

## Audi A8 1994 ➤

### 5-Speed Manual Gearbox 01A Four-Wheel Drive

Gearbox ID	CSU	CUU	CVT	DDN	DJU				
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Edition 06.1997



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List of Workshop Manual Repair GroupsList of Workshop Manual  
Repair GroupsList of Workshop Manual Repair Groups  
**Audi A8 1994 ➤**

**5-Speed Manual Gearbox 01A Four-Wheel Drive**

## Repair Group

00 - Technical data

30 - Clutch

34 - Controls, Housing

35 - Gears, Shafts

39 - Final drive, Differential rear

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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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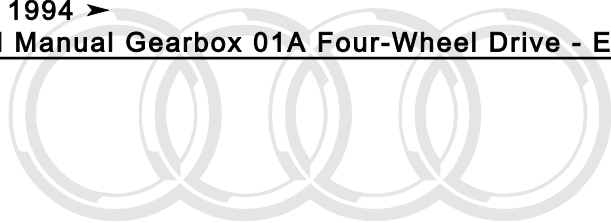
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**Audi A8 1994 ➤**

**Audi 5-Speed Manual Gearbox 01A Four-Wheel Drive - Edition 06.1997**

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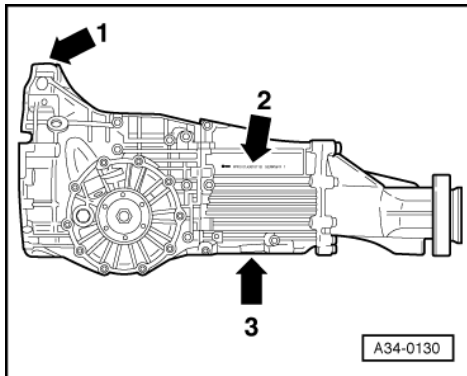
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## 00 - Technical data

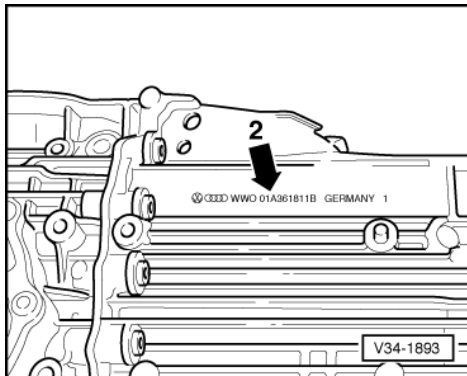
### 1 - Gearbox identification

#### 1.1 - Gearbox identification

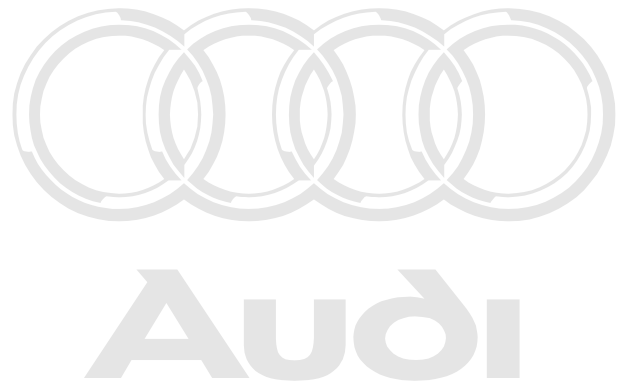
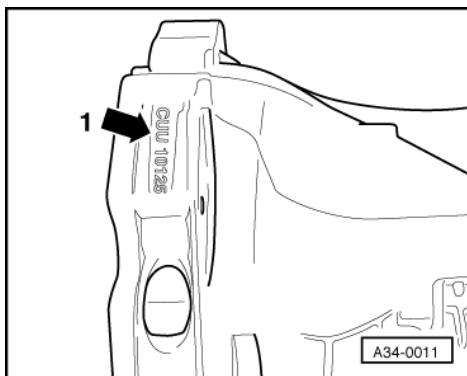


-> Location on gearbox

Code letters and date of manufacture (arrow 1)  
Manual gearbox 01A (arrow 2)  
Code letters (arrow 3)



-> Manual gearbox 01A (arrow 2)



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

<b>Example:</b>	CUU	10	12	5
	Code letters Day Month			Year (1995) of manufacture

Additional information relates only to production.

**Note:**

The gearbox code letters are also stamped on the lower part of the gearbox cover and shown on the vehicle data stickers.

## 1.2 - Code letters, gearbox allocation, ratios, capacities

Manual gearbox		5-speed 01A four-wheel drive		
Code letters		CSU	CVT	CUU
Manufactured	from	05.94	08.94	01.95
	to	10.94	03.95	03.96
Allocation	Model	Audi A8 1994 ►	Audi A8 1994 ►	Audi A8 1994 ►
	Engine	2.8 ltr - 128 kW	2.8 ltr - 128 kW	2.8 ltr - 128 kW
Ratios Z2 : Z1 = i	Final drive	37 : 9 = 4.111	37 : 9 = 4.111	37 : 9 = 4.111
	1st gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	35 : 19 = 1.842	35 : 19 = 1.842	35 : 19 = 1.842
	3rd gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th gear	33 : 35 = 0.943	33 : 35 = 0.943	33 : 35 = 0.943
	5th gear	30 : 38 = 0.789	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444

Code letters	CSU	CVT	CUU
Speedometer	electronic		
Capacity	2.75 litres		
Specification	Gear oil G 052 911 A SAE 75 W-90 (synthetic oil)		
Clutch mechanism	hydraulic		
Clutch plate dia.	240 mm	240 mm	240 mm
Drive shaft flange dia.	130 mm		
Overall ratio i <sub>ov</sub> in top gear	3.246	3.246	3.246
Allocation: rear final drive (code letters)	CGV	CGV	CGV

Manual gearbox		5-speed 01A four-wheel drive	
Code letters		DDN	DJU
Manufactured	from	03.96	07.96
	to	07.96	
Allocation	Model	Audi A8 1994 ►	Audi A8 1994 ►
	Engine	2.8 ltr 5V- 142 kW	2.8 ltr 5V- 142 kW



Manual gearbox		5-speed 01A four-wheel drive	
<b>Ratios</b>	Final drive	37 : 9 = 4.111	37 : 9 = 4.111
Z2 : Z1=i	1st gear	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	35 : 18 = 1.944	35 : 18 = 1.944
	3rd gear	39 : 30 = 1.300	39 : 30 = 1.300
	4th gear	33 : 35 = 0.943	33 : 35 = 0.943
	5th gear	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse gear	31 : 9 = 3.444	31 : 9 = 3.444

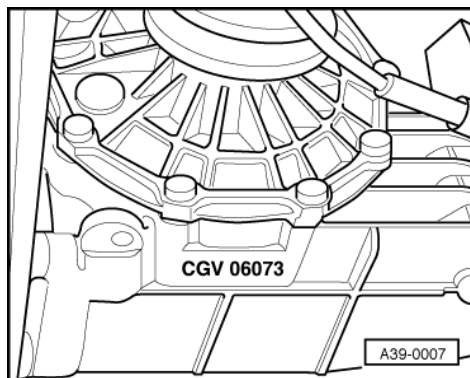
Code letters	DDN	DJU
<b>Speedometer</b>	electronic	
<b>Capacity</b>	2.75 litres	
<b>Specification</b>	Gear oil G 052 911 A SAE 75 W 90 (synthetic oil)	
<b>Clutch mechanism</b>	hydraulic	
Clutch plate dia.	240 mm	240 mm
Drive shaft flange dia.	130 mm	
Overall ratio iov in top gear	3.246	3.246
Allocation: rear final drive (code letters)	CGV	CGV DNU

## 2 - Identification of rear final drive

### 2.1 - Identification of rear final drive

Final drive 01R is fitted in conjunction with manual gearbox 01A (four-wheel drive).

Allocation => Page **4**



-> Code letters and date of manufacture of rear final drive:

<b>Example:</b>	<b>CGV</b>	<b>06</b>	<b>07</b>	<b>3</b>
	Code letters	Day	Month	Year (1993) of manufacture

**Note:**

*The code letters of the rear final drive are also included on the vehicle data stickers.*

**2.2 - Code letters, allocation, ratios and capacities**

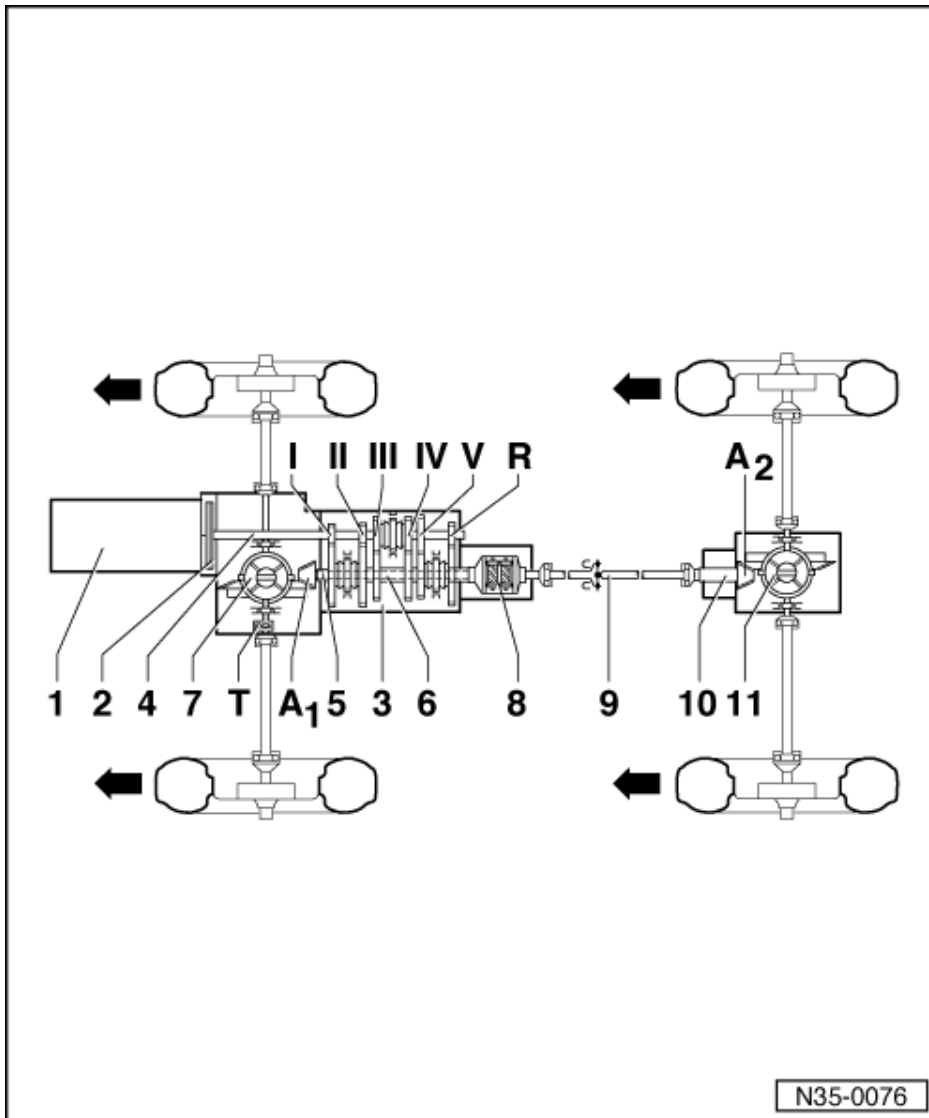
Rear final drive		01R	
Code letters		CGV	DNU
Manufactured	from to	11.93	01.97
Allocation	Model Engine	Audi A8 1994 ► 2.8 ltr 128 kW 2.8 ltr 5V 142 kW	Audi A8 1994 ► 2.8 ltr 5V 142 kW
Ratios	Final drive	37 : 9 = 4.111	37 : 9 = 4.111
Capacity		1.5 ltr	
Specification		Gear oil GL 5 SAE 90 (MIL-L 2105 B)	
Drive shaft flange dia.		108 mm	108 mm
Allocation: manual gearbox (code letters)		CSU CVT CUU DDN DJU	DJU

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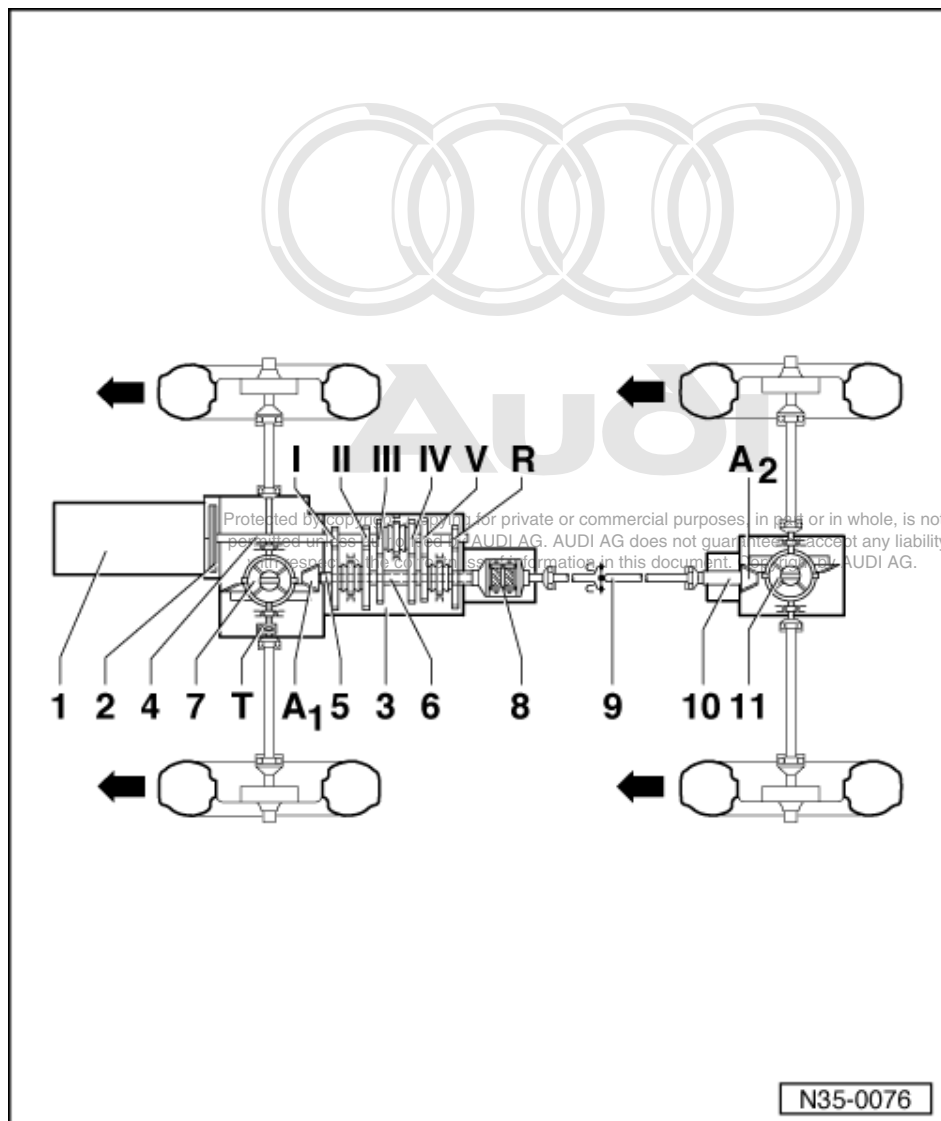
### 3 - Transmission layout

#### 3.1 - Transmission layout



- 1 Engine
- 2 Clutch
- 3 Gearbox
- 4 Input shaft (main shaft)
- 5 Front drive pinion (output shaft)
- 6 Hollow shaft
- 7 Front differential
- 8 Torsen differential
- 9 Propshaft
- 10 Rear drive pinion
- 11 Rear differential

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- I - 1st gear
- II - 2nd gear
- III - 3rd gear
- IV - 4th gear
- V - 5th gear
- R - Reverse gear
- A1 - Front final drive
- A2 - Rear final drive
- T - Speedometer drive

**Note:**

Arrows point in forward direction of travel.

