PORSCHE

Technical Manual

911 Carrera (996)

Technical Information

Repair

Contents:

Group 3
Transmission, manual transmission

WKD 483 721

Supplement Overview

Supple-ment	Edition	Topic	Article number
	05/1997	Basic edition	
0	05/2000		WKD483721
4	09/1997	General supplement	WKD483721.04
5	12/1997	General supplement	WKD483721.05
9	05/1998	General supplement	WKD483721.09
12	06/1998	General supplement	WKD483721.12
13	07/1998	General supplement	WKD483721.13
14	08/1998	General supplement	WKD483721.14
18	11/1998	General supplement	WKD483721.18
22	02/1999	General supplement	WKD483721.22
25	03/1999	General supplement	WKD483721.25
26	04/1999	General supplement	WKD483721.26
28	05/1999	General supplement	WKD483721.28
29	06/1999	General supplement	WKD483721.29
35	10/1999	General supplement	WKD483721.35
44	11/2000	General supplement	WKD483721.44

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Foreword

This manual contains Technical Information as well as instructions on repairs for Porsche vehicles. It is intended for the sole use of workshops belonging to Porsche AG.

The descriptions form the basis for professional and correct maintenance and repair work. The content of the work procedures described is based on the level of training of a fitter who has completed vocational training and has a sound knowledge of the product. This level of knowledge is necessary in order to carry out the work described.

Warning notes

The warning notes and safety instructions are classified by the respective signalising word (Danger, Warning, Caution) beside the warning symbol.

Danger!

Warns against death or very serious injury which will certainly occur if the instructions are not observed.

Warning!

Warns against death or very serious injury which may occur if the instructions are not observed.

Caution!

Warns against minor injury or damage to property if the instructions are not observed.

To prevent injury and restricted operating and traffic safety of the vehicle, or damage to the vehicle as the result of incorrect work, read these instructions carefully and observe them without fail.

It is not possible for Porsche AG to give a detailed evaluation of all danger situations for the persons carrying out the work. It is therefore imperative that all persons carrying out repair and maintenance work on Porsche vehicles use their specialist knowledge to ensure that their own safety is not at risk and the procedure chosen will not have any negative effects on the vehicle - especially with regard to safety.

It is therefore expressly specified that all work involved in the work procedures described should be carried out only in accordance with the valid guidelines and regulations of the local authorities responsible with respect to health and accident prevention and environmen-

tal protection, and in compliance with the legal requirements of individual countries.

Notes

Notes contain advisory information related to the work procedure which makes the fitter's work easier. The following pictogram indicates this information:

Note!

Contains advisory information which makes the work procedure easier.

Due to the continuous development and improvement of our vehicles, there may be discrepancies between the actual technical status of the vehicles and the work descriptions. Any existing deviations are corrected by means of supplements, and the scope of the descriptions is extended with supplements.

Porsche AG retains the right to implement changes at any time and without prior notice.

Use

The workshop documentation for the 911 Carrera (996) model has the designation

-"911 Carrera (996)" Technical Manual- and contains Technical Information as well as instructions on repairs.

The integration of the technical information published in the "911 Carrera (996)" Technical Manual with the instructions 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 "911 Carrera (996)" Technical Manual consists of 15 folders, subdivided into the following Groups

- 0 Entire vehicle - General
- 0 Diagnosis, 1 Engine, part 1 (up to Repair Group 45)
- 0 Diagnosis, 1 Engine, part 2 (up to Repair Group 69)
- 1 Engine, part 1 (up to Repair Group 13)
- 1 Engine, part 2 (as of Repair Group 15)
- 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 '99 model)
- 9 Circuit diagrams, part 2 (as of and including '00 model)

The two folders with Group 0 are to be regarded as one folder; i.e. file the "Technical Information" notices only in the folder "Group 0 Diagnosis, part 1" **-up to Repair Group 45-**.

The second folder Group 0 Diagnosis, part 2 **-as of Repair Group 69-** includes the further Repair Groups belonging to Group 0.

The two folders with Group 1 are to be regarded as one folder; i.e. file the "Technical Information" only in front of the repair descriptions in the folder Group 1 – Engine, part 1 **-up to Repair Group 13-**.

The second folder Group 1 Diagnosis, part 2 **-as of Repair Group 15-** includes the further Repair Groups belonging to Group 0.

The two folders with Group 9 are to be regarded as one folder; i.e. file the "Technical Information" notices only in the folder Group 9 Circuit diagrams, part 1 **-up to '99 model-**.

The second folder Group 9 Circuit diagrams, part 2 **-as of '00 model-** includes the further Repair Groups belonging to Group 9.

The "Boxster (986)" Technical Manual has the same structure in each folder, with the following breakdown for all Groups:

Title page: "Boxster (986)" 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 folders.

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

Note!

Sheets that already exist in the "911 Carrera (996)" Technical Manual and are updated or revised and thereby exchanged by a supplement are designated in the footer with the supplement number corresponding to the current version: e.g. "Printed in Germany ***- 2,- 2000"***

Note!

Due to a system modification in the Technical Literature production, the following procedures have changed in model year 2000!

1 - **The previous record sheet in the folder "0-General" and the supplement contents sheet -red sheet- have been omitted. A supplement overview now appears separately in each folder. The new supplement contents sheet can be destroyed after the supplement is filed in the folder.**

Note!

The supplement overview sheet is replaced with the relevant supplement in the corresponding folder and must no longer be maintained by hand.

2 - **The page numbering in the new and the replaced chapters are no longer continuous. Each new chapter is now given an additional chapter number followed by the page number e.g.-2 Page 11 ⇒ Rep. Gr. 0; General**

3 - **The old page numbering still applies to existing chapters and those that are not replaced.**

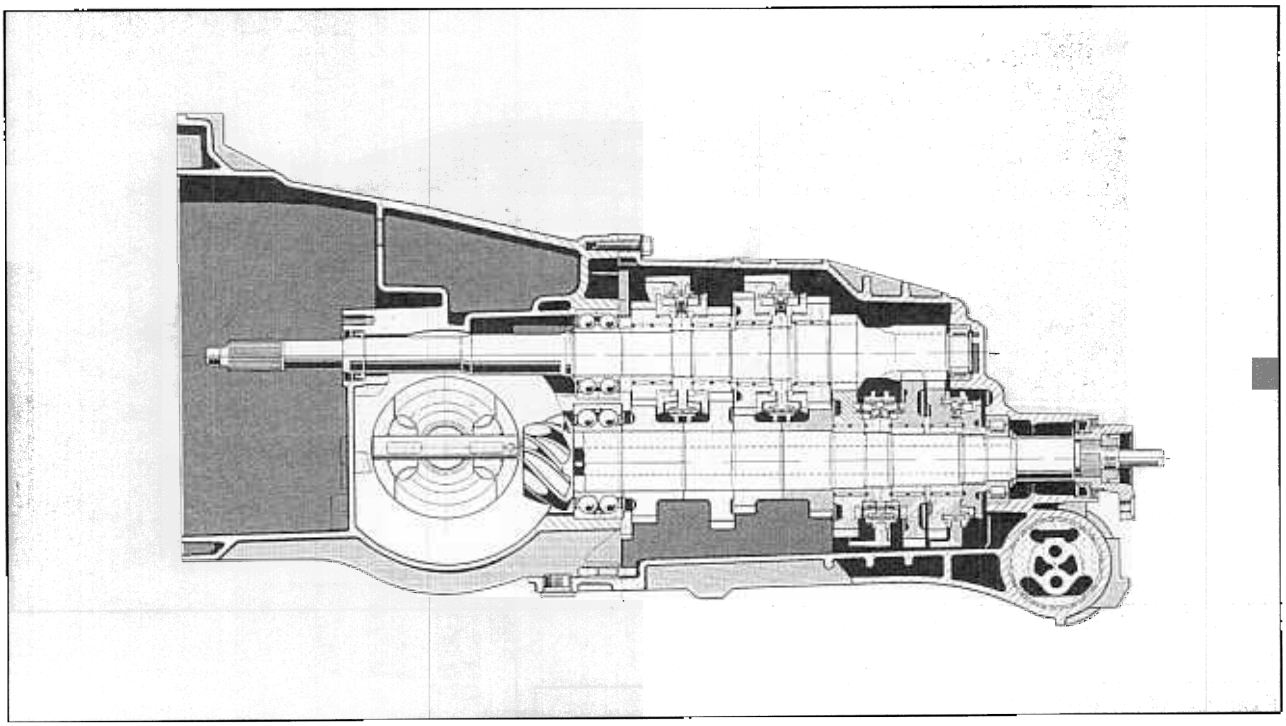
Printed in Germany - 35, October 1999 REPGRU.CHP

Table of Contents

3 Transmission, manual transmission

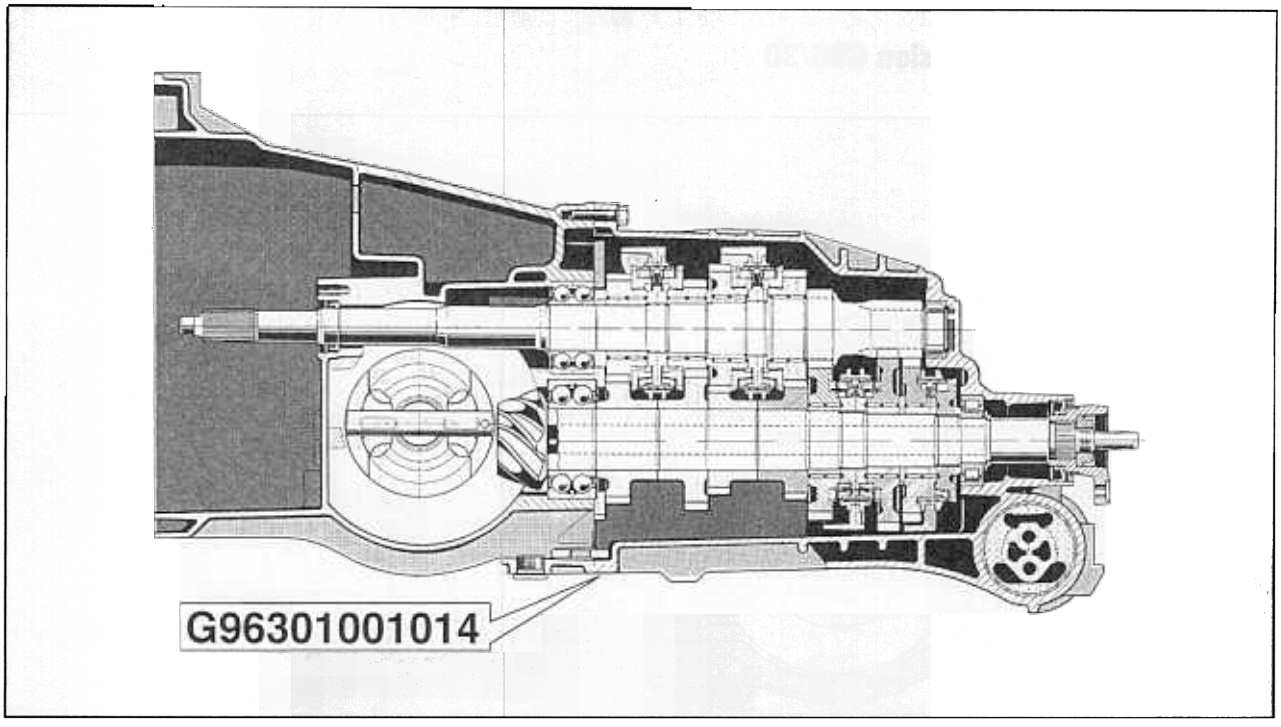
Technical data

6-speed manual transmission G96/30



Type	Code letter	Equipment	Installed in	Model year
G96/30		6-speed	911 Carrera 4 (996)	1999

Structure of the transmission number



Example: G96/301001014	
G96/30	Transmission type
1	Index of types within the transmission no. 1 = normal differential
001014	Serial number

Manual transmission

General data	Manual transmission G 96 / 30
Transmission ratios	G96/30 Z1 : Z2 = Z2 : Z1
1. gear	11 : 42 = 3,82
2. gear	20 : 44 = 2,20
3. gear	31 : 47 = 1,52
4. gear	37 : 45 = 1,22
5. gear	41 : 42 = 1,02
6. gear	44 : 37 = 0,84
Reverse gear	11 : 39 = 3,55
Final drive	Hypoid bevel gear drive with 12 mm offset

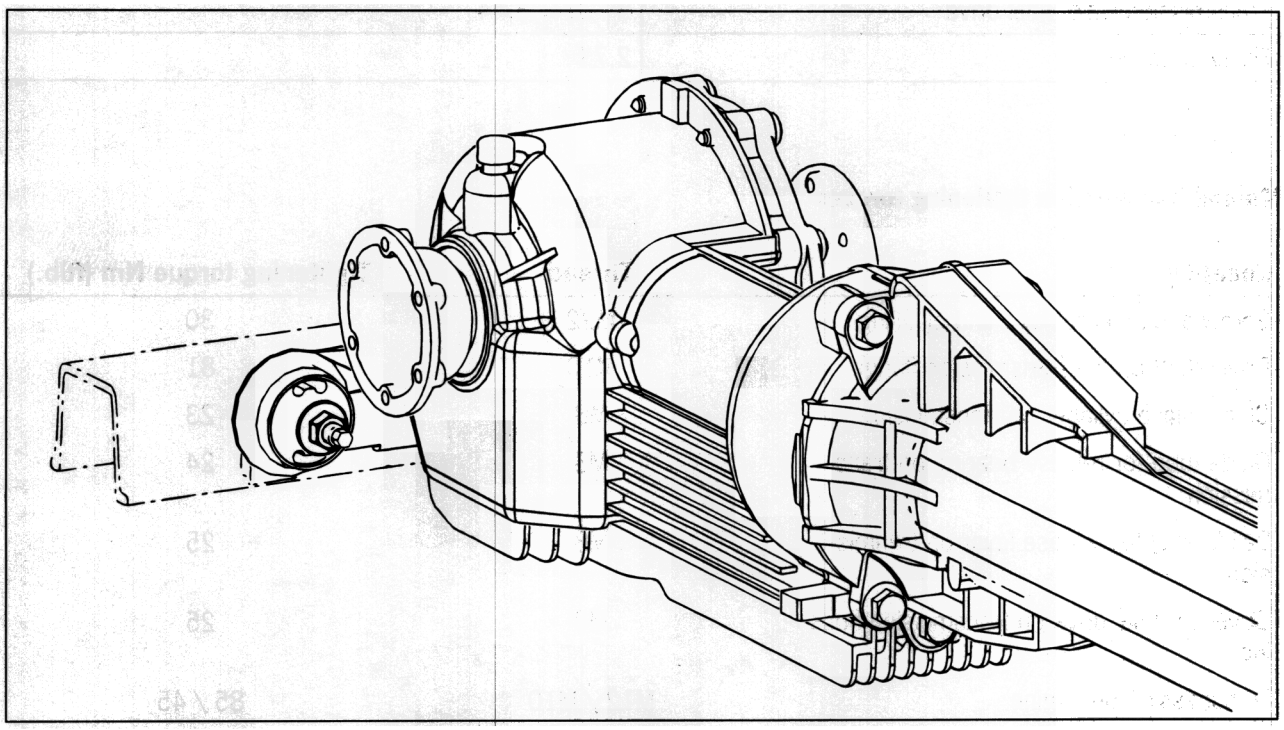
General data	Manual transmission G 96 / 30
Transmission ratio, final drive	9 : 31 = 3,44
Filling capacity	2,7 l

Manual transmission tightening torques

Location	Thread	Tightening torque Nm (ftlb.)
Screw plug, oil drainage and oil filling	M22	30
Drive shaft on the transmission flange	M10	81
Clutch slave cylinder on transmission	M8	23
Guide tube for release bearing on transmission	M8	24
Ball journal for release lever on tranmission	M8	25
Cover for final drive on transmission housing	M8	25
Transmission on engine	M12 / M10	85 / 45
Reversing light switch on transmission	M12	15
Holder for shift cables on transmission	M10	45
Cardan flange on transmission	M20	120[a)]
Drive shaft on transmission flange	M10	45

a) Counter collar nut with 170 Nm (126 ftlb), loosen again and tighten to 120 Nm (89 Nm) ⇒ Rep. Gr. 39 82 19; Install and remove sealing ring for cardan flange.

Front wheel drive Z 96.00



Type	Code letter	Equipment	Installed in	Model year

General data	Front-axle final drive Z 96.00
Transmission ratio, final drive (Z2 : Z1 = i)	31 : 9 = 3,44
Final drive	Bevel gear drive without hypoid offset
Filling capacity	approx. 1.5 l

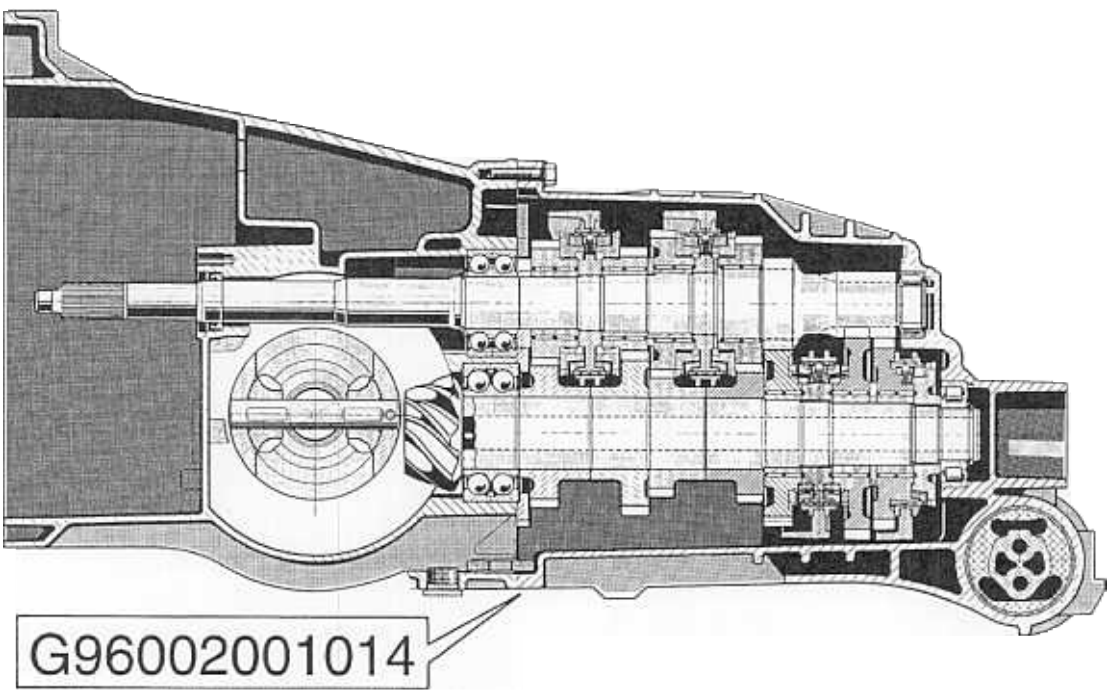
Front-axle drive tightening torques

Location	Thread	Tightening torque Nm (ftlb.)
Screw plug, oil drainage and oil filling		28
Cover on final drive		25
Long-neck tube on final drive		25
Drive shaft on final drive		39
Rear transmission support to transmission mount		65
Rear transmission support on body		65

Location	Thread	Tightening torque Nm (ftlb.)
Front transmission support on front-axle cross member		65
Studs on front-axle cross member	M8	20
Front cross member to final drive	M10	65
Drive shafts on front-axle final drive	M8	39
Diagonal braces on body and front-axle cross member	M12	100
Tank strap on body	M8 x 40	23
Pipe holder on transmission support	M6	7

3 Technical data (manual transmission G96/00)

Key to transmission numbers



127_97

G9600	1	001014
Transmission type	**Index for version within transmission number** 1 = normal differential 2 = limited-slip differential	**Serial number**

Technical data (manual transmission G96/00)

Manual transmission G96/00

General data	Manual transmission G96/00
Transmission ratios	G96/00 $Z_1 : Z_2 = Z_2 : Z_1$
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	2.7 l

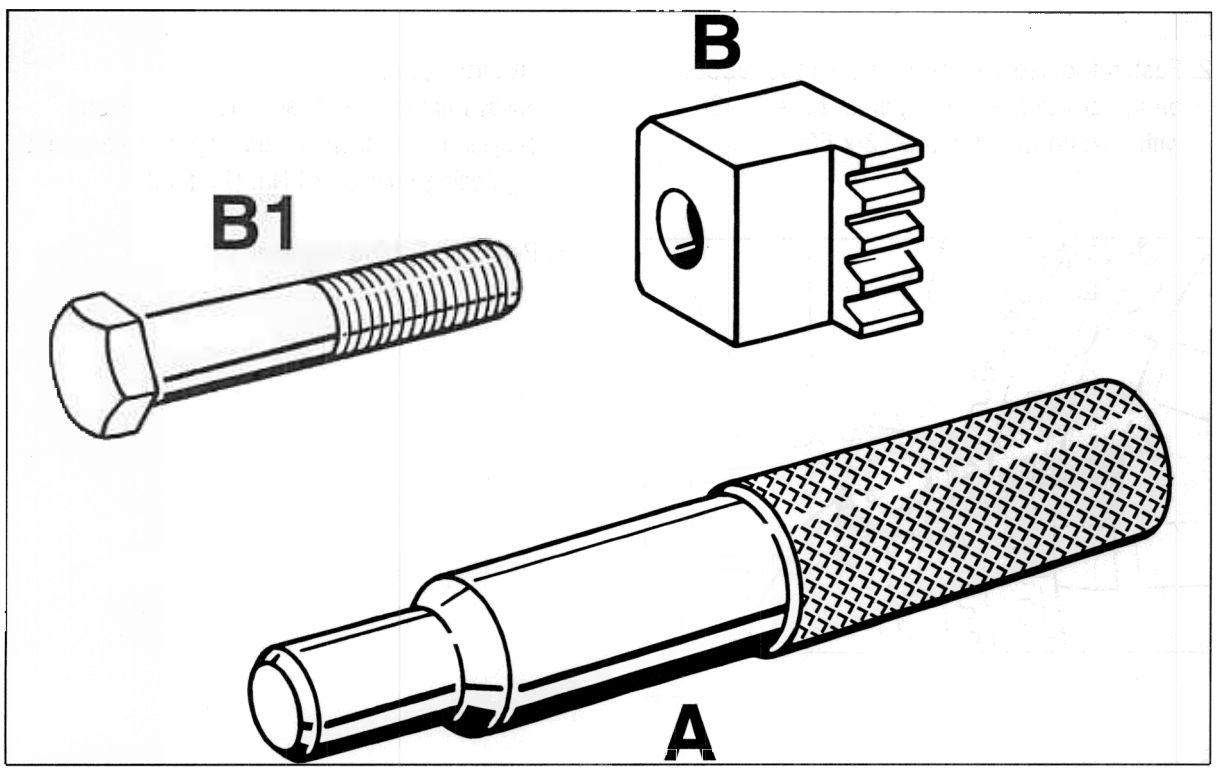
Technical data (manual transmission G96/00)

Tightening torques (transmission G96/00)

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)
Halfshaft flange on limited-slip differential	M10	44 (33)
Transmission on engine	M12 M10	85 (63) 45 (33)
Reversing light switch on transmission	M12	15 (11)
Bracket for shift cables on transmission	M10	45 (33)

30 50 19 Removing and installing clutch

Tools



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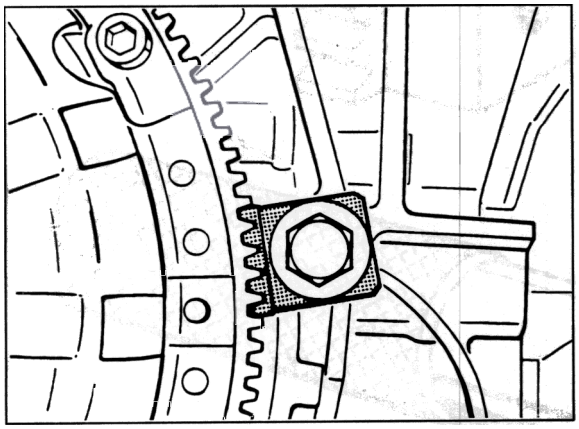
Item	Designation	Special tool	Explanation
A	Centring mandrel	9102	
B	Toothed segment	9538/1	
B1	Fastening screw for toothed segment		Hexagon-head bolt M12 x 50

Assembly instructions

Removal

1. Remove manual transmission. Refer to Group 3 – Manual transmission, Serv. No. 34 35 19.

2. Fasten toothed segment (special tool 9538/1) on the crankcase half (cylinder bank 1 - 3) with hexagon-head bolt M12 x 50.



607_97

3. Detach thrust plate.

Note

In order to avoid deformation of the thrust plate housing, always loosen screws in **several stages** and in **diametrically opposite** sequence.

4. Remove thrust plate and drive plate.

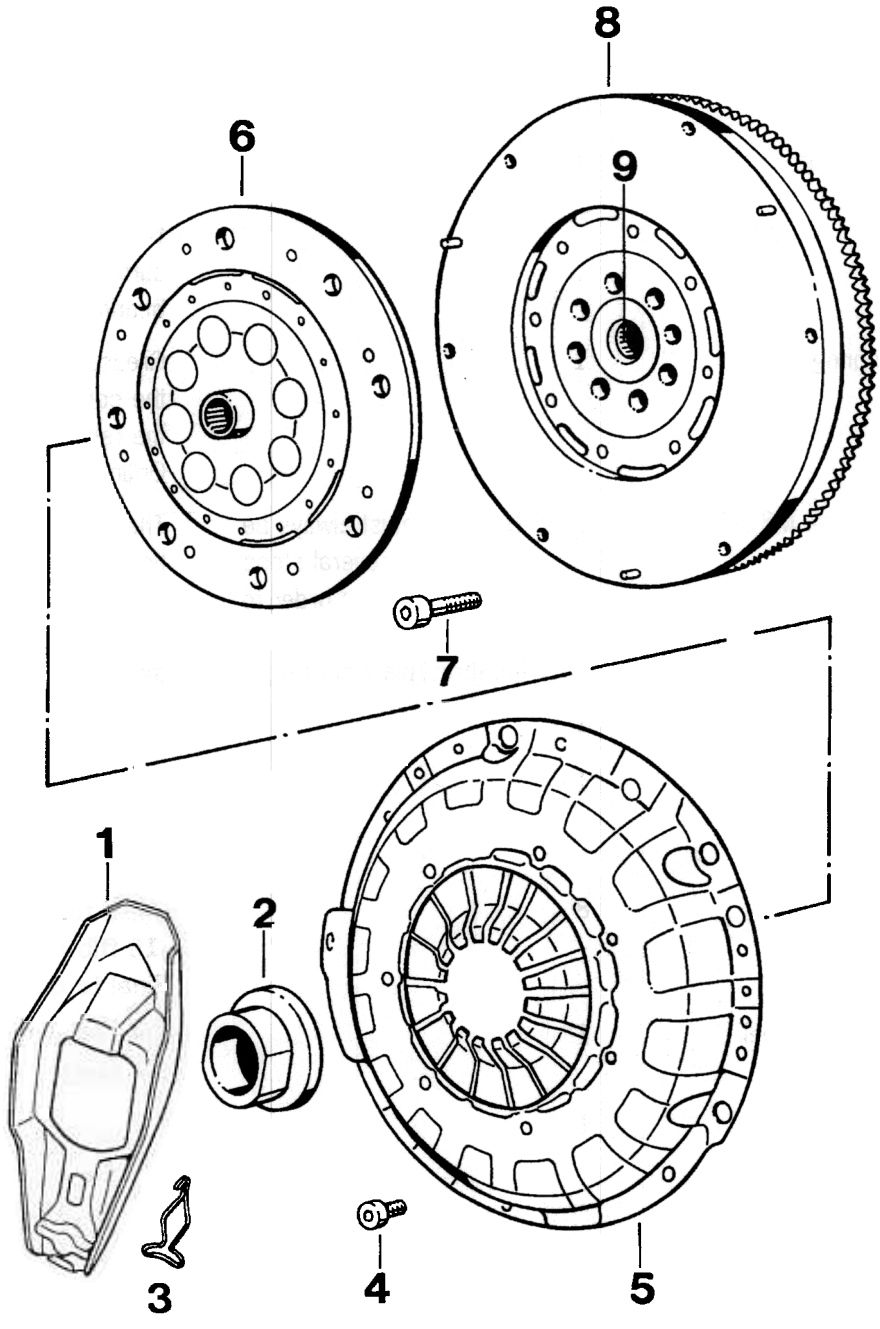
Installation

1. Fit centring mandrel (special tool 9102) with drive plate in the guide bearing (needle bush).

2. Fit thrust plate.
Always tighten pan-head screws in several stages and in diametrically opposite sequence.
Tightening torque: 23 Nm (17 ftlb.)

3. Remove centring mandrel.

30 50 37 Disassembling and assembling clutch



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Disassembling and assembling clutch

No.	Designation	Qty.	Removal Note:	Installation
1	Release lever	1		
2	Release bearing	1		Do not wash out bearing. Replace noisy bearing. **Do not** grease sliding surface of release bearing or guide tube
3	Retainer spring	1		Grease ball journal at the contact point with the retaining spring using Optimol Longtime 3EP
4	Pan-head screw M8 x 16	6	The bolts must always be loosened in several steps and crosswise in order to prevent deformation of the thrust-plate housing	The bolts must always be tightened in several steps and crosswise in order to prevent deformation of the thrust-plate housing
5	Thrust plate	1		
6	Drive plate	1		Centre with centring mandrel, special tool 9102
7	Pan-head screw M10 x 1 x 50	8		**Initial torque 25 Nm (19 ftlb.)** **Final torque: 90° turn**
8	Double-mass flywheel	1		Ensure the centring pins are seated firmly
9	Needle bush			

30 30 19 Removing and installing clutch slave cylinder

Removal

1. Unscrew the front **rear-axle cross member** (two M10 screws) to facilitate subsequent assembly work.

2. Detach line No. 1 on the clutch slave cylinder and remove line from holder No. 2. Cover or close line No. 1 and the connection bore in the clutch slave cylinder.

3. Remove holder with clip No. 2 (to facilitate assembly). To do this, undo the 2 screws on the transmission side cover.

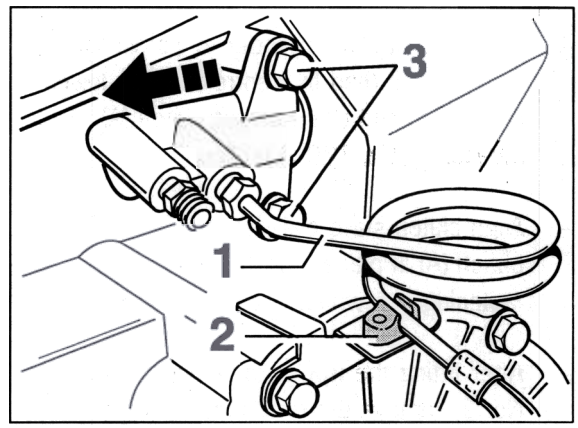
4. Undo fastening screws No. 3 and remove the clutch slave cylinder from the transmission housing.

Note

The following tools can be used to undo and tighten screws No. 3:

Lower screw: 3/8 inch changeover ratchet in combination with a short extension (approx. 100 mm long) and 13 mm socket wrench insert.

Upper screw: 3/8 inch changeover ratchet in combination with an extension (approx. 250 mm long), universal joint and 13 mm socket wrench insert.



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Installation

1. Grease end of the push rod of the clutch slave cylinder – in the area located in the ball socket of the release lever when installed – with a thin coat of **Olista Longtime 3 EP** (available as a spare part).

2. Fit the clutch slave cylinder and tighten the fastening screws (23 Nm (17 ftlb.)).

Note

When inserting clutch slave cylinder, it is necessary to overcome the spring force acting on the push rod whilst fitting a fastening screw. Refer to the assembly instructions in the following text.

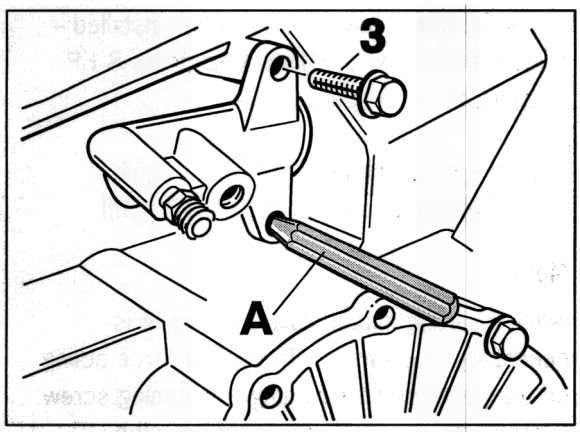
Assembly instructions for inserting the clutch slave cylinder

Move clutch slave cylinder to installation position and then fix/centre it at the lower fastening point using a drift punch (A) measuring 5 x 120 x 10 mm.

Align clutch slave cylinder – with the drift punch (A) in place – so that the **upper** fastening screw No. 3 can be fitted.

After fitting the **upper** fastening screw No. 3, remove the drift punch (A) and screw in the **lower** fastening screw.

Tighten upper and lower fastening screws (23 Nm (17 ftlb.)).



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3. Fit clutch line on clutch slave cylinder (do not tighten it yet).
   Fit holder with clip on the transmission side cover (tightening torque of the two screws: 25 Nm (19 ftlb.)).
   Clip clutch line into the holder and tighten the line.

4. Bleed hydraulic system of the clutch (Rep. Gr. 30 / Serv. No. 30 01 07).

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, the **minimum filling or bleeding time must be 30 seconds**.

5. Check operation of the clutch.
   Repeat the bleeding process if the clutch does not operate (disengage) correctly.

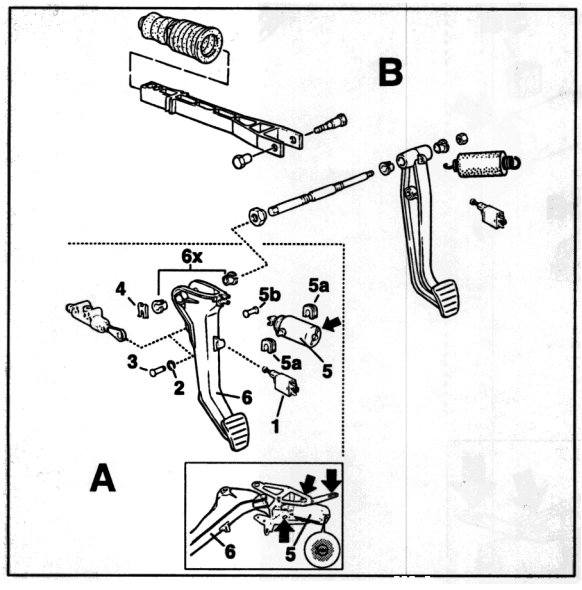
6. Install rear axle cross member.
   Tightening torque of the two screws 65 Nm (48 ftlb.).

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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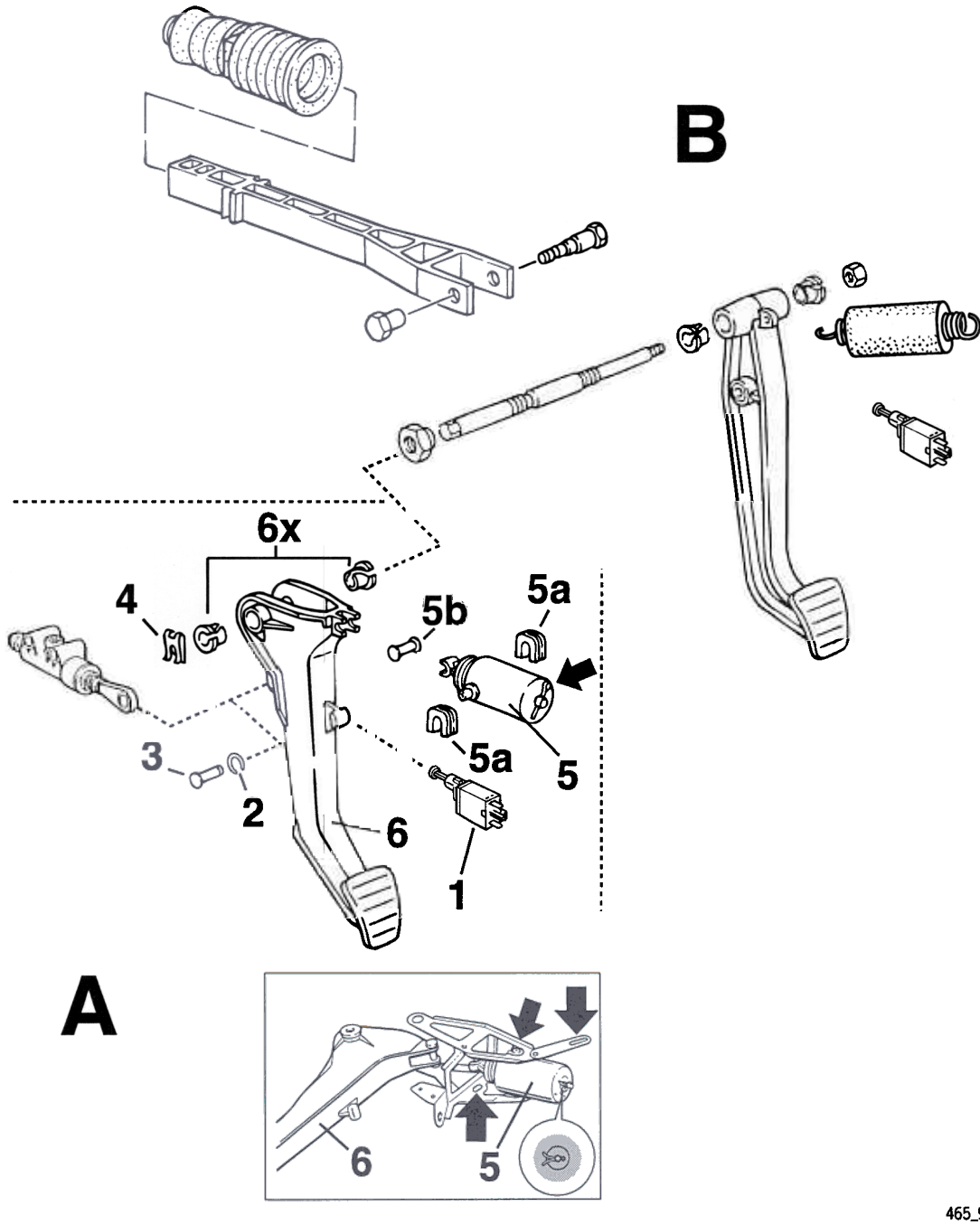
Removing and installing the clutch pedal



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	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. Ensure correct 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. It is important to note instructions regarding grease**
5b	Pin	1		It is important to note instructions regarding grease**
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 specified grease*

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. To see when lubrication of the boost spring bearing points is not permitted, please also refer to the assembly instructions for installation, steps 2.1 and 2.2.

Notes on removal and installation

Removal

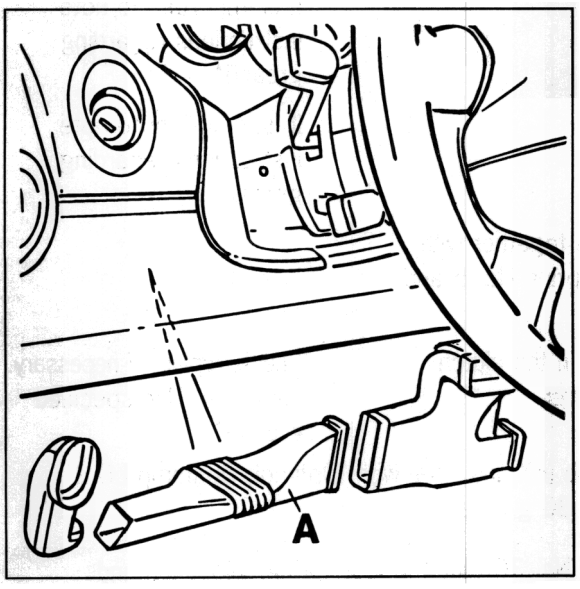
Warning
Danger of injury and / or damage during disassembly and assembly work!
The clutch boost spring can become detached on its own.

> 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 (Figure 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.



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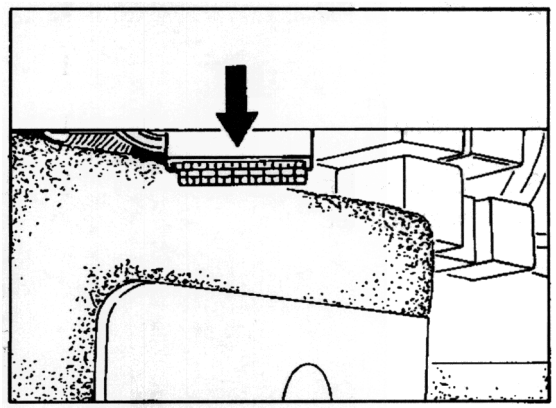
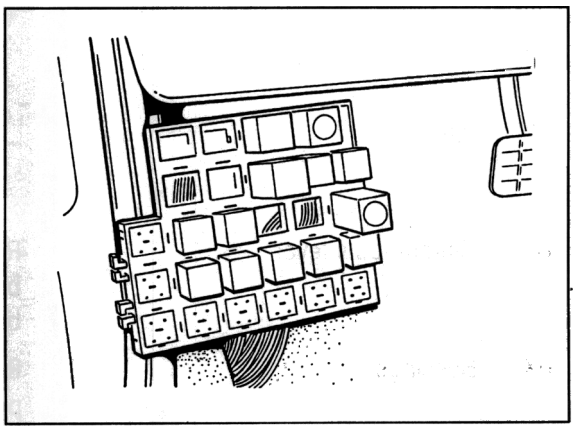
4. Detach diagnostic socket.



12_96

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



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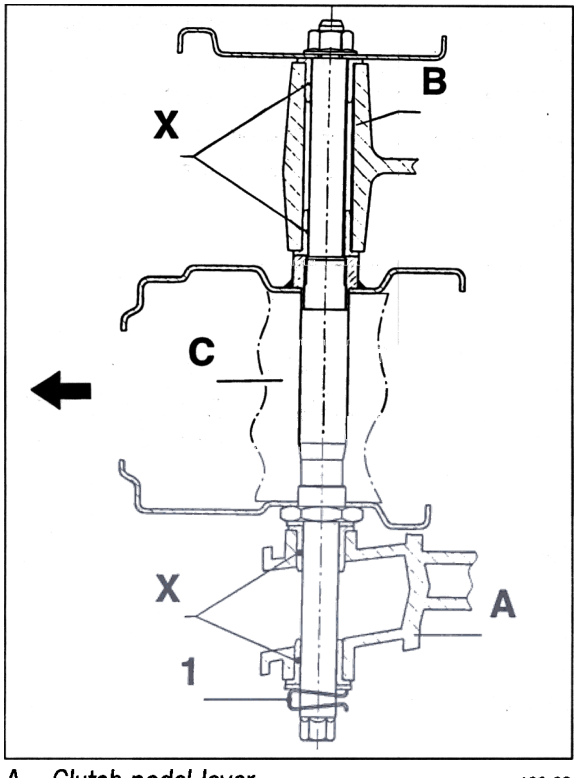
6. Release clutch pedal switch by turning it 90° and pull it out of the installation opening.

7. There is an assembly bore in the guide rod for the clutch boost spring. Insert a 3 mm ø cotter pin in this bore, and bend over the ends (securing: refer to Figure 478_98).

8. Remove pin between the clutch push rod and clutch pedal lever.

9. Remove retainer (1) on the pedal bearing axle.



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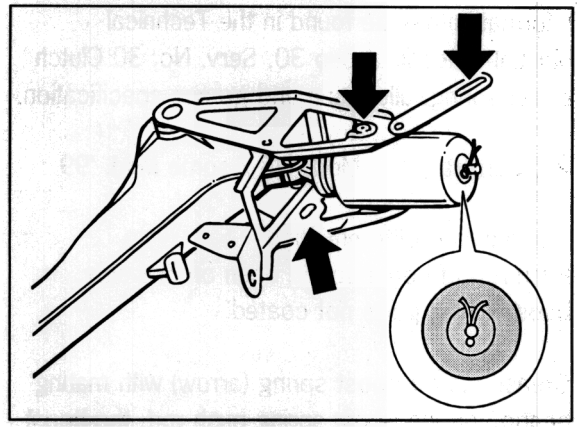
A – Clutch pedal lever
B – Brake pedal
C – Steering outer tube
X – Bearing bushings

– Retainer

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.



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Installation

1. Inspect all bearing bushings X for clutch pedal lever and replace them if necessary. Lubricate sliding surfaces of the bearing bushings X (Figure 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 under step 2.1 or 2.2.
2.1 Carrera (996) Mod. '98 / some Mod. '99
2.2 Carrera (996) from current Mod. '99

Note

In the 911 Carrera (996), different boost springs may be fitted.
Observe proper allocation when replacing the boost spring and/or the bracket.

A modified (optimised) clutch pedal must also be sometimes be using when replacing the boost spring.

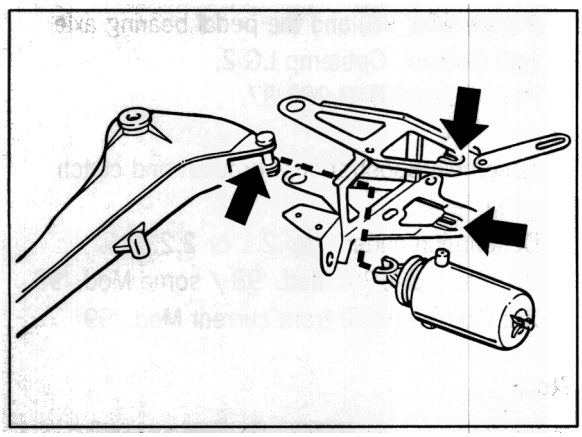
Greasing of the boost spring bearing points is partly necessary and partly not permitted (depending upon the type of boost spring used).

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

2.1 Carrera (996) Mod. '98 / some Mod. '99

Identification/differentiation:
Push rod of boost spring open on one side, boost spring parts 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.



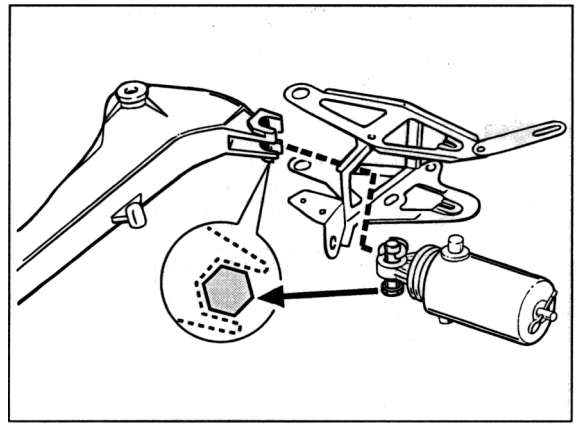
Greasing necessary (arrows) 31_1_98

2.2 Carrera (996) from current Mod. '99

Identification/differentiation:
Push rod closed / boost spring parts coated.
The date of introduction for this boost spring is contained in the Parts Catalogue.

Engage the hexagon bolt of the boost spring in the hexagon on the clutch pedal (arrow).

Important: Do not grease, as the sliding surfaces of this type of boost spring are coated. This non-greasing instruction applies to all sliding surfaces (pin of boost spring, boost spring bearing in bracket, bearing pin on boost spring and boost spring in the shell).



Do not grease (not permitted) 467_98

Note

Gold-coloured bracket (996.423.571.00) and boost spring with **purple** marking (996.423.081.**09** Mod. '98 / some Mod. '99 or 996.423.081.**11** from current Mod. '99) must be used only in this combination and installed only in the 911 Carrera (996).

3. Installation and adjustment specification for boost spring bracket.
   Install preassembled boost spring bracket with clutch pedal lever.

