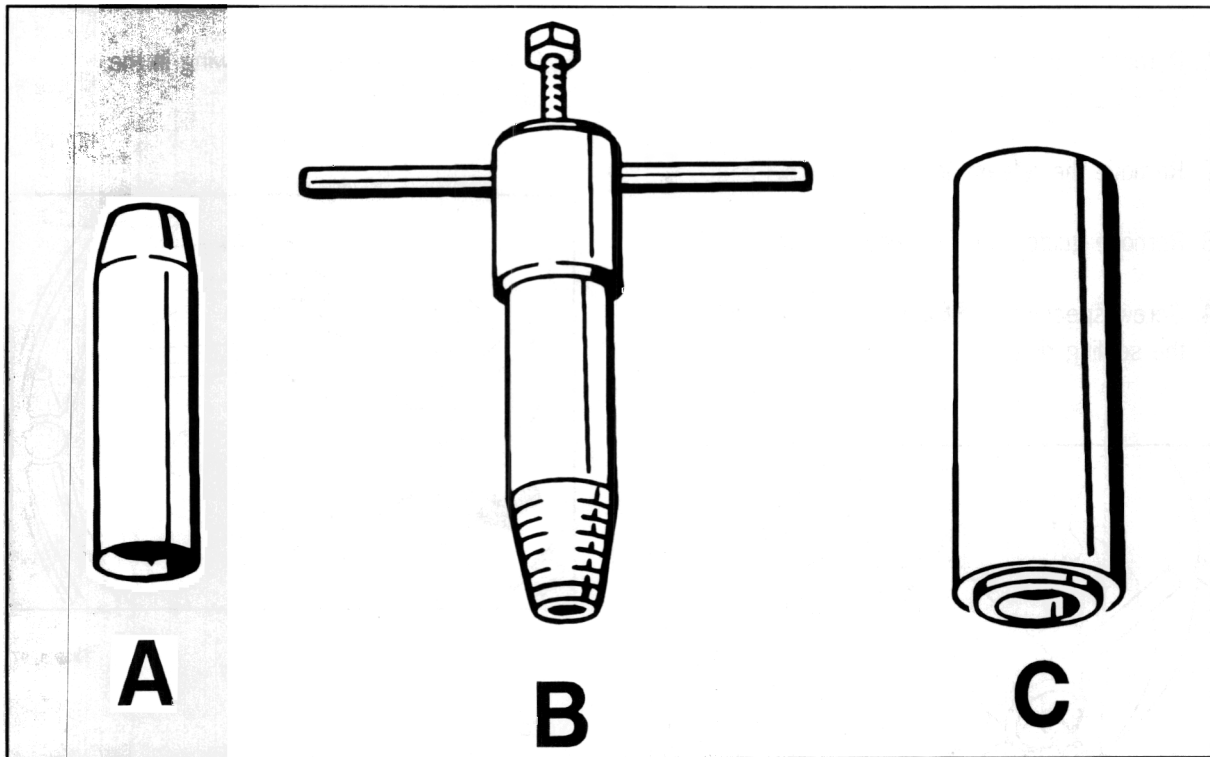
1. Insert closure cap and snap ring into the housing bore.
2. Use special tool **P375** to push the snap ring and closure cap down until the snap ring engages into the groove.

Note

Ensure perfect seating of the snap ring.

3. Tighten the fastening screw for the wheel bearing housing to **25 Nm (19 ftlb.)**.
4. Install transmission.

35 50 19 Removing and installing sealing ring for input shaft – Boxster S



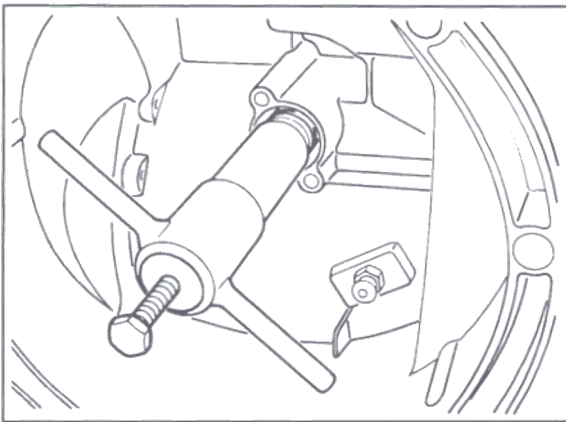
117_97

Item	Designation	Special tool	Explanation
A	Sleeve	9255	
B	Puller	9629/1	
C	Pressure piece	9628	

