

Workshop Manual OCTAVIA

Automatic Gearbox

List of Supplements to OCTAVIA Workshop Manual

Edition: 06.03

Automatic Gearbox

Replaces List of Supplements - Edition: 01.01

Supplement	Edition	Subject	Article Number
	08.96	Basic Edition of Workshop Manual	S00.5116.50.20
1	03.97	Supplement to Basic Edition	S00.5116.51.20
2	01.98	Supplement of New Gearbox Types	S00.5116.52.20
3	04.98	Supplement of New Gearbox Type	S00.5116.53.20
4	08.98	CAN Databus	S00.5116.54.20
5	12.98	Modifications to Shift Elements	S00.5116.55.20
6	03.99	Low-friction Bearings	S00.5116.56.20
7	06.99	Supplement of New Gearbox Types	S00.5116.57.20
8	04.00	Modifications to Repair Groups 00, 01, 32, 37, 38 and 39	S00.5116.58.20
9	01.01	Modifications to Repair Groups 00, 01, 34, 37 and 39	S00.5116.59.20
10	06.03	Modifications to Repair Groups 00, 01, 37, 38 and 39	S00.5116.60.20
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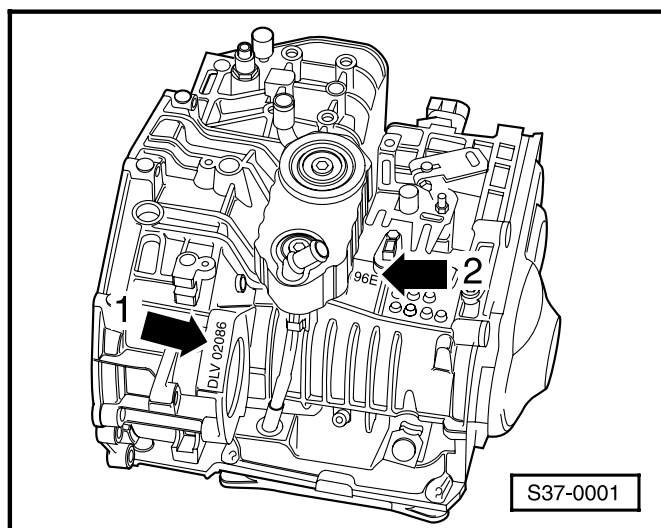
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Identification of gearbox

Location on gearbox

◀ Code letters (arrow 1)

Automatic gearbox 01M (arrow 2)



Example:	DTB	02	08	7
	Code letters	Day	Month	Year (1997) of manufacture

Note:

The code letters of the gearbox are also listed on the vehicle data plates.

SORT.NR.	
FAHRZG.-IDENT-NR. VEHICLE-IDENT-NO.	
TYP/TYPE	
MOTORKB./GETR.KB	
ENG.CODE/TRANS.CODE	
LACKNR./INNENAUSST.	
PAINT NO./INTERIOR	
M-AUSST./ OPTIONS	

V53-1283

◀ The vehicle data plate is located at the rear left on the floor of the luggage compartment.

Code letters, component assignment, ratios, equipment

Automatic gearbox			01M			
Gearbox	Code letters		DMS		DTB	
	Manufactured	from to	01.97 07.98		01.97 07.98	
Torque converter	Code letters		QADC		QADC	
Control valve body	Code letters		QEB ¹⁾		QEB ¹⁾ /QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		4	4	4	4
	Clutch -K2-		3	3	3	3
	Clutch -K3-		5	4	5	4
	Brake -B1-		4	4	4	4
	Brake -B2-		4	5	4	5
Assignment	Engine		1.6-ltr./74 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	45		61	
		Output gear	44		63	
	Ratio		0.978		1.033	
Final drive	No. of teeth	Drive pinion	14		16	
		Crown wheel	73		78	
	Ratio		5.214		4.875	
Drive shaft flange Ø			124 mm			

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		ECT		ERQ	
	Manufactured	from to	08.98 02.99		03.99 04.99	
Torque converter	Code letters		QADC		QADC	
Control valve body	Code letters		QFB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		4	4	4	4
	Clutch -K2-		3	3	3	3
	Clutch -K3-		5	4	5	4
	Brake -B1-		4	4	4	4
	Brake -B2-		4	5	4	5
Assignment	Engine		1.6-ltr./74 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	61		45	
		Output gear	63		44	
	Ratio		1.033		0.978	
Final drive	No. of teeth	Drive pinion	16		16	
		Crown wheel	78		78	
	Ratio		4.875		4.875	
Drive shaft flange Ø			108 mm			

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		ESB		ESE	
	Manufactured	from to	05.99 06.99		06.99 12.99	
Torque converter	Code letters		QADC		QADC	
Control valve body	Code letters		QFB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		4	4	4	4
	Clutch -K2-		3	3	3	3
	Clutch -K3-		5	4	5	4
	Brake -B1-		4	4	4	4
	Brake -B2-		4	5	4	5
Assignment	Engine		1.6-ltr./74 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	45		45	
		Output gear	44		44	
	Ratio		0.978		0.978	
Final drive	No. of teeth	Drive pinion	16		16	
		Crown wheel	78		78	
	Ratio		4.875		4.875	
Drive shaft flange Ø			108 mm			

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		ESJ		FDH	
	Manufactured	from to	01.00 02.00		02.00	
Torque converter	Code letters		QADD		QADD	
Slide valve body	Code letters		QFB ¹⁾		QFB ¹⁾ /QLB ¹⁾	
Number of disks			Inner	Outer	Inner	Outer
	Clutch -K1-		4	4	4	4
	Clutch -K2-		3	3	3	3
	Clutch -K3-		5	4	5	4
	Brake -B1-		4	4	4	4
	Brake -B2-		4	5	4	5
Assignment:	Engine		1.6 l/74 kW		1.6 l/74 kW, 75 kW	
Transmission ratio:	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	R/Reverse gear		2.884		2.884	
Intermediate gear	Number of teeth	Drive gear	45		61	
		Output gear	44		63	
	Transmission ratio		0.978		1.033	
Final drive	Number of teeth	Input shaft	16		16	
		Crown wheel	78		78	
	Transmission ratio		4.875		4.875	
Drive shaft flange Ø			108 mm			

¹⁾ In the Service Workshop the slide valve body is supplied as replacement part with the code letters **KD**.

Automatic gearbox			01M			
Gearbox	Code letters		DSD		ECS	
	Manufactured	from to	08.97 07.98		08.98 04.99	
Torque converter	Code letters		QADC		QADC	
Control valve body	Code letters		QEB ¹⁾ /QFB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		5	5	5	5
	Clutch -K2-		4	4	4	4
	Clutch -K3-		5	4	5	4
	Brake -B1-		5	5	5	5
	Brake -B2-		4	5	4	5
Assignment	Engine		1.8-ltr./92 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	61		61	
		Output gear	63		63	
	Ratio		1.033		1.033	
Final drive	No. of teeth	Drive pinion	15		15	
		Crown wheel	68		68	
	Ratio		4.533		4.533	
Drive shaft flange Ø			124 mm		108 mm	

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		DVH		ECP	
	Manufactured	from to	05.98 07.98		08.98 04.99	
Torque converter	Code letters		QCDC		QCDC	
Control valve body	Code letters		QEB ¹⁾ /QFB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		5	5	5	5
	Clutch -K2-		5	5	5	5
	Clutch -K3-		6	5	6	5
	Brake -B1-		6	6	6	6
	Brake -B2-		5	6	5	6
Assignment	Engine		1.8-ltr./110 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	45		45	
		Output gear	44		44	
	Ratio		0.978		0.978	
Final drive	No. of teeth	Drive pinion	15		15	
		Crown wheel	68		68	
	Ratio		4.533		4.533	
Drive shaft flange Ø			124 mm		108 mm	

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		ELU		EPC	
	Manufactured	from to	05.99 12.99		01.00 02.00	
Torque converter	Code letters		QCDC		QCDD	
Control valve body	Code letters		QFB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		5	5	5	5
	Clutch -K2-		5	5	5	5
	Clutch -K3-		6	5	6	5
	Brake -B1-		6	6	6	6
	Brake -B2-		5	6	5	6
Assignment	Engine		1.8-ltr./110 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	45		45	
		Output gear	44		44	
	Ratio		0.978		0.978	
Final drive	No. of teeth	Drive pinion	15		15	
		Crown wheel	68		68	
	Ratio		4.533		4.533	
Drive shaft flange Ø			108 mm			

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M	
Gearbox	Code letters		FDC	
	Manufactured	from to	02.00	
Torque converter	Code letters		QCDD	
Control valve body	Code letters		QFB ¹⁾ /QLB ¹⁾	
Number of discs			Inner	Outer
	Clutch -K1-		5	5
	Clutch -K2-		5	5
	Clutch -K3-		6	5
	Brake -B1-		6	6
	Brake -B2-		5	6
Assignment	Engine		1.8-ltr./110 kW	
Ratios	1st gear		2.714	
	2nd gear		1.441	
	3rd gear		1.000	
	4th gear		0.742	
	Reverse		2.884	
Intermediate drive	No. of teeth	Input gear	45	
		Output gear	44	
	Ratio		0.978	
Final drive	No. of teeth	Drive pinion	15	
		Crown wheel	68	
	Ratio		4.533	
Drive shaft flange Ø			108 mm	

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		ELZ		EPH	
	Manufactured	from to	05.99 12.99		01.00 02.00	
Torque converter	Code letters		QBDC		QBDD	
Control valve body	Code letters		QFB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		5	5	5	5
	Clutch -K2-		4	4	4	4
	Clutch -K3-		5	4	5	4
	Brake -B1-		5	5	5	5
	Brake -B2-		4	5	4	5
Assignment	Engine		2.0-ltr./85 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.441	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.742	
	Reverse		2.884		2.884	
Intermediate drive	No. of teeth	Input gear	45		45	
		Output gear	44		44	
	Ratio		0.978		0.978	
Final drive	No. of teeth	Drive pinion	15		15	
		Crown wheel	68		68	
	Ratio		4.533		4.533	
Drive shaft flange Ø			108 mm			

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M			
Gearbox	Code letters		FDG		FDF	
	Manufactured	from to	02.00		09.00	
Torque converter	Code letters		QBDD		QBDD	
Control valve body	Code letters		QFB ¹⁾ /QLB ¹⁾		QFB ¹⁾	
Number of discs			Inner	Outer	Inner	Outer
	Clutch -K1-		5	5	5	5
	Clutch -K2-		4	4	4	4
	Clutch -K3-		5	4	5	4
	Brake -B1-		5	5	5	5
	Brake -B2-		4	5	4	5
Assignment	Engine		2.0-ltr./85 kW			
Ratios	1st gear		2.714		2.714	
	2nd gear		1.441		1.551	
	3rd gear		1.000		1.000	
	4th gear		0.742		0.679	
	Reverse		2.884		2.111	
Intermediate drive	No. of teeth	Input gear	45		61	
		Output gear	44		63	
	Ratio		0.978		1.033	
Final drive	No. of teeth	Drive pinion	15		16	
		Crown wheel	68		78	
	Ratio		4.533		4.875	
Drive shaft flange Ø			108 mm			

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Automatic gearbox			01M	
Gearbox	Code letters		FDB	
	Manufactured	from to	09.00	
Torque converter	Code letters		QCDD	
Control valve body	Code letters		QFB ¹⁾	
Number of discs			Inner	Outer
	Clutch -K1-		5	5
	Clutch -K2-		5	5
	Clutch -K3-		6	5
	Brake -B1-		5	5
	Brake -B2-		5	6
Assignment	Engine		1.9-ltr./66 kW	
Ratios	1st gear		2.714	
	2nd gear		1.441	
	3rd gear		1.000	
	4th gear		0.742	
	Reverse		2.884	
Intermediate drive	No. of teeth	Input gear	45	
		Output gear	44	
	Ratio		0.978	
Final drive	No. of teeth	Drive pinion	20	
		Crown wheel	74	
	Ratio		3.700	
Drive shaft flange Ø			108 mm	

¹⁾ Control valve body with code letters **KD** is supplied as a replacement part by the Parts Sector.

Capacities

Planetary gear

Capacities	Planetary gear
New filling	5.3 l
Change	Filled for life, no top-up required
Lubricant	ATF G 052 162 ..

Note:

For the planetary gear in automatic gearbox 01M only lubricant ATF G 052 162 .. should be used.

ATF G 052 162 .. is available as spare part in the following sizes of can:

- ◆ 0.5 l - Spare part no. G 052 162 A1
- ◆ 1.0 l - Spare part no. G 052 162 A2
- ◆ 20.0 l - Spare part no. G 052 162 A6

Final drive

Capacities	Final drive
New filling	0.75 l
Change	Filled for life, no top-up required
Lubricant	Transmission oil (synthetic) G 005 000 .. SAE 75W90

Warning!

Under no circumstances must there be a mix-up of both fillings. Otherwise both fillings must be changed.

Repair information

Scrupulous care and cleanliness, as well as proper tools are essential requirements for carrying out perfect and successful gearbox repairs. The generally valid basic rules of safety naturally also apply to repair work.

A number of generally valid notes for individual repair operations - which are otherwise listed at several points in the workshop manual - are summarised here. They apply to this workshop manual.

Gearbox

- ◆ Do not run engine when the oil sump has been removed or without ATF in the engine and do not tow vehicle.
- ◆ When replacing the automatic gearbox, inspect the ATF in the planetary gear ⇒ page 37-22 and the ATF in the final drive ⇒ page 39-1, and top up if necessary. Capacities and specification ⇒ page 00-4.
- ◆ When the gearbox is removed, protect the torque converter from dropping out.
- ◆ Thoroughly clean connection points and the surrounding area before disconnecting.
- ◆ Before installing the gearbox, check the install dimension of the torque converter ⇒ page 32-3.
- ◆ When installing gearbox, ensure the dowel sleeves are correctly located.
- ◆ Place removed parts down on a clean surface and cover over. Use sheeting or paper. Do not use fluffing cloth!
- ◆ Carefully cover over or seal opened components if repairs are not carried out immediately.
- ◆ Install only clean parts: Do not remove replacement parts from their wrapping until just before installing.
- ◆ Rules for cleanliness when carrying out work on automatic gearbox ⇒ page 37-28.

O-rings, seals, gaskets

- ◆ Always replace O-rings, seals and gaskets.

- ◆ After removing gaskets, inspect the contact surface on the housing or shaft for burrs or damage related to removal operations.
- ◆ Coat the outer circumference and the sealing lip of seals with ATF for installing.
- ◆ Coat O-rings with ATF for inserting in order to avoid the rings being squashed when installed.
- ◆ On no account use any other lubricants in the ATF area otherwise there is a risk of operational problems with the hydraulic gear-box control.
- ◆ The open side of the seals points toward the fluid to be sealed.
- ◆ After installing, inspect ATF level in the final drive and planetary gear and adjust to correct level, if necessary.

Locking elements

- ◆ Do not over-tension circlips, replace if necessary.
- ◆ Circlips must be resting properly in the base of the groove.

Nuts, bolts

- ◆ Slacken the bolts in the opposite direction of the tightening sequence.
- ◆ Slacken and tighten nuts or bolts for attaching covers and housings diagonally in stages, if no tightening sequence is stated.
- ◆ Replace self-locking nuts.
- ◆ Clean the threads of bolts which are inserted with locking fluid, with a wire brush and then insert bolts with AMV 185 101 A1.
- ◆ The tightening torque's stated apply to non-oiled nuts and bolts.

Bearings

- ◆ Position needle bearings with the inscribed side (larger sheet thickness) toward the insertion drift.
- ◆ Insert bearings in gearbox with ATF. Carefully oil taper roller bearings in gearbox for friction torque measurements, particularly up to gearbox date of construction 26.4.1998.
- ◆ Do not insert taper roller bearings in gearbox with ATF from gearbox date of construction 27.4.1998.
- ◆ Do not mix up the outer and inner races of equally large bearings.
- ◆ Always replace all the taper roller bearings fitted to a shaft, and use makes of one manufacturer.

Shims

- ◆ Re-gauge shims with a micrometer at several points. Different tolerances make it possible to exactly gauge the required shim thickness.
- ◆ Inspect for swarf or damage. Install only shims which are in proper condition.

Internally-toothed discs

- ◆ Place new internally-toothed discs in ATF for 15 minutes before installing.

Control valve body

- ◆ If the shift elements are scorched, the control valve body should be replaced.

Clutches

- ◆ Clutches K1, K2 and K3 should be disassembled only for cleaning; if individual parts are faulty, replace clutch.
The clutches are assigned by means of the gearbox code letters.

Self-diagnosis

- ◆ Before carrying out service work on the automatic gearbox, determine the cause of the problem as accurately as possible with the aid of Repair Group 01 Self-Diagnosis ⇒ page 01-1.

Self-diagnosis

Function of self-diagnosis

The control of the automatic gearbox is performed electronically/hydraulically.

The term „self-diagnosis“ relates to this electrical/electronic control.

Control unit -J217- with driving situation shifts (fuzzy logic)

The determination of the gearbox shift point in line with the driving situation and resistance is carried out automatically.

Advantages:

- Gearshifts are conducted to achieve good fuel economy
- Maximum engine power is always available
- Individual adaptation of shift points to all driving situations
- Shift points can be altered as desired

Variation of shift points on uphill or downhill sections

When driving on uphill or downhill sections, the gearshifts are selected automatically by additional shift maps as a function of accelerator pedal position and vehicle speed.

- Shift map for driving on extreme uphill sections is matched to engine power
- Shift map for driving on extreme downhill sections is matched to the braking effect of the engine

Functions of the gearbox control unit

The automatic gearbox control unit -J217- receives information from components which affect the gearshifts and passes on this information to the solenoid valves with which the control valves in the control valve housing are operated.

To enable the cause of a failure of an electrical/electronic component or an open circuit in the wiring to be determined as rapidly as possible, the control unit is equipped with a fault memory. Faults are detected by electrical signals and stored in the fault memory.

Electrical faults which may affect vehicle handling, can be determined with the vehicle system testers V.A.G 1552, V.A.G 1551 or VAS 5051.

Notes:

- ◆ *The description which follows relates to the vehicle system tester V.A.G 1552 using the programme card 5.0 or a higher version.*
- ◆ *Use of the vehicle system testers VAS 5051 and V.A.G 1551 with integrated printer is similar. Minor differences are possible in the readouts in the display.*

List of available functions ⇒ page 01-6.

Backup functions of gearbox control unit

If critical faults occur when driving, the gearbox continues operating in the emergency mode and it is possible to continue driving the vehicle. If the fault occurs in „D“, „3“, or „2“, the emergency mode then activates 3rd gear.

If the fault occurs in „1“, „P“, „N“ or „R“, the emergency mode activates the gear in question.

If the engine is re-started in the emergency mode and the fault occurs (when selector lever is in position „D“, „3“ or „2“), 3rd gear is activated hydraulically until the fault is rectified.

In the case of faults which result in the emergency mode being activated, the gearbox continues to operate in the emergency mode until the fault is no longer detected by the control unit over a certain period.

Faults which may activate the emergency mode:

Open circuit in wiring, short circuit, faulty electrical or hydraulic components.

Recognition of faults by gearbox control unit

If a fault exists, the fault is stored as a static (present) fault. If the fault no longer exists for a certain period or distance, the fault is converted to a sporadic fault.

Faults which are stored in the fault memory as occurring sporadically, are displayed as „Sporadically occurring fault“ when interrogating the fault memory. In this case „SP“ also appears in the right of the display.

Faults which are stored in the fault memory as sporadic faults, are automatically erased after driving a distance of 1000 km or driving for a period of 20 hours.

Technical data of self-diagnosis

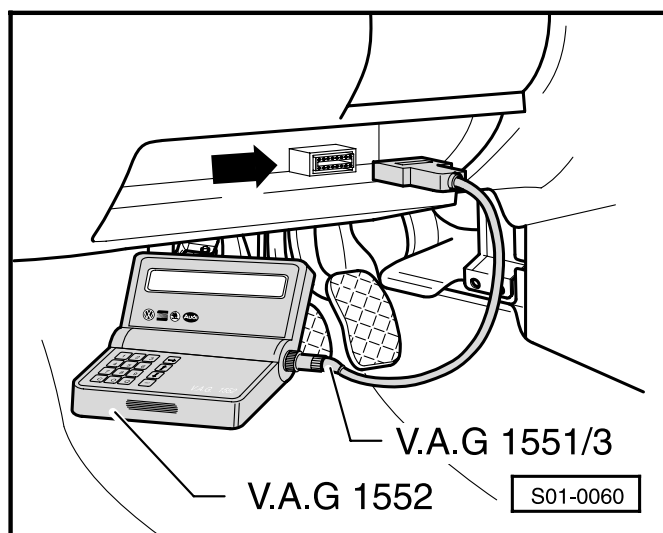
Memory ♦ Permanent memory ♦ Volatile memory	yes no
Data output ♦ Vehicle system test ♦ Flash code output	yes no
Final control diagnosis	no
Basic setting	yes
Coding control unit	no
Reading measured value block	yes
Electrical/electronic components and fitting locations	⇒ page 01-37

Carrying out self-diagnosis

Connecting vehicle system tester V.A.G 1552 and selecting functions

Test requirements

- *Selector lever in position „P“ and handbrake applied.*
- *Supply voltage of vehicle o.k.*
- *Fuses o.k.*
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- *Earth connections and earth point for gearbox o.k.*
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



- Inspect battery earth strap and earth strap between battery and gearbox.
- ◀ Switch off ignition (if not already off), and connect vehicle system tester V.A.G 1552 with diagnostic cable V.A.G 1551/3 to diagnostic connection -arrow-.

Note:

The diagnostic connection is located in the stowage compartment below the steering column.

- Switch on ignition.

Test of vehicle systems
Enter address word XX

HELP

◀ Readout in display:

Notes:

- ◆ *Additional operating information can be retrieved with the HELP key of V.A.G 1552.*
- ◆ *The → key is used for moving forward within the programme.*
- ◆ *If this readout does not appear:*
⇒ V.A.G 1552; Vehicle system tester; Operating instructions.
- Press keys 0 and 2 (the address word „Gearbox electronics“ is selected with 02) and confirm entry with the key Q.

01M927733AG AG4 Gearbox 01M Coding 00000	2770 → WSC XXXXX
---	---------------------

◀ Readout in display:

Control unit identification**Example:**

- ◆ 01M 927 733 AG¹⁾
- ◆ AG4 Gearbox 01M: Automatic gearbox 4-speed 01M
- ◆ 2770: EPROM (program status)
- ◆ Coding 00000: Is not required at present.
- ◆ WSC XXXXX ⇒ Operating instructions V.A.G 1552

¹⁾ Assignment of control unit ⇒ Parts Catalogue.

Control unit does not answer!	HELP
-------------------------------	------

◀ Readout in display:

- A list of the possible causes of the fault can be displayed by pressing the HELP key.
- After rectifying the possible causes of the fault, once again enter the address word for „Gearbox electronics“ and confirm entry.

If „Control unit does not answer!“ is again displayed:

Control unit does not answer!	HELP
-------------------------------	------

◀ Readout in display:

- Test supply voltage of the control unit:
 - Carry out test step 1 ⇒ page 01-32.
 - Inspect cable connections to the diagnostic connection.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
 - ⇒ page 01-7 Fault table, under fault code 65535 Control unit faulty!
- Press → key.

Test of vehicle systems Select function XX	HELP
---	------

◀ Readout in display:

List of available functions

Functions	Page
01 - Interrogating control unit version ⇒ also: Carrying out self-diagnosis	
02 - Interrogating fault memory	01-6
04 - Initiating basic setting	01-15
05 - Erasing fault memory	01-14
06 - Ending output	
08 - Reading measured value block	01-16

Additional functions which are displayed after pressing the HELP key, can be ignored.

Interrogating fault memory

- Connect vehicle system tester V.A.G 1552
⇒ page 01-4.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 0 and 2 (the function „Interrogate fault memory“ is selected with 02) and confirm entry with the key Q.

X faults recognised!

→

◀ The number of stored faults or „No fault recognised!“ appears in the display.

- Press → key.

The faults stored are displayed one after the other.

- After the last fault has been displayed, rectify the faults as described in the fault table
⇒ page 01-7.
- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

Note:

After interrogating fault memory and rectifying faults:

- Erase fault memory ⇒ page 01-14.

Fault table

Notes:

- ◆ All the possible faults which can be detected by the automatic gearbox control unit -J237 and can be displayed by V.A.G 1552, are listed below according to the fault code.
- ◆ If defective parts are displayed during read out of the fault memory, check additional lines to the component for short-circuit and line interruption according to the Current Flow Diagram ⇒ Current Flow Diagrams, Fault Finding, Electrics and Fitting locations.
- ◆ If faults only occur occasionally or the fault memory was not erased after fault elimination, then these faults are displayed for a defined time as „sporadic occurring fault“ ⇒ Fault recognition of the gearbox control unit page 01-2.

Read out on display of V.A.G 1552	
no fault detected	If after repair „No fault detected“ is displayed, the self-diagnosis is completed. If despite the performed self-diagnosis, the automatic gearbox does not shift free of interference: - Check control unit identification ⇒ page 01-5. - In the event of problems repeat driving situation, at the same time read measured values in the measured value block and check all signals for plausibility ⇒ page 01-16. - Check gearbox ⇒ page 37-6.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
00258 Solenoid valve 1 -N88 Line interruption ¹⁾ Short-circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 1 -N88 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 004. - Perform electrical test ⇒ page 01-29.
00260 Solenoid valve 2 -N89 Line interruption ¹⁾ short circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 2 -N89 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 004. - Perform electrical test ⇒ page 01-29.
00262 Solenoid valve 3 -N90 Line interruption ¹⁾ Short-circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 3 -N90 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 004. - Perform electrical test ⇒ page 01-29.

¹⁾ One of these read-outs is displayed additionally for the related component.

²⁾ First check plug connection for contact corrosion or water penetration, replace if necessary. If fault of solenoid valve is displayed, pay particular attention to the plug connection at the gearbox between ribbon cable/slide valve body and wiring harness.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
00264 Solenoid valve 4 -N91 Line interruption ¹⁾ Short-circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 4 -N91 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 004. - Perform electrical test ⇒ page 01-29.
00266 Solenoid valve 5 -N92 Line interruption ¹⁾ Short-circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 5 -N92 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 004. - Perform electrical test ⇒ page 01-29.
00268 Solenoid valve 6 -N93 Line interruption ¹⁾ Short-circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 6 -N93 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 002. - Perform electrical test ⇒ page 01-29.
00270 Solenoid valve 7 -N94 Line interruption ¹⁾ Short-circuit to earth ¹⁾	Line interruption or short-circuit to earth. Solenoid valve 7 -N94 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 004. - Perform electrical test ⇒ page 01-29.
00281 Vehicle speed sender -G68 No signal	Line interruption. Vehicle speed sender -G68 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 002. - Perform electrical test ⇒ page 01-29 and replace if necessary vehicle speed sender -G68 ⇒ page 38-20.

¹⁾ One of these read-outs is displayed additionally for the related component.

²⁾ First check plug connection for contact corrosion or water penetration, replace if necessary. If fault of solenoid valve is displayed, pay particular attention to the plug connection at the gearbox between ribbon cable/slide valve body and wiring harness.

Note for fault code 00281:

♦ Voltage drop is checked by the self-diagnosis.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
00293 Multi-function switch -F125 Undefined switch status	Line interruption Multi-function switch -F125 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.¹⁾ - Reading measured value block ⇒ page 01-16 Display group number 001. - Perform electrical test ⇒ page 01-29 and replace if necessary multi-function switch -F125 ⇒ page 38-20.
00297 Gearbox speed sender -G38 No signal Implausible signal	Line interruption Gearbox speed sender -G38 defective. Plug of the vehicle speed sender -G38 and gearbox speed sender -G68 interchanged.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.¹⁾ - Perform electrical test ⇒ page 01-29. - Replace gearbox speed sender -G38 ⇒ page 38-20. - Inspect plug assignment, see removing and installing gearbox ⇒ page 37-13.
00300 Gearbox oil temperature sender -G93²⁾ No fault type detected	Line interruption Gearbox oil temperature sender -G93 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.¹⁾ - Reading measured value block ⇒ page 01-16 Display group number 005. - Perform electrical test ⇒ page 01-29.
00518 Throttle valve potentiometer -G93³⁾ Signal outside tolerance	Line interruption or short-circuit Signal range of throttle valve control unit -J338 displaced.	- If the fault 00638 is additionally displayed, the fault must be rectified. - Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.¹⁾ - Reading measured value block ⇒ page 01-16 Display group number 001 and 003.

¹⁾ First check plug connection for contact corrosion or water penetration, replace if necessary. If fault of solenoid valve is displayed, pay particular attention to the plug connection at the gearbox between ribbon cable/slide valve body and wiring harness.

²⁾ A damaged ATF temperature sensor is displayed.

³⁾ The transmission of the signal is performed by the throttle valve control unit -J338 via the engine control unit to the gearbox control unit. Therefore the fault memory of the engine control unit always has to be read out if this fault occurs.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
00518 Throttle valve potentiometer -G69¹⁾ Signal outside tolerance	Throttle valve control unit -J338 defective.	- Check throttle valve control unit -J338, replace if necessary ⇒ Repair Group 01 and 24 of the relevant engine. - After replacing throttle valve control unit put system in basic setting ⇒ page 01-15.
	Engine control unit defective.	- Check engine control unit, replace if necessary ⇒ Repair Group 01 and 24 of the relevant engine. - After replacing throttle valve control unit put system in basic setting ⇒ page 01-15.
00529 Speed information missing	Line interruption between engine control unit and gearbox control unit -J217. Engine speed is inaccurate because of improper routing of electrical lines (e.g. subsequent installation of a telephone). Engine speed sender -G28 defective. Engine control unit defective. Short-circuit in dash panel insert.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 003. - Check engine control unit, replace if necessary ⇒ Repair Group 01 and 24 of the relevant engine.
00532 Supply voltage	Supply voltage defective. Supply voltage for solenoid valves is too low.	- Check supply voltage ⇒ Electrical System, Repair Group 27; battery, voltage and load. - Reading measured value block ⇒ page 01-16 Display group number 002. - Check supply voltage to control unit -J217. - Perform electrical test ⇒ page 01-29
00545 Engine/gearbox electrical connection Line interruption ³⁾ Short-circuit to earth ³⁾	Line interruption or short-circuit No connection of engine control unit/gearbox control unit. The signal for the ignition-timing adjustment is not or incorrectly transmitted between the engine and the gearbox control unit.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.²⁾ - Reading measured value block ⇒ page 01-16 Display group number 005. - Check engine control unit, replace if necessary ⇒ Repair Group 01 and 24 of the relevant engine. - Put system in basic setting ⇒ page 01-15

¹⁾ Petrol engines: The transmission of the signal is performed by the throttle valve control unit -J338 via the engine control unit to the gearbox control unit. Therefore the fault memory of the engine control unit always has to be read out if this fault occurs.

²⁾ First check plug connections for contact corrosion or water penetration and replace if necessary.

³⁾ One of these read-outs is displayed additionally for the related component.

Note for fault code 00529:

- ♦ The engine speed signal is transmitted as a digital signal from the engine control unit to the gearbox control unit.

Note for fault code 00532:

- ♦ Condition for fault recognition: Supply voltage after engine start is less than 8 volts.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
00596 Short-circuit between valve wires	Plug connection between ribbon cable/slide valve body and wiring harness. Ribbon cable to slide valve body defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations. ¹⁾ - Perform electrical test ⇒ page 01-29. - Replace ribbon cable ⇒ page 38-18
00638 Engine/gearbox electrical connection 2 No signal	Line interruption or short-circuit to earth. No connection of engine control unit/gearbox control unit. Throttle valve signal/accelerator pedal value is not transmitted to the gearbox control unit.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations. ¹⁾ - Reading measured value block ⇒ page 01-24 Display group number 005. - Check engine control unit, replace if necessary ⇒ Repair Group 01 and 24 of the relevant engine. - Put system in basic setting ⇒ page 01-15
00641 ATF temperature Signal too great	ATF level not OK. Gearbox is too hot, max. 148 °C. Trailing load of vehicle is too high. Wire defect between gearbox control unit and/or defective gearbox oil temperature sender (ATF) -G93 not detected by self-diagnosis.	- Check ATF level ⇒ page 37-22. - Reading measured value block ⇒ page 01-16 Display group number 005. - Perform electrical test ⇒ page 01-29 and if necessary replace ribbon cable ⇒ page 38-18.
00652 Gear monitoring Implausible signal	ATF level not OK. Defective gearbox, gearbox output and engine speed not detected by self-diagnosis. Vehicle speed sender -G68 defective. Multi-function switch -F125 not detected by self-diagnosis. Drive gear of vehicle speed sender -G68 dirty or shifted. Electrical or hydraulic fault of clutch or slide valve body. ²⁾	- Check ATF level ⇒ page 37-22. - Perform fault rectification of fault codes 00281, 00293, 00297 and 00529. - Replace vehicle speed sender -G68 ⇒ page 38-20. - Fault rectification of fault code 00293. - Check drive gear ⇒ page 39-5. - Reading measured value block ⇒ page 01-16 Display group number 007 and while driving determine in which gear the fault occurs.

¹⁾ First check plug connections for contact corrosion or water penetration and replace if necessary.

²⁾ Only replace clutches and slide valve body if all possible causes of faults mentioned have been rectified.

Note for fault code 00641:

- ◆ If the gearbox control unit detects a too low gearbox temperature, it will shift into the next lowest gear. If necessary the Tc clutch is closed additionally.
- ◆ Condition for fault recognition: Gearbox control unit detects an ATF temperature above 148 °C.

Note for fault code 00652:

- ◆ Condition for fault recognition: The ratio between engine to gearbox output speed is implausible with each engaged gear. When the clutch is open the slip speed must be greater for torque converter lockup than the limit speed for the hydraulic converter.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
00660 Kick-down switch/throttle valve potentiometer Implausible signal	Wire defective between Kick-down switch and gearbox control unit. Throttle valve control unit -J338 defective. Throttle control cable incorrectly adjusted. Kick-down switch -F8 defective.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.¹⁾ - Fault rectification of fault code 00518. - Reading measured value block ⇒ page 01-16 Display group number 001. - Perform electrical test ⇒ page 01-29. - Adjust throttle control cable or replace ⇒ Repair Group 23 for diesel engine. ⇒ Repair Group 24 for petrol engine.
01166²⁾ Signal for engine torque Implausible signal	Incorrect or missing signal for engine torque from engine control unit to gearbox control unit.	- Check engine control unit, replace if necessary ⇒ Repair Group 01 and 24 of the relevant engine.
00192 Clutch for torque converter lockup Mechanical fault	Plug connection between ribbon cable/slide valve body and wiring harness. Ribbon cable to slide valve body defective and not detected by self-diagnosis. Engine, gearbox, gearbox output speed is defective and not detected by self-diagnosis. Solenoid valve 4 -N91 or the slide valve operated by it jams. Clutch for torque converter lockup or mechanical fault in torque converter.	- Check wiring and plug connections according to the ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.¹⁾ - Perform electrical test ⇒ page 01-29. - Replace ribbon cable ⇒ page 38-18. - Perform fault rectification of fault codes 00281 and 00529. - Reading measured value block ⇒ page 01-16 Display group number 007 and if necessary replace solenoid valve slide valve body ⇒ page 38-12. - Replace torque converter ⇒ page 32-1.

¹⁾ First check plug connections for contact corrosion or water penetration and replace if necessary.

²⁾ Only for automatic gearbox with databus (CAN databus) see Current Flow Diagram as of Model year 1998.

Note for fault code 00660:

- ◆ A kick-down signal must be detected by the gearbox control unit, if the recognised ratio of the throttle valve value/accelerator pedal value is less than 95 %.

Note for fault code 00192:

- ◆ Condition for fault recognition: The ratio between engine to gearbox output speed is implausible when clutch for torque converter lockup is closed.

Read out on display of V.A.G 1552	Possible cause of fault	Rectifying fault
01312¹⁾ Databus drive in emergency running mode Defective ²⁾ No communication ²⁾	Line interruption or short-circuit in the Databus cables/plug connections. ABS control unit is wrongly coded. Engine control unit is wrongly coded.	- Check CAN databus ⇒ Chassis; Anti-lock brake system Repair Group 45. - Check coding of ABS control unit, if necessary code again ⇒ Chassis; Anti-lock brake system, Repair Group 45 - Check coding of engine control unit, if necessary code again ⇒ Repair Group 24 of the relevant engine.
01314¹⁾ Engine control unit No communication Wrong equipment	Line interruption or short-circuit in the Databus cables/plug connections. Fault in the system: Engine Engine control unit is wrongly coded. Gearbox control unit is wrongly coded or incorrect control unit fitted.	- Check CAN databus ⇒ Chassis; Anti-lock brake system; Repair Group 45. - Check engine control unit ⇒ Repair Group 01 and 24 of the relevant engine. - Check engine control unit, if necessary code again ⇒ Repair Group 24 of the relevant engine. - Replace the gearbox control unit if necessary.
01316¹⁾ Brake control unit No communication	Databus cables/plug connections defective. Fault in the system: ABS	- Check CAN databus ⇒ Chassis; Anti-lock brake system; Repair Group 45. - Check ABS control unit ⇒ Chassis; Anti-lock brake system, Repair Group 45.
65535 Control unit defective	Control unit -J217 defective	- Replace control unit ⇒ page 01-37 - Put system in basic setting ⇒ page 01-15

¹⁾ Only for automatic gearbox with databus (CAN databus) see Current Flow Diagram as of Model year 1998.

²⁾ One of these read-outs is displayed additionally for the related component.

Note for fault codes 01312, 01314 and 01316:

- ◆ The data and information exchanged between engine control unit, brake control unit and gearbox control unit is performed via the so-called CAN databus. All information is transmitted through 2 cables. CAN databus function ⇒ Chassis; Anti-lock brake system, Repair Group 45.

Note for fault code 65535:

Only after having determined the possible cause of the fault and having eliminated the following faults must the control unit -J217 be replaced ⇒ page 01-37 as well as the system has to be put in basic setting 01-15:

- ◆ Hydraulic fault
- ◆ Mechanical fault
- ◆ Fault in individual electrical and electronic components as well as fault in cables and plug connections.

Erasing fault memory

- Fault memory interrogated ⇒ page 01-6.

After completing interrogation of fault memory:

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 0 and 5 (the function „Erase fault memory“ is selected with 05) and confirm entry with the key Q.

Attention
Fault memory was not interrogated

→

◀ If the following readout appears in the display:

Notes:

- ♦ *If the ignition was switched off e.g. between interrogating and erasing the fault memory, the fault memory is then not erased.*
- ♦ *Observe the sequence exactly, in other words first of all interrogate the fault memory and then erase it.*

Test of vehicle systems
Fault memory is erased!

→

◀ Readout in display:

After this readout appears in the display, wait about 5 seconds before the fault memory is then erased.

The fault memory is thus erased.

- Press → key.
- Press keys 0 and 6 (the function „End output“ is selected with 06) and confirm the entry with the key Q.

Note:

Wait about 1 minute before again interrogating the fault memory.

- After interrogating and erasing the fault memory, carry out a road test and once again interrogate fault memory ⇒ page 01-6.

When the fault memory is interrogated, the following readout should appear:

No fault recognized!

◀ Readout in display:

Initiating basic setting

Note:

The basic setting must be carried out after the following repairs:

- ◆ Replacing engine
- ◆ Replacing engine control unit
- ◆ Replacing throttle valve control unit -J338
- ◆ Replacing gearbox control unit -J217
- ◆ Replacing clutch and control valve body
- ◆ Removing and installing gearbox

Requirements:

- Voltage supply o.k. and all electrical components switched off.
- Throttle mechanism correctly set.
- Fault memory interrogated, any faults rectified and fault memory erased.
- Connect vehicle system tester V.A.G 1552
⇒ page 01-4.

Note:

Accelerator pedal must remain in idling position.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press key 04 and confirm the entry with the key Q.

Basic setting
Enter display group number XXX

HELP

◀ Readout in display:

- Press key 0 three times and confirm the entry with the key Q.

System in basic setting

0 →

◀ Readout in display:

The system is now in the basic setting.

- Depress accelerator pedal fully and hold in this position for 3 seconds.
- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

Reading measured value block

- Connect vehicle system tester V.A.G 1552
⇒ page 01-4.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 0 and 8 (the function „Read measured value block“ is selected with 08) and confirm the entry with the key Q.

Read measured value block
Enter display group number XXX

HELP

◀ Readout in display:

- Enter display group number and confirm entry with the key Q.
⇒ page 01-16, List of available display group numbers.

Read measured value block				1	→
1	2	3	4		

◀ Readout in display:

- 4 display blocks always appear in the measured value block (if necessary in physical units). Explanation of the readouts 1 to 4 in the individual display blocks ⇒ page 01-17, Test table.

List of available display group numbers

Readout in display (example)	Display group No.	Display block	Designation
Read measured value block 1 → P 0.8 V 0 % 00000111	001	1 2 3 4	Selector lever position Voltage of throttle valve control unit Accelerator pedal value Switch positions
Read measured value block 2 → 0.983 A 0.985 A 12.76 V 2.50 V	002	1 2 3 4	Actual current of solenoid valve 6 -N93 Specified current of solenoid valve 6 -N93 Battery voltage Voltage at road speed sender -G68
Read measured value block 3 → 0 km/h 900 rpm 0 0 %	003	1 2 3 4	Road speed Engine speed Gear engaged Accelerator pedal value
Read measured value block 4 → 1010 00 0 P 0 km/h	004	1 2 3 4	Solenoid valves Gear engaged Selector lever position Road speed

Readout in display (example)	Display group No.	Display block	Designation
Read measured value block 5 → 45 °C 0011001 0 900 rpm	005	1 2 3 4	ATF temperature Shift outputs Gear to be engaged Engine speed
Read measured value block 6 → +8 % 35 % 41 % 60 %	006	1 2 3 4	Can be ignored at present Can be ignored at present Sporty factor Accelerator pedal value
Read measured value block 7 → R 200 rpm 900 rpm 0 %	007	1 2 3 4	Gear engaged Slip of lock-up clutch Engine speed Accelerator pedal value
Read measured value block 8 →	008		Can be ignored at present

If the specified values are reached in all the display blocks:

- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

Test table

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
001	1	Selector lever position Multifunction switch -F125	Stationary P	P	- Test multifunction switch -F125 ⇒ page 01-29
			Selector lever in R	R	
			N	N	
			D	D	
			3	3	
			2	2	
			1	1	
Continued					

Display group number	Display block	Designation	Test conditions		Readout on V.A.G 1552 Specification	Measures if readout differs from specification
001	2	Signal voltage of throttle valve control unit -J338 (Simos fuel injection and ignition system and Motronic fuel injection and ignition system)	stationary	Idling ¹⁾	0.0 V... ...0.8 V	When accelerating from idling to full throttle, voltage readout constantly rises - Carry out self-diagnosis of engine control unit - Test throttle valve control unit -J338: ⇒ Repair Group 01 or Repair Group 24 of relevant engine - Replace throttle valve control unit -J338 if necessary: ⇒ Repair Group 24 of relevant engine
				Full throttle	3.5 V... ...4.9 V	
	3	Accelerator pedal value ³⁾	stationary	Idling ¹⁾	0...1 %	- Move system into basic setting ⇒ page 01-15 - Test cable connection to engine control unit according to CFD, contact assignment at gearbox control unit ⇒ Electrical Test, page 01-29
				Full throttle	99...100%	
	4	Switch positions ²⁾	Brake	operated	1	- Test brake light switch -F ⇒ Perform electrical test, page 01-29
		Brake light switch -F		not operated	0	
		Wheel slip control				Can be ignored
Continued		Readout 3				Can be ignored

¹⁾ Coolant temperature min 80°C.

²⁾ Readout on V.A.G 1552 in display block 4 is 8-digit, e.g. 10000111.

³⁾ The % readout constantly rises when accelerating from idling speed to full throttle.

Display group number	Dis-play block	Designation		Test conditions		Specifica-tion or readout	Measures if readout differs from specification	
001	4	Switch positions ²⁾					- Test kickdown switch ⇒ page 01-29	
		Kick-down switch -F8 ³⁾	Read-out 4	Kick-down switch	operated	1		
					not operated	0		
		Multi-function switch -F125	Read-out 5	Selector lever in	R, N, D, 3, 2	1	- Test multifunction switch -F125 ⇒ Electrical test, page 01-29 - Set selector lever cable ⇒ page 37-4	
						Contact 63 ¹⁾		P, 1
			Read-out 6	Selector lever in	P, R, 2, 1	1		- Remove starter lockout and re-versing light relay -J226 and repeat readout - Test cables and components according to CFD
						Contact 40 ¹⁾		
			Read-out 7	Selector lever in	P, R, N, D	1	- Test multifunction switch -F125 ⇒ page 01-29 - Set selector lever cable ⇒ page 37-4	
						Contact 62 ¹⁾		
			Read-out 8	Selector lever in	P, R, N	1		- Remove starter lockout and re-versing light relay -J226 and repeat readout - Test cables and components according to CFD
						Contact 18 ¹⁾		

¹⁾ Contact at gearbox control unit at which the output signal is received.

²⁾ The readout on V.A.G 1552 in display block 4 is 8-digit, e.g. 10000111.

³⁾ Ignore in the case of vehicles with electrically operated accelerator pedal.

Display group number	Display field	Designation	Test conditions		Specification or readout	Measures for deviations from nominal value
002	1	Actual current of solenoid valve 6 -N93 ¹⁾	Vehicle in standstill	Full throttle	0.0 A	For fault finding, observe the following: Actual and nominal current must not deviate more than 0.05 A from one another.
				Idle	max. 1.1 A	
	2	Nominal current of solenoid valve 6 -N93 ¹⁾		Full throttle	0.0 A	- Check solenoid valve -N93 ⇒ page 01-29.
				Idle	max. 1.1 A	
	3	Battery voltage		min. 10.8 volts	- Check battery, replace if necessary ⇒ Electrical System, Repair Group 27. - Check supply voltage to gearbox control unit page 01-29.	
				max. 16.0 volts		- Replace gearbox control unit ⇒ page 01-37. - Put system in basic setting ⇒ page 01-15.
	4	Vehicle speed sender -G68		min 2.20 volts	- Check vehicle speed sender -G68 ⇒ page 01-29	
				max. 2.52 volts		
1	Speed ²⁾	while driving ³⁾		...km/h		
003	2	Engine speed	with engine running		...rpm	- Check plug connection to engine control unit, contact assignment at gearbox control unit ⇒ Electrical test, page 01-29 - Eliminate engine fault if necessary ⇒ Repair Group 01 of the relevant engine.

¹⁾ Solenoid valve 6 -N93- controls the ATF main pressure.

²⁾ The signal of the vehicle speed sender -G68 is displayed (read out of speedometer and values on V.A.G 1552 can slightly deviate from one another).

³⁾ When driving: The assistance of a second mechanic is required to read off the nominal values.

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
003	3	Gear engaged	Driving ¹⁾	Neutral	- Test solenoid valves ⇒ page 01-29, Electrical test Further measures ⇒ Display group number 005, display block 3
				Reverse	
				1 Hydraulic	
				1 Mechanical	
				2 Hydraulic	
				2 Mechanical	
				3 Hydraulic	
				3 Mechanical	
				4 Hydraulic	
				4 Mechanical	
	4	Accelerator pedal value ²⁾	Driving ¹⁾	Idling	- Move system into basic setting ⇒ page 01-15 - Test cable connection to engine control unit according to CFD, contact assignment at gearbox control unit ⇒ page 01-29, Electrical test
				Full throttle	

¹⁾ When driving: A 2nd mechanic is required for reading the specified values.

²⁾ The % readout is increased constantly when accelerating from idling speed to full throttle.

Reading measured value block; display group number 004; „Test of solenoid valves when driving“

- ◆ The solenoid valves can be tested when driving in measured value block 08, display group number 004.
- ◆ The solenoid valves actuated -N88, -N89 and -N90 are stated in the table in the individual selector lever positions. These solenoid valves control the shift valves for the corresponding gears.
- ◆ Solenoid valve -N91 controls the shift valve of the torque converter lock-up clutch.
- ◆ The readout on V.A.G 1552 in display block 1 is 6-digit (0000 00).

- ◆ Solenoid valves -N92 and -N94 are comfort valves which enhance smooth gearshifting and are only actuated during a gearshift and read in readout 5 and 6.

Notes:

M = The individual gears are actuated mechanically.

H = The individual gears are actuated hydraulically.

Readout in V.A.G 1552 in display block 1

Readout 1	Readout 2	Readout 3	Readout 4	Readout 5	Readout 6
-N88	-N89	-N90	-N91	-N92	-N94

♦ Solenoid valves not operated are displayed with „0“, solenoid valves operated with „1“.

♦ Solenoid valves operated variably are identified in the tables below with „X“.

Testing the solenoid valves when driving

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
004	1	Solenoid valves/ readout in display -N88 Readout 1 -N89 Readout 2 -N90 Readout 3 -N91 Readout 4 -N92 Readout 5 -N94 Readout 6	Selector lever in: P	1 0 1 0 00	The solenoid valves are operated in line with the driving state - Electrical test ⇒ page 01-29 - Test gearbox ⇒ page 37-6
			R ¹⁾	1 0 1 0 00	
			R ²⁾	0 0 1 0 00	
			N	1 0 1 0 00	
			D ¹⁾	1H	0 0 1 0 X0
				1M	0 0 1 0 X0
				2H	0 1 1 0 00
				2M	0 1 1 0 00
				3H	0 0 0 0 01
				3M	0 0 0 0 01
				4H	1 1 0 0 01
				4M	1 1 0 0 01
			X = variable		
			3 ¹⁾	1H	0 0 1 0 X0
				1M	0 0 1 0 X0
	Continued				

¹⁾ With gear engaged and at least 10 km/h. A 2nd mechanic is required when driving for reading the specified values.

²⁾ Vehicle moving at less than 10 km/h. A 2nd mechanic is required when driving for reading the specified values.

Notes:

♦ M = The individual gears are actuated mechanically.

♦ H = The individual gears are actuated hydraulically.

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
004	1	Solenoid valves/ readout in display -N88 Readout 1 -N89 Readout 2 -N90 Readout 3 -N91 Readout 4 -N92 Readout 5 -N94 Readout 6	Selector lever in:	2H	0 1 1 0 00
				2M	0 1 1 0 00
				3H	0 0 0 0 01
			X = variable	3M	0 0 0 0 01
			2 ¹⁾	1H	0 0 1 0 X0
				1M	0 0 1 0 X0
				2H	0 1 1 0 00
				2M	0 1 1 0 00
			1 ¹⁾	1H	1 0 1 0 X0
				1M	1 0 1 0 X0
			1 ²⁾	1H	0 0 1 0 X0
				1M	0 0 1 0 X0
			X = variable		
	2	Gear engaged	Driving ³⁾	Neutral	0
				Reverse	R
				1 Hydraulic	1H
				1 Mechanical	1M
				2 Hydraulic	2H
				2 Mechanical	2M
				3 Hydraulic	3H
				3 Mechanical	3M
	Con- tinued				

¹⁾ With gear engaged and at least 10 km/h. A 2nd mechanic is required when driving for reading the specified values.

²⁾ Vehicle moving at less than 10 km/h. A 2nd mechanic is required when driving for reading the specified values.

³⁾ When driving: A 2nd mechanic is required for reading the specified values.

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
004	2		4 Hydraulic	4H	Further measures ⇒ Display group number 005, display block 3
			4 Mechanical	4M	
	3	Selector lever position	Driving ¹⁾ P	P	- Test multifunction switch -F125 ⇒ Perform electrical test, page 01-29
			R	R	
			N	N	
			D	D	
			3	3	
			2	2	
			1	1	
	4	Road speed ²⁾	Driving, driven speed ¹⁾	... km/h	
005	1	ATF temperature	Stationary engine running. Exact temperature indicated only from approx. 30 °C	... °C	- Test gear oil temperature sender -G93 ⇒ Perform electrical test, page 01-29
	2	Switch outputs Readout 1 ³⁾	Driving ¹⁾ Influencing ignition timing ⁴⁾ is on	1	- Test wiring according to CFD - Test engine control unit ⇒ Repair Group 01 of relevant engine
			is off	0	
	Continued				- Replace gearbox control unit ⇒ page 01-37

¹⁾ When driving, a 2nd person is required for reading the specified values.

²⁾ What is displayed is the signal of the road speed sender -G68 (speed indicated by speedometer and readout on V.A.G 1552 may differ slightly).

³⁾ Switching on and off always perform together in readout 1 and 2.

⁴⁾ Ignition timing influencing only activated during gearshift.

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
005	2	Switch outputs	Driving ²⁾ Influencing ignition timing ³⁾		- Test wiring according to CFD - Test engine control unit: ⇒ Repair Group 01 of relevant engine
		Readout 2 ¹⁾	is on	1	
			is off	0	- Replace gearbox control unit ⇒ page 01-37
		Switch outputs	Selector lever lock solenoid -N110		
		Readout 3	is on ⁴⁾	1	- Test wiring according to CFD - Test selector lever lock solenoid valve -N110 ⇒ Perform Electrical test, page 01-29
			is off ⁵⁾	0	
		Readout 4	is on	1	
			is off	0	
	Continued	Switch outputs	Cruise control system (not assigned)		- Test wiring according to CFD
		Readout 5	is on	1	
			is off	0	- Test cruise control system ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
		Switch outputs			
	Continued	Readout 6	AC		- Test wiring according to CFD - Test air conditioning: ⇒ Heating, Air Conditioning; Repair Group 01
			is switched off ⁶⁾	1	
			is not switched off	0	

¹⁾ Switching on and off always perform together in readout 1 and 2.

²⁾ When driving, a 2nd person is required for reading the specified values.

³⁾ Ignition timing influencing only activated during gearshift.

⁴⁾ Voltage detected at appropriate contact of gearbox control unit ≤ 1.5 V.

⁵⁾ Voltage detected at appropriate contact of gearbox control unit ≥ 3.5 V.

⁶⁾ If kickdown signal is detected, air conditioning may be switched off.

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
005	2	Readout 7	Park/Neutral signal Selector lever in		- Test wiring according to CFD Selector lever positions D, 3, 2, 1 are ignored
			P, N	1	
			R	0	
			1, 2, 3, D	1/0	
	3	Gear engaged ²⁾	Driving ¹⁾ Neutral	0	If no gearshifts perform but these are displayed, there may be a hydraulic fault - Test solenoid valves ⇒ Electrical Test, page 01-29 - Replace gearbox control unit ⇒ page 01-37
				R	
				1 Hydraulic	
				1 Mechanical	
				2 Hydraulic	
				2 Mechanical	
				3 Hydraulic	
				3 Mechanical	
				4 Hydraulic	
				4 Mechanical	
	4	Engine speed	Driving ¹⁾	... rpm	- Test cable connection to engine control unit according to CFD, contact assignment at gearbox control unit ⇒ Electrical Test, page 01-29 - Rectify any engine fault ⇒ Repair Group 01 of relevant engine

¹⁾ When driving, a 2nd person is required for reading the specified values.

²⁾ Substitute programmes activated by gearbox control unit may prevent gearshifts; interrogate fault memory ⇒ page 01-6.

Display group number	Display block	Designation	Test conditions	Readout on V.A.G 1552 Specification	Measures if readout differs from specification
006	1	Uphill or downhill stretch ²⁾	driving ¹⁾ downhill max.	-32 °C	Can be ignored Readout is computed from signals of speedometer sender, accelerator pedal value and engine speed
			uphill max.	+31.75 °C	
	2	Hill factor ²⁾	driving ¹⁾	0 ... 100 %	Can be ignored
	3	Sporty factor ³⁾	driving ¹⁾	0 ... 100 %	Readout determined by driving style and road conditions (vehicle speed, acceleration, accelerator pedal movement and engine speed)
	4	Accelerator pedal value	driving ¹⁾ idling	0...1 %	⇒ Display group number 003, display block 4
			full throttle	99...100 %	
007	1	gear engaged ⁴⁾	driving ¹⁾ Neutral	0	- Test solenoid valves ⇒ Electrical Test, page 01-29 - Test gearbox ⇒ page 37-6 - Replace gearbox control unit ⇒ page 01-37
			Reverse	R	
			1 Hydr. ⁵⁾	1H + 1H -	
			1 Mech. ⁵⁾	1M + 1M -	
			2 Hydr. ⁵⁾	2H + 2H -	
			2 Mech. ⁵⁾	2M + 2M -	
	Continued		3 Hydr. ⁵⁾	3H + 3H -	

¹⁾ A second person is required for reading the specifications when driving.

²⁾ Towing a trailer or increased payload also results in the readouts shown on V.A.G 1552 rising because of the increased load.

³⁾ High values of sporty factor move the shift points to higher engine speeds.

⁴⁾ If the gearshift is not performed, a clutch or brake may also be faulty.

⁵⁾ A „+“ means that the torque converter slip displayed is positive (engine speed ≥ gearbox input speed).

⁶⁾ A „-“ means that the torque converter slip displayed is negative (engine speed ≤ gearbox input speed).

Display group number	Display field	Designation	Test conditions		Read out on display of V.A.G 1552 nominal value	Measures for deviations from nominal value
007	1	Engaged gear ³⁾	3 mechanical ²⁾		3M + 3M -	
			4 hydraulic ²⁾		4H + 4H -	
			4 mechanical ²⁾		4M + 4M -	
	2	Slip of torque converter lockup clutch	while driving ¹⁾ with engine running	in the hydraulic gears ⁴⁾	0 ... Limit speed of hydraulic torque converter	- Check ATF level. - Check wiring according to current flow diagram. - Perform fault rectification of fault codes 00281 and 00529 according to fault table ⇒ page 01-7.
		Solenoid valve 4 -N91- is controlled.	Tc ⁶⁾ closed	Engine speed: 2000 ... 3000 rpm in the mechanical gears ⁵⁾	0 ... 130 rpm	
	3	Engine speed	When engine is running		... rpm	See Display group number 003, display field 2.
	4	Accelerator pedal value	While driving ¹⁾	Idle	0...1 %	See Display group number 003, display field 4.
				Full throttle	99...100 %	

¹⁾ When driving, the assistance of a second mechanic is required to read off the nominal values.

²⁾ A „+“ means that the displayed converter slip is positive (engine speed ≥ gearbox input speed)

A „-“ means that the displayed converter slip is negative (engine speed ≤ gearbox input speed)

³⁾ If shifting does not occur, the clutch or brake can also be defective

⁴⁾ The torque converter lockup clutch must be opened. It is open if the momentary gear with „H“ = hydraulic with slip is displayed in the display field 1. The sign „+“ is additionally displayed. A „+“ means the engine speed (pump speed) is greater than the turbine speed. A „-“ means the engine speed (pump speed) is less than the turbine speed.

⁵⁾ The gearshift procedure must be terminated. The torque converter lockup clutch must be closed and the accelerator pedal value must be maintained constant (gears are mechanically controlled „M“).

⁶⁾ Tc = Torque converter lockup clutch

Function of CAN Bus

Bus:

The term bus designates a system for transporting and distributing data.

CAN:

Controller Area Network is a bus system which operates with two wires. These are known as bus wires. The data are transmitted along the bus wire serially, in other words in turn, to the connected control units.

These control units communicate by means of the CAN bus, in other words they exchange data over the CAN bus.

Testing a „two-wire bus system“

In the fault table you were requested to test the bus:

- Determine from the corresponding current flow diagram how many control units communicate with each other over the bus.
- Press key 0 twice to select the function „Automatic Test Sequence“.
- **Before testing the bus wires, ensure that there is no operational fault in any of the control units connected to the bus.**

An operational fault will interfere with communication with other control units.

Does any operational fault exist?

- **Rectify this fault first of all.**
- Make a note of the faults and erase the fault memories of all the control units ⇒ Interrogating fault memory and Erasing fault memory of the relevant control unit.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Rectify the operational faults by referring to the fault table in the appropriate workshop manuals.

You have rectified all the operational faults:

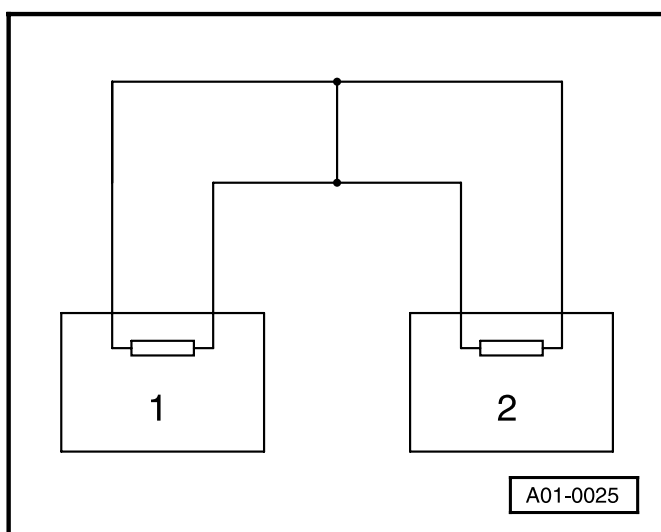
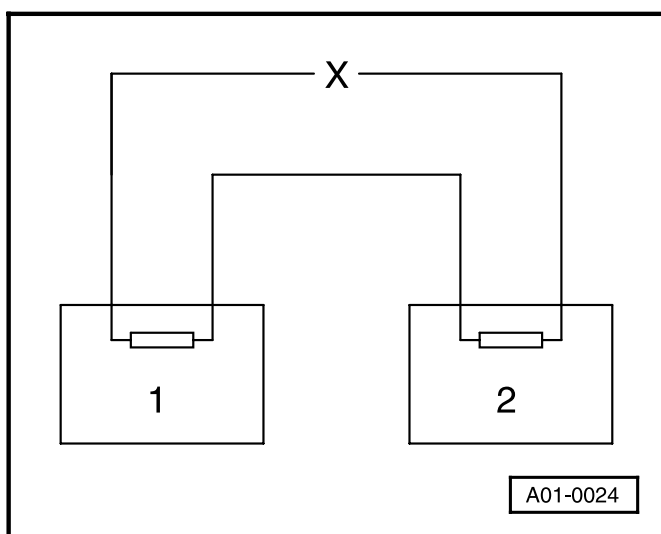
- Is there still a problem with the communication of the control units, then you have to check the bus wires.

In fault finding the bus wires, distinguish two cases:

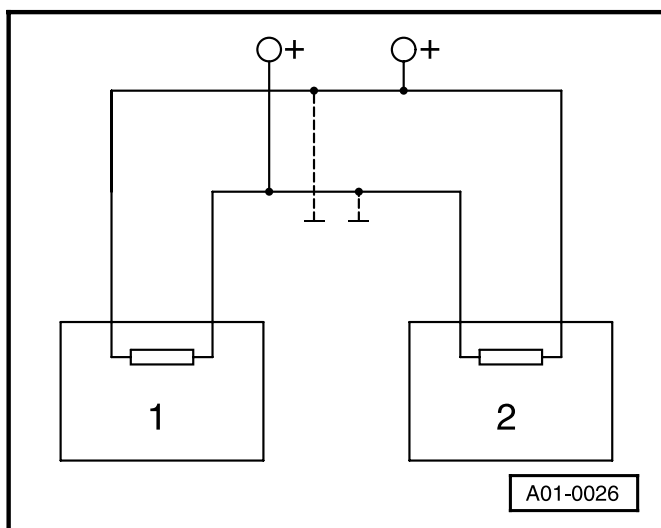
- ♦ Two control units communicate over a „two-wire bus system“.
- ♦ Three or more control units communicate over a „two-wire bus system“.

Communication between two control units is performed over a „two-wire bus system“.

- Switch off the ignition.
 - ◀ - Unplug both control units.
 - Check whether there is an open circuit in one of the bus wires.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.



- ◀ - Test whether the bus wires have a short circuit to each other.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.



- ◀ - Test whether one of the bus wires has a short circuit to positive or to earth.

You are not able to find any fault in the bus wires:

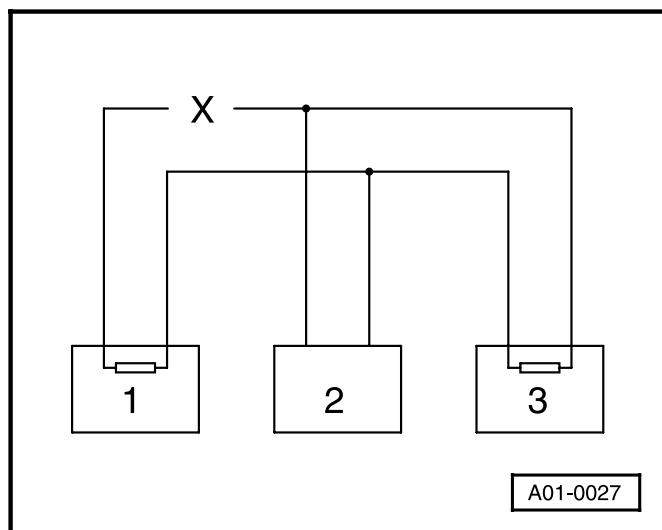
- As a check, replace the control unit which can be exchanged with the minimal amount of time and cost.
- If there is still a fault in the communication of control units over the bus, replace the second control unit.

Communication between three or more control units is performed over a „two-wire bus system“.

- Analyse the faults stored in the control units.

Example 1:

On the basis of the faults entered in the fault memories, you are able to recognize that control unit 1 has no link to control units 2 and 3.