To do this:

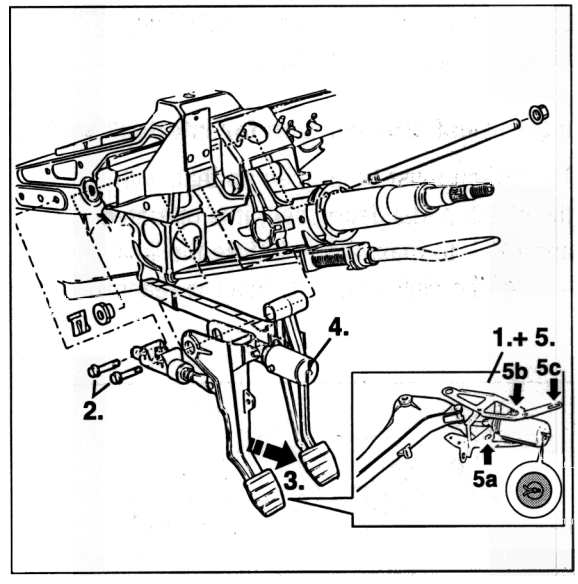
Step 1:
Tighten the three fastening nuts (arrows) only slightly (the bracket must still be movable).

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).

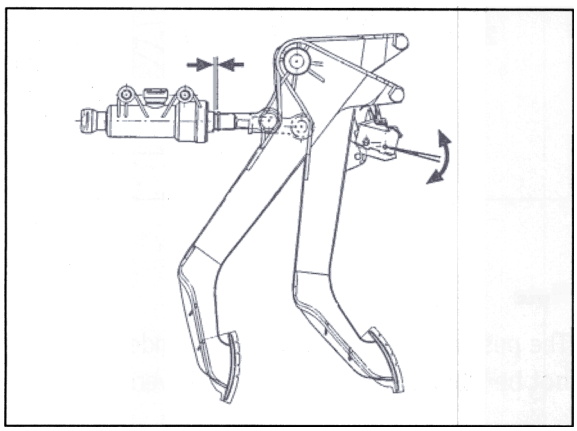
4. Fit new retainer on the pedal bearing axle and subsequently secure the retainer by wedging it with a mandrel.

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.

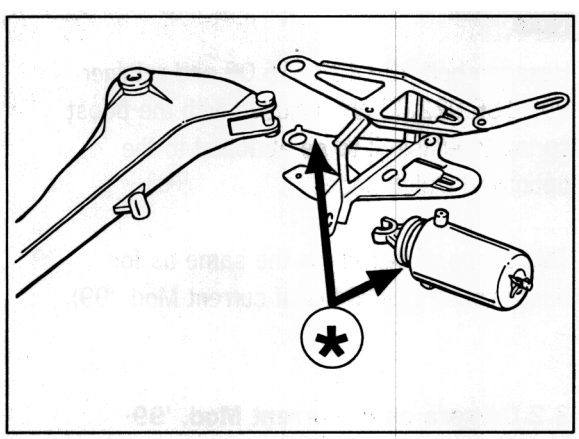
30 Clutch boost spring: allocation and grease specification

1. Boost spring / bracket allocation

Gold-coloured bracket (**996**.423.571.00) and boost spring with **purple** marking (996.423.081.09 or 996.423.081.11 / see boost spring allocation) must be used only in this combination and installed only in the 911 Carrera (996).

Note

The silver-coloured bracket (**986**.423.571.00) and boost spring with white marking (986.423.081.08 or 986.423.081.11) are assigned to the Boxster and must **not** be installed in the 911 Carrera (996).



31_98

* Differentiation/identification

2. Standard boost spring allocation

2.1 Carrera Mod. '98 / some Mod. '99

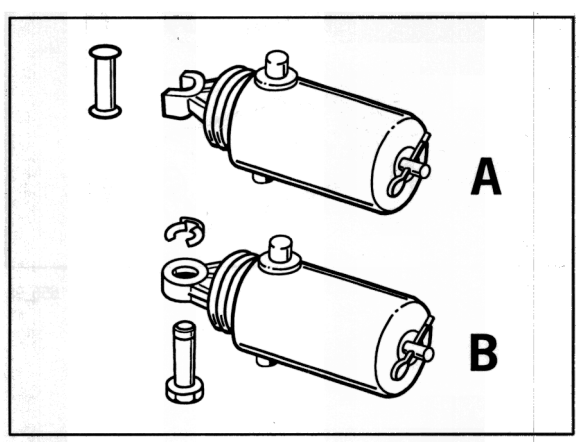
Boost spring **A**. Push rod of boost spring open on one side. Boost spring with **purple** marking.

Observe replacement procedure and grease specification.

2.2 Carrera as of current Mod. '99

Boost spring **B**. Push rod of boost spring closed. Boost spring with **purple** marking.

Do not grease any areas as the components are coated.



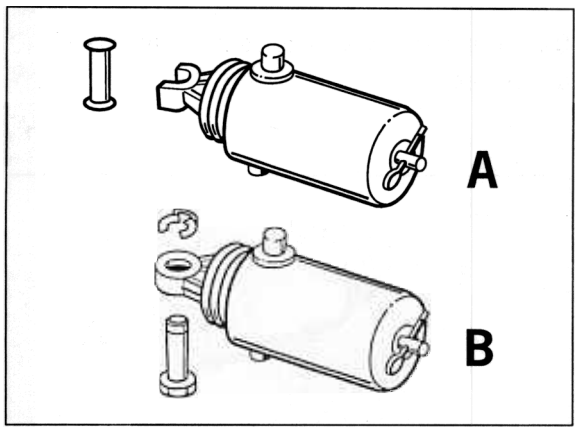
556_98

3. Boost spring: Replacement procedure

3.1 Carrera Mod. '98 / some Mod. '99

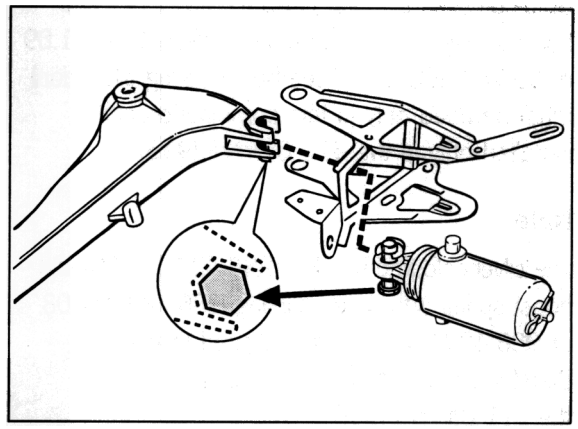
The standard boost spring **A** (push rod on boost spring is open on one side / boost spring painted **purple**) Spare Part No. 996.423.081.**09** is no longer available after existing supplies are used up.

Boost spring **B** 996.423.081.**11** can then be used as a replacement (closed push rod / boost spring painted **purple**).
This boost spring must **not be greased**.



556_98

When boost spring **B** is installed *for the first time*, the optimised clutch pedal 996.423.139.**09** must also be used.



467_98

Note

Hexagon bolt 999.423.315.06 and retainer 999.166.022.02 are included with the boost spring to enable it to be attached to the optimised clutch pedal.

This scope of delivery is the same as for boost spring type **B** (as of current Mod. '99).

3.2 Carrera as of current Mod. '99

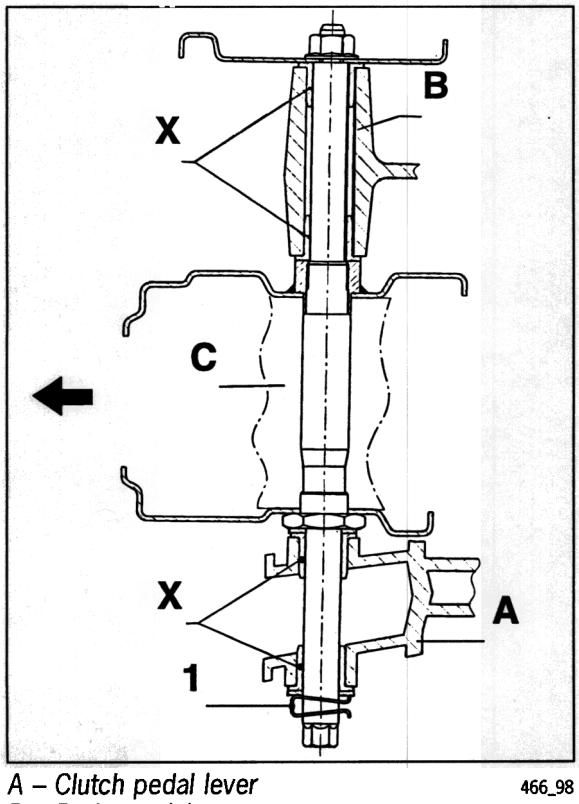
Boost spring **B** (Figure 556_98) is used as standard and for replacement.

4. Grease specification

The following grease specification must be observed during assembly work on the pedals.

4.1 Pedal bearing axle

Greasing generally necessary.
Lubricate sliding surfaces of the bearing bushings X and the pedal bearing axle with Optimol, Optitemp LG 2, Part No. 000.043.203.37.



466_98

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

1 – Retainer

4.2 Clutch master cylinder push rod

Do not grease, as this could result in damage.

4.3 Area around boost spring

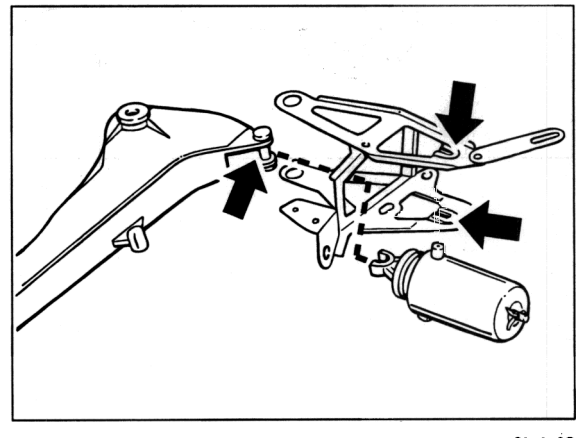
Depending upon the type of boost spring used, greasing is either necessary **or** not permitted. The following general rule applies: **Do not grease** coated parts, as otherwise the coating is lost.

4.3.1 Carrera Mod. '98 / some Mod. '99

A. Boost springs installed as standard:
Push rod open on one side. Parts uncoated.

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 interior of the boost spring housing are lubricated with a special grease. This grease is not available as a spare part. If necessary, replace the complete boost spring (with housing).



31_1_98

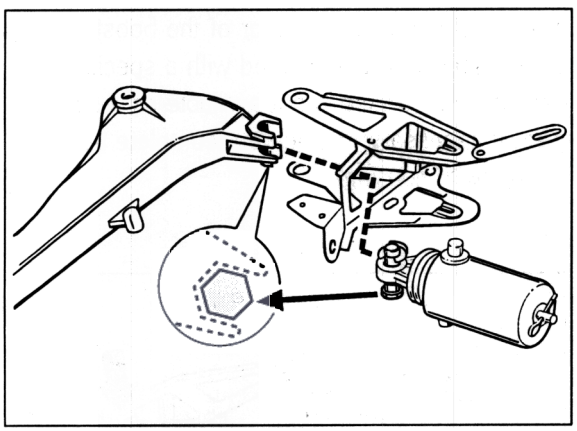
B. Spare part replacement boost springs
Part No. 996.423.081.**11** (type used as of current Model '99 / Figure 467_98).
Distinguishing feature: closed push rod, boost spring with **purple** marking and hexagon bolt for attachment to the clutch pedal.

Do not grease any areas as the components are coated.

4.3.2 Carrera as of current Mod. '99

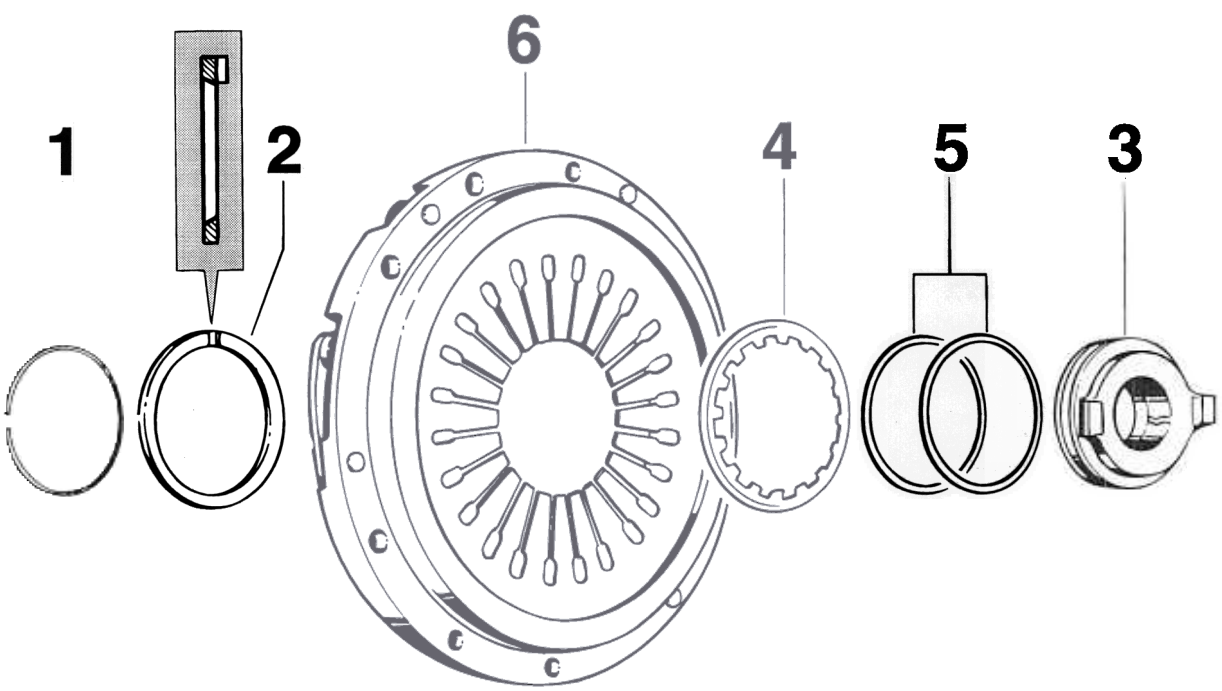
Push rod closed / attachment to clutch pedal by means of a hexagon bolt.

Do not grease any points, as the parts are coated.



467_98

30 45 19 Removing and installing release bearing – GT3



354_99

Printed in Germany - 28, 1999 9963021

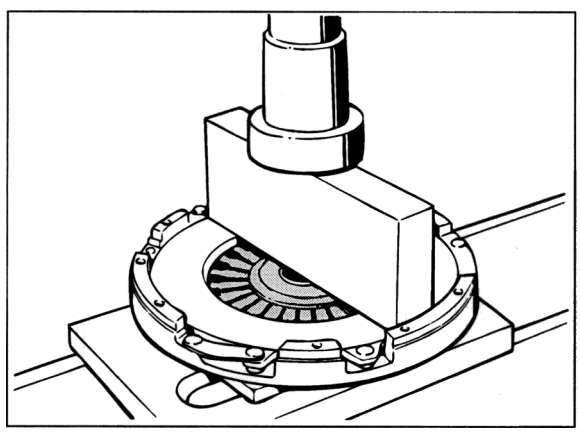
Removing and installing release bearing – GT3

No.	Designation	Qty.	Removal Note:	Installation
	Snap ring	1	Remove using pointed-nose pliers, simultaneously push down pressure plate using a press	Ensure correct seating
2	Thrust plate	1		Engage lug (twist lock) in the opening of a diaphragm spring latch
3	Release bearing	1	Check, do not wash out, just dry wipe	Do not grease sliding surface
4	Spring washer	1	Mount in correct position	
5	Spacer washer	2		**Fit 2 spacer washers**
6	Pressure plate	1		Check for wear, replace if necessary

Removing and installing release bearing – GT3

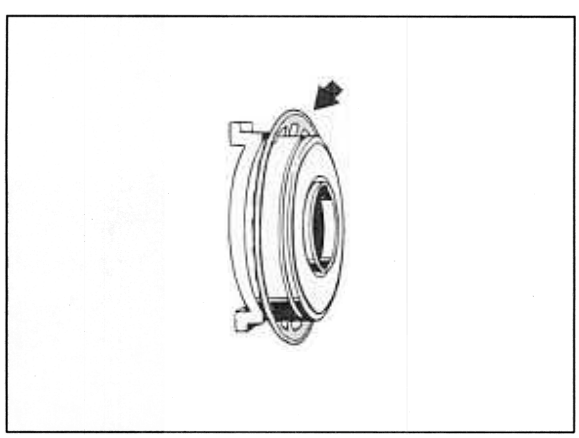
Assembly instructions

1. The snap ring can be fitted only using a workshop press. Use a block of hardwood as a pressure piece.



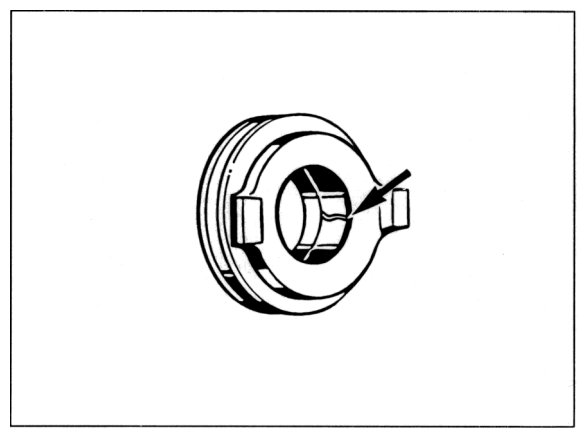
355_99

2. Fit spring washer in correct position.



356_99

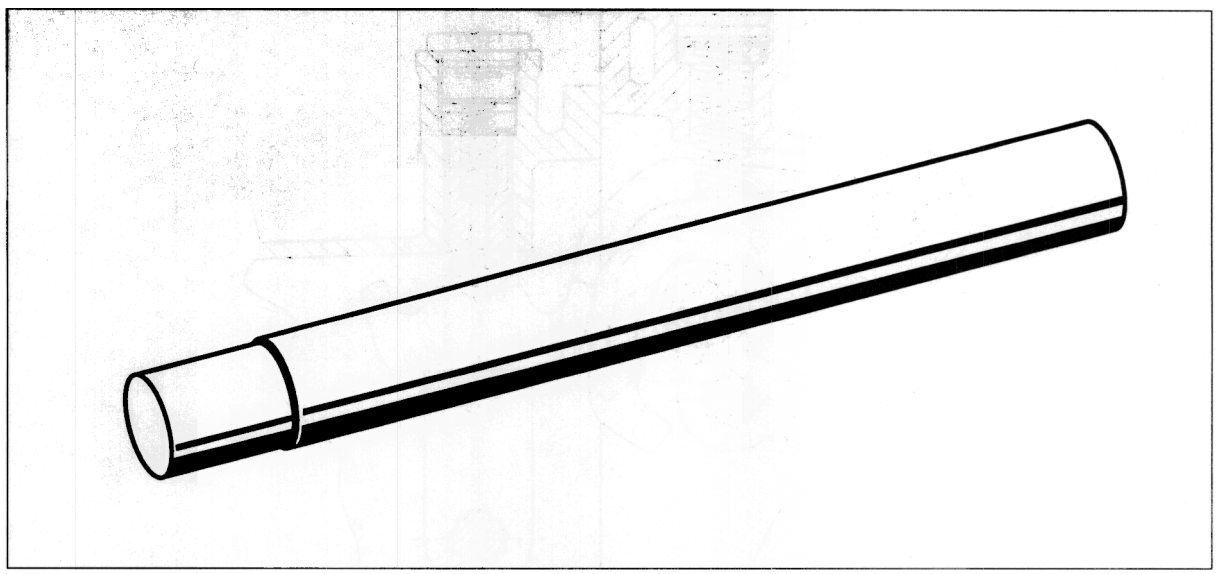
3. Do not grease the sliding surfaces of the release bearing and the guide tube. The guide sleeve is slotted (irregular course - arrow)



358_99

34 49 19 Removing and installing closure cap for selector mechanism

Tools

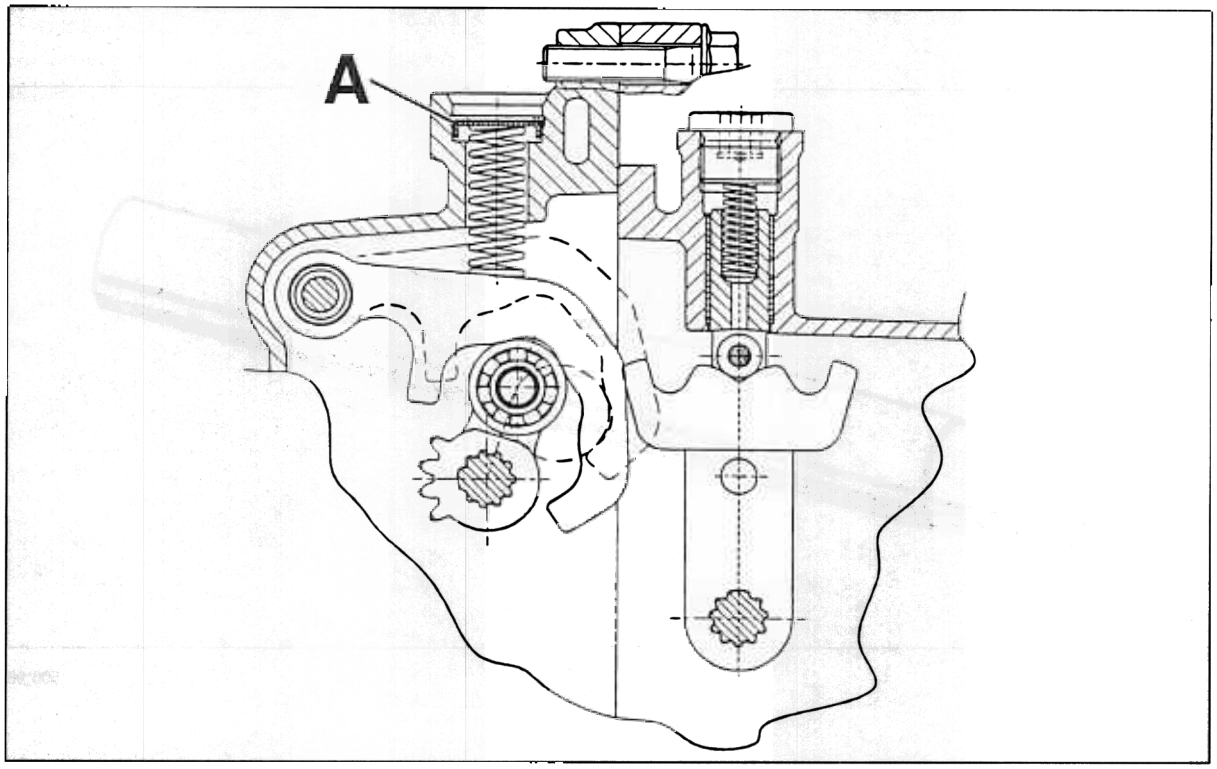


500_98

Item	Designation	Special tool	Explanation
	Mandrel	P 375	

Printed in Germany - 18, 1998 9963419

Removing and installing closure cap for selector mechanism



075_98

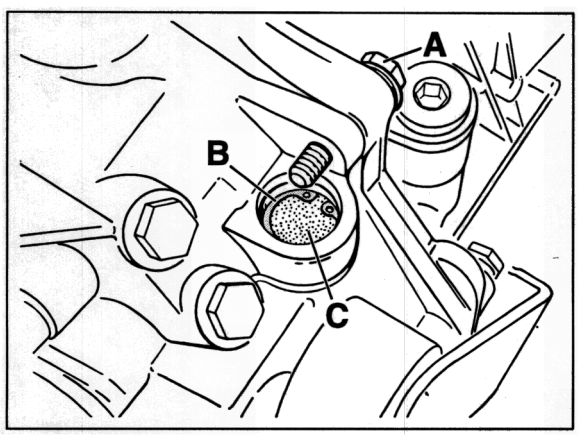
A – Closure cap

Removing and installing closure cap for selector mechanism

Removal

1. Remove transmission
   (refer to Service No. 34 35 19).

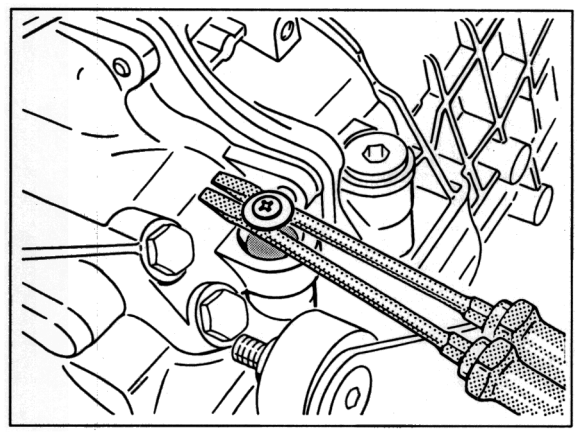
2. Shift gear lever to neutral, unscrew fastening screw "A" and remove snap ring "B".



076_98

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

3. Drill a hole of 3.5 mm in the centre of the closure cap (coat drill with thick grease in order to prevent drilling chips from falling into the transmission), screw in sheetmetal screw (4.8 x 25) with a large washer and lever out the closure cap using two screwdrivers.



484_98

Installation

1. Insert the closure cap and snap ring into the hole in the housing.

2. Using special tool **P375** press the snap ring and closure cap down until the snap ring engages into its groove.

Note

Ensure that the snap ring is perfectly secure.

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

4. Install the transmission.

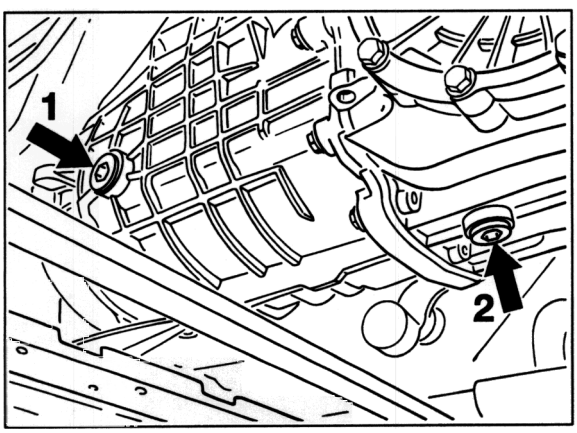
34 01 55 Changing transmission oil

Filling capacity: 2.7 l

Note

Use only oils approved by Porsche.
See Parts Catalogue.

1. Unscrew the oil filler and drain screws and drain the oil with the vehicle horizontal.



1 – Filler screw
2 – Drain screw
88 - 97

2. Clean the drain and filler screws.

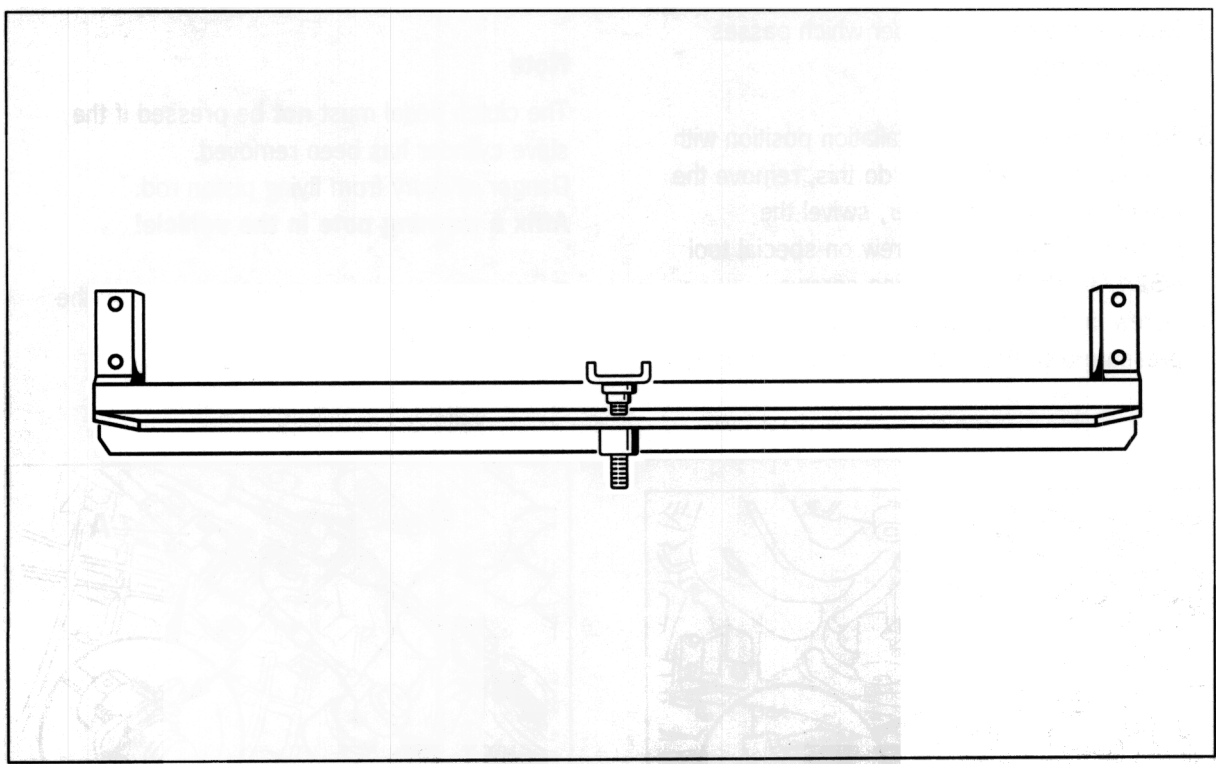
3. Fill with oil up to the bottom edge of the oil filler opening.

4. Tighten the drain and filler screws with **30 Nm** (18 ftlb.).

Printed in Germany, 1997 996341

34 35 19 Removing and installing transmission G 96

Tools



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Item	Designation	Special tool	Explanation
	Retaining device	9624/1	

Printed in Germany, 1997 996341

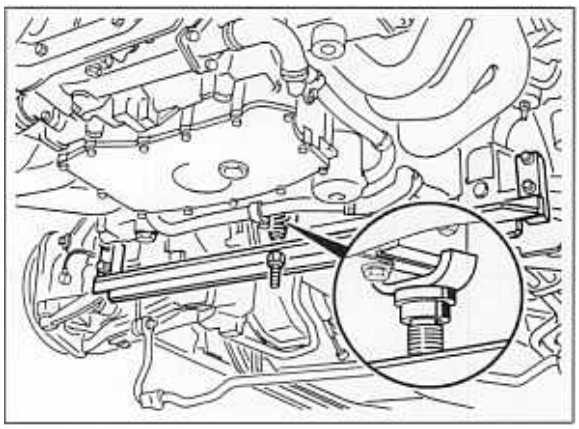
Removing and installing transmission

Removal

1. Remove underbody panels (middle and rear).

2. Remove the cross member which passes under the transmission.

3. Secure the engine in installation position with special tool **9624/1**. To do this, remove the mounting for the stabilizer, swivel the stabilizer forward and screw on special tool **9624/1** with four fastening screws. Screw in the pressure screw until the pressure disc has contact with the crankcase.



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4. Remove drive shafts at the transmission and protect the shafts against damage (use scrap pieces of hose with a diameter of 30 mm).

5. Disconnect the plug connection for the reversing light switch.

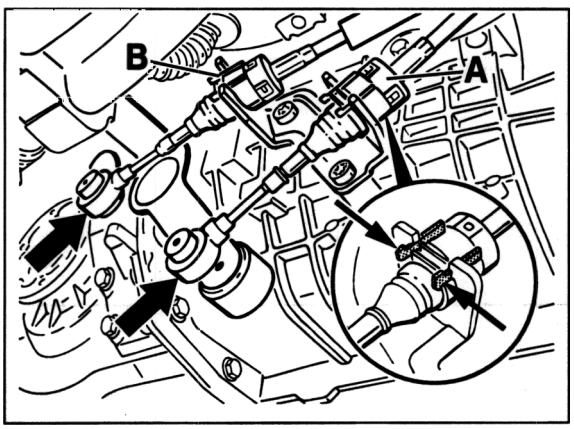
6. Unclip the hydraulic line for the clutch slave cylinder at the side transmission case cover.

7. 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!

8. Disengage shift and selector cables on the transmission:



133 - 97

Note

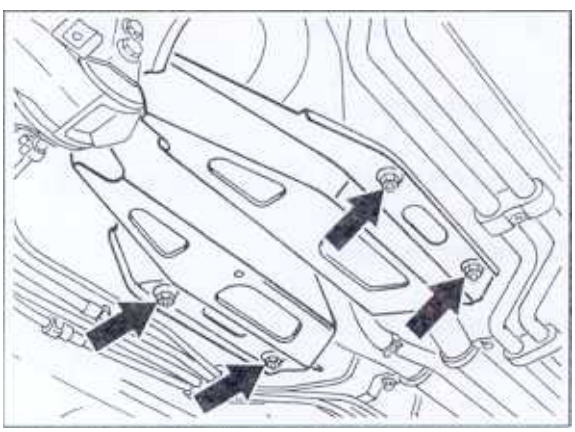
The shift and selector cables must not be excessively bent or kinked.

Pull off shift and selector cables at the transmission shift and selector levers.

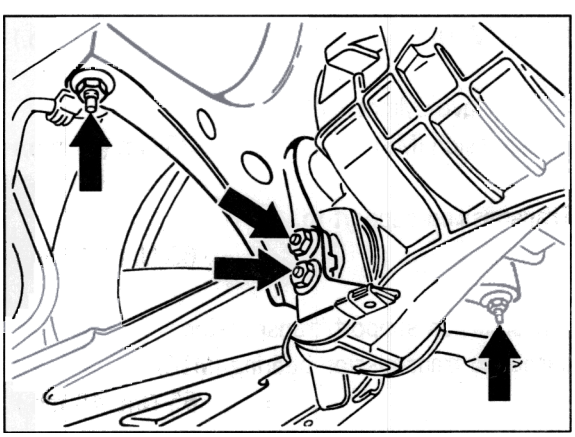
Detach the support bracket sleeves A and B at the support bracket. To do this, release the support bracket sleeves (press tabs in the direction indicated by the arrow) and carefully pull them out of the support bracket.

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

10. Remove transmission holder and transmission support.



97-122

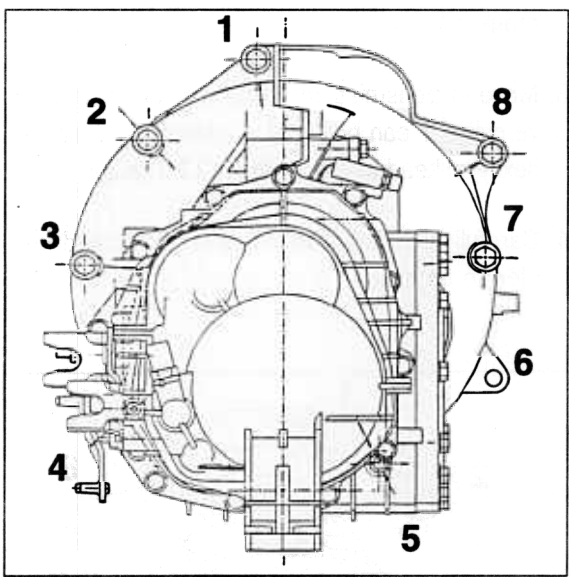


97-123

11. Unscrew transmission/engine fastening screws. To do this, use a long 3/8 inch extension.

Note

The engine may be lowered by up to 25 mm in order to improve accessibility to the upper screws.



97-130

12. Pull transmission to the front and lower it carefully.

Installation

Install in reverse order, observing the following points:

Note

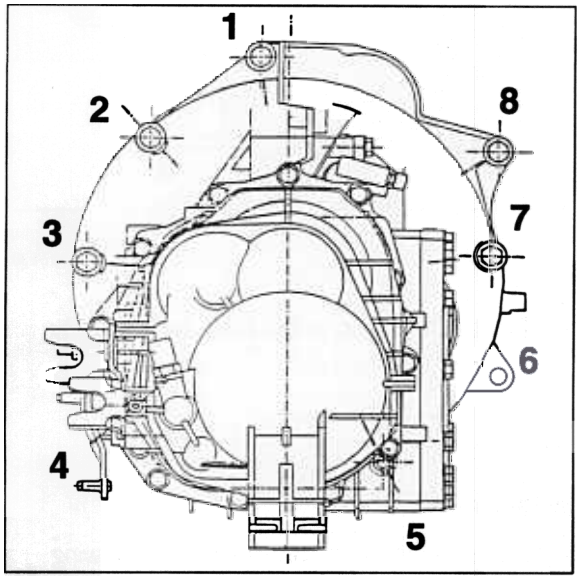
Each time the shift cables are removed from the transmission lever, the retaining clips of the shift cable end pieces **must** be replaced.

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. Move in transmission so far that the clutch slave cylinder can be fitted. Tightening torque for hexagon-head bolts **23 Nm (17 ftlb.)**.

4. Carefully move transmission in further and fasten to engine.



97-130

No.	Screw/nut	Nm (ftlb.)
1	M12 x 60	85 (63)
2	M12 x 90	85 (63)
3	M12 x 90	85 (63)
4 *	M10	45 (33)
5	M10 x 45	45 (33)
6**	M12	85 (63)
7	M12 x 60	85 (63)
8	M12 x 60	85 (63)

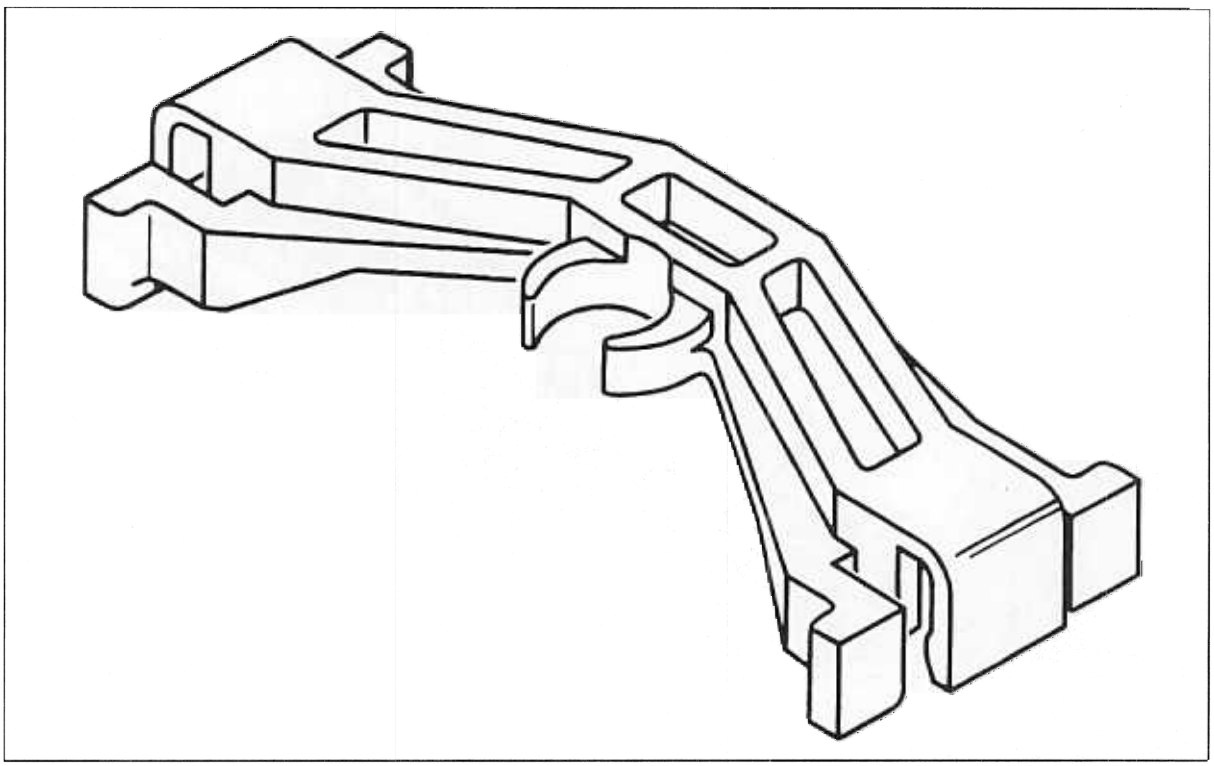
* Multiple-tooth nut
** Hexagon nut
(as of 4.9.97: M12 x 50 hexagon-head bolt)

Tightening torques:

Cross member to carrier side member (M10)	=	65 Nm (48 ftlb.)
Stabiliser to rear axle cross member side part (M8)	=	23 Nm (17 ftlb.)
Drive shaft to transmission flange (M10)	=	81 Nm (60 ftlb.)
Clutch slave cylinder to transmission (M8)	=	23 Nm (17 ftlb.)
Transmission support to body (M10)	=	65 Nm (48 ftlb.)
Transmission support/transmission carrier to transmission bearing (M10)	=	65 Nm (48 ftlb.)
Transmission support to body (M10)	=	65 Nm (48 ftlb.)

34 08 19 Removing and installing shift console

Tools

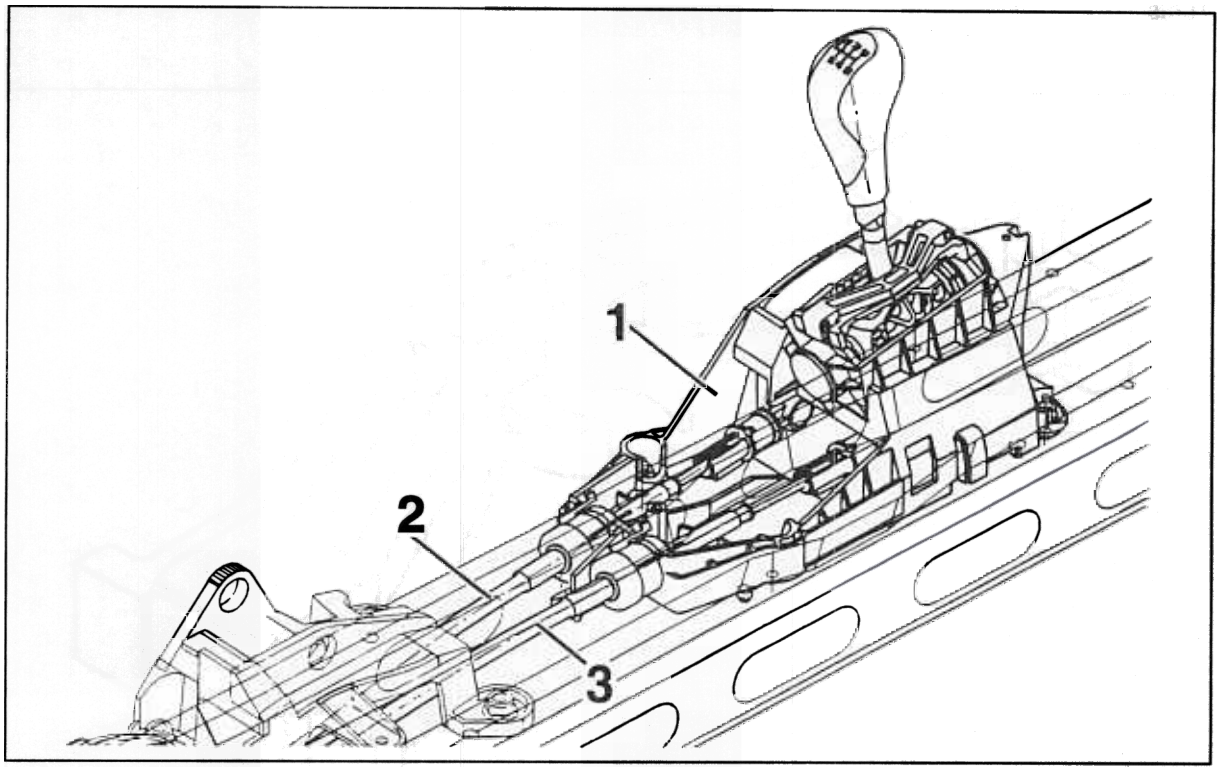


600_96

Item	Designation	Special tool	Explanation
	Locking bridge	9619	

Printed in Germany - 4, 1997 996347

Removing and installing shift console



556_97

1 – Shift console
2 – Selector cable (blue)
3 – Shift cable (black)

Removing and installing shift console

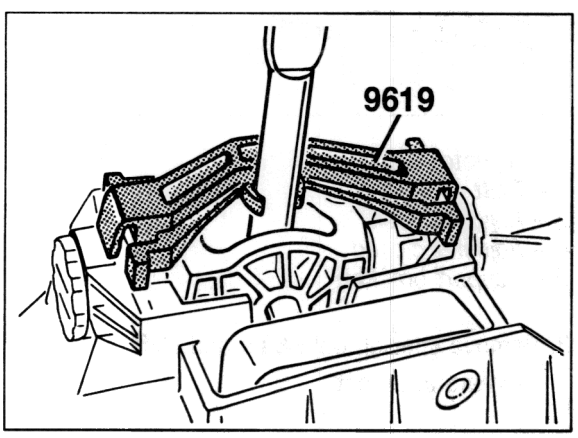
Removal

Note

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

1. Remove centre console (refer to Service No. 68 17 19).

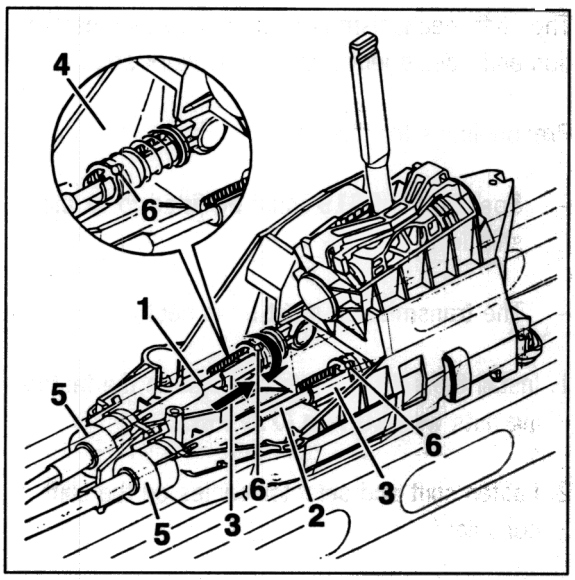
2. Move shift lever to neutral position and fix shift lever with special tool **9619**.



602-96

3. Remove shift console cover.

4. Disengage the selector and shift cables on the shift console. To do this, slide the locking sleeves (6) forward as far as they will go and turn clockwise to removal position.



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

550_97

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 shift mechanism 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.

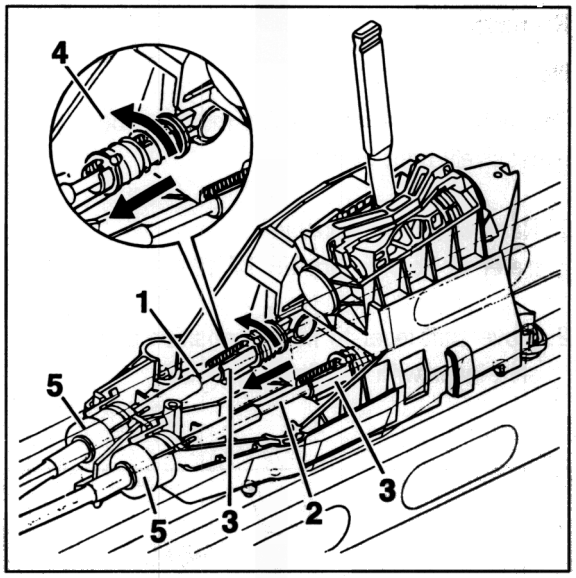
The transmission must be in neutral.

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

2. 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 open adjusters (3) and close the adjusters (see enlarged view).
   The locking sleeves must move to the end position automatically.