### 3.2 - Notes on engine output/brake test and towing/tow starting

- ♦ Engine output and brake test

=> Special Information; Transmission; No. 8

- ♦ Tow-starting and towing

=> Booklet; Maintenance

## 4 - Calculations

### 4.1 - Calculations

### 4.2 - Calculating transmission ratios "i"

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#### Transmission ratio

Transmission ratio	= No. of teeth driven gear	: No. of teeth drive gear
--------------------	----------------------------	---------------------------

Ratios	Formula
iG = gear ratio	ZG2 : ZG1
iA = axle ratio	ZA2 : ZA1
iov = overall ratio	iG x iA

<b>Example:</b>		
	<b>5th gear</b>	<b>Final drive</b>
Drive gear	ZG1 = 38	ZA1 = 9
Driven gear	ZG2 = 30	ZA2 = 37

<b>Calculating:</b>	
iG	= 30 : 38 = 0.789
iA	= 37 : 9 = 4.111
iov	= (30 : 38) x (37 : 9) = 0.789 x 4.111 = 3.246

## 5 - Repair instructions

### 5.1 - Repair instructions

### 5.2 - Contact corrosion

Contact corrosion can occur if non-approved fasteners are used on the vehicle (bolts, nuts, washers etc.).

For this reason the manufacturer installs only fasteners with a special surface coating (Dachromet). These parts can be identified by their greenish colour.

Rubber, plastic and adhesives also consist of non-conductive materials.

If you are not sure whether used parts can be re-installed, always fit new parts.



**Warning!**

- ♦ Use only Genuine Audi A8 Parts.
- ♦ Accessories must be approved by AUDI
- ♦ Damage resulting from contact corrosion is not covered by the warranty.

### 5.3 - General repair instructions

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 summarized here. They apply to this Workshop Manual.

#### Special tools

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

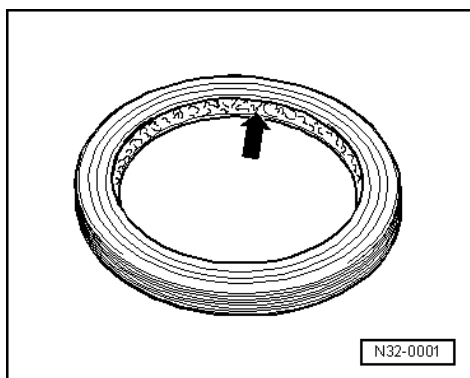
=> Booklet; Special tools, Workshop equipment

#### Gearbox

- ♦ When exchanging the manual gearbox or rear final drive, check oil level and top-up if necessary => Page **181**.
- ♦ Capacities and specifications => from Page **4**.
- ♦ Thoroughly clean all connections and the surrounding area before disconnecting.
- ♦ When installing gearbox, ensure dowel sleeves are correctly seated.

#### O-rings, seals, gaskets

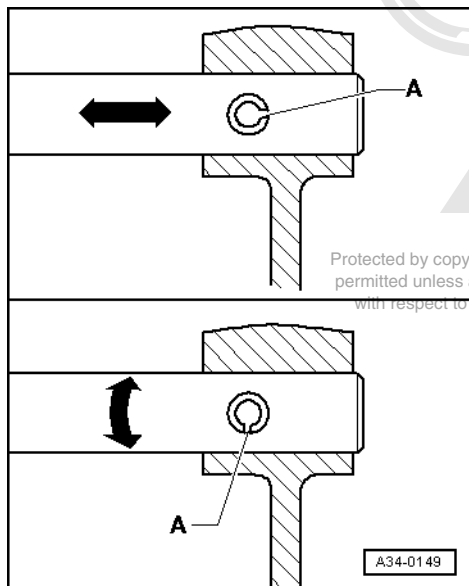
- ♦ Always renew O-rings, seals and gaskets.
- ♦ After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.
- ♦ Thoroughly clean housing joint surfaces before assembling.



- ♦ -> Before installing radial shaft oil seals, lightly oil outer edge and fill space between sealing lips -arrow- with grease.
- ♦ The open side of the oil seals faces toward the side with fluid filling.
- ♦ When replacing oil seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).
- ♦ Lightly oil O-rings before installing; this prevents the rings being crushed when inserting.
- ♦ Check oil level after renewing gaskets and seals =>Page **181**.

## Sealants

- ◆ Thoroughly clean housing joint surfaces before applying sealing paste.
- ◆ Apply sealing paste AMV 188 000 02 thinly and evenly.
- ◆ Breather holes must remain free of sealing paste.



## Locking elements

- ◆ Always renew circlips.
- ◆ Do not overstretch circlips.
- ◆ Circlips must locate properly in the groove.
- ◆ -> Renew spring pins. Position: slit -A- should be in line with the line of force -arrow-.

## Nuts, bolts

- ◆ Loosen nuts or bolts, opposite to tightening sequence.
- ◆ Tighten and loosen bolts and nuts for securing covers and housings in a diagonal sequence.
- ◆ Especially delicate parts, such as clutch pressure plates, must not be distorted. Loosen and tighten bolts and nuts in stages in a diagonal sequence.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.
- ◆ Renew self-locking bolts and nuts.
- ◆ The threads of bolts which are secured by a locking fluid should be cleaned with a wire brush. 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. tap). Otherwise there is a danger of bolts shearing when subsequently being removed.

## 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.
- ◆ Grease needle bearing for gearbox input shaft in rear of flywheel.
- ◆ Lubricate all bearings in gearbox housing with gear oil before installing.
- ◆ Heat inner races of taper roller bearings to approx. 100 °C before installing. Press in onto stop when installing so there is no axial clearance.
- ◆ 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.
- ◆ The taper roller bearings for the output shaft and the differential in the gearbox are low-friction bearings. Do not additionally oil new taper roller bearings when measuring friction torque. The bearings are pre-treated at the factory with a special type of oil for this purpose.



### **Shims**

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

### **Gears, synchro-hubs, inner races for sliding gears**

- ♦ Heat gears and synchro-hubs to approx. 100 °C before installing. Press in onto stop when installing so there is no axial clearance.
- ♦ Heat inner races for sliding gears to approx. 100 °C when installing.
- ♦ The temperature can be checked with Temperature tester V.A.G 1558.
- ♦ Observe installation position.

### **Sliding gears**

- ♦ After assembling, check axial clearance of 1st to 5th sliding gears and reverse sliding gear (0.15 ... 0.35 mm) and check for freedom of movement.

### **Synchroniser rings**

- ♦ Do not interchange synchroniser rings. When reusing always fit to the same gear.
- ♦ Check for wear, renew if necessary.
- ♦ Lubricate with gear oil before installing.

### **Clutch mechanism**

- ♦ When removing gearbox, remove clutch slave cylinder without disconnecting pipes.
- ♦ Do not depress clutch pedal after removing slave cylinder. Otherwise the piston will be pressed out of the slave cylinder.
- ♦ Do not cant clutch pressure plate, loosen and tighten in a diagonal sequence and in stages.
- ♦ To reduce odour caused by a burnt clutch, thoroughly clean the clutch bellhousing, the flywheel and the parts of the engine facing the gearbox.



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## 30 - Clutch

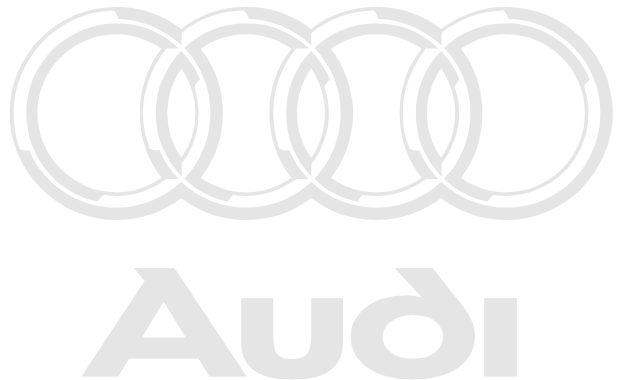
### 1 - Servicing clutch mechanism

#### 1.1 - Servicing clutch mechanism

Contact corrosion. Notes => Page **7** .

**Notes:**

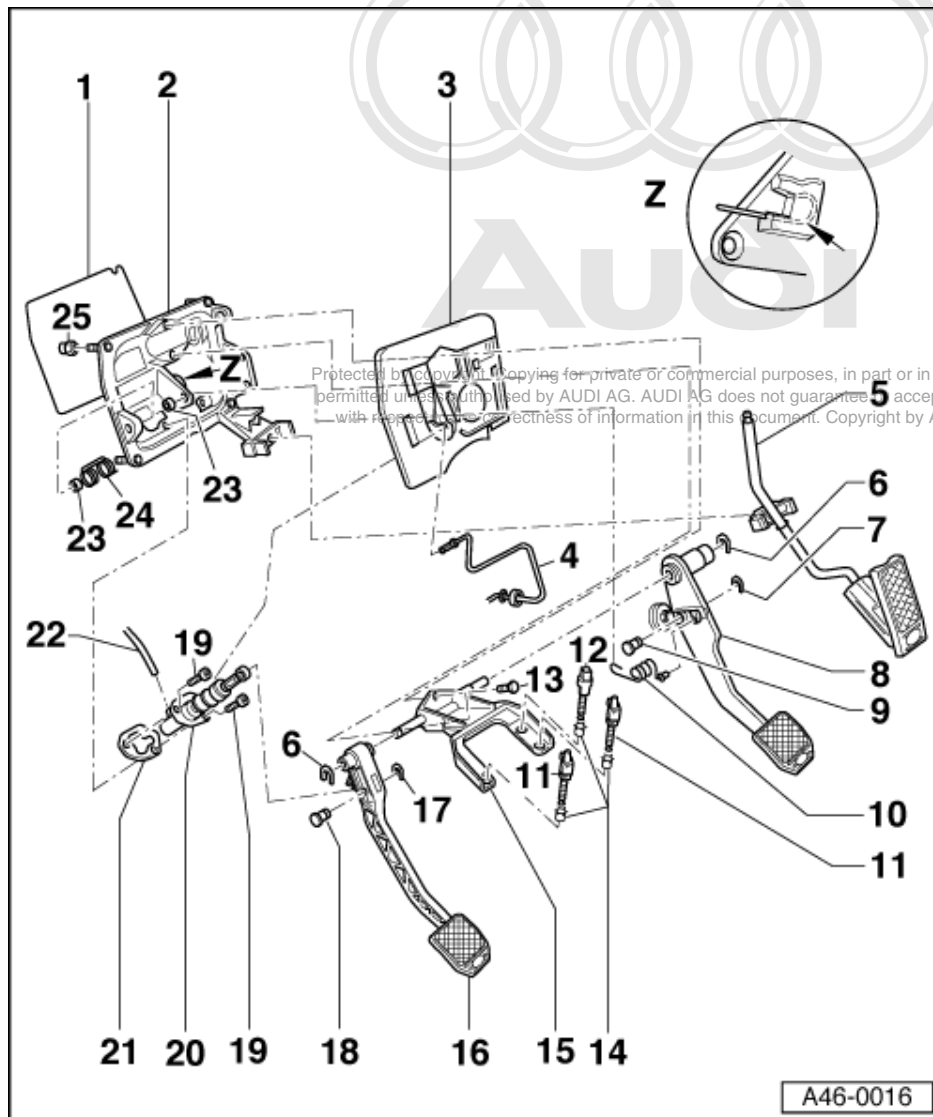
- ◆ For vehicles with coded radio, obtain and note the radio code.
- ◆ Disconnect battery earth strap with the ignition switched off.
- ◆ Lubricate all bearings and contact surfaces with G 052 142 A 2 polycarbamide grease.
- ◆ Make sure that no brake fluid escapes into the plenum chamber or onto the gearbox below. If this does happen, clean the affected areas thoroughly.
- ◆ When performing work in the footwell, put cloths on the carpet to protect it from possible brake fluid spills.