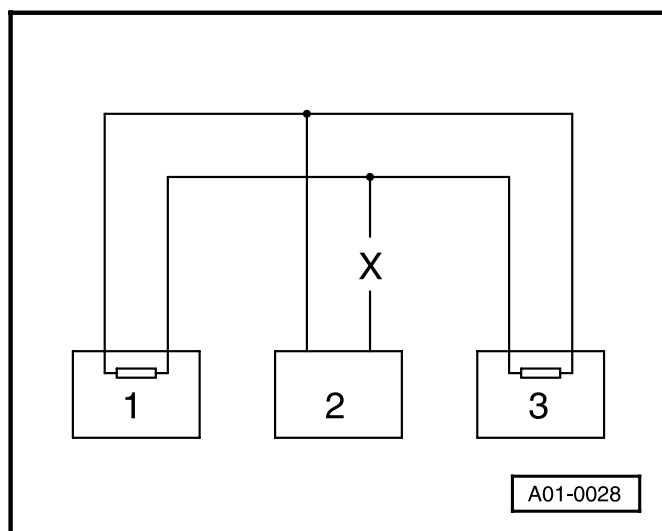


Control unit	Faults entered in the fault memory:
1	◆ No message from control unit 2 ◆ No message from control unit 3
2	◆ No message from control unit 1
3	◆ No message from control unit 1

- Switch off the ignition.
- Unplug the control units which are linked by the bus wires and determine whether there is an open circuit in one of the bus wires.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.
- If you are not able to detect any fault in the bus wires, replace control unit 1.

Example 2:

On the basis of the faults entered in the fault memories, you are able to recognize that control unit 2 has no link to control units 1 and 3.



Control unit	Faults entered in the fault memory:
1	◆ No message from control unit 2
2	◆ No message from control unit 1 ◆ No message from control unit 3
3	◆ No message from control unit 2

- Switch off the ignition.

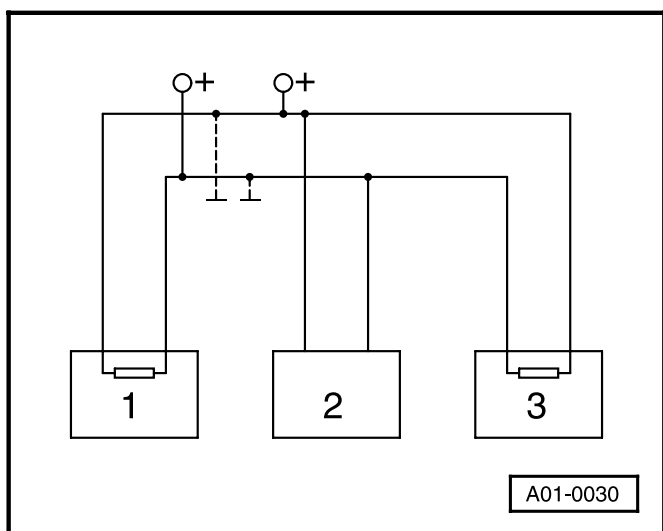
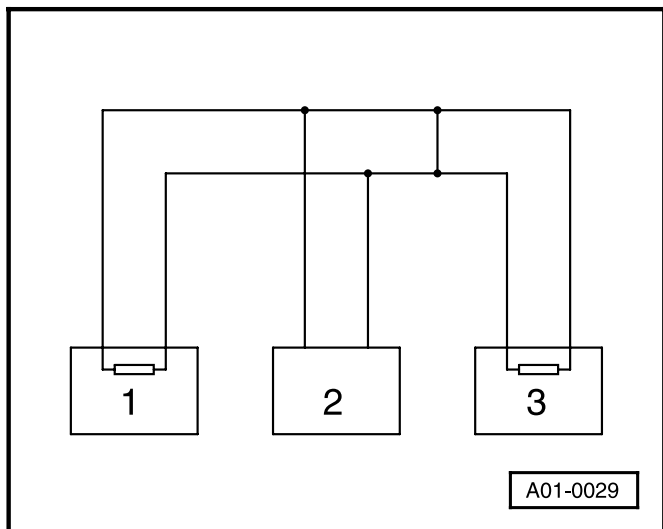
- Unplug the control units which are linked by the bus wires and determine whether there is an open circuit in one of the bus wires.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.
- If you are not able to detect any fault in the bus wires, replace control unit 2.

Example 3:

On the basis of the faults entered in the fault memories, you are able to recognize that transmission or reception mode is not possible in any of the control units.

Control unit	Faults entered in the fault memory:
1	♦ Hardware fault
2	♦ Hardware fault
3	♦ Hardware fault

- Switch off the ignition.
- ◀ - Unplug the control units which are linked by the bus wires and test the bus wires in respect of a short circuit to each other.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.



- ◀ - Test the bus wires in respect of a short circuit to positive and to earth.

Are you able to detect a fault in the bus wires?

- Determine whether one of the control units is responsible for a short circuit of the bus wires to each other, to positive or to earth.
- Unplug each of the control units linked by the bus wires individually one after the other and check whether the „hardware fault“ is thus rectified.
- If the fault is rectified, replace the control unit which you have unplugged at that moment. If the fault is not rectified, plug in the control unit again and unplug the next control unit linked by the bus wires.

Gearbox: Electrical test

Special tools, testers and aids required

- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Auxiliary cable (e.g. V.A.G 1594)
- ◆ Test box (e.g. V.A.G 1598/18)

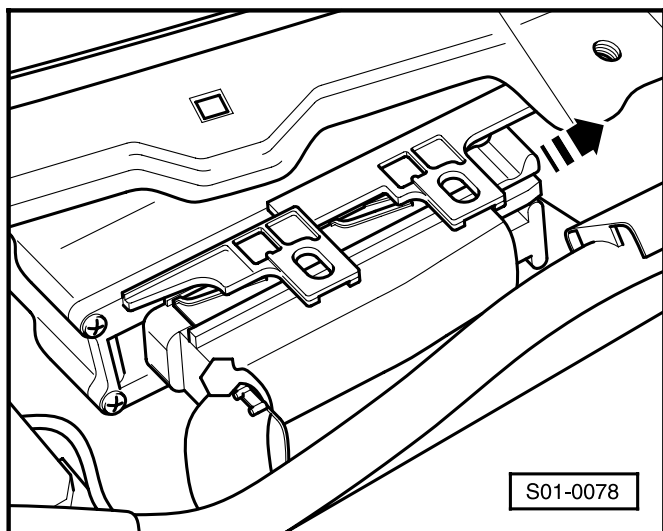
Test requirements:

- *Voltage supply of vehicle o.k.*
- *Fuses o.k.*
 - ⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder
- *Earth connections and earth point for gearbox and gearbox control unit o.k.*
 - ⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder
- Inspect battery earth strap and earth strap between battery and gearbox.

Important!

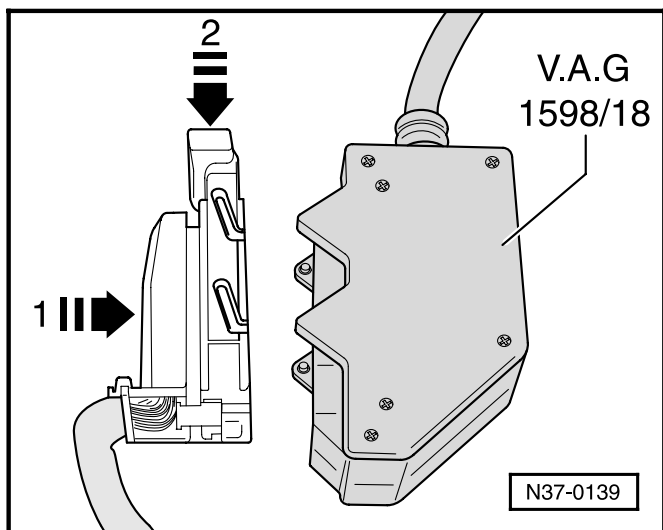
Switch on the relevant range at the tester before connecting the test cables in order to avoid damaging the electronic components.

- ◆ *The specified values stated apply to an ambient temperature of 0 ... 40 °C.*
- ◆ *If the readouts obtained differ from the specifications, determine fault on the basis of current flow diagram.*
 - ⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder
- ◆ *If the readouts obtained differ only slightly from the specifications, clean contacts and connectors of the test equipment and test cables, and repeat test. Inspect the cables and connections before replacing any components. It is particularly important to repeat the resistance measurement at the component if the specification is less than 10 Ω.*



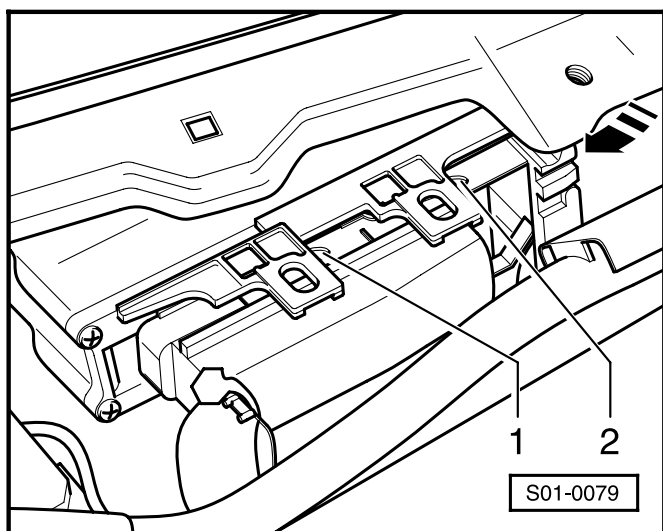
The automatic gearbox control unit -J217 is located in the centre right of the plenum chamber.

- Switch off ignition, release multi-pin connector in direction of arrow and unplug from the control unit.



- Plug test box (e.g. V.A.G 1598/18) into the multi-pin connection (1) and lock in direction of arrow (2).

The test box (e.g. V.A.G 1598/18) can be used to test the wiring on the basis of the CFD.



- After carrying out the electrical test, plug in the multi-pin connection at the control unit -J217 and lock -arrow-.

Note:

When connecting, ensure that the guides -1- and -2- are positioned onto the pins of the control unit.

Multi-pin connector (68-pin connector) of control unit -J217 (sockets on V.A.G 1598/18)

1- Earth (terminal 31)	35- Not assigned
2- Not assigned	36- Not assigned
3- CAN bus ¹⁾	37- Not assigned
4- Not assigned	38- Not assigned
5- Not assigned	39- Not assigned
6- Gearbox oil (ATF) temperature sender -G93	40- Multifunction switch -F125
7- Not assigned	41- Accelerator pedal value from engine control unit ²⁾
8- Not assigned	42- Not assigned
9- Solenoid valve 3 -N90	43- Road speed sender -G68 (screening)
10- Solenoid valve 7 -N94	44- Gearbox speed sender -G38 (screening)
11- Park/Neutral signal	45- Supply voltage (terminal 30)
12- A/C cut-off at kickdown	46- Not assigned
13- Retardation of ignition timing/quantity injected ²⁾	47- Solenoid valve 4 -N91
14- Not assigned	48- Not assigned
15- Brake light switch -F signal voltage	49- Not assigned
16- Kickdown switch -F8	50- Not assigned
17- Not assigned	51- Not assigned
18- Multifunction switch -F125	52- Not assigned
19- Engine speed signal ²⁾	53- Not assigned
20- Road speed sender -G68	54- Solenoid valve 2 -N89
21- Gearbox speed sender -G38	55- Solenoid valve 1 -N88
22- Supply voltage solenoid valve 6 -N93	56- Solenoid valve 5 -N92
23- Supply voltage (terminal 15)	57- Selector lever position indication
24- K wire of diagnosis	58- Solenoid valve 6 -N93
25- CAN bus ¹⁾	59- Not assigned
26- Not assigned	60- Not assigned
27- Not assigned	61- Supply voltage for cruise control system ²⁾
28- Not assigned	62- Multifunction switch -F125
29- Selector lever lock solenoid -N110	63- Multifunction switch -F125
30- Not assigned	64- Not assigned
31- Not assigned	65- Road speed sender -G68
32- Not assigned	66- Gearbox speed sender -G38
33- Not assigned	67- Supply voltage for solenoid valves
34- Not assigned	68- Not assigned

¹⁾ Only for automatic gearbox with databus (CAN bus) ⇒ current flow diagram from Model Year 1998. This cable is not assigned for gearboxes without databus ⇒ current flow diagram from Model Year 1997.

²⁾ Only for automatic gearbox without databus (CAN bus) ⇒ current flow diagram from Model Year 1997. This cable is not assigned for gearboxes with databus ⇒ current flow diagram from Model Year 1998.

Summary of test steps (68-pin connector)

♦ Carry out only the test steps listed for the particular component from the fault table and the measured value block.

Test of component		Test of component	
Supply voltage of control unit -J217	- Carry out test step 1	Solenoid valve 5 -N92	- Carry out test step 10
Selector lever lock solenoid -N110	- Carry out test steps 2 and 13	Solenoid valve 6 -N93	- Carry out test step 11
Brake light switch -F	- Carry out test step 3	Solenoid valve 7 -N94	- Carry out test step 12
Multifunction switch -F125	- Carry out test steps 4 and 5	Kickdown switch -F8	- Carry out test step 14
Solenoid valve 1 -N88	- Carry out test step 6	Road speed sender -G68	- Carry out test steps 15 and 16
Solenoid valve 2 -N89	- Carry out test step 7	Gearbox speed sender -G38	- Carry out test steps 17 and 18
Solenoid valve 3 -N90	- Carry out test step 8	Gearbox oil (ATF) temperature sender -G93	- Carry out test step 19
Solenoid valve 4 -N91	- Carry out test step 9	CAN bus	- Carry out test step 20

Test table

Switch on measuring range: Voltage measurement 20 V					
Test step	V.A.G 1598/18 Sockets	Test of	• Test conditions - Additional operations	Specifica- tion	Measures if readouts differ from specification
1	23 + 1	Supply voltage of control unit -J217	• Ignition switched on	approx. battery voltage	- Test wiring according to CFD - Test cable from contact 1 to earth - Test cable from contact 23 to terminal 15 electrical centre - Test cable from contact 45 to terminal 30 electrical centre
	45 + 1		• Ignition switched off/on		
2	29 + 1	Supply voltage for selector lever lock solenoid -N110	• Ignition switched on	approx. battery voltage	- Test wiring according to CFD - Carry out test step 13 - Replace selector lever lock solenoid ⇒ page 37-1, Servicing shift mechanism
3	15 + 1	Brake light switch -F	• Ignition switched on • Brake pedal not depressed	≤ 1 V	- Test wiring according to CFD - Test brake light switch -F ⇒ Running Gear; Repair Group 45;
			- Brake pedal depressed	approx. battery voltage	

Switch on measuring range: Voltage measurement 20 V					
Test step	V.A.G 1598/18 Sockets	Tested	• Test conditions - Additional operations	Nominal value	Measures for deviations from nominal value
4	18 + 1	Supply voltage for multi-function switch -F125	- Ignition switched on - Selector lever in „P“, „R“, „N“	approx. battery voltage	- Check fuses. - Remove relay for starter interlock switch and reversing light -J226 and repeat measurement. - Perform test step 5 - Check wiring from gearbox control unit to multi-function switch -F125 ⇒ page 01-36
			Selector lever in „D“, „3“, „2“, „1“	≤ 3 volts	

Switch on measuring range: Resistance measurement 200 Ω					
Test step	V.A.G 1598/18 Sockets	Tested	• Test conditions - Additional operations	Nominal value	Measures for deviations from nominal value
5	63 + 1 63 + 23 40 + 1 40 + 23 62 + 1 62 + 23 18 + 1 18 + 23	Line connection from gearbox control unit to multi-function switch -F125	- Test step 4 already performed - Ignition switched off. - Plug removed from multi-function switch -F125 and relay for starter interlock switch and reversing light -J226	∞ Ω ¹⁾	Check wiring from gearbox control unit to multi-function switch -F125 ⇒ page 01-36
6	55 + 67	Solenoid valve 1 -N88	Ignition switched off	55...75 Ω	Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	55 + 1 67 + 1			∞ Ω ¹⁾	
7	54 + 67	Solenoid valve 2 -N89	Ignition switched off	55...75 Ω	Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	54 + 1 67 + 1			∞ Ω ¹⁾	
8	9 + 67	Solenoid valve 3 -N90	Ignition switched off	55...75 Ω	Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	9 + 1 67 + 1			∞ Ω ¹⁾	

¹⁾ V.A.G 1526 A switches to largest Ω range.

Switch on measuring range: Resistance measurement 200 Ω					
Test step	V.A.G 1598/18 Sockets	Tested	• Test conditions - Additional operations	Nominal value	Measures for deviations from nominal value
9	47 + 67	Solenoid valve 4 -N91	• Ignition switched off	4...7 Ω	- Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	47 + 1 67 + 1			$\infty \Omega^1$	
10	56 + 67	Solenoid valve 5 -N92	• Ignition switched off	55...75 Ω	- Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	56 + 1 67 + 1			$\infty \Omega^1$	
11	58 + 22	Solenoid valve 6 -N93	• Ignition switched off	4...7 Ω	- Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	58 + 1			$\infty \Omega^1$	
	22 + 1			$\infty \Omega^1$	
12	10 + 67	Solenoid valve 7 -N94	• Ignition switched off	55...75 Ω	- Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
	10 + 1			$\infty \Omega^1$	
13	23 + 29	Selector lever lock solenoid -N110	• Ignition switched off	25...35 Ω	- Remove plug for selector lever illumination and repeat measurement, repair selector lever illumination if necessary. - Check wiring ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting locations - Replace selector lever lock solenoid -N110 ⇒ page 37-1, Repairing gearshift mechanism
14	1 + 16	Kick-down switch -F8	• Ignition switched off	$\infty \Omega^1$	- Check wiring ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting locations - Adjust throttle control cable or replace ⇒ Repair Group 20 of the relevant engine.
			• not operated accelerator pedal - Press accelerator pedal down to kick-down	$\leq 1.5 \Omega$	

¹⁾ V.A.G 1526 A switches to largest Ω range.

Switch on measuring range: Resistance measurement 20 kΩ					
Test step	V.A.G 1598/18 Sockets	Tested	• Test conditions - Additional operations	Nominal value	Measures for deviations from nominal value
15	20 + 65	Vehicle speed sender -G68	• Ignition switched off	min.	- Check wiring from gearbox control unit to vehicle speed sender -G68 ⇒ page 01-36
				max.	
				0.75 kΩ	
				1 kΩ	
16	1 + 43 23 + 43	Screening -G68	• Ignition switched off	∞ Ω ¹⁾	- Check wiring from gearbox control unit to vehicle speed sender -G68 ⇒ page 01-36
17	21 + 66	Gearbox speed sender -G38	• Ignition switched off	min.	- Check wiring from gearbox control unit to gearbox speed sender -G38 ⇒ page 01-36
				max.	
				0.75 kΩ	
				1 kΩ	
18	1 + 44 23 + 44	Screening -G38	• Ignition switched off	∞ Ω ¹⁾	- Check wiring from gearbox control unit to gearbox speed sender -G38 ⇒ page 01-36

Switch on measuring range: Resistance measurement 2 MΩ					
Test step	V.A.G 1598/18 Sockets	Tested	• Test conditions - Additional operations	Nominal value	Measures for deviations from nominal value
19	6 + 67	Gearbox oil temperature sender (ATF) -G93	• Ignition switched off • ATF temperature approx. 20 °C - Switch over hand multimeter V.A.G 1526 to 200 kΩ approx. 60 °C approx. 120 °C	0.250 MΩ	- Check wiring from gearbox control unit to slide valve body ⇒ page 01-36
				48.8 kΩ 7.4 kΩ	

¹⁾ V.A.G 1526 A switches to largest Ω range.

Switch on measuring range: Resistance measurement					
Test step	V.A.G 1598/20 Sockets	Tested	• Test conditions - Additional operations	Nominal value	Measures for deviations from nominal value
20 ¹⁾	3 + 1 3 + 23 25 + 1 25 + 23	Short-circuit to earth and terminal 15 of CAN databus lines	• Ignition switched off • Engine control unit removed • Brake control unit removed	endless Ω ²⁾	- Check wiring $\Rightarrow$ Current Flow Diagrams, Electrical Fault Finding, Fitting locations. - Check CAN $\Rightarrow$ Chassis; Anti-lock brake system Repair Group 45.

1) Only for gearbox with databus (CAN databus) $\Rightarrow$ Current Flow Diagram as of Model year 1998.

2) V.A.G 1526 A switches to largest Ω range.

Notes:

- ♦ The data and information exchanged between engine control unit, brake control unit and gearbox control unit is performed via the so-called CAN databus. All information signals are transmitted through 2 cables. CAN databus function $\Rightarrow$ page 01-28.1.
- ♦ If the test is O.K., the two cable databus system must be tested $\Rightarrow$ page 01-28.1.

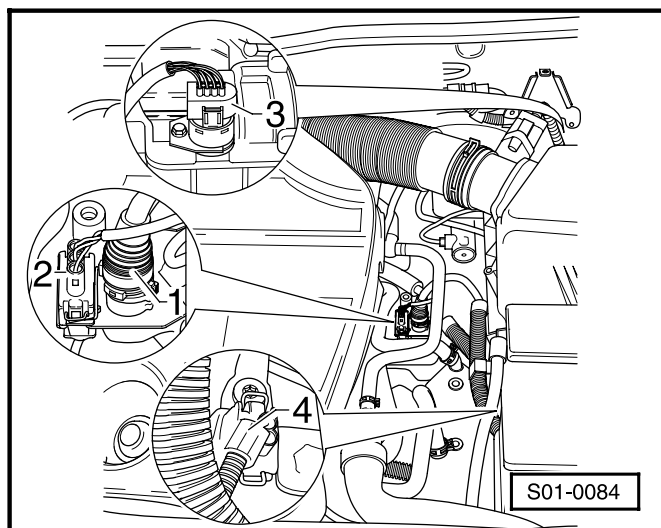
Inspecting cable connection between 68-pin gearbox control unit and gearbox

Perform if:

- ♦ the actuator diagnosis or
- ♦ the electrical test indicates faults in or between gearbox and gearbox control unit -J217.

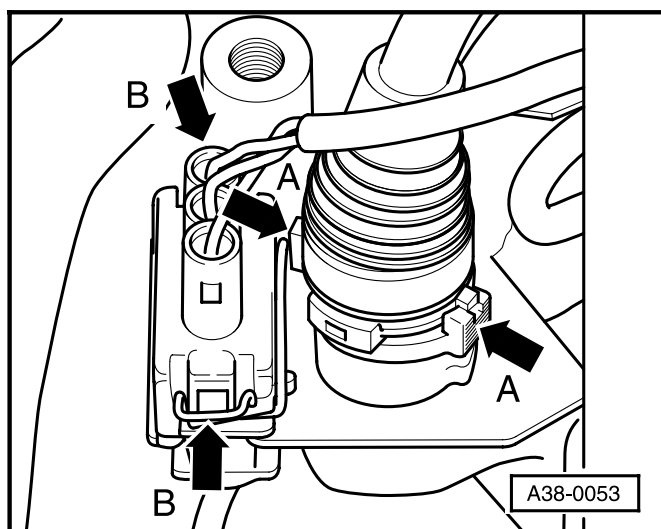
Test requirements:

- ♦ Ignition switched off
- ♦ Connect test box V.A.G 1598/18 only to 68-pin connector of gearbox wiring harness.
- ♦ Perform measurements with test box V.A.G 1598/18 outside the vehicle.



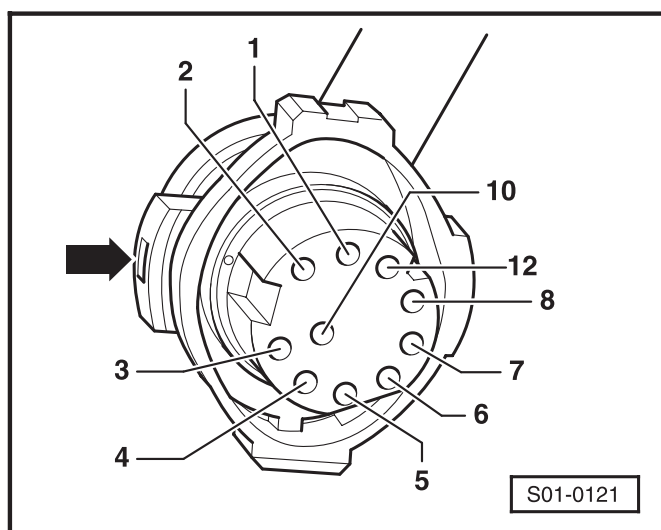
List of plug connections which must be disconnected for the test.

- 1 - Plug connection for slide valve body
⇒ Test; page 01-36.1
- 2 - 3-pin plug connection for vehicle speed sender -G68 slide valve body ⇒ Test; page 01-36.4
- 3 - 8-pin plug connection for multi-function switch -F125 ⇒ Test; page 01-36.2
- 4 - 2-pin plug connection for gearbox speed sender -G38 ⇒ Test; page 01-36.5



Inspecting cable connection for plug of slide valve body

- ◀ - Pull out plug upward by pressing on the lateral catches -arrows A- ⇒ Fitting location see item 1, page 01-36.1.



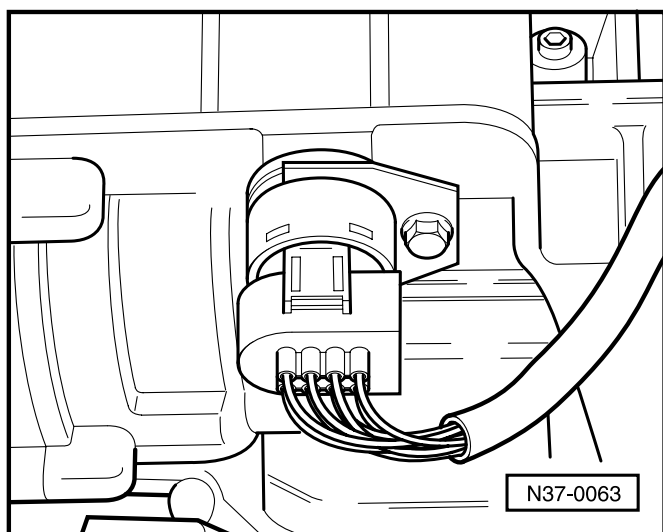
- ◀ - Check cable connections with hand multimeter V.A.G 1526 A or V.A.G 1715 between contacts of plug and sockets of test box V.A.G 1598/18 for continuity.

The nominal values of the resistances can be read in the following table.

Switch on measuring range: Resistance measurement 200 Ω			
Plug contact	Test box V.A.G 1598/18 Socket	Nominal value	Measures for deviations from nominal value
1	67	$\leq 1.5 \Omega$	- Rectify open circuit in wiring ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting locations. - Check plug for: - Contact corrosion - Water penetration - Leakage
2	22	$\leq 1.5 \Omega$	
3	55	$\leq 1.5 \Omega$	
4	54	$\leq 1.5 \Omega$	
5	9	$\leq 1.5 \Omega$	
6	47	$\leq 1.5 \Omega$	
7	56	$\leq 1.5 \Omega$	
8	58	$\leq 1.5 \Omega$	
10	10	$\leq 1.5 \Omega$	
12	6	$\leq 1.5 \Omega$	

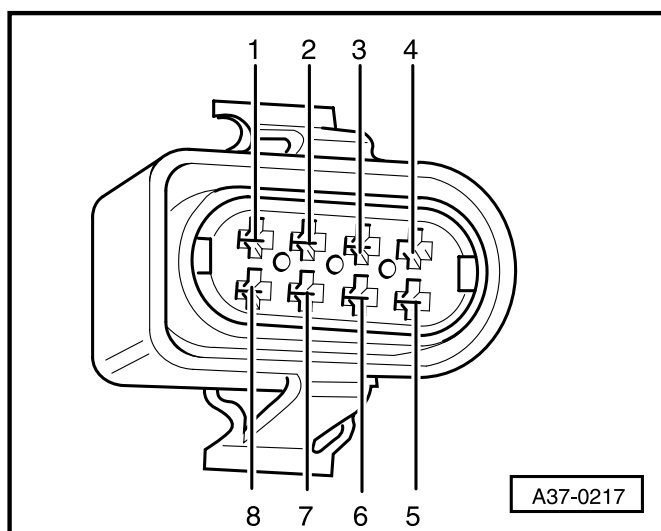
Notes:

- ♦ If this test of the wiring does not show any unauthorised deviations, the wiring harness in the gearbox must be checked. Therefore the ribbon cable must be removed ⇒ page 38-18.
- ♦ Only after a satisfactory test of the wiring harness in the gearbox must the slide valve body be replaced ⇒ page 38-12.



Inspecting cable connection for multi-function switch (8-pin plug connection)

- ◀ - Remove 8-pin plug from multi-function switch
⇒ Fitting location item 3, page 01-36.1.



- ◀ - Use hand-held multimeter V.A.G 1526A or V.A.G 1715 to test continuity and voltage of cable connections between the connector contacts of the 8-pin connector and the sockets of test box V.A.G 1598/18.

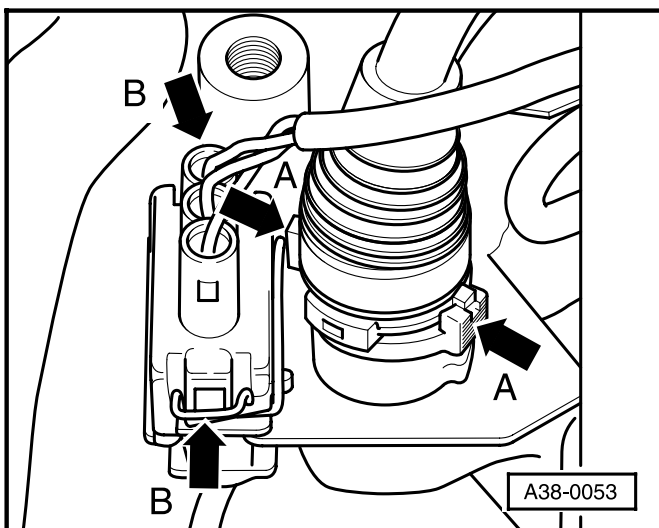
Refer to the two tables below for the specified resistances and voltages.

Switch on measuring range: Resistance measurement 200 Ω			
Connector contact 10-pin	Test box V.A.G 1598/18, socket	Specification	Measures if readout differs from specification
1	63	$\leq 1.5 \Omega$	- Rectify any open circuit in wiring according to current flow diagram - Test connectors for: - Contact corrosion - Ingress of water - Leaks
2	40	$\leq 1.5 \Omega$	
3	1	$\leq 1.5 \Omega$	
4	not assigned	$\leq 1.5 \Omega$	
5	18	$\leq 1.5 \Omega$	
6	62	$\leq 1.5 \Omega$	
7	23	$\leq 1.5 \Omega$	
8	not assigned	$\leq 1.5 \Omega$	

Switch on measuring range: Voltage measurement 20 V			
Connector contact 10-pin	Test box V.A.G 1598/18, socket	Specification	Measures if readout differs from specification
7	1	approx. battery voltage	- Fuse, or rectify open circuit in wiring according to current flow diagram

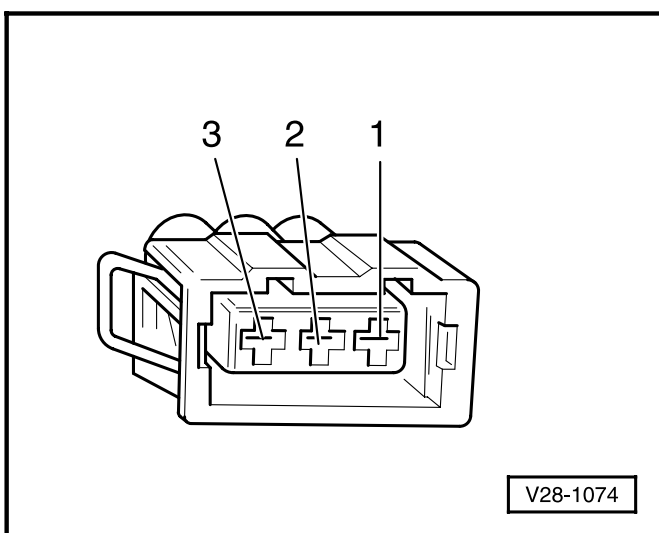
Notes:

- ♦ If test step 4 of the test table on page 01-32 does not comply with specifications but these tests do not reveal any permissible variations, it is then necessary to replace the multifunction switch -F125 $\Rightarrow$ page 38-20.
- ♦ If a variation from the specification occurs when reading the corresponding measured value block, but the electrical test is o.k., it is then necessary to replace the multifunction switch -F125 $\Rightarrow$ page 38-20.



Testing cable connection to road speed sender -G68 (3-pin connector)

- Press on the side locks -arrows B- and unplug the connector by pulling up; fitting location $\Rightarrow$ page 01-36.1, item 2.



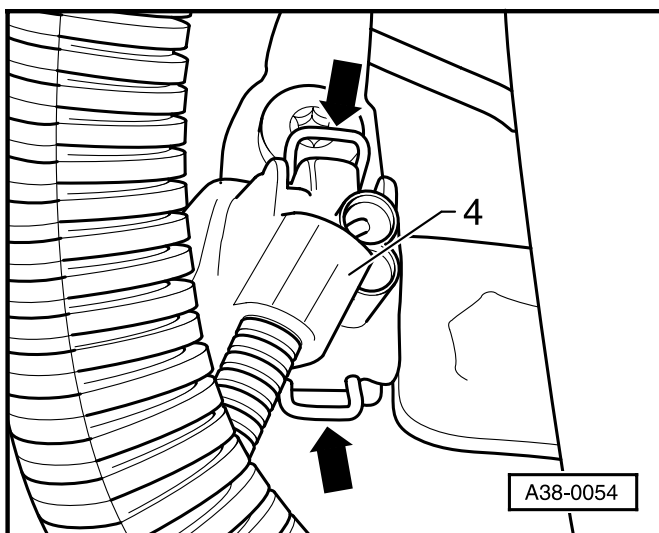
- Use hand-held multimeter V.A.G 1526A or V.A.G 1715 to test continuity of cable connections between the contacts of the 3-pin connector and the sockets of test box V.A.G 1598/18.

Refer to the table overleaf for the specified resistances.

Switch on measuring range: Resistance measurement 200 Ω			
Connector contact 3-pin	Test box V.A.G 1598/18, socket	Specification	Measures if readout differs from specification
1	65	$\leq 1,5 \Omega$	- Rectify any open circuit in wiring according to current flow diagram - Test connectors for: - Contact corrosion - Ingress of water - Leaks
2	20	$\leq 1,5 \Omega$	
3	43	$\leq 1,5 \Omega$	

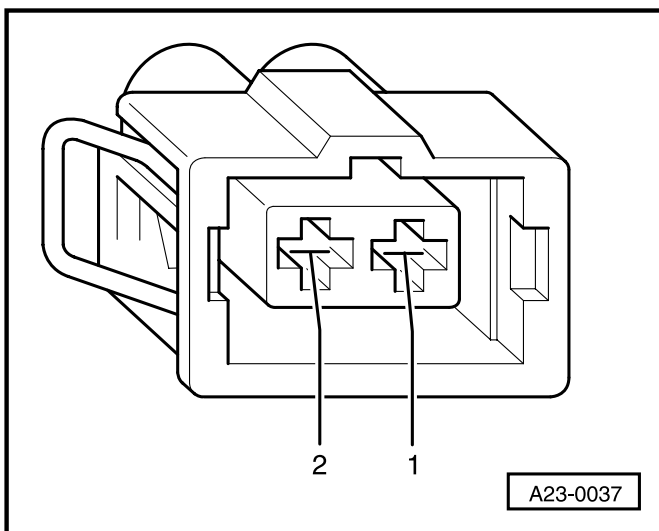
Note:

- If this test of the cable connection does not reveal any impermissible variations, it is then necessary to replace the road speed sender -G68 $\Rightarrow$ page 38-20.



Testing cable connection to gearbox speed sender -G38 (2-pin connector)

- Press on the side locks -arrows- and unplug the connector by pulling up; fitting location $\Rightarrow$ page 01-36.1, item 4.



- Use hand-held multimeter V.A.G 1526A or V.A.G 1715 to test continuity of cable connections between the contacts of the 2-pin connector and the sockets of test box V.A.G 1598/18.

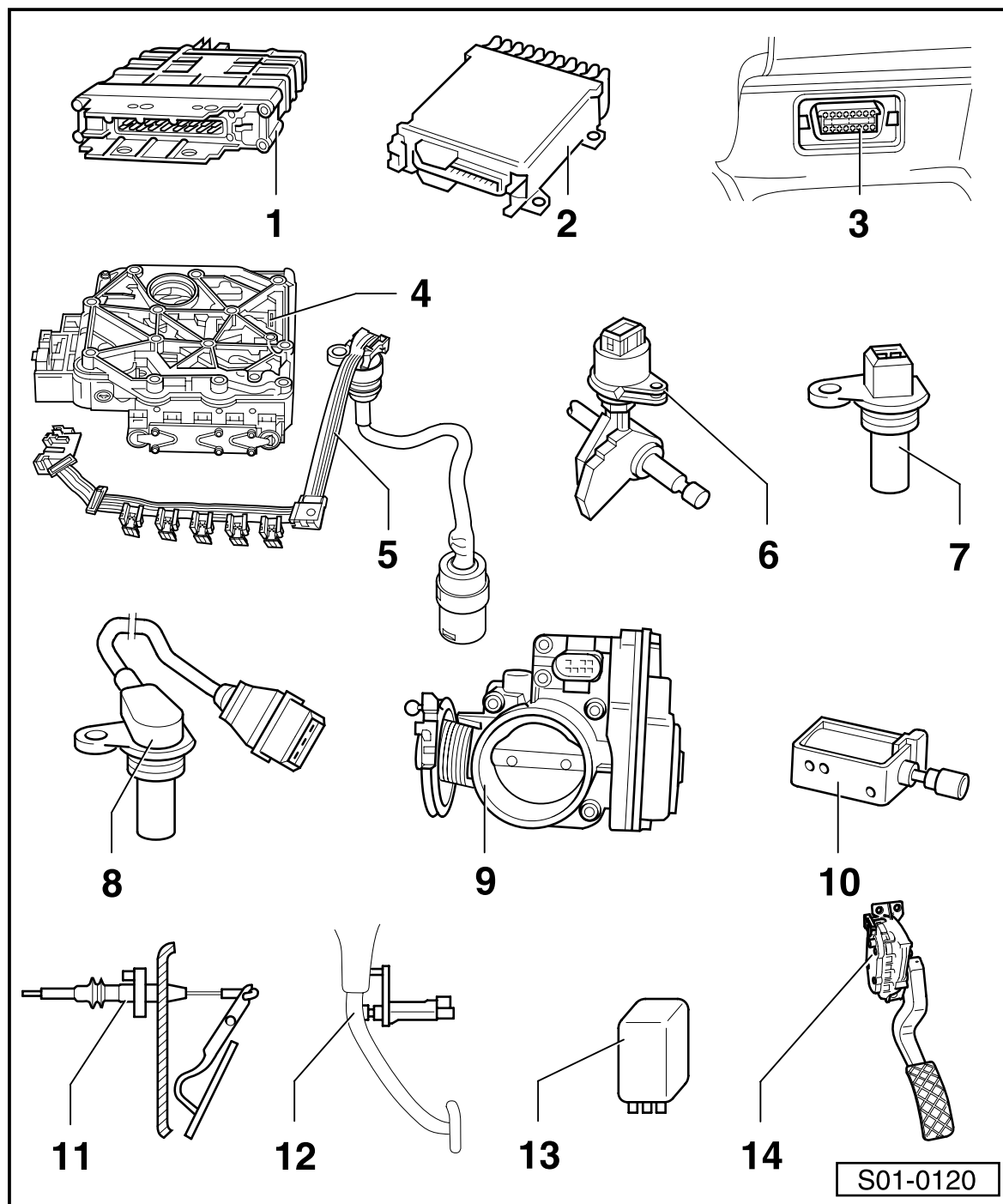
Refer to the table overleaf for the specified resistances.

Switch on measuring range: Resistance measurement 200 Ω			
Connector contact 2-pin	Test box V.A.G 1598/18, socket	Specification	Measures if readout differs from specification
1	21	$\leq 1.5 \Omega$	- Rectify any open circuit in wiring according to current flow diagram Test connectors for: - Contact corrosion - Ingress of water - Leaks
2	66	$\leq 1.5 \Omega$	

Note:

- If this test of the cable connection does not reveal any impermissible variations, it is then necessary to replace the gearbox speed sender -G38 $\Rightarrow$ page 38-20.

Electrical and electronic components - Fitting locations

**1 - Automatic gearbox control unit -J217**

- ♦ Fitting location: in right of plenum chamber
- ♦ Removing and installing ⇒ page 01-40
- ♦ Is tested by self-diagnosis ⇒ page 01-4

2 - Engine control unit

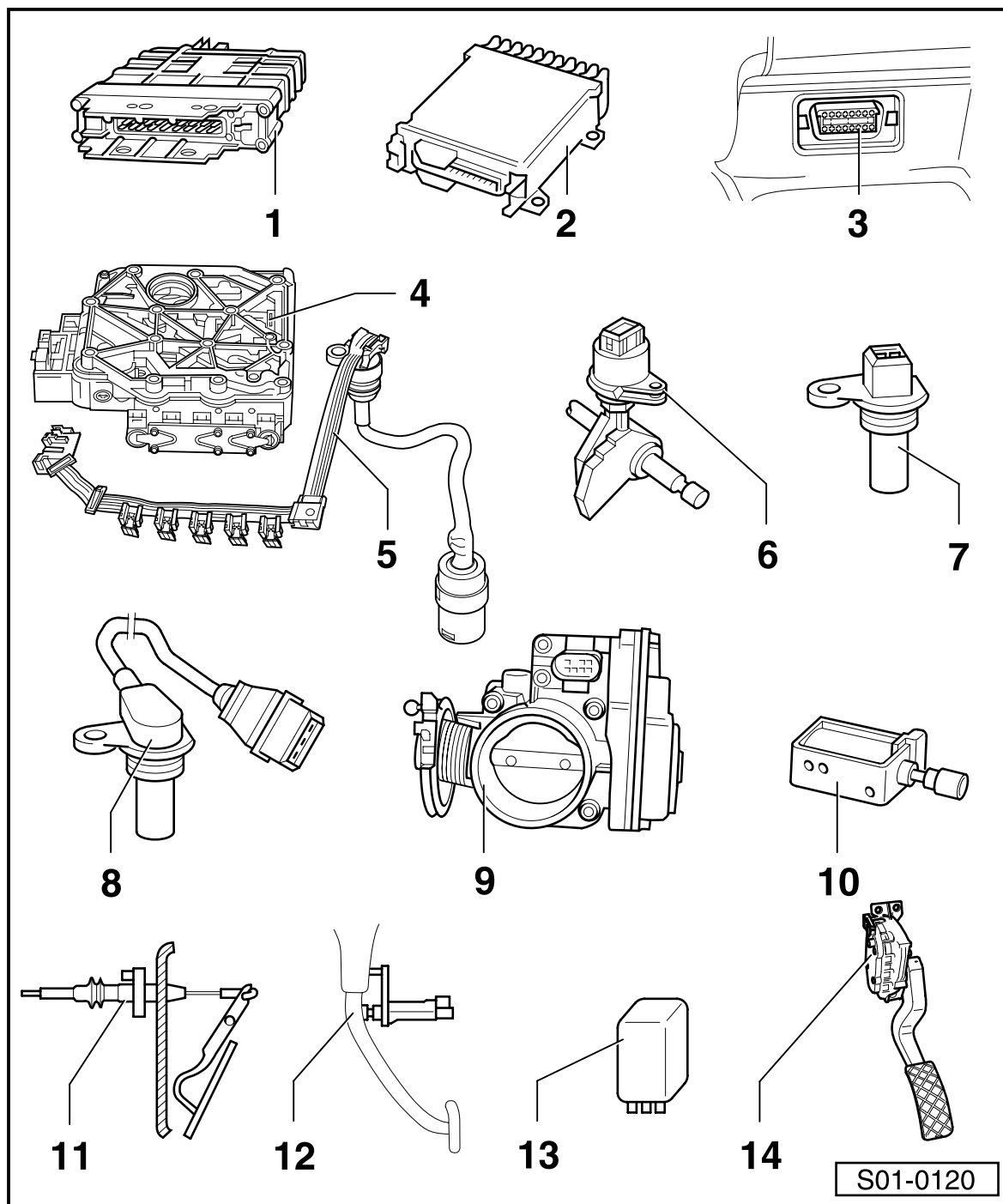
- ♦ Fitting location: in middle of plenum chamber
 - ♦ Removing and installing:
- ⇒ Repair Group 23 of diesel engine, Repair Group 24 of petrol engine

Note:

If engine or gearbox control unit is replaced, the system must be restored to the basic setting ⇒ page 01-15, Initiating basic setting.

3 - Diagnostic connection

- ♦ Fitting location: in storage recess below steering column



4 - Control valve body

- ◆ Fitting location: below gearbox oil pan
- ◆ Removing and installing ⇒ page 38-12
- ◆ The solenoid valves -N88, -N89, -N90, -N91, -N92, -N93 and -N94 are attached to the control valve body
- ◆ Components are tested by self-diagnosis

5 - Printed conductor with integrated ATF temperature sender -G93

- ◆ Fitting location: in oil pan below control valve body
- ◆ Removing and installing ⇒ page 38-18
- ◆ Do not bend, kink or otherwise damage printed conductor
- ◆ Temperature sender -G93 is tested by self-diagnosis

6 - Multifunction switch -F125

- ◆ Fitting location: at rear of gearbox
- ◆ Removing and installing ⇒ page 38-23
- ◆ Is tested by self-diagnosis

7 - Gearbox speed sender -G38

- ◆ Fitting location: at top of gearbox
- ◆ Removing and installing ⇒ page 38-23
- ◆ Is tested by self-diagnosis

8 - Vehicle speed sender -G68

- ◆ Fitting location: at top of gearbox, concealed by gearbox bracket
- ◆ Removing and installing ⇒ page 38-23
- ◆ Is tested by self-diagnosis

9 - Throttle valve control unit -J338

- ◆ Removing and installing:
- ⇒ Repair Group 24 of petrol engine, Repair Group 23 of diesel engine
- ◆ Signal is tested by self-diagnosis
 - ◆ Signal is transmitted by throttle valve control unit through engine control unit to gearbox control unit. If throttle valve control unit is indicated as cause of fault in the self-diagnosis, always also conduct self-diagnosis of engine control unit:
- ⇒ Repair Group 01 of relevant engine
- ◆ After completing repairs, initiate basic setting ⇒ page 01-15

10 - Selector lever lock solenoid -N110

- ◆ Fitting location: in shift mechanism
- ◆ Removing and installing ⇒ page 37-1, Servicing shift mechanism
- ◆ Can be tested in measured value block ⇒ page 01-16 and in Electrical Test ⇒ page 01-29

11 - Kickdown switch -F8

- ◆ Fitting location: integrated in throttle cable
 - ◆ To replace kickdown switch, replace throttle cable and adjust
 - ◆ Removing and installing, adjusting:
- ⇒ Repair Group 20 of relevant engine
- ◆ Can be tested in measured value block ⇒ page 01-16 and in Electrical Test ⇒ page 01-29

12 - Brake light switch -F

- ◆ Fitting location: in pedal assembly
 - ◆ Removing and installing:
- ⇒ Running Gear; Repair Group 45; Electrical and Electronic Components and Fitting Locations
- ◆ Can be tested in measured value block ⇒ page 01-16 and in Electrical Test ⇒ page 01-29

13 - Starter lockout and reversing light relay -J226

- ◆ Fitting location: on relay carrier
- ⇒ "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

14 - Accelerator pedal position sender -G79

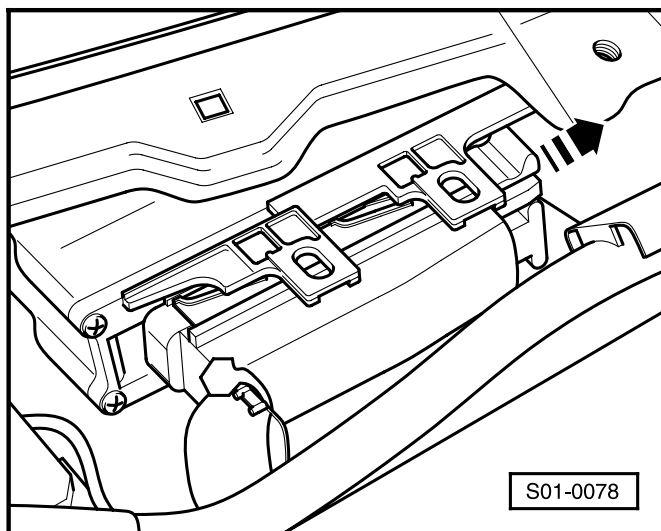
- ◆ Fitting location: sender is part of accelerator pedal
 - ◆ Removing and installing:
- ⇒ Repair Group 20 of relevant engine
- ◆ Testing:
- ⇒ Repair Group 24 of petrol engine, Repair Group 23 of diesel engine

Removing and installing automatic gearbox control unit -J217

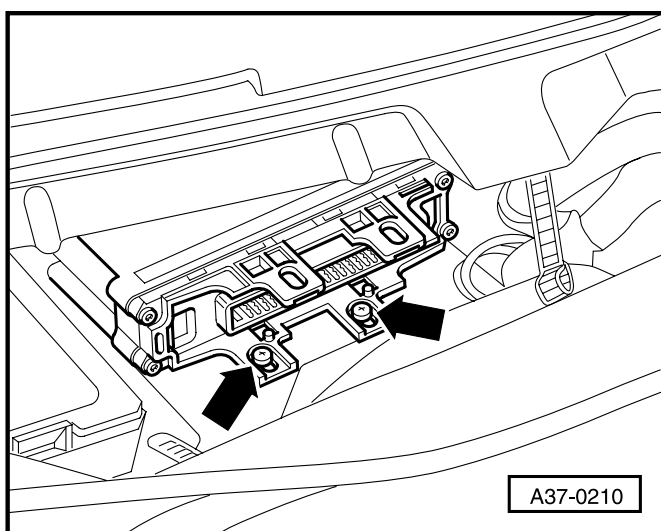
Fitting location: The control unit is located in the centre right of the plenum chamber.

Removing

- Open flap at front.
- Remove right wiper arm:
⇒ Electrical System; Repair Group 92
- Remove cover for plenum chamber:
⇒ General Body Repairs; Repair Group 66
- ◀ - Switch off ignition, release multi-pin connector in direction of arrow and unplug from control unit.

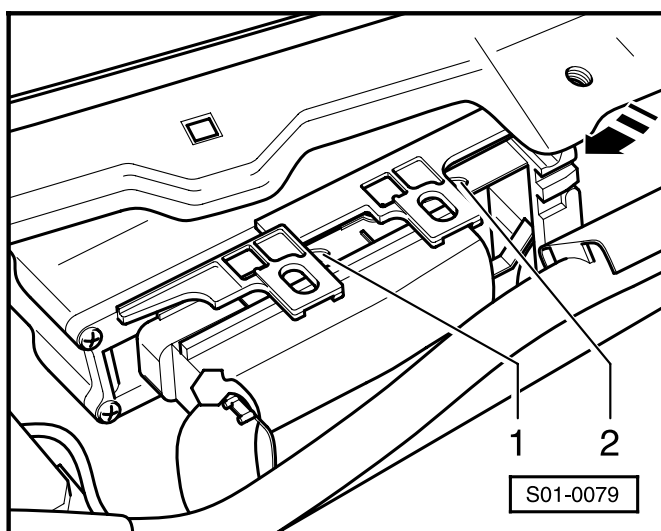


- ◀ - Slacken screws -arrows- and unplug control unit.



Installing

- Attach control unit.
- ◀ - Ensure guides -1- and -2- at the multi-pin connector slide into the pins of the control unit. After this, lock connector in direction of arrow.



Torque converter

The torque converter is equipped with a lockup clutch. The lockup clutch is closed in line with engine load and vehicle speed and drives the 1st, 2nd, 3rd and 4th gear mechanically irrespective of slip.

The lockup clutch is integrated in the torque converter.

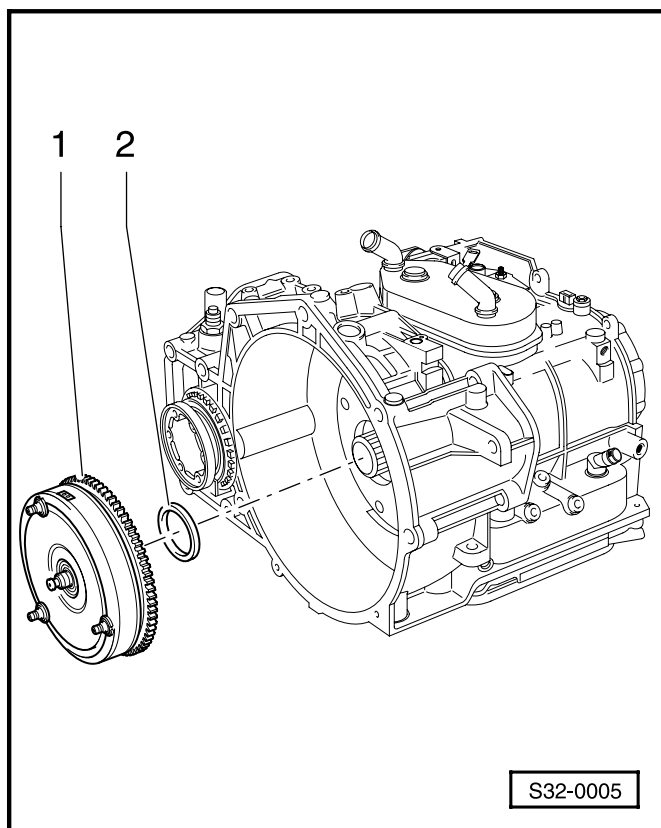
The ATF pump is driven by the torque converter.

Warning!

Before installing the transmission, check installed dimension of torque converter ⇒ page 32-4.

Notes:

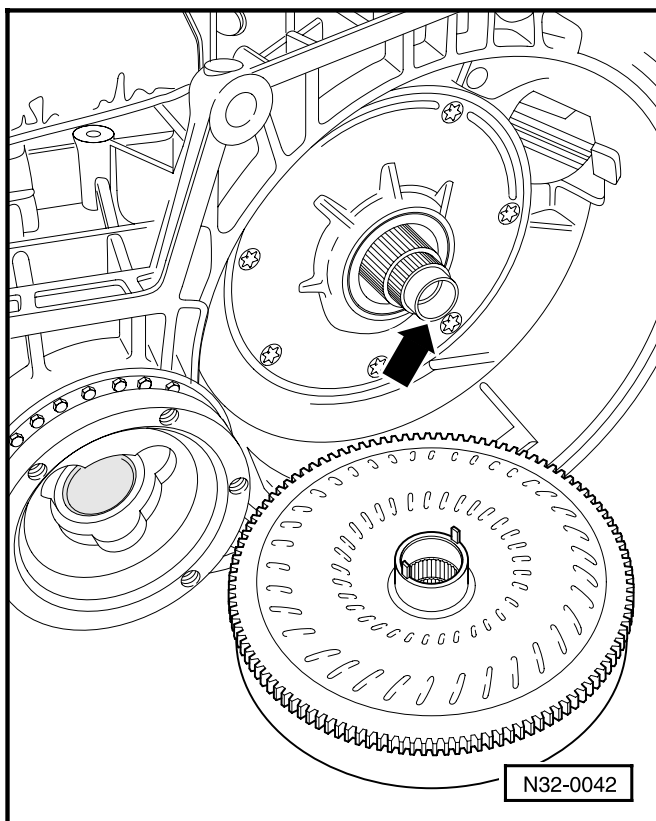
- ◆ Rules for cleanliness when working on automatic gearbox ⇒ page 37-28.
- ◆ Repair instructions ⇒ page 00-5.
- ◆ Coat seals with ATF. Other lubricants result in operating problems in the hydraulic gearbox control.

**1 - Torque converter**

- ◆ Secure to prevent it dropping out when the gearbox removed
- ◆ Code letters ⇒ page 00-2
- ◆ Installing ⇒ page 32-4
- ◆ Installation dimension ⇒ page 32-4

2 - Seal

- ◆ Replacing ⇒ page 32-3

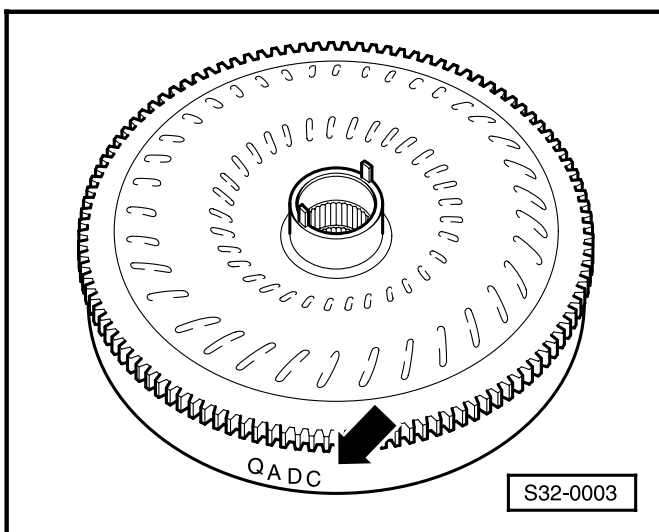


Identification of torque converter

There are different torque converters.

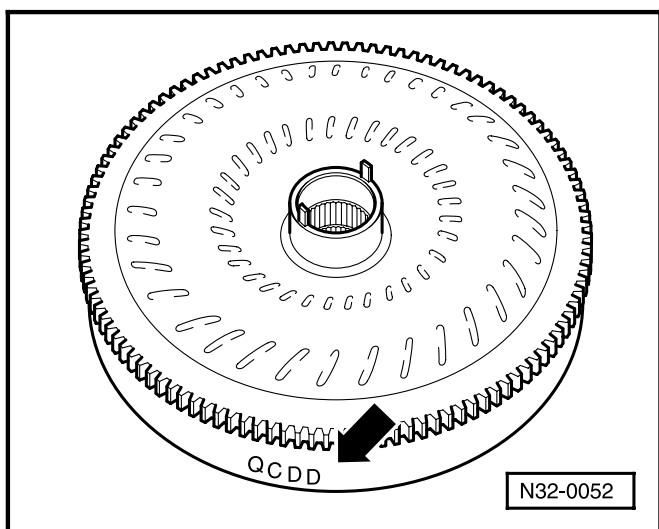
- Old version of torque converter is equipped with a friction bearing on the turbine shaft (arrow).

New version of the torque converter is equipped with an integrated needle bearing. This version must not have a friction bearing fitted to the turbine shaft (arrow).



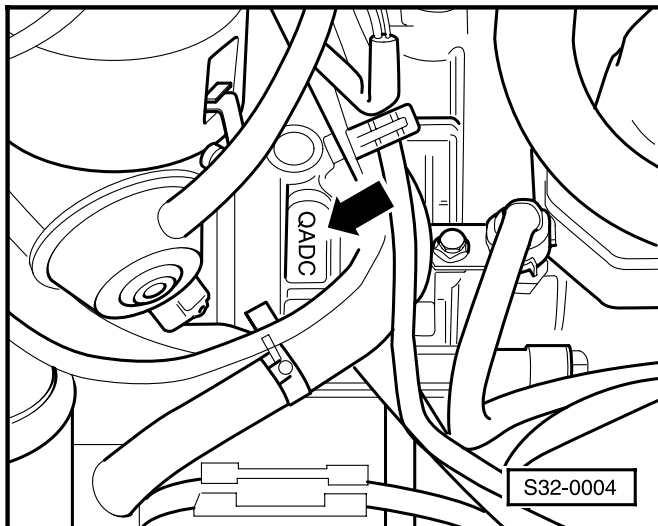
The identification is provided by means of code letters (arrow).

- Old version of torque converter can be installed only into the gearbox with the friction bearing on the turbine shaft. Identification character is letter -C- in the fourth position (arrow).



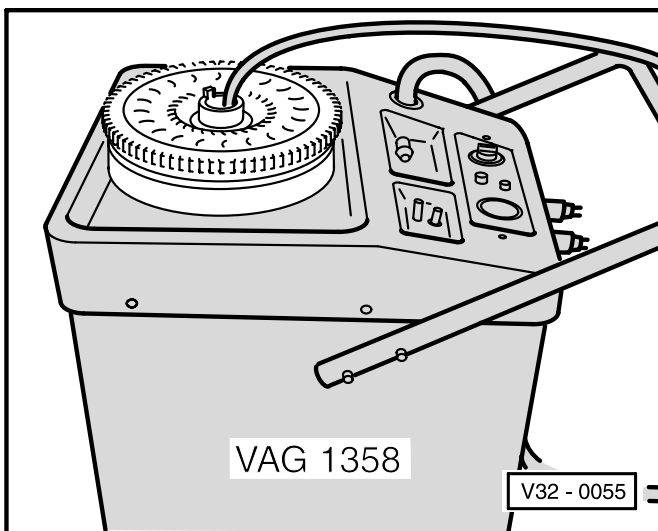
- New version of torque converter can only be installed in the gearbox without the friction bearing on the turbine shaft. Identification character is letter -D- in the fourth position (arrow).

Assignment of torque converter/gearbox
⇒ page 00-2.



◀ Code letters of torque converter

(Gearbox installed)



Draining torque converter

Special tools, testers and aids required

- ◆ Extraction device, e.g. V.A.G 1358
- ◆ Adapter, e.g. V.A.G 1358 A/1

If the ATF is contaminated by abrasion, or if a major overhaul has been carried out on the gearbox, the torque converter should be drained as follows:

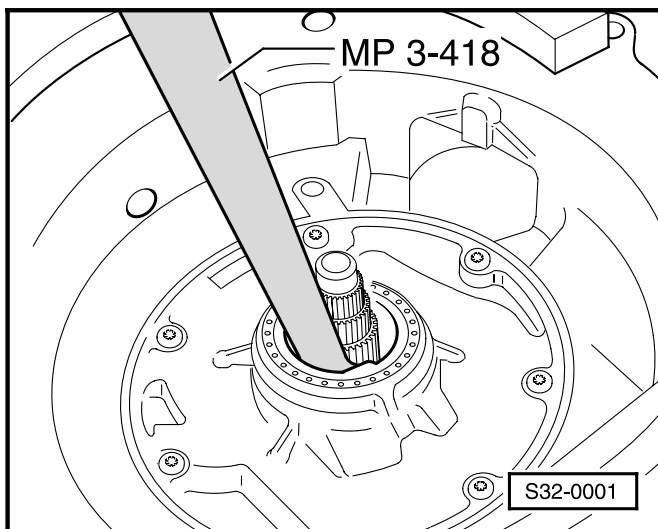
- ◀ - Extract ATF from torque converter (e.g. with V.A.G 1358 and V.A.G 1358 A/1).

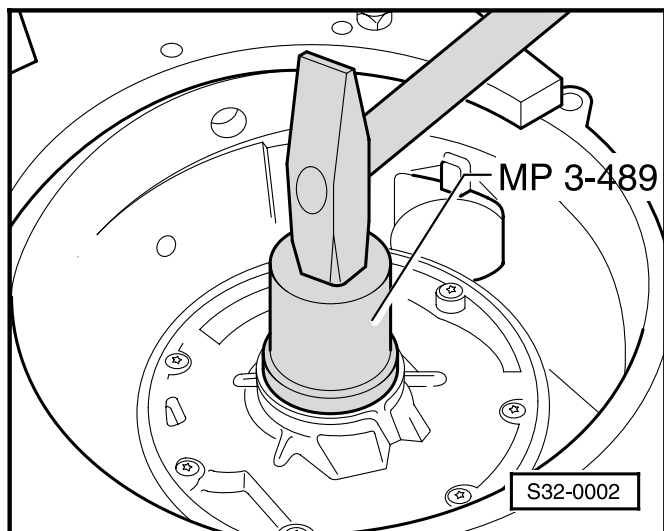
Removing and installing torque converter seal

Special tools, testers and aids required

- ◆ Extraction lever MP 3-418
- ◆ Insertion sleeve MP 3-489

◀ Removing seal for torque converter





◀ Installing seal for torque converter flush

Note:

The open side of the seal points toward the gear-box. Apply a thin film of ATF to outer circumference and sealing lip of seal.

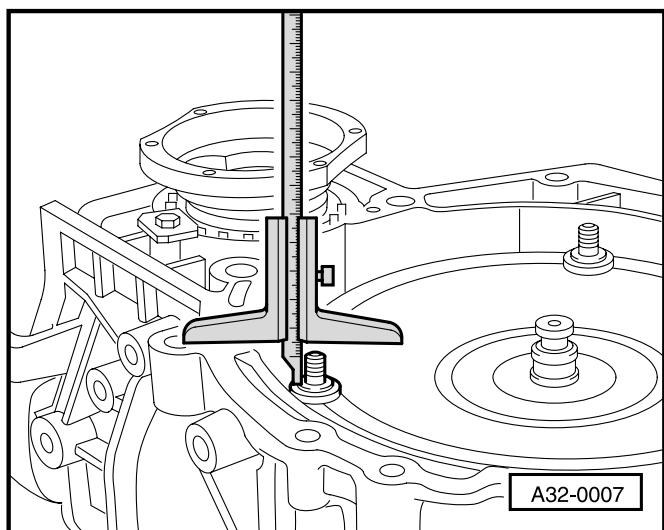
Installing torque converter

- Push torque converter hub through the seal as far as the first stop onto the gearbox shaft.
- Press torque converter by hand into the torque converter bell and turn until the studs of the torque converter hub engage in the driver of the pump gear and the torque converter is felt to slip in.

Installation dimension

- ◀ If the torque converter is correctly inserted, the distance between the contact surfaces at the bottom at the threaded bolts at the torque converter and the contact surface of the torque converter bell is about 22 mm.

If the torque converter is not fully inserted, this distance is about 10 mm.



Warning!

If the torque converter is incorrectly inserted, the driver of the torque converter or the ATF pump may be destroyed when the gearbox is flanged to the engine.

Servicing shift mechanism

Important!

Before carrying out work on the engine when it is running, move selector lever into position „P“ and apply handbrake.

Inspecting shift mechanism

Selector lever in position „P“ and ignition switched on:

- Brake pedal is not operated:

The selector lever is locked and cannot be shifted out of position „P“. The selector lever lock solenoid blocks the selector lever.

- Brake pedal is operated:

The selector lever lock solenoid releases the selector lever. It is now possible to engage a drive position.

Selector lever in position „N“ and ignition switched on:

- Brake pedal is not operated:

The selector lever is locked and cannot be shifted out of position „N“. The selector lever lock solenoid blocks the selector lever.

