

Audi 100 1991 ➤

Automatic gearbox 097									
Gearbox ID	AEG	AEK	AEM	ANZ	APA	AZB	CBU	CEA	CFT
	CFX								

Edition 04.1998



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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi 100 1991 ➤

Automatic gearbox 097

Repair Group

00 - Technical data

32 - Torque converter

37 - Controls, Housing

38 - Gears, Hydraulic controls

39 - Final drive, Differential



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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Audi 100 1991 ➤

Audi Automatic gearbox 097 - Edition 04.1998

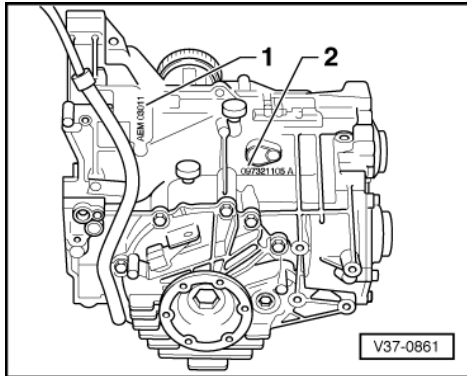


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00 - Technical data

1 - Identification of gearbox

1.1 - Identification of gearbox

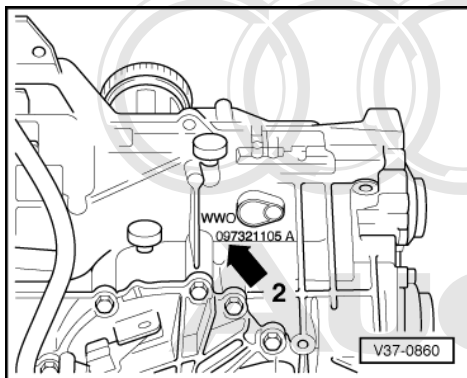


The "4-speed automatic gearbox 097" is installed in the Audi 100 1991 ä in combination with 4, 5 and 6 cylinder engine. Assignment => Page **2**

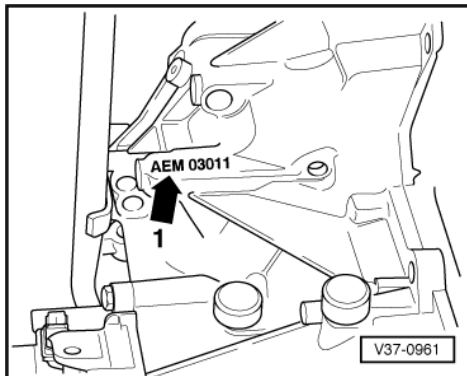
Location on gearbox

-> Code letters (arrow 1)

Automatic gearbox 097 (arrow 2)



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-> Code letters and date of manufacture of gearbox (arrow 1)

Example:

AEM	03	01	1
Code letters	Day	Month	Year (1991) of production

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

2 - Code letters, gearbox allocation, ratios, equipment

2.1 - Code letters, gearbox allocation, ratios, equipment

Automatic gearbox			097					
Gearbox	Code letters		AEK		AEM		ANZ	
	Production	From To	01.91 09.91		01.91 12.92		01.91 09.91	
Torque converter	Code letters		LBCA		LCCA		LBCA	
Valve body	Code letters		LAC		LAC		LAC	
	Production	From To	01.91 09.91		01.91 12.92		01.91 09.91	
Number of plates			Inner	Outer	Inner	Outer	Inner	Outer
	Clutch -K1-		5	4	5	4	5	4
	Clutch -K2-		5	5	5	5	5	5
	Clutch -K3-		5	4	5	4	5	4
	Brake -B1-		6	6	6	6	6	6
	Brake -B2-		6	7	6	7	6	7
Allocation	Model		Audi 100 1991 ä		Audi 100 1991 ä		Audi 100 1991 ä	
	Engine		2.3 l - 98 kW		2.8 l - 129 kW		2.3 l - 98 kW	

Gearbox	Code letters		AEK	AEM	ANZ
Ratios	1 st gear		2.714	2.714	2.714
	2 nd gear		1.551	1.551	1.551
	3 rd gear		1.000	1.000	1.000
	4 th gear		0.679	0.679	0.679
	R gear		2.111	2.111	2.111
Intermediate drive	No. of teeth	Input gear	42	44	42
		Output gear	53	51	53
	Ratio		1.261	1.159	1.261
Final drive	No. of teeth	Drive pinion	11	10	11
		Crown wheel	43	37	43
	Ratio		3.909	3.700	3.909
Drive shaft	Flange ø mm		130	130	130

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Automatic gearbox	097
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Gearbox	Code letters		APA		AZB 1)		CBU	
	Production	From To	01.91	09.91	05.91	12.92	09.91	12.92
Torque converter	Code letters		LACA		LCCA		LACA	
Valve body	Code letters		LAC		LAC		LAC	
	Production	From To	01.91	09.91	05.91	12.92	09.91	12.92
Number of plates			Inner	Outer	Inner	Outer	Inner	Outer
	Clutch -K1-		5	4	5	4	5	4
	Clutch -K2-		5	5	5	5	5	5
	Clutch -K3-		5	4	5	4	5	4
	Brake -B1-		5	5	6	6	5	5
	Brake -B2-		6	7	6	7	6	7
Allocation	Model		Audi 100 1991 ä		Audi 100 1991 ä		Audi 100 1991 ä	
	Engine		2.0 l - 74 kW, 85 kW		2.8 l - 129 kW		2.0 l - 85 kW	

1) US version

Gearbox		Code letters	APA	AZB 1)	CBU
Ratios	1 st gear		2.714	2.714	2.714
	2 nd gear		1.551	1.551	1.551
	3 rd gear		1.000	1.000	1.000
	4 th gear		0.679	0.679	0.679
	R gear		2.111	2.111	2.111
Intermediate drive	No. of teeth	Input gear	42	44	44
		Output gear	53	51	51
	Ratio		1.261	1.159	1.159
Final drive	No. of teeth	Drive pinion	11	11	9
		Crown wheel	43	38	38
	Ratio		3.909	3.455	4.222
Drive shaft	Flange ø mm		130	130	130

1) US version

Automatic gearbox			097						
Gearbox	Code letters		CEA		CFT 1)		CFX 1)		
	Production	From To	09.91 12.92		11.92		11.92		
Torque converter	Code letters		LBCA		LBCA		LACA		
Valve body	Code letters		LAC		LBA		LBA		
	Production	From To	09.91 12.92		11.92		11.92		
Number of plates			Inner	Outer	Inner	Outer	Inner	Outer	
			Clutch -K1-	5	4	5	4	5	4
			Clutch -K2-	5	5	5	5	5	5
			Clutch -K3-	5	4	5	4	5	4
			Brake -B1-	6	6	5	5	5	5
			Brake -B2-	6	7	6	7	6	7
			Allocation	Model	Audi 100 1991 ä		Audi 100 1991 ä		Audi 100 1991 ä



Engine	2.3 l - 98 kW	2.3 l - 98 kW	2.0 l - 85 kW
--------	---------------	---------------	---------------

1) Automatic gearbox for vehicles with modified selector elements, planetary gearbox and selection program.

Gearbox	Code letters	CEA	CFT 1)	CFX 1)
Ratios	1 st gear	2.714	2.714	2.714
	2 nd gear	1.551	1.441	1.441
	3 rd gear	1.000	1.000	1.000
	4 th gear	0.679	0.743	0.743
	R gear	2.111	2.884	2.884
Intermediate drive	No. of teeth	Input gear	44	44
		Output gear	51	51
	Ratio		1.159	1.159
Final drive	No. of teeth	Drive pinion	9	11
		Crown wheel	38	43
	Ratio		4.222	3.909
Drive shaft	Flange ø mm		130	130

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1) Automatic gearbox for vehicles with modified selector elements, planetary gearbox and selection program.

3 - Capacities

3.1 - Capacities

Planetary gearbox

Capacities	Planetary gearbox	Automatic gearbox
Fresh fill	5.4 ltr.	097
Oil change	approx. 2.3 l 1)	
Lubricant	VW ATF	

1) ATF replacement intervals for planetary gearbox

=> Maintenance Booklet

VW ATF is obtainable as a replacement part.

Container 0.5 ltr. -Part No. G 052 162 A1

Container 1.0 ltr. -Part No. G 052 162 A2

Checking/changing ATF => Page 30 .

Final drive

Capacities	Final drive	Automatic gearbox
Fresh fill	1.0 ltr.	097
Oil change	Filled for life No change	

Capacities	Final drive	Automatic gearbox
Lubricant	Gear oil SAE75 W90 (synthetic oil)	

Gear oil SAE 75 W90 (synthetic oil) is available as a replacement part

Container 0.5 ltr. -Part No. G 052 145 A1

Container 1.0 ltr. -Part No. G 052 145 A2

Checking oil level in final drive => Page **163** .

4 - General repair instructions

4.1 - General repair instructions

Notes:

- ◆ An exchange component which contains all the selector elements and the valve body is available for the automatic gearbox 097.
- ◆ The exchange component is assigned to the gearbox code letters => Page **2** onwards.
- ◆ Installation instructions:

=> Special information; Transmission; No. 10

The maximum possible care and cleanliness and proper tools are essential to ensure satisfactory and successful gearbox repairs. The usual basic safety precautions also naturally apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair operations, which are otherwise mentioned at various points in the Workshop Manual, are summarised here. They apply to this Workshop Manual.

Special tools

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For a complete list of special tools used in this Workshop Manual

=> Booklet; Special tools, Workshop equipment

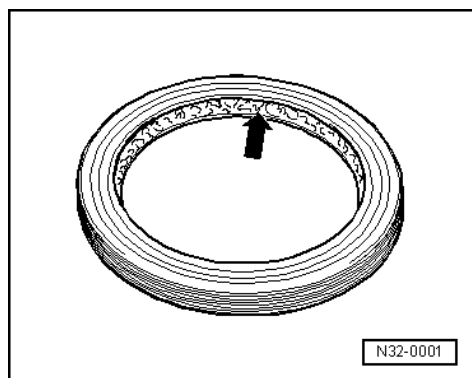
Gearbox

- ◆ Do not run the engine or tow the vehicle if the oil sump is removed or if the ATF has been drained from the gearbox.
- ◆ If the gearbox is removed from the vehicle, secure the torque converter to prevent it dropping out.
- ◆ Thoroughly clean all connections and the surrounding areas before disconnecting.
- ◆ When installing gearbox, ensure that the dowel sleeves are fitted correctly.
- ◆ Place removed parts on a clean surface and cover. Use sheeting and paper. Do not use fluffy cloths!
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components: Only remove replacement parts from packaging immediately prior to installation.
- ◆ Check and if necessary correct the following levels on replacing automatic gearbox: ATF in the planetary gearbox => Page **4** .

O-rings, seals, gaskets

- ◆ Always renew O-rings, seals and gaskets.
- ◆ After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.

- ♦ Thoroughly clean housing joint surfaces before assembling.



- ♦ -> Before installing oil seals (radial shaft seals), pack space between sealing lips -arrow- with grease.
- ♦ The open side of the seals must face the fluid against which the seal is to serve.
- ♦ Before installing, lightly lubricate outer circumference of seal and sealing lips with ATF or gear oil, depending on fitting location.
- ♦ Lightly oil O-rings before installing to prevent them being trapped and damaged when assembling.
- ♦ Use only ATF in the parts of the gearbox where ATF is the specified lubricant. Other types of lubricant can cause problems with the hydraulic actuation of the gearbox.
- ♦ After installation, check and if necessary correct the following levels in the area affected: ATF in the planetary gearbox => Page 4 .

Nuts, bolts

- ♦ Slacken the bolts in reverse sequence to the specified tightening sequence.
- ♦ Nuts and bolts which secure covers and housings should be slackened and tightened crosswise in stages if no tightening sequence is specified.
- ♦ Parts which are particularly sensitive to distortion (e.g. valve body) must be kept straight when removing and installing; loosen or tighten diagonally in stages.
- ♦ The tightening torques stated apply to non-oiled nuts and bolts.
- ♦ Replace self-locking bolts and nuts.
- ♦ Use a wire brush to clean the threads of bolts screwed in with a locking agent. Then apply AMV 185 101 A1 when inserting.
- ♦ Threaded holes into which self-locking bolts or bolts coated with locking fluid are screwed, must be cleaned (e.g. with a tap). Otherwise there is a danger of bolts shearing when subsequently being removed.

Locking elements

- ♦ Do not over- stretch circlips.
- ♦ Always replace circlips which have been damaged or over-tensioned.
- ♦ Circlips must be properly seated in the base of the groove.

Bearings

- ♦ Install needle bearings with the lettering on the bearing (the side with thicker metal) facing towards the drift or other tool used for installing.
- ♦ Lubricate bearings with gear oil or ATF, depending on fitting location. Do this particularly carefully when measuring frictional torque.
- ♦ Do not interchange the outer or inner races of bearings of the same size.
- ♦ Always replace the taper roller bearings on one shaft together and use new bearings from a single manufacturer.
- ♦ Heat inner races of taper roller bearings to approx. 100 °C before installing. Press in up to stop when installing so there is no axial clearance.

Shims

- ♦ Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain exact shim thickness required.
- ♦ Check for burrs and damage.

- ♦ Only install perfect, undamaged shims.

Inner plates

- ♦ Soak inner plates in ATF for 15 minutes before installing.

Valve body

- ♦ Replace the valve body if any of the selector elements are scorched.

Clutches

- ♦ Clutches K1, K2 and K3 are only to be dismantled for cleaning purposes; replace clutch if components are defective.
Clutches are assigned by way of gearbox code letters

Self-diagnosis

- ♦ Before performing repairs to the automatic gearbox, determine the cause of the fault as precisely as possible using the Self-diagnosis.

The self-diagnosis is described in the Booklet Audi 100 1991 ä, Automatic gearbox 097, Self-diagnosis.

=> Automatic gearbox 097, Self-diagnosis; Repair group 01;



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32 - Torque converter

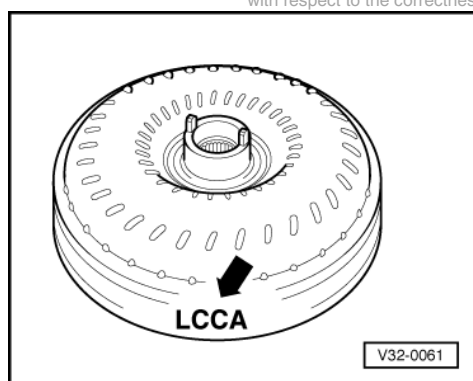
1 - Torque converter

1.1 - Torque converter

ATF pump is driven via the torque converter.

1.2 - Identification of torque converter

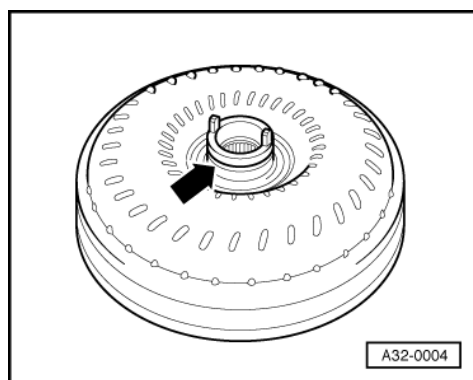
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-> There are various torque converters. They are identified by code letters (arrow).

Gearbox/torque converter allocation =>from Page 2

1.3 - Checking torque converter

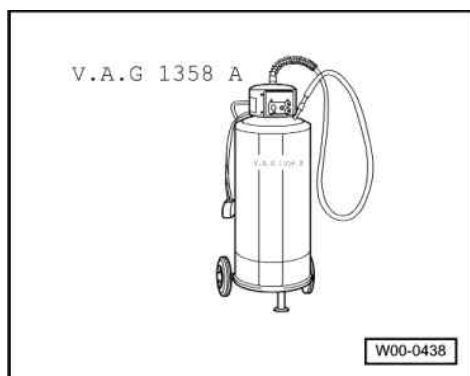


- -> Check torque converter hub -arrow- for scoring.

Note:

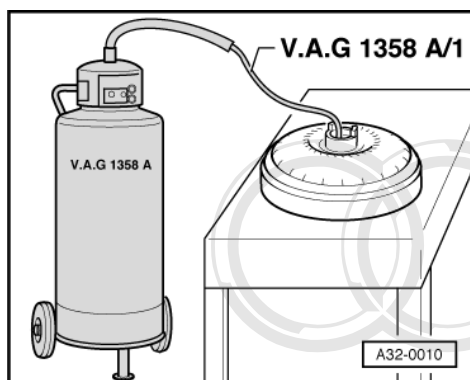
The torque converter must be completely replaced if damage or faults are detected.

1.4 - Draining torque converter



Special tools, testers and workshop equipment required

- ♦ V.A.G 1358 A Oil extractor

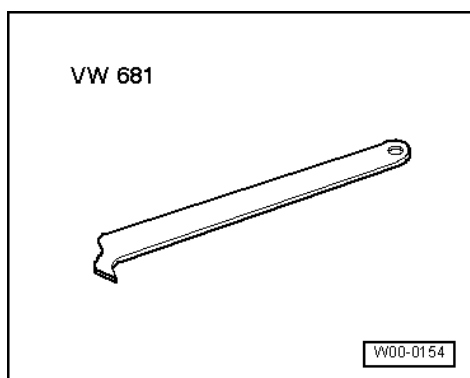


If the torque converter has become fouled by abrasion or when performing a major overhaul of the gearbox, drain the torque converter as follows:

- -> Extract ATF from torque converter using V.A.G 1358 A and probe V.A.G 1358 A/1.

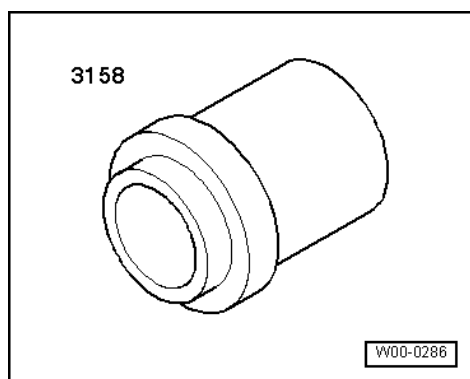
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1.5 - Replacing torque converter oil seal



Special tools, testers and workshop equipment required

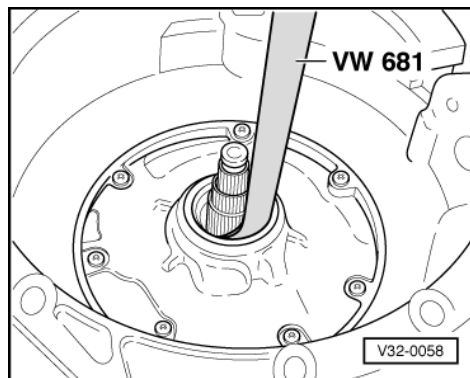
- ♦ VW 681 Oil seal extractor



- ♦ 3158 Drift sleeve

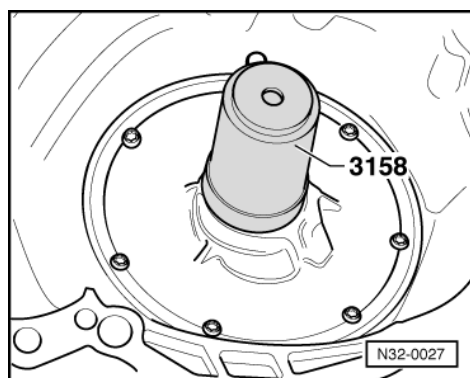
Removing

- Removing gearbox => Page 24 .



- Remove torque converter.
- Attach the gearbox to the repair stand => Page 49 or place on a level surface.
- -> Use the extraction lever VW 681 to remove the oil seal for the torque converter.

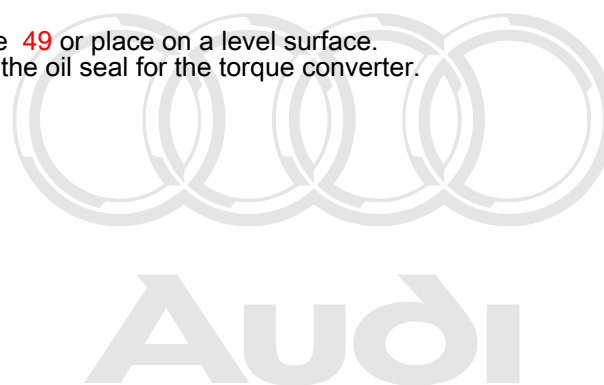
Installing



- Lightly lubricate outer circumference and sealing lips of seal with ATF.
- Installation position: Open side of the oil seal faces gearbox
- -> Use drift sleeve 3158 to push on oil seal for torque converter up to the stop.

1.6 - Installing torque converter

- Push the torque converter hub through the oil seal as far as the first stop.



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- Exerting slight pressure, turn converter inwards until converter hub recess engages in driver of pump gear and converter is felt to slide inwards.

Warning

If the torque converter is incorrectly inserted, the driver of the torque converter or the ATF pump will be severely damaged when the gearbox is attached to the engine.



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37 - Controls, Housing

1 - Servicing shift mechanism

1.1 - Servicing shift mechanism

Warning

Before working on engine when it is running, move selector lever into position "P" and apply handbrake.

1.2 - Checking shift mechanism

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Selector lever in position "P" and ignition key in removal position:

- It must only be possible to remove ignition key in this position.
- Selector lever cannot be shifted out of position "P" with ignition key removed.

Selector lever in "P" position and ignition switched on:

- Brake pedal not depressed:

The selector lever is locked and cannot be moved from the "P" position. The solenoid for the selector lever lock locks the selector lever.

- Brake pedal depressed:

The solenoid for the selector lever lock releases the selector lever. It is possible to shift into a driving gear. Slowly shift the selector lever from "P" through "R, N, D, 3, 2" checking whether the selector lever position in the dash panel insert is the same as the selector lever position.

Selector lever in "N" position and ignition switched on:

- Brake pedal not depressed:

Selector lever is locked and cannot be shifted out of "N" position. The solenoid for the selector lever lock locks the selector lever.

- Brake pedal depressed:

The solenoid for the selector lever lock releases the selector lever. It is possible to shift into a driving gear.

Notes:

- ♦ The starter must not operate in the selector lever positions "1", "2", "3", "D" and "R".
- ♦ At speeds over 5 km/h and with the selector lever set to "N", the solenoid for the selector lever lock should not engage and should lock the selector lever. It should be possible to shift the selector lever into a gear.
- ♦ When travelling at speeds below 5 km/h (almost stopped) and shifting into selector lever position "N", solenoid for selector lever lock must not engage until after approx. 1s. It is then only possible to shift the selector lever out of "N" if the brake pedal is depressed.

1.3 - Dismantling and assembling shift mechanism

Dismantling the shift mechanism involves the following work:

- ◆ Remove front centre console for work on selector lever housing (gate), selector lever lock solenoid or locking cable

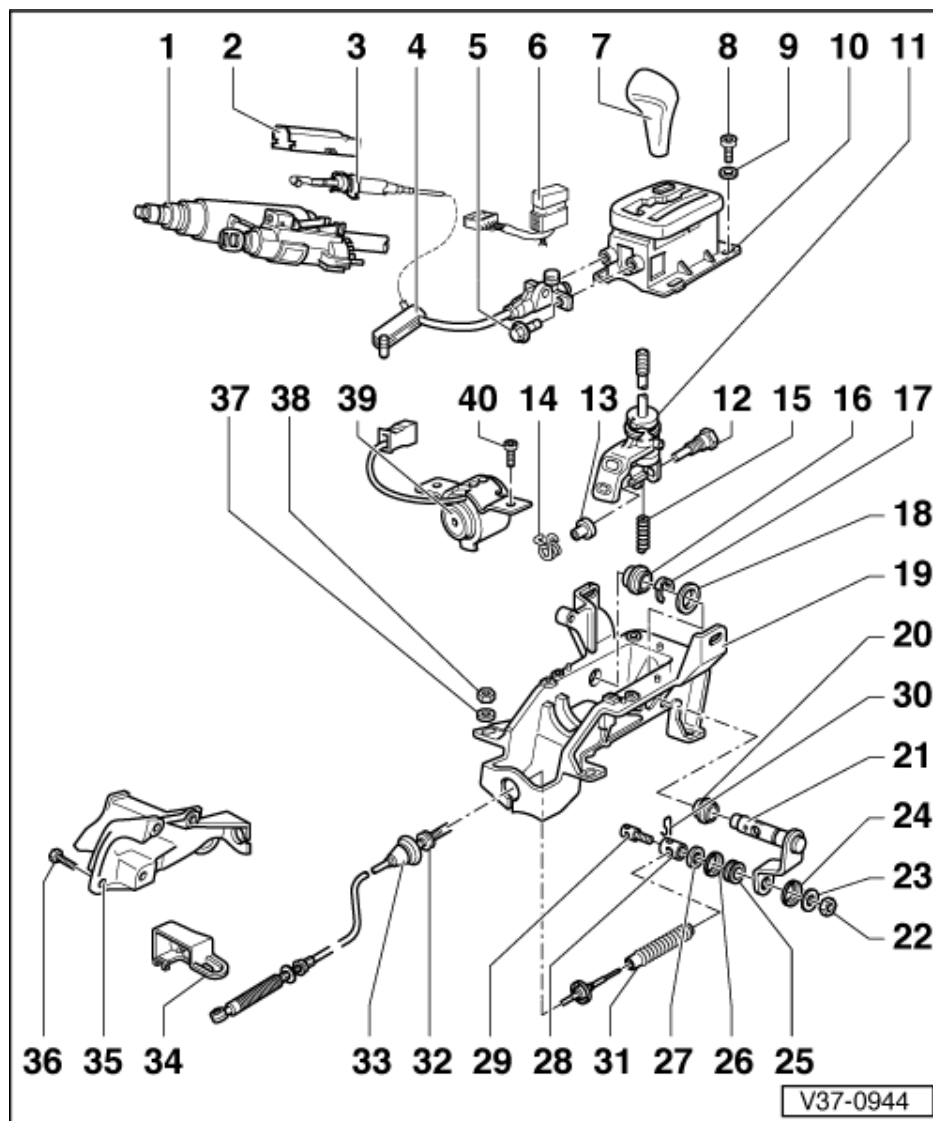
=> General body repairs; Repair group 70; Dash panel, Removing and installing rear centre console Dash panel, Removing and installing rear centre console

=> General body repairs; Repair group 70; Dash panel; Removing and installing the front centre console Dash panel Removing and installing the front centre console

- ◆ Additionally remove steering wheel and dash panel insert to replace locking cable

=> Electrical system; Repair group 94; Removing and installing steering column switch Removing and installing steering column switch

=> Electrical system; Repair group 90; Dash panel; Removing and installing dash panel insert Dash panel Removing and installing dash panel insert



- 1 Ignition switch
- 2 Trim cap
- 3 Locking cable



- ♦ For ignition key removal lock
- ♦ Must not be kinked
- ♦ Removing and installing => Page 20
- ♦ Adjusting => Page 22

4 Clamp

5 Bolt, 9 Nm

6 Program switch -E122

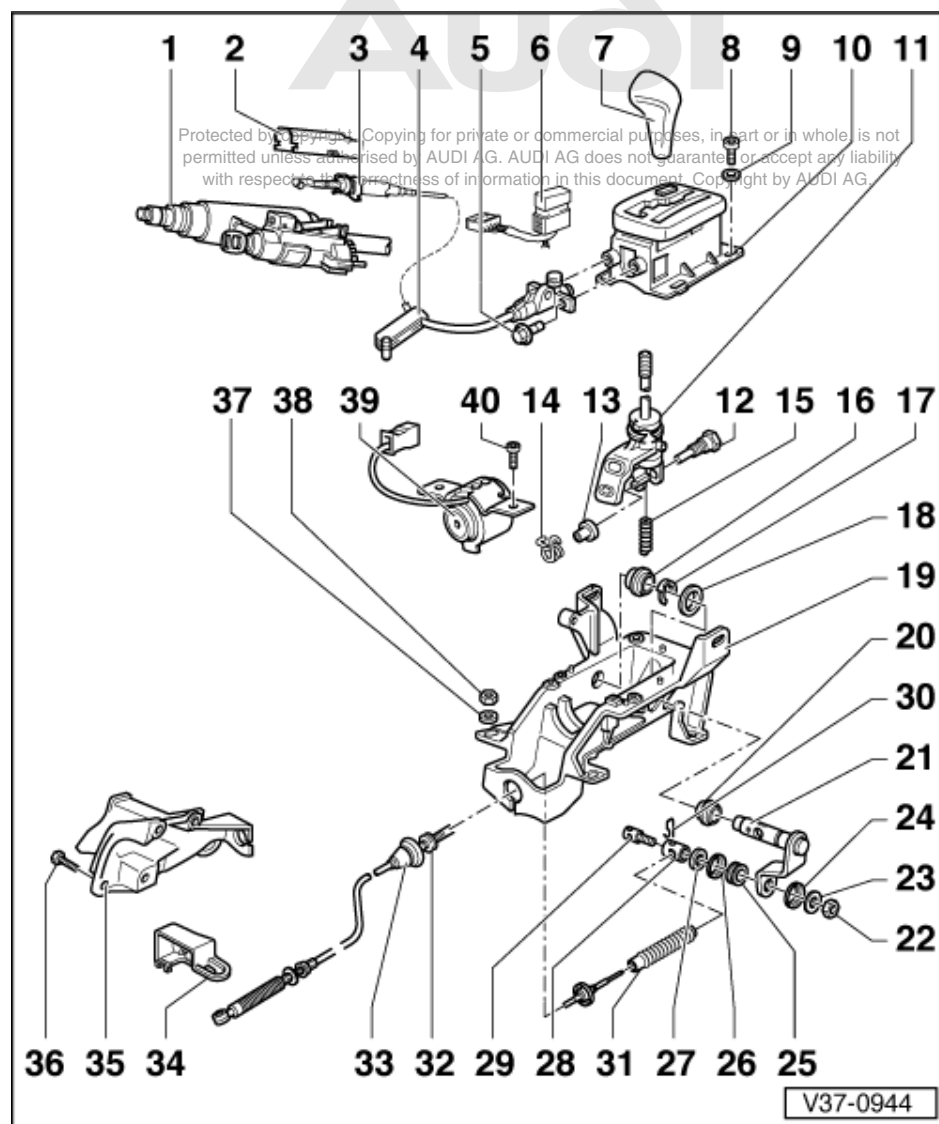
- ♦ Can be tested in the vehicle by self-diagnosis

=> Automatic gearbox 097, Self-diagnosis; Repair group 01; Performing self-diagnosis Performing self-diagnosis

7 Selector lever knob

8 Bolt, 9 Nm

9 Washer



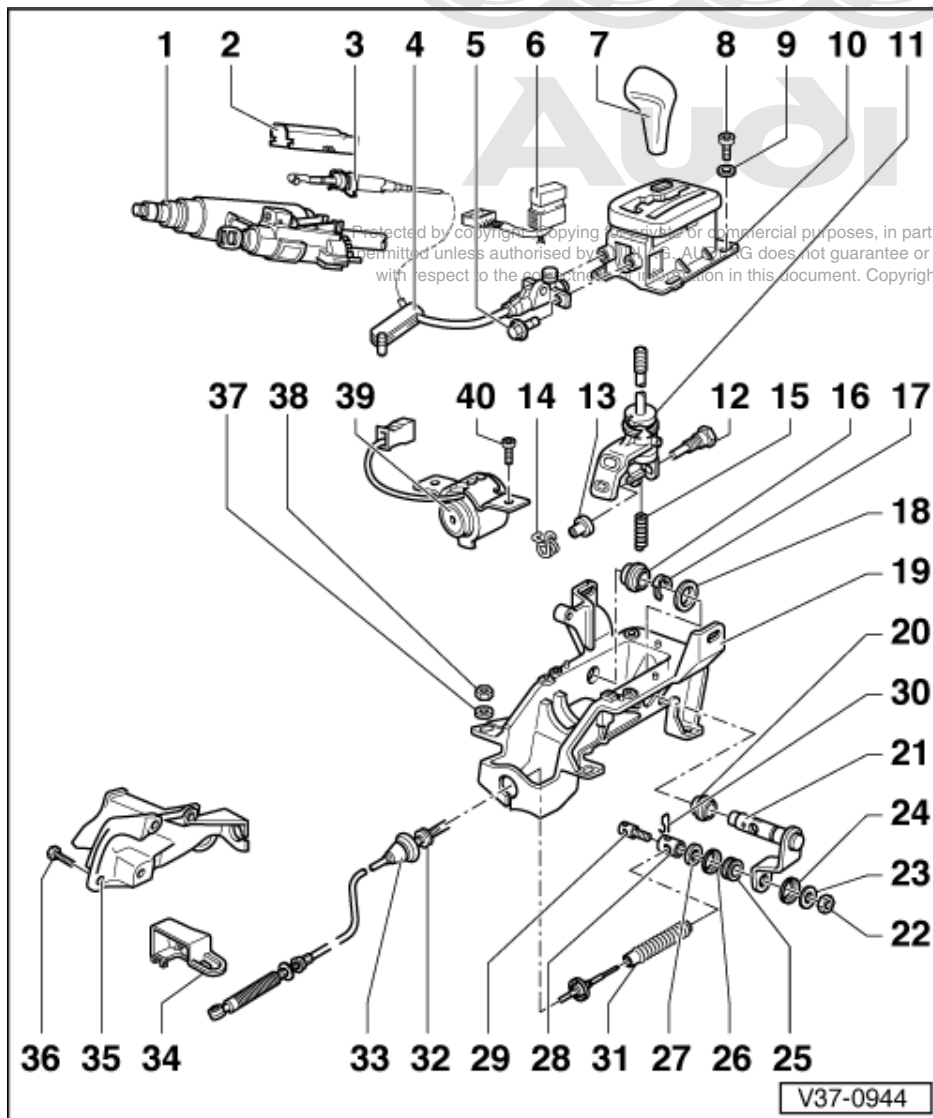
10 Selector lever housing (gate)

- ♦ Unscrew locking cable at selector lever housing before removing selector lever housing
- ♦ Install after adjusting selector lever lock solenoid -N110
- ♦ Aligning
=> Fig. 20

11 Selector lever

- ♦ With fork for locking selector lever position "P" and "N" as well as detent for releasing ignition key by means of locking cable in selector lever position "P"

- ♦ Checking gap between selector lever and selector lever lock solenoid -N110 => Fig. 20
- 12 Guide pin, 22 Nm**
 - ♦ Install after inserting compression spring -Item 15 -



13 Bushing

- ♦ For torsion spring -Item 14 -

14 Torsion spring

15 Compression spring

- ♦ Insert in selector lever before installing guide pin -Item 12 -

16 Bushing

- ♦ Grease with G 000 660 after installation

17 Lock washer

- ♦ Install after inserting shift mechanism lever -Item 21 -

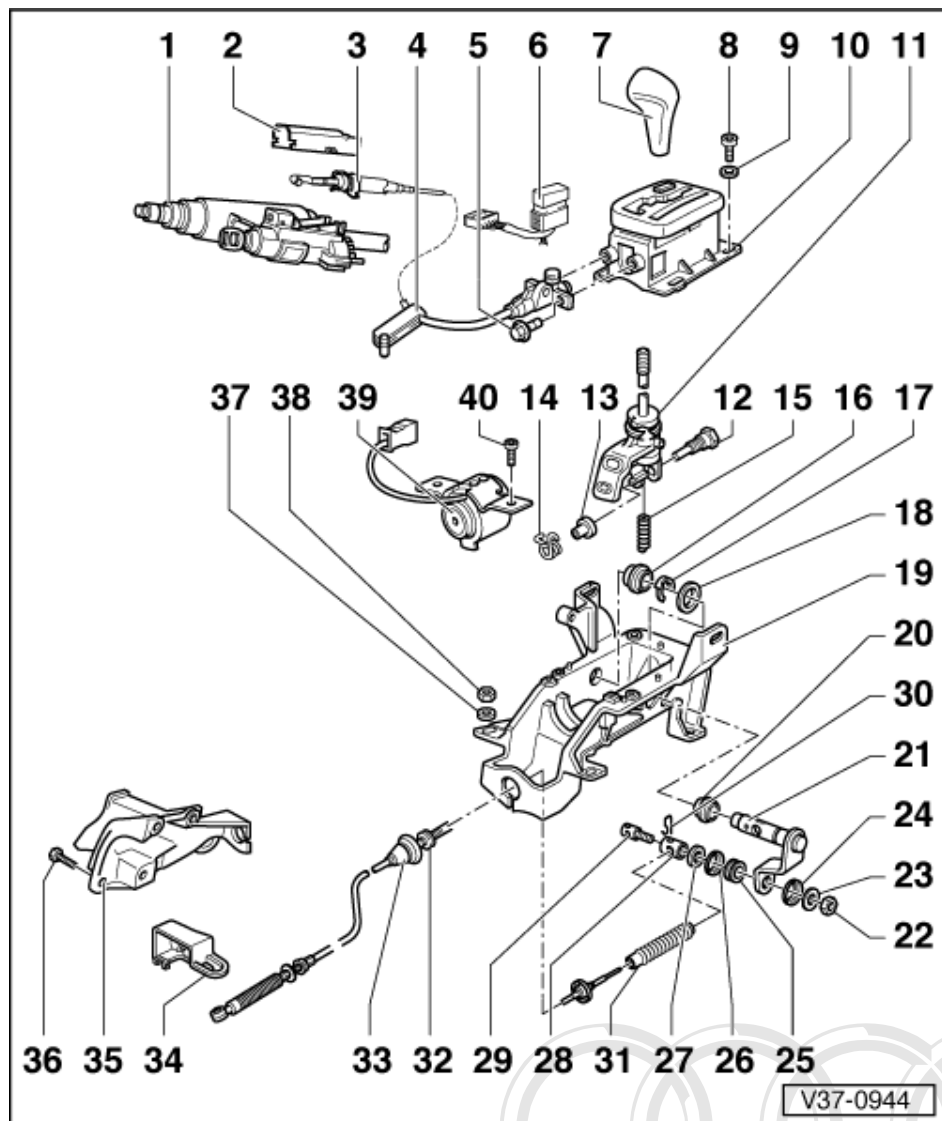
18 Washer

19 Gearshift mounting

20 Bushing

- ♦ Grease with G 000 660 after installation

21 Shift mechanism lever



22 Nut, 20 Nm

23 Washer

24 Sealing collar

25 Bushing

- ♦ Insert in shift mechanism lever -Item 21 -

26 Sealing collar

27 Washer

28 Clamping sleeve

- ♦ For selector lever cable

29 Clamping pin

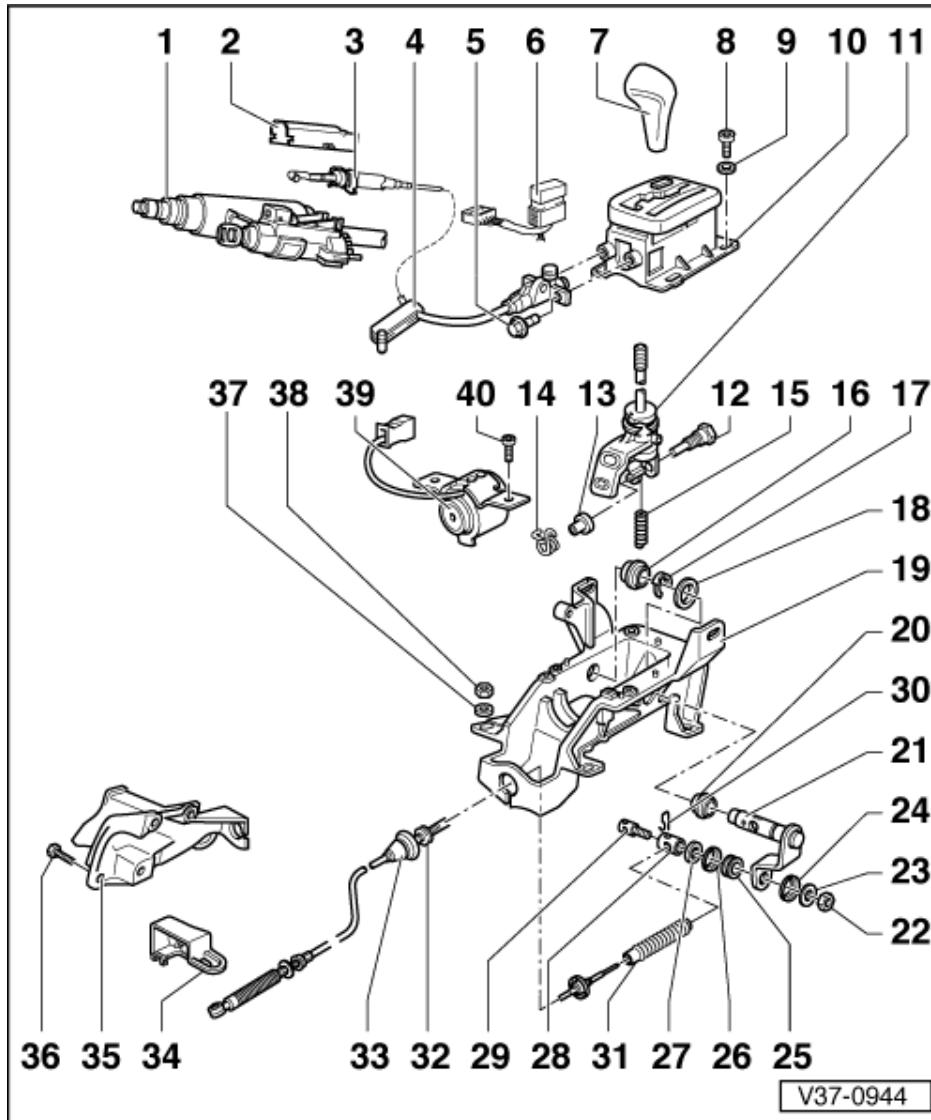
- ♦ For selector lever cable

30 Spring clip

31 Bellows

- ♦ Replace if damaged
- ♦ Ensure correct installation position

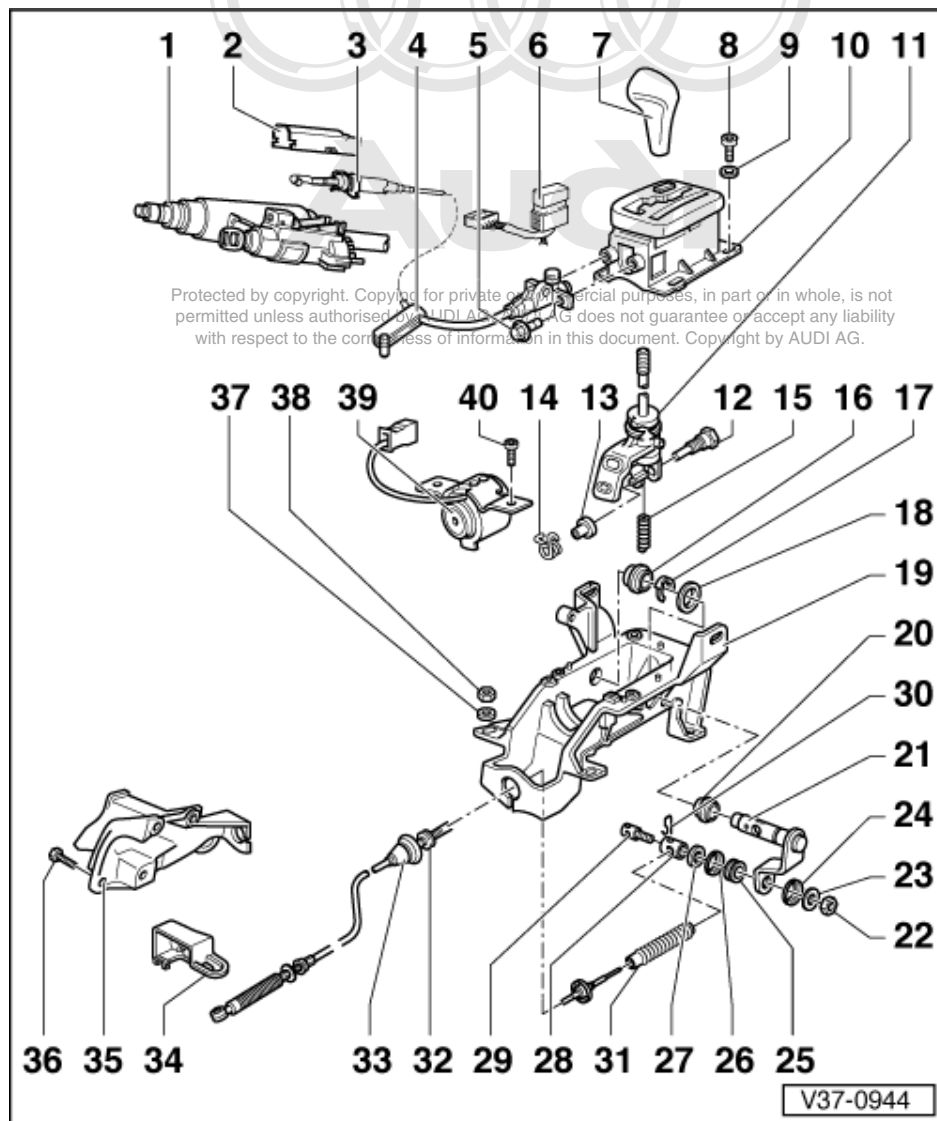
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32 Selector lever cable

- ◆ With guide and bushing
- ◆ Ensure correct installation of bellows for selector lever cable to prevent ingress of moisture into cable
- ◆ Insert screw fastenings at support brackets with locking fluid AMV 185 101 A1.
- ◆ Tighten selector lever cable to 13 Nm at support brackets
- ◆ Check tightness of guide tube
- ◆ Do not bend or kink, lightly grease ball socket before installing
- ◆ Adjusting:
 - Move selector lever to position "P".
 - Unfasten nut at clamping element for selector lever cable.
 - Move operating lever on gearbox to position "P" (to rear as far as stop).
 - Tighten nut -Item 22 - of clamping pin to 20 Nm in this stress-free gear selector cable position.

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33 Grommet

- ♦ Replace if damaged

34 Securing clip

- ♦ Remove before prising out selector lever cable
- ♦ Always replace bent fastener

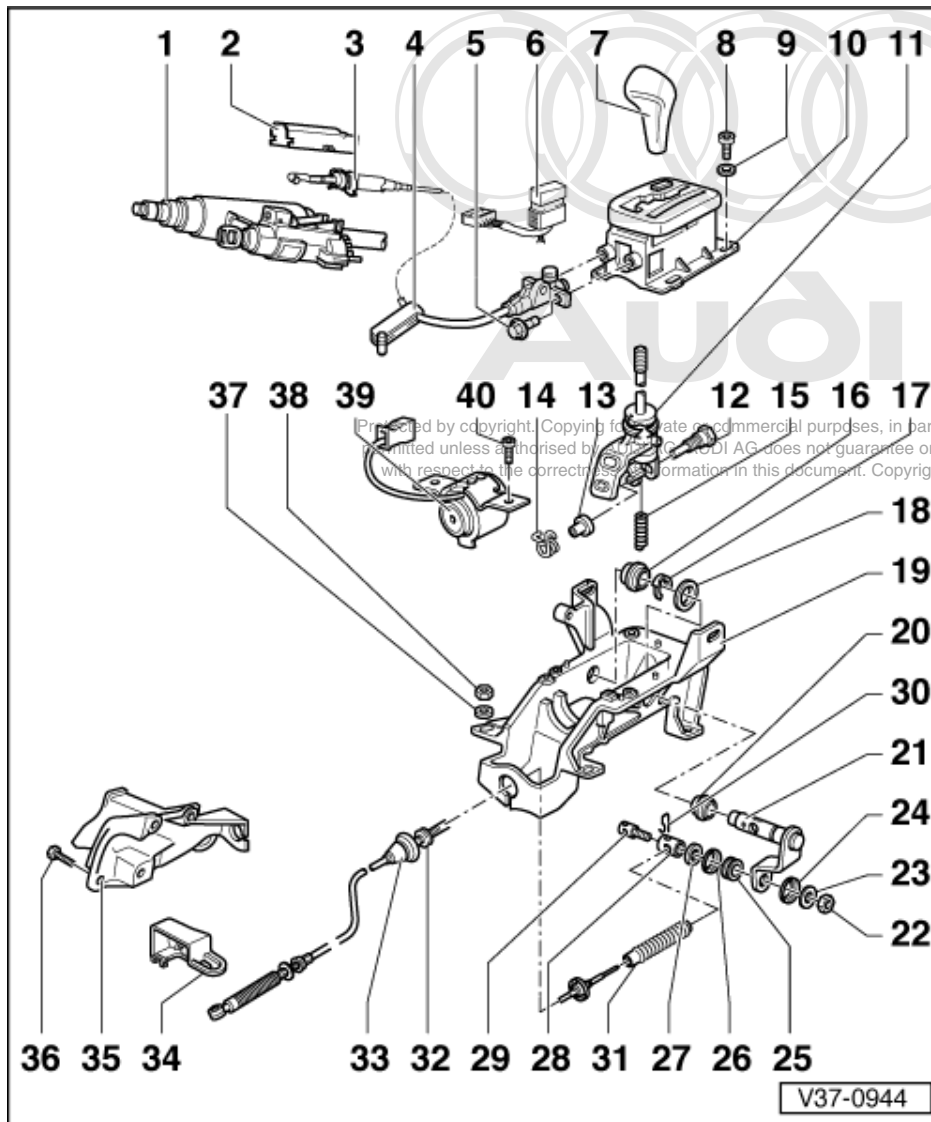
35 Final drive support

- ♦ With support bracket for selector lever cable

36 Bolt, 40 Nm

37 Washer

38 Nut, 10 Nm



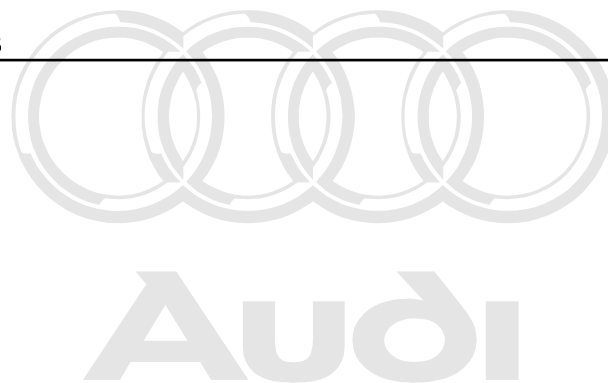
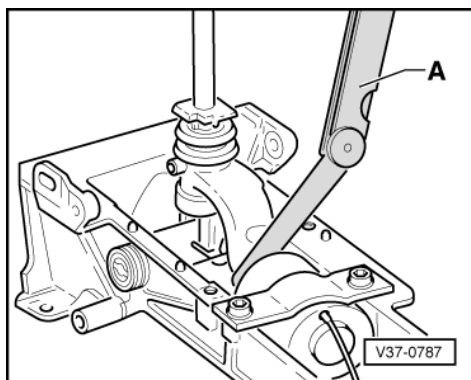
39 Selector lever lock solenoid -N110-

- ♦ Can be checked in electrical test and in measured value block

=> Automatic gearbox 097, Self-diagnosis; Repair group 01, Performing self-diagnosis; Read measured value block Read measured value block

- ♦ Installation:
 - Press solenoid with catch in axial direction against shift mechanism mount and tighten bolts of solenoid.
 - Switch on ignition after installing shift mechanism; solenoid blocks selector lever in position "P" and "N" ; selector lever can be shifted out of position "P" or "N" with brake pedal pressed.
 - Checking gap between selector lever and solenoid => Fig. 20 .

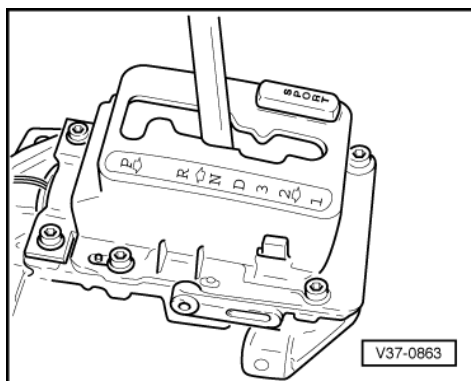
40 Bolt, 10 Nm



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-> Fig.1 Checking gap between selector lever and selector lever lock solenoid -N110

- In selector lever position "R", use feeler gauge -A- to measure gap between selector lever and selector lever lock solenoid.
 - Specification: 0.6 ... 1.4 mm
- Alter gap if necessary by moving solenoid in mounting holes.



-> Fig.2 Aligning selector lever housing with selector lever

- After installing selector lever lock solenoid, centrally align lower hole in fork with solenoid and apply voltage to solenoid.
- Fit selector lever housing (gate). Selector lever must be opposite position "N" on selector lever housing.
- After screwing on selector lever housing, shift selector lever through all positions and check whether "P" and "1" stops are reached.

1.4 - Removing/installing and adjusting locking cable

Note:

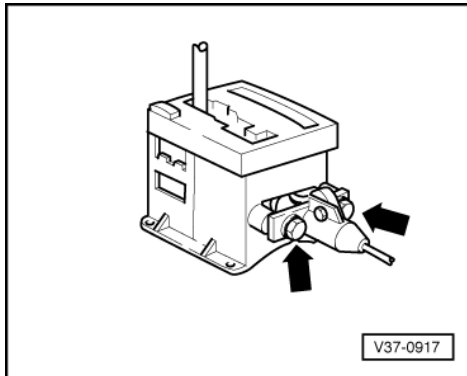
After attaching locking cable to ignition/starter switch, adjust locking cable => Page 22 and then fasten to selector lever housing.

Removing

- Removing centre console

=> General body repairs; Repair group 70; Dash panel, Removing and installing rear centre console Dash panel, Removing and installing rear centre console

=> General body repairs; Repair group 70; Dash panel; Removing and installing the front centre console Dash panel Removing and installing the front centre console

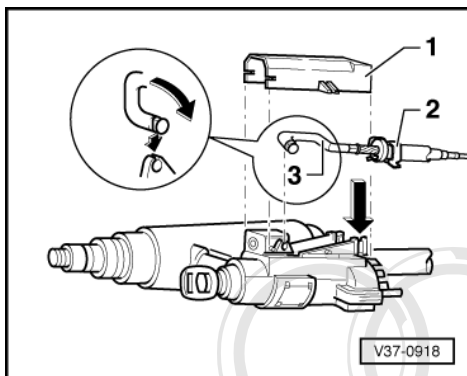


- Removing steering wheel and dash panel insert

=> Electrical system; Repair group 94; Removing and installing steering column switch Removing and installing steering column switch

=> Electrical system; Repair group 90; Dash panel; Removing and installing dash panel insert Dash panel Removing and installing dash panel insert

- Move selector lever to position "N".
- -> Loosen hexagon bolts -arrows-.



- -> Remove trim cap -1-.
- Unfasten spring clip -2-.
- Swivel locking cable -3- by approx. 90° and lift out of fastening lug at ignition/starter switch.
- Detach clip for locking cable at air duct and remove locking cable.

Installing

Install in reverse order, paying attention to the following:

- Insert locking cable from above into fastening lug at ignition/starter switch (flattened side of locking cable and fastening lug must be aligned) and swivel locking cable downwards through approx. 90°.
- Fit spring clip.

Note:

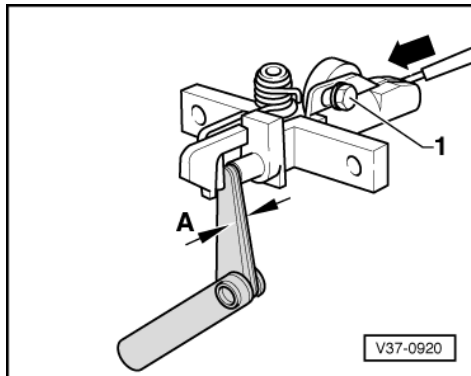
Ensure spring clip engages properly, as otherwise cap cannot be fitted.

- Fit trim cap over ignition/starter switch.

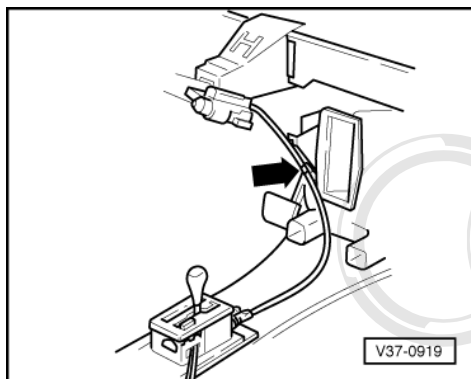
Adjusting

Note:

Locking cable must be adjusted in installation position.



- -> Slacken off bolt -1-.
- Turn ignition/starter switch to "Drive" position.
- Fix locking-cable support bracket in front of selector lever housing (gate) in screw-on position.
- Position feeler gauge -A- (1.5 mm) between locking flap and locking pin.
- Adjust locking cable by moving it in arrow direction such that locking pin is pressed against feeler gauge.
- Tighten bolt -1- to 10 Nm in this position.
- Turn ignition/starter switch several times to removal/"drive" position.
- Re-check dimension between locking pin and locking flap.
 - Specification: 1.4 ... 1.7 mm
- Move selector lever to position "N".
- Install locking cable at selector lever housing (gate).



- -> Make sure there are no kinks in locking cable.

Functional check

- Shift selector lever to position "P" and turn ignition key to removal position:
 - Selector lever must be blocked in position "P".
 - The ignition key can be removed.
- Turn ignition key to "drive" position and shift selector lever to position other than "P"; turn ignition key to removal position; press down selector lever and shift to position "P"; keep lever pressed down and shift back to position other than "P":
 - It must only be possible to remove ignition key.

2 - Checking gearbox

2.1 - Checking gearbox

2.2 - Performing self-diagnosis

Notes:

- ♦ Always start by performing self-diagnosis to determine cause of trouble

=> Automatic gearbox 097, Self-diagnosis; Repair group 01; Performing self-diagnosis Performing self-diagnosis

- ♦ The automatic gearbox is only to be checked as described in "Fault finding. Transmission" binder, after having first completed the self-diagnosis and the cause of damage cannot be located and rectified.

2.3 - Checking shift points

=> Binder "Fault recognition. Transmission"; No. 13

2.4 - Fault finding table for "4-speed automatic gearbox"

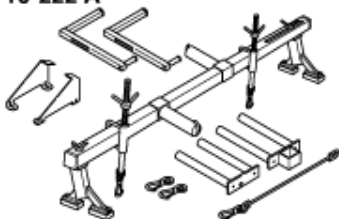
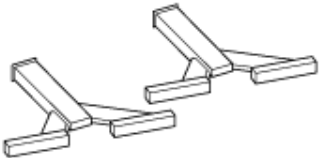
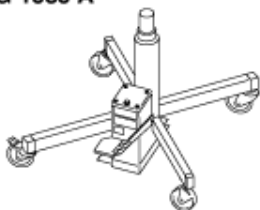
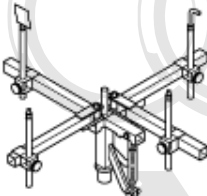
=> Binder "Fault recognition. Transmission"; No. 14

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3 - Removing and installing gearbox

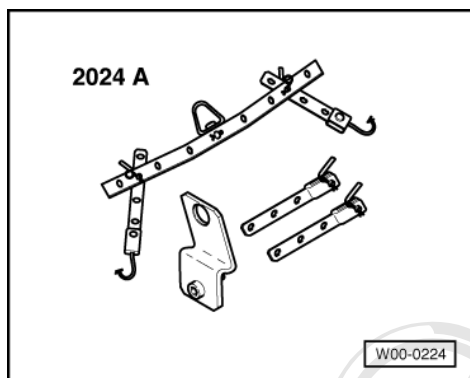
3.1 - Removing and installing gearbox

10-222 A 	10-222 A/1 
V.A.G 1383 A 	3282 
3282/1...24 	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG. W34-0016

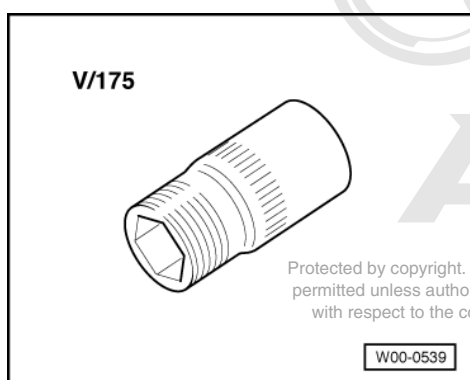
Special tools, testers and workshop equipment required

- ♦ 10-222 A Support bar
- ♦ 10-222 A/1 Support
- ♦ V.A.G 1383 A Engine/Gearbox jack
- ♦ 3282 Gearbox support
- ♦ 3282/2 Adjustment plate

Special tools, testers and workshop equipment required



- ♦ 2024 A Lifting tackle

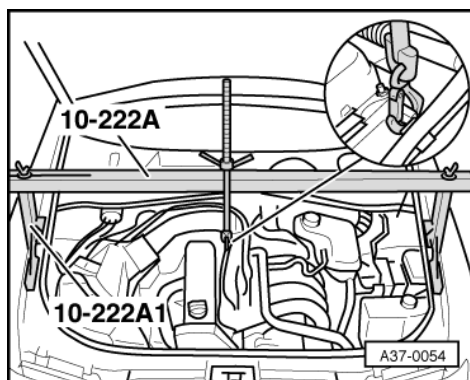


- ♦ V/175: Wrench socket

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Removing

- Observe or obtain radio code on vehicles with coded radio.



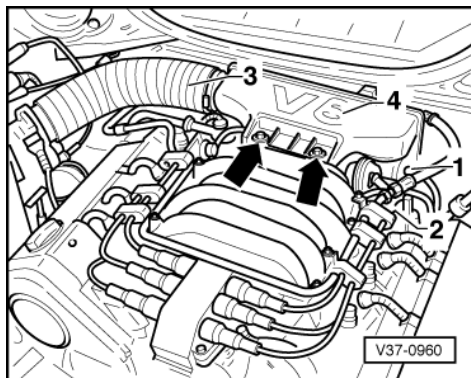
- With ignition switched off disconnect battery earth strap.
- Disconnect speedometer connector at gearbox.

Vehicles with 4 and 5-cyl. engine

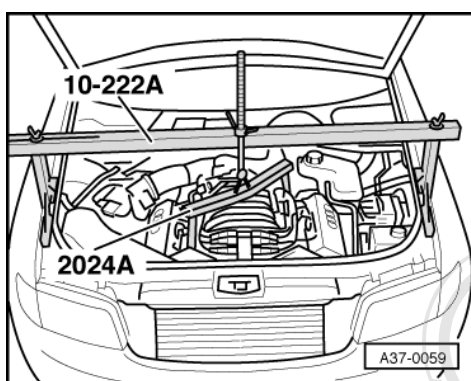
- -> Fit support bar 10-222 A with supports 10-222 A/1 and support engine/gearbox in this position.

Vehicles with 6-cyl. engine

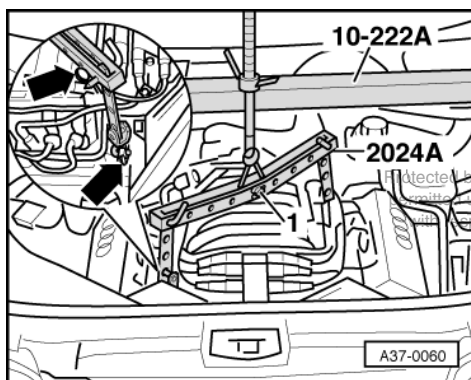
- Remove engine cover.



- -> Pull off vacuum hoses -1- and -2-.
- Remove air duct hose -3- and screw out bolts -arrows-.
- Remove noise insulation -4-.

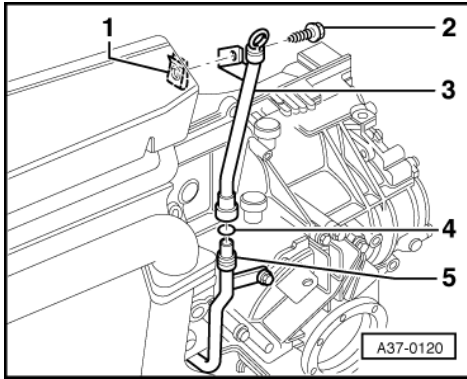


- -> Set up support bar 10-222 A on wing panel flanges. Spindle is at front.



- -> Dismantle lifting eye from lifting tackle 2024 A. Re-insert pin -1- in centre hole on lifting tackle and secure with locking pin.
- Engage pin on lifting tackle 2024 A on spindle of support bar 10-222 A.
- Engage lifting tackle 2024 A at front right and rear left of engine; to do so, pull spark-plug connectors off cylinders 1 and 6.
- Secure hooks and locating pins of lifting tackle with locking pins -arrows in magnified view-.
- Pre-tension spindle of support bar 10-222 A.

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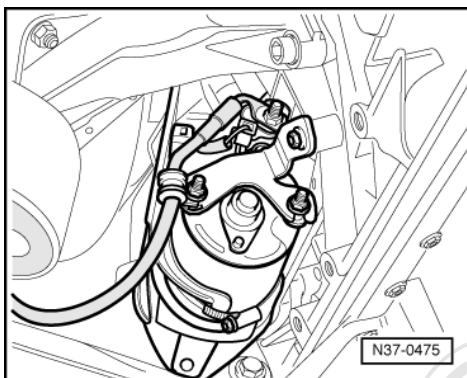


Vehicles with split ATF filler pipe:

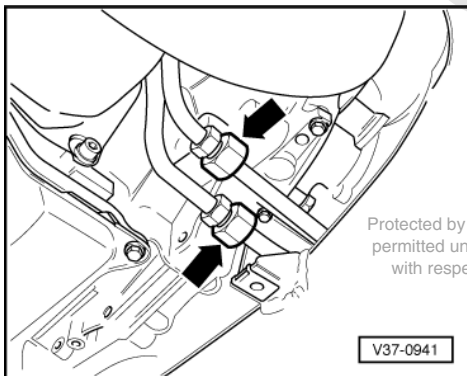
- -> Unfasten bolt -2- and pull upper ATF filler pipe -3- off lower ATF filler pipe -5-.
- Then seal off lower ATF filler pipe with clean, non-fibrous cloth.

Continued for all vehicles

- Remove upper engine/gearbox connecting bolts.
- Remove noise insulation tray.
- Remove noise insulation tray bracket.
- Remove protective plate for drive shaft.
- If fitted, remove bodywork cross piece beneath exhaust system.

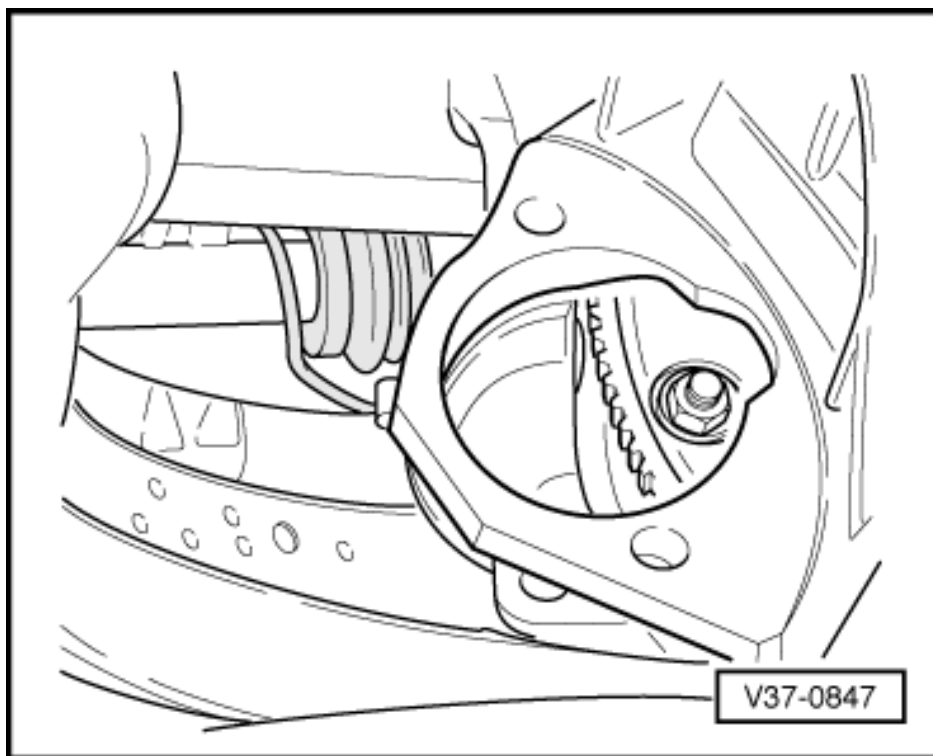


- Removing front exhaust system with catalytic converter => Repair group 26 of respective engine workshop manual.
- Disconnect drive shafts at flanges and tie up.
- -> Remove starter.

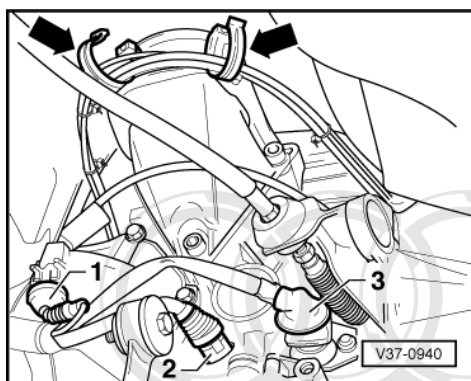


- Place drip tray V.A.G 1306 underneath the gearbox.
- -> Detach ATF pipes at connection point -arrows-.

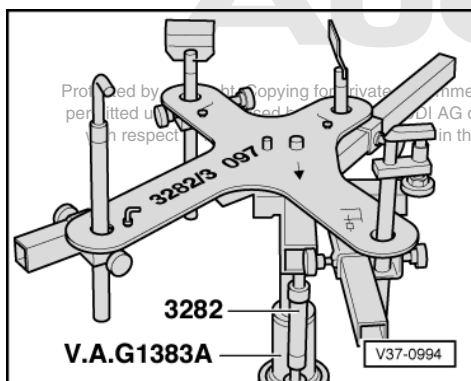
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- -> Unscrew 3 torque converter nuts through starter opening using Matra V175 15 mm A/F socket attachment (turn crankshaft 1/3 turn each time).



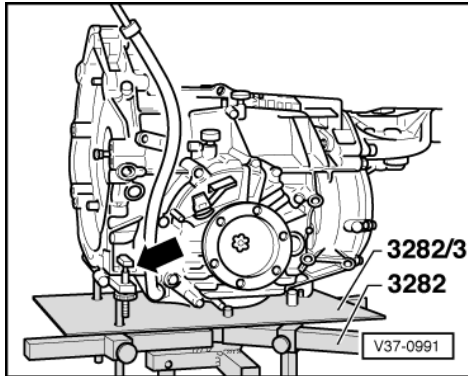
- Unscrew protective plate for multi-function switch
- -> Pull off connectors -1 ... 3- at rear of gearbox.
- Unhook -arrows- cable holders for procon-ten system at gearbox and press cables upwards.



- -> Set up gearbox support 3282.

The gearbox mount 3282 is set up with the adjusting plate 3282/2 for removing the automatic gearbox 097.

The symbols on the adjusting plate indicate the mounts required, the arrow points forward.

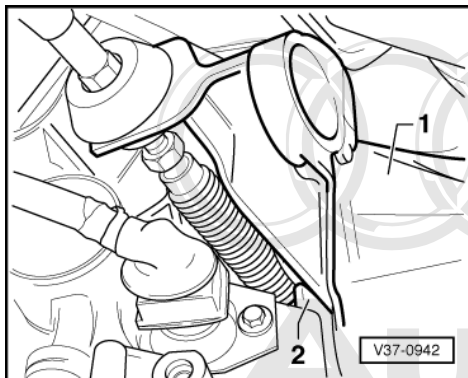


- -> Move jack V.A.G 1383 A with gearbox support 3282 under the gearbox and support gearbox.
- Align adjustment plate parallel to gearbox and lock safety support -arrow- on gearbox.

Note:

If gearbox support 3282 is not available, gearbox can be removed and installed using gearbox lifter V.A.G 1383 A and universal support V.A.G 1359/2.

- Unscrew bolts for right and left gearbox supports and lower gearbox slightly.



- -> Unscrew right gearbox support -1- at gearbox.
- Unhook fastener -2- at end of selector lever cable; press ball socket of selector lever cable off gear selector lever.
- Disengage selector lever cable from gearbox support.
- Lay selector lever cable to one side.
- Remove lower engine/gearbox connecting bolts.
- Press gearbox off engine; when doing this, press torque converter out of drive plate.
- Press torque converter against ATF pump.
- Lower gearbox slightly.
- Secure torque converter to prevent it falling out.

Installing

Install in reverse order, paying attention to the following:

Note:

Before installing exchange gearbox clean ATF pipes and ATF cooler => Page 42 .



- Before installing gearbox, ensure that torque converter has been correctly inserted into gearbox => Page 10.
- Before installing gearbox, ensure that dowel sleeves at cylinder block are positioned correctly.
- To secure torque converter on drive plate only use correct nuts as specified in the parts catalogue.

=> Parts catalogue

- Tighten torque converter nuts with Matra V175 15 mm A/F socket attachment.
- Adjusting gate selector cable => Page 17 onwards.
- Check oil level in final drive of automatic gearbox => Page 163.
- Checking ATF level => Page 30

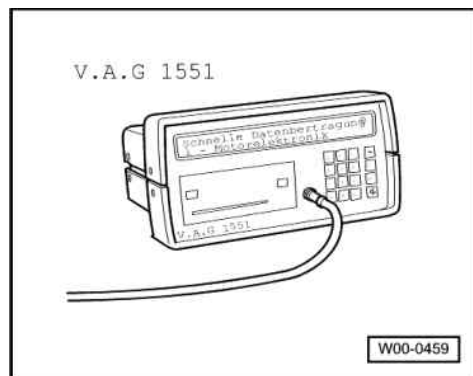
Tightening torques

Component	Nm
Drive plate to torque converter	60
ATF pipe to ATF pipe	40
Gearbox support to gearbox	40
Gearbox support to subframe	40
Drive shaft to gearbox	40
	M8 40
	M10 80
Gearbox to engine	M12 80
	M10 45

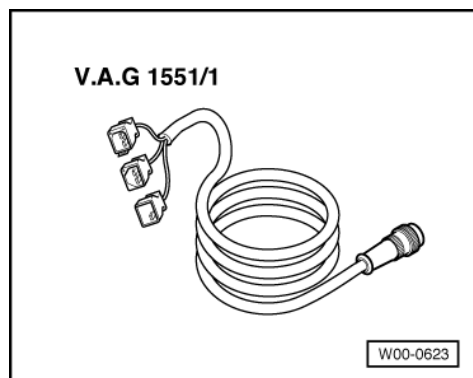
4 - Checking and topping up ATF level

4.1 - Checking and topping up ATF level

Special tools, testers and workshop equipment required



- ♦ -> V.A.G 1551 fault reader



- ♦ -> V.A.G 1551/1 line

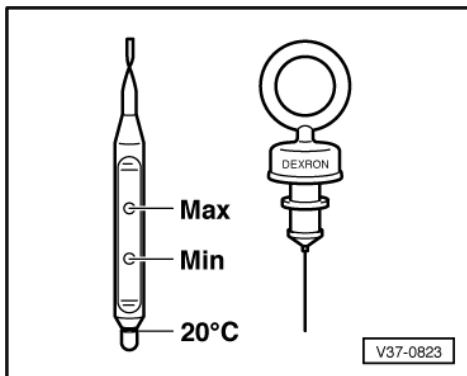
Additionally required information

- ♦ Workshop manual Audi 100 1991 ä, Automatic gearbox 097 self-diagnosis

4.2 - Checking ATF level

Test requirements:

- Vehicle must be level (horizontal)
- The gearbox must not be in emergency running mode.



- Selector lever set to "P" and engine must be running at idling speed.
- -> ATF must be filled as far as 20 oC-mark when cold
- Connect fault reader V.A.G 1551 and enter address word "02 Gearbox electronics" and advance until "Select function XX" is indicated on display

=> Automatic gearbox 097; Repair group 01; Performing self-diagnosis; Connecting fault reader V.A.G 1551 (or V.A.G 1552) and selecting function Performing self-diagnosis Connecting fault reader V.A.G 1551 (or V.A.G 1552) and selecting function

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Enter "08" to select the function "Reading measured value block" and confirm entry with Q key.

-> Indicated on display:

Reading measured value block
Enter display group number XXX

- Enter "005" to select Display group number "005" and confirm entry with Q key.

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-> Indicated on display:

Read measured value block	5
30 oC 0011011 0 900 rpm	

- Read off ATF temperature in display zone 1.
- ATF must be at operating temperature (approx. 60 oC).

Check ATF level again and top up/drain off.
ATF level must be between min. and max. mark.



Warning

An insufficient ATF filling as well as filling to excess affects the function of the gearbox. ATF level is therefore to be checked at regular intervals.

4.3 - Topping up ATF

Note:

Excess ATF would cause malfunctions and must therefore be drawn off again. This can be done using probe V.A.G 1358 A/1 and V.A.G 1358A.

- Pour in ATF using funnel (for new fill, initially approx. 3 ltr.).
- Then start engine and shift through all the selector lever positions with the vehicle stationary.
- Checking ATF level => Page **30**.
- Use non-fibrous cloth to wipe over dipstick.

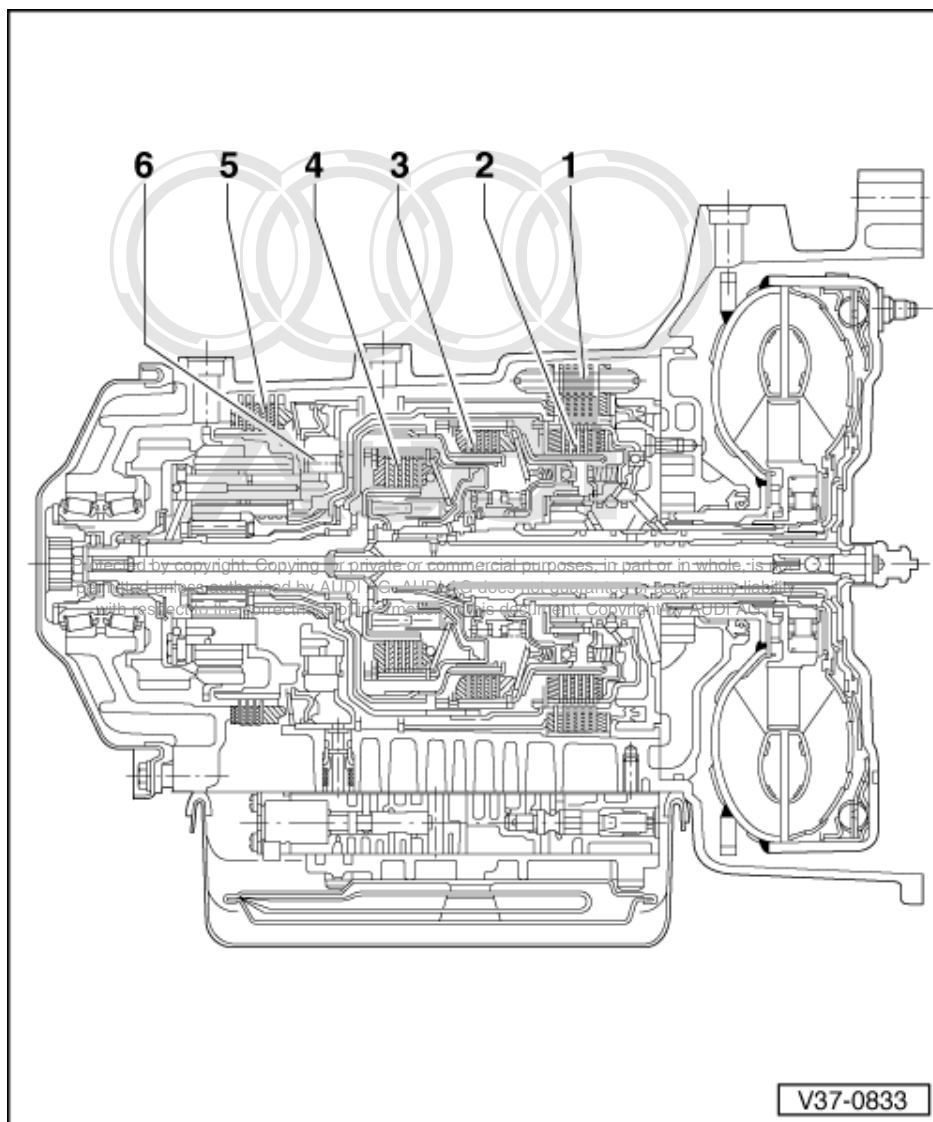
The ATF level will vary according to the temperature of the ATF. The min. and max. -marks on the ATF dipstick are referenced to an ATF temperature of 60 °C.



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5 - Gearbox with selector elements up to 11.92

5.1 - Gearbox with selector elements up to 11.92



Position of selector elements

1 = 2nd and 4th gear brake -B2-

2 = Reverse gear clutch -K2-

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

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

5 = Reverse gear brake -B1-

6 = Free wheel clutch

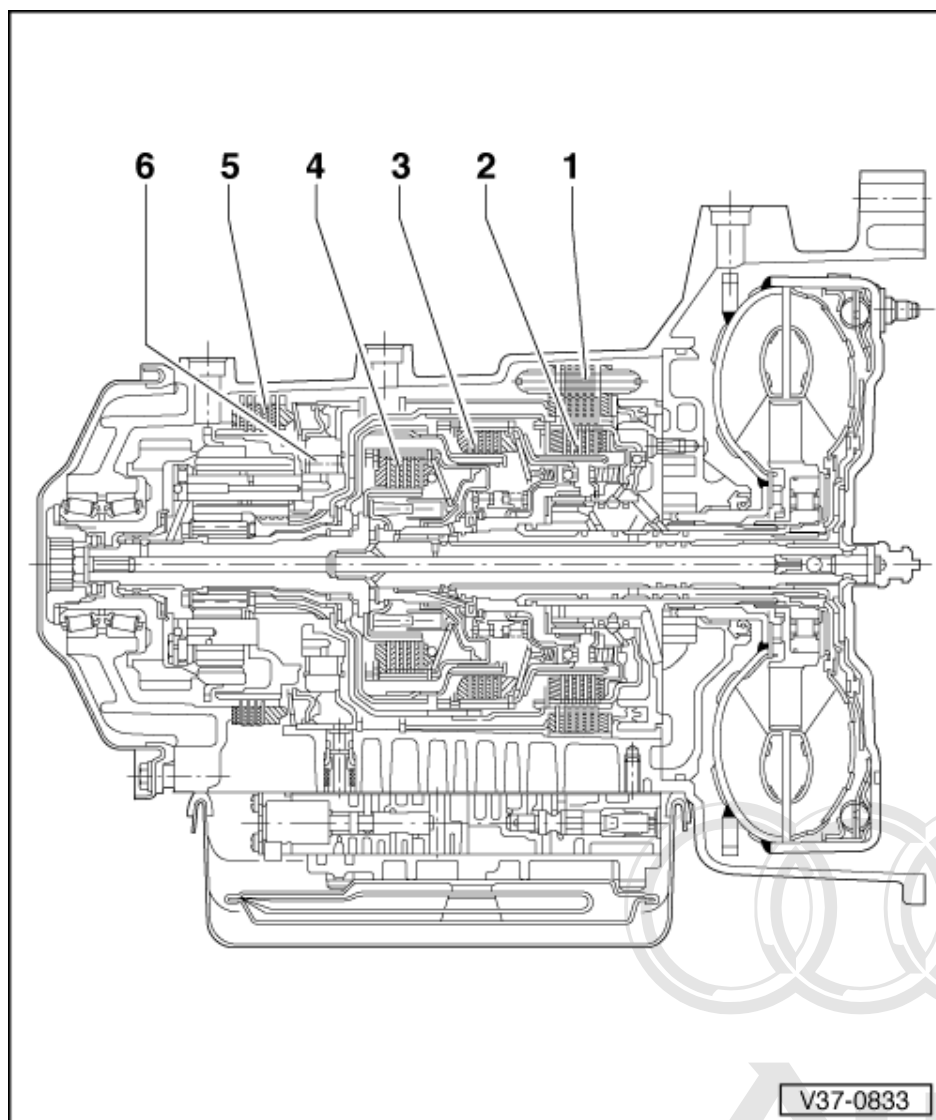
The following table shows which selector elements are operated in the individual gears to help you deal with complaints regarding poor acceleration and speed performance or generally with drive train faults. It is thus possible to establish which selector elements are not functioning correctly.



Before starting repairs to the gearbox, first carry out the self-diagnosis.