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## 1.2 - Assembly overview, pedal cluster



### 1 Butyl cord

- ♦ Always renew

### 2 Pedal bracket

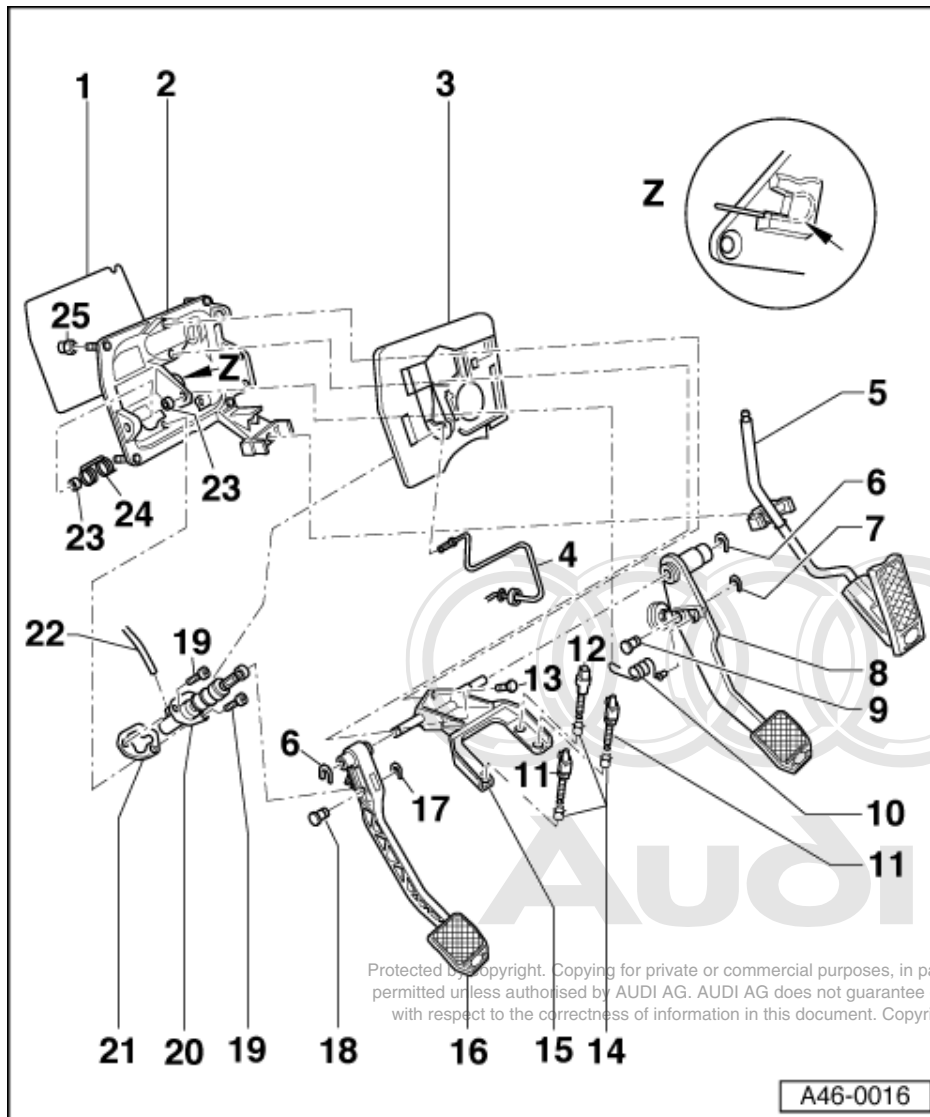
- ♦ Removing and installing

=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing pedal bracket Removing and installing pedal cluster Removing pedal bracket

### 3 Insulation

### 4 Pipe

- ♦ For clutch master cylinder
- ♦ With pipe union nut
- ♦ Tighten pipe union nut to 15 Nm



#### 5 Accelerator pedal

- ◆ Removing and installing

=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing pedal bracket Removing and installing pedal cluster Removing pedal bracket

#### 6 Circlip

- ◆ Renew
- ◆ Fit onto mounting bracket shaft

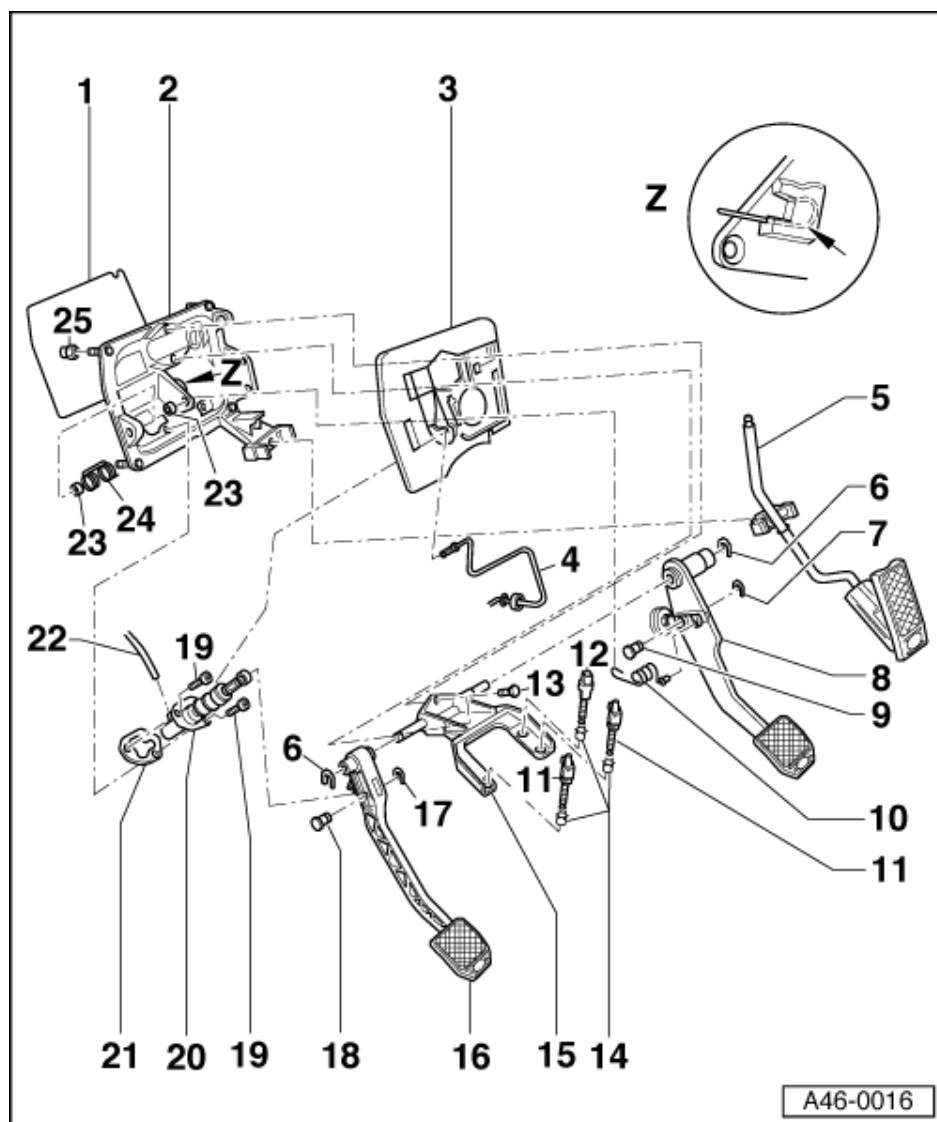
#### 7 Circlip

- ◆ Renew
- ◆ Fit onto pin

#### 8 Brake pedal

- ◆ Removing and installing

=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing mounting bracket Removing and installing pedal cluster Removing mounting bracket



9 Pin

10 Coil spring

11 Vent valves

- ♦ For cruise control system

12 Brake light switch

13 Bolt - 20 Nm

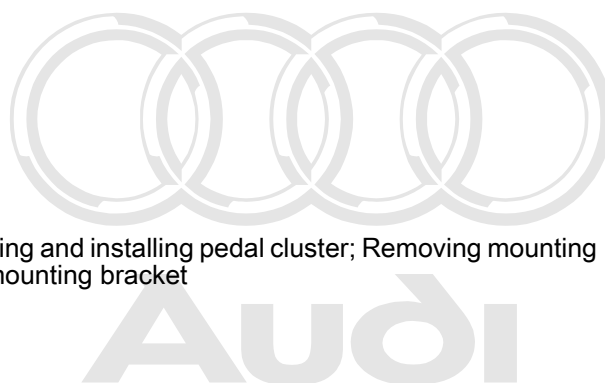
14 Clip

- ♦ Insert into mounting bracket

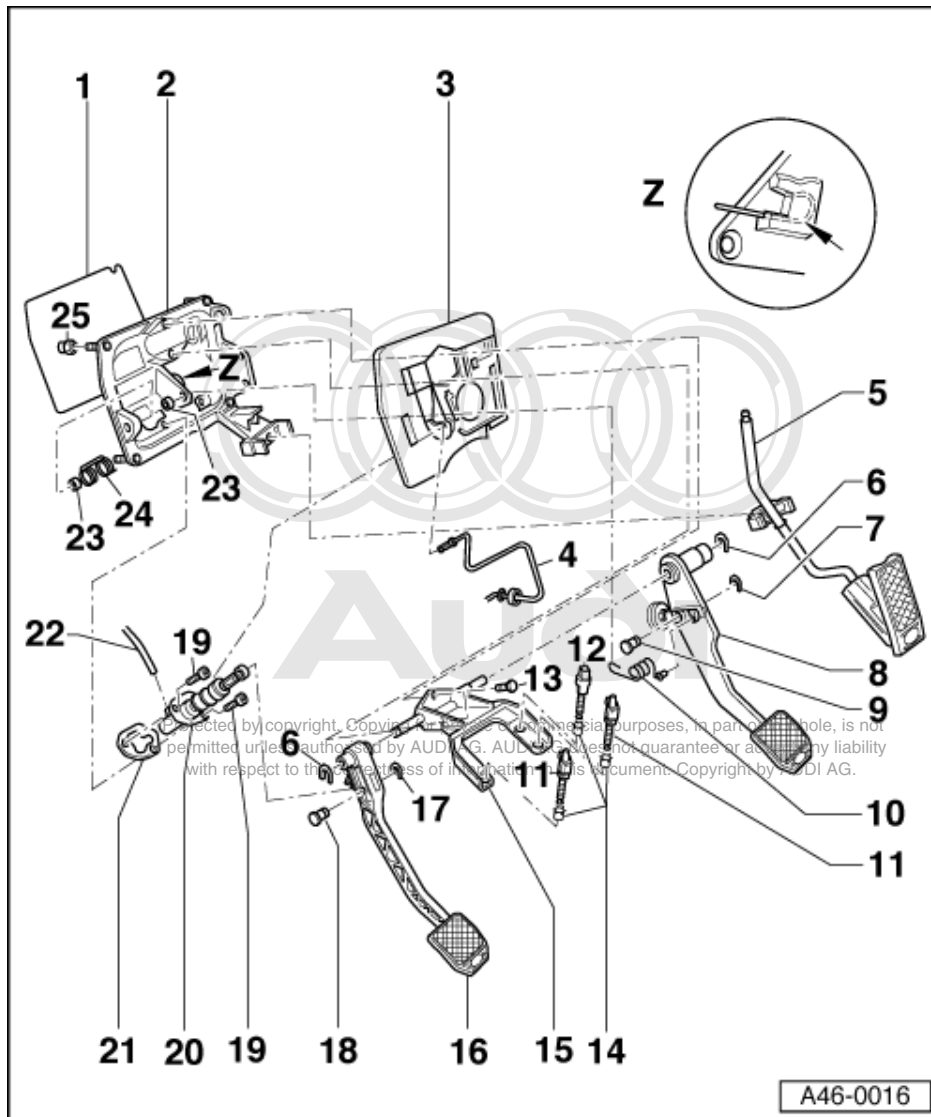
15 Mounting bracket

- ♦ Removing and installing

=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing mounting bracket Removing and installing pedal cluster Removing mounting bracket



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#### 16 Clutch pedal

- ◆ Is fixed in position by adjusting the plastic clevis
- ◆ Fit onto mounting bracket shaft
- ◆ Removing and installing => Page 17

#### 17 Circlip

- ◆ Renew
- ◆ Fit onto pin

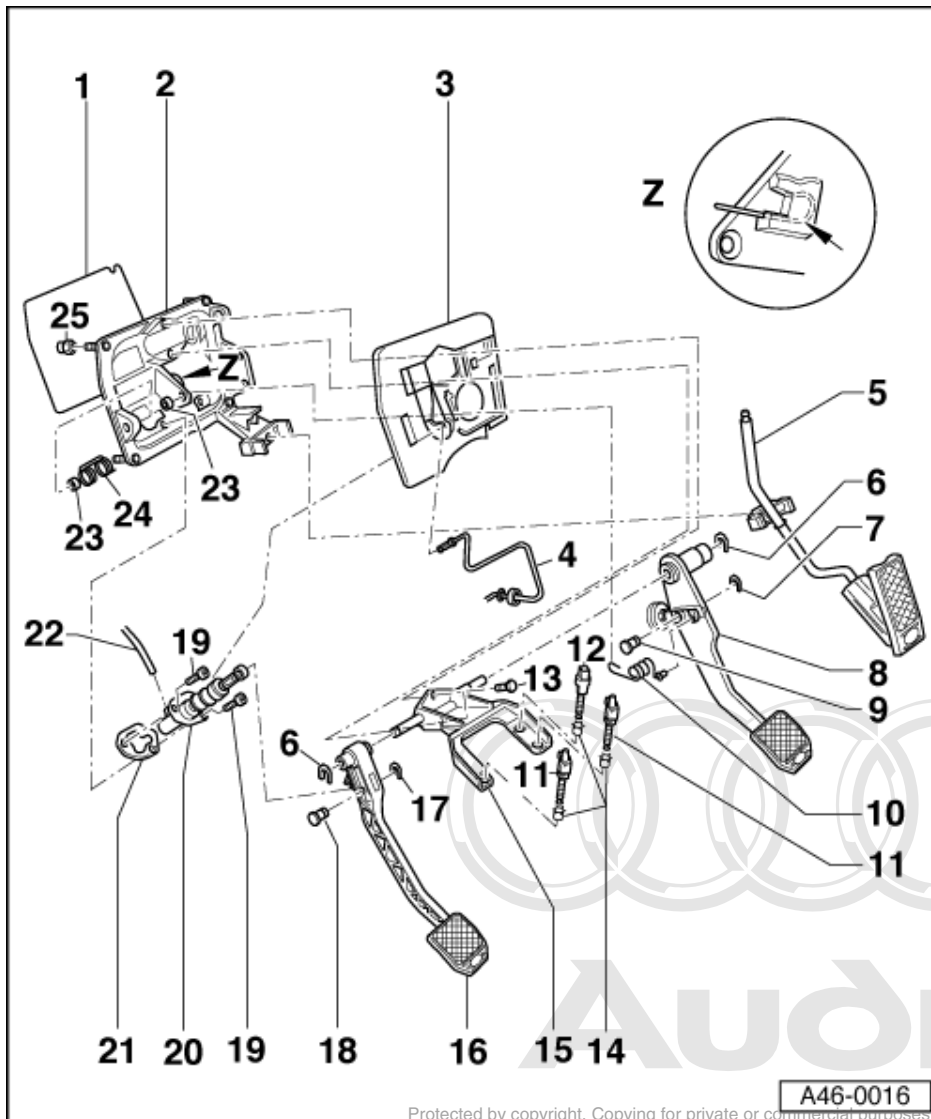
#### 18 Pin

- ◆ Insert into clutch pedal and master cylinder

#### 19 Bolt - 20 Nm

#### 20 Master cylinder

- ◆ Renew if leaking
- ◆ Removing and installing  
=> page 17
- ◆ Adjusting plastic clevis => Fig. 1



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A46-0016

**21 Gasket**

- ♦ Insert between pedal bracket and master cylinder

**22 Supply hose**

- ♦ Fit onto master cylinder

**23 Bearing bush**

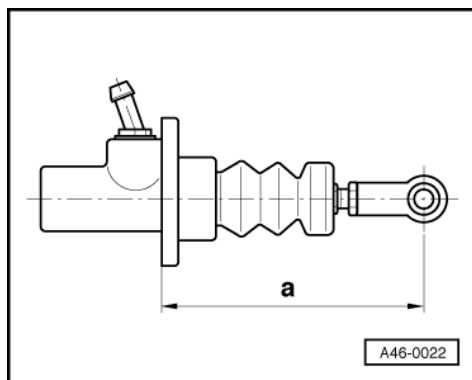
- ♦ Renew if damaged

**24 Coil spring**

- ♦ Do not grease
- ♦ Removing and installing  
=> page 17
- ♦ Press into pedal bracket as far as stop  
=> Inset Z

**25 Hexagon nut - 20 Nm**

- ♦ Renew



→ Fig.1 Adjusting plastic clevis

- Check distance -a- when renewing the master cylinder, adjust if necessary.
  - Dimension  $a = 114.5 \pm 0.5$  mm
  - When measuring, the plastic clevis must be at right angles to the contact surface of the clutch master cylinder.