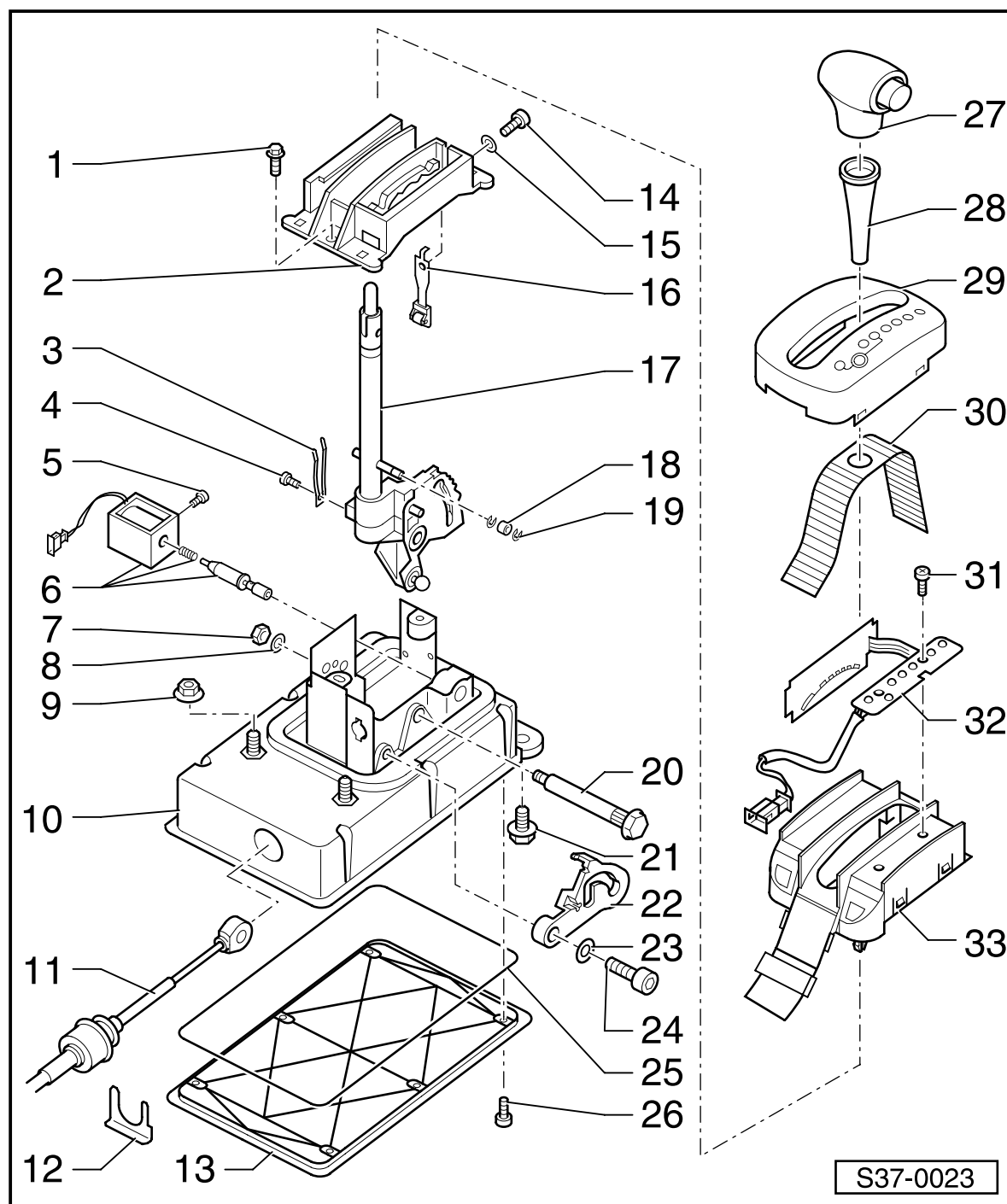
- Brake pedal is operated:

The selector lever lock solenoid releases the selector lever. It is now possible to engage a drive position.

Notes:

- ◆ *It must not be possible to operate the starter when the selector lever is in positions „1“, „2“, „3“, „D“ and „Readout in display“.*
- ◆ *At a speed of more than 5 km/h and with selector lever moved into position „N“, the selector lever lock solenoid must not engage and block the selector lever. Selector lever can be moved into a drive position.*
- ◆ *At speeds of less than 5 km/h (practically stationary) and with selector lever shifted into position „N“, the selector lever lock solenoid must not engage until after about 1 second. Selector lever cannot be shifted out of position „N“ unless brake pedal is operated.*

Disassembling and assembling shift mechanism



S37-0023

1 - Bolt, 8 Nm

2 - Locking segment

3 - Contact spring

♦ For selector lever position display

4 - Bolt, 4 Nm

♦ Move selector lever into „P“ for slackening and tightening

5 - Bolt, 1.5 Nm

♦ 3 in total

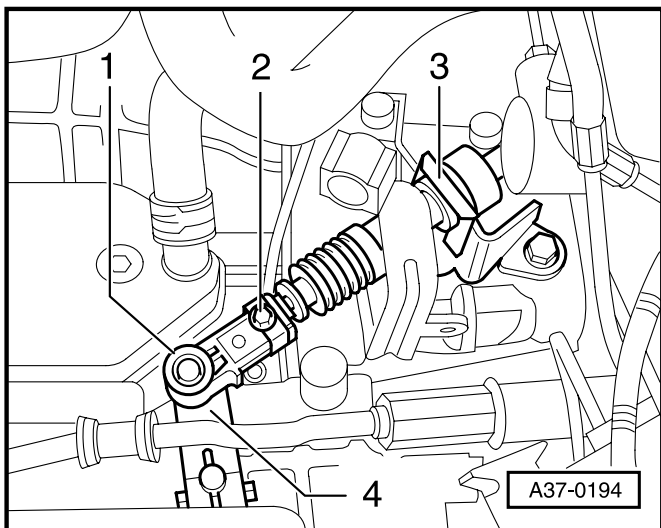
- 6 - Selector lever lock solenoid -N110**
- ◆ Route wiring harness so that it cannot be damaged either by the selector lever or by the selector lever lock solenoid
 - ◆ Can be tested in the Electrical test ⇒ page 01-29 and in Measured value block ⇒ from page 01-16
 - ◆ Remove and install with selector lever in position „1“
 - ◆ Operational check:
 - Move selector lever into „P“ and apply 12 V to solenoid. It must not be possible to move selector lever into any drive position.
 - Interrupt operation of solenoid; it should now be possible to engage all drive positions.
 - Pin must not catch on the lever.
 - Move selector lever into „N“ and check as for „P“.
- 7 - Nut, 13 Nm**
- ◆ Always replace
- 8 - Washer**
- 9 - Nut, 25 Nm**
- ◆ With collar
- 10 - Shift housing**
- ◆ Does not need to be removed for replacing selector lever cable or component parts of shift mechanism
- 11 - Selector lever cable**
- ◆ Must not be kinked
 - ◆ Setting ⇒ page 37-5
 - ◆ Removing and installing ⇒ page 37-4
- 12 - Locking clasp**
- ◆ For cable sleeve
- 13 - Bottom cover**
- ◆ For shift housing
- 14 - Bolt, 7 Nm**
- 15 - Washer**
- 16 - Detent spring**
- ◆ With roller
- 17 - Selector lever**
- ◆ With release
- 18 - Roller**
- 19 - Circlip**
- 20 - Collar bolt**
- ◆ With splines
 - ◆ Restrain only at bolt head, do not rotate!
 - ◆ Grease shank
- 21 - Collar bolt, 25 Nm**
- 22 - Locking lever**
- ◆ For locking in selector lever position „P“
- 23 - Washer**
- 24 - Bolt**
- ◆ Standard bolt 0.5 Nm
 - ◆ Offset bolt, tightening torque according to bolt diameter
- 25 - Gasket**
- 26 - Bolt**
- 27 - Selector lever grip**
- ◆ For removing, push section of selector lever -item 28- down and pull grip up and off
 - ◆ For installing, press grip onto selector lever and pull section of shaft up to lock in place
- 28 - Selector lever shaft section**
- 29 - Cover panel with indicator**
- ◆ Fitted onto frame -item 33-
 - ◆ To remove, carefully release catches
- 30 - Cover strip**
- ◆ Insert into frame -item 33-
- 31 - Screw**
- 32 - Selector lever position display**
- ◆ With contact plate and connector
- 33 - Frame**
- ◆ Inserted into shift housing
 - ◆ To remove, carefully compress catches at the 4 attachment points

Removing and installing and setting selector lever cable

Note:

After installation the selector lever cable must be set ⇒ page 37-5.

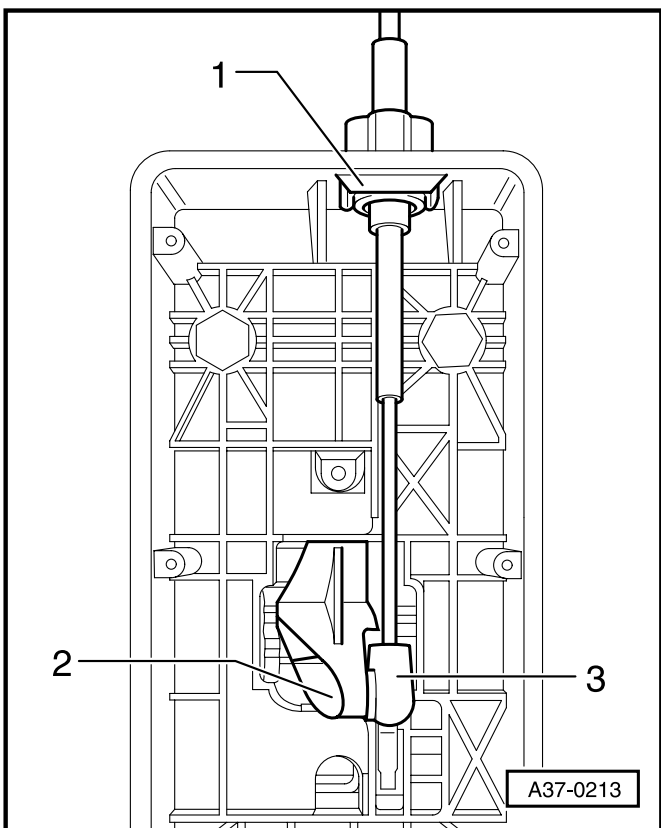
Removing



- Shift the selector lever to position "P".
- ◀ In the engine compartment push back the selector lever cable -1- with a screwdriver on the selector lever gear -4-, remove securing clasp -3- on the abutment.
- Lift vehicle.
- Remove front part of exhaust system:
 - ⇒ 1.6 ltr/74 kW engine, Mechanical Components; Rep. Gr. 26;
 - ⇒ 1.8 ltr/92 kW engine, Mechanical Components; Rep. Gr. 26;
 - ⇒ 1.8 ltr/110 kW engine, Mechanical Components; Rep. Gr. 26;

- Remove the heat protecting plate of the exhaust system located under the gear shift control.

- Unscrew the cover under the gear shift control.



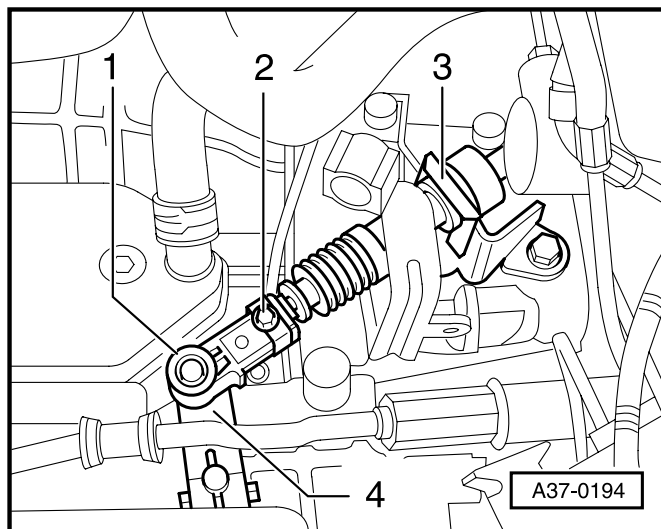
- ◀ With a screwdriver push back the selector lever cable -3- from the selector lever -2-.
- Pull off locking clasp -1- for cable sleeve.
- Remove the selector lever cable.

Installing

Carry out installation in reverse order.

Notes:

- ◆ Do not bend or buckle the selector lever cable.
- ◆ Grease the ball socket slightly before installation.
- ◆ The bellows of the selector lever cable must be correctly fitted as otherwise dirt or moisture may penetrate into the selector lever cable.
- ◆ Check the bellows for damage: the bellows must be replaced together with the selector lever cable.
- Selector lever and lever/ gearshift shaft are on position "P".



Setting

- Move selector lever into position „P“.
- ◀ - Slacken screw -2- at the front ball socket -1- of the selector lever cable.
- Likewise move gearbox selector lever -4- into position „P“ (rear stop). The parking lock should be engaged.
- Check whether the selector lever cable is routed free of stress.
- Tighten screw -2- (5 Nm).
- After installing and setting the selector lever cable, carry out a check.

Check

- Press the lock button in the selector lever grip and pull selector lever in position „P“ about 5 mm back and release.
 - ◆ The lever should engage automatically in the previous position.
- Press the lock button in the selector lever grip and move selector lever in position „P“ about 5 mm forward and release.
 - ◆ The lever should engage automatically in the previous position.
- If the lever does not engage automatically, repeat setting.

Testing gearbox

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552
- ◆ V.A.G 1551/3
- ◆ Pressure tester (e.g. V.A.G 1702)

Note:

First of all carry out self-diagnosis ⇒ page 01-4, and if it is not possible to determine and rectify the cause of the problem, then test the automatic gearbox as follows.

Testing shift points

Gearbox shifts into the next gear too soon or too late

Before testing the shift points:

- Carry out self-diagnosis ⇒ page 01-4 and rectify any faults which exist.
- If necessary, initiate basic setting ⇒ page 01-15.
- Inspect ATF level ⇒ page 37-22.
- Check engine setting:
⇒ Workshop Manual of appropriate engine

When testing the shift points, note the fact that the speedometer may differ from the specified readout within the permissible tolerance.

The shift operations are listed in the table, starting from the gearbox code letters.

Connect V.A.G 1552 for testing the shift points ⇒ page 01-4.

H = Hydraulic gearshift (with torque converter slip)

M = Mechanical gearshift (without torque converter slip)

Positions of the shift segments in the relevant gears ⇒ page 37-26, Gearbox with shift elements

Only the kickdown shift points are stated.

Shift points in km/h

Code letters of automatic gearbox 01M	Additional test conditions	Gearshifts	Kickdown km/h ¹⁾
DMS 74 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 H 3 M - 4 H 4 H - 4 H	40...46 83...89 102...108 127...133 127...133
DTB, ECT 74 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	45...51 91...97 101...115 132...138 132...138
ERQ, ESB, ESE, ESJ 74 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	48...54 96...102 107...121 140...146 140...146
ELZ, EPH, FDG 85 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	49...55 101...107 118...124 148...154 148...154
DSD, ECS 92 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	48...54 99...105 120...139 150...156 150...156
DVH, ECP, ELU, EPC, FDC 110 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	53...59 107...113 107...161 155...161 155...161
FDH 74 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	45...51 91...97 91...107 132...138 132...138
FDF 85 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	42...48 82...88 82...103 131...137 131...137
FDB 66 kW engine	- Driven on flat road - ATF temperature not higher than 140 °C	1 H - 2 H 2 H - 3 H 3 H - 3 M 3 M - 4 H 4 H - 4 M	43...49 85...91 85...138 131...138 131...138

¹⁾ A 2nd person is required for checking the readouts in the display.

Measure limit speed of hydraulic converter

Note:

- ♦ *The limit speed of the hydraulic converter refers to the engine speed on the braked vehicle with the selector lever in position D.*
- Start engine and read off engine speed at V.A.G 1552 ⇒ page 01-16, Reading measured value block.
- Securely lock the vehicle with the hand and foot brake.
- Place selector lever in selector lever position D.
- Briefly apply full throttle (max. 5 s), if necessary repeat test after 20 s. While doing so the speed listed in the table must be reached.

Limit speed of hydraulic converter in rpm

Code letters of automatic gearbox 01M (engine power in kW)	Code letters of torque converter	Limit speed of hydraulic converter rpm
FDB (66 kW)	QCDD	2500...2700
DMS, ECT (74 kW)	QADC	2300...2500
DTB, ERQ, ESB, ESE (74 kW)	QADC	2350...2550
ESJ (74 kW)	QADD	2350...2550
FDH (74 kW)	QADD	2450...2650
ELZ (85 kW)	QBDC	2550...2750
EPH, FDG (85 kW)	QBDD	2550...2750
FDF (85 kW)	QBDD	2400...2600
DSD, ECS (92 kW)	QADC	2400...2600
DVH (110 kW)	QCDC	2300...2500
ECP, ELU (110 kW)	QCDC	2200...2400
EPC, FDC (110 kW)	QCDD	2200...2400

- If the final speed is not reached, the following faults may be present:

Speed too high	Forward clutch slips, overrunning clutch slips
Speed too low by up to 200 rpm:	Check engine setting
Speed too low by above 200 rpm:	Torque converter defective.

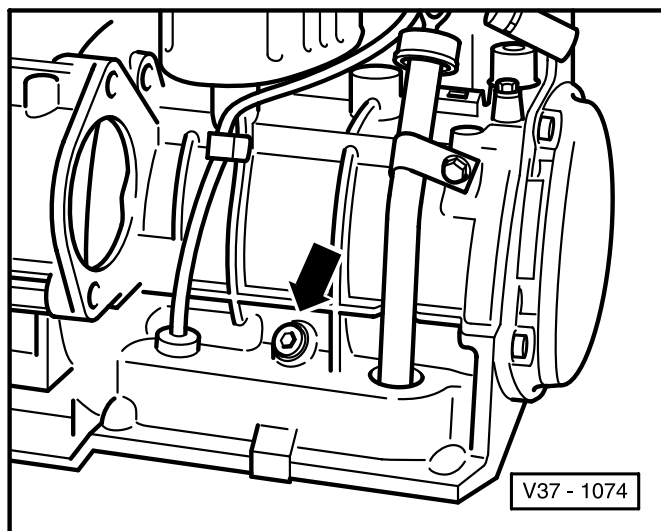
In case of doubt always first check the engine setting and if necessary correct.

The correct torque converter must always be assigned to the correct gearbox ⇒ page 00-2.

Measure main pressure

The pressure test gives information concerning interference in the hydraulic control. It should only be undertaken when all other tests result in no origin of damage.

- Interrogate fault memory and correct possible electrical fault before measuring the main pressure.
- Interrogate fault memory ⇒ page 01-6.
- ◀ - Unscrew bolt -arrow- for the main pressure hole, always replace bolt, 15 Nm.
- Connect pressure tester (e.g. V.A.G 1702) and during engine running bleed by means of knurled screw.
- Increase ATF temperature to 60 °C, therefore connect V.A.G 1552 and read measured value block ⇒ page 01-16.



Specified main pressure in bar (MPa)

	Selector lever positions and test conditions			
	D Idling	R Idling	Connector for solenoid valve unplugged ¹⁾ D Engine speed approx. 2000 rpm	R Engine speed approx. 2000 rpm
Main pressure in bar (MPa)	3.4...3.8 (0.34...0.38)	5...6 (0.5...0.6)	12.2...13.2 (1.22...1.32)	23...24 (2.3...2.4)

¹⁾ After plugging in connector for solenoid valves, interrogate fault memory ⇒ page 01-6, and then erase fault memory ⇒ page 01-14.

Cause if pressure varies from specification

Possible cause	Remedy
Idling speed too high	Set engine
ATF pump faulty	Test ATF pump, replace if necessary
Control valve in control valve body jamming	Replace control valve body

Fault finding table

Before looking for the cause of the problem, carry out the following steps:

- ◆ Check ATF level, top up if necessary
⇒ page 37-22
- ◆ Interrogate fault memory ⇒ page 01-6
- ◆ Read measured value block ⇒ page 01-16
- ◆ Rectify any electrical/electronic faults
⇒ page 01-29

Note:

Check wiring and plug connections according to the Current Flow Diagrams, repair if necessary. Pay attention to the following points and rectify the defect.

1. Contamination or corrosion of contacts
2. Plug connection at slide valve body
3. Open circuit in wiring harness
4. Cable lug lock
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting locations.

Note:

If gearshift elements are burnt perform the following:

- ◆ *Replace slide valve body ⇒ page 38-12*
- ◆ *Clean torque converter ⇒ page 32-2*
- ◆ *Clean pump, gearshift elements, ATF radiator, planetary gear carrier and gearbox housing*

Only clean the components of the automatic gearbox with technical petrol. All other cleaning agents can contain aggressive substances which could have a negative effect on certain components.

Problem	Possible cause of fault	Rectifying fault
Driven plate fractured	No centring bushes for engine/gearbox	- Insert engine/gearbox centring bushes and replace driven plate
Gearbox has oil stains	Gearbox leaking	- Clean engine/gearbox and pinpoint leak at gearbox or engine; use leak oil detection spray ND G001 900 A1, if necessary - If gearbox leaking, seal or replace faulty components - Replace gaskets, seals, bolted connections or gearbox housing (torque converter housing) ⇒ page 37-28
	Too much ATF was poured in	- Clean gearbox, check ATF level ⇒ page 37-22
	Too much oil was poured in	- Clean gearbox, check oil level, extract if necessary ⇒ page 39-1
ATF flows out in area of torque converter	Clearance of driven plate not o.k.	- Set clearance of driven plate
	Torque converter bush faulty	- Replace torque converter ⇒ page 32-1
	Torque converter seal faulty	- Replace torque converter seal; if contact surface damaged, additionally replace torque converter ⇒ page 32-1
	ATF pump leaking	- Repair ATF pump ⇒ page 38-1
ATF in coolant or coolant in ATF	ATF cooler faulty	- Replace ATF cooler ⇒ page 37-29 - Replace coolant - Replace ATF ⇒ page 37-22 - If excess coolant in ATF, planetary gear and clutch must be disassembled and cleaned
Shift mechanism is stiff	Shift mechanism outside of gearbox is stiff Shift mechanism in gearbox is stiff	- Detach selector lever cable at shift shaft lever and service shift mechanism ⇒ page 37-1 - Service park lock ⇒ page 38-20
Hard gearshifts immediately after repairs	Basic setting not performed	- Initiate basic setting ⇒ page 01-15
Selector lever position 1, automatic gearbox does not shift into 1st gear (no power transmitted)	1st to 3rd gear clutch -K1- or reverse gear brake -B1- faulty	- Service 1st to 3rd clutch -K1- ⇒ page 38-5 - or service reverse gear brake -B1- ⇒ page 37-33

Complaint	Possible fault cause	Fault removal
Selector lever position: D, 3 or 2, automatic gearbox does not shift to 1 st gear (no power transmission)	1 st through 3 rd gear clutch -K1- or free-wheel defective	- Repair 1st through 3rd gear clutch -K1- ⇒ page 38-5 - Repair freewheel ⇒ page 38-3
Selector lever position: D, 3 or 2, automatic gearbox does not shift to 2 nd gear	2 nd and 4 th gear brake -B2- defective	- Repair 2nd through 4th gear ⇒ page 37-61
Selector lever position: D or 3, automatic gearbox does not shift to 3 rd gear	Reverse gear clutch -K2- defective	- Repair reverse gear clutch -K2- ⇒ page 38-8
Selector lever position: D, automatic gearbox does not shift to 4 th gear	4 th gear clutch -K3- or 2 nd and 4 th gear brake -B2 - defective	- Repair 4th gear clutch -K3- ⇒ page 38-10 - Repair 2nd through 4th gear brake -B2- ⇒ page 37-61
Selector lever position: R, automatic gearbox does not shift to R gear	Reverse gear clutch -K2- defective or reverse gear brake -B1- defective	- Repair reverse gear clutch -K2- ⇒ page 38-8 - Repair reverse gear brake -B1- ⇒ page 37-33
Selector lever position: D, 3 or 2 or 1, no drive in any gear	1 st through 3 rd gear clutch -K1- defective, reverse gear brake -B1- defective or freewheel defective	- Repair 1st through 3rd gear clutch -K1- ⇒ page 38-5 - Repair reverse gear brake -B1- ⇒ page 37-33 - Repair freewheel ⇒ page 38-3
Shifts do not occur	Control valve housing or magnet in control valve housing jammed	- Replace control valve housing ⇒ page 38-12
Uncontrolled or heavy shifts	Short-circuit between the valve leads or cable guide rail, throttle slide in control valve housing or solenoid valve defective	- Replace control valve housing ⇒ page 38-12
Shift: When changing gear one shift is heavy	Check in which gear change the shift is heavy Relevant shift elements defective	- Check position of shift elements ⇒ page 37-26 - Replace shift elements ⇒ page 37-28
Gearbox shifts to emergency program	Wrong control unit built in. Conductor foil (cable guide rail) defective Leads to the solenoid valves defective Throttle slide in control valve housing jammed	- Select control unit from spare part catalogue and if necessary replace - Perform self-diagnosis ⇒ page 01-4 and electrical test ⇒ page 01-29, subsequently replace damaged component or lines - Replace control valve housing ⇒ page 38-12
Park lock does not engage	Selector lever cable defective or wrong setting Notch lever, parking gear or notch lever mechanism defective	- Replace selector lever cable and set ⇒ page 37-1 - Repair park lock ⇒ page 38-20

Problem	Possible cause of fault	Rectifying fault
Noises in final drive	Taper roller bearings loud	- Replace taper roller bearings ⇒ page 39-4
	Drive pinion loud	- Replace drive pinion ⇒ page 39-8
	Output gear loud	- Replace output gear ⇒ page 39-8
	Input gear loud	- Replace input gear ⇒ page 39-5
	Differential loud	- Replace differential ⇒ page 39-14
Performance problems (idle speed jolts)	Leak at throttle valve connection (sometimes only if engine/gearbox moved)	- Inspect throttle valve connection and air ducts for leaks ⇒ Workshop Manual Engine; Repair Group 24 of engine installed (check code letters for assignment); Testing intake system for leaks (unmetered air)
Engine speed drops when gear is engaged	Engine control unit faulty	- Replace engine control unit ⇒ Workshop Manual Engine; Repair Group 24 of engine installed (check code letters for assignment); Replacing control unit
Vehicle does not start or in incorrect selector lever position	Starter lockout and reversing light relay faulty	- Replace relay ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
Selector lever cannot be shifted out of „N“ or „P“ when brake operated; „P“ or „N“ are not blocked	Selector lever lock solenoid -N110- faulty	- Replace selector lever lock solenoid ⇒ page 37-1
	Control unit -J217- faulty	- Replace control unit -J217 ⇒ page 01-37
Contacts of multifunction switch -F125 scorched	Multifunction switch faulty Wiring and plug connection scorched Wiring and also seals of wiring faulty Contact corrosion at multifunction switch	- Replace multifunction switch ⇒ page 38-20 - Replace wiring and plug connections ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
Insufficient level in planetary gear, axle oil level too high (or vice versa) - no external leaks on gearbox	Shaft seal for gearbox faulty, planetary gear oil filling and axle filling have mixed	- Check planetary gear oil level ⇒ page 37-22, check axle oil level ⇒ page 39-1 - Carry out road test and once again check planetary gear oil level and axle oil level - If fluid level has changed, replace seal of gearbox and O-ring of bearing supporting ring ⇒ page 39-8
Oil stains on gearbox only in area of breathers - no other external leaks on gearbox	Shaft seal for gearbox faulty, planetary gear oil filling and axle filling have mixed so that fluids flow out through breather	- After repairs, top up fluid levels as per specification and capacity ⇒ page 00-4.
Gearbox shifts down when driving at constant speed for no obvious reason	ATF insufficiently cooled so that gearbox activates a safety function when shifting down	- Determine why ATF temperature rises - Pay attention to additional components or modification to vehicle which may affect cooling system (e.g. towing device without corresponding modification of radiator fan motor)
	Engine speed signal is not detected by the automatic gearbox control unit	- Read measured value block ⇒ page 01-16

Removing and installing gear-box

Special tools, testers and aids required

- ◆ Hose clamp MP 7-602
- ◆ Supporting device MP 9-200
- ◆ Gearbox mount 3282
- ◆ Adjusting plate 3282/2
- ◆ Transporting device MP 3-478
- ◆ Gearbox holder MP 3-501

Exchange components of "shift element components"

What should be done first

Before removing the automatic gearbox, first of all carry out a damage analysis with the aid of Repair Group 01 Self-Diagnosis.

How do I obtain an exchange component

The exchange component -arrow- is assigned to the gearbox on the basis of its code letters and can be ordered in the same way as any other Genuine Part.

What is an exchange component

An exchange component is a low-priced replacement part set. The parts list describes the parts which are included with the exchange component.

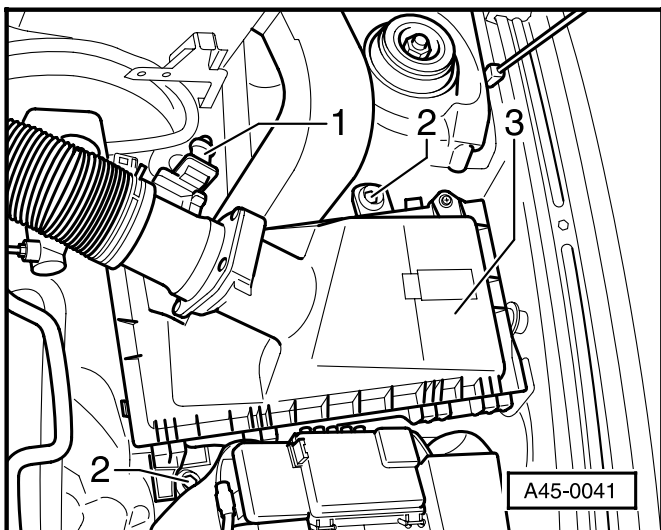
Adjustment operations

It is always necessary to set the clutch play when installing an exchange component.

If not more than only two shims are fitted for each brake (-B1- and -B2-), it is not necessary to set the two brakes. They are then already correctly set and can be installed directly after being removed from their wrapping.

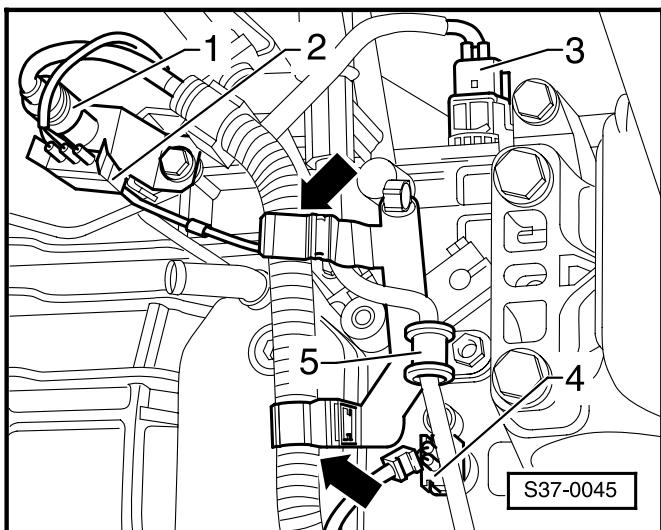
Replacement component with more than two shims for the brake -B1- or -B2-

Only if more than two shims are supplied; adjust reverse gear-brake ⇒ page 37-54 or set 2nd and 4th gear-brake -B2- ⇒ page 37-61.

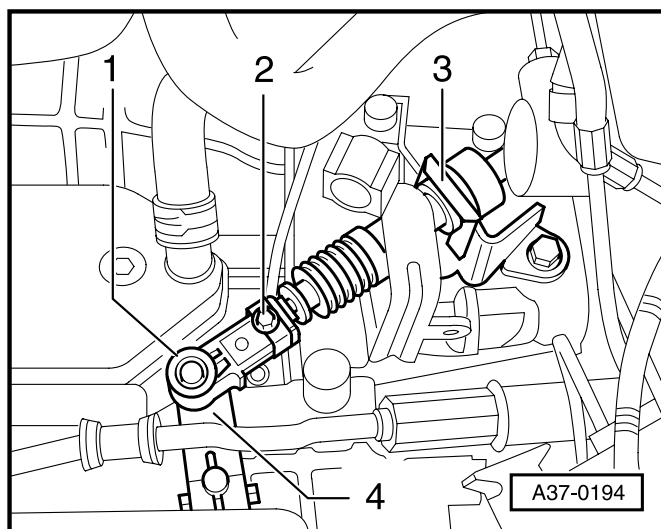


Removing

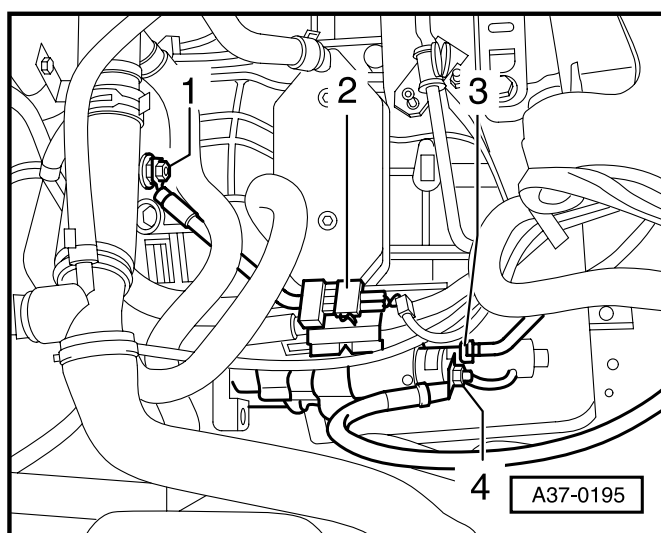
- On models fitted with a coded radio set, pay attention to the coding.
- Disconnect earth strap of battery.
- Remove battery and battery tray.
- Remove engine cover.
- ◀ - Unplug connector -1- from air mass meter (G70).
- Unscrew fixing screws -2- and take out air filter housing -3-.



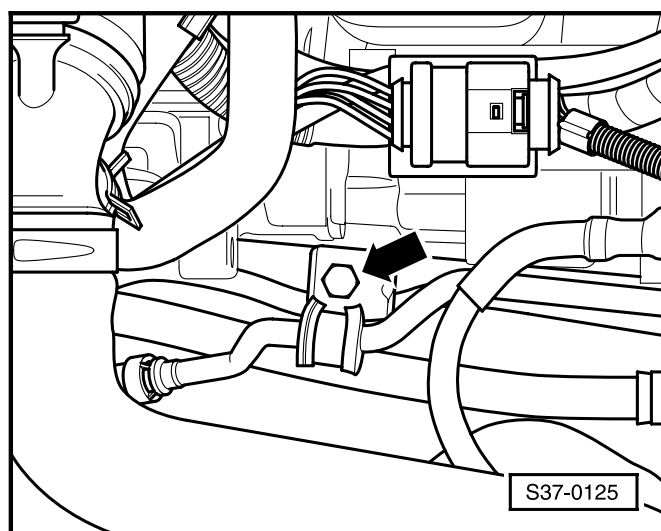
- ◀ - Disconnect the following plugs:
 - 1 - For slide valve body
 - 2 - For vehicle speed sender (G68)
 - 3 - For multi-function switch (F125)
 - 4 - Gearbox speed sender (G38)
 - Speedometer sender (G22) ⇒ page 39-1
- Remove bracket for pressure line -5- of power-assisted steering at gearbox support.
- Detach cable harness from the fixtures -arrows- and run out to the side.



- Move selector lever into position "P".
- ◀ - Use a screwdriver to press off selector lever cable -1- at the gearbox selector lever -4-. Pull off locking clasp -3- at the support bearing.
- Take off selector lever cable and place to the side.
- Unbolt fixture for PAS pressure pipe.

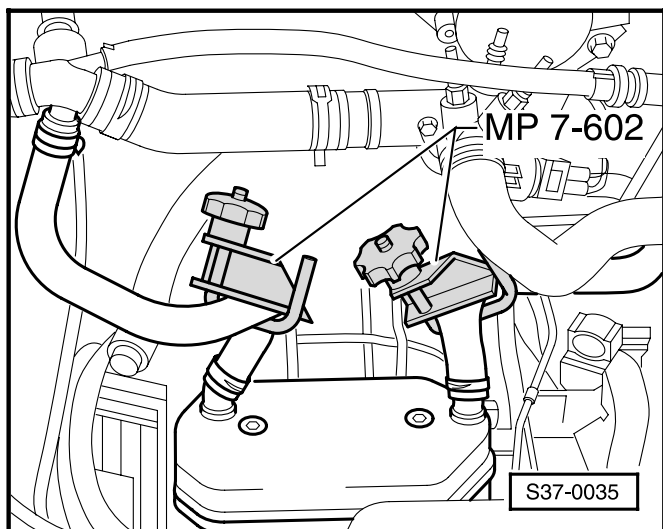


- ◀ - Disconnect earth cable -1-.
- Disconnect cables -3- and -4- at the starter.
- Separate plug connection -2- and pull out of the fixture.
- Detach cables from the fixture at the starter and place to the side, unbolt fixture.

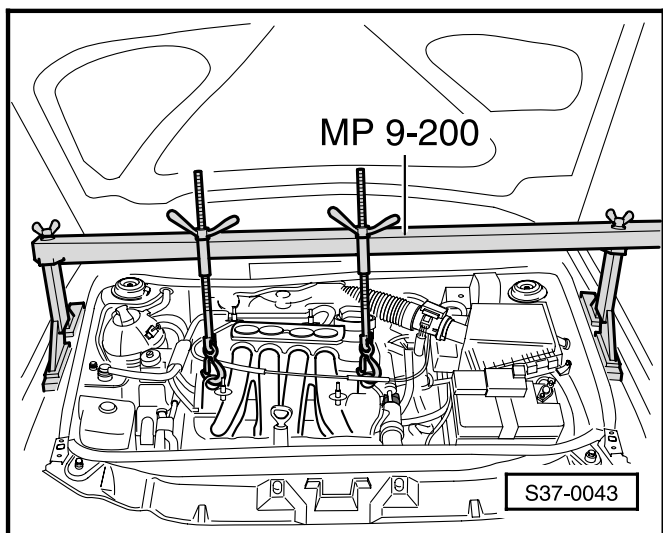


Models with 1.9-ltr./66 kW engine

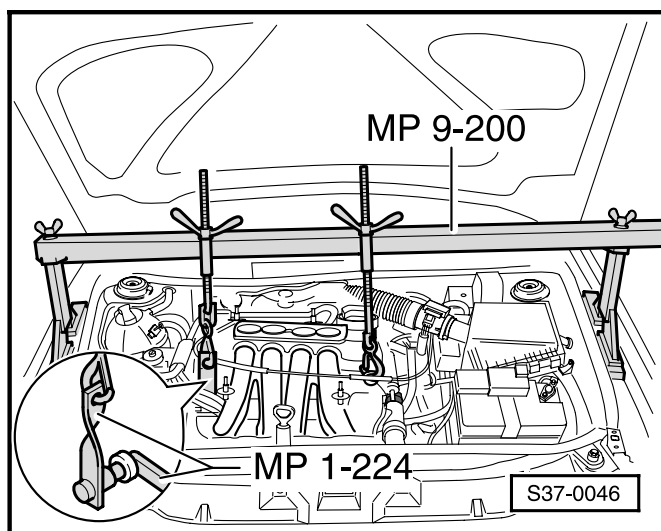
- ◀ - Remove bolt -arrow- and take off bracket for pressure line.

**Continued for all models**

- ◀ - Use MP 7-602 to compress hoses of ATF cooler and detach from ATF cooler.

**Models with 1.6-ltr./74 kW, 1.8-ltr./110 kW, 1.9-ltr./66 kW and 2.0-ltr./85 kW engine**

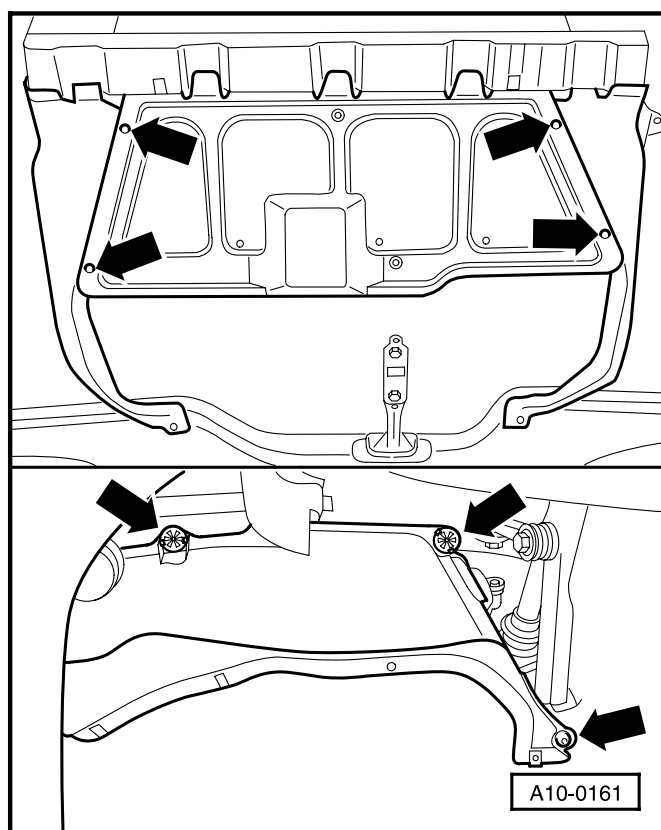
- ◀ - Insert lifting device MP 9-200 with supports and take up weight of engine with the spindle of the lifting device.
- Raise engine slightly with the spindle of the lifting device MP 9-200.

**Models with 1.8-ltr./92 kW engine**

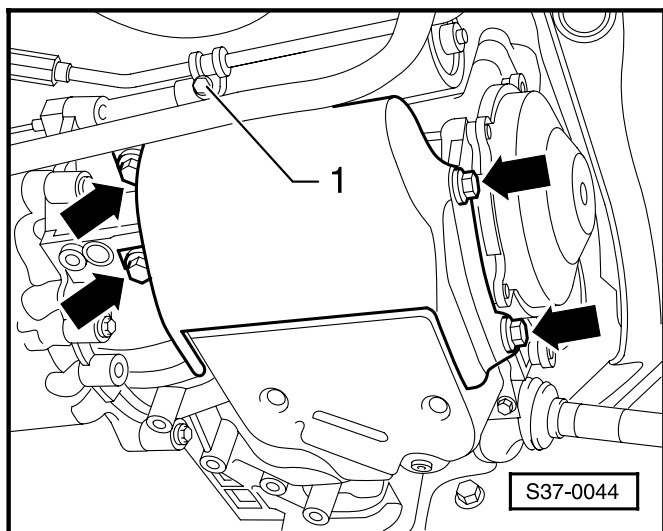
- ◀ - Insert supporting device MP 9-200 with supports.
- Bolt holder MP 1-224 to the right suspension eye and attach to supporting device MP 9-200.
- Lightly pre-load engine/gearbox unit at the spindles.

Continued for all models**Note:**

When inserting the hooks for the supporting device, pay attention to the hose and cable connections in the area of the suspension eyes of the engine so that these are not damaged.



- ◀ - Remove engine panel in the middle, on the left and right -arrows-.



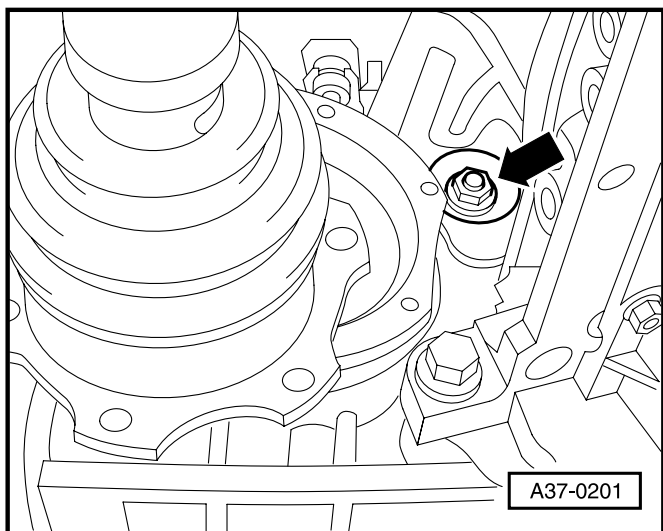
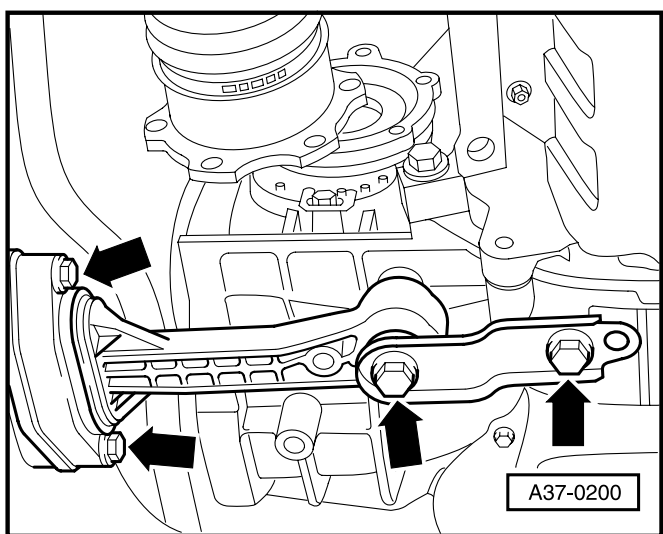
- ◀ - Detach bracket -1- for pressure line.
- Take off gearbox guard -arrows-.
- Unbolt drive shafts from the flanges of the gearbox ⇒ Running Gear; Repair Group 40.

Models with 1.9-ltr./66 kW engine

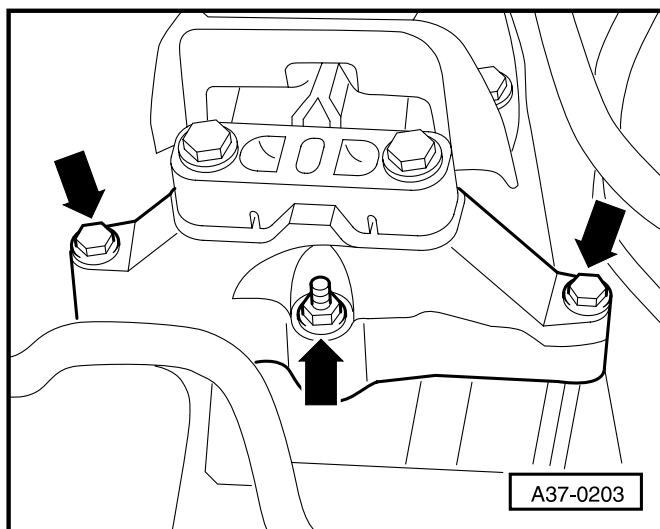
- Detach right drive flange ⇒ page 39-2.1.

Continued for all models

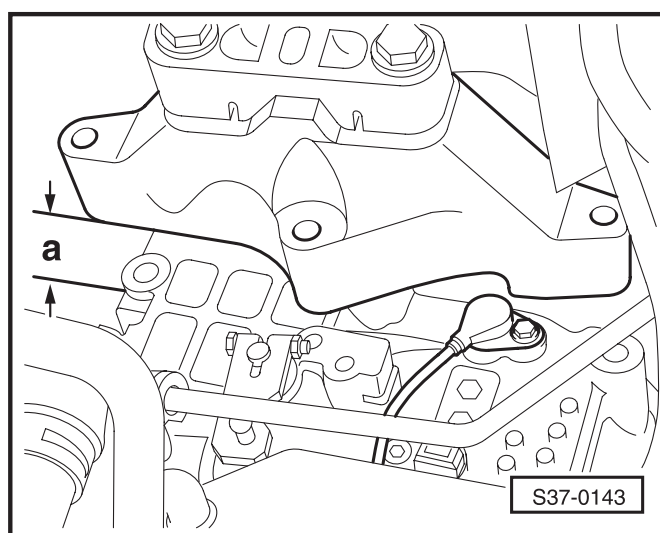
- ◀ - Unbolt pendulum support -arrows-.



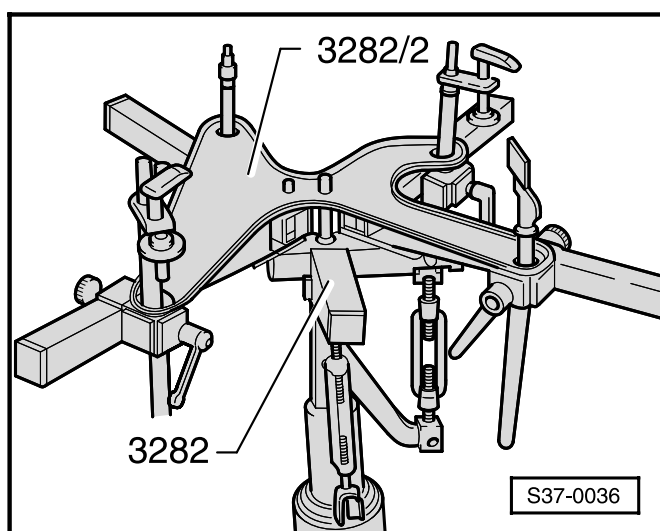
- Pull off plug in the hole of the torque converter plate.
- ◀ - Unscrew 3 nuts -arrow- from torque converter; rotate crankshaft $\frac{1}{3}$ revolution to unscrew each nut.



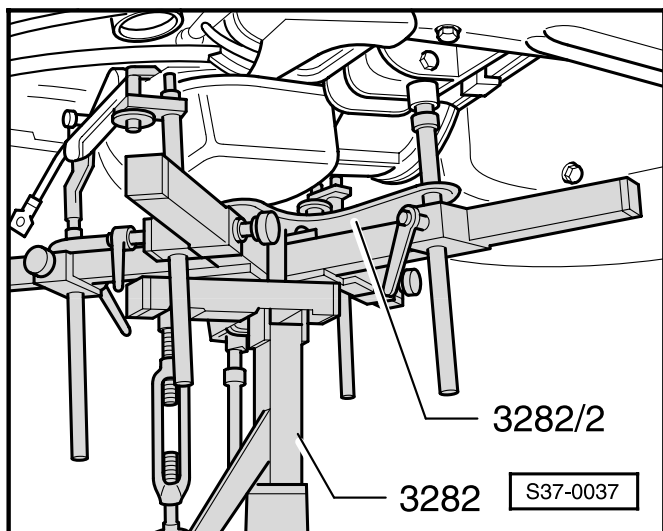
- ◀ - Unbolt left gearbox support box from gearbox -arrows-.
- Unscrew all engine/gearbox connecting screws from the top.



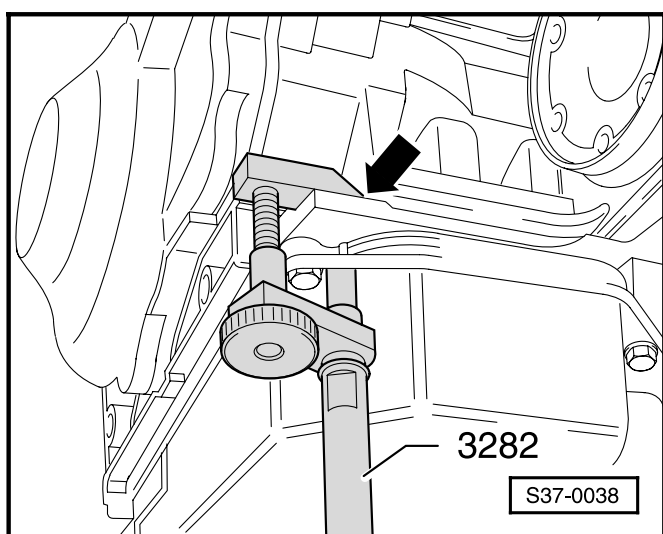
- ◀ - Lower gearbox by adjusting the spindle on the supporting device MP 9-200 about $a = 60 \text{ mm}$.



- ◀ - Align gearbox mount 3282.
- ◆ The gearbox mount 3282 is set up with the adjusting plate 3282/2 for removing automatic gearbox 01M.
- ◆ The symbol on the adjusting plate points to the required mounts.



- ◀ - Move gearbox jack (e.g. V.A.G 1383 A) with gearbox mount 3282 below the gearbox and support gearbox.



- ◀ - Position drift of the locking mount onto the oil sump and secure on the gearbox housing (arrow).
- Remove the bottom bolts connecting engine/gearbox.
- Press gearbox off the engine and at the same time push torque converter out of the driven plate.
- Push torque converter into the gearbox housing.
- Lower gearbox slightly.
- Guide pressure pipe of PAS past the gearbox.
- Carefully lower gearbox.
- Secure torque converter to prevent it dropping out.

Installing

Installation is carried out in the reverse order.

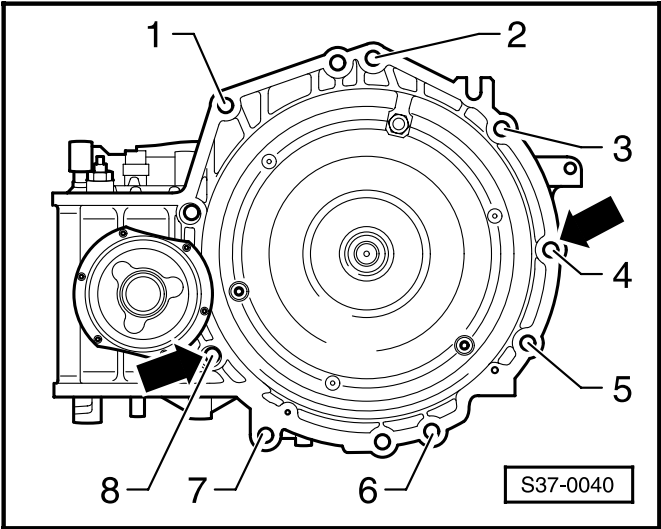
- Before installing the gearbox, ensure that the torque converter is correctly inserted into the gearbox ⇒ page 32-3.

Note:

Before installing a replacement gearbox, clean the oil cooler.

- Before installing, check to ensure the dowel sleeves are correctly inserted at the engine.

- Mount intermediate plate onto the dowel sleeves.
- Ensure that no lines or cables are jammed in-between when pushing together engine and gearbox.
- Use only genuine nuts (M10 x 1) for attaching the torque converter at the driven plate.
- Always replace self-locking nuts and bolts.
- Always replace gaskets and O-rings.
- Adjust selector lever cable ⇒ page 37-4.
- Inspect axle oil in final drive ⇒ page 39-1.
- Inspect ATF level ⇒ page 37-22.
- Install left and right drive shafts:
⇒ Running Gear; Repair Group 40.
- Initiate basic setting ⇒ page 01-15.



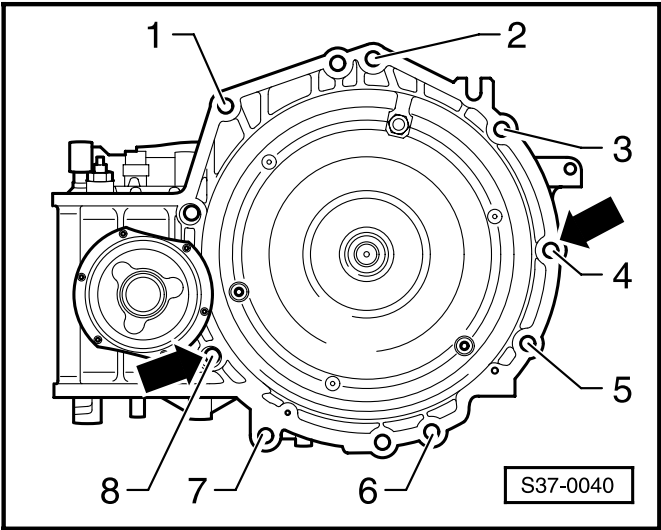
Tightening torques

◀ Gearbox to engine 1.8 I/92 kW, 2.0 I/85 kW and 1.8 I/110 kW

Item	Bolt	Nm
1	M12 x 55	80
2 ¹⁾	M12 x 55	80
3 ¹⁾	M12 x 180	80
4 ¹⁾	M12 x 180	80
5	M10 x 50	45
6	M10 x 50	45
7	M10 x 50	45
8	M12 x 55	80

1) Bolt with threaded pin M8

Dowel sleeves for centering (arrows)



◀ Gearbox to engine 1.6 I/74 kW, 1.6 I/75 kW and 1.9 I/66 kW

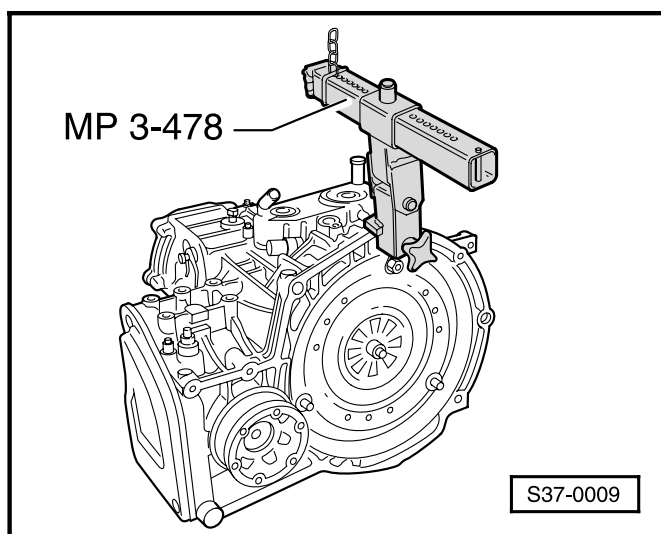
Item	Bolt	Nm
1	M12 x 65	80
2 ¹⁾	M12 x 65	80
3 ¹⁾	M12 x 180	80
4 ¹⁾	M12 x 180	80
5	M10 x 50	45
6	M10 x 50	45
7	M10 x 50	45
8	M12 x 80	80

1) Bolt with threaded pin M8

Dowel sleeves for centering (arrows)

Component	Tightening torque
Drive plate to torque converter M10 x 1	57 Nm
Gearbox support to gearbox ¹⁾	50 Nm + 90°
Drive shaft to gearbox	⇒ Chassis; Repair Group 40
Gearbox - protection plate to gearbox	45 Nm
Pendulum support to gearbox ¹⁾	⇒ Engine; Repair Group 10
Pendulum support to assembly carrier ¹⁾	⇒ Engine; Repair Group 10

¹⁾ Always replace these bolts



Transporting an automatic gearbox

The special tool MP 3-478 can be used for transporting the automatic gearbox as well as aligning the gearbox mount 3282.

- ◀ - Attach special tool MP 3-478 to flange of gearbox housing.
- Push in locking pin so that the 8 holes are visible in the direction of the chain.

Inspecting ATF level, topping up if necessary

Special tools, testers and aids required

- ◆ ATF filling system, e.g. V.A.G 1924
- ◆ Vehicle system tester V.A.G 1552

Notes:

- ◆ Only ATF with the Part No. G 052 162 .. (colour: colourless-yellow) may be used for topping up. It is not permitted to use any additives!
- ◆ If the ATF is black and has a sharp odour, this can result in scorching of the shift elements ⇒ page 37-8, Fault table.

Can:

- ◆ 0.5-ltr. Part No. G 052 162 A1
- ◆ 1.0-ltr. Part No. G 052 162 A2

- ◀ - If the ATF level is checked, always replace the seal -arrow- of the screw plug for checking ATF.

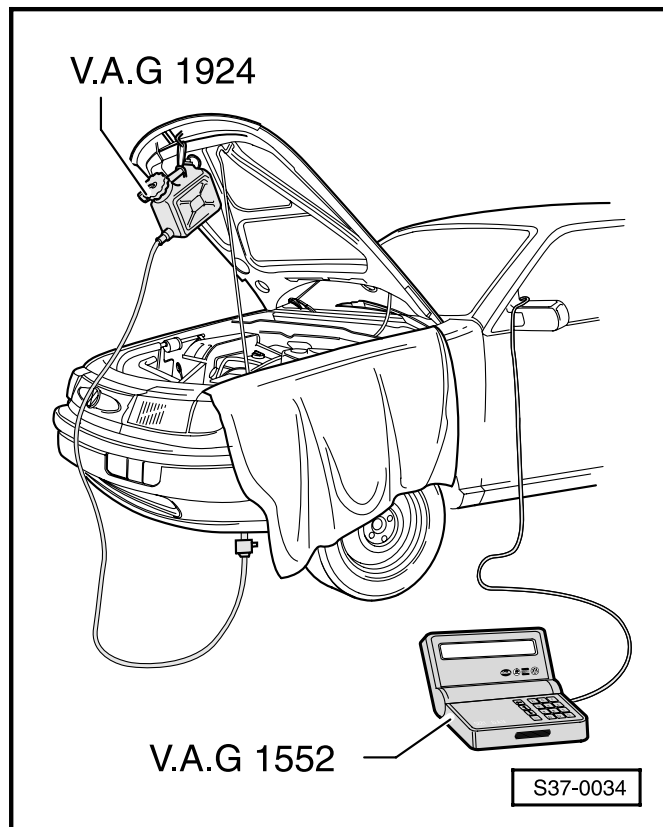
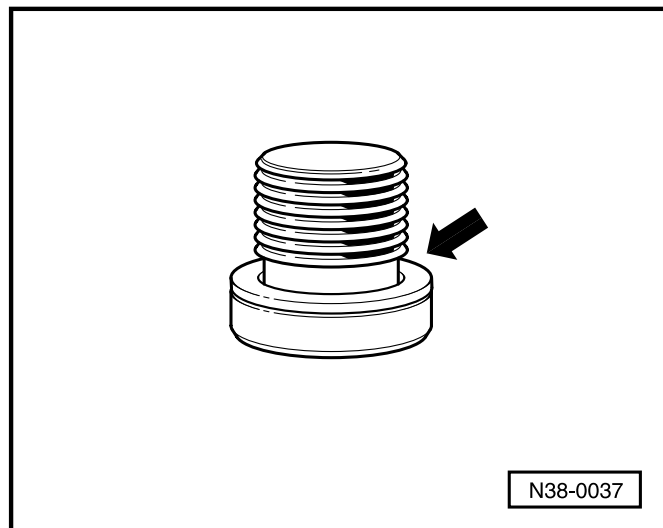
Inspecting ATF level

Inspection requirements

- Gearbox not in emergency mode, ATF temperature not more than approx. 30 °C.
- Vehicle standing on level ground.
- Selector lever position „P“.
- Air conditioning and heating system must be switched off.
- ◀ - Attach reservoir of ATF filling system V.A.G 1924 to the vehicle.
- Connect vehicle system tester V.A.G 1552 ⇒ page 01-4.
- Start engine.
- Raise vehicle.

Note:

Read off the temperature on the vehicle system tester V.A.G 1552.



- Press keys 0 and 8 (function „Read measured value block“ is selected with 08) and confirm the entry with the key Q.
- Press keys 0, 0 and 5 („Display group number 005“ is selected with 005) and confirm the entry with the key Q.

Read measured value block	5	→
40 °C	0011011	0 900 rpm

◀ Readout in display:

The first display block indicates the ATF temperature.

Note:

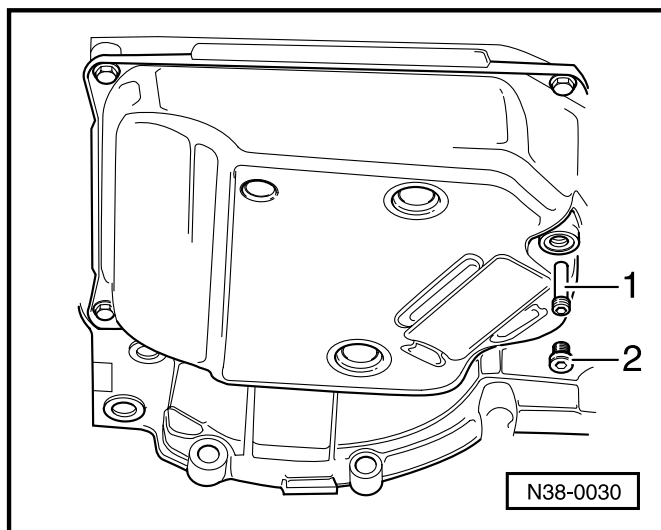
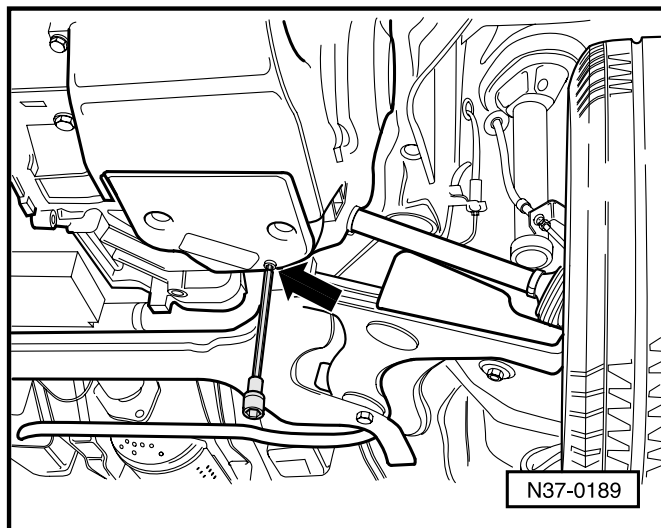
The ATF temperature must not be higher than approx. 30 °C.

Warning!

Wear eye protection.

- Place a collecting vessel below the gearbox.
- ◀ - Remove the ATF inspection plug in the oil sump -arrow-.

The ATF in the overflow pipe runs out.



- ◀ - Check whether the overflow pipe -1- is fully screwed in (2 Nm; 5 mm hexagon socket). The overflow pipe must not be unscrewed.
- Warm ATF up to inspection temperature.