=> Automatic gearbox 097, Self-diagnosis; Repair group 01;

5.2 - Position of selector elements on gearboxes up to 11.92



Gear	B1	B2	K1	K2	K3	F
R	x			x		
1H			x			x
2H		x	x			
3H			x	x		
3LT1			x		x	
3M			x	x	x	
3LT2				x	x	
4M		x			x	

X = Clutches, brakes or free wheel engaged
H = Hydraulic

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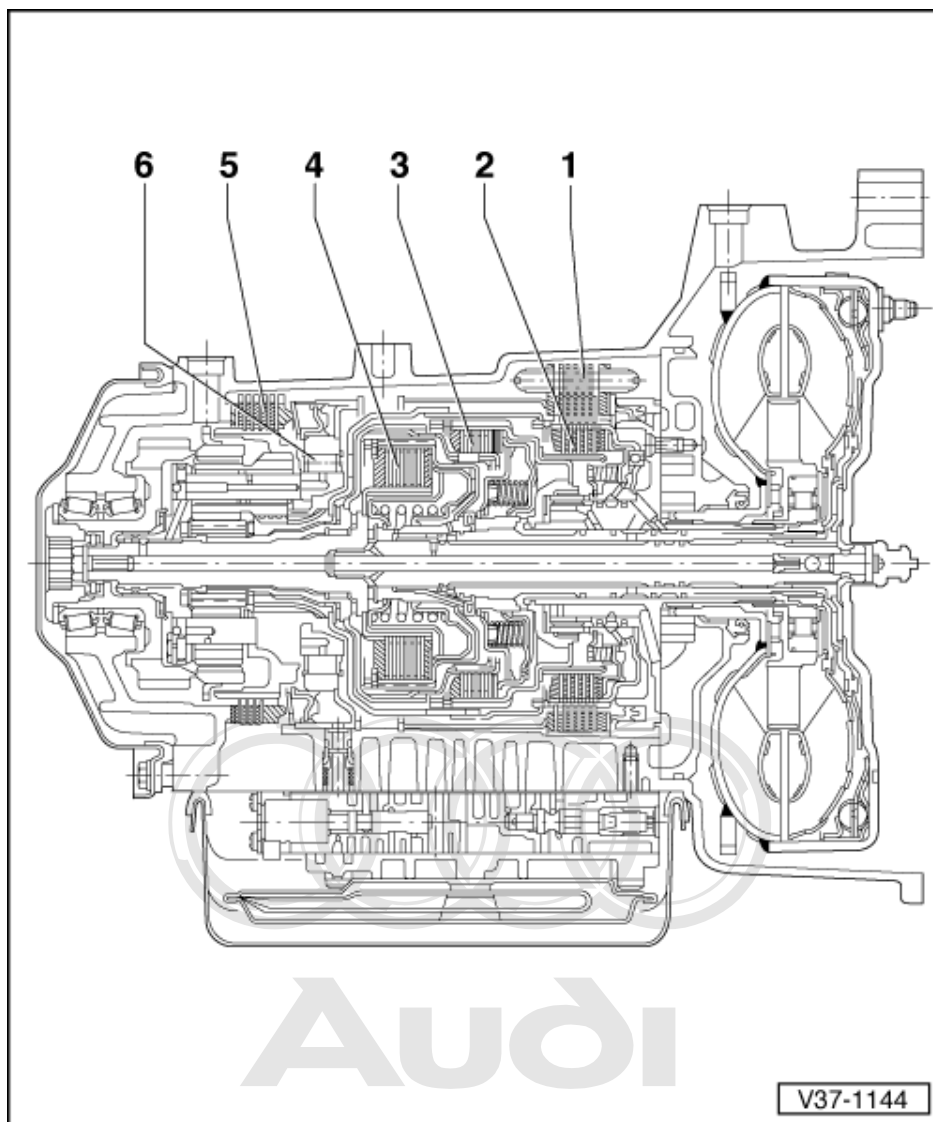
X = Clutches, brakes or free wheel engaged
M = Mechanical

LT1 = Load splitting

LT2 = Load splitting

6 - Gearbox with selector elements as of 11.92

6.1 - Gearbox with selector elements as of 11.92



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Position of selector elements

1 = 2nd and 4th gear brake -B2-

2 = Reverse gear clutch -K2-

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

4 = 4th gear clutch -K3-

5 = Reverse gear brake -B1-

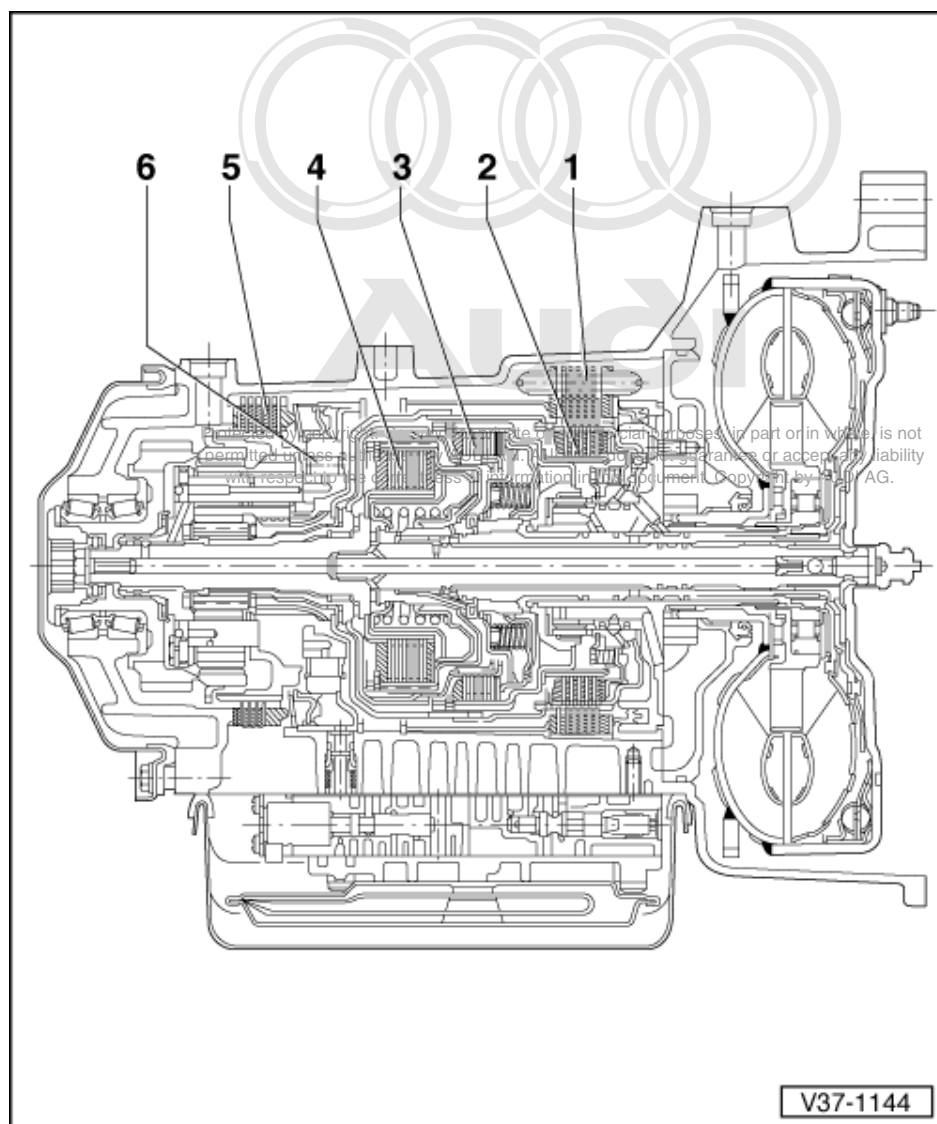
6 = Free wheel clutch

The following table shows which selector elements are operated in the individual gears to help you deal with complaints regarding poor acceleration and speed performance or generally with drive train faults. It is thus possible to establish which selector elements are not functioning correctly.

Before starting repairs to the gearbox, first carry out the self-diagnosis.

=> Automatic gearbox 097, Self-diagnosis; Repair group 01;

6.2 - Position of selector elements on gearboxes as of 11.92



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

Gear	B1	B2	K1	K2	K3	F
4M		x			x	

X = Clutches, brakes or free wheel engaged
H = Hydraulic
M = Mechanical

Note:

Figs. V37-0833 and V37-1144 show the automatic gearbox 096. The layout of the selector elements for the automatic gearbox 097 is identical.

7 - Dismantling and assembling gearbox

7.1 - Dismantling and assembling gearbox

- Observe the general repair instruction=> Page 5 .

Removing and installing ATF pipes => Page 37 .

Cleaning ATF pipes and ATF cooler => Page 42 .

Dismantling and assembling planetary gearbox
-Overview- => Page 44 .

Overview of adjustment work for planetary gearbox => Page 82 .

Removing and installing valve body => Page 148 .

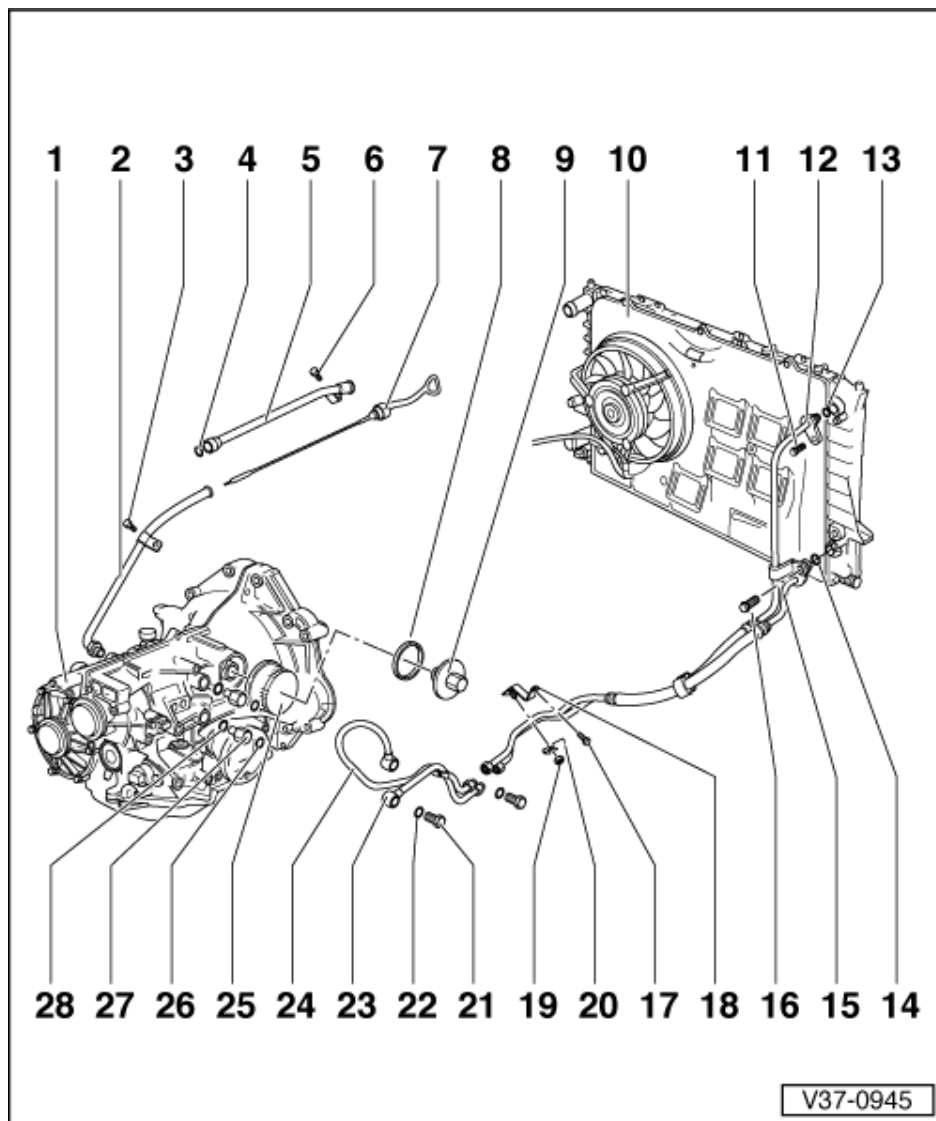
7.2 - Rules for cleanliness when working on the automatic gearbox

- ◆ Thoroughly clean all connections and the surrounding areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use sheeting and paper. Do not use fluffy cloths!
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components: Only remove replacement parts from packaging immediately prior to installation.
- ◆ Always renew O-rings, seals and gaskets.
- ◆ Lightly lubricate O-rings with ATF before inserting to prevent them being trapped and damaged when assembling.
- ◆ Do not use any other lubricants in or on components that are lubricated with ATF. Otherwise, problems may occur with the hydraulic actuation of the gearbox.
- ◆ After installation, check and if necessary top up gear oil and ATF.

7.3 - Removing and installing ATF pipes

Notes:

- ◆ Observe rules for cleanliness when working on the automatic gearbox=> Page 37 .
- ◆ Thoroughly clean all connections and the surrounding areas before disconnecting.
- ◆ Insert ATF pipes completely by hand up to stop in gearbox or cooler and then screw on.
- ◆ After renewing ATF pipes => checking ATF level and topping up. Page 30 .
- ◆ Following gearbox repairs or routine maintenance work, ATF filter is not to be re-installed. Seal off opening in gearbox with flat seal and oil cooler cap => Page 42 , Fig. 1 and 2 .



1 Gearbox housing

2 ATF filler pipe

- ◆ Tighten to 80 Nm on sump
- ◆ Allocation as per engine version

=> Replacement parts catalogue

3 Bolt, 10 Nm

4 O-ring

- ◆ Always replace
- ◆ Only fitted on gearboxes with 2-piece filler pipe

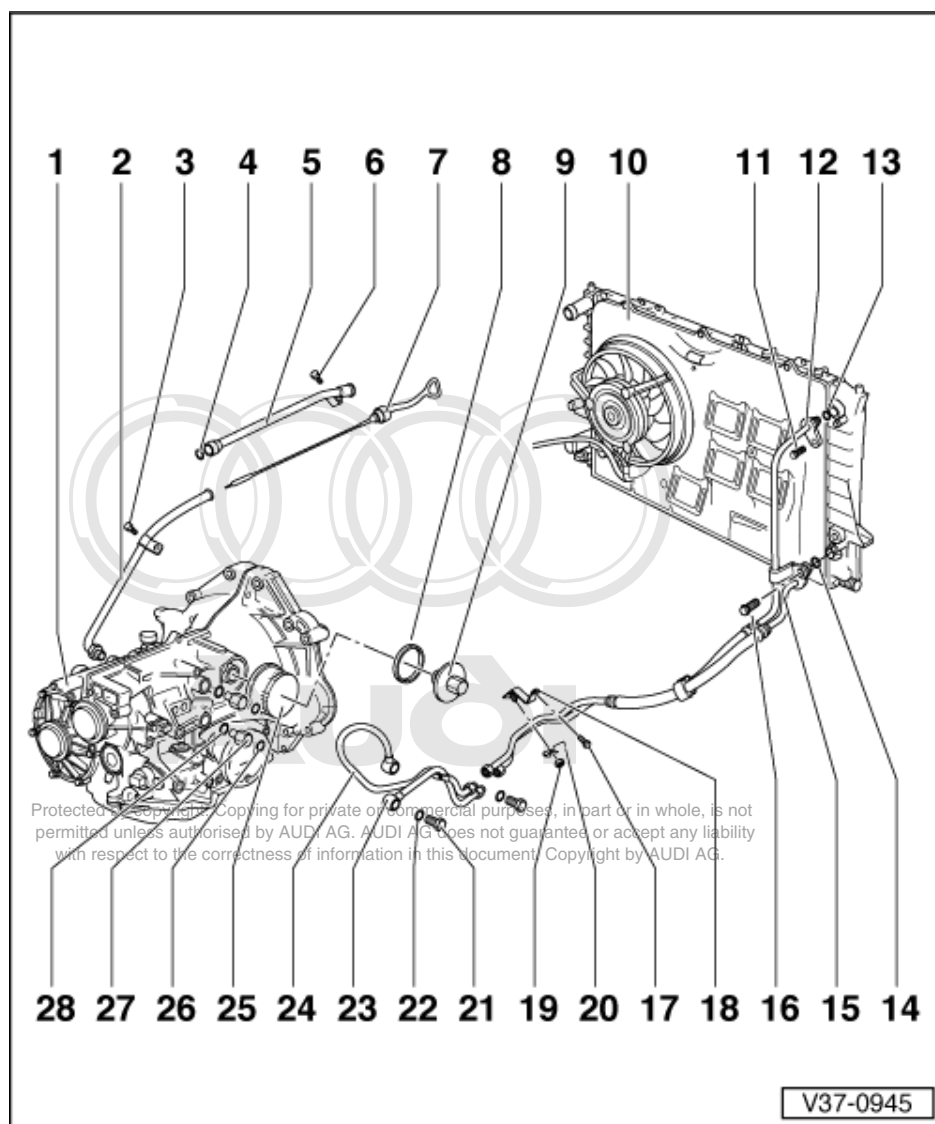
5 ATF filler pipe

- ◆ 2-piece design, combined with -Item **2** -
- ◆ Allocation as per engine version

=> Replacement parts catalogue

6 Bolt, 10 Nm

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7 ATF dip stick

- ♦ Checking ATF level => Page **30**

8 Flat seal

- ♦ Always replace
- ♦ Moisten with ATF for insertion in oil cooler cap

9 Oil cooler cap, 25 Nm

- ♦ Fitted in place of ATF filter -Item **25** -
- ♦ Removing ATF filter and installing oil cooler cap => Figs. **42**

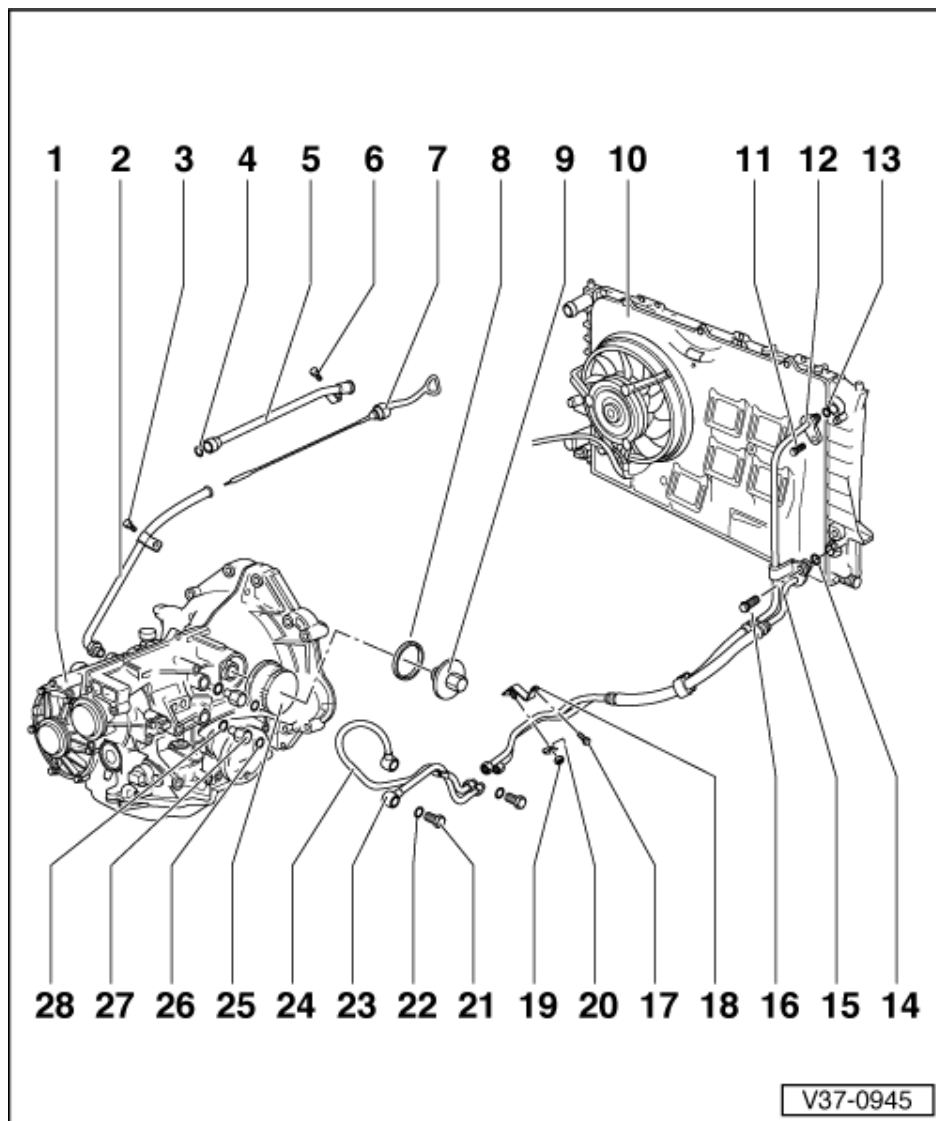
10 Radiator

- ♦ With integrated ATF cooler

11 Bolt, 10 Nm

12 Return pipe

- ♦ With hoses and securing clips



13 O-ring

- ◆ Always replace

14 O-ring

- ◆ Always replace

15 Supply pipe

- ◆ With hoses and securing clips

16 Bolt, 10 Nm

17 Bolt, 10 Nm

18 Bracket

- ◆ For feed and return lines

19 Nut

20 Retaining clip

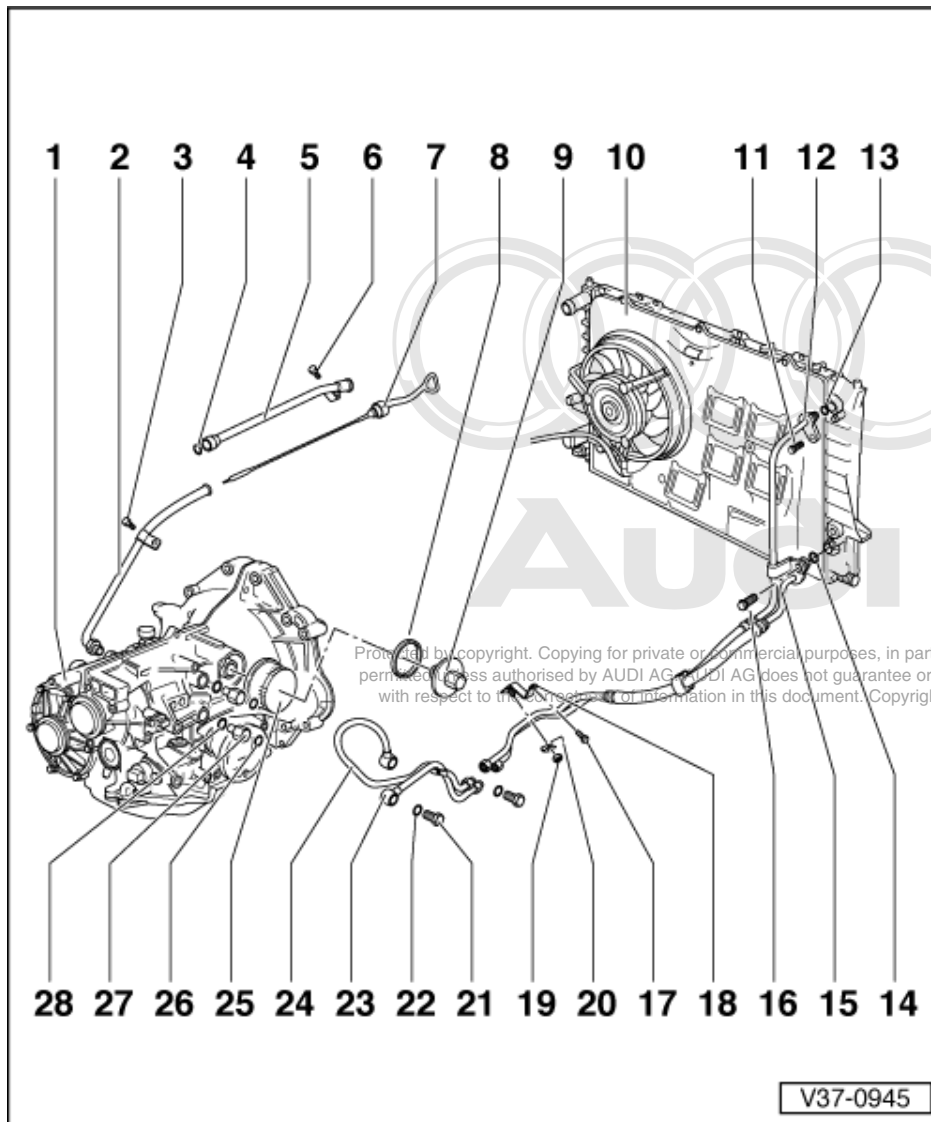
- ◆ For feed and return lines

21 Banjo bolt, 30 Nm

22 Sealing ring

- ◆ Always replace

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23 Supply hose

- ♦ Screw (40 Nm) to supply pipe

24 Return pipe

- ♦ Screw (40 Nm) to return line

25 ATF filter

- ♦ Can be removed without removing gearbox

Note:

Do not re-install ATF filter. Seal off opening in gearbox with flat seal and oil cooler cap => , Figs. 42

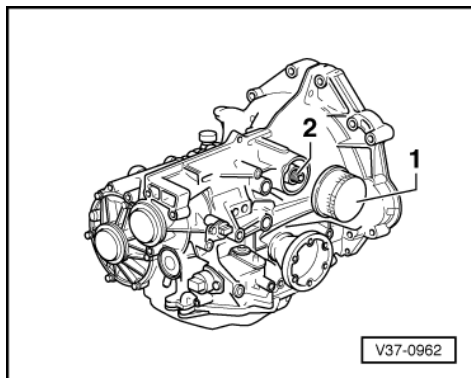
26 Sealing ring

- ♦ Always replace

27 Threaded connection, 60 Nm

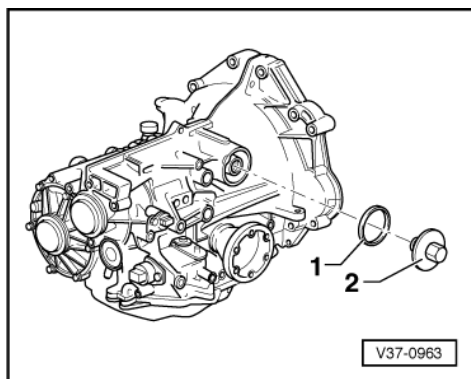
28 O-ring

- ♦ Always replace



-> Fig.1 Removing ATF filter and threaded connection

- Detach ATF filter -1- from gearbox.
- Use pliers to screw out threaded connection -2-.



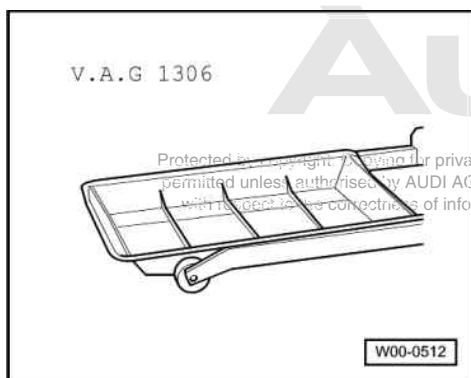
-> Fig.2 Sealing hole on gearbox housing with oil cooler cap

- Moisten flat seal -1- with ATF.
- Insert flat seal in oil cooler cap -2-.
- Seal hole on gearbox housing with oil cooler cap.

Tightening torque: 25 Nm

7.4 - Cleaning ATF pipes and ATF cooler

Special tools, testers and workshop equipment required



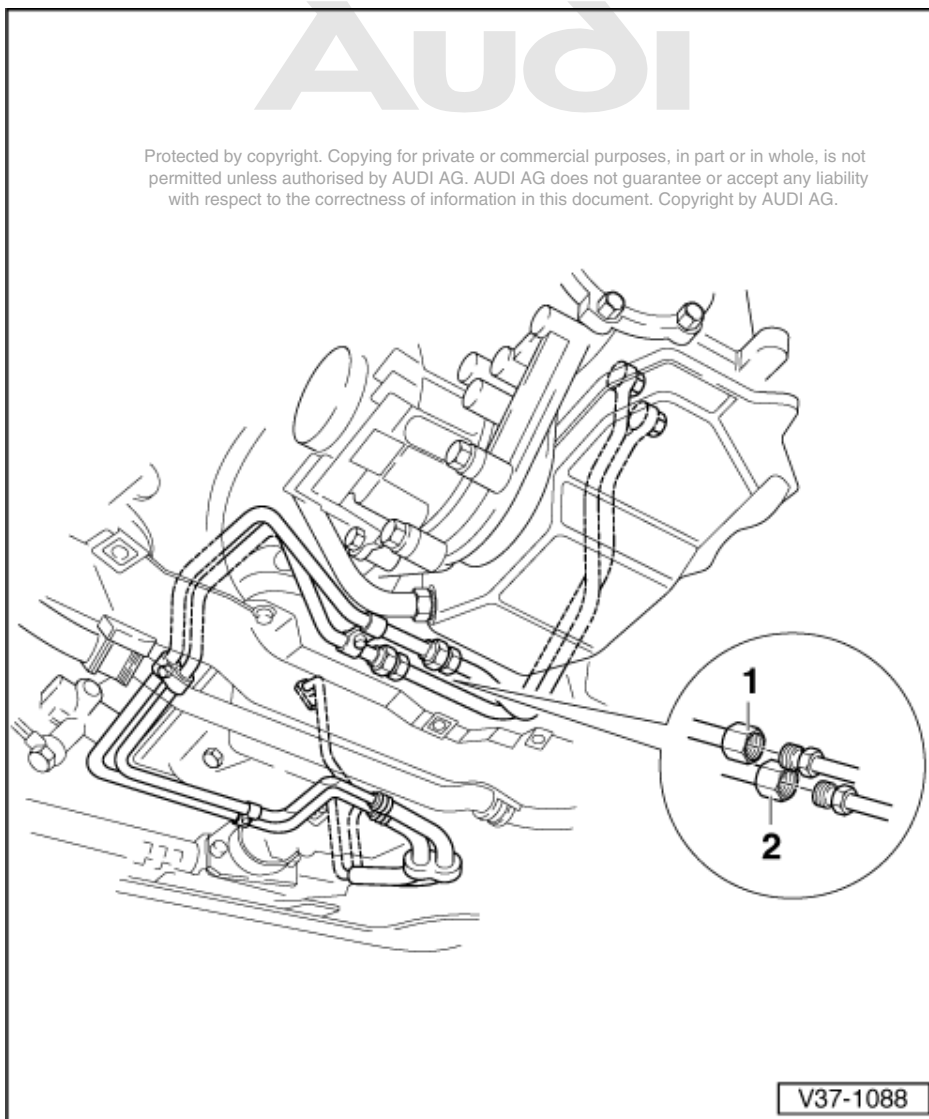
- ♦ V.A.G 1306 Drip tray
- ♦ Commercially available compressed air gun

Note:

- ♦ Observe the notes under "Removing and installing ATF pipes" => Page 37 .
- ♦ Before installing exchange gearbox, always blow out ATF cooler and ATF pipes with compressed air (max. 10 bar).
- ♦ On installation, insert ATF pipes completely by hand up to stop in gearbox or cooler and then screw on.

Warning
Wear eye protection.

- Place drip tray V.A.G 1306 underneath the gearbox.



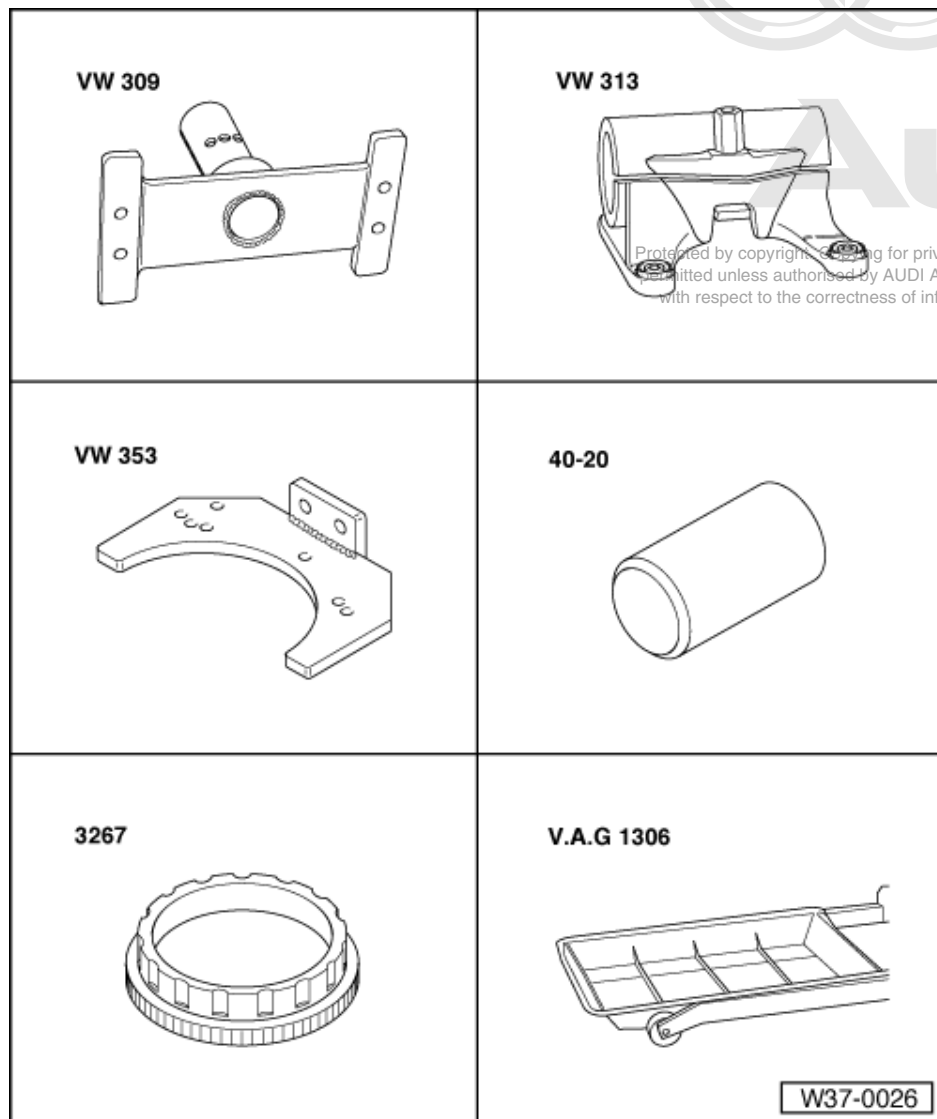
- Unfasten union nuts of ATF pipes -1- and -2-.
- Unfasten holders for rigid ATF pipes.
- Attach hose (ø 18 mm) to ATF pipe -1- and secure with hose clip.
- Hang other end of hose in a suitable container.
- Blow through ATF pipe -2- several times with a compressed air gun.
- Change hose from ATF pipe -1- over to ATF pipe -2- and repeat sequence.
- Tighten union nuts -1- and -2- to tightening torque and re-attach holders of ATF pipes.



- Check and top up ATF level =>Page 30

8 - Dismantling and assembling planetary gearbox

8.1 - Dismantling and assembling planetary gearbox

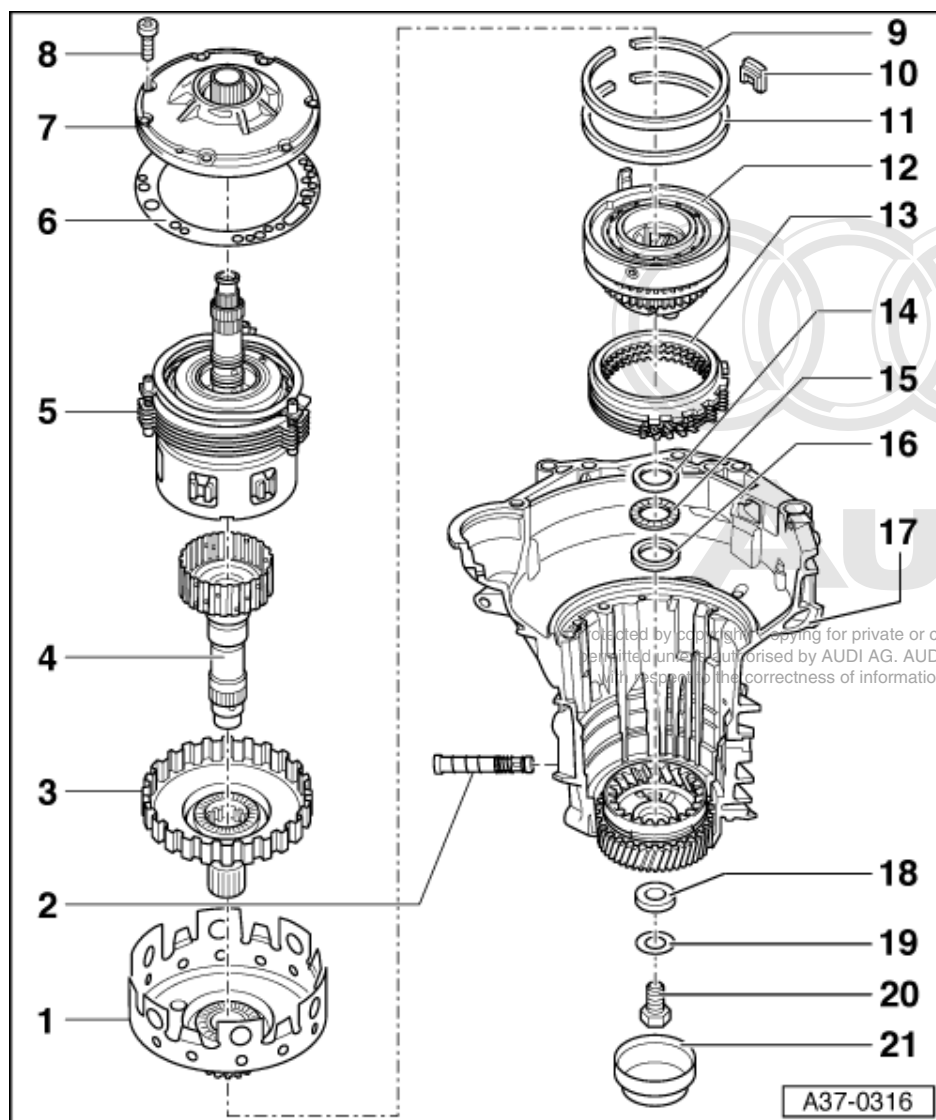


Special tools, testers and workshop equipment required

- ♦ VW 309 Holding plate
- ♦ VW 313 Support clamp
- ♦ VW 353 Gearbox support
- ♦ 40-20 Drift sleeve
- ♦ 3267 Assembly ring
- ♦ V.A.G 1306 Drip tray

This exploded view diagram illustrates the assembly of a mechanical component, likely a pump or valve. The components are numbered 1 through 21. The assembly is shown in two main sections, separated by a dashed vertical line. The left section shows the main body (1) with internal components (2, 3, 4, 5) and a top cover (6) with a central shaft (7) and a cap screw (8). The right section shows the internal components (9, 10, 11, 12, 13, 14, 15, 16, 17) and a bottom cover (18) with a central shaft (19) and a cap screw (20). A small bowl-like component (21) is shown at the bottom right. The diagram is labeled A37-0316 in the bottom right corner.

1 Large sun gear
♦ Lift up and out



2 Sealing plug

- ♦ Take out before removing the free wheel => Removing valve body, Page 148

3 Large input shaft

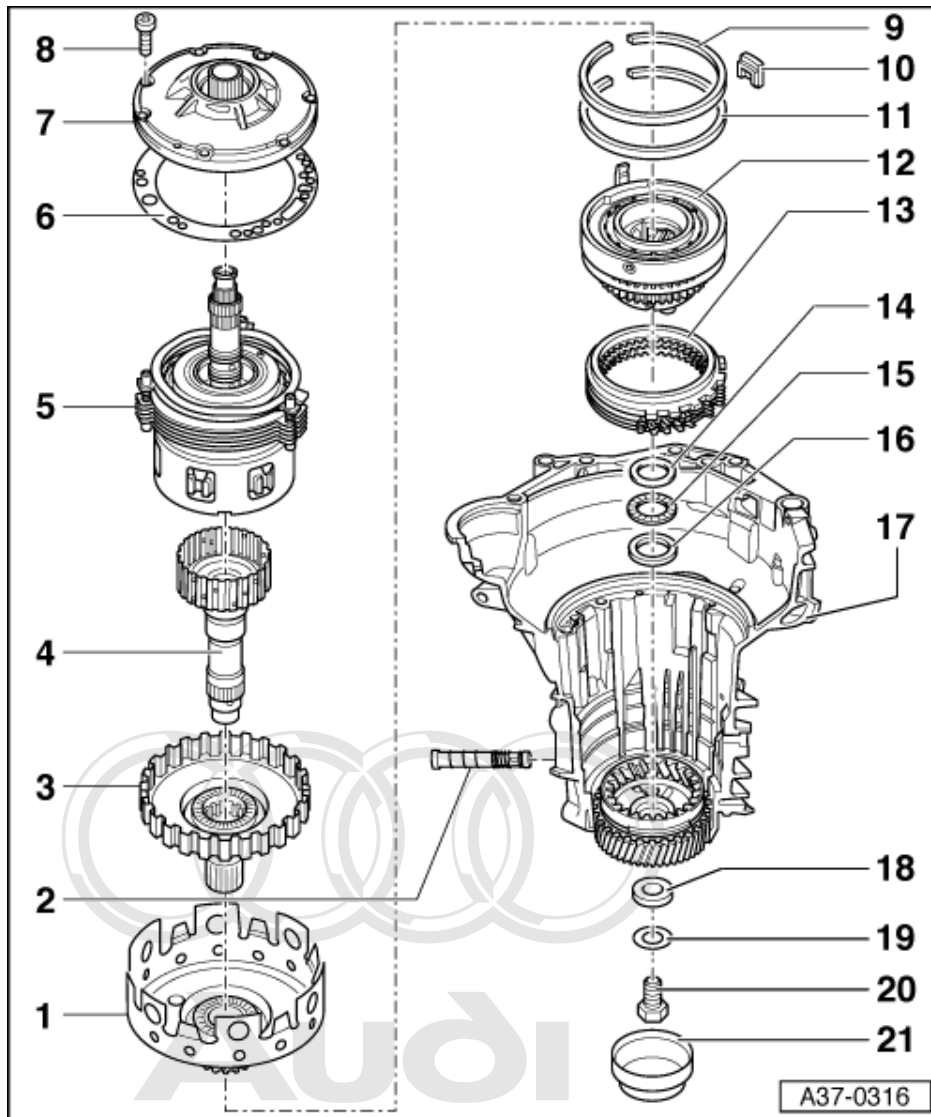
- ♦ Lift up and out

4 Small input shaft

- ♦ To remove, unscrew bolt -Item 20 -
- ♦ Lift up and out

5 Assembly

- ♦ With 3rd and 4th gear clutch -K3- with pump shaft
- ♦ With 1st - 3rd gear clutch -K1- with turbine shaft
- ♦ With reverse gear clutch -K2-
- ♦ With 2nd and 4th gear brake -B2-
- ♦ With supporting tube for -B2-
- ♦ Lift up and out together at pump shaft



6 Gasket
 ♦ Take off

7 ATF pump

- ♦ To remove, unscrew all the bolts -Item 8 -
- ♦ To press off the pump, screw two M8 bolts evenly into the two threaded holes

8 Bolt

- ♦ For ATF pump

9 Circlip

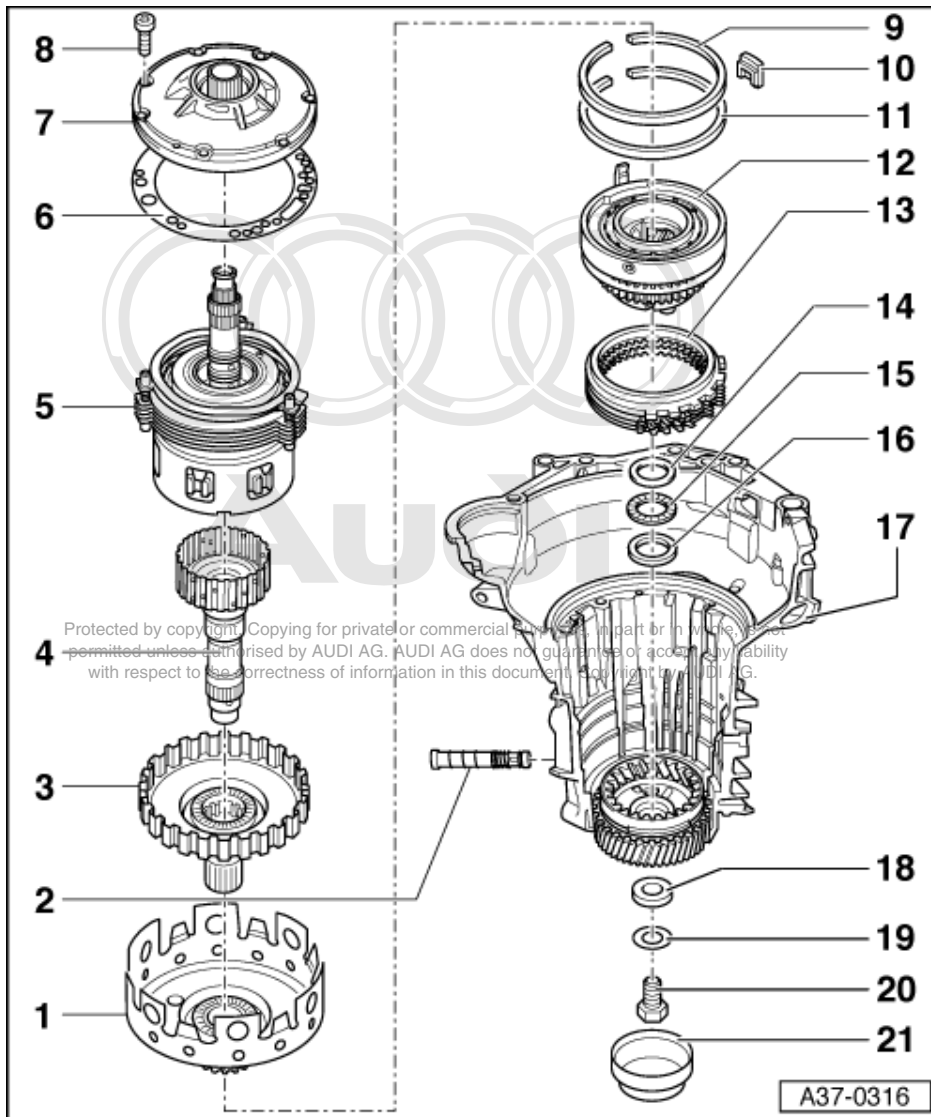
- ♦ For supporting tube for -B2-
- ♦ Lift out

10 Baffle plate

- ♦ Remove after lifting out circlip -Item 9 -

11 Circlip

- ♦ For freewheel
- ♦ Lift out



12 Free wheel

- ♦ With planet carrier
- ♦ Before removing free wheel, remove valve body and plug -Item **49**

13 Reverse gear brake -B1-

- ♦ Remove pressure plate together with plates and shim(s) from the top

14 Axial needle bearing washer

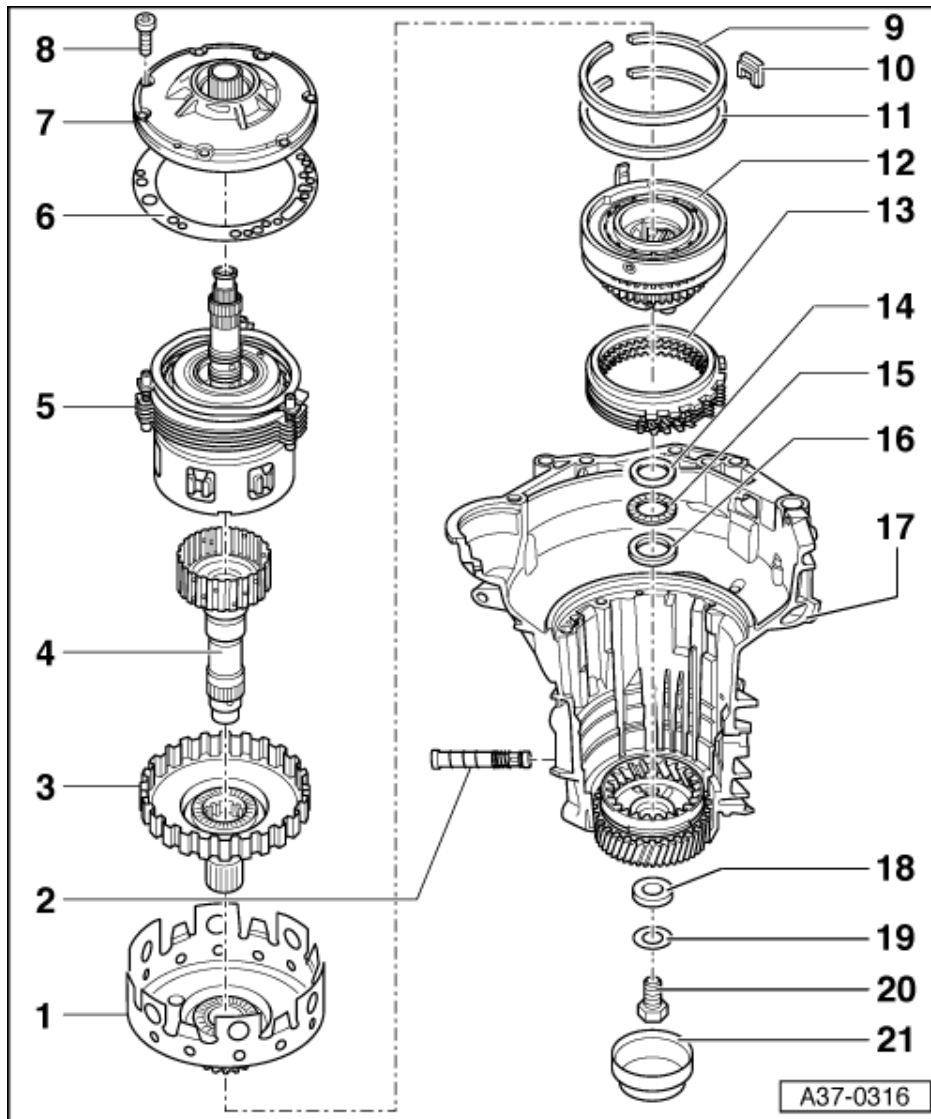
- ♦ Take off

15 Axial needle bearing

- ♦ Take off

16 Axial needle bearing washer

- ♦ Take off



17 Gearbox housing with input gear

- ◆ Input gear does not have to be removed when dismantling planetary gearbox
- ◆ Removing and installing input gear => Page 169 .

18 Planet carrier shim

- ◆ Take off after slackening the bolt -Item 20 -

19 Washer

- ◆ Take off after slackening the bolt -Item 20 -

20 Bolt

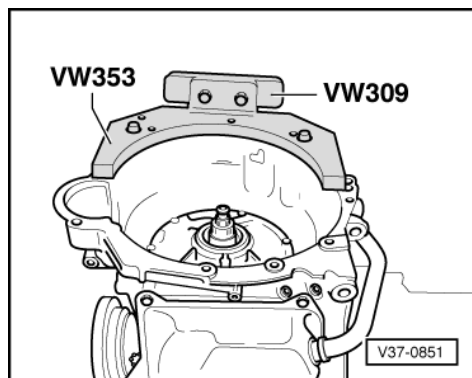
- ◆ For small input shaft
- ◆ Unscrew to remove

21 Cap

- ◆ Knock out with chisel
- ◆ Cannot be removed without being damaged

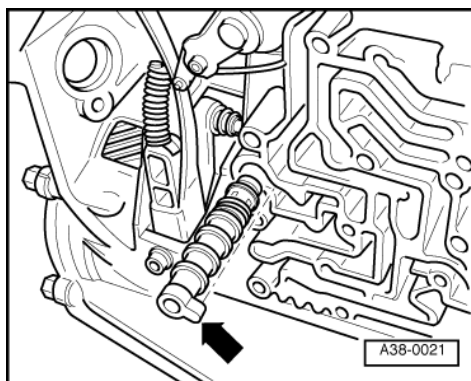
8.3 - Dismantling planetary gearbox

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- Allow the ATF to drain out.



ATF can be drawn off using probe V.A.G 1358 A/1 and V.A.G1358 A.

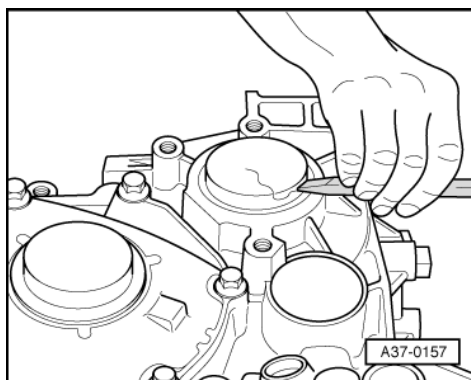
- Take out torque converter.
- -> Secure gearbox to repair stand
- Place drip tray V.A.G 1306 underneath the gearbox.
- Removing valve body => Page 148 .



- -> Take out sealing plug -arrow-.

Note:

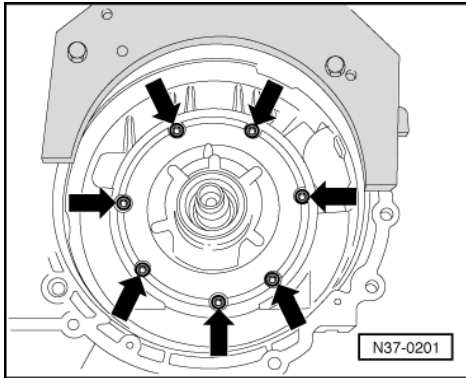
Plug must be removed to avoid damaging it.



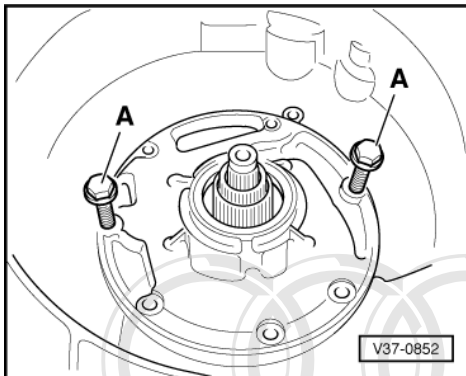
- -> Remove sealing cap.



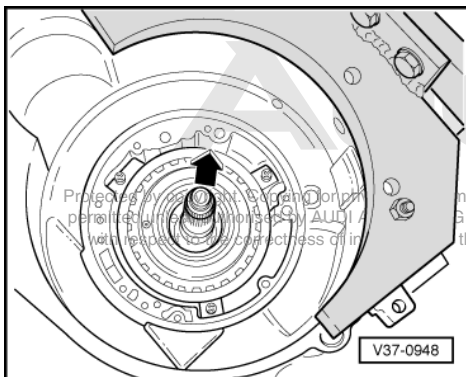
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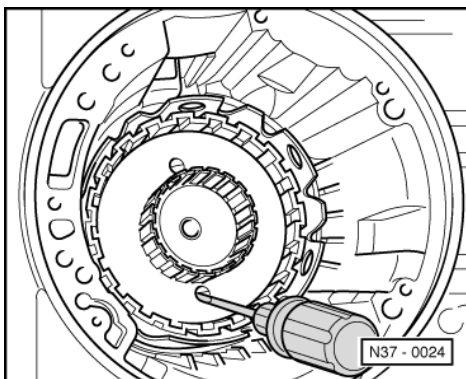
- -> Remove ATF pump bolts (arrows).



- -> To remove ATF pump, screw in two M8 bolts -A- into the tapped holes of the ATF pump.
- Tighten the bolts -A- evenly to press ATF pump off gearbox housing and remove.

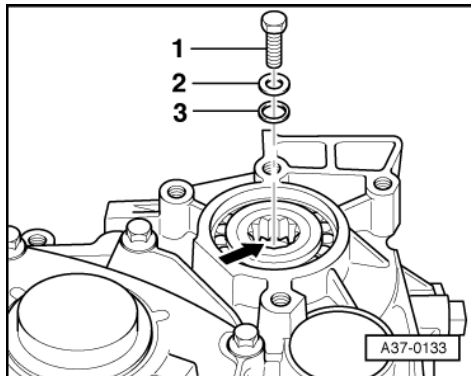


- -> Take hold of pump shaft and jointly pull out -arrow- all the clutches together with supporting tube for -B2-, plates for -B2-, springs and spring caps





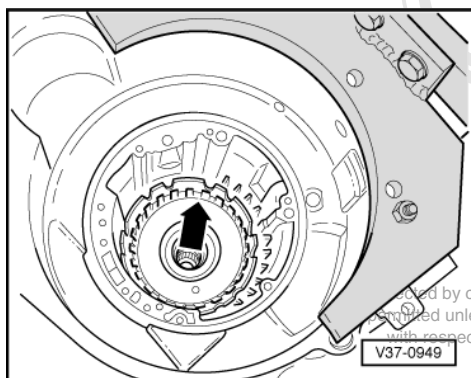
- Engage parking lock.
- -> Insert screwdriver through holes in "large input shaft" and "large sun gear" so as to enable "bolt for small input shaft" to be unfastened and tightened.



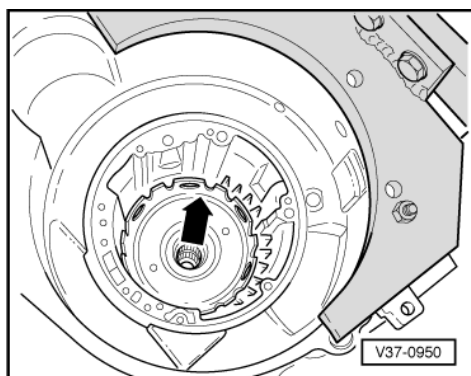
- -> Loosen bolt -1- for "small input shaft".
- Remove bolt with washer -2- and shim -3- for "small input shaft".

Planet carrier axial needle bearing remains in gearbox/input gear.

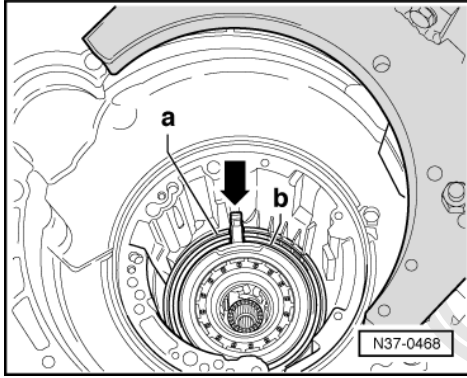
- Pull out small input shaft.



- -> Pull out large input shaft (arrow).



- -> Pull out large sun gear (arrow).

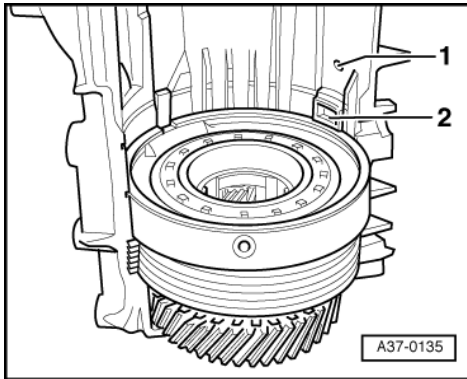


Note:

Plug must be removed before taking out free wheel.

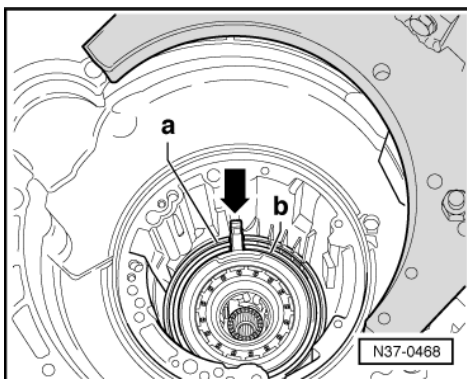
- -> Remove circlip -a- for supporting tube for -B2-.

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- -> Pull off baffle block -2-.

1 ATF breather drilling

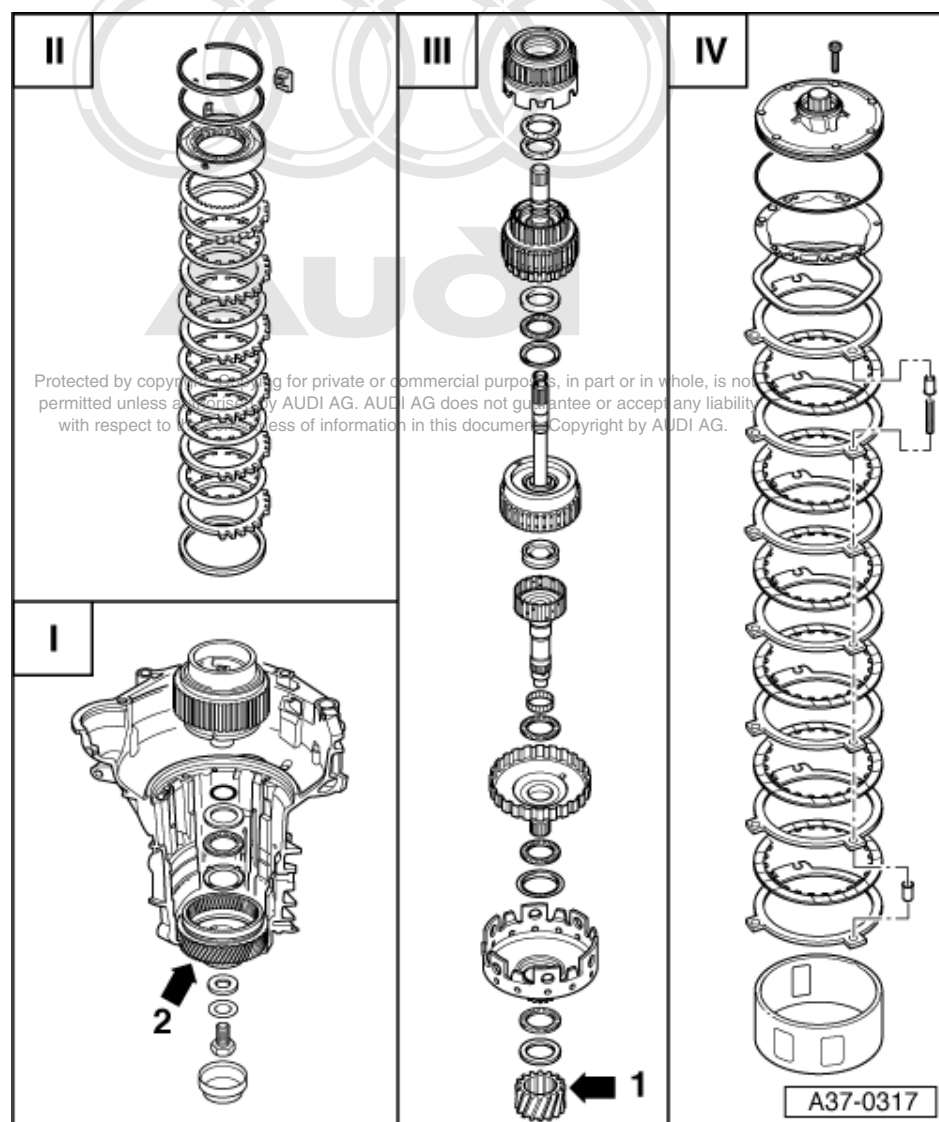


- -> Remove free wheel circlip -b-.
- Take hold of the inside of the planet carrier and pull it out together with free wheel and dished washer.
- Remove pressure plate, plates and shim(s) of the reverse gear brake -B1-.
- Take off axial bearing and washers.

Note:

Assembling planetary gearbox => Page 54.

8.4 - Assembling planetary gearbox -overview-



Notes:

- ♦ An exchange component containing all selector elements and the valve body is available for repair work on the automatic gearbox 097.
- ♦ The exchange component is assigned to the gearbox code letters => Page 2 onwards.
- ♦ Installation instructions:

=> Special information; Transmission; No.10

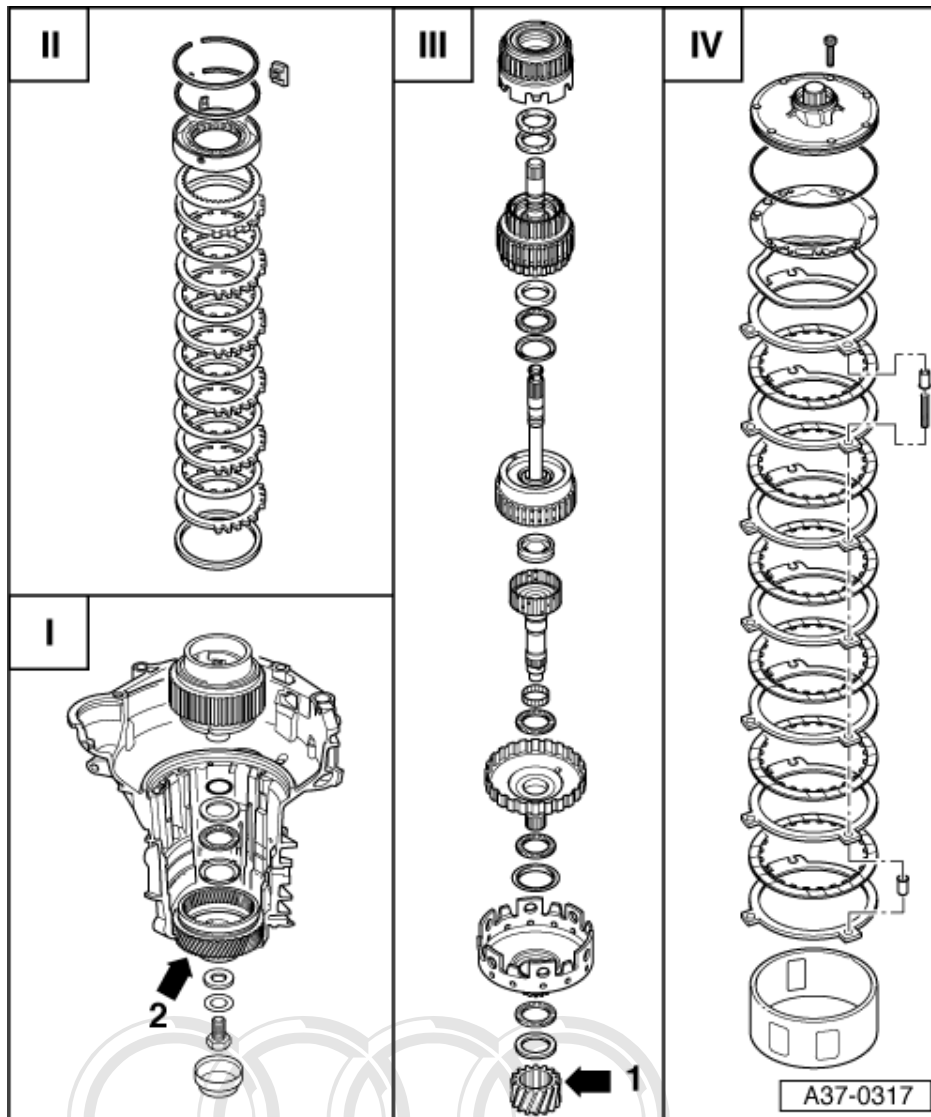
I - Installing planet carrier

=> Page 56

Note:

It is not necessary to remove input gear -arrow 2-.

Removing and installing input gear => Page 169.



II - Installing components from reverse gear brake -B1- up to circlip for -B2- supporting tube
=> Page 59

Note:

To remove and install free wheel, valve body with plug must be removed

=> Page 148.

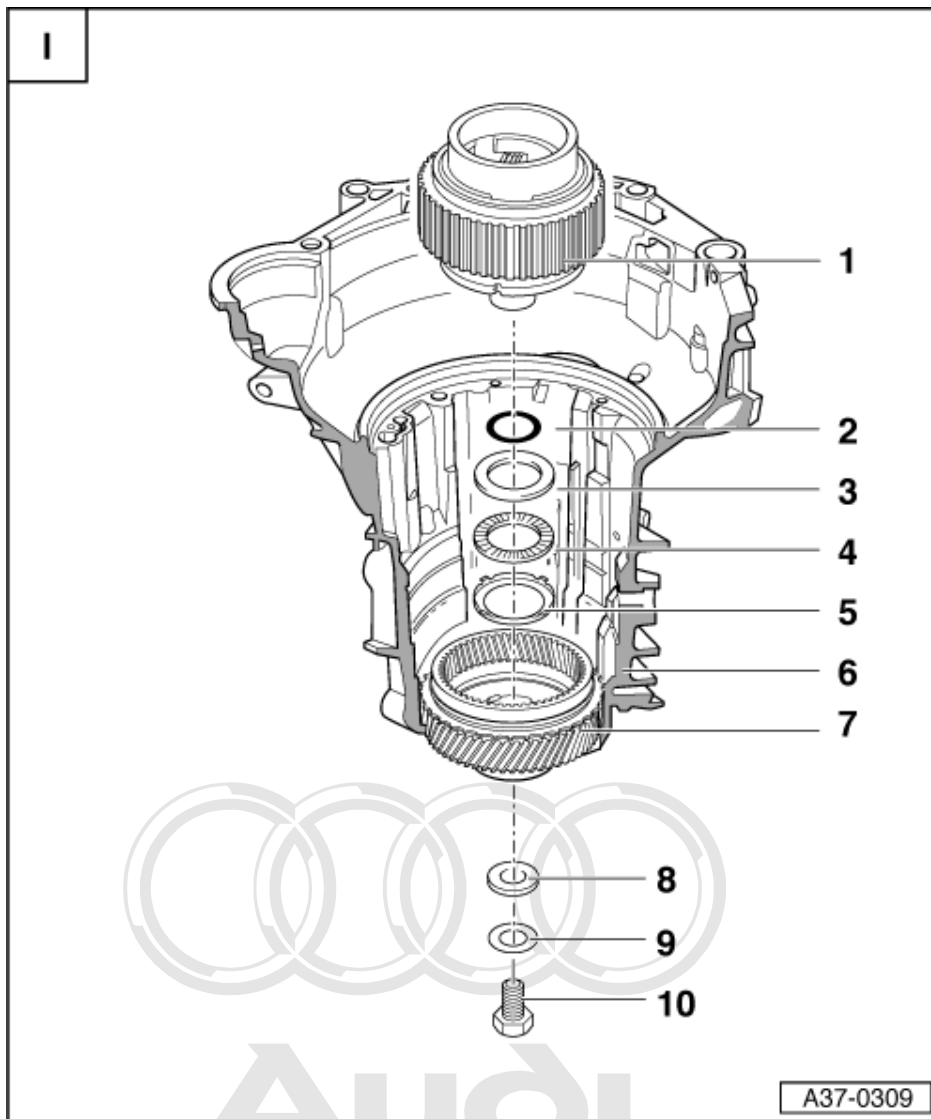
III - Installing components from small sun gear up to reverse gear clutch -K2- => Page 63

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Small sun gear -arrow 1- cannot be removed from planet carrier on gearboxes as of 11.92, => Page 2 onwards.

IV - Installing supporting tube for -B2- as far as ATF pump => Page 68

8.5 - I - Installing planet carrier



=> Overview, Page 54

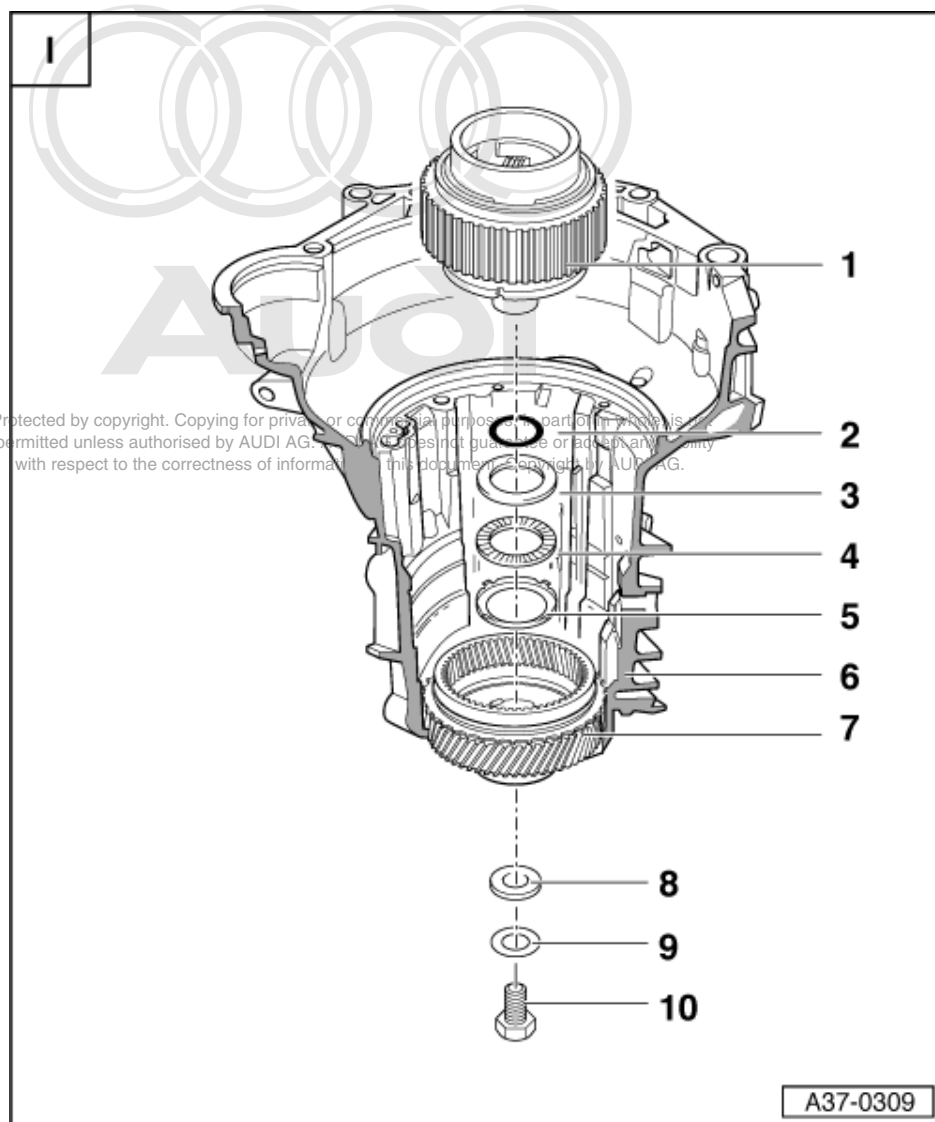
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Note:

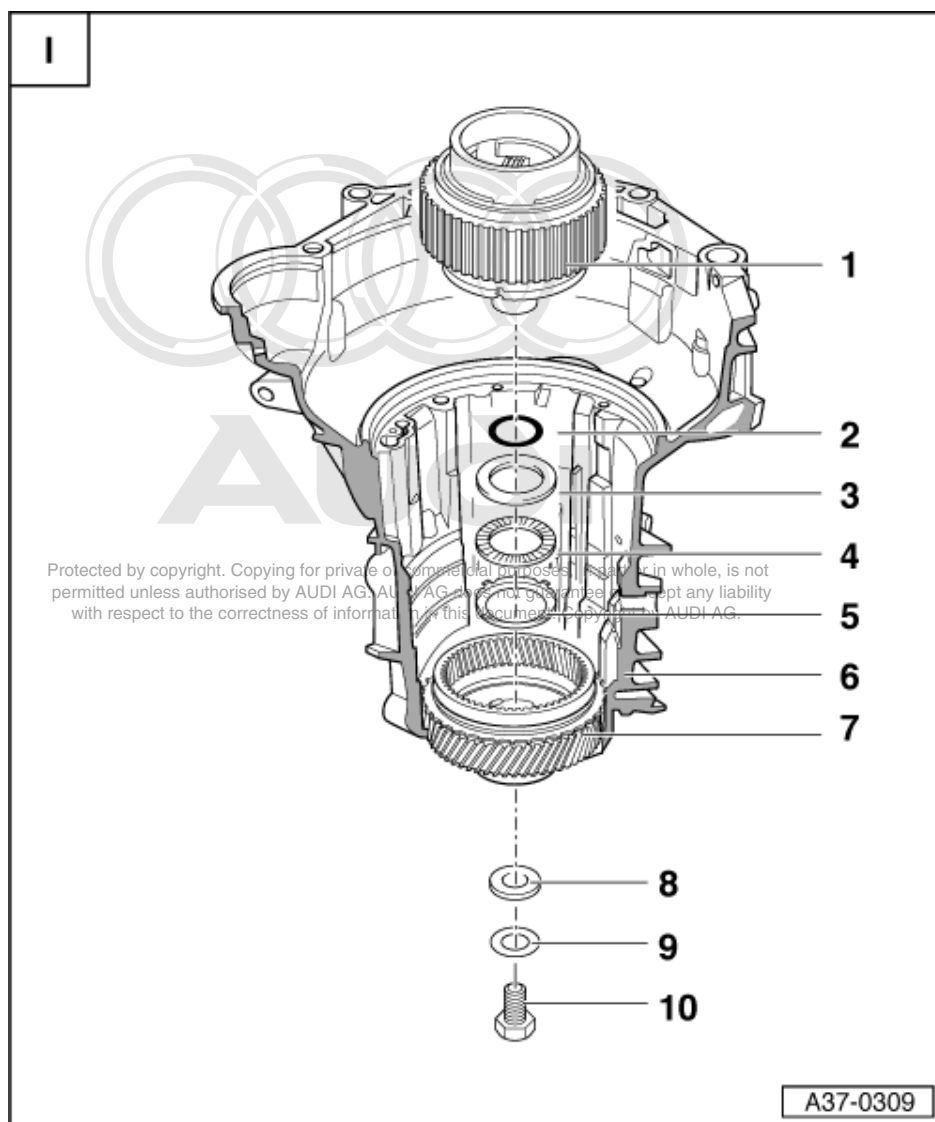
- ♦ Dismantling planetary gearbox =>Page 49
- ♦ Assembling planetary gearbox => Page 72 .

1 Planet carrier

- ♦ Modified ratios for gearboxes as of 11.92 => Page 2 onwards
- ♦ Small sun gear cannot be removed on gearboxes as of 11.92
- ♦ Adjusting => Page 83



- 2 O-ring
 - ♦ Always replace
 - ♦ Insert in planet carrier
- 3 Axial needle bearing washer
- 4 Axial needle bearing
- 5 Axial needle bearing washer
 - ♦ Install smooth side in input gear
- 6 Gearbox housing with input gear installed
- 7 Input gear
 - ♦ Do not remove to dismantle planetary gearbox
 - ♦ Removing and installing input gear or axial needle bearing for planet carrier => Page 169



8 Planet carrier shim

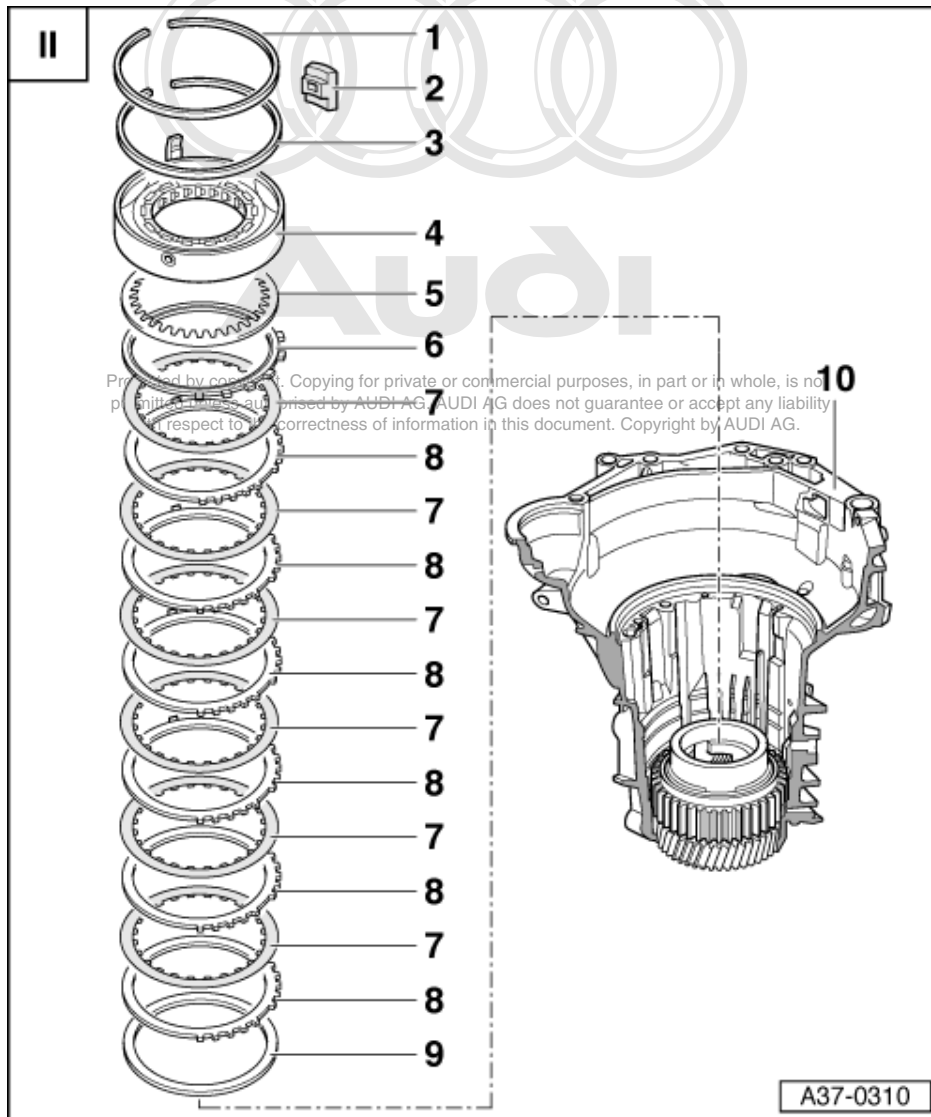
- ♦ Determining thickness => Adjusting planet carrier, Page **83**

9 Washer

10 Bolt, 30 Nm

- ♦ For small input shaft

8.6 - II - Installing components from reverse gear brake -B1- up to circlip for -B2- supporting tube



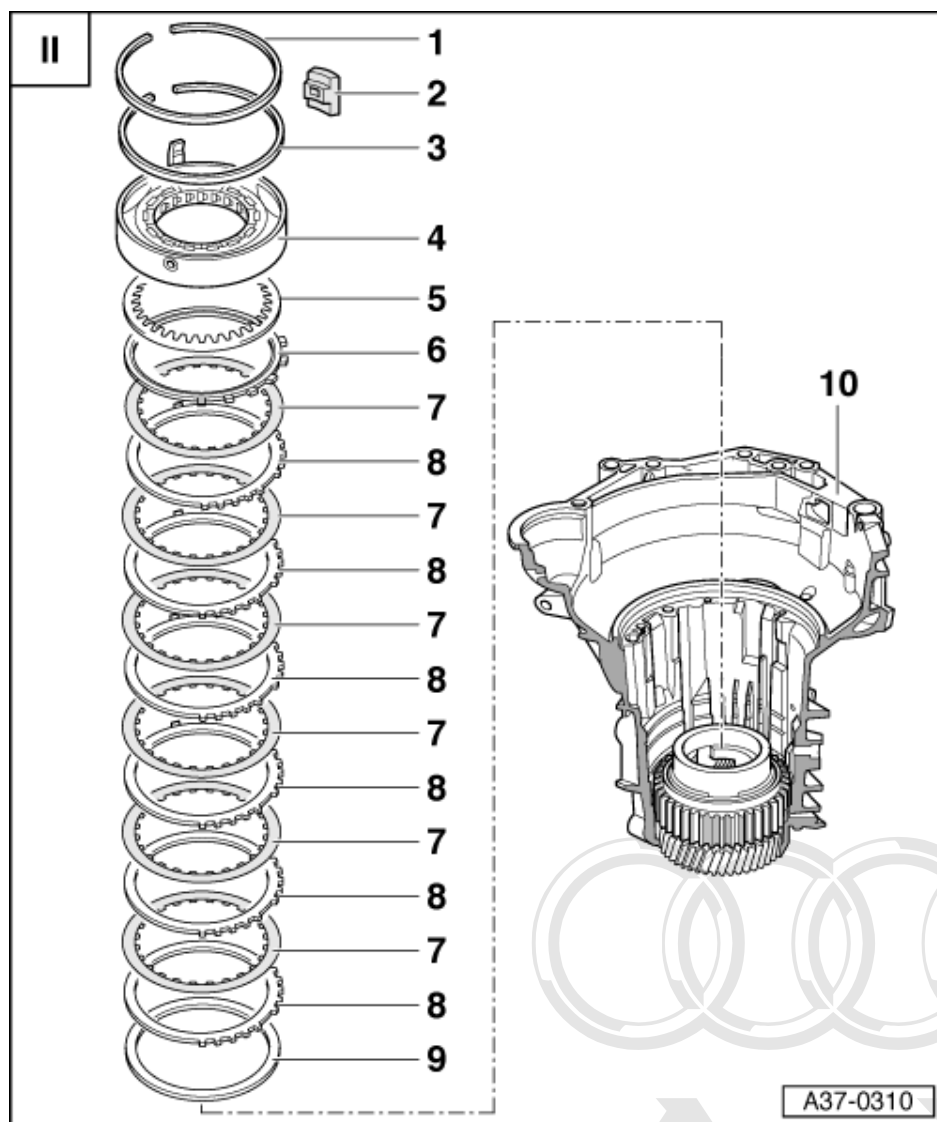
=> Overview, Page 54

Note:

- ◆ Dismantling planetary gearbox =>Page 49
- ◆ Assembling planetary gearbox => Page 72 .