**Notes:**

*If the clutch does not return by itself when the plastic clevis is correctly adjusted, this may be caused by:*

- ♦ Air in hydraulic system.
- ♦ Pedal partially seized on axis shaft.

### 1.3 - Removing and installing clutch pedal and coil spring

#### Removing

- Remove mounting bracket -item 14 .

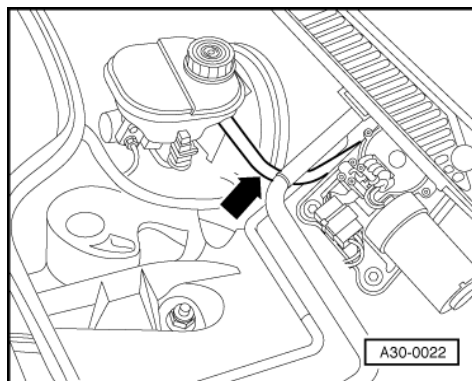
=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing mounting bracket Removing and installing pedal cluster Removing mounting bracket

- Unhook coil spring.
- Pull off circlip for clutch pedal.
- Pull clutch pedal off mounting bracket shaft.

#### Installing

- Fit clutch pedal onto mounting bracket shaft and press circlip on.
- Hook coil spring into pedal bracket.
- When bolting on mounting bracket, fit coil spring onto clutch pedal.

### 1.4 - Removing and installing master cylinder



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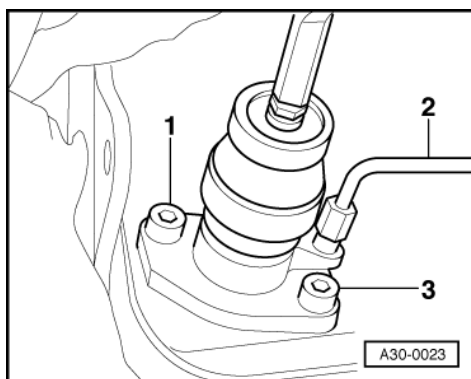


## Removing

- Remove mounting bracket -item **14** .

=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing mounting bracket Removing and installing pedal cluster Removing mounting bracket

- -> Fit clamp on supply hose -arrow- for master cylinder and pull hose off master cylinder.



- -> Detach pipe -2- on master cylinder.
- Remove bolts -1- and -3-.
- Pull cylinder inwards.

## Installing

Installation is carried out in the reverse order, when doing this note the following:

- Renew gasket.
- Bleed clutch system => page **22** .




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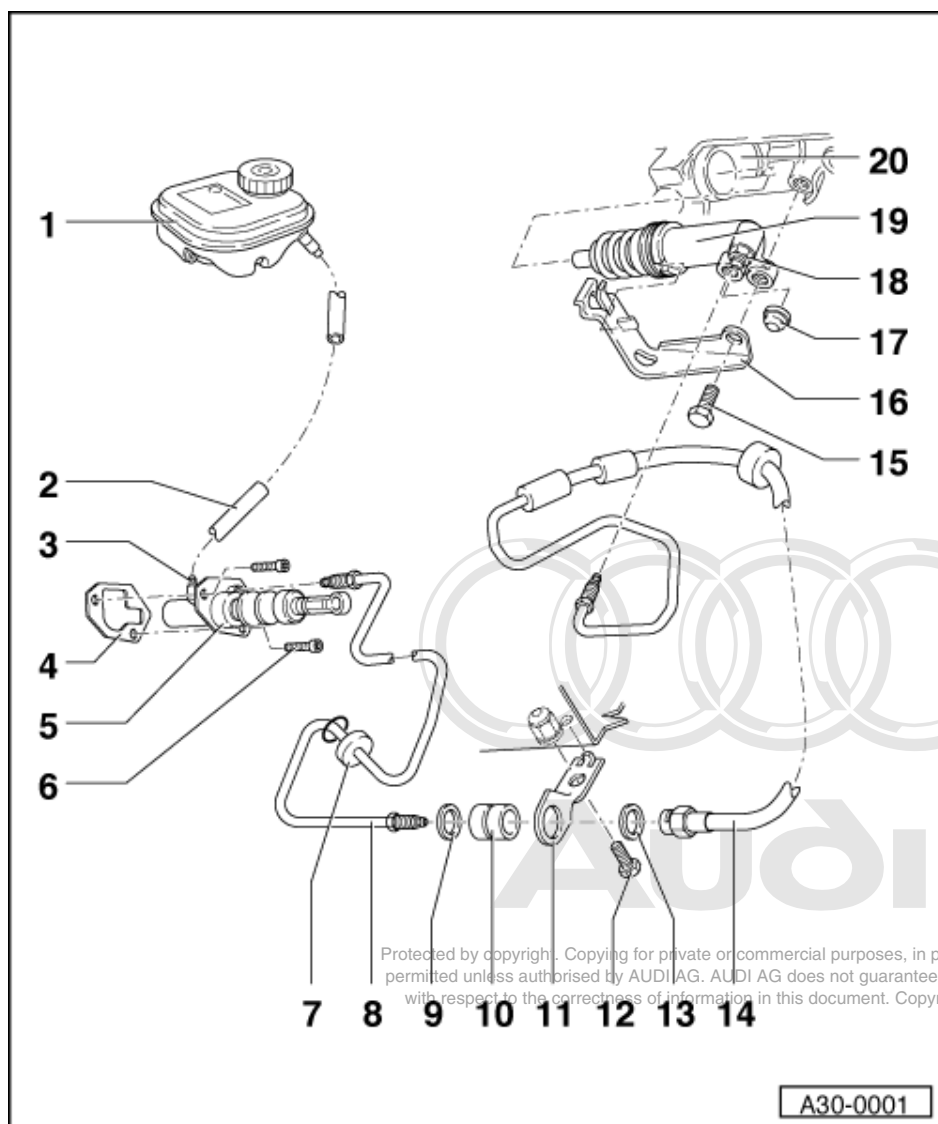


This diagram illustrates the assembly of a vehicle's brake system. The components are numbered as follows:

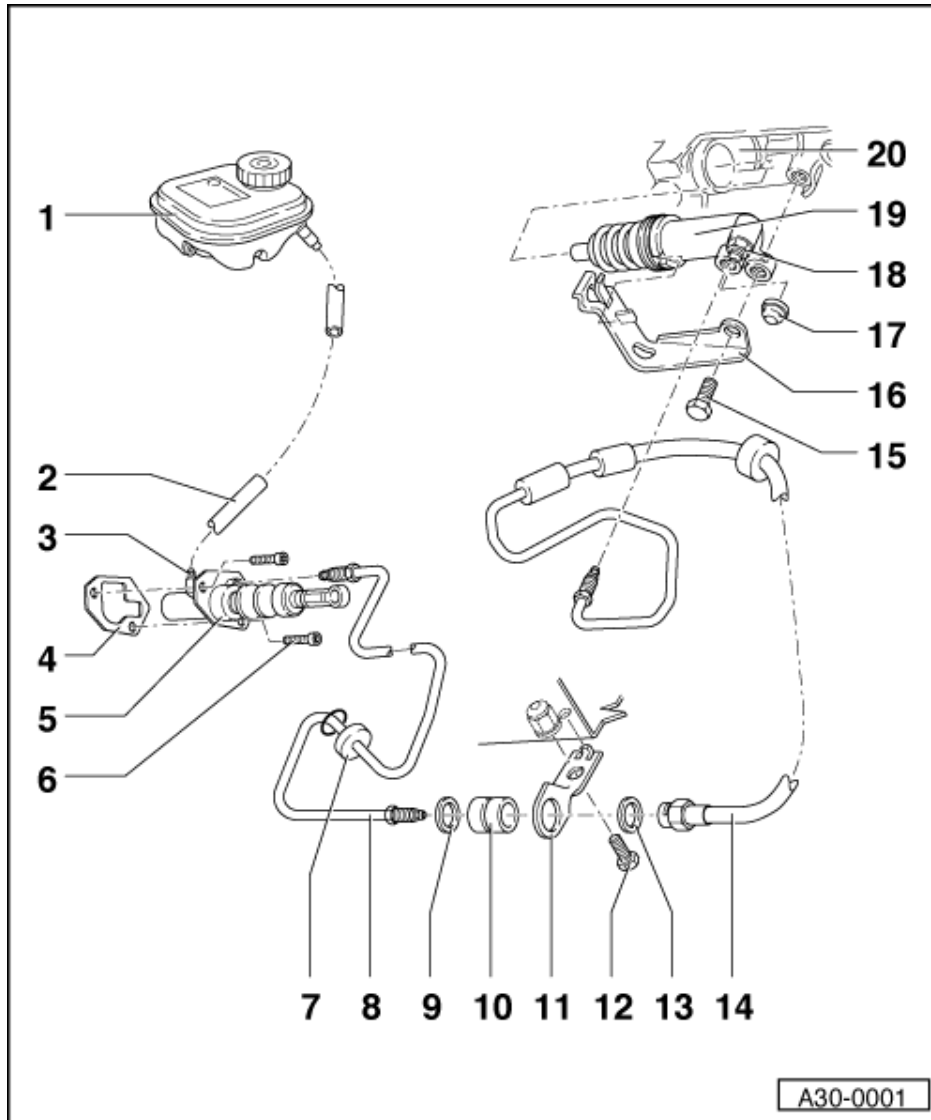
- 1**: Master cylinder
- 2**: Brake line
- 3**: Brake line fitting
- 4**: Brake line fitting
- 5**: Brake line fitting
- 6**: Brake line fitting
- 7**: Brake line
- 8**: Brake line fitting
- 9**: Brake line fitting
- 10**: Brake line fitting
- 11**: Brake line fitting
- 12**: Brake line fitting
- 13**: Brake line fitting
- 14**: Brake line fitting
- 15**: Brake line
- 16**: Brake line fitting
- 17**: Brake line fitting
- 18**: Brake line fitting
- 19**: Brake line fitting
- 20**: Brake line fitting

- inder, pull elbow out from rubber plug
- et and master cylinder
- 
- The Audi logo, consisting of four interlocking rings, is displayed in a light gray color at the bottom of the slide.

1.5 - Hydraulic system - general layout 19



- 6 Bolt - 20 Nm**
  - ♦ For securing master cylinder to pedal bracket
- 7 Grommet**
- 8 Pipe**
  - ♦ With pipe union nut
  - ♦ Tighten pipe union nut to 15 Nm
- 9 Washer**
- 10 Bush**
- 11 Bracket**
  - ♦ For pipe
- 12 Bolt - 25 Nm**



**13 Washer**

**14 Hose/metal pipe**

- ◆ With pipe union nut
- ◆ Tighten pipe union nut to 15 Nm

**15 Bolt - 25 Nm**

- ◆ For securing slave cylinder to gearbox housing
- ◆ Self-locking
- ◆ Renew

**16 Bracket**

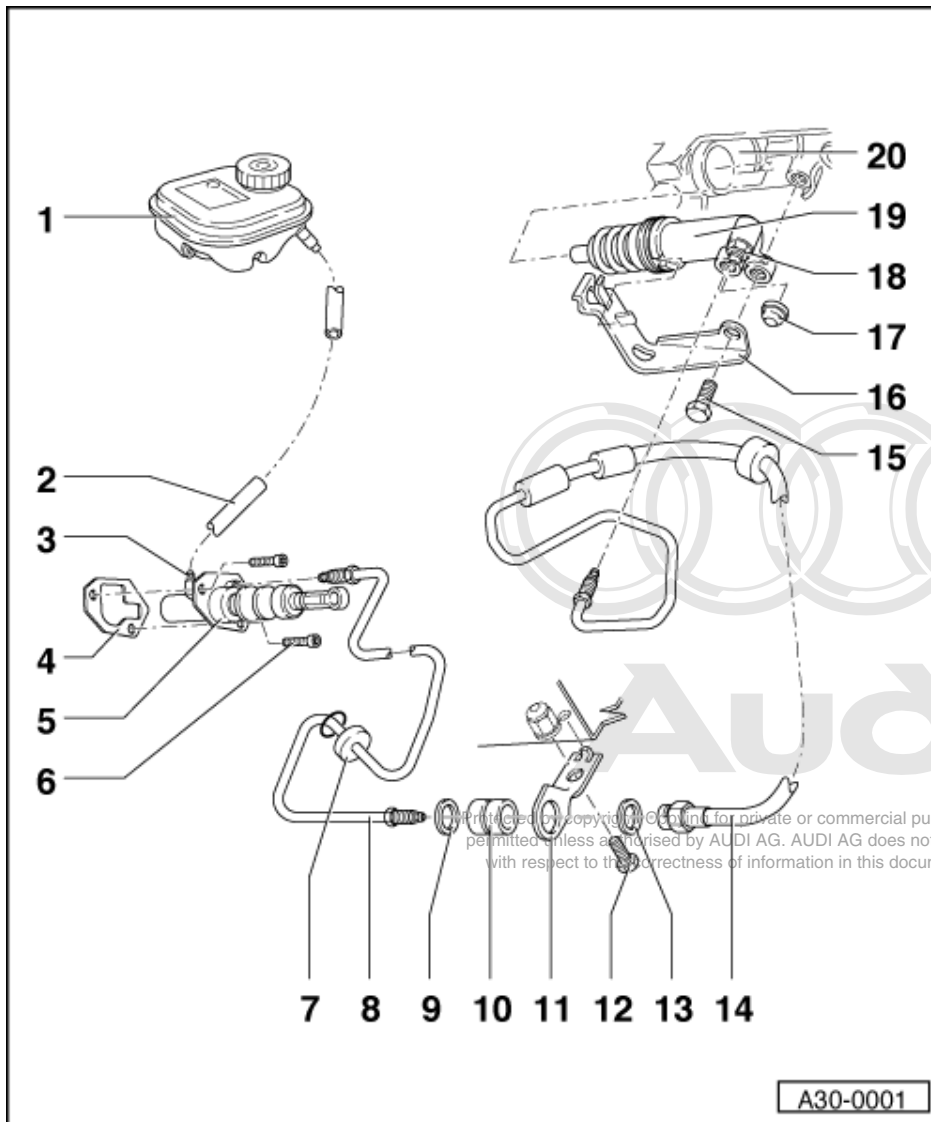
- ◆ For pipe

**17 Dust cap**

**18 Bleed valve**

- ◆ Tighten to 4.5 Nm
- ◆ Follow correct sequence of work when bleeding => Page 22

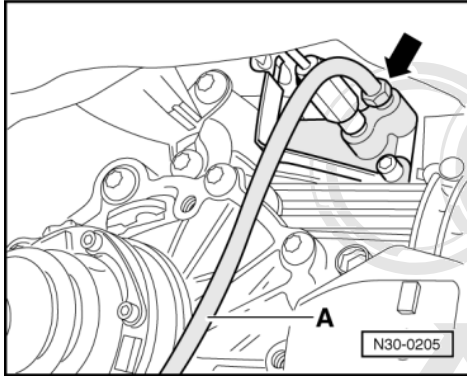
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**19 Slave cylinder**

- ◆ Do not depress clutch pedal after removing slave cylinder
- ◆ On slave cylinders with plastic support ring, grease outer surface of ring when installing
- ◆ Coat contact surface of clutch slave cylinder push rod with a thin layer of copper grease, e.g. Z 381 351 TE
- ◆ When installing, press in until the securing bolt can be fitted easily.
- ◆ After working on hydraulic clutch mechanism, bleed slave cylinder => Page 22

**20 Gearbox****1.6 - Bleeding clutch system****Notes:**

- ◆ When performing the following steps, make sure that no brake fluid escapes onto the gearbox.
- ◆ The clutch system must be bled after performing work on hydraulic clutch mechanism.
- ◆ Top-up brake fluid reservoir to "max." marking with brake fluid before bleeding clutch system.