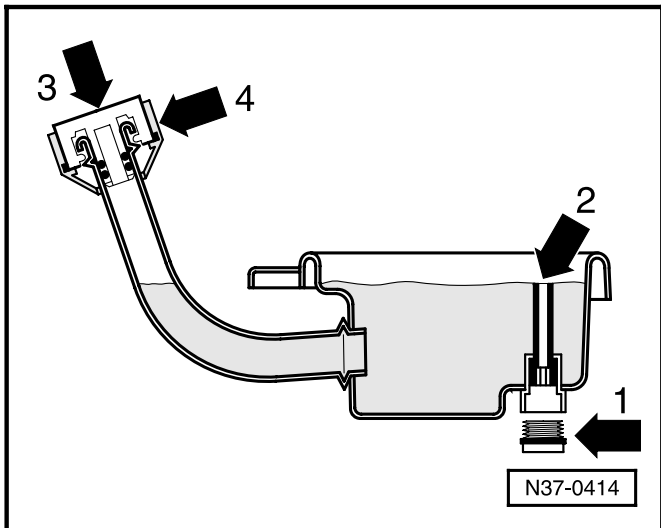
Inspection temperature: 35 °C to 45 °C ¹⁾

¹⁾ 50 °C for tropical countries

If ATF drips out of the hole:

It is not necessary to top up the ATF.

- Insert screw plug with new seal and tighten to 15 Nm. The ATF inspection is thus completed.

**◀ If only the ATF present in the overflow pipe drips out of the hole:**

ATF needs to be topped up.

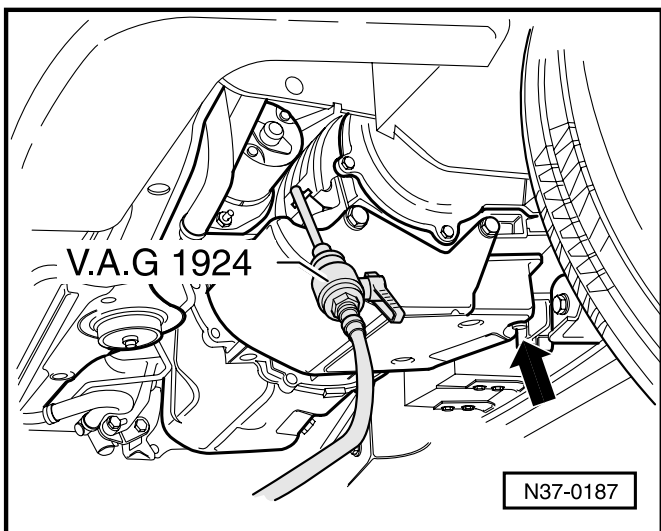
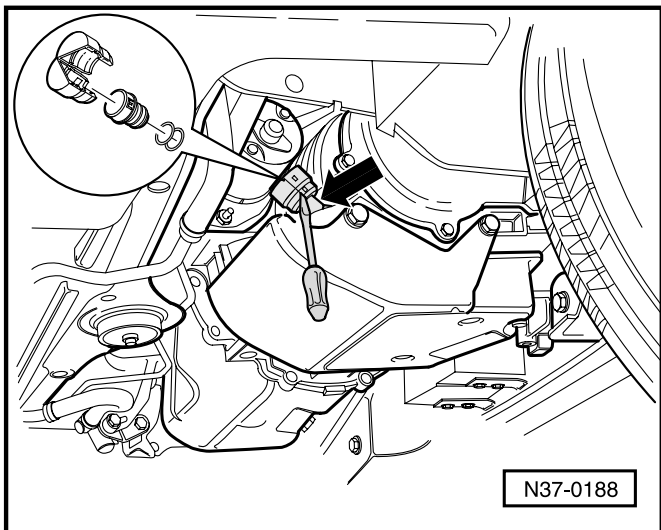
- 1 - Screw plug
- 2 - Overflow pipe
- 3 - Plug
- 4 - Cap

Topping up ATF

- ◀ - Use a screwdriver to lever open cap -arrow- for securing the plug. The catch of the cap is destroyed when this is done; always fit on a new cap.
- Pull plug out of filler pipe.

Note:

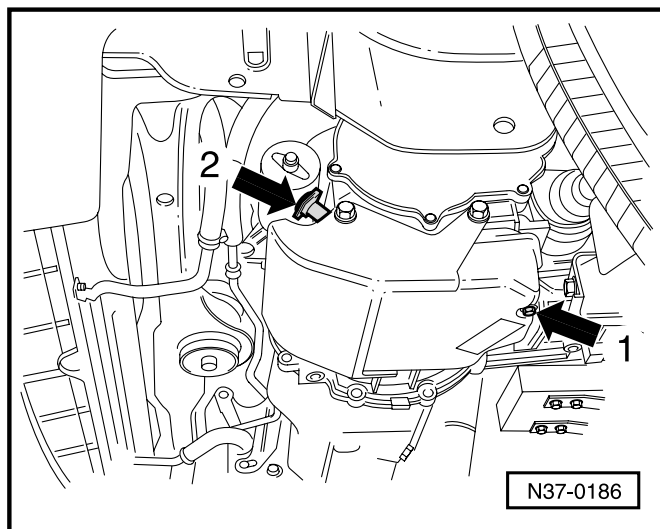
On certain gearboxes a cap with a clasp lock is fitted. This cap can be re-inserted.



- ◀ - Pour in ATF (e.g. with V.A.G 1924) until ATF flows out of the inspection hole -arrow-.

Warning!

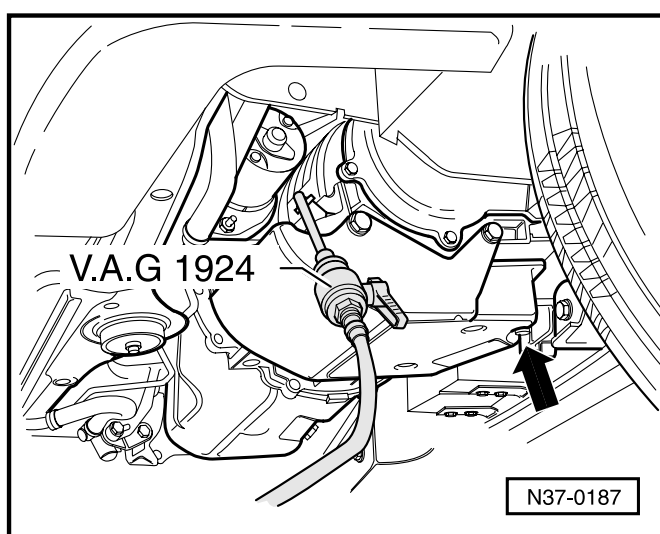
An insufficient as well as an excess amount of ATF adversely affects proper operation of the gearbox.



- ◀ - Tighten screw plug with new seal -arrow 1- to 15 Nm.
- Fit on plug of filler pipe and secure with new cap -arrow 2-.
- Lock cap in place.

Warning!

Always replace cap without clasp lock. The cap secures the plug.



Pouring in ATF after repairs

Notes:

- ◆ Pay attention to disposal instructions.
- ◆ The engine must not be started and the car must not be towed if there is no ATF in the system!

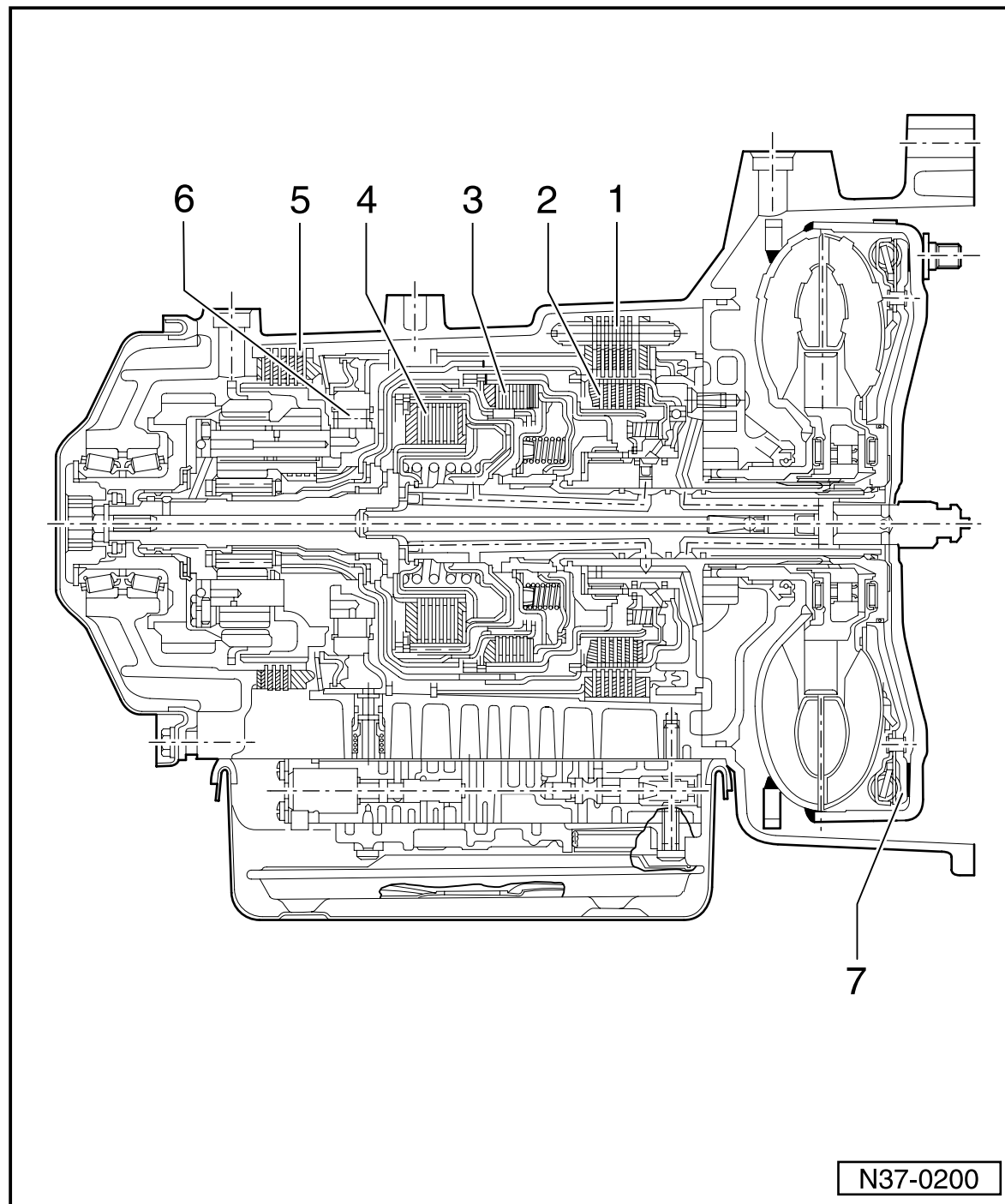
- ◀ - Pour in 3 litres of ATF through filler pipe (e.g. with V.A.G 1924).
- Then, start engine and shift through all the selector lever positions once with car stationary.
- After this, inspect ATF level and top up
⇒ page 37-22.

Note:

- ◆ It is important to observe all the instructions and inspection conditions for „Inspecting ATF level and topping up“.

Capacity of planetary gear ⇒ page 00-4.

Gearbox with shift elements



Arrangement of shift elements

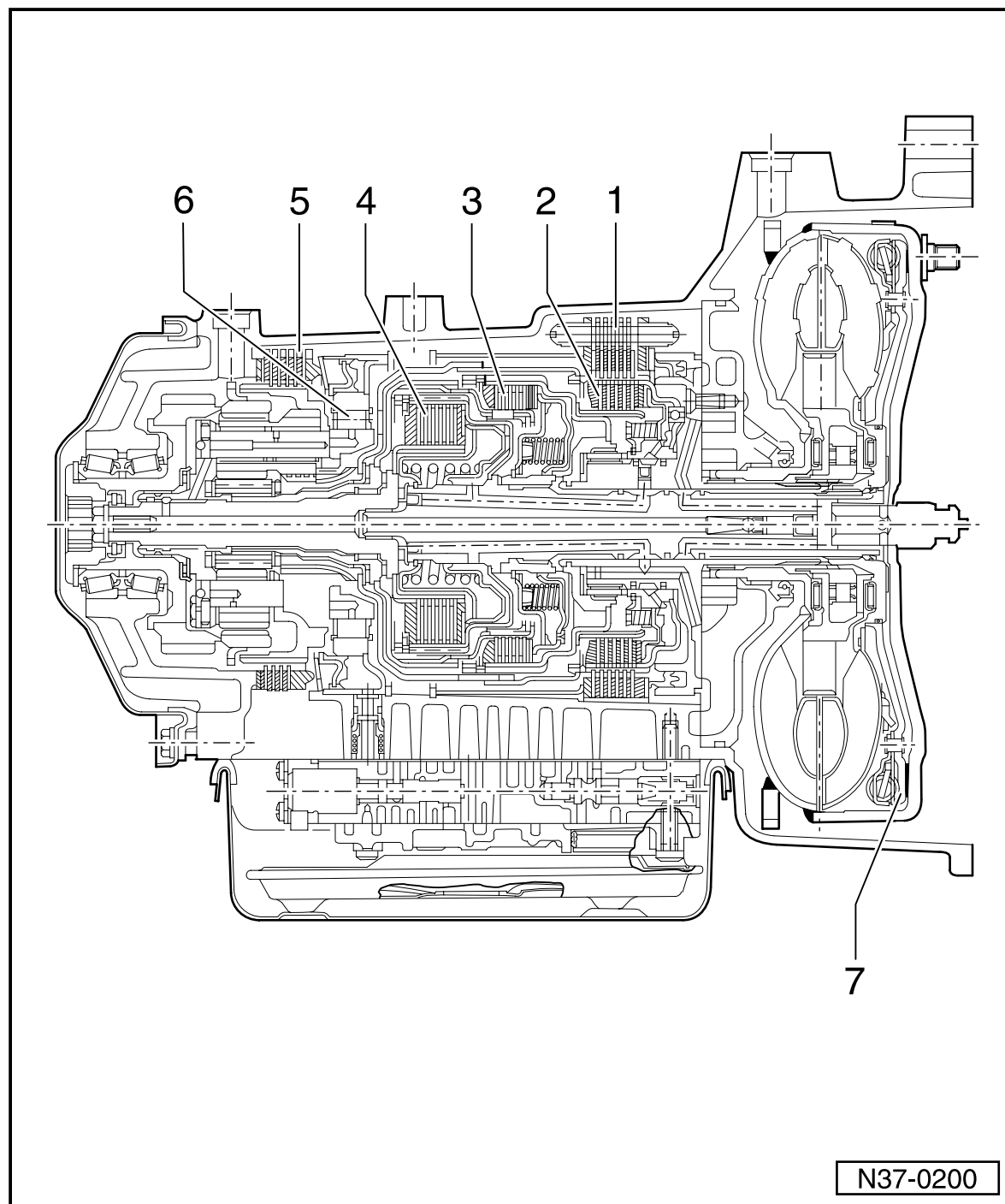
- 1 = 2nd and 4th gear brake -B2-
- 2 = Reverse gear clutch -K2-
- 3 = 1st to 3rd gear clutch -K1-
- 4 = 3rd and 4th gear clutch -K3-
- 5 = Reverse gear brake -B1-
- 6 = Freewheel -F-

7 = Torque converter lock-up clutch -Wk-

Position of shift elements

When dealing with problems regarding poor performance in terms of acceleration and vehicle speed or generally in the case of faults to the transmission, the table overleaf provides information of the shift elements which are operated in the individual gears. This makes it possible to conclude which shift elements are not operating properly.

Before carrying out repairs on the gearbox, first of all conduct self-diagnosis ⇒ page 01-4.



Gear	B1	B2	K1	K2	K3	F	Wk
R	x			x			
1H			x			x	
1M			x			x	x
2H		x	x				
2M		x	x				x
3H			x		x		
3M			x		x		x
4H		x			x		
4M		x			x		x

X = clutches, brakes or freewheel Engaged/
locked

H = hydraulic

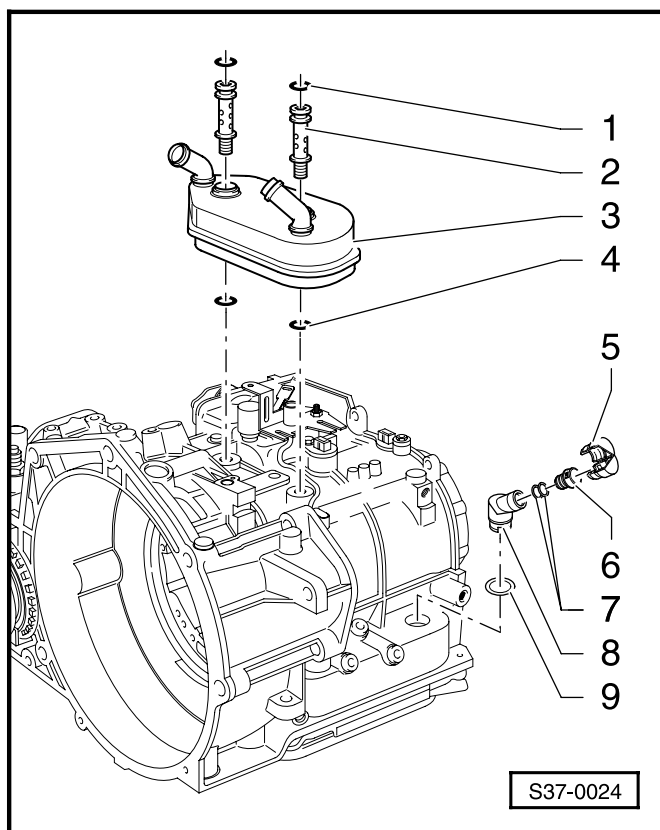
M = mechanical

Disassembling and assembling gearbox

Rules for cleanliness when working on automatic gearbox

- ◆ Thoroughly clean connection points and the surrounding area before disconnecting.
- ◆ Place removed parts down on a clean surface and cover over. Use sheeting and paper. Do not use fluffing cloths!
- ◆ Carefully cover over or seal opened components if repairs are not carried out immediately.
- ◆ Install only clean parts: Do not remove replacement parts from their wrapping until just before installing.
- ◆ Always replace O-rings, seals and gaskets.
- ◆ Coat O-rings with ATF for inserting in order to avoid the ring being squeezed.
- ◆ It is not allowed to use any other lubricants in the ATF area otherwise there is a risk of operational problems in the hydraulic gearbox control.
- ◆ If scorching of the shift elements is present, it is necessary to clean the gearbox. Use only cleaning petroleum for this purpose. Other cleaning products may contain aggressive substances which could have a negative effect on certain components.
- ◆ After installation, inspect ATF level in the planetary gear and adjust to correct level if necessary ⇒ page 37-22, and inspect oil level (ATF) in final drive ⇒ page 39-1, respectively.

Removing and installing ATF cooler and ATF filler pipe

**1 - O-ring**

- ◆ Always replace

2 - Banjo bolt, 35 Nm**3 - ATF cooler****4 - O-ring**

- ◆ Always replace

5 - Cap

- ◆ For securing plug; always replace after inspecting ATF level ⇒ page 37-22

6 - Plug**7 - O-rings**

- ◆ Always replace

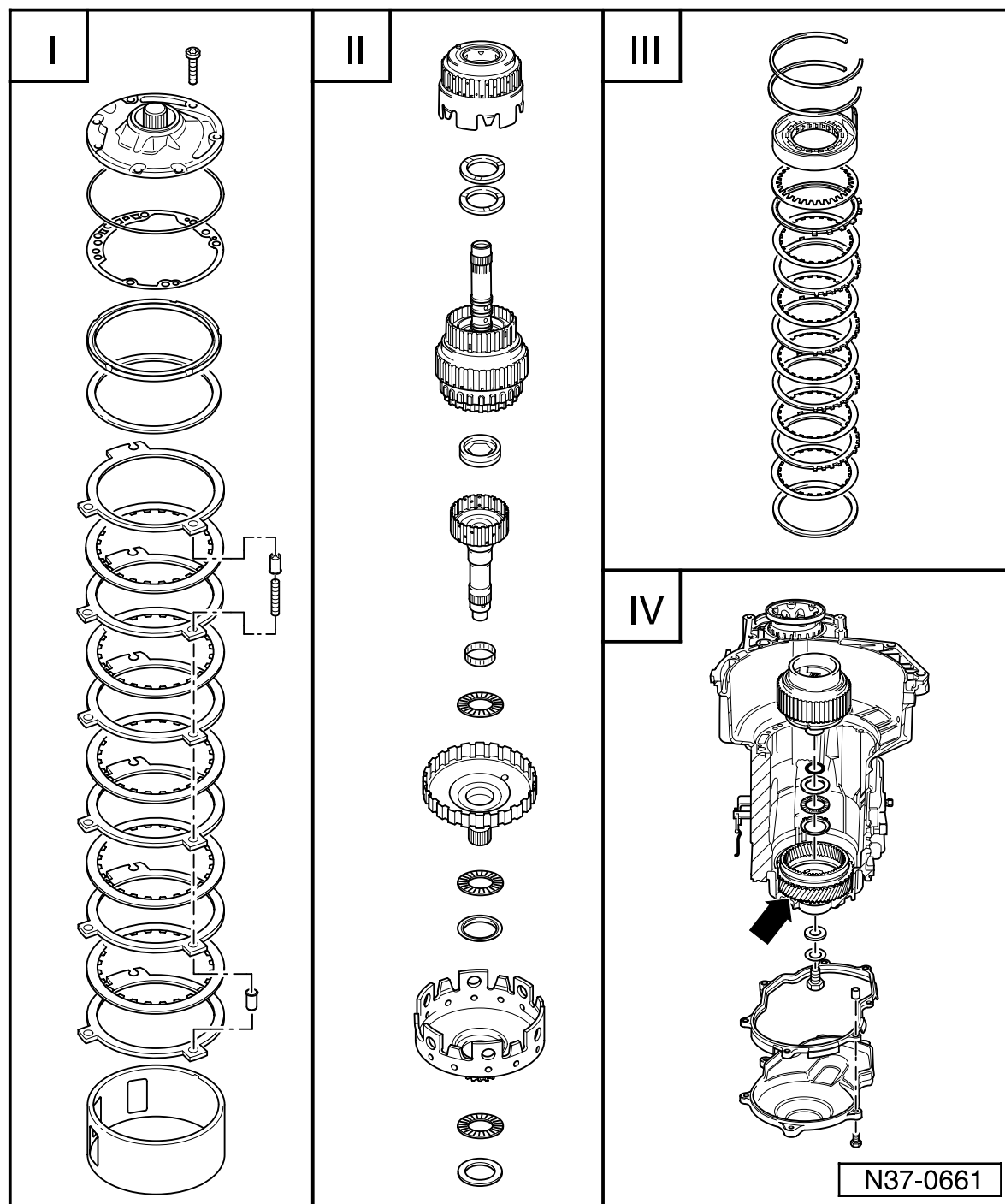
8 - ATF filler pipe

- ◆ Removing:
 - Remove oil sump ⇒ page 38-15.
 - Compress retaining clip of ATF filler pipe.

9 - O-ring

- ◆ Always replace

Disassembling and assembling planetary gear -Summary-



I - Removing and installing supporting tube for -B2- up to ATF pump ⇒ page 37-31

II - Removing and installing large sun wheel up to reverse gear clutch -K2- ⇒ page 37-32

III - Removing and installing freewheel and reverse gear brake -B1- ⇒ page 37-33

IV - Removing and installing planet carrier ⇒ page 37-34

Notes:

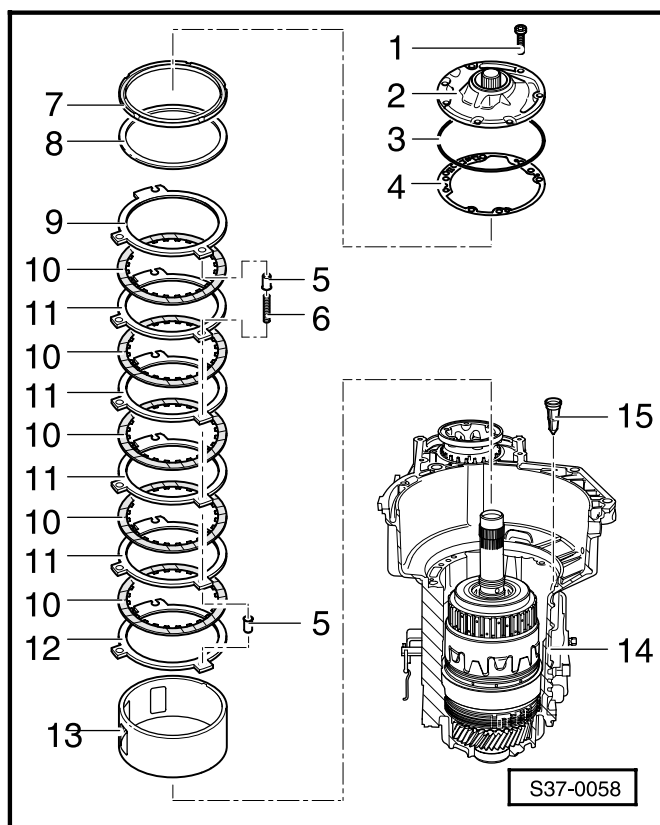
It is not necessary to remove the input gear (arrow).

Removing and installing input gear ⇒ page 39-5.

Disassembling planetary gear ⇒ page 37-35.

Assembling planetary gear ⇒ page 37-41.

I - Removing and installing ATF pump up to supporting tube for -B2-



Notes:

Assembly overview ⇒ page 37-30.

Disassembling planetary gear ⇒ page 37-35.

Assembling planetary gear ⇒ page 37-41.

1 - Bolt

- ◆ 7x
- ◆ Tighten to 8 Nm, then torque a further 90°
- ◆ Can be torqued by 90° in several stages

2 - ATF pump with -B2- piston

- ◆ Is supplied as replacement part matched to gearbox code letters
- ◆ Disassembling and assembling ⇒ page 38-1

3 - O-ring

- ◆ Always replace
- ◆ Fit onto ATF pump

4 - Gasket

- ◆ Always replace

5 - Spring bowl

- ◆ Insert 3 spring bowls after installing first externally-toothed disc
- ◆ Install 3 spring bowls before inserting the last externally-toothed disc

6 - Spring

- ◆ 3x

7 - Retaining ring

8 - Shim

- ◆ Determining thickness ⇒ page 37-61, Setting 2nd and 4th gear brake -B2-

9 - Externally-toothed disc -B2-

- ◆ 3 mm thick

10 - Internally-toothed disc -B2-

- ◆ Quantity ⇒ page 00-2
- ◆ Place new internally-toothed disc in ATF for 15 minutes before installing

11 - Externally-toothed disc -B2-

- ◆ Quantity ⇒ page 00-2
- ◆ Always install 2 mm thick externally-toothed discs

12 - Externally-toothed disc -B2-

- ◆ Place a 3 mm thick externally-toothed disc onto supporting tube

13 - Supporting tube -B2-

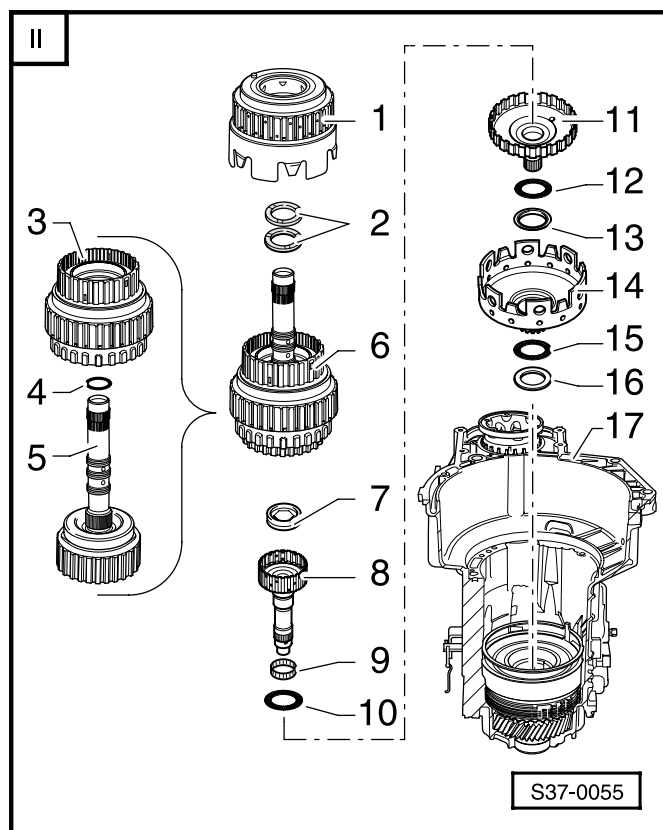
- ◆ For disc set of -B2-
- ◆ Different length depending on number of internally-toothed discs installed
- ◆ Is supplied as replacement part assigned to gearbox code letters
- ◆ Insert so that the slot engages in the wedge of the freewheel

14 - Gearbox housing with clutches installed

15 - Strainer

- ◆ Installed from 14.02.00

II - Removing and installing reverse gear clutch -K2- up to large sun wheel



Notes:

Assembly overview ⇒ page 37-30.

Disassembling planetary gear ⇒ page 37-35.

Assembling planetary gear ⇒ page 37-41.

1 - Reverse gear clutch -K2-

- ◆ Disassembling and assembling ⇒ page 38-8
- ◆ Turn when installing until all internally toothed discs are meshed

2 - Shim

- ◆ Determining thickness ⇒ page 37-57, Setting clutch play between -K1- and -K2-
- ◆ 1 or 2 shims may be installed

3 - 1st to 3rd gear clutch -K1-

- ◆ Is supplied as replacement part assigned to gearbox code letters
- ◆ Clutches -K1- and -K3- are pressed together
- ◆ Disassembling and assembling ⇒ page 38-5

4 - O-ring

- ◆ Always replace
- ◆ Press clutch -K1- off -K3- for replacing ⇒ page 37-40

5 - 3rd and 4th gear clutch -K3- with turbine shaft

- ◆ Is supplied as replacement part assigned to gearbox code letters
- ◆ Clutches -K1- and -K3- are pressed together
- ◆ Disassembling and assembling ⇒ page 38-10
- ◆ Different versions ⇒ page 32-2

6 - 1st to 3rd gear clutch -K1- with 3rd and 4th gear clutch -K3- with turbine shaft

- ◆ Clutches -K1- and -K3- are pressed together
- ◆ Pressing -K1- off -K3- ⇒ page 37-40
- ◆ Pressing -K1- onto -K3- ⇒ page 37-40
- ◆ Turn to install until all internally-toothed discs are meshed

7 - Axial needle bearing with washer

- ◆ Moisten disc with ATF so that bearing sticks to 3rd and 4th gear clutch
- ◆ Axial needle bearing points toward small input shaft

8 - Small input shaft

9 - Needle bearing

10 - Axial needle bearing

11 - Large input shaft

12 - Axial needle bearing

13 - Washer for axial needle bearing

- ◆ With collar
- ◆ Installation position: collar points toward large sun wheel

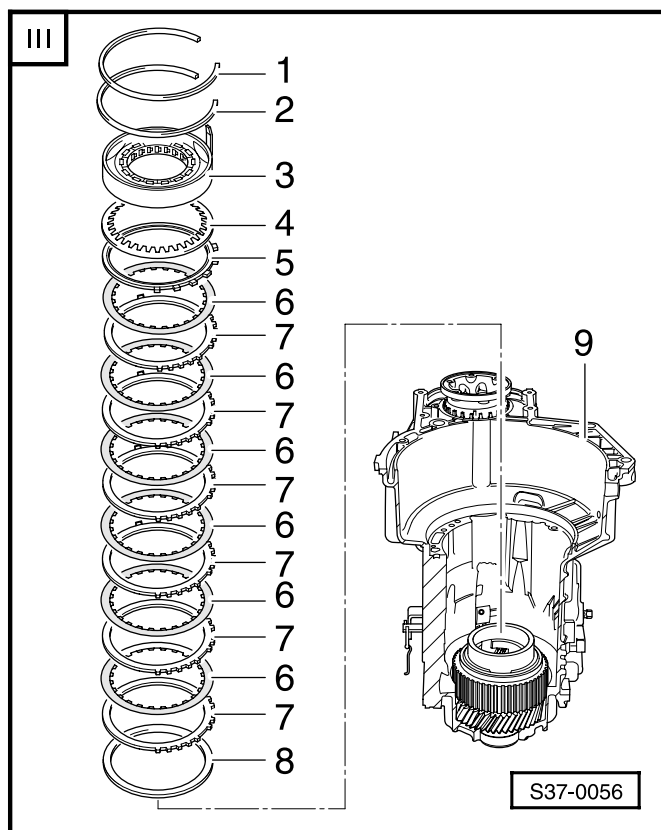
14 - Large sun wheel

15 - Axial needle bearing

16 - Washer for axial needle bearing

17 - Gearbox housing with freewheel and circlips installed

III - Removing and installing freewheel and reverse gear brake -B1-



4 - Disk spring

- ◆ curved side points to freewheel

5 - Actuating plate -B1-

- ◆ fit smooth side towards the disks
- ◆ different thickness depending on the number of inside disks fitted
- ◆ assigned as spare part to the gear-box code letters

6 - Inside disk, -B1-

- ◆ piece number inside disks -B1-
⇒ page 00-2
- ◆ put new inside disks in ATF for 15 mins before fitting

7 - Outside disk, -B1-

- ◆ piece number outside disk -B1-
⇒ page 00-2

8 - Adjusting dial

- ◆ determine thickness ⇒ set reverse gear brake -B1-, page 37-54
- ◆ 1 or 2 adjusting dials may be fitted

9 - Gearbox housing with assembled planet carrier

Notes:

Summary ⇒ page 37-30.

Disassembling planetary gear ⇒ page 37-35.

Assembling planetary gear ⇒ page 37-41.

1 - Circlip

- ◆ for supporting tube -B2-
- ◆ fitting location: open ends of circlip point towards freewheel retaining wedge

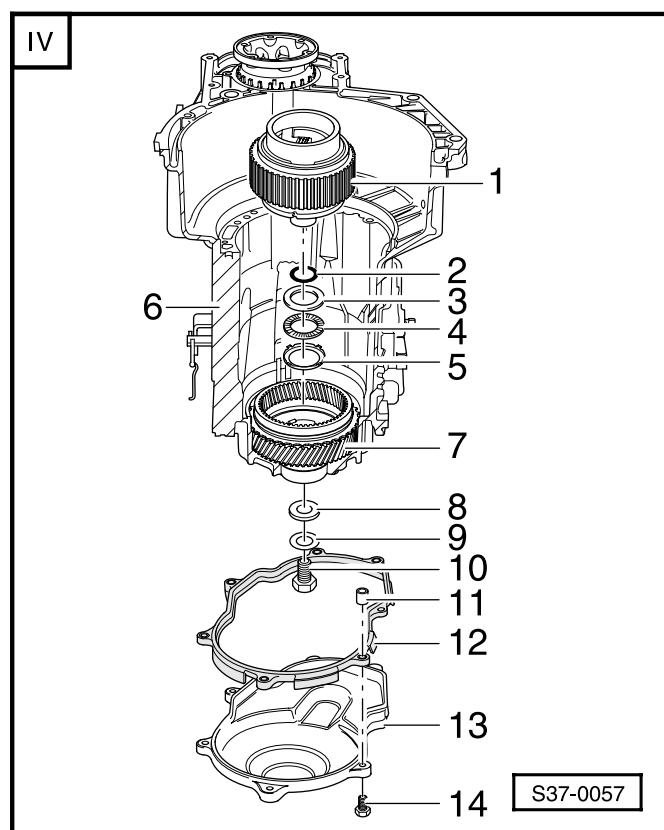
2 - Circlip

- ◆ for freewheel
- ◆ fitting location: open ends of circlip point towards freewheel retaining wedge

3 - Freewheel with piston -B1-

- ◆ disassembling and assembling
⇒ page 38-3
- ◆ before disassembling the freewheel remove the control valve housing and sealing plugs ⇒ page 38-12 -Pos 2- and gearbox speed sender -G38-
⇒ page 38-23 -Pos. 29-
- ◆ assemble with mounting ring MP 3-491

IV - Removing and installing planet carrier



7 - Input gear

- ◆ do not remove to disassemble the planetary gear
- ◆ removing and installing input gear or axial needle bearing ⇒ page 39-5

8 - Adjusting dial for planet carrier

- ◆ determine thickness ⇒ page 37-50, set planetary gear

9 - Washer

10 - Screw, 30 Nm

- ◆ for small drive shaft

11 - Spacer bush

- ◆ insert 7 in the seal

12 - Seal

- ◆ always replace

13 - Cover

14 - Screw, 8 Nm

- ◆ insert with locking agent AMV 185 101 A1

Notes:

Summary ⇒ page 37-30.

Disassembling planetary gear ⇒ page 37-35.

Assembling planetary gear ⇒ page 37-41.

1 - Planet carrier

- ◆ set ⇒ page 37-50

2 - Toroidal sealing ring

- ◆ always replace
- ◆ fit in planet carrier

3 - Washer for axial needle bearing

4 - Axial needle bearing

5 - Washer for axial needle bearing

- ◆ smooth side points to input gear

6 - Gearbox housing with assembled input gear

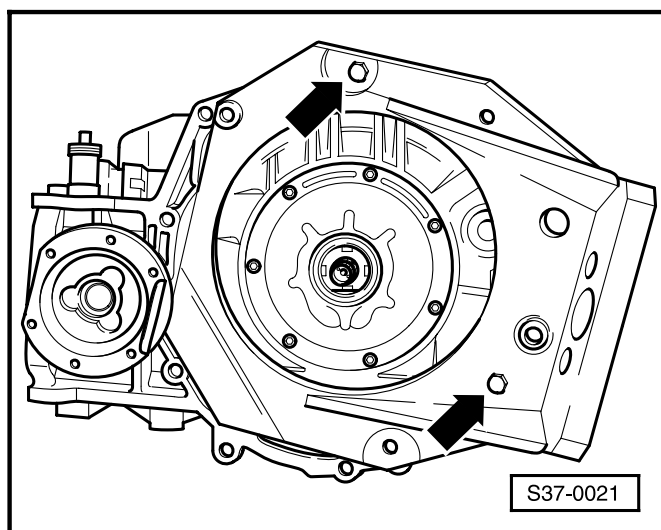
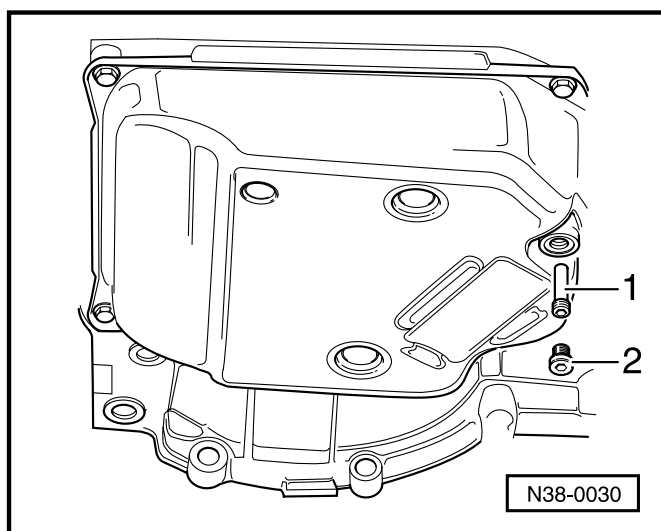
Disassembling and assembling planetary gear

Special tools, testers and aids required

- ◆ Mounting ring MP 3-491
- ◆ Sealant AMV 185 101 A1
- ◆ Thrust plate MP 3-407
- ◆ Plunger MP 3-408
- ◆ Pipe section MP 3-409
- ◆ Pipe section MP 3-450
- ◆ Gearbox holder MP 3-501
- ◆ Pipe section 3110
- ◆ Setting tool 3459

Disassembling planetary gear

- Place collector under gearbox.
- ◀ - Remove ATF overflow tube -1- and screw plug -2-
- Drain ATF.
- Close ATF cooler connections.
- Remove torque converter from gearbox page 32-1.



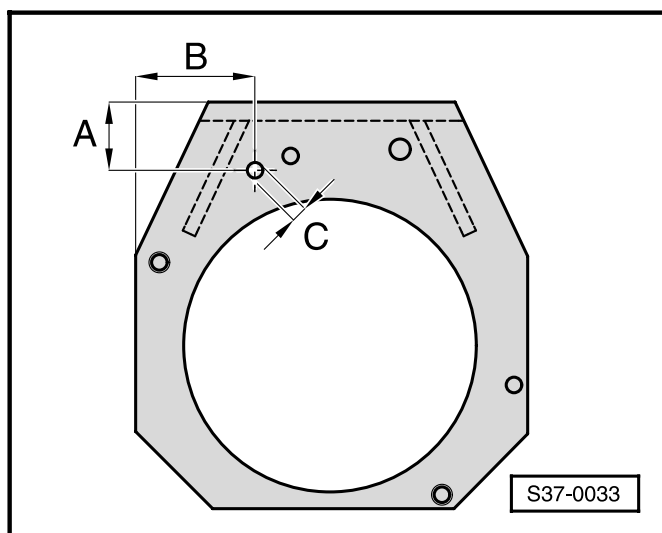
- ◀ - Secure gearbox to assembly support (arrow). Comply with note.

Caution!

The centre of gravity of the gearbox is located outside the turning centre on the tensioning block. To turn the gearbox a second mechanic must hold the gearbox housing to prevent back-swing.

Note:

Before first securing the gearbox the gearbox holder must be finished in accordance with the measurements below.

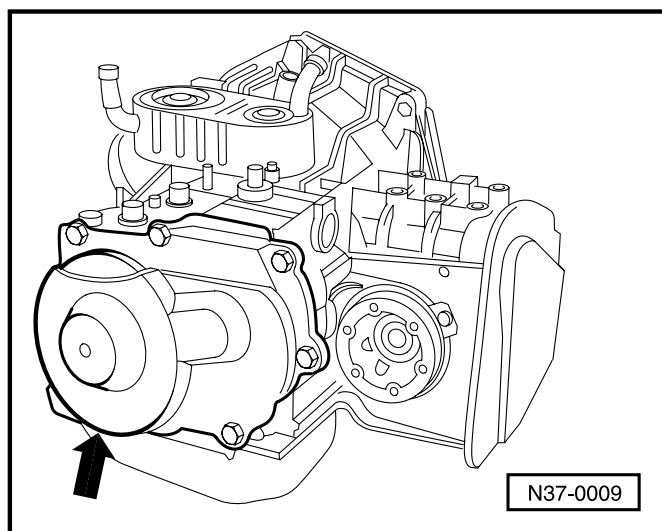


◀ - Drill additional bore holes in gearbox holder

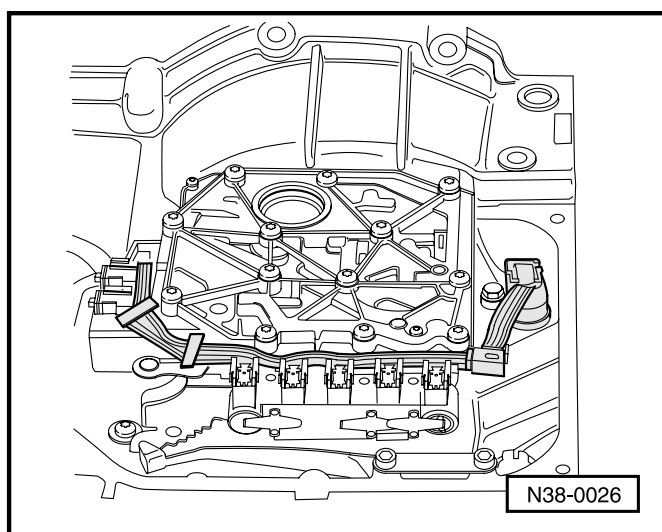
A = 55 mm

B = 96 mm

Ø C = 12 mm



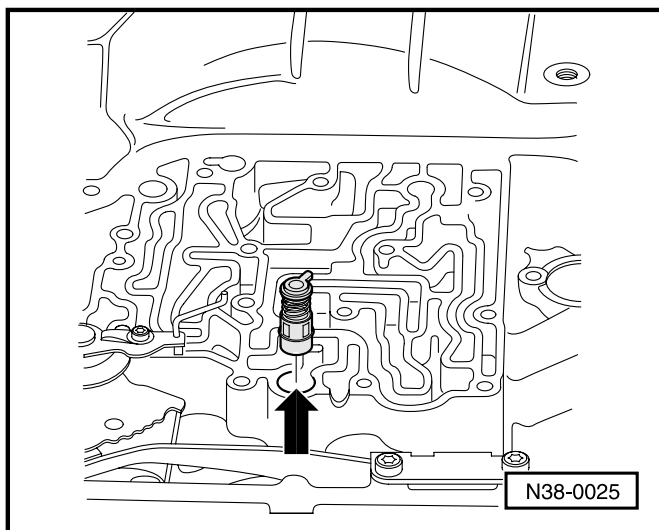
◀ - Remove cover and seal (arrow) of gearbox housing.



- Remove oil sump.

- Remove ATF strainer.

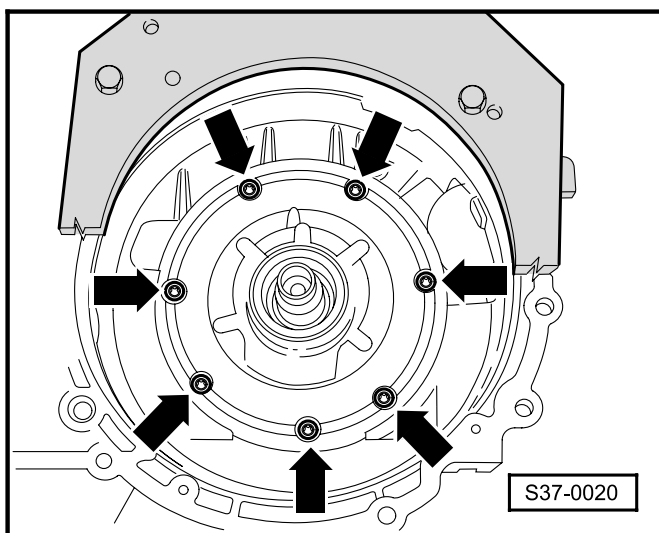
◀ - Remove control valve housing with conductor foil ⇒ page 38-12.



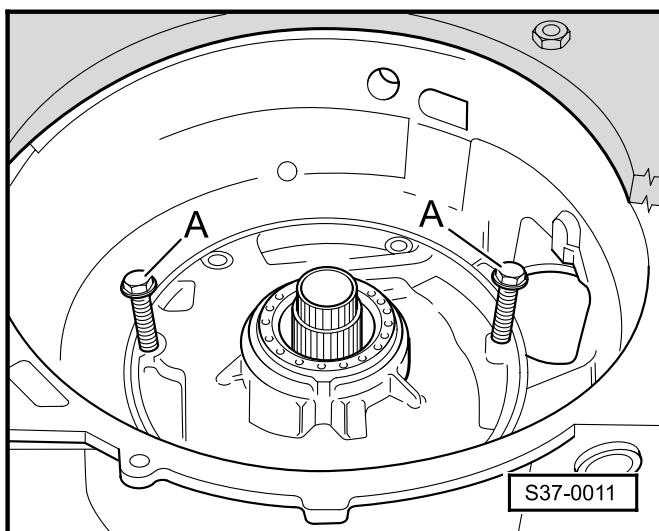
- ◀ - Remove seal plug for -B1- (arrow).
- Remove sender for gearbox speed -G38-
⇒ page 38-20.

Note:

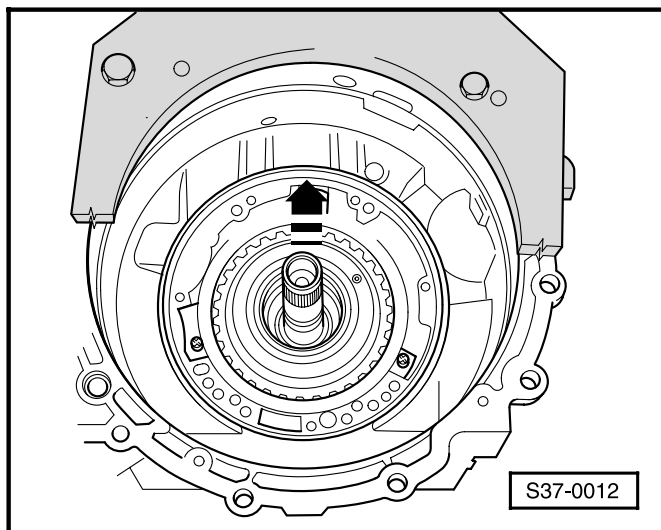
The seal plug and sender for gearbox speed must be removed to prevent damage to these parts.



- ◀ - Remove screws -arrows- for ATF pump.



- ◀ - Screw down screws -A- (M8) in the threaded holes of the ATF pump.
- By tightening screws -A- evenly press back ATF pump from gearbox housing.

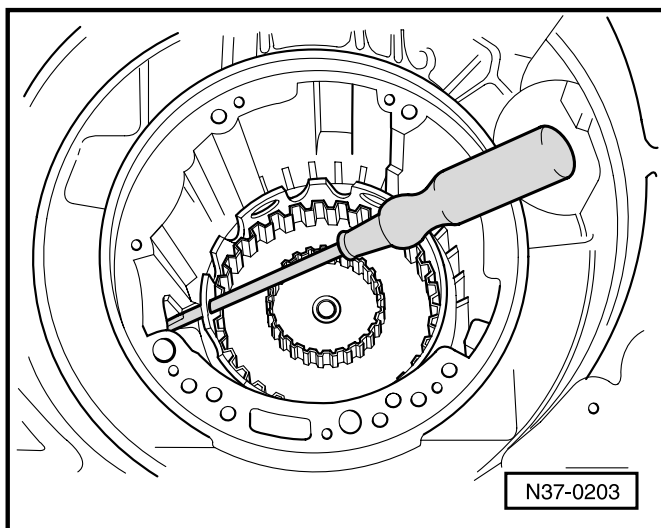


- ◀ - Grab turbine shaft and pull out all clutches with supporting tube for -B2-, disks for -B2-, springs and helical springs together.

Clutches -K1- and -K3- are pressed together.

-K1- need only be pressed away from -K3- if one of the clutches must be disassembled or replaced.

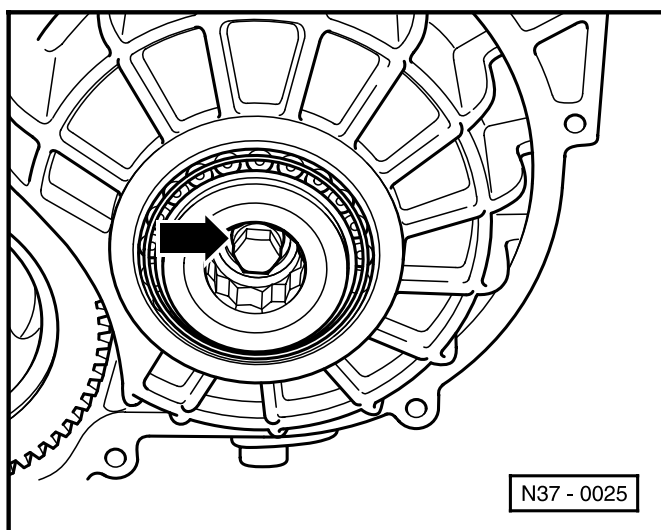
Pressing away -K1- from -K3- ⇒ page 37-40.



- Fitting park lock.
- ◀ - Insert a screwdriver through the bores of the large sun wheel to release the screw for the small drive shaft.

Note:

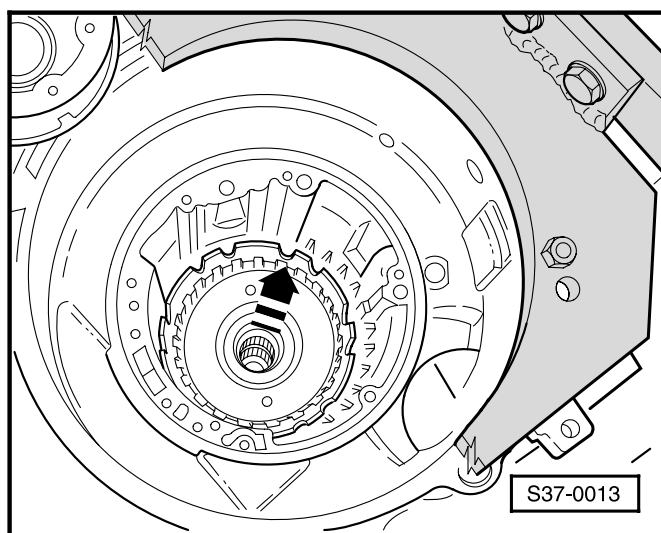
If the park lock cannot be fitted also block the large drive shaft with a second screwdriver.



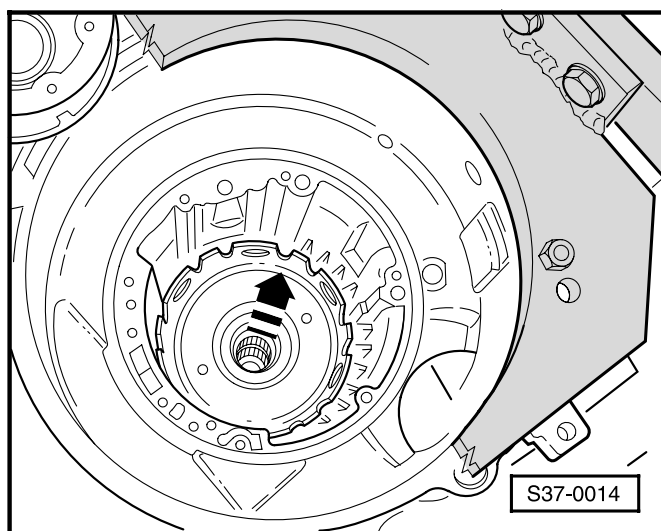
- ◀ - Remove screw -arrow- with washer and adjusting dial for the small drive shaft.

Axial needle bearing for planetary carrier remains in gearbox/input gear.

- Remove small drive shaft.



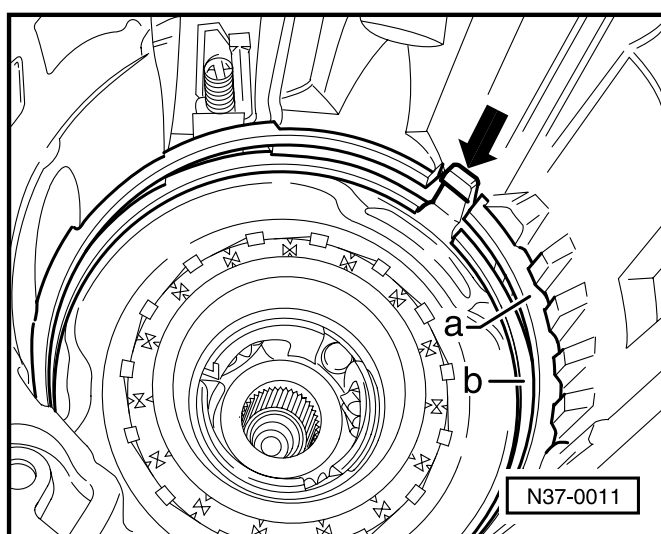
- ◀ - Remove large drive shaft (arrow).



- ◀ - Remove large sun wheel (arrow).

Note:

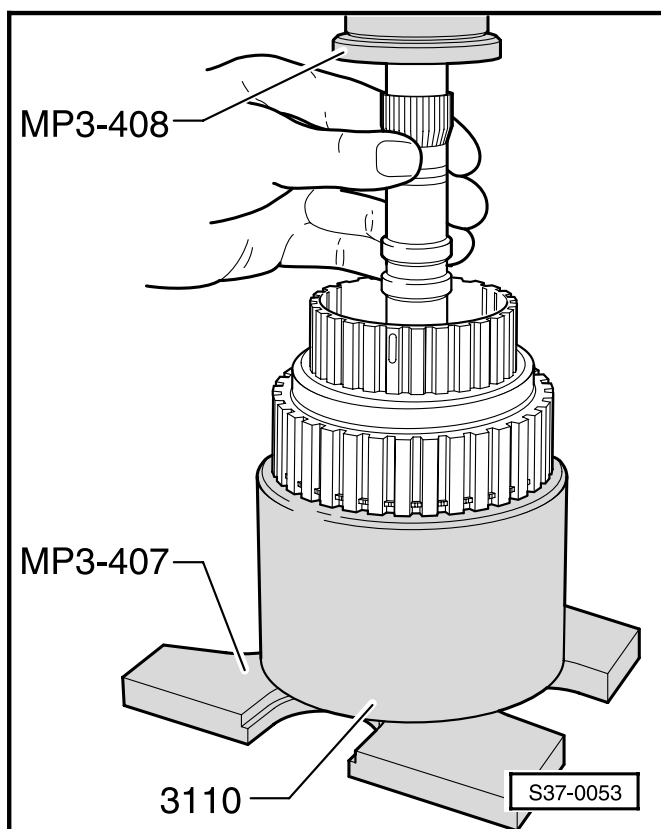
Before removing the freewheel the gearbox speed sender -G38 and seal plug must have been removed.



- ◀ - Remove circlip for supporting tube -a- and circlip for freewheel -b-.
- Grab the inside of the planet carrier and pull out together with the freewheel and disk spring.
 - Remove actuating plate, disks and adjusting dial(s) of reverse gear brake -B1-.
 - Remove axial bearing and washers.

Notes:

- ◆ *To disassemble the planetary gear it is not necessary to remove the input gear. Removing and installing input gear ⇒ page 39-5.*
- ◆ *Assembling planetary gear ⇒ page 37-41.*



Pressing off clutch -K1- from -K3-

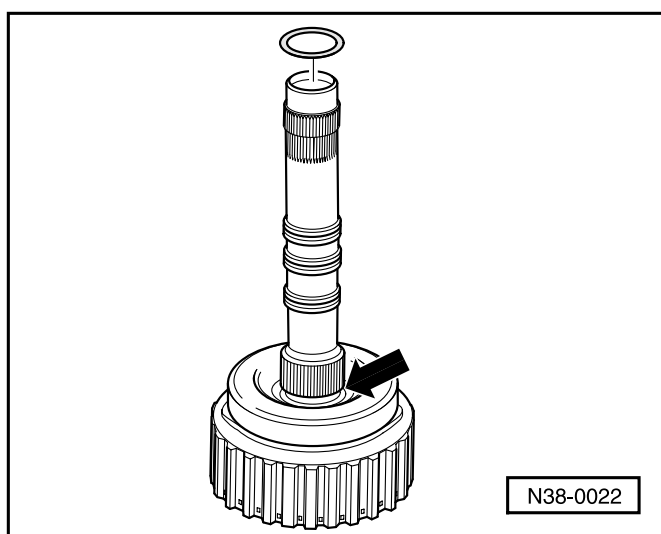
Clutches -K1- and -K3- are pressed together.

-K1- and -K3- need only be pressed off if one of the clutches is to be disassembled or replaced.

- Make sure the pressure areas of the tools are not damaged.

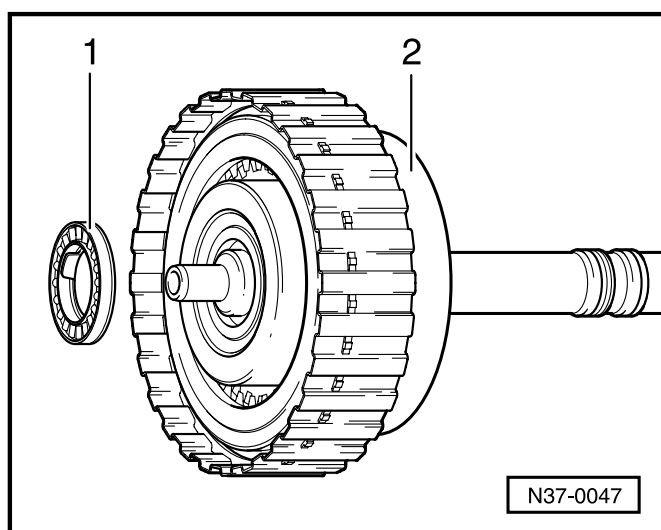
The pin in supporting tube 3110 points to thrust plate MP 3-407.

- ◀ - Hold the turbine shaft while pressing off.

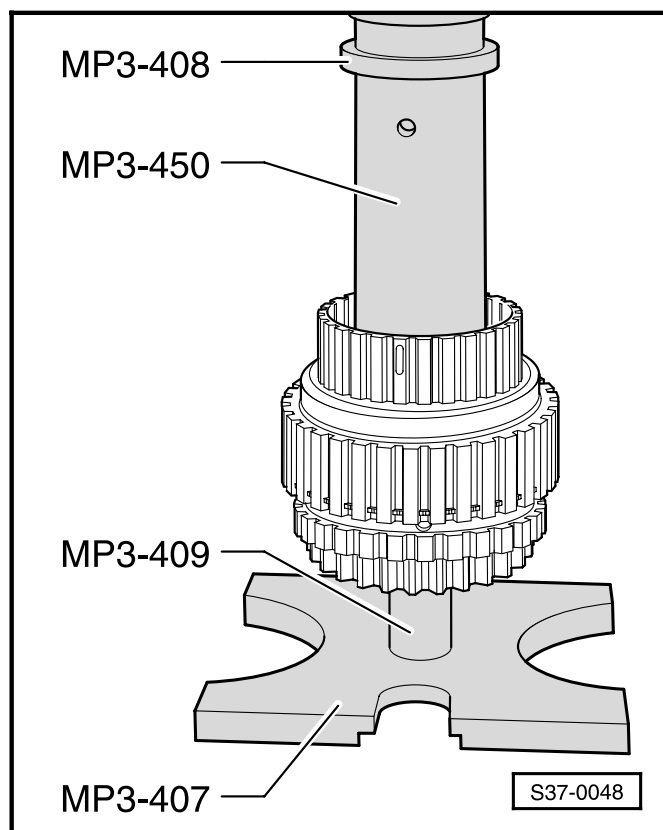


Pressing clutch -K1- on -K3-

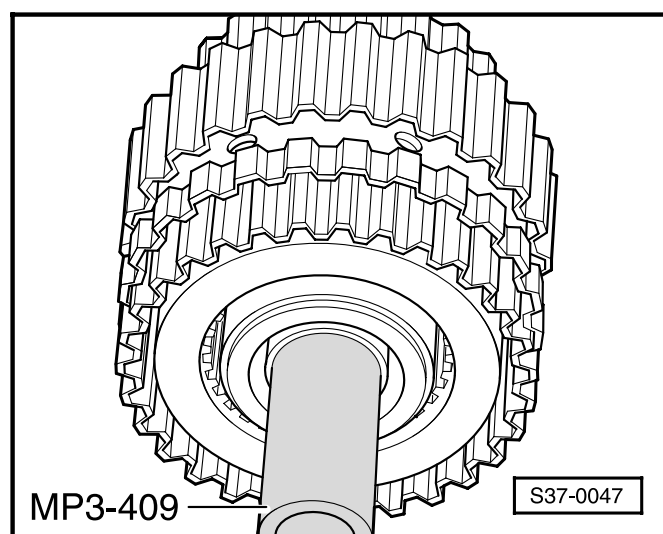
- ◀ - Fit new toroidal sealing ring in the groove of the turbine shaft (arrow).
- Wet toroidal sealing ring with ATF.



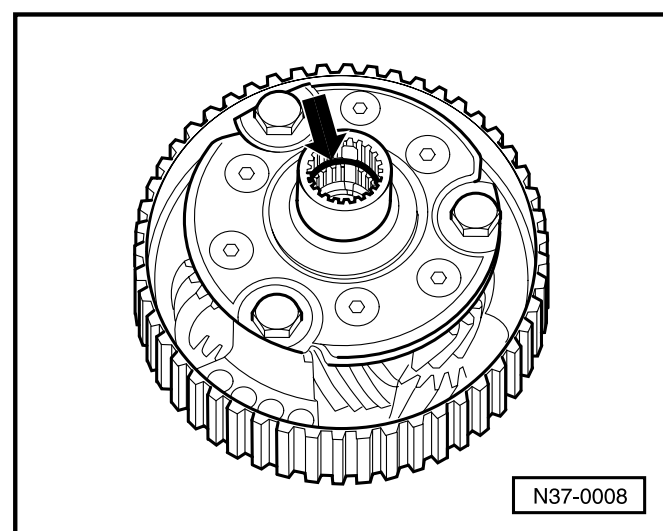
- ◀ - Position axial needle bearing with washer (1) on the 3rd and 4th gear clutch -K3- (2).
- Wet the axial needle bearing washer with ATF to ensure the bearing sticks to -K3- during installation.



- Make sure the pressure areas of the tools are not damaged.
- ◀ - Prepare -K1- and -K3- for pressing as shown here.



- ◀ - Before pressing centre MP 3-409 on the surface for the axial needle bearing (this figure shows the bottom side of -K3-).
- Carefully press down clutch -K1- up to the sensible stop.
- Do not exert any further compression forces on the clutches.

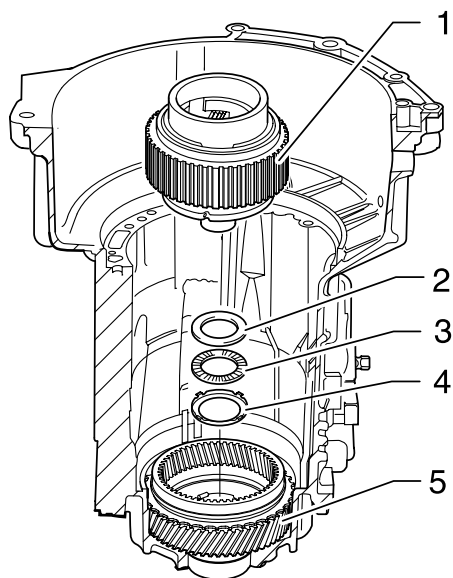


Assembling the planetary gear

- ◀ - Insert toroidal sealing ring in the planet carrier.