1 Circlip

- ◆ For supporting tube -B2-
- ◆ Insert baffle block before fitting circlip
- ◆ Installation position: Circlip open ends faces free wheel retaining wedge



2 Baffle plate

- ◆ Insert before inserting circlip (Item 1)

3 Circlip

- ◆ For free wheel
- ◆ Installation position: open ends of circlip face toward retaining wedge of free wheel

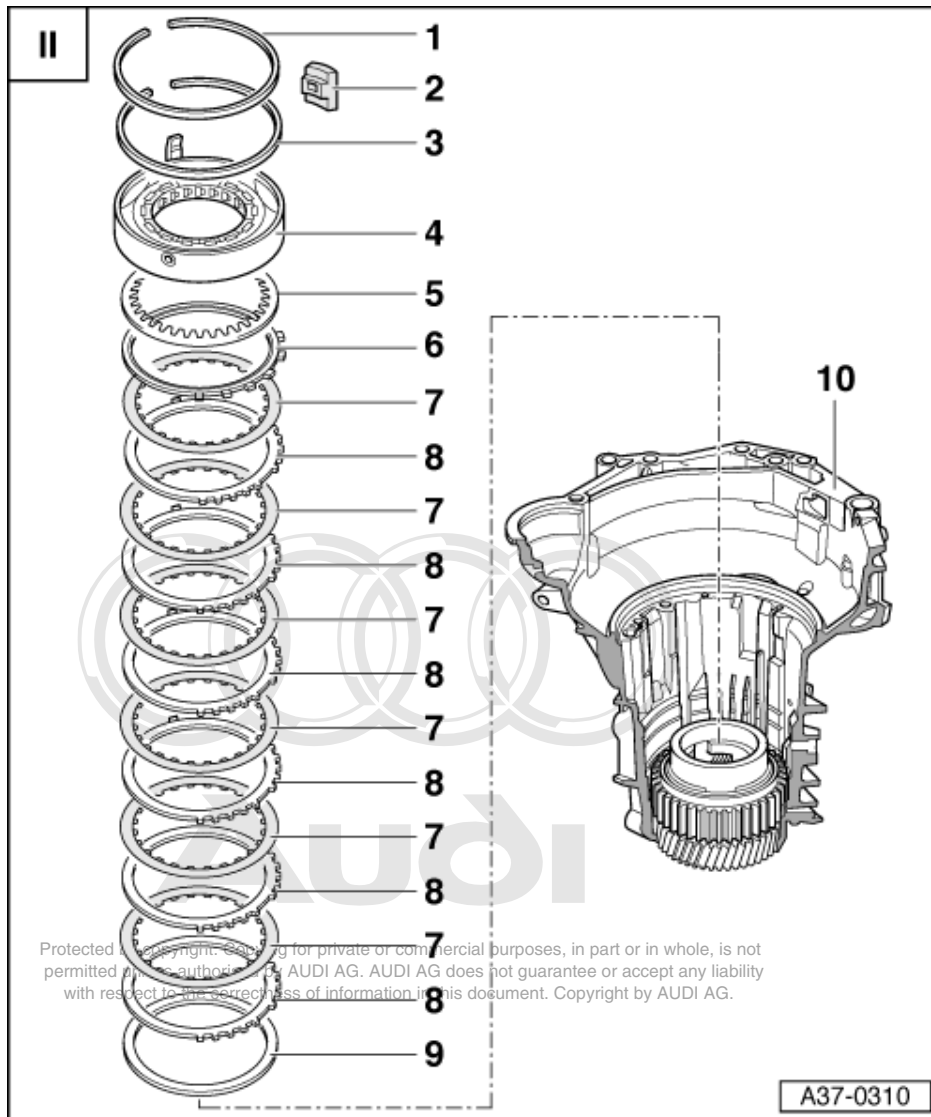
4 Free wheel with -B1- piston

- ◆ Before removing free wheel, remove valve body and sealing plugs => Page 148
- ◆ Dismantling and assembling => Page 113
- ◆ Use assembly ring 3267 for installing

5 Dished washer

- ◆ Convex side faces toward free wheel

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6 Pressure plate -B1-

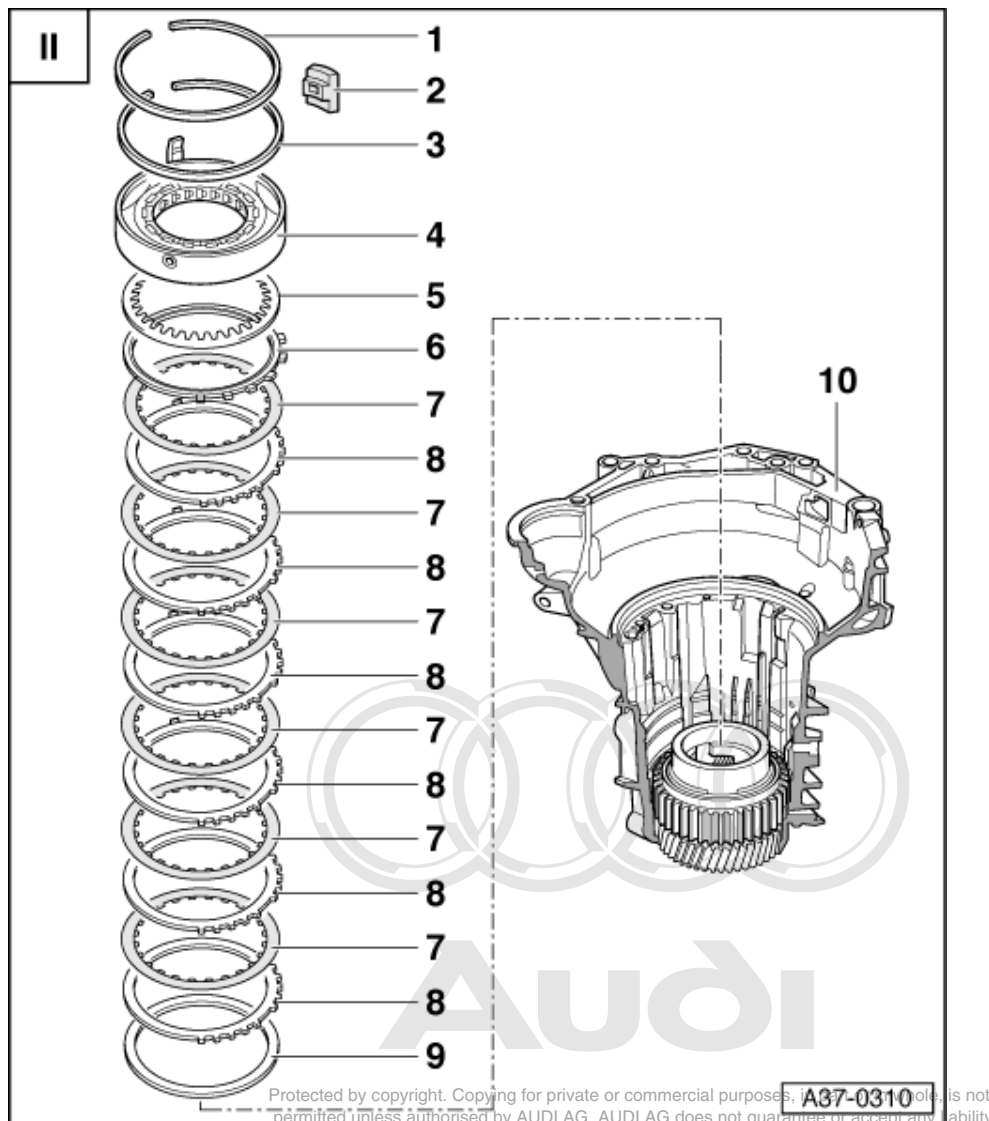
- ◆ Install with flat side facing plates
- ◆ Differing thickness depending on number of inner plates fitted:
 - ◆ Gearboxes with 5 inner plates
 - ◆ For gearboxes APA and CBU: 7.5 mm (additional shim => Item 9, with a thickness of 3.7 mm fitted)
 - ◆ Gearboxes with 6 inner plates
 - ◆ 7.5 mm

Gearboxes as of 11.92 => Page 2 onwards

- ◆ Gearboxes with 5 inner plates
- ◆ 13.5 mm
- ◆ As a replacement part it is allocated according to gearbox code letters

7 Inner plate, -B1-

- ◆ Number of inner plates -B1- => Page 2 onwards
- ◆ Before installing place plates in ATF for 15 minutes



8 Outer plate, -B1-

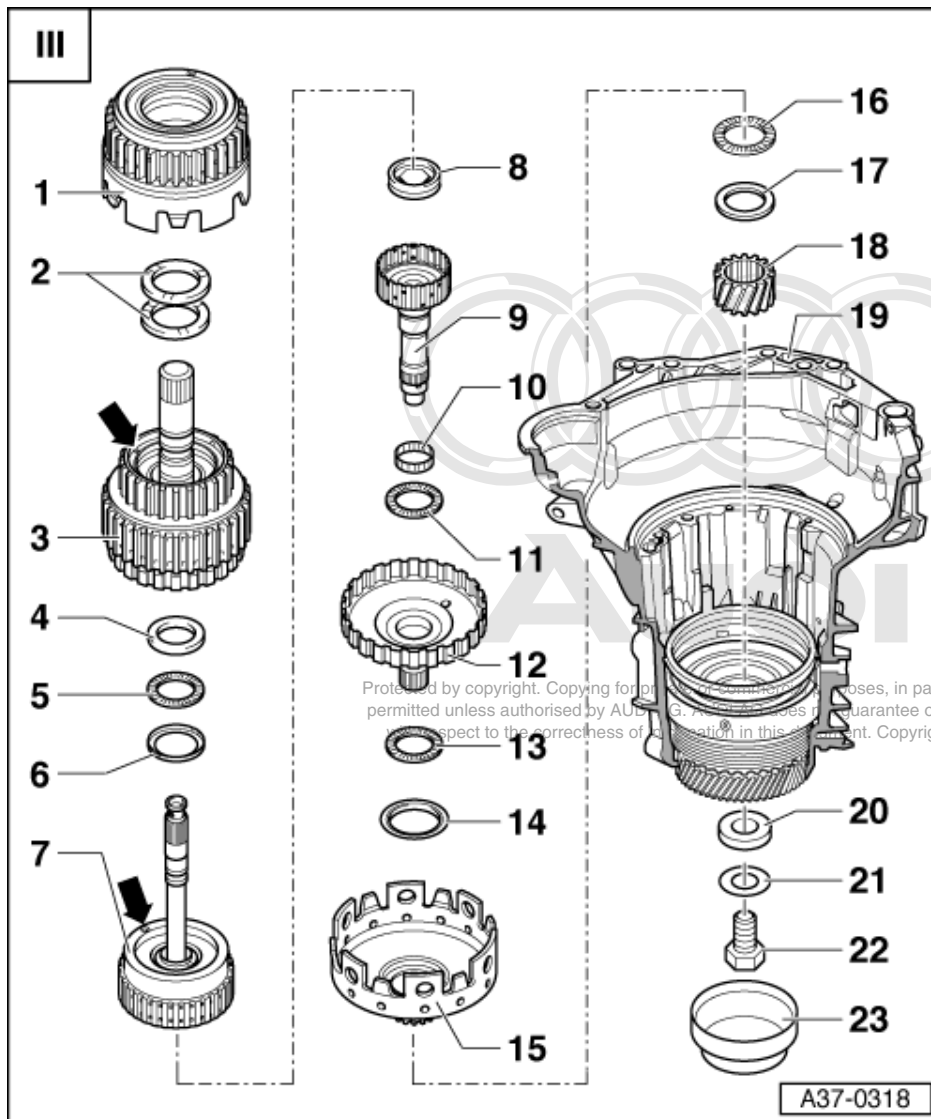
- ◆ Number of outer plates -B1- => Page 2 onwards

9 Shim

- ◆ Determining thickness => Adjusting reverse gear brake -B1-, Page 90
- ◆ 1 or 2 shims can be installed
- ◆ Gearboxes APA and CBU are fitted with additional 3.7 mm thick shim

10 Gearbox housing with planet carrier installed

8.7 - III - Installing components from small sun gear up to reverse gear clutch -K2-



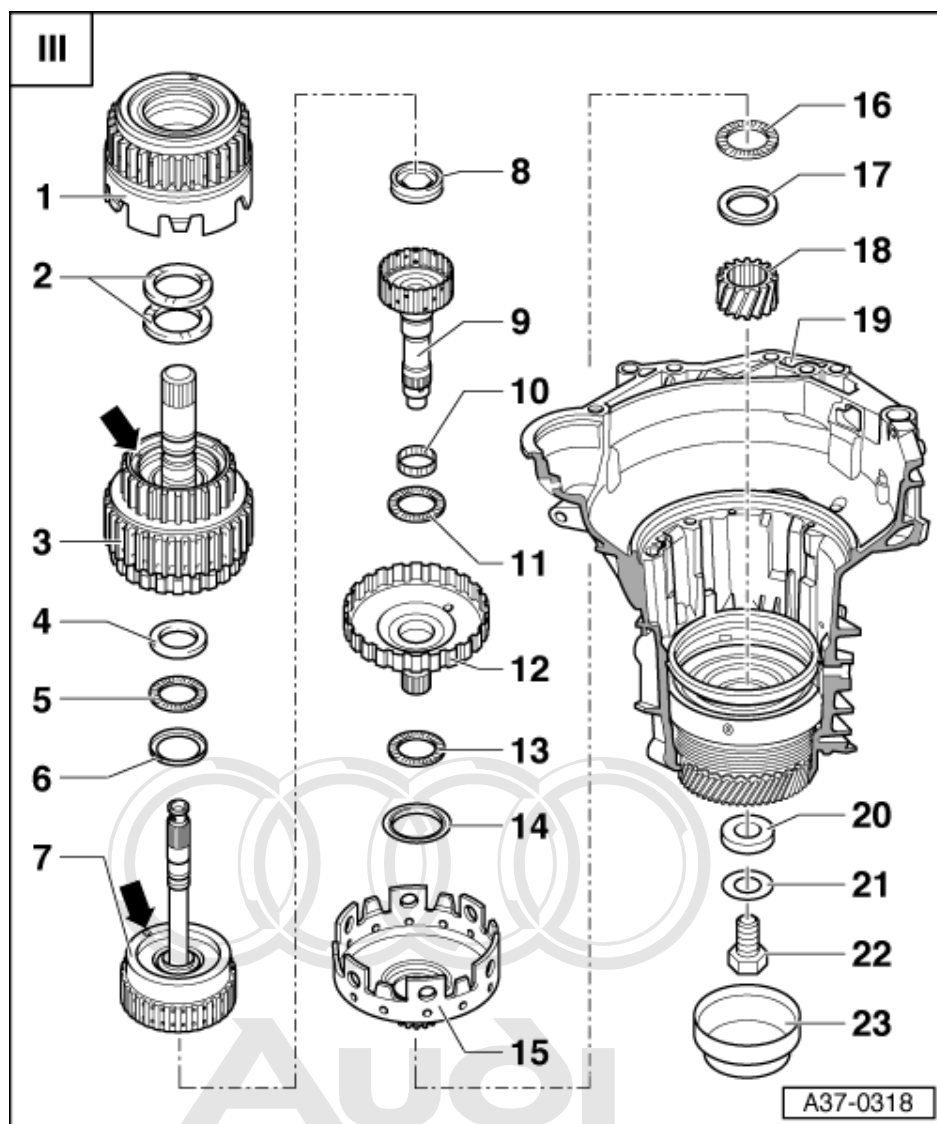
=> Overview, Page 54

Note:

- ♦ Dismantling planetary gearbox =>Page 49
- ♦ Assembling planetary gearbox => Page 72 .

1 Reverse gear clutch -K2-

- ♦ When installing, rotate clutch until all the inner plates have meshed
- ♦ Dismantling and assembling =>Page 133



2 Shim

- ◆ Determining thickness => Adjusting clutch play between -K1- and -K2-, Page 96
- ◆ 1 or 2 shims can be installed

3 1st - 3rd gear clutch -K1- with turbine shaft

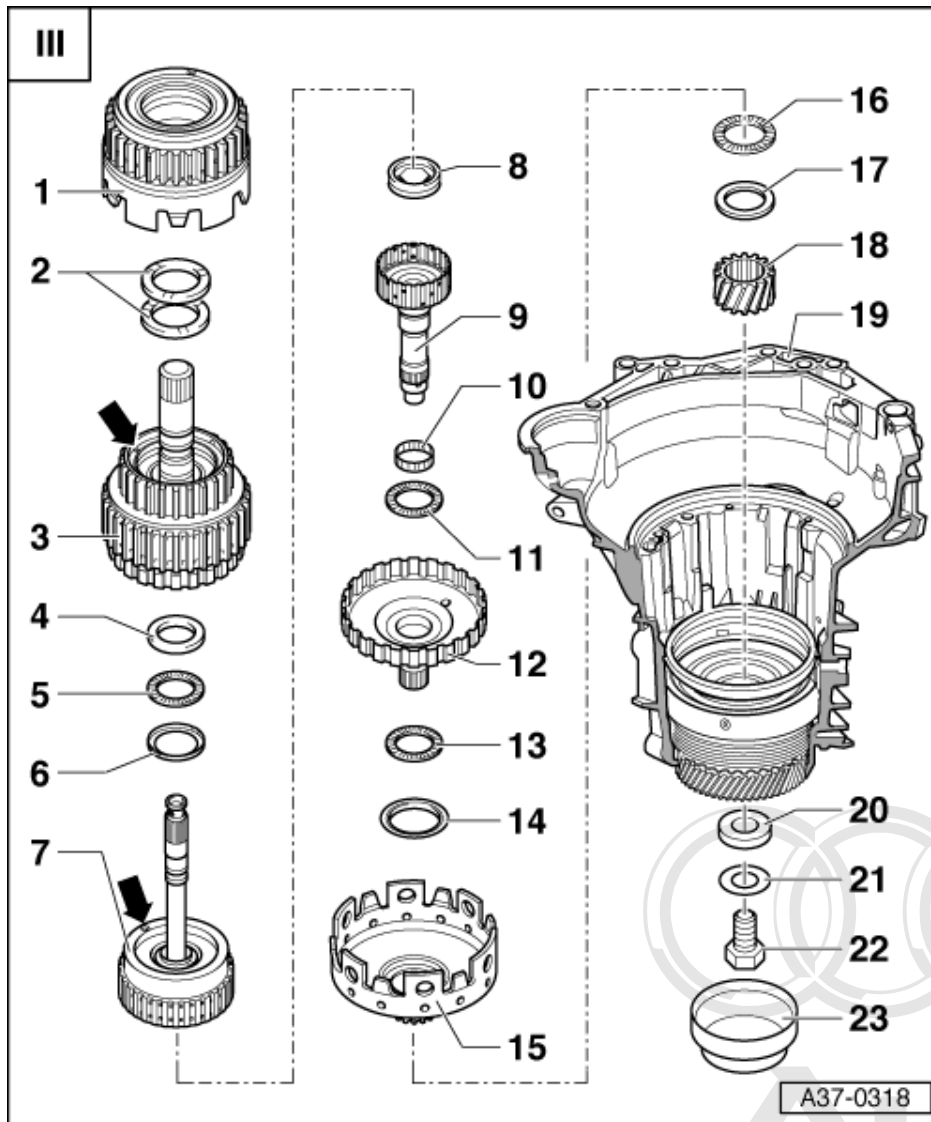
- ◆ With ball valve (arrow) Dismantling and assembling
=> Page 116
- ◆ With no ball valve (gearboxes as of 11.92 => Page 126

4 Axial needle bearing washer

5 Axial needle bearing

6 Axial needle bearing washer

- ◆ Lugs face axial needle bearing



7 3rd and 4th gear clutch -K3- with pump shaft

- ♦ With ball valve (arrow) Dismantling and assembling
=> Page 137
- ♦ 4th gear clutch -K3- with no ball valve (gearboxes as of 11.92 => Page 143)

8 Axial needle bearing with washer

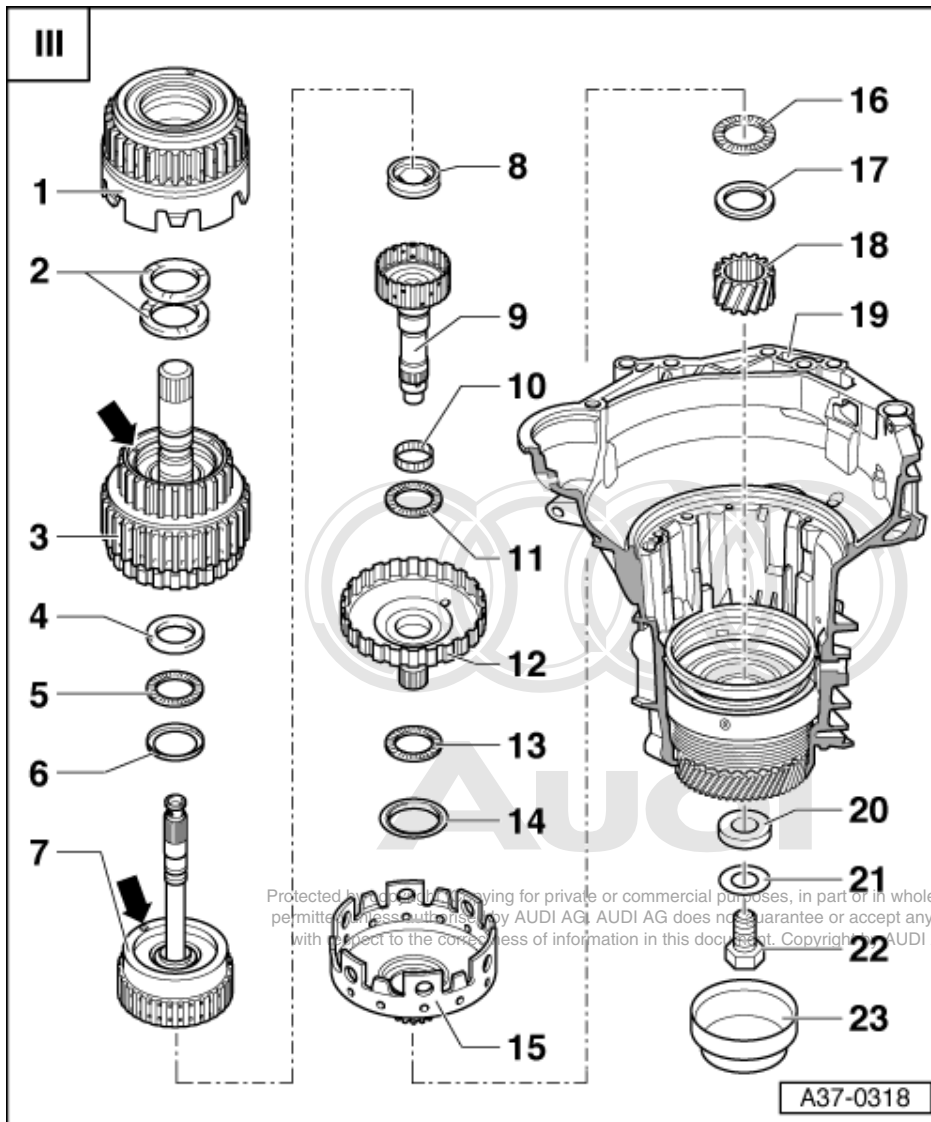
- ♦ One-piece with washer
- ♦ Axial needle bearing faces towards small input shaft
- ♦ May also be two-piece

9 Small input shaft

- ♦ Adapted to modified clutch -K3- as of 11.92

10 Needle bearing

11 Axial needle bearing



12 Large input shaft

- ♦ Adapted to modified clutch -K3- as of 11.92

13 Axial needle bearing

14 Axial needle bearing washer

- ♦ With shoulder

15 Large sun gear

- ♦ Modified ratio (number of teeth) as of 11.92

16 Axial needle bearing

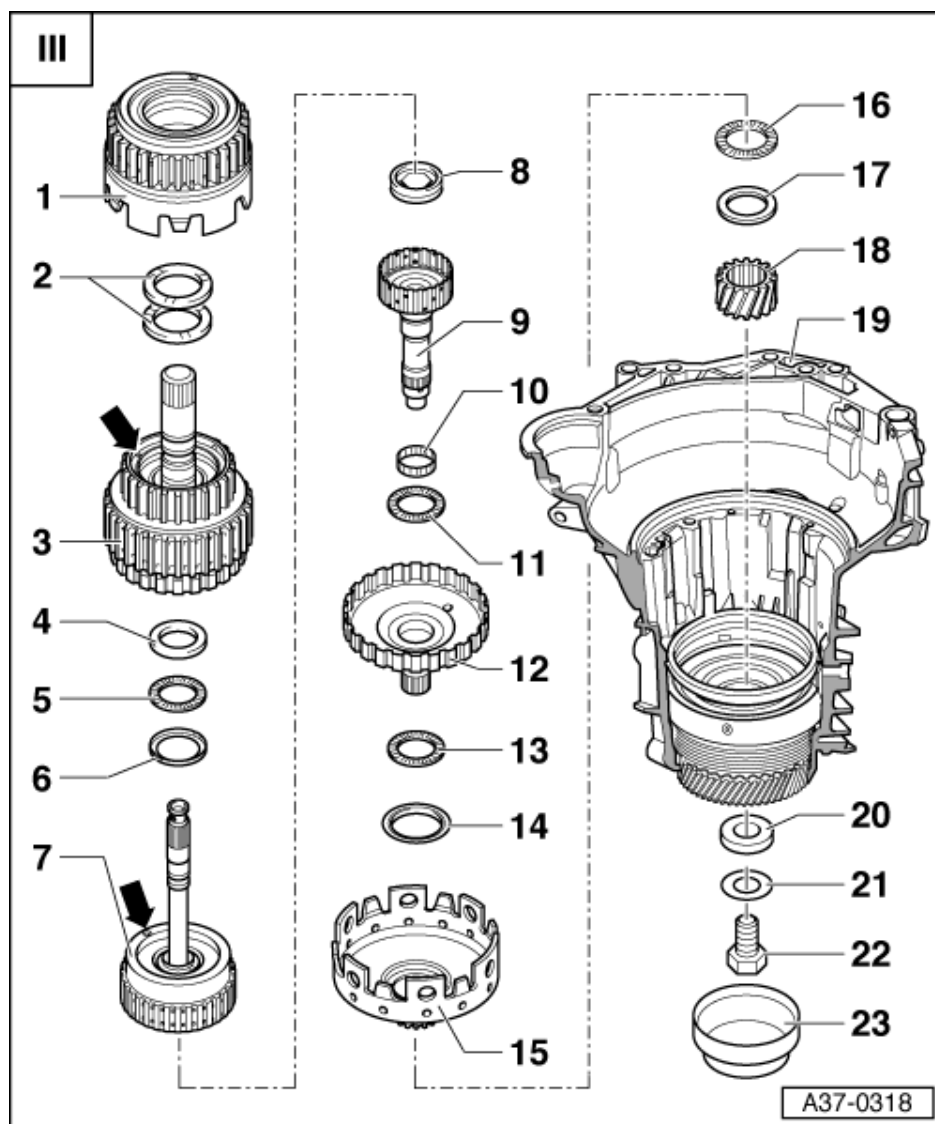
- ♦ Modified outside $\varnothing$ as of 11.92

17 Axial needle bearing washer

- ♦ Modified size as of 11.92

18 Small sun gear

- ♦ Cannot be removed from planet carrier on gearboxes as of 11.92 => Page 2 onwards



19 Gearbox housing with free wheel and circlips installed

20 Planet carrier shim

- ♦ Determining thickness => Adjusting planet carrier, Page 83

21 Washer

22 Bolt, 30 Nm

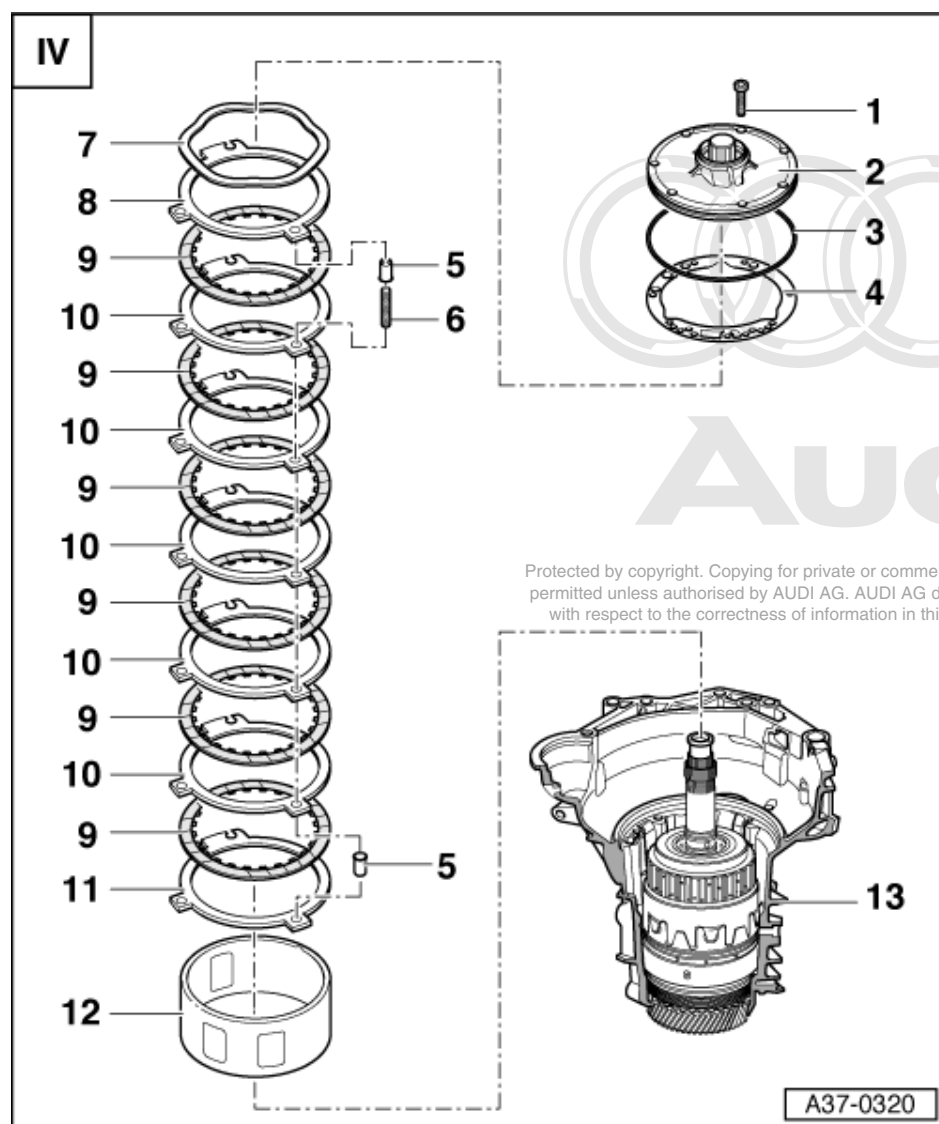
- ♦ For small input shaft

23 Cap

- ♦ Drive in with fitting sleeve 40-20

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8.8 - IV - Installing supporting tube for -B2- up to ATF pump



=> Overview, Page 54

Note:

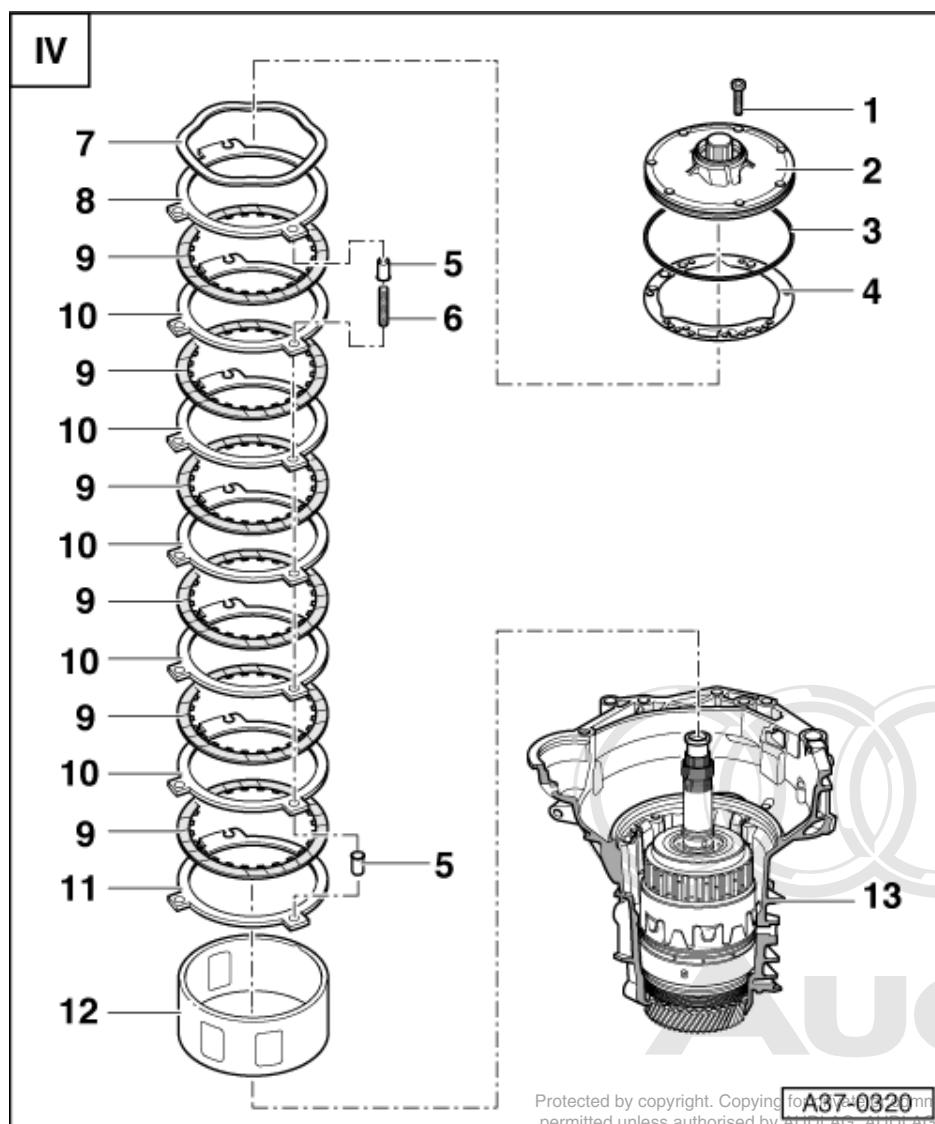
- ♦ Dismantling planetary gearbox =>Page 49
- ♦ Assembling planetary gearbox => Page 72 .

1 Bolt

- ♦ Qty. 7
- ♦ Tighten to 8 Nm and turn 90° further
- ♦ The turning further of 90° may be done in several stages

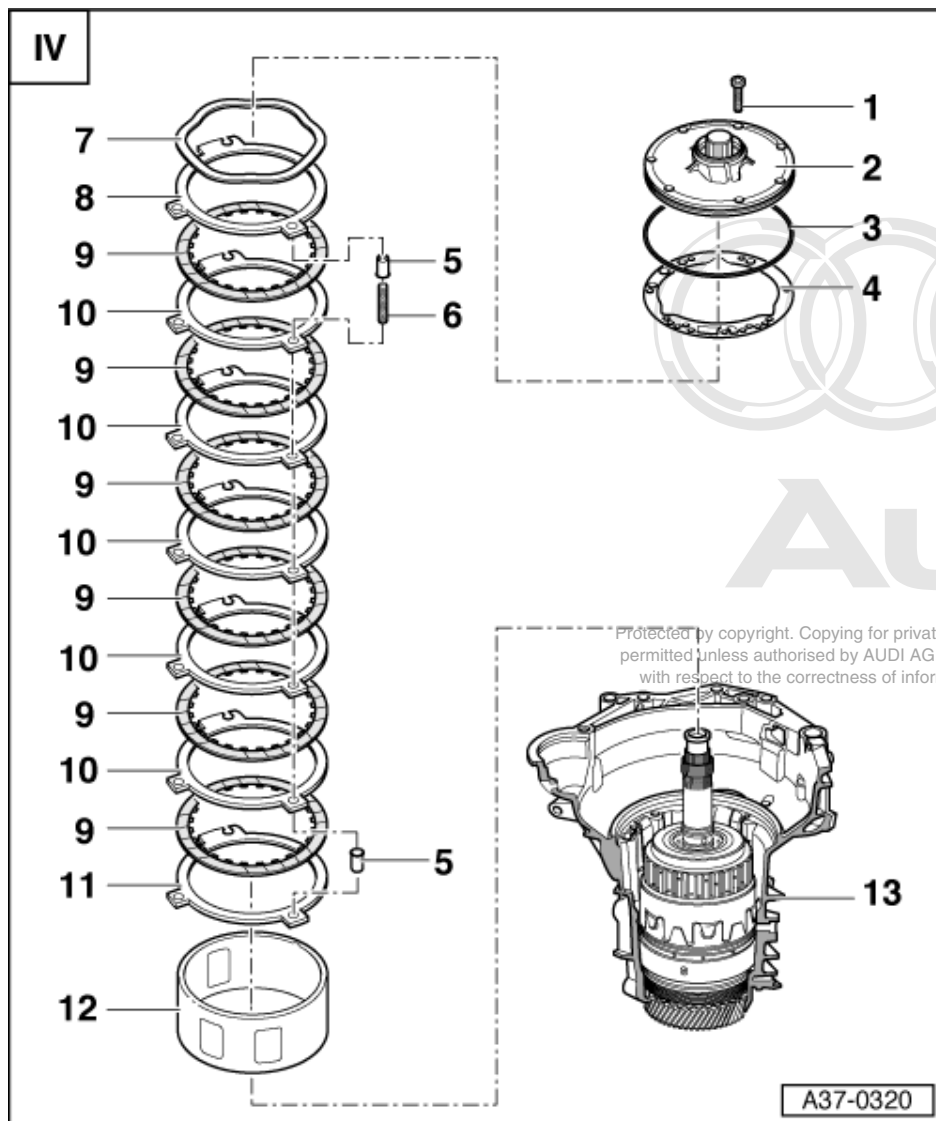
2 ATF pump with piston -B2-

- ♦ Dismantling and assembling => Page 109



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- 3 O-ring**
 - ♦ Always replace
 - ♦ Place on ATF pump
- 4 Gasket**
 - ♦ Always replace
- 5 Spring cap, Qty. 6**
 - ♦ Install 3 spring caps after installing first outer plate
 - ♦ Install 3 spring caps before installing last outer plate
- 6 Spring**
 - ♦ Qty. 3
- 7 Corrugated washer**



8 Outer plate -B2-

- ◆ Number of outer plates => Page 2 onwards
- ◆ Determining thickness of outer plate => Adjusting 2nd and 4th gear break -B2-, Page 102
- ◆ 1 or 2 outer plates can be installed

9 Inner plate -B2-

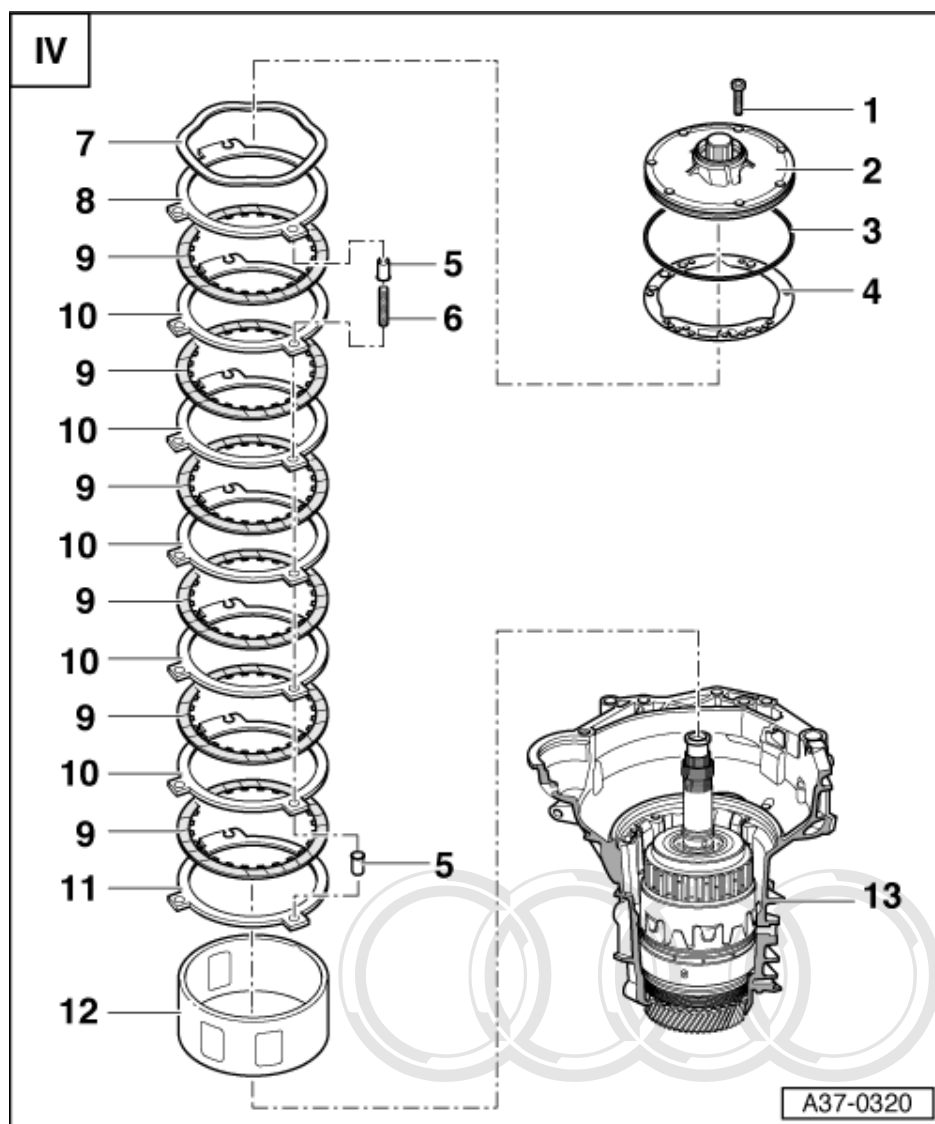
- ◆ Number of inner plates => Page 2 onwards
- ◆ Before installing place new inner plates in ATF for 15 minutes

10 Outer plate -B2-

- ◆ Always install 2 mm thick outer plates
- ◆ Number of outer plates => Page 2 onwards

11 Outer plate -B2-

- ◆ Fit 3 mm thick outer plate to supporting tube



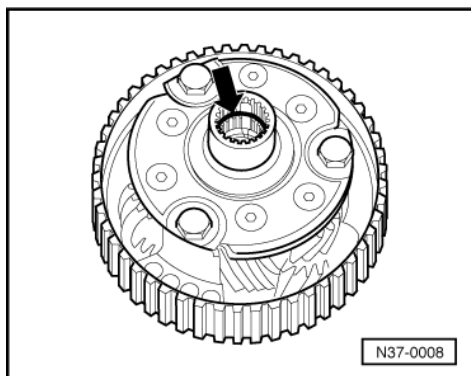
12 Supporting tube -B2-

- ♦ For the -B2- plate package
- ♦ Insert so that notch locates on freewheel wedge
- ♦ As a replacement part it is allocated according to gearbox code letters

13 Gearbox housing with clutches installed

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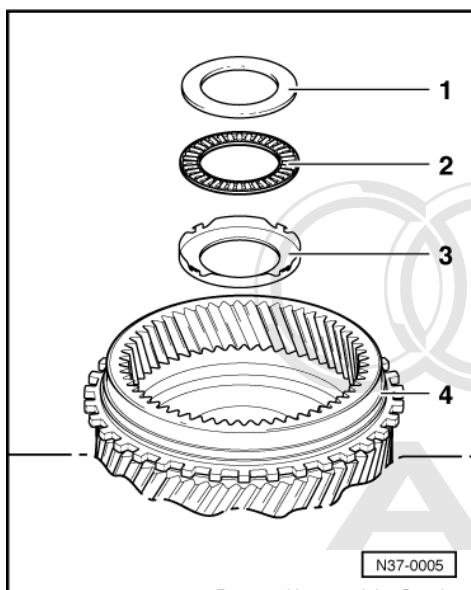
8.9 - Assembling planetary gearbox



- -> Fit O-ring -arrow- into planet carrier.

Note:

The planet carrier must be adjusted after replacing planet carrier, large sun gear, large input shaft or small input shaft => Page 83 .



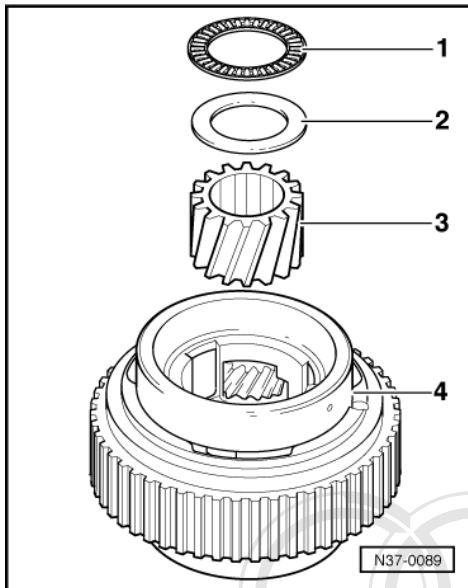
- -> Insert axial needle bearing with washers in input gear.

1 - Axial needle bearing washer

2 - Axial needle bearing

3 - Axial needle bearing washer, insert smooth side into input gear.

4 -Input gear is installed in gearbox housing =>Page 54 .



- -> Inserting small sun gear with washer and axial needle bearing into planet carrier.

1 - Axial needle bearing

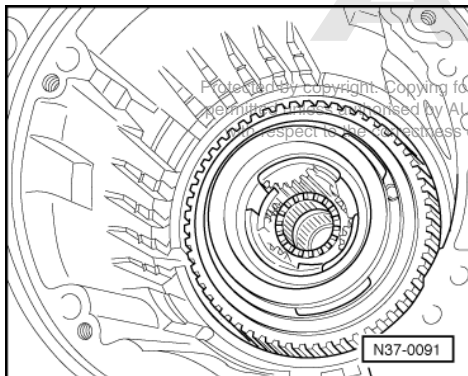
Note:

Modified outside $\varnothing$ on gearboxes as of 11.92.

2 - Axial needle bearing washer

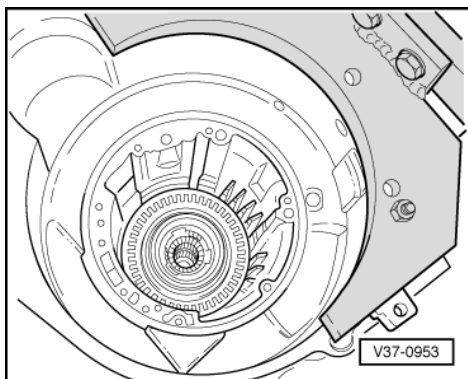
3 - Small sun gear cannot be removed from planet carrier on gearboxes as of 11.92, => Page 2 onwards.

4 - Planet carrier



- -> Insert planet carrier in input gear.
- Centrally align washer and axial needle bearing on "small sun gear".

- Insert shim(s).
- Insert inner and outer -B1- plates.
- Insert pressure plate of -B1- with flat side facing plates.



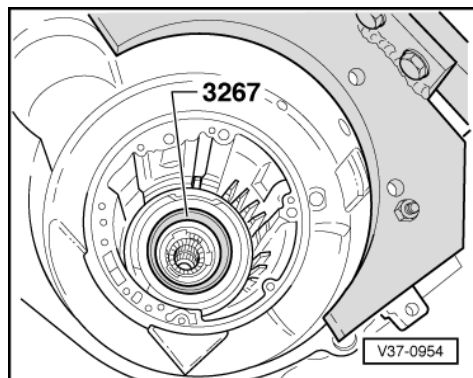
Thickness of pressure plate varies according to number of plates => Page 61 .

- -> Insert dished washer with convex facing towards free wheel.

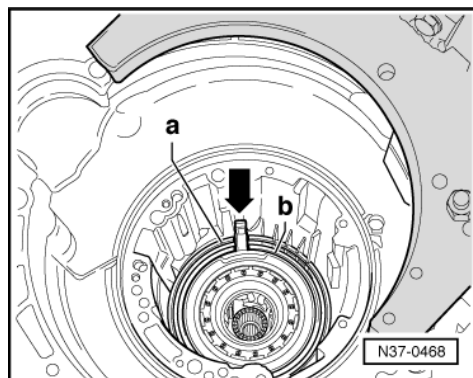
When replacing

- ◆ Gearbox housing
- ◆ Free wheel
- ◆ Piston for reverse gear brake -B1-
- ◆ or the plates

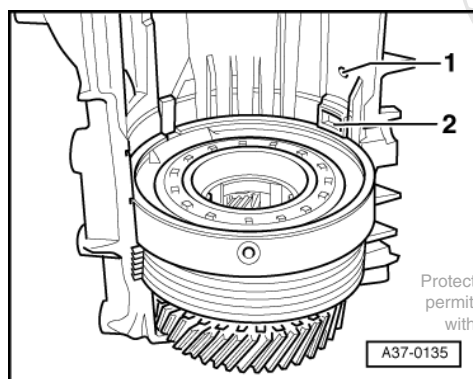
necessitates adjustment of -B1-, => Page 90 .



- -> Preload free wheel rollers with assembly ring 3267 and insert free wheel.

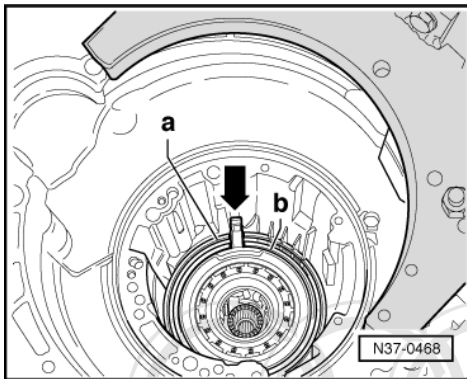


- -> Installation position of free wheel: The retaining wedge (arrow) must be seated in the machined groove on gearbox housing.
- Install circlip for free wheel -b-.
- Insert circlip gaps over freewheel retaining wedge (arrow).

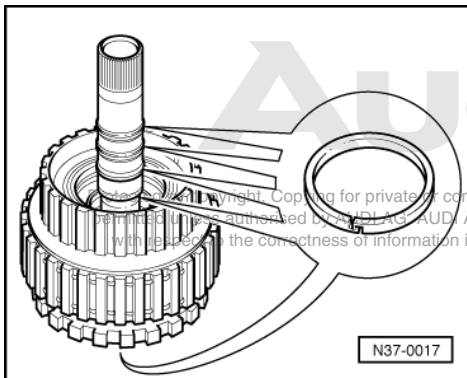


- -> Insert baffle block -2- in gearbox housing groove, where ATF breather drilling -1- is located.

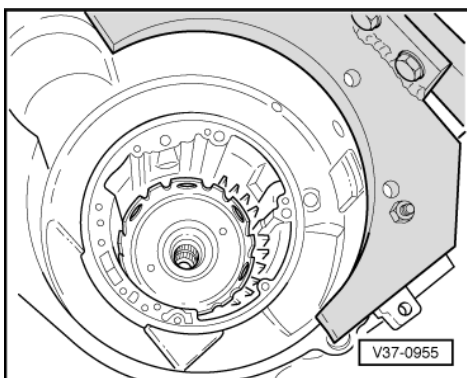
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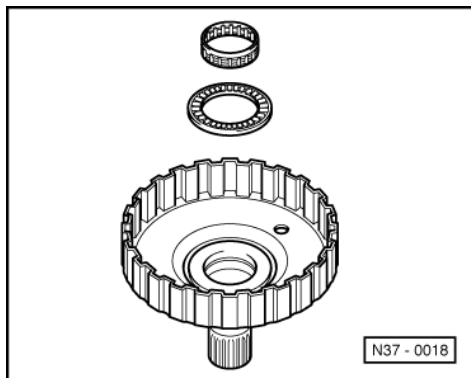
- -> Install circlip -a- for supporting tube for -B2- with open ends of circlip facing toward retaining wedge - arrow- of free wheel.
- Perform check measurement of -B1-
=> Page 95



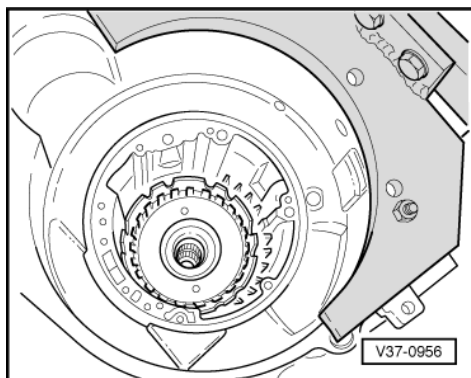
- -> Insert washer with axial needle bearing in large sun gear.
- 1 - Axial needle bearing
 - 2 - Washer with shoulder (smooth side faces axial needle bearing)
 - 3 - Large sun gear



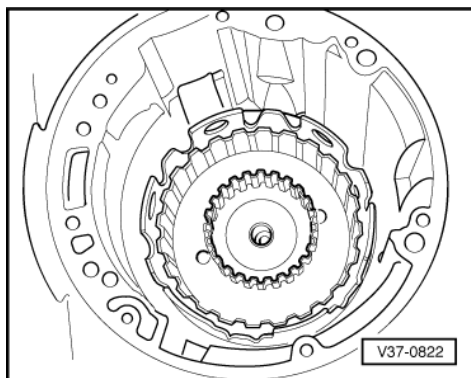
- -> Insert large sun gear with bearing.
- Centre washer with axial needle bearing between the two sun gears.



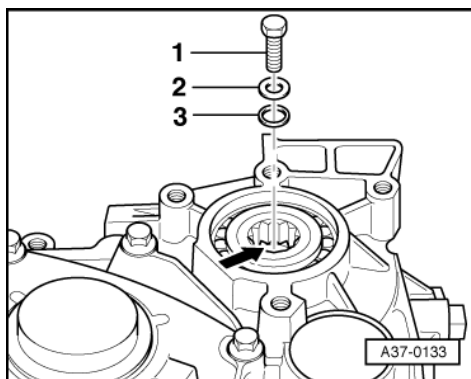
- -> Insert axial needle bearing and needle bearing in large input shaft.



- -> Insert large input shaft with bearing.



- -> Insert small input shaft.



- -> Install small input shaft bolt -1- with washer -2- and shim -3-,

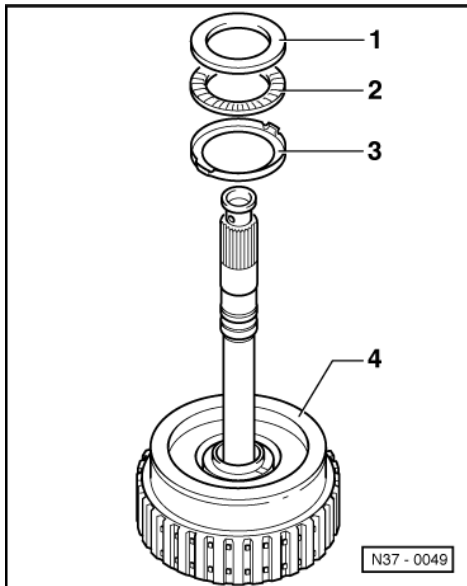


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Tightening torque 30 Nm.

Notes:

- ◆ Insert shim -3- onto small input shaft shoulder (arrow).
- ◆ Determining shim thickness => adjusting planet carrier, Page 83 .
- Performing planet carrier check measurement
=> Page 89



- -> Insert axial needle bearing with washers in -K3-.

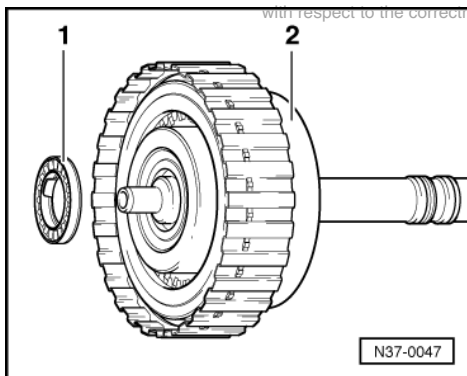
- 1 - Axial needle bearing washer
- 2 - Axial needle bearing
- 3 - Washer for axial needle bearing (smooth side faces -K3-)
- 4 - 3rd and 4th gear clutch -K3-

On gearboxes as of 11.92 => Page 2 onwards, clutch -K3- is only used to select 4th gear.

Note:

Ensure the piston rings are properly seated.

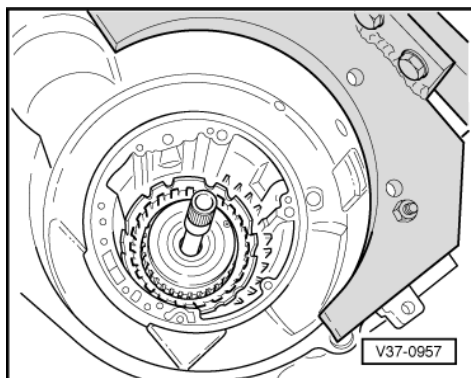
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- Moisten washer of axial needle bearing with ATF so that bearing sticks to 3rd and 4th gear clutch -K3- on installation.



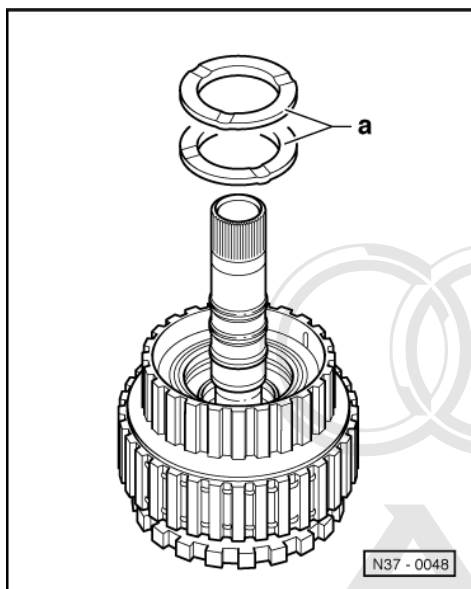
- -> Attach axial needle bearing with washer -1- to 3rd and 4th gear clutch -K3- (-Item 2-).
- Installation position: Bearing washer faces toward -K3-.



- -> Insert 3rd and 4th gear clutch -K3-.

Note:

On insertion, turn 3rd and 4th gear clutch -K3- until all plates mesh.

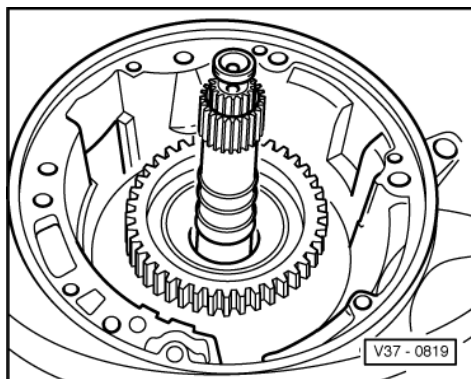


- -> Insert shim(s) -a- in -K1-.

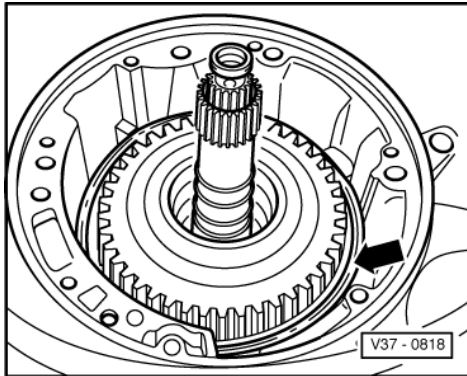
Notes:

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- ♦ The shim thickness must be recalculated when replacing -K1-, -K2-, the small input shaft or the ATF pump, => Adjusting clutch play between -K1- and -K2-, Page 96 .
- ♦ 1 or 2 shims can be installed.



- -> Insert 1st - 3rd gear clutch -K1-.

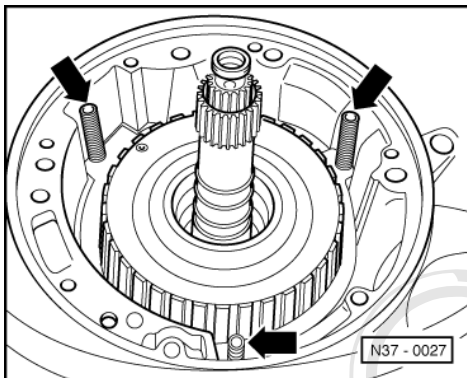


- -> Insert reverse gear clutch -K2-.

Note:

When installing, rotate reverse gear clutch -K2- until all the plates have meshed.

- Insert supporting tube -arrow- for plate package of 2nd and 4th gear brake -B2- such that recess on lower part of supporting tube engages in retaining wedge of free wheel



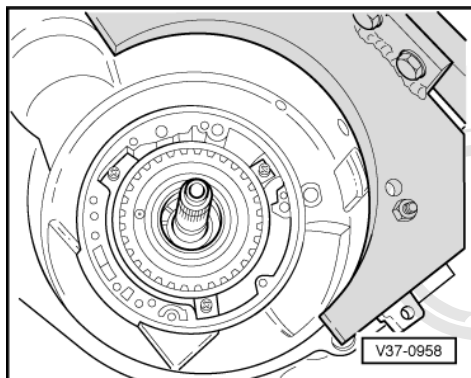
- -> Install plates of 2nd and 4th gear brake -B2- in following sequence:
 - First insert a 3 mm thick outer plate.
 - Insert three spring caps in outer plate.
 - Insert compression springs (arrows).
 - Insert all, but the last outer plate.
 - Determining last outer plate => IV - Adjusting 2nd and 4th gear brake -B2-, Page 102 .

Note:

Replacement of the following components necessitates adjustment of 2nd and 4th gear brake -B2- => Page 102 :

- ◆ Gearbox housing
- ◆ Supporting tube
- ◆ ATF pump
- ◆ Plates

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- -> Attach three spring caps to the compression springs before inserting last measured outer plate.
- Insert last outer plate.

Note:

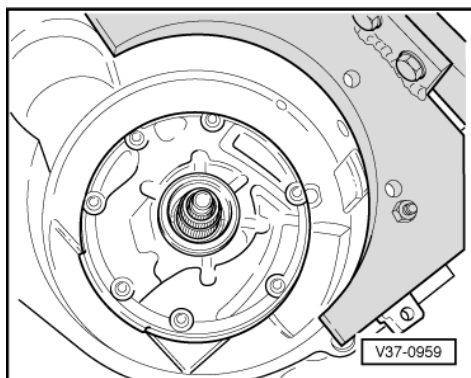
If the measurement reveals that two outer plates have to be inserted, these are to be attached jointly to the spring caps.

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- Install corrugated washer
- Insert gasket for ATF pump, paying attention to position of holes.
- Fit O-ring on ATF pump.

Note:

Ensure the piston rings are properly seated.



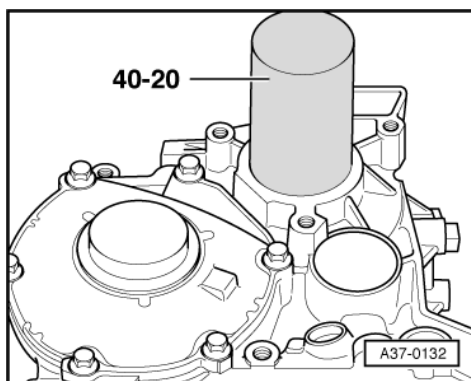
- -> Insert ATF pump. Installation position is specified by holes for bolts.
- Tighten bolts evenly in diagonal sequence to 8 Nm.

Note:

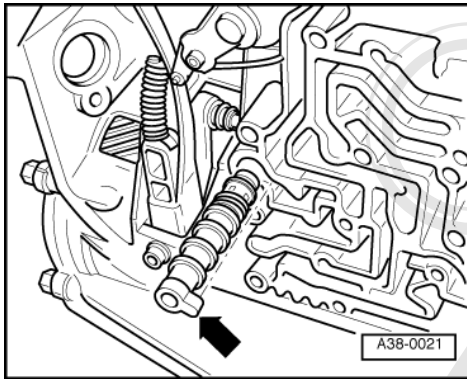
Ensure that the O-ring is not damaged.

- Then turn bolts 90° further.

Turning further can be done in several stages.



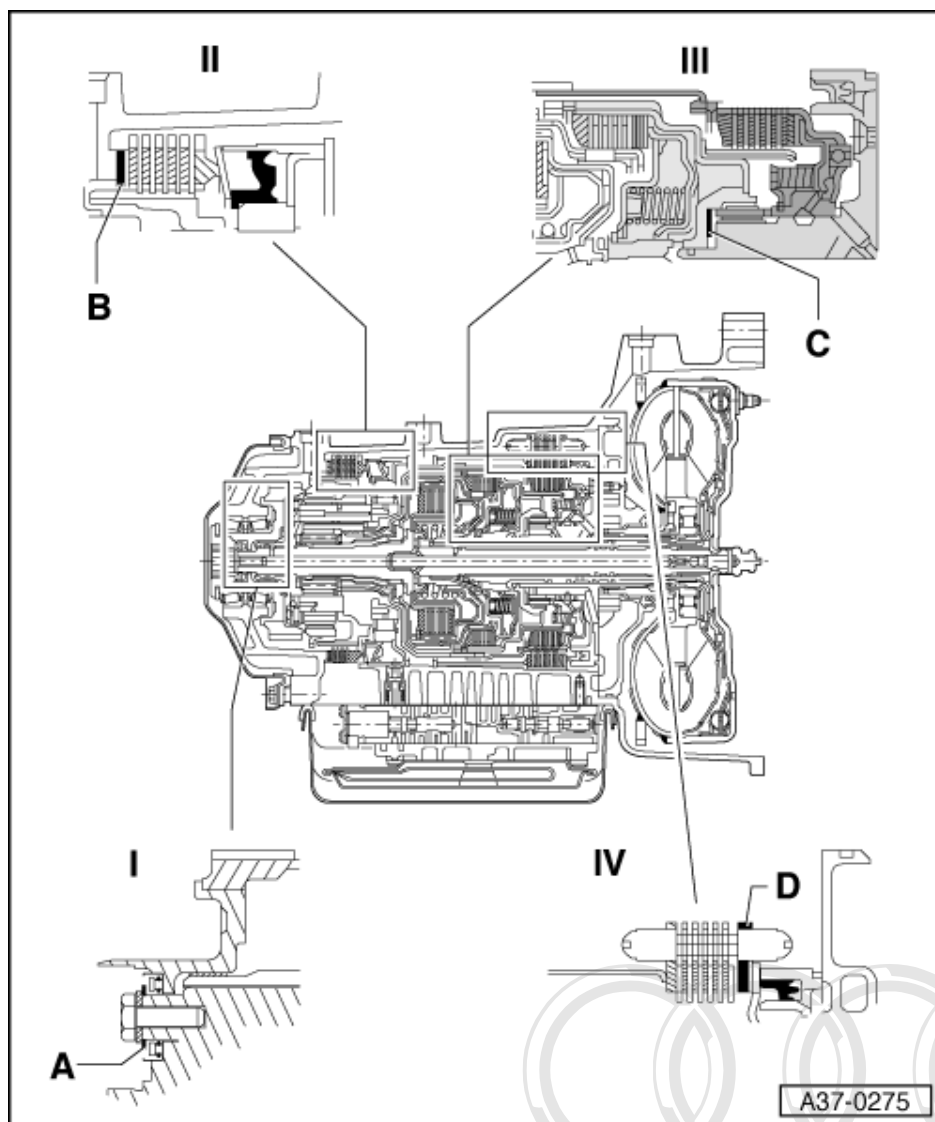
- Carry out check measurement of clutch play => Page 101 .
- -> Drive in cover with drive sleeve 40-20.



- -> Insert sealing plugs with O-rings.
- Installation position: Lug -arrow- engages in oil channel
- Installing valve body => Page 148 onwards
- Installing sump => Page 148 onwards
- Installing torque converter.
- Installing gearbox => Page 24 onwards.
- Topping up ATF and checking ATF level =>Page 30 .



8.10 - Planetary gearbox adjustments - overview



I - Planet carrier

- ◆ A - Shim
- ◆ Determining thickness => Adjusting planet carrier, Page 83

II - Reverse gear brake -B1-

- ◆ B - Shim
- ◆ Determining thickness => Adjusting reverse gear brake -B1-, Page 90

III - Clutch play

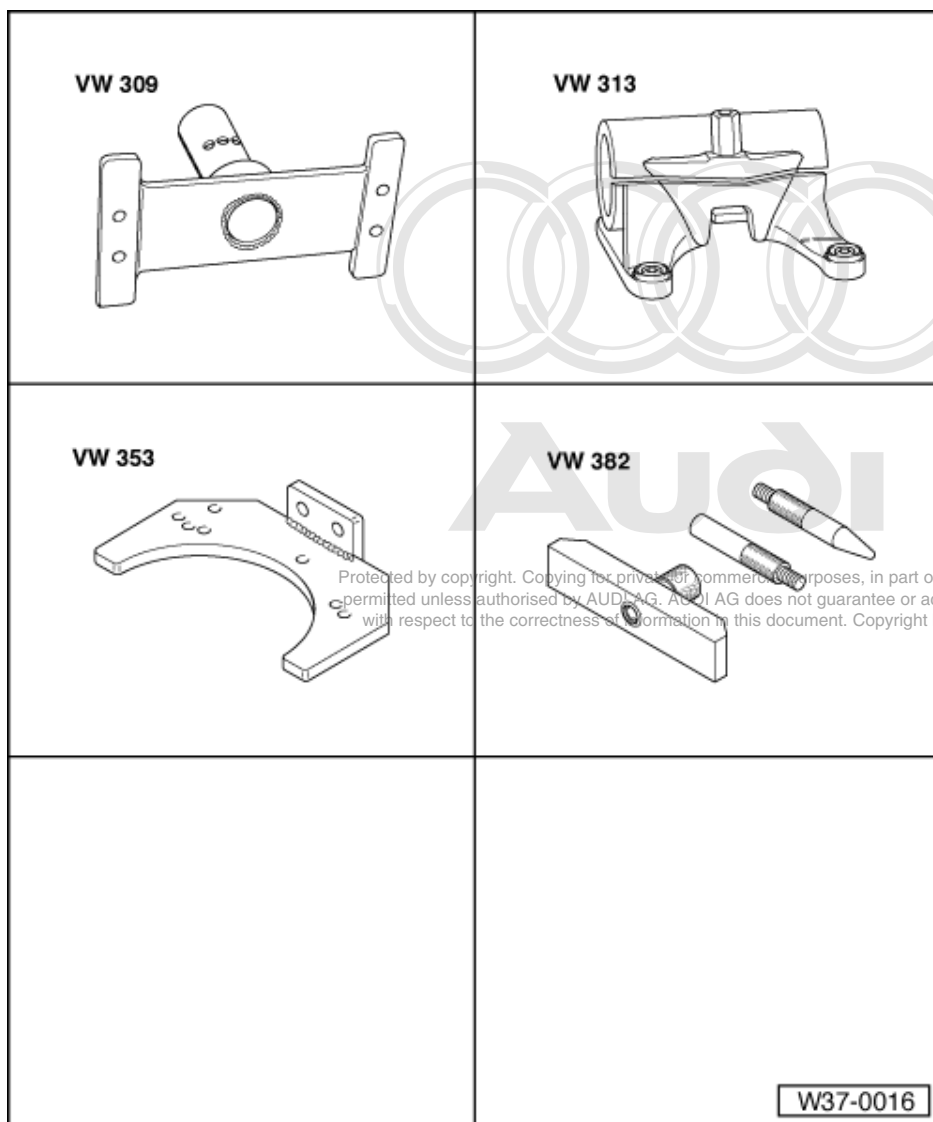
- ◆ C - Shim
- ◆ Determining thickness => Adjusting clutch play between K1- and K2- Page 96

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

- ◆ D - Outer plate/shim
- ◆ Determining thickness => Adjusting 2nd and 4th gear brake -B2-, Page 102

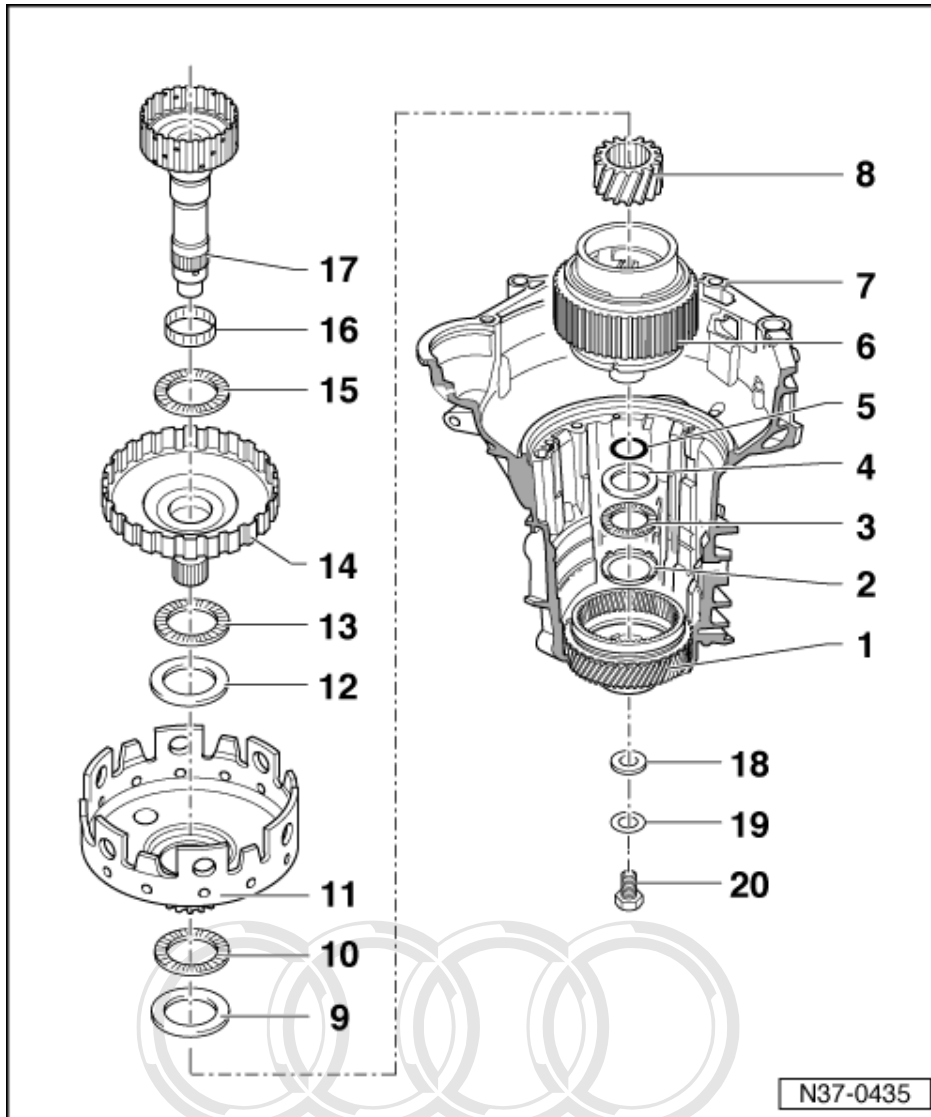
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8.11 - I - Adjusting planet carrier



Special tools, testers and workshop equipment required

- ◆ VW 309 Holding plate
- ◆ VW 313 Support clamp
- ◆ VW 353 Gearbox support
- ◆ VW 382 Measuring device



Overview of components

- To adjust planet carrier, install components in gearbox housing without shim (Item 18).

1 Input gear

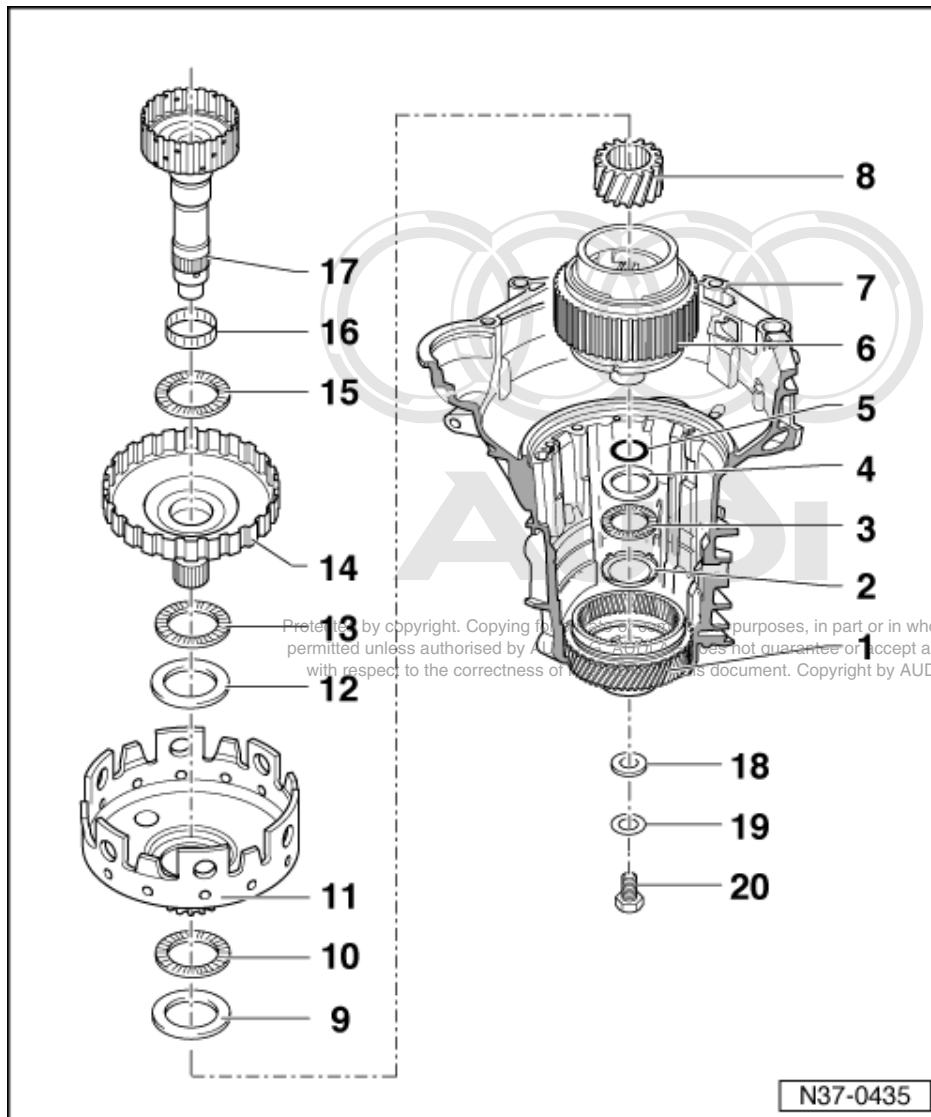
- ♦ Do not remove to adjust the planet carrier
- ♦ Removing and installing input gear or axial needle bearing for planet carrier => Page 169

2 Axial needle bearing washer

- ♦ Insert smooth side in input gear

3 Axial needle bearing

4 Axial needle bearing washer



5 O-ring

- ◆ Always replace
- ◆ Insert into planet carrier => Assembling planet carrier, Page 72

6 Planet carrier

7 Gearbox housing

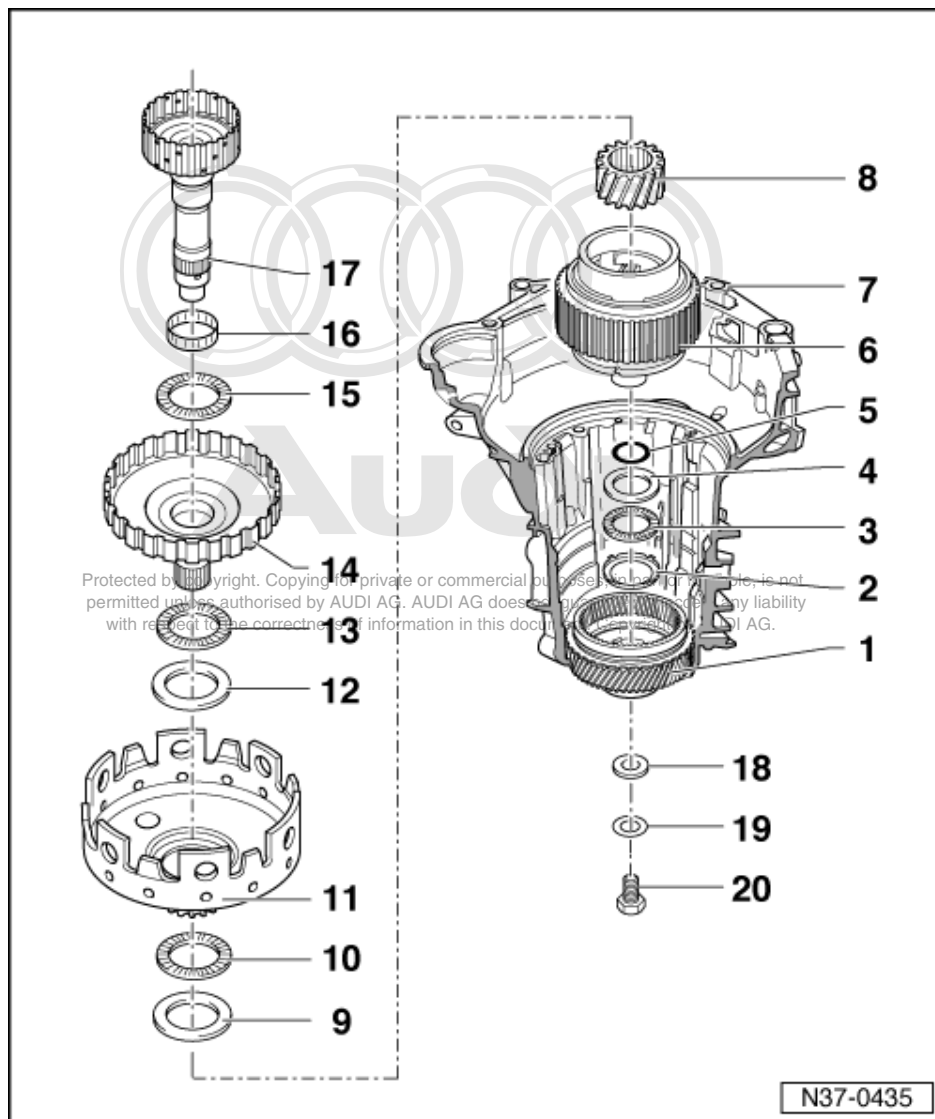
- ◆ With input gear and axial needle bearing
- ◆ Axial needle bearing remains in input gear
- ◆ If axial needle bearing is damaged => Removing and installing input gear, Page 169

8 Small sun gear

- ◆ Cannot be removed from planet carrier on gearboxes as of 11.92 => Page 2 onwards

9 Washer

10 Axial needle bearing



11 Large sun gear

12 Washer

- ♦ Insert into large sun gear => Assembling planetary gearbox, Page 72

13 Axial needle bearing

14 Large input shaft

15 Axial needle bearing

16 Needle bearing

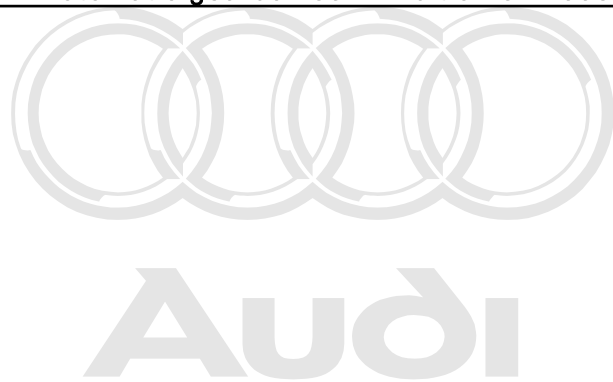
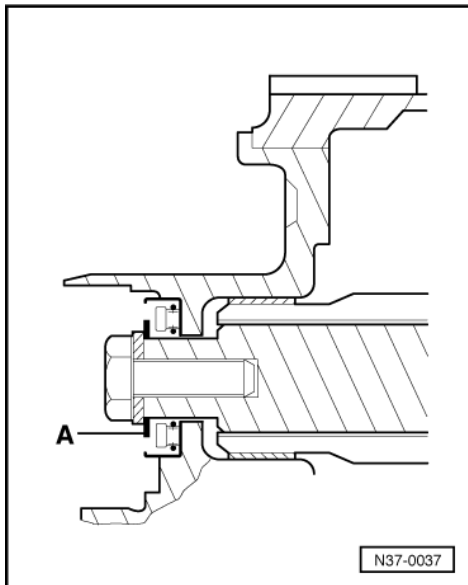
17 Small input shaft

18 Shim

- ♦ Do not install in planet carrier when adjusting

19 Washer

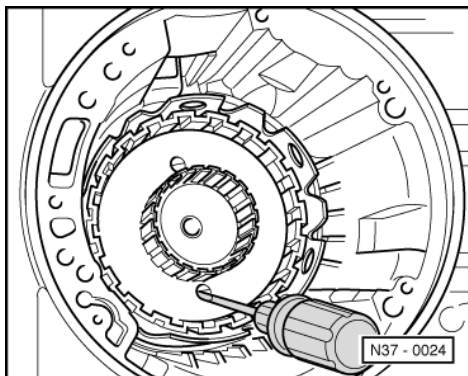
20 Small input shaft bolt, 30 Nm



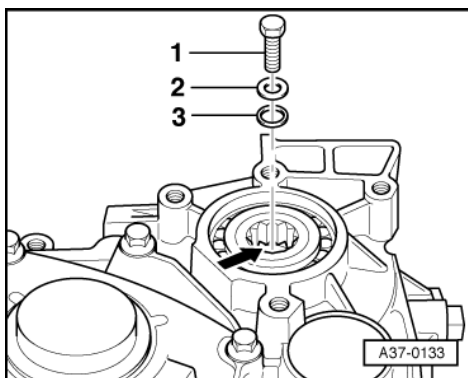
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-> **Determining shim -A-**

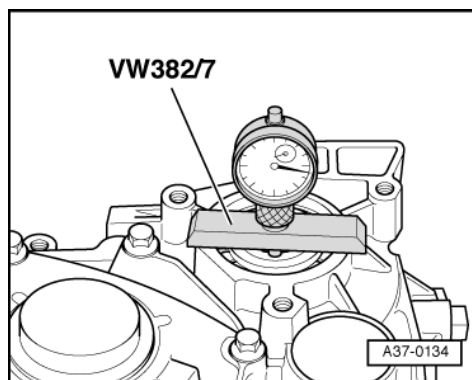
- Install all components (Item 3 ... 17 and 19 ... 20) => Page 84 in gearbox housing for adjustment of planet carrier.
- Engage parking lock.