603-1-96

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

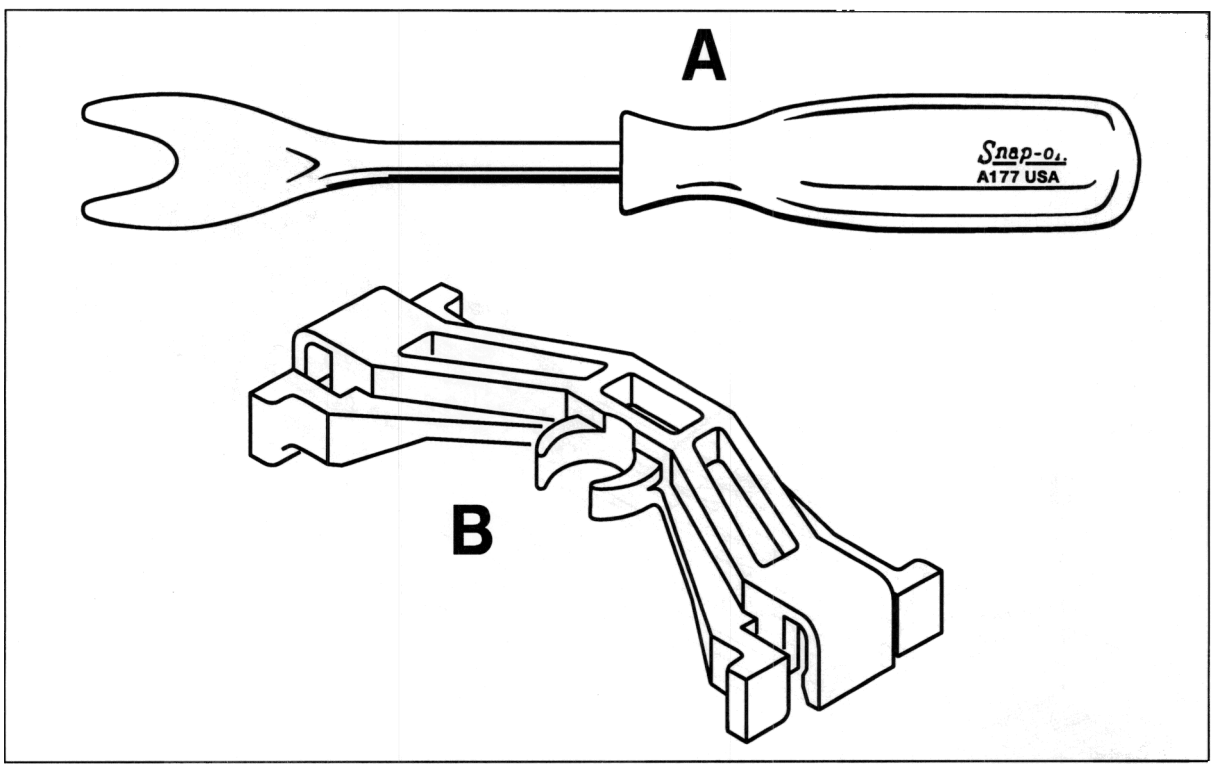
3. Remove special tool **9619** and shift through all gears as a test.

4. Clip in shift console cover.

5. Install centre console
   (refer to Service No. 68 17 19).

34 12 19 Removing and installing shift and selector cables

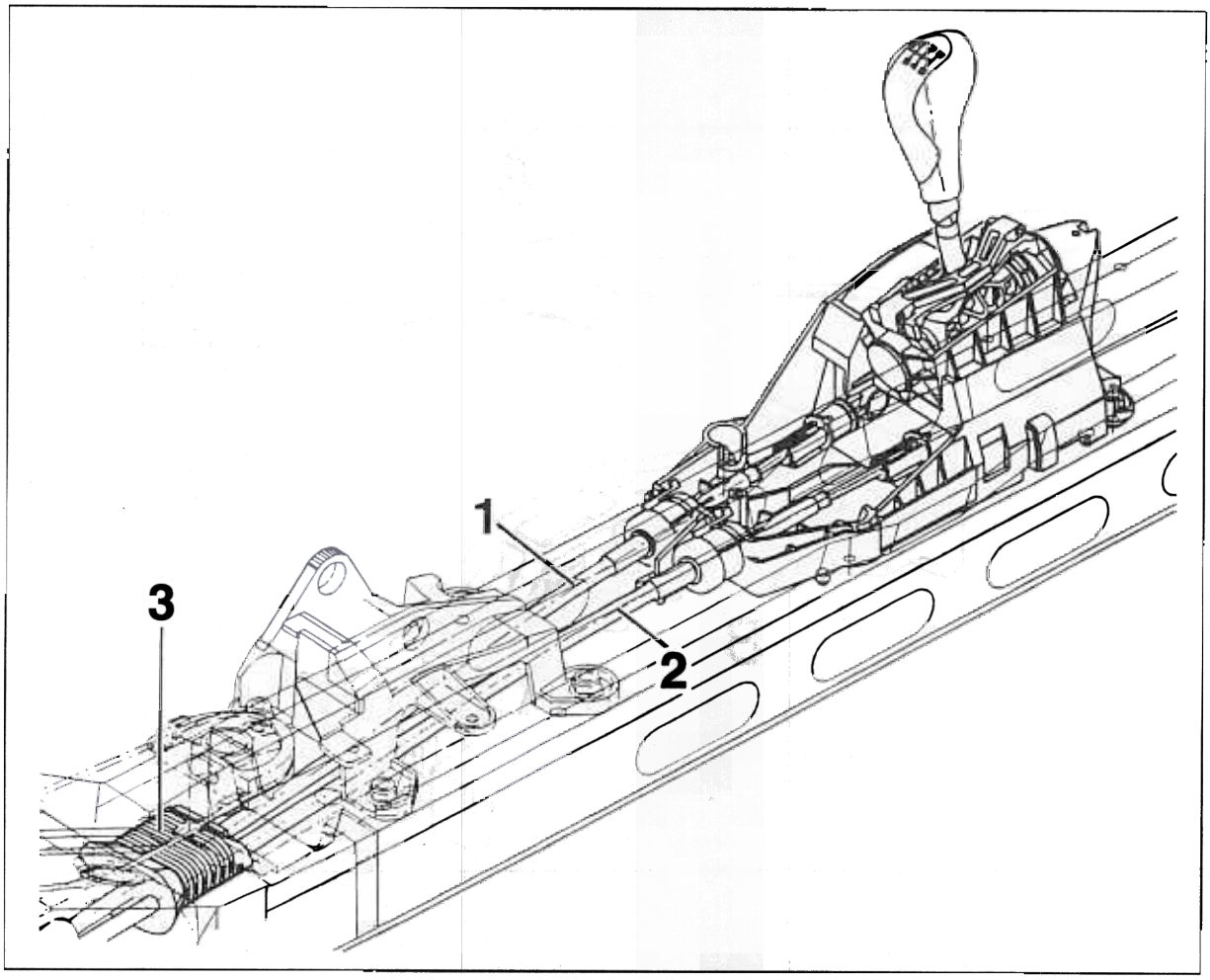
Tools



459_97

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

Removing and installing shift and selector cables



555_97

1 – Selector cable (blue)
2 – Shift cable (black)
3 – Rubber sleeve

Removing and installing shift and selector cables

Note

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

Removal

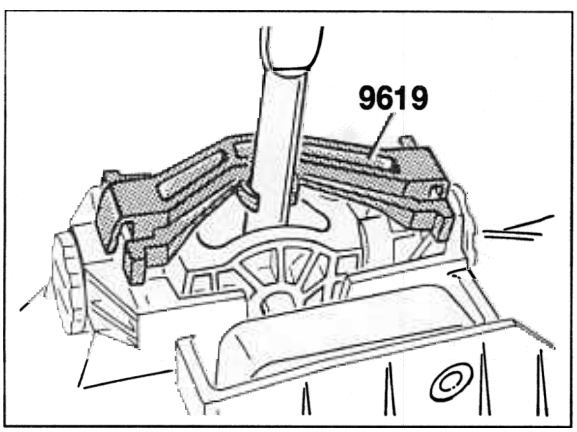
Note

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

1. Remove centre console (refer to Service No. 68 17 19).

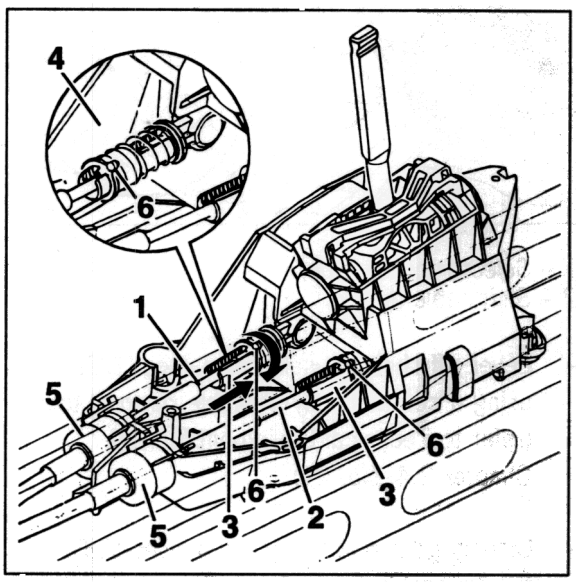
2. Lift shift console cover up and off.

3. Move shift lever to neutral position and fix shift lever with special tool **9619**.



602-96

4. Disengage the selector and shift cables on the shift console. To do this, slide the locking sleeves (6) forward as far as they will go and turn clockwise to removal position.



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

550_97

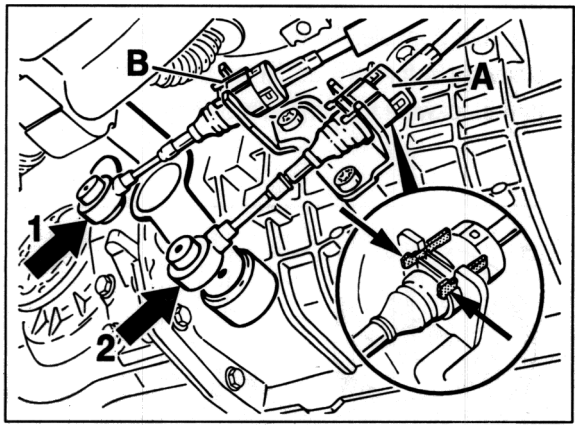
5. Disengage support bracket sleeves (5) on the shift console. To do this, release the support bracket sleeves and carefully pull out of the support bracket.

6. Remove parking brake console.

7. Remove underbody panel (middle and rear).

Printed in Germany - 4, 1997 996347

8. Disengage shift and selector cables on the transmission:



554_97

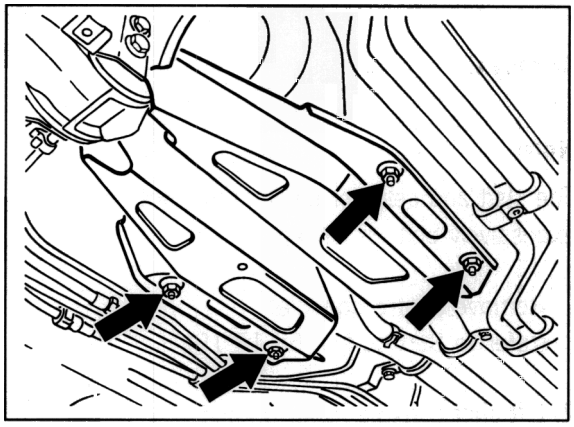
1 – Selector cable (blue)
2 – Shift cable (black)

Lever off shift and selector cables (1/2) using a commercially available removal tool (refer to Technical Equipment Manual, Chapter 2.4, No. 21).

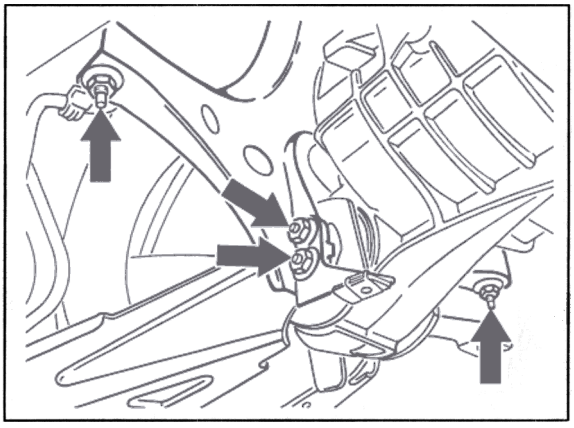
Disengage support bracket sleeves (A/B) on the support bracket. To do this, release the support bracket sleeves (press tabs in the direction indicated by the arrow) and carefully pull them out of the support bracket.

9. Remove cross member.

10. Place transmission jack under the transmission and remove transmission support.

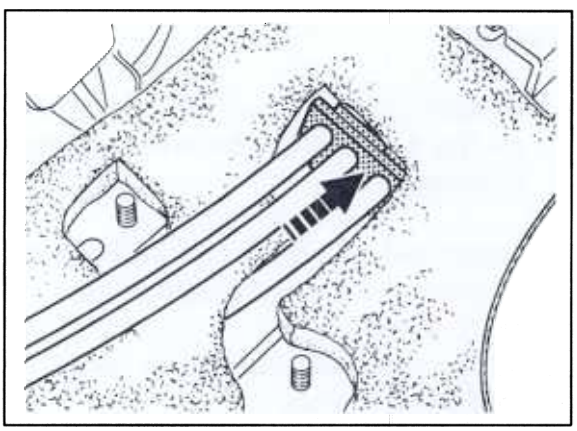


97-122



97-123

11. From the passenger compartment, press rubber sleeve out to the rear and pull B+ wire out of the slotted sleeve.



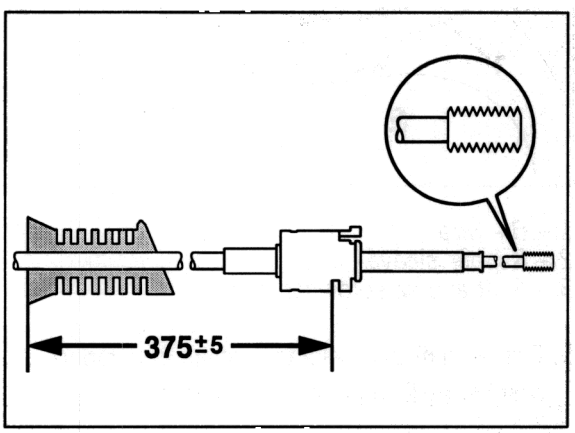
552_97

Installation

Note

Each time the shift cables are removed from the transmission lever, the retaining clips of the shift cable end pieces **must** be replaced.

1. Position rubber sleeve.

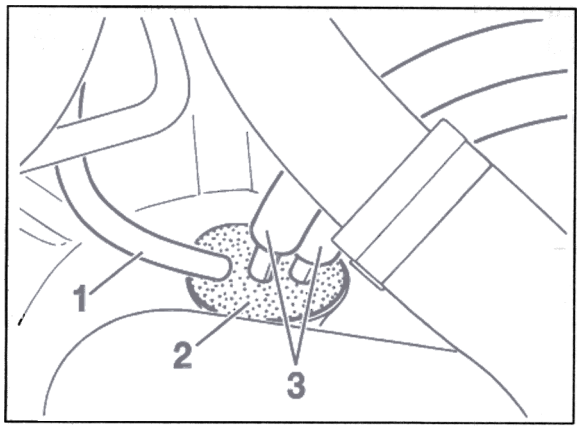


1 – Rubber sleeve 553_97

2. Apply a generous coating of lubricant (e.g. Contifix tyre mounting paste) on the rubber sleeve and B+ wire in the area of the body opening.

3. Push shift and selector cables through the body opening from behind.
Take care not to soil the vehicle interior.

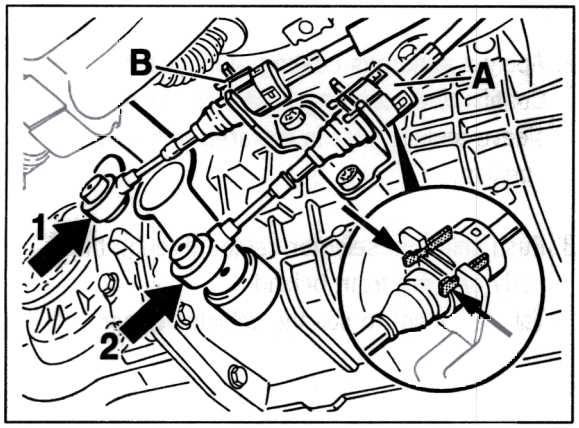
4. Insert B+ wire into the slot of the rubber sleeve and press sleeve into the body opening.



551_97

1 – B+ wire
2 – Rubber sleeve
3 – Shift and selector cables

5. Fasten shift and selector cables on support bracket (A/B) and on transmission lever (1/2).



554_97

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

6. Install transmission support and cross member.

7. Install parking brake console.

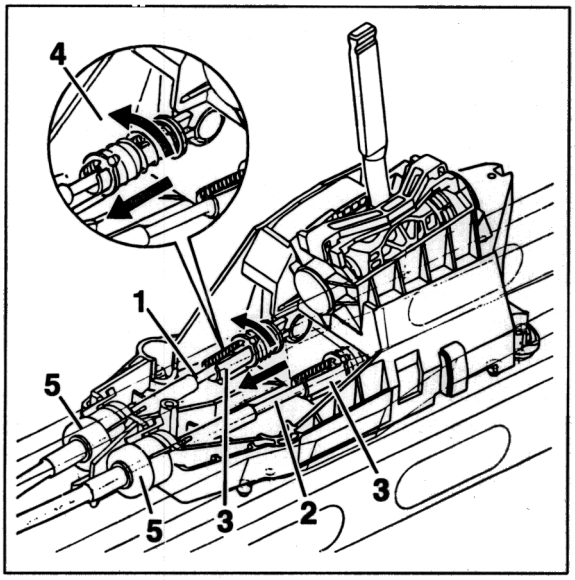
Note

The shift and selector cables are routed underneath the console.

8. 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 open adjusters (3) and close the adjusters (see enlarged view).
   The locking sleeves must move to the end position automatically.



603-1-96

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

9. Remove special tool **9619** and shift through all gears as a test.

10. Clip in shift console cover.

11. Adjust parking brake
(refer to Service No. 46 83 16).

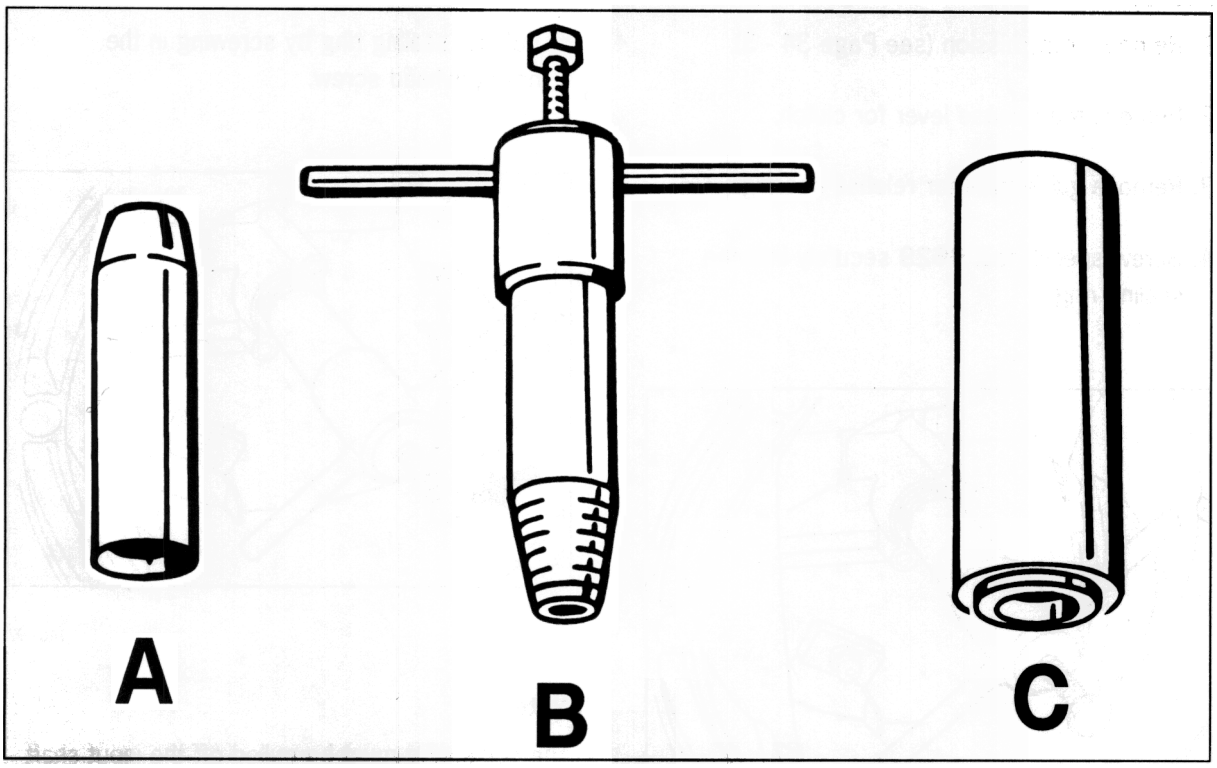
12. Install centre console
(refer to Service No. 68 17 19).

13. Fit underbody panels (middle and rear).

Tightening torques:

Parking brake console to body (M8)	=	23 Nm (17 ftlb.)
Transmission support to body (M10)	=	65 Nm (48 ftlb.
Transmission support/transmission carrier to transmission bearing (M10)	=	65 Nm (48 ftlb.)
Cross member to carrier side member (M10)	=	65 Nm (48 ftlb.)

35 50 19 Removing and installing sealing ring for input shaft



117 - 97

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

Printed in Germany, 1997 996351

Removing and installing sealing ring for input shaft

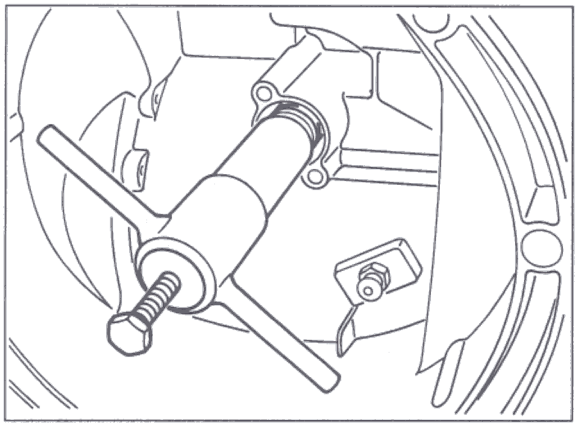
Removal

1. Remove transmission (see Page 34 - 3).

2. Remove the release lever for clutch.

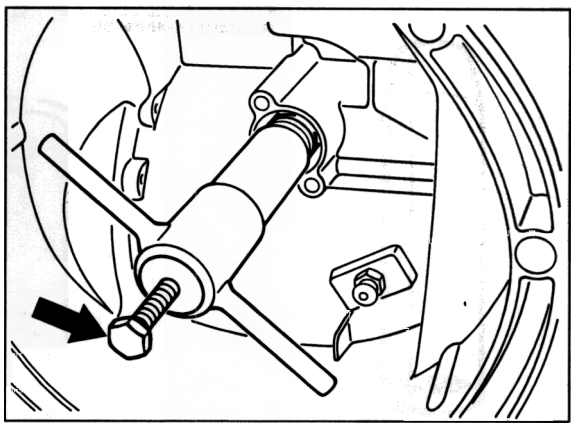
3. Remove guide tube for release bearing.

4. Screw special tool **9629** securely into the sealing ring.



139 - 97

5. Pull out sealing ring by screwing in the hexagon-head screw.



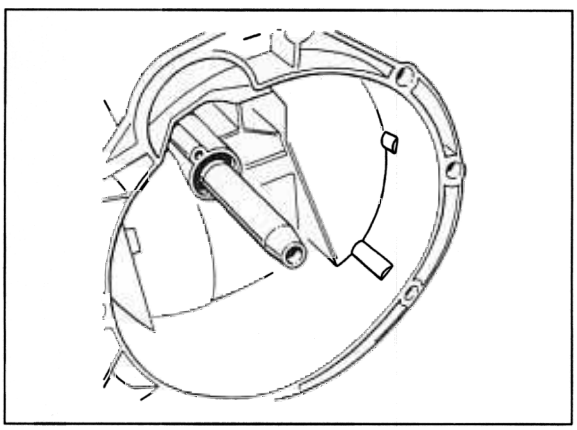
140 - 97

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

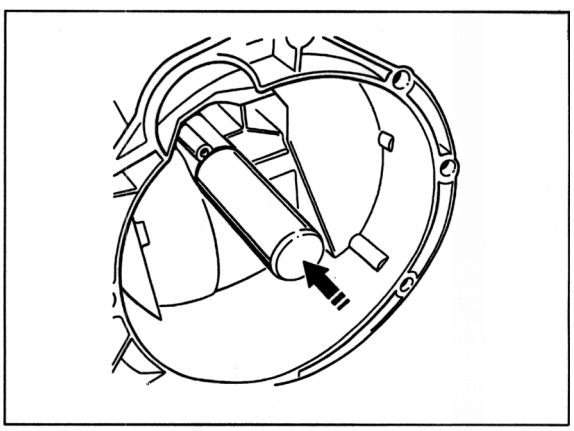
1. Push assembly sleeve **9255** onto the toothing of the input shaft.



141 - 97

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

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



142 - 97

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 3 EP (available as spare part).

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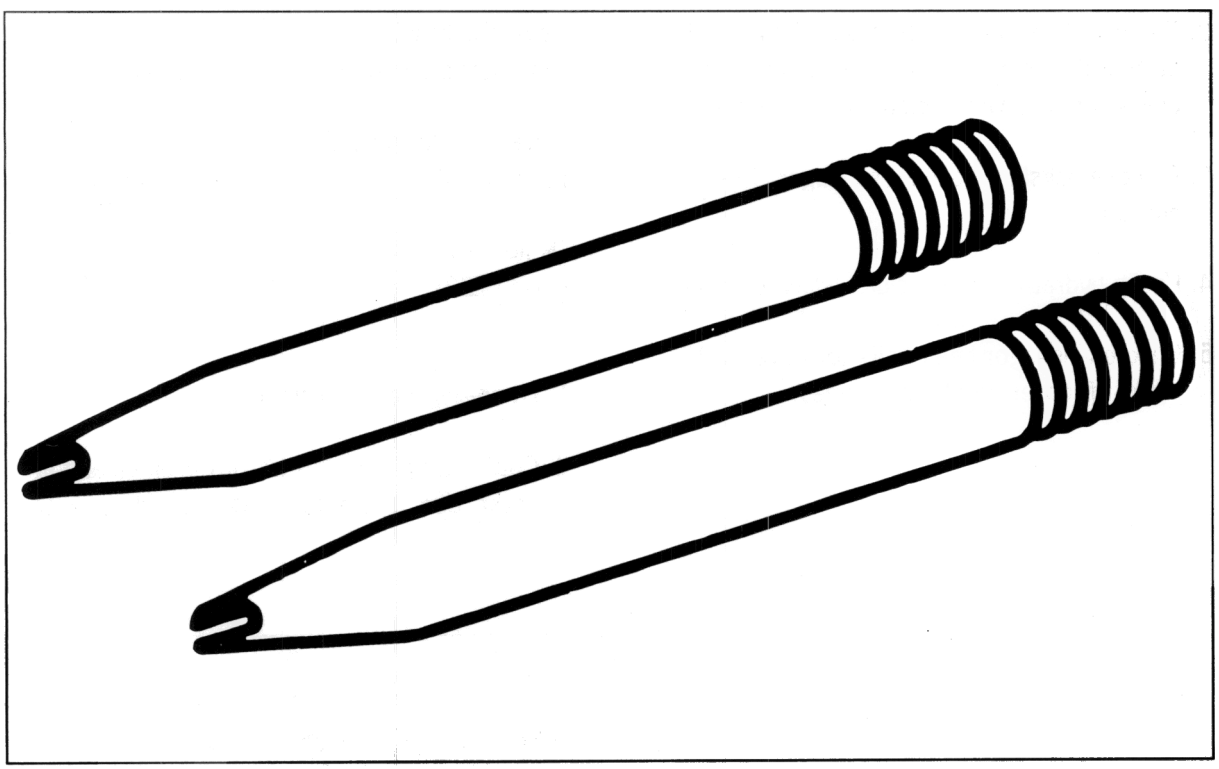
39 20 19 Removing and installing cover for final drive

Tool



137 - 97

Item	Designation	Special tool	Explanation
	Centering pins	9321	M8

Printed in Germany, 1997 996391

Removing and installing cover for final drive

Removal

1. Drain transmission oil.

2. Remove drive shaft at the transmission and protect the shaft against damage (use scrap pieces of hose with a diameter of 30 mm).

3. Remove halfshaft flange (see Pages 39 - 5 and 39 - 9).

4. Unclip hydraulic line for clutch slave cylinder.

5. Unscrew hexagon-head bolts for cover and press off cover on alternate sides.

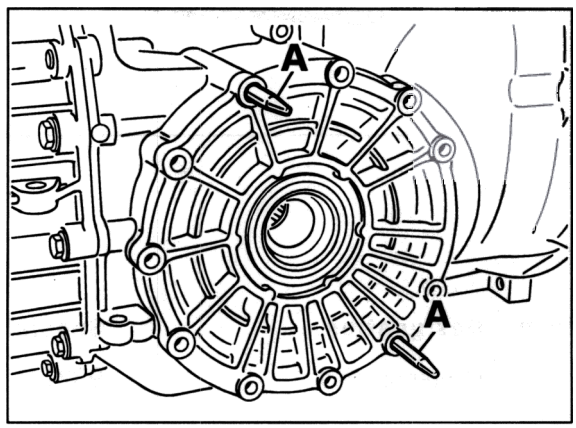
Installation

Tightening torques:

Cover for final drive to transmission (M8)	=	25 Nm (18 ftlb.)
Drive shaft to transmission flange (M10)	=	81 (60 ftlb.)
Oil filler and oil drain plugs (M22)	=	30 Nm (22 ftlb.)

1. Fit sealing ring **untwisted**.

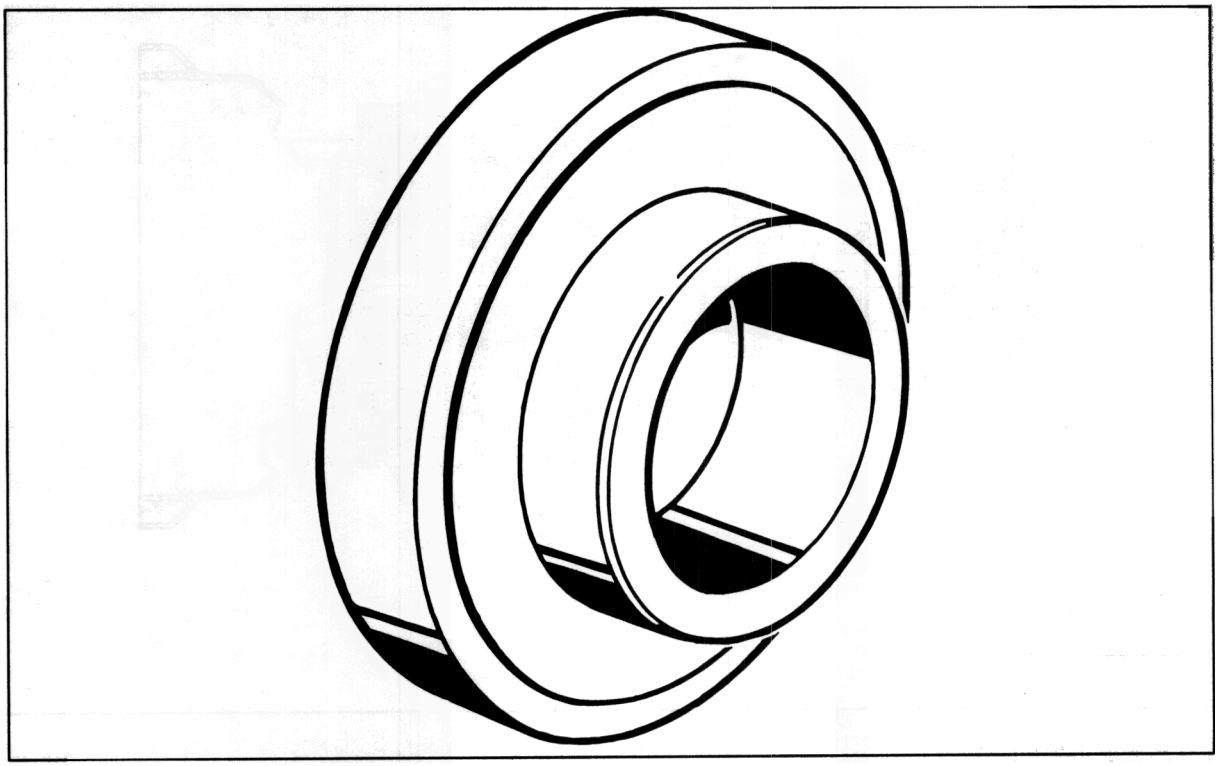
2. Coat sealing ring with transmission oil and fit cover. Use special tool **9321** to aid assembly.



129 - 97

39 22 19 Sealing ring for limited-slip differential -- Removing.and installing the halfshaft flange

Tool



143 - 97

Item	Designation	Special tool	Explanation
	Pressure piece	9252	

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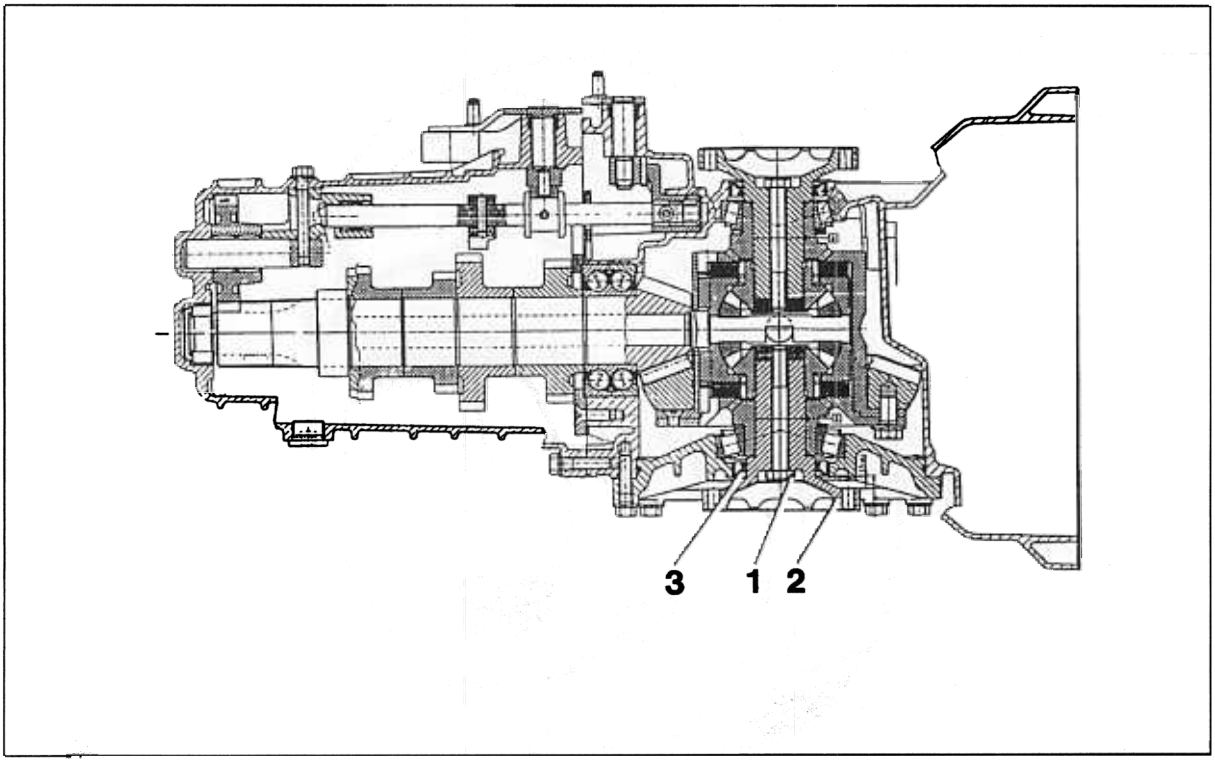
Sealing ring for limited-slip differential -- Removing and installing the halfshaft flange



115-97

1 – Hexagon-head bolt
2 – Halfshaft flange
3 – Sealing ring

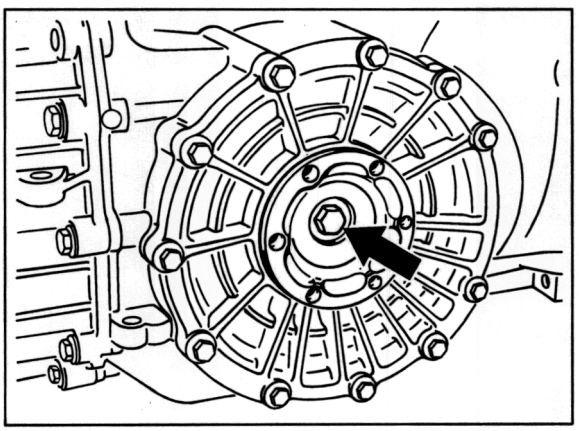
Sealing ring for limited-slip differential -- Removing and installing halfshaft flange

Note

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

Removal

1. Unscrew fastening screw for halfshaft flange and pull out halfshaft flange.

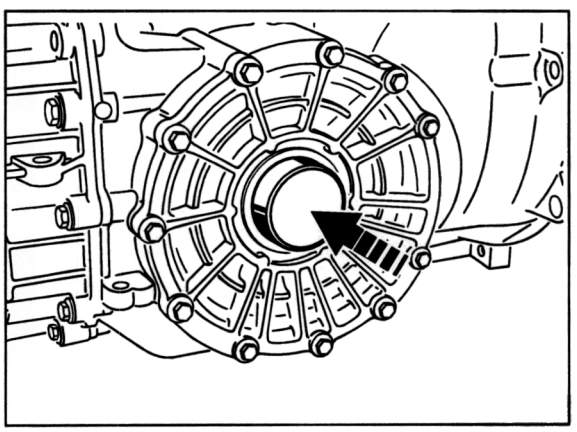


113 - 97

2. Lever out sealing ring using a suitable tool

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**.



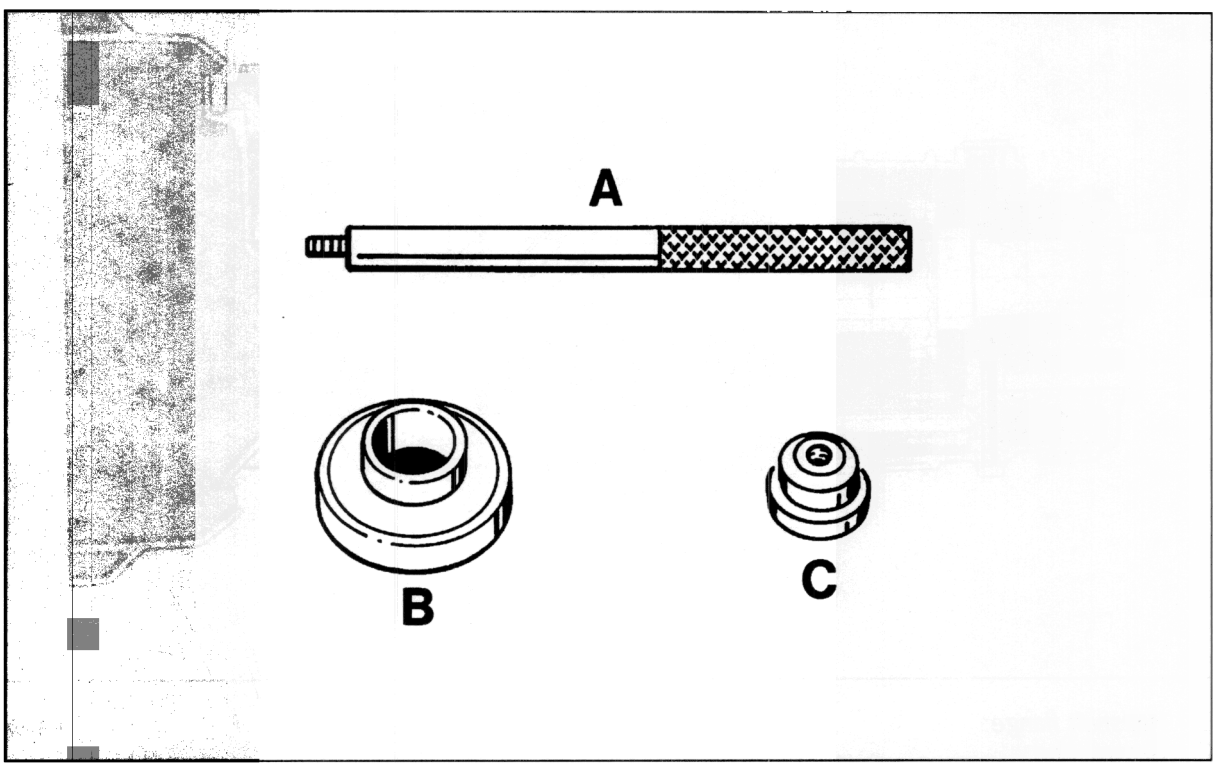
114 - 97

2. Tighten the fastening screw for the halfshaft flange with **44 Nm** (33 ftlb.).

Printed in Germany, 1997 996391

39 22 19 Sealing ring for differential -- Removing and installing halfshaft flange

Tool



128 - 97

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

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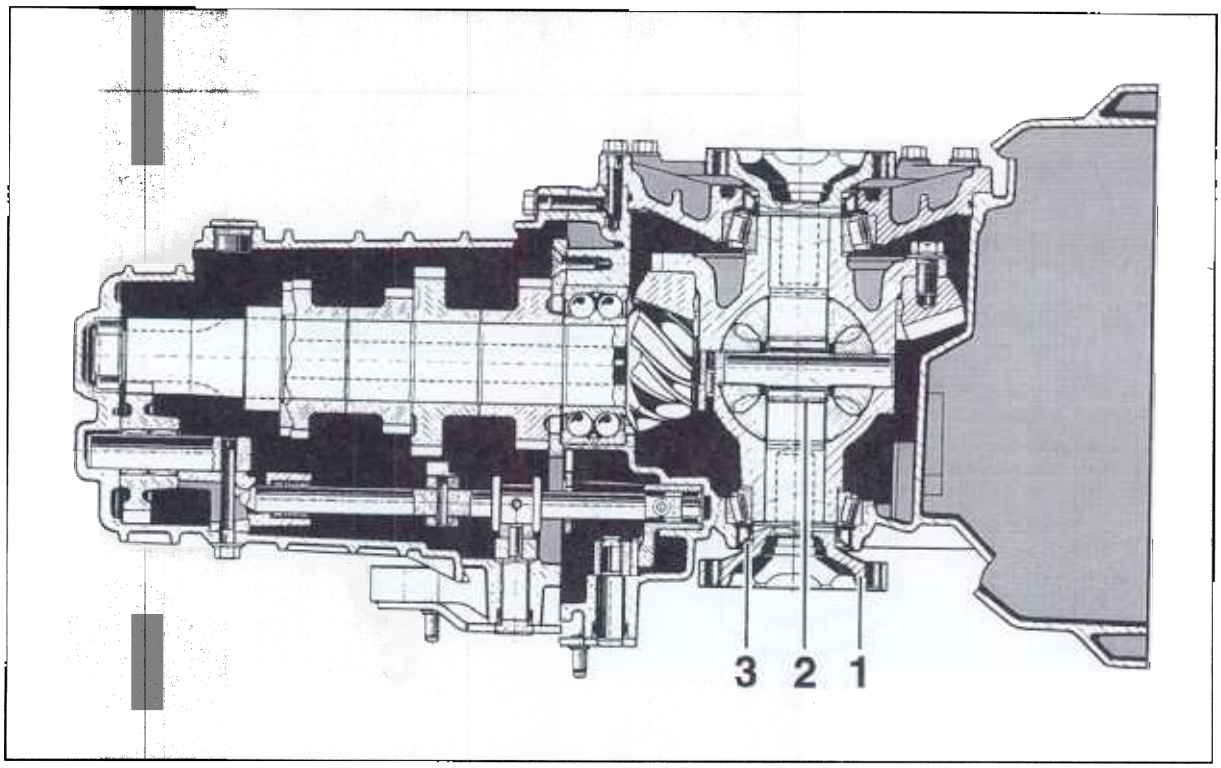
Sealing ring for limited-slip differential -- Removing and installing halfshaft flange



116-97

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

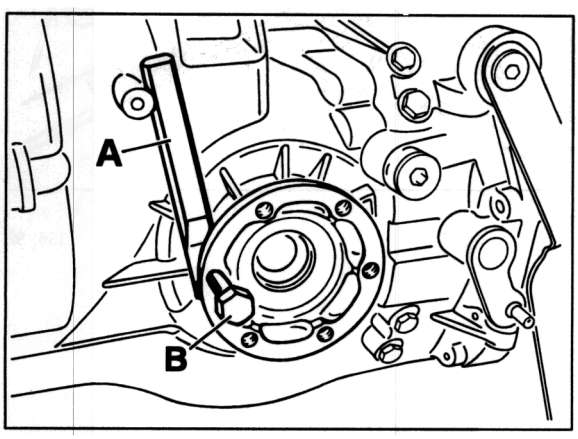
Sealing ring for limited-slip differential -- Removing and installing halfshaft flange

Note

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

Removal

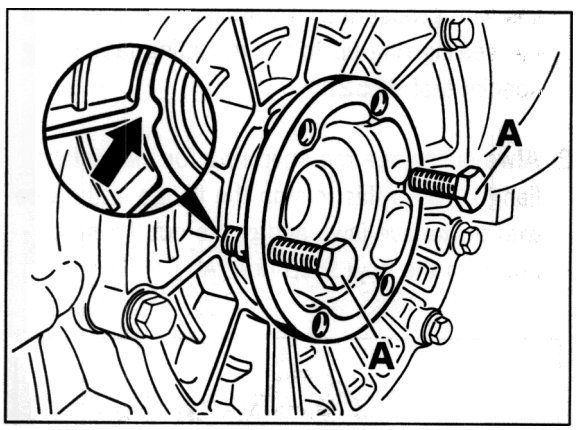
1. Remove right halfshaft flange. To do this, place a chisel or spacer "A" under the halfshaft flange and pull out the halfshaft flange by turning the screw "B".



134 - 97

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).



135 - 97

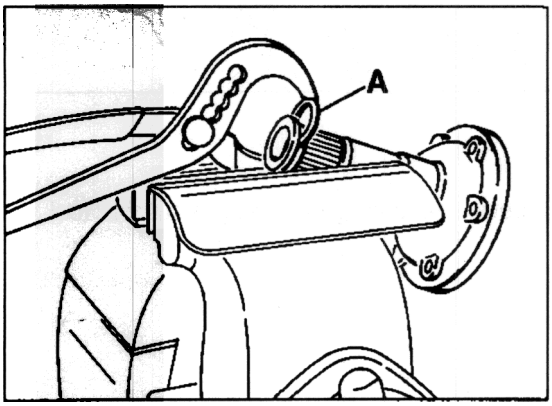
2. Lever out sealing ring using a suitable tool.

Printed in Germany, 1997 996391

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**.

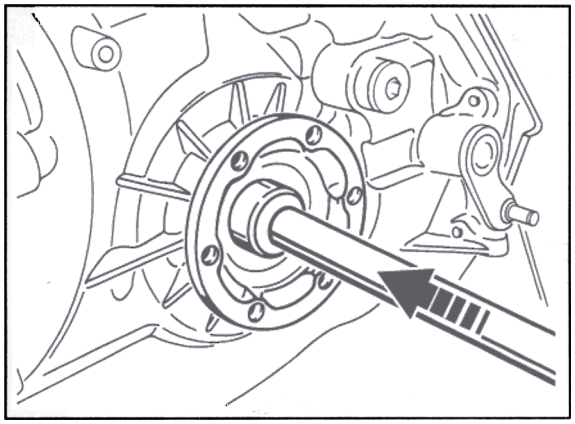
2. **Always** replace the snap ring for the halfshaft flange. To do this, clamp the flange in the vice with protective jaws and press out the snap ring with the new snap ring "A".