Note:

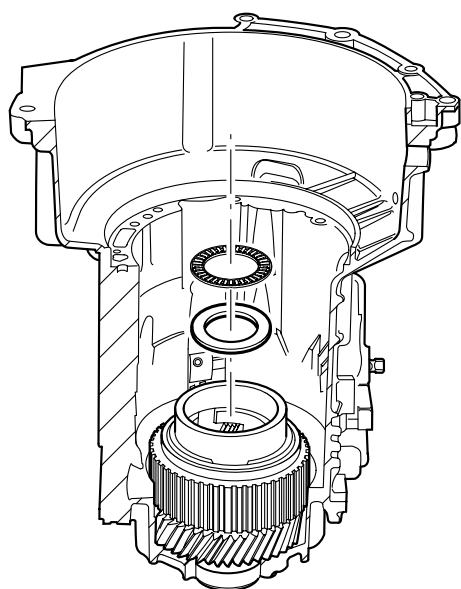
If the planet carrier is replaced set the planet carrier ⇒ page 37-50.



A37-0152

◀ - Position the axial needle bearing with washer in planet carrier in the input gear.

- 1 - Install planet carrier with assembled toroidal sealing ring
- 2 - Washer for axial needle bearing
- 3 - Axial needle bearing
- 4 - Washer for axial needle bearing, fit smooth side in input gear
- 5 - Input gear is installed in gearbox housing ⇒ 37-31



A37-0153

◀ - Position the washer and axial needle bearing on the small sun wheel in the planet carrier.

- Centre the washer and axial needle bearing on the small sun wheel.

Notes:

When replacing

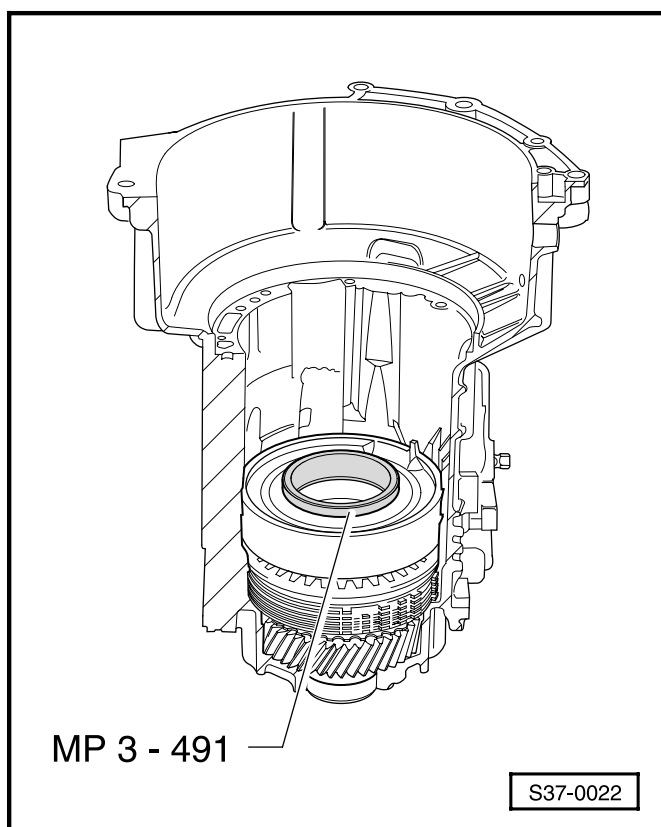
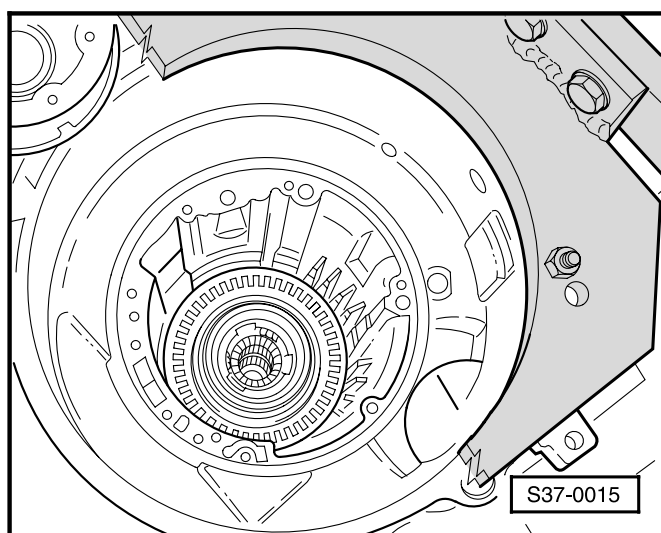
- ◆ Gearbox housing
- ◆ Freewheel
- ◆ Piston for reverse gear brake -B1-
- ◆ Or the disks

Set -B1- ⇒ page 37-54

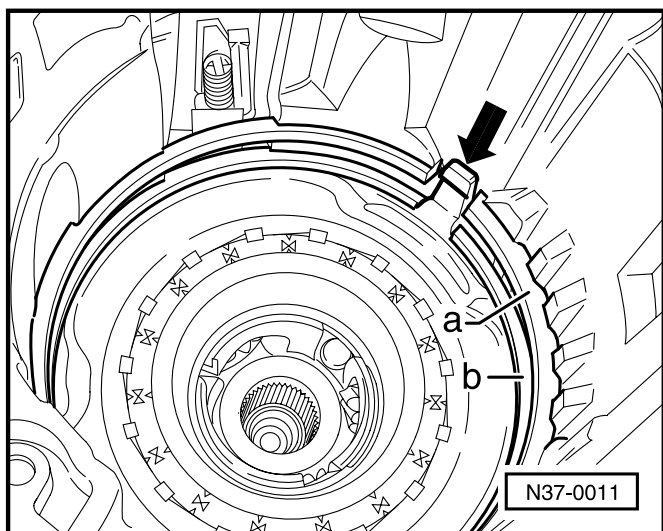
- Insert adjusting dial(s)
- Insert inside and outside disks of -B1-
- Insert actuating plate with the smooth side to the disks.

The thickness of the actuating plate differs according to the number of disks ⇒ page 37-32.

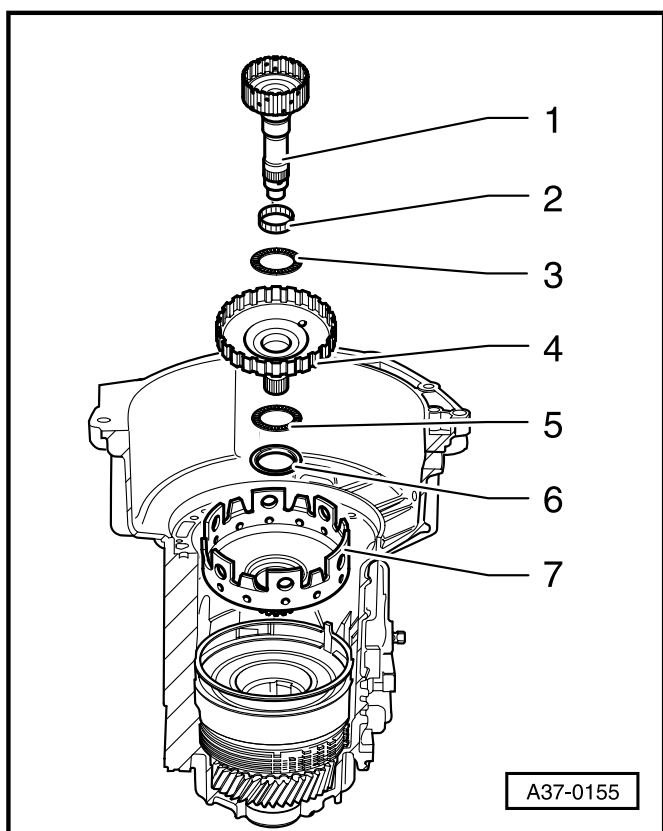
- ◀ - Insert disk spring with the curved side to the freewheel.



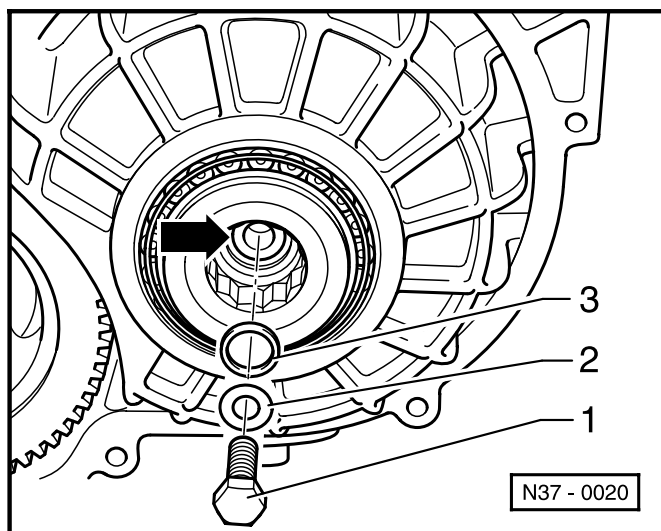
- ◀ - Prestress the freewheel cylinders with mounting ring MP 3-491 and insert freewheel.



- ◀ - Install circlip for freewheel -b- and circlip for supporting tube -a-.
- The circlip openings point to the freewheel retaining wedge (arrow).
- Install the sender for the gearbox speed -G38- ⇒ page 38-20.
- Perform check measurement of -B1- ⇒ page 37-57.



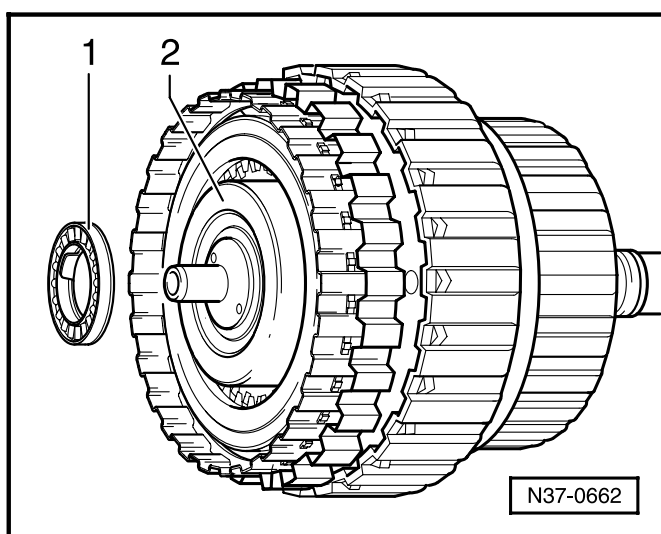
- ◀ - Insert the parts in reverse order to the numbers in the gearbox housing:
- 1 - Small drive shaft
- 2 - Needle bearing
- 3 - Axial needle bearing
- 4 - Large drive shaft
- 5 - Axial needle bearing
- 6 - Washer for axial needle bearing (collar points to large sun wheel)
- 7 - Large sun wheel



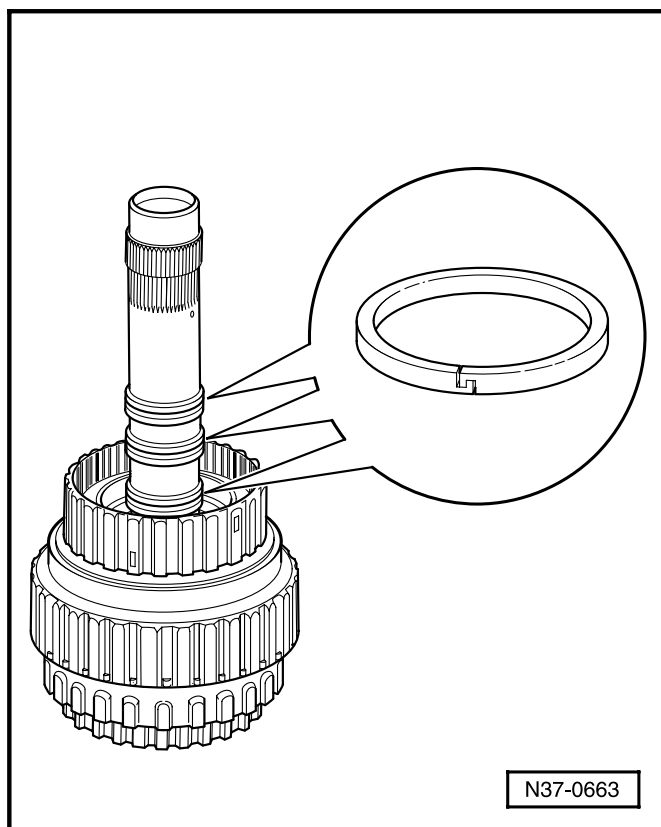
- ◀ - Install screw for small drive shaft -1- with washer -2- and adjusting dial -3-, torque 30 Nm.

Notes:

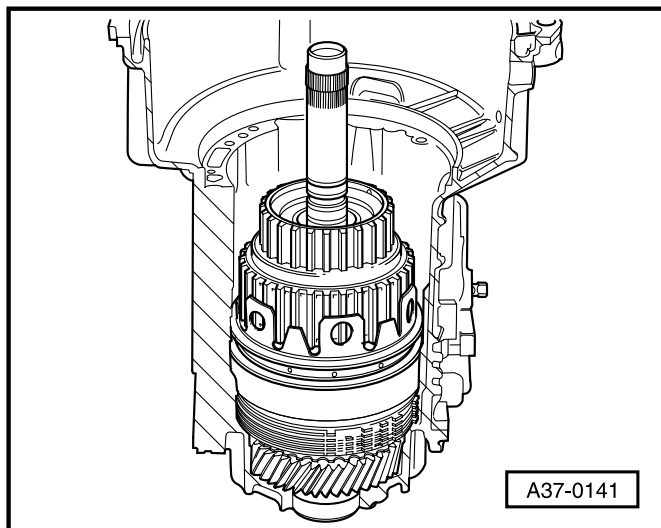
- ◆ *Position adjusting dial -3- on the small drive shaft collar (arrow).*
- ◆ *Determine the thickness of the adjusting dial ⇒ set planet carrier, page 37-50.*
- Perform check measurement of planet carrier ⇒ page 37-53.



- ◀ - Fit axial needle bearing with washer (1) on the 3rd and 4th gear clutch -K3- (2).
- Wet the washer of the axial needle bearing with ATF to ensure the bearing sticks to -K3- during assembly.



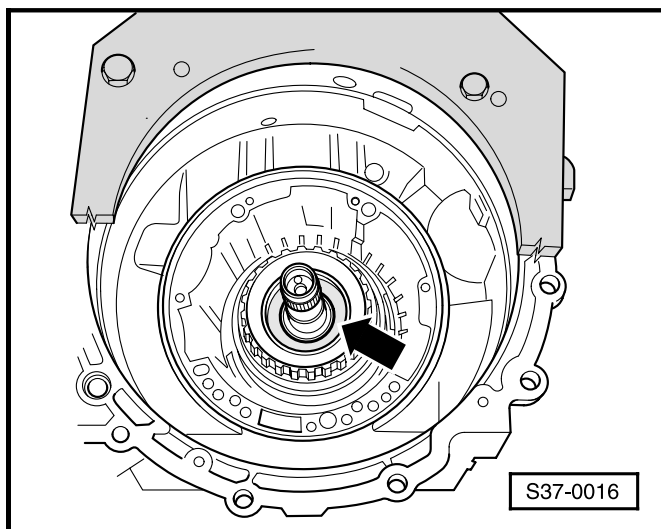
- ◀ - Check piston ring seat on -K3-.
- Make sure the piston-ring joints interlock.



- ◀ - Install 1st through 3rd gear clutch -K1- with 3rd and 4th gear clutch -K3-.

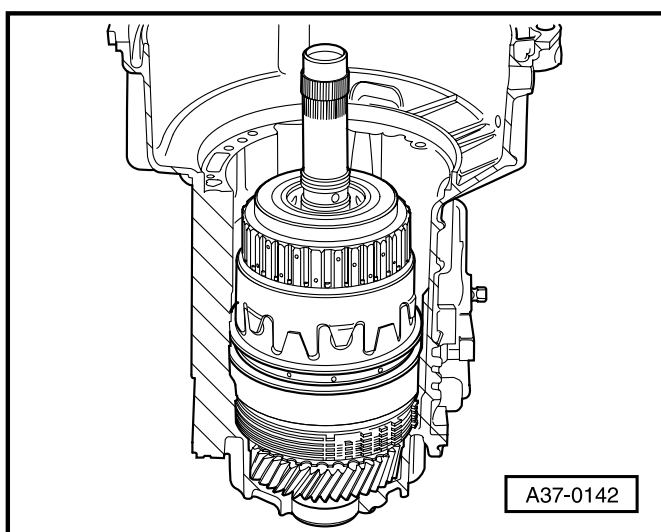
Note:

Turn the 1st through 3rd gear clutch -K1- with 3rd and 4th gear clutch during mounting until all disks are in the gearing.



Note:

- ◆ When replacing -K1- and -K2-, the small drive shaft or the ATF pump measure the adjusting dial again ⇒ set clutch play between -K1- and -K2-, page 37-52.
- ◆ 1 or 2 adjusting dials may be installed.
- ◀ - Insert adjusting dial -arrow- in -K1-.



- ◀ - Install reverse gear clutch -K2-.

Note:

Turn reverse gear clutch -K2- during mounting until all disks are in the gearing.

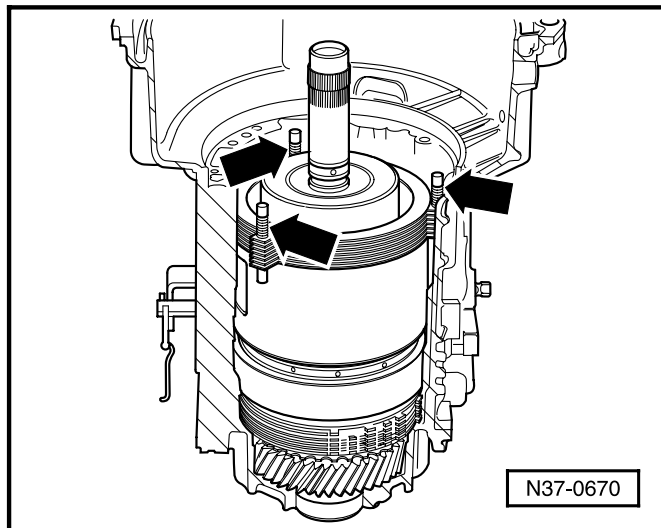
- Install the supporting tube for the disk packet of -B2- in such a way that the groove of the supporting tube locks into the freewheel wedge.

Note:

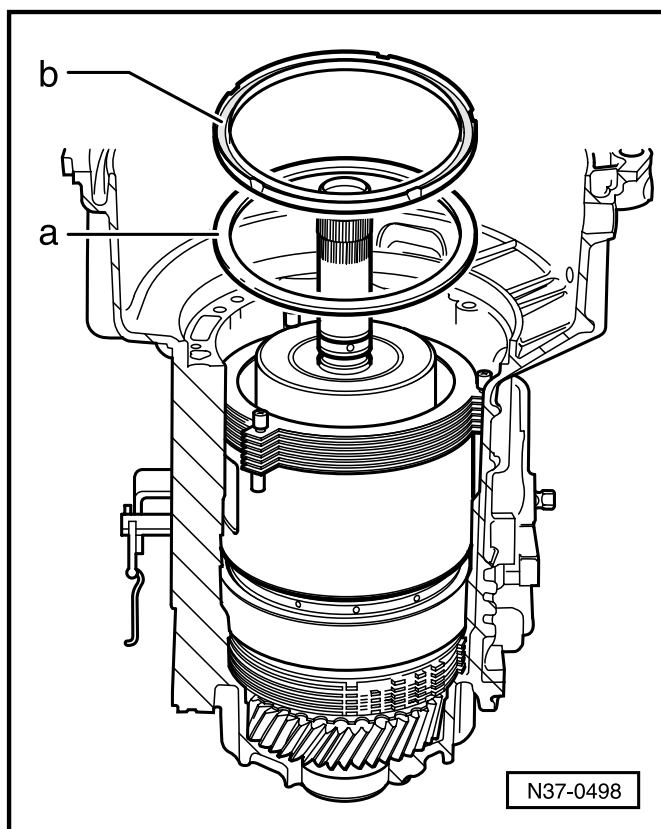
When replacing the

- ◆ Gearbox housing
- ◆ Supporting tube
- ◆ ATF pump
- ◆ Retaining ring
- ◆ Or the disks

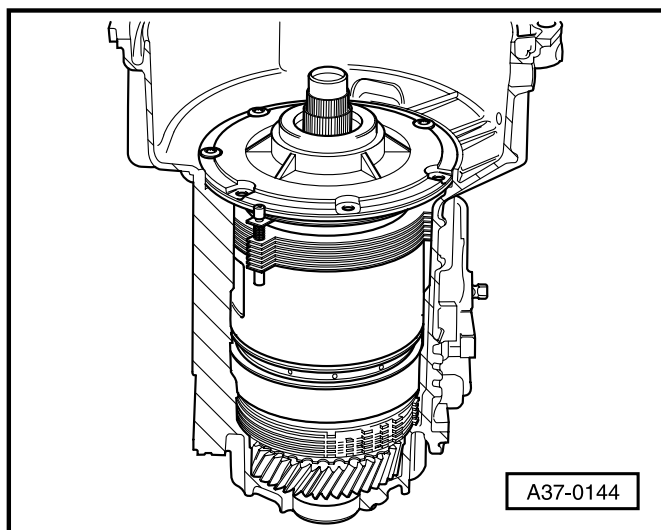
Set the 2nd and 4th gear brake -B2- ⇒ page 37-61.



- ◀ - Install the -B2- disks as follows:
 - First install a 3 mm thick outside disk.
 - Insert three helical springs in the outside disk.
 - Insert pressure springs (arrow).
 - Install all disks up to the last outside disk.
- Before installing the last 3mm thick outside disk fit three helical springs on the pressure springs.



- ◀ - Install adjusting dial -a-.
- Position retaining ring -b- on the adjusting dial. Smooth side to the dial.



- Install the ATF pump seal.
- Fit the toroidal sealing ring to the ATF pump.

Note:

Make sure the toroidal sealing rings are correctly fitted.

- ◀ - Install the ATF pump.
- Tighten the screws evenly crosswise. Torque: 8 Nm.

Note:

The toroidal sealing ring must not be damaged.

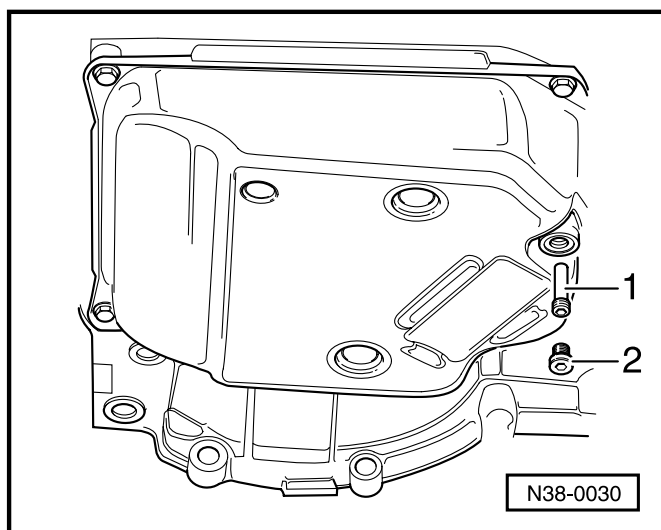
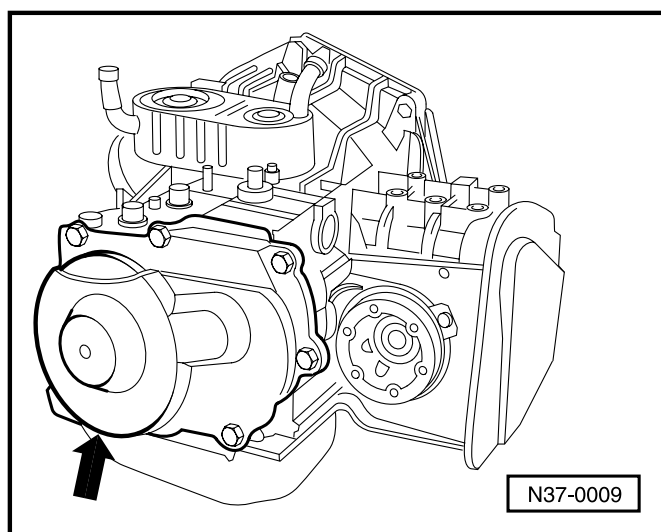
- Subsequently tighten the screws by 90°.

Further tightening may occur in successive steps.

- Perform a check measurement of the clutch play ⇒ page 37-60.

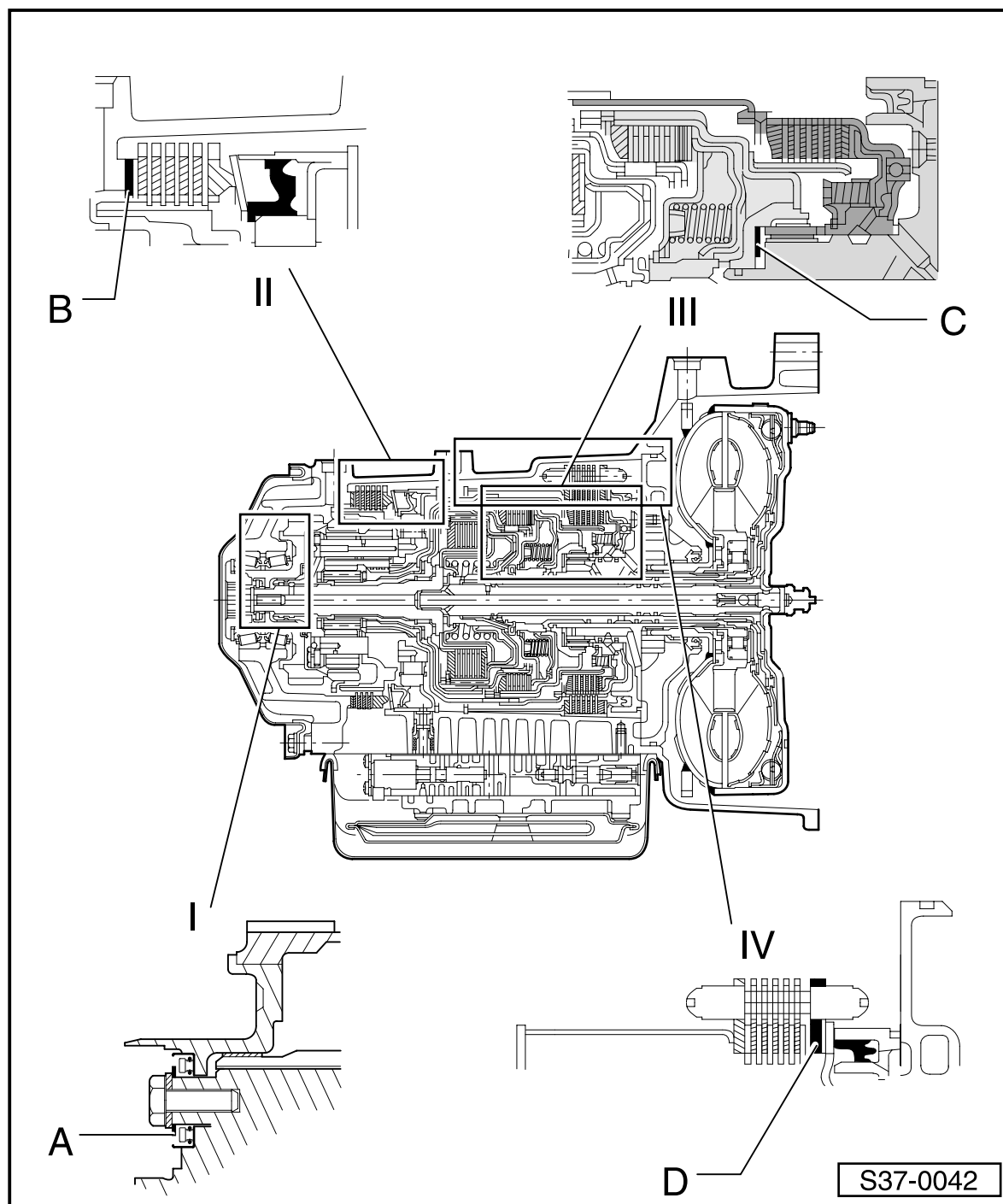
- Install seal plug with control valve housing and oil sump ⇒ page 38-12.

- ◀ - Install cover (arrow) with seal and spacer bush. Torque: 8 Nm.



- ◀ - Install ATF overflow tube -1- (2 Nm) and locking screw -2- (15 Nm) with new sealing ring.
- Install torque converter ⇒ page 32-3.
- Install gearbox ⇒ page 37-18.

Summary of all setting operations on planetary gear

**I = Planet carrier**

- ◆ A - adjusting dial
- ◆ Determine thickness ⇒ set planet carrier, page 37-50

II = Reverse gear brake -B1-

- ◆ B - adjusting dial
- ◆ Determine thickness ⇒ set reverse gear brake -B1-, page 37-54.

III = Clutch play

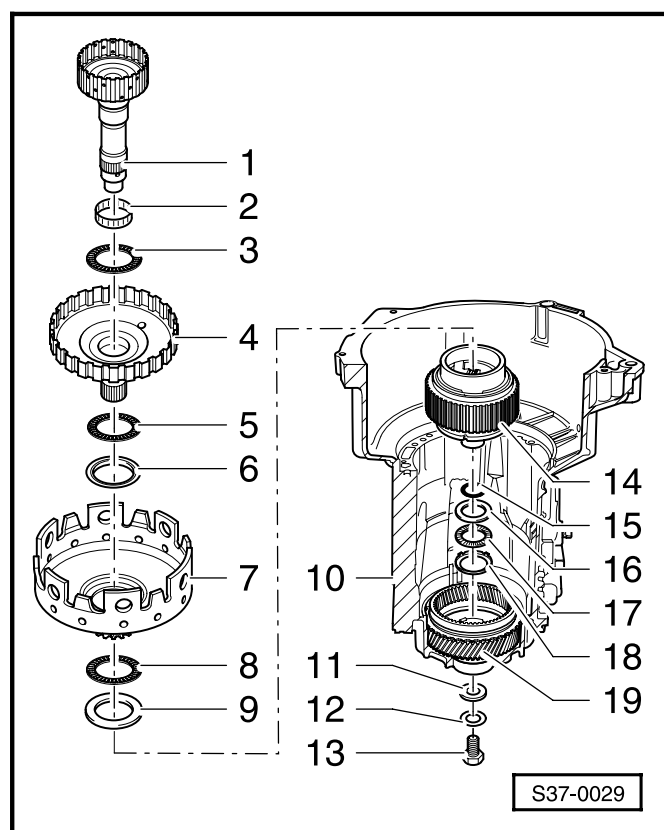
- ◆ C - adjusting dial
- ◆ Determine thickness ⇒ set clutch play between -K1- and -K2- ⇒ page 37-57.

IV = 2nd and 4th gear brake -B2-

- ◆ D - adjusting dial
- ◆ Determine thickness ⇒ set 2nd and 4th gear brake -B2-, page 37-61

S37-0042

I - Setting planet carrier



Summary of components for setting the planet carrier

- Install the components for setting the planet carrier with adjusting dial (Pos. 11) in the gearbox housing.

Special tools, testers and aids required

- ♦ Measuring device MP 3-404/7

1 - Small drive shaft

2 - Needle bearing

3 - Axial needle bearing

4 - Large drive shaft

5 - Axial needle bearing

6 - Washer

- ♦ insert in the large sun wheel
⇒ assemble planetary gear, page 37-41

7 - Large sun wheel

8 - Axial needle bearing

9 - Washer

10 - Gearbox housing

- ♦ with input gear and axial needle bearing
- ♦ axial needle bearing remains in input gear
- ♦ if axial needle bearing is damaged
⇒ remove and install the input gear, page 39-5

11 - Adjusting dial

- ♦ do not fit to install planet carrier

12 - Washer

13 - Screw for small drive shaft, 30 Nm

14 - Planet carrier

15 - Toroidal sealing ring

- ♦ always replace
- ♦ insert in planet carrier
⇒ assemble planetary gear, page 37-41.

16 - Washer for axial needle bearing

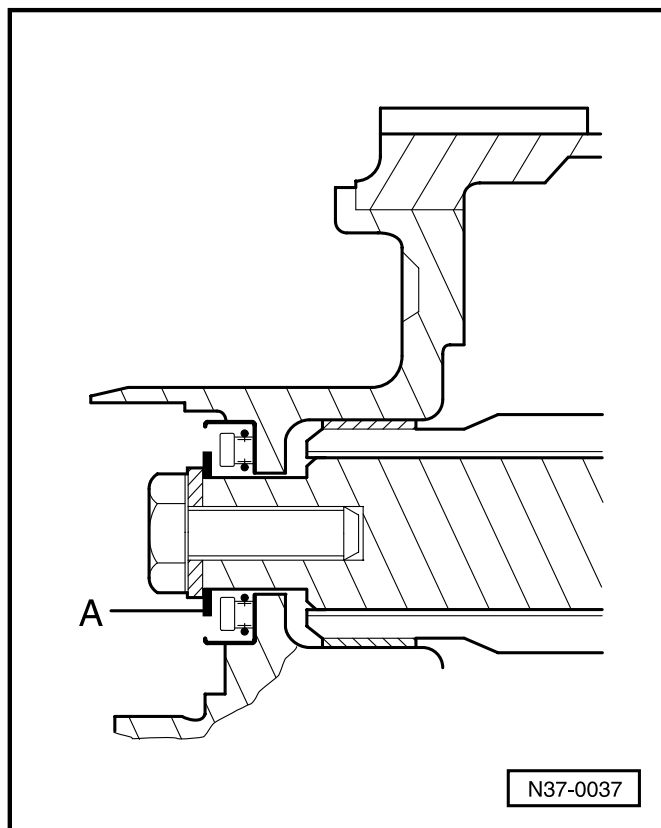
17 - Axial needle bearing

18 - Washer for axial needle bearing

- ♦ insert smooth side in the input gear.

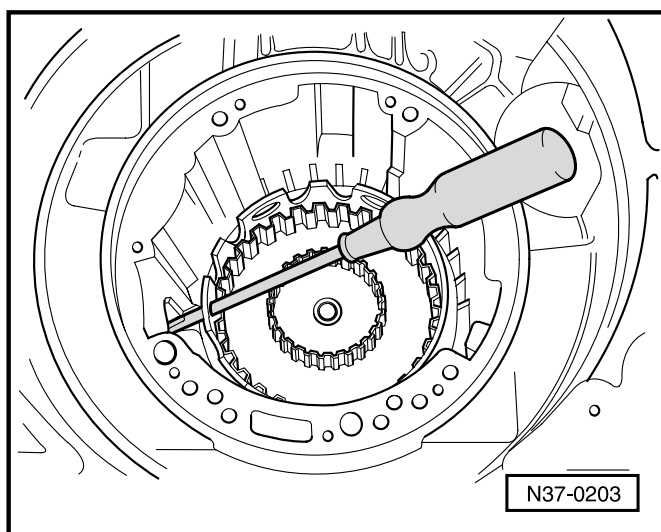
19 - Input gear

- ♦ do not remove to set the planet carrier
- ♦ remove or install the input gear or axial needle bearing for planet carrier
⇒ page 39-5



◀ Shim to be gauged -A-

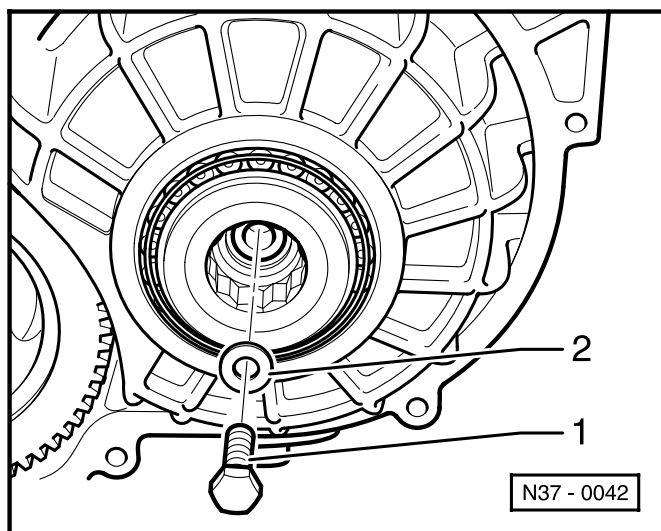
- Install all the components (items 1 to 9 and 14 to 18) into the gearbox housing for setting the planet carrier ⇒ page 37-50.



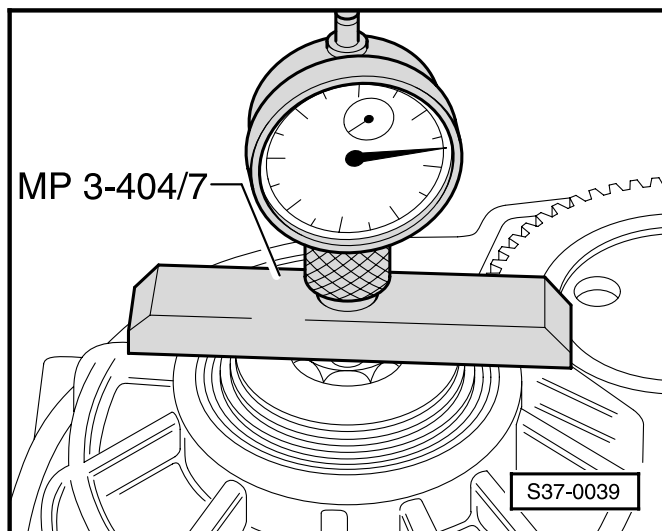
- ◀ - Place a screwdriver through the holes of the „large sun wheel“ in order to be able to slacken and tighten the „bolt for small input shaft“.
- Engage parking lock.

Note:

If it is not possible to engage the parking lock, block the large input shaft with an additional second screwdriver.



- ◀ - Install bolt for small input shaft -1- together with washer -2- but without the shim. Tightening torque: 30 Nm



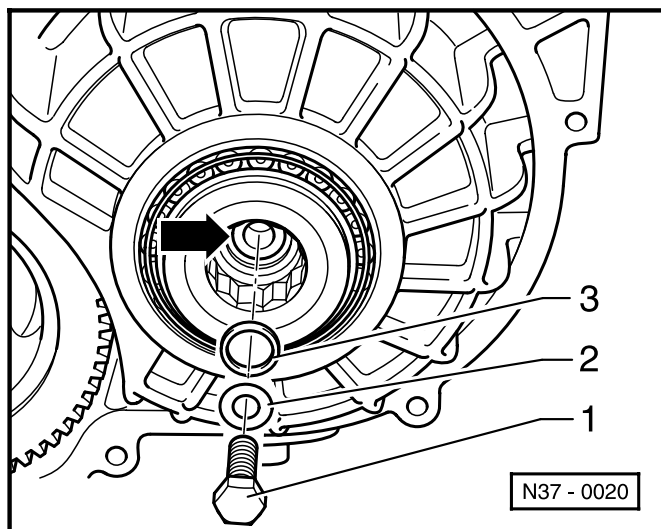
- ◀ - Insert dial gauge into MP 3-404/7.
- Position tip of dial gauge onto the bolt of the small input shaft with a preload of 1 mm.
- Set dial gauge to „0“.
- Push up small input shaft and check reading on gauge.

Example: reading 2 mm

- Determine thickness of shim according to the table and determine part number according to Parts Catalogue.

Table of shims -A-:

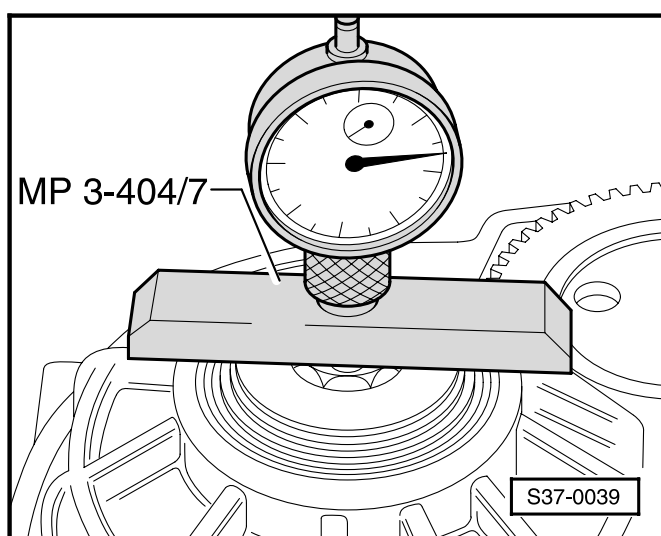
Reading obtained (mm)	Shims (mm)
1.26 ... 1.35	1.0
1.36 ... 1.45	1.1
1.46 ... 1.55	1.2
1.56 ... 1.65	1.3
1.66 ... 1.75	1.4
1.76 ... 1.85	1.5
1.86 ... 1.95	1.6
1.96 ... 2.05	1.7
2.06 ... 2.15	1.8
2.16 ... 2.25	1.9
2.26 ... 2.35	2.0
2.36 ... 2.45	2.1
2.46 ... 2.55	2.2
2.56 ... 2.65	2.3
2.66 ... 2.75	2.4
2.76 ... 2.85	2.5
2.86 ... 2.95	2.6
2.96 ... 3.05	2.7
3.06 ... 3.15	2.8
3.16 ... 3.25	2.9

**Example:**

Reading obtained 2.00 mm

Insert an 1.7 mm thick shim.

- Remove bolt for small input shaft.
- ◀ - Place calculated size of shim -3- onto the small input shaft (arrow).
- Tighten bolt for small input shaft -1- together with washer -2-. Tightening torque 30 Nm.
- Carry out a check measurement of the planet carrier.

**Check measurement of planet carrier**

- ◀ - Insert dial gauge into MP 3-404/7.
- Position tip of dial gauge onto the bolt of the small input shaft with a preload of 1 mm.
- Set dial gauge to „0“.
- Move small input shaft up and down and check play indicated on dial gauge.

Play:

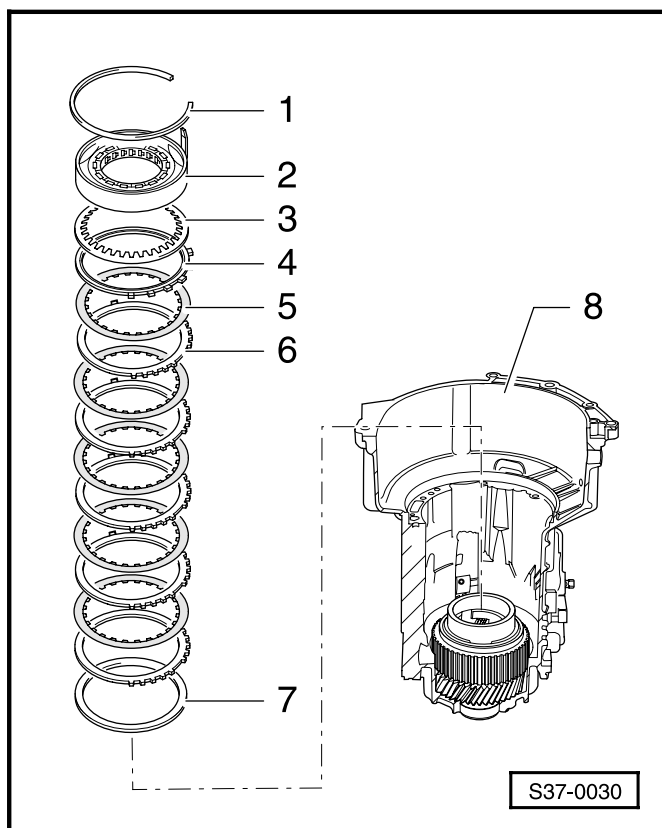
min. = 0.23 mm

max. = 0.37 mm

Note:

If the planet carrier was set with the reverse gear brake -B1- and freewheel removed, it is then necessary to install the reverse gear brake -B1- before installing the planet carrier ⇒ page 37-42, Assembling planetary gear.

II - Setting reverse gear brake -B1-



Summary of components for setting the reverse gear brake -B1-

Note:

Install the components in the gearbox housing without the shim(s) -item 7- for setting the reverse gear brake -B1-.

1 - Circlip

2 - Freewheel with -B1- piston

Note:

Before removing or installing the freewheel, remove control valve housing and take out sealing plug ⇒ page 38-12 and remove gearbox speed sender -G38 ⇒ page 38-20.

3 - Dished washer

- ◆ Convex side faces toward freewheel

4 - Pressure plate

- ◆ Install flat side facing the discs
- ◆ Different thickness depending on the number of internally-toothed discs installed
- ◆ Is assigned as replacement part to the gearbox code letters (different identification)

5 - Internally-toothed disc -B1-

- ◆ Quantity ⇒ page 00-2

6 - Externally-toothed disc -B1-

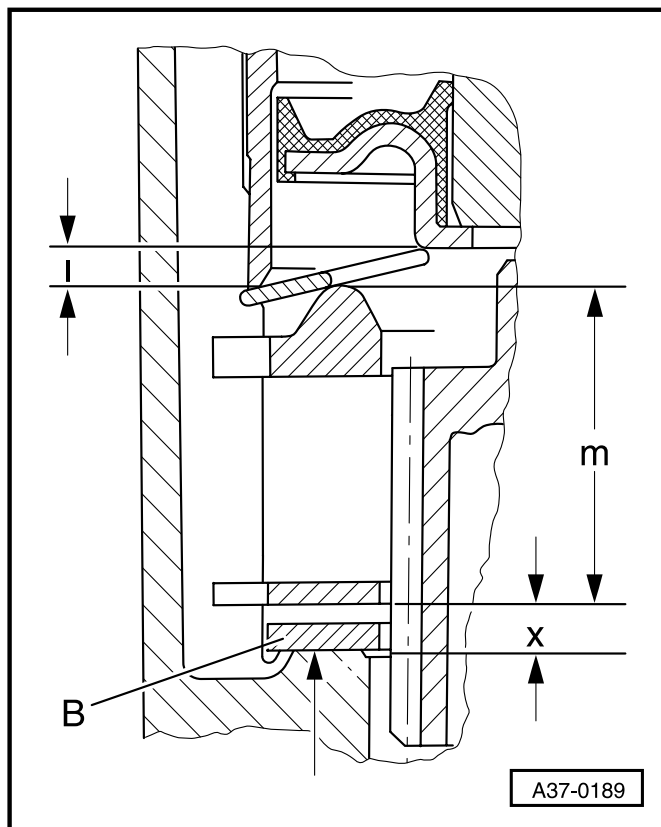
- ◆ Quantity ⇒ page 00-2

7 - Shim

- ◆ 1 or 2 shims may be installed

8 - Gearbox housing

- ◆ With input gear and planet carrier installed



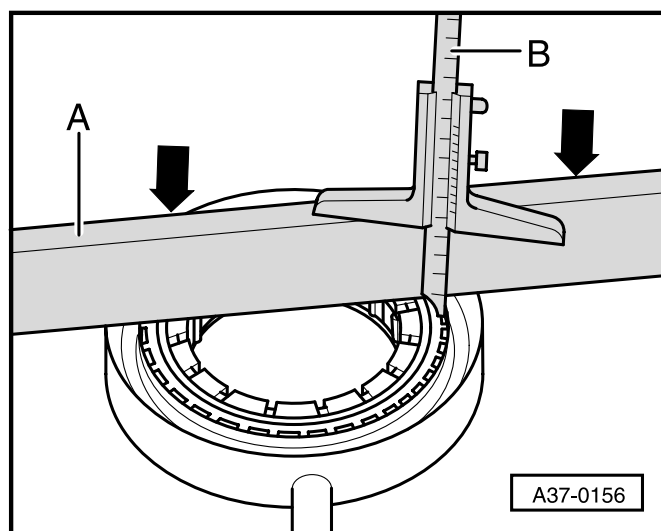
◀ Determining thickness of shim -B-

The thickness of the shim is determined by the size of gap „x“ and should be selected by referring to the table ⇒ page 37-56.

$$x = K + (l : 2) - m$$

- ◆ B = Shim
- ◆ x = Size of gap
- ◆ l = Position of piston in freewheel
- ◆ m = Height of disc set with pressure plate
- ◆ K = Constant value = 26.9 mm

„K“ is determined by the installed height in the gearbox housing and cannot be adjusted.

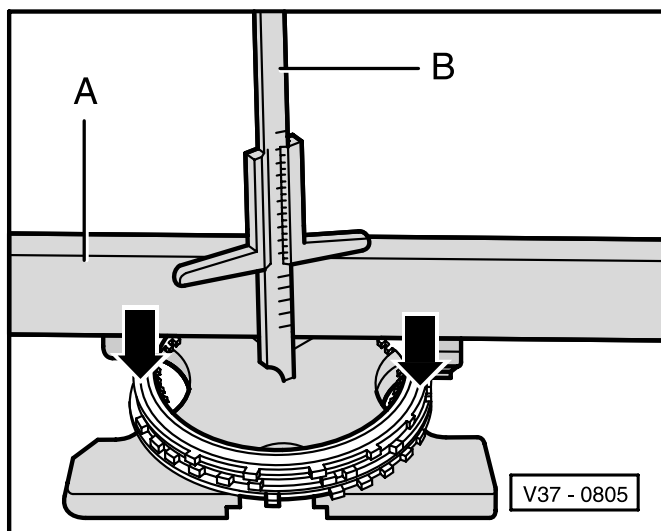


Determining value „l“:

- ◀ - Press piston in direction of arrow as far as stop.
- Mount straightedge „A“ onto outer race of freewheel.
- Measure to inner edge of piston with depth gauge „B“.

Example:

Measurement obtained	=	51.8 mm
- Straightedge	=	-48.2 mm
Value determined for „l“	=	3.6 mm



Determining value „m“:

- ◀ - Mount straightedge „A“ onto pressure plate.
- Press disc set with pressure plate together in direction of arrow and measure thickness of disc set with depth gauge „B“.

Example:

Measurement obtained = 73.5 mm

- Straightedge = -48.2 mm

Value determined for „m“ = 25.3 mm

$$x = K + (l : 2) - m$$

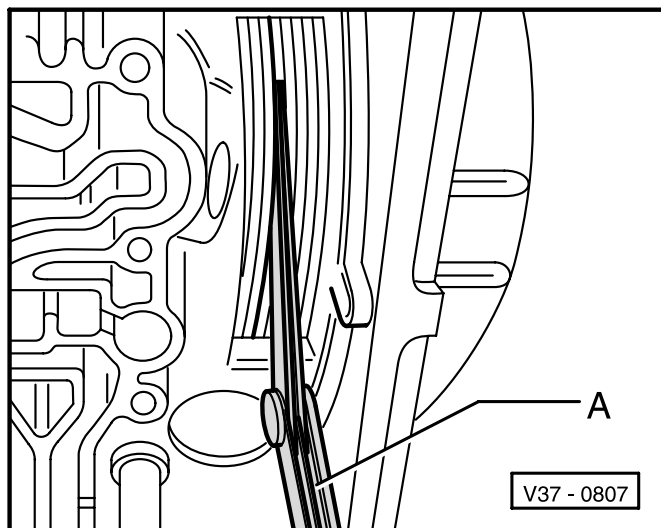
$$x = 26.9 + (3.6 : 2) - 25.3 = 3.4 \text{ mm}$$

- Select shims according to the table:

Table of shims -B-:

Gap „x“ (mm)	Shims (mm)
2.36...2.45	1.0
2.46...2.55	1.1
2.56...2.65	1.2
2.66...2.75	1.3
2.76...2.85	1.4
2.86...2.95	1.5
2.96...3.05	1.6
3.06...3.15	1.7
3.16...3.25	1.8
3.26...3.35	1.9
3.36...3.45	1.0+1.0
3.46...3.55	1.0+1.1
3.56...3.65	1.1+1.1
3.66...3.75	1.1+1.2
3.76...3.85	1.2+1.2
3.86...3.95	1.2+1.3
3.96...4.05	1.3+1.3
4.06...4.15	1.3+1.4
4.16...4.25	1.4+1.4

- Determine thickness of shim by referring to the table and determine part number by referring to Parts List.



- After determining the adjusting dial for -B1- perform check measurement.

Check measurement of reverse gear brake -B1-

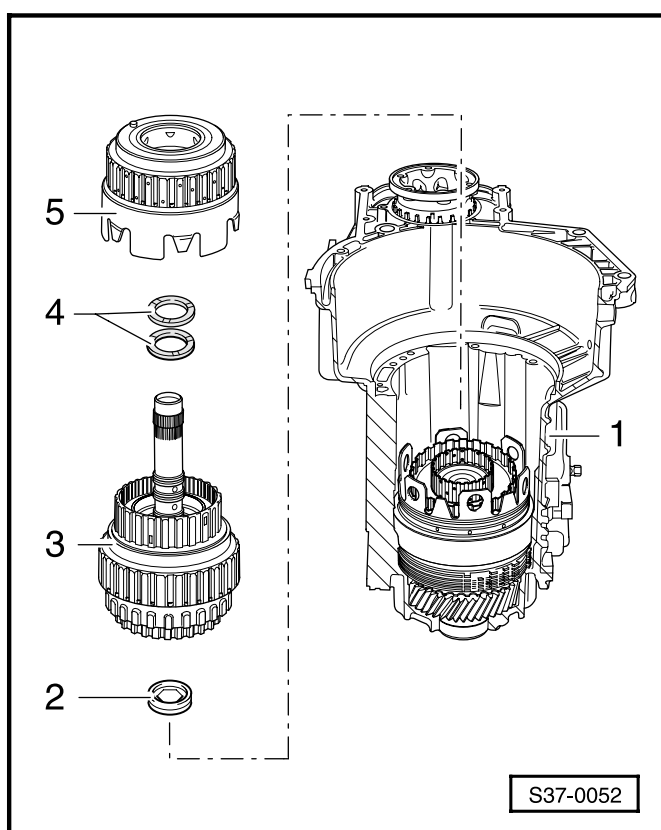
- Install parts up to freewheel and secure with circlip $\Rightarrow$ assemble planetary gear, page 37-41.
- ◀ - Measure the play between the disks with a feeler gauge "A".

Play:

Min. = 1.20 mm

Max. = 1.80 mm

III - Setting clutch play between -K1- and -K2-



1 - Gearbox housing

- ♦ Planetary gear installed up to small drive shaft $\Rightarrow$ assemble planetary gear, page 37-41

2 - Axial needle bearing with washer

- ♦ Axial needle bearing points to small drive shaft
- ♦ Washer points to -K3-

3 - 1st through 3rd gear clutch -K1- with 3rd and 4th f-gear clutch -K3- with turbine shaft

- ♦ Clutches -K1- and -K3- are compressed

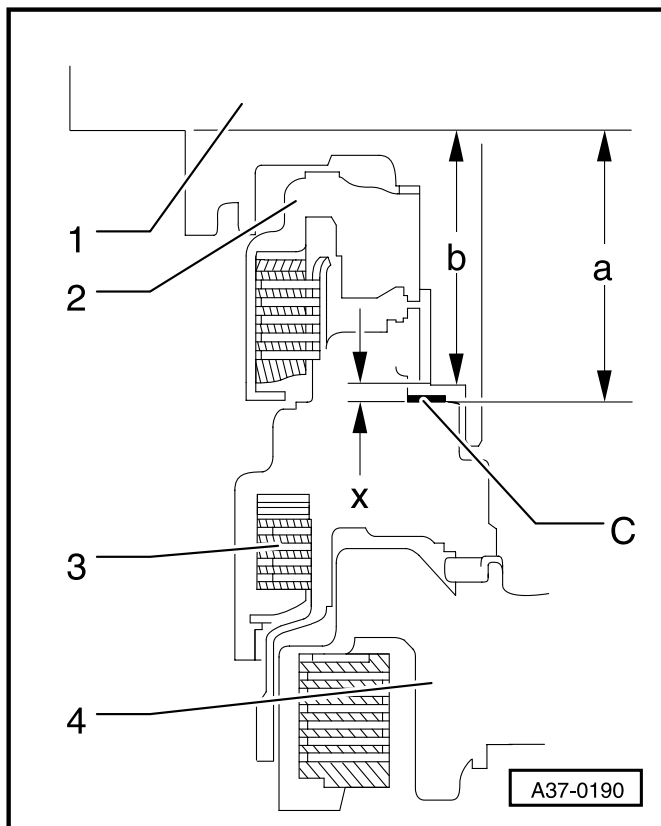
4 - Adjusting dial

- ♦ do not assemble to set the clutch play
- ♦ 1 or 3 adjusting dials may be installed

5 - Reverse gear clutch -K2-

Summary of components for setting the planet carrier

- ♦ Universal dial gauge holder MP 3-447
- Install components for setting the clutch play without the shim (item 4)
 $\Rightarrow$ page 37-41, Installing planet gear.



Determining thickness of shim(s) -C-

◀ The thickness of the shim(s) depends on the size of the gap „x“. It is calculated using the formula below:

$$\text{Size of gap } x = a - b$$

1 - ATF pump

2 - Reverse gear clutch -K2-

3 - 1st to 3rd gear clutch -K1-

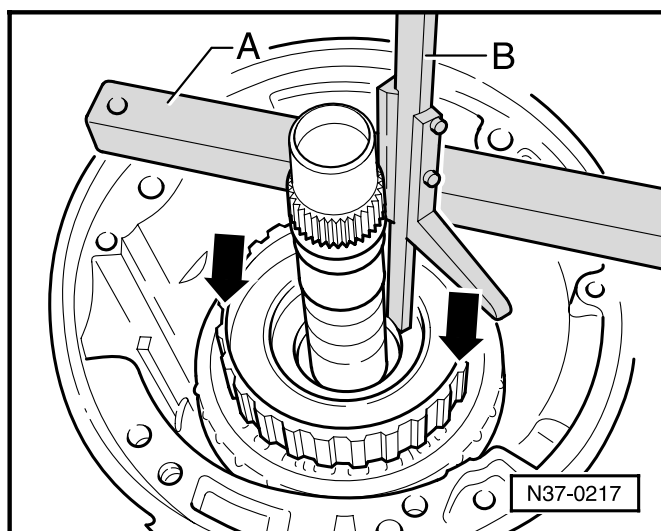
4 - 3rd and 4th gear clutch -K3-

C = Shim (s)

x = Size of gap

a = Installed depth of clutch -K1-; determining ⇒ page 37-58

b = Size of housing of ATF pump; determining ⇒ page 37-59

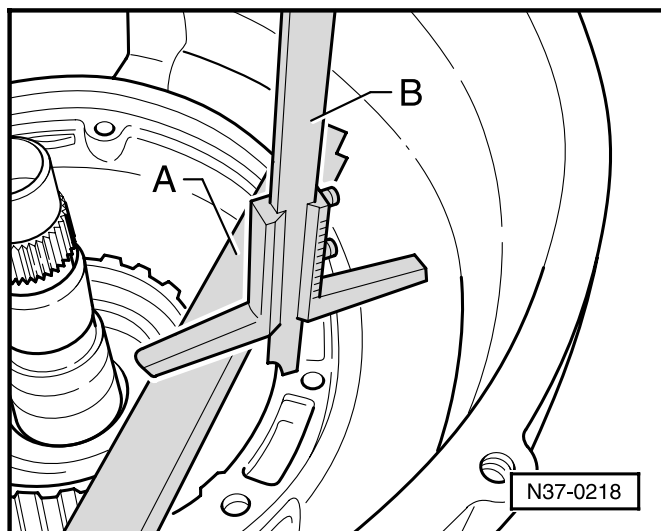


Determining value „a“:

- ◀ - Place straightedge „A“ onto gearbox housing.
- Press -K1- down in direction of arrow and use depth gauge „B“ to measure into -K1-.

Example:

Reading obtained 1 = 88.5 mm



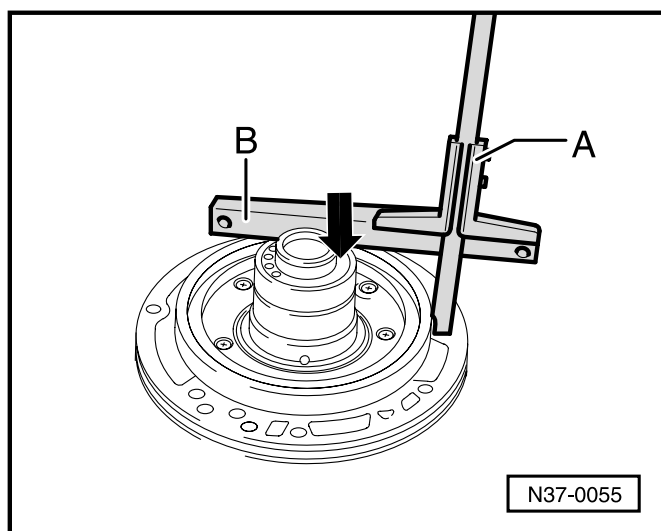
- ◀ - Place straightedge „A“ onto gearbox housing.
- Use depth gauge „B“ placed on pump flange to measure to gearbox housing.

Example:

Reading obtained 2 = 34.3 mm

Example for calculating value „a“

Reading obtained 1	=	88.5 mm
- Reading obtained 2	=	- 34.3 mm
Calculated value a	=	54.2 mm



Determining value „b“:

- ◀ - Place straightedge -B- onto the top of the impeller support (arrow) and measure with depth gauge -A- on pump flange. Carry out measurement with gasket fitted.

Example:

Measurement obtained	=	70.5 mm
- Straightedge	=	- 19.5 mm
Calculated value b	=	51.0 mm

Size of gap x = a - b

= 54.2 mm - 51.0 mm = 3.2 mm

Table of shims -C-:

Gap dimension „x“ (mm)	Shims (mm)	Colour of shims
... 2.54	1.4	white
2.55 ... 3.09	1 + 1	blue + blue
3.10 ... 3.49	1.2 + 1.2	green + green
3.50 ... 3.89	1.4 + 1.4	white + white
3.90 ... 4.29	1.6 + 1.6	black + black
4.30 ... 4.69	1.8 + 1.8	grey + grey
4.70 ... 5.04	1.2 + 1.2 + 1.6	green + green + black
5.05 ... 5.25	1.2 + 1.2 + 1.8	green + green + grey

- Determine thickness of the shims according to the table and refer to the spare part catalogue to determine the spare part number.
- Perform control measurement of the clutch clearance after fitting the ATF pump ⇒ page 37-60.

Control measurement (clutch clearance)

- Clutch clearance can only be measured after installing the ATF pump.
- Reverse gear-clutch -K1- must be installed.
- Attach dial gauge holder to gearbox housing and place dial gauge with 1 mm bias on the turbine shaft.

Note:

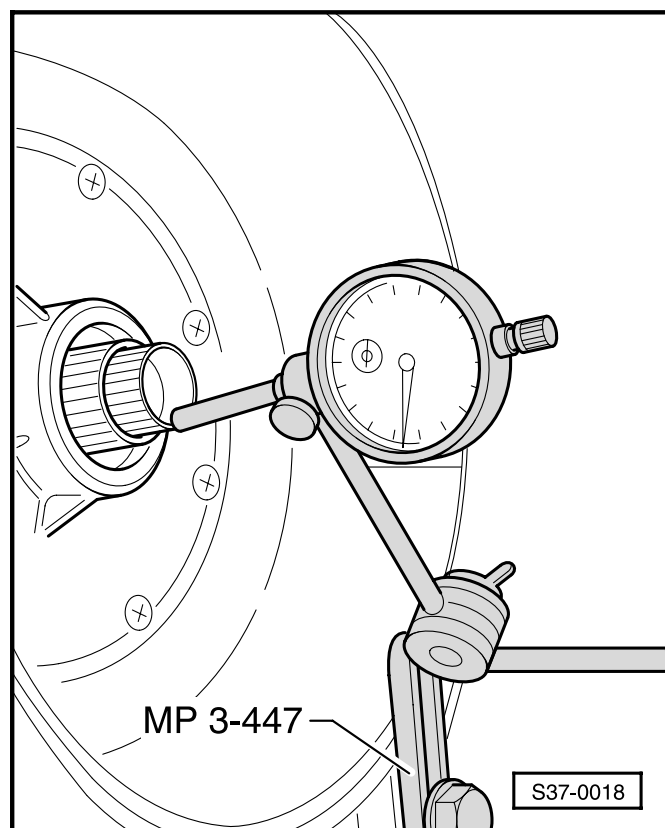
The gearbox must be put into the installed position so that the turbine shaft can move.

- ◀ - Pull out and re-insert turbine shaft (stiff) and read off clearance on dial gauge.

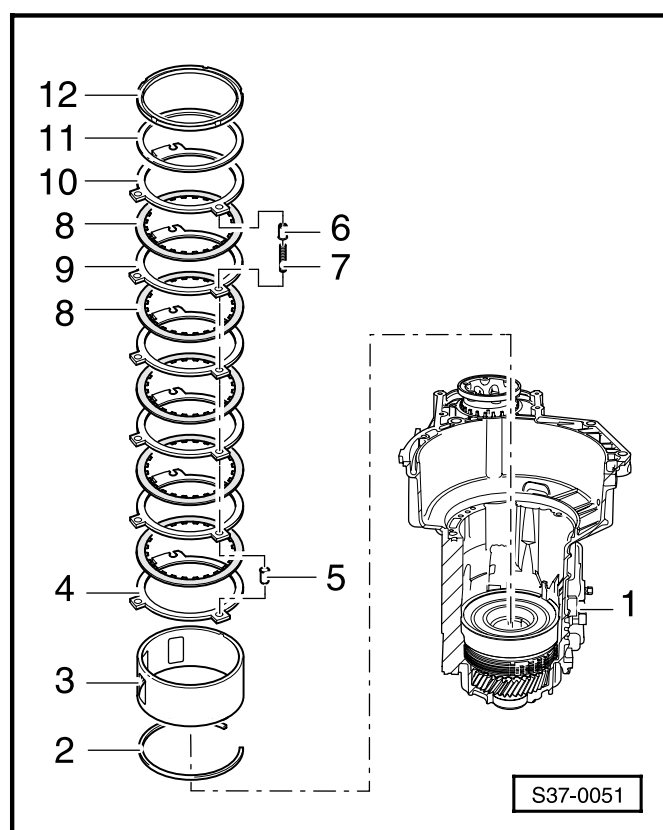
Clearance:

minimum = 0.5 mm

maximum = 1.2 mm



IV - Setting 2nd and 4th gear brake -B2-



- Install components for setting 2nd and 4th gear brake -B2- without adjusting dial (Pos. 11), without the last outside disk (Pos. 10) and without helical spring (Pos. 6) ⇒ Assembling planetary gearbox ⇒ page 37-41.