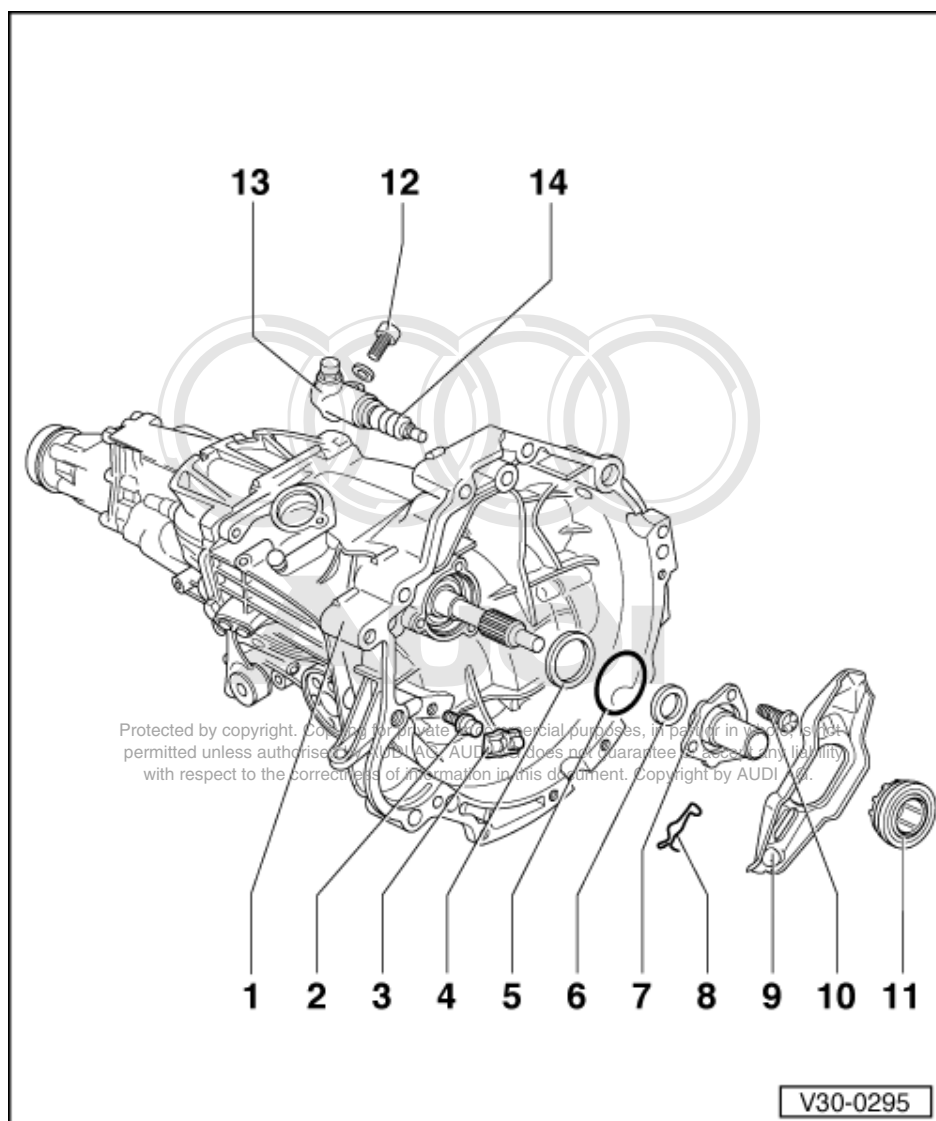


- Bleed clutch system using the brake filling and bleeding appliance V.A.G 1238 B and bleed hose V.A.G 1238 B/3.
  - Working pressure 2.5 bar
- -> Connect bleed hose -A- to slave cylinder (arrow) and open bleed valve.
- Depress clutch pedal several times after completion of bleeding process.
- Close bleeder screw. Tightening torque: 4.5 Nm
- Bleed system again if necessary.

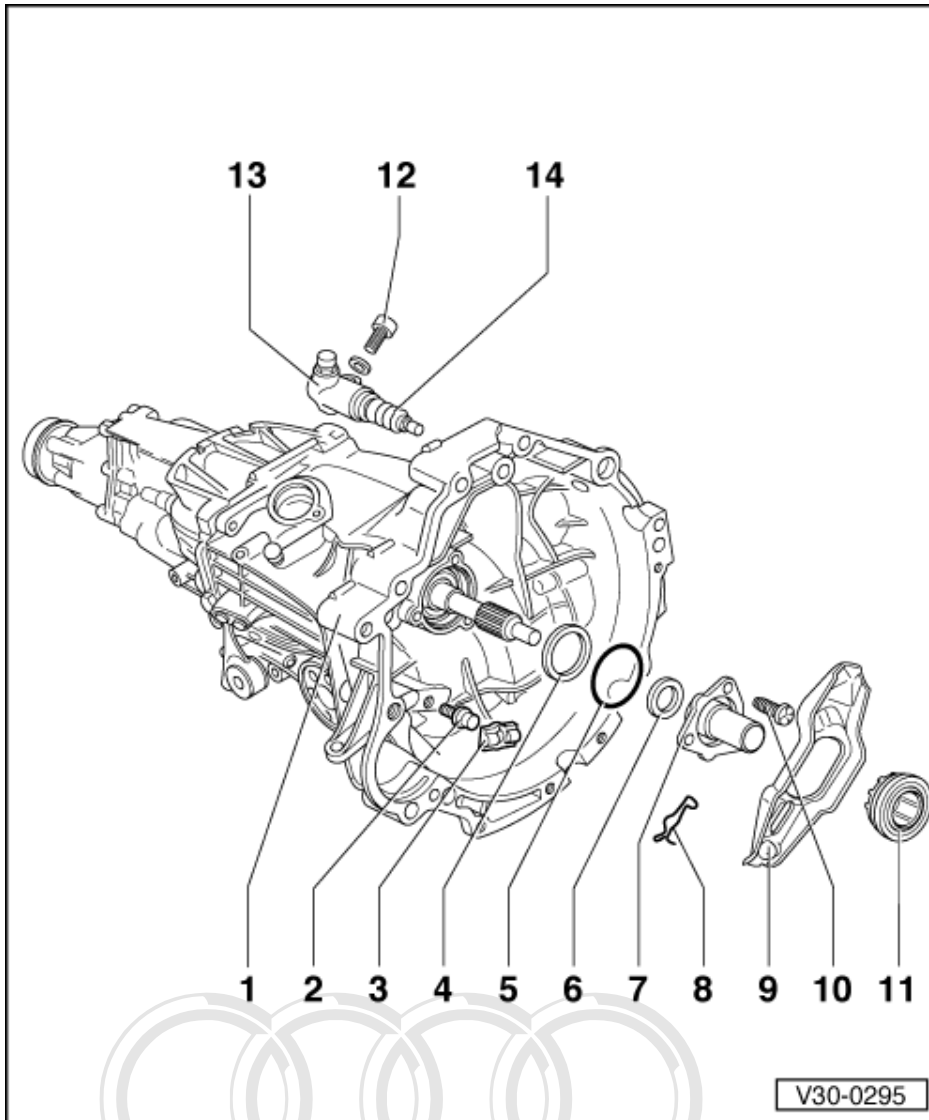


## 2 - Servicing clutch release mechanism

### 2.1 - Servicing clutch release mechanism



- 1 Gearbox
- 2 Ball stud
  - ◆ Tighten to 25 Nm
  - ◆ Lubricate with MoS2 grease
- 3 Intermediate piece
- 4 Dished washer
  - ◆ Smaller diameter (convex side) to guide sleeve
- 5 O-ring
  - ◆ Renew



#### 6 Input shaft oil seal

- ♦ Pull out of guide sleeve with oil seal extractor lever VW 681
- ♦ Knock in onto stop with fitting sleeve VW 192

#### 7 Guide sleeve

- ♦ Before removing and installing, cover input shaft splines with a shrink-fit hose to protect oil seal.

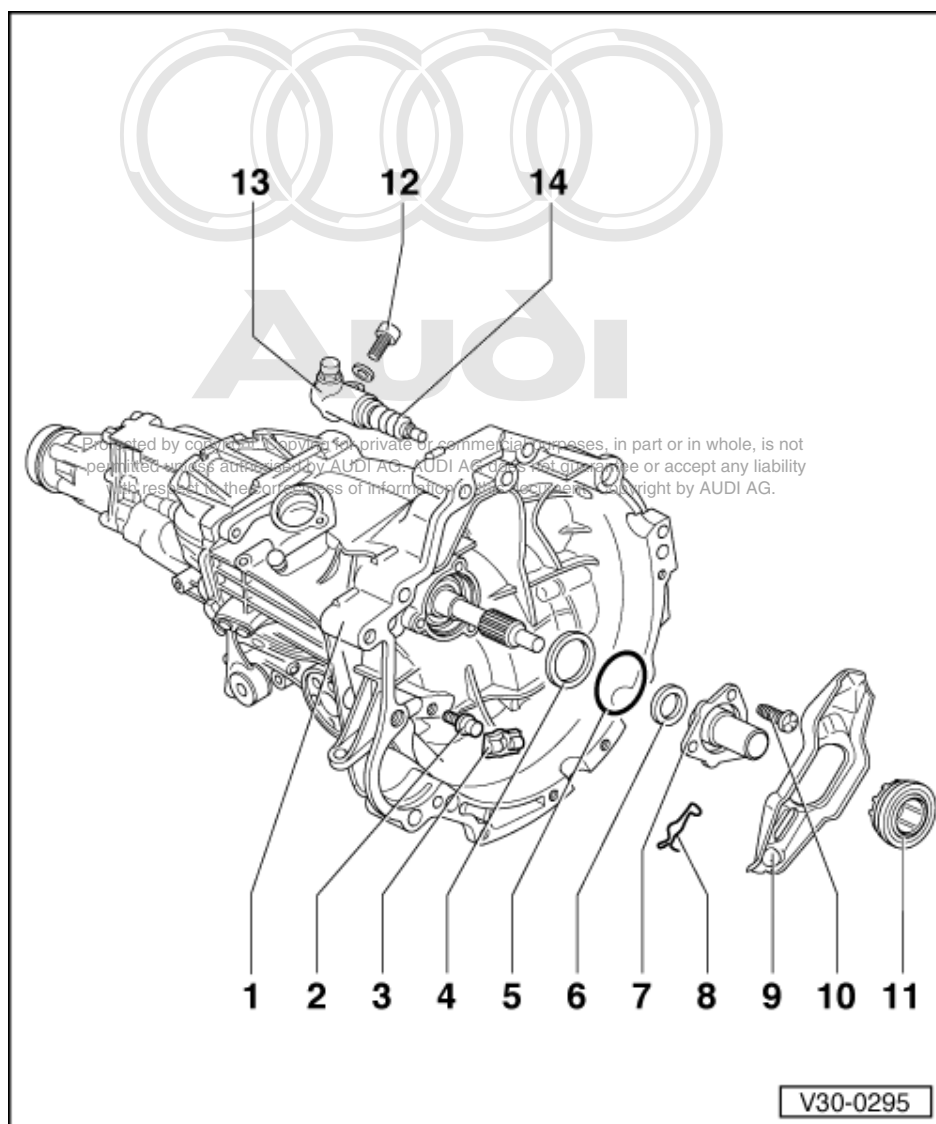
#### 8 Retaining spring

- ♦ Secure to clutch release lever

#### 9 Clutch release lever

- ♦ Before installing, coat contact surface of clutch slave cylinder push rod with a thin layer of copper grease, e.g. Z 381 351 TE

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**10 Torx socket head bolt,**  
**35 Nm**

- ◆ Self-locking
- ◆ Renew

**11 Release bearing**

- ◆ Do not wash-out bearing, only wipe
- ◆ Renew noisy bearings

**12 Hexagon socket head bolt,**  
**20Nm**

**13 Slave cylinder**

- ◆ When installing, press in so that securing bolt can be fitted easily.
- ◆ Do not operate clutch pedal after slave cylinder has been removed