- -> Insert screwdriver through holes in "large input shaft" and "large sun gear" so as to enable "bolt for small input shaft" to be unfastened and tightened.



- -> Install bolt -1- small input shaft with washer -2- but without shim -3-.
Tightening torque: 30 Nm



- -> Set up dial gauge so that top of gauge is positioned on bolt head centre with 1 mm preload.
- Zero dial gauge.
- Move small input shaft up and take reading.

Example: Reading 2 mm

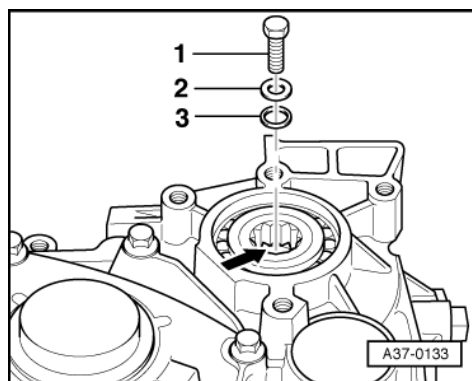
- Select thickness of shim according to table => Page 88 and determine Part No. from parts catalogue.

Table of "shims":

Gauge reading (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

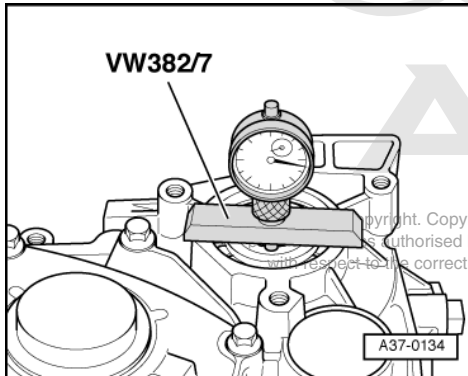
Example:

If the reading is 2.00 mm use a shim with a thickness of 1.7 mm.



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- Remove small input shaft bolt.
- -> Fit determined shim -3- onto small input shaft (arrow).
- Tighten small input shaft bolt -1- with washer -2-
Tightening torque 30 Nm.
- Carry out planet carrier check measurement =>Page 89 .



Planet carrier check measurement

- -> Insert dial gauge in VW 382/7 and place the tip on the bolt of the small input shaft.
- Move small input shaft up and down and take reading of play on dial gauge.

Play:

Min. = 0.23 mm

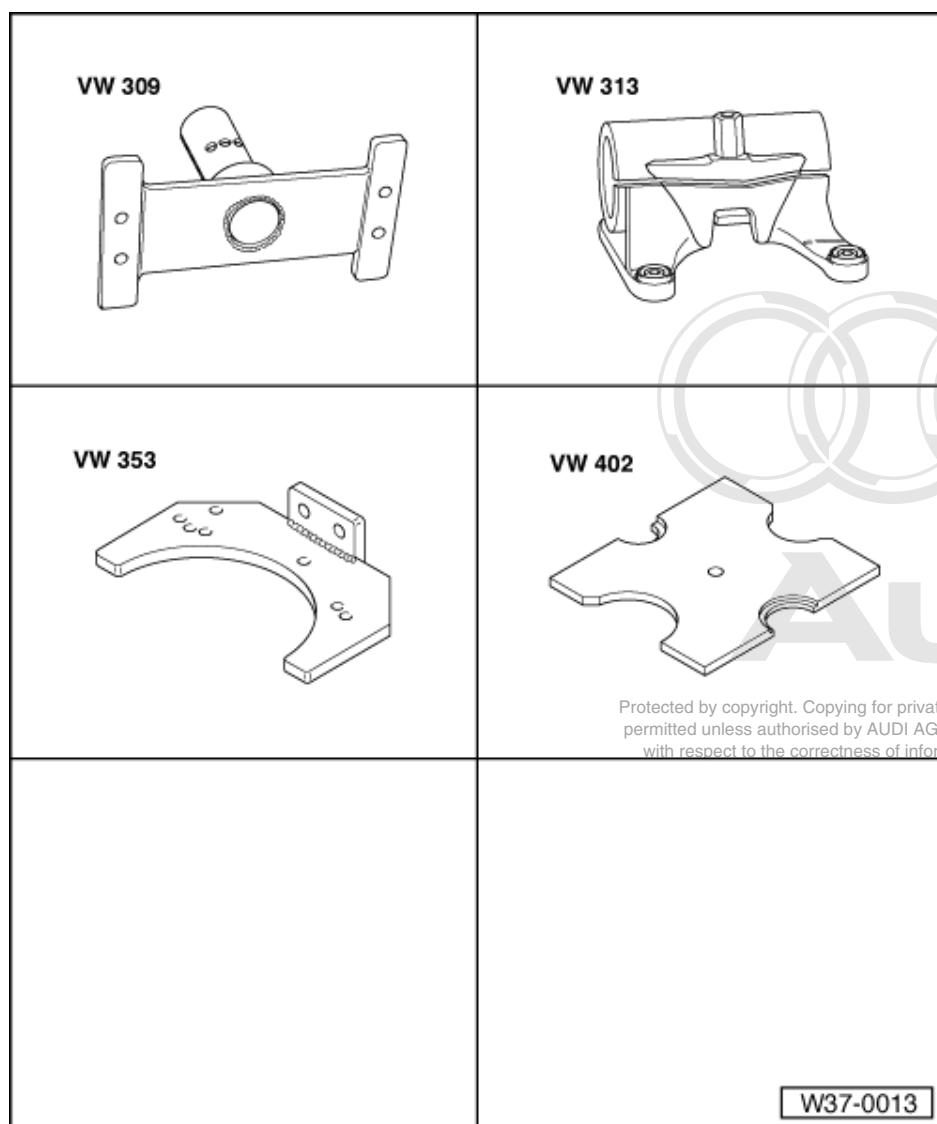
Max. = 0.37 mm

Note:

If the planet carrier has been adjusted with reverse gear brake -B1- and free wheel removed then before installing planet carrier install reverse gear brake -B1-, => Assembling planetary gearbox, Page 72 .

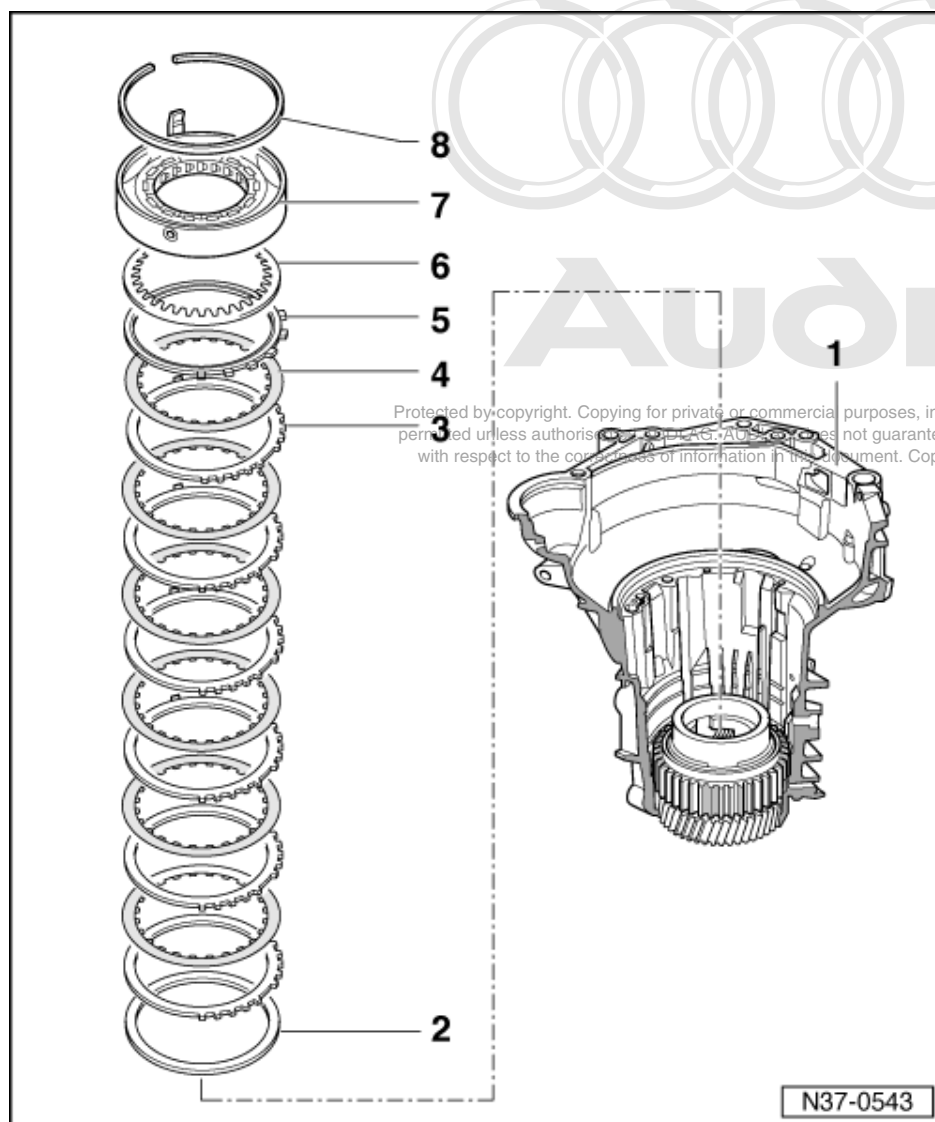


8.12 - II - Adjusting reverse gear brake -B1- - overview



Special tools, testers and workshop equipment required

- ♦ VW 309 Holding plate
- ♦ VW 313 Support clamp
- ♦ VW 353 Gearbox support
- ♦ VW 402 Thrust plate



Overview of components

- To adjust reverse gear brake -B1- install components without shims (Item 72).

1 Gearbox housing

- ♦ With input gear and planet carrier installed

2 Shim

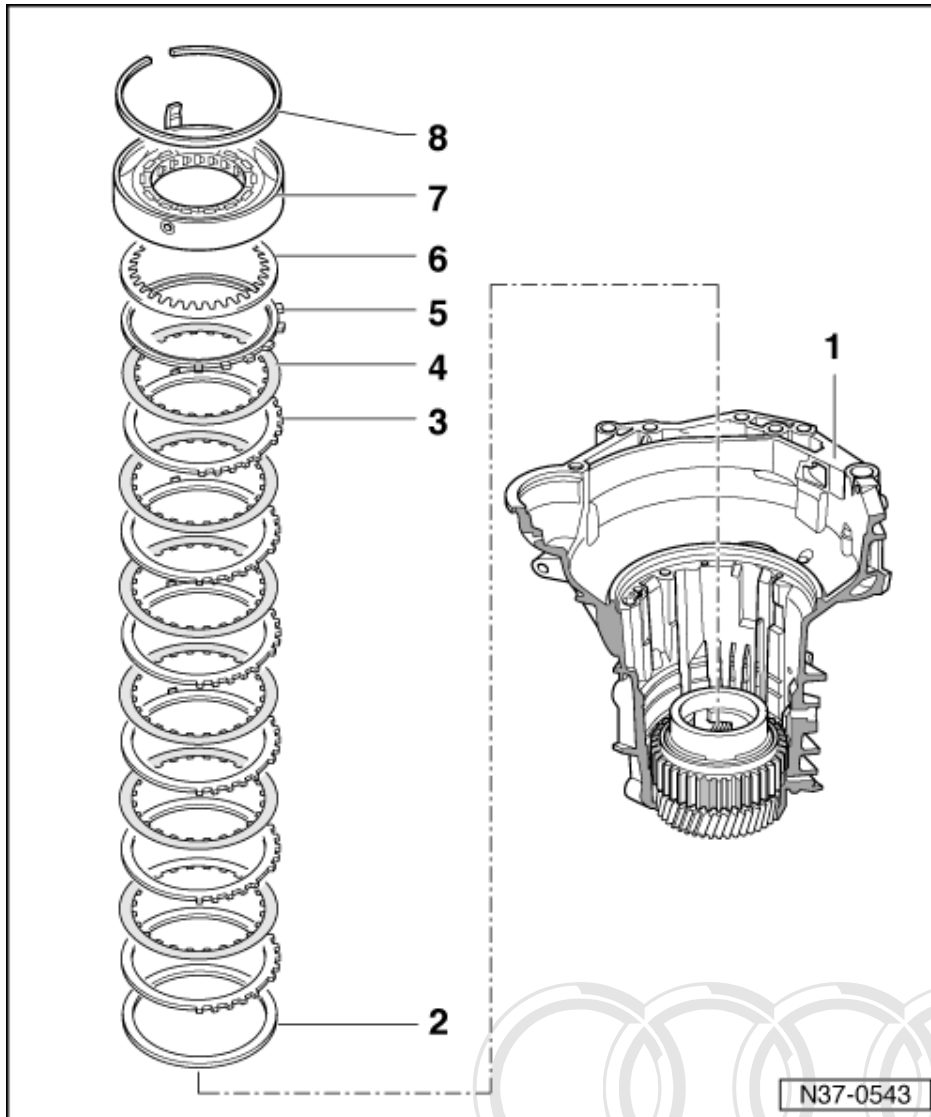
- ♦ 1 or 2 shims can be installed
- ♦ Gearboxes APA and CBU are fitted with additional 3.7 mm thick shim

3 Outer plate -B1-

- ♦ Number of outer plates => Page 2 onwards

4 Inner plate -B1-

- ♦ Number of outer plates => Page 2 onwards



5 Pressure plate

- ◆ Installation position: Flat side faces toward plates
- ◆ As a replacement part it is allocated according to gearbox code letters

6 Dished washer

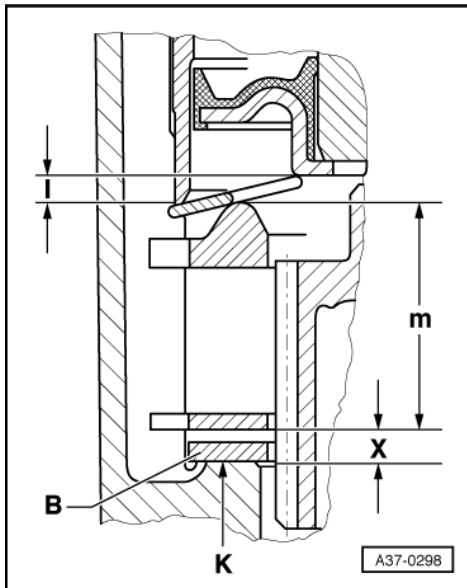
- ◆ Installation position: Convex side faces toward free wheel

7 Free wheel with -B1- piston

Before removing or installing freewheel, remove valve body and take out sealing plugs => Page 148.

8 Circlip

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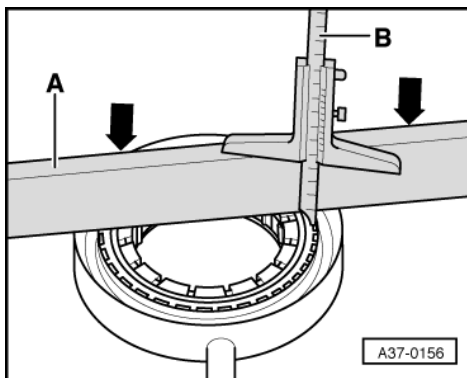


-> Determining thickness of shim(s) -B-

The thickness of the shim(s) depends on the size of gap "x". Gap "x" is calculated using the following formula:

- ◆ B = Shim
- ◆ x = Gap
- ◆ l = Position of piston in free wheel; determining
=> Page 93
- ◆ m = Height of plate package including pressure plate; determining => Page 94
- ◆ K = Constant = 30.5 mm

"K" is determined by installation height in gearbox housing and is not adjustable.



Calculating "l"

- -> Press piston in direction of arrow as far as stop.
- Place straightedge "A" onto outer race of free wheel.
- Measure to inner edge of piston with depth gauge "B".

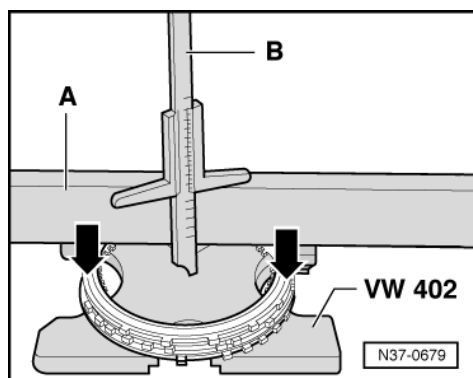
Example:

Measured value	= 51.8 mm
- Straightedge	= - 48.2 mm

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Calculated value l	= 3.6 mm
--------------------	----------

Calculating "m"



- ➔ Place straightedge "A" on thrust plate.
- Compress plates package including pressure plate in direction of arrow and measure the thickness of plate set with depth gauge "B".

Example:

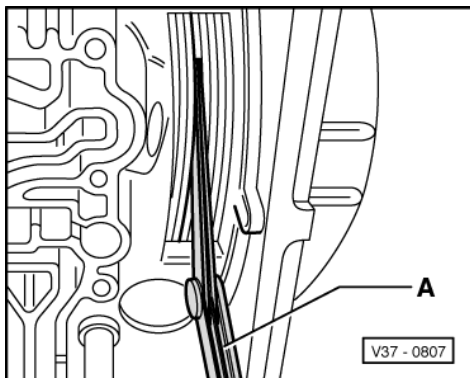
Measured value	= 77.2 mm
- Straightedge	= - 48.2 mm
Calculated size m	= 29.0 mm

- Determine size of shim according to table:

Table of "shims":

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

- Ascertain thickness of shims according to table and determine Part No. from parts catalogue.
- After determining shim for -B1- carry out check measurement.



Reverse gear brake -B1- check measurement

- Install parts up to free wheel and secure with circlip => Assembling planetary gearbox, Page 72 .
- -> Measure play between plates with feeler gauge "A".

Play:

Min. = 1.2 mm

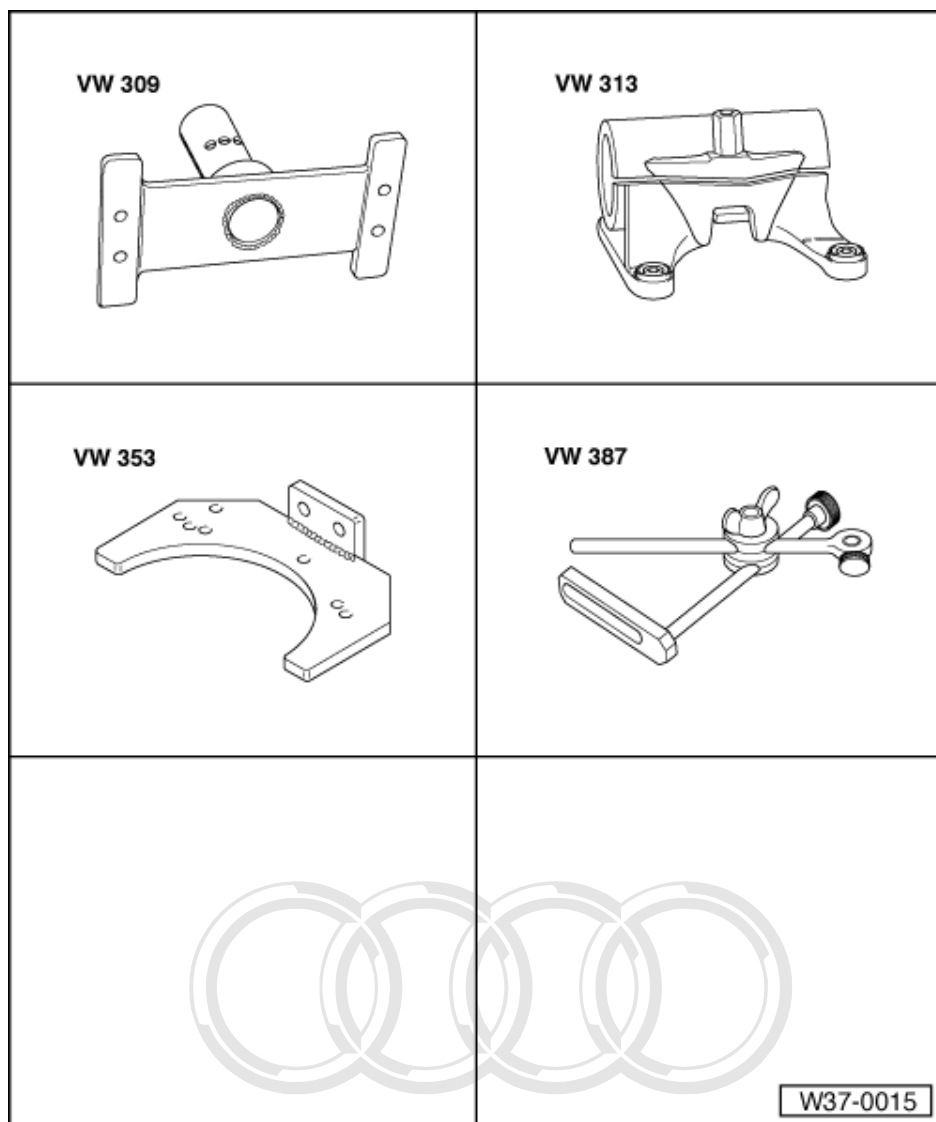
Max. = 1.8 mm



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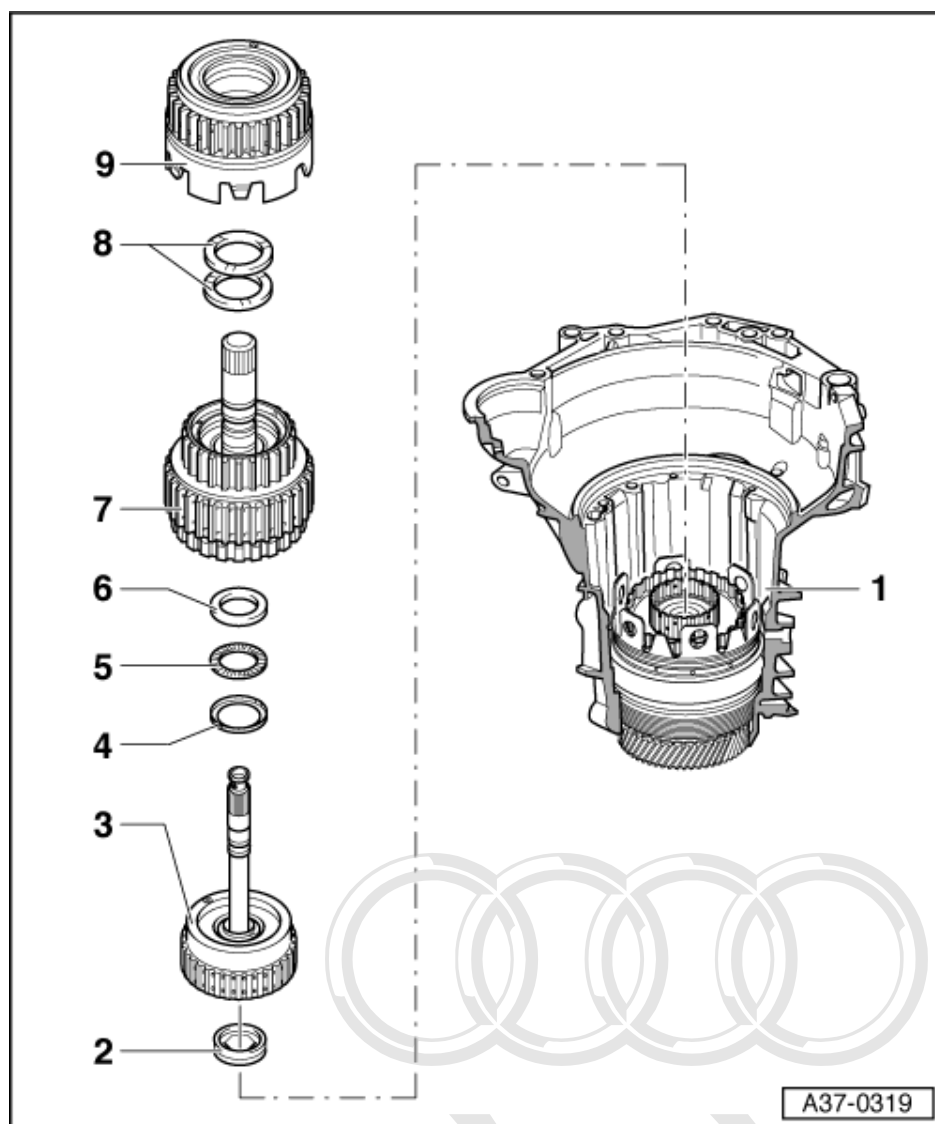
8.13 - III - Adjusting clutch play between -K1- and -K2-



Special tools, testers and workshop equipment required

- ♦ VW 309 Holding plate
- ♦ VW 313 Support clamp
- ♦ VW 353 Gearbox support
- ♦ VW 387 Universal dial gauge holder

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Overview of components

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- To adjust the clutch play, install components without shim(s) (-Item 72

1 Gearbox housing

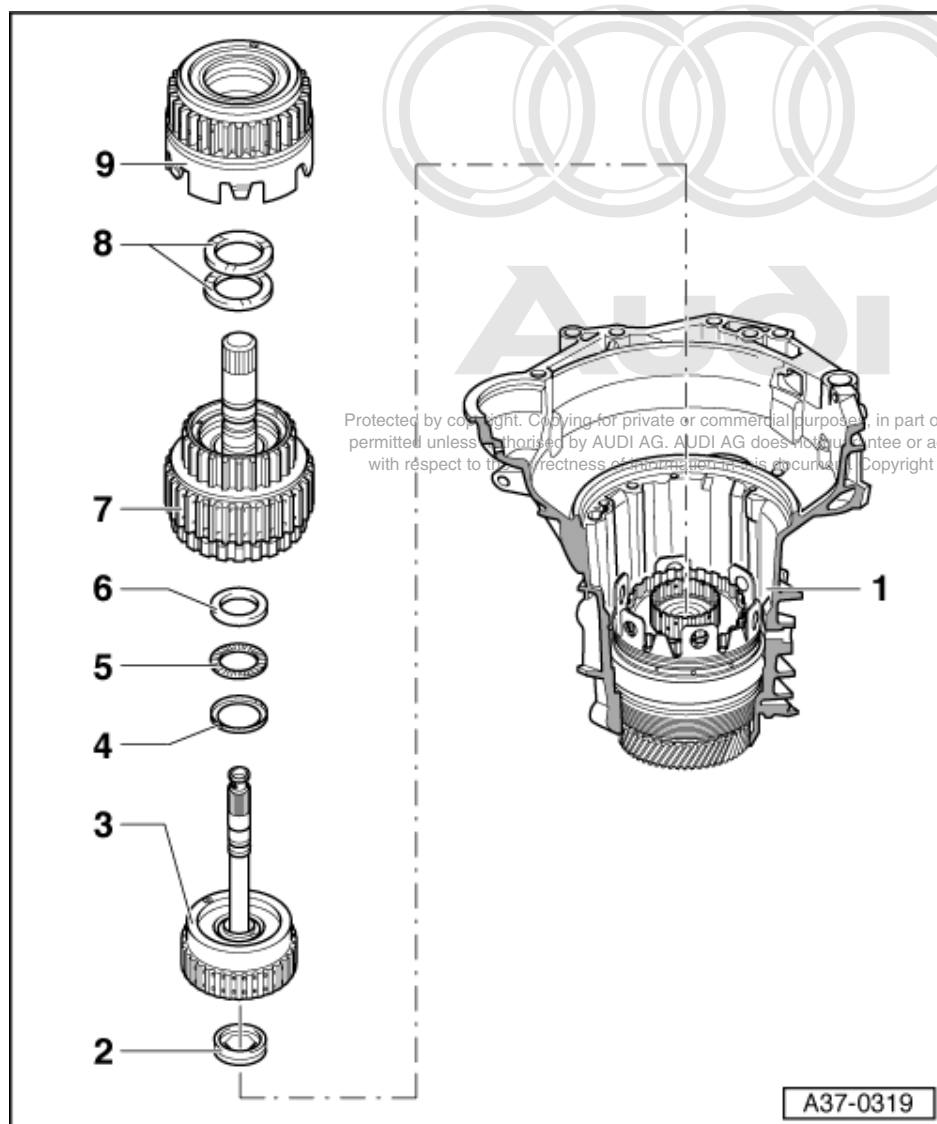
- ♦ Planetary gearbox installed up to small input shaft => Assembling planetary gearbox, Page 72

2 Axial needle bearing with washer

- ♦ Axial needle bearing faces towards small input shaft
- ♦ Washer faces towards -K3-
- ♦ May also be 2-piece

3 3rd and 4th gear clutch -K3- with pump shaft

- ♦ On gearboxes as of 11.92 =>Page 2 onwards, clutch -K3- is only used to select 4th gear.

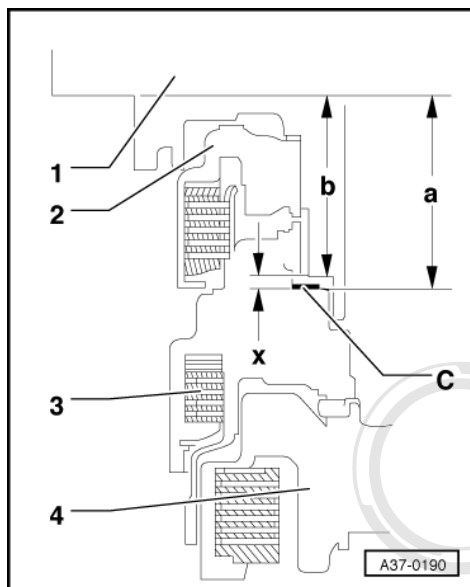


- 4 Axial needle bearing washer**
 - ◆ Lugs face axial needle bearing
- 5 Axial needle bearing**
- 6 Axial needle bearing washer**
- 7 1st - 3rd gear clutch -K1- with turbine shaft**
- 8 Shims**
 - ◆ Do not install when adjusting clutch play
 - ◆ Up to 3 shims can be installed
- 9 Reverse gear clutch -K2-**

Determining thickness of shim(s) -C-

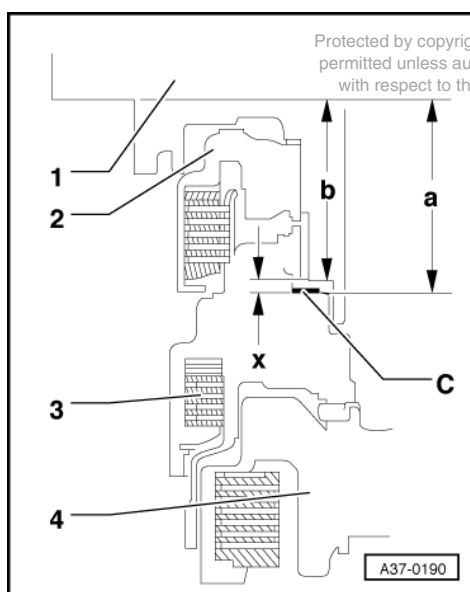
Requirements:

- Planet carrier has been installed and adjusted => Assembling planetary gearbox, Page [72](#).
- To perform measurement, gearbox housing must be turned on repair stand so that input gear is facing downwards, as shown on => Page [97](#)



-> The thickness of the shim(s) depends on the size of gap "x". Gap "x" is calculated using the following formula:

$$\text{Gap } x = a - b$$



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1 - ATF pump

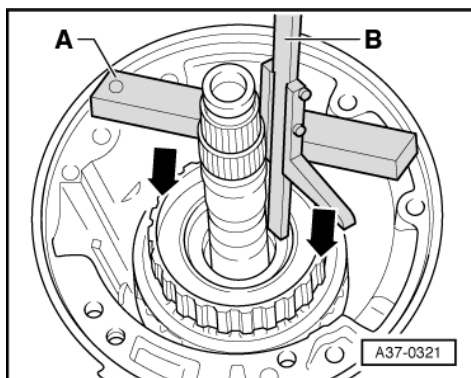
2 - Reverse gear clutch -K2-

3 - 1st - 3rd gear clutch -K3-

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

C = Shim(s)
x = Size of gap
a = Installed depth of clutch -K1-; Calculating =>Page
100

b = Size of ATF pump housing; Calculating =>Page
100



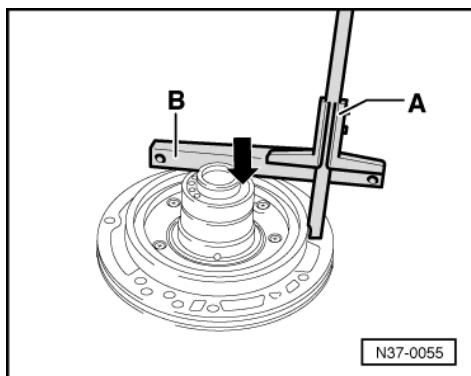
Calculating "a"

- -> Place short straightedge "A" onto pump flange on gearbox housing.
- Press -K1- down in direction of arrow and measure distance into -K1- with depth gauge "B".

Example:

Measurement	= 73.7 mm
- Straightedge	= - 19.5 mm
Calculated value a	= 54.2 mm

Calculating "b"



- Place paper gasket onto ATF Pump.
- -> Place straightedge -B- onto stator support (arrow) and measure with depth gauge -A- to gasket of pump flange.

Example for calculating "b":

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

Gap x = a - b

= 54.2 mm - 51.0 mm = 3.2 mm

- Determine size of shim according to table:

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In this example, two shims are required (each 1.2 mm thick).

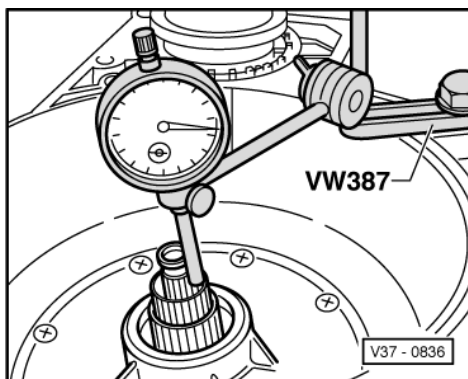
Table of "shims":

Gap "x" (mm)	Shims (mm)
... 2.54	1.4
2.55 ... 3.09	1 + 1
3.10 ... 3.49	1.2 + 1.2
3.50 ... 3.89	1.4 + 1.4
3.90 ... 4.29	1.6 + 1.6
4.30 ... 4.69	1.8 + 1.8
4.70 ... 5.04	1.2 + 1.2 + 1.6
5.05 ... 5.25	1.2 + 1.2 + 1.8

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- Ascertain thickness of shims according to table and determine Part No. from parts catalogue.
 - Carry out clutch play check measurement after installing ATF pump.

Checking measurement (clutch play)

- The clutch play cannot be measured until the ATF pump has been installed.
- Reverse gear clutch -K1- must be installed.
- Attach dial gauge holder to gearbox housing and place dial gauge on turbine shaft with a preload of 1 mm.

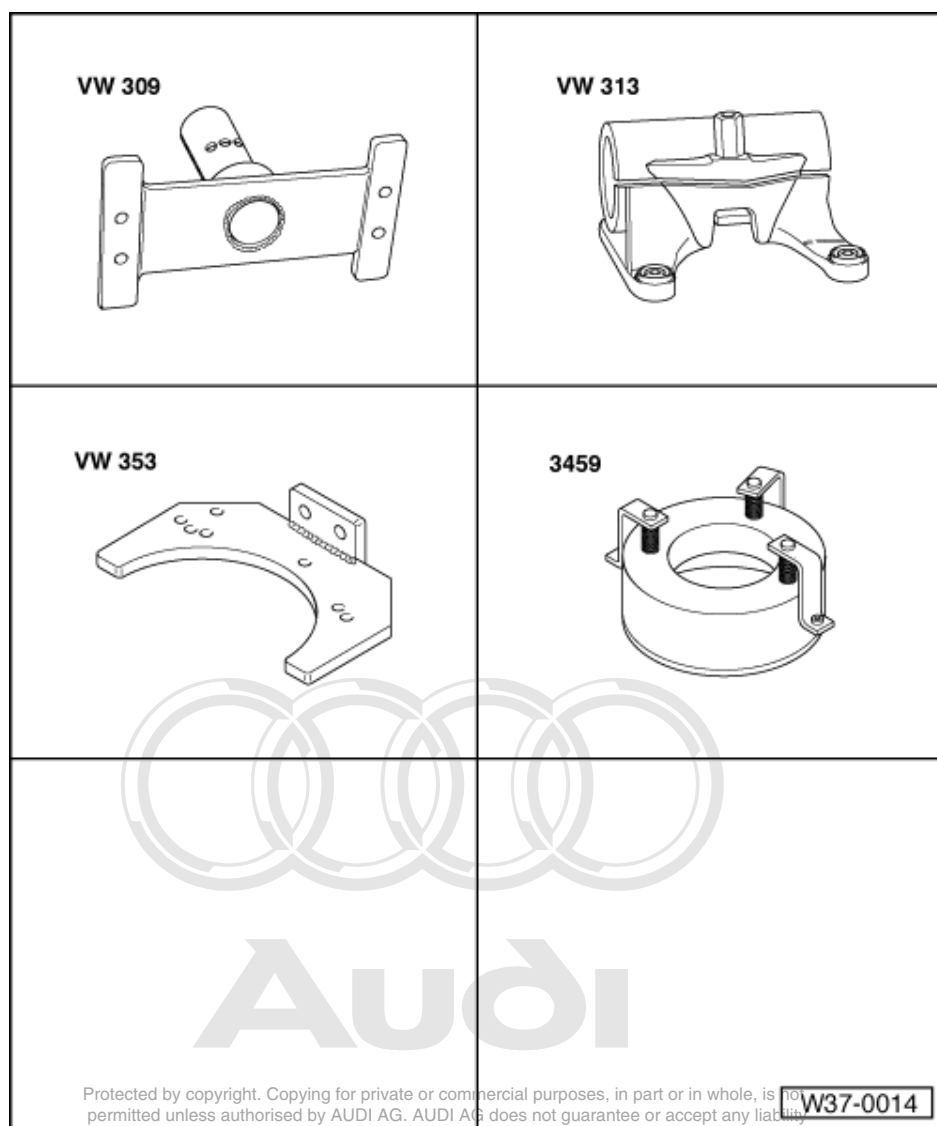


- -> Move turbine shaft up and down and take reading of play on dial gauge.

Play:
Min. = 0.5 mm
Max. = 1.2 mm

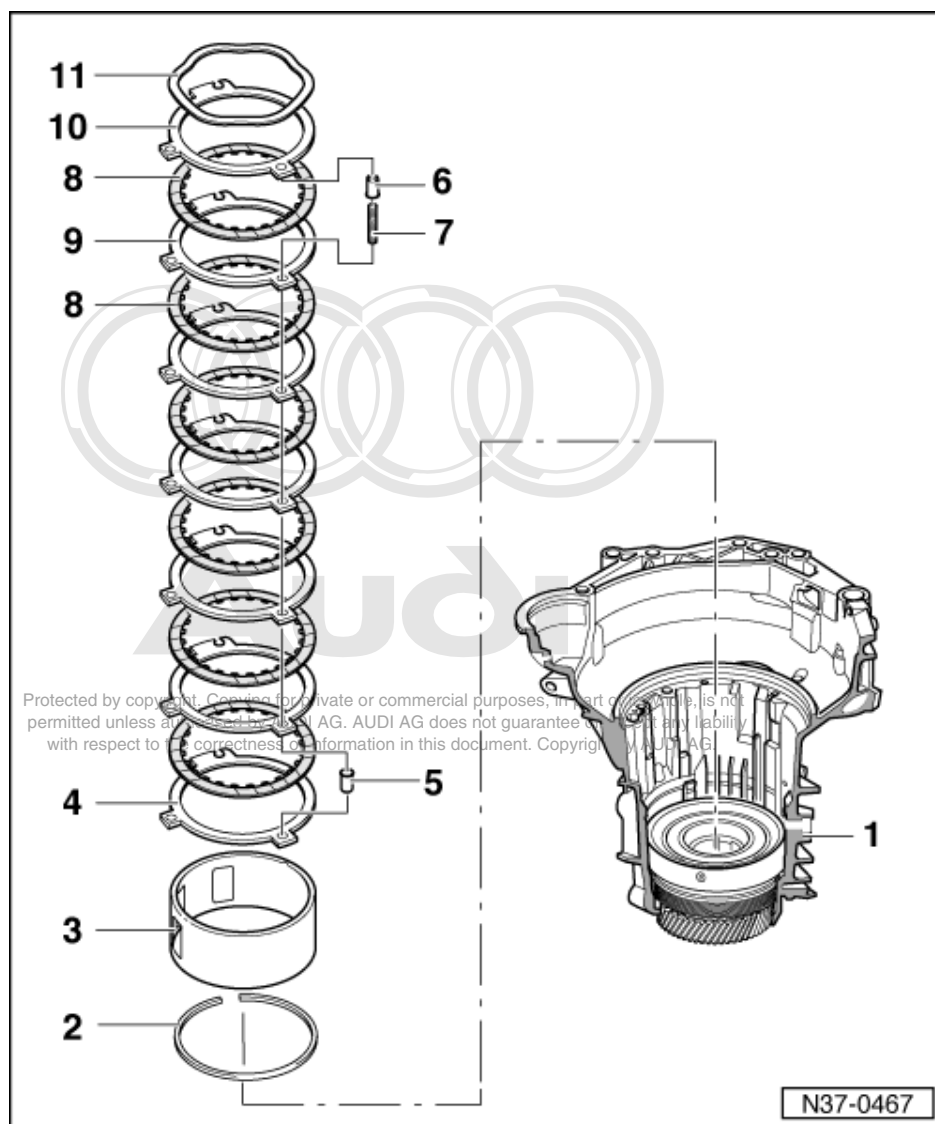


8.14 - IV - Adjusting 2nd and 4th gear brake -B2-



Special tools, testers and workshop equipment required

- ♦ VW 309 Holding plate
- ♦ VW 313 Support clamp
- ♦ VW 353 Gearbox support
- ♦ 3459 Adjustment tool



Overview of components

The brake -B2- play is determined by the thickness of the last outer plate(s) (Item **10**).

- To adjust, install components without corrugated washer (Item **11**), without last outer plate(s) (Item **10**) and without spring caps (Item **6**).

1 Gearbox housing

2 Circlip

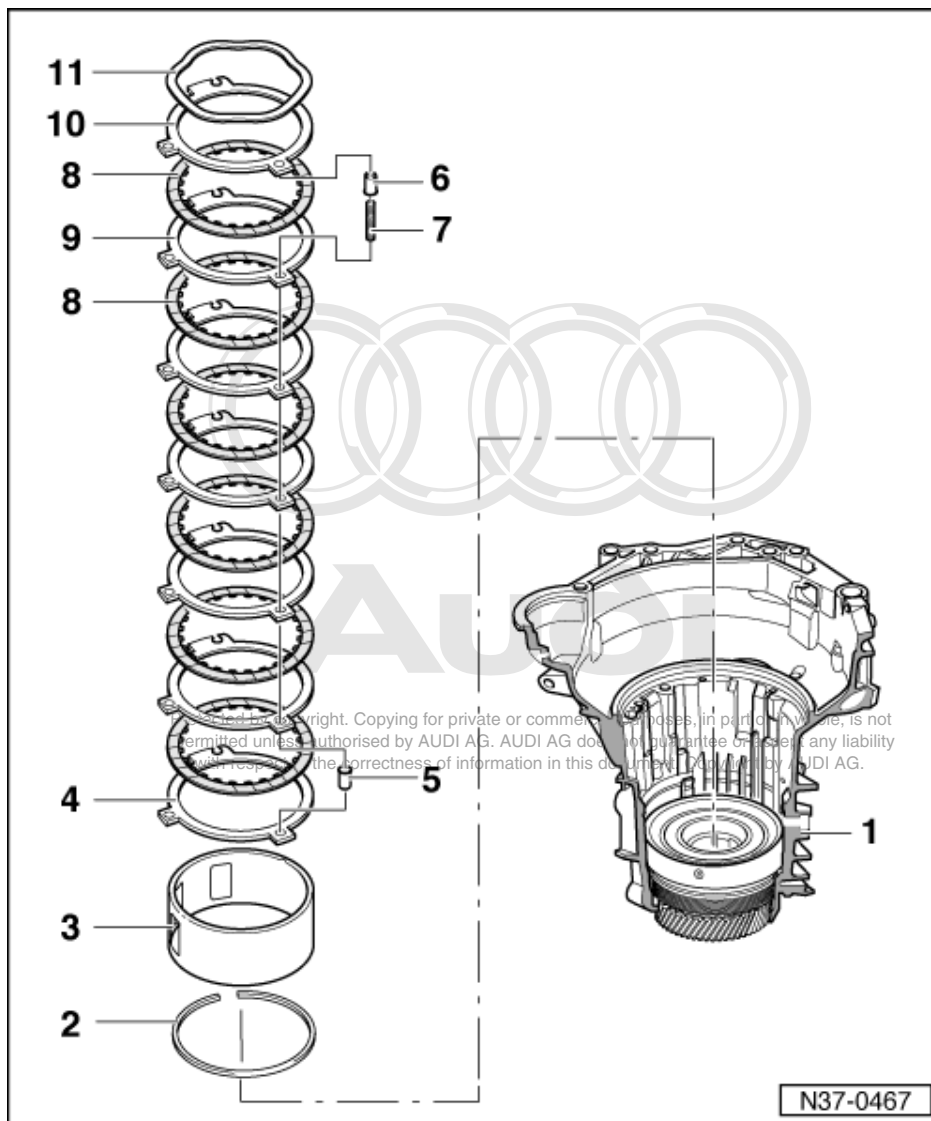
- ♦ For supporting tube -B2-
- ♦ Installation position: Open ends face toward retaining wedge of free wheel

3 Supporting tube -B2-

- ♦ Insert so that notch locates on free wheel wedge



- N37-0467



10 Outer plate -B2-

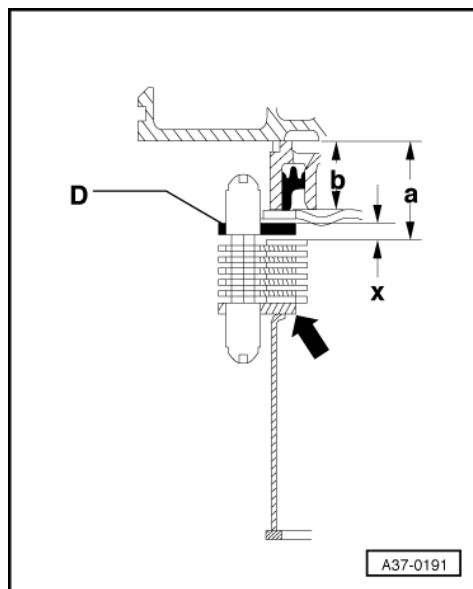
- ♦ Do not install to adjust -B2-
- ♦ To adjust; 2 outer plates can be installed.

11 Corrugated washer

- ♦ Do not install to adjust -B2-

Calculating thickness of last outer plate -D-

The thickness of the last outer plate(s) is determined by gap "x". For this the formula



-> Gap $x = a - b - 3.6 \text{ mm}$

must be used. The illustration shows the assembled brake -B2- in the gearbox. Special tool 3459, which exerts a force on the plate package, is not illustrated.

3.6 mm - This amount allows for the settling caused by the force exerted by special tool 3459

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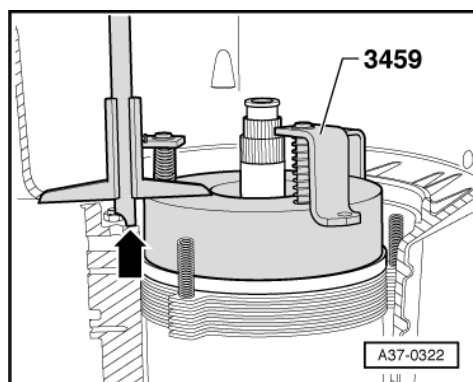
First outer plate -arrow- is always 3 mm thick.

Determining dimension a:

Assemble planetary gearbox up to the last inner plate of -B2-, => Page 72 . The last outer plate, the last 3 spring caps and the corrugated spring washer are not installed.

- Place 3459 onto the last inner plate and turn so that the 3 clips align with the 3 holes for the ATF pump.
- Bolt 3459 to flange for ATF pump with 5 Nm.

The plate package for -B2- is now pressed together for the measurements.



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

Dimension a = Height of 3459 in mm - measured value

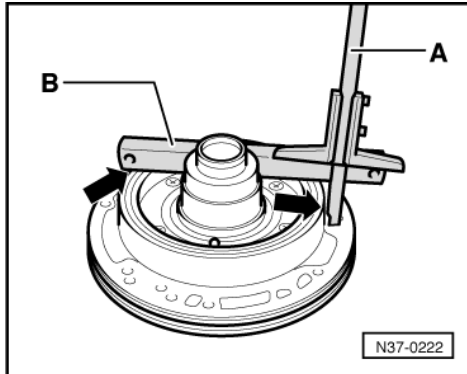
Example:

Height of 3459	= 60.0 mm
- Measured value	= - 29.8 mm

Calculated value a	= 30.2 mm
--------------------	-----------

- Note calculated value a.
- Remove 3459.

Determining dimension b:



- Push piston into ATF pump up to stop.
- Place paper gasket onto ATF Pump.
- -> Place straightedge "B" onto stator support (arrow) and measure with depth gauge "A" to gasket of pump flange.

Example:

Measured value	= 40.1 mm
- Straightedge	= - 19.5 mm
Calculated size b	= 20.6 mm

- Note calculated value b.

Gap x = a - b - 3.6 mm

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$$\text{Gap } x = 30.2 - 20.6 - 3.6 \text{ mm} = 6.0 \text{ mm}$$

- Determine thickness of outer plate(s) according to table:

Table of "plates":

Gap "x" (mm)	Plate (mm)
4.25 ... 4.49	2.75
4.50 ... 4.74	3.00
4.75 ... 4.99	3.25
5.00 ... 5.24	3.50
5.25 ... 5.49	3.75
5.50 ... 5.74	2.00 + 2.00
5.75 ... 5.99	2.00 + 2.25
6.00 ... 6.24	2.25 + 2.25
6.25 ... 6.49	2.25 + 2.50
6.50 ... 6.74	2.50 + 2.50
6.75 ... 7.00	2.50 + 2.75

- Ascertain thickness of outer plate(s) according to table and determine Part No. from parts catalogue.

In this example two outer plates must be installed (each 2.25mm thick).

- Fit three spring caps onto the compression springs.
- Install determined last outer plate(s).
- Install corrugated washer



- Further assembly is described on => Page **80** onwards.

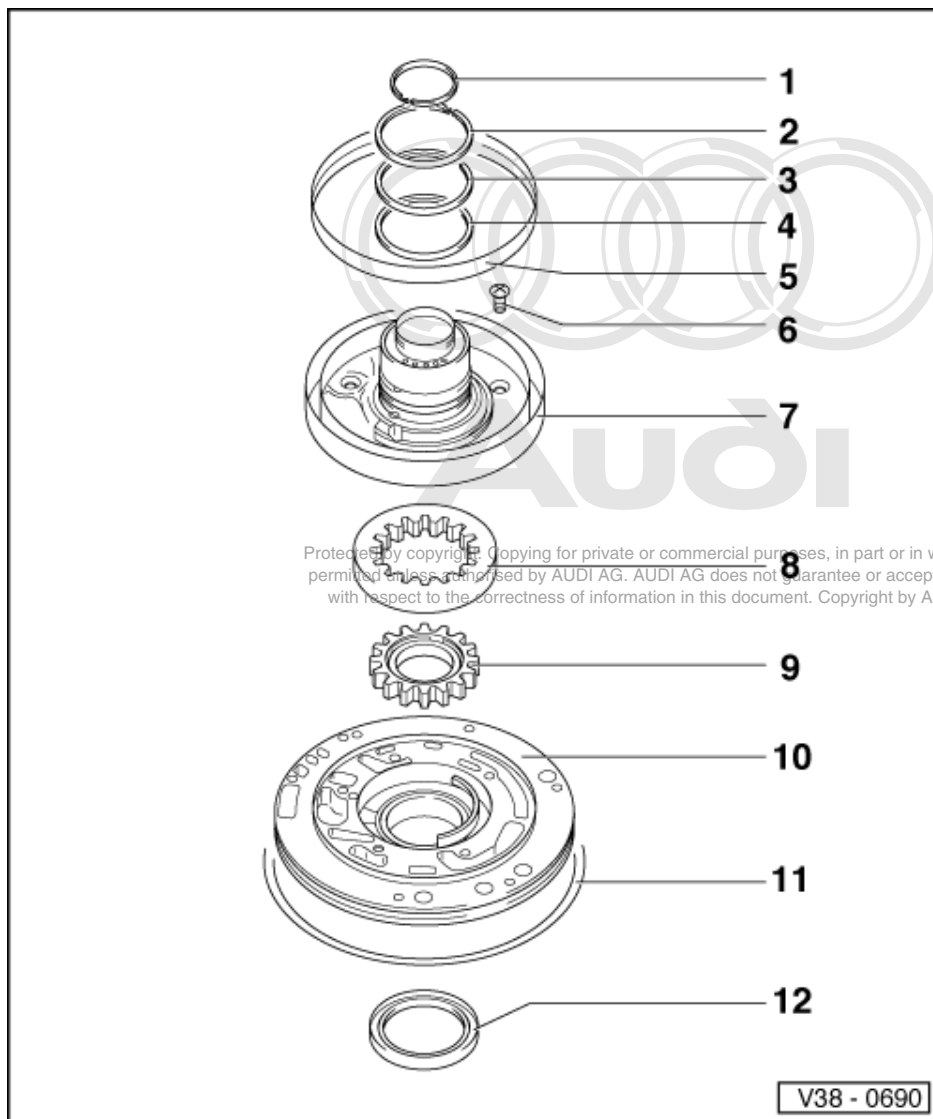


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38 - Gears, Hydraulic controls

1 - Dismantling and assembling ATF pump

1.1 - Dismantling and assembling ATF pump



Replacement ATF pump parts and the ATF pump are allocated according to gearbox code.

1 Piston ring

- ♦ Checking correct positioning
=> Fig. 112
- ♦ Removing and installing
=> Fig. 112

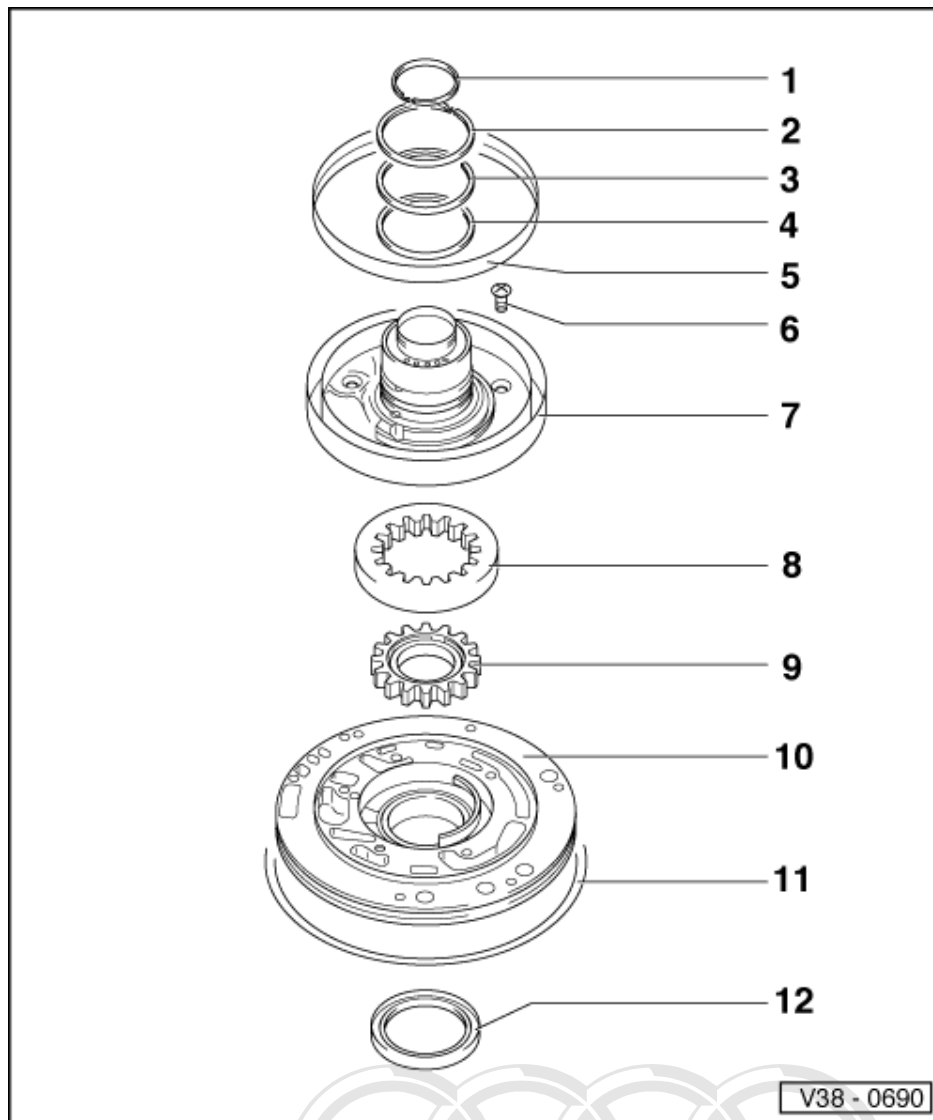
2 Piston ring

- ♦ Checking correct positioning
=> Fig. 112
- ♦ Removing and installing
=> Fig. 112

3 Piston ring



- ♦ Checking correct positioning
=> Fig. 112
- ♦ Removing and installing
=> Fig. 112



4 Thrust washer

5 Piston

- ♦ Sealing lips are vulcanised to piston
- ♦ Moisten sealing lips with ATF before installing
- ♦ Turn piston slightly when installing

6 Bolt, 10 Nm

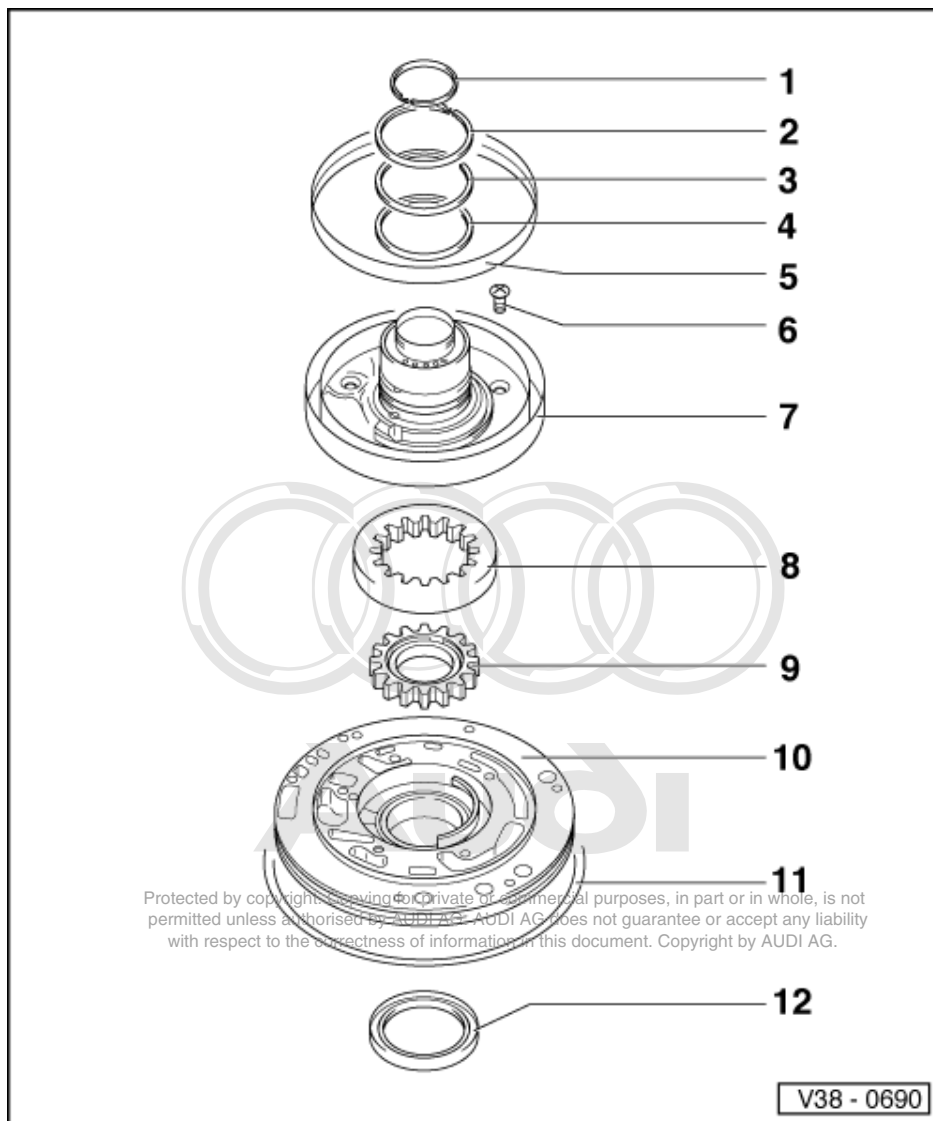
- ♦ Then turn 45° further

7 Stator support

8 Outer gear

- ♦ Manufacturer's marking faces stator support
- ♦ If outer gear is incorrectly installed, the ATF pump may not operate freely in the installed position

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9 Inner gear

- ♦ Larger groove faces stator support

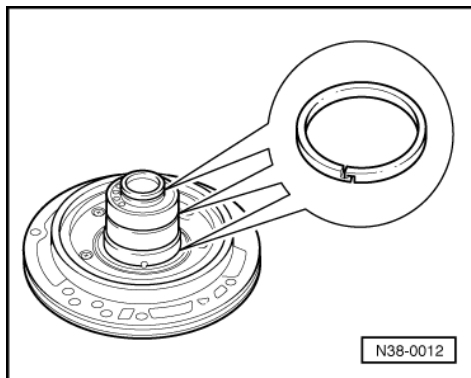
10 Housing for ATF pump

11 O-ring

- ♦ Always replace

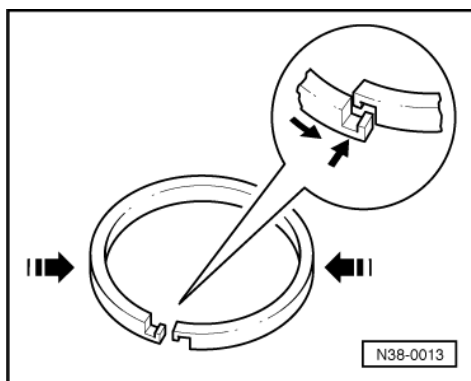
12 Torque converter oil seal

- ♦ Removing and installing
=>Page 9



-> Fig.1 Checking seating of piston rings

- Ensure that the ends of the piston rings are hooked together.



-> Fig.2 Removing and installing piston ring

Removing

- Press ends of piston ring together and release by hand.
- Press two ends of piston ring apart and remove; do not twist piston ring out of groove on one side.

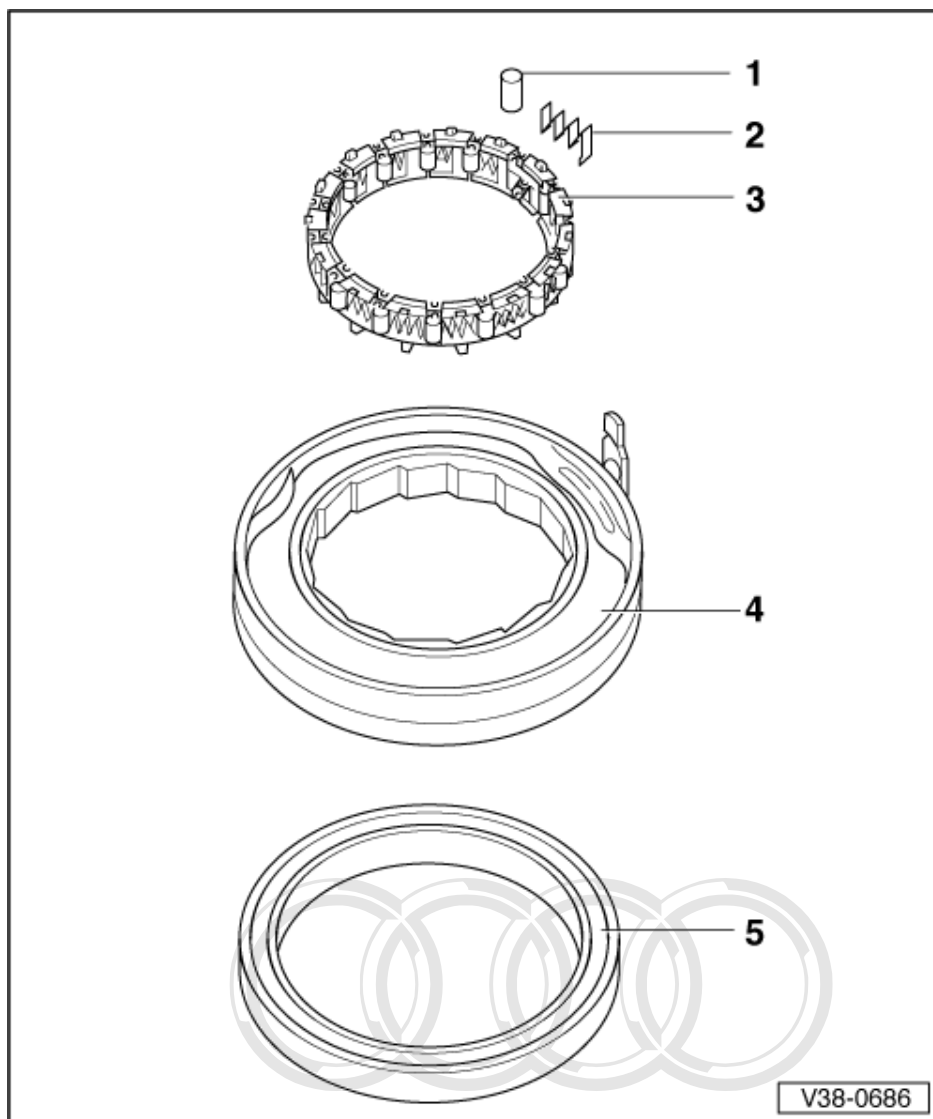
Installing

- Place piston ring in groove.
- To hook ends together press sides of ring in and guide ends over one another.

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2 - Dismantling and assembling free wheel with -B1- piston

2.1 - Dismantling and assembling free wheel with -B1- piston



1 Rollers

- ♦ Installing
=> Fig. 114

2 Springs

- ♦ Installing
=> Fig. 114

3 Cage

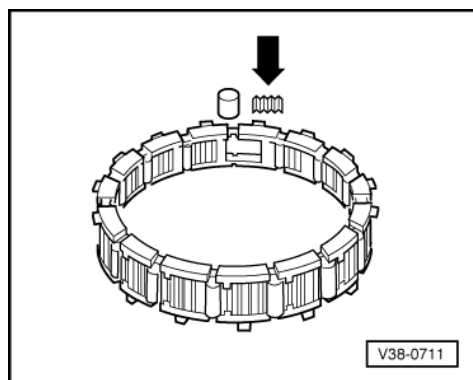
- ♦ Inserting
=> Fig. 114
- ♦ Securing
=> Fig. 114

4 Outer race

5 Piston

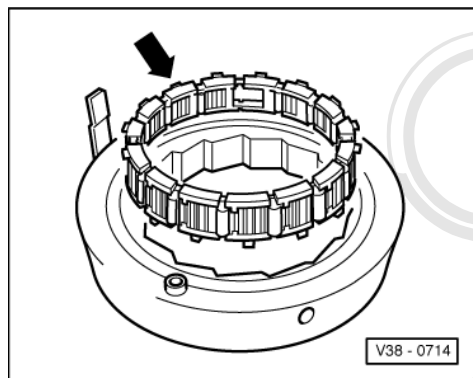
- ♦ Sealing lips are vulcanised to piston
- ♦ Moisten sealing lips with ATF before installing
- ♦ Turn piston slightly when installing
- ♦ Installation position

=> Fig. 115



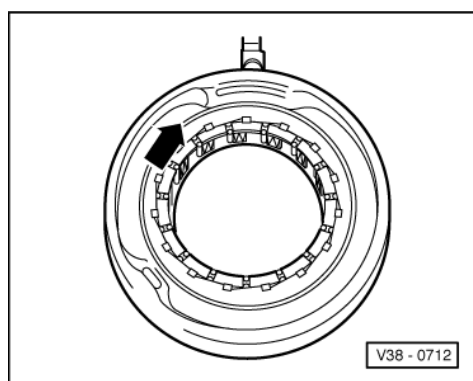
-> Fig.1 Installing rollers and springs

- Insert springs so that spring -arrow- engages in cage.
- Then insert roller between cage and spring.



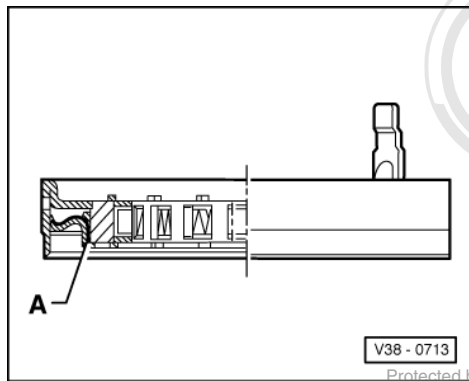
-> Fig.2 Inserting cage with springs and rollers

- Install with large lugs -arrow- facing up.



-> Fig.3 Securing cage

- Secure cage by turning in direction of arrow as far as the stop.



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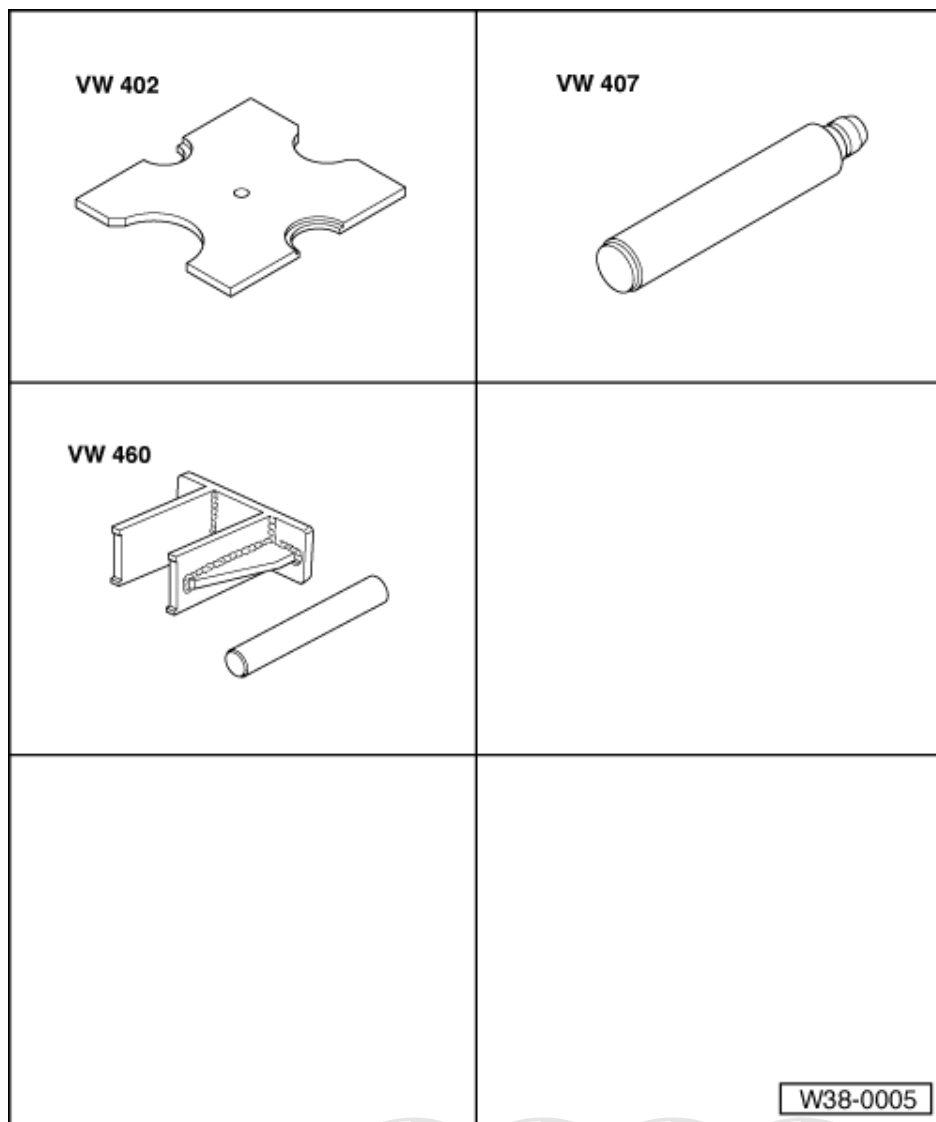
-> **Fig.4 Installed position of piston**

- Insert piston -A- as shown.



3 - Dismantling and assembling 1st - 3rd gear clutch -K1- with turbine shaft for gearboxes up to 11.92

3.1 - Dismantling and assembling 1st - 3rd gear clutch -K1- with turbine shaft for gearboxes up to 11.92

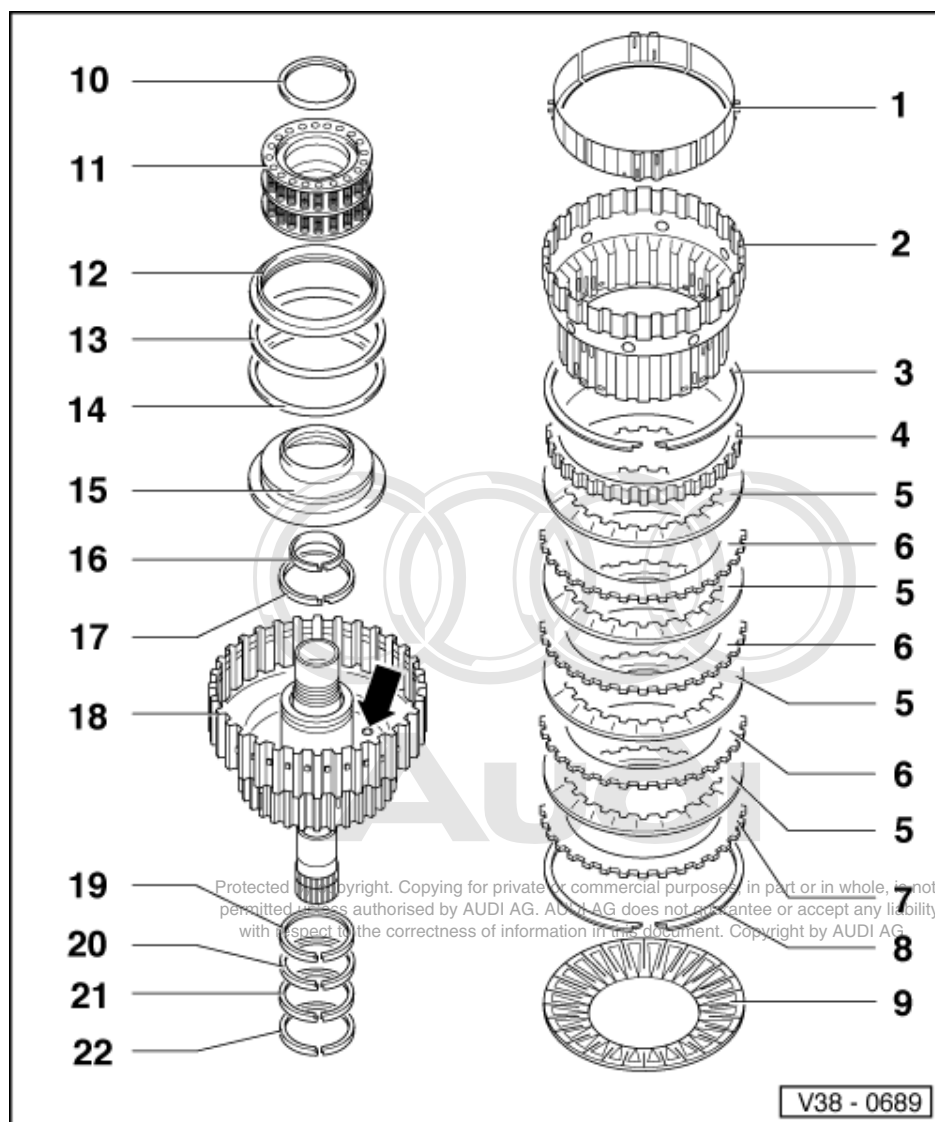


Special tools, testers and workshop equipment required

- ♦ VW 401 Thrust plate
- ♦ VW 407 Thrust tool
- ♦ VW 460 Removal device



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Notes:

Only when cleaning or carrying out visual check the clutch must be dismantled.

When doing this ensure that the ball valve (arrow) is not damaged.