1 - Gearbox housing

- ♦ Planetary gear installed up to free-wheel

2 - Circlip

- ♦ for supporting tube

3 - Supporting tube -B2-

- ♦ for disk packet of -B2-
- ♦ different lengths depending on the number of installed inside disks
- ♦ assigned as spare part to the gear-box code letters
- ♦ fit in such a way that the groove engages the freewheel wedge

4 - Outside disk -B2-

- ♦ 3 mm thick

5 - Helical spring

- ♦ insert 3 helical springs after installing the first outside disk (Pos. 4)

6 - Helical spring

- ♦ do not install to set -B2-
- ♦ insert 3 helical springs before installing the last outside disk

7 - Spring

- ♦ 3
- ♦ assigned as spare part to the gear-box code letters

8 - Inside disk -B2-

- ♦ part number ⇒ page 00-2
- ♦ assigned as spare part to the gear-box code letters

9 - Outside disk -B2-

- ♦ always install 2mm thick outside disks
- ♦ part number ⇒ page 00-2

10 - Outside disk -B2-

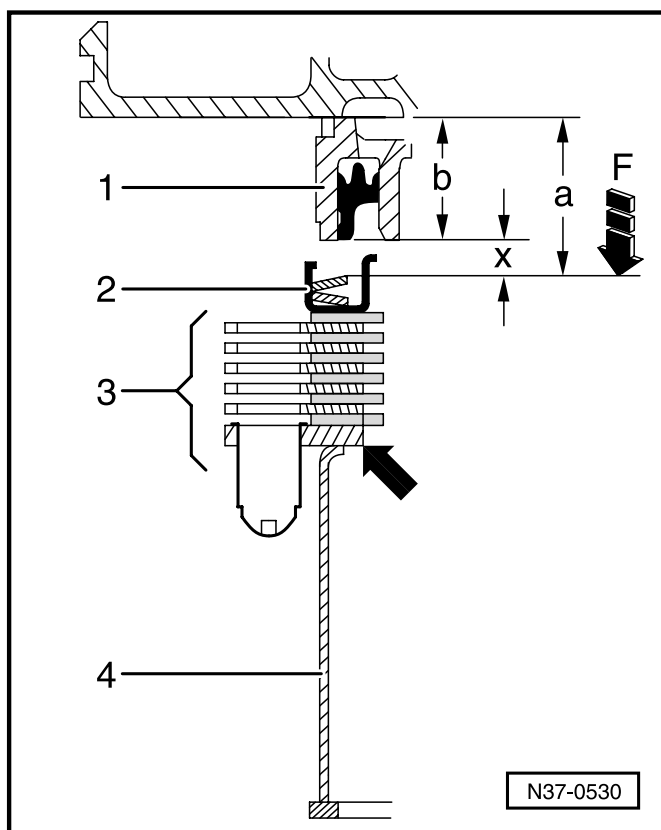
- ♦ 3 mm thick
- ♦ do not install to set -B2-

11 - Adjusting dial

- ♦ do not install to set -B2-
- ♦ 1 or 2 adjusting dials may be installed

12 - Retaining ring

- ♦ To set -B2- the smooth side is positioned on the last inside disk (Pos. 8)



◀ Determining the thickness of adjusting dial -D-

The thickness of the adjusting dial is determined by gap dimension "x" and must be selected from the table ⇒ page 37-64.

Gap dimension $x = a - b - 2.65 \text{ mm}$

To make this formula more understandable the figure represents the measuring situation.

Special tool 3459 that exerts a force -F- via the retaining ring on the disk packet is not shown.

a = determining the mounting depth of the 2nd and 4th gear brake -B2- page 37-62.

b = determining the housing dimension of the ATF pump ⇒ page 37-63.

2.65 mm - this takes into account the setting rate due to force -F-.

1 - ATF pump

2 - Retaining ring

3 - Disks of -B2- without the last outside disk

4 - Supporting tube

Note:

The first outside disk -arrow- is 3 mm thick.

Determining value "a":

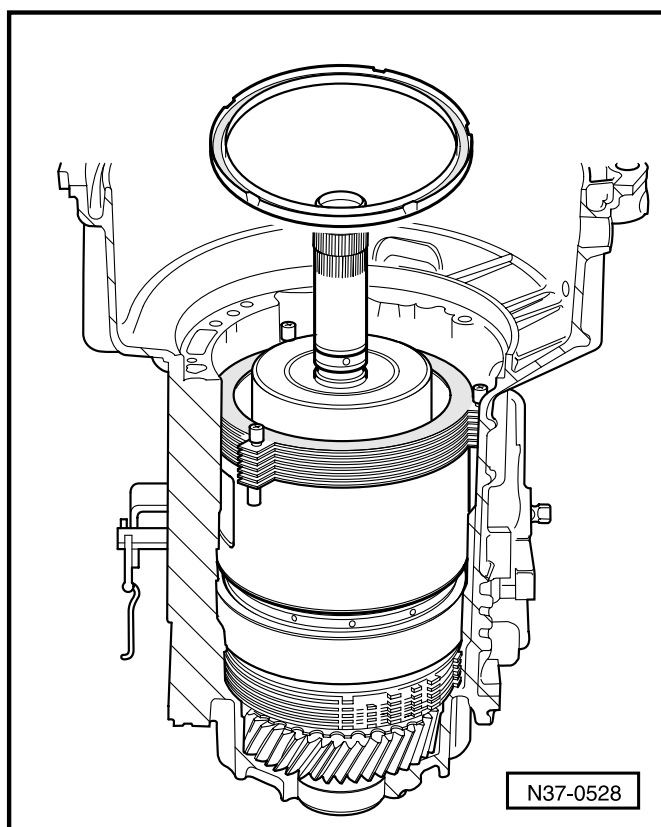
Assemble the planetary gear up to the last inside disk of -B2- ⇒ page 37-41. The last outside disk and adjusting dial are not fitted!

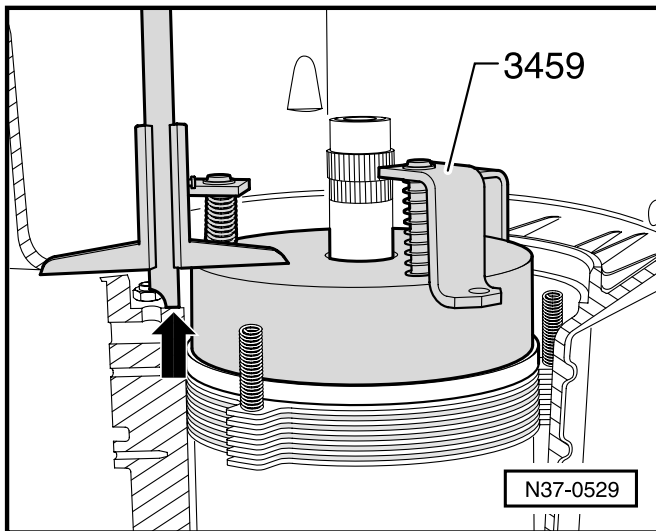
◀ - Place the retaining ring with the smooth side on the last inside disk.

- Position 3459 on the retaining ring and turn until the three clips are aligned with the 3 bores for ATF pump.

- Screw 3459 with 5 Nm on the flange for ATF pump

The disk packet of -B2- is now compressed for measurement.





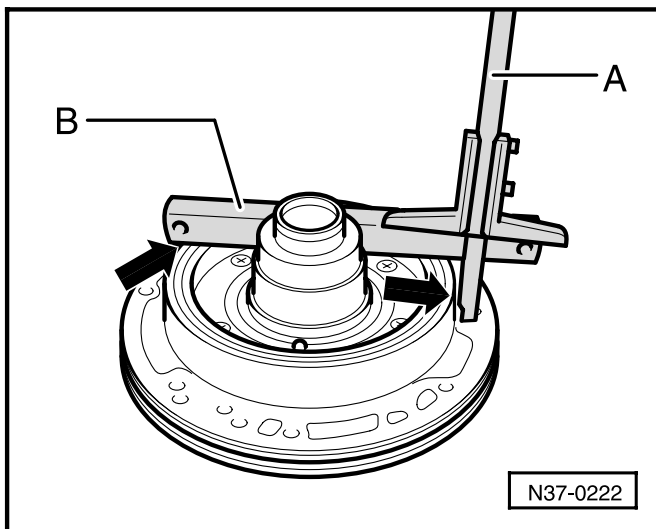
- Measure with depth gauge from pump flange/gearbox housing -arrow- on 3459.

Dimension a = height of 3459 in mm - measured value

Example:

Height of 3459	=	60.0 mm
Measured value	=	- 32.3 mm
Determined value a	=	27.7 mm

- Disassemble 3459 and remove retaining ring.



Determining value "b":

- Position ruler "B" at the bottom of the reactor support -arrow- and measure on pump flange with depth gauge "A". Perform measurement with seal fitted.

Example:

Measured value	=	39.8 mm
- Ruler	=	- 19.5 mm
Determined value b	=	20.3 mm

Gap dimension $x = a - b - 2.65 \text{ mm}$

$$= 27.7 - 20.3 - 2.65 = 4.75 \text{ mm}$$

- Determine adjusting dial thickness according to table $\Rightarrow$ page 37-64

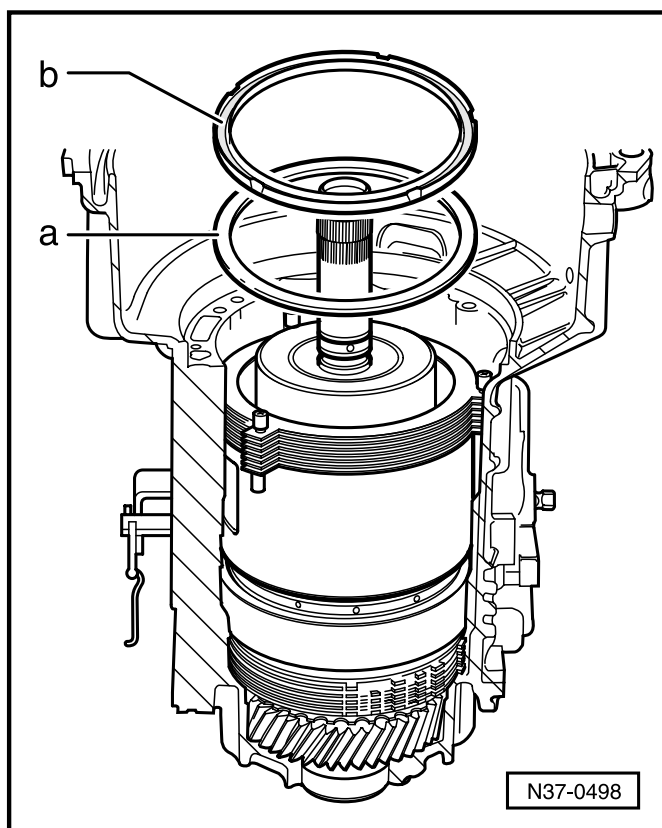
Table for Adjusting Dial -D-:

Gap dimension "x" (mm)	Disk (mm)
3.25 ... 3.50	1.00
3.51 ... 3.75	1.25
3.76 ... 4.00	1.50
4.01 ... 4.25	1.75
4.26 ... 4.50	1.00 + 1.00
4.51 ... 4.75	1.00 + 1.25
4.76 ... 5.00	1.25 + 1.25
5.01 ... 5.25	1.25 + 1.50
5.26 ... 5.50	1.50 + 1.50
5.51 ... 5.75	1.50 + 1.75
5.76 ... 6.00	1.75 + 1.75

- Determine the thickness of the adjusting dial according to the table and the spare part number according to the spare part catalogue.

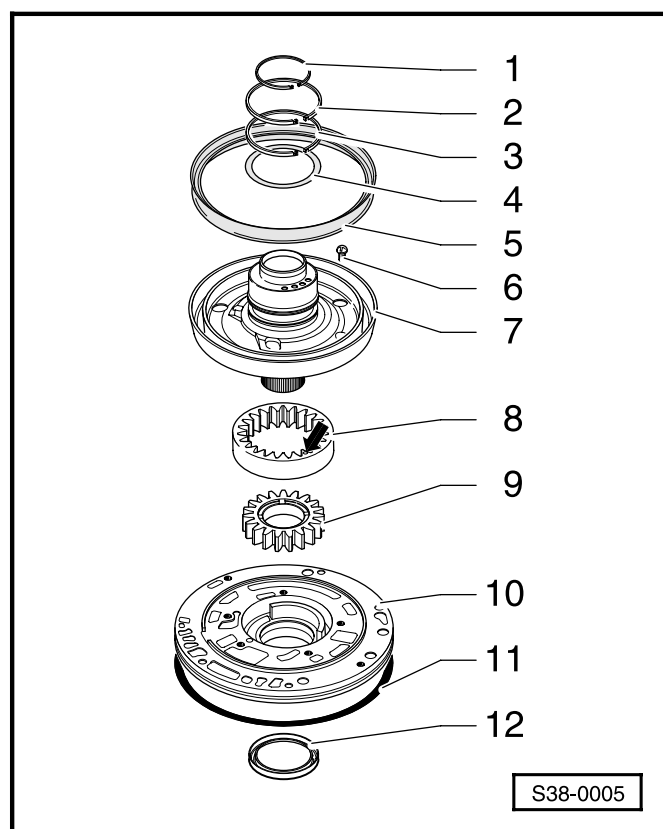
In this example two adjusting dials had to be installed.

- Position three helical springs on the pressure springs.
- Insert the last -3 mm thick- outside disk



- ◀ - Insert the determined adjusting dial -a-
- Position retaining ring -b- on the adjusting dial.
- Further assembly as from ⇒ page 37-48

Disassembling and assembling ATF pump



1 - Piston ring

- ◆ Check to ensure correctly fitted
⇒ Fig. 1
- ◆ Removing and installing ⇒ Fig. 2

2 - Piston ring

- ◆ Check to ensure correctly fitted
⇒ Fig. 1
- ◆ Removing and installing ⇒ Fig. 2

3 - Piston ring

- ◆ Check to ensure correctly fitted
⇒ Fig. 1
- ◆ Removing and installing ⇒ Fig. 2

4 - Thrust washer

5 - Piston

- ◆ Sealing lips are vulcanised to the piston
- ◆ To remove, lift out of the impeller support at several points with a screwdriver
- ◆ Before inserting, moisten sealing lips with ATF
- ◆ Fitting location: sealing lip points toward impeller support

6 - Screw, 10 Nm

- ◆ and then torque a further 45°

7 - Impeller support

8 - Outer gear

- ◆ Manufacturer's marking (arrow) points toward impeller support
- ◆ If outer gear is installed incorrectly, the ATF pump may not operate freely when installed

9 - Inner gear

- ◆ Large shoulder points toward impeller support

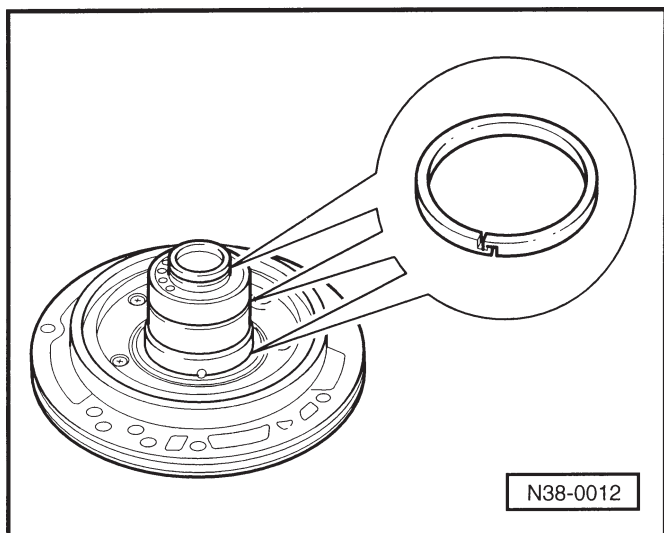
10 - Housing for ATF pump

11 - O-ring

- ◆ Always replace

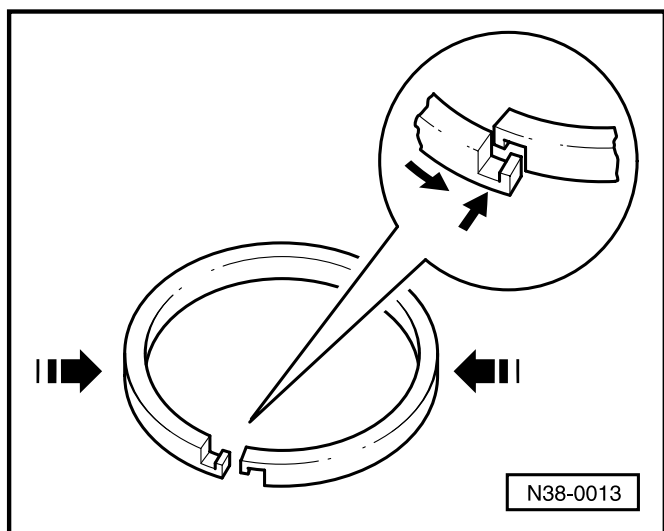
12 - Torque converter seal

- ◆ Removing and installing ⇒ page 32-3



◀ Fig. 1 Inspecting seat of piston rings

- Ensure that the gaps of the piston rings are properly hooked to each other.



◀ Fig. 2 Removing and installing piston ring

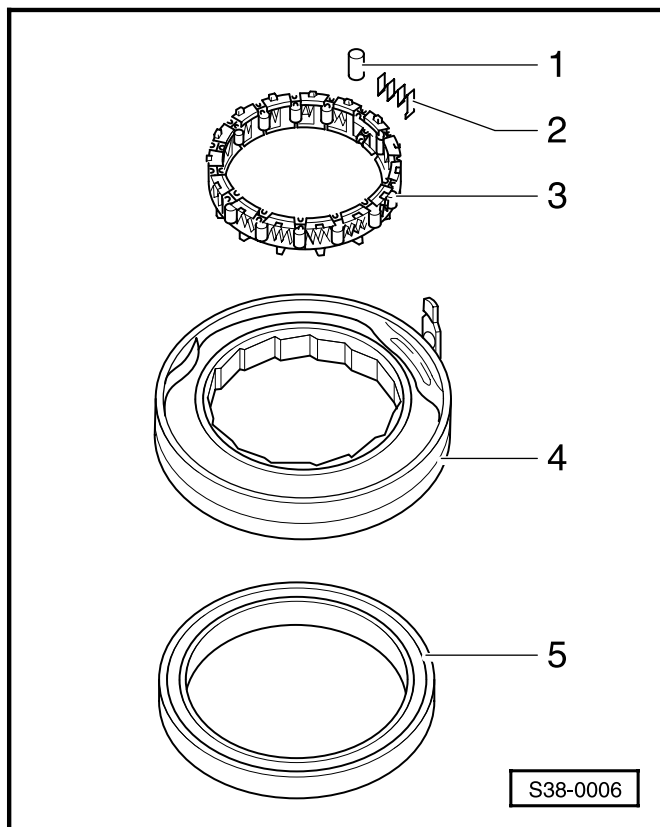
Removing:

- Compress piston ring and release by hand.
- Spread piston ring apart at both sides and take off; do not remove from the groove at only one side.

Installing:

- Place piston ring into the groove.
- Compress piston ring so that it hooks together and at the same time position the gaps one above the other.

Disassembling and assembling freewheel with -B1- piston



1 - Rollers

- ◆ Installing ⇒ Fig. 2

2 - Springs

- ◆ Installing ⇒ Fig. 2

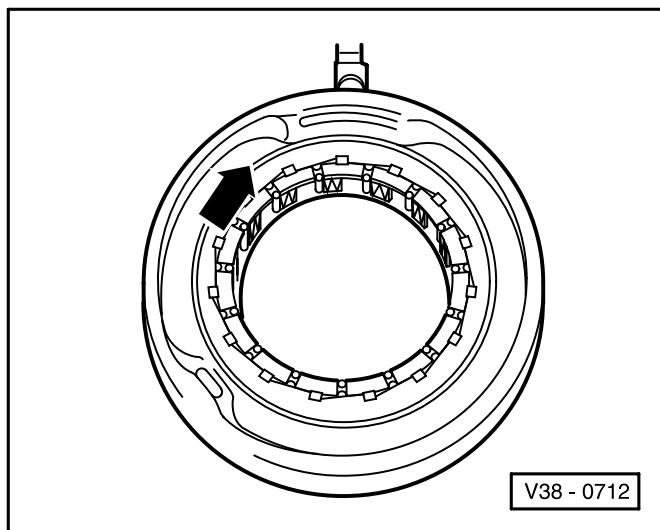
3 - Cage

- ◆ Fitting location ⇒ Fig. 3
- ◆ Removing and installing ⇒ Fig. 1

4 - Outer race

5 - Piston

- ◆ Sealing lips are vulcanised to the piston
- ◆ To remove, lift out of the outer race at several points with a screwdriver
- ◆ Before inserting, moisten sealing lips with ATF



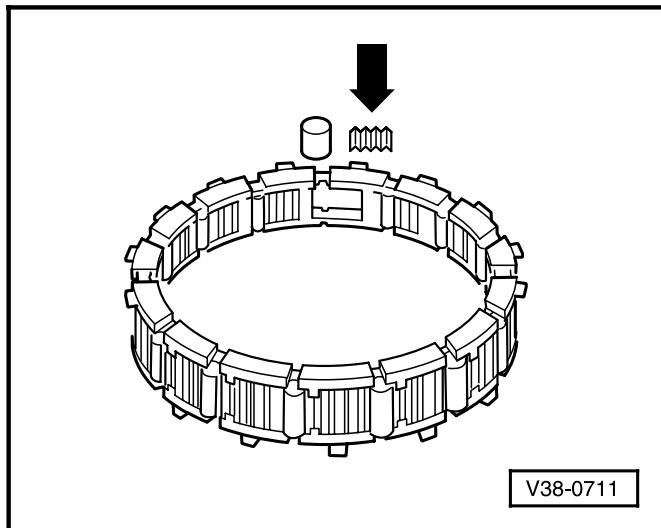
◀ Fig. 1 Removing and installing cage

Removing:

- Turn cage to the left as far as the stop.
- Press cage up and out of the outer race.

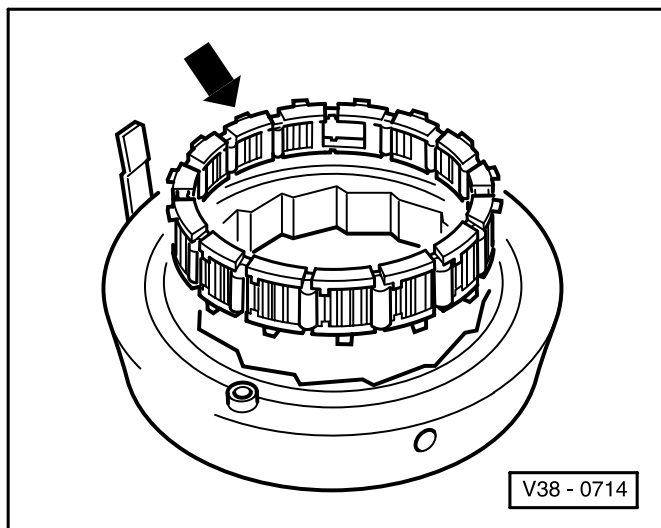
Installing:

- Insert cage into the outer race. Fitting location ⇒ Fig. 3.
- Turn cage to the right as far as the stop -arrow- in order to secure it.



◀ Fig. 2 Installing rollers and springs

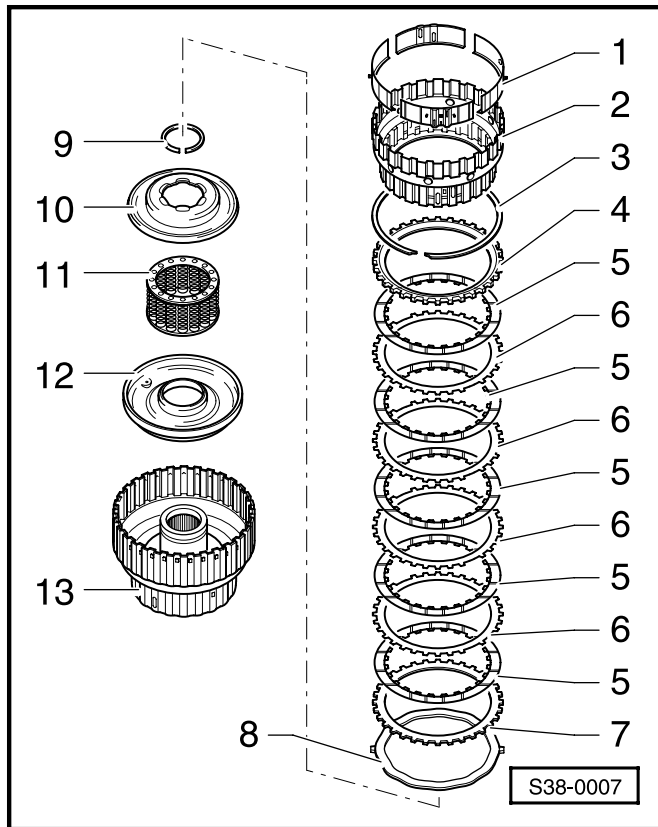
- Press long end of the spring -arrow- into the recess at the cage.
- After this, insert rollers between cage and spring.



◀ Fig. 3 Fitting location of cage in outer race

- Insert large lugs -arrow- facing up.

Disassembling and assembling 1st through 3rd gear clutch -K1-



Special tools, testers and aids required

- ◆ Thrust plate MP 3-406
- ◆ Thrust plate MP 3-407
- ◆ Plunger MP 3-408
- ◆ Thrust piece MP 6-418
- ◆ Pipe section, slit MP 3-486

Notes:

Clutches -K1- and -K3- are compressed.

Pressing off -K1- and -K3- ⇒ page 37-40.

Pressing on -K1- and -K3- ⇒ page 37-40.

1 - Supporting bearing

- ◆ four-point clip out of inside disk carrier
- ◆ insert ⇒ figure 2

2 - Inside disk carrier

- ◆ insert ⇒ figure 4
- ◆ assemble ⇒ figure 2

3 - Circlip

- ◆ different thicknesses
- ◆ mark after disassembly and position again in same location

4 - Thrust plate

- ◆ smooth side towards inside disk
- ◆ install together with inside disk carrier ⇒ figure 2

5 - Inside disk carrier

- ◆ part number ⇒ page 00-2
- ◆ installing ⇒ Figure 2
- ◆ before installing soak new inside disk in ATF for 15 minutes

6 - Outside disk

- ◆ part number ⇒ page 00-2
- ◆ installing ⇒ figure 2
- ◆ always 1.5 mm thick

7 - Outside disk

- ◆ always 2.0 mm thick
- ◆ installing ⇒ figure 2

8 - Wave spring washer

9 - Circlip

- ◆ removing and installing ⇒ figure 1
- ◆ mark after disassembly and position again in same location

10 - Piston cover

- ◆ sealing lips are vulcanised on cover
- ◆ before installing wet sealing lips with ATF

11 - Intermediate spring ring

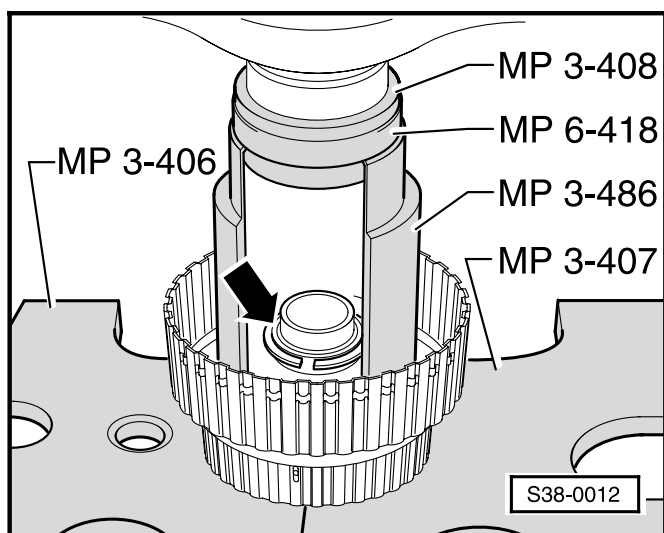
- ◆ with spring support tray and pressure spring

12 - Piston

- ◆ to remove lift out of clutch housing using a number of screwdrivers in various locations
- ◆ sealing lips are vulcanised on piston
- ◆ before installing wet sealing lips with ATF
- ◆ turn piston slightly during installation

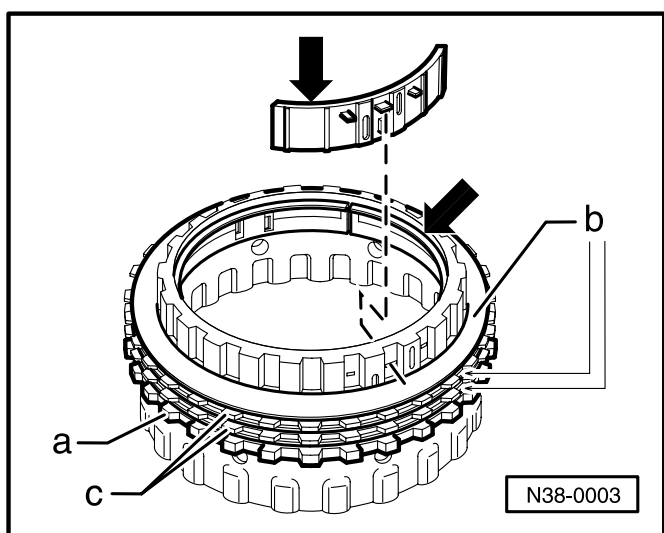
13 - Clutch housing

- ◆ before installing the inside disk carrier insert wave spring washer (Pos. 8), inside and outside disks in the clutch housing ⇒ figure 3



◀ Fig. 1 Removing and installing circlip

- Press down piston cover with intermediate spring ring until the circlip (arrow) can be removed and installed.

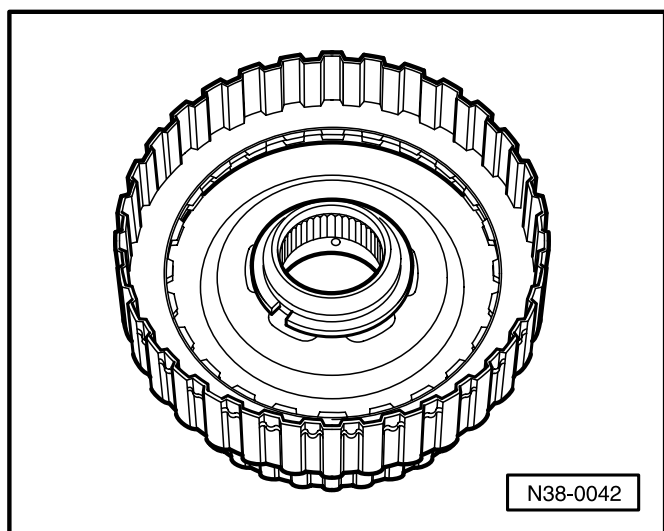


◀ Fig. 2 Fitting thrust plate and disks on inside disk carrier

- Position thrust plate -a- with the smooth side to the inside disk with the raised side towards inside disk carrier.
- Fit 3 inside disks -b- and 2 outside disks -c- (1.5 mm).
- Clip on supporting bearing with edge (arrow).

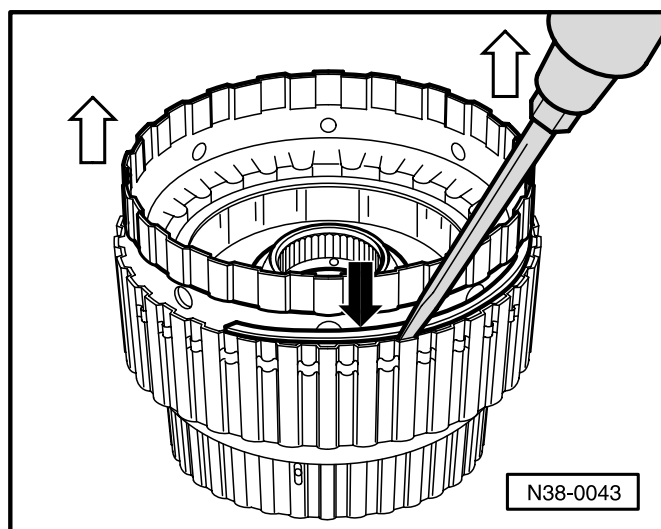
Notes:

- ♦ Correctly latch the retaining lobes.
- ♦ Fit wave spring washer and further disks in the clutch housing ⇒ figure 3.



◀ Fig. 3 Fitting wave spring washer and outside and inside disks in the clutch housing

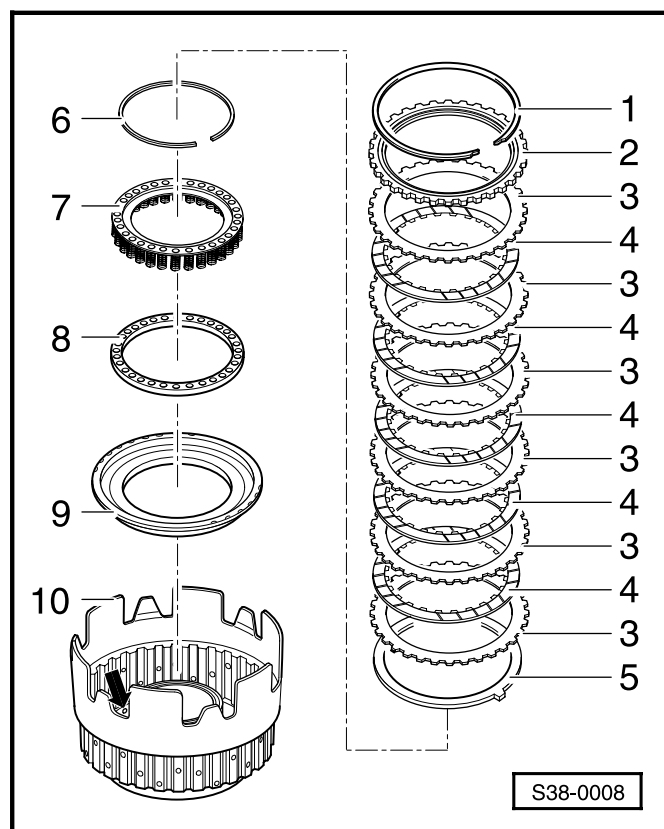
- first insert wave spring washer
- insert 2 mm thick outside disk
- insert remaining inside and outside disks.



◀ Fig. 4 Inserting internally-toothed disc carrier and installing circlip

- To install the circlip -black arrow-, raise internally-toothed disc carrier slightly -white arrows-.

Disassembling and assembling reverse gear clutch -K2-



4 - Internally-toothed disc

- ◆ Quantity ⇒ page 00-2
- ◆ Place new internally-toothed disc in ATF for 15 minutes before installing

5 - Corrugated spring washer

6 - Circlip

- ◆ Removing and installing ⇒ Fig. 1
- ◆ Fitting location ⇒ Fig. 2

7 - Spring supporting disc

- ◆ With springs
- ◆ Fitting location ⇒ Fig. 2
- ◆ Preassemble with spring supporting ring for installing. Ensure springs are correctly located

8 - Spring supporting ring

9 - Piston

- ◆ To remove from clutch bell, lift out with screwdriver at several points
- ◆ Sealing lips are vulcanized to piston
- ◆ Moisten sealing lips with ATF before inserting
- ◆ Do not tilt piston when installing

10 - Clutch bell

Special tools, testers and aids required

- ◆ Pressure plate MP 3-406
- ◆ Removal device MP 3-481/3
- ◆ Assembly ring MP 3-491

Note:

When carrying out repairs on the clutch, ensure that the ball valve (arrow) is not damaged.

1 - Circlip

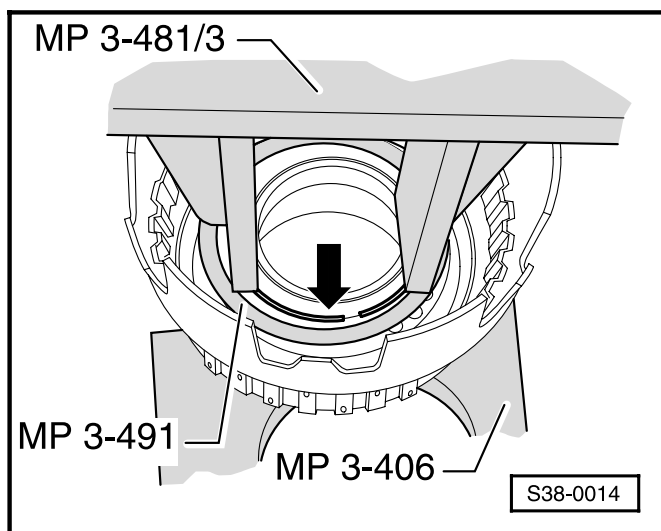
- ◆ After removing, mark and re-insert at the same point
- ◆ Thickness differs

2 - Pressure plate

- ◆ Position serrated or smoothly ground face end pointing toward internally-toothed discs
- ◆ Thickness differs
- ◆ Is supplied as a replacement part assigned to gearbox code letters

3 - Externally-toothed disc

- ◆ Quantity ⇒ page 00-2

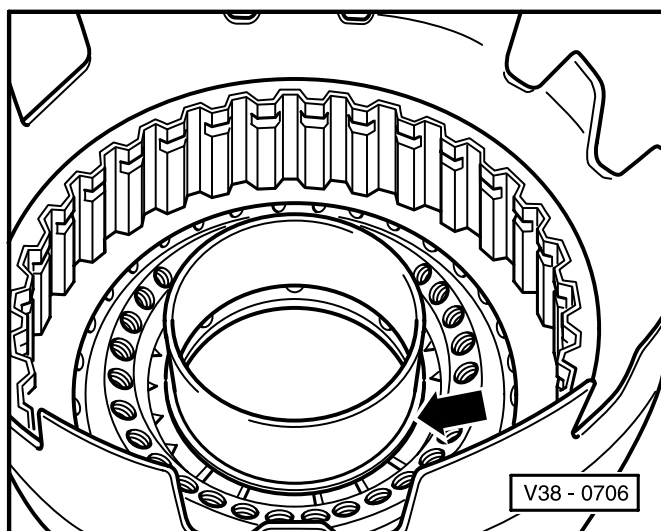


◀ Fig. 1 Removing and installing circlip (arrow)

- Use MP 3-491 to carefully press down spring supporting disc sufficiently to allow the circlip to be removed and installed, respectively.

Note:

Do not damage ball valve of clutch bell.



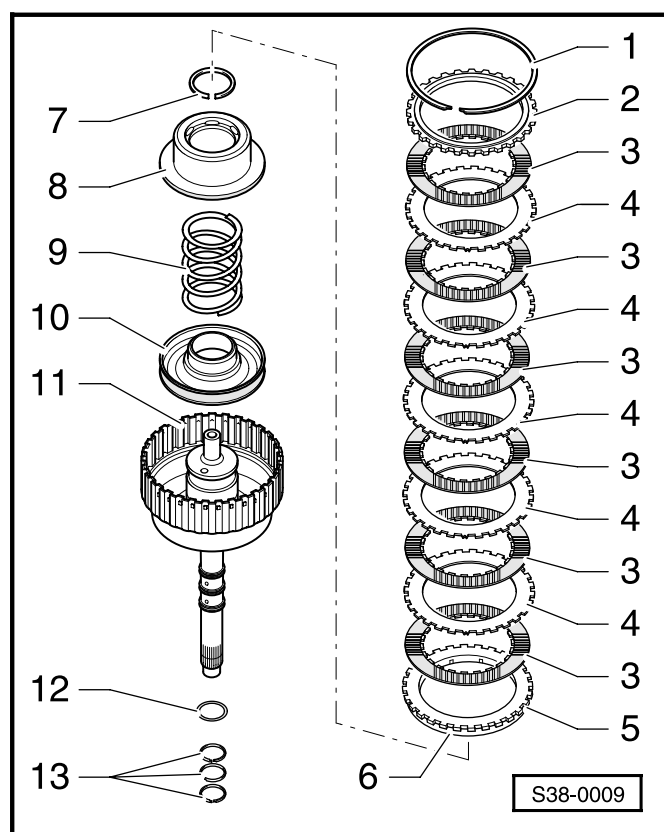
◀ Fig. 2 Inspecting fitting location of spring supporting disc and circlip

Circlip (arrow) should be located in the groove of the clutch bell. Spring supporting disc should be centred relative to hub.

Note:

Do not confuse groove with the shoulder on the shaft.

Disassembling and assembling 3rd and 4th gear clutch -K3- with turbine shaft



Special tools, testers and aids required

- ◆ Thrust plate MP 3-406
- ◆ Thrust plate MP 3-407
- ◆ Plunger MP 3-449
- ◆ Assembly device MP 3-494

Notes:

Clutches -K1- and -K3- are compressed.

Pressing off -K1- and -K3- ⇒ page 37-40.

Pressing on -K1- and -K3- ⇒ page 37-40.

1 - Circlip

- ◆ different thicknesses
- ◆ mark after removing and install in same location

2 - Thrust plate

- ◆ fitting position: smooth side points to the disks

3 - Inside disk

- ◆ part number ⇒ page 00-2
- ◆ before fitting soak new inside disk in ATF for 15 minutes

4 - Outside disk

- ◆ part number ⇒ page 00-2

5 - Thrust plate

- ◆ caulked to wave spring washer (Pos. 6)
- ◆ insert with caulked wave spring washer pointing to piston

6 - Wave spring washer

- ◆ caulked with thrust plate (Pos. 5)

7 - Circlip

- ◆ different thicknesses
- ◆ removing and installing ⇒ figure 2
- ◆ mark after removing and install in same location

8 - Piston cover

- ◆ under great spring tension
- ◆ sealing lips are vulcanised on piston cover
- ◆ removing and installing ⇒ figure 2
- ◆ before fitting wet sealing lips with ATF

9 - Spring

- ◆ insert between piston and piston cover

10 - Piston

- ◆ sealing lips are vulcanised on piston
- ◆ before inserting wet sealing lips with ATF

11 - Clutch housing with turbine shaft

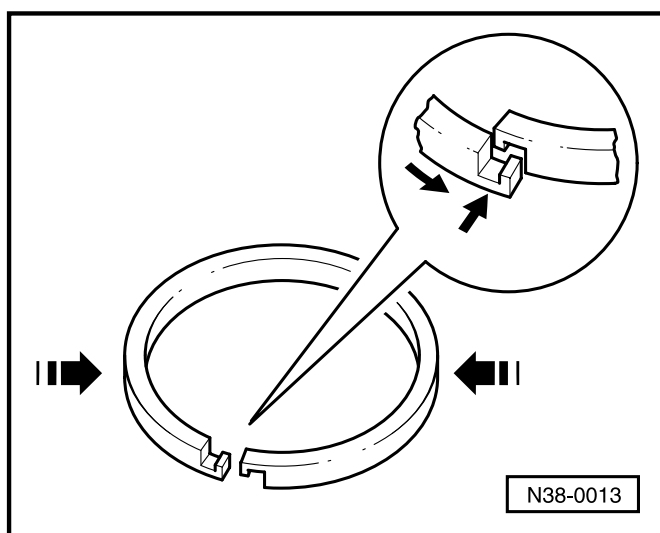
- ◆ different heights depending on the number of inside and outside disks
- ◆ version assigned to gearbox code letters

12 - Toroidal sealing ring

- ◆ always replace
- ◆ install ⇒ figure 4

13 - Piston ring

- ◆ removing and installing ⇒ figure 1
- ◆ check correct fit ⇒ figure 3



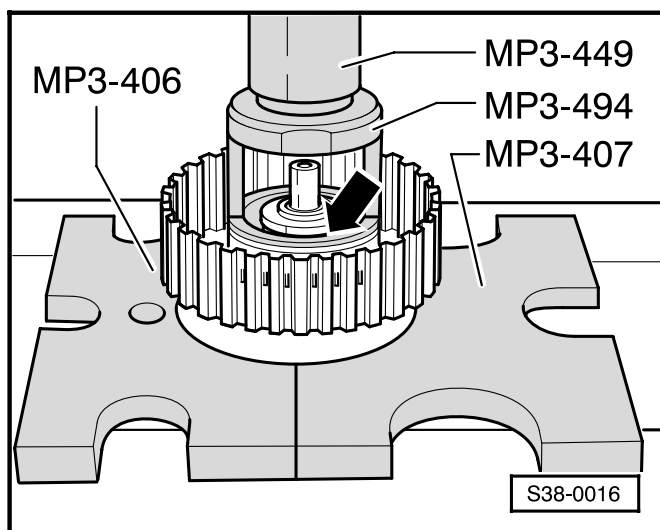
◀ Fig. 1 Removing and installing piston ring

Removing

- compress piston ring and release by hand
- expand piston ring on both sides and remove; do not remove from groove on one side only.

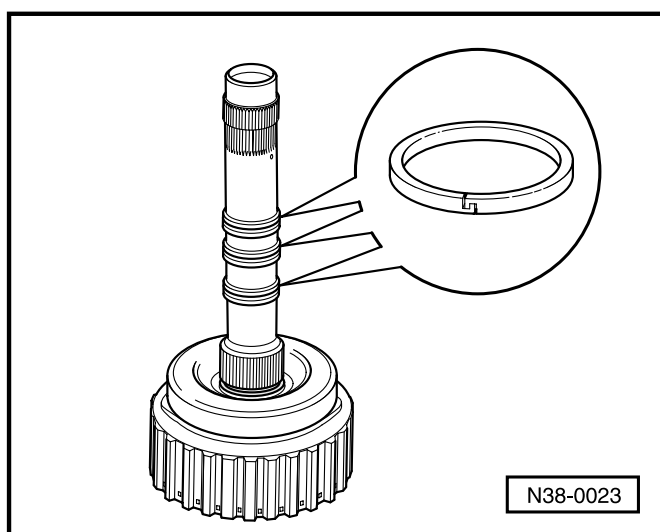
Installing

- insert piston ring in groove.
- to lock compress piston ring and guide the joints over one another.



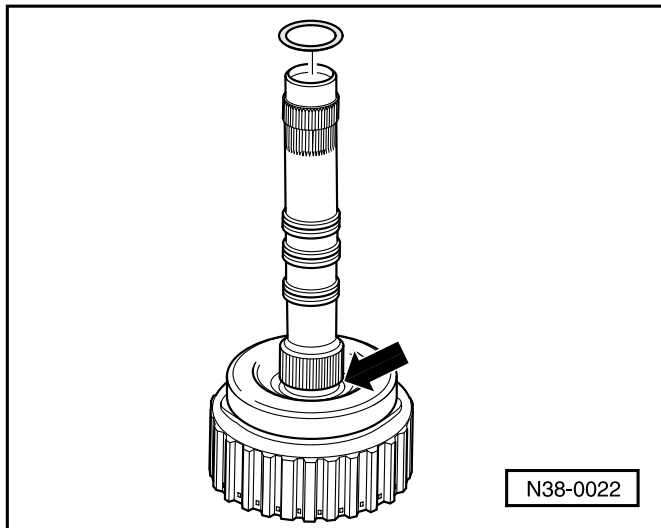
◀ Fig. 2 Removing and installing the circlip

- carefully press the piston cover down until the circlip -arrow- can be removed and fitted.



◀ Fig. 3 Checking fit of piston ring

- make sure the piston ring joints are inter-locked.



◀ Fig. 4 Installing O-ring

- Place O-ring into the groove of the turbine shaft (arrow).

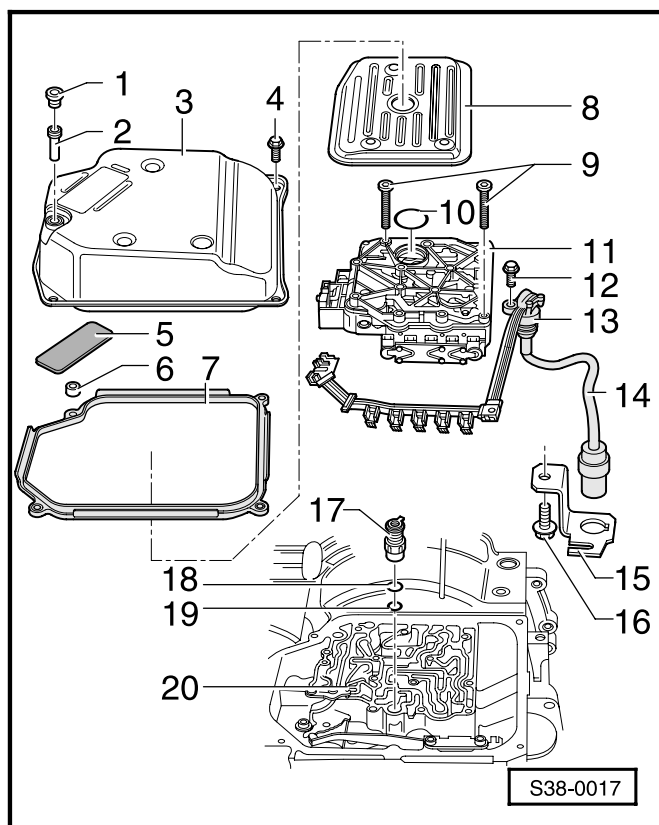
Removing and installing control valve housing

Important!

Do not run engine if oil sump is removed or without ATF in engine and do not tow vehicle.

Notes:

- ◆ *The control valve housing or the printed conductor can also be removed with the gearbox installed.*
- ◆ *After re-installing the oil sump, inspect ATF level and top up ⇒ page 37-22.*
- ◆ *Always replace the control valve housing which is dirty or faulty.*
- ◆ *The parts shown in the illustration which follows can be removed with the gearbox installed.*
- ◆ *Rules for cleanliness when carrying out work on automatic gearbox ⇒ page 37-28.*
- ◆ *Repair instructions ⇒ page 00-5.*
- ◆ *Coat O-rings with ATF. Other lubricants cause operational problems of the hydraulic gearbox control.*

**14 - Ribbon cable with plug**

- ◆ Removing and installing ⇒ page 38-18
- ◆ With cable duct and connector
- ◆ Can also be installed or removed with the gearbox mounted

15 - Bracket for plug of ribbon cable**16 - 20 Nm**

- ◆ For bracket

17 - Sealing plugs

- ◆ Take out free wheel before installing and removing.
- ◆ Insert in such a way that the lug is seated in the groove at the housing ⇒ Fig. 2
- ◆ Place O-rings onto the sealing plug

18 - O-ring

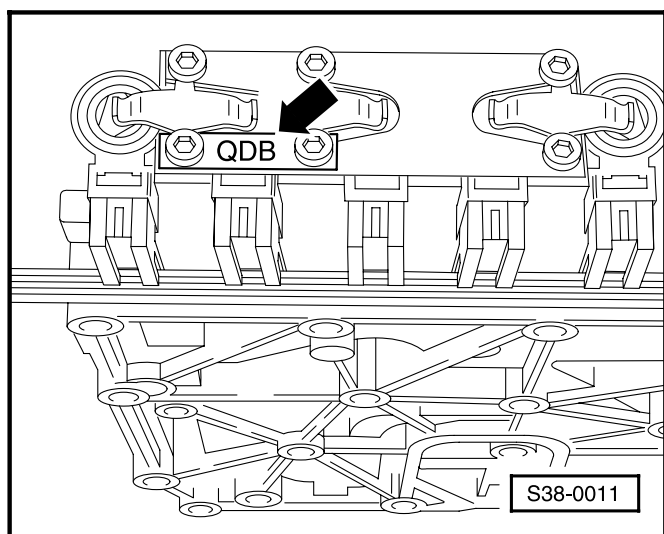
- ◆ Always replace

19 - O-ring

- ◆ Always replace

20 - Actuator rod for manual slider

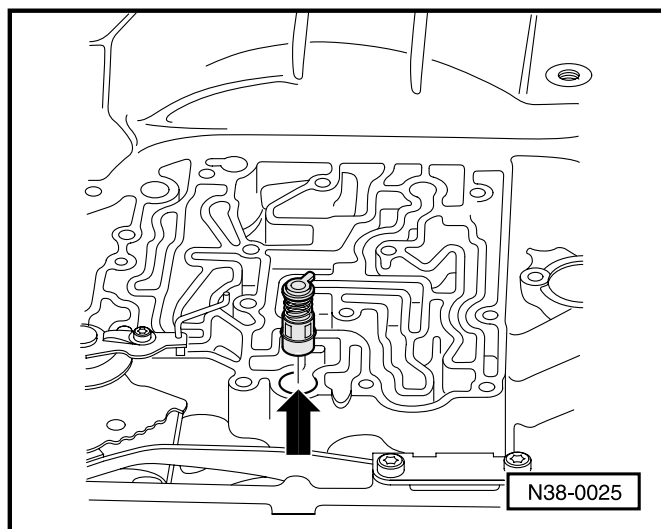
- ◆ Setting ⇒ Removing and installing slide valve body, page 38-18



◀ **Fig. 1 Slide valve body identification**

Identification characters are embossed in identification tag. The identification tag must remain with the slide valve body.

Assignment of slide valve body/gearbox ⇒ page 00-2.



◀ Fig. 1 Inserting sealing plug

Pull out sealing plug before removing and installing the freewheel in the gearbox housing otherwise the sealing plug and the O-ring will be damaged.

- Fit O-rings onto the sealing plug.
- Insert sealing plug into the hole of the gearbox housing -arrow-.
- The lug of the sealing plug is inserted into the oil passage.

Removing and installing oil sump

Removing

- Place a collecting vessel below the gearbox.
- ◀ - Open ATF screw plug -2-.
- Unscrew overflow pipe -1- with a 5 mm hexagon socket wrench.
- Allow ATF to flow out.

Note:

A residual quantity of ATF remains in the oil sump.

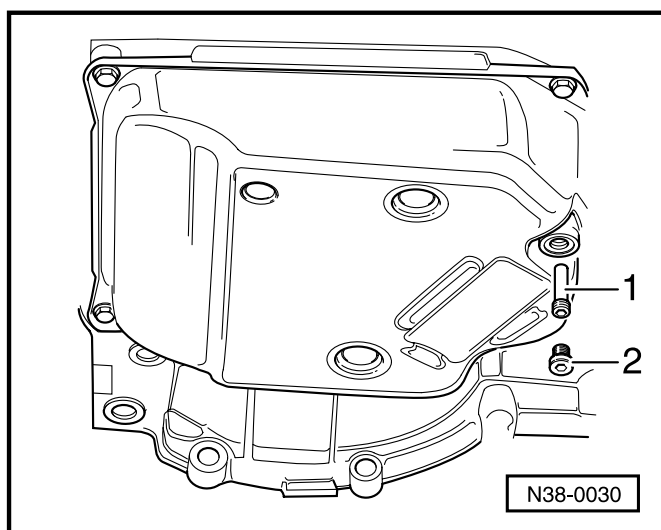
- Unbolt guard plate at gearbox.
- Slacken bolts of oil sump diagonally across.

Installation

Note:

Clean magnet in the oil sump. Ensure the magnet is making contact with the oil sump over its entire surface.

- Replace gaskets.
- Tighten bolts for oil sump diagonally across.
- Pour in ATF after repairs ⇒ page 37-25.



Tightening torques

Component	Tightening torque
Overflow tube to oil pan	2 Nm
ATF screw plug to oil pan	15 Nm
Oil pan to gearbox housing (crosswise)	12 Nm
Protection plate to gearbox housing	50 Nm

Removing and installing ATF strainer

Removing

- Remove oil pan ⇒ page 38-15
- ◀ - Detach ATF strainer from slide valve body.

Installing

- Insert intake collar of ATF strainer approximately 3 mm into the slide valve body (not up to the stop). When installing the oil pan, the ATF strainer must be pressed into the correct installation position.

Note:

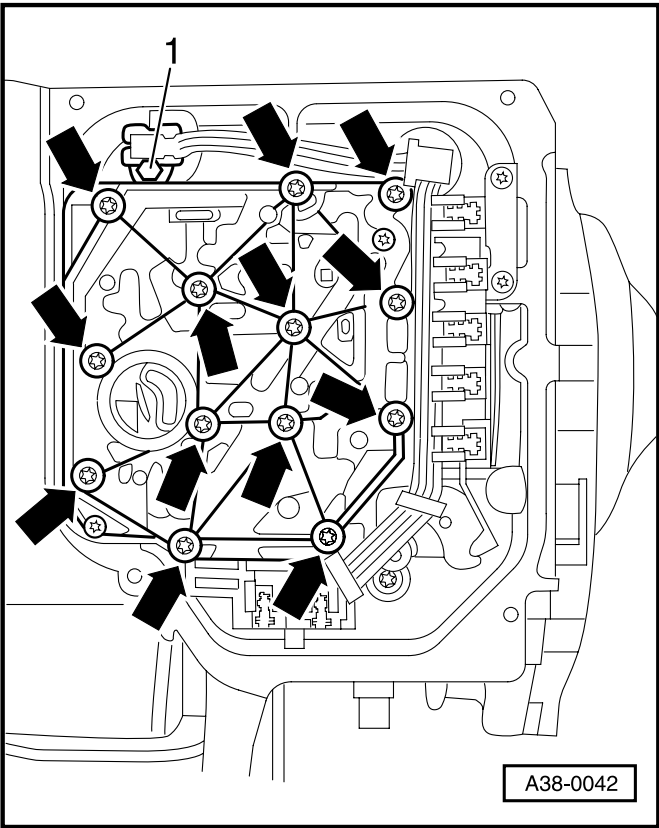
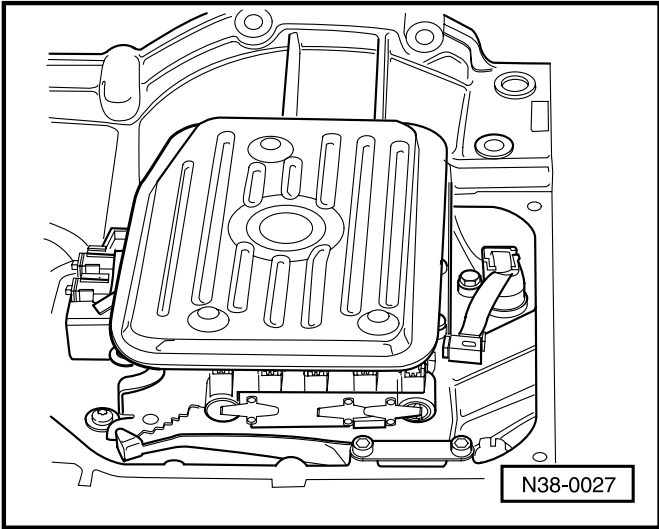
The gasket is vulcanised on the intake collar of the ATF strainer.

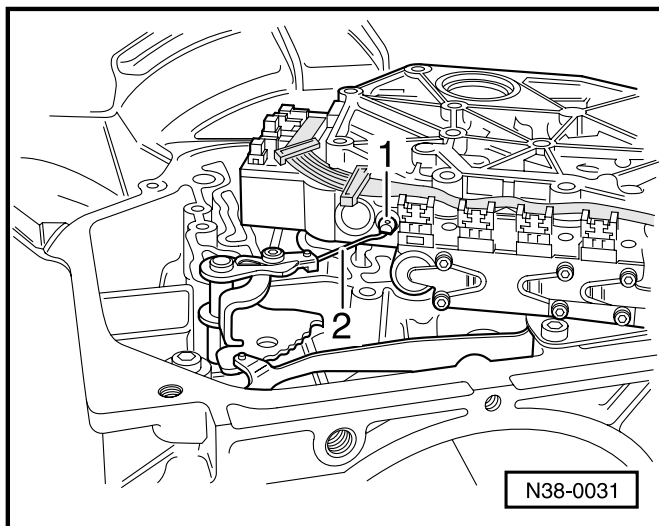
- Install oil pan ⇒ page 38-15.
- Top up ATF after repair ⇒ page 37-25.

Removing and installing slide valve body

Removing

- Shift selector lever into position „1“.
- Remove oil pan ⇒ page 38-15.
- Remove ATF strainer ⇒ page 38-16.
- Unbolt bracket for plug of ribbon cable, release plug.
- ◀ - Loosen locking screw -1- for cable duct. Press cable duct from inside to outside out of the gearbox housing. Slacken bolts -arrows-.



**Notes:**

- ◆ Only the indicated fixing screws should be loosened.
- ◆ When loosening other screws, the function of the slide valve body can be affected or the slide valve body splits up.

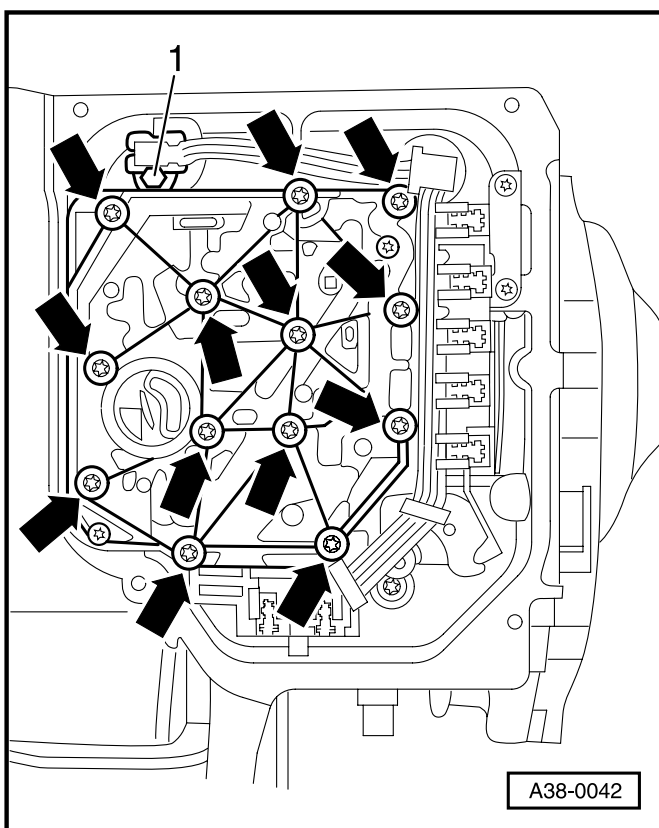
- ◀ - Remove slide valve body from gearbox. To do so release the actuator rod -2- from the manual slider -1-.
- Pull cable with plug of ribbon cable through the gearbox housing.

Installing

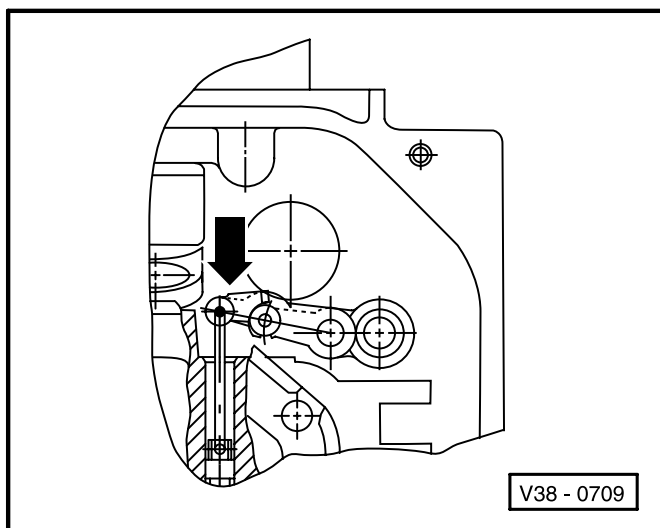
- Position slide valve body without force onto the gearbox, to do so hang actuator rod -2- into the manual slider -1-.

Note:

Installation position of manual slider: The flat point at manual slider -1- points toward the gearbox.



- ◀ - First slightly tighten screws for slide valve body -arrows-
- Then finally tighten screws for slide valve body from inside to outside to 5 Nm.
- Route ribbon cable in such a way that when installing it is not kinked or twisted.
- Pull plug of ribbon cable through the gearbox housing.
- Insert cable duct and tighten locking screw -1-.



Adjust actuator rod for manual slider

- Shift shift shaft into selector lever position „P“.
- Slacken screw for manual slider and replace.
- ◀ - Push actuator rod with manual slider into the slide valve body up to the stop (in direction of arrow) and tighten bolt to 4 Nm.

Notes:

- ♦ Always replace bolt with retaining clip of manual slider.
- ♦ Manual slider must always lie against the stop. Counterhold bolt when tightening in direction of arrow.
- ♦ Check: In selector lever position „1“ the manual slider must be flush to the outside with the slide valve body.

Tightening torques

Component	Tightening torque
Overflow tube to oil pan	2 Nm
ATF screw plug to oil pan	15 Nm
Slide valve body to gearbox housing (from inside to outside)	5 Nm
Bolt for manual slider	4 Nm
Bolt for cable duct	15 Nm
Oil pan to gearbox housing (crosswise)	12 Nm
Protection plate to gearbox housing	50 Nm

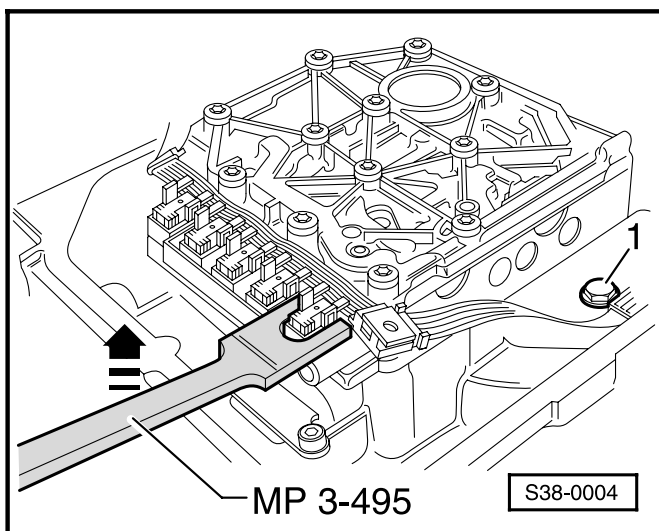
Removing and installing ribbon cable with plug

Special tools, testers and aids required

- ♦ Assembly lever for ribbon cable MP 3-495

Notes:

- ♦ Gearbox oil temperature sender (ATF) -G93 is integrated into the ribbon cable.
- ♦ Slide valve body is installed and removed.