**14 Push rod**

- ◆ Coat contact surface of push rod with copper grease, e.g. Z 381 351 TE



## 3 - Servicing clutch

### 3.1 - Servicing clutch

#### Notes:

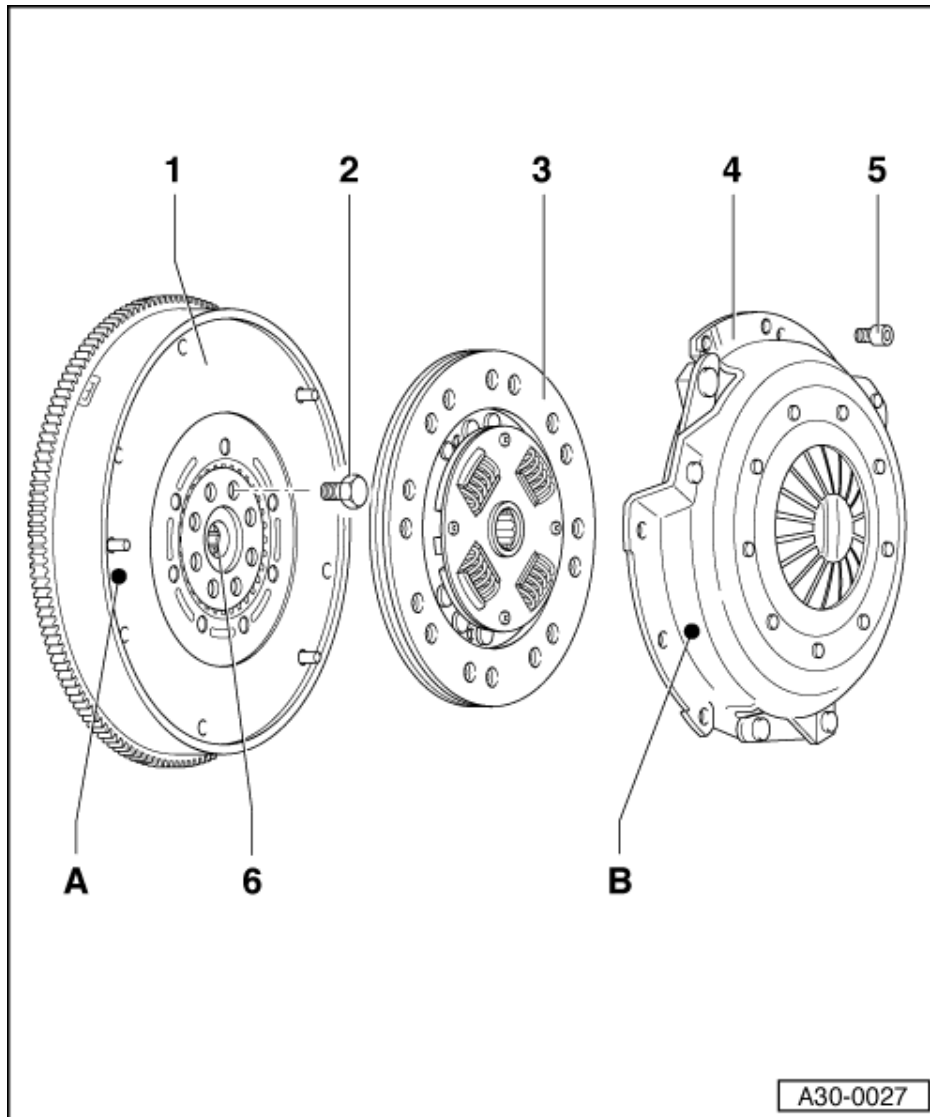
- ◆ Observe general repair instructions =>Page 8.
- ◆ Before renewing the clutch plate and pressure plate

=> Fault-finding No. 9 - Defects on the clutch and clutch mechanism

- ◆ Replace clutch plates and pressure plates with damaged or loose rivets.
- ◆ Select the correct clutch plate and pressure plate according to engine code:

=> Parts catalogue

- ◆ Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Then move clutch plate to and fro on input shaft until hub moves freely on shaft. Excess grease must be removed.
- ◆ Pressure plates have an anti-corrosion coating and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.
- ◆ If the clutch has burnt out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the gearbox to reduce the smell of burnt linings.





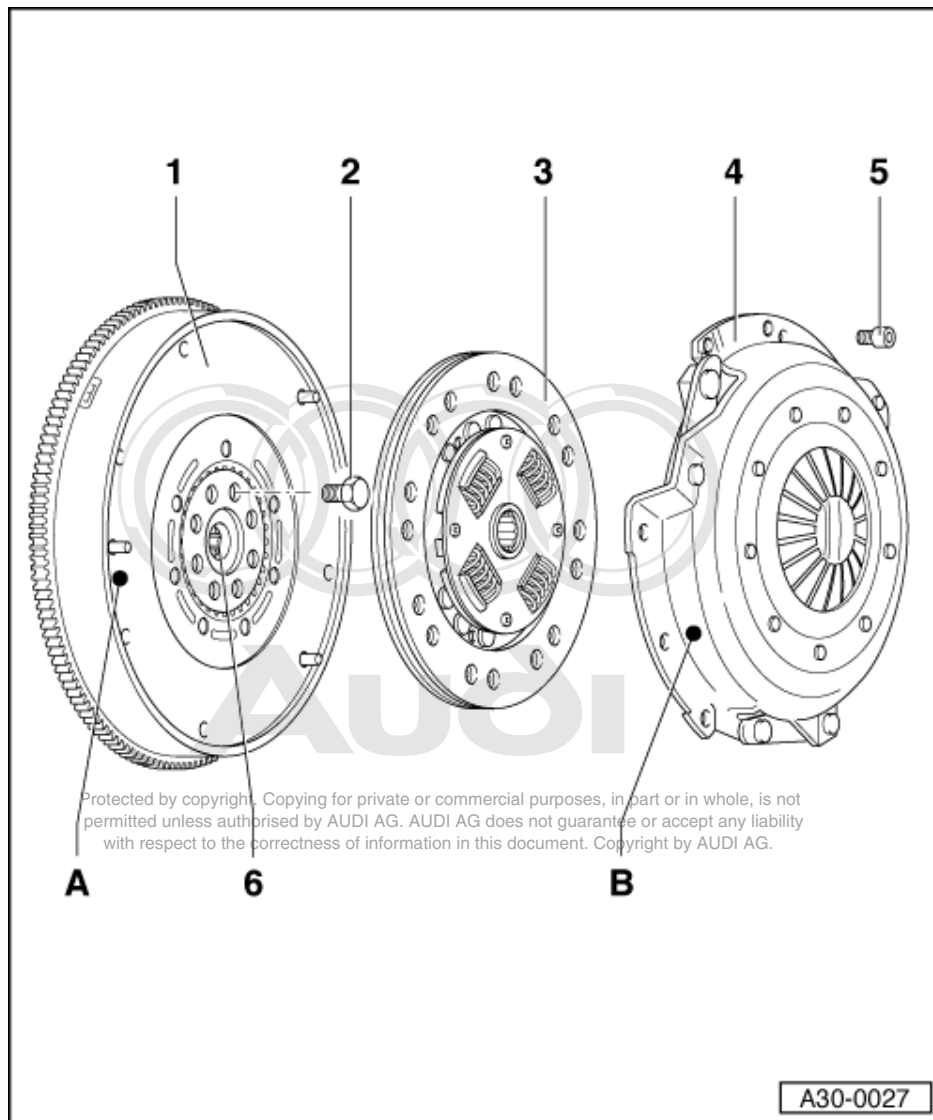
- Remove gearbox to work on the clutch=>Page 49 .

**A - Coloured marking on dual-mass flywheel**

- ◆ On all 2.8 ltr 5V 142 kW engines
- ◆ On some 2.8 ltr 128 kW engines
- ◆ White marking -A- on dual-mass flywheel must coincide with white marking -B- on pressure plate.

**B - Coloured marking on pressure plate**

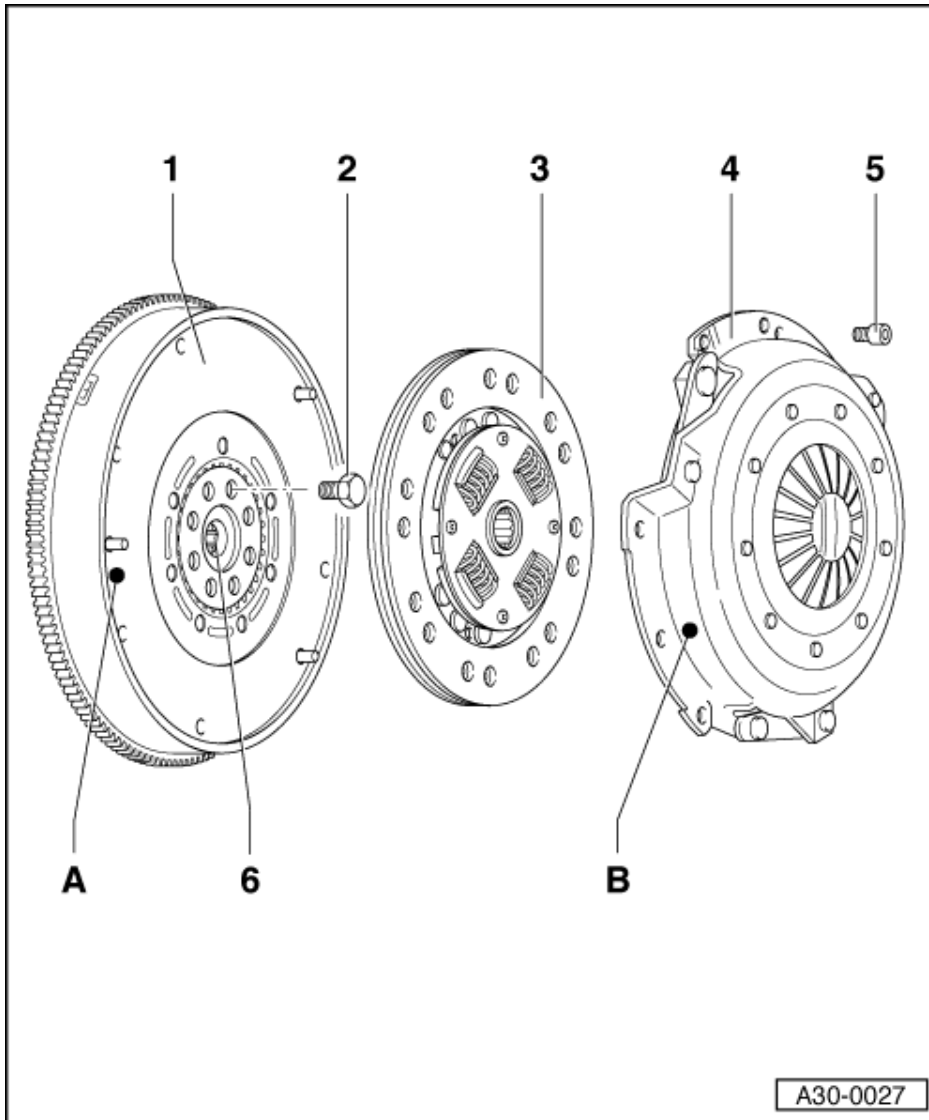
- ◆ On all 2.8 ltr 5V 142 kW engines
- ◆ On some 2.8 ltr 128 kW engines
- ◆ White marking -A- on dual-mass flywheel must coincide with white marking -B- on pressure plate.



**1 Dual mass flywheel**

- ◆ Ensure centring pins are tightly seated
- ◆ Contact surface for clutch lining must be free of grooves, oil and grease
- ◆ Removing and installing

=> 6-Cylinder engine, Mechanics; Repair group 13; Crankshaft group; Removing and installing flywheel/drive plate, installation dimensions Crankshaft group Removing and installing flywheel/drive plate, installation dimensions



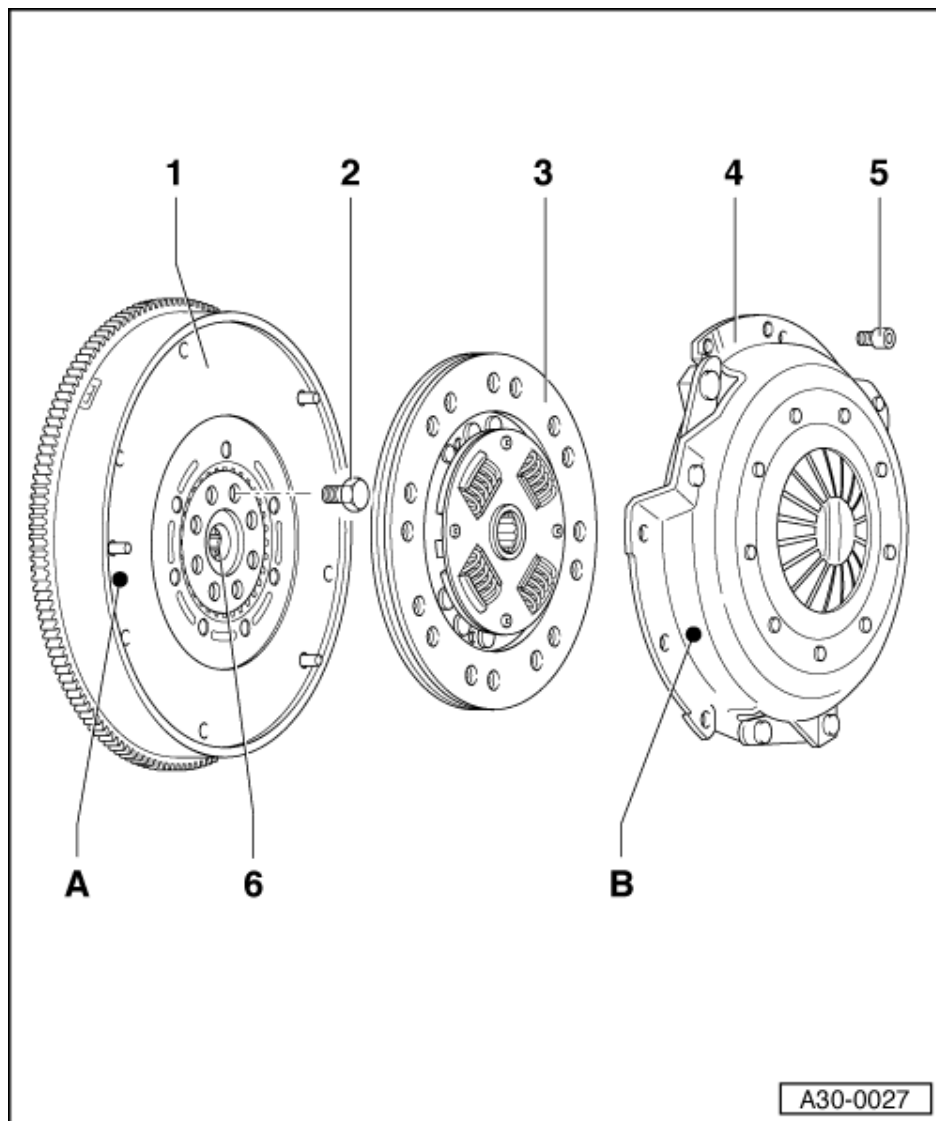
**2 Bolt for dual-mass flywheel - 60 Nm + turn 180°further**

- ◆ Renew

**3 Clutch plate**

- ◆ Installation position:  
Spring pack (coil springs) towards pressure plate and gearbox  
Clutch lining must make full contact with flywheel.  
Marking "Getriebeseite" (if provided) goes towards pressure plate and gearbox
- ◆ Do not grease
- ◆ Clutch plate diameter  
=> from Page **2**
- ◆ Centring => Fig. **1**
- ◆ Lightly grease splines

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#### 4 Pressure plate

- ◆ Removing and installing => Fig. 1
- ◆ Check ends of diaphragm spring  
=> Fig. 2
- ◆ Checking spring connection and riveted fastenings => Fig. 3