1 Supporting ring

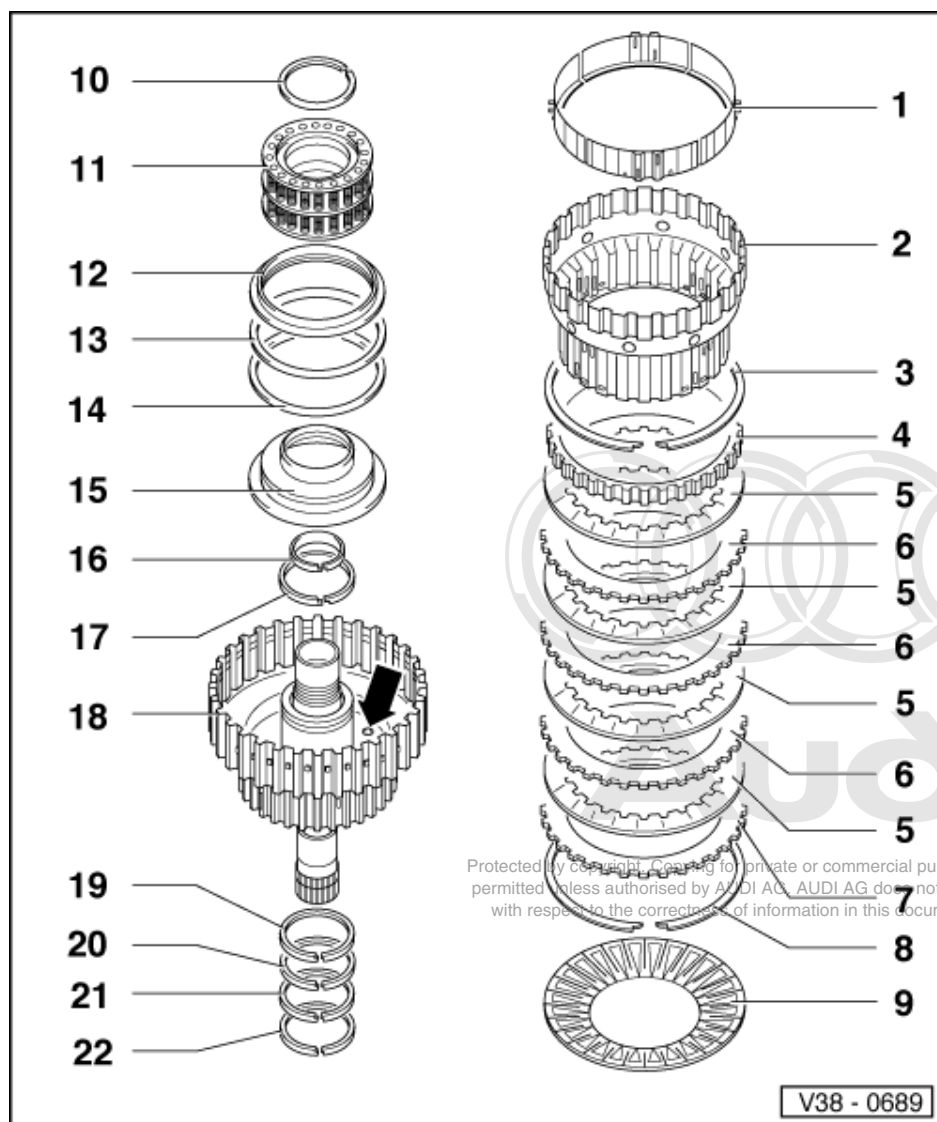
- ◆ Unclip in 4 pieces from inner plate carrier
- ◆ Inserting
=>Fig. 124

2 Inner plate carrier

- ◆ Inserting
=>Fig. 124
- ◆ Assembling
=>Fig. 124

3 Circlip

- ◆ Differing thickness
- ◆ Mark after removing and insert at same point



4 Pressure plate

- ◆ Smooth side faces inner plate
- ◆ Insert together with inner plate carrier,
=> Fig. 124

5 Inner plate

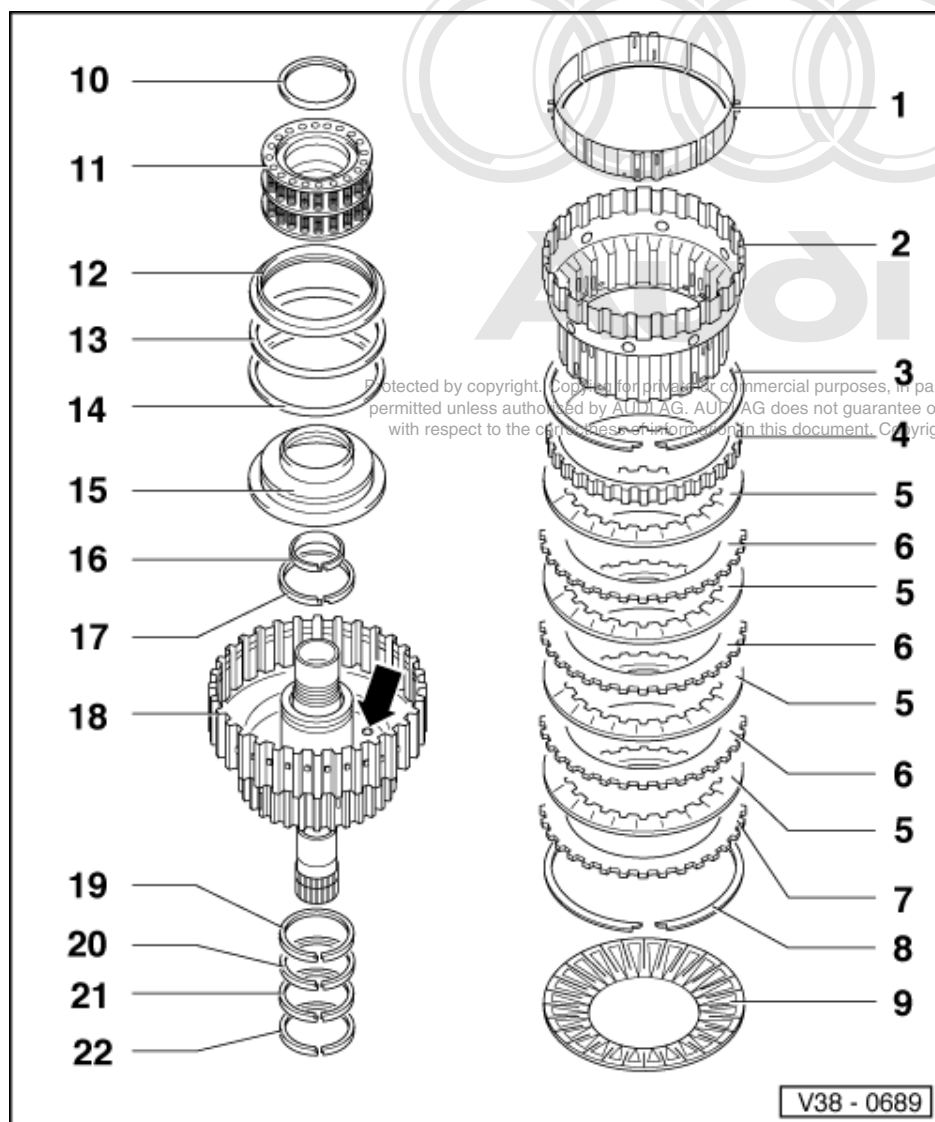
- ◆ Number of inner plates => Page 2
- ◆ Installing
=> Fig. 124
- ◆ Before installing place new inner plates in ATF for 15 minutes

6 Outer plate

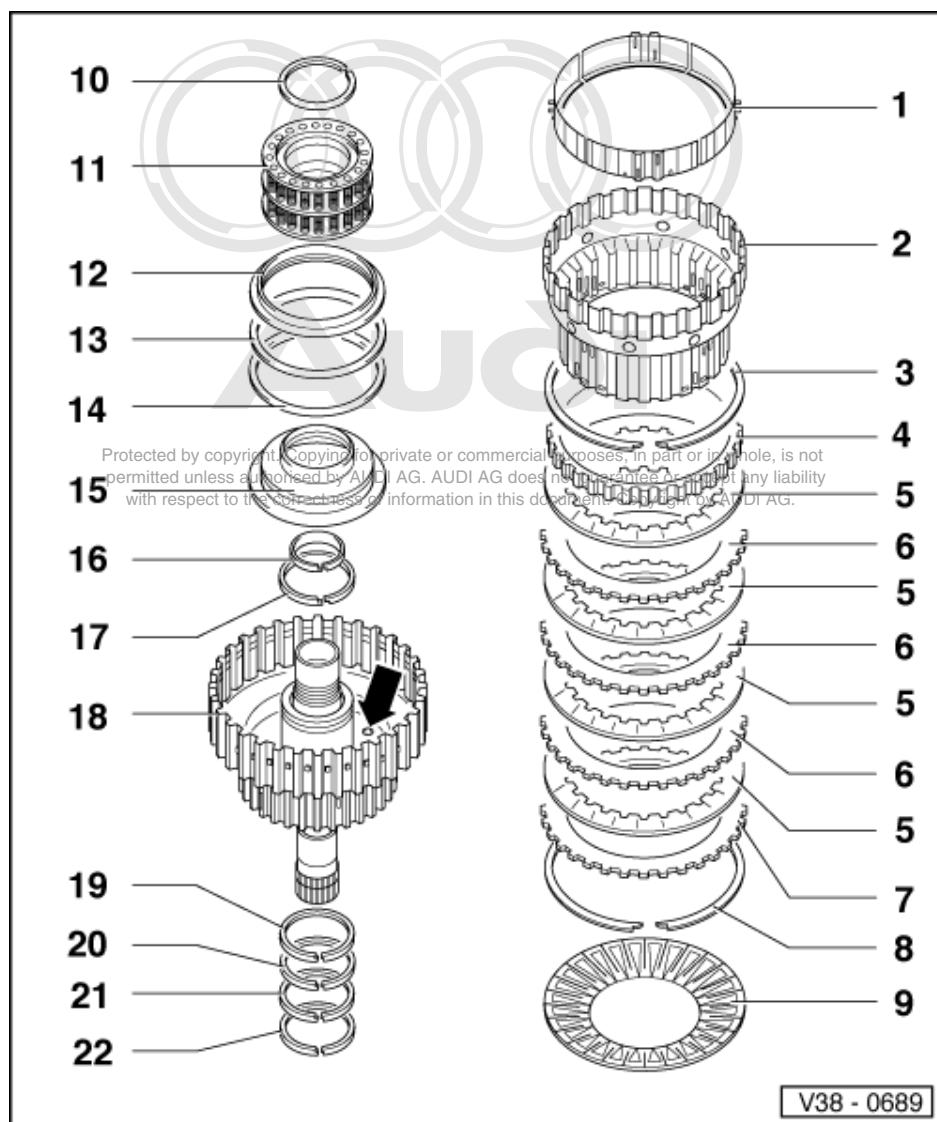
- ◆ Number of outer plates => Page 2
- ◆ Installing
=> Fig. 124

7 Pressure plate

- ◆ Curved side faces ring tensioning spring
- ◆ Installing
=> Fig. 124



- 8 Circlip**
- ♦ Inserting
=> Fig. 123
- 9 Ring tensioning spring**
- ♦ Curved side faces piston
- 10 Circlip**
- ♦ Removing and installing
=> Fig. 123
- 11 Intermediate spring ring**
- ♦ With spring supporting shell and compression springs
- 12 Actuator ring**
- ♦ Insert with curvature facing spring spacer
- 13 Dished washer**
- ♦ Convex side faces actuator ring
 - ♦ Installation position
=> Fig. 123



14 Dished washer

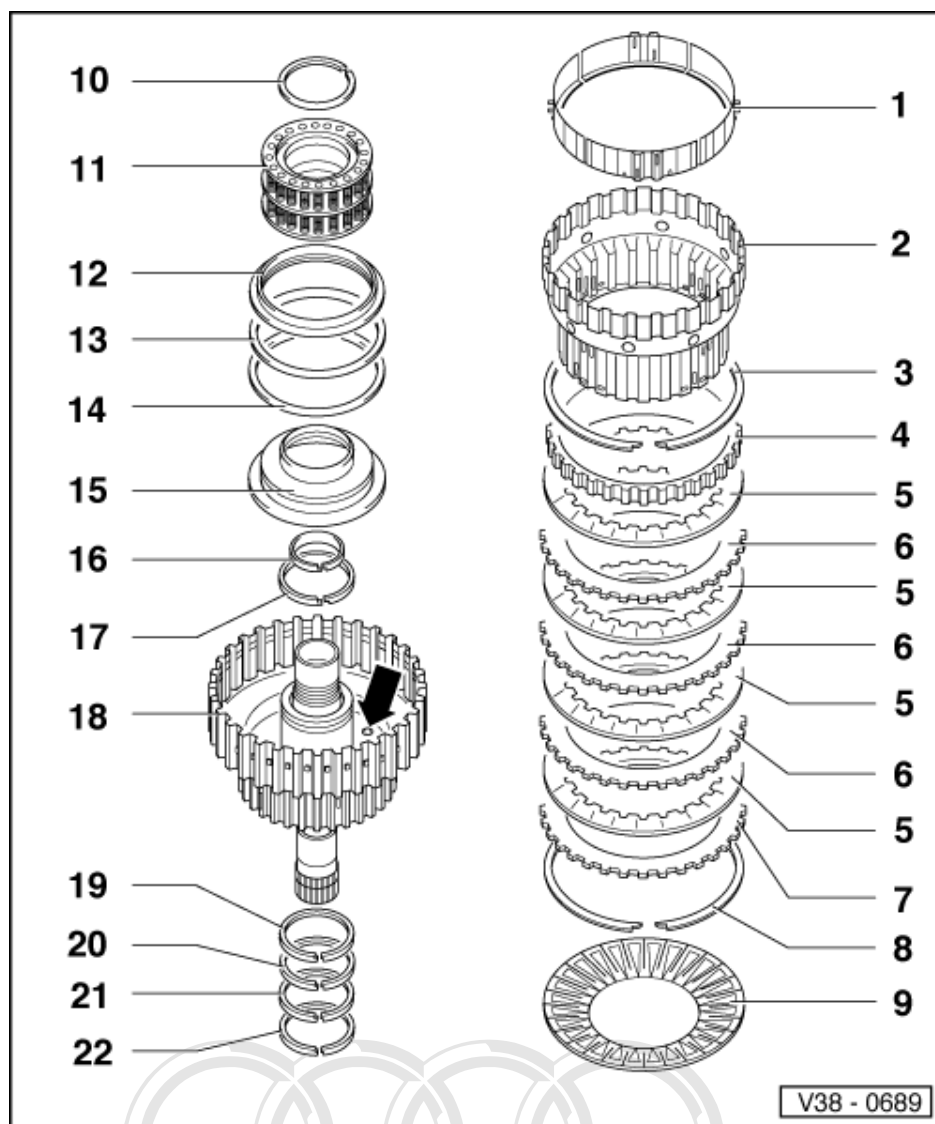
- ◆ Curved side faces piston
- ◆ Installation position
=>Fig. 123

15 Piston

- ◆ Sealing lips are vulcanised to piston
- ◆ Moisten sealing lips with ATF before installing
- ◆ Turn piston slightly when installing

16 Piston ring (small dia.)

- ◆ Checking correct positioning
=> Fig. 125
- ◆ Removing and installing
=>Fig. 125



17 Piston ring

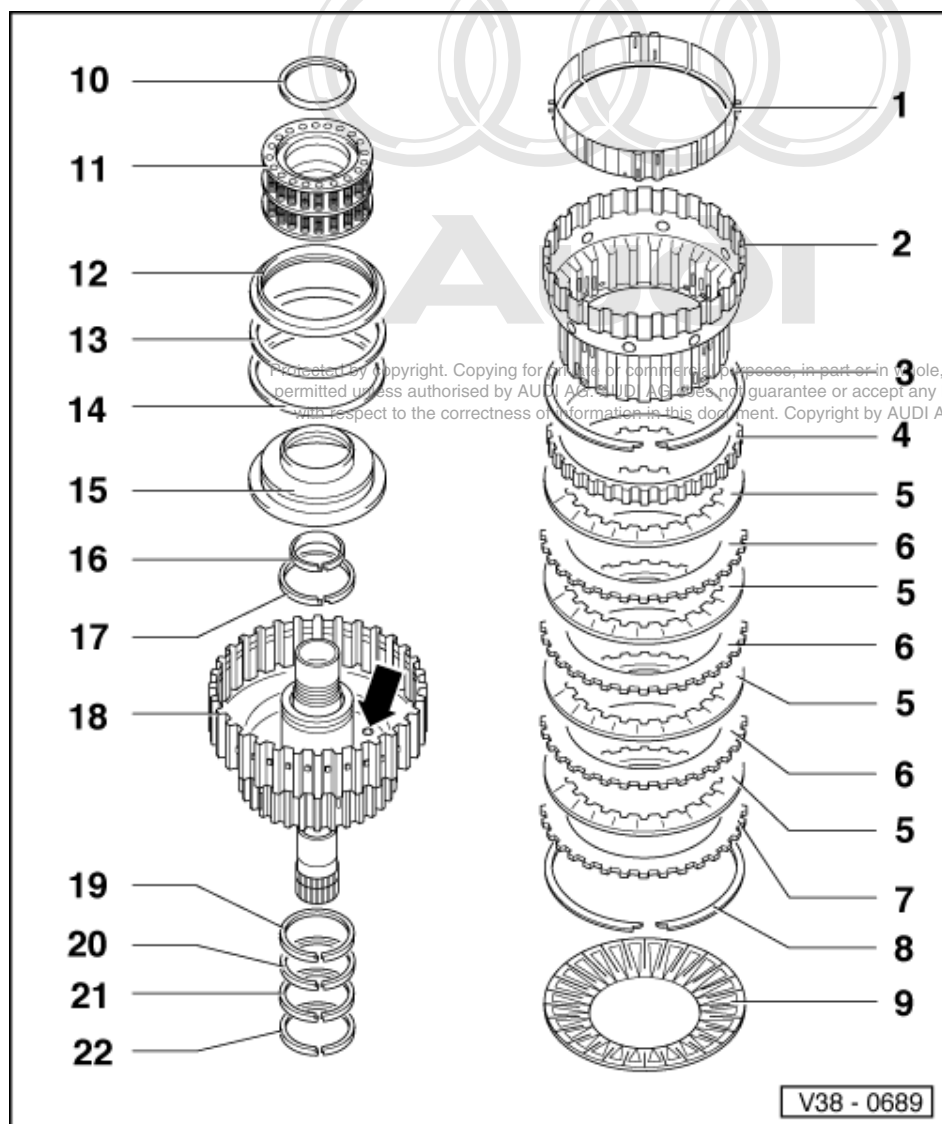
- ♦ Checking correct positioning
=> Fig. 125
- ♦ Removing and installing
=> Fig. 125

18 Clutch housing with turbine shaft

- ♦ Check mounting bushes; replace clutch housing if bushes damaged
- ♦ Before fitting inner plate carrier, insert ring tensioning spring (item 124)

19 Piston ring

- ♦ Checking correct positioning
=> Fig. 125
- ♦ Removing and installing
=> Fig. 125



20 Piston ring

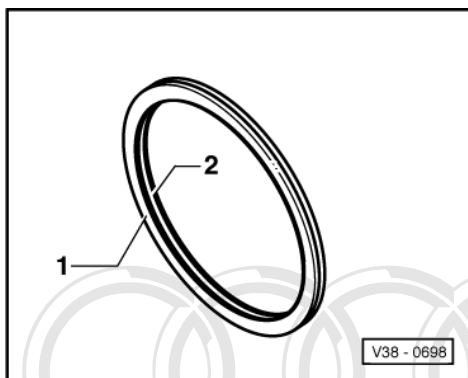
- ♦ Checking correct positioning
=> Fig. 125
- ♦ Removing and installing
=> Fig. 125

21 Piston ring

- ♦ Checking correct positioning
=> Fig. 125
- ♦ Removing and installing
=> Fig. 125

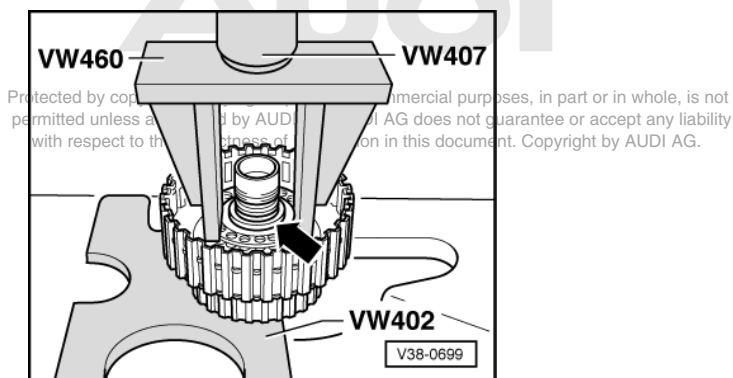
22 Piston ring

- ♦ Checking correct positioning
=> Fig. 125
- ♦ Removing and installing
=> Fig. 125



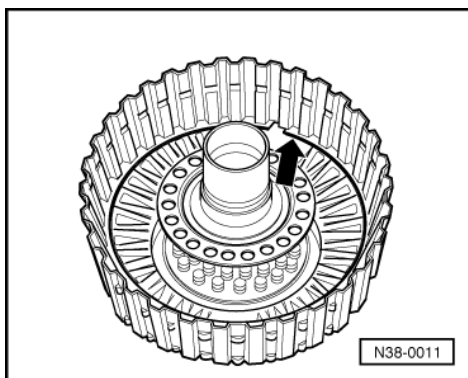
-> Fig.1 Installation position of dished washers

- Fit dished washers 1 and 2 such that outer edges make contact when fitted together; air gap remains in inside diameter.



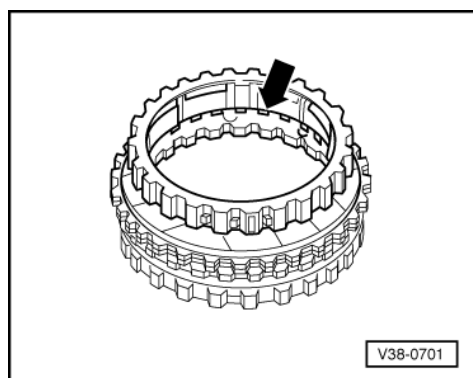
-> Fig.2 Removing and installing circlip (arrow)

- Press spring ring down far enough for the circlip (arrow) to be inserted in the groove.



-> Fig.3 Inserting circlip

- Insert circlip (arrow) in groove; ring tensioning spring is slightly pretensioned.

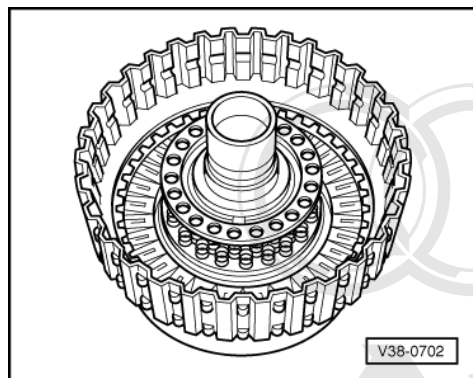


-> Fig.4 Positioning inner and outer plates on inner plate carrier and clipping in thrust bearing

- Clip in thrust bearing (arrow) after inserting pressure plate as well as inner and outer plates.

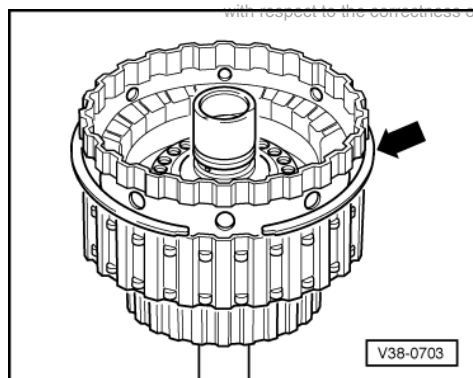
Note:

The inner and one outer plate must be inserted in clutch housing before fitting inner plate carrier.



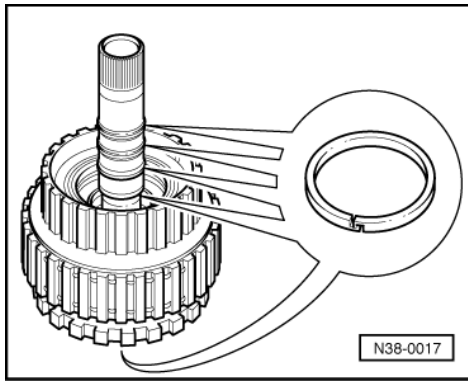
-> Fig.5 Inserting pressure plate, first inner plate and first outer plate in clutch housing

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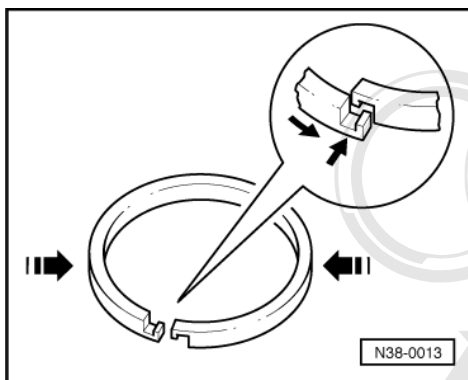
-> Fig.6 Inserting inner plate carrier and installing circlip (arrow).

- Lift inner plate carrier slightly to fit circlip.



-> Fig.7 Checking seating of piston rings

- Ensure that the ends of the piston rings are hooked together.



-> Fig.8 Removing and installing piston ring

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Removing

- Press ends of piston ring together and release by hand.
- Press two ends of piston ring apart and remove; do not twist piston ring out of groove on one side.

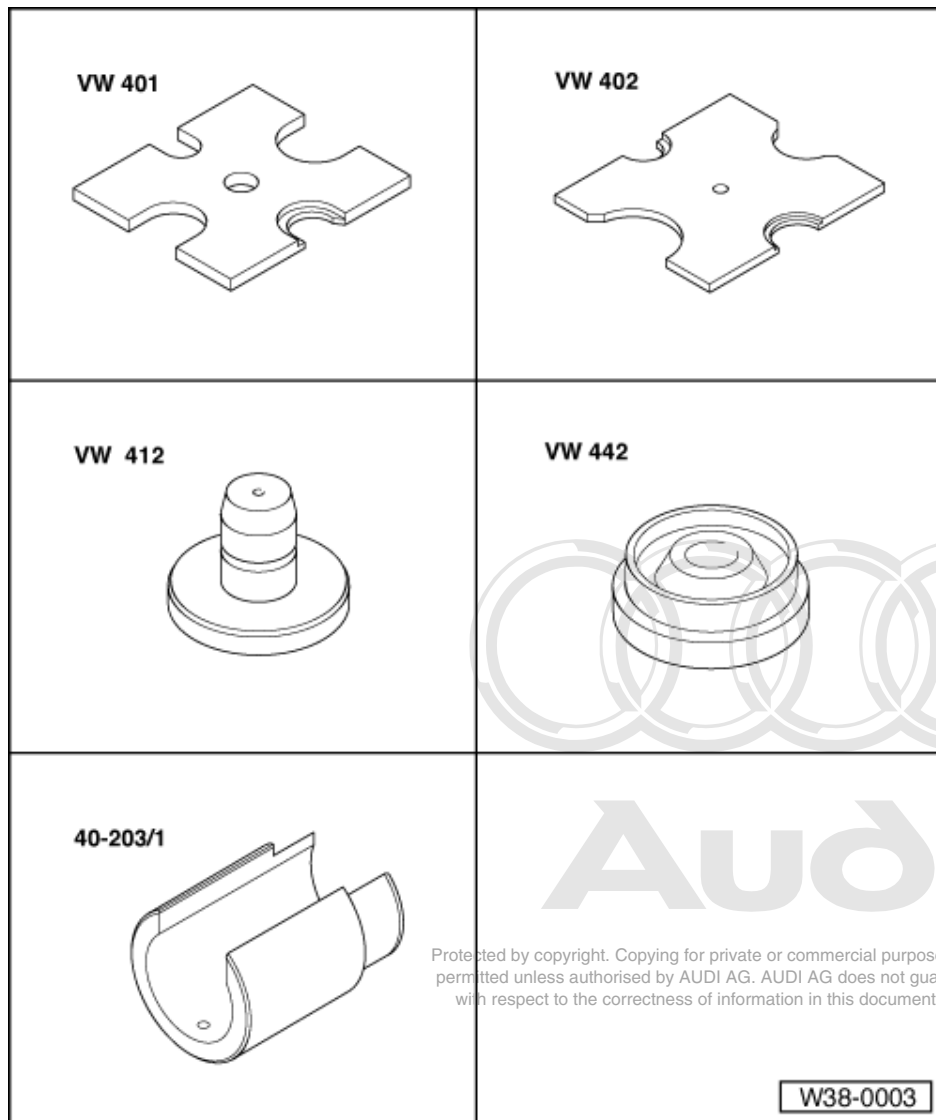
Installing

- Place piston ring in groove.
- To hook ends together press sides of ring in and guide ends over one another.



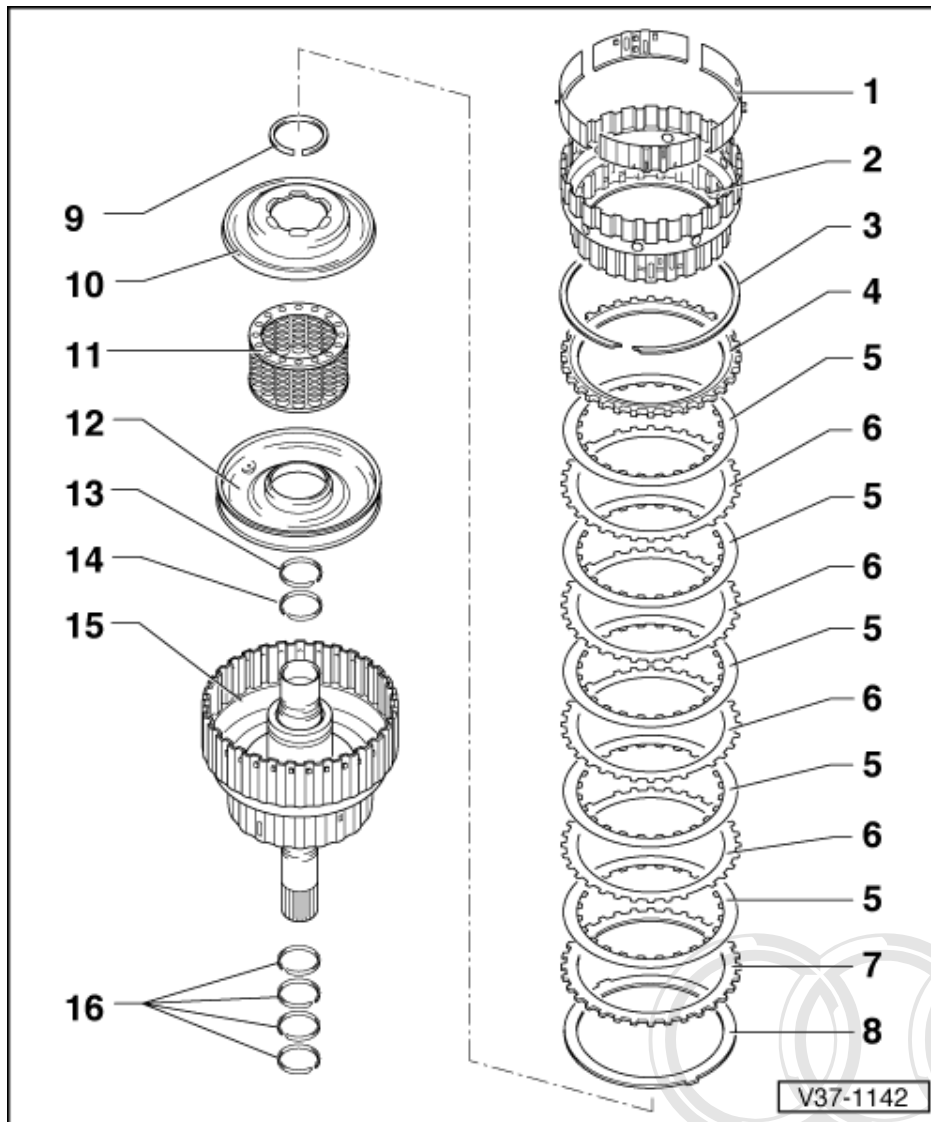
4 - Dismantling and assembling 1st - 3rd gear clutch -K1- with turbine shaft for gearboxes as of 11.92

4.1 - Dismantling and assembling 1st - 3rd gear clutch -K1- with turbine shaft for gearboxes as of 11.92



Special tools, testers and workshop equipment required

- ♦ VW 401 Thrust plate
- ♦ VW 402 Thrust plate
- ♦ VW 412 Thrust tool
- ♦ VW 442 Thrust piece
- ♦ 40-203/1 Tube



Note:

Only when cleaning or carrying out visual check the clutch must be dismantled.

1 Supporting ring

- ◆ Unclip in 4 pieces from inner plate carrier
- ◆ Inserting
=> Fig. 131

2 Inner plate carrier

- ◆ Inserting
=> Fig. 132
- ◆ Assembling
=> Fig. 131

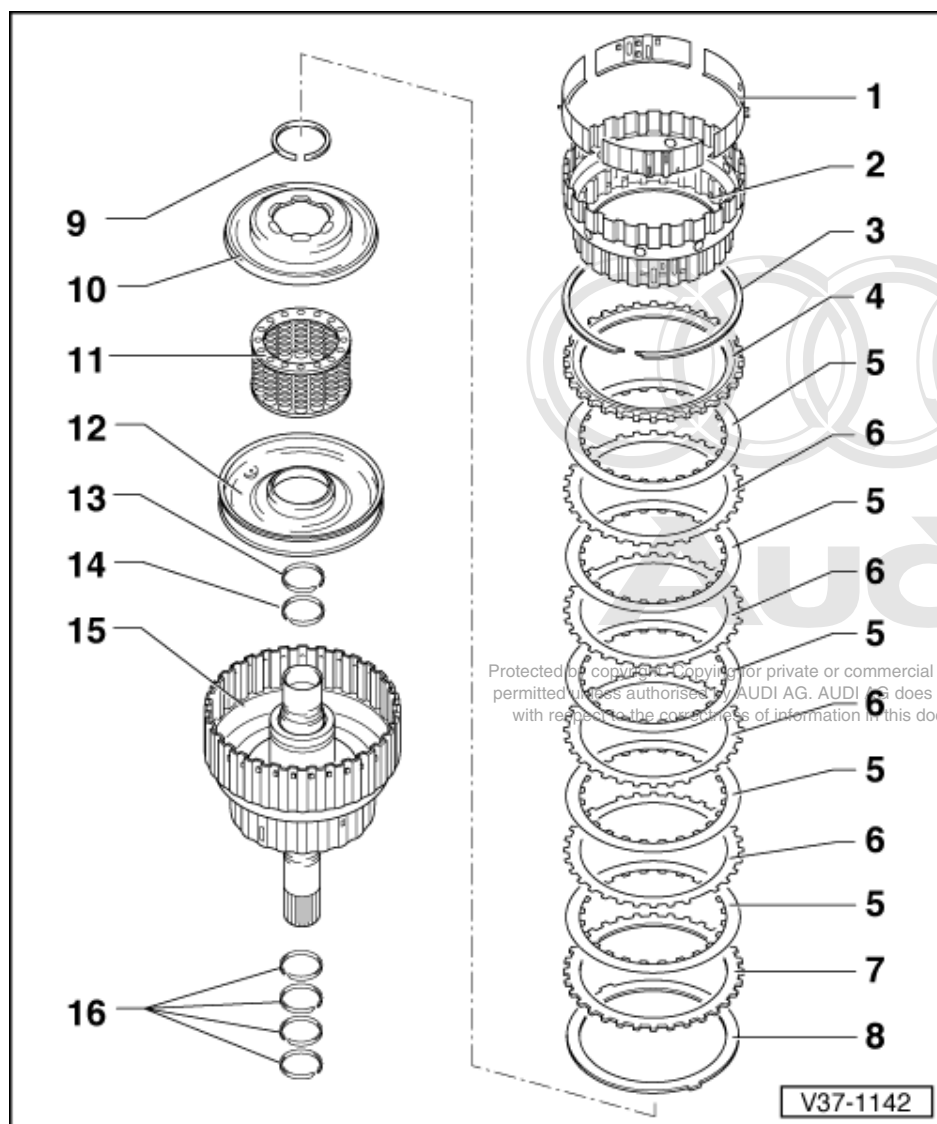
3 Circlip

- ◆ Differing thickness
- ◆ Mark after removing and insert at same point

4 Pressure plate

- ◆ Smooth side faces inner plate
- ◆ Insert together with inner plate carrier
=> Fig. 131

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5 Inner plate

- ◆ Number of inner plates => Page 2
- ◆ Installing
=> Fig. 131
- ◆ Before installing place new inner plates in ATF for 15 minutes

6 Outer plate

- ◆ Number of outer plates => Page 2
- ◆ Installing
=> Fig. 131
- ◆ Always 1.5 mm thick

7 Outer plate

- ◆ always 2.0 mm thick
- ◆ Installing
=> Fig. 131

8 Corrugated washer

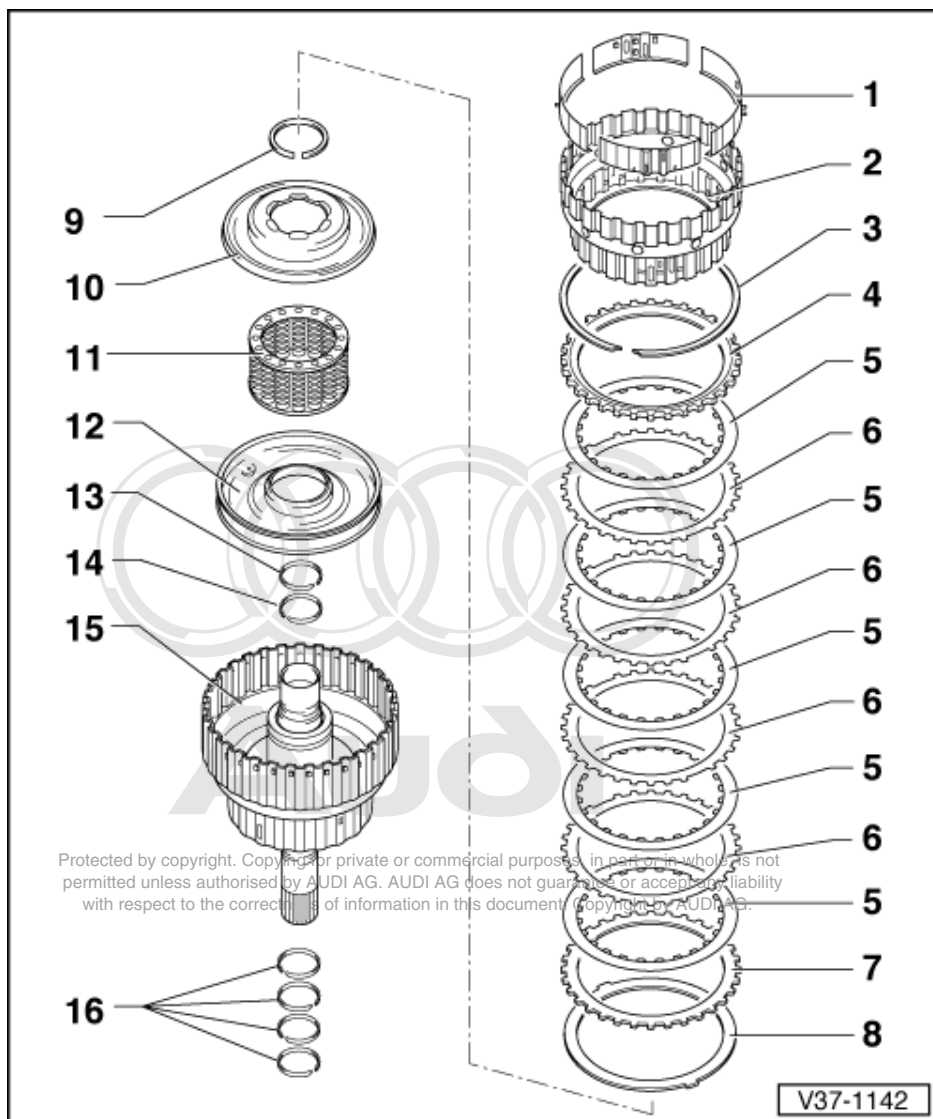
9 Circlip

- ◆ Removing and installing
=> Fig. 131

10 Piston cap

- ◆ Sealing lips are vulcanised to cap
- ◆ Moisten sealing lips with ATF before installing

- ♦ Turn cap slightly when installing



11 Intermediate spring ring

- ♦ With spring supporting shell and compression springs

12 Piston

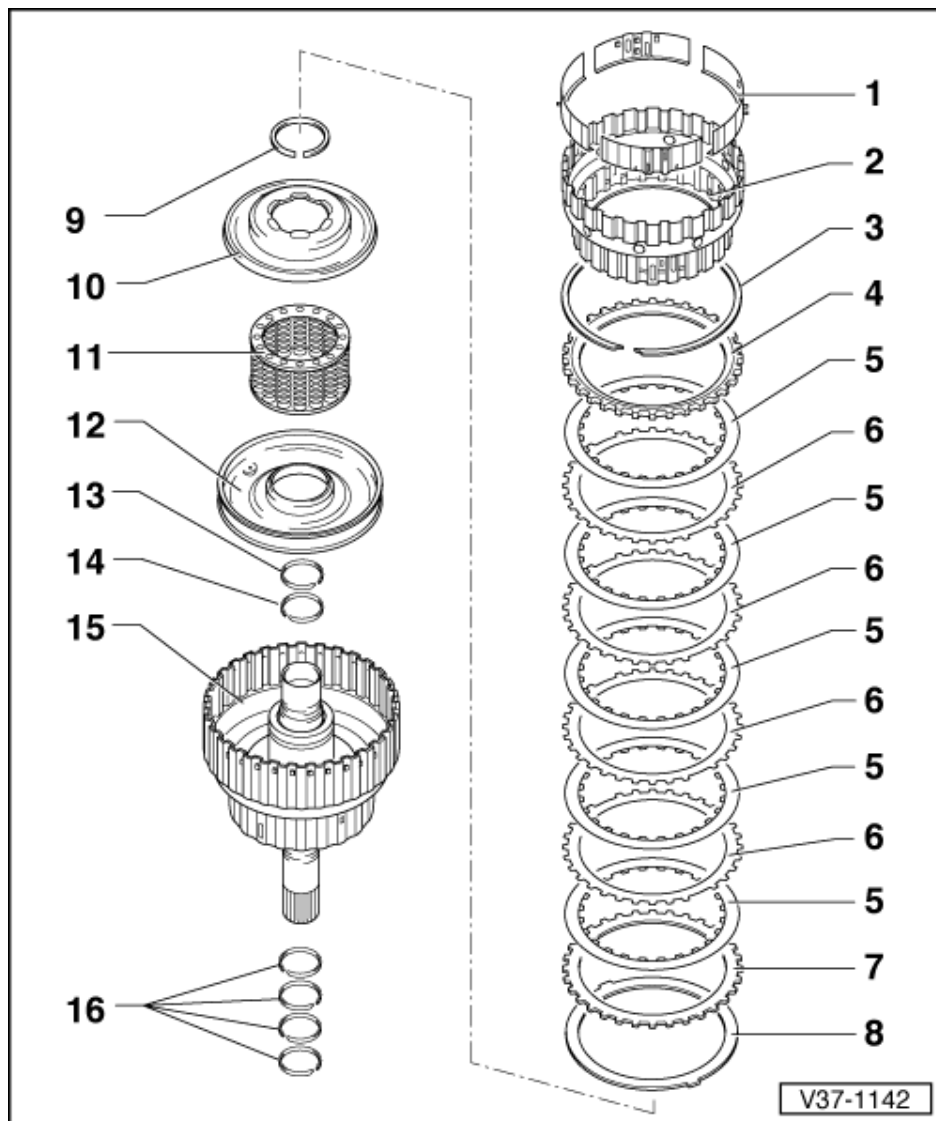
- ♦ Sealing lips are vulcanised to piston
- ♦ Moisten sealing lips with ATF before installing
- ♦ Turn piston slightly when installing

13 Piston ring (small dia.)

- ♦ Checking correct positioning
=> Fig. 132
- ♦ Removing and installing => Page 132

14 Piston ring

- ♦ Checking correct positioning
=> Fig. 132
- ♦ Removing and installing => Page 132

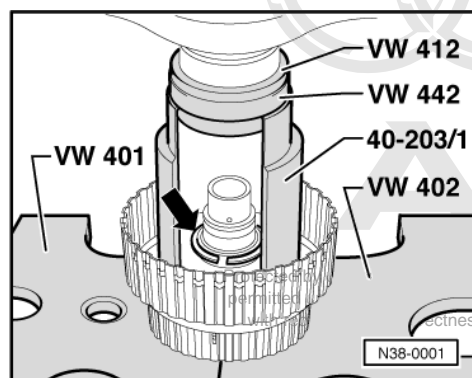


15 Clutch housing with turbine shaft

- ◆ Check mounting bushes; replace clutch housing if bushes damaged
- ◆ Before fitting inner plate carrier, insert corrugated washer (Item 131)

16 Piston ring

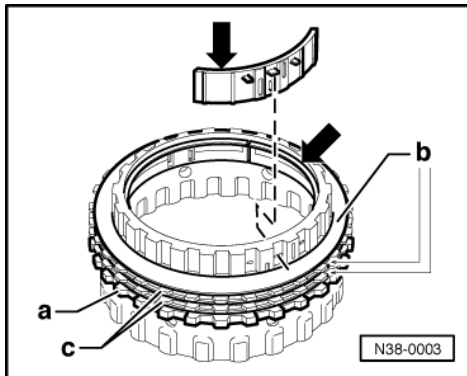
- ◆ Checking correct positioning
=> Fig. 132
- ◆ Removing and installing => Page 132



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-> **Fig.1 Removing and installing circlip**

- Press piston cap with intermediate spring ring down far enough for the circlip (arrow) to be inserted in the groove.



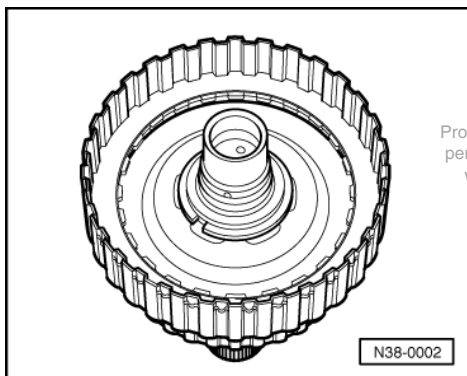
-> **Fig.2 Fitting thrust plate and plates onto inner plate carrier**

- Install thrust plate -a- with smooth side facing inner plate and stepped side towards inner plate carrier.
- Install 3 inner plates -b- and 2 outer plates -c-.
- Clip in thrust bearing with edge (arrows) facing upwards.

Note:

Engage locating lugs correctly.

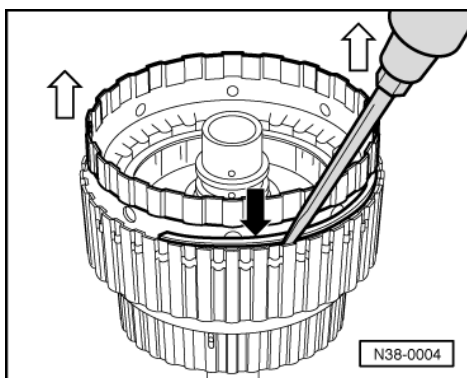
- Install corrugated washer and remaining plates in clutch housing => Fig. 131 .



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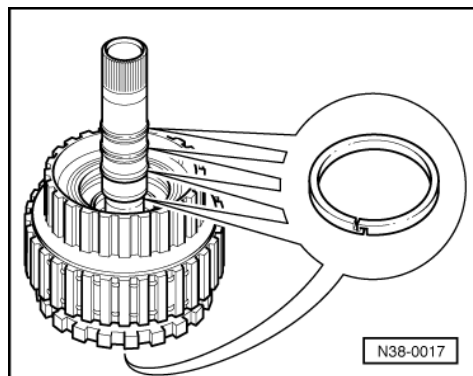
-> **Fig.3 Installing corrugated washer and inner and outer plates in clutch housing**

- First insert corrugated spring washer.
- Insert 2 mm thick outer plate.
- Insert remaining inner and outer plates.



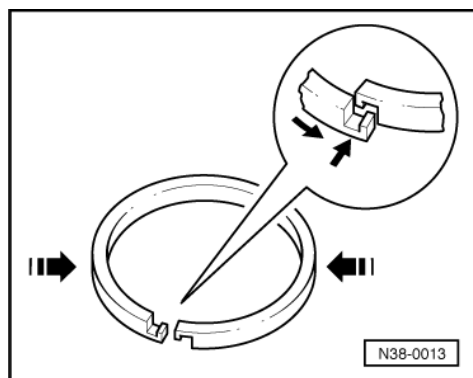
-> Fig.4 Inserting inner plate carrier and installing circlip (arrow).

- Lift inner plate carrier slightly -white arrows- to install circlip -black arrow-.



-> Fig.5 Checking seating of piston rings

- Ensure that the ends of the piston rings are hooked together.



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-> Fig.6 Removing and installing piston ring

Removing

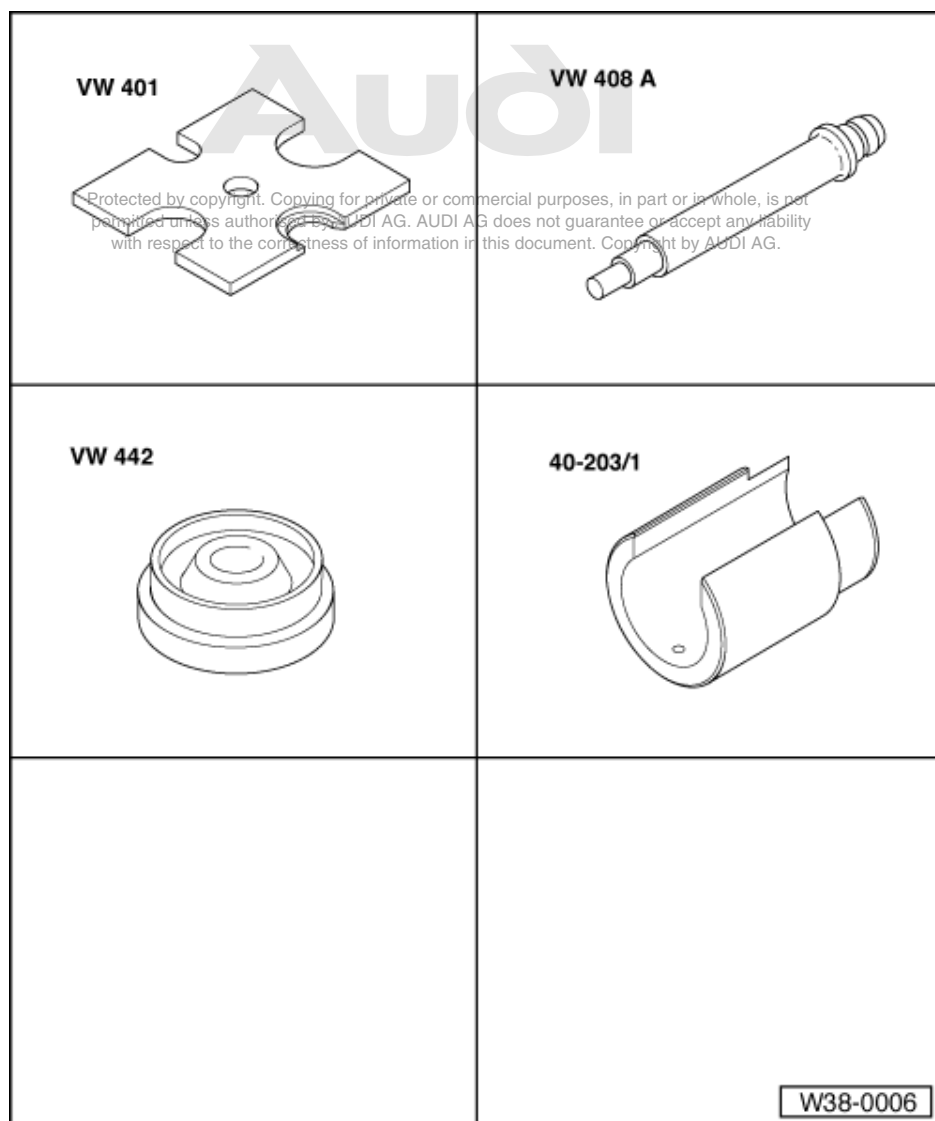
- Press ends of piston ring together and release by hand.
- Press two ends of piston ring apart and remove; do not twist piston ring out of groove on one side.

Installing

- Place piston ring in groove.
- To hook ends together press sides of ring in and guide ends over one another.

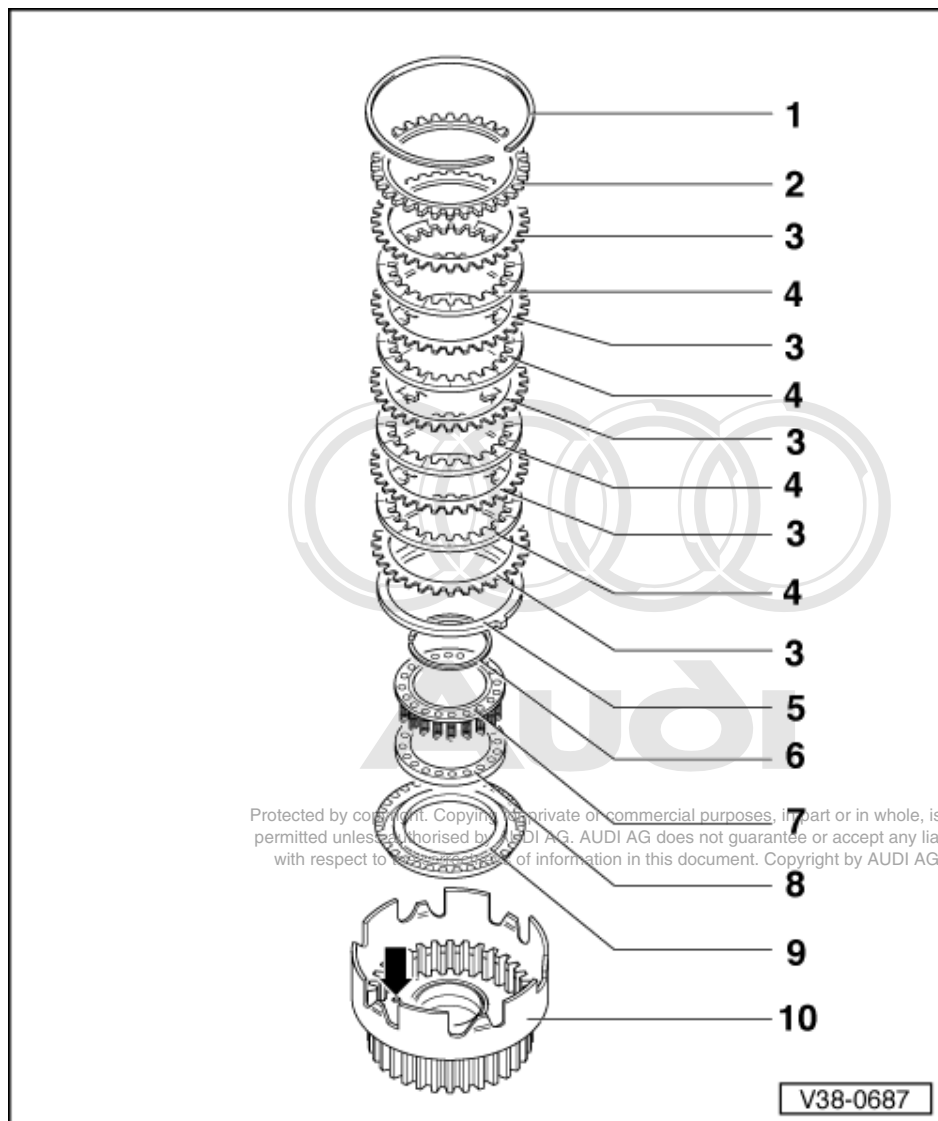
5 - Dismantling and assembling reverse gear clutch -K2-

5.1 - Dismantling and assembling reverse gear clutch -K2-



Special tools, testers and workshop equipment required

- ◆ VW 401 Thrust plate
- ◆ VW 408 A Pressure tool
- ◆ VW 442 Thrust piece
- ◆ 40-203/1 Tube

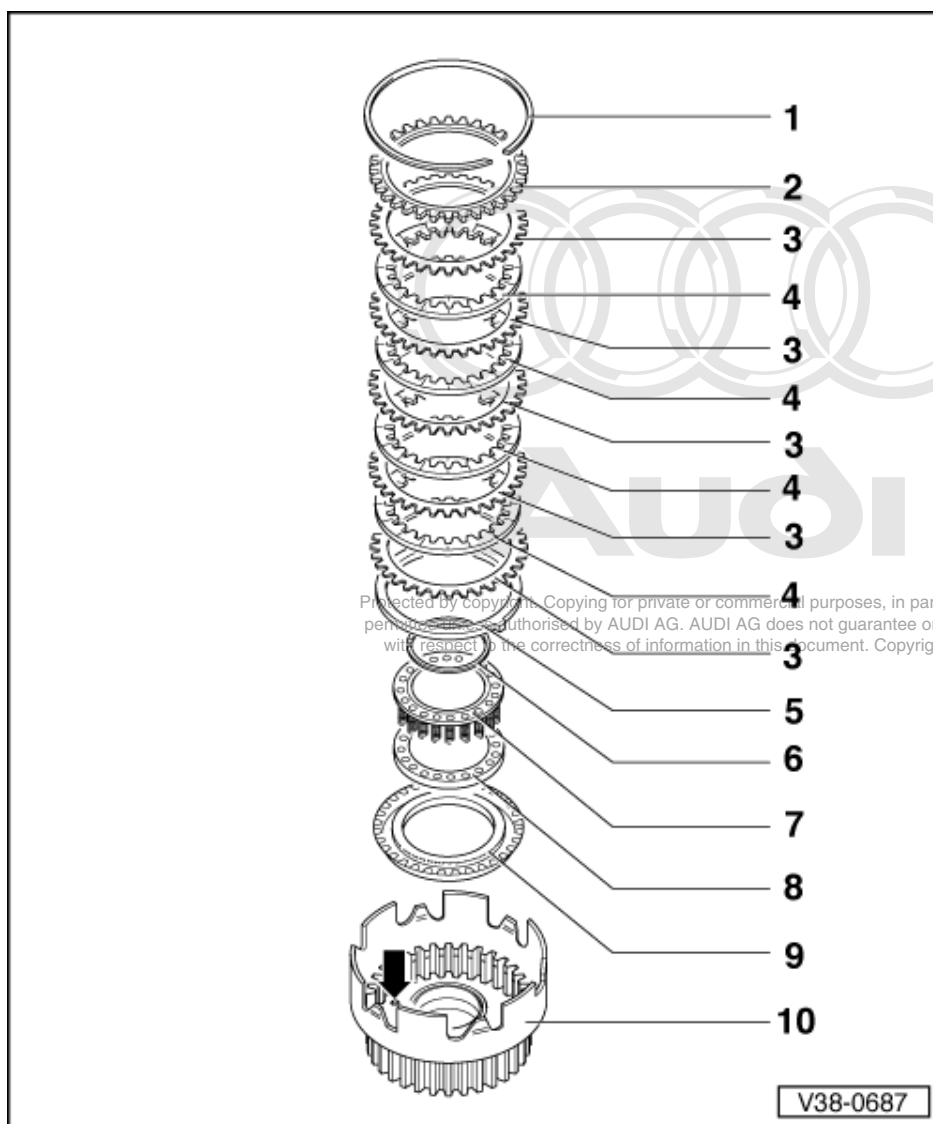


Notes:

Only when cleaning or carrying out visual check the clutch must be dismantled.

When doing this ensure that the ball valve (arrow) is not damaged.

- 1 **Circlip**
 - ♦ Mark after removing and insert at same point
- 2 **Pressure plate**
 - ♦ Smooth side facing inner plates
- 3 **Outer plate**
 - ♦ Number of outer plates=>Page 2 onwards
- 4 **Inner plate**
 - ♦ Number of inner plates=>Page 2 onwards
 - ♦ Before installing place new inner plates in ATF for 15 minutes



5 Corrugated washer

6 Circlip

- ◆ Removing and installing
=> Fig. 136
- ◆ Installation position
=> Fig. 136

7 Spring supporting plate

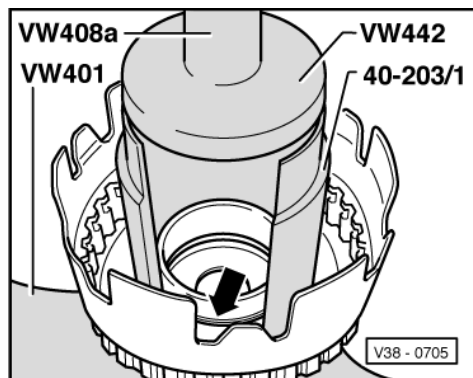
- ◆ With springs
- ◆ Installation position
=> Fig. 136

8 Spring supporting ring

9 Piston

- ◆ Sealing lips are vulcanised to piston
- ◆ Moisten sealing lips with ATF before installing
- ◆ Turn piston slightly and keep straight when installing

10 Clutch housing with tube



-> Fig.1 Removing and installing circlip (arrow)

Removing

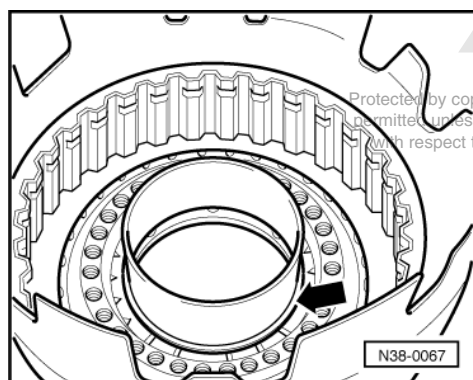
- Carefully press down spring support plate (taking care not to bend it) and spread circlip.

Installing

- Attach new circlip and press down carefully with spring support plate. Support plate must be centred with hub, as otherwise it will become bent.

Note:

Do not damage clutch housing ball valve.

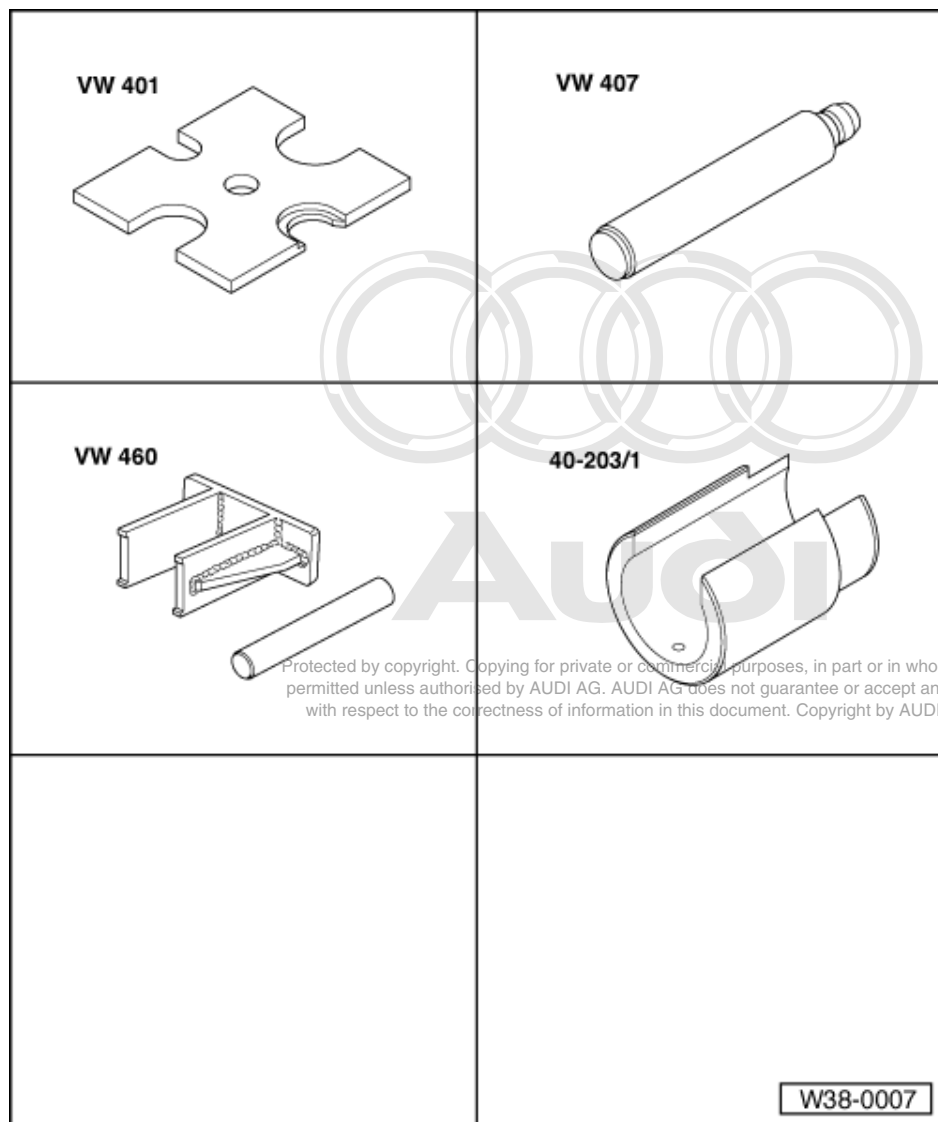


-> Fig.2 Installation position of spring supporting plate, checking circlip

Circlip (arrow) must be seated in the groove of clutch housing. Spring supporting plate must be centred relative to hub.

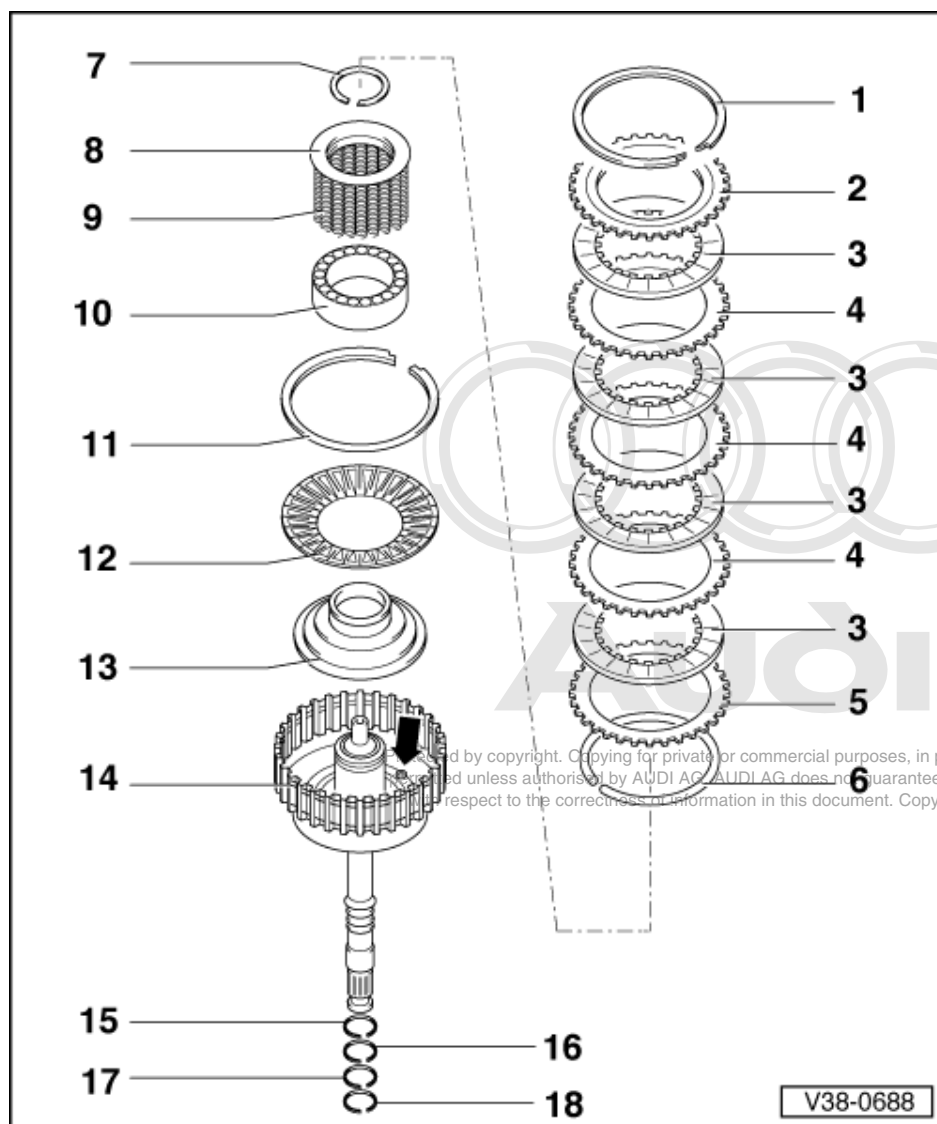
6 - Dismantling and assembling 3rd and 4th gear clutch -K3- with pump shaft for gearboxes up to 11.92

6.1 - Dismantling and assembling 3rd and 4th gear clutch -K3- with pump shaft for gearboxes up to 11.92



Special tools, testers and workshop equipment required

- ◆ VW 401 Thrust plate
- ◆ VW 407 Thrust tool
- ◆ VW 460 Removal device
- ◆ 40-203/1 Tube

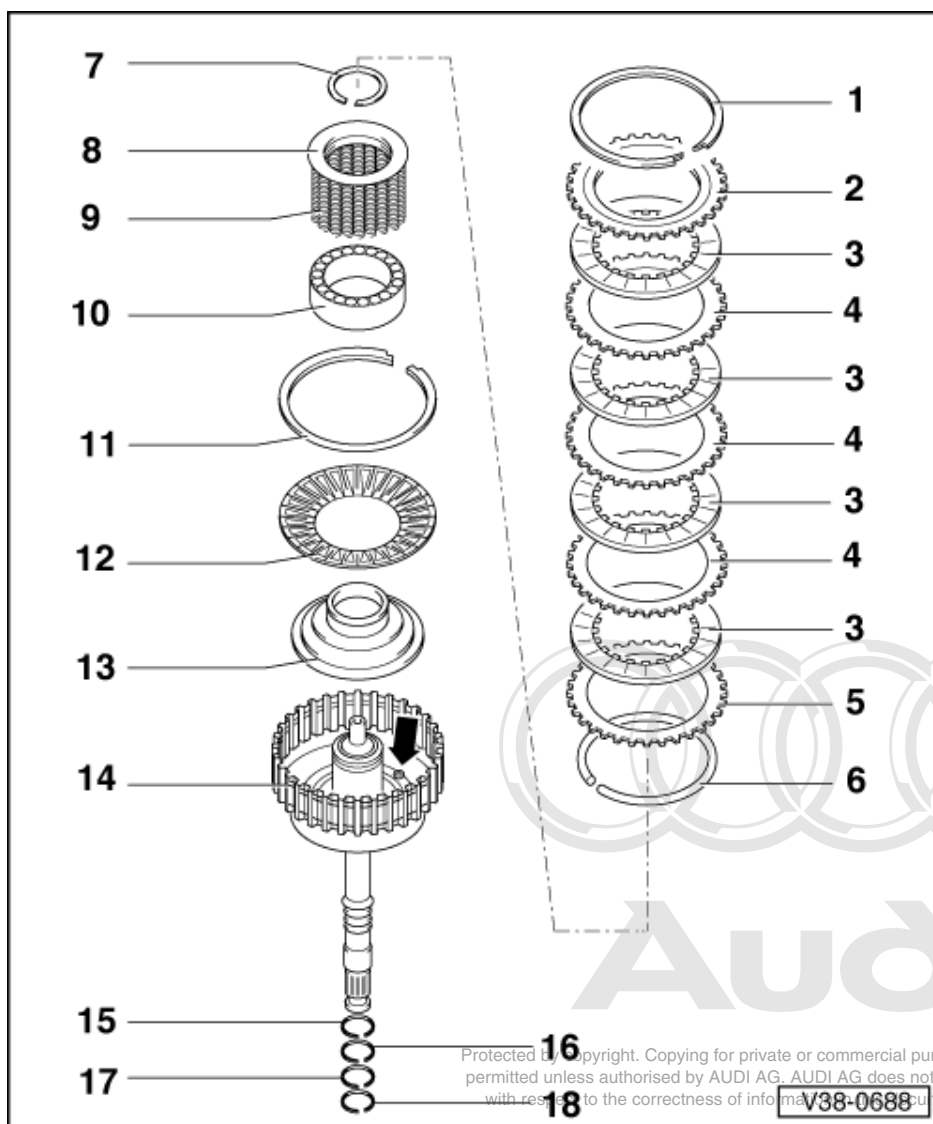


Notes:

Only when cleaning or carrying out visual check the clutch must be dismantled.

When doing this ensure that the ball valve (arrow) is not damaged.

- 1 **Circlip**
 - ◆ Differing thickness
 - ◆ Mark after removing and insert at same point
- 2 **Pressure plate**
 - ◆ Install with stepped side facing circlip
- 3 **Inner plate**
 - ◆ Number of inner plates=>Page 2 onwards
 - ◆ Before installing place new inner plates in ATF for 15 minutes
- 4 **Outer plate**
 - ◆ Number of outer plates=>Page 2 onwards
- 5 **Pressure plate**
 - ◆ Install with curved side facing corrugated washer



6 Corrugated washer

- ♦ Insert into rounded side of pressure plate

7 Circlip

- ♦ Removing and installing
=> Fig. 142

8 Spring supporting ring

9 Springs

- ♦ Position on spring supporting ring

10 Spring support

11 Circlip

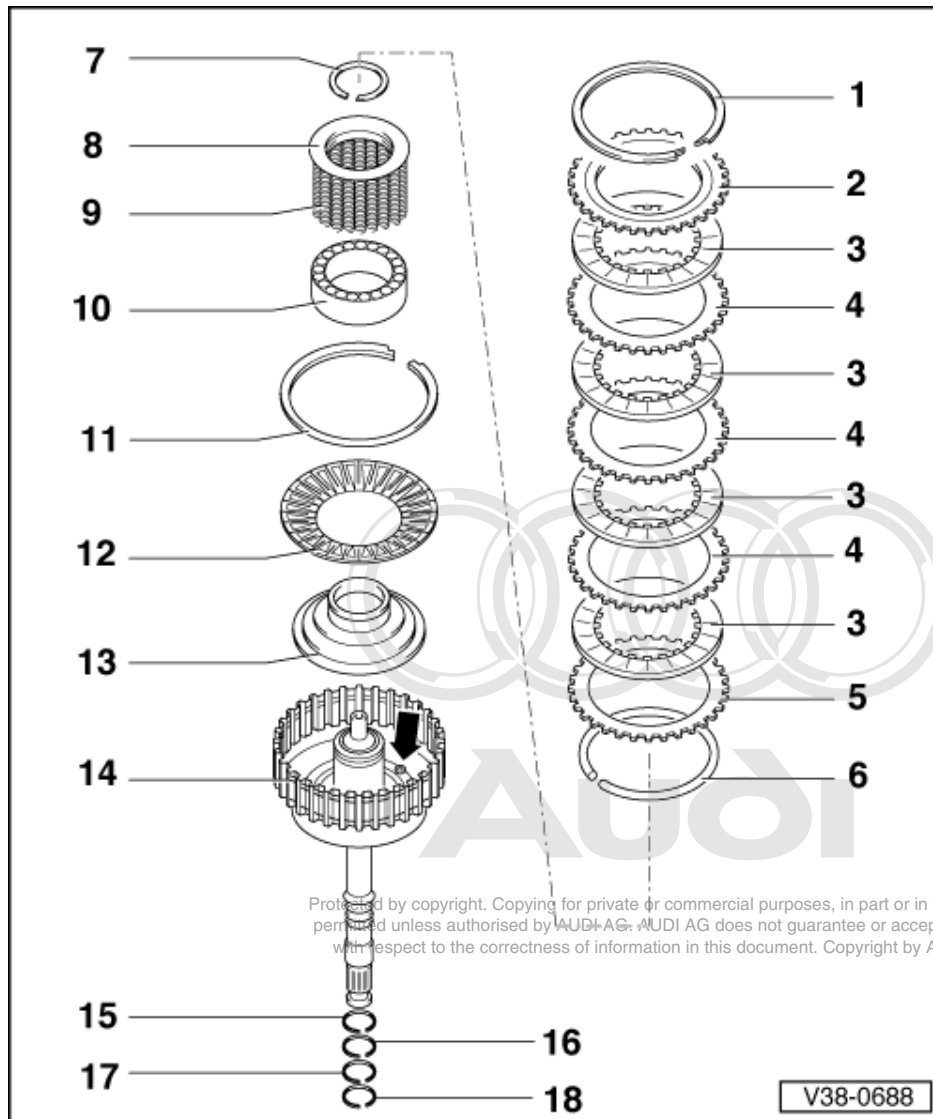
- ♦ Must be fitted in groove of clutch housing

12 Ring tensioning spring

- ♦ Curved side faces piston

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V38-0688

**13 Piston**

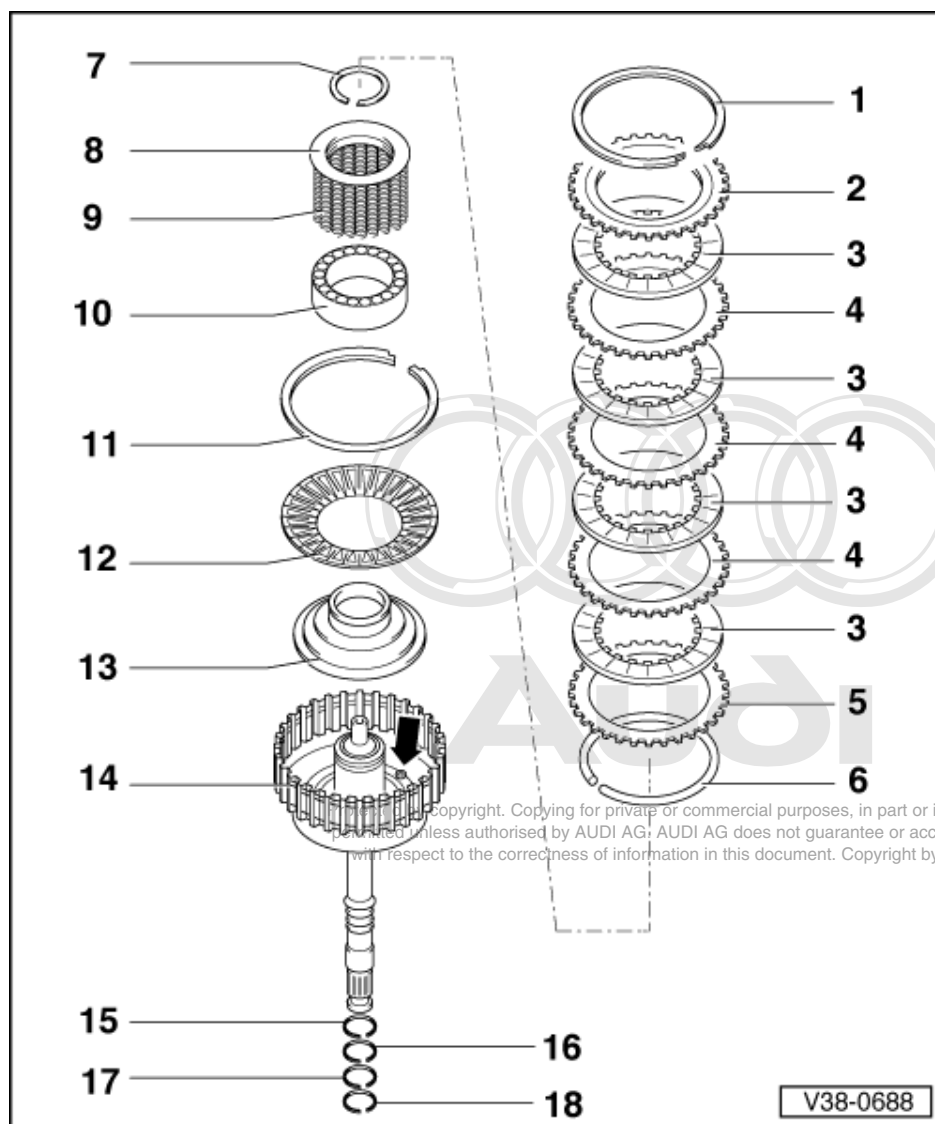
- ◆ Sealing lips are vulcanised to piston
- ◆ Moisten sealing lips with ATF before installing
- ◆ Turn piston slightly when installing

14 Clutch housing with pump shaft**15 Piston ring**

- ◆ Only replace defective piston rings
- ◆ Destroyed on being dismantled
- ◆ Checking correct positioning
=> Fig. 142
- ◆ Installing
=> Fig. 142

16 Piston ring

- ◆ Only replace defective piston rings
- ◆ Destroyed on being dismantled
- ◆ Checking correct positioning
=> Fig. 142
- ◆ Installing
=> Fig. 142

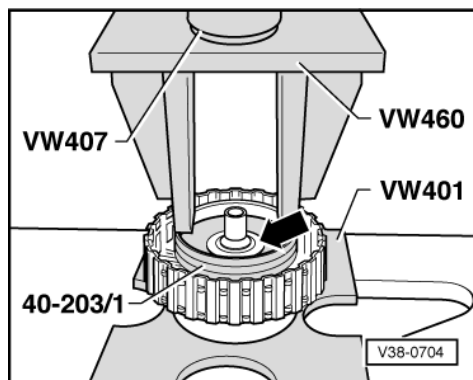


17 Piston ring

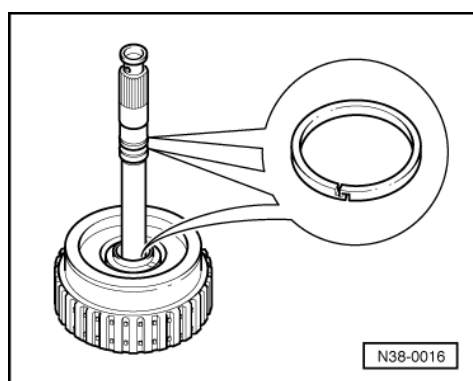
- ♦ Checking correct positioning
=> Fig. 142
- ♦ Installing
=> Fig. 142

18 Piston ring

- ♦ Checking correct positioning
=> Fig. 142
- ♦ Installing
=> Fig. 142

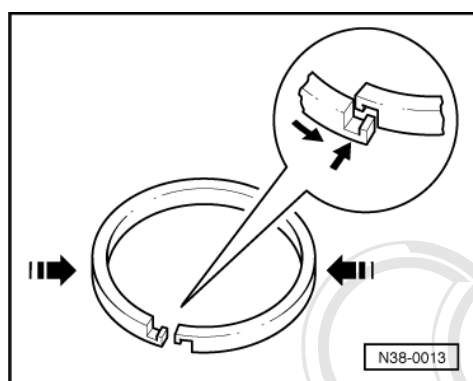


-> Fig.1 Removing and installing circlip (arrow)



-> Fig.2 Checking seating of piston rings

- Ensure that the ends of the piston rings are hooked together.



-> Fig.3 Removing and installing piston ring

Removing

- Press ends of piston ring together and release by hand.
- Press two ends of piston ring apart and remove; do not twist piston ring out of groove on one side.

Installing

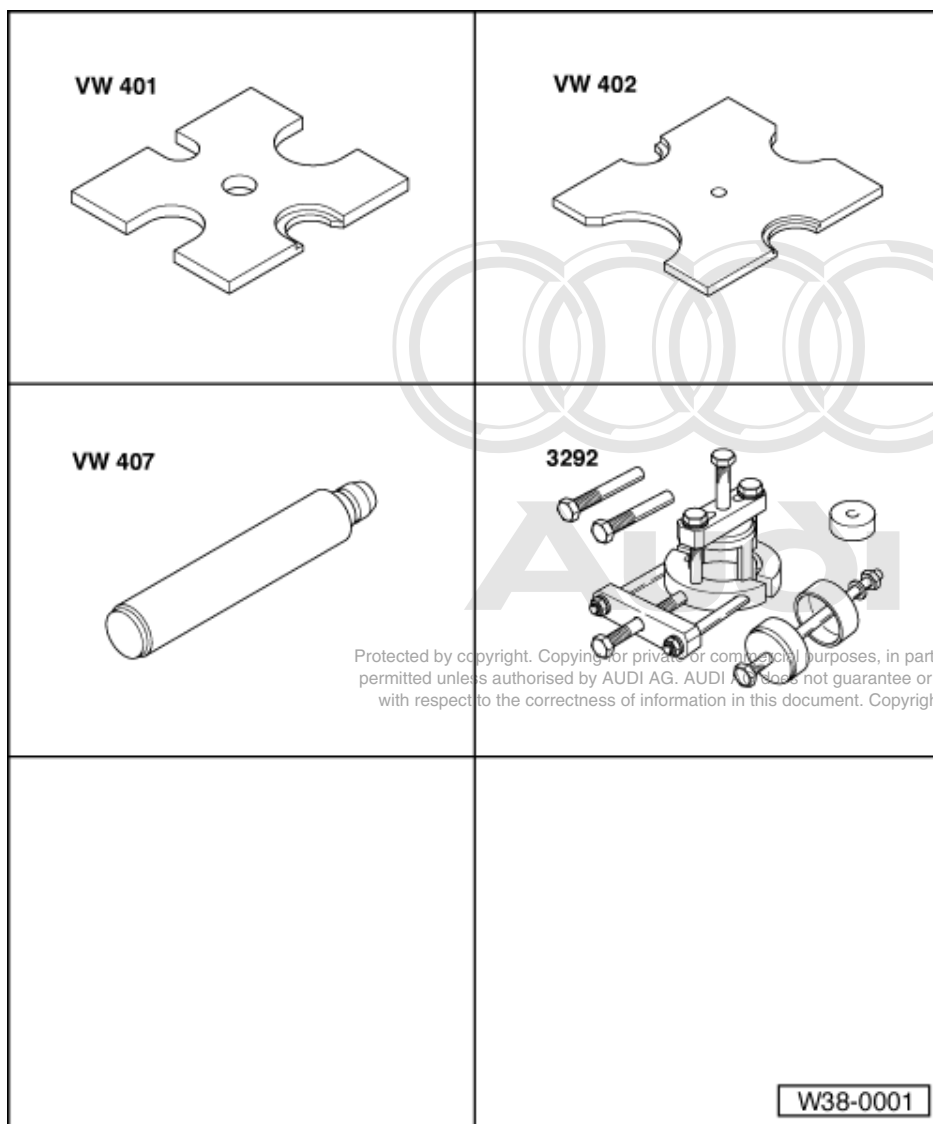
- Place piston ring in groove.

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- To hook ends together press sides of ring in and guide ends over one another.