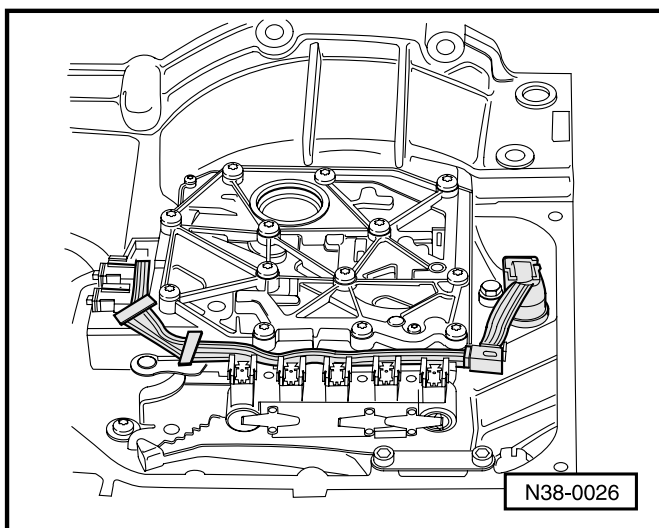
Removing

- Remove ATF strainer ⇒ page 38-16.
- Unbolt bracket for plug of ribbon cable and release plug.
- ◀ - Loosen locking screw -1- for cable ducts. Press cable duct from inside to outside out of the gearbox housing.
- Lever off ribbon cable from solenoid valves with MP 3-495 in direction of arrow.

Note:

If the catch on the solenoid valves is damaged, the slide valve body must be replaced.

- Pull cable with plug of ribbon cable through opening.



Installing

- ◀ - Route ribbon cable in such a way that when installing it is not kinked or twisted.
- Press individual plug until it latches onto the solenoid valves.
- Pull plug of ribbon cable through the gearbox housing.
- Insert cable duct and tighten locking screw to 15 Nm.

Tightening torques

Component	Tightening torque
Overflow tube to oil pan	2 Nm
ATF screw plug to oil pan	15 Nm
Bolt for manual slider	4 Nm
Locking screw for cable duct	15 Nm
Oil pan to gearbox housing (crosswise)	12 Nm
Protection plate to gearbox housing	50 Nm

Disassembling and assembling parking lock

Special tools, testers and aids required

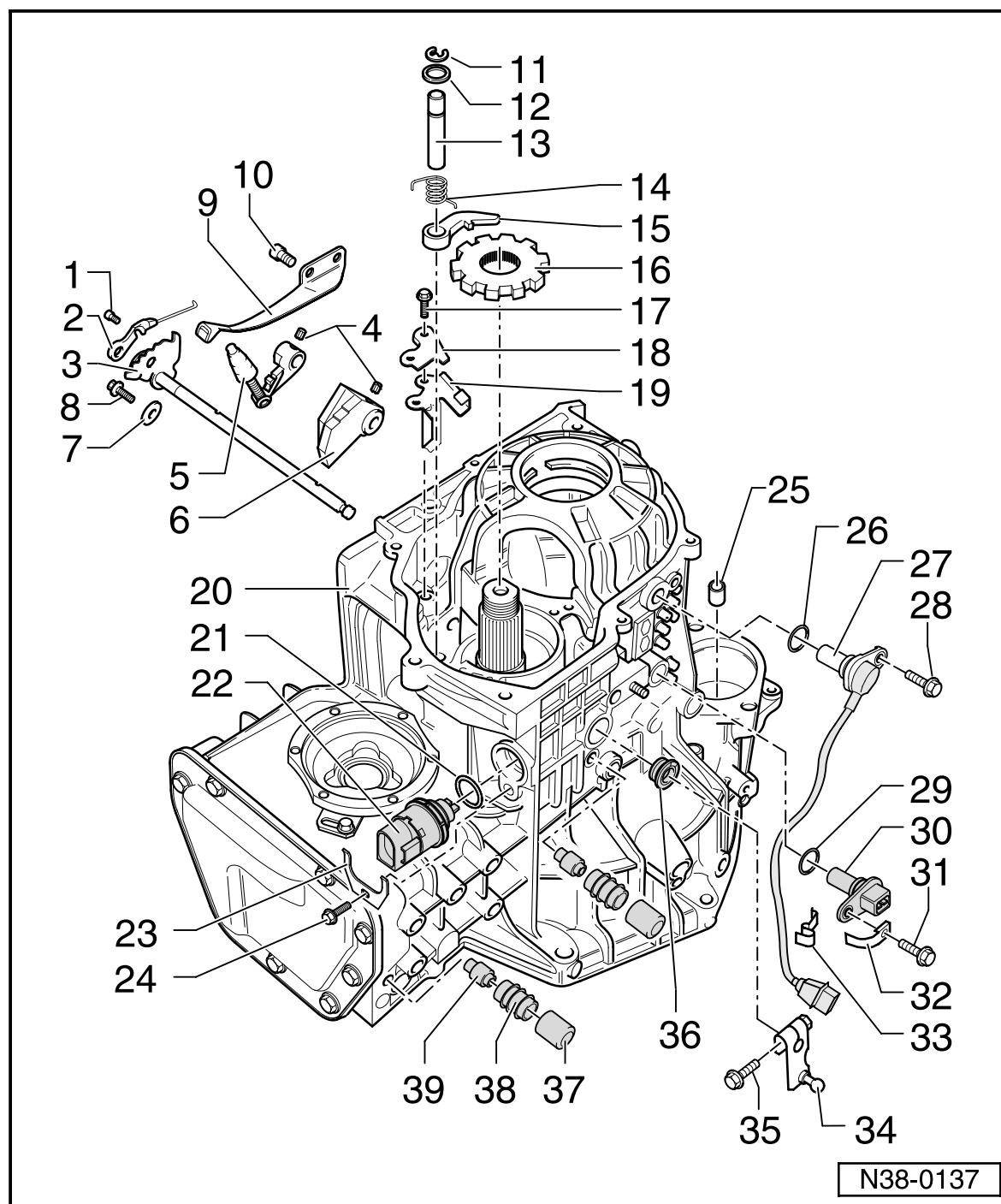
- ◆ Locking fluid AMV 185 101 A1
- ◆ Pipe section MP 3-479
- ◆ Drift MP 3-481/2

Important!

Do not run engine when oil sump removed or without ATF in engine and do not tow vehicle.

Notes:

- ◆ *Rules for cleanliness when carrying out work on automatic gearbox ⇒ page 37-28.*
- ◆ *Repair instructions ⇒ page 00-5.*
- ◆ *Coat O-rings with ATF. Other lubricants cause operational problems of the hydraulic gearbox control.*
- ◆ *Multifunction switch -F125, gearbox speed sender -G38 and vehicle speed sender -G68 can be tested in the vehicle by self-diagnosis ⇒ page 01-4.*
- ◆ *The output gear has to be removed in order to disassemble and assemble the parking lock ⇒ page 39-8, Removing and installing drive pinion.*



1 - 4 Nm

2 - Hand slide control

♦ Setting ⇒ page 38-12

3 - Shift shaft with shift segment

♦ Removing and installing ⇒ Fig. 2

4 - Tensioning sleeve

♦ Removing and inserting ⇒ Fig. 1

5 - Engagement lever

♦ Insert together with shift shaft and detent segment

6 - Detent segment

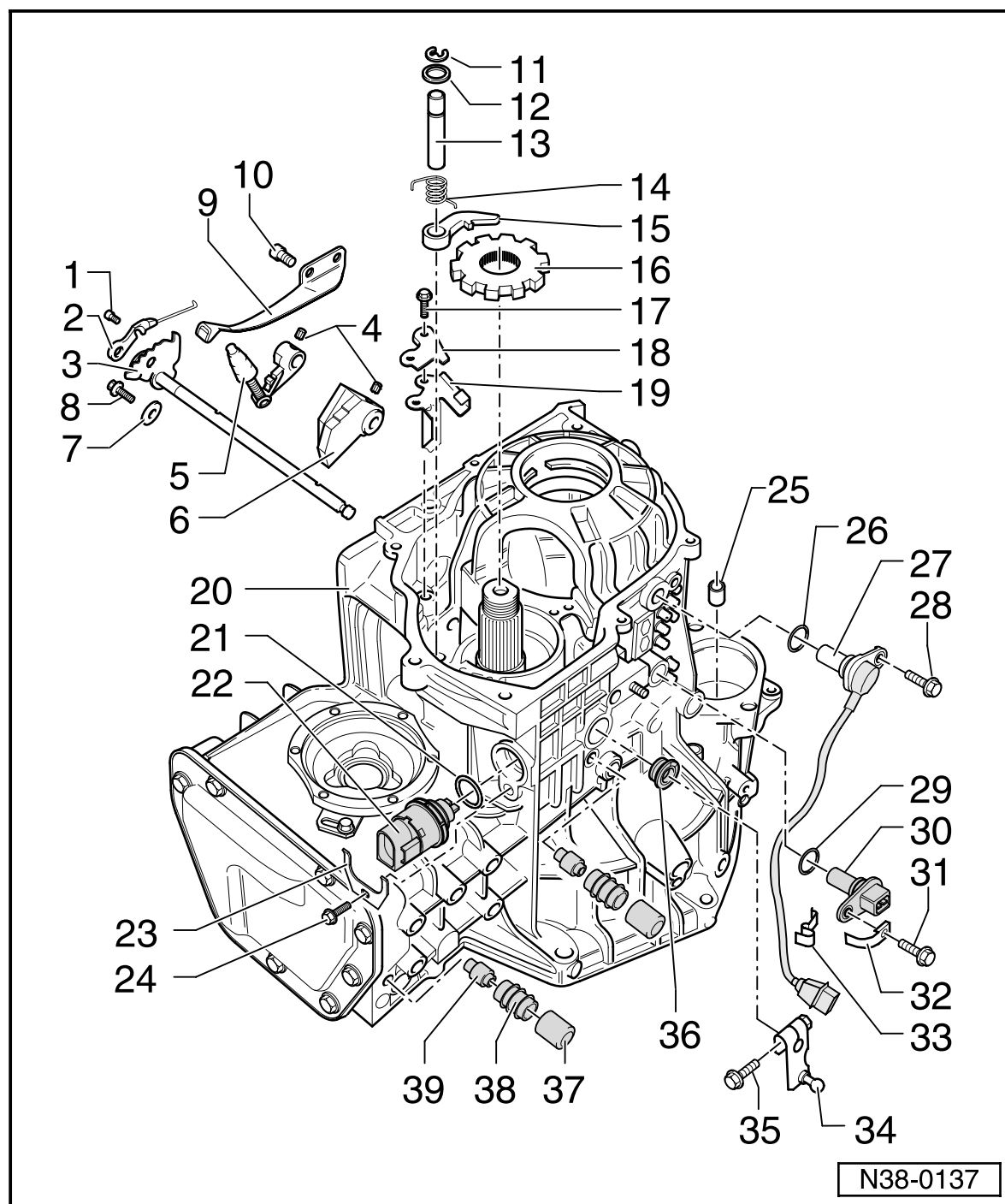
♦ Insert together with shift shaft and engagement lever

7 - Lock washer

8 - 10 Nm

9 - Spring for shift segment

10 - 10 Nm

**11 - Circlip**

- ◆ Always replace
- ◆ Install only at shaft with slot for circlip

12 - Washer**13 - Shaft for detent lever**

- ◆ Is secured by circlip and bearing cap of drive pinion

14 - Restoring spring

- ◆ Inserting ⇒ Fig. 4

15 - Detent lever

- ◆ Inserting with restoring spring ⇒ Fig. 4

16 - Park lock gear

- ◆ Rounded side points toward spline of drive pinion

17 - 14 Nm**18 - Supporting plate**

- ◆ Installing ⇒ Fig. 3

19 - Guide plate

- ◆ Insert before supporting plate
⇒ Fig. 3

20 - Gearbox housing

- ◆ Drive gear does not need to be removed for disassembling park lock

21 - O-ring

- ◆ Always replace

22 - Multifunction switch -F125

- ◆ Is tested by self-diagnosis in vehicle
⇒ page 01-4
- ◆ Take out before removing shift shaft (item 3)

23 - Bracket

- ◆ For multifunction switch

24 - 10 Nm

- ◆ Insert with locking fluid AMV 185 101 A1

25 - Bush for starter

- ◆ Removing ⇒ Fig. 6
- ◆ Inserting ⇒ Fig. 7

26 - O-ring

- ◆ Always replace

27 - Vehicle speed sender G68

- ◆ Removing and installing ⇒ Fig. 5
- ◆ Is tested by self-diagnosis in vehicle
⇒ page 01-4

28 - 10 Nm

- ◆ Insert with locking fluid AMV 185 101 A1

29 - O-ring

- ◆ Always replace

30 - Gearbox speed sender -G38

- ◆ Is tested by self-diagnosis in vehicle
⇒ page 01-4

31 - 10 Nm

- ◆ Insert with locking fluid AMV 185 101 A1

32 - Retaining clip

- ◆ For cable to vehicle speed sender
- ◆ Secure with bolt (item 31)

33 - Retaining clip

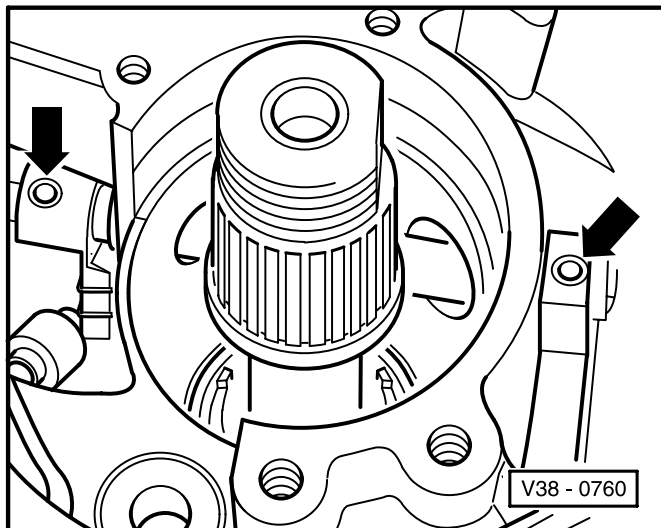
- ◆ For cable to vehicle speed sender
- ◆ Press onto gearbox reinforcing rib

34 - Gearbox selector lever**35 - 10 Nm****36 - Seal**

- ◆ Use screwdriver for levering out
- ◆ Use MP 3-479 for inserting flush

37 - Breather cap**38 - Breather****39 - Breather pipe**

- ◆ Use pliers for removing
- ◆ Use drift MP 3-481/2 for inserting as far as stop



◀ Fig. 1 Removing and inserting roll pins (arrows)

Removing

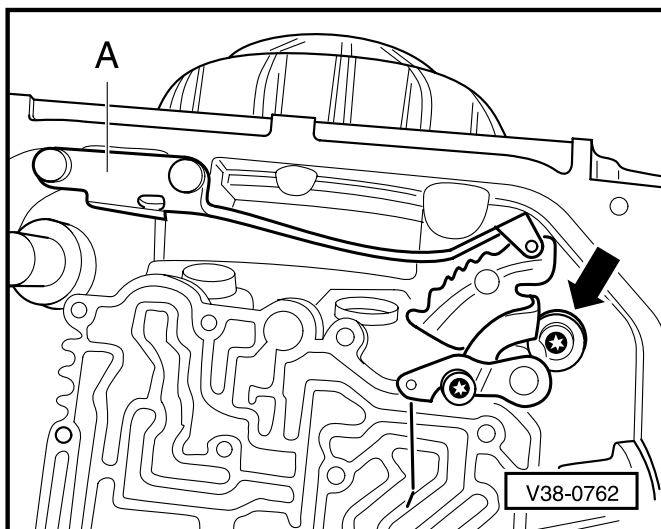
- Knock out roll pin for engaging lever and roll pin for detent segment only sufficiently far to enable the shift shaft to be pulled out.

Note:

Roll pin of engaging lever may drop into the planetary gear.

Inserting

- Position front of roll pins at component.
- After inserting the shift shaft, the engaging lever and the detent segment, knock in roll pins flush.

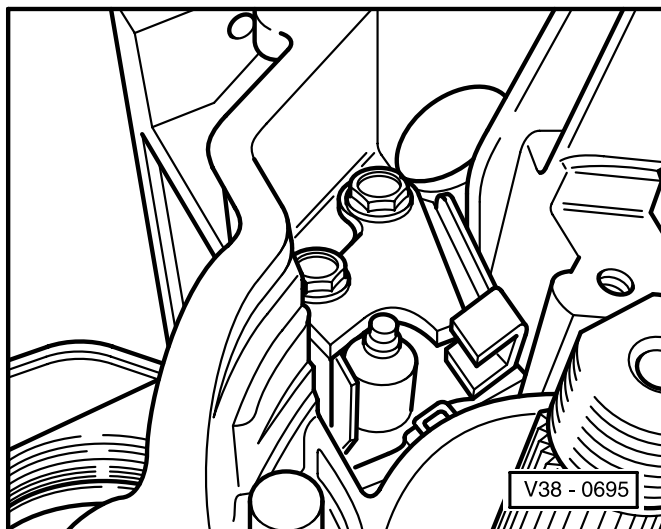


◀ Fig. 2 Removing and installing shift shaft with shift segment

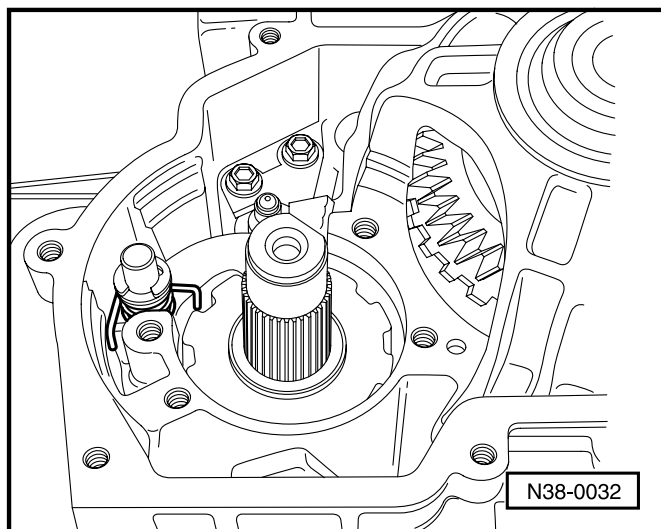
Do not damage printed conductor when control valve body installed.

- Remove gearbox selector lever ⇒ page 38-23, item 33.
- Remove spring for shift segment -A-.
- Remove bolt and washer (arrow).

The washer secures the shift shaft from drifting out.



◀ Fig. 3 Installing guide plate and support-plate



◀ Fig. 4 Inserting detent lever with restoring spring

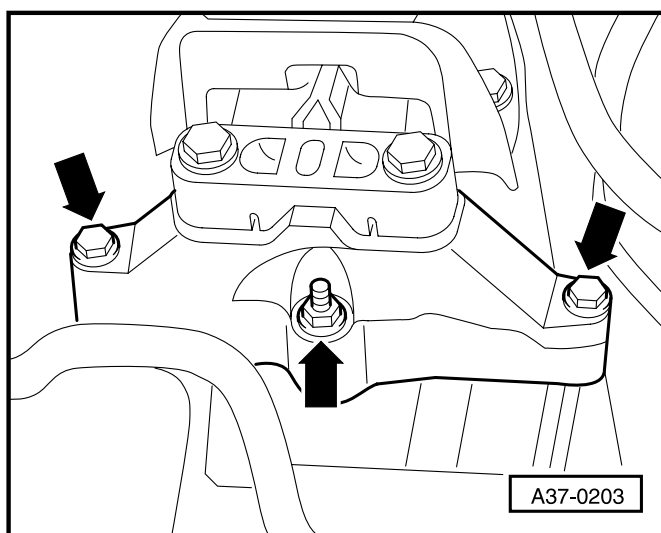
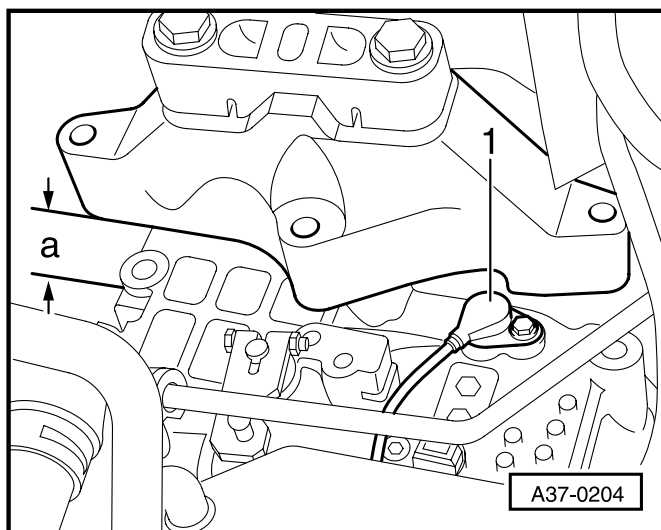
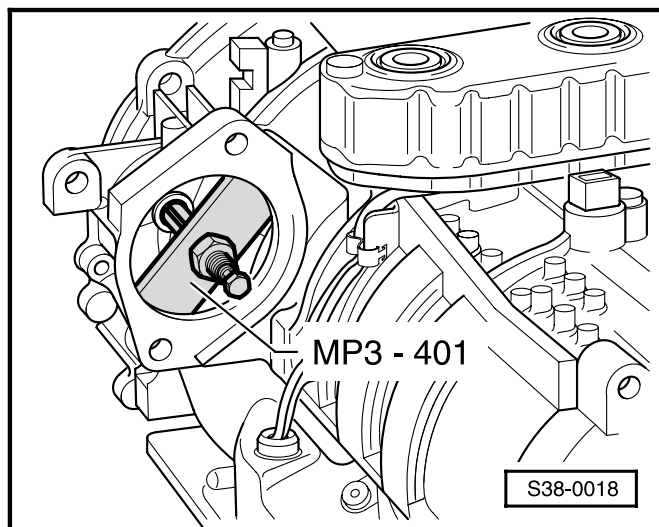


Fig. 5 Removing and installing vehicle speed sender -G68

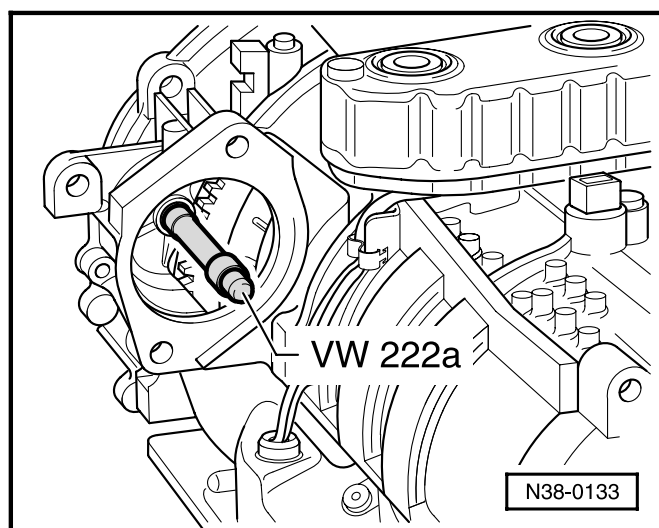
- Support gearbox from below with vehicle jack and intermediate plate.
- ◀ - Unscrew bolts for gearbox holder -arrows-. Tightening torque of gearbox holder to gearbox 50 Nm.



- ◀ - Lower gearbox by the dimension $a = 60$ mm.
- Unscrew vehicle speed sender -1-.



◀ Fig. 6 Pulling out bush for starter



◀ Fig. 7 Inserting bush for starter

Inspecting axle oil in final drive

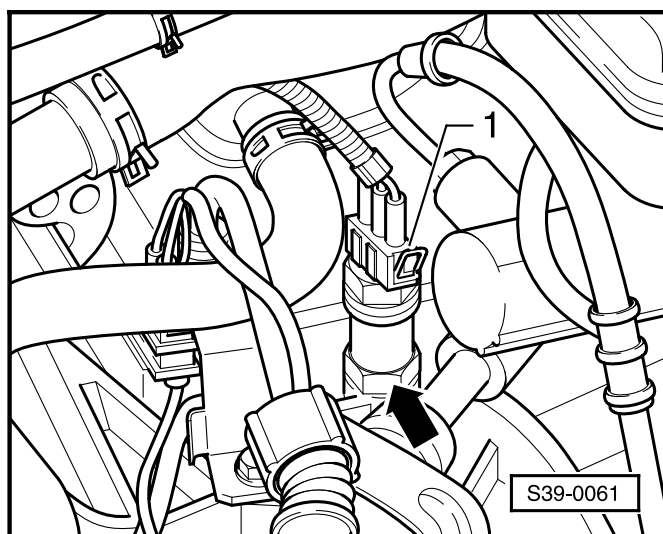
Special tools, testers and aids required

- ◆ Extraction device (e.g. V.A.G 1358 A)

Note:

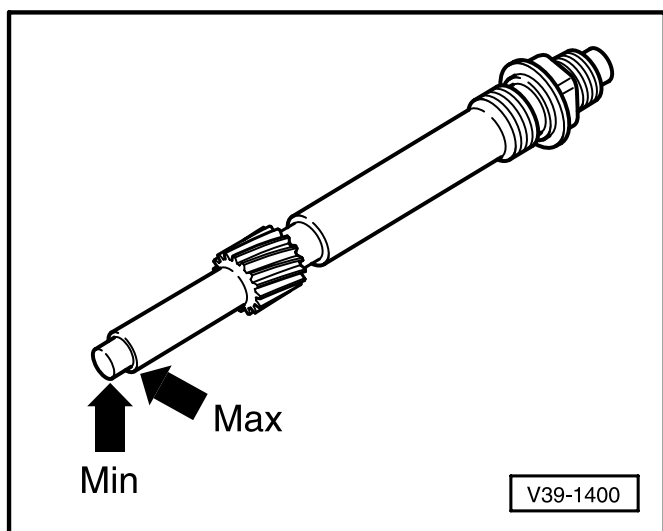
Specification and capacity of final drive ⇒ page 00-4.

Axle oil level is checked with gearbox installed.



Inspecting:

- ◀ - Unplug connector -1- and remove speedometer drive by placing a size 22 open-end wrench at the bottom hexagon (arrow).
- Wipe off speedometer drive with a cleaning rag.
- Once again install speedometer drive and remove.
- Axle oil level should be between the Min. and Max. markings.
- Adjust to correct level, if necessary.



- ◀ The quantity of axle oil between Min. and Max. is 0.1 ltr. Excess oil can be extracted with the extraction device (e.g. V.A.G 1358 A).

Removing and installing seal for joint flange

(gearbox assembled)

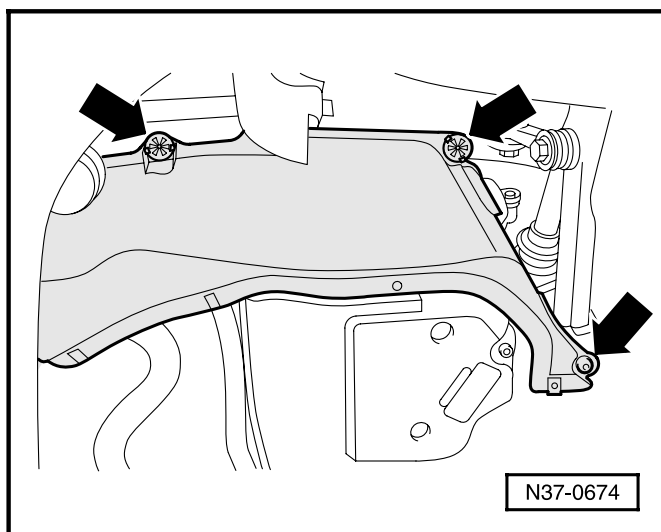
Special tools, testers and aids required

- ◆ Thrust piece MP 3-410
- ◆ Pulling tool MP 3-487
- ◆ Puller Kukko 20/10 with hook 1-90
- ◆ Thrust piece MP 3-499
- ◆ Ejector lever MP 3-418

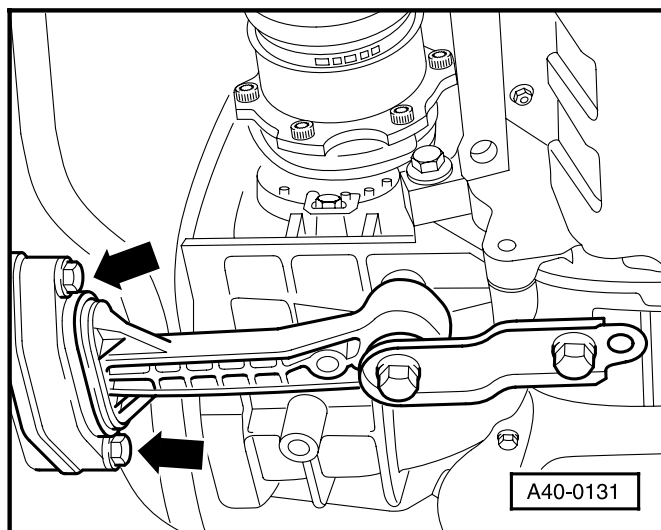
Removing

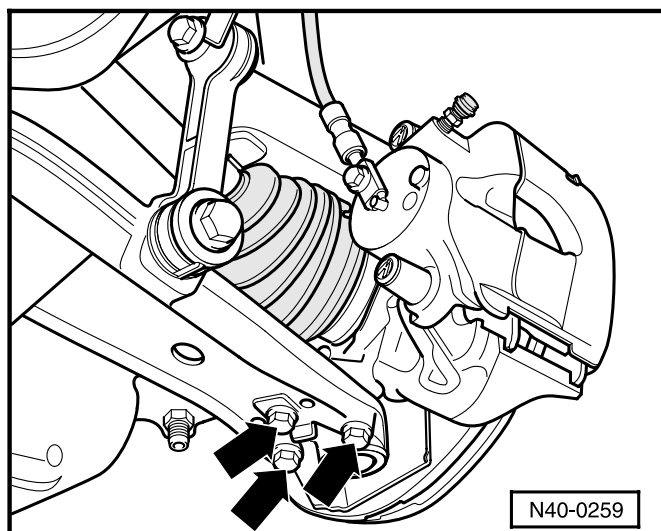
Sealing ring from left joint flange

- Lift vehicle and remove wheel.
- ◀ - Remove soundproofing left -arrow-.
- Unscrew drive shaft from flange.



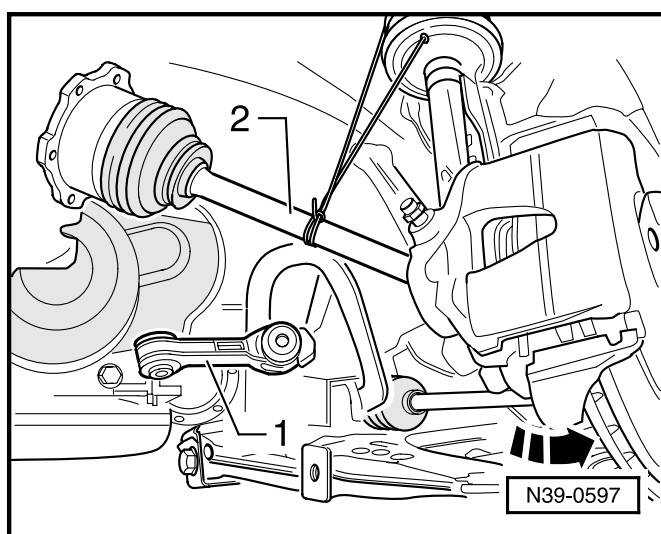
- ◀ - Remove articulated support from unit carrier -arrows-



**Note:**

Mark the mounting location of the screws -arrows- as otherwise the axle geometry must be checked.

- ◀ - Release screws -arrows-.



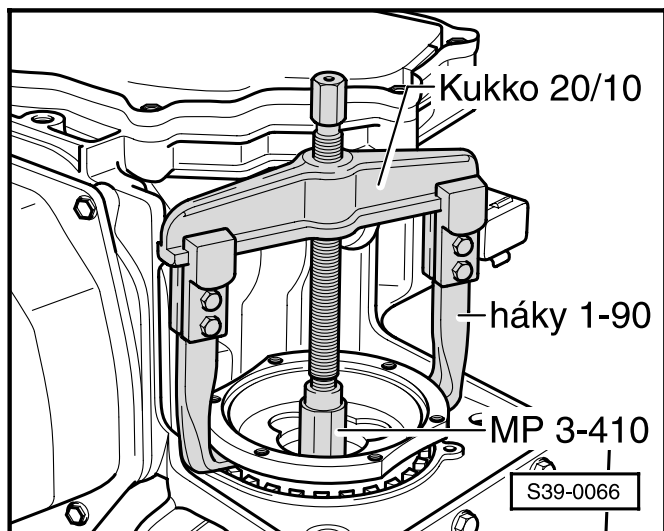
- ◀ - Release the coupling rod left -1- from the axle link and turn the coupling rod upwards.
- Swing the wheel bearing housing outwards.
- Separate the articulated joint between the unit carrier and the gearbox, while doing so push the engine/gearbox unit forwards (2nd mechanic)
- Raise the articulated joint and secure to suspension strut with wire.

Sealing ring for right joint flange:

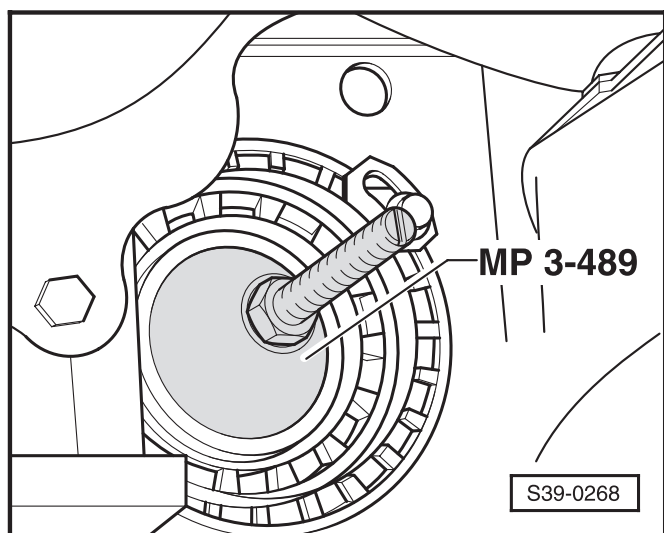
- If present remove protective cover for inside right CV universal joint from engine
- Unscrew articulated joint from joint flange and tie up with wire.

All:

- Pierce closing cap in joint flange with a screwdriver and remove.
- Remove circlip from flange using flat pliers for circlip removal.

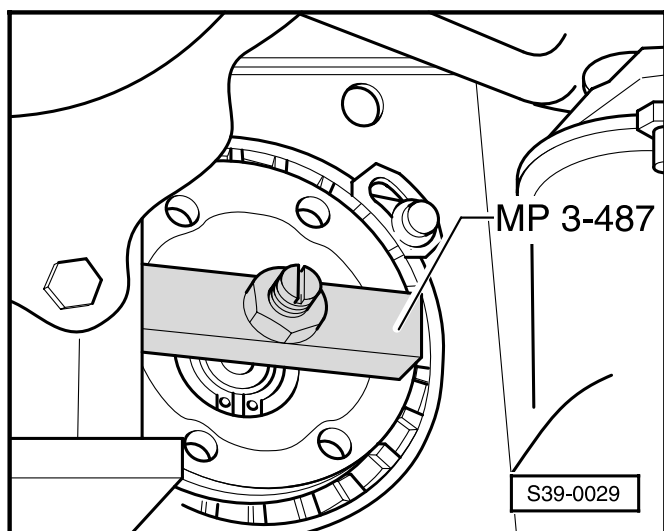


- ◀ - Position device MP 3-410 onto the flange of the drive shaft.
- Install extractor Kukko 20/10 with hooks 1-90.
- Pull off flange
- Pull out seal for drive flange with MP 3-418.

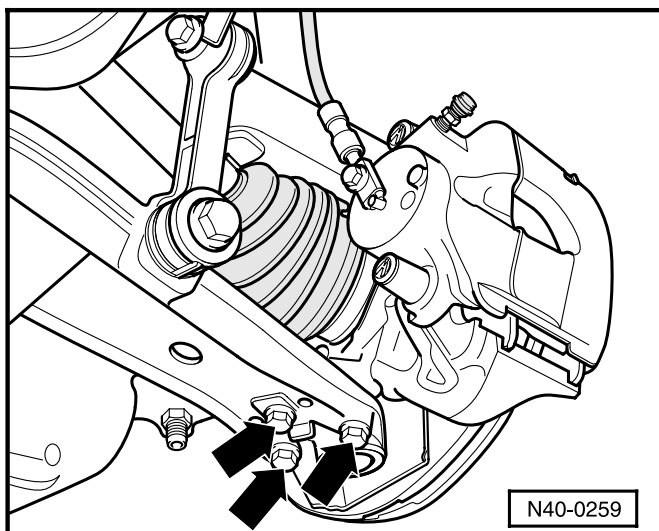


Installing

- Fill the space between the sealing and dust lip with multipurpose grease.
- ◀ - Insert new seal for flange of drive shaft with thrust piece MP 3-489, threaded rod M10 (approx. 80 mm long) and nut with washer up to the stop.



- Mount flange of drive shaft, disc spring and circlip.
- ◀ - Insert flange of drive shaft with MP 3-487.
- Install circlip and seal flange of drive shaft with sealing cover.



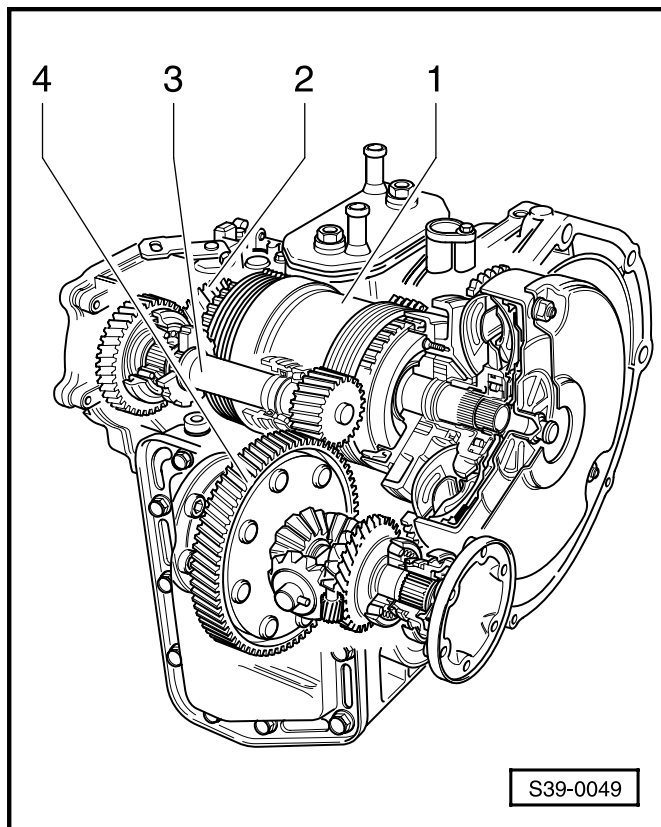
- Assemble steering joint with track control arm.
- ◀ - Tighten bolts -arrows- to specified torque (20 Nm + 90°, bolts seated on old impression).
- Attach coupling rod bracket to track control arm (45 Nm).
- Install drive shaft.
- Fit on wheel.
- With gearbox installed, inspect gear oil in final drive ⇒ page 39-1.

Tightening torques

Steering joint to track control arm ¹⁾	20 Nm + 90°
Drive shaft to gearbox	⇒ Running Gear; Repair Group 40
Coupling rod bracket to track control arm	45 Nm
Pendulum support to subframe ¹⁾	20 Nm + 90°
Protective cap to engine	35 Nm
Wheel bolts	110 Nm

¹⁾ Always replace these bolts.

Disassembling and assembling final drive



1 - Planetary gear

- ◆ Disassembling ⇒ page 37-35
- ◆ Assembling ⇒ page 37-41

2 - Input gear

- ◆ Removing and installing ⇒ page 39-5
- ◆ Setting ⇒ page 39-27
- ◆ Setting final drive (summary) ⇒ page 39-23

Note:

Repairs to the input gear can only be carried out after removing the individual parts of the planetary gear.

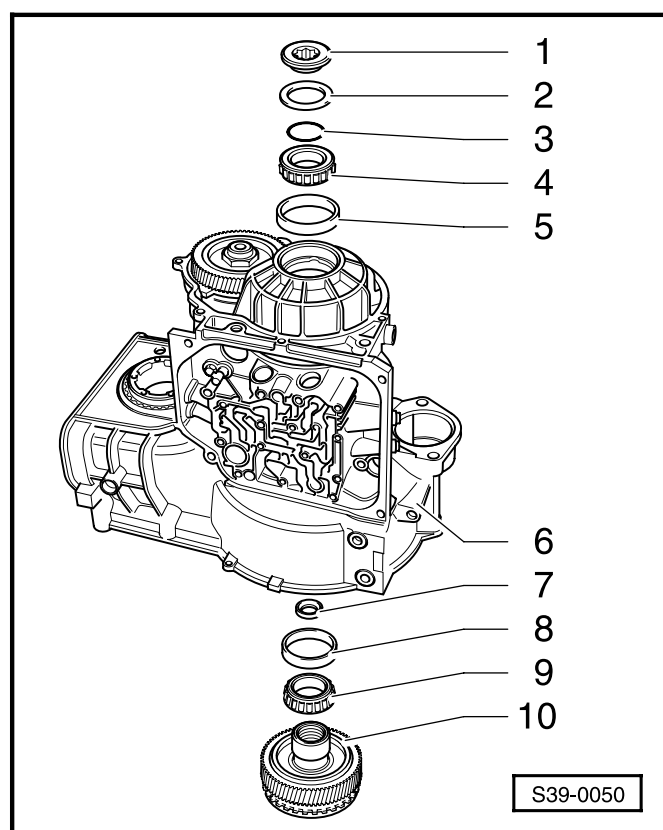
3 - Pinion

- ◆ Removing and installing ⇒ page 39-8
- ◆ Setting ⇒ page 39-24
- ◆ Setting final drive (summary) ⇒ page 39-23

4 - Differential

- ◆ Removing and installing ⇒ page 39-14
- ◆ Disassembling and assembling ⇒ page 39-19
- ◆ Setting ⇒ page 39-28
- ◆ Setting final drive (summary) ⇒ page 39-23

Removing and installing the input gear



Special tools, testers and aids required

- ◆ Locking agent AMV 185 101 A1
- ◆ Thrust disk MP 3-464
- ◆ (V.A.G 1582)
- ◆ (V.A.G 1582-3)
- ◆ Plunger MP 3-423
- ◆ Drive sleeve MP 3-427
- ◆ Thrust plate MP 3-407
- ◆ Multipurpose tool MP 3-419
- ◆ Compression tool MP 3-428

Notes:

The pinion and differential need not be removed.

*When replacing the input gear set planet carrier
⇒ page 37-50.*

1 - Tensioning screw, 250 Nm

- ◆ set park lock to install or remove
- ◆ use 22 mm plug-in element
- ◆ fit the axial needle bearing (Pos. 7) before installing the tensioning screw.

2 - Disk spring

- ◆ fit with curved side to tensioning screw

3 - Adjusting dial

- ◆ determine thickness ⇒ set input gear, page 39-27

4 - Inner ring/tapered roller bearing

- ◆ fit on input gear with locking agent AMV 185 101 A1 after dimensioning the adjusting dial ⇒ figure 3

5 - Outer ring/tapered roller bearing

- ◆ drive out with mandrel
- ◆ drive in with MP 3-464
- ◆ insert with locking agent AMV 185 101 A1

6 - Gearbox housing

7 - Axial needle bearing

- ◆ fit smooth side to input gear
- ◆ position in input gear before fitting tensioning screw (Pos. 1)

8 - Outer ring/tapered roller bearing

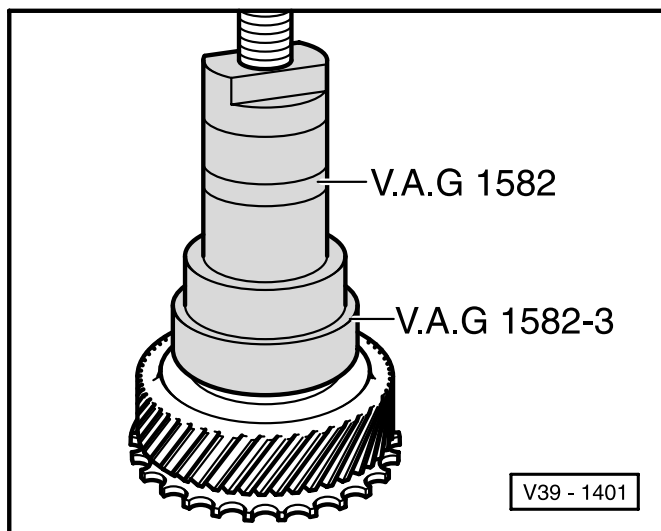
- ◆ drive out with mandrel
- ◆ drive in with MP 3-464 and adequately long mandrel
- ◆ insert with locking agent AMV 185 101 A1

9 - Inner ring/tapered roller bearing

- ◆ draw out ⇒ figure 1
- ◆ press down ⇒ figure 2
- ◆ insert with locking agent AMV 185 101 A1 ⇒ figure 3

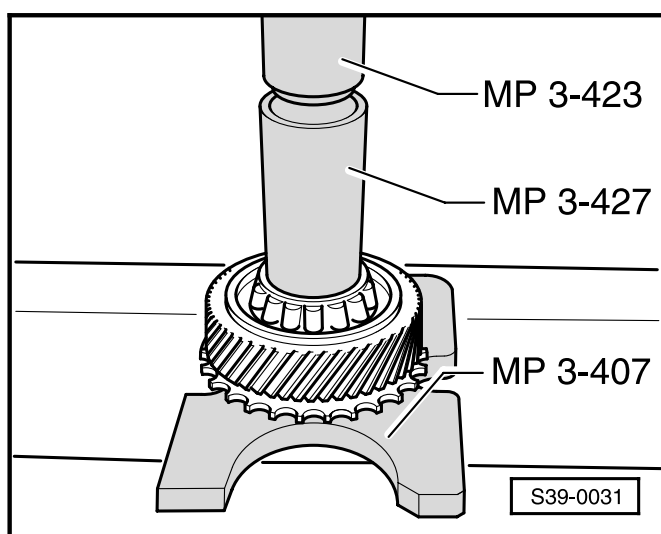
10 - Input gear

- ◆ with pulse generator for driving speed sender -G68-
- ◆ number of teeth ⇒ page 00-2
- ◆ set ⇒ page 39-27
- ◆ always replace the input gear and output gear together in case of damage
- ◆ removing ⇒ figure 4



◀ Fig. 1 Removing taper roller bearing inner race

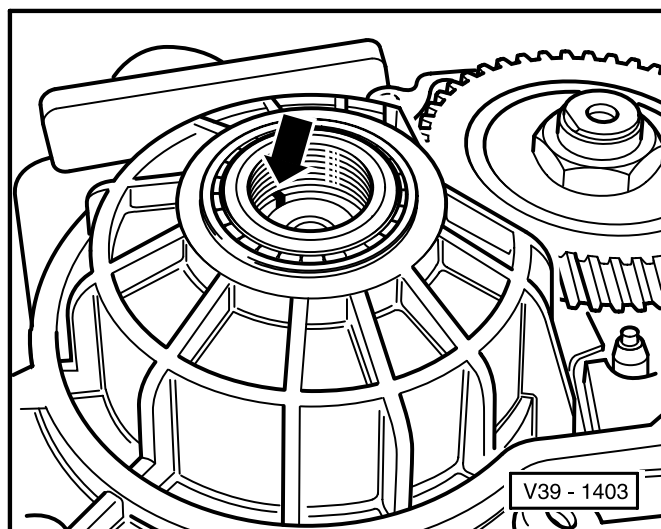
- Fit thrust piece onto input gear.



◀ Fig. 2 Pressing on taper roller bearing inner race

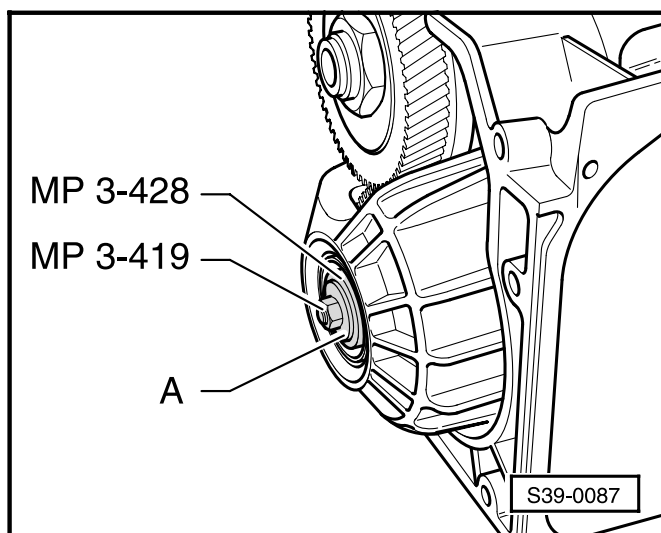
Note:

A thrust piece should be placed below the hub of the input gear in order to avoid any damage to the input gear.



◀ Fig. 3 Inserting taper roller bearing inner race

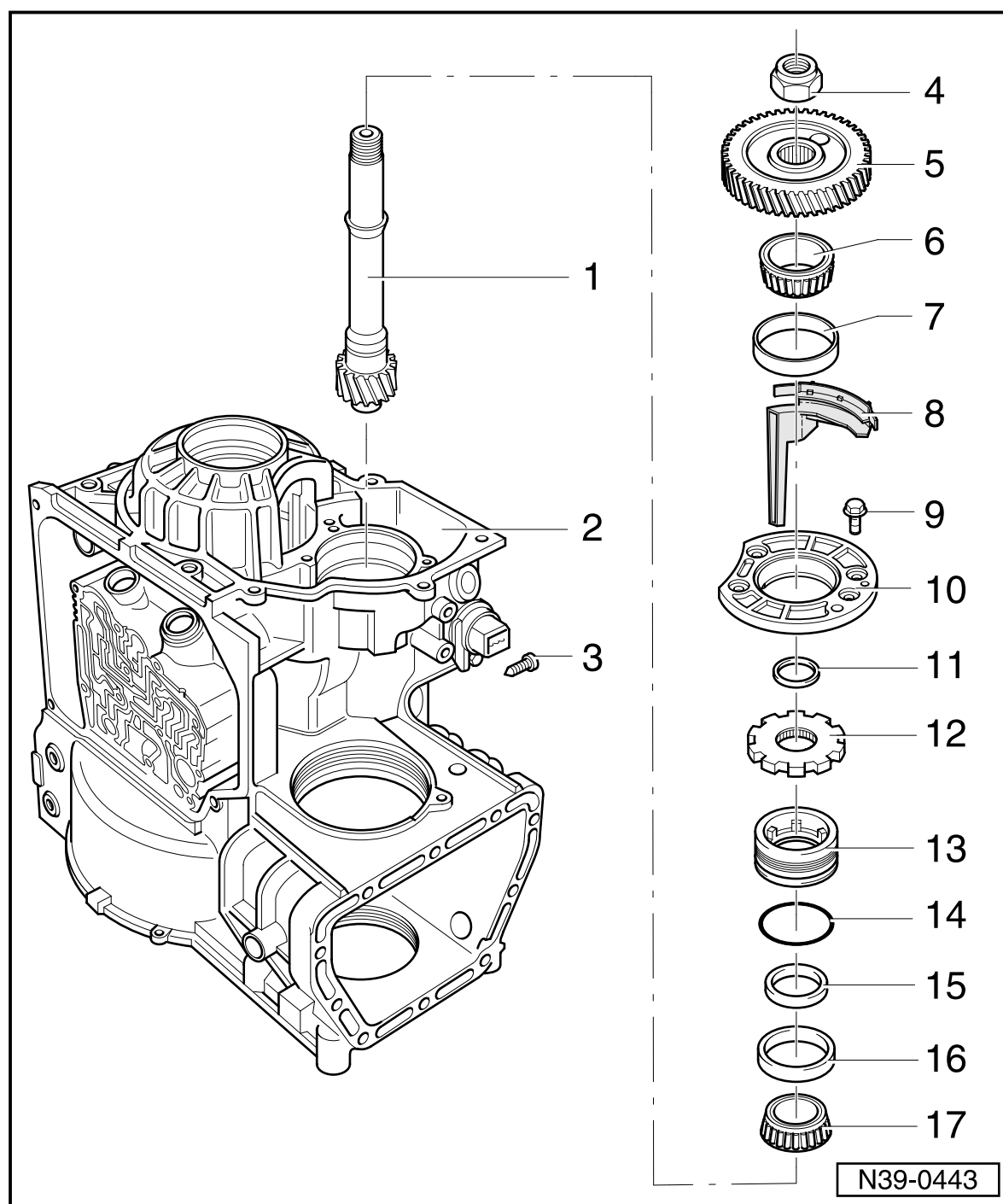
- Insert taper roller bearing inner race -arrow- with AMV 185 101 A1.



◀ Fig. 4 Removing input gear

- Position compression tool MP 3-428 with collar in the threaded bore of the input gear
- Fit washer -A- and install MP 3-419.
- Carefully draw out the input gear with MP 3-419.
- Remove MP 3-419 and the input gear.

Removing and installing drive pinion



Special tools, testers and aids required

- ◆ Sealing mass AKD 456 000 02
- ◆ V.A.G 1582
- ◆ V.A.G 1582/4
- ◆ Auxiliary part MP 3-403/1
- ◆ Thrust plate MP 3-407
- ◆ Thrust washer MP 3-413
- ◆ Pipe section MP 3-414
- ◆ Plunger MP 3-411
- ◆ Thrust piece MP 3-411
- ◆ Thrust washer MP 3-456
- ◆ Compression ring MP 3-483
- ◆ Thrust piece MP 3-484

- ◆ Thrust piece MP 3-472
- ◆ Mounting device MP 3-424
- ◆ Compression pipe MP 3-485
- ◆ Pipe section, slit MP 3-486/1
- ◆ Pipe section, slit MP 3-486/3
- ◆ Wrench for lifting eye nut MP 3-488
- ◆ Socket wrench MP 3-490
- ◆ Adapter MP 3-492
- ◆ Thrust piece MP 3-4014

Note:

To remove the drive pinion first remove the gear-shift shaft after removing the park lock gear ⇒ page 38-20, disassembling and assembling the park lock.

1 - Drive pinion

- ◆ number of teeth ⇒ page 00-2
- ◆ setting ⇒ page 39-24
- ◆ removing ⇒ figure 8

2 - Gearbox housing**3 - Circlip, 250 Nm**

- ◆ remove screw before removing or installing the bearing support ring -pos. 13-.
- ◆ insert with sealing mass AKD 456 000 02

4 - Hexagonal nut, 250 Nm

- ◆ set park lock to remove or install
- ◆ caulk with mandrel
- ◆ always replace

5 - Output gear

- ◆ number of teeth ⇒ page 00-2
- ◆ release with 2 screwdrivers ⇒ figure 1
- ◆ always replace the input gear and output gear together in case of damage

6 - Inner ring/ tapered roller bearing

- ◆ removing ⇒ figure 2
- ◆ compressing ⇒ figure 3

7 - Outer ring/tapered roller bearing

- ◆ drive out with mandrel
- ◆ compressing ⇒ figure 4

8 - ATF oil guard

- ◆ install together with bearing cover (Pos. 10)

9 - Screw, 25 Nm**10 - Bearing cover****11 - Adjusting dial**

- ◆ determine thickness ⇒ page 39-24

12 - Park lock gear

- ◆ rounded side points to drive pinion toothing

13 - Bearing support ring, 200 Nm

- ◆ remove screw -Pos. 3- before removing and installing the bearing support ring
- ◆ removing and installing ⇒ figure 5
- ◆ bearing support ring can only be released after removing the gearshift shaft ⇒ page 38-20 disassembling and assembling the park lock
- ◆ carefully insert the bearing support ring, do not damage the sealing lips or the sealing ring spring
- ◆ bearing support ring with sealing ring for drive pinion ⇒ figure 6

14 - Toroidal sealing ring

- ◆ always replace
- ◆ position on bearing support ring -Pos. 13-

15 - Sealing ring for drive pinion

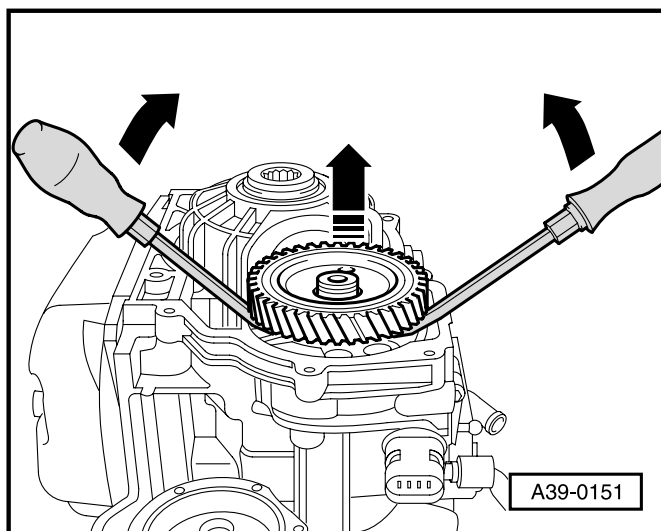
- ◆ drive out with MP 3-424
- ◆ mounting location ⇒ figure 6
- ◆ driving in ⇒ figure 7

16 - Outer ring/ tapered roller bearing

- ◆ driving in ⇒ figure 9

17 - Inner/tapered roller bearing

- ◆ drive out with MP 3-472
- ◆ compress ⇒ figure 10

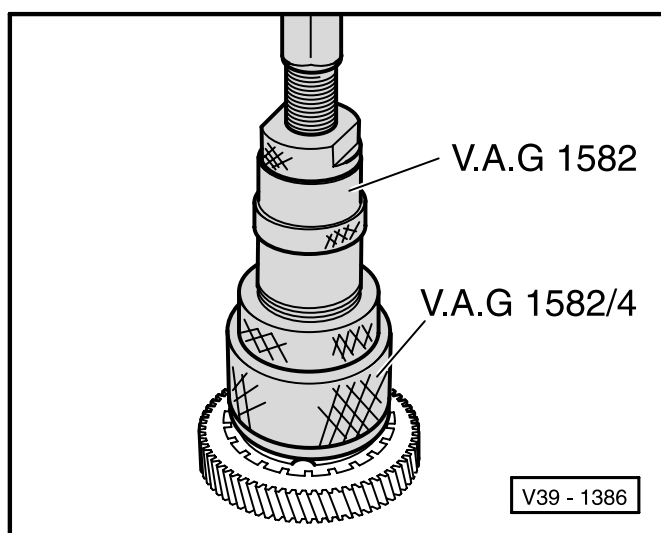


◀ Fig. 1 Pressing off output gear

- Use 2 screwdrivers to press output gear off the drive pinion.

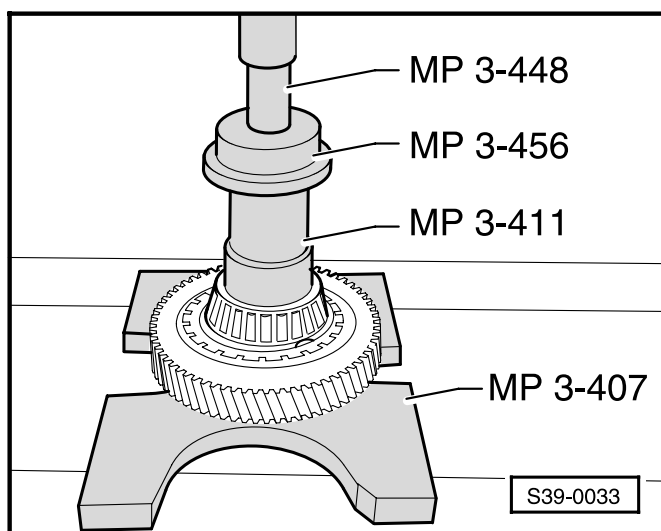
Note:

Do not damage the output gear and the sealing surface on the gearbox housing.

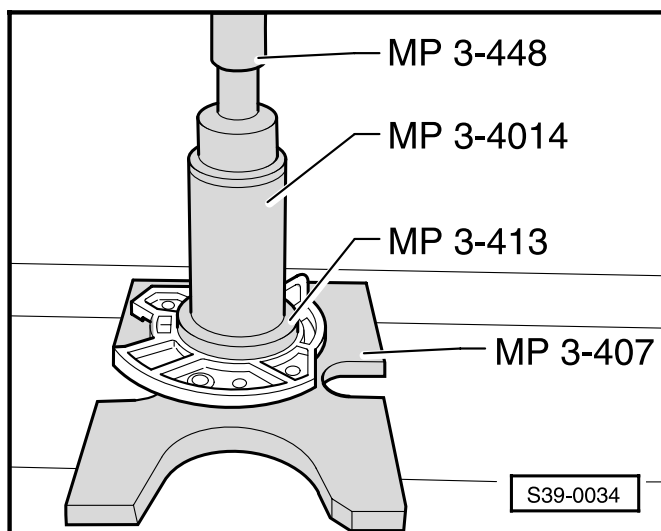


◀ Fig. 2 Removing taper roller bearing inner race

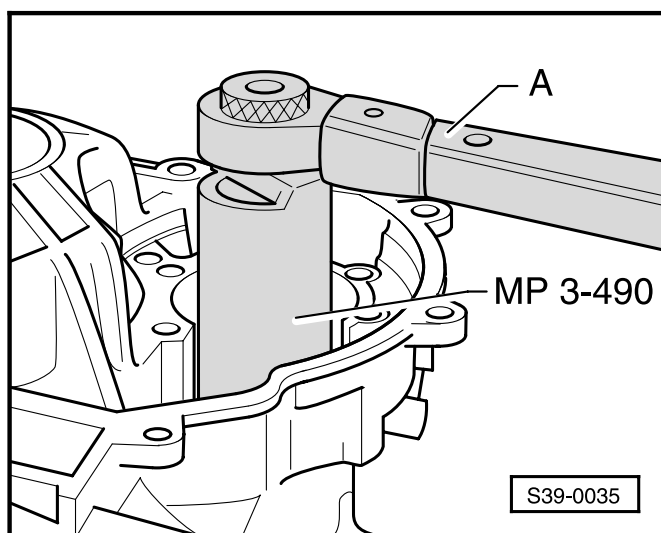
- Fit thrust piece onto the collar of the output gear.



◀ Fig. 3 Pressing on taper roller bearing inner race

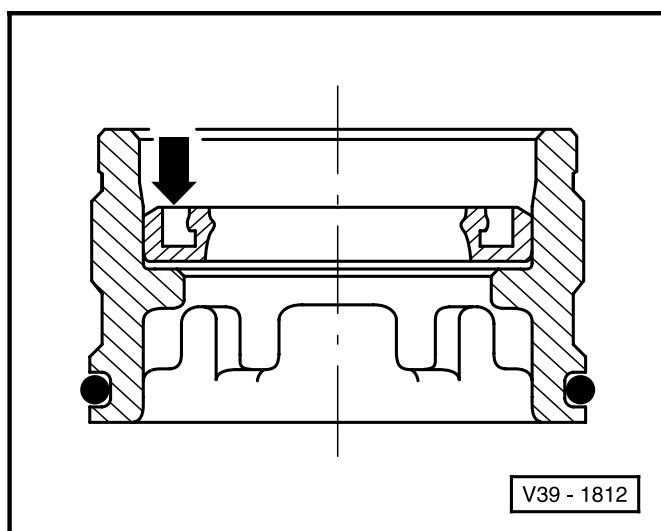


◀ Fig. 4 Pressing in taper roller bearing outer race



◀ Fig. 5 Removing and installing bearing supporting ring

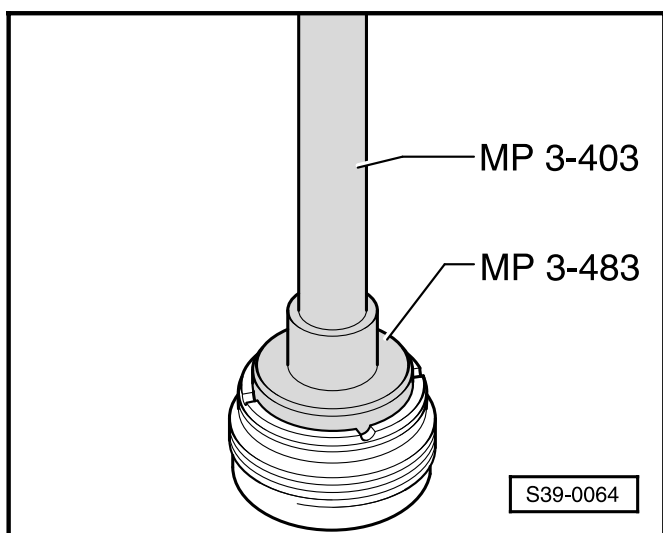
- Remove locking screw ⇒ page 39-8, item 3.
- A - Torque wrench
- Tighten bearing supporting ring to 200 Nm and secure with locking screw. Insert screw with sealing compound AKD 456 000 02.