A – New snap ring

175 - 97

3. Grease the snap ring well and drive in the halfshaft flange using the special tools **P254** and **9247/1**.



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PORSCHE

Technical Manual

911 Carrera 4 (996)

Repair

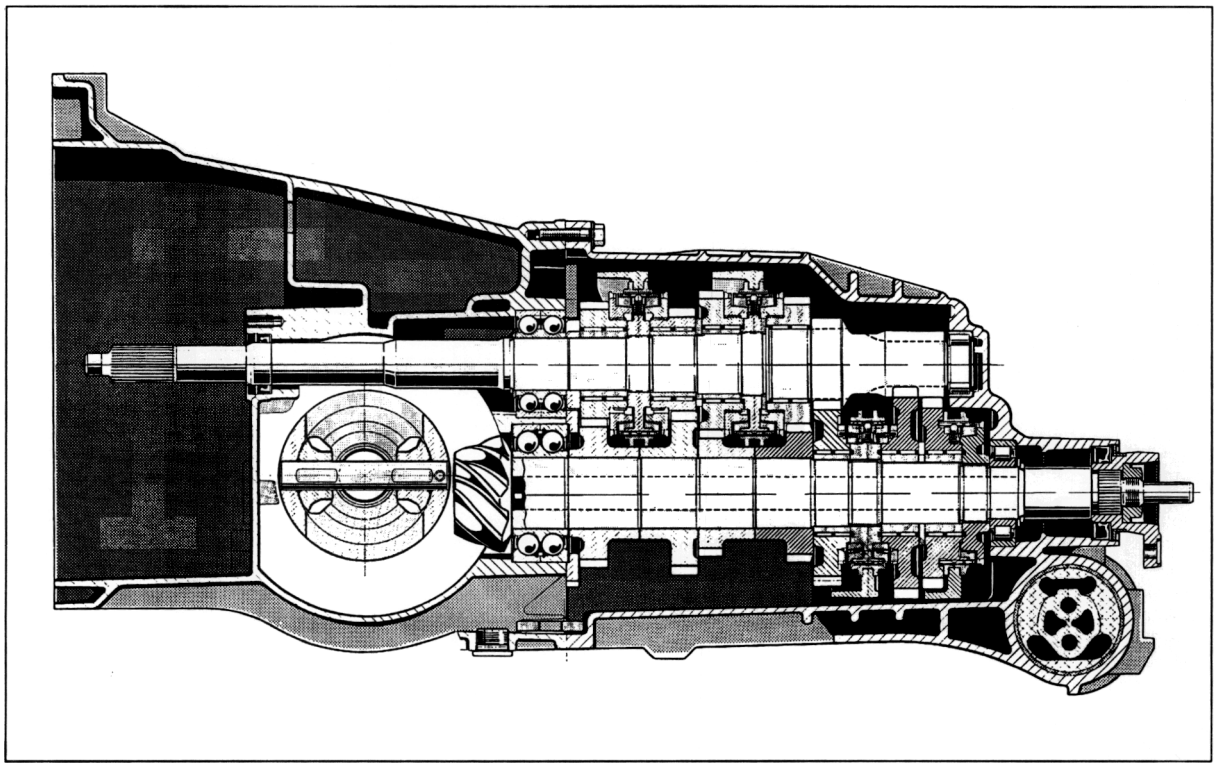
Group 3

Transmission, manual transmission

3 Transmission, manual transmission

3 Technical data

6-speed manual transmission G96/30

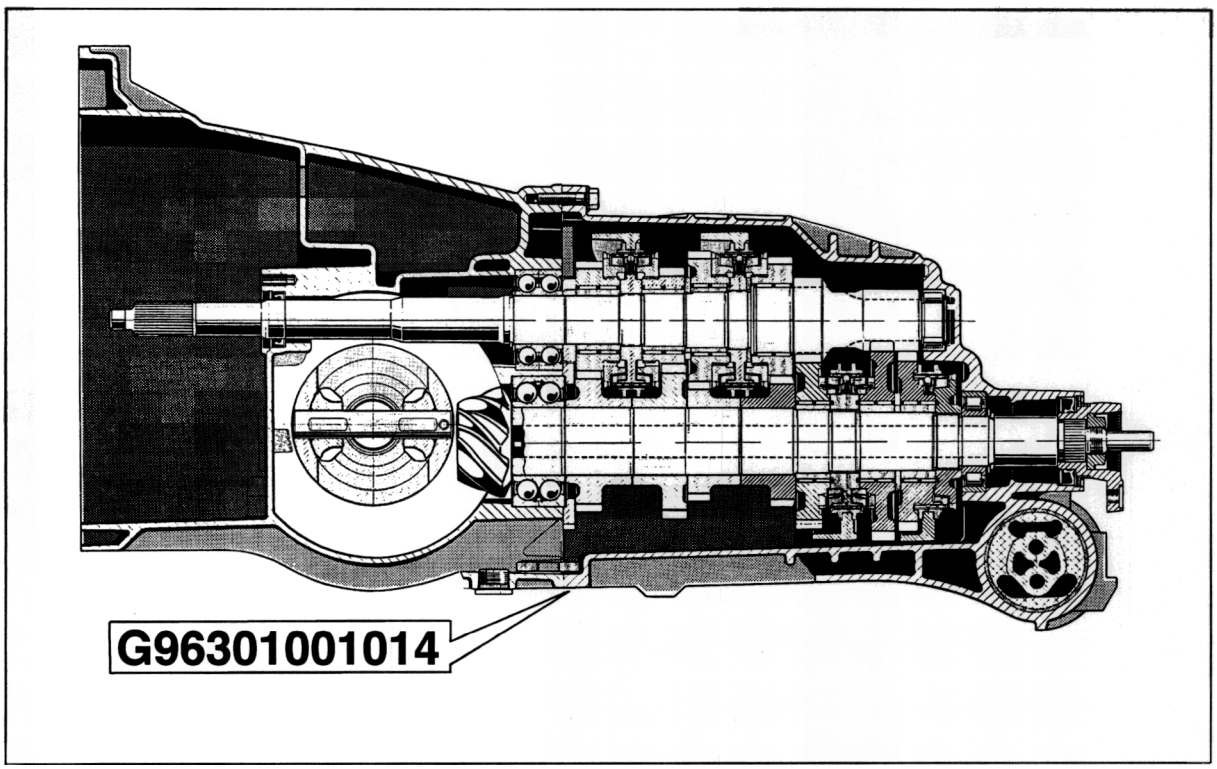


301_98

Type	Code letter	Equipment	Installed in	Model year
G96/30		6-speed	911 Carrera 4 (996)	1999

3 Technical data

Key to transmission numbers



303_98

G96/30	1	001014
Transmission type	**Index for version within transmission number** 1 = normal differential	**Serial number**

Technical data

Manual transmission G96/30

General data	Manual transmission G96/00
Transmission ratios	G96/30 $Z_1 : Z_2 = Z_2 : Z_1$
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:	2.7 l

Technical data

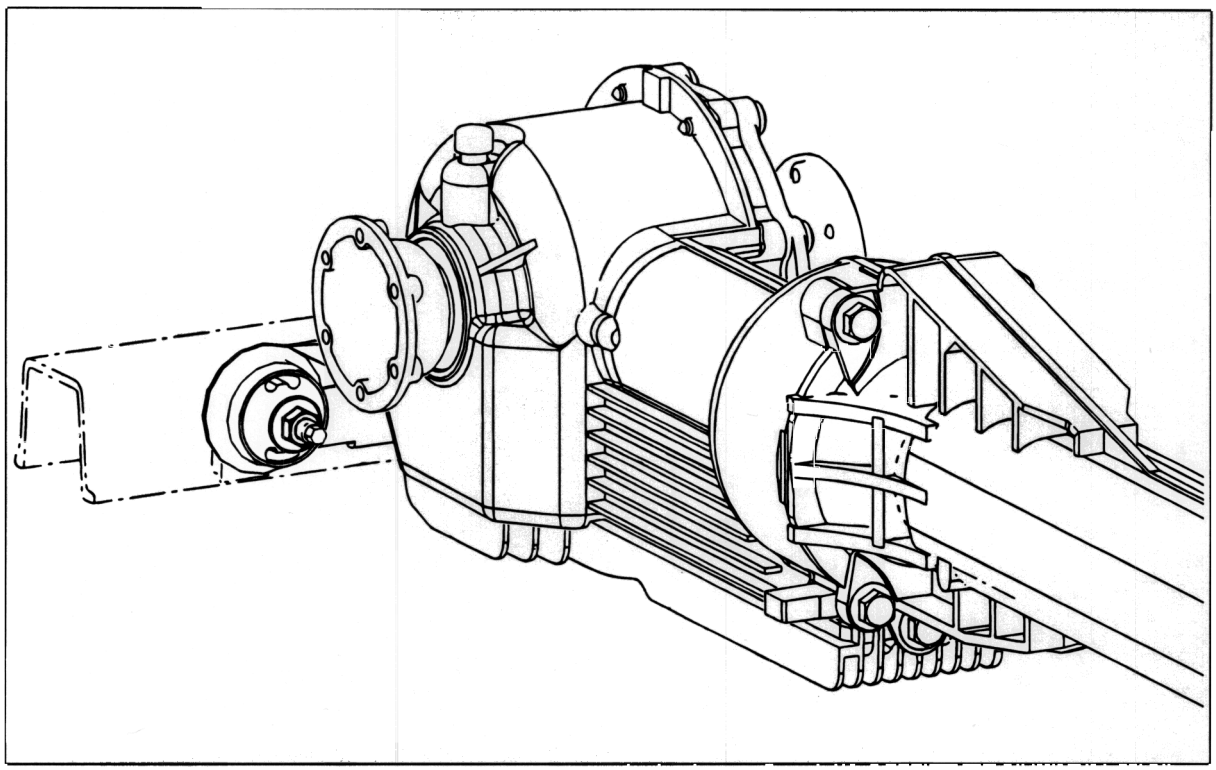
Tightening torques (manual transmission G96/30)

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)
Cardan flange on transmission	M20	120 (89) *

* Counter collar nut with 170 Nm (126 ftlb.), loosen again and tighten to 120 Nm (89 ftlb.) (refer to Serv. No. 39 82 19).

3 Technical data

Final drive Z96/00



278_98

Type	Code letter	Equipment	Installed in	Model year
Z96/00			911 Carrera 4 (996) world-wide	1999

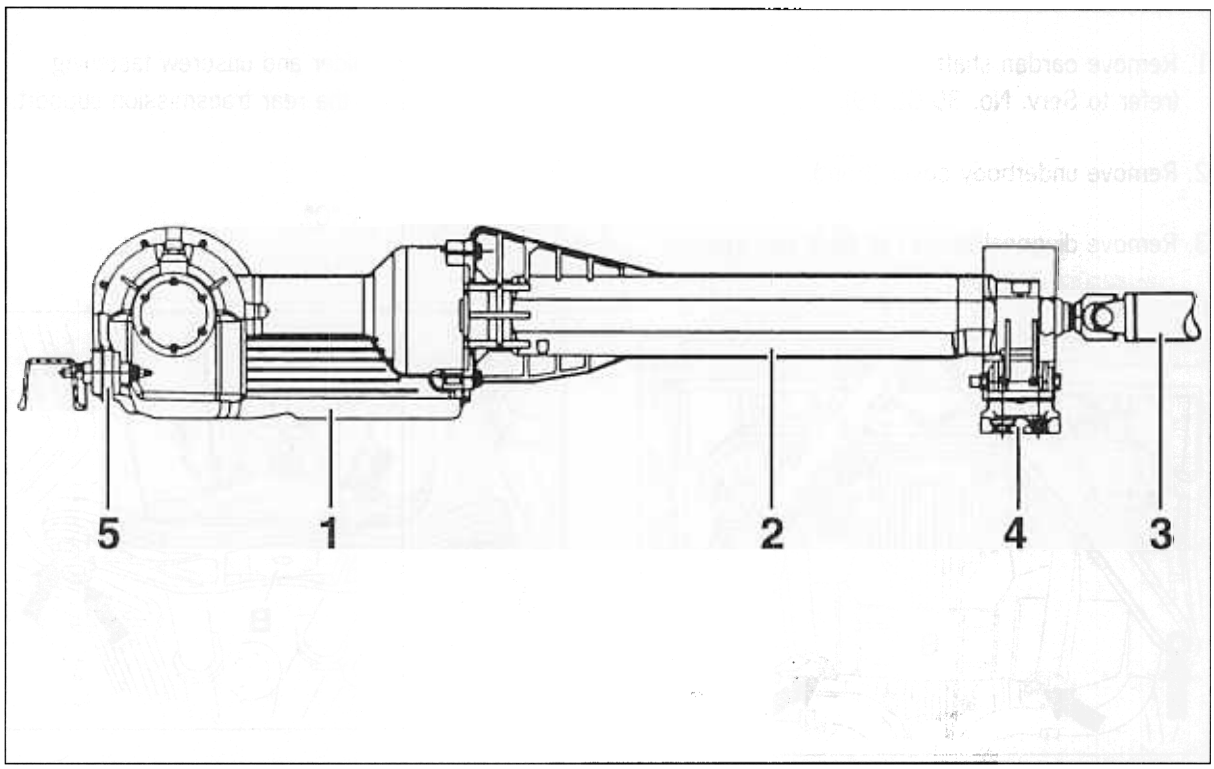
General data	Front-axle final drive Z96/00
Transmission ratio final drives ($Z_2 : Z_1 = i$)	31 : 9 = 3.444
Final drive	Bevel gear drive without hypoid offset
Capacity	Approx. 1.5

Technical data

Tightening torques, final drive Z96/00

Location	Thread	Tightening torque Nm (ftlb.)
Screw plug, oil drainage and oil filling	M18	28 (21)
Lid on final drive	M8	25 (19)
Long-neck tube on final drive	M8	25 (19)
Drive shaft on final drive	M8	39 (29)
Rear transmission support on transmission mount	M10 x 90	65 (48)
Rear transmission support on body	M10	65 (48)
Front transmission support on front-axle cross member	M10	65 (48)
Stud on front-axle cross member	M8	20 (15)
Front transmission support on final drive	M10	65 (48)

39 88 19 Removing and installing front final drive



249_98

1 – Front final drive
2 – Long-neck tube with central shaft
3 – Cardan shaft
4 – Transmission support, rear
5 – Transmission support, front

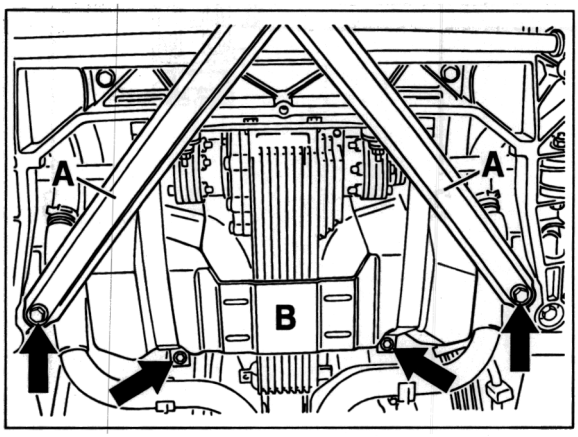
Removing and installing front final drive

Removal

1. Remove cardan shaft
(refer to Serv. No. 39 02 19)

2. Remove underbody cover (front).

3. Remove diagonal braces at front and cover.



A – Diagonal braces 243_98
B – Cover

4. Remove drive shafts at the transmission and protect the shafts against damage (use scrap pieces of hose with a diameter of 30 mm).

Note

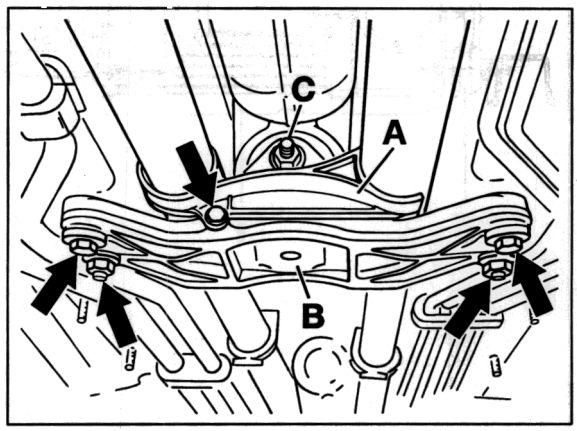
To protect the coolant pipes against scratches when the final drive is removed or installed, it is advisable the protect the pipes with adhesive tape in the area of the final drive.

5. Place transmission jack under the transmission and secure with fixing strap.

6. Remove pipe holder and unscrew fastening screws/nuts for the rear transmission support.

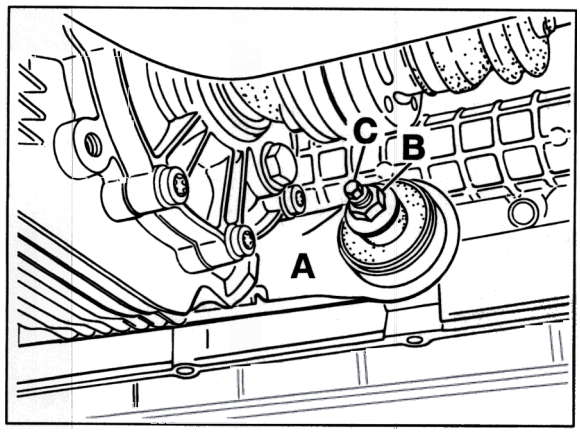
Note

Do **not** undo screw "C"



A – Pipe holder 244_98
B – Transmission support
C – Screw

7. Undo fastening nuts for front transmission support and unscrew the studs.



245_98

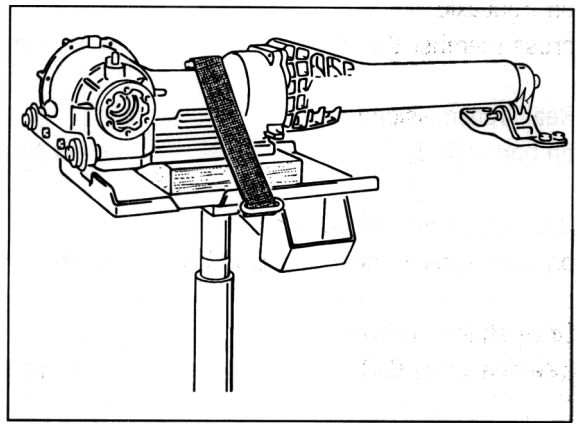
A – Transmission support
B – Hexagon nut
C – Stud

8. Carefully lower the transmission out. When doing so, avoid damaging the coolant pipes.

Installation

Install in reverse order, observing the following points:

1. Carefully lift in the transmission with a universal transmission jack. When doing so, do not damage the coolant pipes.



250_98

2. Push studs through the front transmission mounts and screw into the front-axle cross member.

3. Fasten transmission mounts on the front-axle cross member and on the body.

Note

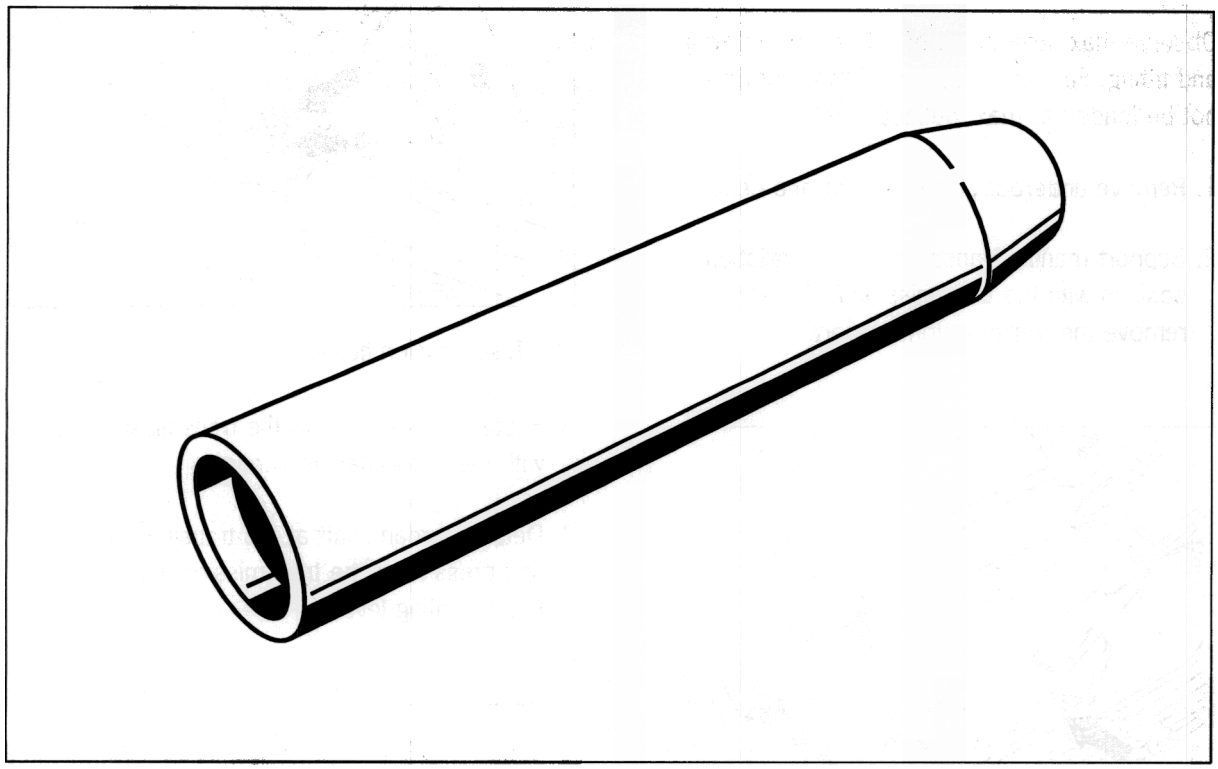
If the hexagon-head bolt (M10 x 90) was undone on the rear transmission support/ transmission mount, it is important to tighten the front transmission support first, then the rear transmission support and the M10 x 90 screw on the rear transmission mount last.

Tightening torques:

Studs on front-axle cross member (M8)	= 20 Nm (15 ftlb.)
Front transmission support on transmission (M10)	= 65 Nm (48 ftlb.)
Front transmission support on front-axle cross member (M10)	= 65 Nm (48 ftlb.)
Rear transmission support on body (M10)	= 65 Nm (48 ftlb.)
Rear transmission support on transmission mount (M10 x 90)	= 65 Nm (48 ftlb.)
Drive shafts on front-axle final drive (M8)	= 39 Nm (29 ftlb.)
Diagonal braces on body and front-axle cross member (M12)	= 100 Nm (74 ftlb.)
Tank strap on body (M8 x 40)	= 23 Nm (17 ftlb.)
Pipe holder on transmission support (M6)	= 7 Nm (5.0 ftlb.)

39 02 19 Removing and installing cardan shaft

Tools



237_98

Item	Designation	Special tool	Explanation
	Assembly sleeve	9255	

Removing and installing cardan shaft

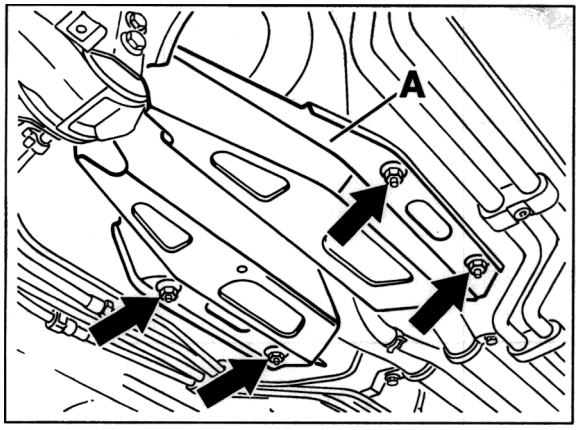
Removal

Note

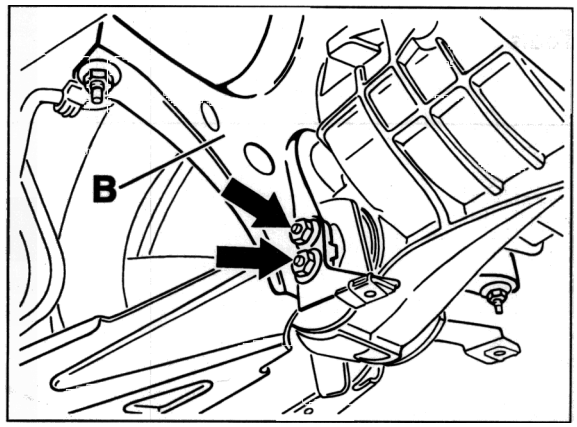
Observe max. joint angle of 20° when removing and fitting. Furthermore, the cardan joint must not be loaded at max. deflection (stop).

1. Remove underbody covers (rear and centre).

2. Support manual transmission in installation position with the transmission jack and remove the transmission support.



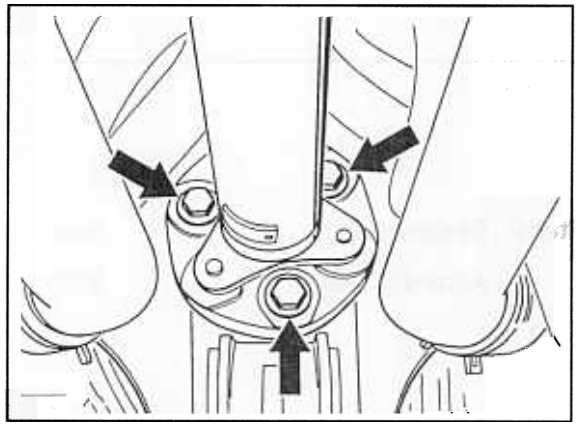
A – Transmission support 225_98



B – Transmission holder 226_98

3. Fasten transmission to the transmission holder with the two fastening screws.

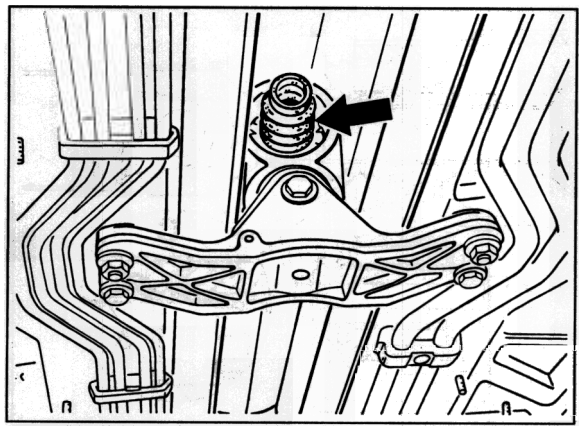
4. Detach cardan shaft at the transmission side and press it off the transmission flange with two mounting levers.



227_98

5. Pull cardan shaft out of the splines of the central shaft and remove.

6. Remove bellows from the central shaft.



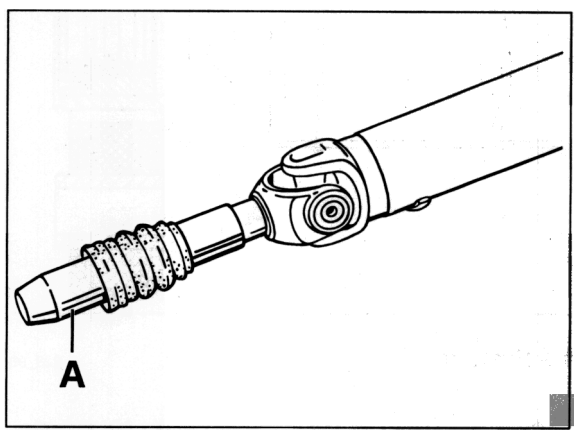
235_98

Installation

Install in reverse order, observing the following points:

1. Always replace bellows for cardan shaft.

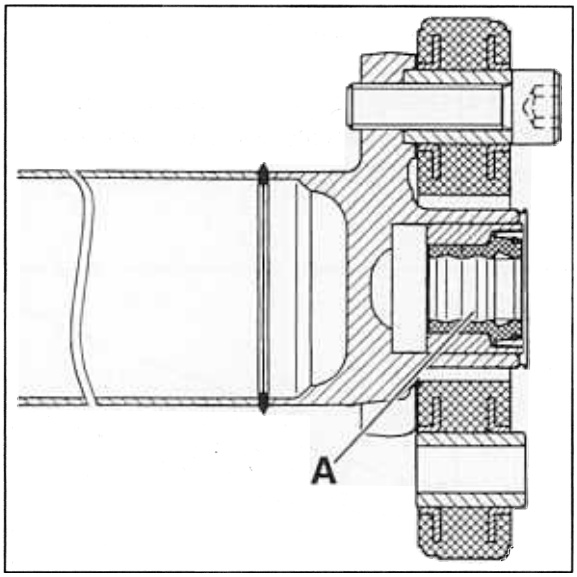
2. Slide assembly sleeve **9255** over the shaft splines, lightly lubricate sleeve with Vaseline and push on the bellows to the stop.



A – Assembly sleeve 9255

236_98

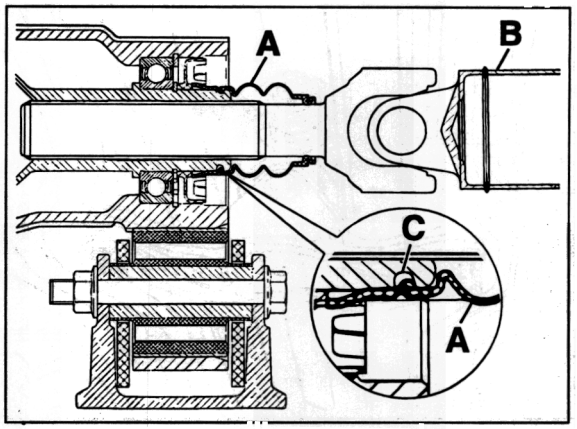
3. Grease bushing with approx. 3 g of **Olista Longtime 3EP**.



A – Bushing 238_98

4. Grease splines of the cardan shaft with **Olista Longtime 3 EP**. Slide shaft into the central shaft splines and fit on the transmission side.

5. Push bellows forward until it engages in the groove of the central shaft. Check whether the bellows is seated properly by pulling on it.



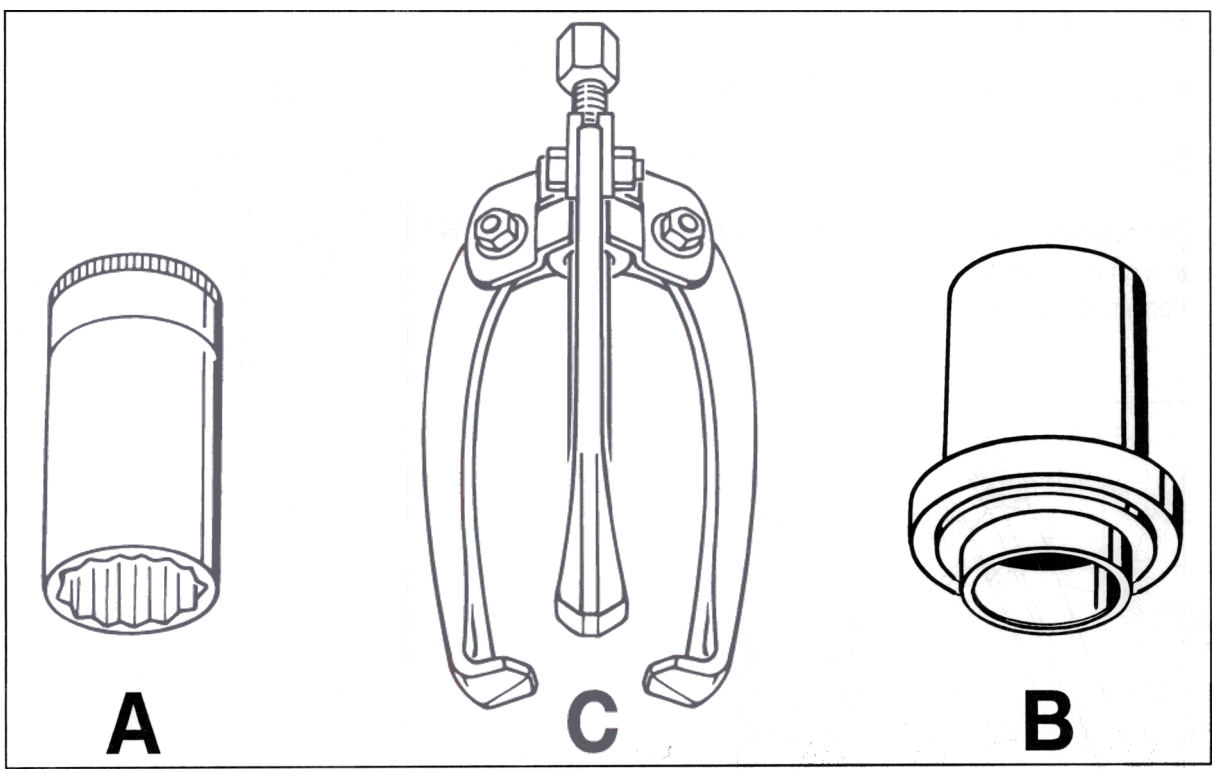
A – Bellows 240_98
B – Cardan shaft
C – Central shaft groove

Tightening torques:

Cardan shaft on transmission flange (M10)	=	45 Nm (33 ftlb.)
Transmission support/ transmission carrier on transmission mount (M 10)	=	65 Nm (48 ftlb
Transmission support on body (M10)	=	65 Nm (48 ftlb.)

39 82 19 Removing and installing sealing ring for cardan flange

Tools



276_98

Item	Designation	Special tool	Explanation
A	Socket wrench insert		commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 64).
B	Pressure piece	9639	
C	Three-arm puller		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 112-1)

Removing and installing sealing ring for cardan flange

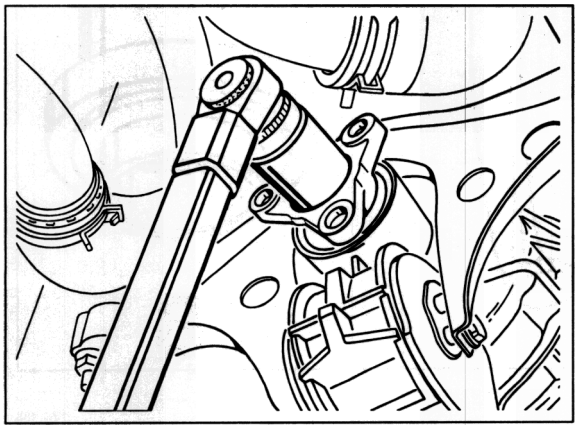
Removal

1. Remove cardan shaft
   (refer to Serv. No. 39 02 19).

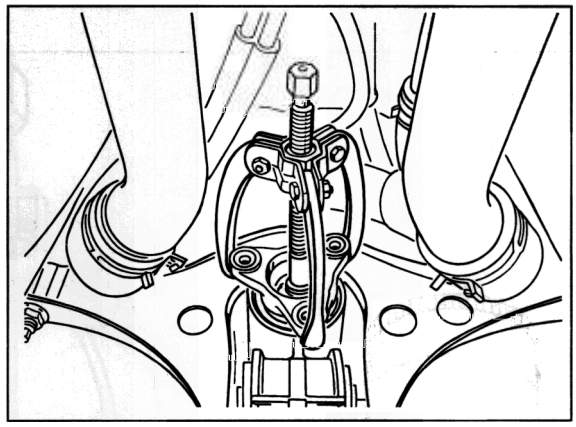
2. Place oil collection tray under the transmission.

3. Engage a gear and firmly set the hand brake.

4. Remove collar nut with a long a/f 30 socket wrench insert (refer to Workshop Equipment Manual, Chapter 2.4, No. 64).



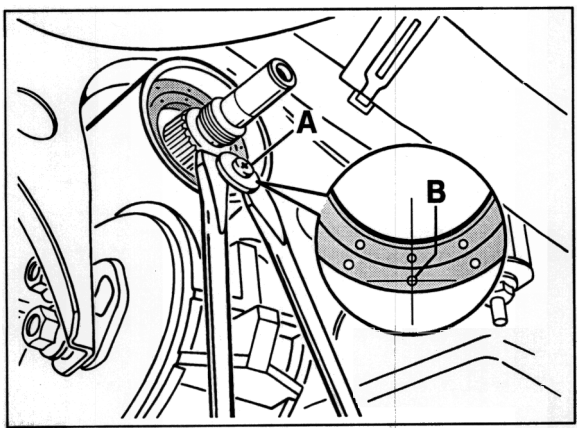
264_98



265_98

5. Pull off the cardan flange with a three-arm puller (refer to Workshop Equipment Manual, Chapter 2.4, No. 112-1).

6. Remove sealing ring.
   To do this, use an angle drill to make a 3.5 mm dia. hole in the lowest non-rubberised surface "B".
   Screw in a large sheetmetal screw (4.8 x 25) with a large washer and lever out the sealing ring with two screwdrivers.



A – Sheetmetal screw 4.8 x 25
B – 3.5 mm bore

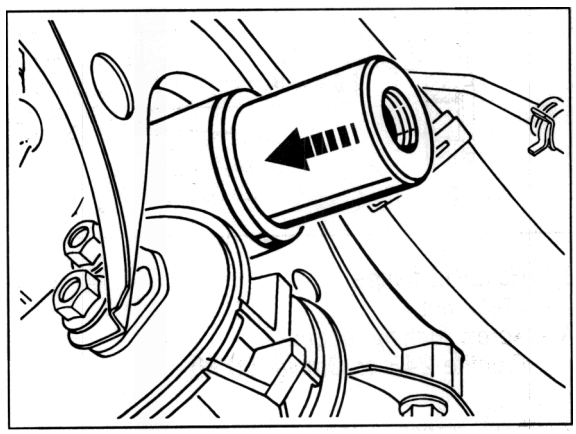
273_98

Installation

1. Remove drilling chips in the transmission neck.

2. Degrease the pinion shaft journal (splines and thread), halfshaft flange splines and thread of the collar nut with cleaning agent (e.g. Loctite quick cleaner).

3. Fill the space between the dust and sealing lips on the sealing ring with grease (e.g. Liqui - Moly) and drive in the sealing ring up to the mounting face using special tool **9639**.

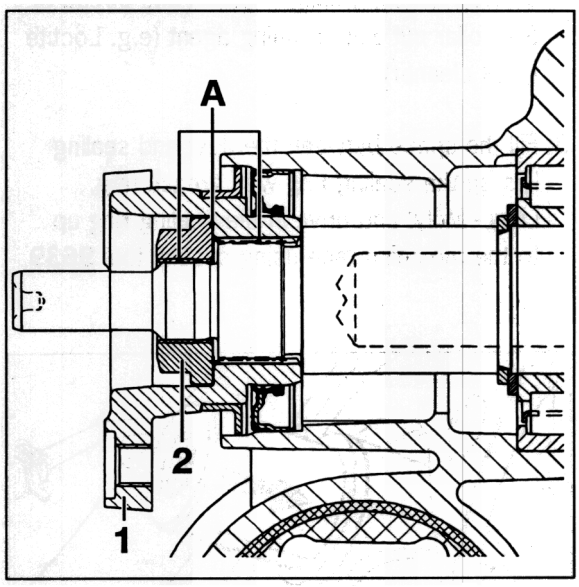


274_98

4. Coat halfshaft flange splines with screw locking lacquer (e.g. Loctite 243 or Omnifit 50 M) and fit the flange.

5. Coat contact surface and thread of the collar nut with screw locking lacquer (as in step 4).

6. Counter collar nut with **170 Nm (126 ftlb.)**, **loosen again** and tighten to **120 Nm (89 ftlb.)**.



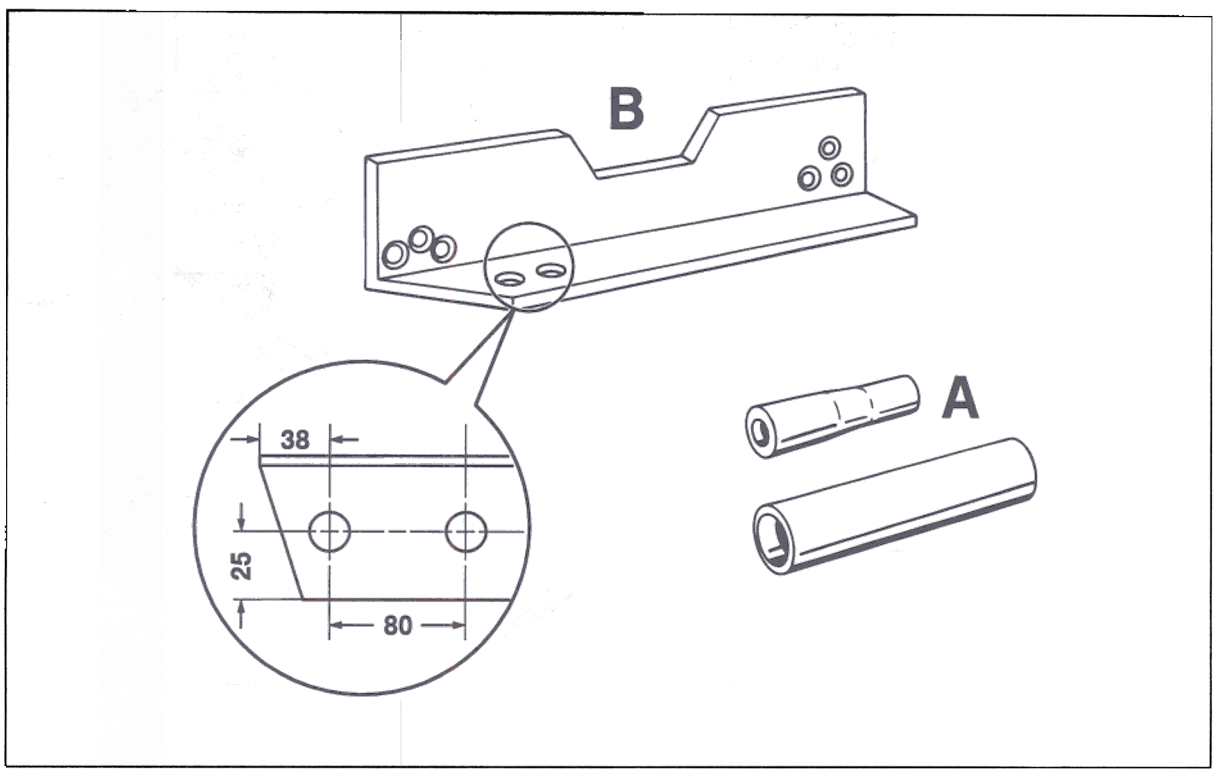
275_98

1 – Halfshaft flange
2 – Collar nut
A – Screw locking lacquer (Loctite 243 or Omnifit 50 M)

7. Check transmission oil (refer to Serv. No. 39 90 55).

39 60 19 Removing and installing the viscous clutch

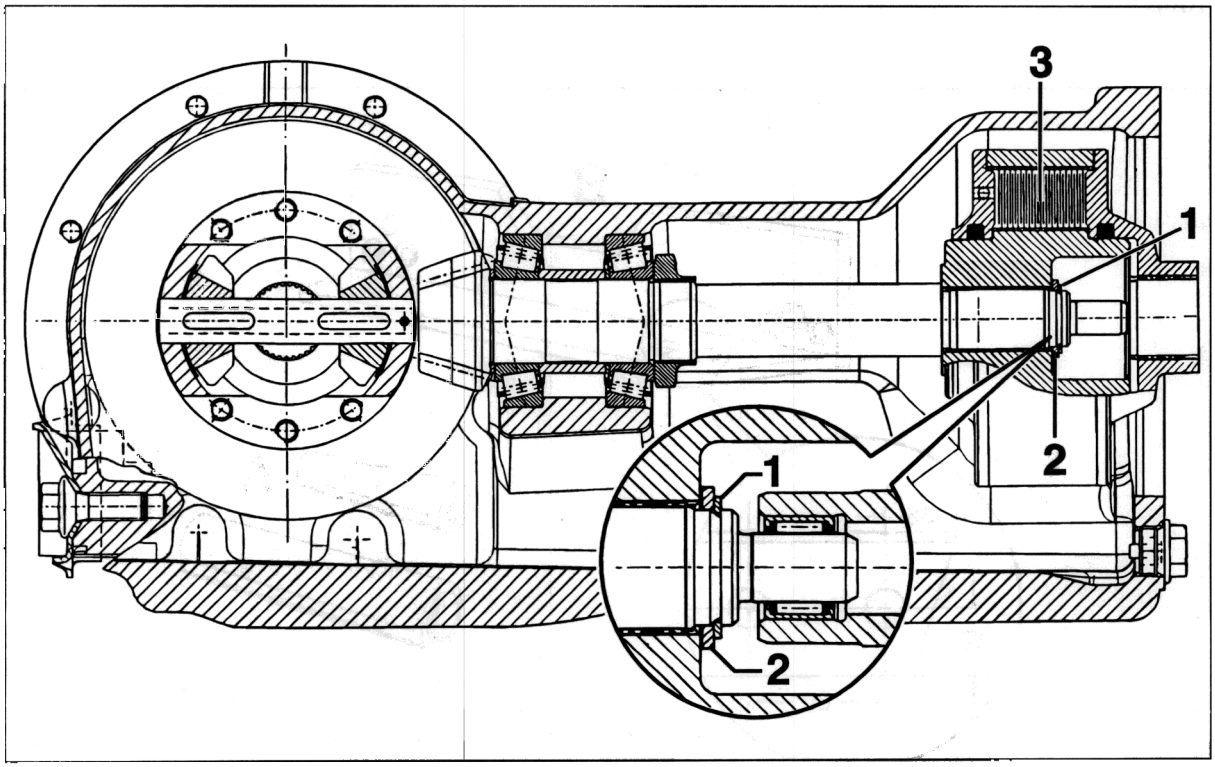
Tools



257_98

Item	Designation	Special tool	Explanation
A	Assembly aid	9638	2 parts
B	Holding rail	VW 457	Drill two 10.5 mm holes

Removing and installing the viscous clutch



1 – Snap ring
2 – Supporting ring
3 – Viscous clutch

254_98

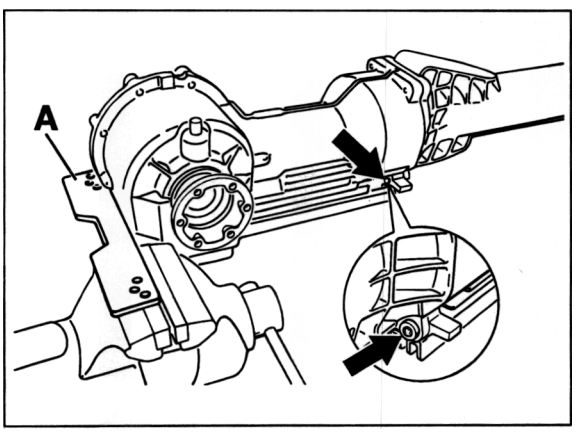
Removing and installing the viscous clutch

Removal

1. Remove cardan shaft (refer to Serv. No. 39 02 19).

2. Remove front final drive (refer to service No. 39 88 19).

3. Clamp final drive into the vise with special tool **VW 457**, drain oil and remove the long-neck pipe.



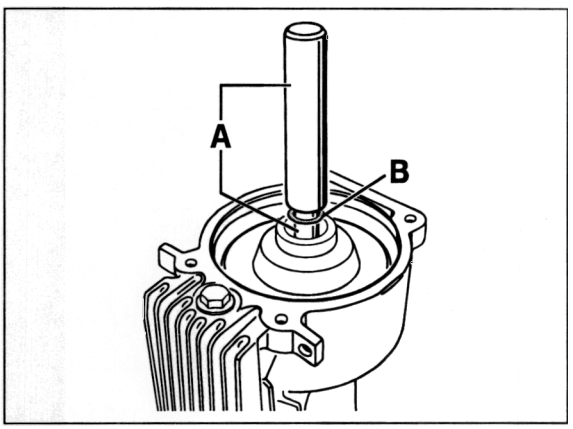
A – Special tool VW 457 255_98

4. Remove snap ring and take out viscous coupling with supporting ring.

Installation

Install in reverse order, observing the following points:

1. Insert supporting disc and fit snap ring with special tool **9638**.



A – Special tool
B – Snap ring 256_98

2. Always replace O-ring for long-neck pipe and coat with Vaseline.

3. Uniformly tighten fastening screws for long-neck pipe in diagonally opposite sequence.

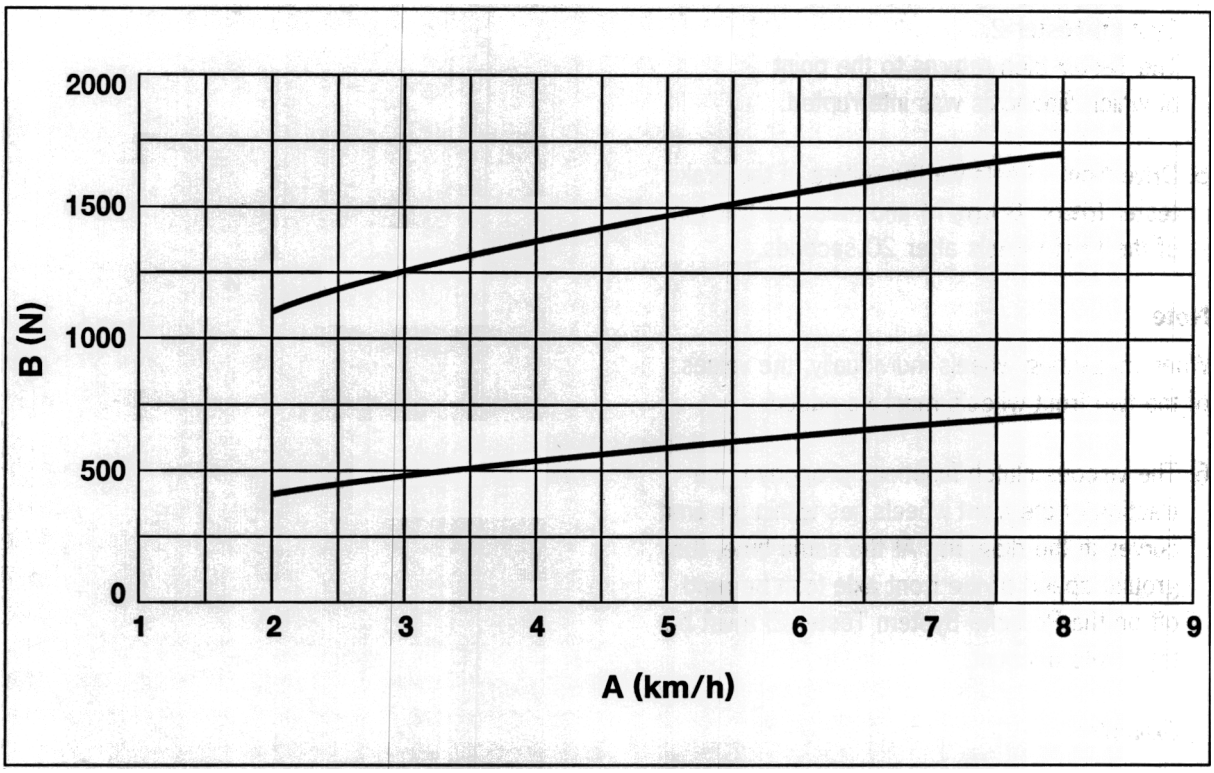
4. Fill in oil for final drive (refer to Serv. No. 39 90 55).