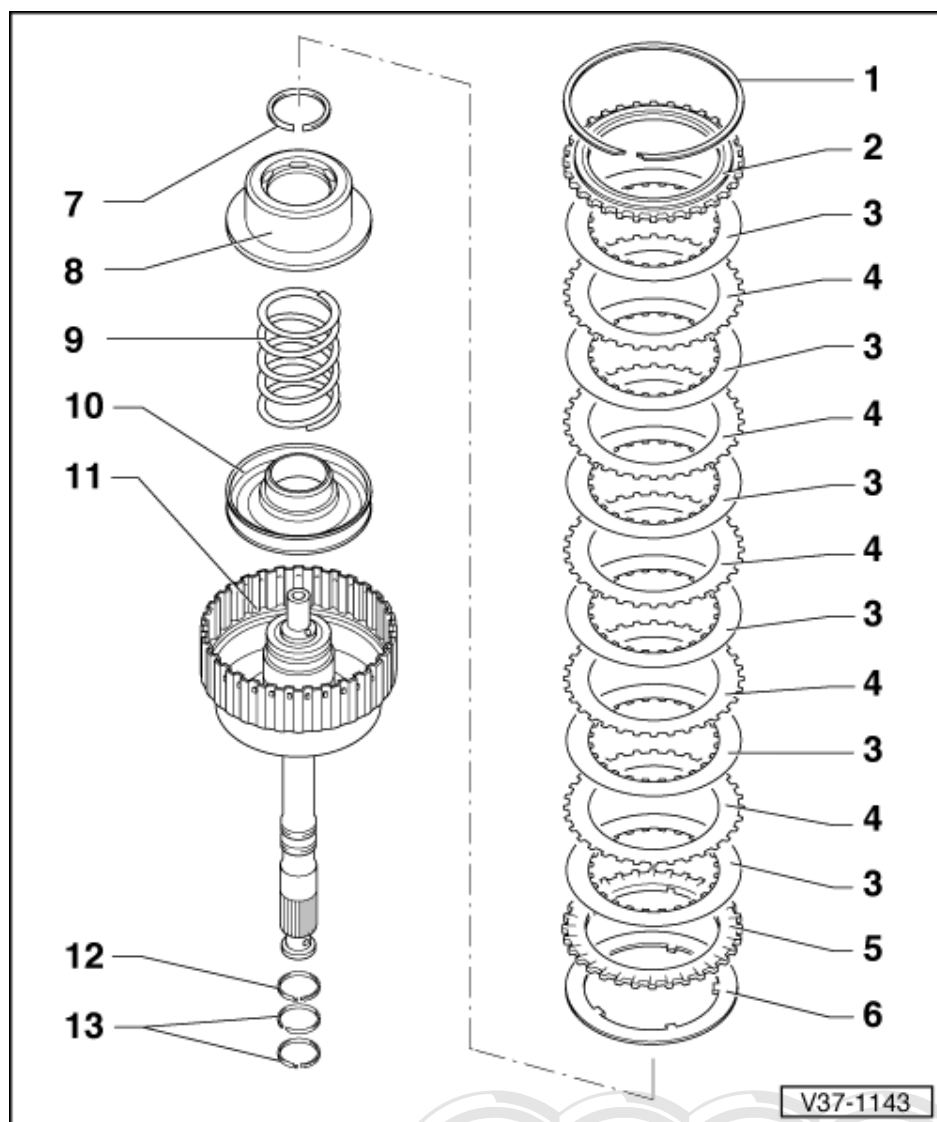
7 - Dismantling and assembling 4th gear clutch -K3- with pump shaft for gearboxes as of 11.92

7.1 - Dismantling and assembling 4th gear clutch -K3- with pump shaft for gearboxes as of 11.92



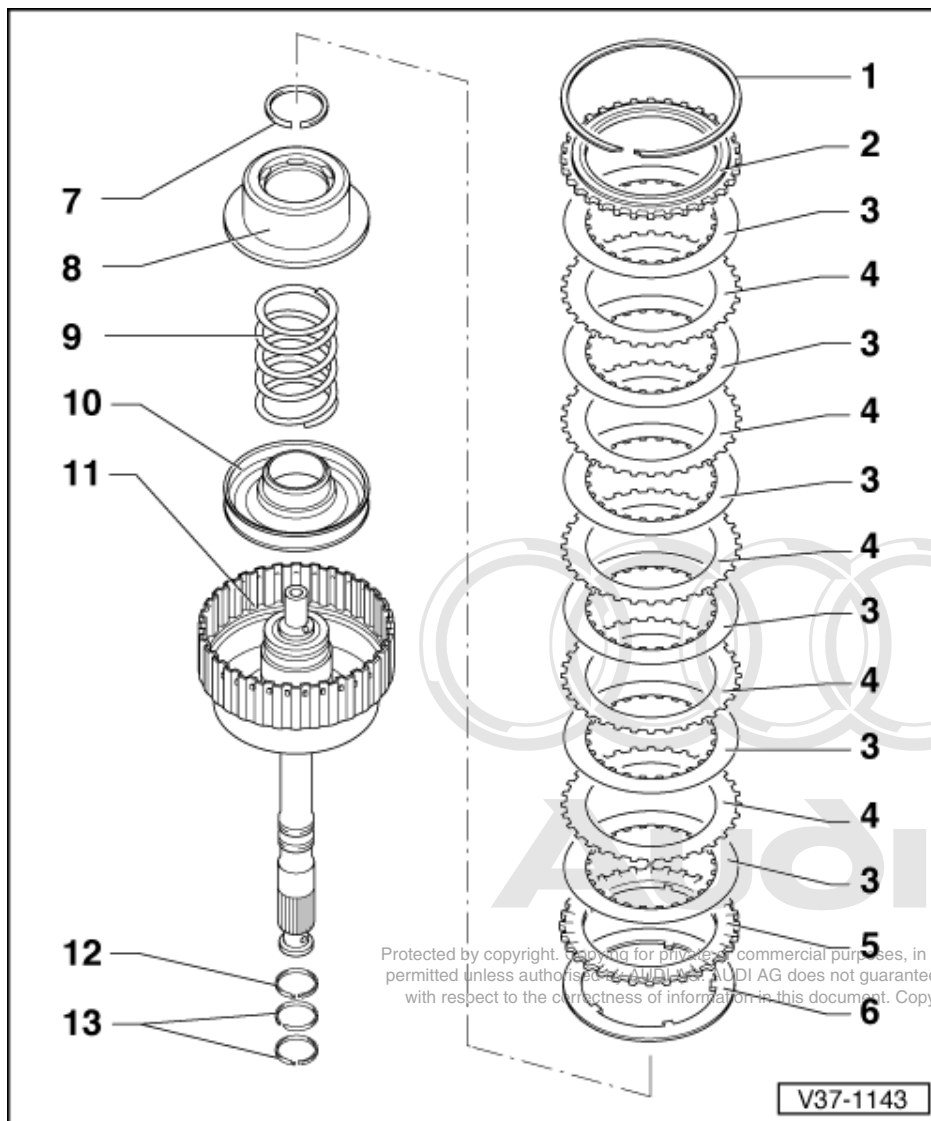
Special tools, testers and workshop equipment required

- ♦ VW 401 Thrust plate
- ♦ VW 402 Thrust plate
- ♦ VW 407 Thrust tool
- ♦ 3292/1 From assembly tool 3292



- 1 Circlip
 - ◆ Differing thickness
 - ◆ Mark after removing and insert at same point
- 2 Pressure plate
 - ◆ Install with stepped side facing circlip
- 3 Inner plate
 - ◆ Number of inner plates=>Page 2 onwards
 - ◆ Before installing place new inner plates in ATF for 15 minutes
- 4 Outer plate
 - ◆ Number of outer plates=>Page 2 onwards
- 5 Pressure plate
 - ◆ Install with peened corrugated washer facing piston
- 6 Corrugated washer
 - ◆ Peened to pressure plate -Item 5 -

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7 Circlip

- ◆ Removing and installing => Page 147

8 Piston cap

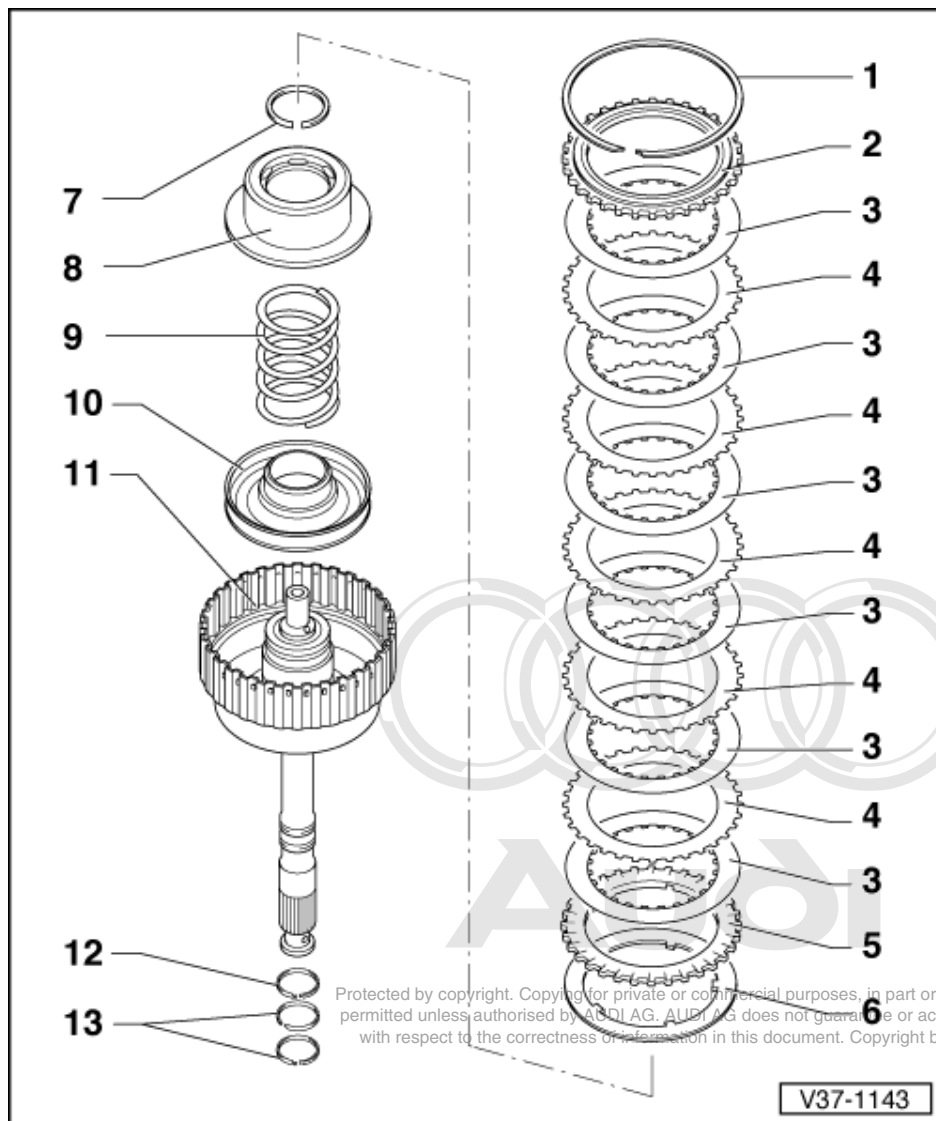
- ◆ Sealing lips are vulcanised to piston cap
- ◆ Moisten sealing lips with ATF before installing
- ◆ Turn piston cap slightly when installing
- ◆ When removing and installing press down and fit circlip (Item 7)

9 Spring

- ◆ Seat between piston and piston cap

10 Piston

- ◆ Sealing lips are vulcanised to piston
- ◆ Moisten sealing lips with ATF before installing
- ◆ Turn piston slightly when installing



11 Clutch housing with pump shaft

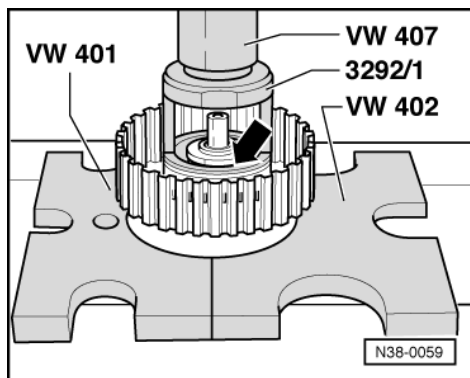
- ◆ Height varies according to number of inner and outer plates

12 Piston ring

- ◆ Only replace defective piston rings
- ◆ Destroyed on being dismantled
- ◆ Checking correct positioning
=> Fig. 147
- ◆ Installing
=> Fig. 147

13 Piston ring

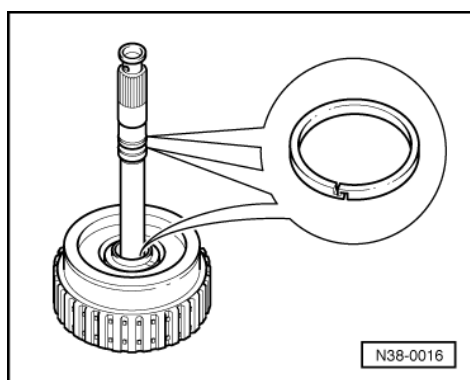
- ◆ Checking correct positioning
=> Fig. 147
- ◆ Removing and installing
=> Fig. 147



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-> Fig.1 Removing and installing circlip (arrow)

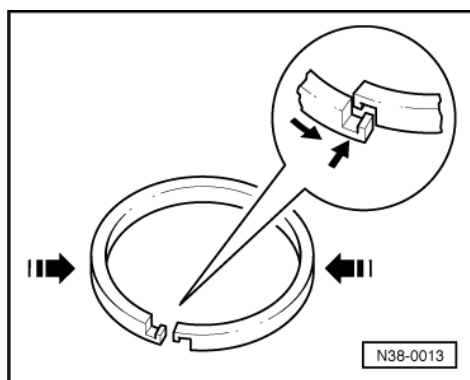
- Press piston cap down carefully until the circlip can be removed or installed.
- Mark circlip after removing and reinstall in same position.



-> Fig.2 Checking seating of piston rings

A piston ring is fitted on the pump shaft inside the clutch housing.

- Ensure that the ends of the piston rings are hooked together.



-> Fig.3 Removing and installing piston ring

Removing

- Press ends of piston ring together and release by hand.



- Press two ends of piston ring apart and remove; do not twist piston ring out of groove on one side.

Installing

- Place piston ring in groove.
- To hook ends together press sides of ring in and guide ends over one another.

8 - Removing and installing valve body

8.1 - Removing and installing valve body

Warning

Do not run the engine or tow the vehicle if the oil pan is removed or if ATF has been drained from the gearbox.

Notes:

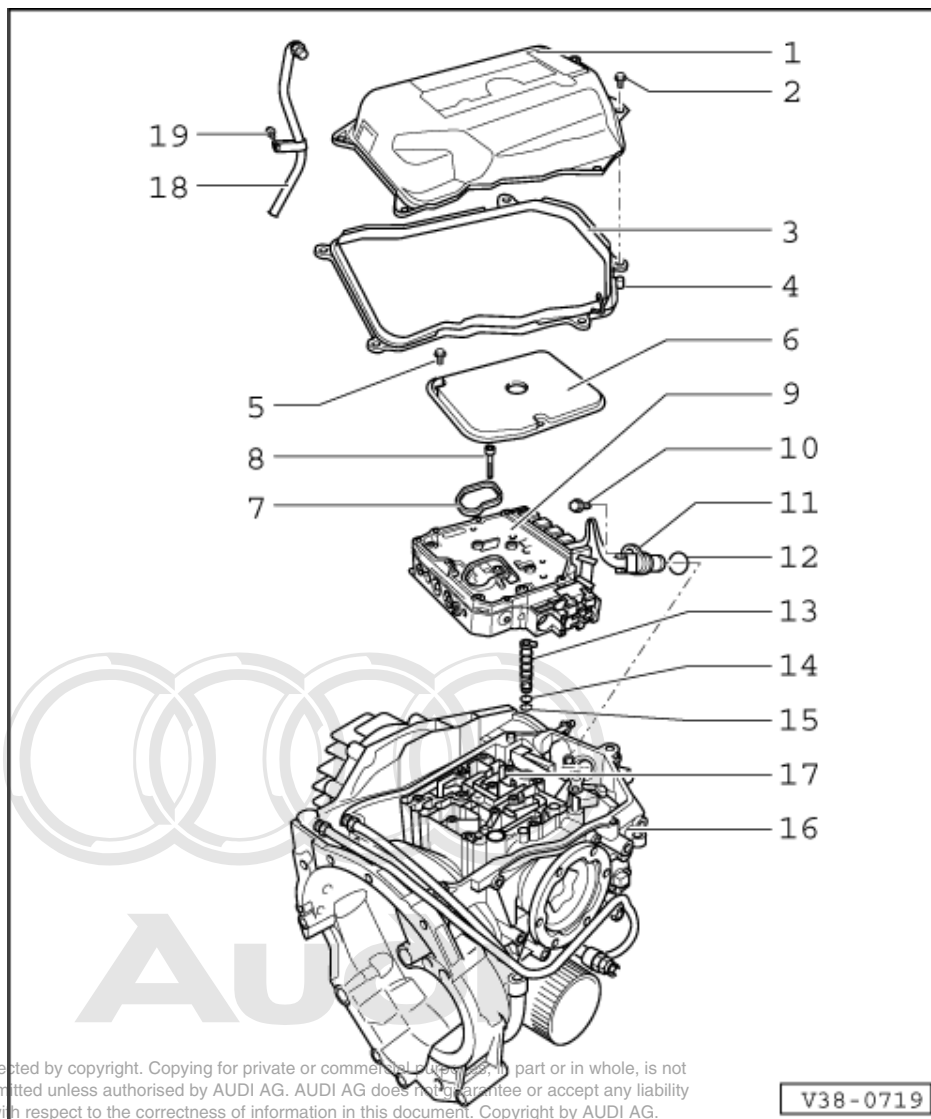
- ♦ An exchange component containing all selector elements and the valve body is available for repair work on the automatic gearbox 097.
- ♦ The exchange component is assigned to the gearbox code letters => Page **2** onwards.
- ♦ Installation instructions:

=> Special information; Transmission; No. 10

- ♦ The parts shown in the following illustration can be removed with the gearbox installed.
- ♦ Always renew the valve body if it is dirty or defective.
- ♦ General repair instructions =>Page **5**.
- ♦ Lubricate O-rings with ATF. Other types of lubricant will cause problems with the hydraulic actuation of the gearbox.
- ♦ Starter is to be removed on vehicles with 6-cyl. engine.



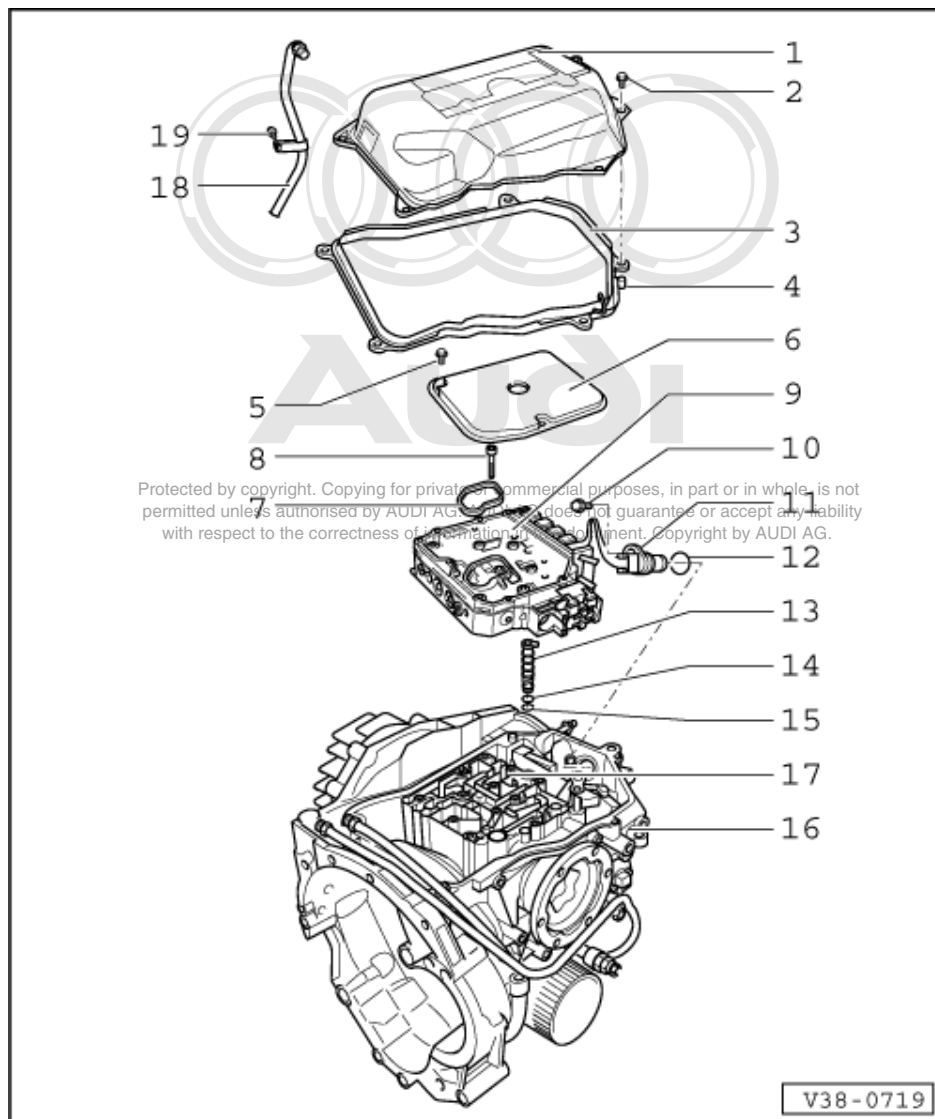
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V38-0719

- 1 Sump**
 - ♦ Unscrew ATF filler pipe before removing
- 2 Bolt, 12 Nm**
- 3 Gasket**
 - ♦ Always replace
 - ♦ Press spacer bushes into gasket
- 4 Spacer bush**
 - ♦ Press into gasket
- 5 Bolt, 8 Nm**
- 6 ATF screen**
 - ♦ Fasten in gasket
 - ♦ Installing
=>Fig. 153
- 7 Gasket**
 - ♦ Always replace
 - ♦ Fasten into ATF screen



8 Bolt, 5 Nm

9 Valve body

- ◆ Identification =>Fig. 153
- ◆ Inserting with cable loom => Fig. 152

10 Bolt, 10 Nm

11 Cable inlet connector

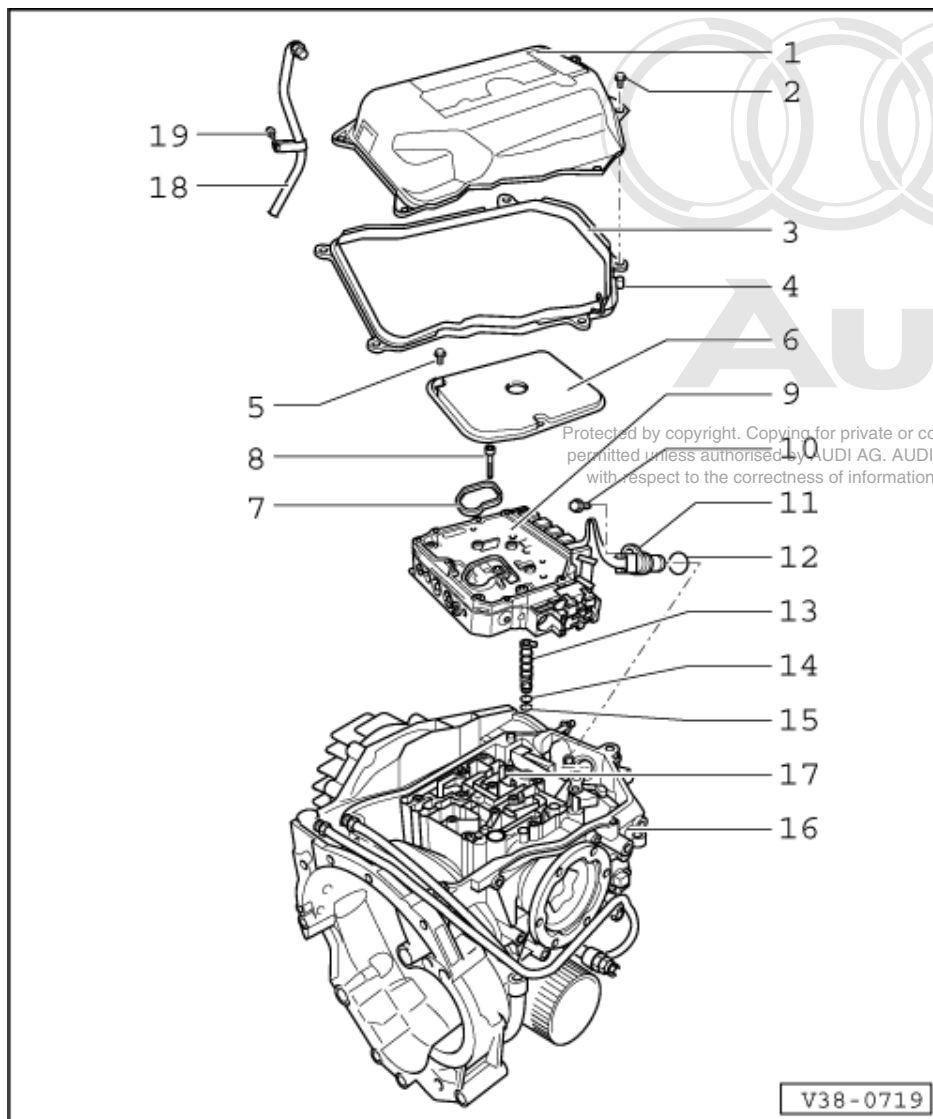
- ◆ Attach to gearbox housing

12 O-ring

- ◆ For cable transition piece
- ◆ Always replace

13 Sealing plug

- ◆ Take out before removing and installing free wheel
- ◆ Insert so that the lug is located in the groove on housing
=>Fig. 152
- ◆ Place O-rings onto sealing plug



14 O-ring

- ♦ Always replace

15 O-ring

- ♦ Always replace

16 Gearbox housing

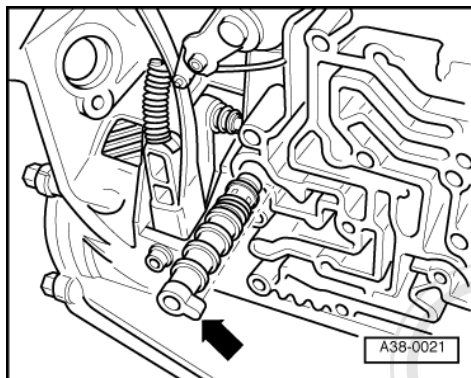
17 Operating rod for manual selector valve

- ♦ Adjusting
=>Fig. 152
- ♦ Install with stepped side facing selector valve

18 ATF filler pipe

- ♦ Screw (80 Nm) to sump

19 Bolt, 10 Nm

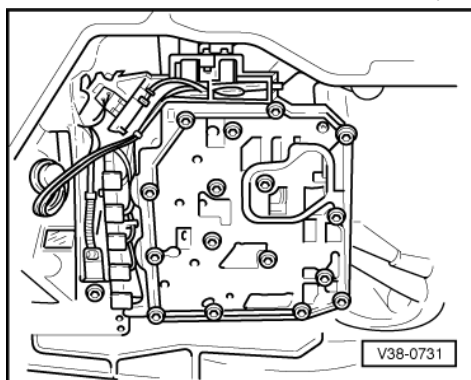


-> Fig.1 Inserting sealing plug

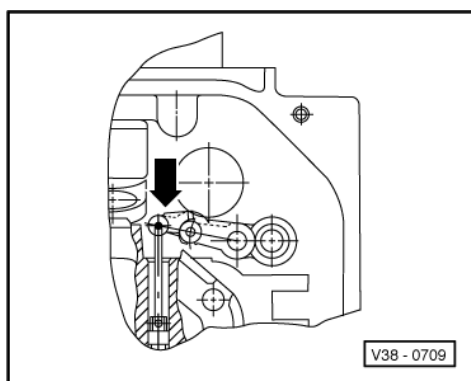
Pull sealing plug out of housing before removing and installing free wheel otherwise the sealing plug and the O-ring will be damaged.

- Fit O-rings to sealing plug.
- Insert sealing plug in hole in gearbox housing. The lug -arrow- is inserted into the oil channel.

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-> Fig.2 Inserting valve body with cable loom

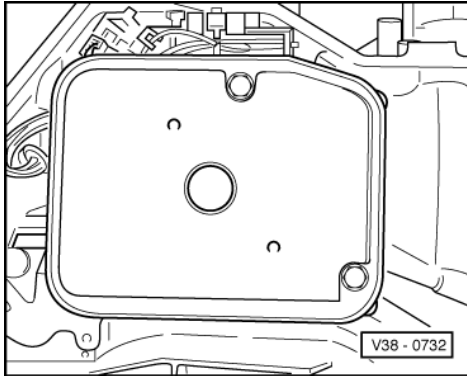


-> Fig.3 Adjusting operating rod for manual selector valve

- Move selector shaft to position "P".
- Push operating rod with selector valve into valve body as far as stop (in direction of arrow) and tighten bolt to 4 Nm.

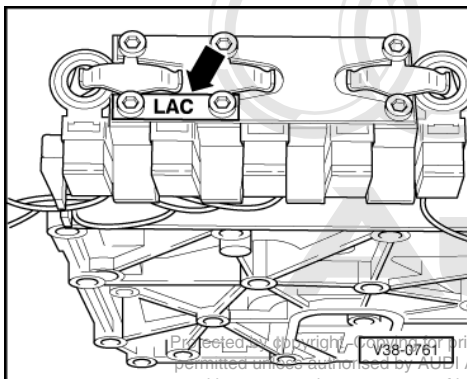
Notes:

- ♦ Manual selector valve must always be resting against the stop. Provide support in direction of arrow when tightening bolt.
- ♦ Always replace bolt of manual selector valve.



-> Fig.4 Installing ATF screen

- Fasten gasket into ATF screen before fitting screen.



-> Fig.5 Identification of valve body

Code letters are stamped on a metal tab. Metal tab must remain on the valve chest.

Allocation valve chest/gearbox =>from Page 2

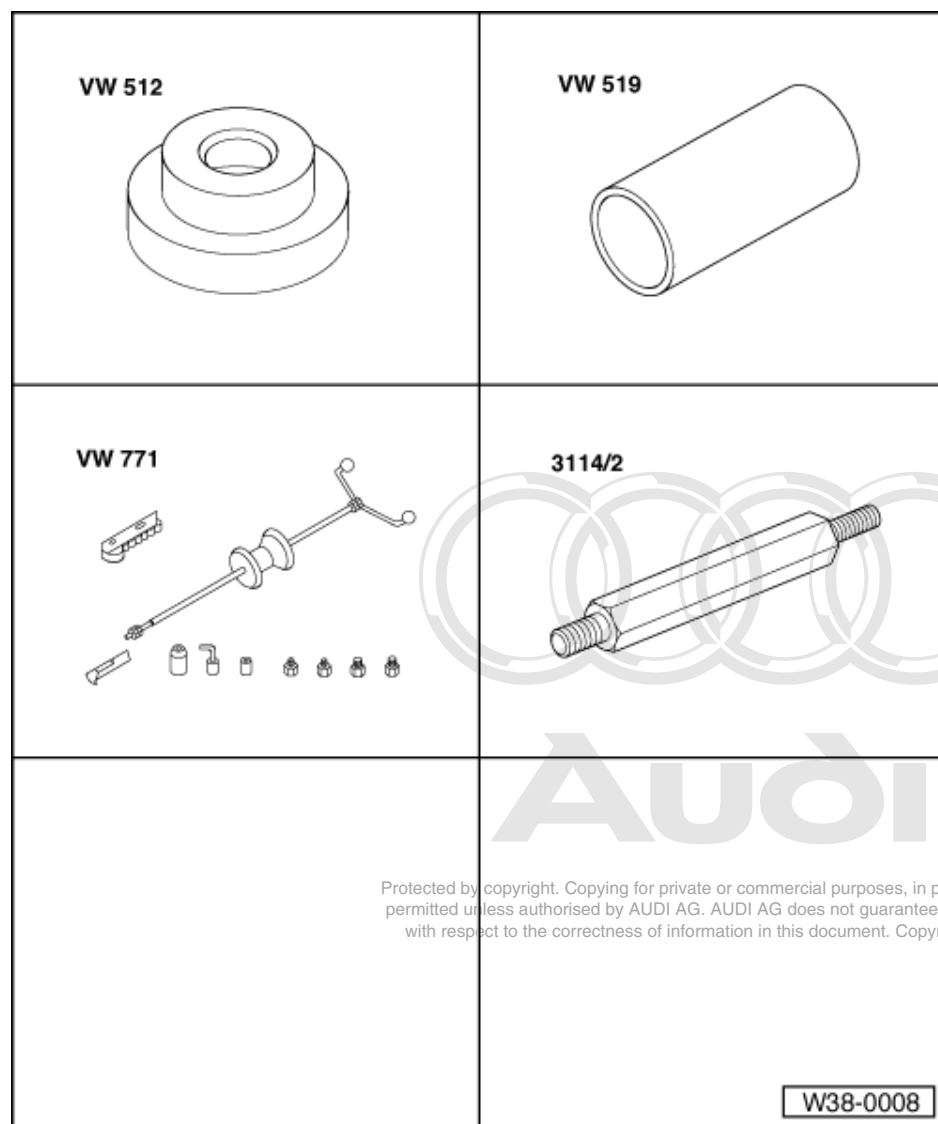
Note:

If the valve body has no identifying tab it must remain together with the gearbox. If a new valve body is fitted, ensure that it is the correct version for the gearbox => allocation from Page 2.



9 - Dismantling and assembling parking lock

9.1 - Dismantling and assembling parking lock



Special tools, testers and workshop equipment required

- ♦ VW 512 Thrust disk
- ♦ VW 519 Tube
- ♦ VW 771 Multi-purpose tool
- ♦ 3114/2 Straightening tool

Warning

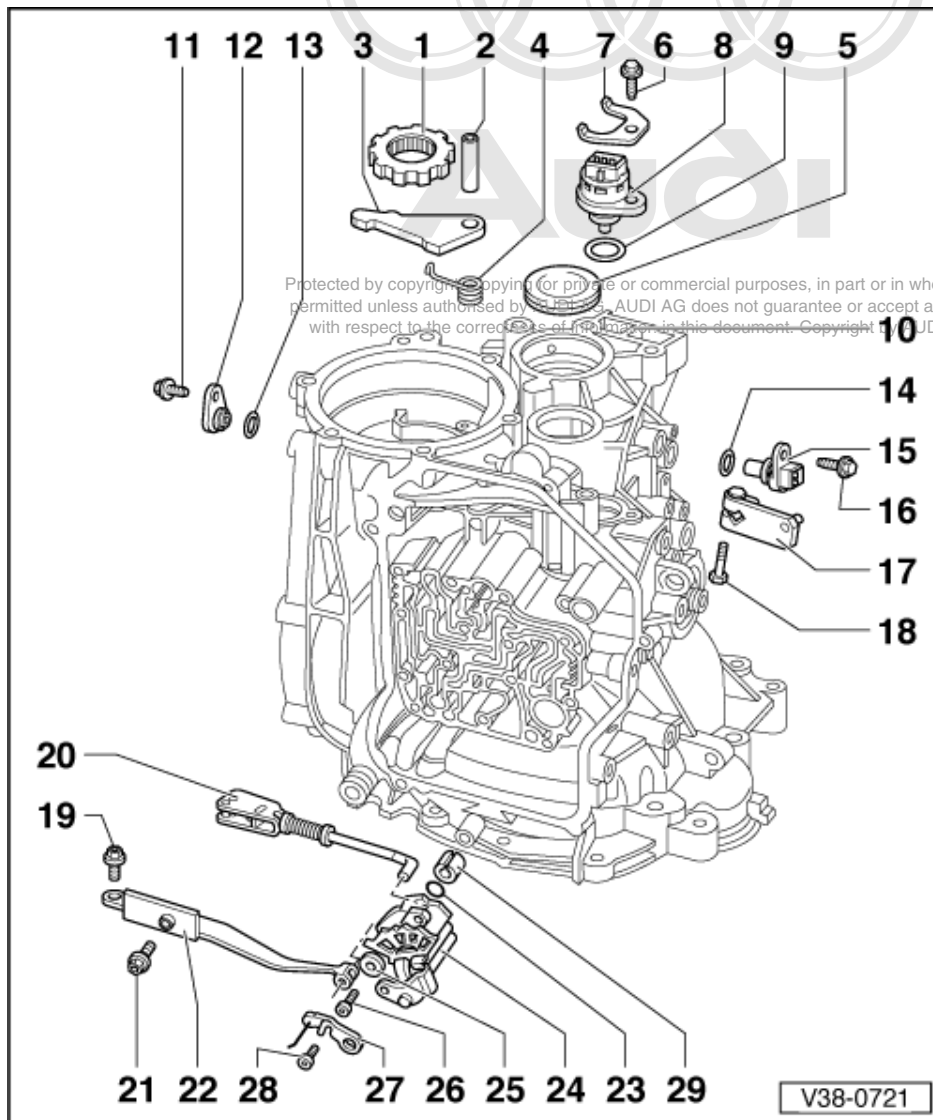
Do not run the engine or tow the vehicle if the oil pan is removed or if ATF has been drained from the gearbox.

Notes:

- ♦ General repair instructions =>Page 5 .
- ♦ Lubricate O-rings with ATF. Other types of lubricant will cause problems with the hydraulic actuation of the gearbox.
- ♦ Multi-function switch -F125. and road speed sender -G68 can be tested in the vehicle by self-diagnosis.

=> Automatic gearbox 097, Self-diagnosis; Repair group 01, Performing self-diagnosis; Read measured value block Read measured value block

- ♦ The output gear has to be removed in order to dismantle and assemble the parking lock
=> Removing and installing drive pinion, Page 177 .
- ♦ Shim "S4" for the drive pinion must be re-measured => Page 213 . if the parking lock gear is replaced.



1 Parking lock gear

- ♦ To remove, remove drive pinion cover and output => Page 177 onwards
- ♦ Installation position:
Rounded side of parking lock gear faces drive pinion cover
- ♦ If parking lock gear is renewed, thickness of shim "S4" for drive pinion must be re-determined
=> Page 213

2 Shaft for detent lever

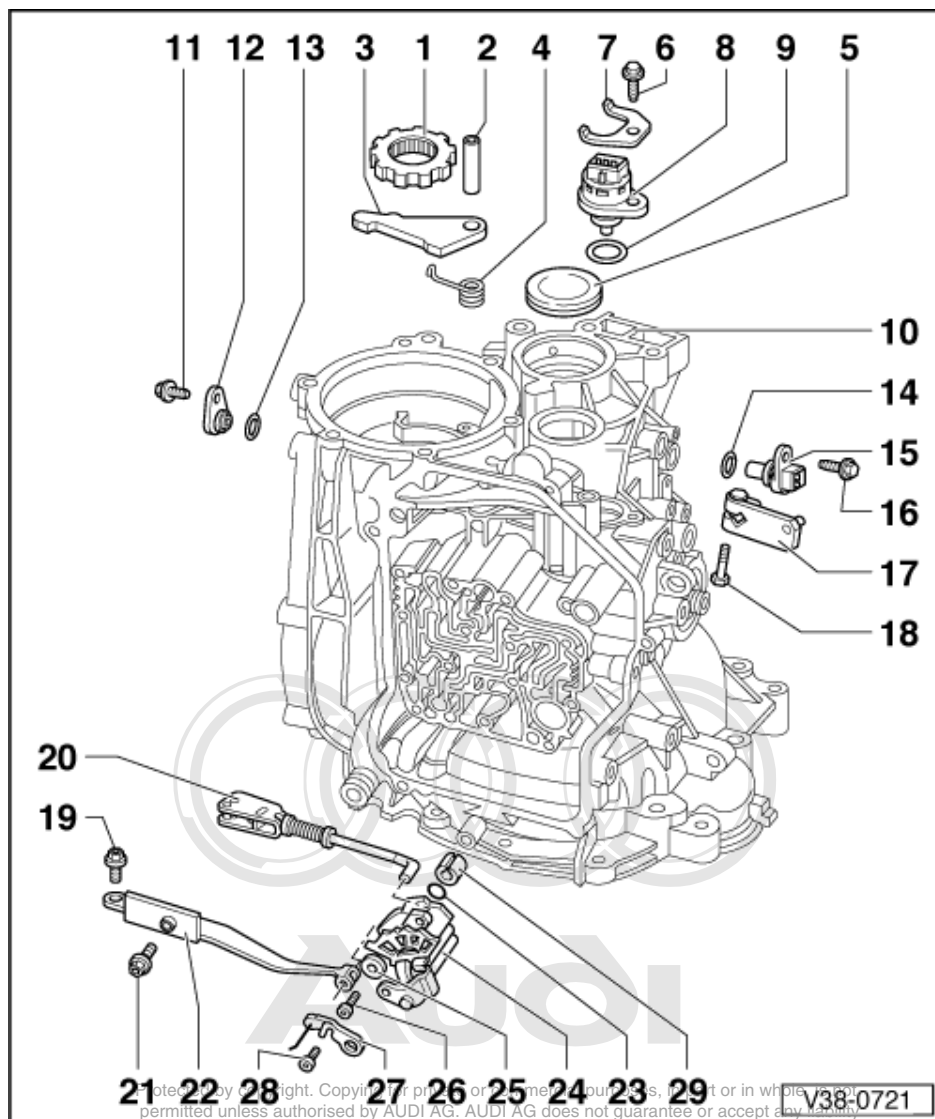
- ♦ Pulling out
=> Fig. 161
- ♦ Drive in with a drift
- ♦ Peening
=> Fig. 161

3 Detent lever

- ♦ To remove, remove drive pinion cover and output => Page 177 onwards
- ♦ To remove, pull out detent lever shaft -Item 2 -
- ♦ Insert with return spring



- ♦ Installation position: Must be aligned centrally with parking lock gear.

**4 Return spring**

- ♦ Supported on gearbox housing and hooked into detent lever

5 Cap

- ♦ Knock out with a screwdriver
- ♦ Driving home
=> Fig. 38-61

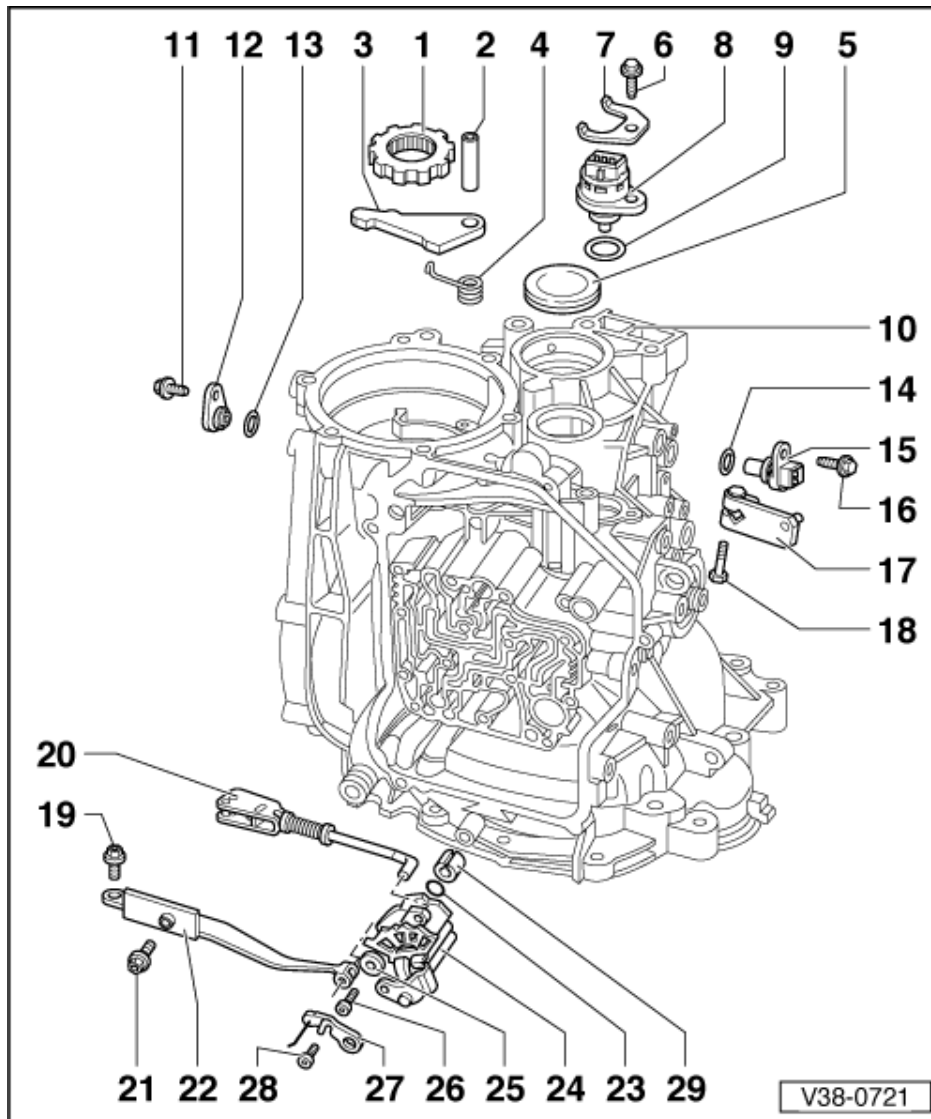
6 Bolt, 10 Nm**7 Bracket**

- ♦ For multi-function switch

8 Multi-function switch -F125-

- ♦ Remove before dismantling selector shaft -Item 24 -
- ♦ Tested in the vehicle by self-diagnosis

=> Automatic gearbox 097; Repair group 01; Performing self-diagnosis; Read measured value block Performing self-diagnosis Read measured value block

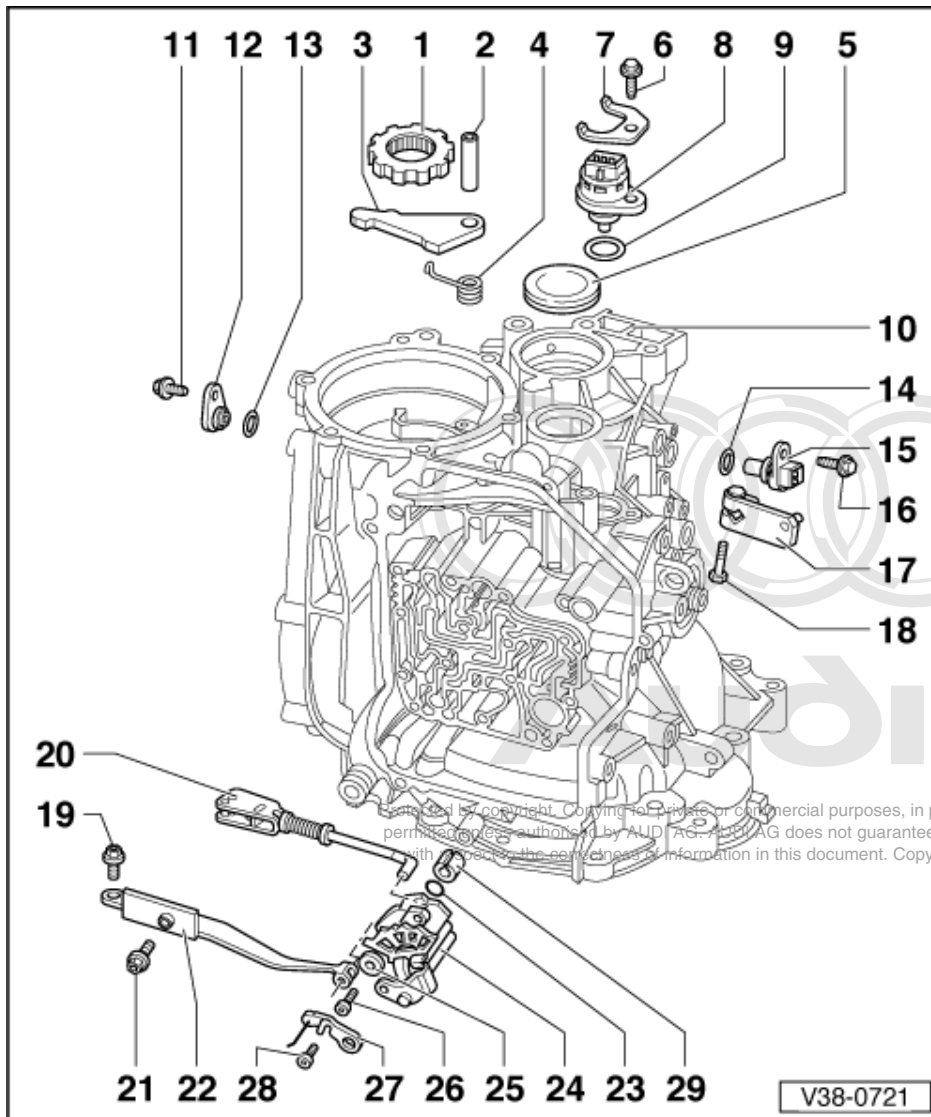


- 9 O-ring
 - ◆ Always replace
- 10 Gearbox housing
- 11 Bolt, 10 Nm
- 12 Plug
- 13 O-ring
 - ◆ Always replace
- 14 O-ring
 - ◆ Always replace
- 15 Road speed sender -G68
 - ◆ Tested in the vehicle by self-diagnosis

=> Automatic gearbox 097; Repair group 01; Performing self-diagnosis; Read measured value block Performing self-diagnosis Read measured value block

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- ◆ Functioning is impaired by dirt; clean if necessary



16 Bolt - 10 Nm

17 Lever

- ♦ For selector shaft

18 Bolt, 10 Nm

19 Bolt, 10 Nm

- ♦ Installing
=> Fig. 162

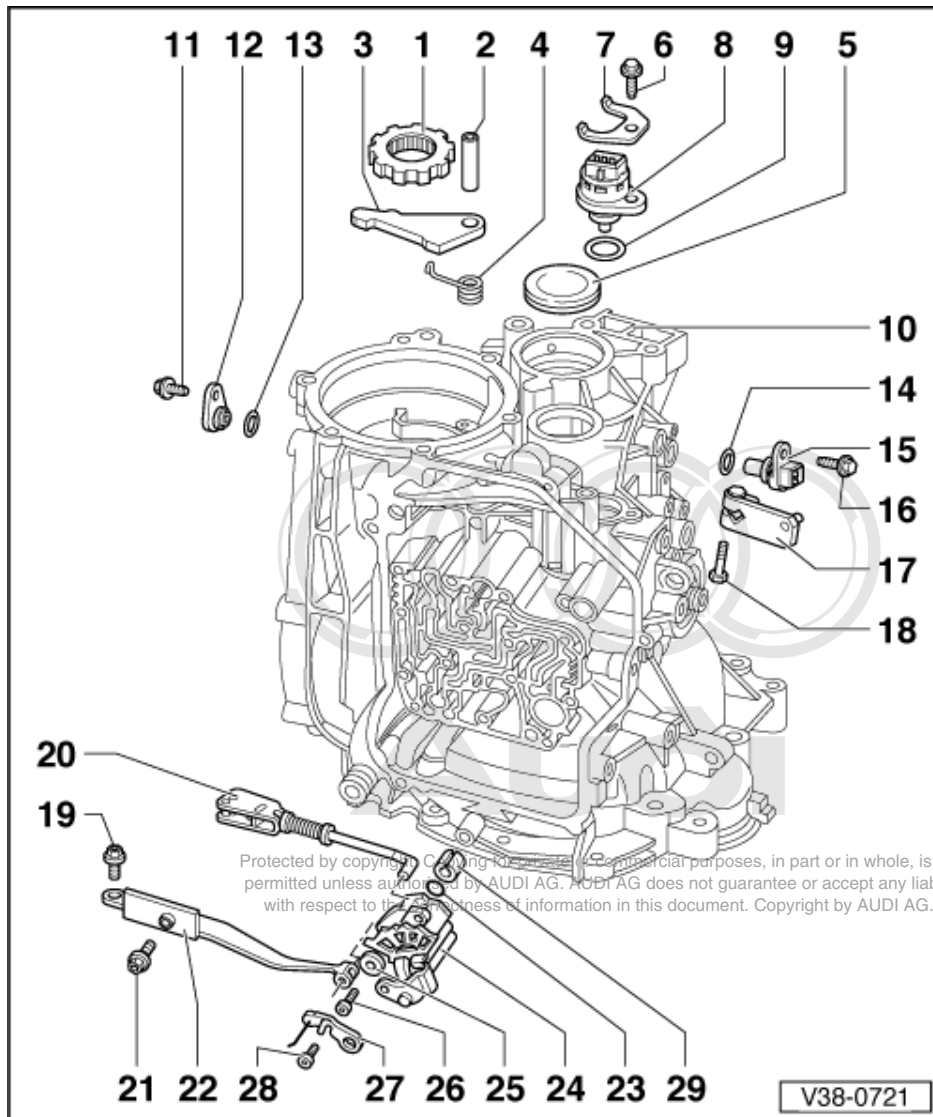
20 Engaging lever

21 Bolt, 10 Nm

- ♦ Installing
=> Fig. 162

22 Detent spring

- ♦ To remove, remove drive pinion cover and output => Page 177 onwards
- ♦ To remove, slacken off bolts -Item 18 and 6 - and lift parking lock detent lever -Item 3 - by hand
- ♦ When installing, fit bolts in correct sequence=> Fig. 162



23 O-ring

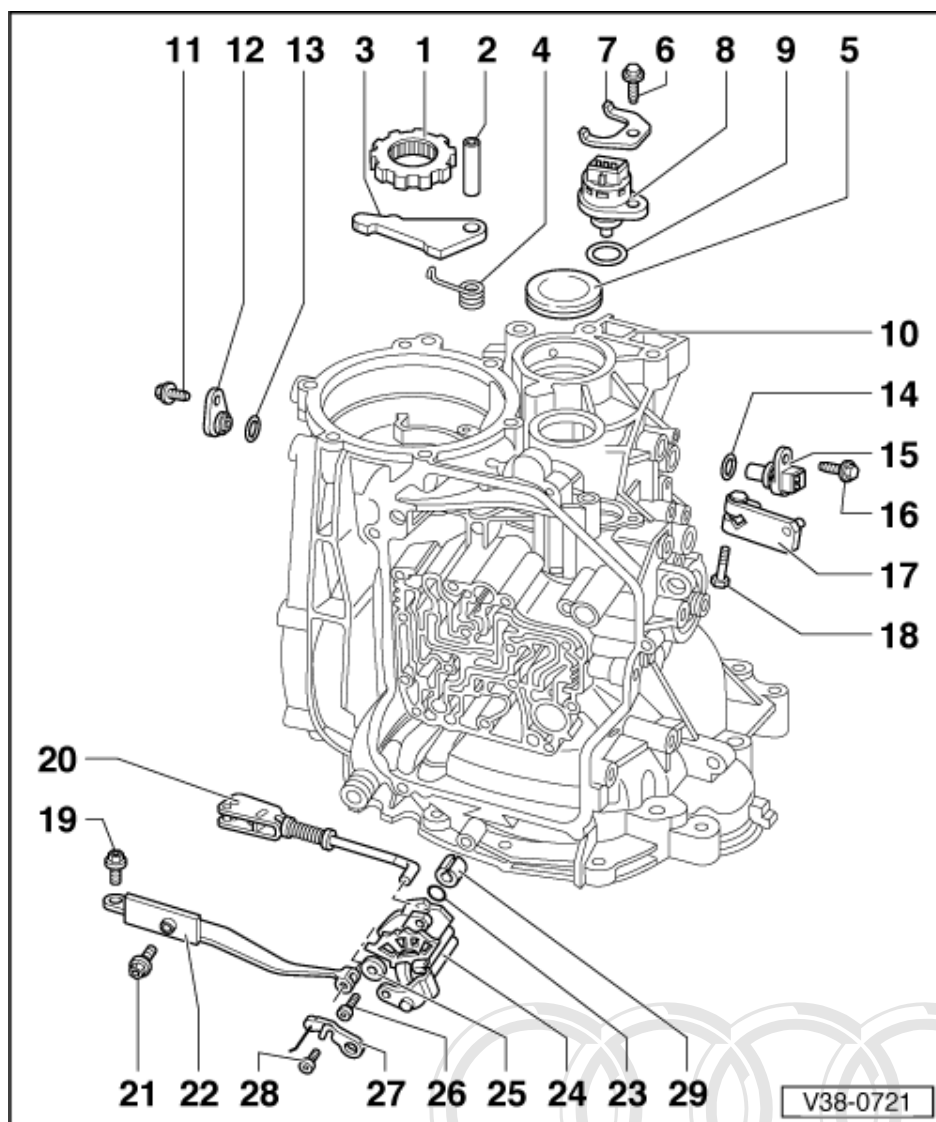
- ◆ Always replace
- ◆ Seat in selector shaft groove
- ◆ Installation position
=> Fig. 161

24 Selector shaft

- ◆ Before removing selector shaft, take out multi-function switch -F125- (-Item 8 -) And engaging spring - Item 22 -
- ◆ When installing, insert together with engaging lever -Item 20 -
- ◆ Securing with washer -Item 161
- ◆ Note positions of components
=> Fig. 161

25 Lock washer

- ◆ Inserting
=> Fig. 161



26 Bolt, 10 Nm

- ◆ Secures selector shaft
- ◆ Installing
=> Fig. 161

27 Operating rod for manual selector valve

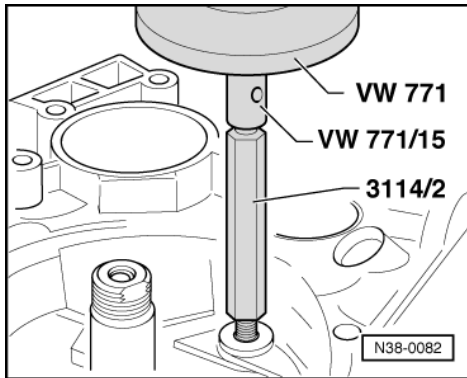
- ◆ Adjusting
=> Page 152 , Fig. 3

28 Bolt, 4 Nm

29 Bush

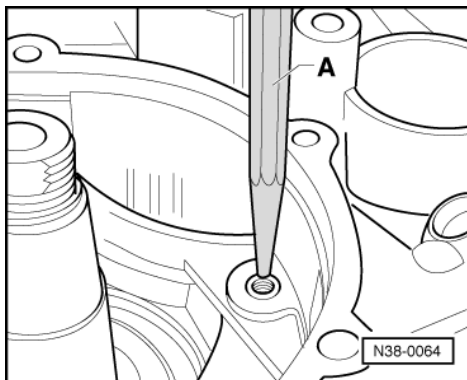
- ◆ Drive in and drive out with drift
- ◆ Insert before installing selector shaft in gearbox housing

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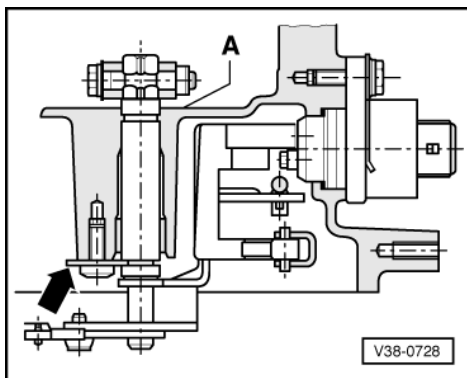
-> Fig.1 Pulling out shaft for detent lever

- Pull out shaft with multi-purpose tool VW 771.



-> Fig.2 Peening shaft for detent lever

- Drive in shaft with threaded hole upwards.
- Secure shaft by peening gearbox housing to shaft using a centre punch -A-.



-> Fig.3 Selector shaft with lock washer

Selector shaft is secured in position by lock washer (arrow) to stop it moving.

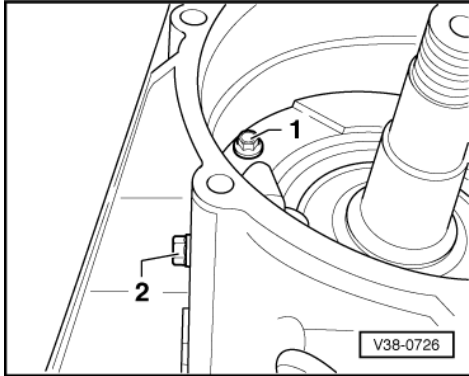
A - O-ring



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Note:

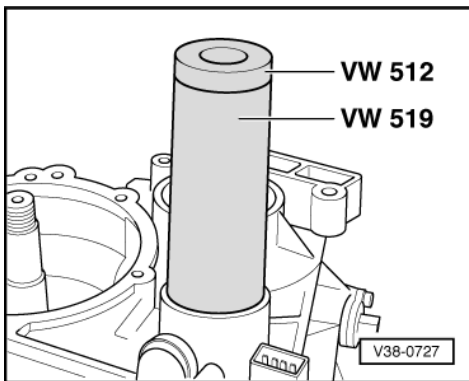
Fig. shows sectional view of selector shaft.



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-> Fig.4 Inserting bolts for detent spring

- Screw in bolts -1- and -2- by approx. 3 thread turns.
- Tighten bolt -2- to 10 Nm and then tighten bolt -1- to 10 Nm.

**-> Fig.5 Driving home plug**

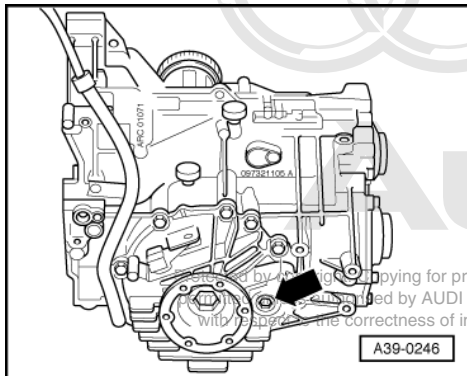
39 - Final drive, Differential

1 - Checking oil in final drive

1.1 - Checking oil in final drive

Test requirements:

- Gearbox should be cold or just hand-warm.
- Oil level is checked with gearbox installed.
- Vehicle must be standing on level surface.



Checking:

- -> Unscrew plug -arrow- to check gear oil level.

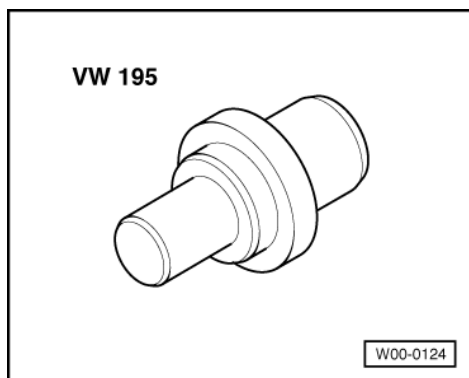
Oil level must be up to bottom edge of filler hole.

- Top up with gear oil if necessary: Specification => Page 4 .
- Tighten screw plug to 25 Nm.

2 - Replacing oil seals for left flange shaft or right drive flange (gearbox installed)

2.1 - Replacing oil seals for left flange shaft or right drive flange (gearbox installed)

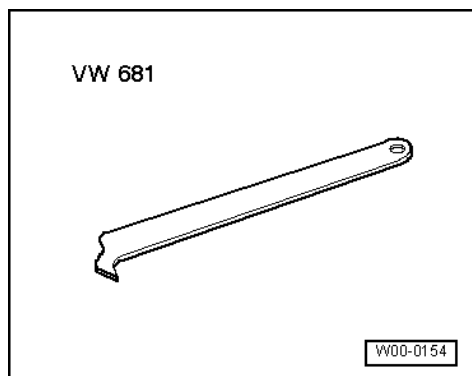
2.2 - Replacing oil seal for flange shaft (left)





Special tools, testers and workshop equipment required

- ♦ Drift VW 195



- ♦ VW 681 Oil seal extractor

Additionally required information

- ♦ Workshop manual Audi 100 1991 ä Front wheel drive running gear

Removing

- Gearbox installed.
- Only loosen drive shaft/wheel hub nut and wheel bolts when vehicle is standing on its own wheels.
- Remove front left wheel.
- Remove drive shaft

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=> Running gear, Front and four-wheel drive; Repair group 40; Servicing drive shaft; Removing and installing drive shaft Servicing drive shaft Removing and installing drive shaft

- Place drip tray V.A.G 1306 underneath the gearbox.
- Unscrew the central bolt in the flange shaft (left); use a mandrel to prevent the flange shaft from rotating.
- Pull out the flange shaft.
- Pull out flange shaft oil seal with oil seal extractor VW 681.

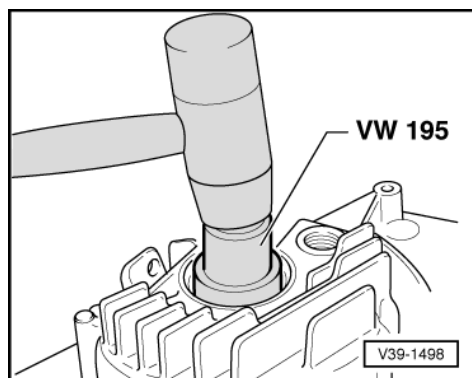
Installing

Install in reverse order, paying attention to the following:

- Coat outer circumference of seal with gear oil.
- Fill space between sealing and dust lips with multipurpose grease.

Note:

The oil seal must be inserted to the same depth all the way round the housing.



- -> Drive new seal in up to stop, when doing this do not cant seal.
- Install flange shaft.
- Install drive shaft.

=> Running gear, Front and four-wheel drive; Repair group 40; Servicing drive shaft; Removing and installing drive shaft Servicing drive shaft Removing and installing drive shaft

- Fit wheel.
- With gearbox installed, check gear oil level in final drive=> Page **163** .

Tightening torques

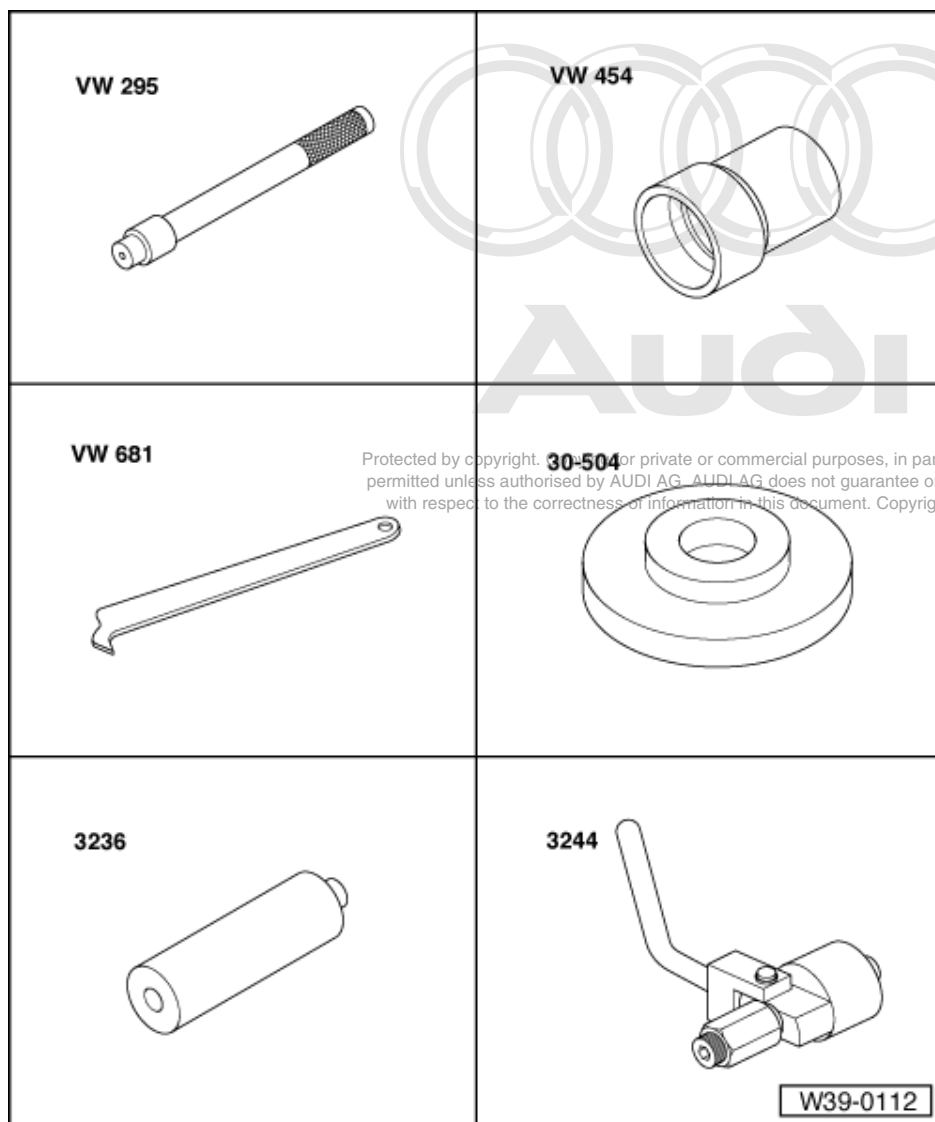
Flange shaft to gearbox	25 Nm
Drive shaft to gearbox M 10	80 Nm
Drive shaft to wheel hub:	
Bolt M 14 x 1.5	120 Nm
Always replace bolt	+ 90o
Bolt M 16 x 1.5	200 Nm
Always replace bolt	+ 90o
Wheel bolts to wheel hub	110 Nm



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2.3 - Replacing seal for right-hand drive flange.



Special tools, testers and workshop equipment required

- ♦ VW 295 Drift
- ♦ VW 454 Thrust piece
- ♦ VW 681 Oil seal extractor
- ♦ 30-504 Press tool
- ♦ 3236 Thrust piece
- ♦ 3244 Pressing-on tool

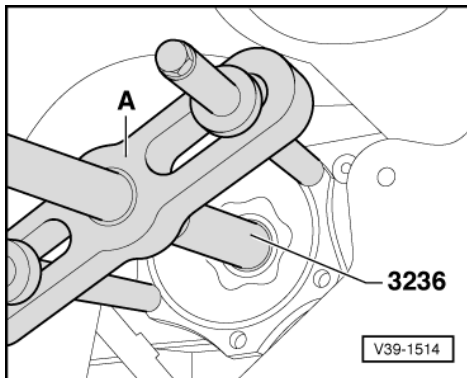
Additionally required information

- ♦ Workshop manual Audi 100 1991 ä Front wheel drive running gear

Removing

- Only loosen drive shaft/wheel hub nut and wheel bolts when vehicle is standing on its own wheels.
- Remove front right wheel.
- Remove drive shaft

=> Running gear, Front and four-wheel drive; Repair group 40; Servicing drive shaft; Removing and installing drive shaft Servicing drive shaft Removing and installing drive shaft



- Remove drive flange circlip.
- Place drip tray V.A.G 1306 underneath the gearbox.
- -> Use thrust piece 3236 and two-arm puller Kukko 18/1 -A- to pull off drive flange.
- Pull out drive flange oil seal with oil seal extractor VW 681.

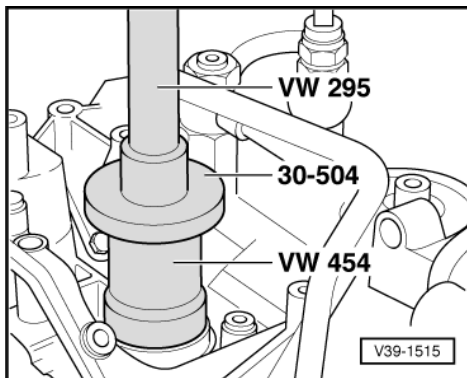
Installing

Install in reverse order, paying attention to the following:

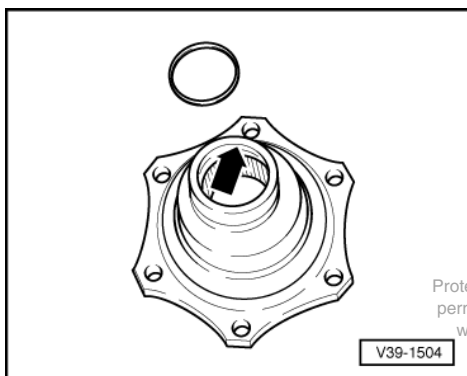
- Coat outer circumference of seal with gear oil.
- Fill space between sealing and dust lips with multipurpose grease.

Note:

The oil seal must be inserted to the same depth all the way round the housing.

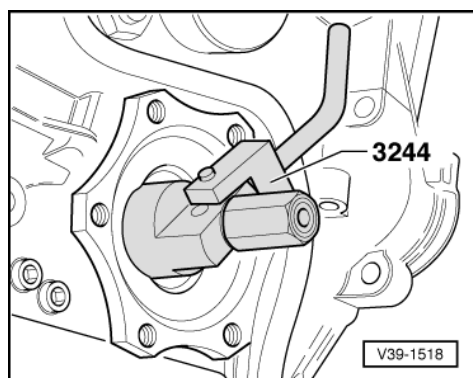


- -> Drive new seal in up to stop, when doing this do not cant seal.



- -> Insert new O-ring in drive flange -arrow-.

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- -> Pull in drive flange.
- Fit drive flange circlip.
- Install drive shaft.

=> Running gear, Front and four-wheel drive; Repair group 40; Servicing drive shaft; Removing and installing drive shaft Servicing drive shaft Removing and installing drive shaft

- Fit wheel.
- With gearbox installed, check gear oil level in final drive=> Page **163** .

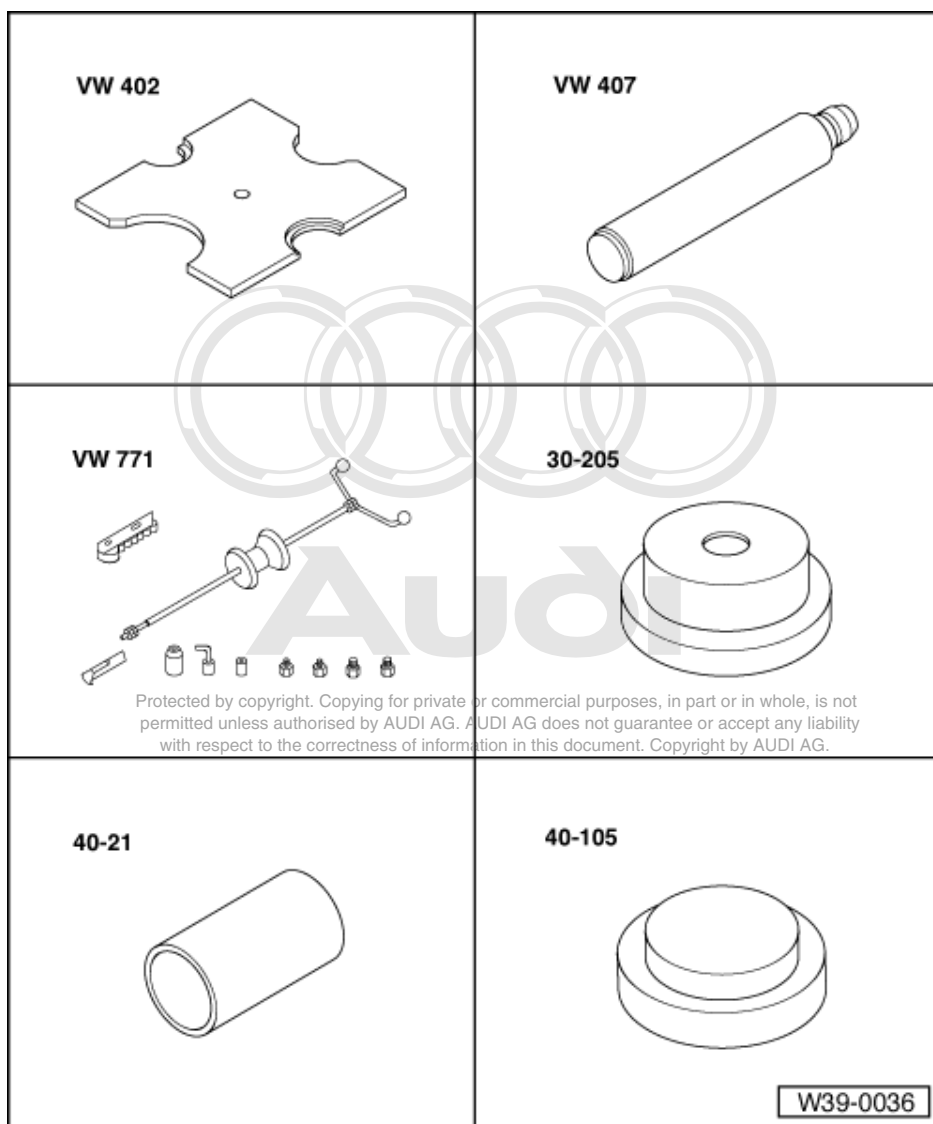
Tightening torques

Drive shaft to gearbox M 10	80 Nm
Drive shaft to wheel hub:	
Bolt M 14 x 1.5	120 Nm
Always replace bolt	+ 90°
Bolt M 16 x 1.5	200 Nm
Always replace bolt	+ 90°
Wheel bolts to wheel hub	110 Nm

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3 - Dismantling and assembling final drive

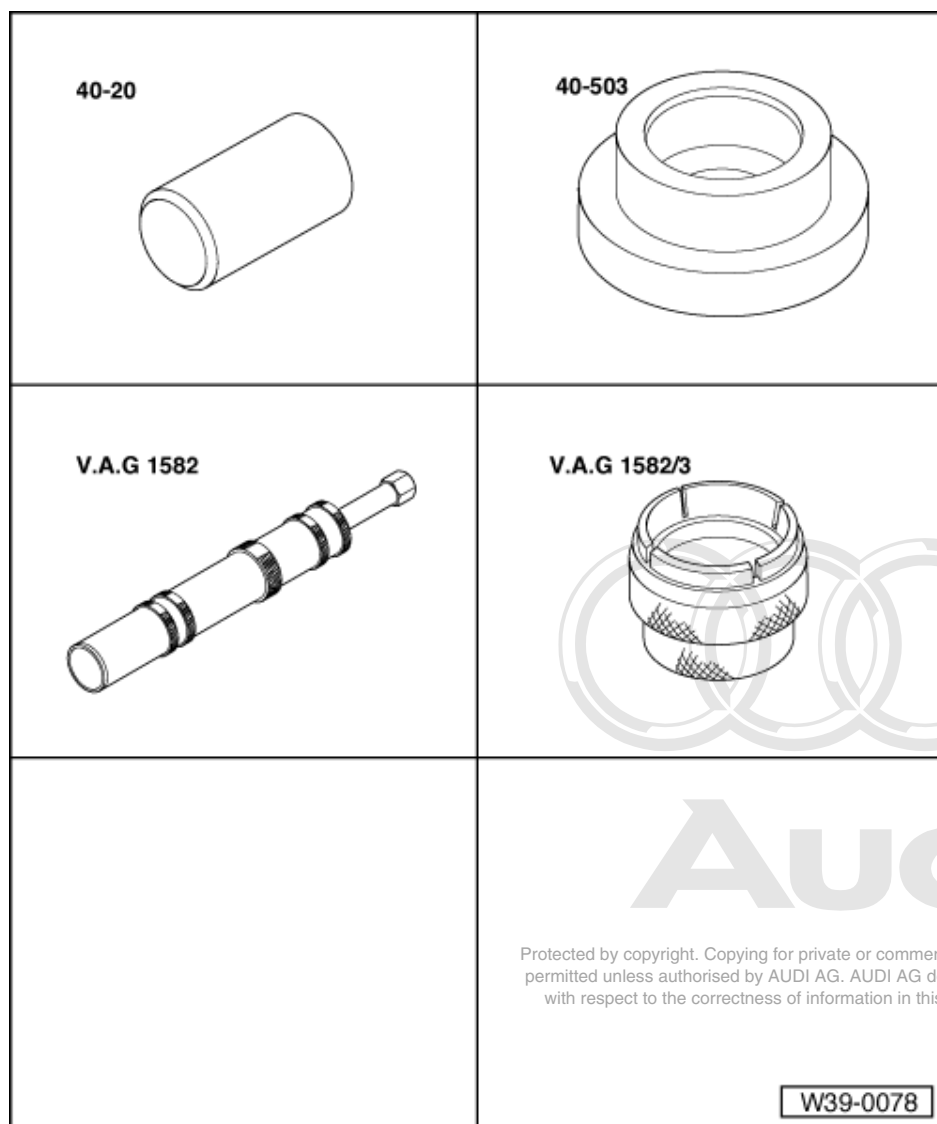
3.1 - Dismantling and assembling final drive



3.2 - Removing and installing input gear

Special tools, testers and workshop equipment required

- ◆ VW 402 Pressure plate
- ◆ VW 407 Thrust tool
- ◆ VW 771 Multi-purpose tool
- ◆ 30-205 Thrust plate
- ◆ 40-21 Drift sleeve
- ◆ 40-105 Thrust plate

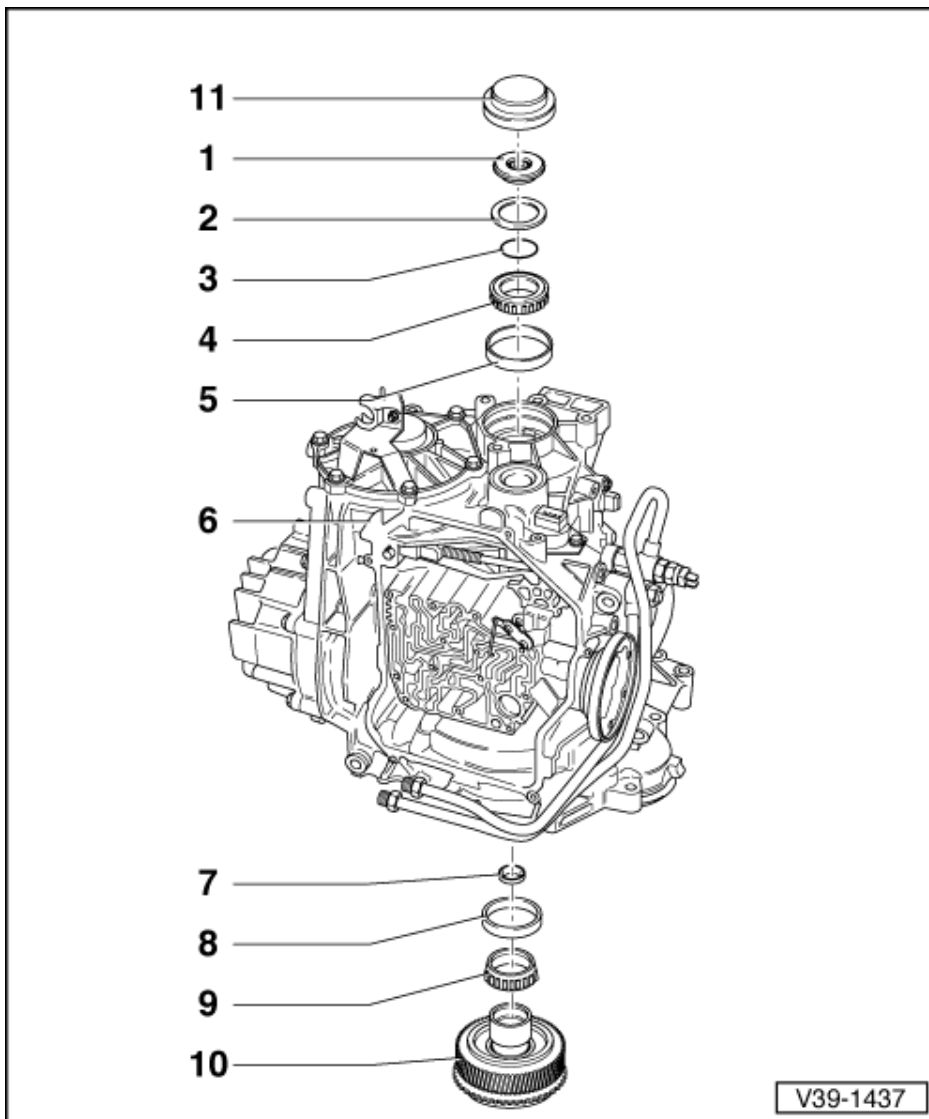
**Special tools, testers and workshop equipment required**

- ♦ 40-20 Drift sleeve
- ♦ 40-503 Press tool
- ♦ V.A.G 1582 Taper roller bearing puller
- ♦ V.A.G 1582/3 Grip piece

Notes:

- ♦ The input gear can only be removed once the planetary gearbox has been removed => Page 45 .
- ♦ Measure friction torque at drive pinion nut before and after removing input gear => Page 209 . Note friction torque value.
- ♦ If taper roller bearings are not renewed, set to previously measured friction torque again.
- ♦ The drive pinion and differential do not need to be removed in order to remove input gear.
- ♦ Always replace input gear and output gear together.
- ♦ After replacing the taper roller bearings, the input gear, planet carrier and clutch play between K1 and K2 must be adjusted.
=> Page 96 .
- ♦ After replacing input gear (together with output gear), the input gear, "S4" shim, drive pinion, planet carrier and clutch play between K1 and K2 must be adjusted => Pages 96 .
- ♦ Always replace the taper roller bearings on one shaft together and use new bearings from a single manufacturer.

- ◆ Do not interchange the outer or inner races of bearings of the same size.