◀ Fig. 6 Bearing supporting ring with seal for drive pinion

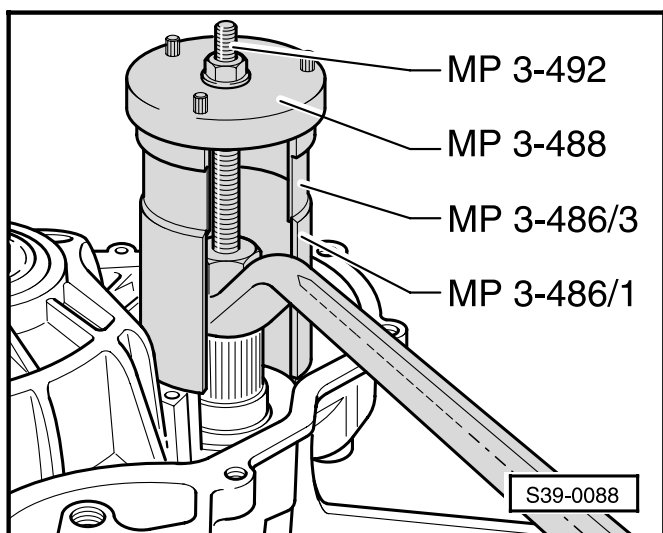
Fitting location:

- ♦ Open side of seal (arrow) faces toward taper roller bearing outer race.

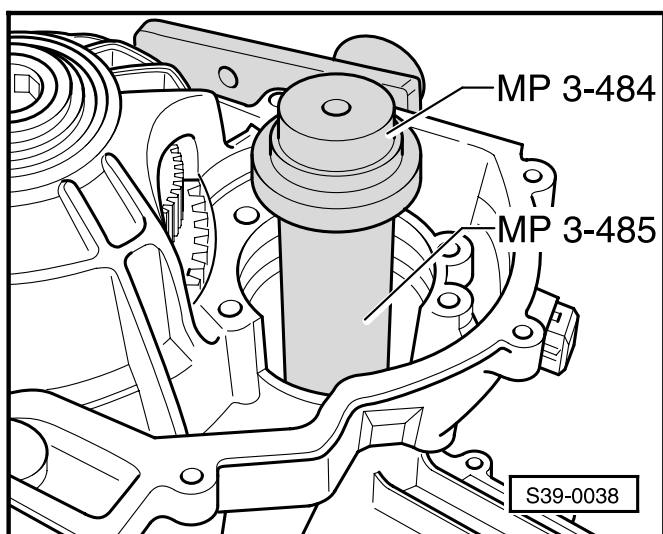


◀ Fig. 7 Driving in sealing ring for drive pinion

- Position the sealing ring in such a way that the sealing lip points outward to special tool MP 3-483.

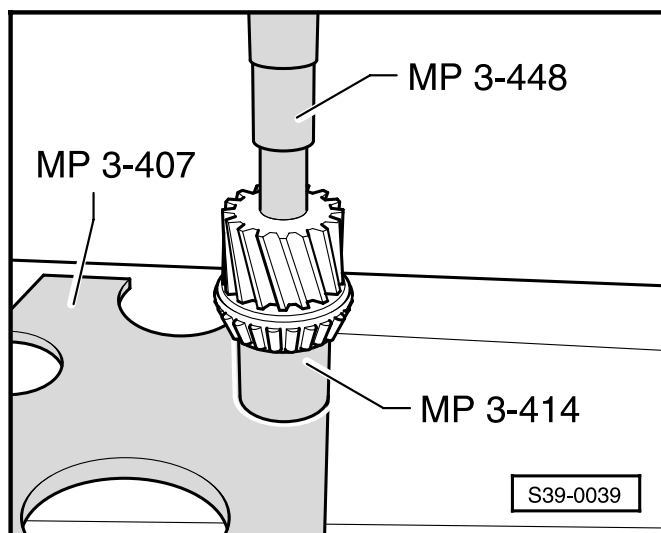


◀ Fig. 8 Removing the drive pinion



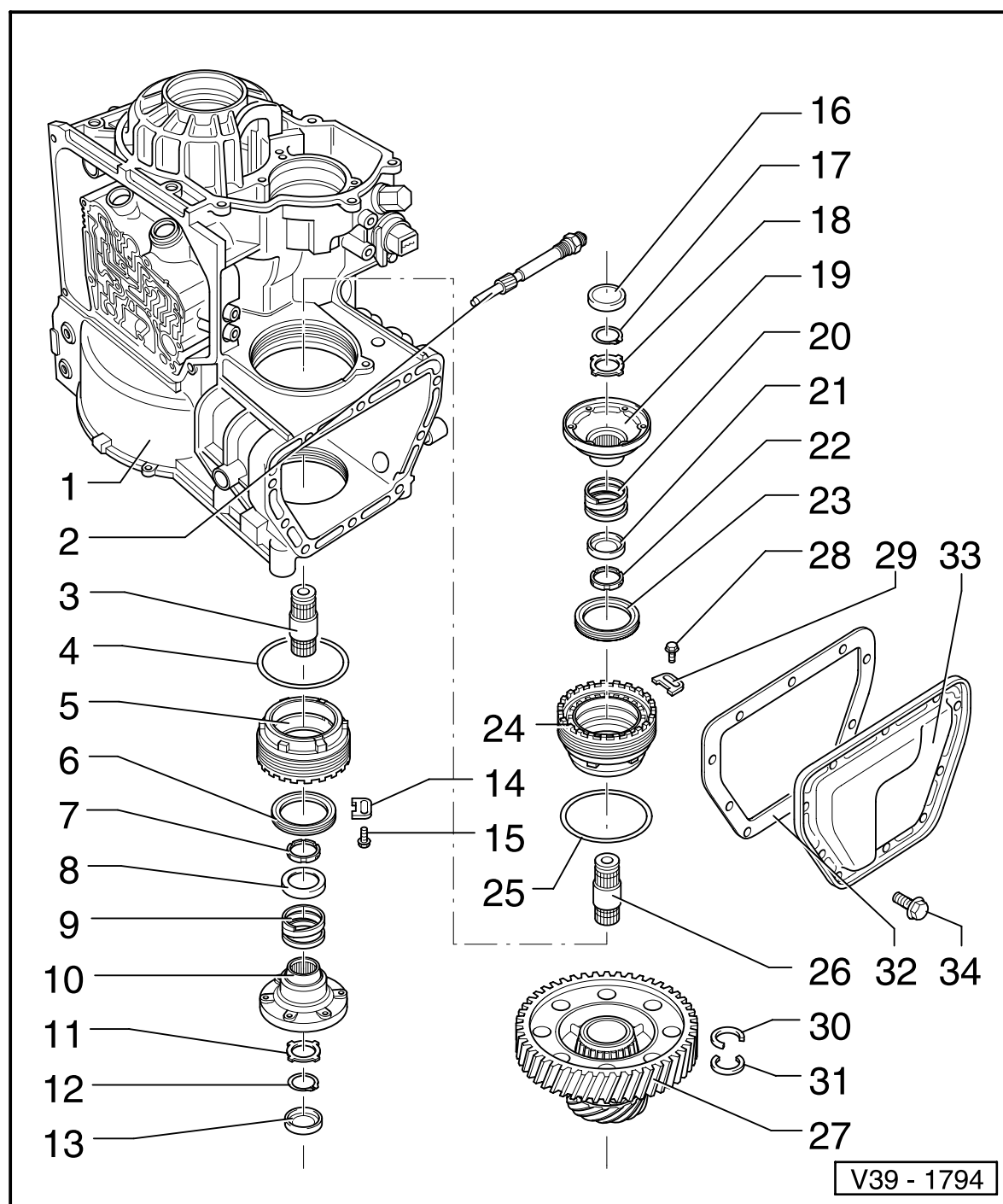
◀ Fig. 9 Driving in the outer ring/tapered roller bearing

- Insert the drive pinion with the tapered roller bearing/inner ring, then drive in the outer ring



◀ Fig. 10 Pressing on taper roller bearing inner race

Removing and installing differential



Special tools, testers and aids required

- ◆ Sealing mass AMV 185 101 A1
- ◆ Tool MP 3-410
- ◆ Extraction lever MP 3-418
- ◆ Drawing in tool MP 3-487
- ◆ Wrench for lifting eye nut MP 3-488

- ◆ Puller Kukko 20/10 with hook 1-90

- ◆ Thrust piece MP 3-499

Notes:

- ◆ If tapered roller bearings are to be used again mark the adjusting ring ⇒ figure 2
- ◆ It is not necessary to remove the drive pinion to disassemble and assemble the differential.

1 - Gearbox housing

2 - Drive for speedometer sender -G22

- ◆ removing and installing ⇒ page 39-1

3 - Output shaft/joint flange

- ◆ remove before removing the differential
- ◆ to remove remove circlip (Pos. 31)
- ◆ before installing set the differential
- ◆ install thread to joint flange

4 - Toroidal sealing ring

- ◆ always replace

5 - Adjusting dial

- ◆ remove ⇒ figure 3
- ◆ if bearing is reused mark fitting location and position on marking when installing ⇒ figure 2
- ◆ observe setting instructions when fitting new bearings ⇒ setting differential, page 39-28

6 - Sealing ring for joint flange

- ◆ can be replaced with the gearbox mounted ⇒ page 39-2
- ◆ remove with MP 3-418
- ◆ before fitting fill space between sealing lips with multipurpose grease
- ◆ driving in ⇒ figure 1

7 - Tapered ring

- ◆ wider collar points to stop disk

8 - Stop disk

- ◆ position over pressure spring

9 - Pressure spring**10 - Joint flange**

- ◆ before removing remove the inner circlip on the differential bevel gear
- ◆ removing ⇒ figure 4
- ◆ installing ⇒ figure 5
- ◆ insert with tapered ring, stop disk and pressure spring

11 - Disk spring

- ◆ curved side points outwards

12 - Circlip**13 - Closing cap****14 - Lock****15 - Screw, 12 Nm**

- ◆ insert with locking agent AMV 185 101 A1

16 - Closing cap**17 - Circlip****18 - Disk spring**

- ◆ curved side points outwards

19 - Joint flange

- ◆ before removing remove the inner circlip on the differential bevel gear
- ◆ removing ⇒ figure 4
- ◆ installing ⇒ figure 5
- ◆ insert with tapered ring, stop disk and pressure spring

20 - Pressure spring**21 - Stop disk**

- ◆ position over pressure spring

22 - Tapered ring

- ◆ wider collar points to stop disk

23 - Sealing ring for joint flange

- ◆ can be replaced with the gearbox mounted ⇒ page 39-2
- ◆ remove with MP 3-418
- ◆ before fitting fill space between sealing lips with multipurpose grease
- ◆ driving in ⇒ figure 1

24 - Bearing housing, 150 Nm

- ◆ remove with MP 3-488
- ◆ when installing new bearing observe setting instructions ⇒ setting differential, page 39-28
- ◆ installing ⇒ figure 6

25 - Toroidal sealing ring

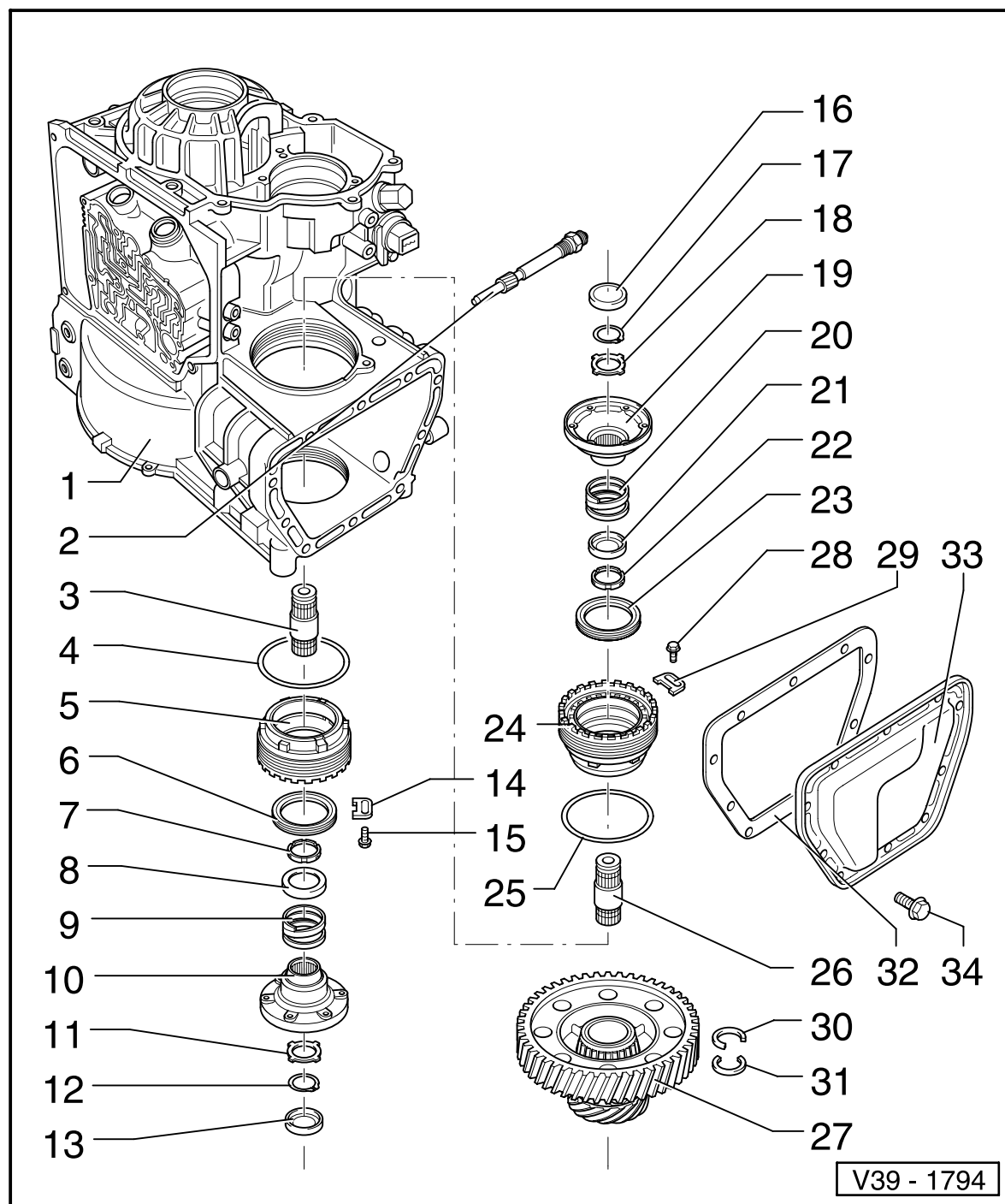
- ◆ always replace

26 - Output shaft/joint flange

- ◆ remove before removing the differential
- ◆ to remove remove circlip (Pos. 30)
- ◆ before installing set the differential
- ◆ install thread to joint flange

27 - Differential

- ◆ before removing the differential remove the bearing housing, adjusting dial and output shaft
- ◆ disassembling and assembling ⇒ page 39-19

**28 - Screw, 12 Nm**

- ◆ insert with locking agent AMV 185 101 A1

29 - Lock**30 - Circlip**

- ◆ only remove after removing the joint flange as the pressure spring (Pos. 20) is preloaded
- ◆ removing and installing ⇒ figure 7

31 - Circlip

- ◆ only remove after removing the joint flange as the pressure spring (Pos. 9) is preloaded
- ◆ removing and installing ⇒ figure 7

32 - Seal

- ◆ always replace

33 - Cover

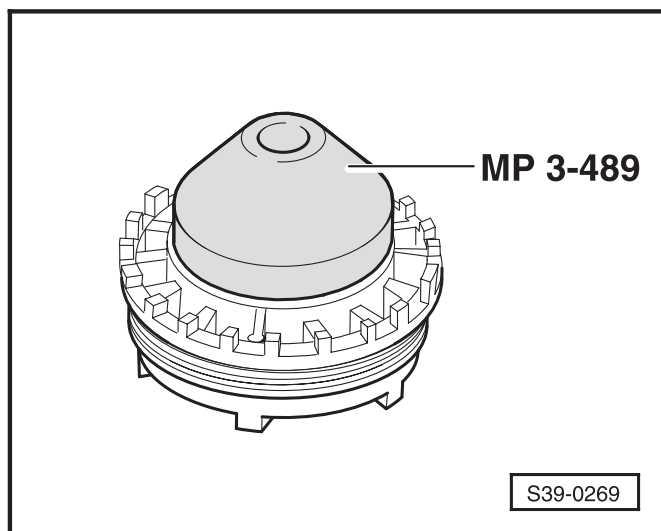
- ◆ for differential

34 - Screw, 28 Nm

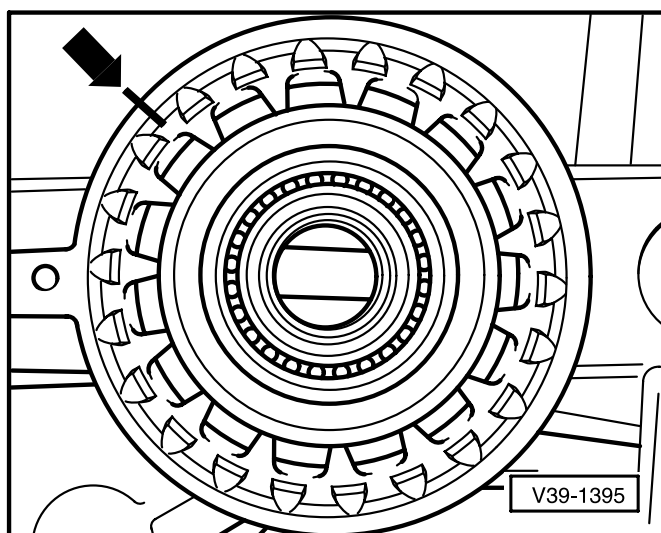
- ◆ insert with locking agent AMV 185 101 A1

Note:

After setting the tapered roller bearing lock the bearing housing and adjusting ring.

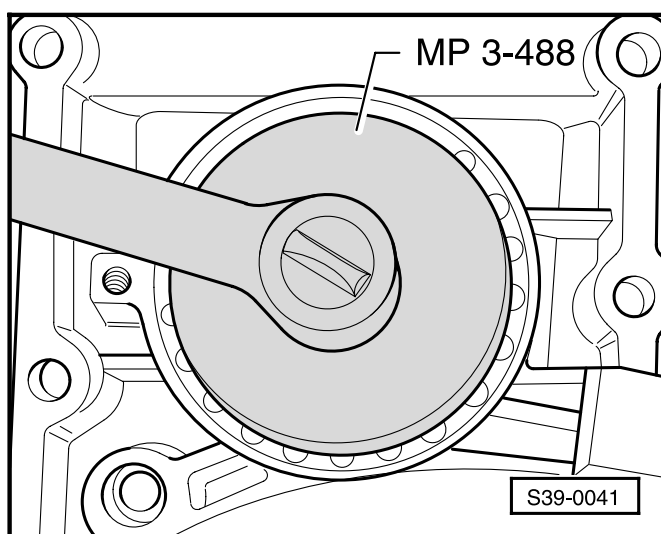


◀ Fig. 1 Knock in seal for flange of drive shaft up to the stop

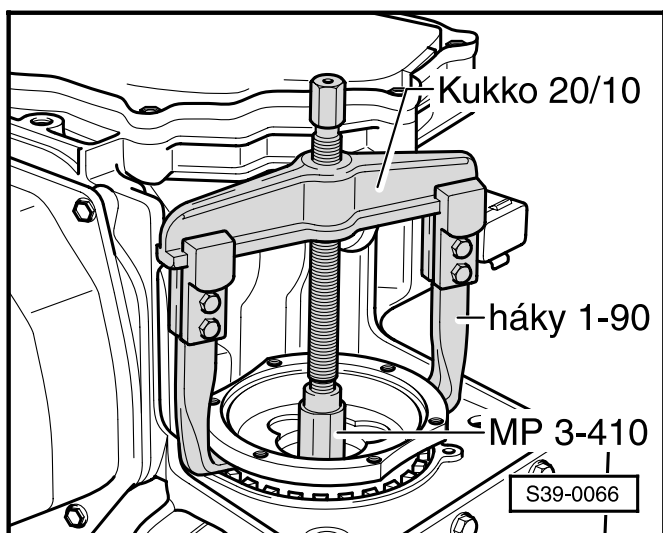


◀ Fig. 2 Mark adjusting ring

- If used bearings are reused, mark fitting location (arrow) and when reinstalling position on the marking.

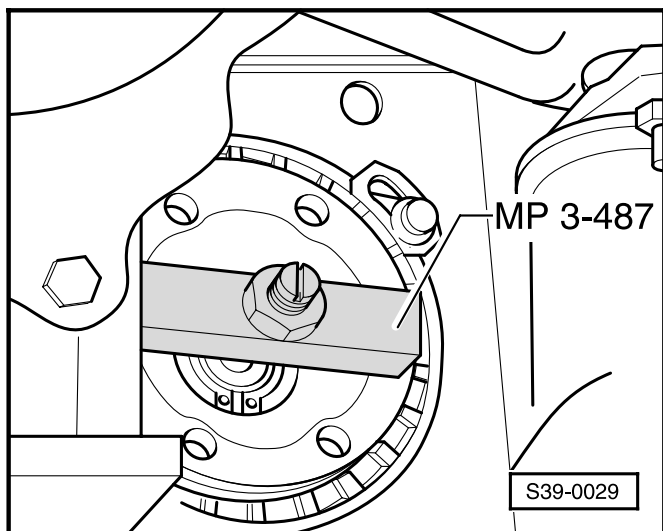


◀ Fig. 3 Removing adjusting ring



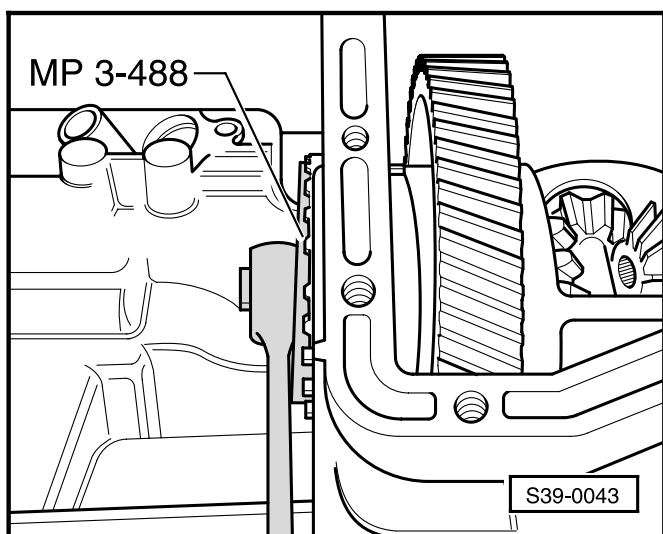
◀ Fig. 4 Removing joint flange

- Use flat pliers for opening circlips to remove the circlip.
- Remove the flange of the articulated shaft with puller Kukko 20/10 with hook 1-90 and MP 3-410 (place under cabinet).



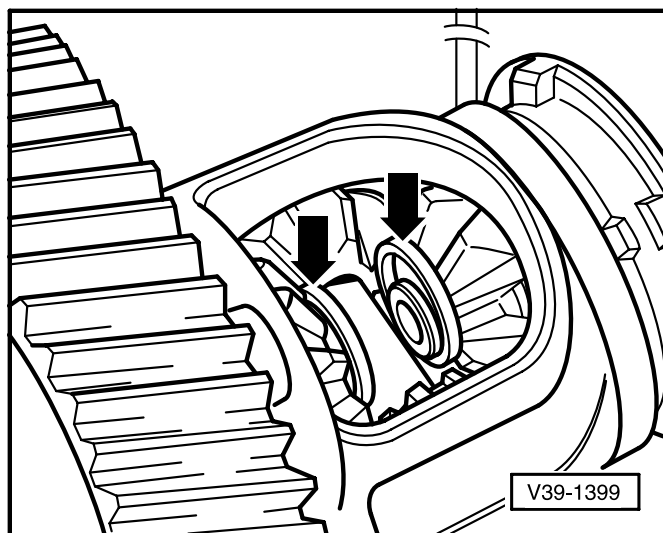
◀ Fig. 5 Installing joint flange

- Position the joint flange, disk spring and circlip.
- Draw in the joint flange with MP 3-487.
- Fit circlip and seal joint flange with closing cover.



◀ Fig. 6 Installing bearing housing

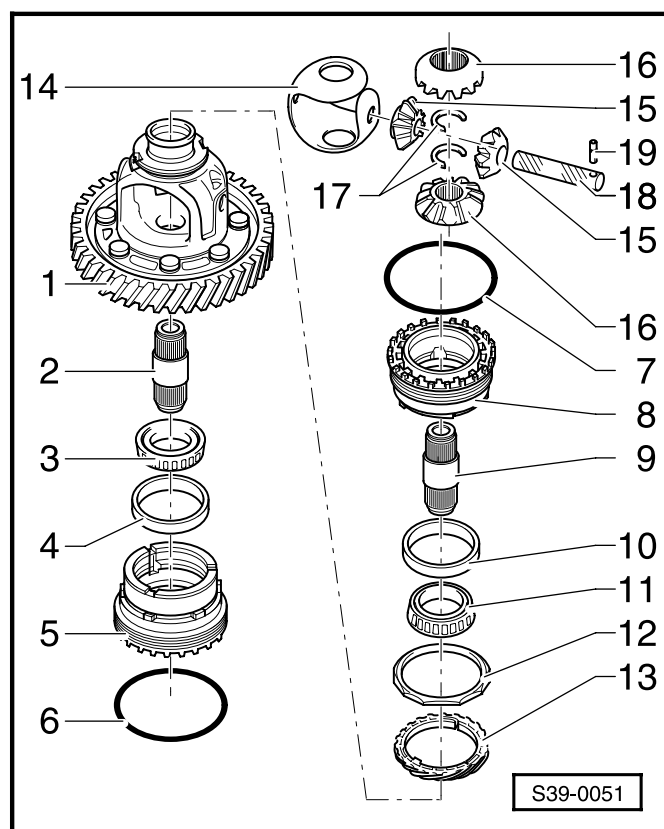
- Position differential and screw down the bearing housing up to the stop with 150 Nm.



◀ Fig. 7 Installing circlip

- Remove circlip -arrows- with two screwdrivers.

Disassembling and assembling differential



Special tools, testers and aids required

- ◆ V.A.G 1582
- ◆ V.A.G 1582/3
- ◆ Thrust piece MP 3-484
- ◆ Insertion sleeve MP 3-427
- ◆ Pressure plunger MP 6-405
- ◆ Thrust plate MP 3-407
- ◆ Pressure plunger MP 3-448
- ◆ Thrust plate MP 3-464

Notes:

- ◆ Heat taper roller bearing inner race to 100 °C before fitting on.
- ◆ Heat setting ring for taper roller bearing to 100 °C before inserting the taper roller bearing outer race.

1 - Differential housing with riveted gear for final drive

- ◆ Final drive gear is riveted to the differential housing and then machined
- ◆ If the differential or the final drive gear is damaged, the differential housing should be replaced together with the riveted final drive gear
- ◆ Number of teeth of final drive gear
⇒ page 00-2

2 - Output shaft/joint flange

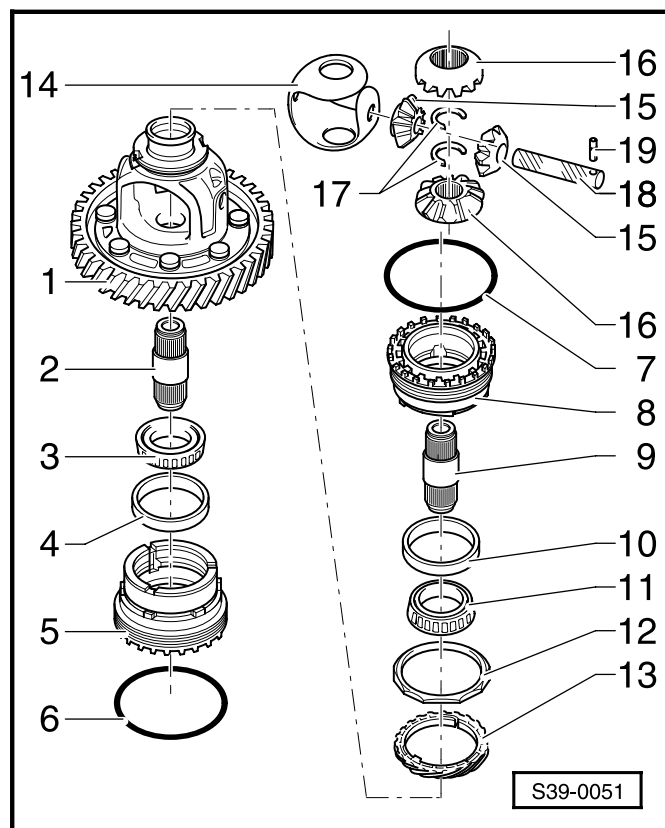
- ◆ Removing and installing
⇒ page 39-14

3 - Taper roller bearing inner race

- ◆ Removing ⇒ Fig. 1
- ◆ Pressing on ⇒ Fig. 2

4 - Taper roller bearing outer race

- ◆ Remove and install only once setting ring heated
- ◆ Use drift for removing
- ◆ Inserting ⇒ Fig. 4



5 - Bearing body for taper roller bearing

- ◆ Removing and installing ⇒ page 39-14, Removing and installing differential

6 - O-ring

- ◆ Always replace

7 - O-ring

- ◆ Always replace

8 - Setting ring for taper roller bearing

- ◆ Removing and installing ⇒ page 39-14, Removing and installing differential

9 - Output shaft/joint flange

- ◆ Removing and installing ⇒ page 39-14, Removing and installing differential

10 - Taper roller bearing outer race

- ◆ Remove and install only once setting ring heated
- ◆ Use drift for removing
- ◆ Inserting ⇒ Fig. 4

11 - Taper roller bearing inner race

- ◆ Remove item 12 and 13 before pulling off
- ◆ Pulling off ⇒ Fig. 1
- ◆ Pressing on ⇒ Fig. 2

12 - Driver bush

- ◆ Remove together with speedometer drive gear -item 13-
- ◆ Use drift for fitting on

13 - Speedometer drive gear

- ◆ Use drift for removing
- ◆ Fit on together with driver bush -item 12-

14 - Thrust washer assembly

- ◆ Place into differential housing before inserting the differential bevel gears

15 - Small differential bevel gears

- ◆ Inserting ⇒ Fig. 3

16 - Large differential bevel gears

- ◆ Inserting ⇒ Fig. 3

17 - Circlip

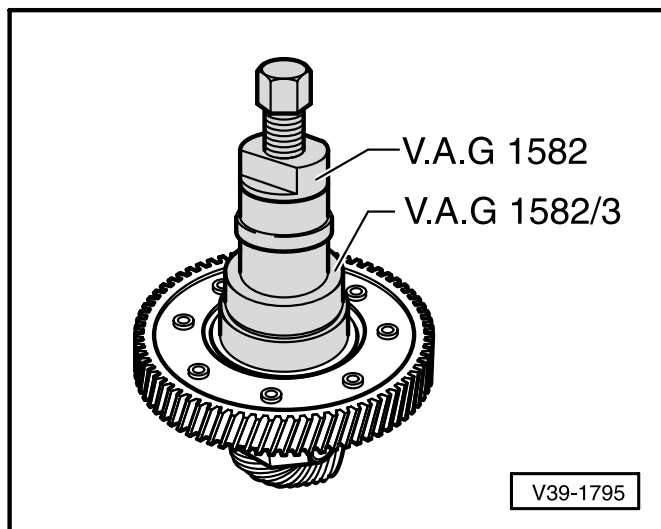
- ◆ Removing ⇒ page 39-18, Fig. 6

18 - Shaft for differential bevel gears

- ◆ Take out tensioning sleeve for removing ⇒ Fig. 5
- ◆ Use drift for removing
- ◆ When inserting, do not damage thrust washer assembly

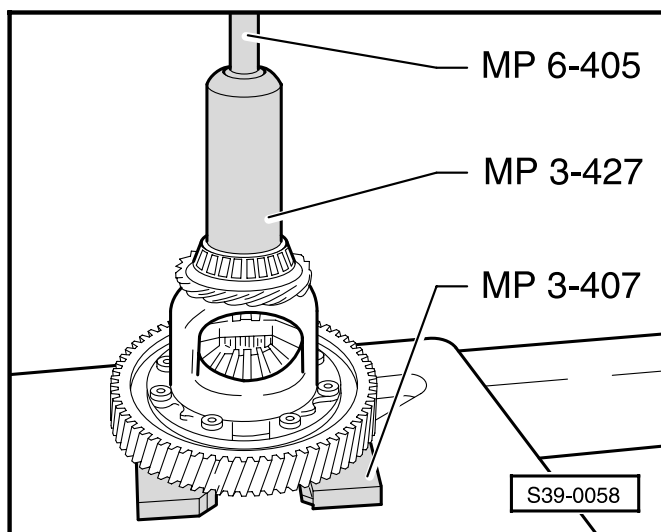
19 - Tensioning sleeve

- ◆ Replace
- ◆ For securing the shaft of the differential bevel gears
- ◆ Removing and installing ⇒ Fig. 5

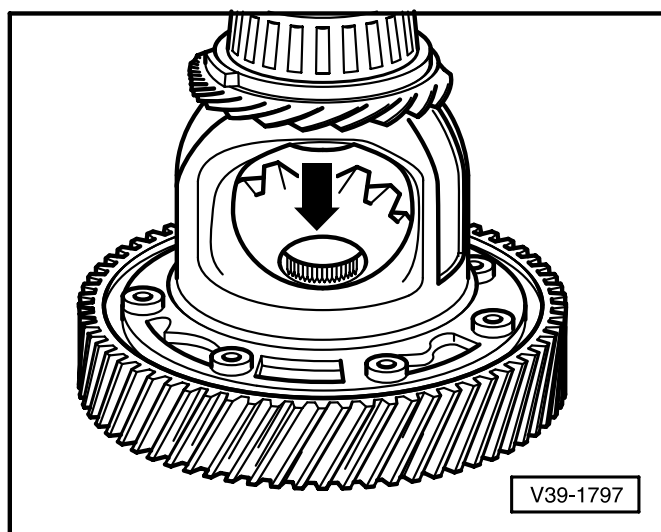


◀ Fig. 1 Pulling off taper roller bearing inner race

- Mount thrust piece MP 3-484 onto differential housing.

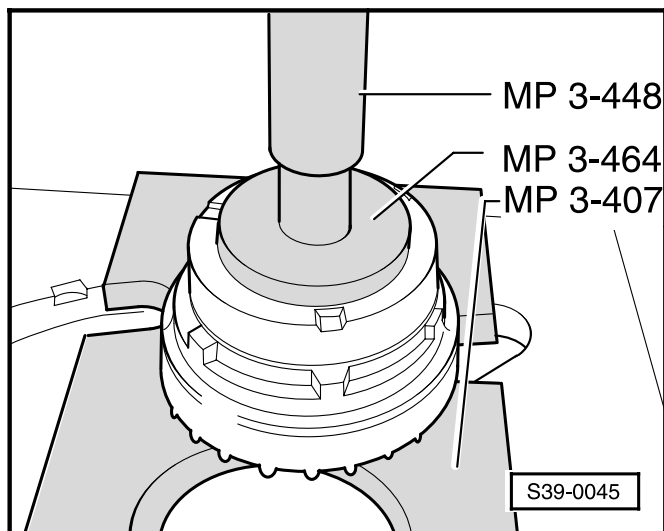


◀ Fig. 2 Pressing on taper roller bearing inner race



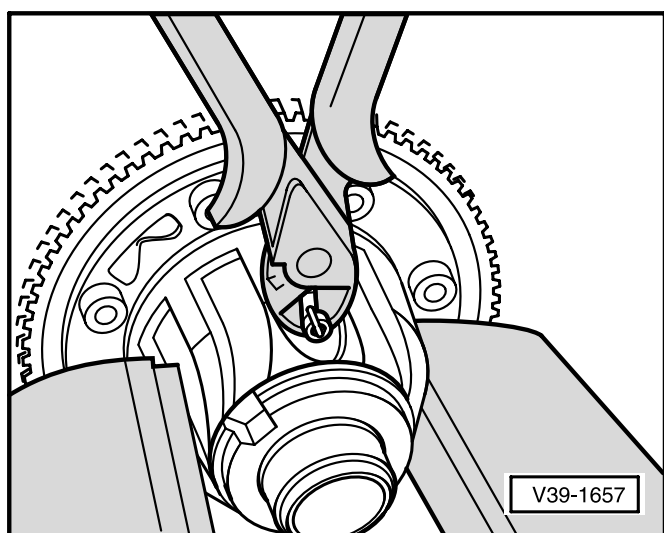
◀ Fig. 3 Inserting differential bevel gears

- Insert thrust washer assembly with ATF.
- Insert small differential bevel gears, knock in shaft and secure with tensioning sleeve.
- Insert large differential bevel gears offset 180° and swivel into place in direction of arrow.



◀ Fig. 4 Pressing in taper roller bearing outer race

- Heat setting ring or bearing body, insert outer race and press in as far as the stop.



◀ Fig. 5 Removing and installing tensioning sleeve

- ◆ Length of tensioning sleeve 28.5 mm

Removing

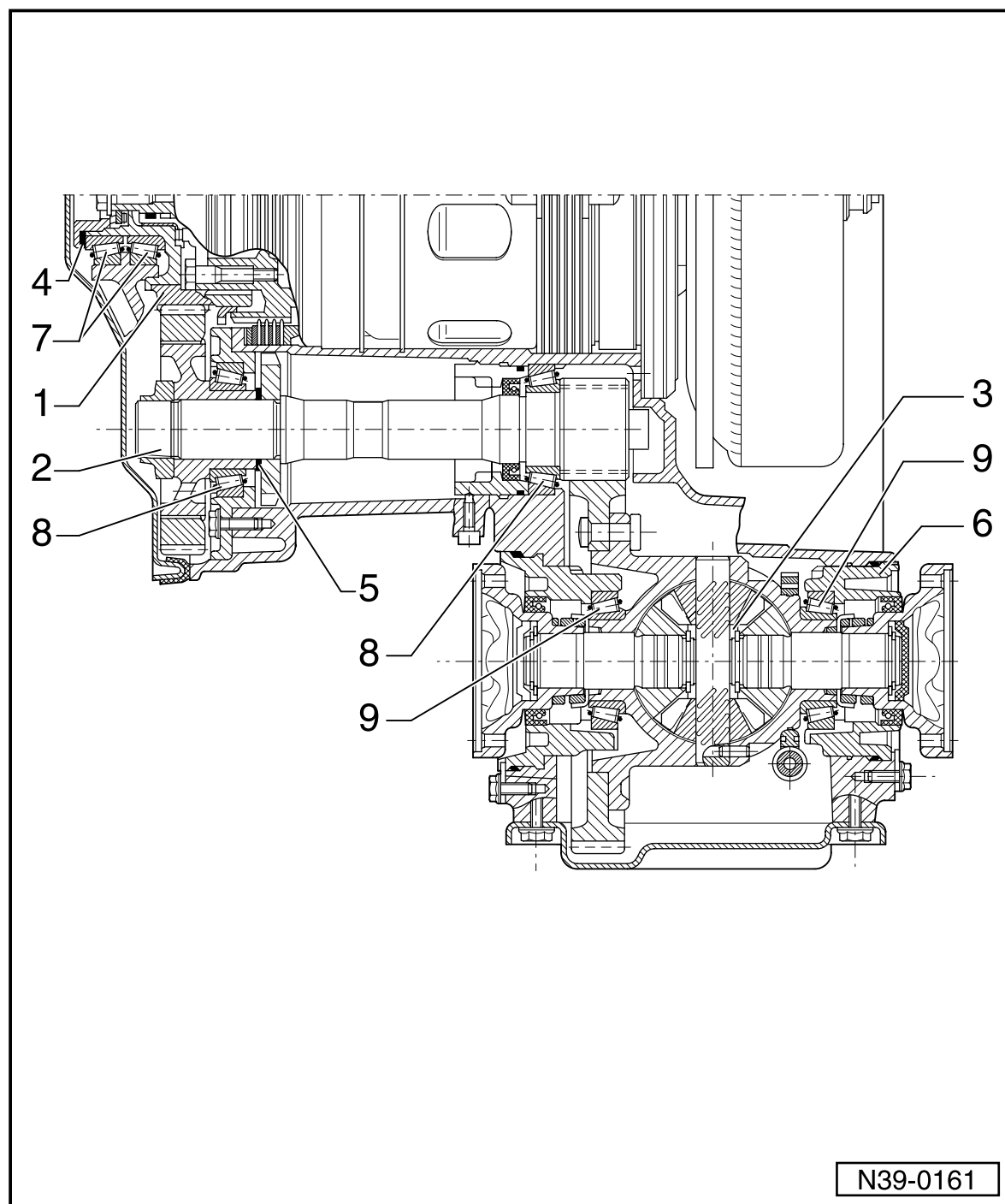
- Use side nippers to pull out tensioning sleeve.

Installing

- Replace tensioning sleeve.
- Insert tensioning sleeve as far as the stop.

Setting final drive

Setting final drive -summary-



N39-0161

Note:

Summary of setting operations when individual components of the gearbox are replaced
⇒ page 39-24.

1 - Input gear

- ◆ Setting ⇒ page 39-28
- ◆ Always replace together with output gear

2 - Drive pinion

- ◆ Setting ⇒ page 39-25

3 - Differential

- ◆ Setting ⇒ page 39-30

4 - Shim for drive pinion

5 - Shim for drive pinion

6 - Shim ring for differential

7 - Taper roller bearing for input gear

- ◆ Always replace together

8 - Taper roller bearing for drive pinion

- ◆ Always replace together

9 - Taper roller bearing for differential

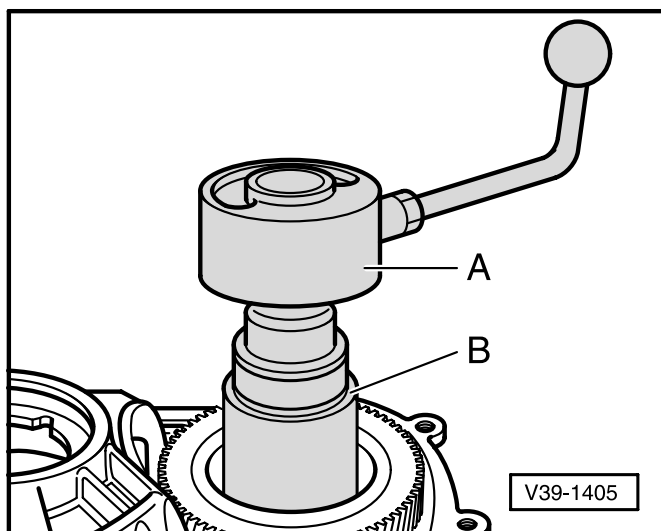
- ◆ Always replace together

Setting operations when replacing individual components

When carrying out removal and installation work at the gearbox, it is only necessary to conduct a re-setting of input gear, drive pinion with output gear or differential housing, if components which directly affect the setting of the final drive, are replaced. Pay attention to the table below in order to avoid carrying out unnecessary setting operations:

The following must be set:	Component to be replaced:		
	Differential housing with riveted gear ⇒ page 39-30	Input gear ¹⁾ ⇒ page 39-28	Drive pinion with output gear ¹⁾ ⇒ page 39-25
Gearbox housing	X	X	X
Input gear ¹⁾		X	X
Taper roller bearing for input gear		X	
Output gear ¹⁾		X	X
Drive pinion			X
Taper roller bearing for drive pinion			X
Differential housing with gear	X		
Taper roller bearing for differential, bearing body or shim ring	X		
Bearing supporting ring, park lock gear or bearing cap			X

¹⁾ Always replace input gear and output gear together.



Before disassembling final drive

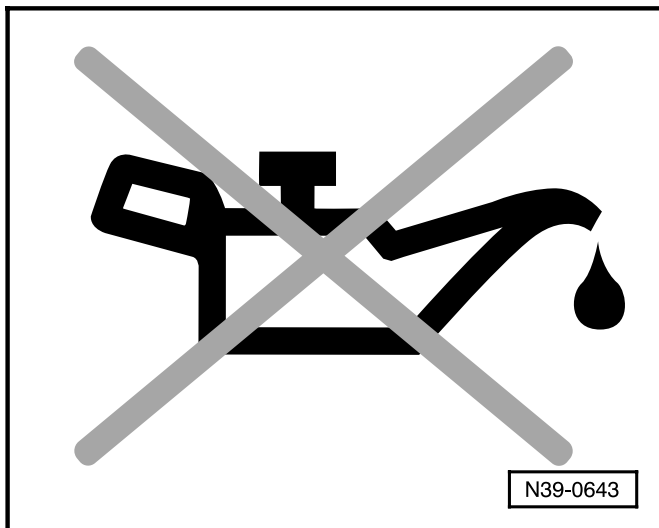
Before the final drive is disassembled, it is necessary to measure the actual friction torque at the drive pinion.

Note the measurement obtained.

◀ Measuring actual friction torque

A - Commercially available torque gauge
0...600 Ncm

B - Wrench bit (width across flats 41 mm)



If taper roller bearings are replaced

- Oil taper roller bearings when installing up to gearbox date of manufacture 26.4.1998.

From gearbox date of manufacture 27.4.1998 taper roller bearings with the modified friction coefficient have been installed.

These taper roller bearings must not be oiled.

- ◀ - Do not oil taper roller bearings from gearbox date of manufacture 27.4.1998.

Setting drive pinion

Special tools, testers and aids required

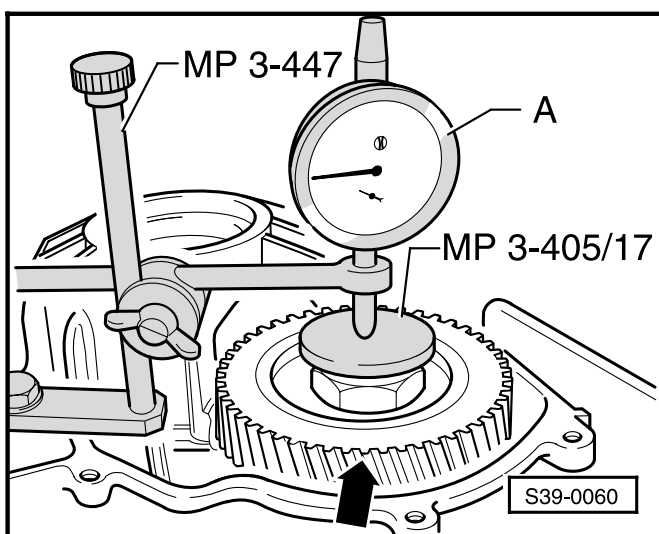
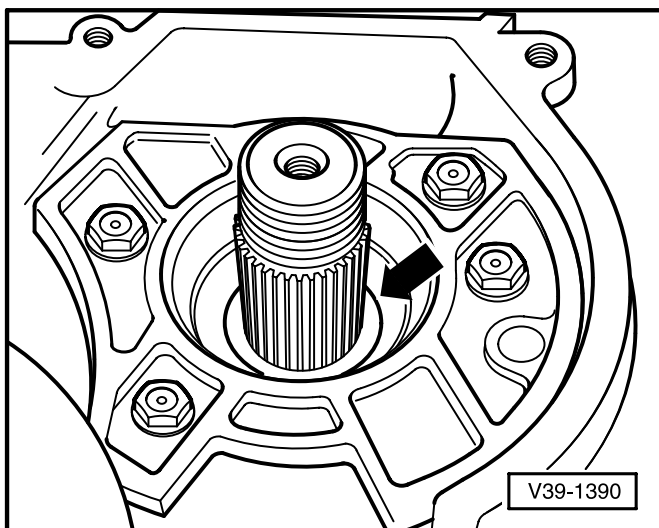
- ◆ Universal dial gauge holder MP 3-447
- ◆ End gauge MP 3-405/17

Requirements:

- Supporting ring for drive pinion bearing is installed and secured.
- Park lock mechanism and park lock gear are installed.

Setting:

- ◀ - Fit two shims (each 1.5 mm thick) -arrow- onto the drive pinion.
- Engage park lock.
- Mount output gear with taper roller bearing onto drive pinion and tighten hexagon nut fully to 250 Nm (width across flats 41 mm).



- ◀ - Insert dial gauge -A- and set to „0“ with a preload of 1 mm. Move drive pinion back and forward. Read off play on dial gauge and note (example 0.93).

Note:

Do not rotate the drive pinion during the measurement otherwise the bearings will settle and falsify the result of the measurement.

Determining shims

The specified bearing preload is achieved if the result of the measurement (0.93 mm), the preload of the bearings of 0.12 mm and the amount of settling 0.10 mm are deducted from the 2 x 1.5 mm thick shims.

Example:

Shims inserted	3.00 mm
- Result of measurement	0.93 mm
- Preload	0.12 mm
- Amount of settling	0.10 mm
= Thickness of shim	1.85 mm

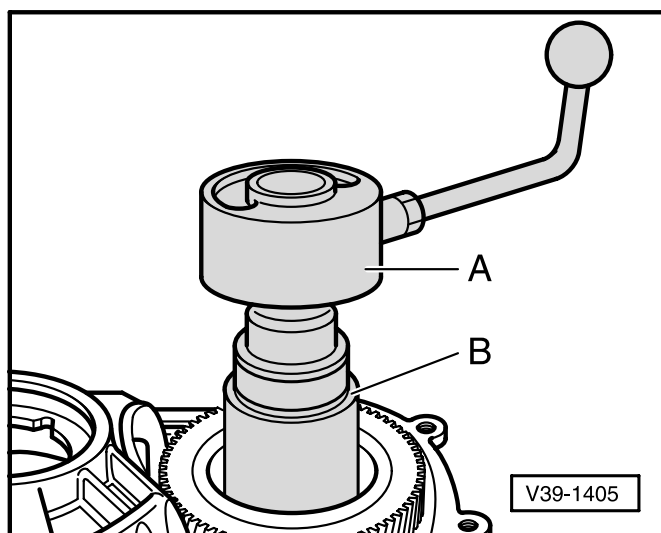
- Take off output gear, determine size of shim according to the table ⇒ page 39-26 and fit onto drive pinion.
- Install output gear again, tighten hexagon nut fully to 250 Nm and secure with drift.

Table of „shims“ for drive pinion and input gear

Thickness measured (mm)	Shim to be installed (mm)	Thickness measured (mm)	Shim to be installed (mm)	Thickness measured (mm)	Shim to be installed (mm)
0,975...0,999	1,000	1,550...1,574	1,575	2,125...2,149	2,150
1,000...1,024	1,025	1,575...1,599	1,600	2,150...2,174	2,175
1,025...1,049	1,050	1,600...1,624	1,625	2,175...2,199	2,200
1,050...1,074	1,075	1,625...1,649	1,650	2,200...2,224	2,225
1,075...1,099	1,100	1,650...1,674	1,675	2,225...2,249	2,250
1,100...1,124	1,125	1,675...1,699	1,700	2,250...2,274	2,275
1,125...1,149	1,150	1,700...1,724	1,725	2,275...2,299	2,300
1,150...1,174	1,175	1,725...1,749	1,750	2,300...2,324	2,325
1,175...1,199	1,200	1,750...1,774	1,775	2,325...2,349	2,350
1,200...1,224	1,225	1,775...1,799	1,800	2,350...2,374	2,375
1,225...1,249	1,250	1,800...1,824	1,825	2,375...2,399	2,400
1,250...1,274	1,275	1,825...1,849	1,850	2,400...2,424	2,425
1,275...1,299	1,300	1,850...1,874	1,875	2,425...2,449	2,450
1,300...1,324	1,325	1,875...1,899	1,900	2,450...2,474	2,475
1,325...1,349	1,350	1,900...1,924	1,925	2,475...2,499	2,500
1,350...1,374	1,375	1,925...1,949	1,950	2,500...2,524	2,525
1,375...1,399	1,400	1,950...1,974	1,975	2,525...2,549	2,550
1,400...1,424	1,425	1,975...1,999	2,000	2,550...2,574	2,575
1,425...1,449	1,450	2,000...2,024	2,025	2,575...2,599	2,600
1,450...1,474	1,475	2,025...2,049	2,050	2,600...2,624	2,625
1,475...1,499	1,500	2,050...2,074	2,075	2,625...2,649	2,650
1,500...1,524	1,525	2,075...2,099	2,100	2,650...2,674	2,675
1,525...1,549	1,550	2,100...2,124	2,125	2,675...2,700	2,700

Different tolerances make it possible to exactly gauge the required thickness of shim.

Part Number: ⇒ Parts List



◀ Measuring friction torque

A - Commercially available torque gauge
0...600 Ncm

B - Wrench bit (width across flats 41 mm)

Replacing taper roller bearings for gearboxes up to gearbox date of manufacture 26.4.1998

- Moisten these taper roller bearings with ATF for inspecting the friction torque.

The friction torque of these taper roller bearings must be 80...120 Ncm higher than the friction torque which was measured previously at the drive pinion.

Replacing taper roller bearings for gearboxes from gearbox date of manufacture 27.4.1998

- ◀ - Install these new taper roller bearings as supplied, and do not oil additionally.

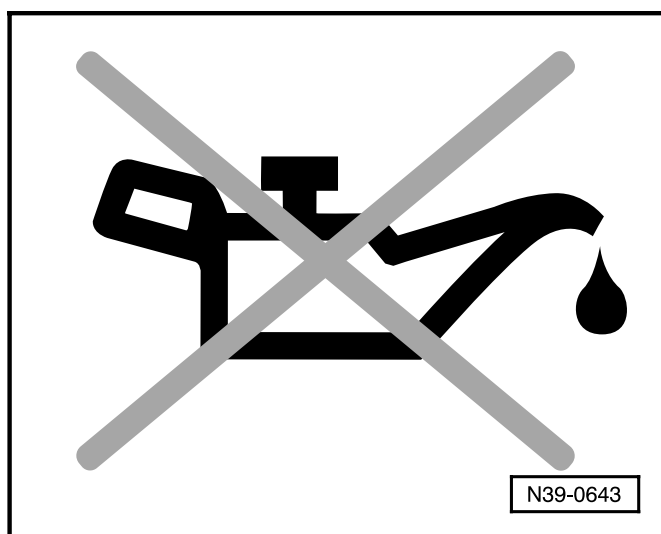
The friction torque of these new taper roller bearings must be 60...160 Ncm higher than the friction torque which was measured previously at the drive pinion.

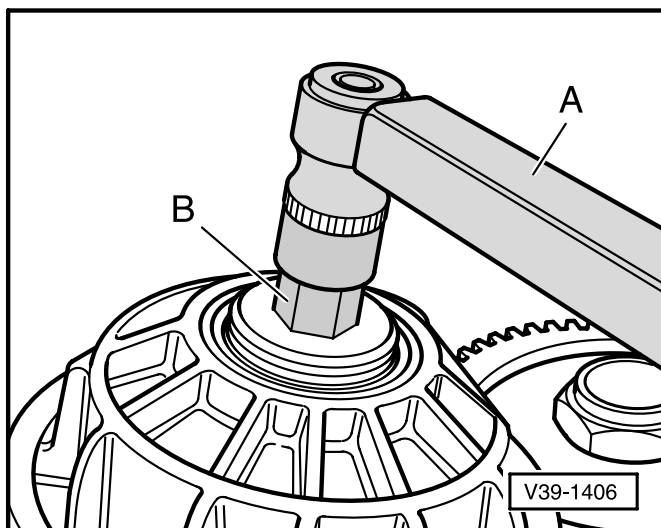
Note:

These new taper roller bearings have a modified friction value. If these taper roller bearings are oiled, it is not possible to achieve the stated friction value.

Example:

	Friction value
Drive pinion (actual friction torque)	= 100 Ncm ¹⁾
Drive pinion (mean value)	= 110 Ncm
Friction value of drive pinion (actual friction torque) + drive pinion (mean value)	= 210 Ncm





Setting input gear

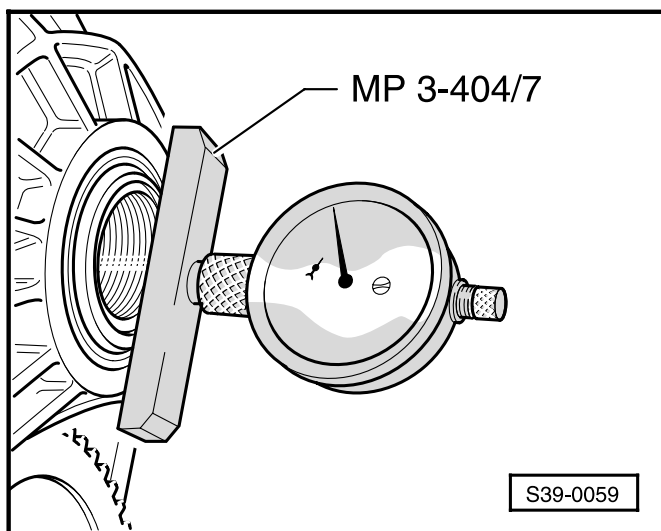
Special tools, testers and aids required

- ◆ Measuring device MP 3-404/7
- ◀ - Tighten tensioning bolt to 100 Nm without dished washer and without shim.

A - Torque wrench
B - 22 mm bit

Park lock must be engaged.

- Remove tensioning bolt.



- ◀ - Measure distance between input gear and inner race of taper roller bearing.

- Insert dial gauge and set to „0“ with a preload of 3 mm. Note measurement (example 1.00 mm).

The thickness of the dished washer 1.50 mm must be added to this measurement of 1.00 mm = 2.50 mm.

Determining shim

The specified bearing preload is achieved if the bearing preload of 0.18 mm is deducted from the figure obtained (dished washer + measurement) of 2.50 mm.

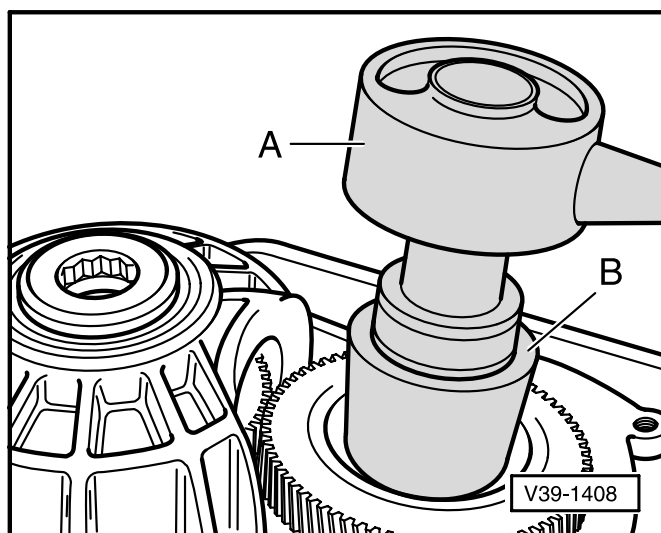
Example:

Dished washer + measurement	2.50 mm
- Bearing preload	0.18 mm
= Thickness of shim	2.32 mm

- Determine shim according to the table and fit onto the input shaft. Table of shims ⇒ page 39-26.
- Insert axial needle bearing and attach tensioning bolt including dished washer with a torque of 250 Nm.

Note:

Insert axial needle bearing of input shaft before tightening the tensioning bolt. Installation position: flat side facing input gear.



◀ Measuring friction torque

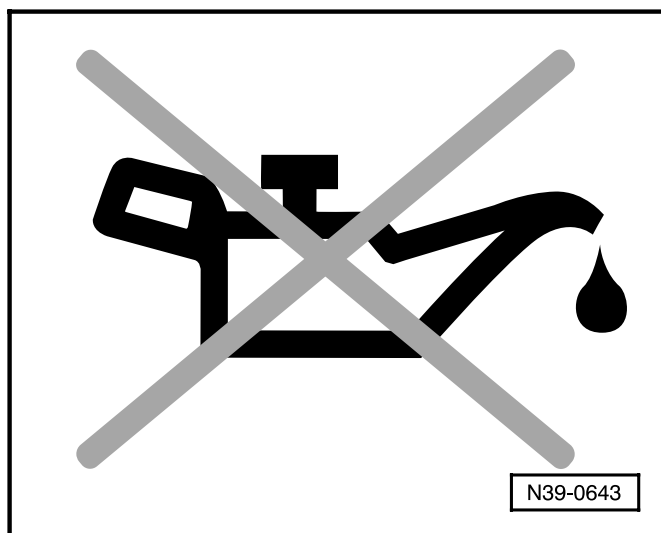
A - Commercially available torque gauge
0...600 Ncm

B - Wrench bit (width across flats 41 mm)

Replacing taper roller bearings for gearboxes up to gearbox date of manufacture 26.4.1998

- Moisten these taper roller bearings with ATF for inspecting the friction torque.

The friction torque of these taper roller bearings must be 180...220 Ncm higher than the friction torque which was measured previously at the drive pinion.



Replacing taper roller bearings for gearboxes from gearbox date of manufacture 27.4.1998

- ◀ - Install these new taper roller bearings as supplied, and do not oil additionally.

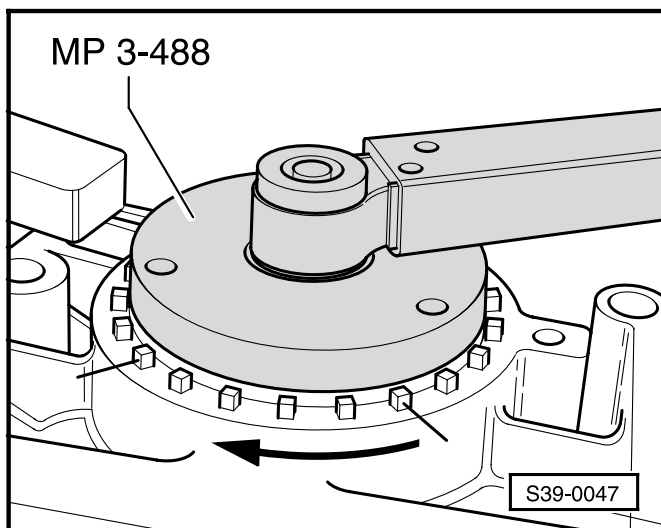
The friction torque of these new taper roller bearings must be 50...170 Ncm higher than the friction torque which was measured previously at the drive pinion.

Note:

These new taper roller bearings have a modified friction value. If these taper roller bearings are oiled, it is not possible to achieve the stated friction value.

Example:

	Friction value
Drive pinion (result of measurement)	= 210 Ncm ¹⁾
Input gear (mean value)	= 110 Ncm
Friction value of input gear + drive pinion	= 320 Ncm



Setting differential

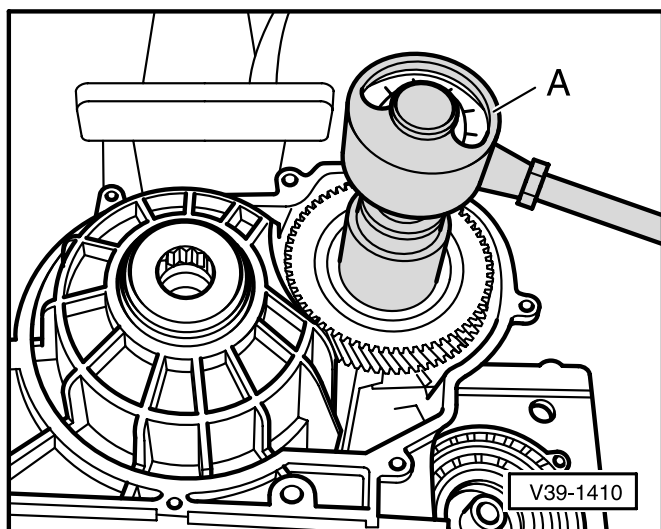
Special tools, testers and aids required

- ◆ Wrench for ring nut MP 3-488
- ◀ Use MP 3-488 to tighten bearing body to 150 Nm as far as the stop and secure.
- Tighten shim ring to 50 Nm and mark.

Note:

Do not rotate differential during the measurement otherwise the bearings will settle and the result of the measurement will be falsified.

- Turn on shim ring by five locking lugs and secure; the preload of the taper roller bearings is set in this way.



◀ Measuring friction torque

A - Commercially available torque gauge
0...600 Ncm

B - Wrench bit (width across flats 41 mm)

Replacing taper roller bearings for gearboxes up to gearbox date of manufacture 26.4.1998

- Moisten these taper roller bearings with ATF for inspecting the friction torque.

The friction torque of these taper roller bearings must be 60...80 Ncm higher than the friction torque which was measured previously at the drive pinion.

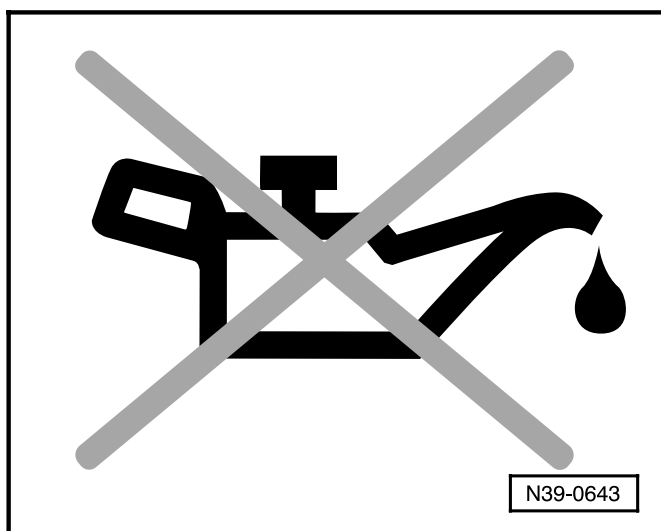
Replacing taper roller bearings for gearboxes from gearbox date of manufacture 27.4.1998

- ◀ Install these new taper roller bearings as supplied, and do not oil additionally.

The friction torque of these new taper roller bearings must be 35...100 Ncm higher than the friction torque which was measured previously at the drive pinion.

Note:

These new taper roller bearings have a modified friction value. If these taper roller bearings are oiled, it is not possible to achieve the stated friction value.



Example:

	Friction value
Drive pinion (result of measurement)	= 320 Ncm ¹⁾
Differential (mean value)	= 70 Ncm
Friction value of differential + drive pinion = 390 Ncm	