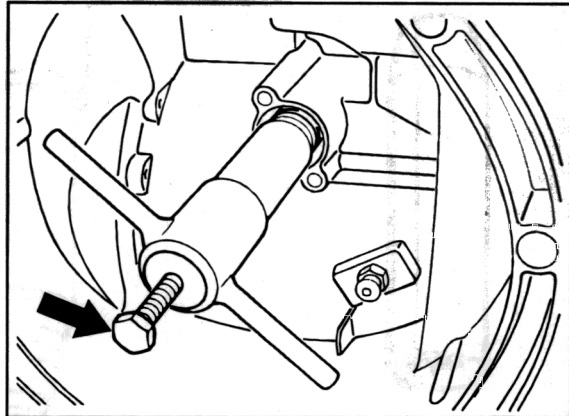
Removing and installing sealing ring for input shaft

Removal

1. Remove transmission (refer to Serv. No. 34 35 19).
2. Remove the release lever for clutch.
3. Remove guide tube for release bearing.
4. Screw special tool **9629/1** securely into the sealing ring.
5. Pull out sealing ring by screwing in the hexagon-head screw.



139_97



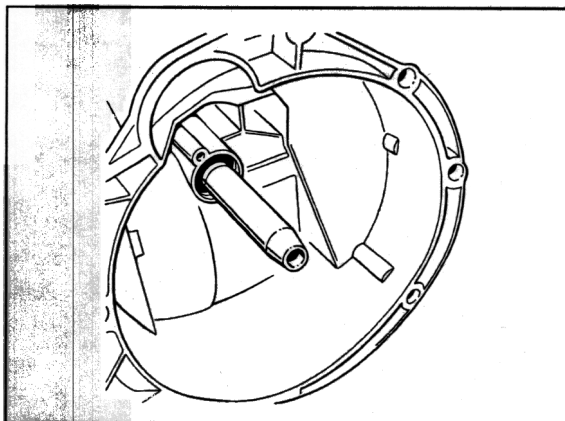
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Note

The coil spring must be pulled off the input shaft with a wire hook if the spring should jump down when removing the sealing ring.