1 Socket head fastener, 250 Nm

- ◆ Engage parking lock to remove and install
- ◆ Removing and installing
=> Fig. 174
- ◆ Before installing socket head fastener insert axial needle bearing (Item 7)

2 Dished washer

- ◆ Curved side faces socket head fastener

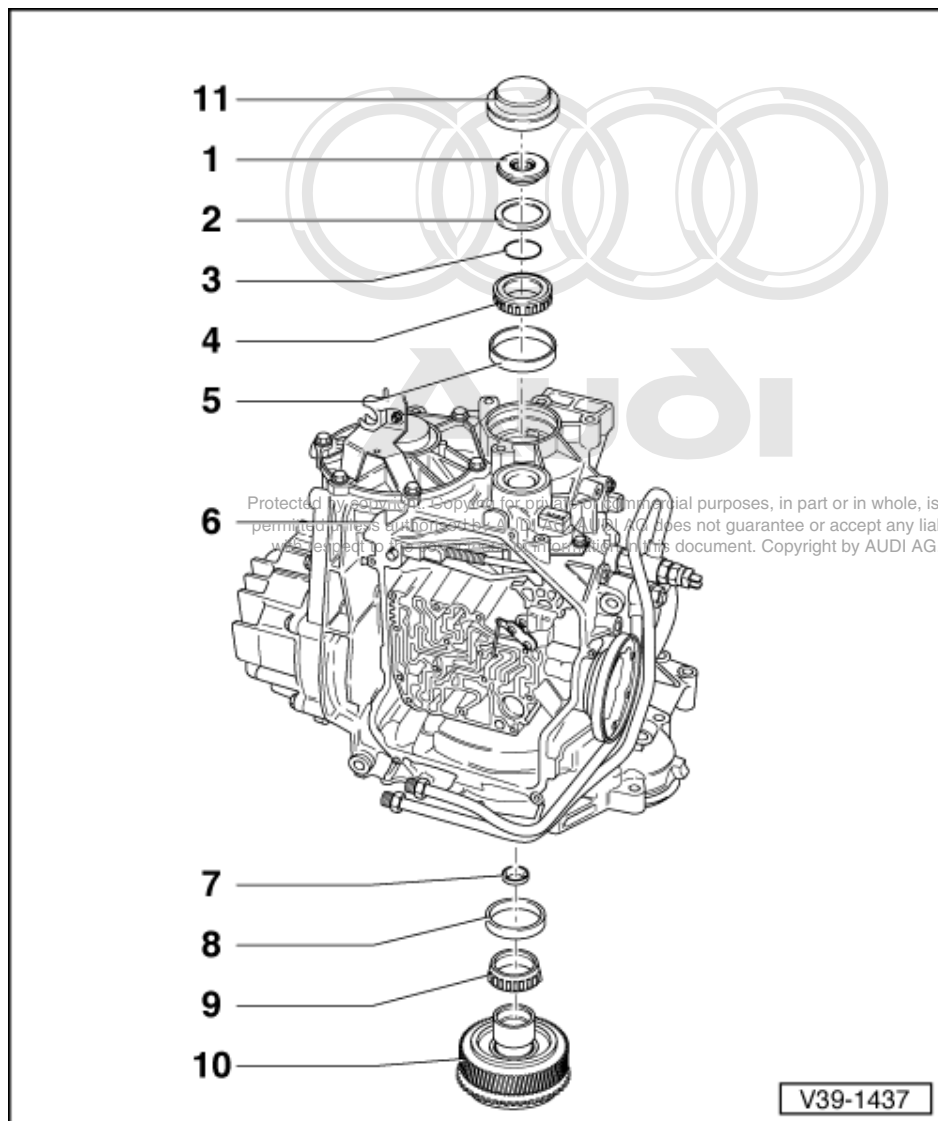
3 Shim

- ◆ Determining thickness => Adjusting input gear, Page 206

4 Taper roller bearing inner race

- ◆ Insert such that lugs engage in groove of inner race/taper roller bearing (Item 175)
- ◆ After measuring thickness of shim, fit onto input gear with locking fluid AMV 185 101 A1

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5 Taper roller bearing outer race

- ◆ Drive out with drift
- ◆ Drive in with 30-205
- ◆ Insert with locking fluid AMV 185 101 A1

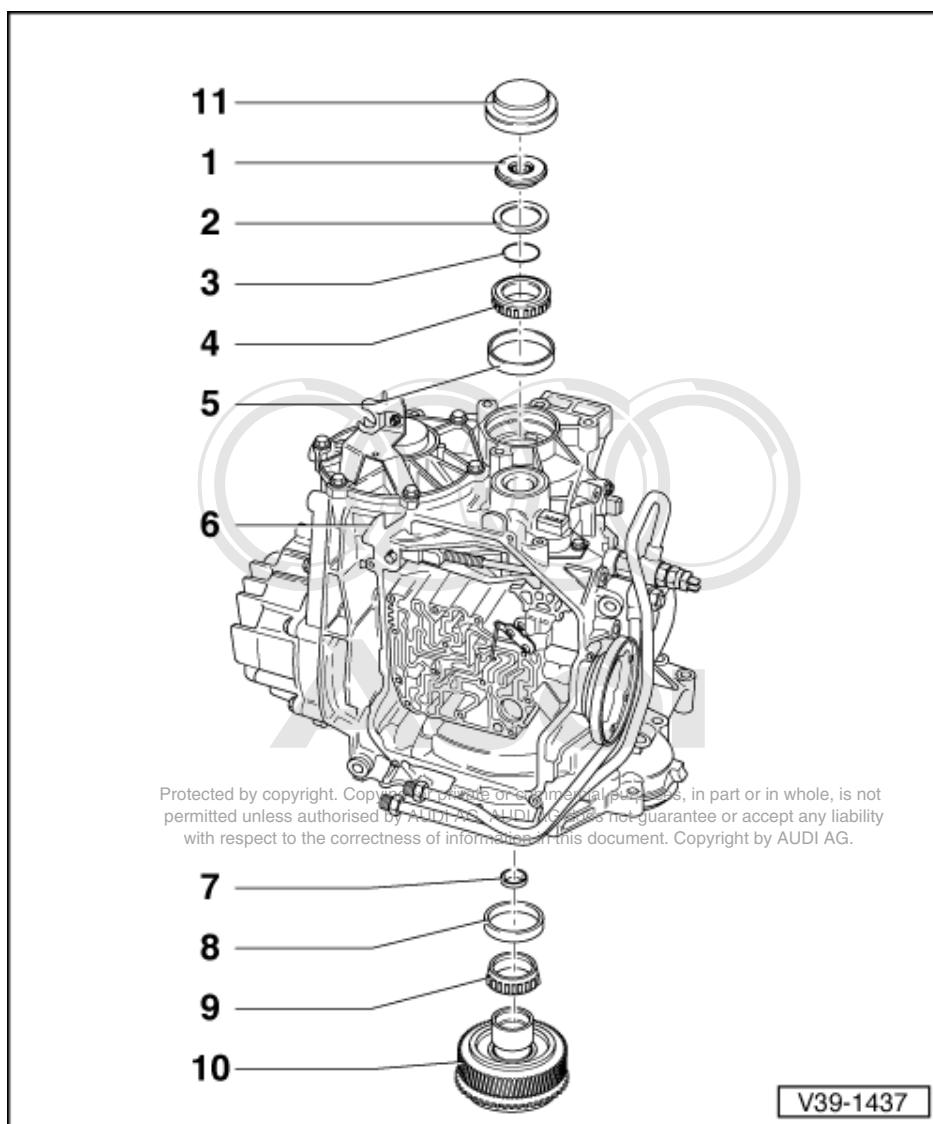
6 Gearbox housing

7 Axial needle bearing

- ◆ Install with flat side facing input gear
- ◆ Insert into input gear before installing socket head fastener (Item 1)

8 Taper roller bearing outer race

- ◆ Drive out with drift
- ◆ Drive in with 30-205 and appropriately long drift
- ◆ Insert with locking fluid AMV 185 101 A1



9 Taper roller bearing inner race

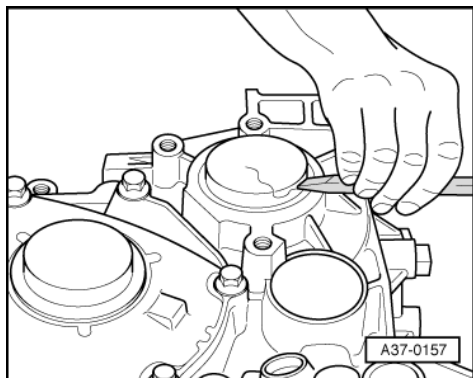
- ♦ Pulling off
=> Fig. 174
- ♦ Pressing on
=> Fig. 175
- ♦ Insert with locking fluid AMV 185 101 A1

10 Input gear

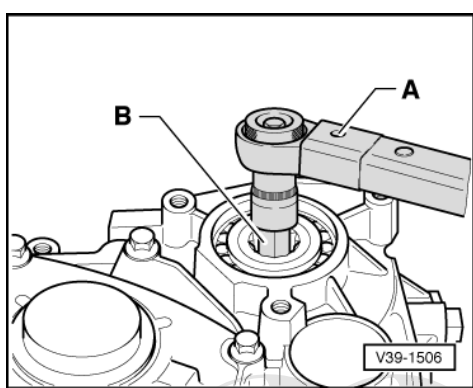
- ♦ With impulse wheel for road speed sender -G68-
- ♦ Number of teeth => Page 2 onwards
- ♦ Adjusting => Page 206
- ♦ If signs of damage exist, always replace input gear and output gear together
- ♦ If input gear is replaced, adjust planet carrier
=> Page 83
- ♦ Removing
=> Fig. 176

11 Cap

- ♦ Knocking out
=> Fig. 174
- ♦ Driving in
=> Fig. 177



-> Fig.1 Driving out cover

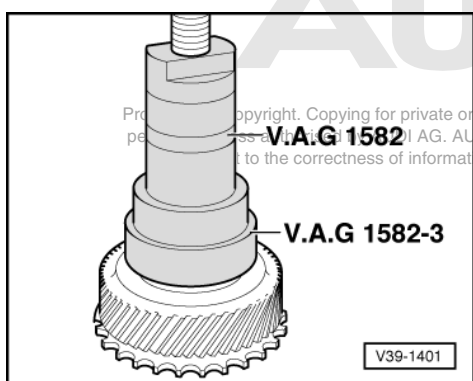


-> Fig.2 Removing and installing tensioning bolt

A - Torque wrench

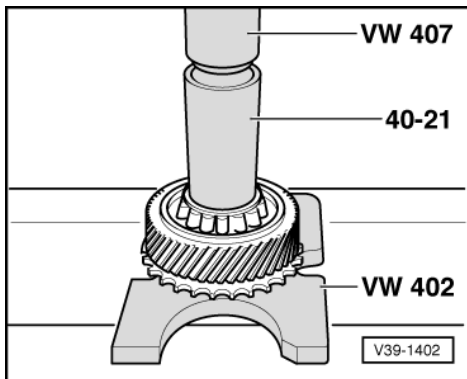
B - 22 mm AF socket insert

- Engage parking lock to loosen and tighten.



-> Fig.3 Pulling off taper roller bearing inner race

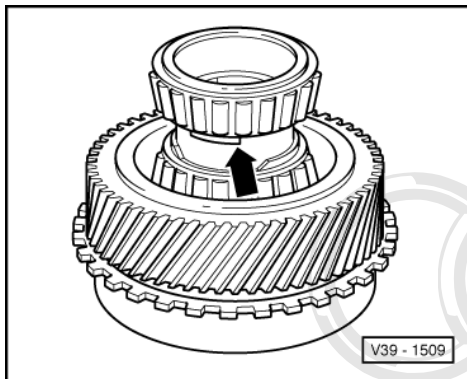
- Place press piece 40-105 on input gear.



-> Fig.4 Pressing on taper roller bearing inner race

Note:

A press piece must be placed below the hub of the input gear to avoid damaging the input gear.



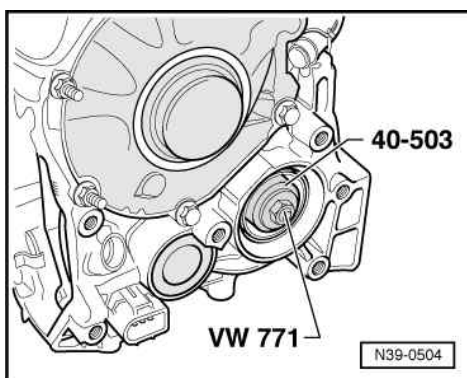
-> Fig.5 Inserting taper roller bearing inner race

- Insert taper roller bearing inner race such that lugs of inner race fit (arrow) in grooves of opposite inner race.

Note:

Taper roller bearings with no lugs may also be fitted.

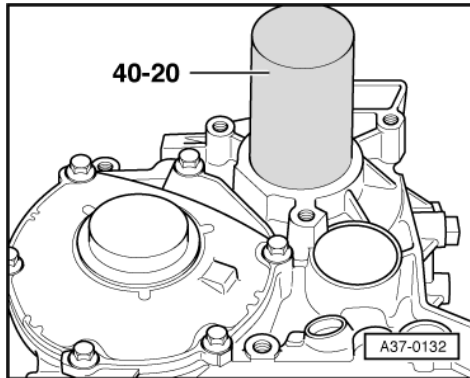
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-> Fig.6 Removing input gear

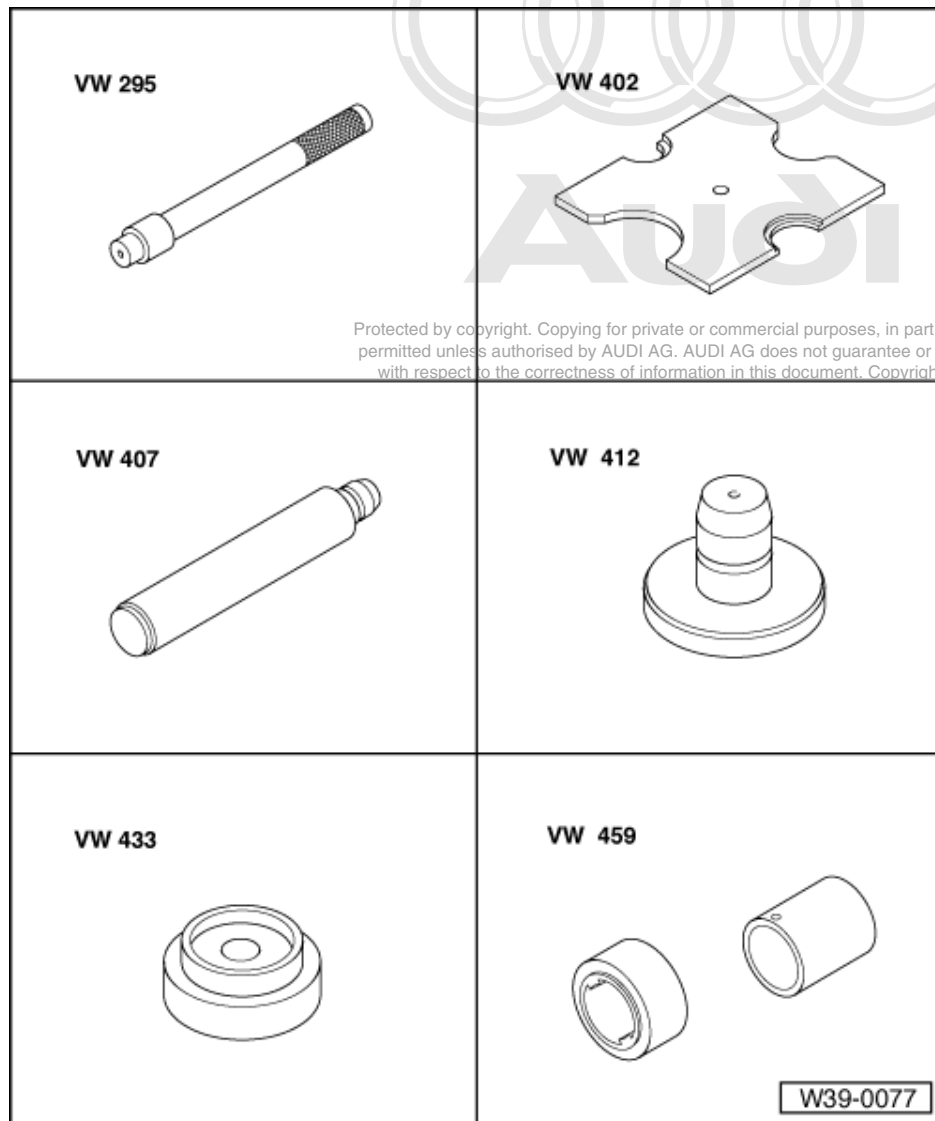
- Fit press tool 40-503 with shoulder in threaded hole of input gear.
- Join press tool with VW 771 through hole of input gear.
- Drive out input gear carefully.



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-> Fig.7 Driving in cover

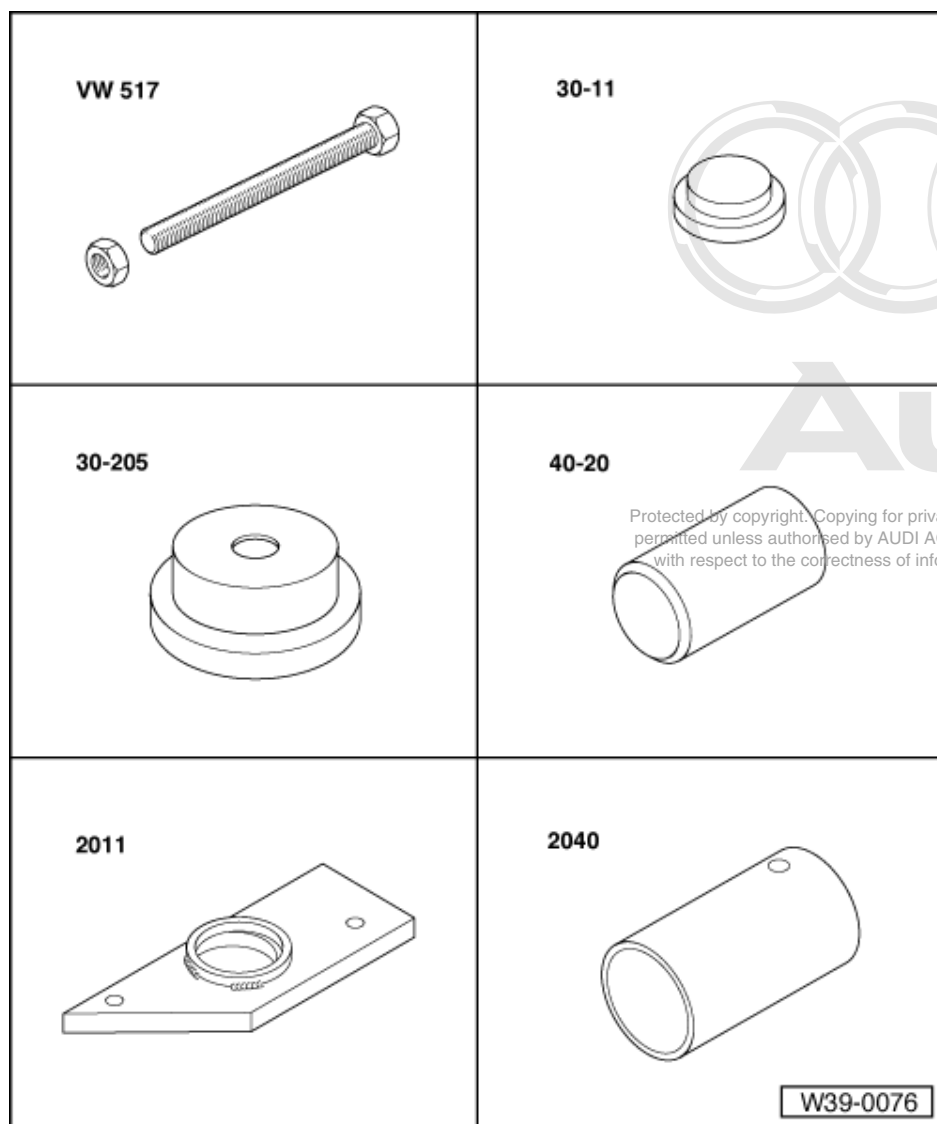
3.3 - Removing and installing drive pinion



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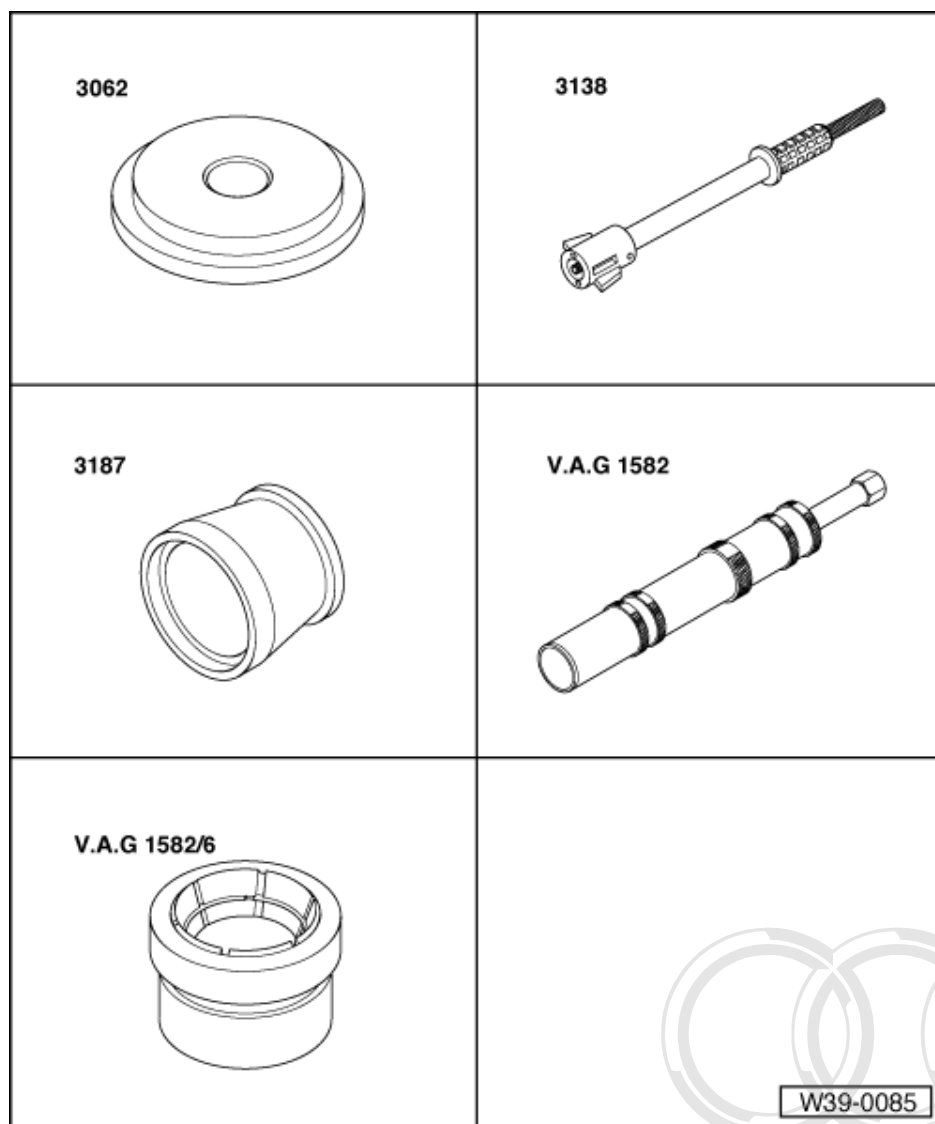
Special tools, testers and workshop equipment required

- ◆ VW 295 Drift
- ◆ VW 402 Pressure plate
- ◆ VW 407 Thrust tool
- ◆ VW 412 Thrust tool
- ◆ VW 433 Thrust piece
- ◆ VW 459/2 Installing and removing tool



Special tools, testers and workshop equipment required

- ♦ VW 517 Threaded stem
- ♦ 30-11 Thrust plate
- ♦ 30-205 Thrust plate
- ♦ 40-20 Drift sleeve
- ♦ 2011 Support bridge
- ♦ 2040 Tube



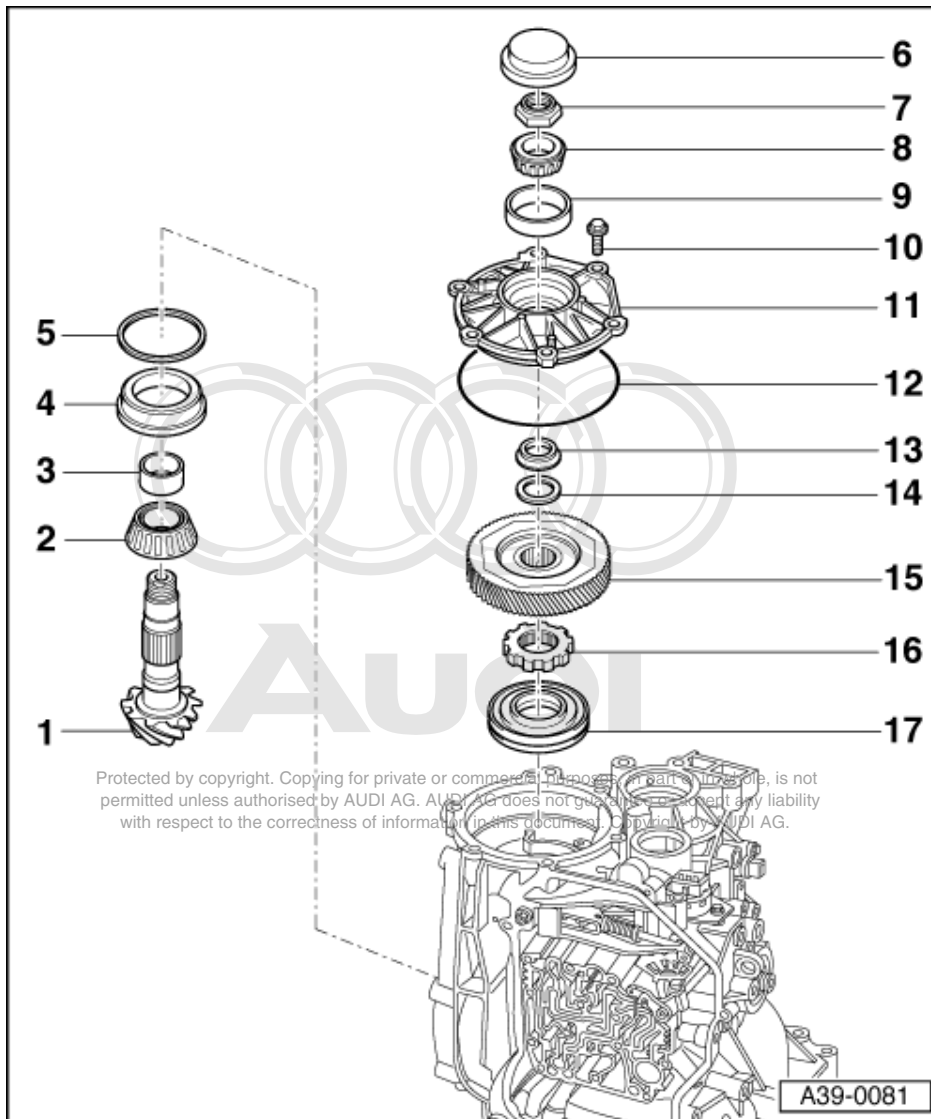
Special tools, testers and workshop equipment required

- ◆ 3062 Thrust disk
- ◆ 3138 Drift
- ◆ 3187 Assembly sleeve
- ◆ V.A.G 1582 Taper roller bearing puller
- ◆ V.A.G 1582/5 Grip piece

Notes:

- ◆ Drive pinion and crown wheel may only be replaced together.
- ◆ If the same final drive gear set and taper roller bearings are to be re-installed after a repair, measure the friction torque value (with planetary gearbox removed) before starting the repair => Page 218 . Note the reading obtained in order to check the friction torque after the repair is completed.
- ◆ If the drive pinion cover, spacer tube, input gear or parking lock gear are replaced, re-determine thickness of shim "S4" for the drive pinion => Page 213 .
- ◆ If the taper roller bearings or the bush for the drive pinion are replaced, re-determine thickness of shims "S3" and "S4" for the drive pinion => Page 213 .
- ◆ If the drive pinion (with crown wheel) is replaced, re-determine thickness of shims "S3" and "S4" and shims "S1" and "S2" (for final drive) => Pages 222
- ◆ Insert seal for drive pinion -Item 184 in dry condition. Do not grease sealing lips.

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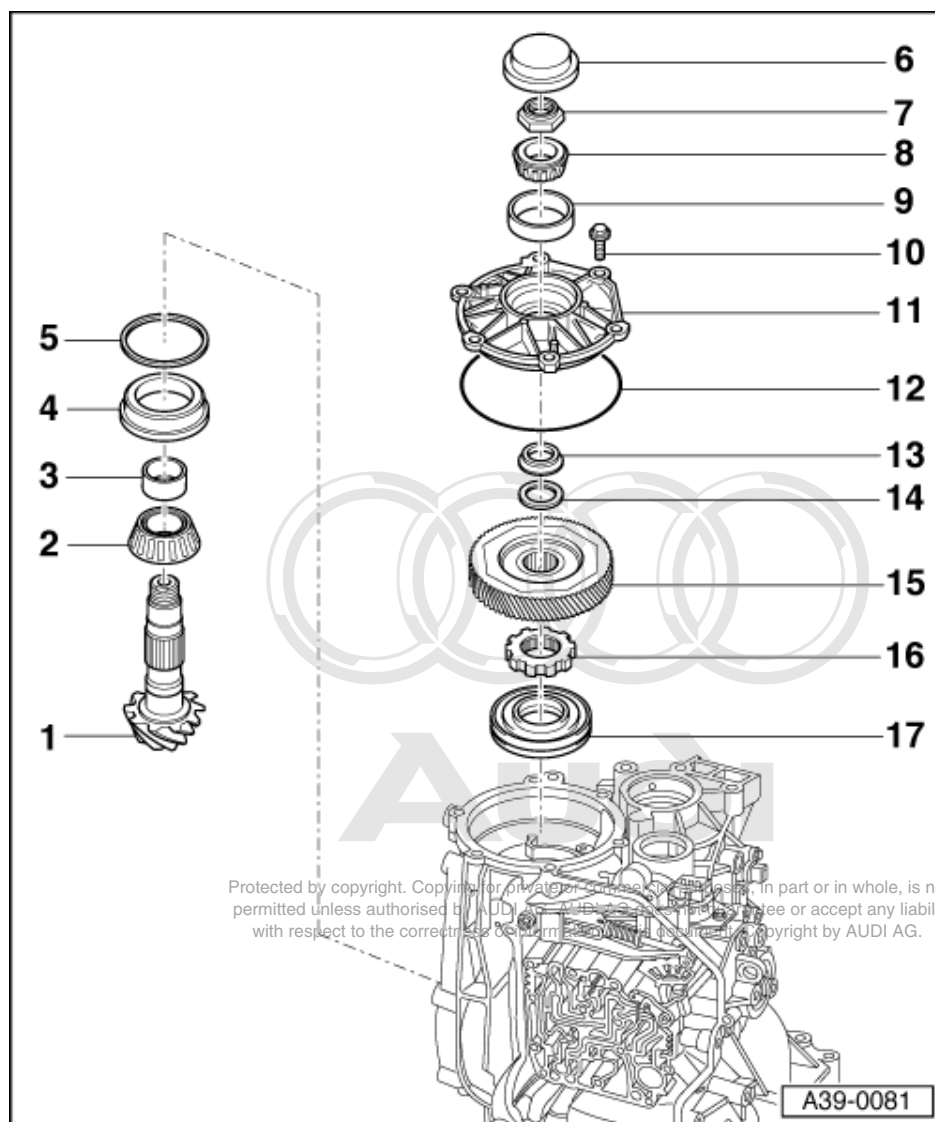
- 1) Adjustments are required if these components are replaced
=> Page 205

1 Drive pinion1)

- ♦ To remove, remove differential =>Page 187
- ♦ Is mated to crown wheel. Replace complete drive set if damaged.
- ♦ Number of teeth => Page 2 onwards
- ♦ Adjusting crown wheel and pinion shaft => Page 211
- ♦ Inserting
=> Fig. 185

2 Taper roller bearing inner race 1)

- ♦ Pulling off
=> Fig. 185
- ♦ Pressing on
=>Fig. 185



3 Bush for drive pinion1)

- ♦ Pulling off with inner race for taper roller bearing
=>Fig. 185
- ♦ Pressing on
=>Fig. 185

4 Taper roller bearing outer race 1)

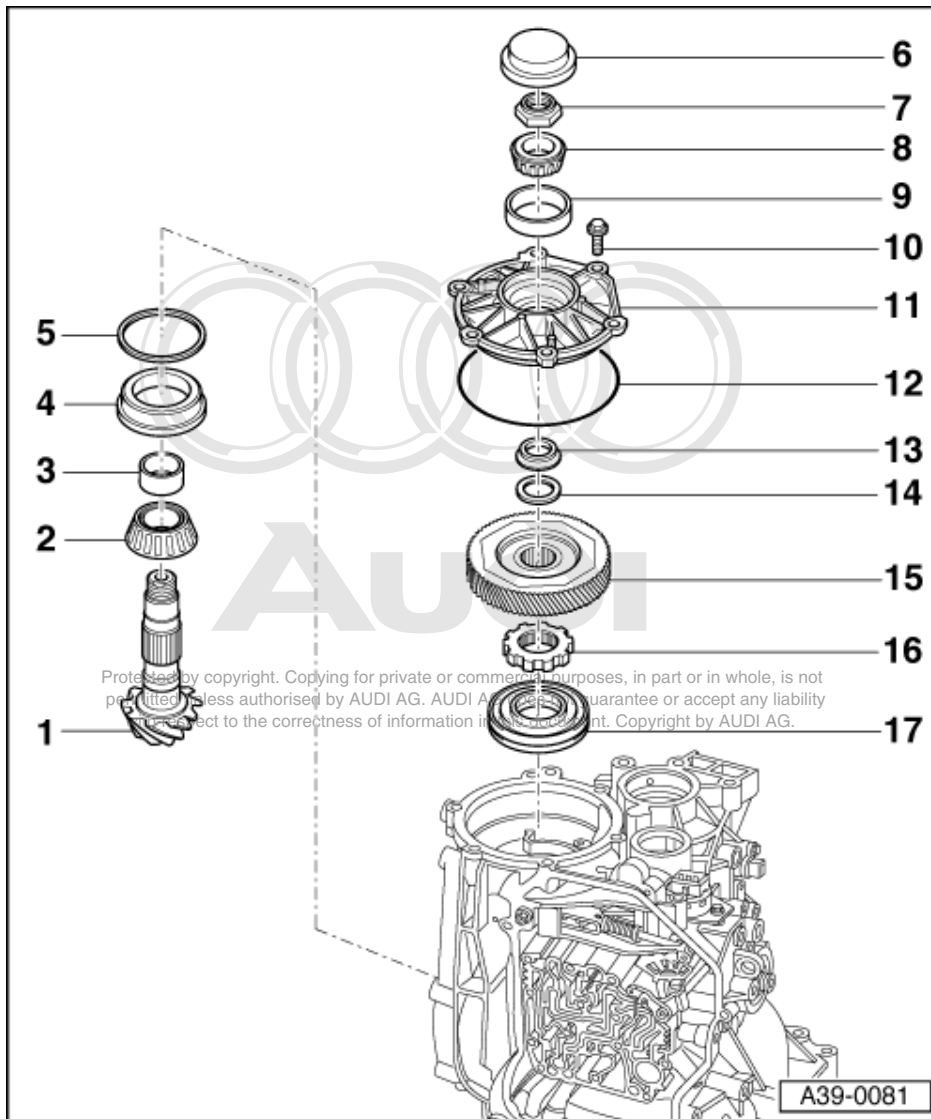
- ♦ Drive out with 3138
- ♦ Fitting
=> Fig. 185

5 Shim S3

- ♦ Determining thickness
=> Page 213 , adjusting drive pinion

6 Cap

- ♦ Knocking out
=> Fig. 187
- ♦ Driving in
=> Fig. 187



7 Hexagon nut

- ◆ Always replace
- ◆ Engage parking lock to loosen and tighten.
- ◆ Tightening torque => Page 213, adjusting drive pinion
- ◆ Secure by peening after checking friction torque
=> Fig. 187

8 Taper roller bearing inner race1)

9 Taper roller bearing outer race1)

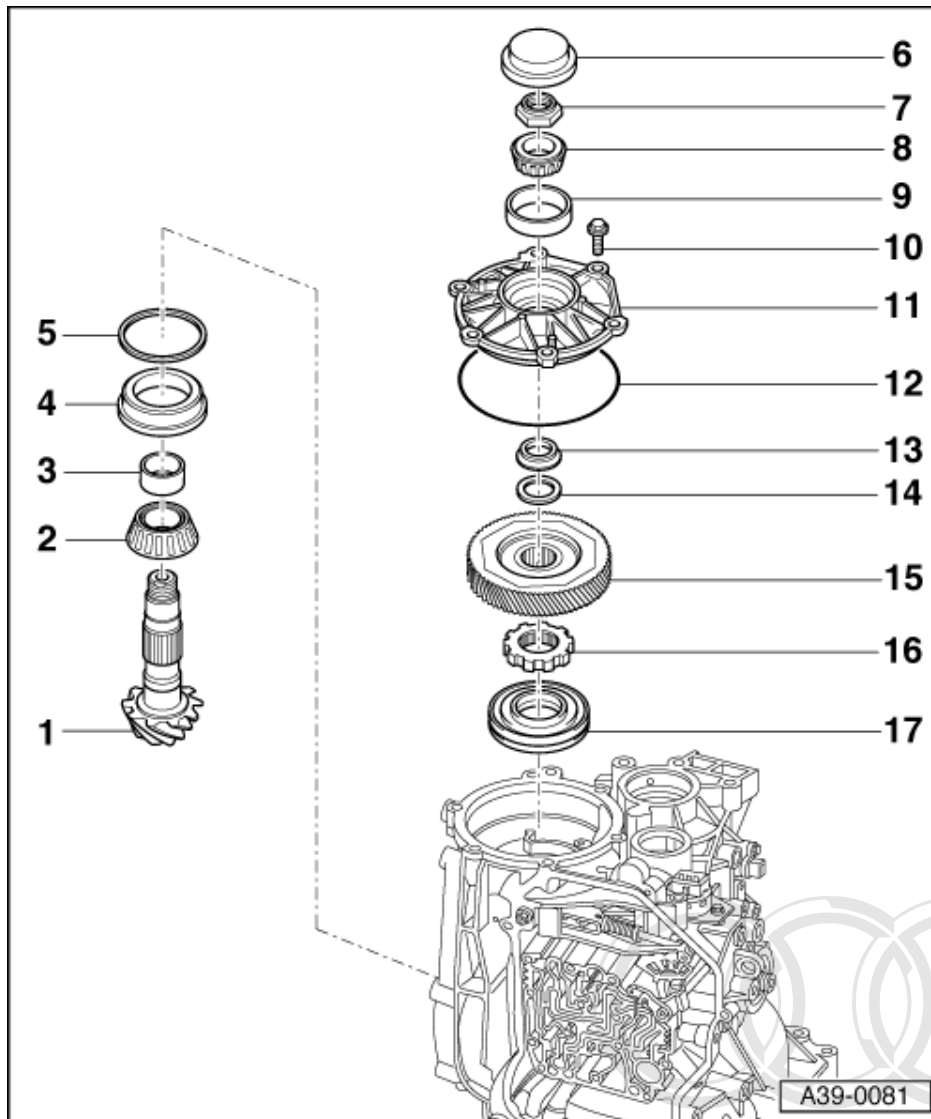
- ◆ Drive out with drift
- ◆ Pressing in
=> Fig. 186

10 Bolt, 25 Nm

- ◆ Tighten in stages and diagonally

11 Cover for drive pinion1)

- ◆ After removing hexagon nut -Item 7 -, cover can be pressed off gearbox housing via tapped holes



12 O-ring

- ♦ Always replace

13 Spacer tube 1)

- ♦ Installation position:
Wider contact surface faces output wheel.

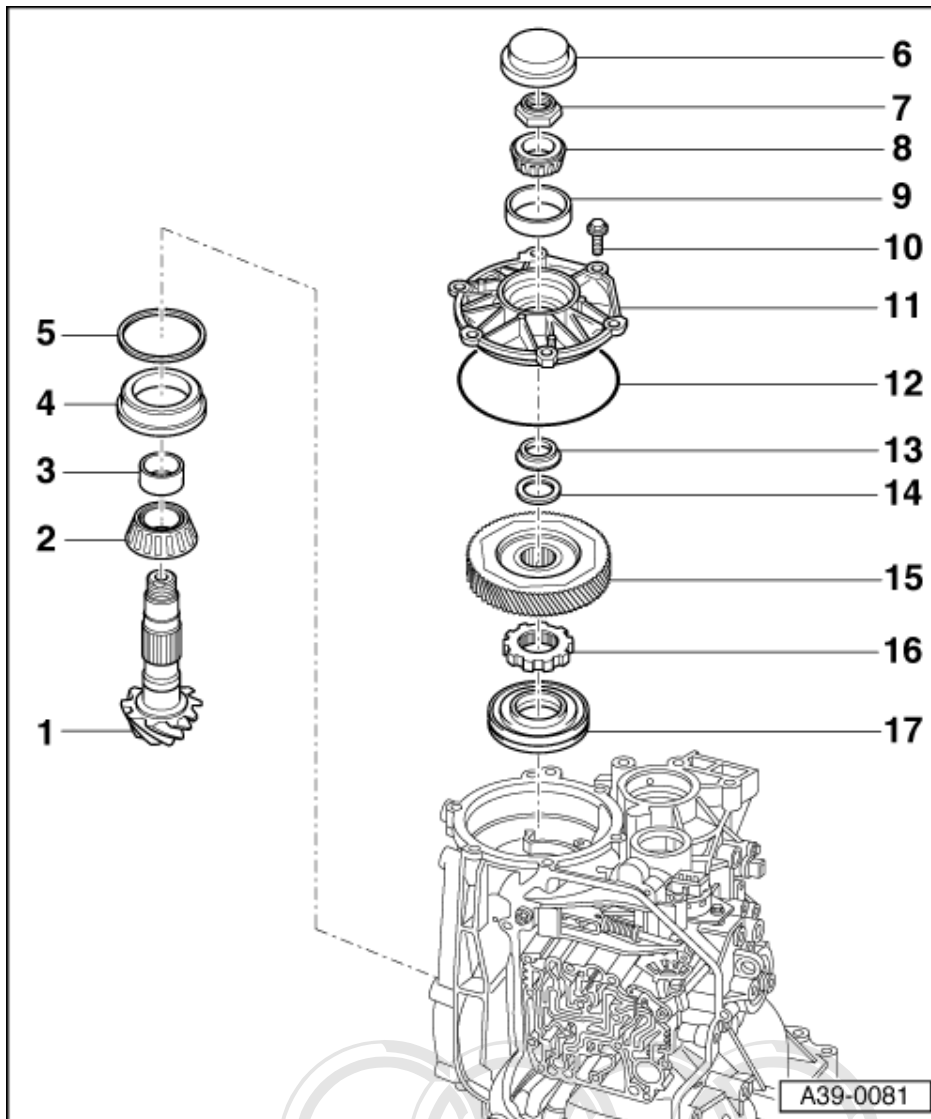
14 Shim S4

- ♦ Determining thickness
=> Page 213, adjusting drive pinion

15 Output gear 1)

- ♦ Number of teeth => Page 2 onwards
- ♦ Pulling off
=> Fig. 186
- ♦ Install heated
- ♦ If signs of damage exist, always replace input gear and output gear together
- ♦ Installation position:
Raised collar faces towards parking lock gear

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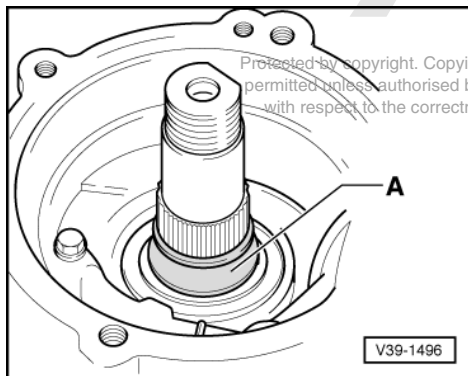


16 Parking lock gear 1)

- ◆ Rounded end faces output gear

17 Oil seal for drive pinion

- ◆ Drive out with drift
- ◆ Always replace
- ◆ Do not oil or grease sealing lips
- ◆ Driving in
=> Fig. 186

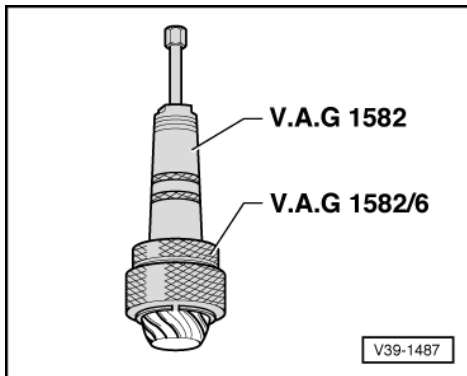


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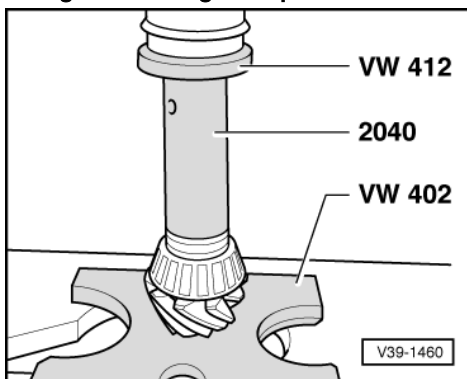
-> Fig.1 Inserting drive pinion

A - Assembly sleeve 3187

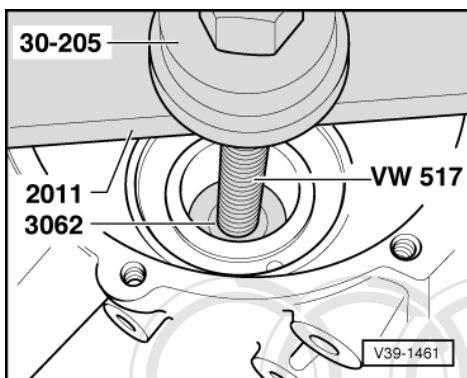
Use assembly sleeve 3187 when inserting drive pinion to avoid damaging the sealing lips.



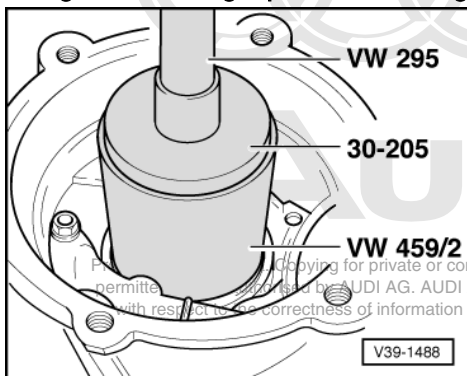
-> Fig.2 Pulling off taper roller bearing inner race with bush for drive pinion



-> Fig.3 Pressing on taper roller bearing inner race with bush for drive pinion



-> Fig.4 Pressing taper roller bearing outer race into gearbox housing



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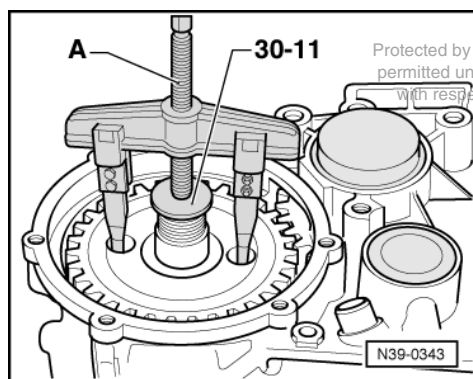
-> Fig.5 Driving in drive pinion oil seal up to stop

Install seal dry; do not oil or grease sealing lips.

Installation position of seal:

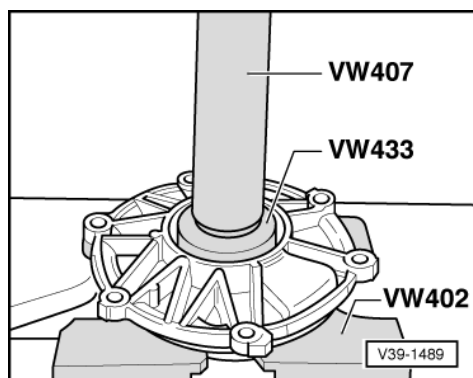
Raised collar (inner) faces parking lock gear.

- Drive in seal as far as stop.

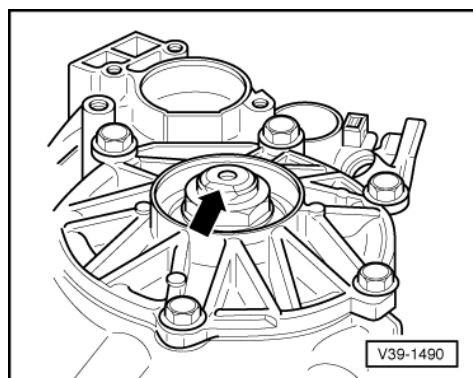


-> Fig.6 Pulling output gear off drive pinion

A - Kukko 20-10 and Matra V 172 pulling hooks.

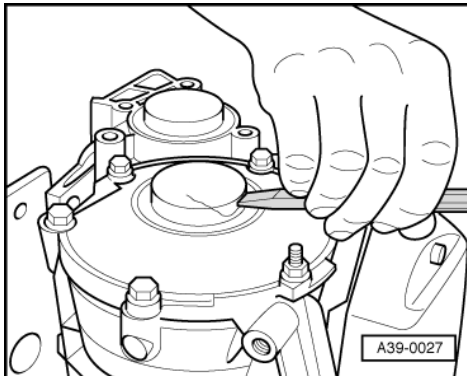


-> Fig.7 Pressing in taper roller bearing outer race



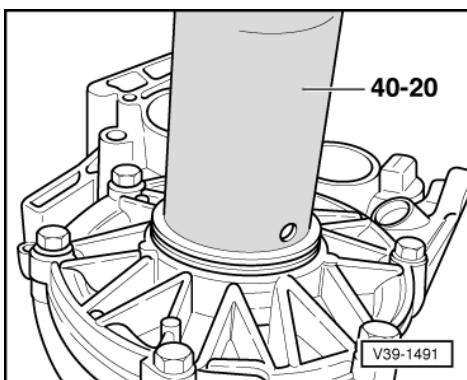
-> Fig.8 Locking hexagon nut

- Secure hexagon nut collar against flat face of drive pinion -arrow- using a drift.



-> Fig.9 Driving out cover

The cover is damaged when it is removed.



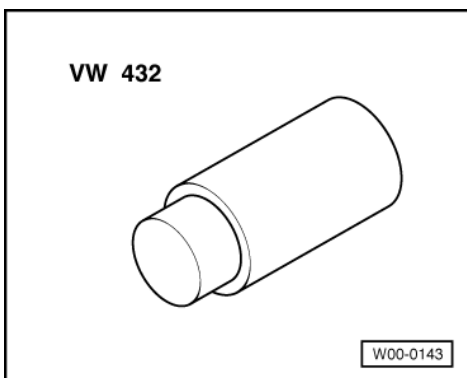
-> Fig.10 Driving in cover

- Drive in new cover with 40-20 as far as stop.

3.4 - Removing and installing differential

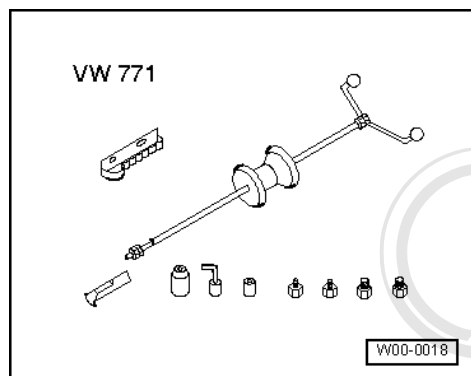
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Special tools, testers and workshop equipment required

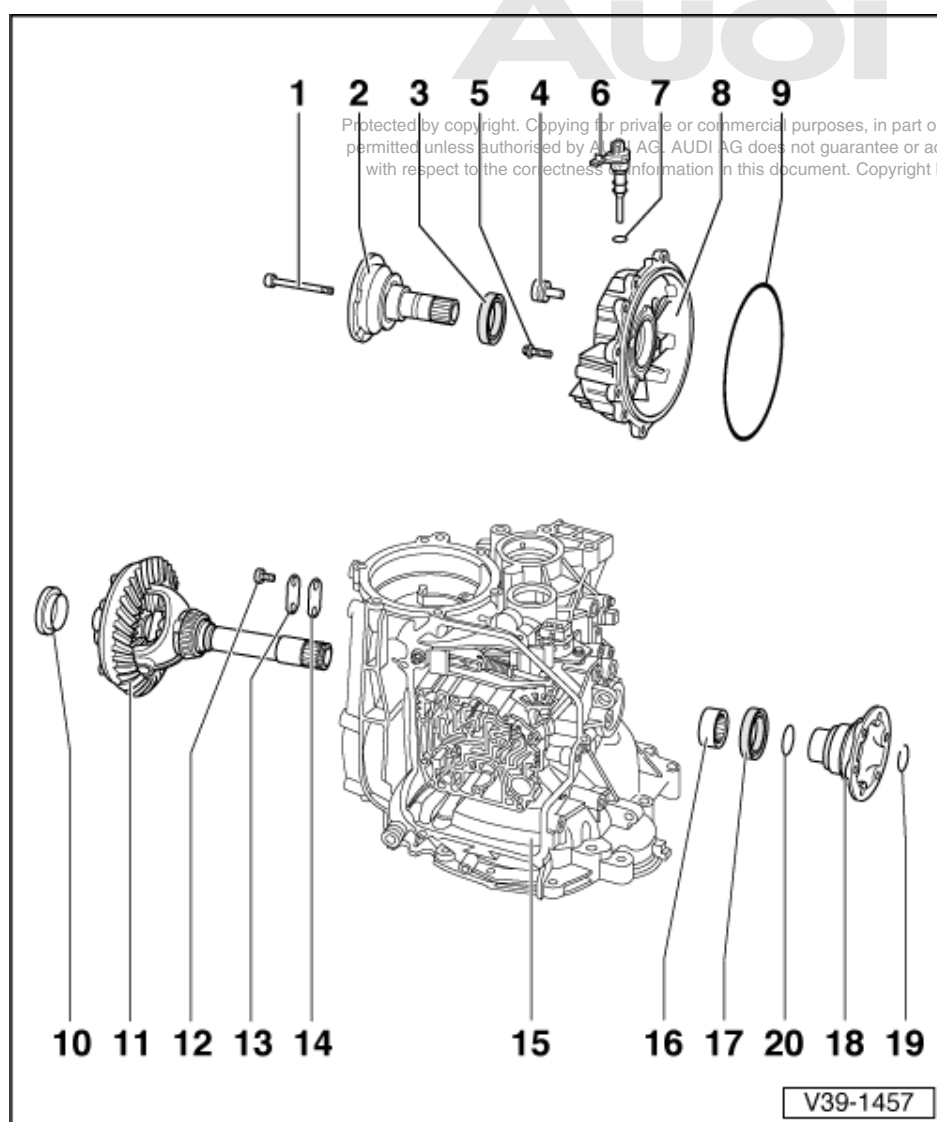




- ♦ VW 432 Thrust piece



- ♦ VW 771 Multi-purpose tool

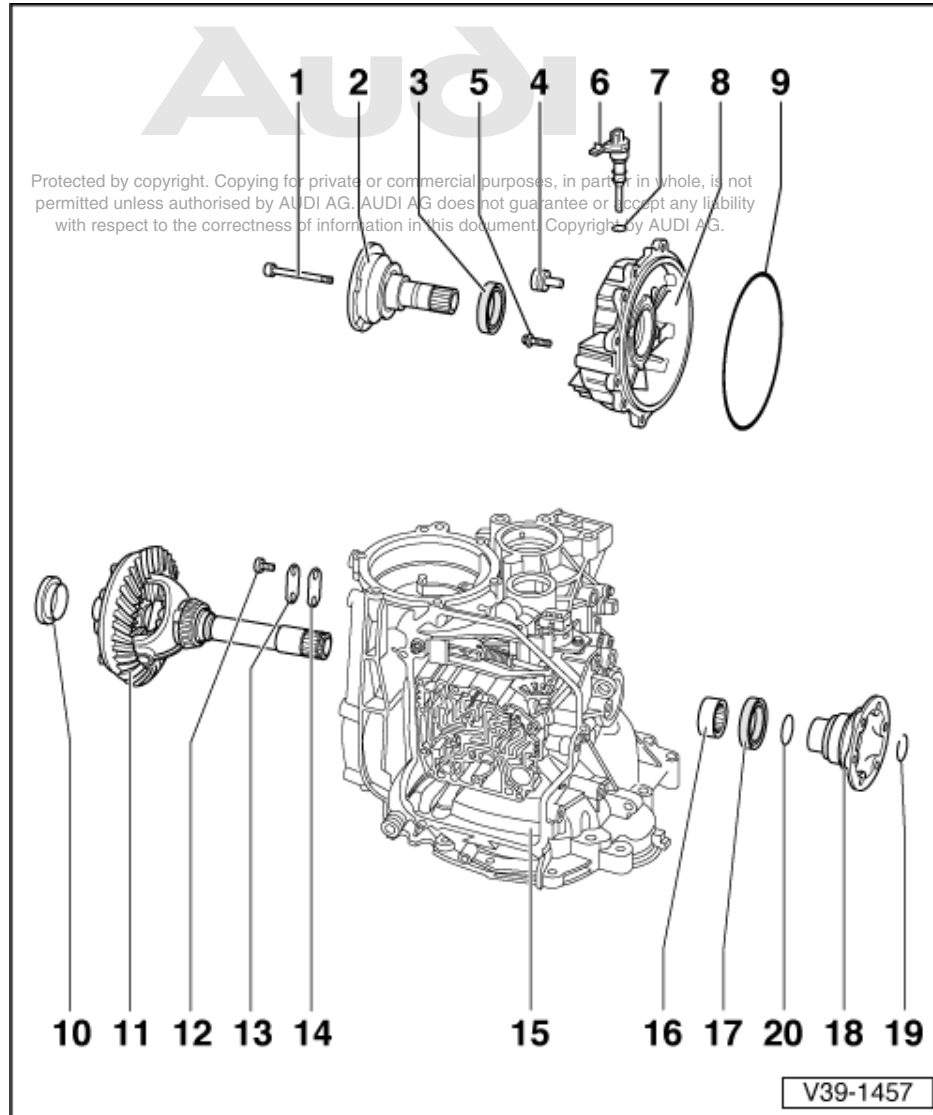


Notes:

- ♦ The drive pinion does not need to be removed for removing and installing the differential gearbox.
- ♦ With the exception of the differential and the cover for axle breather, all the components shown in the illustration can be removed with the gearbox installed.

- ♦ If the same final drive gear set and taper roller bearings are to be re-installed after a repair, measure the backlash => Page 226 . Note the reading obtained in order to check the friction torque after the repair is completed.
- ♦ Cross section view => Page 203 .

1 Bolt, 25 Nm



2 Flange shaft

- ♦ Removing and installing
=> Page 163 onwards

3 Oil seal for flange shaft

- ♦ Before installing, pack space between sealing lips with multi-purpose grease
- ♦ Can be replaced without removing gearbox
=>Page 163
- ♦ Remove with VW 681
- ♦ Driving in => Page 165

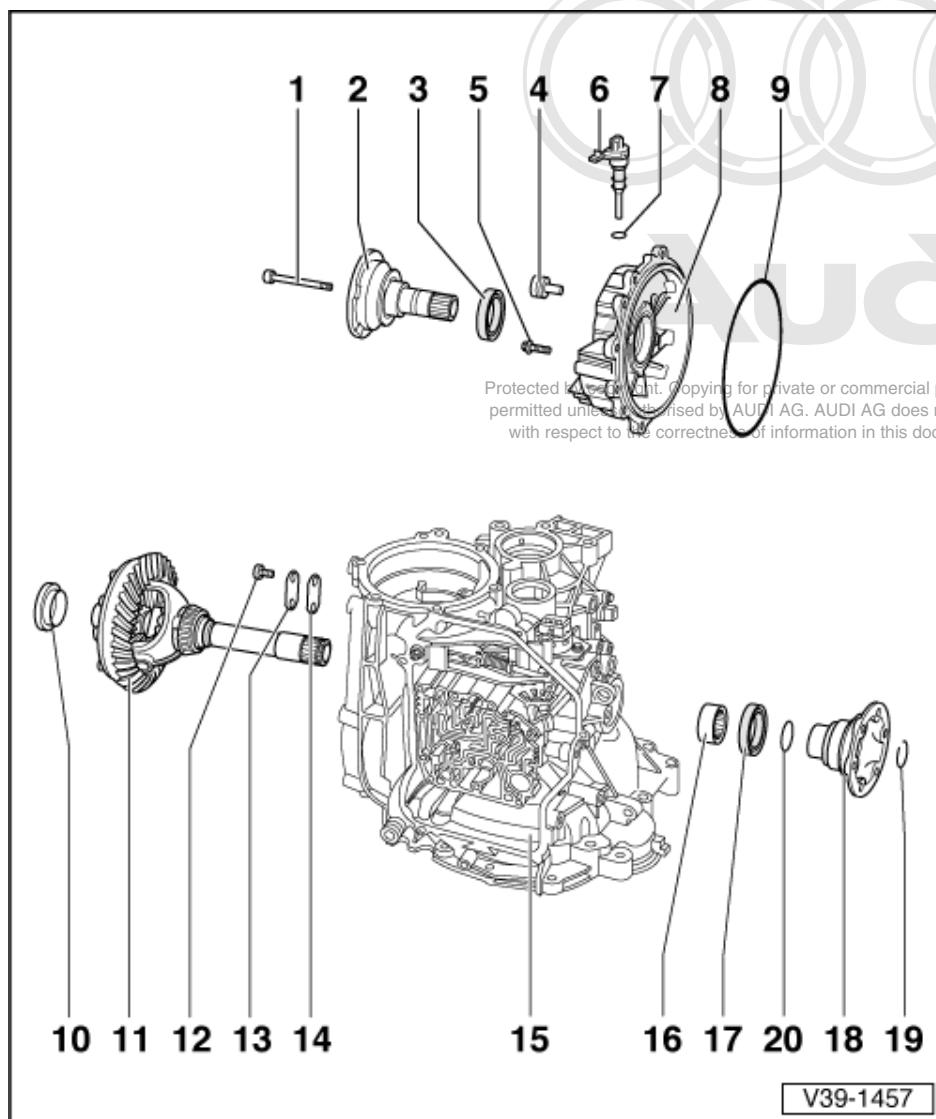
4 Oil filler plug, 25 Nm

- ♦ Checking gear oil with gearbox installed => Page 163

5 Hexagon bolt, 25 Nm

- ♦ Tighten in stages and diagonally

6 Speedometer sender -G22



7 O-ring

- ♦ Always replace

8 Cover for differential

- ♦ Adjust crown wheel after replacing => Page 222 onwards

9 O-ring

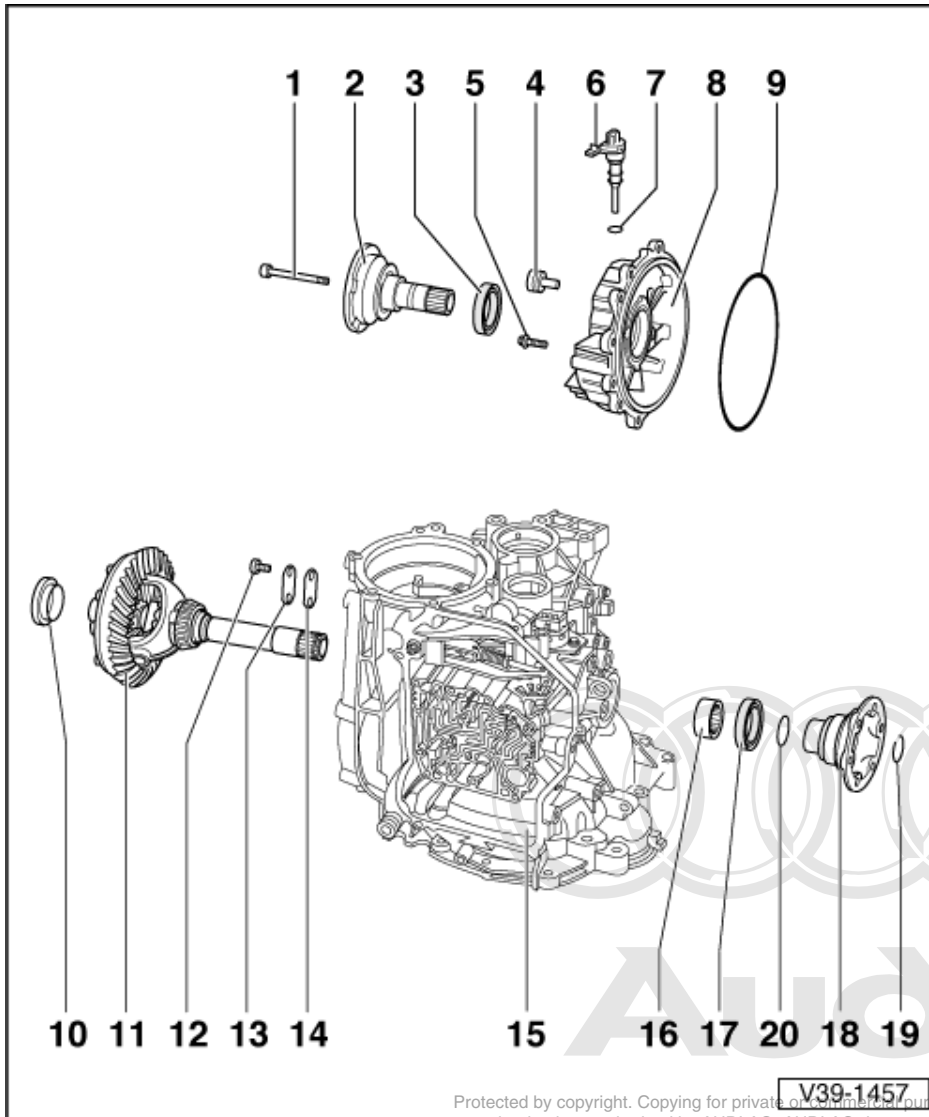
- ♦ Always replace

10 Speedometer input gear

- ♦ Installation position:
Lugs on inner circumference face flange shaft, the taper faces differential gearbox.

11 Differential

- ♦ Dismantling and assembling => Page 194
- ♦ Always replace
- ♦ Adjust crown wheel after replacing => Page 222 onwards



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12 Bolt, 10 Nm

13 Cap

- ♦ For axle breather

14 Gasket

- ♦ Always replace

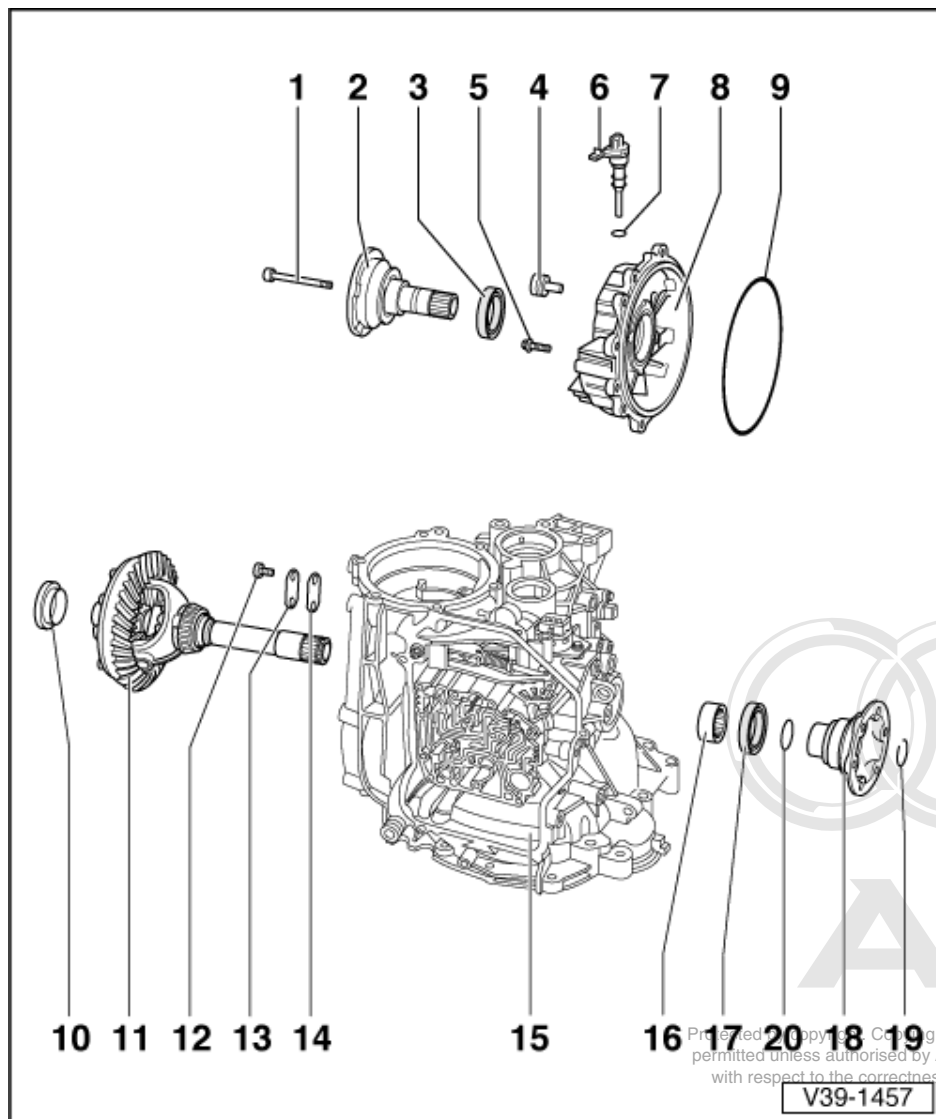
15 Gearbox housing

16 Needle bearing

- ♦ Extracting=> Fig. 193
- ♦ Driving in
=> Fig. 193

17 Oil seal for drive flange

- ♦ Before installing, pack space between sealing lips with multi-purpose grease
- ♦ Can be replaced without removing gearbox
=> Page 163
- ♦ Remove with VW 681
- ♦ Driving in => Page 167



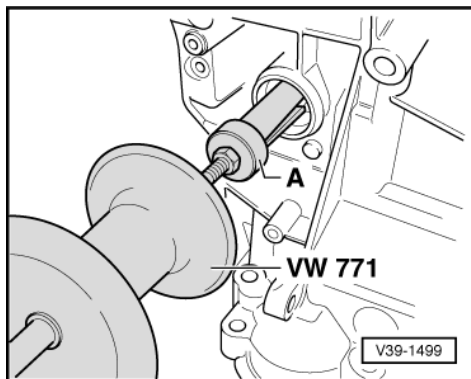
18 Drive flange

- ♦ Removing and installing
=> Page **166** onwards

19 Circlip

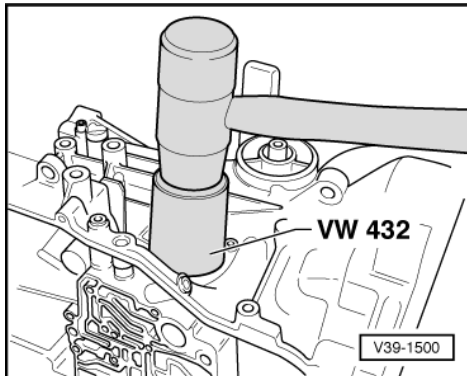
20 O-ring

- ♦ Always replace
- ♦ Insert in drive flange



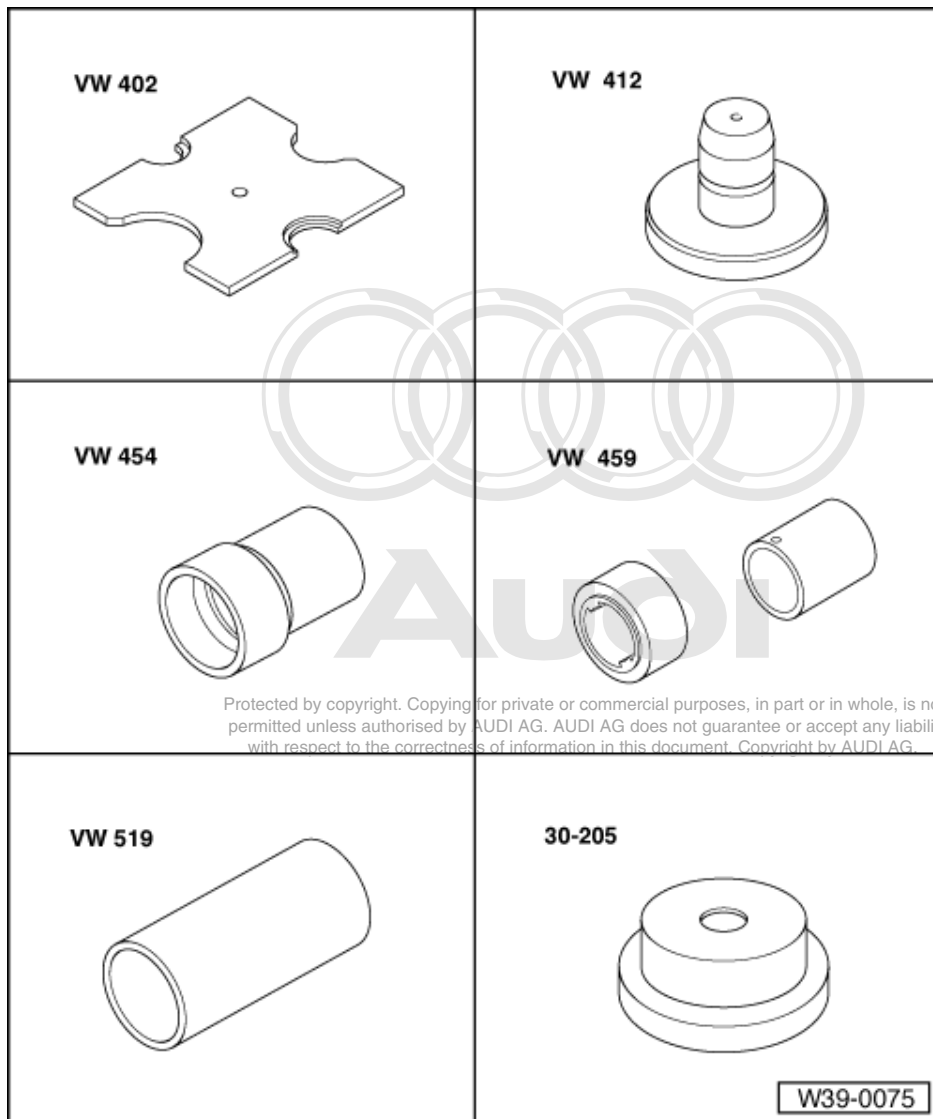
-> Fig.1 Extracting needle bearing

A - Internal extractor 18 ... 23 mm, e.g. Kukko 21/3



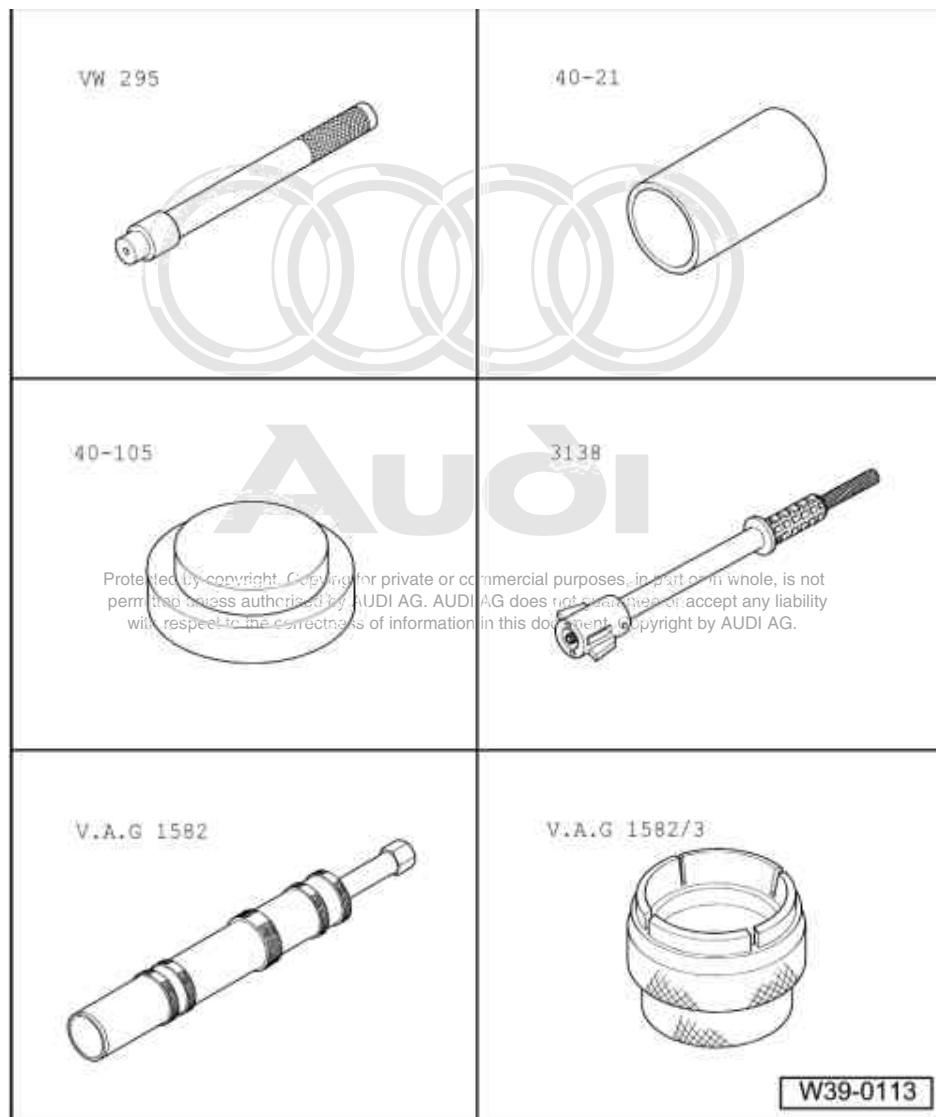
-> Fig.2 Driving in needle bearing

3.5 - Dismantling and assembling differential



Special tools, testers and workshop equipment required

- ♦ VW 402 Pressure plate
- ♦ VW 412 Thrust tool
- ♦ VW 454 Thrust piece
- ♦ VW 459/2 Installing and removing tool
- ♦ VW 519 Tube
- ♦ 30-205 Thrust plate



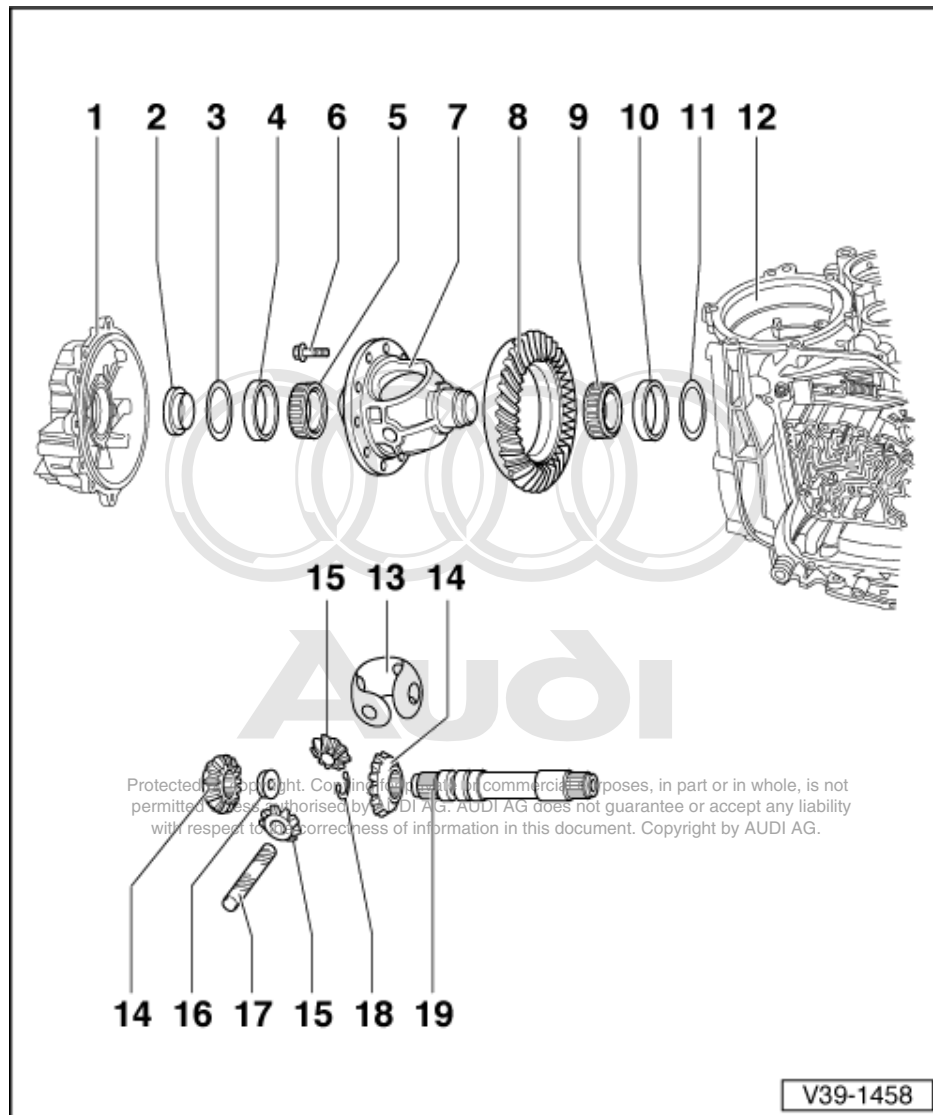
Special tools, testers and workshop equipment required

- ♦ VW 295 Drift
- ♦ 40-105 Thrust plate
- ♦ 3046 Puller
- ♦ 3138 Drift
- ♦ V.A.G 1582 Taper roller bearing puller
- ♦ V.A.G 1582/3 Grip piece

Notes:

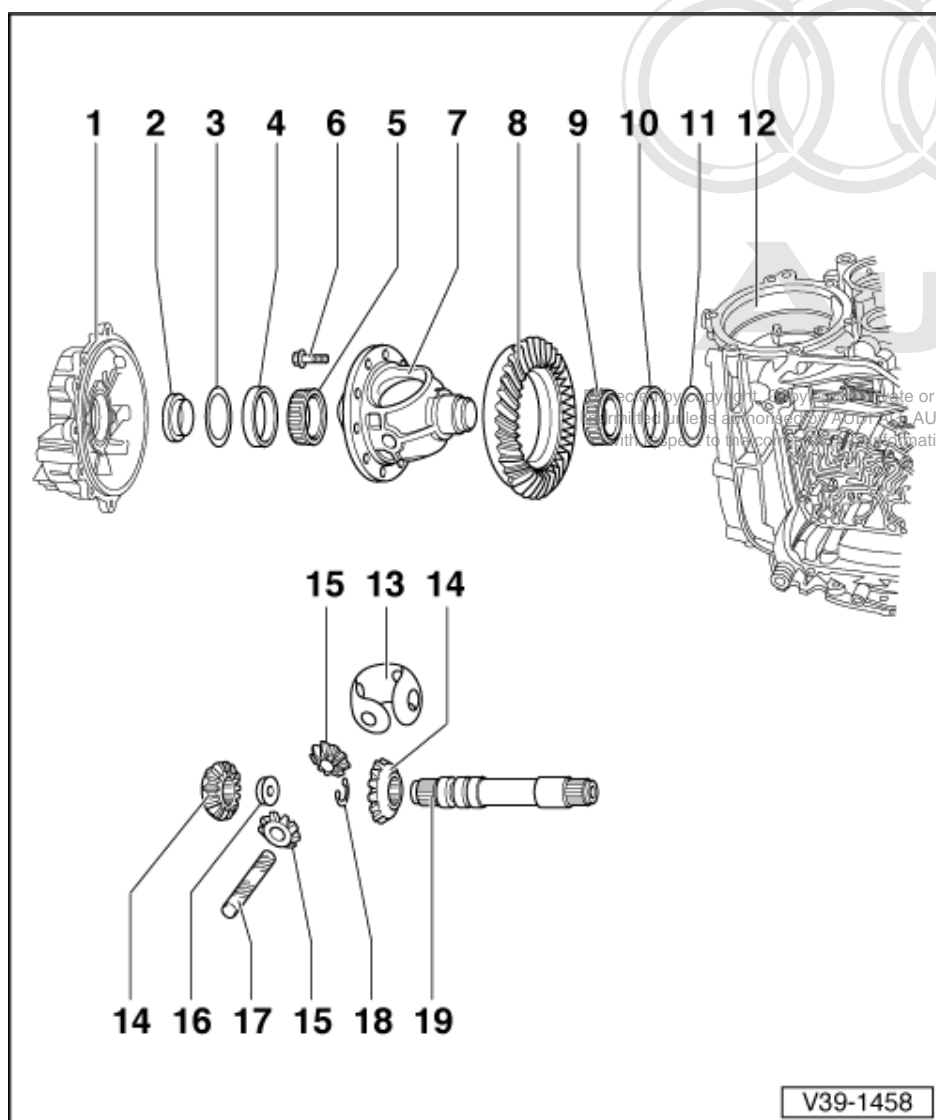
- ♦ Crown wheel and drive pinion may only be replaced together.
- ♦ If the differential taper roller bearings, differential housing or final drive cover are replaced, re-determine thickness of shims "S1" and "S2" for differential => Page 222 .

- ♦ If the crown wheel (with drive pinion) is replaced, re-determine thickness of shims "S1" and "S2" and shims "S3" and "S4" (for drive pinion)
=> Page 213
- ♦ Always replace the taper roller bearings on one shaft together and use new bearings from a single manufacturer.
- ♦ Do not interchange the outer or inner races of bearings of the same size.