Printed in Germany - 14, 1998 C4S39113

Tightening torques:

Long-neck pipe on final drive (M8 x 36)	=	25 Nm (19 ftlb.
Front transmission support on final drive (M10)	=	65 Nm (48 ftlb.)
Oil drain plug on final drive (M18 x 1.5)	=	28 Nm (21 ftlb.)

39 60 01 Checking function of installed viscous clutch



191_98

A = Ground speed of the front axle in kilometres/hour
B = Traction of the front wheels in (N)

Testing conditions:

Test only with viscous clutch at room temperature

Test duration max. 45 seconds (determine measured value after 20 seconds)

Repeat measurement after viscous clutch has cooled down for one hour

1. Connect **Porsche System Tester 2** and select "Actual values" menu (ABS speed).
2. Drive front wheels of the vehicle onto the roller brake tester.
3. Switch the engine off, set the hand brake and shift the transmission to neutral.

4. When the brake-tester rollers have started, switch the ignition on and press the **Continue key >>** of the Porsche System Tester 2.
   The Tester then returns to the point at which diagnosis was interrupted.

5. Drive front wheels via the rollers of the brake tester **(max. 8 km/h)** and measure traction of the front wheels after 20 seconds.

Note

When measuring wheels individually, the values of the two front wheels must be added.

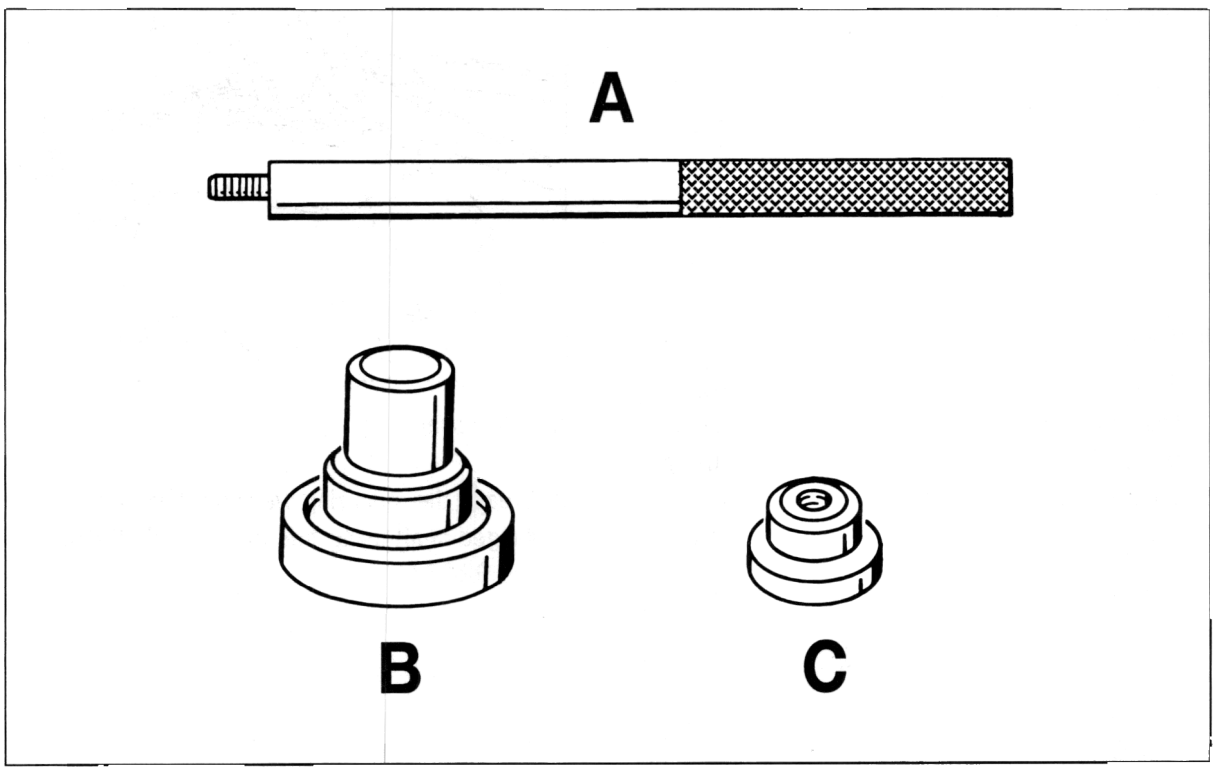
6. The viscous clutch functions properly if the traction of the front wheels lies within the limit curves in the diagram. At the same time, the ground speed of the front axle (can be read off on the Porsche System Tester 2) must be taken into account.

   Example.

   At 5 km/h ground speed, the traction of an intact viscous clutch must lie between approx. 600 N and 1450 N (refer to diagram).

39 59 19 Removing and installing sealing ring for flanged shaft

Tools



259_98

Item	Designation	Special tool	Explanation
A	Pull-in tool and extractor	P254	
B	Pressure piece	9537	
C	Pressure piece	9247/1	

Removing and installing sealing ring for flanged shaft

Removal

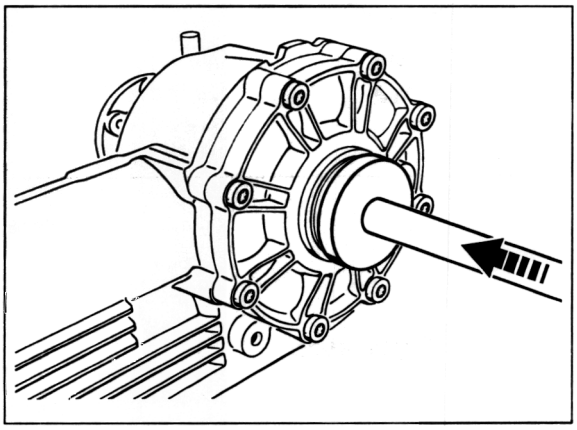
Remove final drive
(refer to Serv. No. 39 88 19).

2. Press out flanged shaft with two mounting levers.

3. Lever out sealing ring using a suitable tool

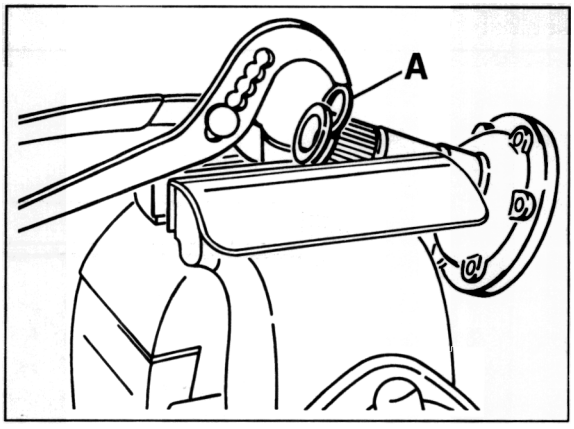
Installation

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 tools **9537** and **P254**.



258_98

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".



A – New snap ring 175_97

3. Grease the snap ring well and drive in the flanged shaft using the special tools **P254** and **9247/1**.

39 58 19 Removing nd installing cover for final drive

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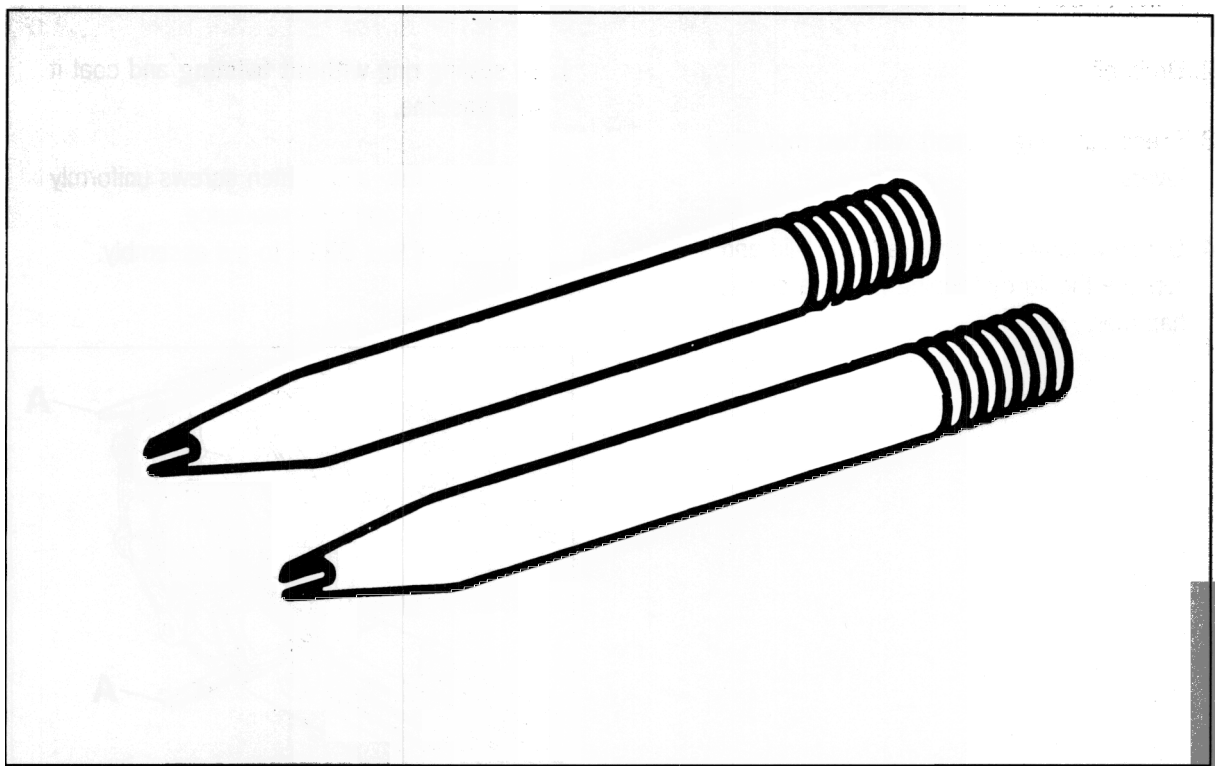


r_97

Item	Designatio	Special tool	Explanatio
	Centri		M8

Removing and installing cover for final drive

Removal

1. Remove final drive
   (refer to Serv. No. 39 88 19).

2. Drain oil.

3. Press out flanged shaft with two mounting levers.

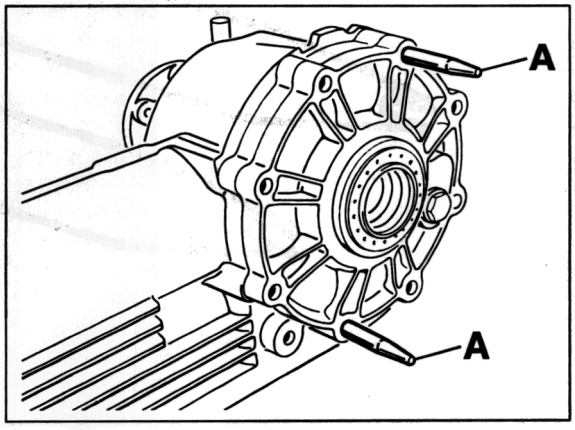
4. Unscrew fastening screws for the lid and remove the lid by tapping it with a plastic hammer.

Installation

Install in reverse order, observing the following points:

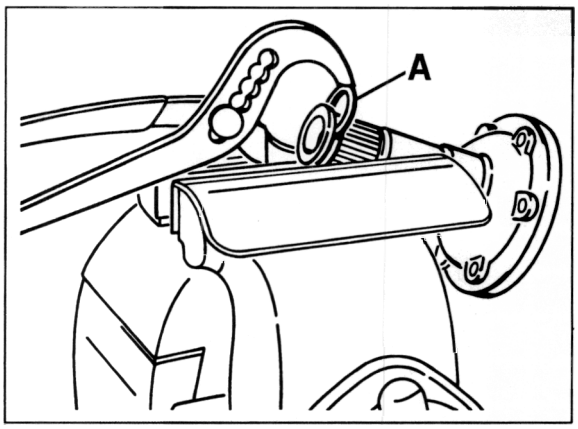
1. Fit sealing ring **without twisting** and coat it with Vaseline.

2. Fit lid carefully and tighten screws uniformly in diagonally opposite sequence.
   Use special tool **9321** to aid assembly.



A – Centring pins 9321 260_98

3. **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".



A – New snap ring 175_97

4. Grease the snap ring well and drive in the halfshaft flange using the special tools **P254** and **9247/1**.

5. Fill in oil (refer to Serv. No. 39 90 55).

Tightening torques:

Oil drain plug on final drive (M18 x 1.5)		28 Nm (21 ftlb.
Lid on final drive (M8)	=	25 Nm (19 ftlb.)

39 90 55 Changing oil for final drive

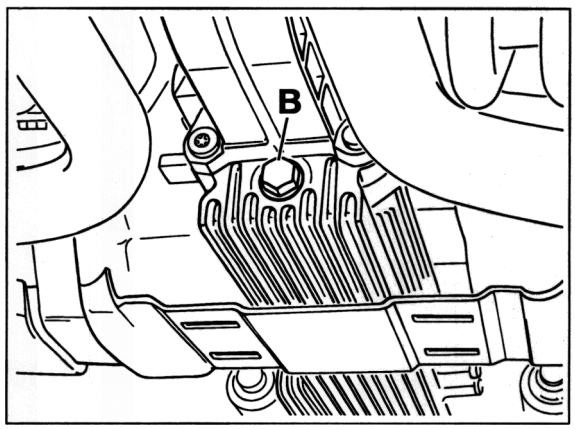
Filling capacity: approx. 1.5 litres

Note

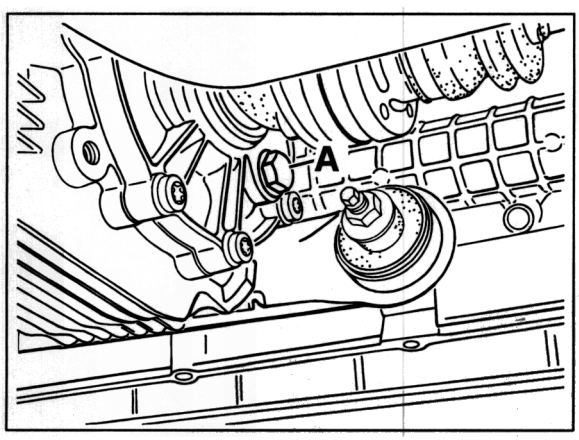
Use only oils approved by Porsche.
See Parts Catalogue.

1. Remove underbody cover (front).

2. Unscrew the oil filler screw and drain plug and drain the oil with the vehicle horizontal.



B – Drain plug 262_98



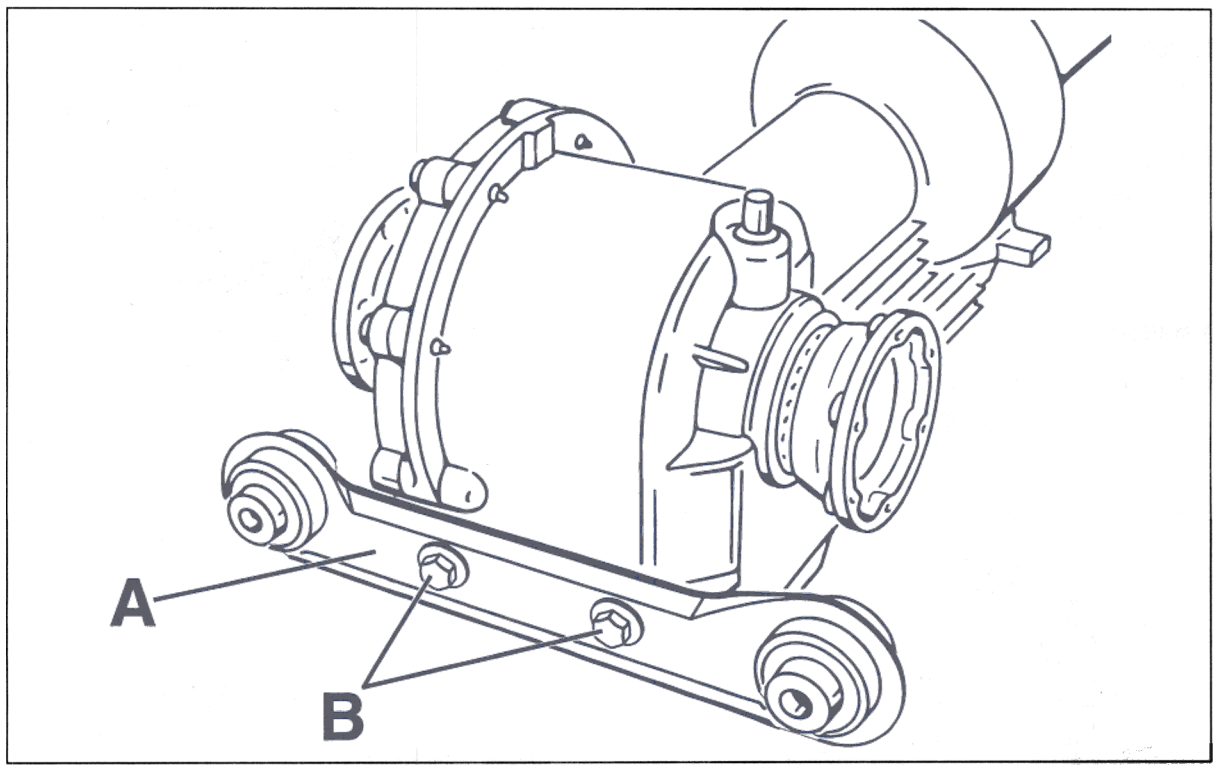
A – Oil filler screw 246_98

3. Clean the drain plug and filler screw.

4. Fill with oil up to the bottom edge of the oil filler opening.

5. Tighten the drain plug and filler screw with **28 Nm (21 ftlb.)**.

39 62 19 Removing and installing support for final drive



482_98

A – Support for final drive
B – Fastening screws

Removing and installing support for final drive

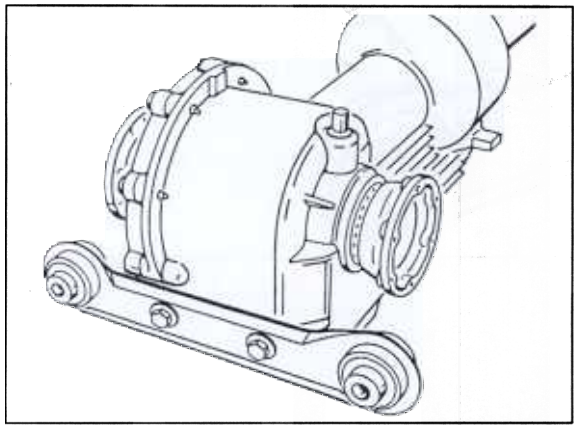
Removal

1. Remove final drive
   (refer to Serv. No. 39 88 19).

2. Unscrew fastening screws and remove support.

Installation

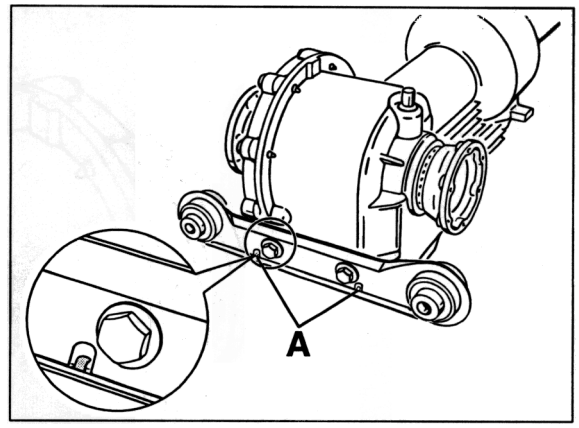
1. Fit support in the correct position (angled side facing upwards).



481_98

Note

At the beginning of the series, supports with tabs were installed. These supports must be fitted with the tabs facing downwards.



A – Tabs

480_98

2. Tighten fastening screws in two stages.
   1st stage:
   Screw both screws to **5 Nm (3.7 ftlb.)**.
   2nd stage:
   Tighten both screws to **65 Nm (48 ftlb.)**.

3. Install final drive.

PORSCHE

Technical Manual

911 Carrera (996) GT3

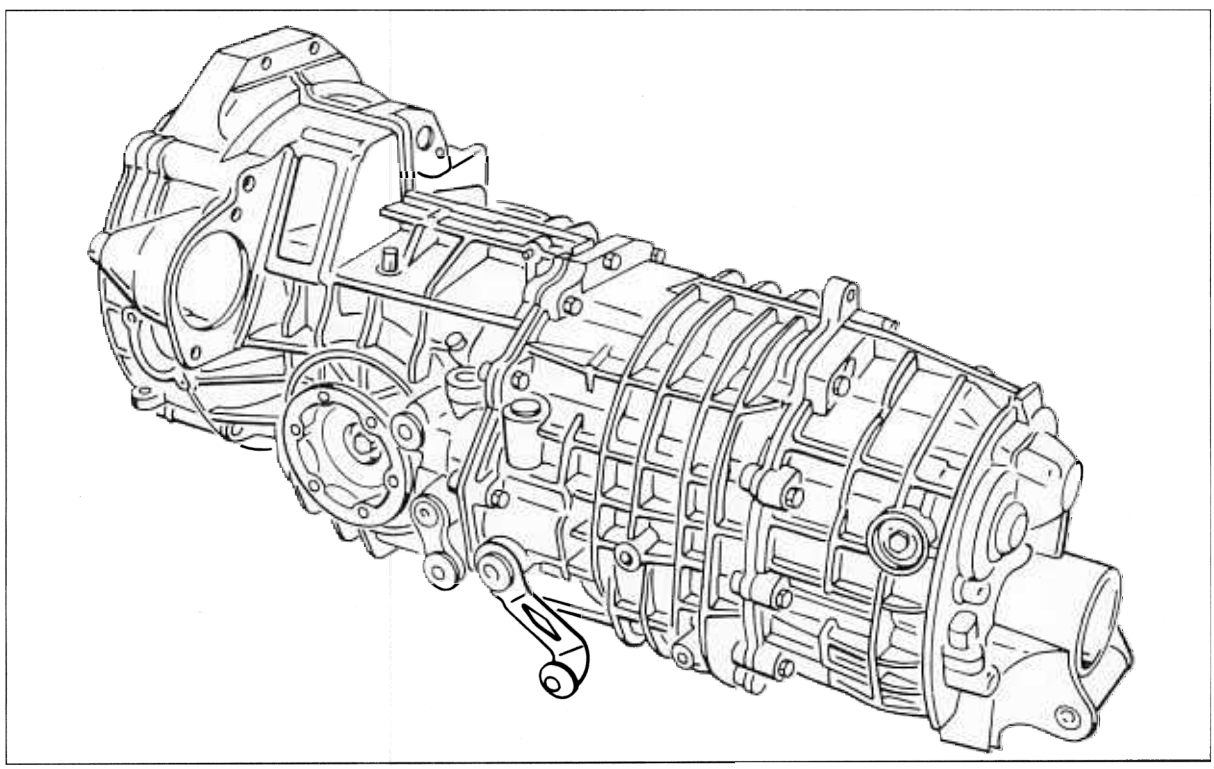
Repair

Group 3
Transmission, manual transmission

3 Transmission, manual transmission (GT3)

3 Technical data – GT3

6-speed manual transmission G96/90

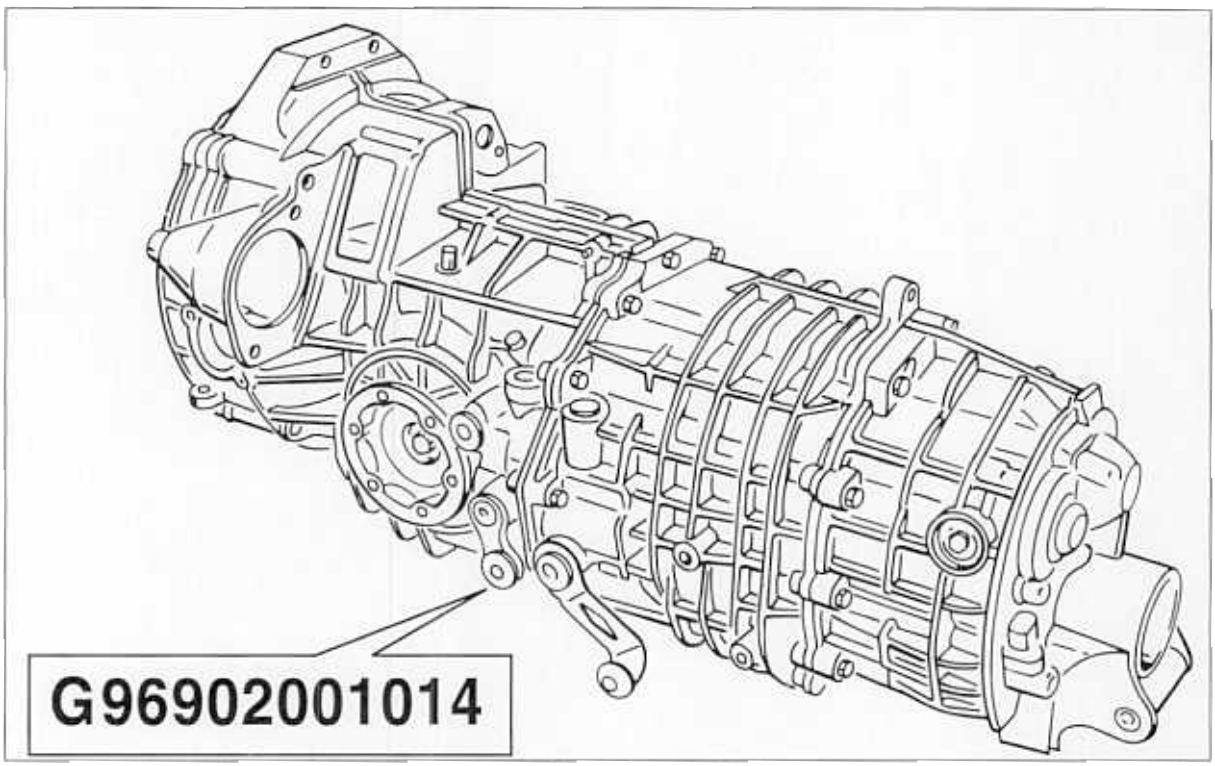


089_99

Type	Code letter	Equipment	Installed in	Model year
G96/90		6-speed	911 Carrera (GT3)	2000

3 Technical data – GT3

Key to transmission numbers



090_99

G9690	1	001014
Transmission type	**Index for version within transmission number** 1 = normal differential 2 = limited-slip differential	**Serial number**

Technical data – GT3

Manual transmission G96/90

General data	Manual transmission G96/90
Transmission ratios	G96/90 $Z_1 : Z_2 = Z_2 : Z_1$
1st gear	11 : 42 = 3.82
2nd gear	20 : 43 = 2.15
3rd gear	25 : 39 = 1.56
4th gear	33 : 40 = 1.21
5th gear	37 : 36 = 0.97
6th gear	39 : 32 = 0.82
Reverse gear	14 : 40 = 2.86
Final drive	hypoid bevel gear drive with 10 mm offset
Transmission ratio final drive	9 : 31 = 3.44
Filling capacity: New filling Change quantity	 3.8 3.3

Technical data – GT3

Tightening torques (transmission G96/90)

Location	Thread	Tightening torque Nm (ftlb.)
Tensioning plate on transmission housing	M8	25 (19)
Tensioning plate on transmission housing	M8 x 30	25 (19)
Fastening bolts for reverse idle gear	M8 x 55	25 (19)
Gear housing on transmission housing	M8 x 35	25 (19)
Front transmission cover on gear housing	M8 x 35	25 (19)
Side transmission cover on gear housing	M8 x 35	25 (19)
Hexagon nut for input shaft	M30 x 1.5	250 (185)
Hexagon nut for input shaft	M22 x 1.5	200 (148)
Hexagon nut for output shaft	M30 x 1.25	300 (222)
Shift forks on shift rods	M8 x 30	18 (13)
Oil pan on transmission housing	5 x 20	8.5 (6.5)
Crown wheel on differential housing	M12 x 1.25	200 (148)
Halfshaft flange fastening	M10 x 85	44 (33)
Screw plug, oil drainage and oil filling	M22 x 1.5	30 (22)

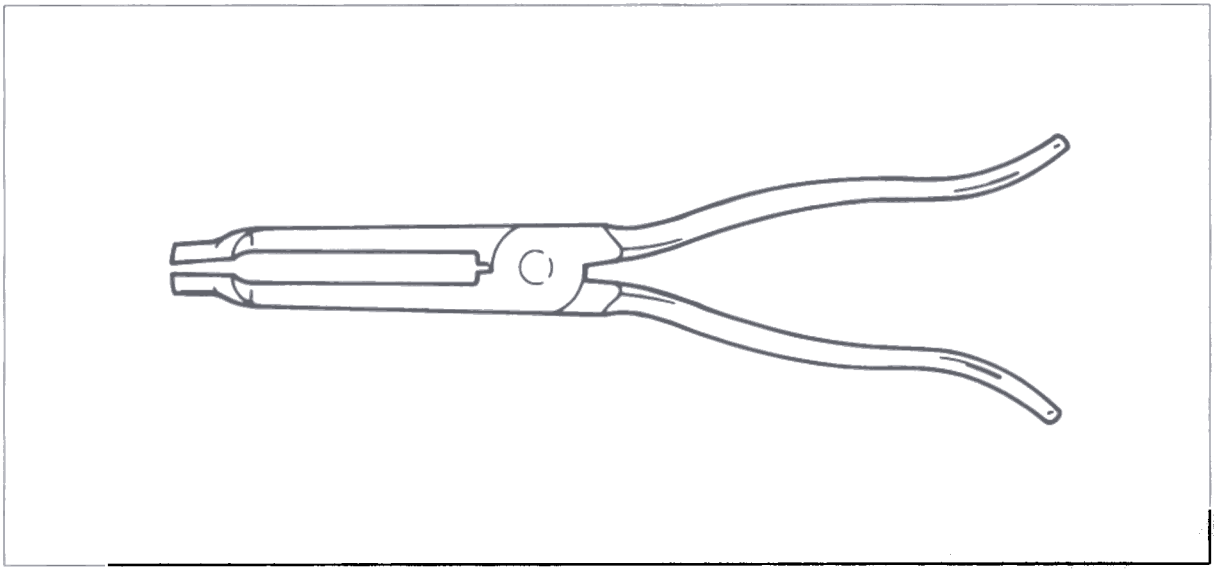
Location	Thread	Tightening torque Nm (ftlb.)
Screw plug for shift rod locking on transmission housing	M10 x 1	12 (9)
Screw plug for shift stop locking on gear housing	M18 x 1.5	20 (15)
Bearing screw for selector lever on transmission housing*	M18 x 1.5	50 (37)
Reversing light switch on front transmission cover	M12 x 1.5	15 (11)
Guide tube on transmission housing	M6 x 14	10 (7.5)
Support for clutch control shaft on transmission housing	M6 x 16	10 (7.5)
Intake pipes on transmission housing	M6 x 20	10 (7.5)

***Caution!**
Parts of the shifting mechanism will fall into the transmission if the bearing screw for the selector lever is unscrewed.

> Unscrew the bearing screw only if the transmission has to be disassembled.

34 35 27 Removing and refitting the transmission – GT3

Tools



119_99

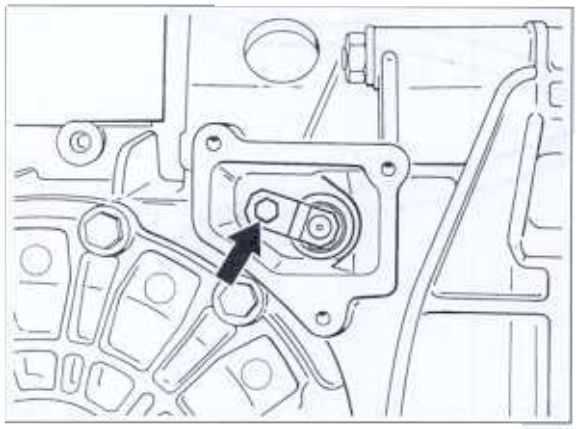
Item	Designation	Special tool	Explanation
	Gripper		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 50)

Removing and refitting the transmission

Removing the transmission

Remove engine-transmission unit.

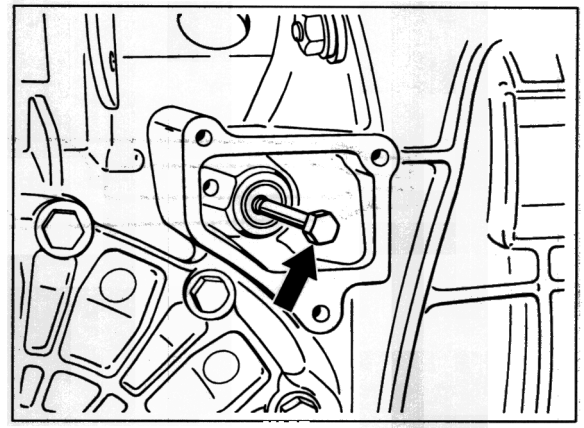
2. Remove air flanges and unscrew hexagon-head bolt for support.



112_99

3. Take out bearing cover using commercially available pliers (refer to Technical Equipment Manual, Chapter 2.4, No. 50).

4. Screw a screw (M6) into the clutch control shaft and pull out shaft.



113_99

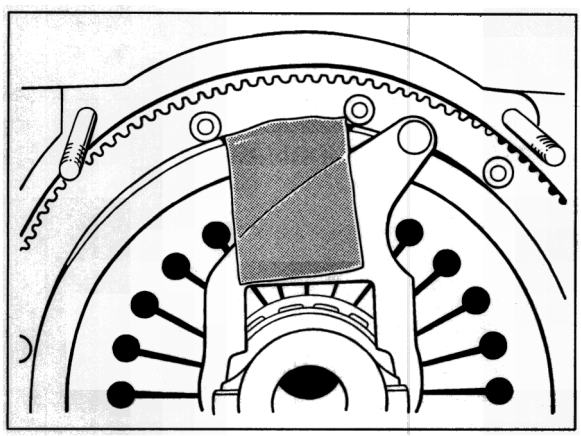
5. Unscrew the fastening nuts for engine/transmission and separate the transmission from the engine.

Refitting the transmission

Note

Grease teeth of the drive shaft with a very thin coat of Olista Longtime 3 EP (only as protection against corrosion).

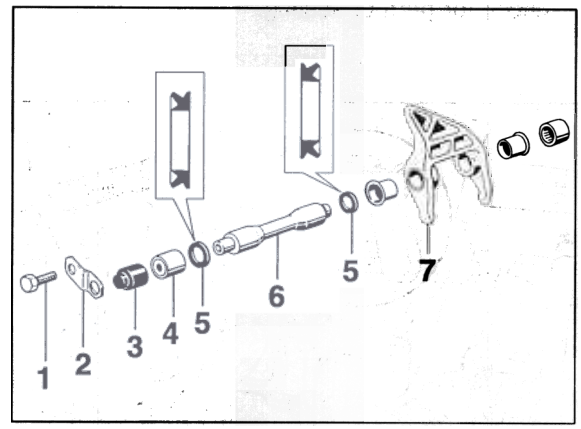
1. Insert release lever into the release bearing and fix in installation position with suitable adhesive tape.



114_99

2. Fit the transmission onto the engine.

3. Fit release lever shaft with sealing rings.



110_99

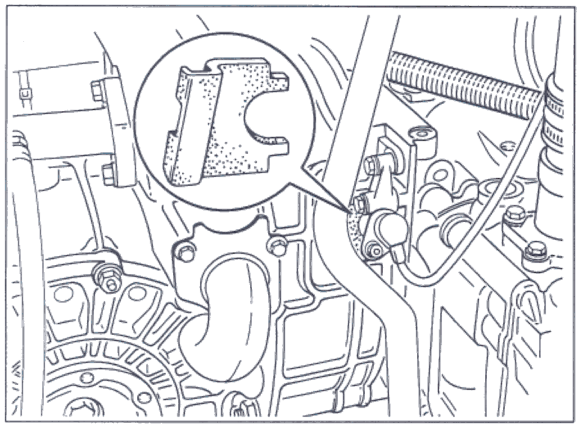
1 – Hexagon-head bolt
2 – Support
3 – Bearing cover
4 – Needle-roller bearing with assembly bore
5 – Sealing ring
6 – Clutch control shaft
7 – Release lever

4. Remove adhesive tape through the assembly opening in the release fork.

5. Fit needle-roller bearing, bearing cover and support. Tighten fastening screw to **10 Nm (7.5 ftlb.)**.

6. Fit air flanges.

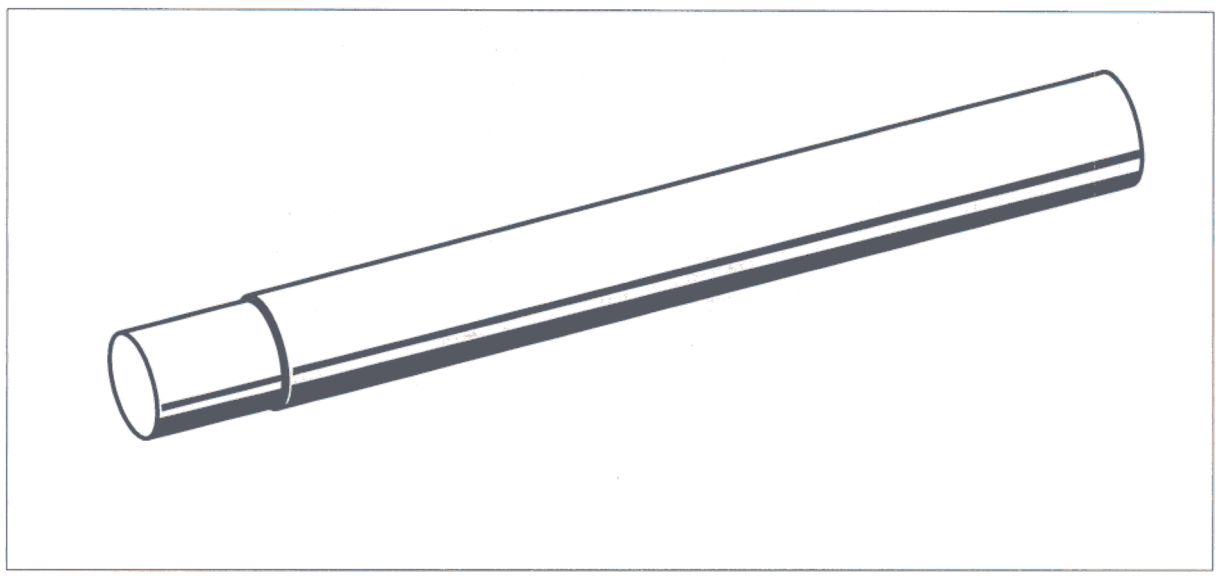
7. Fit closure cap for pulse sender opening and check for perfect seating.



115_99

34 49 19 Removing and installing closure cap for selector force mechanism – GT3

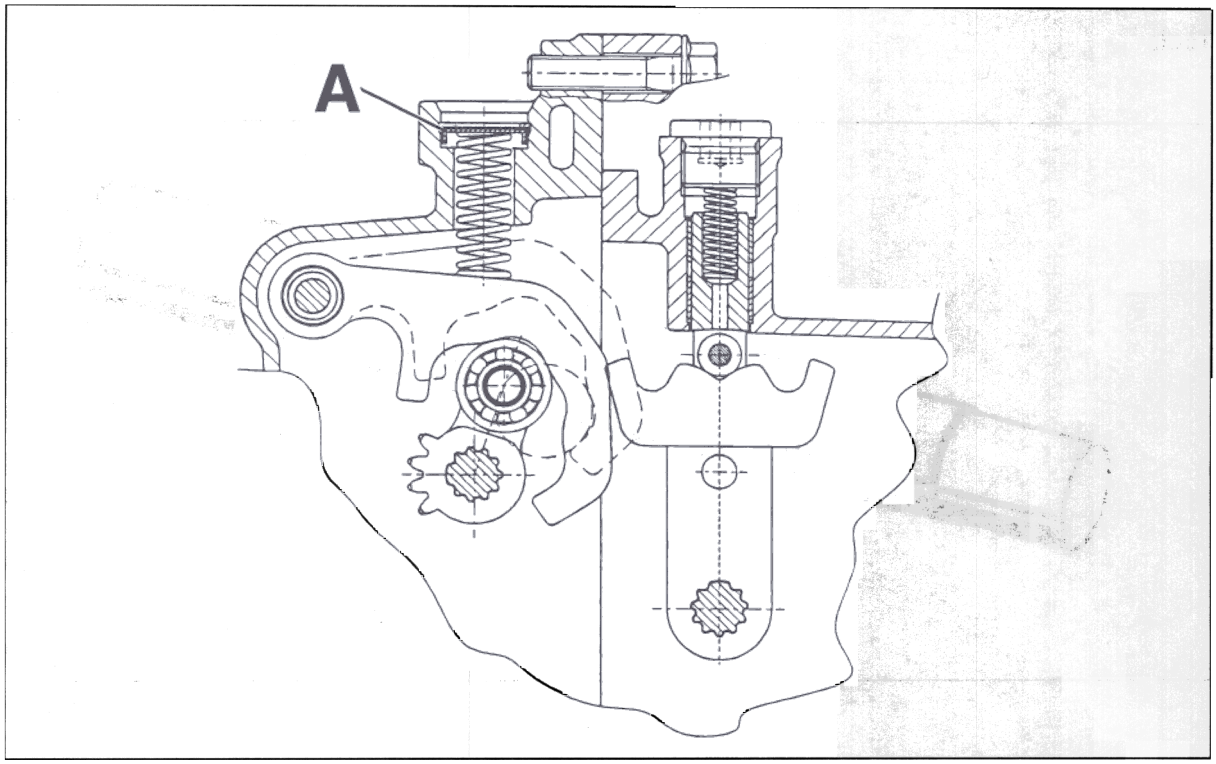
Tools



500_98

Item	Designation	Special tool	Explanation
	Mandrel	P 375	

Removing and installing closure cap for selector force mechanism



075_98

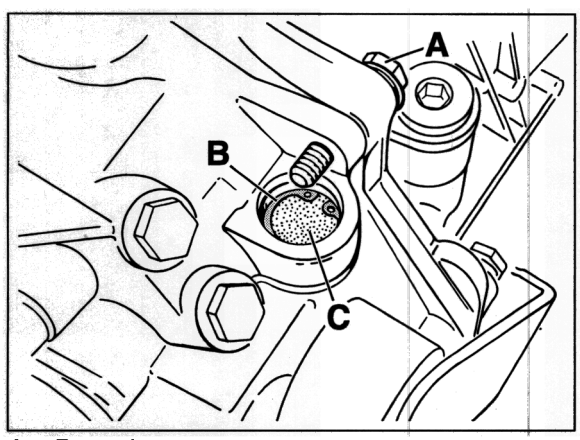
A – Closure cap

Removing and installing closure cap for selector force mechanism

Removal

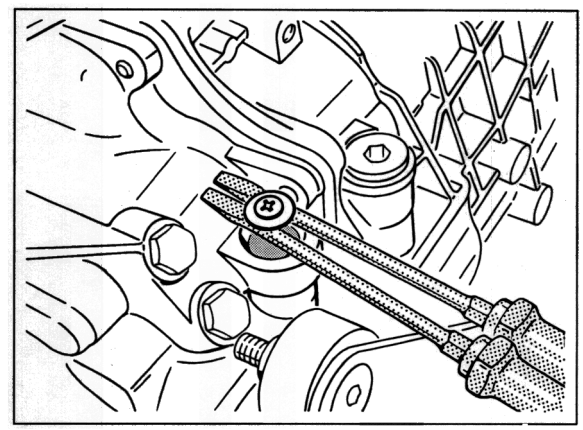
1. Remove engine-transmission unit.

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



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

3. Bore a 3.5 mm large hole into the centre of the closure cap (coat drill with viscous grease to prevent drilling chips from falling into the transmission). Screw in a sheetmetal screw (4.8 x 25) with a large washer and lever out the closure cap using two screwdrivers.



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

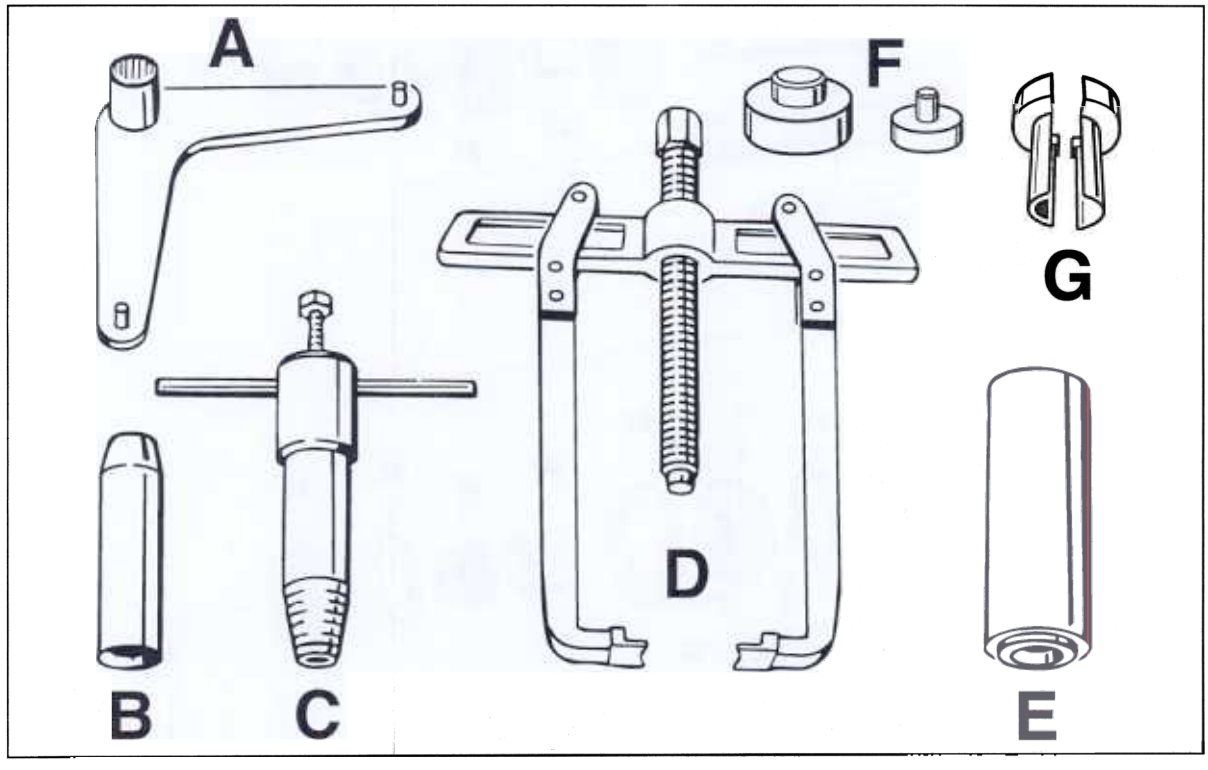
Ensure perfect seating of the snap ring.