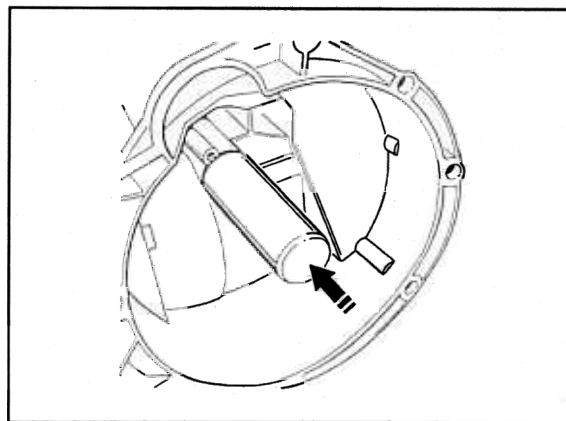
Installation

1. Push assembly sleeve **9255** onto the toothing of the input shaft.



141_97

3. Drive in sealing ring with special tool **9628** as far as the mounting face.



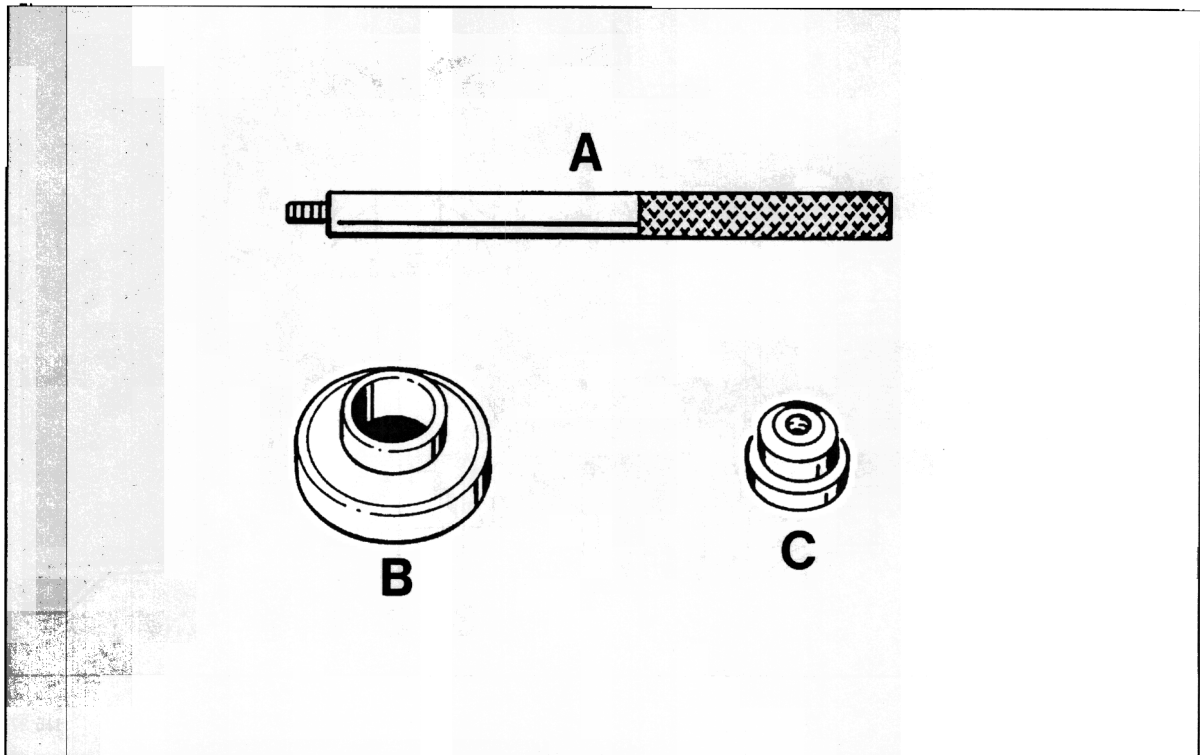
142_97

2. Fill the space between the dust and sealing lips on the sealing ring with grease (e.g. Liqui - Moly).

4. Install guide tube for release bearing.
Always renew fastening screws and tighten with **24 Nm** (18 ftlb.)

5. Fit release lever with release bearing.

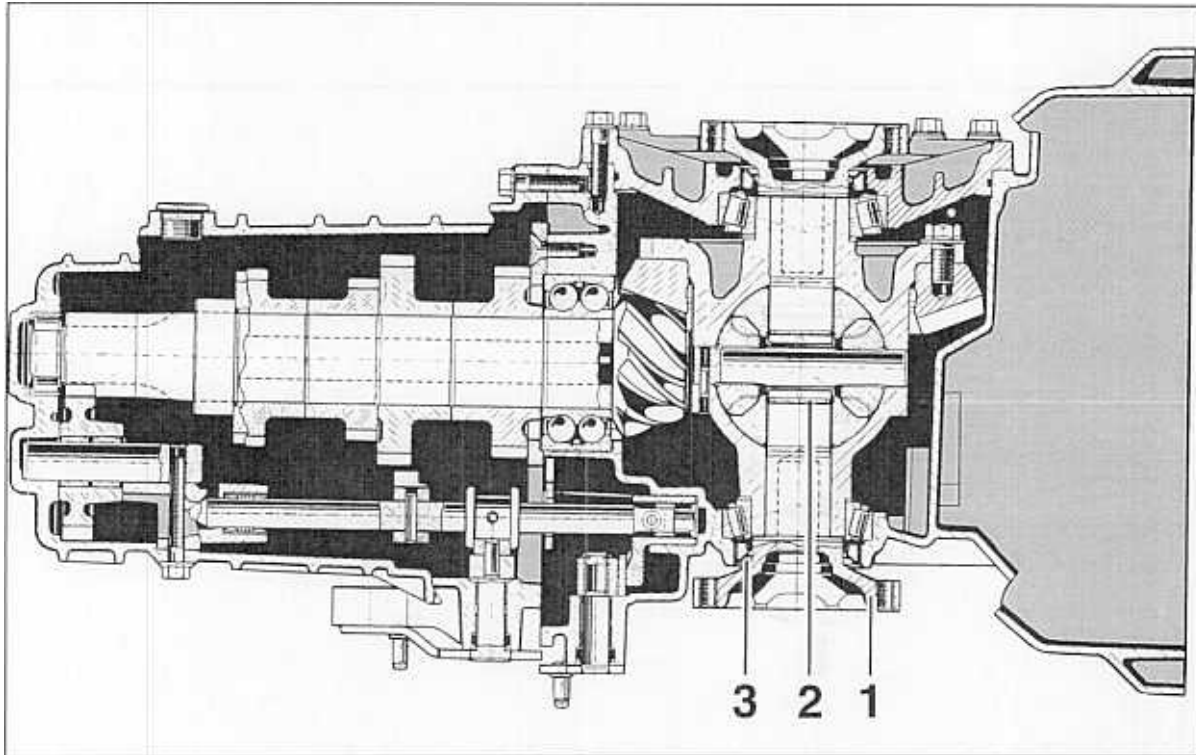
6. Clean teeth of the input shaft and grease with a thin coat of Olista Longtime 3EP.