- 1 Cover for differential**
 - ♦ Removing and installing => Page 187 onwards, removing and installing differential
- 2 Speedometer input gear**
 - ♦ Removing and installing => Page 187 onwards, removing and installing differential
- 3 Shim S1**
 - ♦ Determining thickness => adjusting crown wheel, Page 222
- 4 Taper roller bearing outer race**
 - ♦ Remove with driver 3138
 - ♦ Pressing in
=> Fig. 199
- 5 Taper roller bearing inner race**
 - ♦ Pulling off
=> Fig. 199
 - ♦ Pressing on

=> Fig. 200


6 Bolt, 90 Nm
7 Differential housing

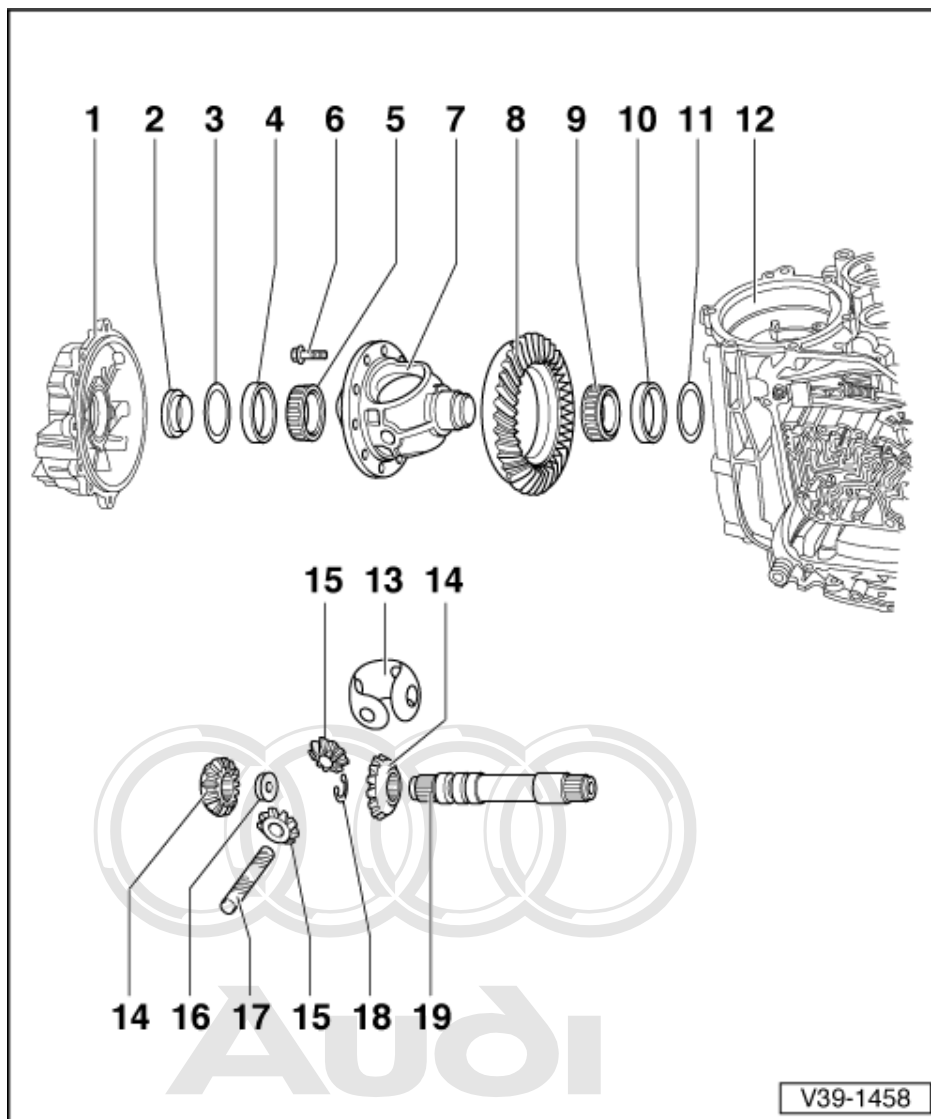
- ◆ When replaced, re-determine thickness of shims "S1" and "S2" for differential=> from Page 222 onwards

8 Crown wheel

- ◆ Number of teeth => Page 2 onwards
- ◆ Install heated => Fig. 200
- ◆ Is mated with output shaft, only replace as a set
- ◆ Adjust drive pinion and crown wheel after replacing => Page 211
- ◆ Drive off differential with a drift
- ◆ Fitting
=>Fig. 200

9 Taper roller bearing inner race

- ◆ Pulling off
=> Fig. 199
- ◆ Pressing on
=> Fig. 200



10 Taper roller bearing outer race

- ♦ Drive out with drift
- ♦ Fitting
=> Fig. 201

11 Shim "S2"

- ♦ Determining thickness => adjusting crown wheel, Page 222

12 Gearbox housing

13 One-piece thrust washer

- ♦ Coat with gearbox oil when installing

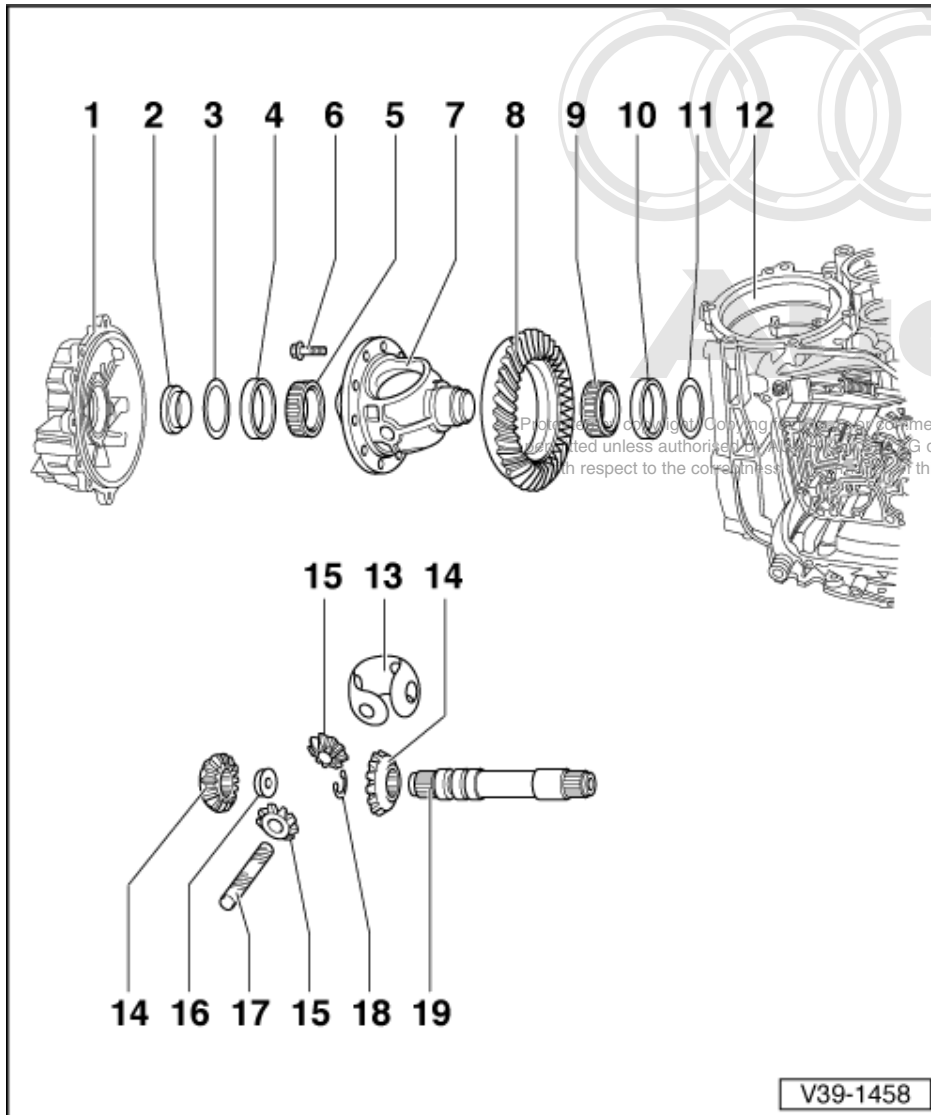
14 Sun wheel

- ♦ Removing and installing
=> Page 201 onwards

15 Planet pinion

- ♦ Removing and installing
=> Page 201 onwards

V39-1458



16 Threaded piece

- ◆ When installing, fit lugs in sun wheel.
- ◆ Insert before inserting shaft for bevel gears

17 Shaft for bevel gears

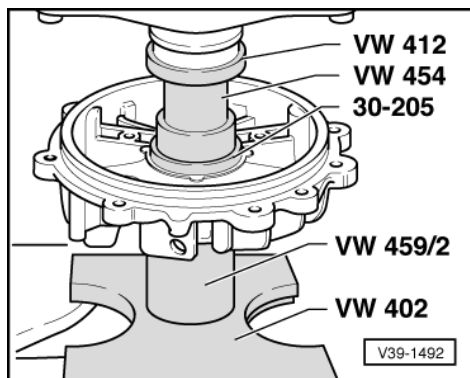
- ◆ Removing and installing => Page 201
- ◆ Check for wear; replace if necessary
- ◆ When driving in, do not damage one-piece thrust washer

18 Circlip

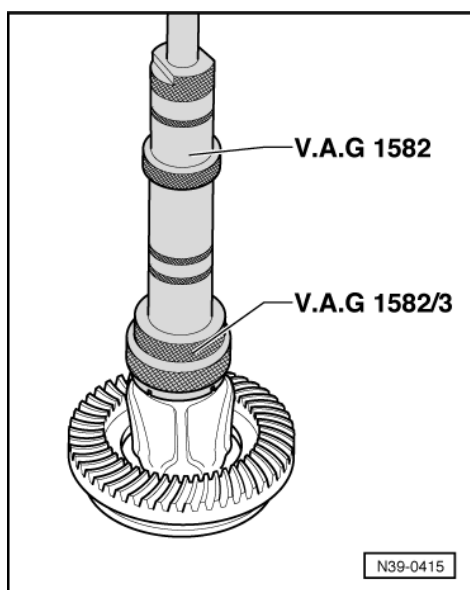
- ◆ For output shaft

19 Output shaft for drive flange

- ◆ Removing and installing
=> Page 201 onwards

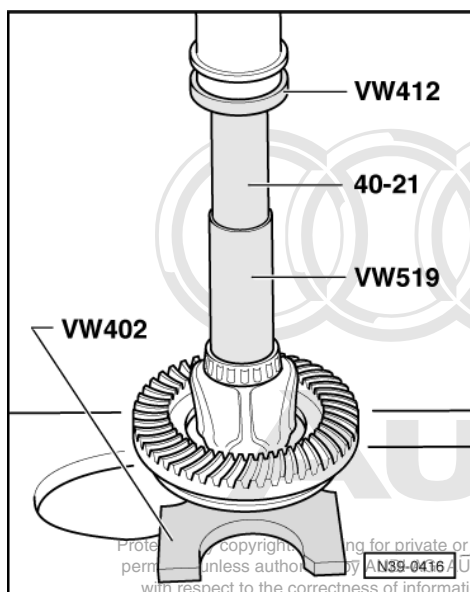


-> Fig.1 Pressing in taper roller bearing outer race



-> Fig.2 Pulling off taper roller bearing inner race

- Place press piece 40-105 on differential housing.

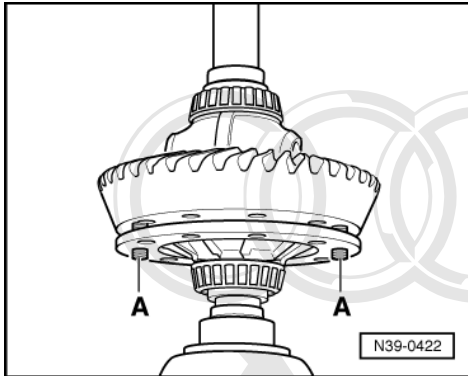


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-> Fig.3 Pressing on taper roller bearing inner race

Warning
Wear protective gloves.

- Heat inner race to approx. 100 oC.
- ♦ Temperature can be checked with temperature tester V.A.G 1558.
- Press taper roller bearing inner race up to stop on differential housing.

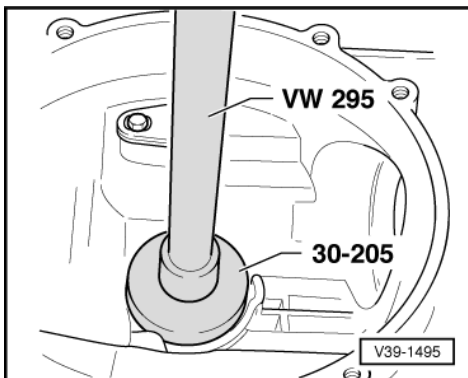


-> Fig.4 Installing heated crown wheel

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Warning
Wear protective gloves.

- Heat crown wheel to approx. 100oC.
- ♦ Temperature can be checked with temperature tester V.A.G 1558.
- Fit crown wheel over centralising pins -A- (local manufacturer) on differential housing.



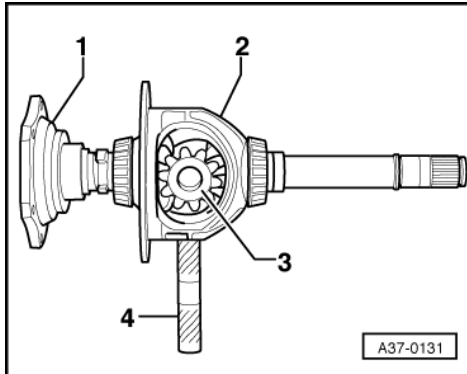
-> Fig.5 Driving taper roller bearing outer race into gearbox housing.

3.6 - Removing and installing differential bevel gears

- Differential removed.

Dismantling

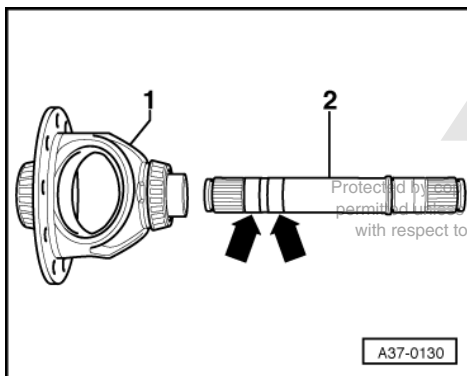
- Remove bolts on crown wheel and drive crown wheel off differential housing with a drift.



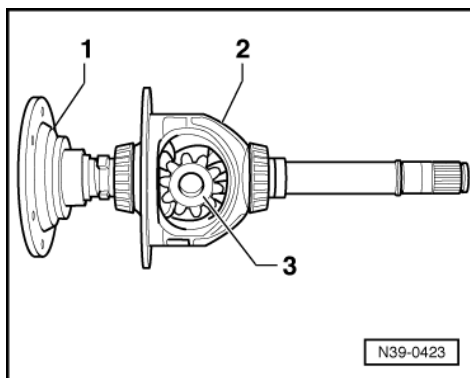
- -> Drive out shaft -4- for planetary pinions.
- Remove threaded piece.
- Remove 3 differential bevel gears from differential housing.
- Take drive flange circlip off output shaft.
- Remove 4th differential bevel gear.
- Pull out output shaft for right-hand drive flange.
- Remove one-piece thrust washer from differential housing

Assembling

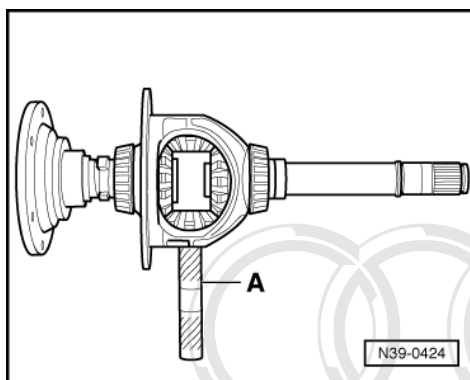
- Lubricate one-piece thrust piece with gear oil and insert in differential housing -1-.



- -> Insert output shaft -2- in differential housing -1-.
- Note correct installation position: Side with two bearing positions -arrows- faces towards differential.
- Fit sun wheel on output shaft -2-, and secure on shaft with circlip.



- -> Insert flange shaft -1-, as an assembly aid, into differential housing -2-.
- Secure sun wheel to left-hand flange shaft using bolt and threaded piece.
- Insert planet pinions -3- spaced at 180° and pivot into place by turning flange shaft.



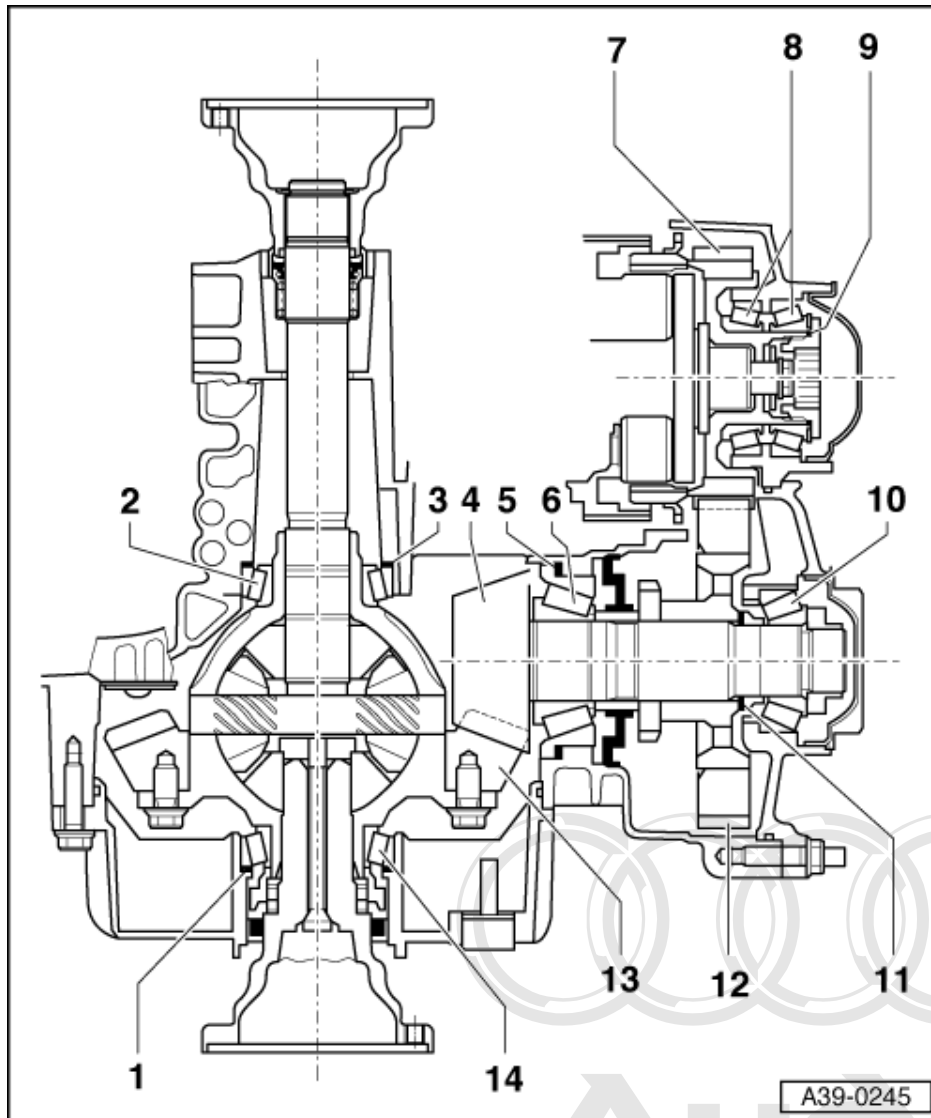
- -> Carefully drive in shaft -A- for planetary pinions. Ensure one-piece thrust washer is seated properly.
- Fit heated crown wheel => Page 200, Fig. 4.
- Remove flange from differential housing.

Audi

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4 - Adjusting final drive

4.1 - Adjusting final drive

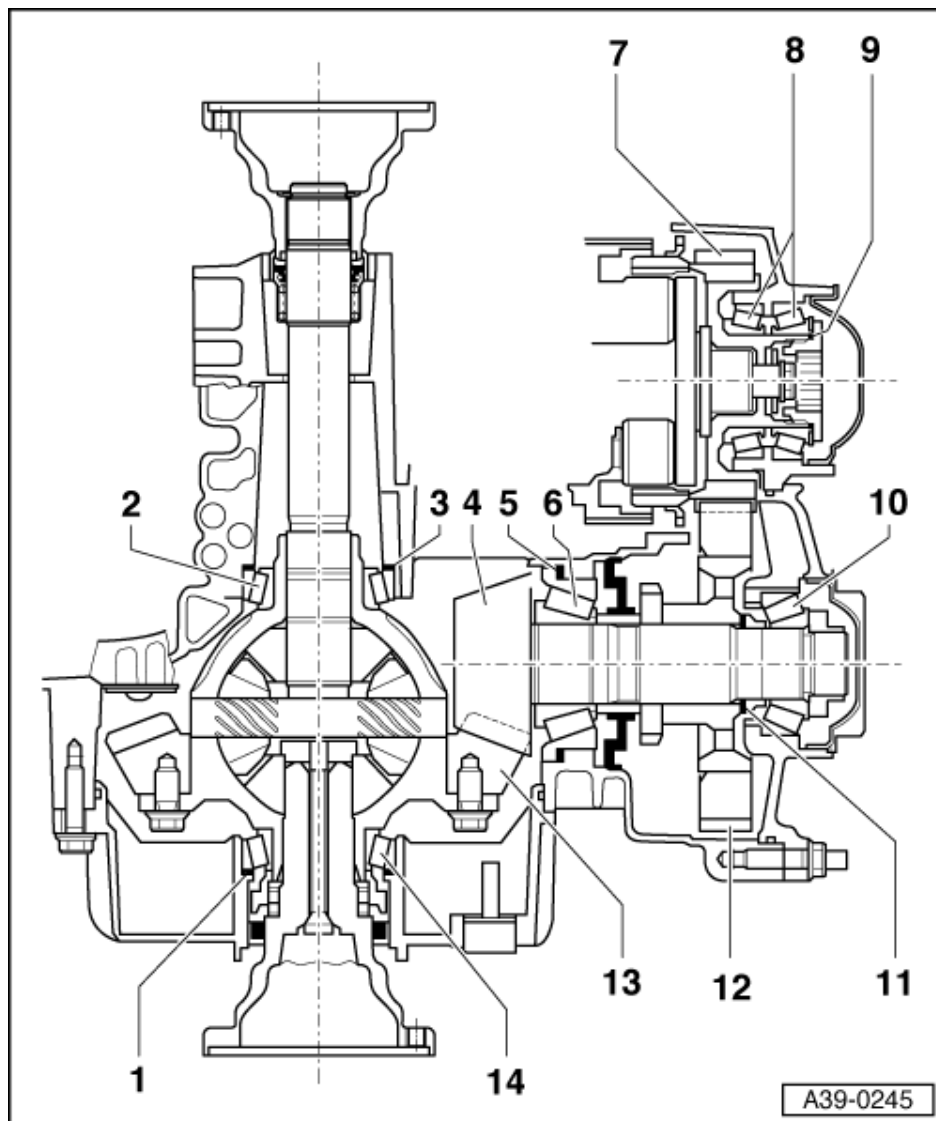


4.2 - Overview of adjustments

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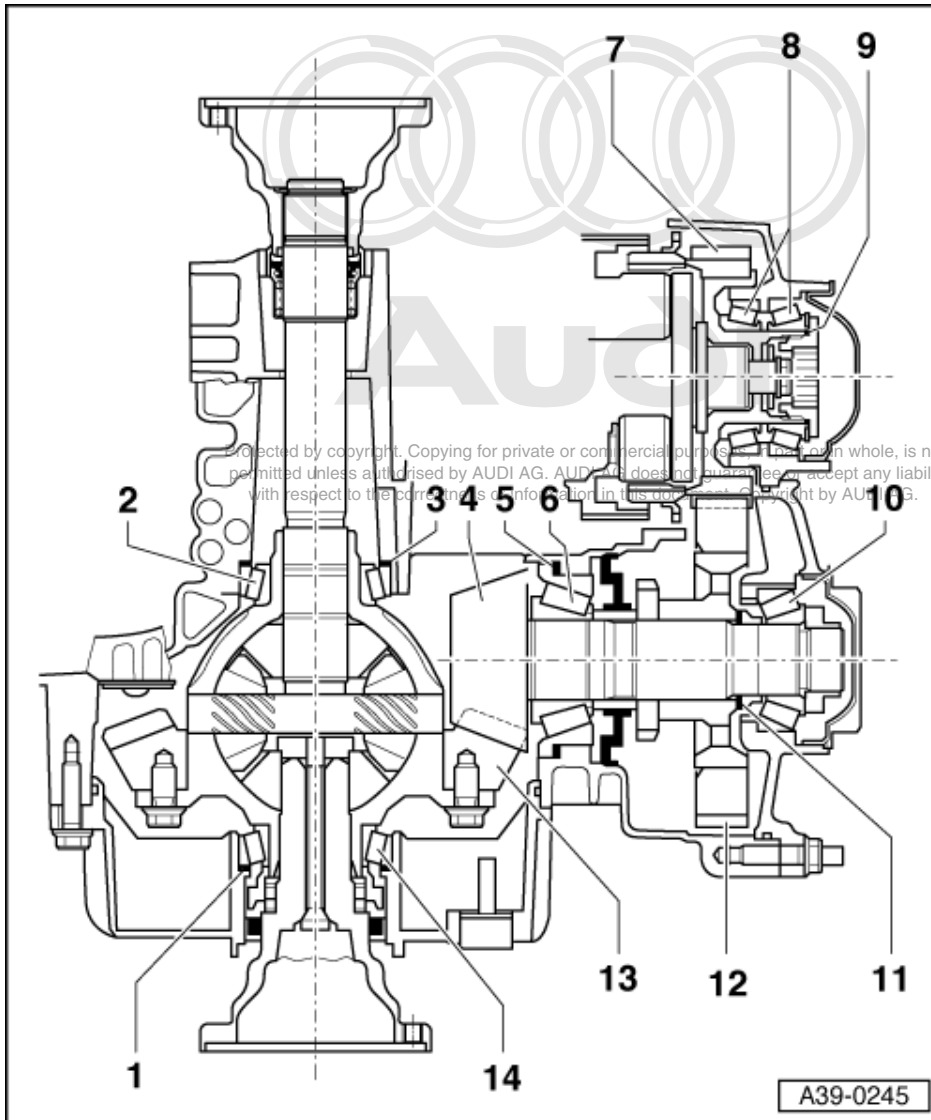
Notes:

- ◆ Overview of adjustments to be completed after replacing individual components
=>Page 205
- ◆ Lubricate all bearings with either ATF or gear oil before fitting (depending on which lubricant they run in when installed). Take special care when lubricating bearings before measuring friction torque.
- ◆ Do not interchange the outer or inner races of bearings of the same size.
- ◆ Check shims for burr/damage. Install only shims which are in perfect condition.
- ◆ Use a micrometer to re-measure shims at several locations.



- 1 Shim "S1" for crown wheel
- 2 Taper roller bearing for differential
- 3 Shim "S2" for crown wheel
- 4 Drive pinion
 - ♦ Only replace together with crown wheel
 - ♦ Adjusting crown wheel and pinion shaft => Page 211
- 5 Shim "S3" for drive pinion
- 6 Large taper roller bearing for drive pinion
- 7 Input gear
 - ♦ Only replace together with output gear
 - ♦ Adjusting => Page 206

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- 8 Taper roller bearing for input gear
- 9 Shim for input gear
- 10 Small taper roller bearing for drive pinion
- 11 Shim "S4" for drive pinion
- 12 Output gear
 - ♦ Only replace together with input gear
- 13 Crown wheel
 - ♦ Only replace together with drive pinion
 - ♦ Adjusting crown wheel and drive pinion => Page 211
- 14 Taper roller bearing for differential

4.3 - Adjustments to be completed after replacing individual components

When working on gearbox the following components only require adjustment if individual components have been replaced that directly affect the final drive adjustment. Refer to following table to avoid unnecessary adjustments:

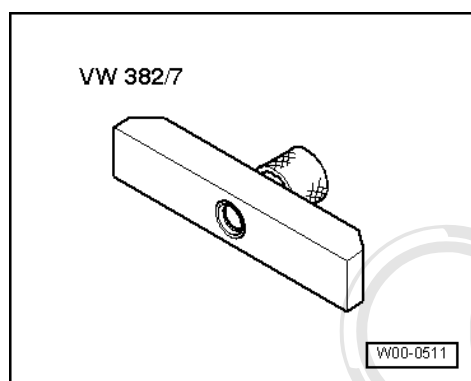
To be adjusted:



Component being replaced:	Crown wheel "S1" + "S2" => Page 211 onwards	Crown wheel "S1" => Page 211 onwards	Drive pinion "S3" + "S4" => Page 211 onwards	Drive pinion "S4" => Page 211 onwards	Adjusting input gear 1) => Page 206
Gearbox housing	X		X		X
Taper roller bearing for input gear					X
Input gear, output gear (always replace together)				X	X
Drive pinion, crown wheel (always replace together)	X		X		
Differential housing without crown wheel	X				
Taper roller bearings for pinion shaft			X		
Taper roller bearing for differential	X				
Cover for differential		X			
Drive pinion cover, drive pinion bush, parking lock wheel, spacer tube				X	

1) If input gear was readjusted, readjust planet carrier and clutch play between K1 and K2.

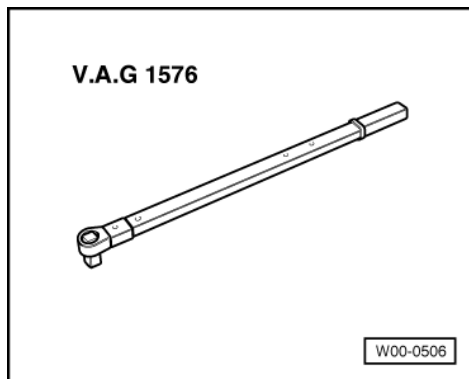
4.4 - Adjusting input gear



Special tools, testers and workshop equipment required

- ♦ VW 382/7 Bridge from measurement tool

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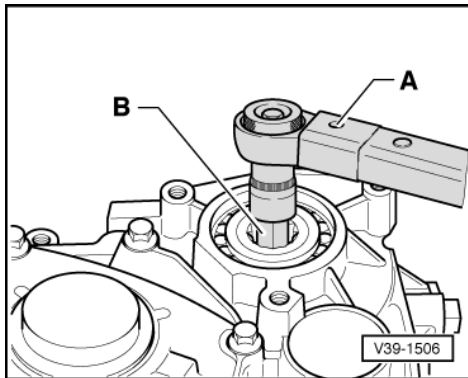
- ◆ V.A.G 1576 Torque wrench
- Planetary gearbox removed

Note:

Measure friction torque at drive pinion nut before and after removing input gear => Page 209. Make a note of the friction torque values; they are required for checking friction torque after assembly.

- First insert inner race without locking fluid.
- Then insert outer races for both taper roller bearings with locking fluid AMV.185.101 A1
=> Page 172 Item 5 and Item 8.

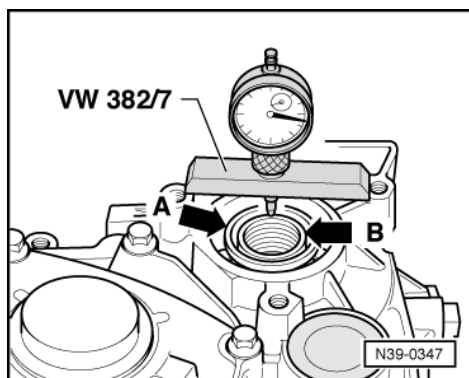
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- Insert input shaft with inner race of inner taper roller bearing.
- Engage parking lock.
- -> Tighten socket head fastener to 100 Nm without dished washer and without shim.

A - Torque wrench
B - 22 mm socket

- Remove socket head fastener.





- Insert dial gauge and set to "0" with 3 mm preload.
- -> Measure distance between input gear -B- and inner race -A- of taper roller bearing, and note dial gauge reading.
- Measurement in following example: 1.00 mm.

Determining thickness of shim

- Starting from the measured reading, add the thickness of the dished washer and subtract the bearing preload allowance. This will give the specified bearing preload.

Example:

Measurement	1.00 mm
+ Dished washer	1.50 mm
- Bearing preload	0.18 mm
= Thickness of shim	2.32 mm

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- Determine shim on the basis of the table and fit onto drive shaft. Table of shims => Page 208
- Insert axial needle bearing for input shaft.
- Bearing installation position => Removing and installing input gear, Page 169.
- Insert dished washer. Installation position: Convex side faces toward socket head fastener.
- Tighten socket head fastener to 250 Nm.

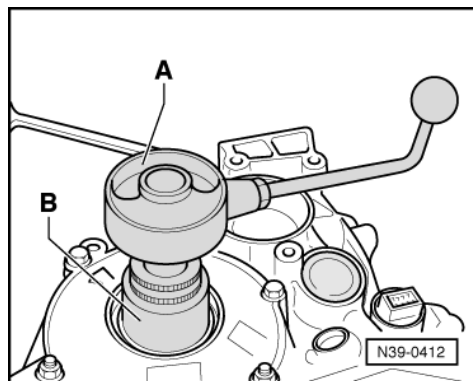
Table of "shims" for input gear

Gauged thickness (mm)	Shim to be fitted (mm)	Gauged thickness (mm)	Shim to be fitted (mm)	Gauged thickness (mm)	Shim to be fitted (mm)
1.575 ... 1.599	1.600	1.900 ... 1.924	1.925	2.225 ... 2.249	2.250
1.600 ... 1.624	1.625	1.925 ... 1.949	1.950	2.250 ... 2.274	2.275
1.625 ... 1.649	1.650	1.950 ... 1.974	1.975	2.275 ... 2.299	2.300
1.650 ... 1.674	1.675	1.975 ... 1.999	2.000	2.300 ... 2.324	2.325
1.675 ... 1.699	1.700	2.000 ... 2.024	2.025	2.325 ... 2.349	2.350
1.700 ... 1.724	1.725	2.025 ... 2.049	2.050	2.350 ... 2.374	2.375
1.725 ... 1.749	1.750	2.050 ... 2.074	2.075	2.375 ... 2.399	2.400
1.750 ... 1.774	1.775	2.075 ... 2.099	2.100	2.400 ... 2.424	2.425
1.775 ... 1.779	1.800	2.100 ... 2.124	2.125	2.425 ... 2.449	2.450
1.800 ... 1.824	1.825	2.125 ... 2.149	2.150	2.450 ... 2.474	2.475
1.825 ... 1.849	1.850	2.150 ... 1.274	2.175	2.475 ... 2.499	2.500
1.850 ... 1.874	1.875	2.175 ... 2.199	2.200	2.500 ... 2.524	2.525
1.875 ... 1.899	1.900	2.200 ... 2.224	2.225	2.525 ... 2.549	2.550

Different tolerances make it possible to obtain exact shim thickness required.

Part number:

=> Replacement part catalogue



-> Checking friction torque

- Planetary gearbox removed; differential installed

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

B - Wrench socket (41 mm AF)

- Read off friction torque. With input gear fitted, reading must be 145 ... 245 Ncm higher than without input gear.

Example:

Friction torque for differential, drive pinion and input gear	415 Ncm
- Friction torque for differential and drive pinion (input gear removed)	210 Ncm
= Friction torque for input gear	205 Ncm

Note:

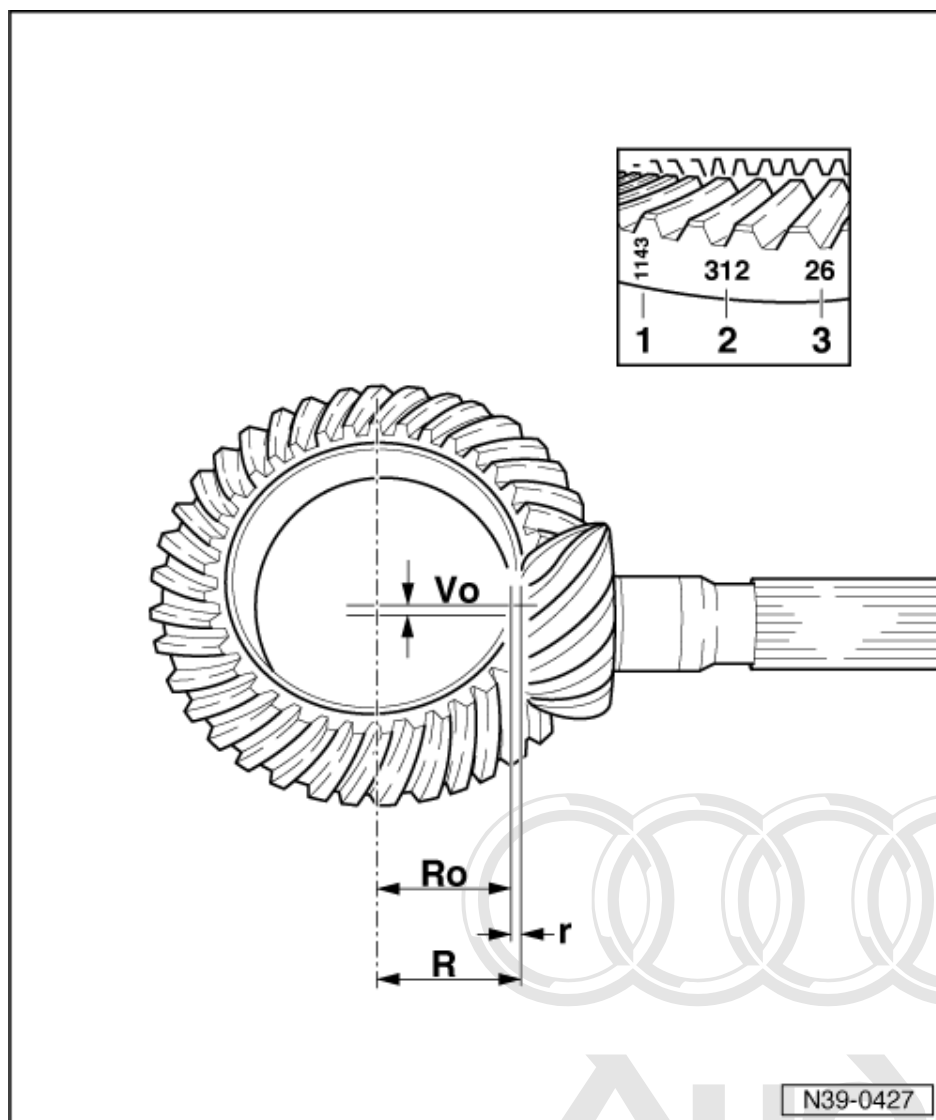
If the old bearings have been re-installed, the friction torque should now be the same as the total friction torque measured before dismantling. (A friction torque up to 80 Ncm higher is also permissible).

- Remove socket head fastener.
- Remove input gear again => Page **169**
- Insert inner race of outer taper roller bearing with locking fluid AMV 185 101 A1.
- Put shim onto input gear.
- Insert axial needle bearing for input shaft. Installation position: Flat side faces toward input gear.
- Insert dished washer. Installation position: Convex side faces toward socket head fastener.
- Tighten socket head fastener to 250 Nm.



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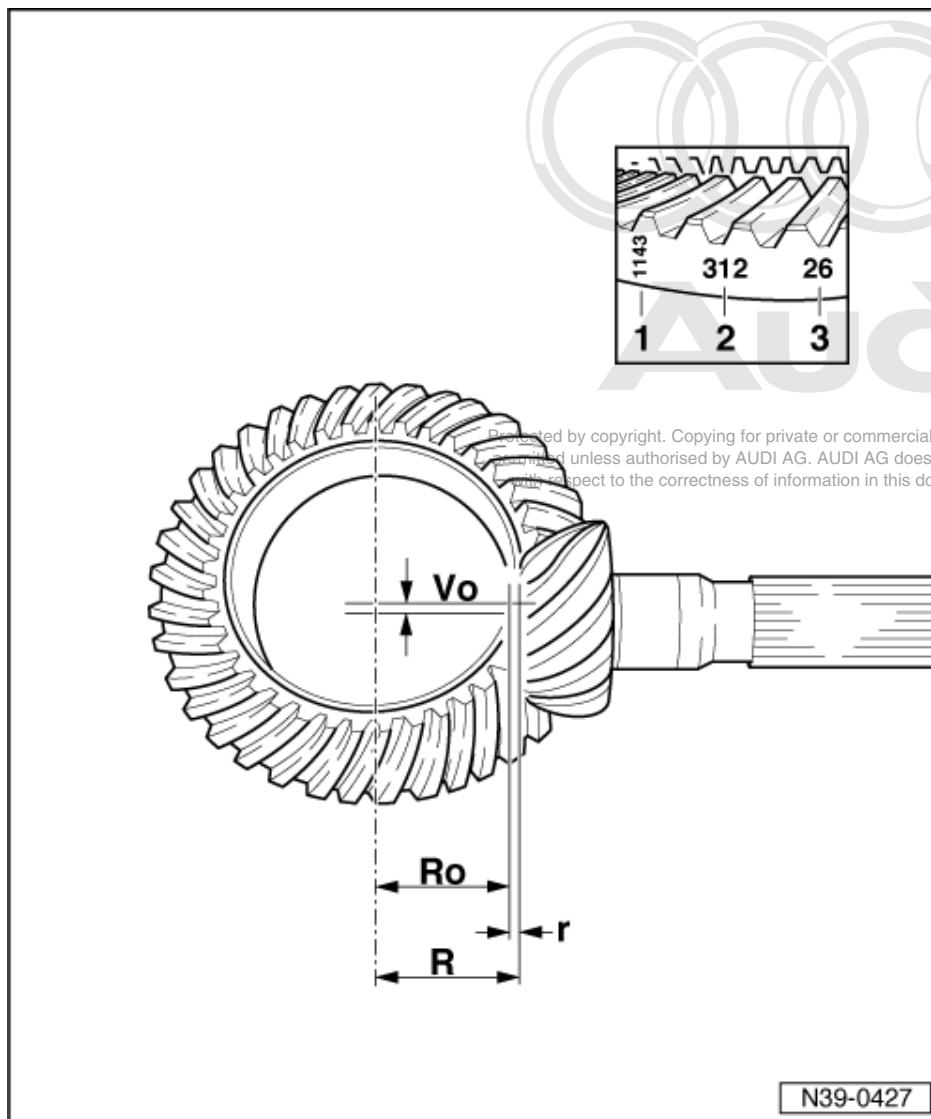
4.5 - Adjusting final drive sets; identification



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- 1 Identification "1143" signifies Oerlikon gear set with a ratio of 43 : 11.
- 2 Gear set pairing number (312).
- 3 Deviation (tolerance) "r" is based on the test machine master gauge used in production. The deviation "r" is always given in 1/100 mm. Example: "26" signifies $r = 0.26$ mm

R_o - Length of test machine master gauge used. " R_o " = 59.20 mm



R - Actual dimension between crown wheel and face of drive pinion at point with quietest running for this gear set.
 V_o - Hypoid offset

5 - Adjusting drive pinion and crown wheel

5.1 - Adjusting drive pinion and crown wheel

5.2 - General notes

- ♦ If the final drive is only being dismantled and re-assembled using the same parts, it is then only necessary to check the friction torque and the backlash.
- ♦ Careful adjustment of the drive pinion and crown wheel is important for the service life and smooth running of the final drive. For this reason, the drive pinion and crown wheel are matched together during manufacture,



and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the drive pinion in an axial direction and at the same time lifting the crown wheel out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.

- ♦ The object of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine in production. Maximum care and cleanliness are essential for achieving good results when performing repairs and taking measurements.
- ♦ The deviation "r", which is related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the crown wheel. The final drive set (drive pinion and crown wheel) must only be replaced together as a matched pair.

5.3 - Recommended sequence for adjusting gear set

When crown wheel and pinion shaft have to be adjusted, in the interests of a rational sequence, keep to the following order:

- 1.) Determine total shim thickness "Stotal" for "S1" + "S2" (adjust preload for taper roller bearings for differential) => Page 224 onwards.
- 2.) Determine total shim thickness "Stotal" for "S3" + "S4" (preload of taper roller bearings for pinion shaft) => Page 215 onwards.
- 3.) Distribute total shim thickness "Stotal" for "S3" + "S4" so that the distance from centre of crown wheel to face of pinion shaft is the same as distance "R" which was determined during production => Page 220 onwards.
- 4.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash exists between crown wheel and drive pinion => from Page 227 .

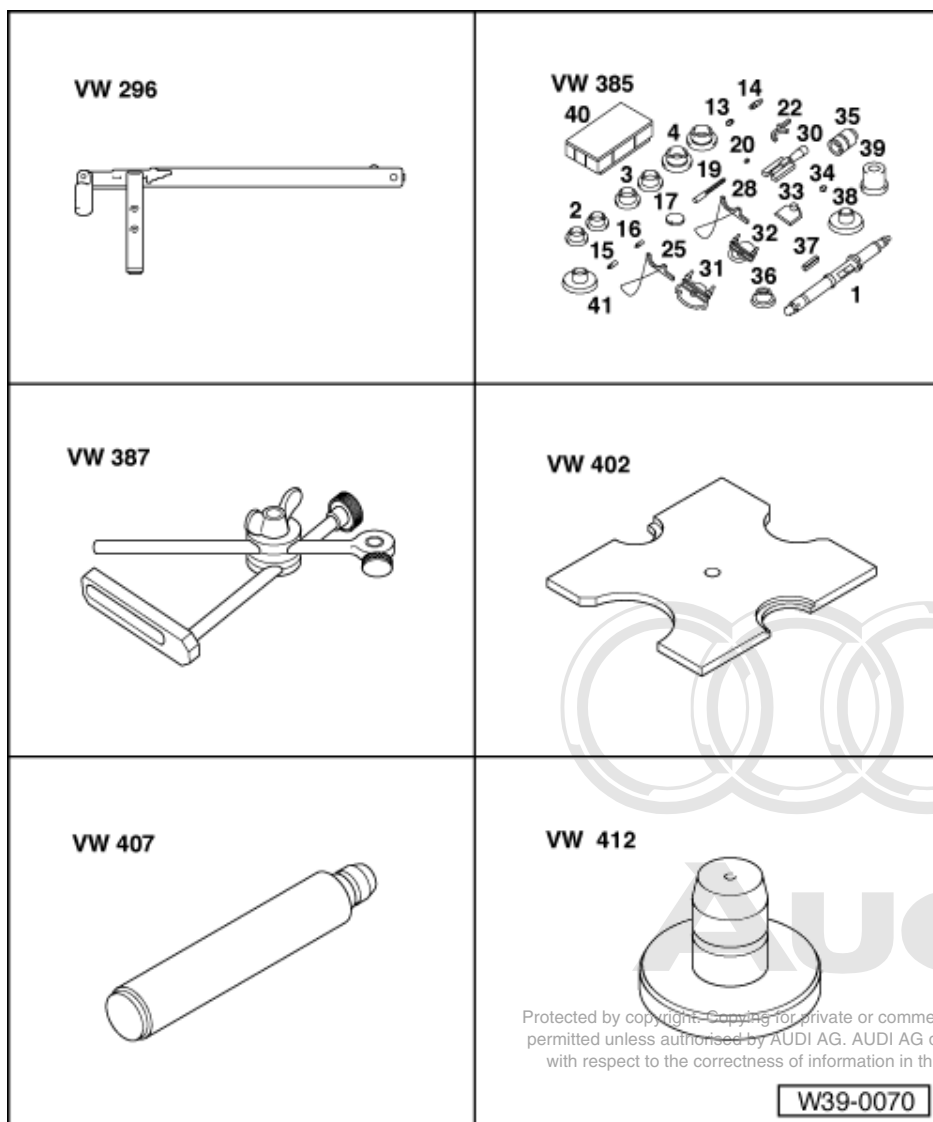
Note:

Overview of components and shims =>Page 203 .



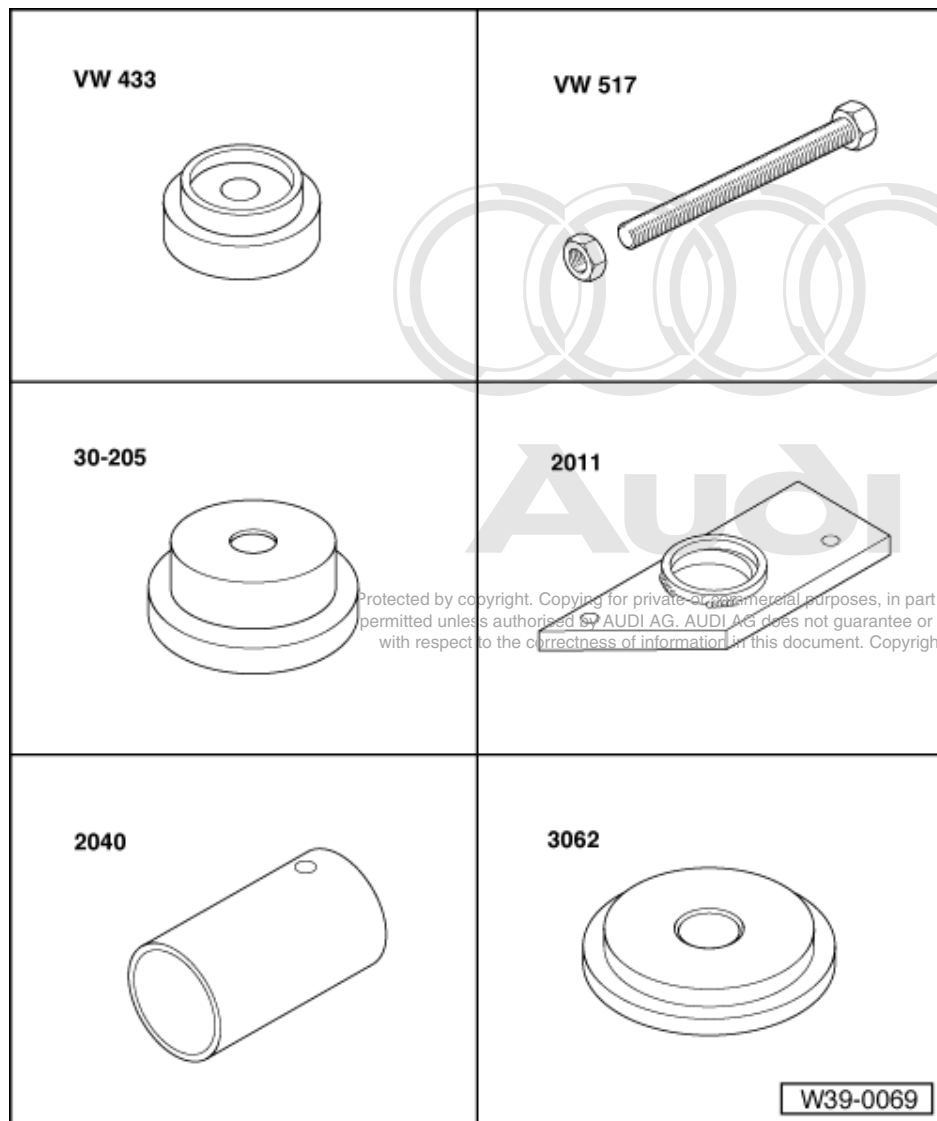
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5.4 - Adjusting drive pinion



Special tools, testers and workshop equipment required

- ◆ VW 296 Pressing-out lever for gear set
- ◆ VW 385 Universal measuring tool
- ◆ VW 387 Universal dial gauge holder
- ◆ VW 402 Pressure plate
- ◆ VW 407 Thrust tool
- ◆ VW 412 Thrust tool



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Special tools, testers and workshop equipment required

- ♦ VW 433 Thrust piece
- ♦ VW 517 Threaded stem
- ♦ 30-205 Thrust plate
- ♦ 2011 Support bridge
- ♦ 3110 Tube
- ♦ 3062 Thrust disk

Readjustment of the pinion shaft is required if

- ♦ Gearbox housing
- ♦ Taper roller bearings for pinion shaft

or

- ♦ Final drive

are replaced.

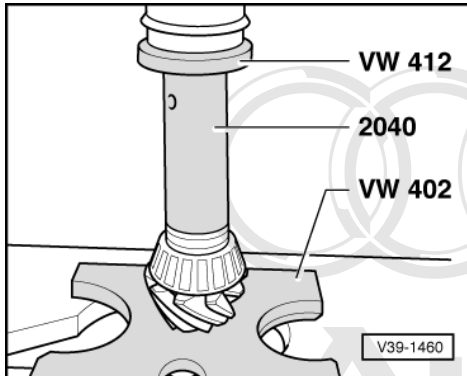
When replacing bushes for drive pinion, parking lock gear, output gear, spacer tube or cover for drive pinion, need only re-determine shim "S4".

Adjustment list => Page **205**

Notes:

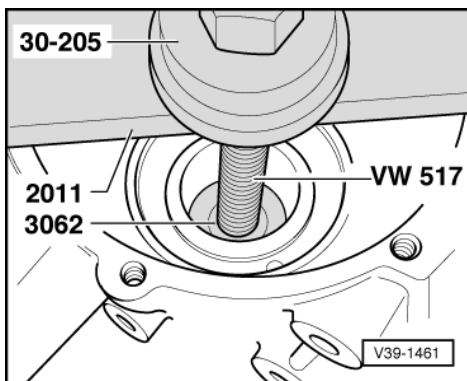
- ◆ If the old bearings are to be re-installed after dismantling the drive pinion, measure the friction torque of the old bearings before dismantling => Page **218**.
- ◆ The same friction torque must then be obtained after re-assembly with the old bearings (A friction torque up to 80 Ncm higher is also permissible).
- ◆ If new bearings are being installed, the friction torque does not have to be measured before dismantling. In this case the friction torque must be as specified for new bearings => Page **218**.

Determining total shim thickness "Stotal" for shims "S3" + "S4"

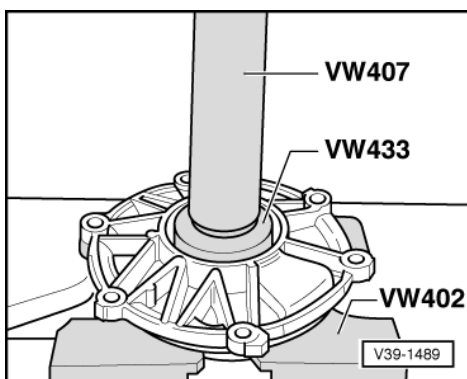


(Setting preload of taper roller bearing for drive pinion)

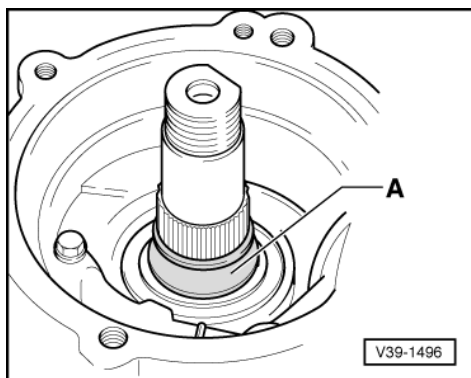
- -> Press on large taper roller bearing inner race with bush for drive pinion.



- -> Pull taper roller bearing outer race with shim "S3" (1.50 mm thick) into gearbox housing.



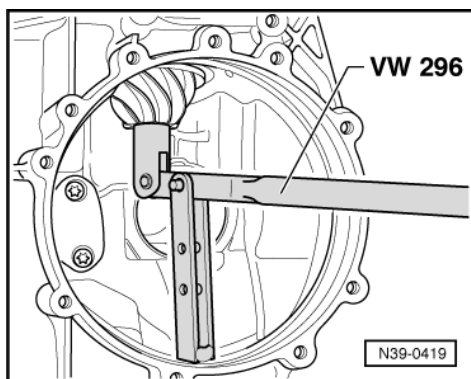
- -> Press taper roller bearing outer race into cover for drive pinion.



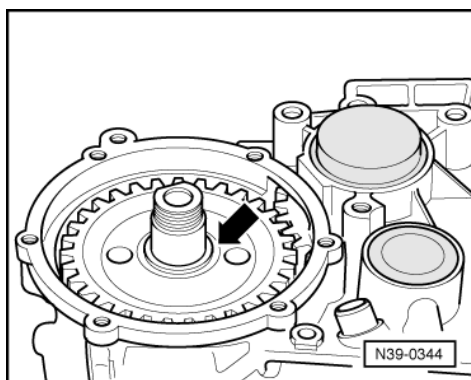
- -> Insert drive pinion in gearbox housing.

A - Assembly sleeve 3187

Use assembly sleeve 3187 when inserting drive pinion to avoid damaging the sealing lips.



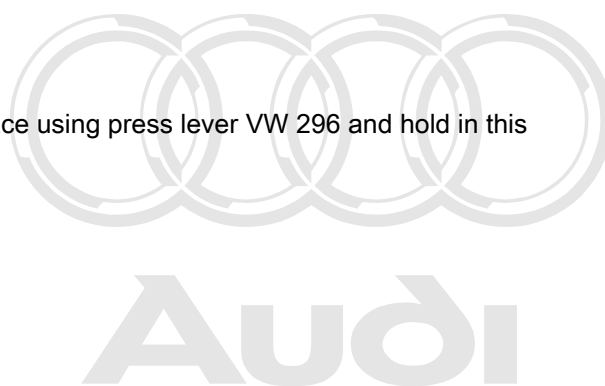
- -> Press drive pinion against taper roller bearing outer race using press lever VW 296 and hold in this position.



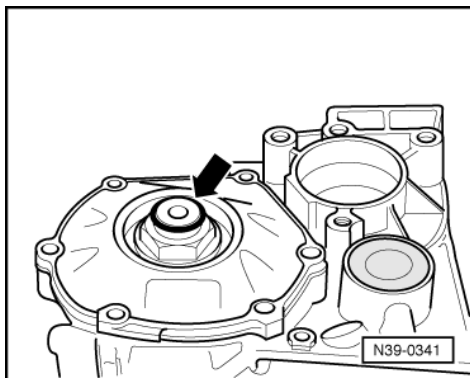
- -> Fit parking lock, gear, output gear and 2.40 mm thick shim "S4" -arrow- (use 2 x 1.20 mm shims).
- Slide on spacer tube.

Note:

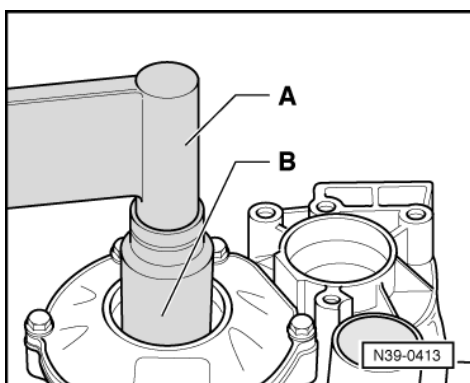
Installation position of parking lock gear, output gear and spacer => Page **183** onwards.



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- Fit cover for drive pinion.
- -> Insert taper roller bearing inner race and screw hexagon nut -arrow- onto drive pinion.
- Tighten the four bolts for drive pinion cover to 25 Nm.
- Engage parking lock.

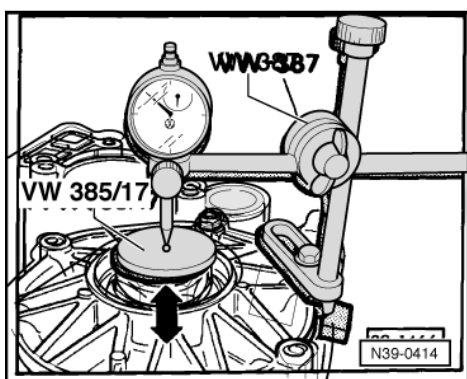


- -> Preload hexagon nut to 340 Nm.

A - Torque wrench

B - Wrench socket (41 mm AF)

- Loosen hexagon nut and tighten to 240 Nm.



- -> Secure dial gauge bracket VW 387 to drive pinion cover and place end dimension plate VW 385/17 on drive pinion.
- Insert dial gauge and set to "0" with 1 mm preload.
- Move drive pinion up and down several times without turning it.

Note:

If the drive pinion is turned, this will give an incorrect measurement.

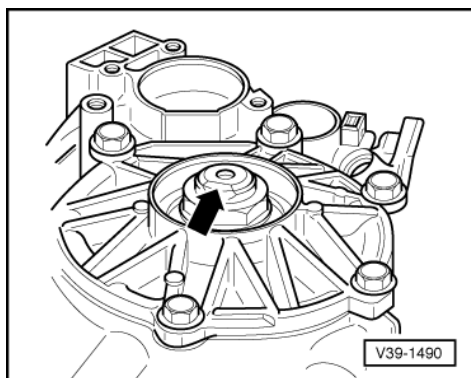
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- Read off axial play on dial gauge and note reading.
- Measurement in following example: 0.95 mm.
- Subtract measured value, bearing preload and settling level from shim "S4" fitted.

Example:

Inserted shim "S4"	2.40 mm
- Measured value	0.95 mm
- Bearing preload and settling level	0.25 mm
= Thickness of shim "S4" to be fitted	1.20 mm

- Remove cover for drive pinion, spacer tube and 2.40 mm shim.



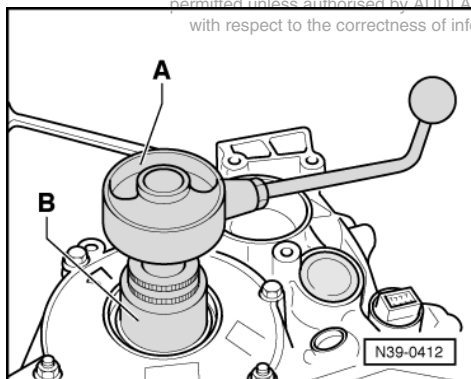
- Install shim with the thickness calculated (1.20 mm in example). Table of shims for "S4" => Page 221 .
- -> Install cover for drive pinion. Preload hexagon nut to 340 Nm, then loosen nut and tighten again to 240 Nm. Secure with punch -arrow-.

Measuring friction torque (check)

Notes:

- ♦ The output gear must be removed if the friction torque of the drive pinion is to be measured with the planetary gearbox and input gear installed.
- ♦ In the place of the output gear, fit a bush pressed out of a defective output gear. Measure thickness of bush, and use shims "S4" to compensate for any difference in thickness between the bush and the previously removed output gear => table on page 221 .
- Input gear and differential removed.

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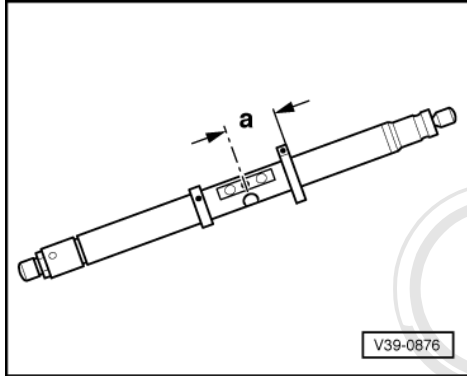


- -> Apply 41 mm AF socket insert -A- and torque gauge 0 ... 600 Ncm -B- to drive pinion nut.
- Read off friction torque. For new taper roller bearings, specified value is 80... 220 Ncm

Note:

If the old bearings have been re-installed, the friction torque should now be the same as the total friction torque measured before dismantling. (A friction torque up to 80 Ncm higher is also permissible).

Determining measurement "e"

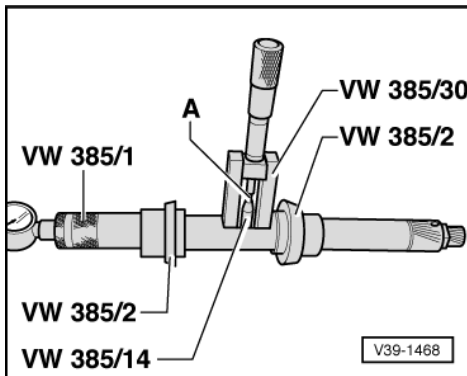


Note:

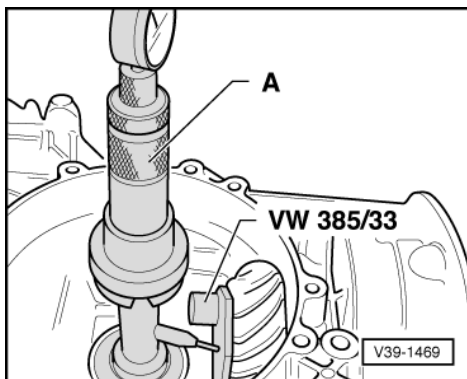
Measurement "e" is required to determine the final shim thickness of "S3" and "S4".

- -> Set universal mandrel VW 385/1 setting ring to dimension $a = 70 \text{ mm}$.

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- -> Arrange universal mandrel as illustrated.
- A - Measuring gauge extension VW 385/16 = 12.3 mm.
- Set universal master gauge VW 385/30 to $R_o = 59.2 \text{ mm}$.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.



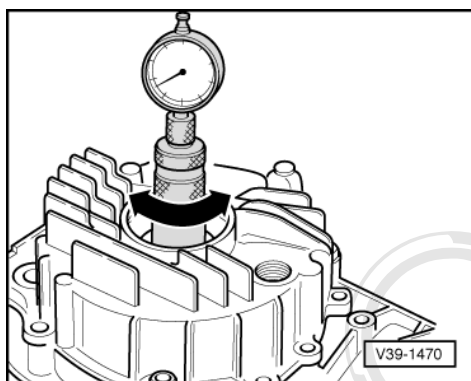


- -> Place end measuring plate on face of drive pinion.

Note:

Ensure plate contact surface fits exactly and is free of oil.

- Insert universal mandrel -A-.
- Fit final drive cover and alternately tighten 4 bolts.
- Using sliding setting ring to pull 2nd centring disc outwards until mandrel can still just be turned by hand.



- -> Turn mandrel until the dial gauge point touches the end measuring plate on drive pinion head, then measure maximum deflection (return point).
- Measurement in following example: "e" = 0.32 mm (in red scale on dial)

Note:

Then, (after removing universal mandrel) check again that the dial gauge, with master gauge VW 385/30 in place, indicates "0" with 2 mm preload. Otherwise correct adjustments.

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Determining thickness of shim "S3"

Example:

- Add measured value "e" to already inserted shim "S3" thickness and subtract dimension "r" (given on crown wheel).

Notes:

- ♦ The deviation "r", which is related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the crown wheel.
- ♦ If dial gauge reading is in red scale, dimension "e" must be added.
- ♦ If dial gauge reading is in black scale, dimension "e" must be subtracted.

Inserted shim "S3"	1.50 mm
+ Determined value "e"	0.32 mm
- Deviation "r"	0.26 mm
= Thickness of shim "S3"	1.56 mm

- Determine shim(s) as accurately as possible from table. Part numbers

=> Parts catalogue

Determining thickness of shim "S4"

- Add measured value "e" to already inserted shim "S4" thickness and subtract dimension "r".

Example:

Inserted shim "S4"	1.20 mm
+ Determined value "e"	0.32 mm
- Deviation "r"	0.26 mm
= Thickness of shim "S4"	1.26 mm

- Determine shim(s) as accurately as possible from table. Part numbers

=> Parts catalogue

Notes:

- ♦ If a thicker "S3" shim is required then a thicker "S4" (same difference) must be installed.
- ♦ If a thinner "S3" shim is required then a thinner "S4" (same difference) must be installed.

Shim "S3" table

Thickness of shims in mm			
1.05	1.30	1.55	1.80
1.10	1.35	1.60	1.85
1.15	1.40	1.65	
1.20	1.45	1.70	
1.25	1.50	1.75	

Shim "S4" table

Thickness of shims 1) in mm				
1.000	1.225	1.450	1.675	1.900
1.025	1.250	1.475	1.700	1.925
1.050	1.275	1.500	1.725	1.950
1.075	1.300	1.525	1.750	1.975
1.100	1.325	1.550	1.775	2.000
1.125	1.350	1.575	1.800	2.400
1.150	1.375	1.600	1.825	
1.175	1.400	1.625	1.850	
1.200	1.425	1.650	1.875	

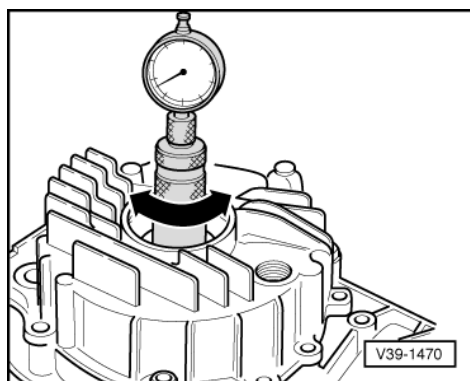
- 1) Shim tolerance variations make it possible to find the exact shim thickness required for "S4", use 2 shims if necessary.

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Performing check measurement

Checking dimension "r"

- Install drive pinion with measured shims "S3" and "S4" and turn in both directions several times.



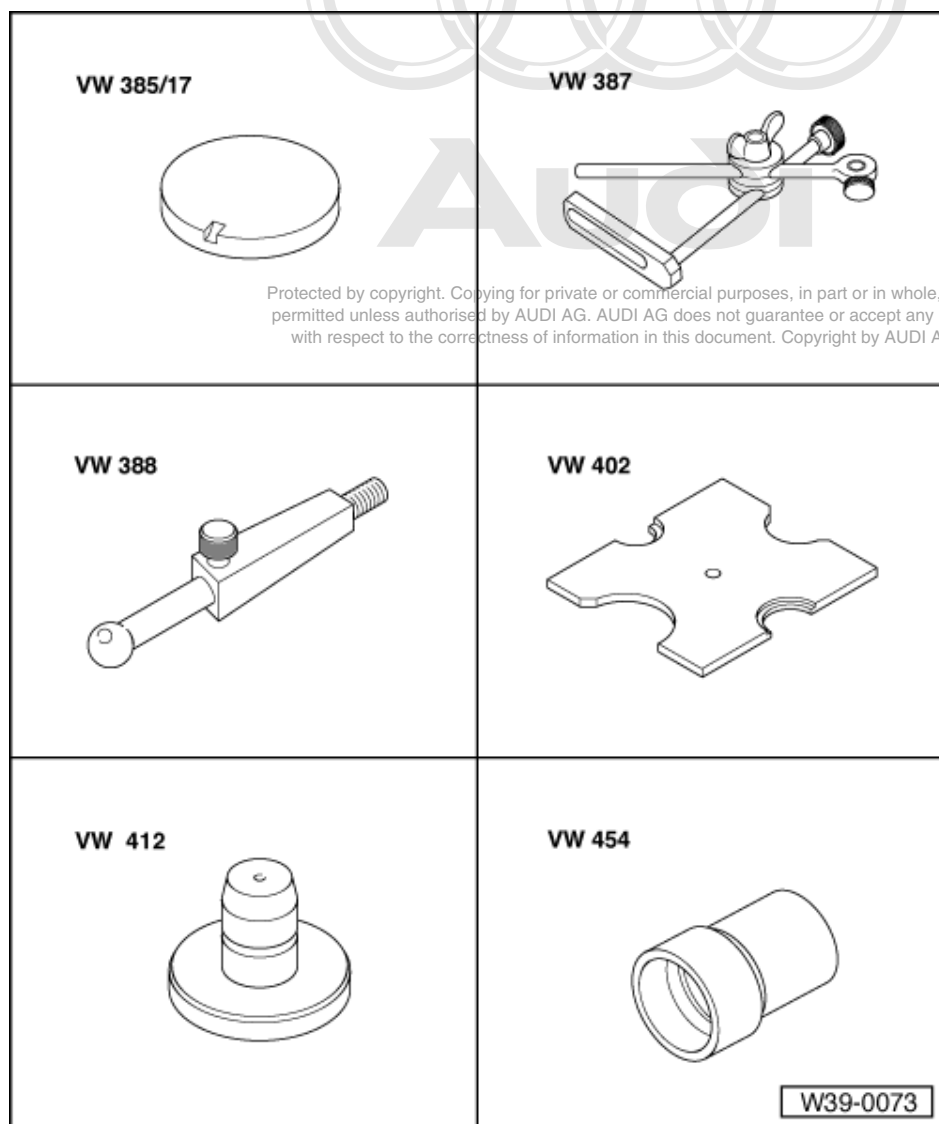


- -> Insert universal mandrel => "Determining measurement `e`" on Page 219 , and perform check measurement.
- Read off dial gauge anti-clockwise (red scale).
 - If the shims have been correctly selected, the deviation "r" (marked on outer circumference of crown wheel) must be shown within a tolerance of ± 0.04 mm.

Note:

Then, (after removing universal mandrel) check again that the dial gauge, with master gauge VW 385/30 in place, indicates "0" with 2 mm preload. Otherwise correct adjustments.

5.5 - Adjusting crown wheel

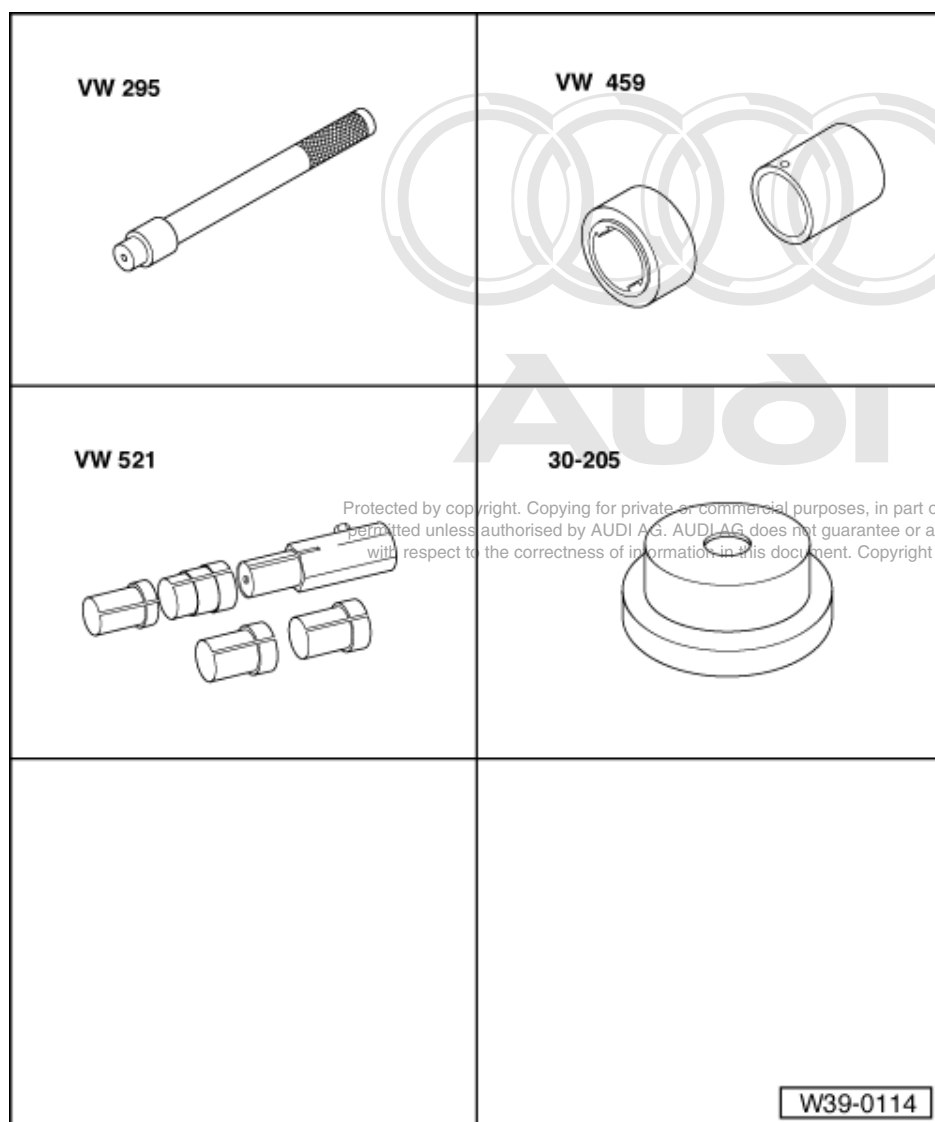


(Adjusting differential)

Special tools, testers and workshop equipment required

- ♦ VW 385/17 End measuring plate
- ♦ VW 387 Universal dial gauge holder
- ♦ VW 388 Test lever
- ♦ VW 402 Pressure plate
- ♦ VW 412 Thrust tool

♦ VW 454 Thrust piece



Special tools, testers and workshop equipment required

- ♦ VW 295 Drift
- ♦ VW 459/2 Installing and removing tool
- ♦ VW 521 Adjustment tool for crown wheel
- ♦ 30-205 Thrust plate

It is necessary to readjust the crown wheel when:

- ♦ Gearbox housing
- ♦ Cover for differential
- ♦ Differential taper roller bearings
- ♦ Differential housing

or

- ♦ Final drive

are replaced.

Adjustment list => Page 205

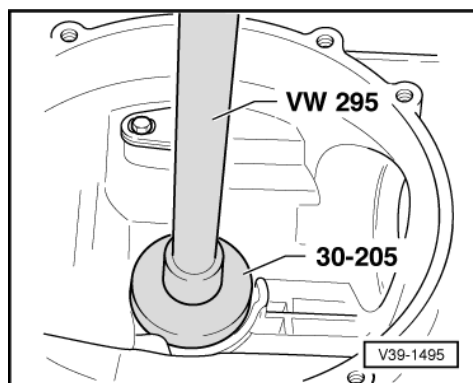
Notes:

- ♦ If the old bearings are to be re-installed after dismantling the differential, measure the friction torque of the old bearings before dismantling => Page 226 .
- ♦ The same friction torque must then be obtained after re-assembly with the old bearings (A friction torque up to 80 Ncm higher is also permissible).
- ♦ If new bearings are being installed, the friction torque does not have to be measured before dismantling. In this case the friction torque must be as specified for new bearings => Page 226 .

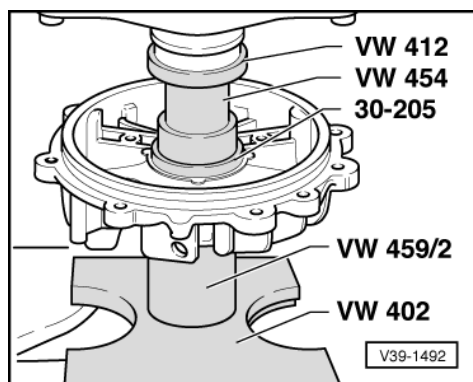
Determining total shim thickness "Stotal" for shims "S1" + "S2"

(Setting preload of taper roller bearing for differential)

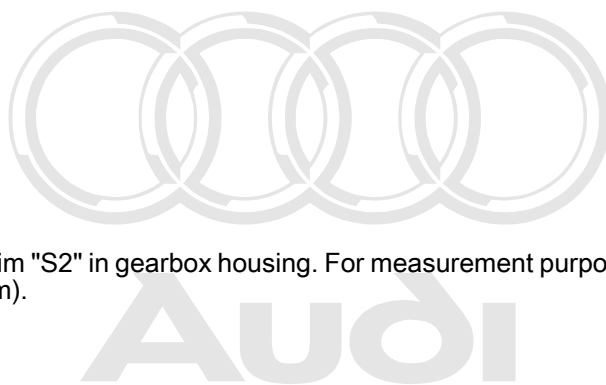
- Drive pinion removed
- Remove oil seal, drive gear for speedometer sender -G22 and outer races of both taper roller bearings for differential.



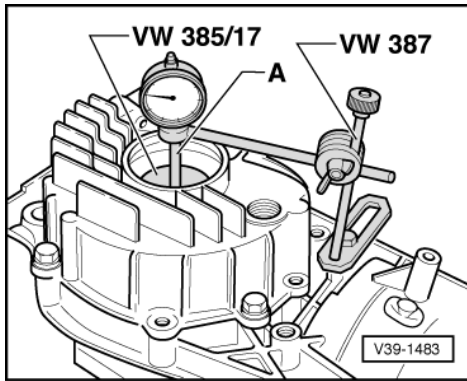
- Remove shims => Page 194 .
- -> Drive in outer race for taper roller bearing with shim "S2" in gearbox housing. For measurement purposes use a 1.50 mm thick "S2" shim (2 shims of 0.75 mm).



- -> Press taper roller bearing outer race without shim "S1" into the final drive cover.
- Fit differential into gearbox housing.
- Fit cover and tighten bolts to 25 Nm.



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- -> Secure dial gauge bracket VW 387 to housing and place end dimension plate VW 385/17 on differential.
- Set dial gauge to "0" with 1 mm preload.
- Move differential up and down several times without turning it.

Note:

If the differential is turned, this will give an incorrect measurement.

- Read off axial play on dial gauge and note reading.

- Measurement in following example: 0.60 mm.

Formula:	
"Stotal" = "S2*" + measurement + bearing preload	

Example:	
Inserted shim(s) "S2*"	1.50 mm
+ Measurement	0.60 mm
+ Bearing preload (constant)	0.40 mm
= Total shim thickness "Stotal" for shims "S1" + "S2"	2.50 mm

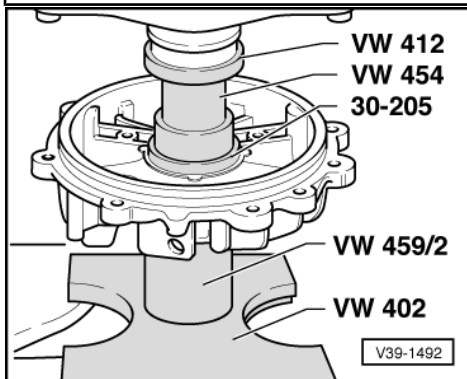
Determining thickness of shim "S1*"

Notes:

- ♦ The preliminary adjustment shim "S1*" will be replaced with the final shim "S1" after determining the backlash.
- ♦ The total shim thickness "Stotal" remains the same.

Formula:	
"S1*" = "Stotal" - "S2*"	

Example:	
Total shim thickness "Stotal" for shims "S1" + "S2"	2.50 mm
- Inserted shim(s) "S2*"	1.50 mm
= Thickness of shim "S1*"	1.00 mm

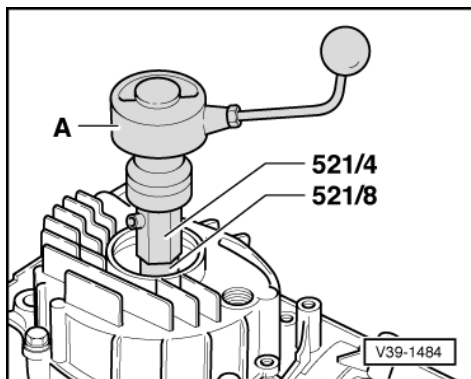


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- -> Press shim "S1" with correct thickness (1.00 mm in example) and outer race for taper roller bearing into the final drive cover.
- Fit cover and tighten bolts to 25 Nm.

Measuring friction torque (check)

- Drive pinion removed
- Differential fitted with shims "S1*" and "S2*"



- -> Apply torque gauge 0 ... 600 Ncm -A- onto differential.
- Read off friction torque. For new taper roller bearings, specified value is 70... 150 Ncm

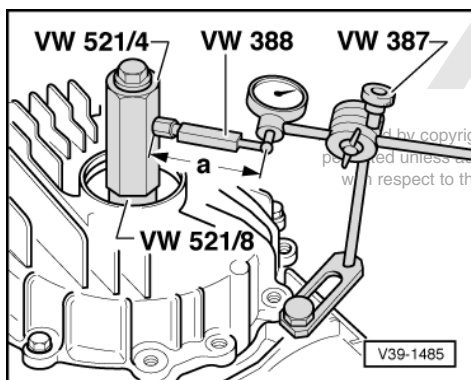
Notes:

- ♦ If the old bearings have been re-installed, the friction torque should now be the same as the total friction torque measured before dismantling. (A friction torque up to 80 Ncm higher is also permissible).
- ♦ If the final drive gear set is being re-adjusted, now perform adjustment of drive pinion and check the setting as described => Page 213 .

Adjusting backlash

(Position of crown wheel in gearbox housing)

- Drive pinion and shims "S3" and "S4" installed
- Install differential.
- Fit final drive cover and tighten bolts to 25 Nm.
- Turn differential several times in both directions so that the taper roller bearings settle.

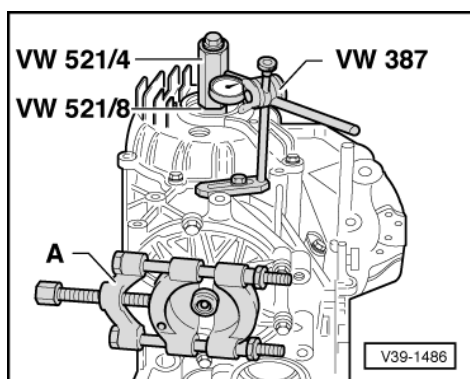


- -> Secure dial gauge retainer VW 387 to the housing.
- Insert adjustment tool for crown wheel VW 521/4 and VW 521/8.
- Set measuring lever VW 388 to dimension "a" = 70 mm.

Measure play between teeth flanks (backlash) as follows:

- Turn crown wheel until it makes contact with a tooth flank (end of backlash travel).

- Set dial gauge to "0" with 1 mm preload.
- Turn crown wheel back until it makes contact with the opposite tooth flank.
- Read off backlash and note reading.



- -> If the drive pinion also turns when taking the measurement, attach clamping tool -A- (e.g. Kukko 17/2) to lock drive pinion.
- Turn crown wheel through 90° in each case and repeat measurement a further 3 times.

Note:

Clamping tool -A- is to be unfastened for further turning of crown wheel.

Determining average backlash

- Add the four measured values together and divide by four.

Example:	
1st Measurement	0.49 mm
+ 2nd Measurement	0.48 mm
+ 3rd Measurement	0.50 mm
+ 4th Measurement	0.49 mm
= Sum of measured values	1.96 mm

- Result: The average backlash is 1.96 divided by 4 = 0.49 mm

Note:

If the individual measurements differ by more than 0.06 mm this means that the installation of the crown wheel is not correct or that the final drive set itself is defective. Check installation, replace final drive set if necessary.

Determining thickness of shim "S2"

- Multiply the backlash figure by 1.17 (constant value), subtract the result from the thickness of the already inserted shim "S2" (1.50 mm in example), and add 0.20 mm for lift (constant value).

Example:	
Inserted shim "S2"	1.50 mm
- Average backlash (0.49 mm x 1.17)	0.57 mm
+ Lift (constant)	0.20 mm
= Thickness of shim "S2"	1.13 mm

- Determine shim(s) as precisely as possible in line with table, => Page 228 . Part numbers

=> Parts catalogue

Determining thickness of shim "S1"

Formula:

$$\text{"S1"} = \text{"Stotal"} - \text{"S2"}$$

Example:

Total shim thickness "Stotal" for "S1" + "S2"	2.50 mm
- Thickness of shim "S2"	1.13 mm
= Thickness of shim "S1"	1.37 mm

- Determine shim(s) as accurately as possible from table. Part numbers

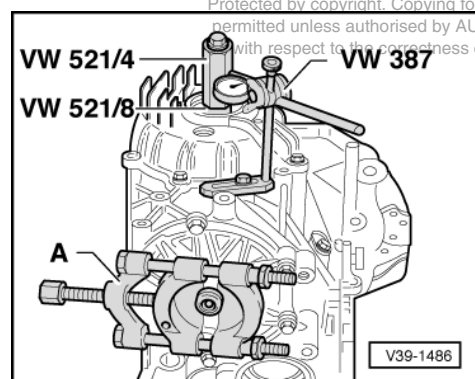
=> Parts catalogue

Table of shims "S1" or "S2"

Thickness of shims 1) in mm		
0.55	0.75	0.95
0.60	0.80	1.00
0.65	0.85	1.05
0.70	0.90	

- 1) Shim tolerance variations make it possible to find the exact shim thickness required for "S1" or "S2", use 2 shims if necessary.

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-> Performing check measurement

- After installing shims "S1" and "S2", turn the differential 5 turns in both directions so that the taper roller bearings settle.
- Measure backlash four times on circumference.
 - Specification: 0.15 ... 0.25 mm