#### 5 Bolt - 25 Nm

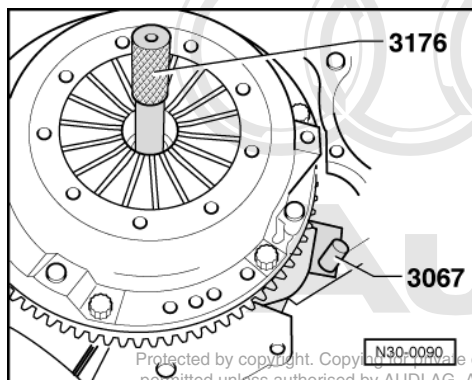
- ◆ Loosen and tighten gradually and diagonally

#### 6 Needle roller bearing

- ◆ Removing and installing

=> 6-Cylinder engine, Mechanics; Repair group 13; Crankshaft group; Removing and installing needle bearing in flywheel Crankshaft group Removing and installing needle bearing in flywheel

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 13; Crankshaft group; Removing and installing needle bearing in flywheel Crankshaft group Removing and installing needle bearing in flywheel

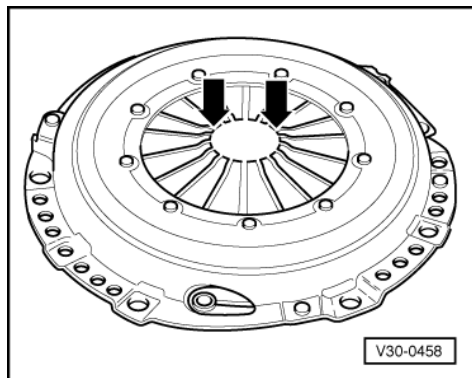


-> Fig.1 Centring clutch plate and removing and installing pressure plate

- Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" towards pressure plate and gearbox

**Notes:**

- ◆ Clutch lining and contact surface of pressure plate must make full contact with flywheel before securing bolts are inserted.
- ◆ Tighten securing bolts evenly and in diagonal sequence to avoid damaging centring holes in pressure plate and centring pins on flywheel.
- On vehicles with 2.8 ltr 5V 142 kW engine (and on 2.8 ltr 128 kW engine, if marking provided), ensure that white marking on dual-mass flywheel coincides with white marking on pressure plate when assembling.
- Loosen and tighten bolts in stages and diagonally - 25 Nm.
- Reverse position of special tool 3067 when removing.
- Use mandrel 3176 to centre clutch plate.

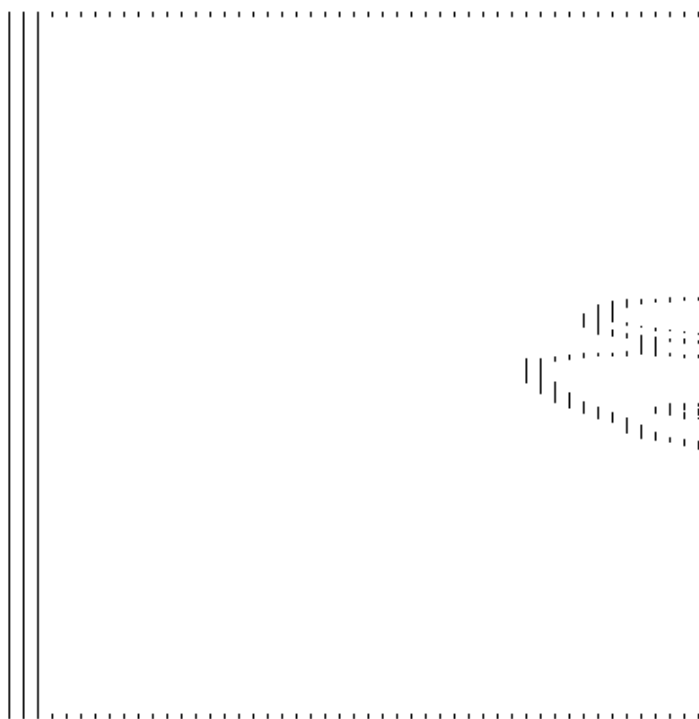


-> Fig.2 Checking ends of the diaphragm spring

- ◆ Wear up to half the thickness of the diaphragm spring is permitted

**Note:**

*When performing repairs always match up clutch pressure plate and clutch plate by checking engine code (see parts catalogue).*



-> Fig.3 Checking spring connection and riveted fastenings

- Check spring connection between pressure plate and cover for cracks and make sure rivet fastenings are seated tightly.
- Renew clutches with damaged springs or loose riveted fastenings -arrows-.

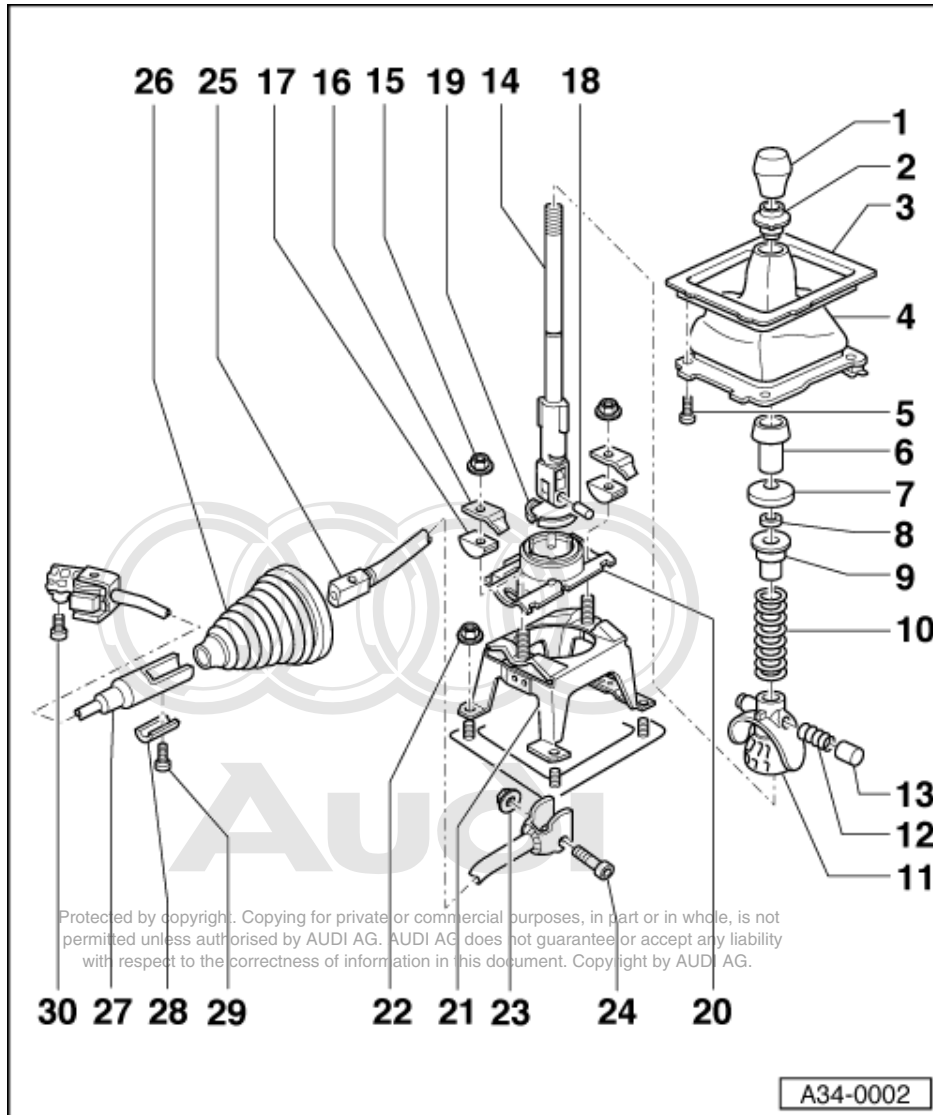


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## 34 - Controls, Housing

### 1 - Servicing selector

#### 1.1 - Servicing selector



#### 1.2 - Servicing selector mechanism

Contact corrosion.  
 Notes => Page

##### Notes:

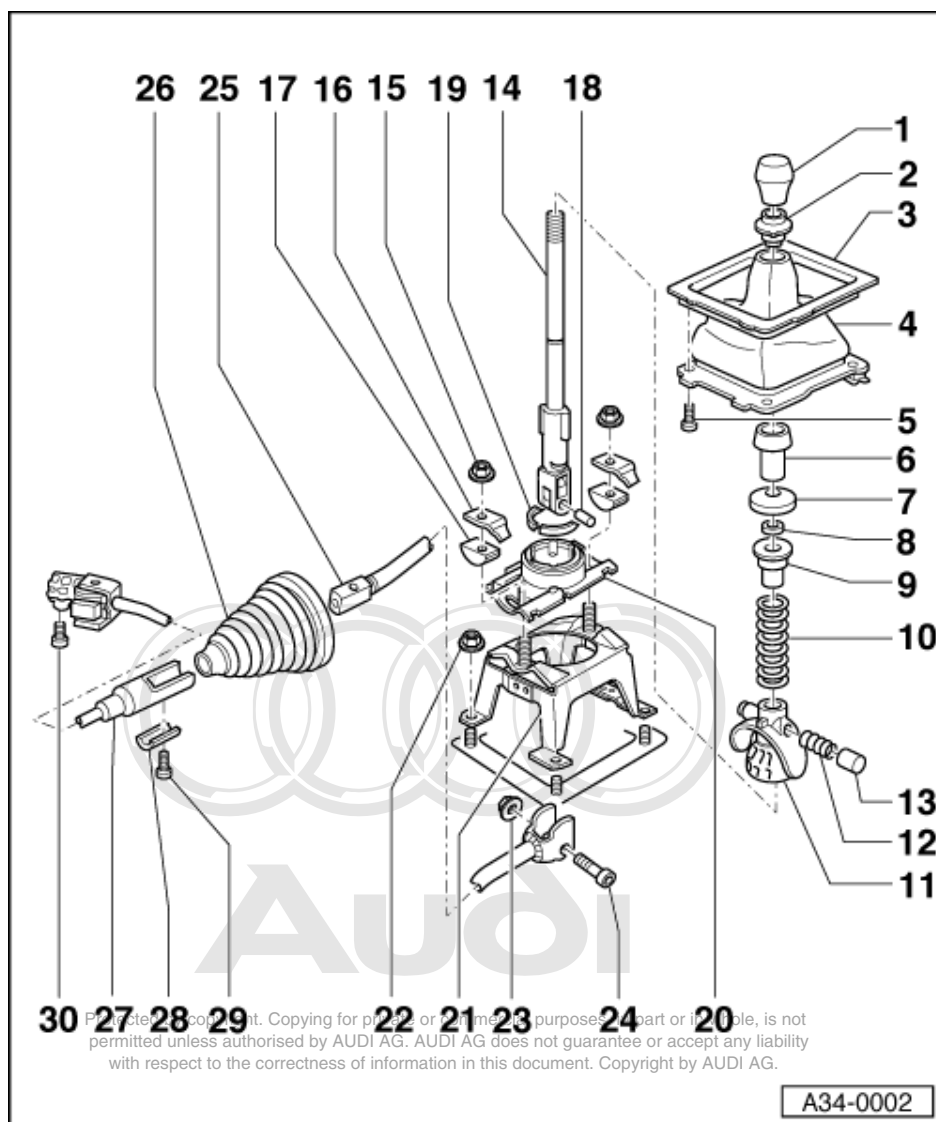
- ♦ Adjusting gear selector mechanism  
 =>Page 37 .



- ♦ Remove centre console before removing gear selector mechanism:

=> General body repairs; Repair group 70; Dash panel; Removing and installing centre console and handbrake lever trim Dash panel Removing and installing centre console and handbrake lever trim

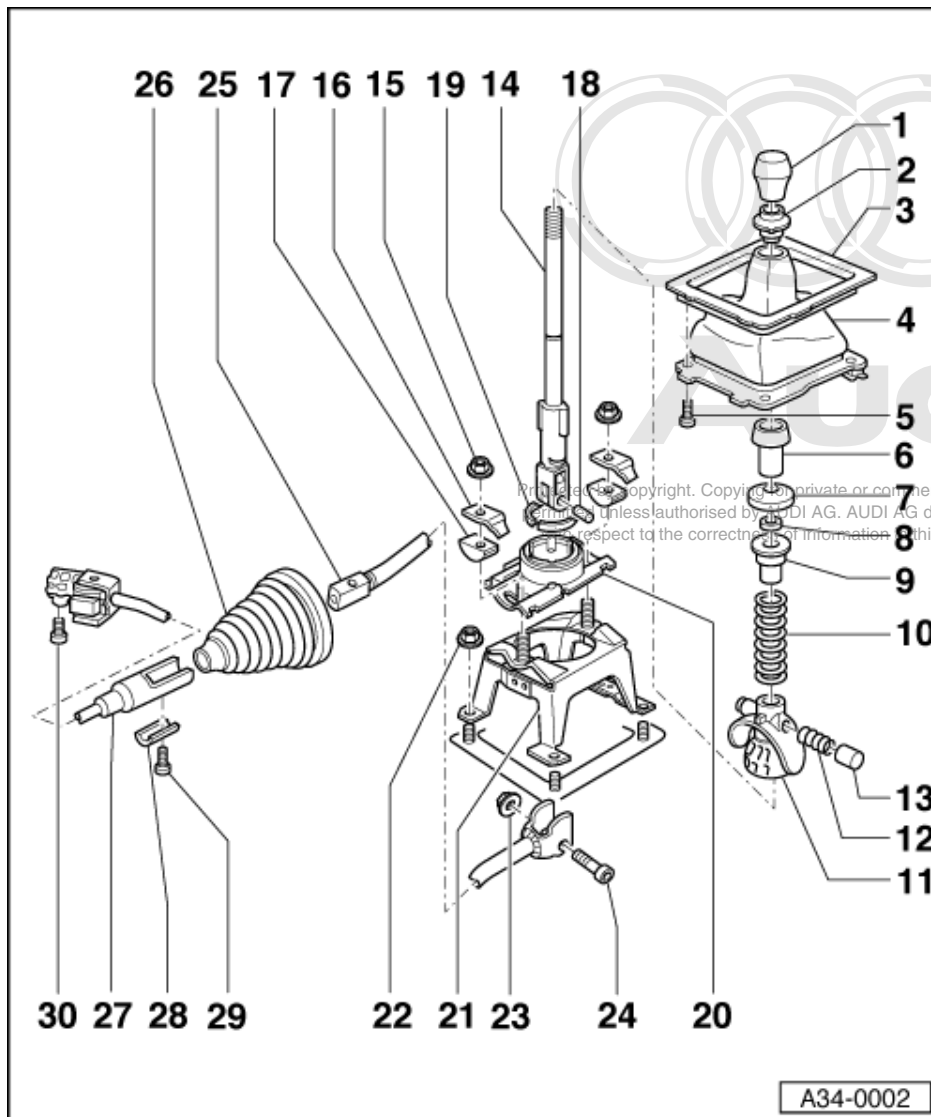
- 1 Gear stick knob
- 2 Bush
- 3 Retaining frame



- 4 Cover
  - ♦ Retainer on rear of cover; prise out carefully from centre console.
- 5 Bolt
- 6 Bush
- 7 Sealing collar
- 8 Circlip
  - ♦ Do not open out too far when fitting
- 9 Spacer bush
- 10 Spring
- 11 Ball stop
  - ♦ Insert spring and bush in the ball stop and assemble on the gear stick so that the spring and bush are on the right when looking forwards.