39 22 19 Removing and installing sealing ring for halfshaft flange – Boxster S**Tools**

128_97

Item	Designation	Special tool	Explanation
A	Pull-in tool and extractor	P 254	
B	Pressure piece	9252	
C	Pressure piece	9247/1	

Removing and installing sealing ring for halfshaft flange – Boxster S



- 1 – Halfshaft flange
- 2 – Snap ring
- 3 – Sealing ring

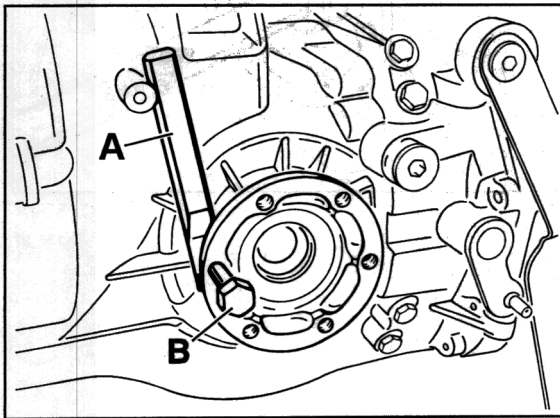
116_97

Removing and installing sealing ring for halfshaft flange – Boxster S**Note**

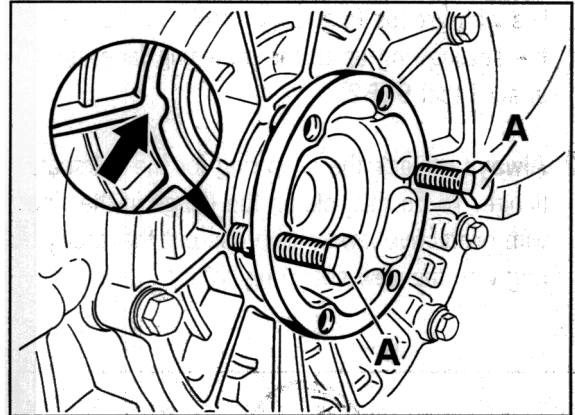
The sealing rings can also be replaced with the transmission installed.

Removal

1. Remove right halfshaft flange. To do this, place a chisel or spacer "A" under the halfshaft flange and pull out the halfshaft flange by turning the screw "B".



134_97



135_97

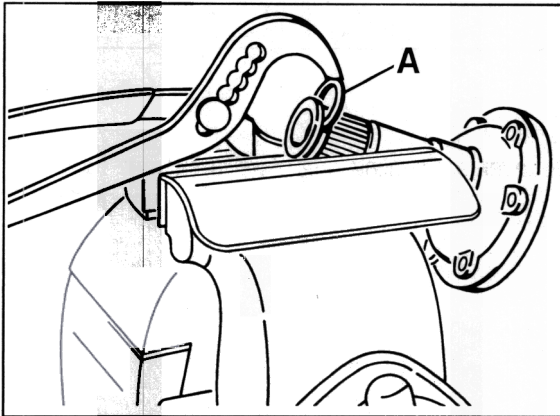
2. Lever out sealing ring using a suitable tool.

Note

Pull out left halfshaft flange by screwing in the hexagon-head bolts "A" on alternate sides. The bolts must be supported on the rib reinforcements of the cover (see Figure).

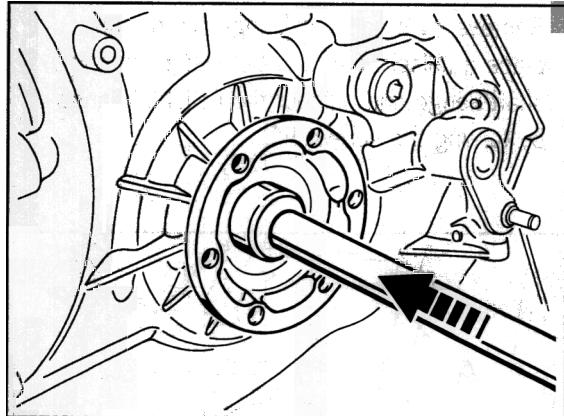
Installation

1. Fill the space between the dust and sealing lips with grease (e.g. Liqui - Moly) and drive in the sealing ring up to the mounting face using special tool **9252**.
2. **Always** replace the snap ring for the halfshaft flange. To do this, clamp the flange in the vice with protective jaws and press out the snap ring with the new snap ring "A".
3. Grease the snap ring well and drive in the half-shaft flange using the special tools **P254** and **9247/1**.



A – New snap ring

175_97



136_97