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

4. Install engine-transmission unit.

34 35 37 Disassembling and assembling transmission – GT3

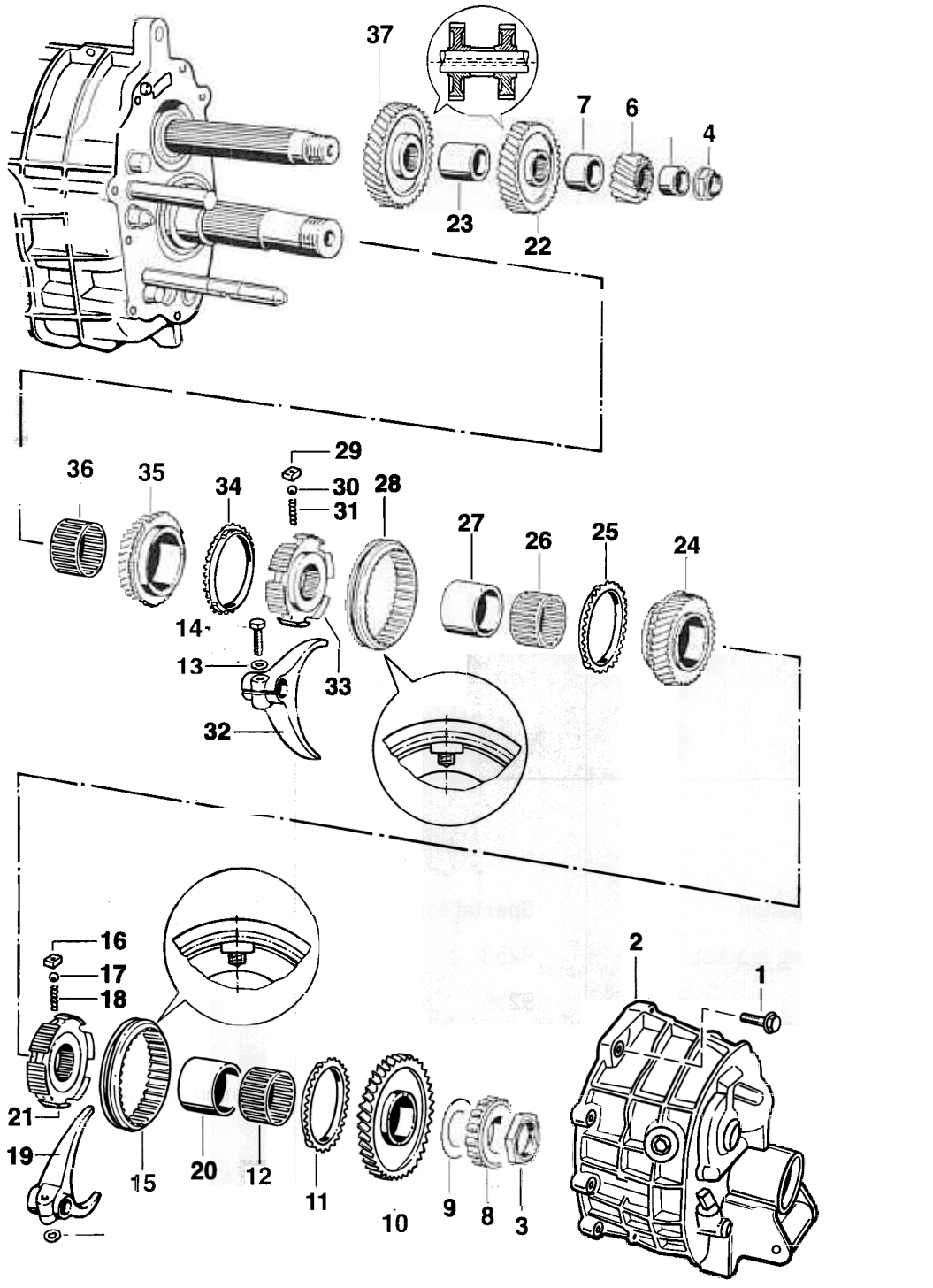
Tools



312_99

Item	Designation	Special tool	Explanation
A	Retaining bracket	9253	
B	Sleeve	9255	
C	Puller	9251	
D	Extractor		with arms from puller 9284
E	Pressure piece	9256	
F	Pressure pieces	9656	
G	Half-shells	9650	

Disassembling and assembling transmission



172_99

No.	Designation	Qty.	Note: Removal	Installation
1	Hexagon-head bolt	10		Tighten to **25 Nm** (19 ftlb.)
2	Front transmission case cover	1		Seal with Loctite 574
3	Hexagon nut (self-locking)	1	Fix the drive shaft with special tool **9253** and shift into a gear	Always replace. Tighten to **300 Nm** (222 ftlb.)
4	Hexagon nut (self-locking)		Fix the drive shaft with special tool **9253** and shift into a gear	Always replace. Tighten to **200 Nm** (148 ftlb.)
5	Inner bearing race	1	Pull off via fixed gearwheel No. 6	Heat to approx. 120°C
6	Fixed gearwheel (reverse gear)	1		
7	Spacer sleeve			
8	Cylindrical-roller bearing	1	Pull off via loose gearwheel No. 10	Heat to approx. 120°C
9	Thrust plate	1		
10	Loose gearwheel (reverse gear)	1		
11	Synchronising ring	1	Mark for refitting	Check for wear. Fit with the same gear wheel (nubs facing the driver dogs)
12	Needle cage	1	Mark for refitting	Fit with the same gear wheel
13	Hexagon-head bolt	2		Tighten to **18 Nm** (13 ftlb.)
14	Washer	2		
15	Shift collar	1	Shift into a gear and remove together with shift fork No. 19. Do not lose the synchronising components	Dotting marks centred with respect to the driver dogs. Stepped side faces loose gearwheel No. 10
16	Driver dog	3		Curved side faces the shift collar
17	Ball	3		

No.	Designation	Qty.	Note: Removal	Installation
18	Spring	3		
19	Shift fork (reverse gear)	1		Fix shift rod with special tool **9650**. Then adjust it so that just enough play remains at the shift collar when reverse gear is engaged. The synchronising ring must be free to rotate in idle position
20	Inner race *	1	Mark for refitting. Pull off via guide sleeve No. 21	Fit with the same gear wheel. Heat to approx. 120°C
21	Guide sleeve (with snap ring)	1		Open side of the snap ring must not lie in the area of the driver dogs. Fit in correct position with shift collar and shift fork (snap ring facing loose gearwheel No. 24)
22	Fixed gearwheel (5th gear)	1		Do not confuse with fixed gearwheel No. 37. Large collar faces spacer sleeve No. 23
23	Spacer sleeve			
24	Loose gearwheel (5th gear)	1		Do not confuse with loose gearwheel No. 35
25	Synchronising ring	1	Mark for refitting	Check for wear. Fit with the same gear wheel (nubs facing the driver dogs)
26	Needle cage	1	Mark for refitting	Fit with the same gear wheel
27	Inner race *	1	Mark for refitting. Pull off via loose gearwheel No. 35 using arms of special tool **9284**	Fit with the same gear wheel. Heat to approx. 120°C

No.	Designation	Qty.	Note: Removal	Installation
28	Shift collar	1		Dotting marks centred with respect to the driver dogs.
29	Driver dog	3		Curved side faces the shift collar
30	Ball	3		
31	Spring	3		
32	Shift fork (5th and 6th gears)	1	Fix shift rod (5th and 6th gears) by shifting into a gear	Adjust. In idle position, the shift collar must be precisely centred between the loose gearwheels
33	Guide sleeve	1		Put on together with shift collar and shift fork
34	Synchronising ring	1	Mark for refitting	Check for wear. Fit with the same gear wheel (nubs facing the driver dogs)
35	Loose gearwheel (6th gear)	1		Do not confuse with loose gearwheel No. 24
36	Needle cage	1	Mark for refitting	Fit with the same gear wheel
37	Fixed gearwheel (6th gear)	1		Do not confuse with fixed gearwheel No. 22 Large collar faces spacer sleeve 23

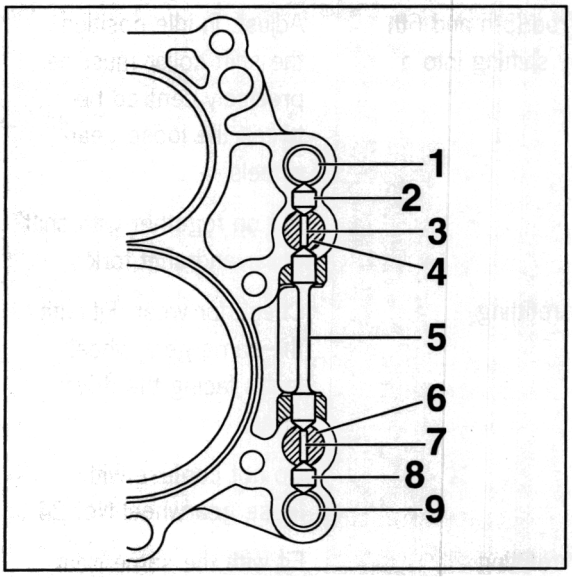
* As the bearing inner races (No. 20 and 27) are subject to tolerances (transition fit), they could have a loose or tight fit on the shaft.

Disassembly and assembly instructions

Disassembly

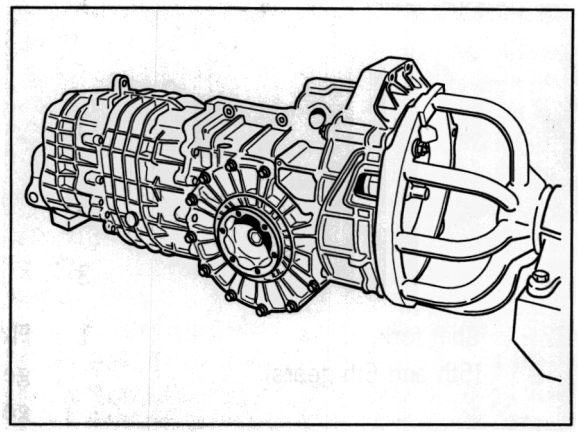
Note

The locking elements or balls of the shift rod lock will fall out without being noticed if the shift rods are moved past the neutral lock or gear lock when the transmission is disassembled or assembled.



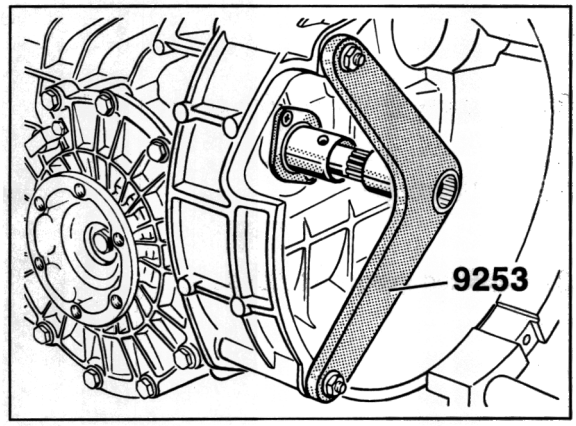
4 and 7 = Intermediate locking elements 320_99

1. Fasten transmission on the assembly support with special tool **P201** and drain the oil.



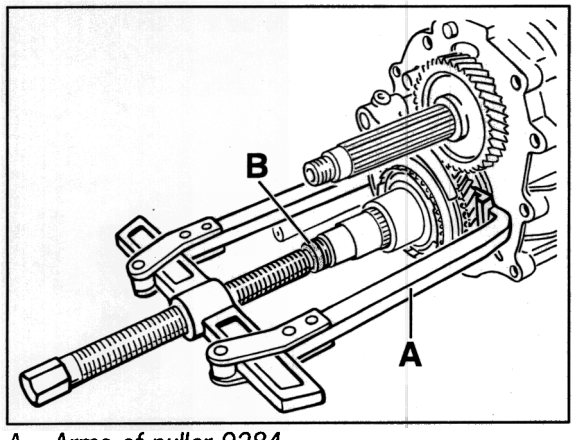
145_99

2. Shift into a gear, fix the drive shaft with special tool **9253** and unscrew the hexagon nuts for the pinion shaft and drive shaft.



146_99

3. Fix shift rod for 5th and 6th gears by shifting into a gear and pull off the needle bearing inner race.

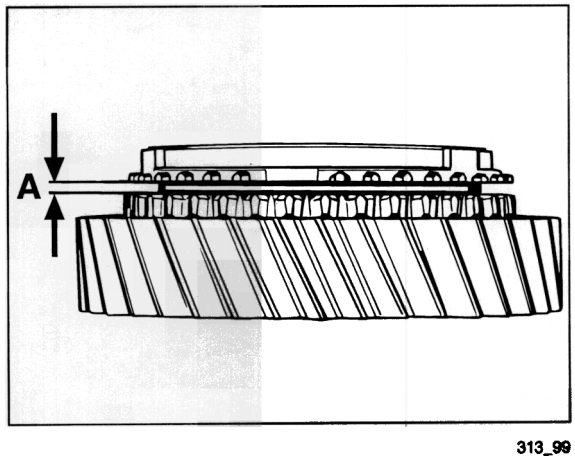


A – Arms of puller 9284
B – Pressure piece 9656
147_99

Assembly

1. Check synchronising rings by pushing them onto the gear wheels and measuring the gap "A" with a feeler gauge.

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

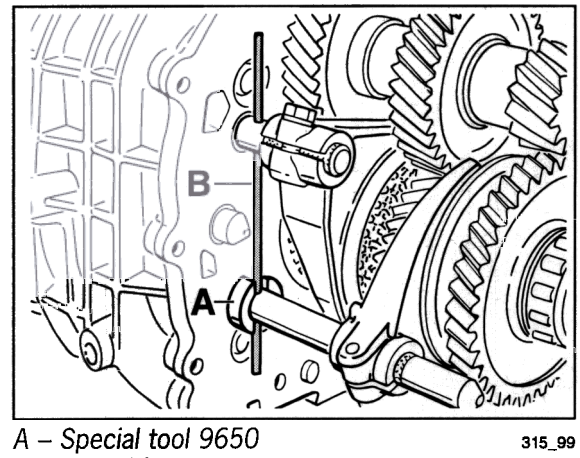


313_99

2. Shift into a gear and fit all gear wheels.

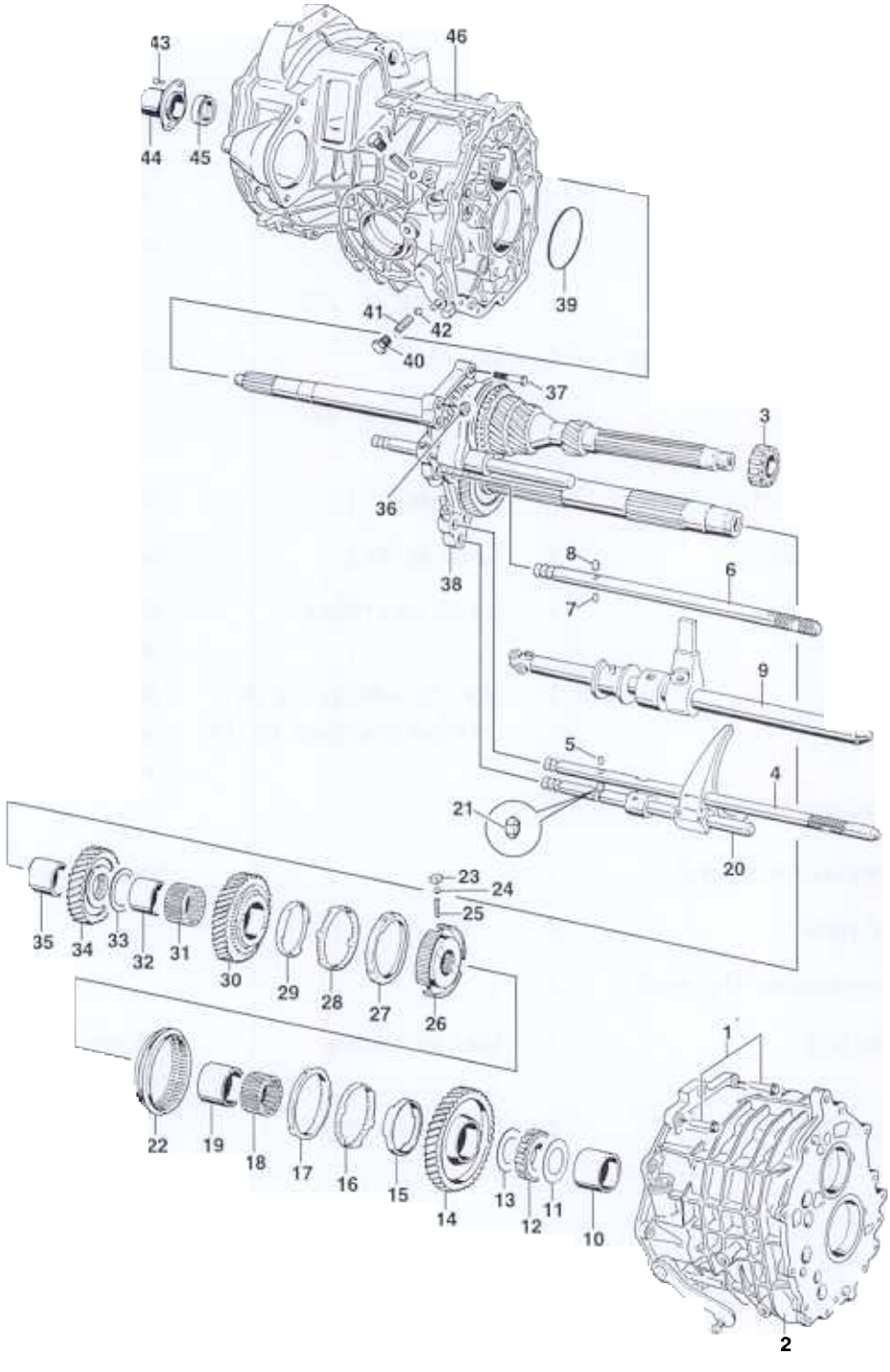
3. Move the shift rods for 5th/6th gear and reverse gear to installation position and adjust the shift forks.

4. Adjust shift fork for reverse gear.
To do this, fix the shift rod with special tool **9650**. Then adjust the fork so that just enough play remains at the shift collar when reverse gear is engaged. The synchronising ring must be free to rotate in idle position.



A – Special tool 9650
B – M6x110 screw
315_99

34 35 37 Disassembling and assembling transmission



216_99

No.	Designation	Qty.	Note: Removal	Installation
1	Hexagon-head bolt	12		Tighten to **25 Nm** (19 ftlb.)
2	Gear housing	1		Roller of the shift catch must engage in the driver of selector shaft No. 9. Seal with Loctite 574
3	Cylindrical-roller bearing	1		Heat to approx. 120°C
4	Shift rod (reverse gear)*	1	See Page 34 - 221	
5	Intermediate locking element	1	Do not lose	Insert with viscous grease
6	Shift rod (5th and 6th gears)*	1	See Page 34 - 221	
7	Intermediate locking element	1	Same as No. 5	Same as No. 5
8	Locking element	1	Same as No. 5	Same as No. 5
9	Selector shaft	1	Do not lose rollers	Fit rollers with viscous grease
10	Inner race		Mark for refitting. Pull off via loose gearwheel No. 14	Fit with the same gear wheel. Heat to approx. 120°C
11	Thrust plate	1		
12	Cylindrical-roller bearing	1		Heat to approx. 120°C
13	Thrust plate	1		
14	Loose gearwheel (1st gear)	1		
15	Friction ring	1	Mark for refitting	Fit with the same gear wheel
16	Tapered ring	1	Mark for refitting	Fit with the same gear wheel. Lugs must engage in the cut-outs on the loose gearwheel

No.	Designation	Qty.	Note: Removal	Installation
7	Synchronising ring	1	Mark for refitting	Check for wear. Fit with the same gear wheel. Drivers must engage in the cut-outs on the conical ring gearwheel. The nubs face the driver dogs
18	Needle bearing	1	Mark for refitting	Fit with the same gear wheel
19	Inner race	1	Shift rods in idle position. Pull off via loose gearwheel No. 30 Mark for refitting	Fit with the same gearwheel. Heat to approx. 120 °C
20	Shift rod/shift fork (1st and 2nd gears)*		See Page 34 - 221. Remove with shift collar No. 22	
21	Locking element	1	Same as No. 5	Same as No. 5
22	Shift collar (with asymmetrically pointed teeth)	1		Insert in correct position with guide sleeve and shift rod. The tooth gap inside the guide sleeve must be precisely aligned with the oil bore of the pinion shaft.
23	Driver dog	3		
24	Ball	3		
25	Spring	3		
26	Guide sleeve	1		The tooth gap inside the guide sleeve must be precisely aligned with the oil bore of the pinion shaft

No.	Designation	Qty.	Note: Removal	Installation
27	Synchronising ring	1	Mark for refitting	Check for wear. Fit with the same gear wheel. Drivers must engage in the cut-outs on the conical ring gearwheel. The nubs face the driver dogs
28	Tapered ring	1	Mark for refitting	Fit with the same gear wheel. Lugs must engage in the cut-outs on the loose gearwheel
29	Friction ring	1	Mark for refitting	Fit with the same gear wheel
30	Loose gearwheel (2nd gear)	1		
31	Needle bearing	1	Mark for refitting	Fit with the same gear wheel
32	Inner race	1	Mark for refitting. Pull off via fixed gearwheel No. 34	Fit with the same gear wheel. Heat to approx. 120°C
33	Thrust plate	1		
34	Fixed gearwheel (3rd gear)	1		Large collar faces thrust plate No. 33
35	Spacer sleeve	1		
36	Hexagon nut			Tighten to **25 Nm** (19 ftlb.)
37	Hexagon-head bolt	6		Tighten to **25 Nm** (19 ftlb.)
38	Tensioning plate with gear set*	1	See Page 34 - 221	
39	Adjusting shim (S_3)	X	Note the quantity and thickness for reinstallation	Remeasure if necessary
40	Screw plug	4		Tighten to **12 Nm** (9 ftlb.
41	Spring	4		
42	Ball	4		

No.	Designation	Qty.	Removal	Note: Installation
43	Oval-head screw	2		Tighten to **10 Nm** (7.5 ftlb.)
44	Guide tube			
45	Shaft seal	1	See Serv. No. 35 50 19	Install only after fitting the gear set
46	Transmission housing	1		

* If the differential is still installed, the locking pieces (Nos. 40, 41, 42) must be taken out before the shift rods (Nos. 4, 6, 20) and tensioning plate (No. 38) can be removed.

Note

As the bearing inner races (Nos. 10, 19 and 32) are subject to tolerances (transition fit), they could have a loose or tight fit on the shaft.

Disassembly and assembly instructions

Disassembly

In the interest of simplifying the work, the complete gear set is not removed. Instead, the pinion shaft is partially disassembled while still installed.

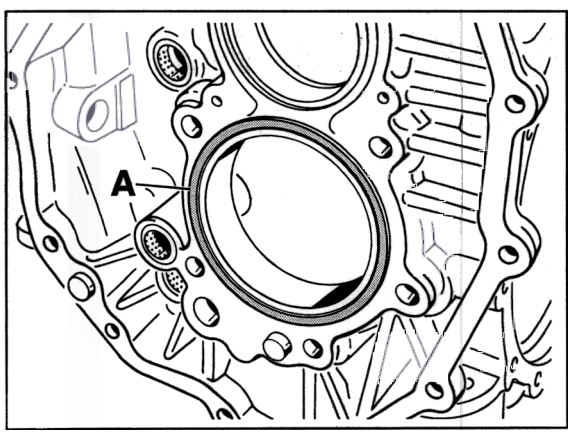
Note

The locking elements or balls (No. 42) of the shift rod lock will fall out without being noticed if the shift rods are moved past the neutral lock or gear lock when the transmission is disassembled or assembled (also see Pages 34 - 221 and 34 - 214).

Tap the gear housing with a plastic hammer to detach it from the transmission housing, and press the roller of the shift catch out of the selector shaft driver.

Assembly

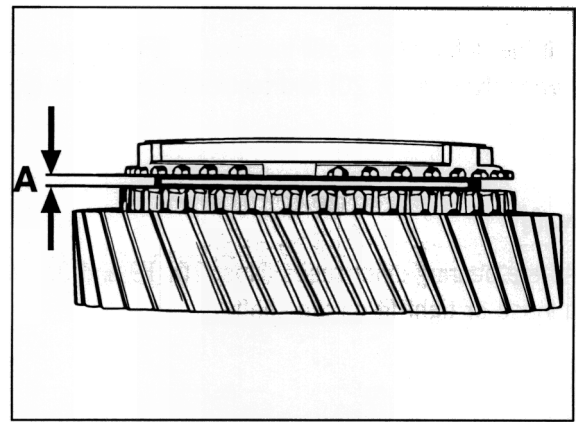
1. Apply some grease on the adjusting shims to the corresponding thickness and "glue" them onto the housing (use the number of adjusting shims "S_3" noted during disassembly or the number of adjusting shims as calculated during adjustment of the drive pinion).



A – Adjusting shim "S_3" 380_99

2. Check synchronisation of 1st and 2nd gears. To do this, place the friction ring and the synchronising ring in the correct position on the gear wheel. Measure gap dimension "A" with a feeler gauge.

Installation dimension (new)	= 1.5...2.0 mm
Wear dimension	= 1.2 mm

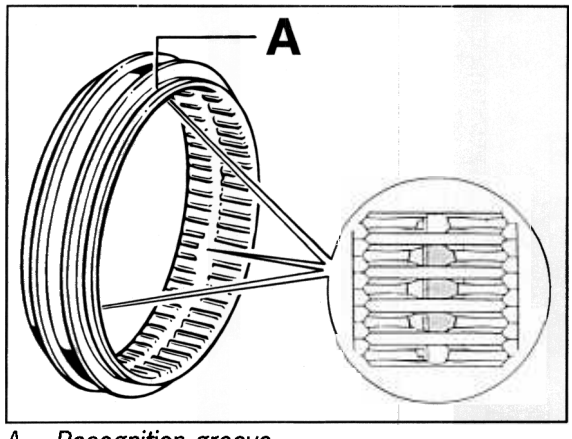


313_99

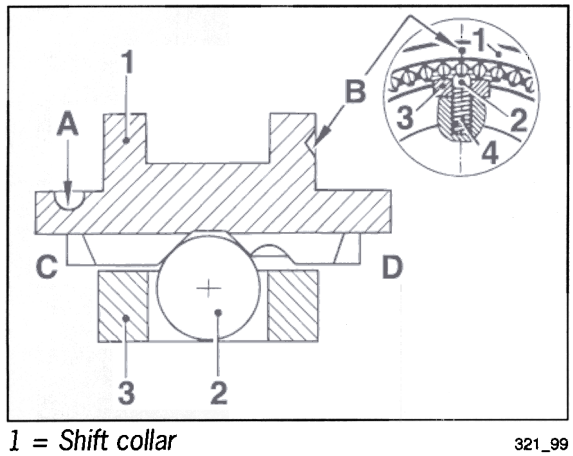
3. Install the completely preassembled gear set.

4. Tighten tensioning plate fastening screw to **25 Nm** (19 ftlb.).

5. Fit shift collar onto the guide sleeve so that the dotting marks "B" are centred with respect to the balls.
Additionally, the recognition groove "A" around it must face the 2nd gear.

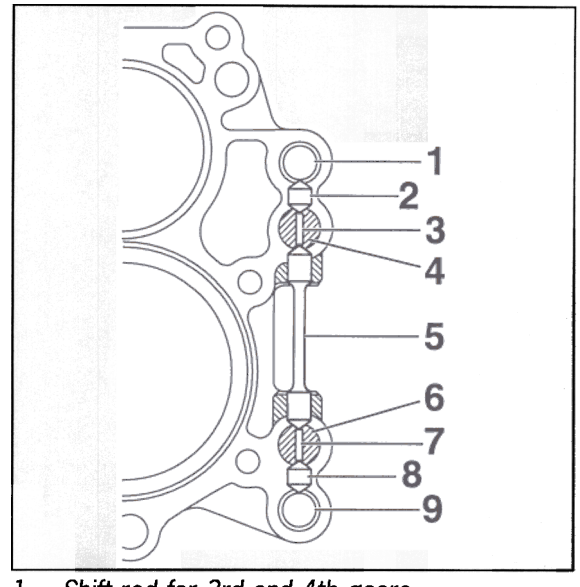


A = Recognition groove (must face the 2nd gear) 324_99



1 = Shift collar
2 = Ball
3 = Driver dog
4 = Spring
A = Recognition groove
B = Dotting mark
C = 2nd gear side
D = 1st gear side 321_99

6. Observe installation position of the locking elements.

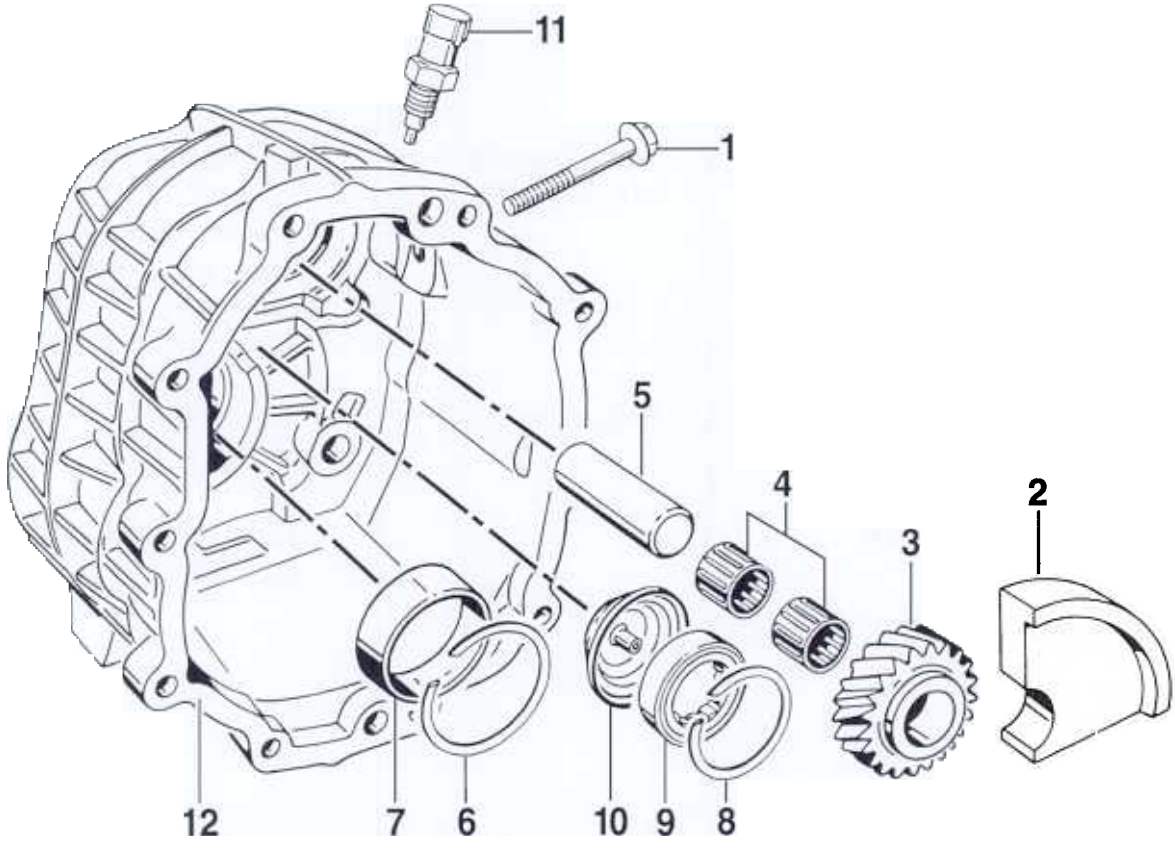


1 = Shift rod for 3rd and 4th gears
2 = Lock (short)
3 = Shift rod for 5th and 6th gears
4 = Intermediate lock
5 = Lock (long)
6 = Shift rod for reverse gear
7 = Intermediate lock
8 = Lock (short)
9 = Shift rod for 1st and 2nd gears 320_99

Note

Do not move the shift rods past the neutral lock or gear lock during or after assembly. The small locks and balls of the shift rod lock could fall out unnoticed. Shift into a gear in order to prevent the shift rods from being moved unintentionally.

34 55 37 Disassembling and assembling front transmission cover – GT3

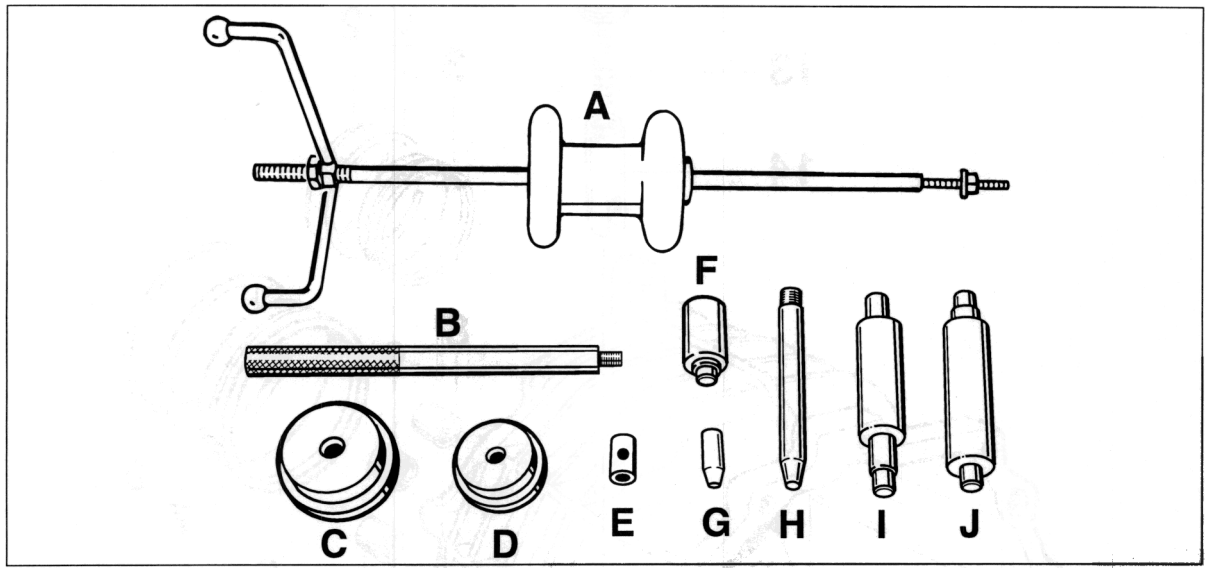


173_99

No.	Designation	Qty.	Note: Removal	Installation
1	Hexagon-head bolt	1		Tighten to **25 Nm** (19 ftlb.)
2	Bearing segment			
3	Reverse idler gear	1		Small collar faces bearing segment No. 2
4	Needle cage			
5	Pin			
6	Snap ring	1		
	Bearing outer race	1	Heat transmission cover to approx. 120°C	Heat transmission cover to approx. 120°C. Drive in with an aluminium or copper rod after heat exchange
8	Snap ring			
9	Cylindrical-roller bearing	1	Same as No. 7	Same as No.
10	Oil guide lid			
1	Reversing light switch	1		Tighten to **15 Nm** (11.0 ftlb.)
12	Transmission cover	1		

34 52 37 Disassembling and assembling gear housing – GT3

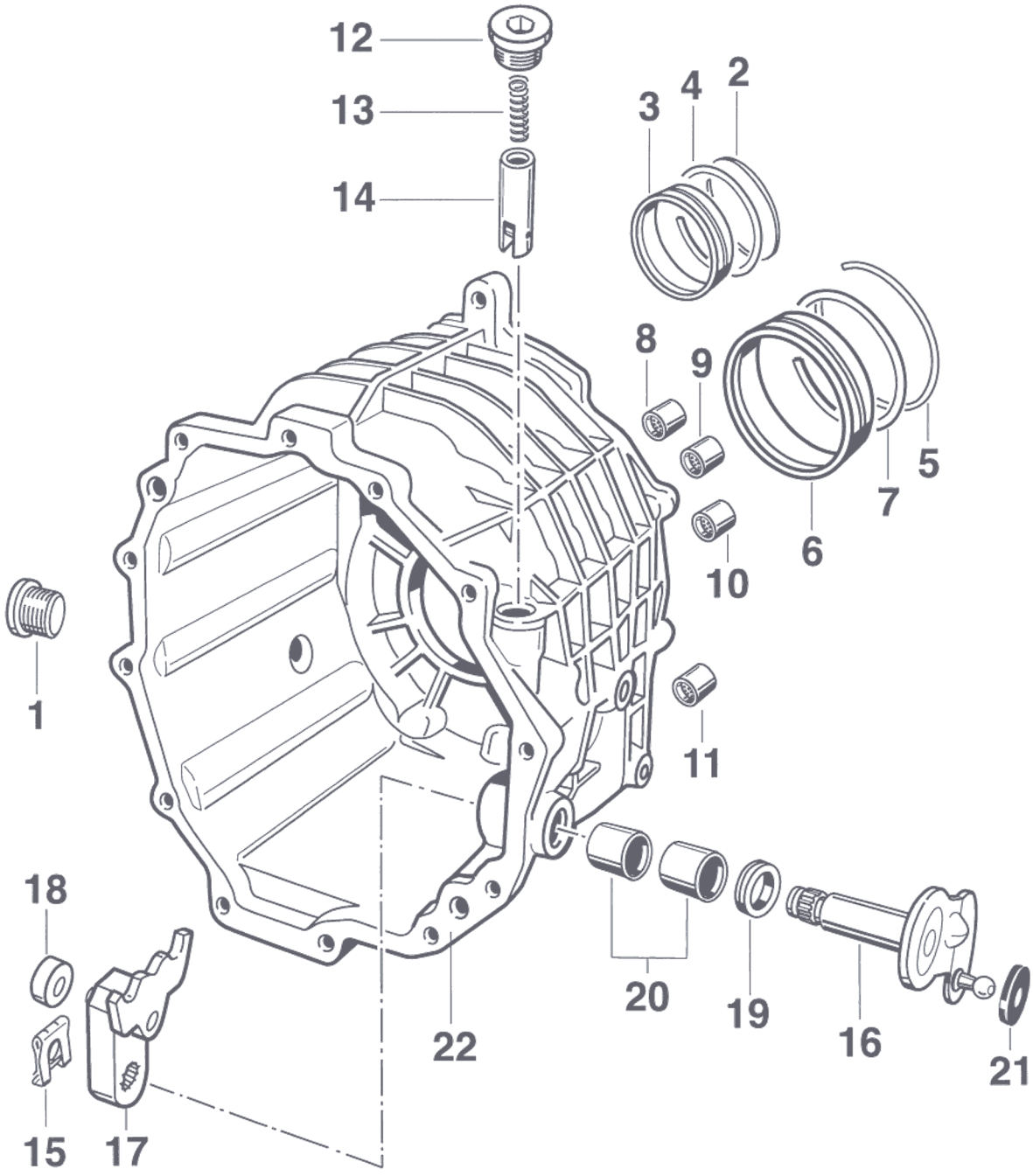
Tools



309_99

Item	Designation	Special tool	Explanation
A	Striker	VW 771	
B	Mandrel	P 254	
C	Pressure piece	P 254 a	
D	Pressure piece	P 254 b	
E	Threaded piece	VW 771/15	
F	Pressure piece	9649/1	
G	Protective sleeve	9649	
H	Pressure piece	9648/2	
	Pressure piece	9648/1	
J	Pressure piece	9648	

Disassembling and assembling gear housing

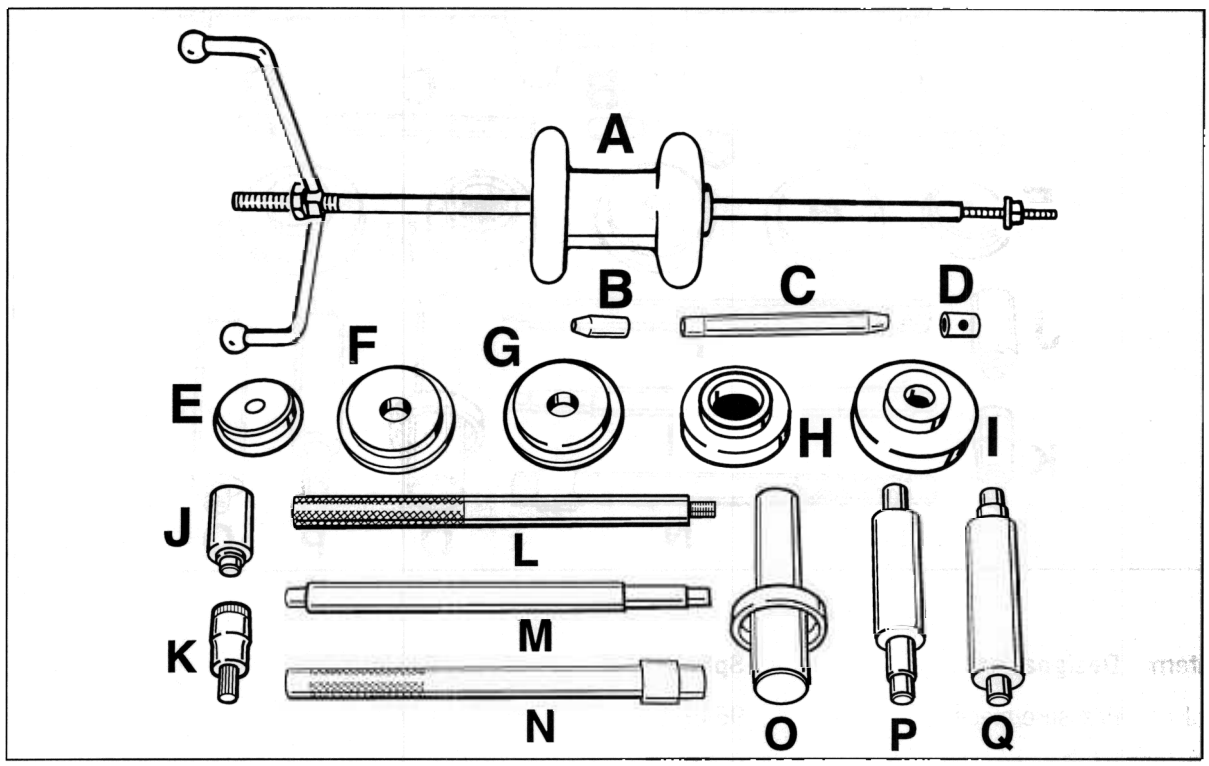


No.	Designation	Qty.	Note: Removal	Installation
1	Screw plug	1		Tighten to **30 Nm** (22 ftlb.)
2	Snap ring	1		
3	Bearing outer race	1	Drive out from the inside using special tools **P 254** and **P 254 b**	Drive in with special tools **P 254** and **P 254 b**
4	Snap ring	1		
5	Snap ring	1		
6	Bearing outer race	1	Drive out from the inside using special tools **P 254** and **P 254 a**	Drive in with special tools **P 254** and **P 254 a**
	Snap ring			
8	Ball sleeve	1	Remove with special tools **VW 771**, **VW 771/15** and internal (e.g. Messrs. Schrem 14-20)	Drive into correct position with special tool **9648** (installation depth 14 mm)
9	Ball sleeve	1		Same as No. 8 (installation depth 0.6 mm)
10	Ball sleeve	1	Same as No. 8	Same as No. 8 (installation depth 0.6 mm)
11	Ball sleeve	1	Same as No. 8	Same as No. 8 (installation depth 14 mm)
12	Screw plug	1		Tighten to **20 Nm** (15 ftlb.)
13	Compression spring			
14	Locking pin			
15	Circlip	1		Ensure perfect seating
16	Shift lever	1		Use protective sleeve (special tool **9646**)

No.	Designation	Qty.	Removal	Note: Installation
17	Shift catch	1		
18	Roller	1		"Glue" on with viscous grease
19	Shaft seal	1		Fill the space between the dust and sealing lips with grease (e.g. Liqui Moly). Drive in with special tool **9649/1**
20	Bearing sleeve	2	Drive out with special tool **9684/2**	Drive into correct position with special tool **9684/1**
21	Rubber washer	1		
22	Gear housing	1		

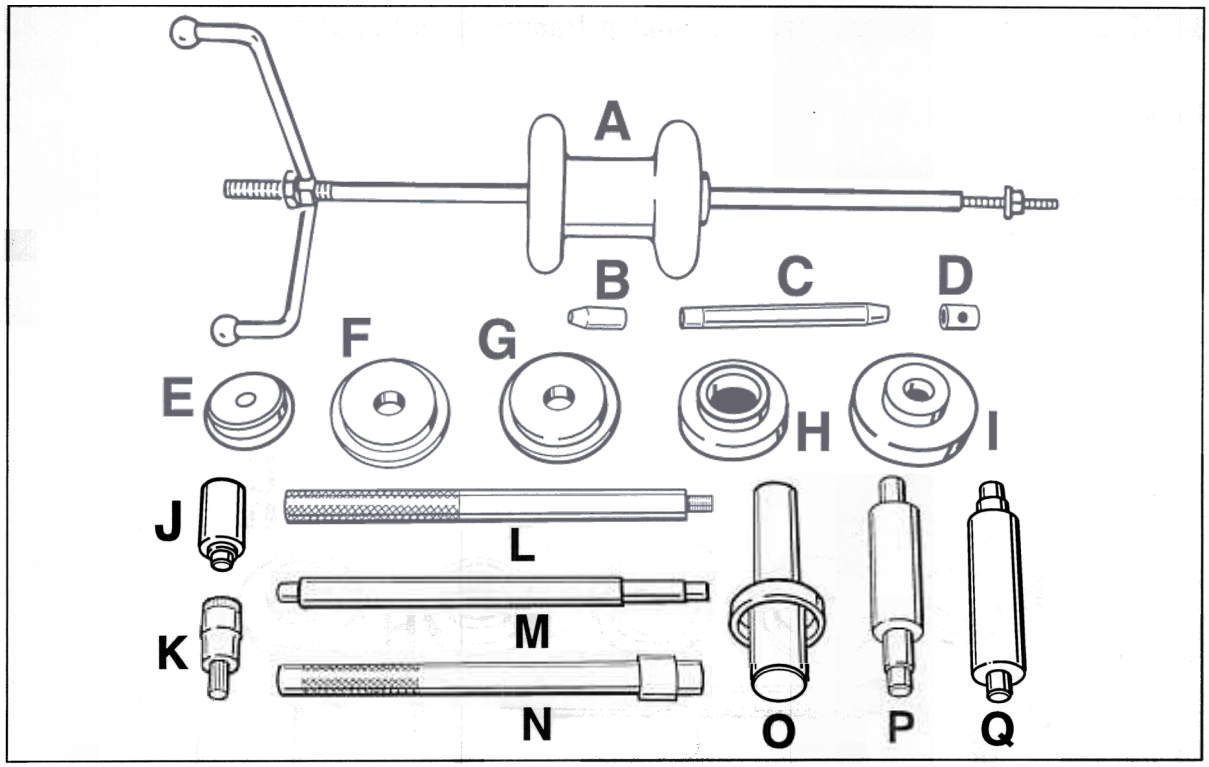
34 37 37 Disassembling and assembling transmission housing – GT3

Tools



310_99

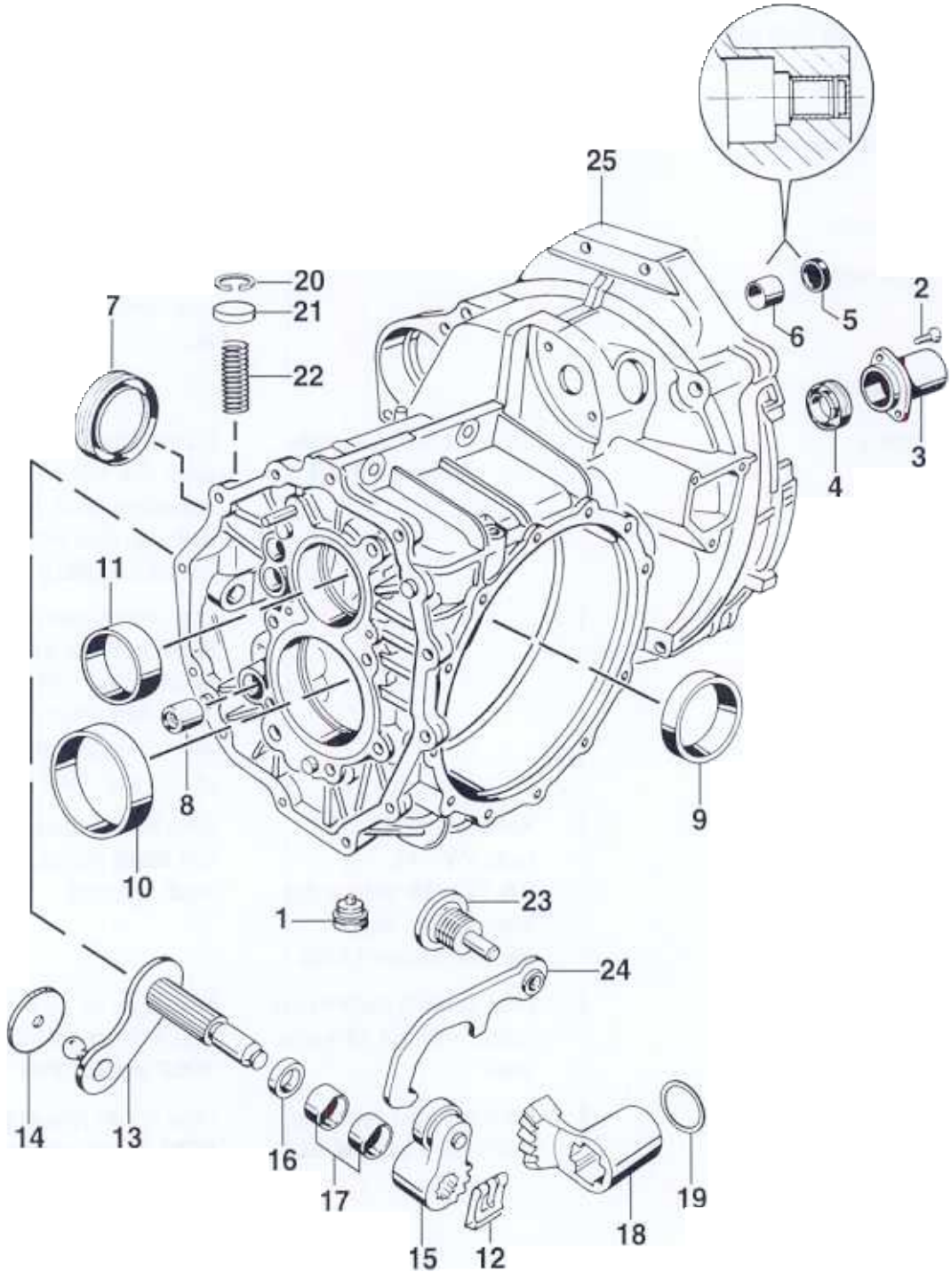
Item	Designation	Special tool	Explanation
A	Striker	VW 771	
B	Protective sleeve	9649	
C	Pressure piece	9648/2	
D	Threaded piece	VW 771/15	
E	Pressure piece	P 254 b	
F	Pressure piece	3062	
G	Pressure piece	9247/4	
H	Pressure piece	9252	
	Pressure piece	VW 513	



310_99

Item	Designation	Special tool	Explanation
	Pressure piece	9649/1	
K	Socket wrench insert	9658	
L	Pull-in tool and extractor	P 254	
M	Mandrel	9515	
N	Mandrel	VW 295	
O	Pressure piece	P 264 b	
P	Pressure piece	9648/1	
Q	Pressure piece	9648	

Disassembling and assembling transmission housing



192_99

No.	Designation	Qty.	Note: Removal	Installation
1	Screw plug (with sealing ring)	1		Clean, tighten to **30 Nm** (22 ftlb.). Replace the sealing ring
2	Oval-head screw	2		Tighten to **10 Nm** (7.5 ftlb.)
3	Guide tube	1		
4	Shaft seal	1		Install only after fitting the gear set (also see Serv. No. 35 50 19)
5	Closure cap	1		
6	Bushing	1	Drive out from the inside with special tool **9515**	Do not grease, oil or clean with solvent (e.g. solvent naphtha). Drive in up to the stop with special tool **9515**
7	Shaft seal	1		Drive in with special tool **9252** as far as the mounting face. Fill the space between the dust and sealing lips with grease (e.g. Liqui Moly)
8	Ball sleeve	4	Remove with special tools **VW 771**, **VW 771/15** and suitable internal puller (e.g. Messrs. Schrem 14-20)	Drive in with special tool **9648** (installation depth 0.6 mm)
9	Bearing outer race	1	Drive out with aluminium or copper mandrel, changing sides	Drive in as far as the stop with special tools **3062** and **VW 295**
10	Bearing outer race	1	Drive out from the inside with special tool **VW 513**	Drive in with special tool **9247/4** and mandrel of special tool **P 254**

No.	Designation	Qty.	Note: Removal	Installation
1	Bearing outer race	1	Drive out from the inside with special tool **P 264 b**	Drive in with special tool **P 254 b** and mandrel of special tool **P 254**
12	Circlip	1		Fit in correct position and make sure it is seated properly
13	Selector lever	1		Use special tool **9649**. Insert in correct position
14	Rubber washer	1		
15	Selector lever			
16	Shaft seal	1		Fill the space between the dust and sealing lips with grease (e.g. Liqui Moly). Drive in with special tool **9649/1**
17	Bushing	2	Drive out with special tool **9684/2**	Drive in with special tool **9684/1**
18	Shift pinion	1		End clearance 0...0.15 mm. Adjust with washer (No. 19)
19	Adjusting shim	X	Mark for refitting	Remeasure if necessary
20	Snap ring	1		Use special tool **P 375** to push the snap ring and closure cap (No 21) down until the snap ring engages in its groove.
21	Closure cap			
22	Compression spring	1		

No.	Designation	Qty.	Note: Removal	Installation
23	Bearing screw*	1	Remove with special tool **9658**. **Unscrew it only if the transmission has to be disassembled!**	Tighten to **50 Nm** (37 ftlb.)
24	Swivel arm	1		
25	Transmission housing	1		

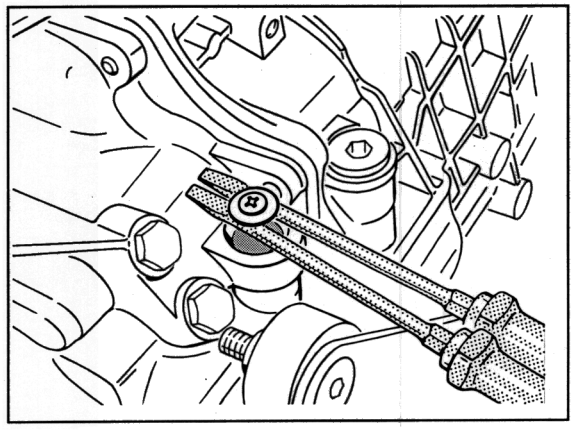
***Caution!**
Parts of the shifting mechanism will fall into the transmission if the bearing screw No. 23 is unscrewed.

> Unscrew the bearing screw only if the transmission has to be disassembled.

Disassembly and assembly instructions

Disassembly

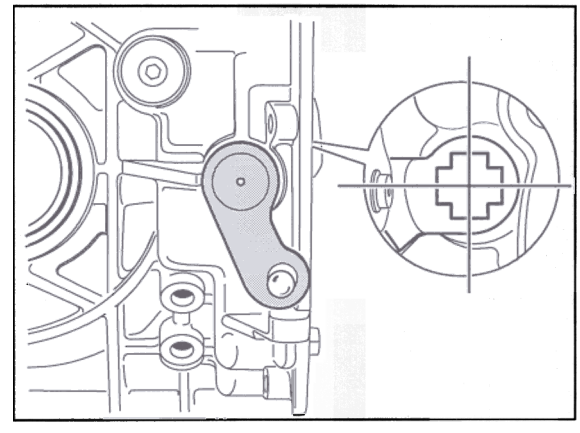
1. Remove closure cap.
   To do this, drill a 3.5 mm hole into the centre of the cap, screw in a sheetmetal screw (4.8 x 25) with large washer, and lever the cap out using two screwdrivers.



484_98

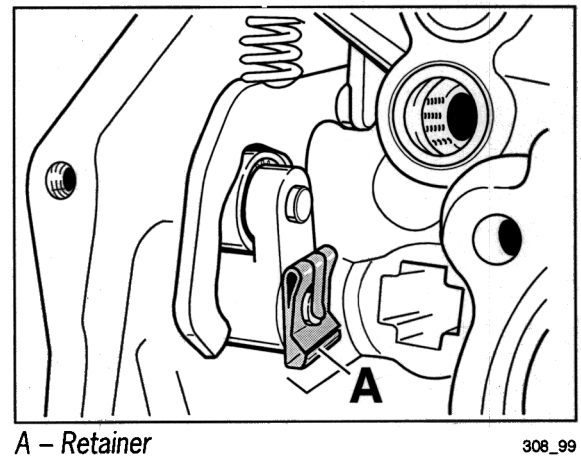
Assembly

1. Fit selector lever and shift pinion in the correct position.
   (The driver cross is vertical and the selector lever reaches the flat surface of the housing.



400_99

2. Fit the retainer in the correct position and make sure it is seated properly.

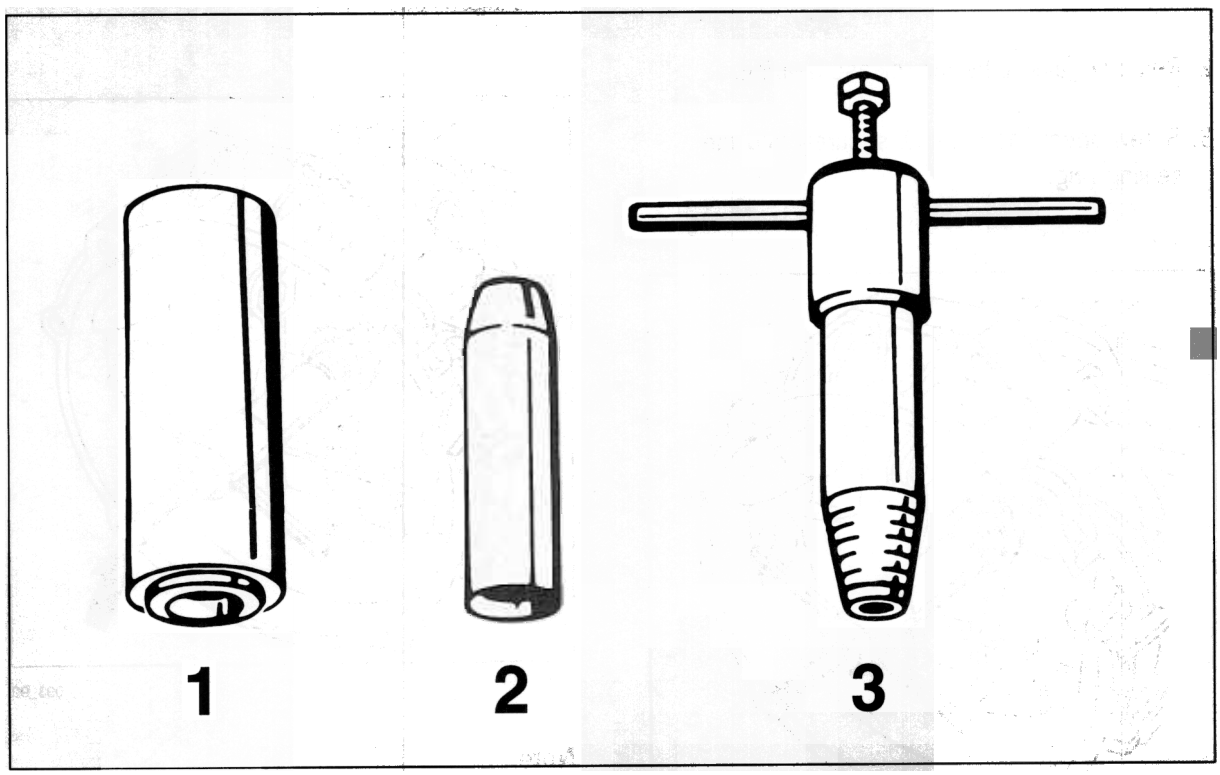


A – Retainer

308_99

35 50 19 Removing and installing sealing ring for input shaft – GT3

Tools



091_99

Item	Designation	Special tool	Explanation
1	Pressure piece	9256	
2	Sleeve	9255	
3	Puller	9251	

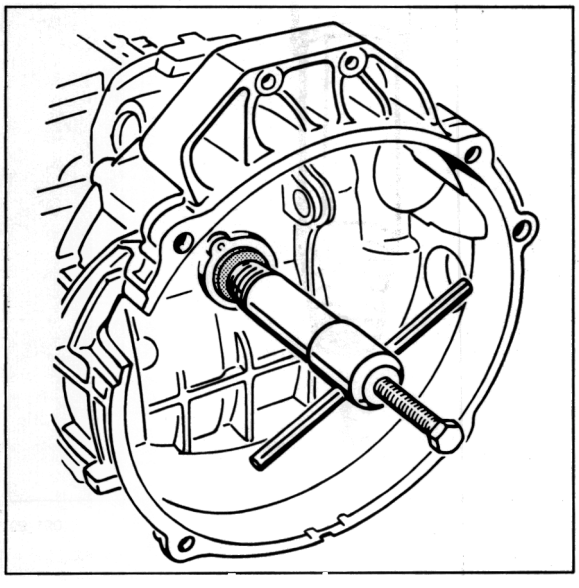
Removing and installing sealing ring for input shaft

Removal

1. Remove engine-transmission unit and remove the transmission.

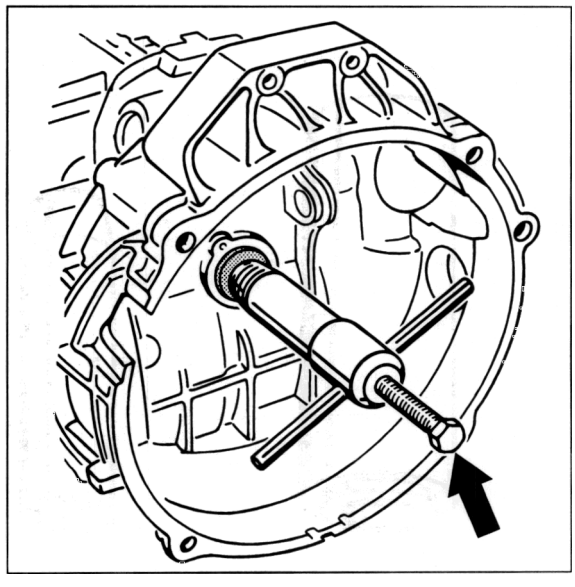
2. Remove guide tube for release bearing.

3. Screw special tool **9251** securely into the sealing ring.



092_99

4. Pull out sealing ring by screwing in the hexagon-head screw.



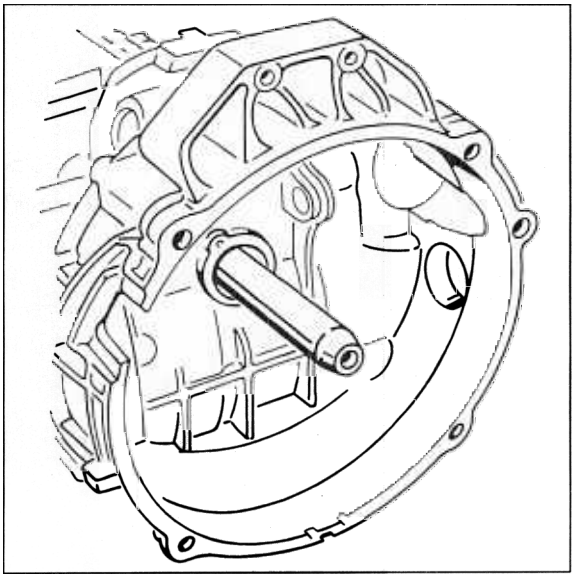
093_99

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

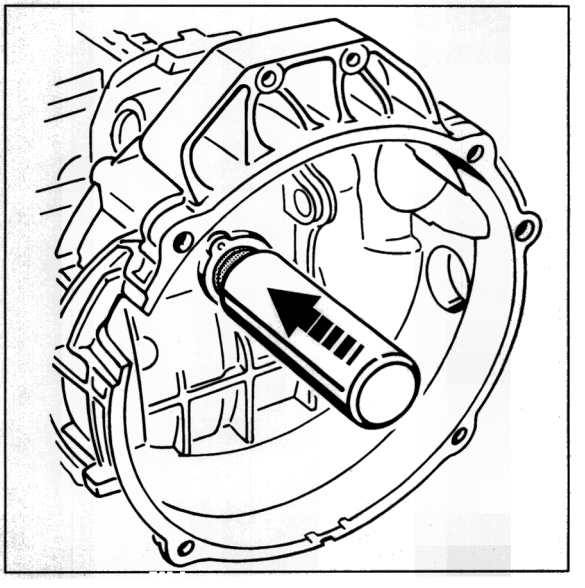
1. Push assembly sleeve **9255** onto the toothing of the input shaft.



094_99

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

3. Drive in sealing ring with special tool **9256** as far as the mounting face.

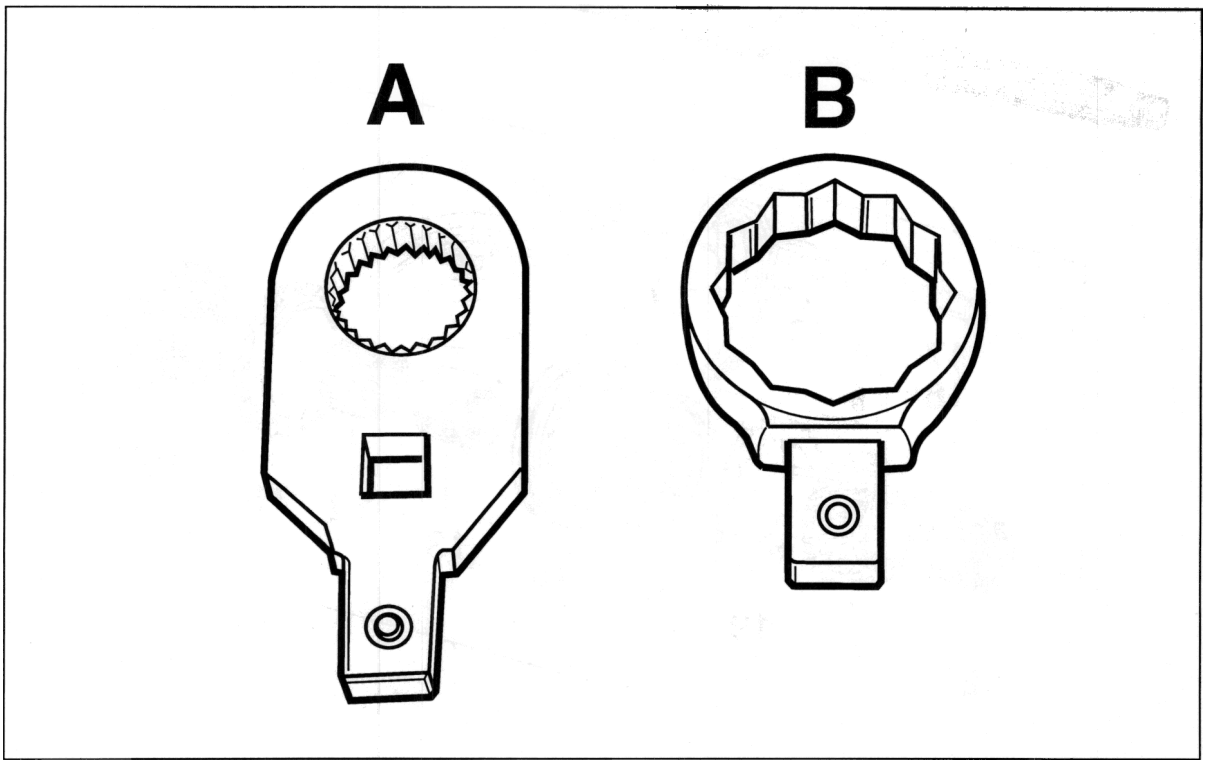


095_99

4. Install the guide tube and tighten the fastening screws to **10 Nm (7.5 ftlb.)**.

35 40 37 Disassembling and assembling input shaft – GT3

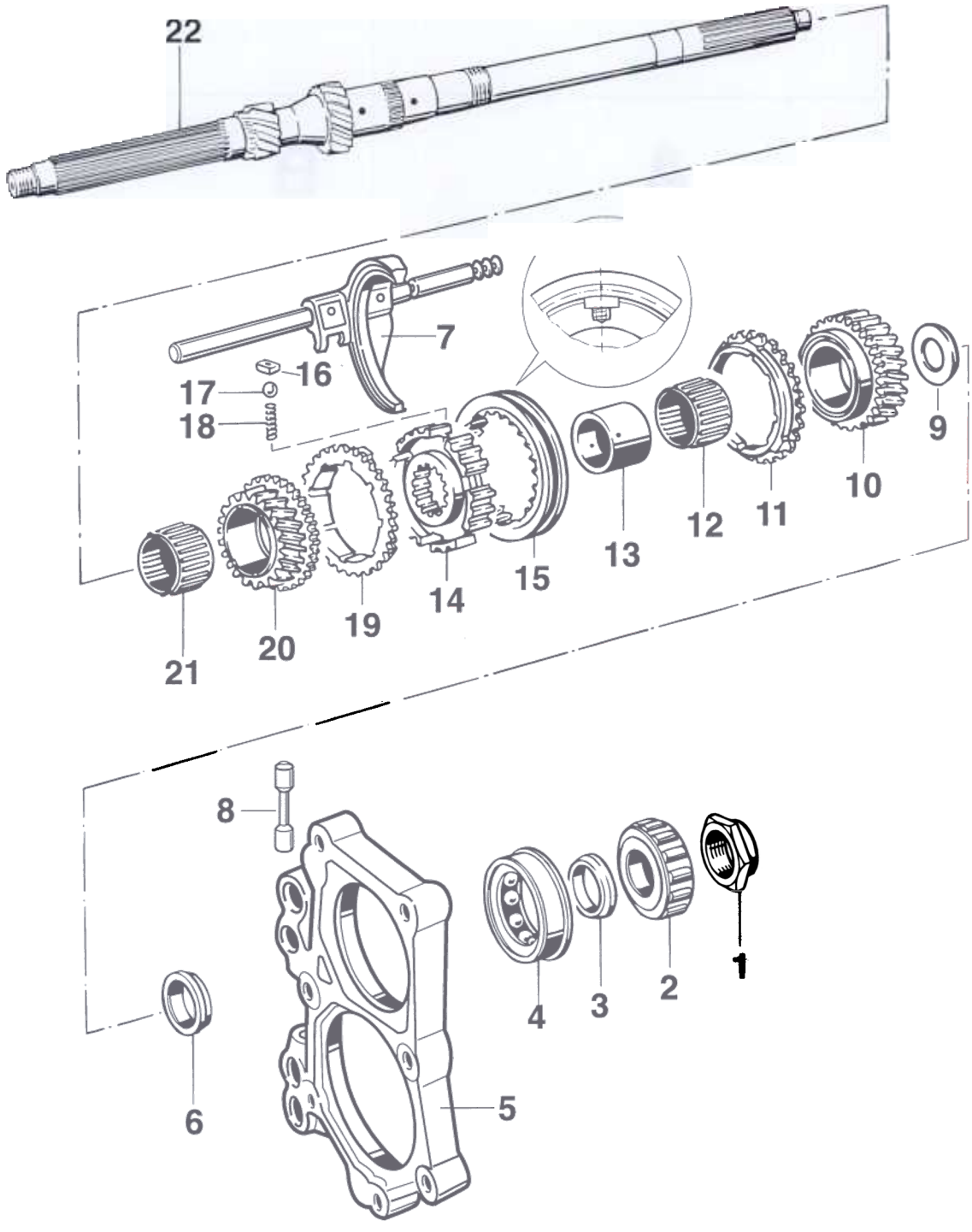
Tools



252_99

Item	Designation	Special tool	Explanation
A	Insert	9282	
B	Ring wrench insert, a/f 41		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 96-2)

Disassembling and assembling input shaft



187_99

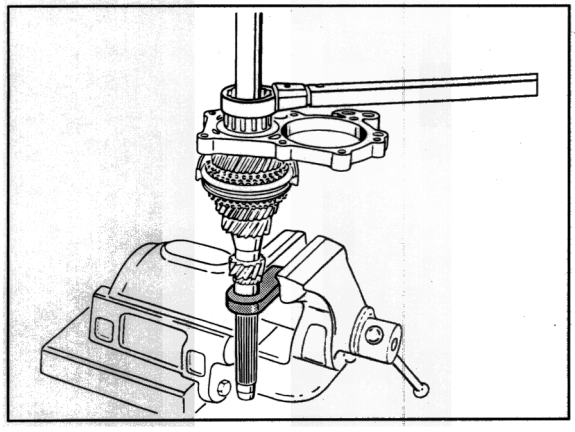
No.	Designation	Qty.	Note: Removal	installation
1	Hexagon nut (self-locking)	1	Undo with special tool **9282** and ring wrench insert (a/f 41)	Always replace. Tighten to **250 Nm** (185 ftlb.)
2	Cylindrical-roller bearing	1	Using a suitable separator (e.g. Kukko 17-1), press it off via the 3rd gear gear-wheel	Heat to approx. 120°C
3	Bearing inner race	1		Heat to approx. 120°C
4	Four-point bearing	1		
5	Tensioning plate	1		Put on with lock No. 8
6	Bearing inner race	1		Heat to approx. 120°C
7	Shift rod/shift fork (3rd and 4th gears)			
8	Locking element			
9	Thrust plate	1		Large flat-ground side faces the needle-roller assembly
10	Loose gearwheel (4th gear)	1		Replace only in pairs
11	Synchronising ring	1	Mark for refitting	Check for wear; fit in the correct position with the same gear wheel (nubs facing the driver dogs)
12	Needle-roller assembly	1	Mark for refitting	Fit with the same gear wheel
13	Inner race	1		Heat to approx. 120°C
14	Guide sleeve	1	Remove with shift collar	Put on together with shift collar and synchronising components

No.	Designation	Qty.	Note: Removal	Installation
15	Shift collar (with asymmetrically pointed teeth)	1	Synchronising components could pop out	Dotting marks centred with respect to the driver dogs. Recognition groove must face to the loose gearwheel for 3rd gear. Put on together with guide sleeve
16	Driver dogs	3		Insert in correct position; curved side faces the shift collar
17	Ball	3		
18	Spring	3		
19	Synchronising ring	1	Mark for refitting	Check for wear; fit in the correct position with the same gear wheel (nubs facing the driver dogs)
20	Loose gearwheel (3rd gear)	1		Replace only in pairs
21	Needle-roller assembly	1	Mark for refitting	Fit with the same gear wheel
22	Input shaft			

Disassembly and assembly instructions

Disassembly

1. Clamp retaining device **9282** in a vice, push the input shaft on it and undo the hexagon nut using a commercially available ring wrench insert (see Workshop Equipment Manual, Chapter 2.4, No. 92-2).



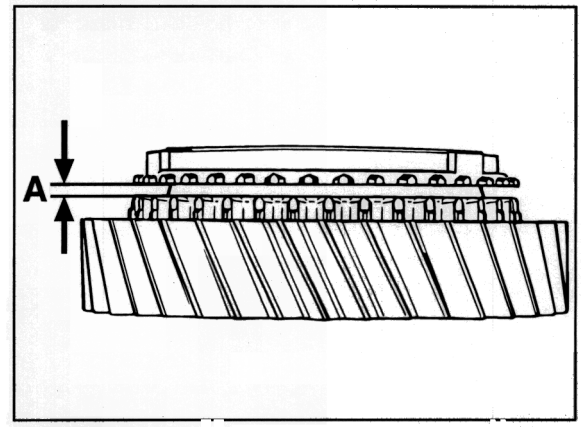
253_99

2. Using a suitable separator (e.g. Kukko 17-1), press all parts off the input shaft via the 3rd gear gearwheel

Assembly

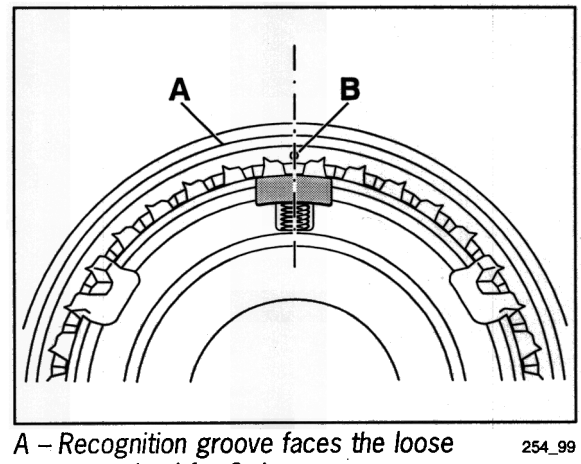
1. Check synchronising rings by pushing them onto the gear wheels and measuring the gap "A" with a feeler gauge.

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



323_99

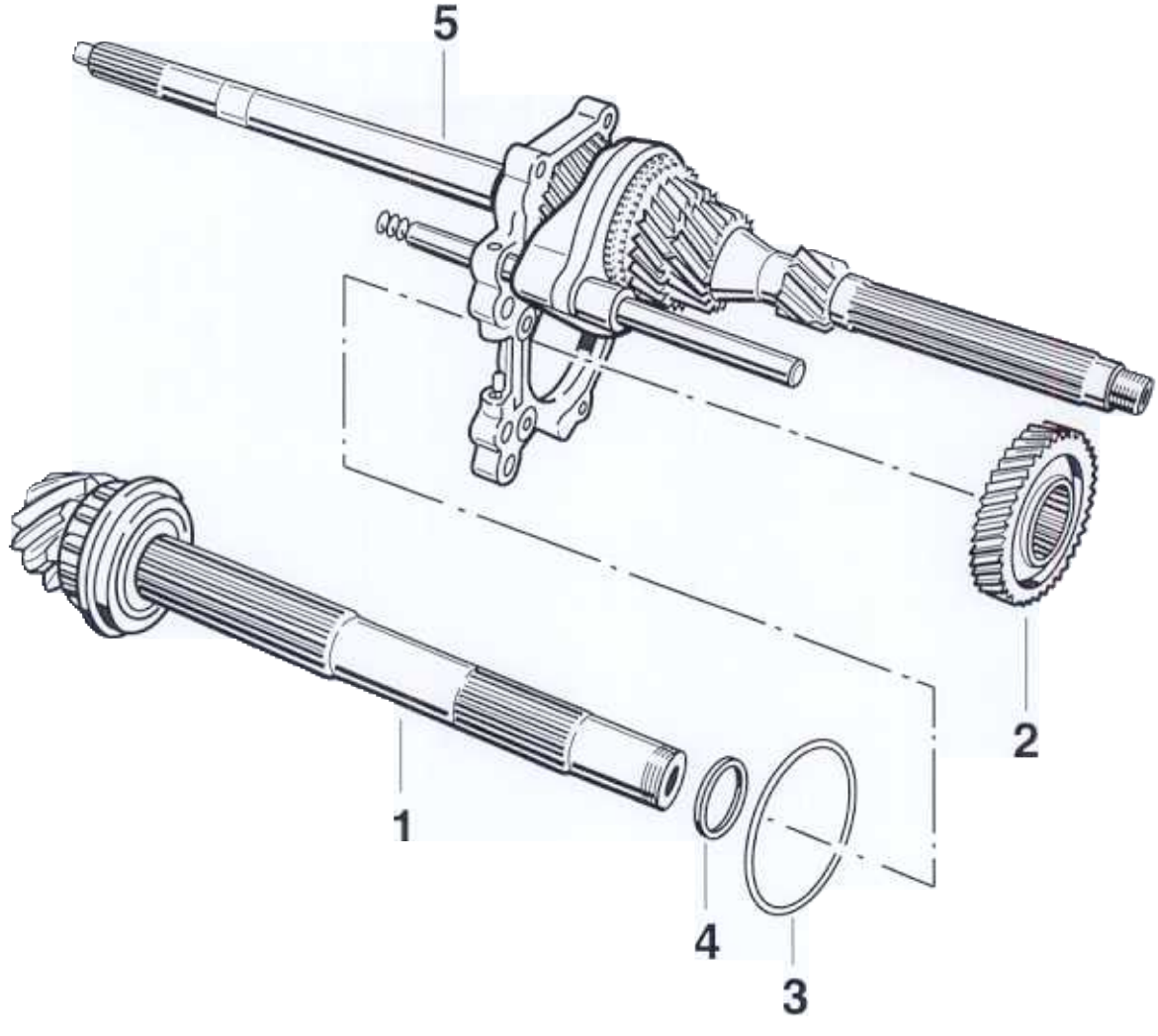
2. Marking of the shift collar.



A – Recognition groove faces the loose gear wheel for 3rd gear
B – Dotting marks centred with respect to the driver dogs

254_99

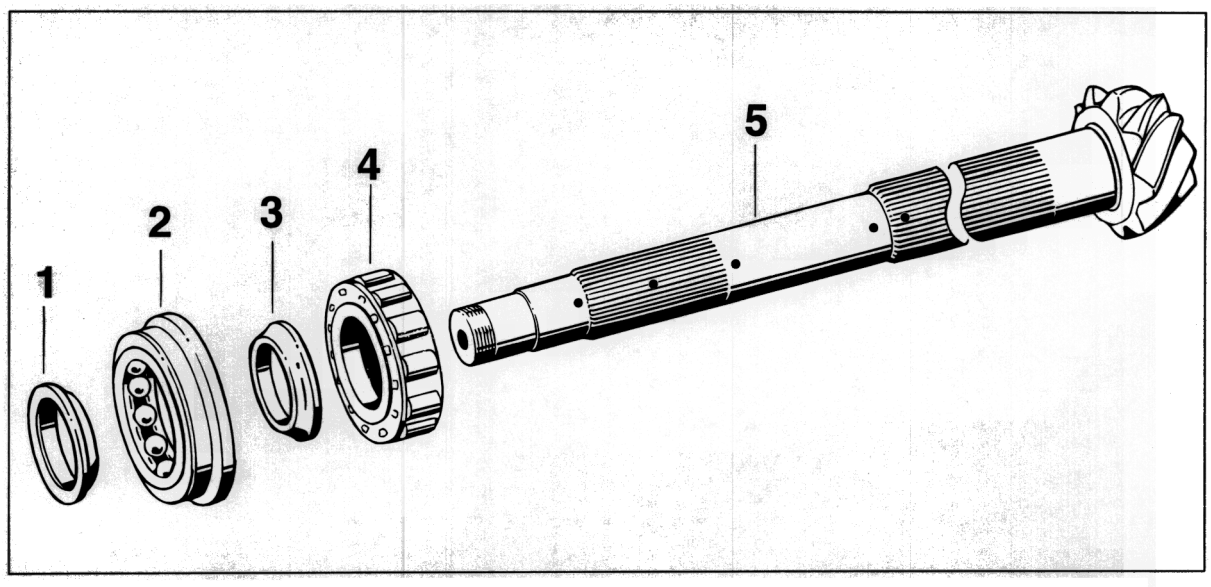
35 59 19 Removing and installing pinion shaft – GT3



198_99

No.	Designation	Qty.	Removal / Note:	Installation
1	Pinion shaft	1		Observe pairing number.
2	Fixed gearwheel for 4th gear	1		Large flat-ground collar faces the tensioning plate
3	Adjusting shim (S_4)	X	Note the quantity and thickness for reinstallation	
4	Adjusting shim (S_5)	X	Note the quantity and thickness for reinstallation	
5	Input shaft with tensioning plate	1		

35 61 55 Replacing bearings for pinion shaft – GT3

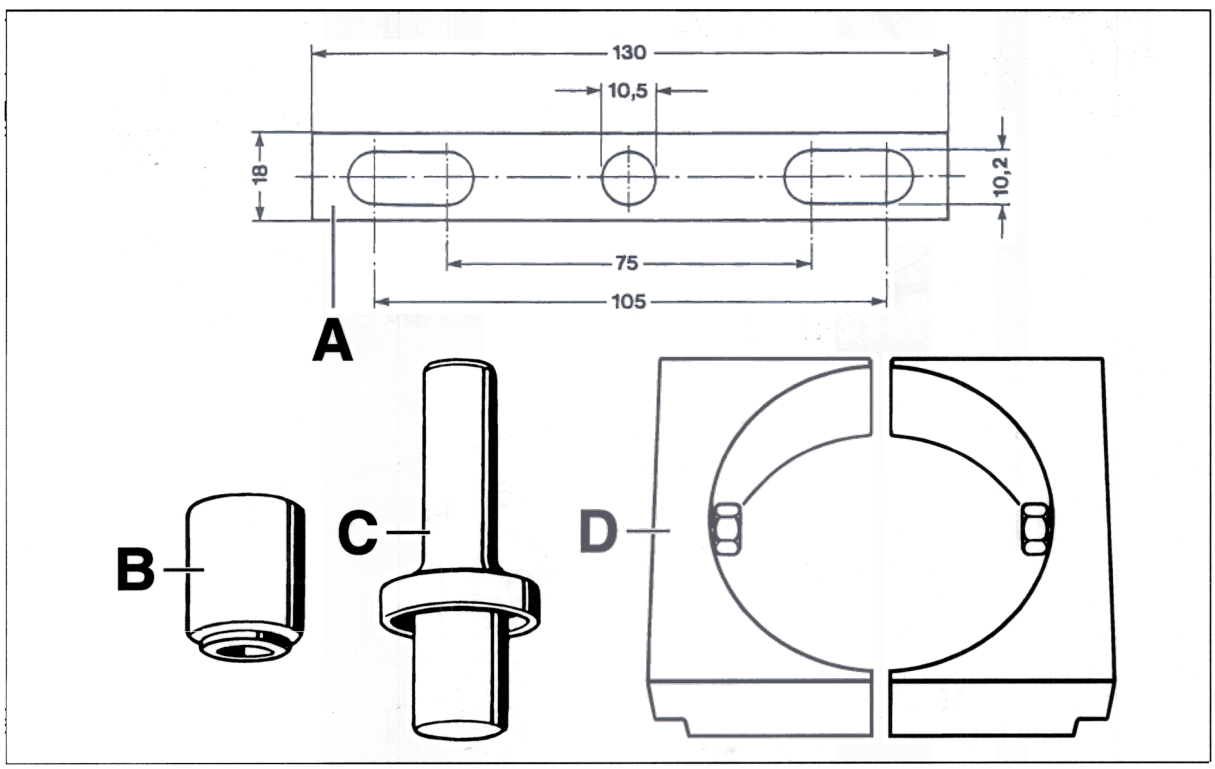


152_99

No.	Designation	Qty.	Removal	Note: Installation
1	Bearing inner race	1	Mark for refitting, press off with a suitable separator (e.g. Kukko 15 - 17).	**Do not confuse with inner race No. 3.** Heat to approx. 120 °C and press on
2	Four-point bearing			
3	Bearing inner race	1	Mark for refitting, press off with a suitable separator (e.g. Kukko 15 - 17).	**Do not confuse with inner race No. 1.** Heat to approx. 120 °C and press on
4	Cylindrical-roller bearing	1	Press off with a suitable separator (e.g. Kukko 15 - 17)	Heat to approx. 120 °C and press on in correct position
5	Pinion shaft	1		Observe pairing number. Readjust if necessary

39 40 37 Disassembling and assembling GKN differential lock – GT3

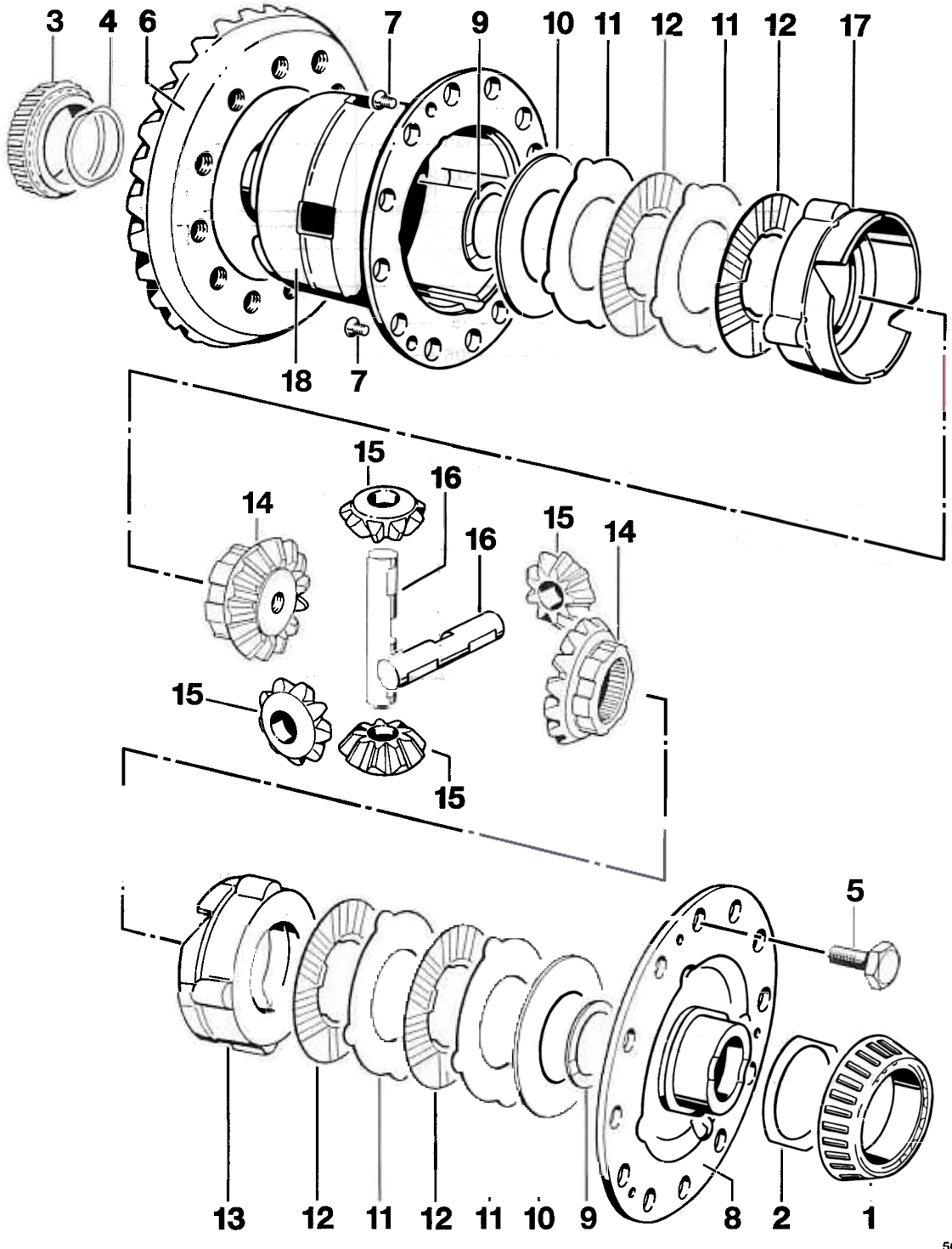
Tools



96_99

Item	Designation	Special tool	Explanation
A	Connecting piece		Shop-made (flat steel 6 x 18)
B	Pressure piece	P263	
C	Pressure piece	P264b	
E	Clamping jaws	9646	

Disassembling and assembling GKN differential lock



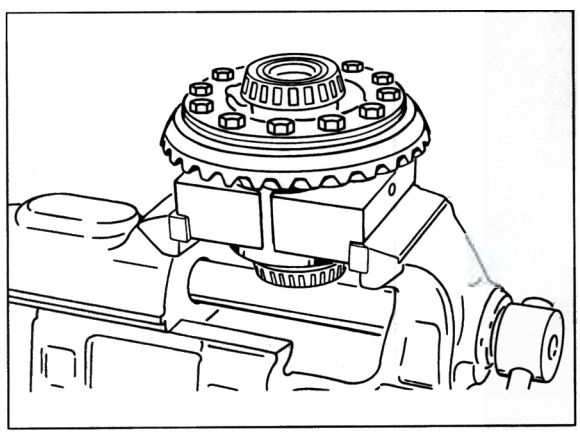
No.	Designation	Qty.	Note: Removal	Installation
1	Large inner race of tapered roller bearing	1	Pull off with special tool P263	Press on with special tool P264b
2	Adjusting shim	X	Mark for refitting	Determine thickness again if necessary
3	Small inner race of tapered roller bearing	1	Pull off with special tool P263	Press on with special tool P264b
4	Adjusting shim	X	Mark for refitting	Determine thickness again if necessary
5	Hexagon-head bolt (with ribbed support)	12	Clamp limited-slip differential into the vice with special tool 9646	Always replace. Thread must be dry and free of grease. Tighten to 200 Nm (148 ftlb.)
6	Crown wheel	1		Thread holes must be dry and free of grease. Observe pairing number. Readjust if necessary
7	Countersunk screw	3		Tighten to 15 Nm (11 ftlb). Remove grade on bolt head if necessary
8	Lid	1	Mark installation position for refitting	
9	Thrust plate	2		Stick to lid with viscous grease
10	Cup spring	2		Insert in correct position
11	Outer disc	4		
12	Inner disc	4		
13	Thrust ring (outside)	1	Mark for refitting	Do not confuse with thrust ring no. 17
14	Shaft bevel gear (with threaded washer)	2		
15	Bevel pinion	4		
16	Axle	2		

No.	Designation	Qty.	Note: Removal	Installation
17	Thrust ring (inside)	1	Mark for refitting	Do not confuse with thrust ring no. 13
18	Housing	1		

Disassembly and assembly instructions

Disassembly

1. Clamp the differential lock into the vice using special tool **9646** and unscrew the crown wheel screws.



097_99

2. Mark installation position of lid in relation to housing for retrofitting.

3. Unscrew countersunk screws (no. 7), remove lid and take out all inner parts. Mark thrust rings for refitting.

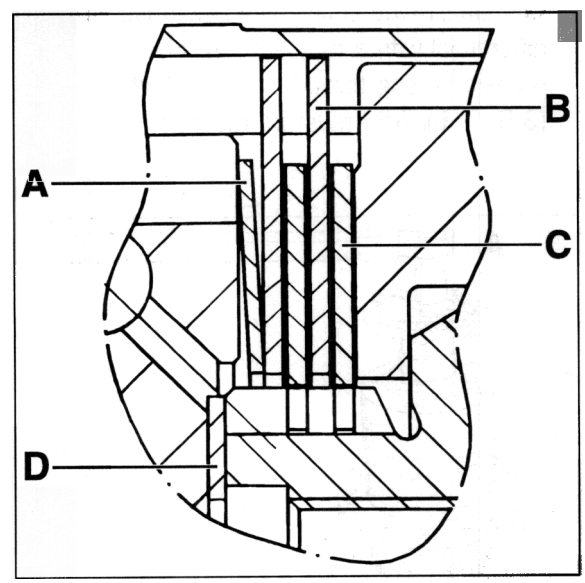
Assembly

Note

Always replace the **complete** disc pack in the case of repairs.
Replacing individual discs is not permitted.

1. Lightly oil all surfaces of the discs, thrust rings and axles with transmission oil.

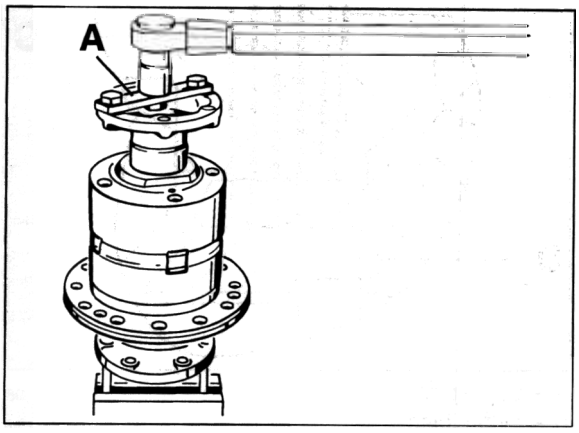
2. Install cup springs so that the cambers point inwards to the disc pack.



563_98

A – Cup spring
B – Outer disc
C – Inner disc
D – Thrust plate

3. After assembly, measure the basic locking torque with one shaft bevel gear driven and the other one fixed. To do this, clamp one flange in the vice with two screws and position differential. Insert second flange with shop-made connecting piece and turn differential with a torque screwdriver.
A basic locking torque of **5 ... 15 Nm (3.5 ... 11 ftlb)** must be reached.

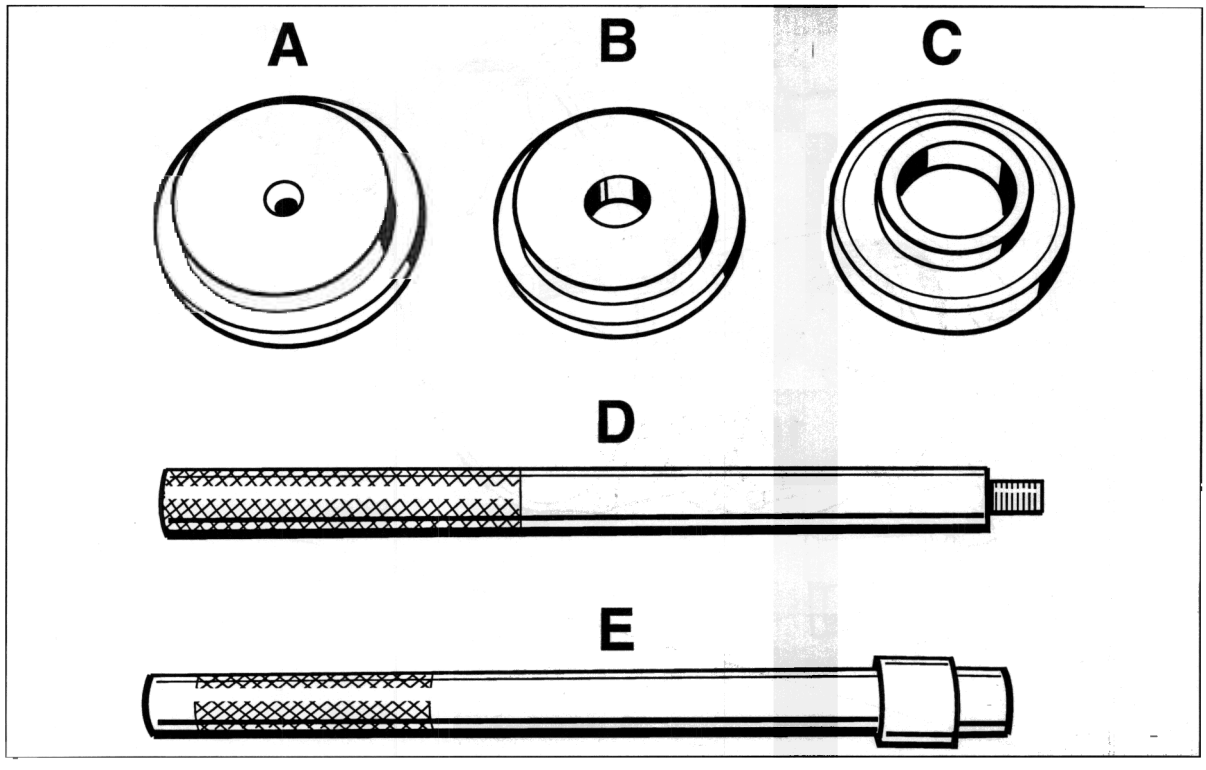


571_98

No.	Designation	Qty.	Note: Removal	Installation
1	Hexagon-head bolt	2		Tighten to **44 Nm** (33 ftlb.)
2	Halfshaft flange	2		
3	Hexagon-head bolt	12		Tighten to **25 Nm** (19 ftlb.)
4	Lid	1		
5	O-ring	1		Replace, apply light coat of oil, do not twist
6	Differential lock	1		
7	Sealing ring	2		Fill the space between the dust and sealing lips with grease (e.g. Liqui Moly). Drive in with pressure piece **9252** as far as the mounting face.
8	Bearing outer race	1	Drive out with aluminium or copper mandrel, changing sides	Drive in as far as the stop with special tools **3062** and **VW 295**
9	Bearing outer race	1	Heat lid to approx. 120°C	Heat lid to approx. 120°C When thermal equilibrium is reached, drive in with mandrel of special tool **P254** and special tool **9247/4**
10	Pan-head screw	2		Tighten to **8.5 Nm** (6 ftlb.)
11	Oil pan			
12	Transmission housing	1		

39 40 19 Removing and installing differential lock – GT3

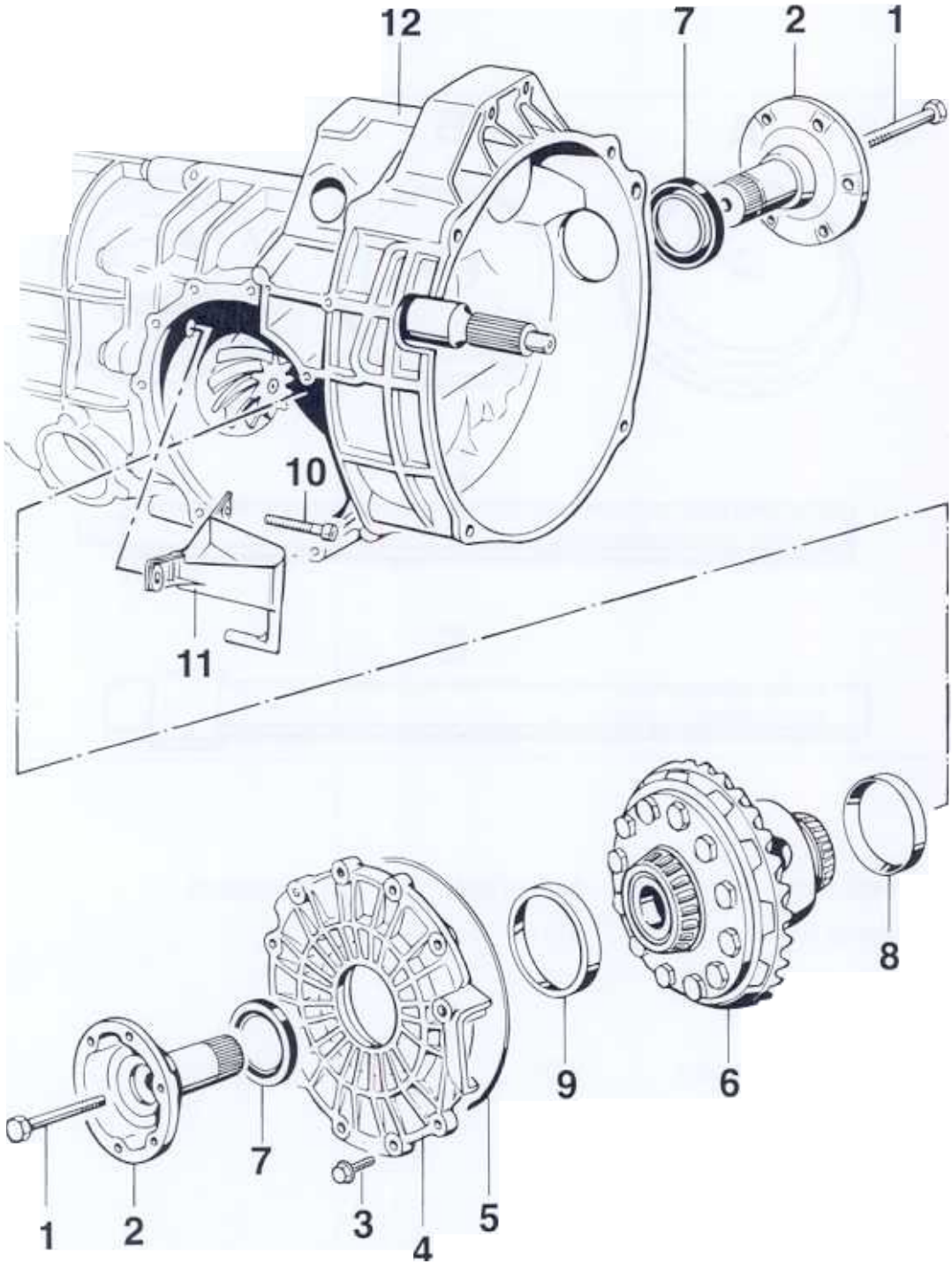
Tools



311_99

Item	Designation	Special tool	Explanation
A	Pressure piece	9247/4	
B	Pressure piece	3062	
C	Pressure piece	9252	
D	Pull-in tool and extractor	P254	
E	Mandrel	VW295	

Removing and installing differential lock



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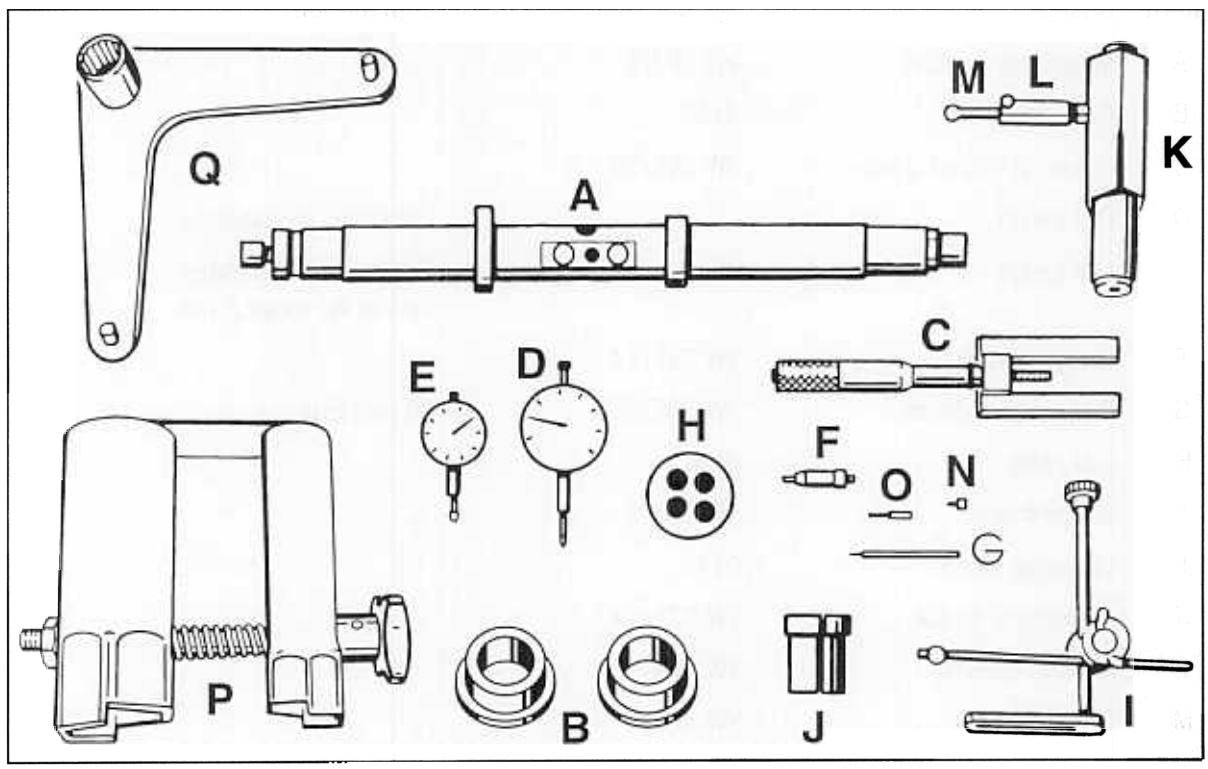
39 08 15 Adjusting drive set – GT3

Tools



381_99

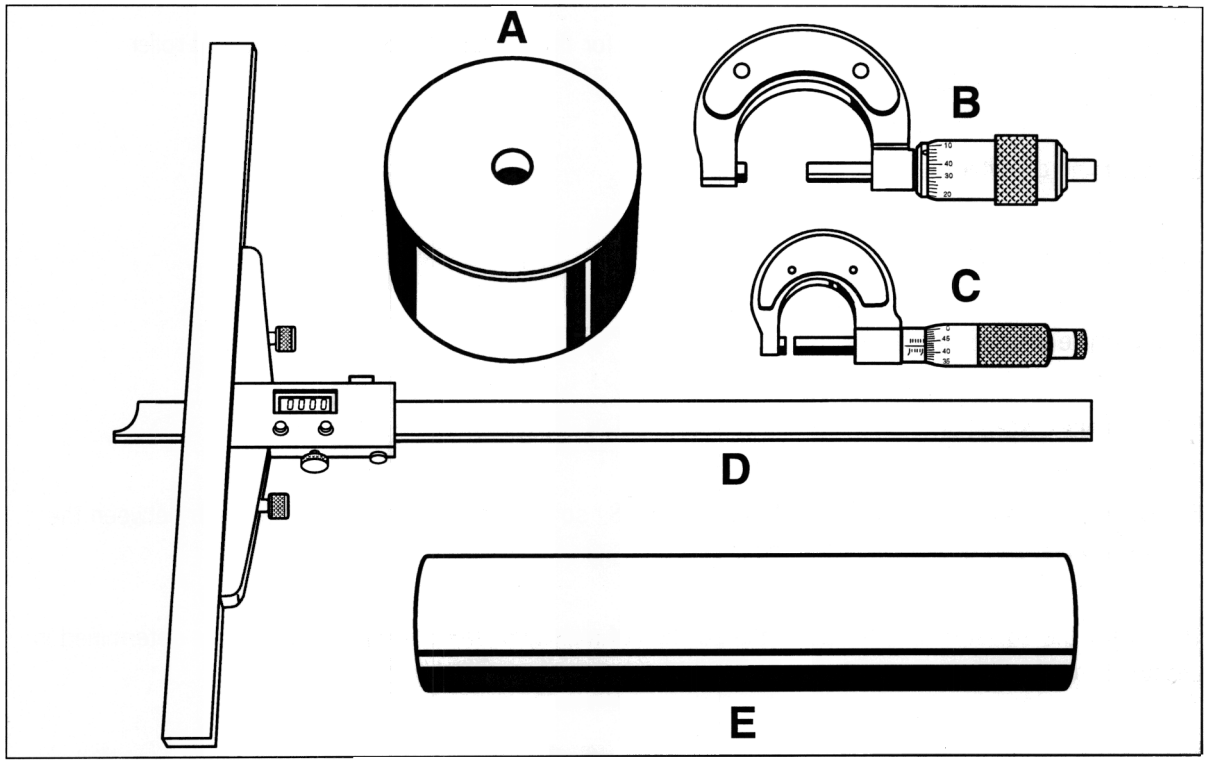
Adjusting drive set

Tools

Item	Designation	Special tool	Explanation
A	Measuring mandrel	VW 385/1	
B	Centring discs	9109	
C	Universal master gauge	VW 385/30	
D	Dial gauge		Commercially available
E	Dial gauge		Commercially available, measuring range 3 mm
F	Gauge plunger	VW 385/14	
G	Dial gauge extension	VW 385/56	30 mm long
H	End plate	9281	
	Gauge holder	VW 387	
J	Clamping sleeve	9145	
K	Adjustment device	VW 521/14	
L	Measuring lever	VW 388	
M	Gauge plunger	VW 388	
N	Dial gauge extension	VW 382/10	6.0 mm long
O	Dial gauge extension	9150	20 mm long
P	Clamping device	9562	
Q	Retaining device	9253	

Adjusting drive set

Tools



391_99

Item	Designation	Special tool	Explanation
A	Measuring plate	9508/1	
B	Micrometer		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 135)
C	Micrometer		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 135)
D	Depth gauge with digital display		Commercially available (refer to Technical Equipment Manual, Chapter 2.4, No. 140)
E	Assembly sleeve	9263	

Appropriate sequence for readjusting the drive set

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

1. Determine total disc thickness "Stot" (S_1 plus S_2) for the correct preload of the tapered roller bearings/differentials.

2. Determine disc thickness "S_3".

3. Determine disc thickness "S_4".

4. Determine disc thickness "S_5".

5. Determine installation dimension "E".

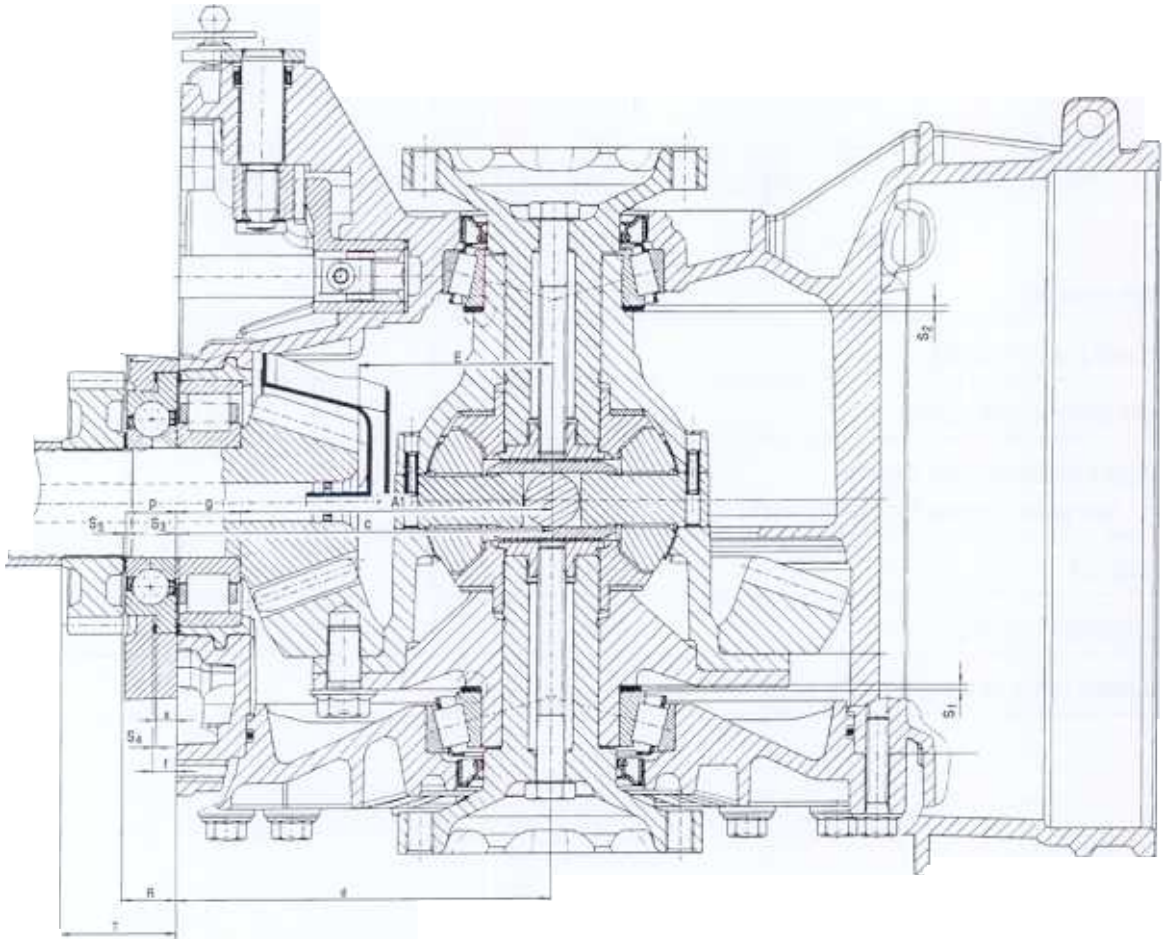
6. Divide the total disc thickness "Stot" into S_1 and S_2 so that the circumferential backlash between the crown wheel and drive pinion is correct.

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

The greatest possible cleanliness during all assembly work and measuring procedures is an essential requirement for a perfect result.

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

Adjust: Part replaced	Crown wheel (S_1 + S_2)	Drive pinion (S_3/S_4/S_5)
Transmission housing	x	x
Side transmission cover	x	
Large cylindrical-roller bearing and four-point bearing for pinion shaft	x	
Drive set	x	
Differential housing	x	
Tapered roller bearing for differential	x	



384_99

Care and cleanliness during all assembly work and measuring procedures are essential requirements for a perfect result.

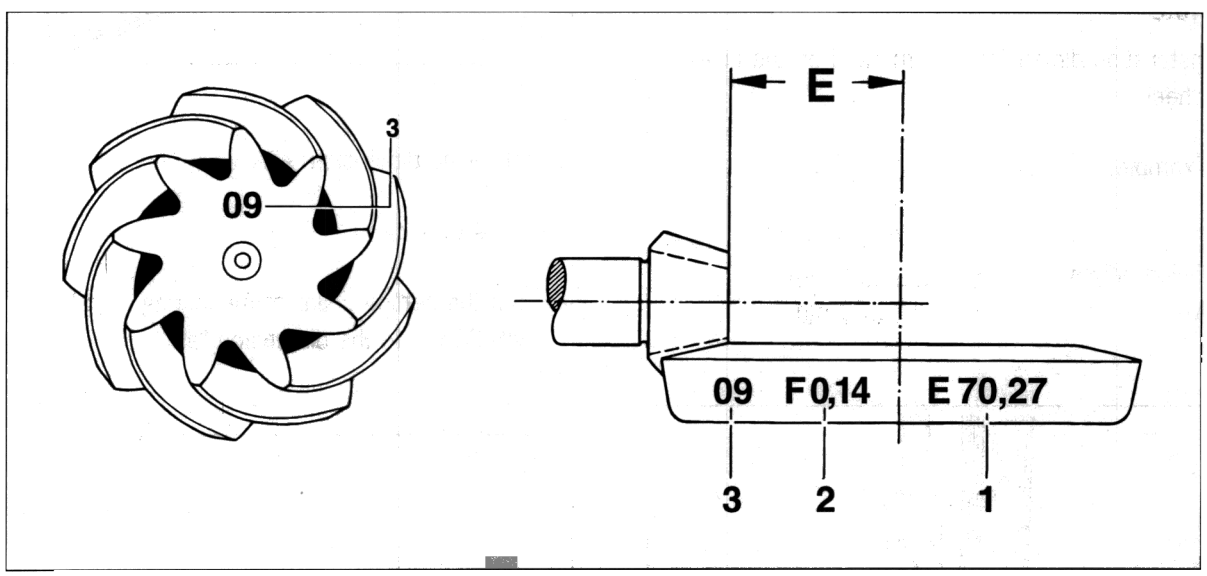
Key to symbols

S_3	=	Disc thickness, transmission housing side
S_4	=	Disc thickness, retaining plate side
S_5	=	Disc thickness between 4-point bearing and gearwheel for 4th gear (combination of two discs and deviation in the total disc thickness used of ± 0.03 mm permissible)
S_2	=	Disc thickness on small tapered roller bearing
S_1	=	Disc thickness on large tapered roller bearing (crown wheel side)
E	=	Installation dimension. Max. deviation from the installation dimension engraved on the crown wheel: ±0.04 mm.
c	=	Distance from centre of differential/flat surface in recess of the transmission housing bearing bore
d	=	Distance from centre of differential /flat surface of transmission housing
f	=	Depth of the bearing opening in the retaining plate
g	=	Bearing width of cylindrical-roller bearing
p	=	Bearing width of 4-point bearing
s	=	Rib width of 4-point bearing
R	=	Position of gear set (always 19.6 mm). Flat surface of transmission housing to right-hand flat surface of the hub of the gear wheel for 4th gear
T	=	Check dimension, gear set position = 41.575 ± 0.055 mm (only for production).
A_1	=	Installation dimension of pinion shaft
V_1	=	Preload of main bearing assembly on the tensioning plate side: 0.07 mm

39 08 15 Adjusting drive set – GT3

General

The adjustment of the pinion shaft and crown wheel is crucial for the service life and smooth running of the rear-wheel drive assembly. Therefore, the drive wheel and crown wheels are paired as early as during manufacture. They are checked with special testing machines to ensure a good positon of the contact pattern and low noise in both directions of rotation. The position with the greatest smoothness of operation is determined by shifting the pinion shaft in axial direction. This position is then marked on the crown wheel as the installation dimension "E".



383_99

E = Installation dimension
1 = Installation dimension "E" (e.g. 70.27 mm)
2 = Circumferential backlash "F" (e.g. 0.14 mm)
3 = Pairing number

Adjusting drive set

Adjusting pinion shaft

Determining thickness of adjusting shim "S_3"

$S_3 = A_1 + g - c$

Determine A_1

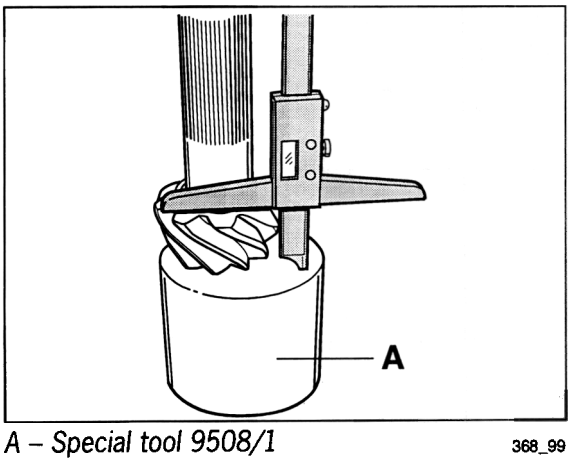
A_1 = Installation dimension E + pinion height

Note

Installation dimension E is marked on the crown wheel.

Example:

E	70.27 mm
Pinion height	+ 42.31 mm
A_1	112.58 mm

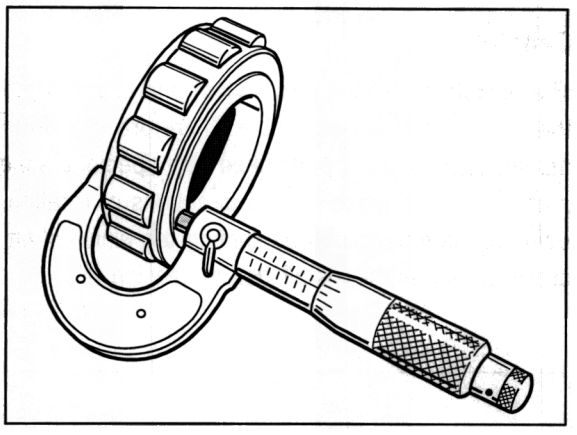


A – Special tool 9508/1 368_99

2. Determine dimension "g".

Measure width of cylindrical-roller bearing.

For example: 22.96 mm

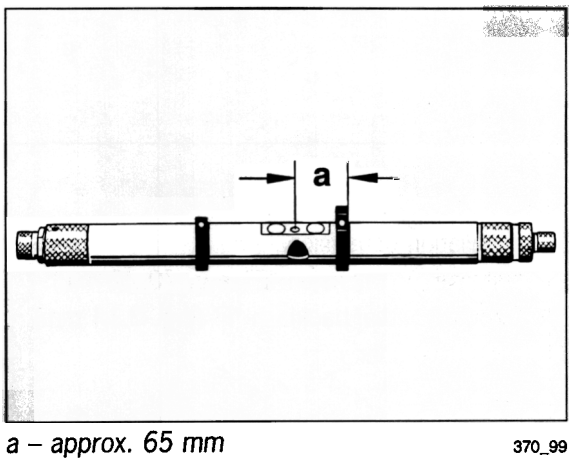


369_99

3. Determine dimension "c".

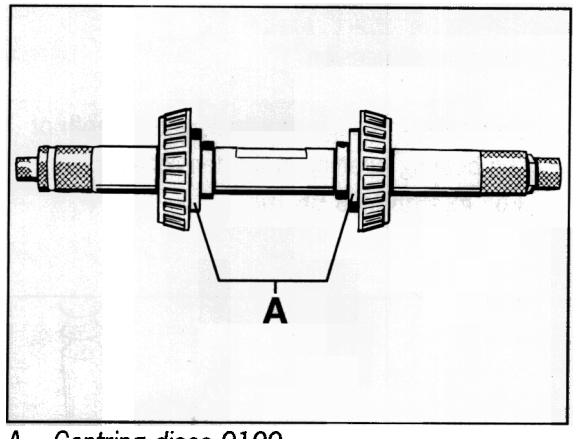
$c = c_1 + c_2 - c_3$

Set the setting collar of measuring mandrel VW 385/1 to the dimension "a".



a – approx. 65 mm 370_99

Fit centring discs **9109** and tapered roller bearings on the measuring mandrel and insert it into the housing.

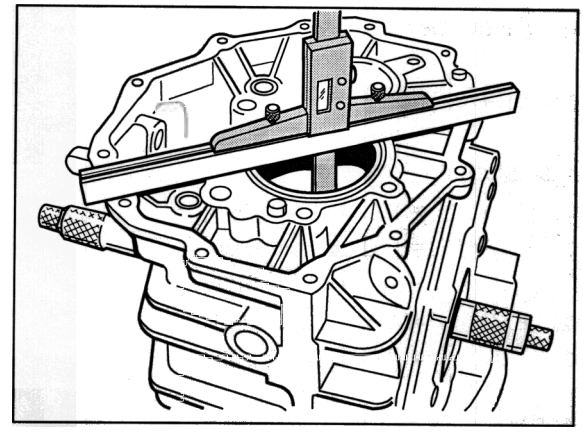


A – Centring discs 9109 371_99

Fit side transmission cover **without** sealing rings and fasten it with four screws tightened in diagonally opposite sequence.

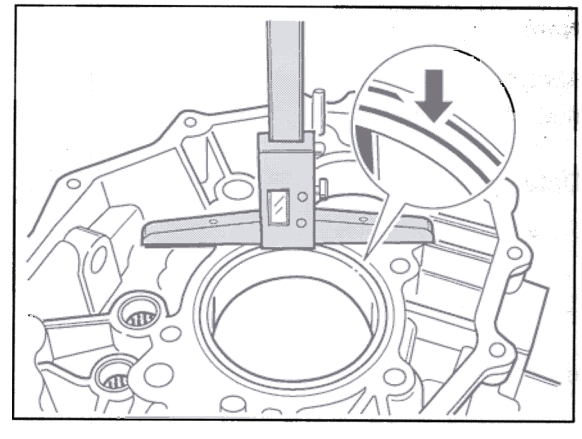
Pull out the 2nd centring disc with the spindle far enough so that the measuring mandrel can still just be turned manually.

Determine "c_1".
To do this, measure with a depth gauge from the flat housing surface onto the measuring mandrel.
For example: 119.00 mm



373_99

Determine "c_3".
To do this, measure with a depth gauge from the flat housing surface onto the cast-in rim.
For example: 0.45 mm



372_99

"c_2" = Measuring mandrel radius

Determine "c"

$c = c_1 + c_2 - c_3$

Example:

c_1	=	119.00 mm
c_2	=	+ 16.00 mm
		135.00 mm
c_3	=	– 0.45 mm
c	=	134.55 mm

4. Determine disc thickness "S_3".

$S_3 = A_1 + g - c$

A_1	=	112.58 mm
g	=	+ 22.96 mm
		135.54 mm
c	=	– 134.55 mm
S_3	=	0.99 mm

Note

Always round the calculated disc thickness up or down to the nearest 0.05 mm.

Determining thickness of adjusting shim "S_4"

$S_4 = d + f - s - S_3 - c + V_1$

1. Determe dimension "d".

$d = d_1 + d_2$

determine d_1

To do this, measure with a depth gauge from the flat housing surface onto the measuring mandrel (as in measurement of "c_1").
For example: 119.00 mm

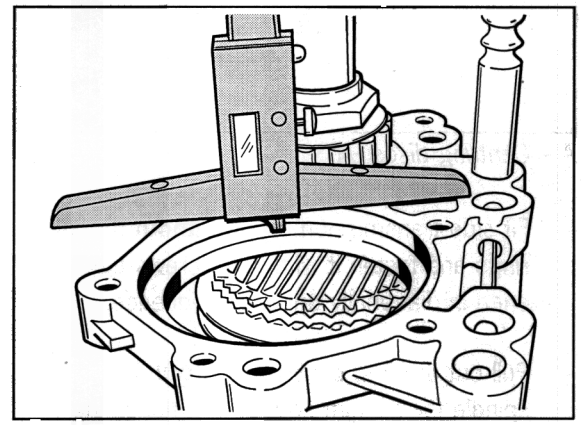
d_2 = Measuring mandrel radius

determine d:

d_1	=	119.00 mm
d_2	=	+ 16.00 mm
d	=	135.00 mm

2. Determine dimension "f"

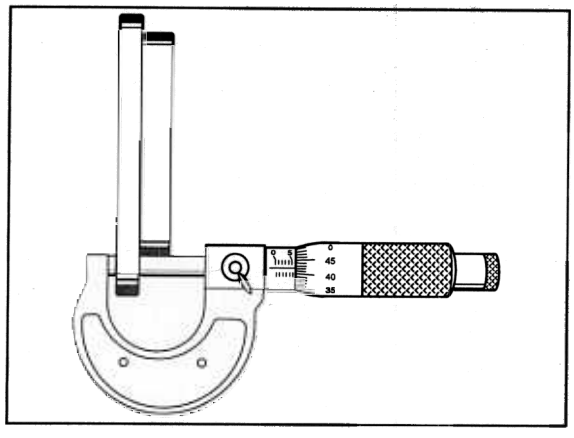
Use a depth gauge to measure the depth of the bearing opening in the tensioning plate.
For example: 8.56 mm



374_99

3. Determine dimension "s"

Measure rib width of the four-point bearing.
For example: 6.98 mm



386_99

4. Determine disc thickness "S_4"

S_4 = d + f – s – S_3 – c + V_1

d		135.00 mm
f	=	+ 8.56 mm
		143.56 mm
s	=	– 6.98 mm
		136.58 mm
S_3	=	– 1.00 mm
		135.58 mm
c	=	– 134.55 mm
		1.03 mm
V_1	=	+ 0.07 mm
S_4	=	1.10 mm

V_1= Preload is always 0.07 mm

Note

Round the calculated disc thickness up or down to the nearest 0.05 mm.

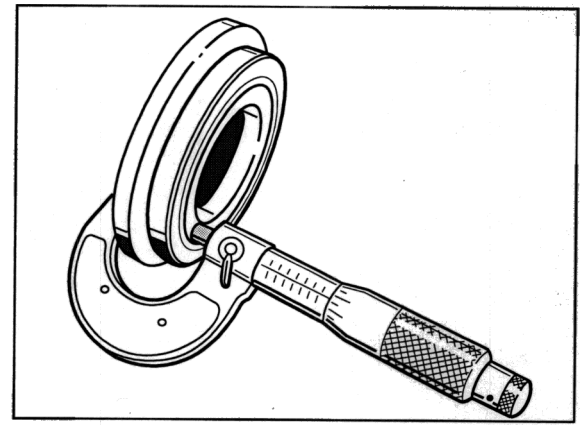
Determining thickness of adjusting shim "S_5"

S_5 = d + R – p – S_3 – c

R = Design position of the gear set. **Always 19.6 mm**

1. Determine dimension "p".

Measure bearing width of the four-point bearing.
For example: 17.95 mm



377_99

2. Determine disc thickness "S_5"

$S_5 = d + R - p - S_3 - c$

d	=	135.00 mm
R	=	+ 19.60 mm
		154.60 mm
p	=	– 17.95 mm
		136.65 mm
S_3	=	– 1.00 mm
		135.65 mm
		– 134.55 mm
S_5		1.10 mm

Note

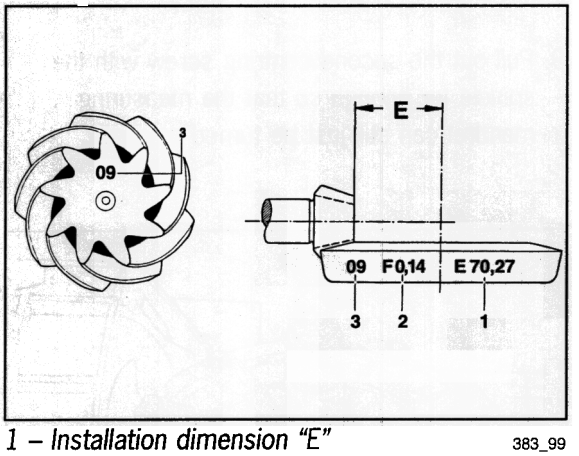
Always round the calculated disc thickness up or down to the nearest 0.05 mm.

39 08 15 Adjusting drive set – GT3

Checking installation dimension "E"

Note

Installation dimension "E" is marked on the crown wheel.

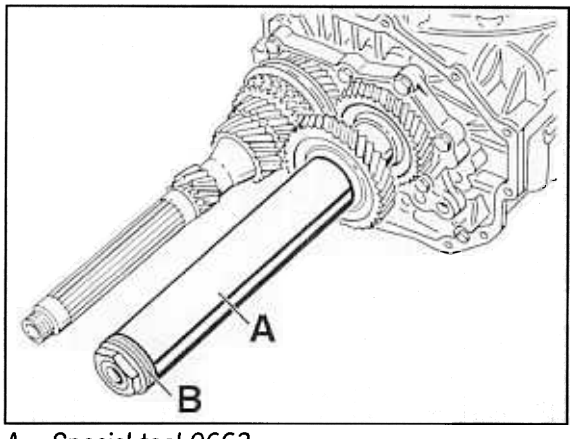


1 – Installation dimension "E" (e.g. 70.27 mm) 383_99

1. Install gear set with adjusting shims "S_3", "S_4" and "S_5", and tighten all hexagon-head bolts for the tensioning plate to **25 Nm** (19 ftlb.).

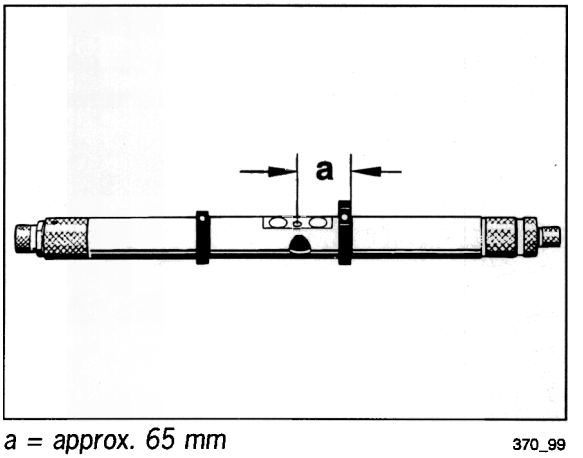
2. Shift into 4th gear.

3. Fix the drive shaft with special tool **9253** and tighten the collar nut for the pinion shaft to **300 Nm** (222 ftlb.).



A – Special tool 9663
B – Discs (Part No. 950.302.296.03) 387_99

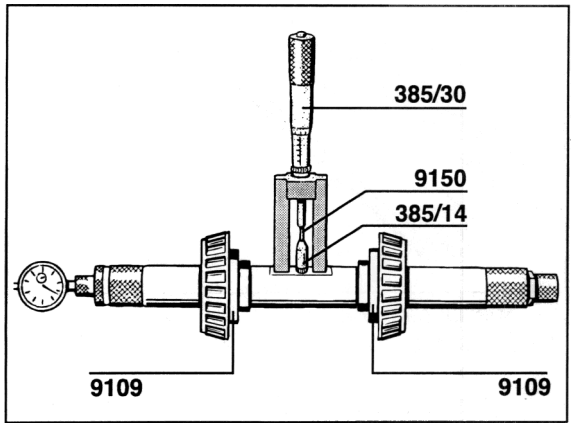
4. Set the setting collar of measuring mandrel **VW 385/1** to the dimension "a".



a = approx. 65 mm 370_99

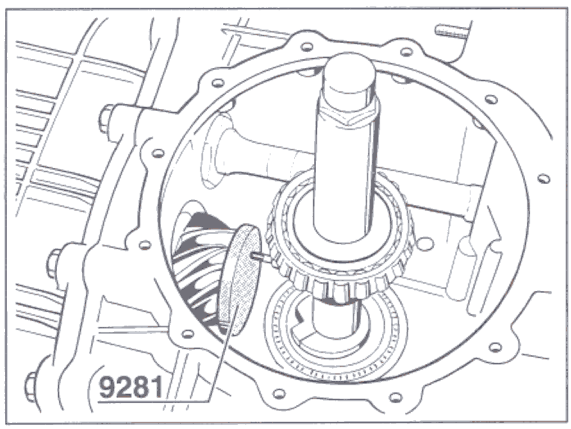
5. Complete measuring mandrel with centring discs **9109**, tapered roller bearings, gauge plunger **VW 385/14** and dial gauge extension **9150**.

6. Use master gauge **385/30** to set the measuring mandrel to the setting dimension (in the example: 70.27 mm). Zero the dial gauge (3 mm measurement range) with 1 mm preload.



378_99

7. Place final dimension plate **9281** on the drive pinion head and insert the measuring mandrel into the transmission housing. The dial gauge extension lies in the area of the final dimension plate.



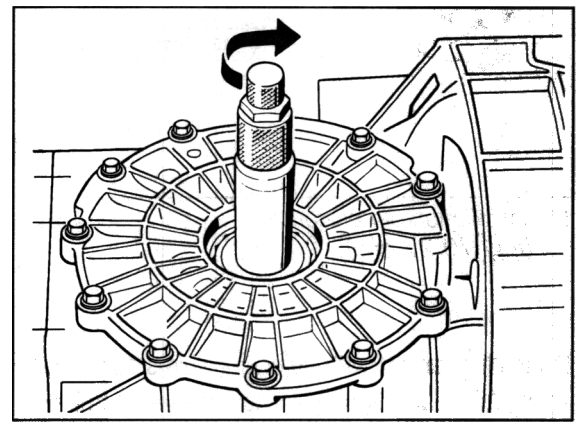
388_99

8. Fit side transmission cover **without** O-ring and fasten it with four screws tightened in diagonally opposite sequence.

Note

Do not use a hammer when fitting the side transmission cover (the final dimension plate is held by magnets and could fall off). Move the cover to its installation position only by uniformly tightening the screws.

9. Pull out the second centring screw with the spindle far enough so that the measuring mandrel can still just be turned manually.



389_99

10. Carefully turn the measuring mandrel until the dial gauge extension is at right angles to the front face of the drive pinion head. It is at this point that the dial gauge pointer reaches its max. deflection (reversal point) and the dial gauge can be read off.

Note

Maximum deviation of the measured value from the set installation dimension "E": ± 0.04 mm.

39 08 15 Adjusting drive set – GT3

Adjusting crown wheel

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

Readjustment of the crown wheel is necessary if:

the transmission housing, side transmission cover, taper roller bearings for the differential, differential housing or gear set is replaced.

Note

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

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

2. Fit one 2.5 mm thick spacer ring each on the crown wheel side and the opposite side of the differential to be used.

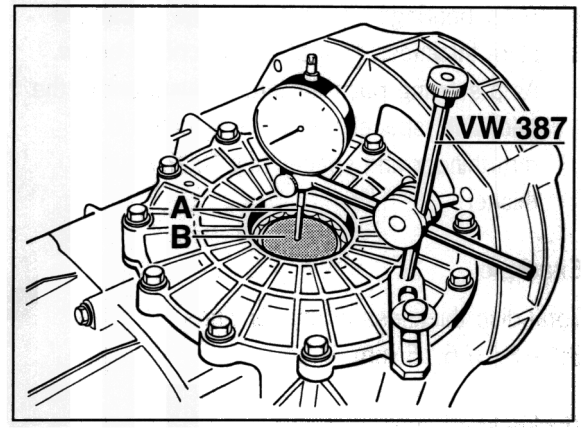
3. Fit special tool **VW 521/4** opposite the crown wheel (S_2 side) in the differential housing.

4. Fit differential into the transmission housing and turn it through several revolutions.

5. Install the side transmission cover without sealing ring and tighten all hexagon-head bolts to **25 Nm** (19 ftlb.).

6. Place the final dimension plate **VW 385/17** onto the collar of the differential.

7. Secure the universal dial gauge holder **VW 387** with dial gauge and extension on the housing and set it to "0" with 2 mm preload.



365_99

A = Dial gauge extension (approx. 30...40 mm long)
B = Final dimension plate **VW 385/17**

8. Move the differential up and down with special tool **VW 521/4**. Read and make a note of the play indicated on the dial gauge.

Note

Do not turn the differential when measuring the play, otherwise the measurement result will be falsified.

9. Calculate "S tot.".
   "S tot." = Shim thickness used
   + Measurement result
   + Compression of the tapered roller bearings

Example

Shim thickness used	5.00 mm
Measurement result	0.75 mm
Compression (constant value)	0.40 mm
"S tot."	6.15 mm

10. Remove the differential, pull off both tapered roller bearings and distribute the calculated shim thickness "S tot." as described below. As a starting point for later adjustment of the backlash, spacer ring S_1 is selected 0.70 mm thinner and spacer ring S_2 0.70 mm thicker.

Example

Total disc thickness of spacer rings
$S_1 + S_2 = 6.15$ mm

Thickness of spacer ring S_1

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

Thickness of spacer ring S_2

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

Note

The spacer rings are available in thicknesses from 1.5 to 2.8 mm in increments of 0.05 mm.

The calculated ring thicknesses must be rounded up or down to the dimensions to be used so that the total disc thicknesses S_1 and S_2 are not changed.

Example:

Calculated ring thicknesses

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

Rounded ring thicknesses

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

Measure the adjusting shims at several points with a micrometer. Permissible size deviation: 0.02 mm. Also check shims for burrs and signs of damage.

Setting circumferential backlash

Note

The backlash to be set is inscribed on the edge of the crown wheel.

1. Fit the gear set with the adjusting shims determined during adjustment of the pinion shaft.

Note

Always tighten the collar nut of the drive pinion to **300 Nm** (222 ftlb.) before carrying out the measurement.

2. Fit the differential with tapered roller bearings and the determined spacer rings (S_1 + S_2) into the housing.

3. Put on the side transmission cover and tighten all hexagon-head bolts to **25 Nm** (19 ftlb).

Note

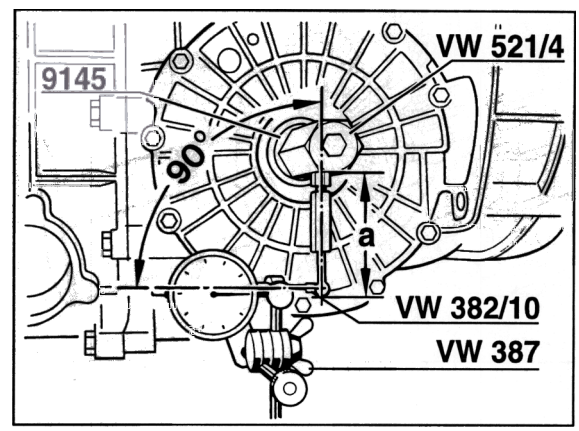
Always make sure a certain amount of backlash is present when tightening the screws. The drive pinion must not jam under any circumstances.

4. Screw measuring lever **VW 388** together with the adjusting device **VW 521/4** and set the lever length to 91 mm using the gauge plunger. See dimension "a" in the illustration.

5. Insert the adjusting device with clamping sleeve (special tool **9145**) into the differential and clamp it securely.

6. Turn the differential several times in both directions so that the tapered roller bearings can settle.

7. Fit the universal dial gauge holder with flat extension so that a right angle is produced between the dial gauge axis and the lever.

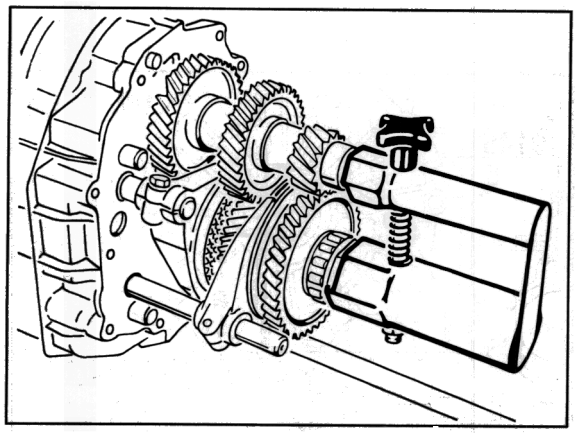


Dimension "a" = 91 mm 366_99

8. 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

It is essential to fix the drive pinion with special tool **9562** during the measurement.



390_99

9. Repeat the measuring procedure another three times after continuing to turn the crown wheel through 90° in each case. The measured values must not differ by more than 0.03 mm.

Note

The backlash to be set is inscribed on the edge of the crown wheel. The permissible deviation is ± 0.04 mm.

10. The spacer rings (S_1 + S_2) must be changed again if the prescribed backlash is not attained. The total shim thickness (S tot.) must not change, however.