- ♦ Install ball stop before fitting circlip (item **19**)



**12 Spring**

**13 Bush**

- ♦ Fitting position: The rounded end faces the gear stick

**14 Gear stick**

- ♦ Can only be fitted into ball housing in one position

**15 Nut - 25 Nm**

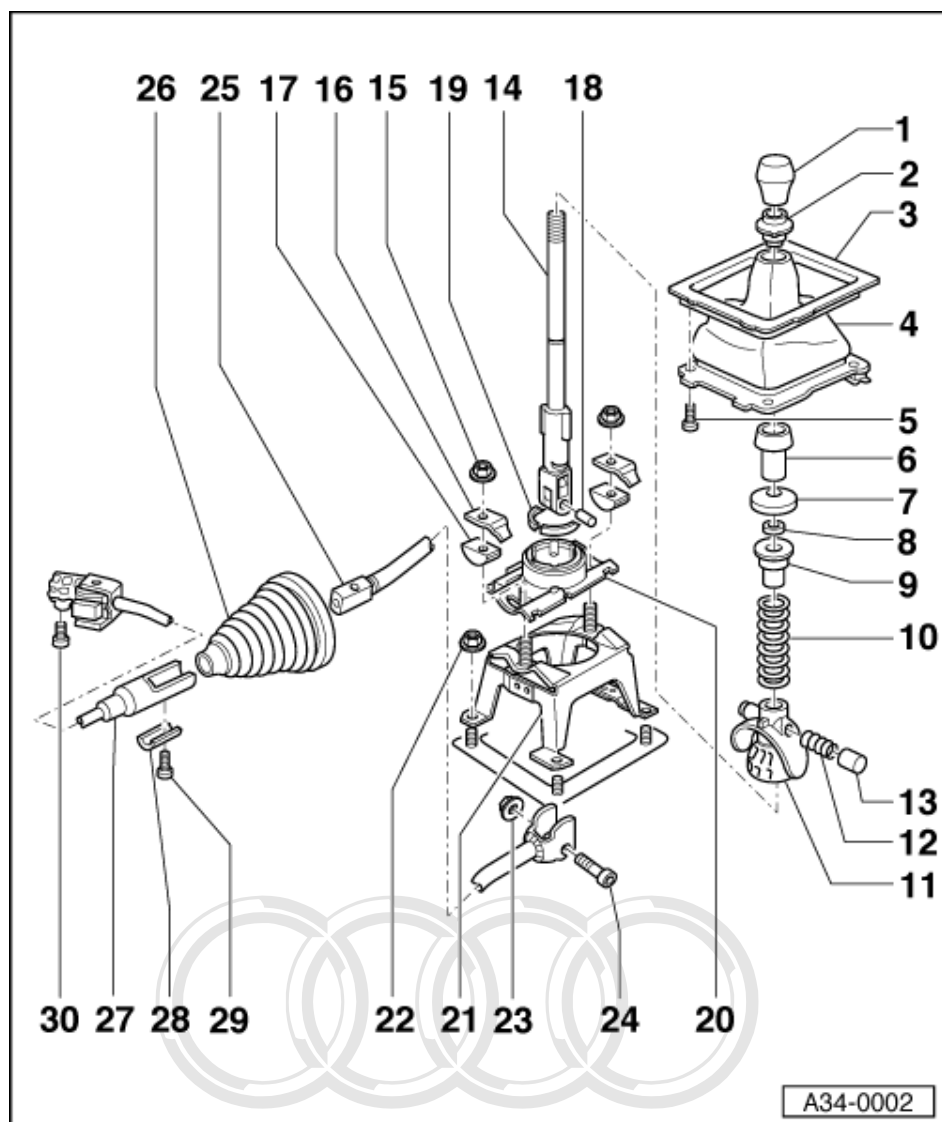
**16 Leaf spring**

**17 Connector**

**18 Spacer**

**19 Circlip**

- ♦ Renew
- ♦ Remove before removing the ball stop
- ♦ Fitting position: the rounded side faces to ball housing (item **20**)

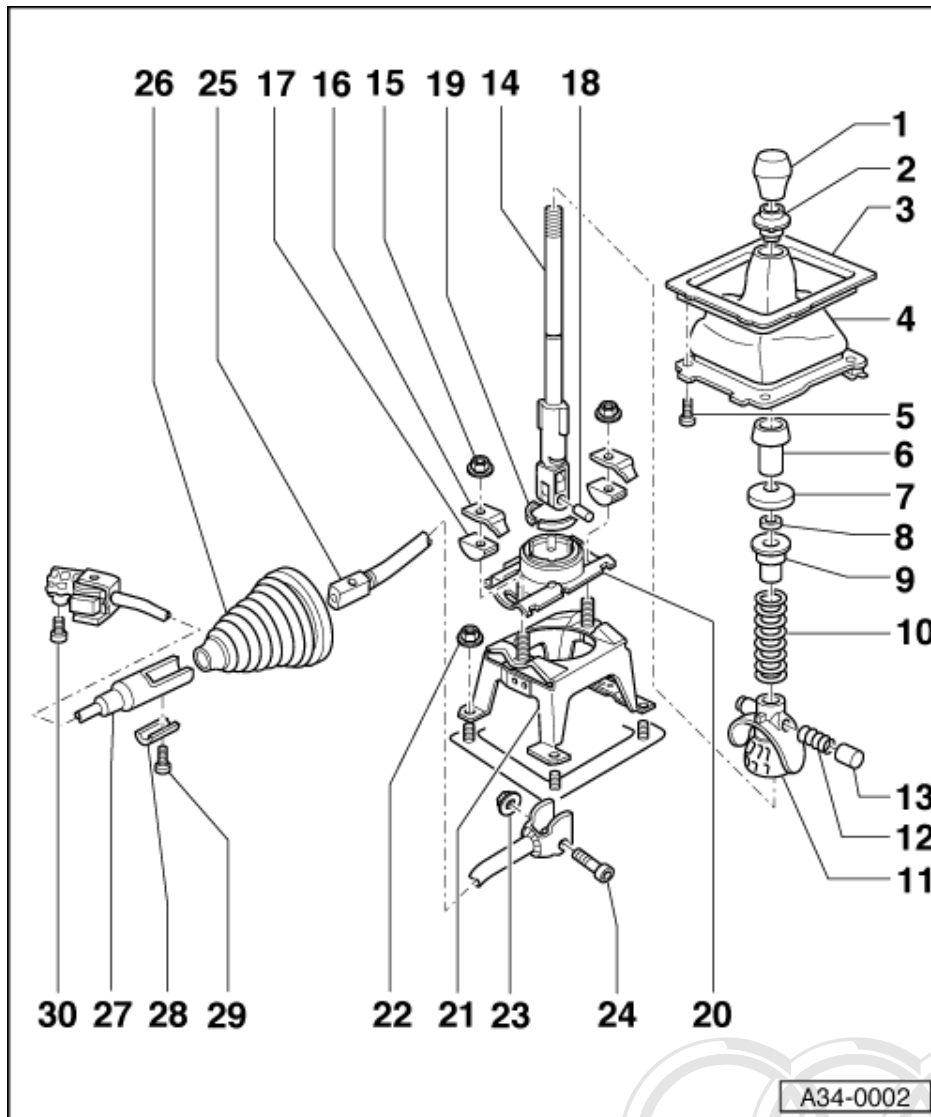
**20 Ball housing**

- ◆ Limit pieces for ball stop on left and right sides must be engaged
- ◆ Installation position: reverse detent faces left

**21 Console****22 Nut - 10 Nm****23 Nut - 10 Nm**

- ◆ Self-locking
- ◆ Renew

**24 Bolt****25 Rear selector rod**



#### 26 Bellows

- ◆ Remove catalytic converter and heat shield before removing and installing
- ◆ Pull carefully over selector rod
- ◆ Can also be fitted from passenger compartment if selector mechanism is removed.

#### 27 Selector rod

- ◆ With selector joint

#### 28 Clamp

#### 29 Bolt - 25 Nm

- ◆ Before slackening bolt, take off and push back heat shield

#### 30 Bolt - 20 Nm

- ◆ Self-locking
- ◆ Renew

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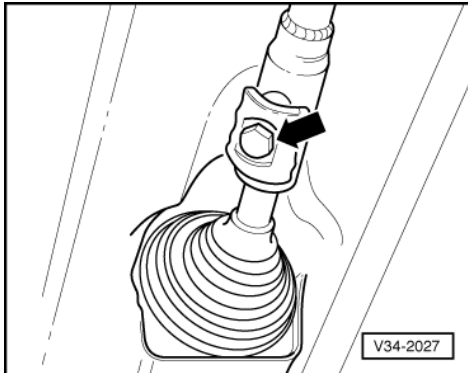
### 1.3 - Adjusting gear selector mechanism

#### Requirements:

- ◆ All components of selector mechanism must be in proper condition.
- ◆ Linkage must move freely.
- ◆ Gearbox, clutch and clutch mechanism must be in proper condition.



- ♦ Gearbox in neutral.
- Unbolt heat shield and push it towards rear final drive, so that bolt securing selector rod is accessible.

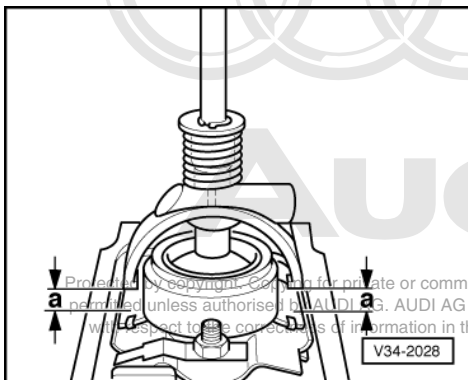


- -> Slacken bolt -arrow- for selector rod.

**Note:**

*Shown in illustration with catalytic converter and heat shield removed.*

- Remove gear stick knob and cover.
- Set ball housing bearing to horizontal position (as seen facing forwards).
- Tilt the gear stick backwards slightly.



- -> Distance -a- between ball stop buffers and ball housing should be equal on both sides.  
Hold gear stick in this position (second mechanic required).  
Tighten selector rod bolt below vehicle to 25 Nm.

**Note:**

*The gear stick must remain in the same position while the bolt is being tightened.*

- Fit heat shield.

## 1.4 - Checking gear stick adjustment

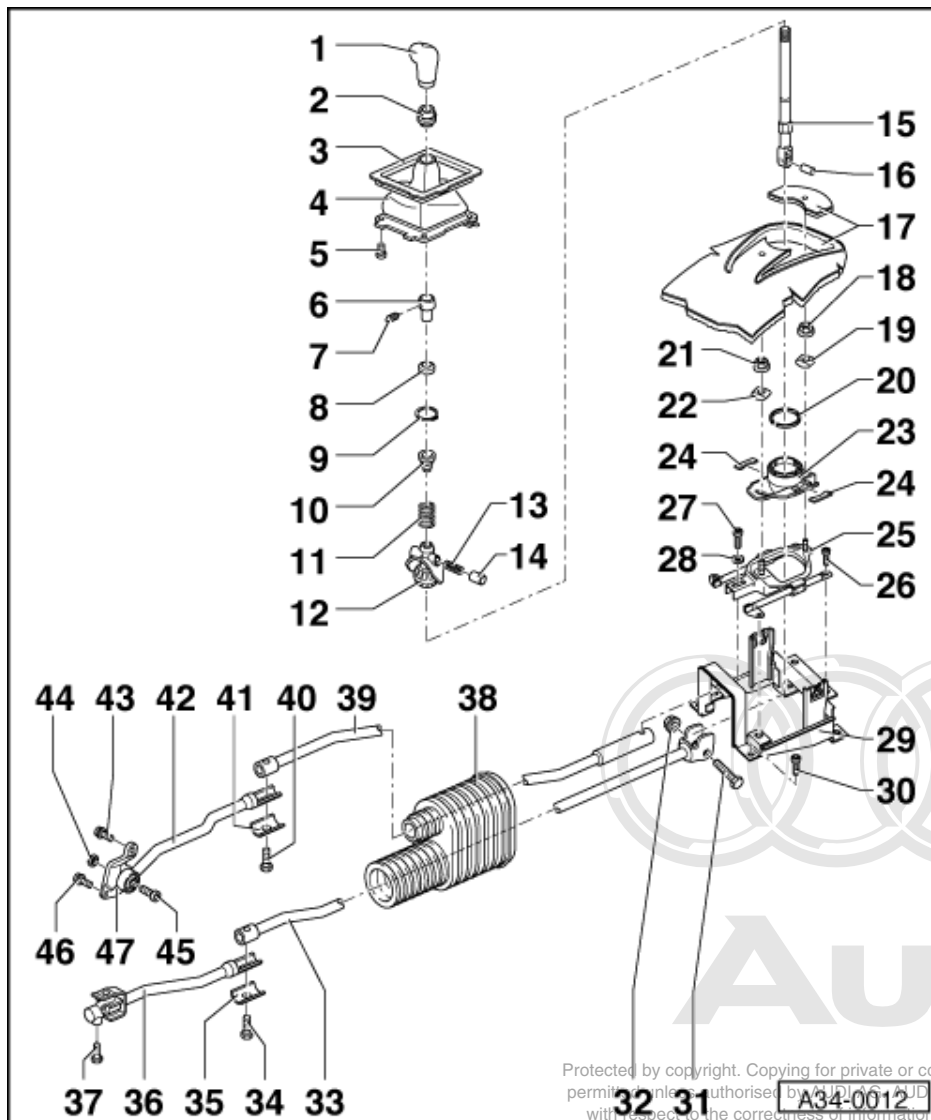
- The gear stick lever must rest in the 3rd/4th gear gate when gearbox is in neutral.
- Operate clutch.
- Check that all gears can be engaged.
- Check operation of reverse gear lock.
- Move gear stick into 5th/reverse gate and pull towards reverse gear position (but do not press down gear stick).
  - The amount of travel until contact is made with reverse gear stop should be 5 ... 10 mm (measured at gear stick knob).
- Take gear stick out of reverse gate (without pushing towards the centre).
  - The gear stick should return by itself from the 5th/reverse gate into the 3rd/4th gate.

- Check fine adjustment if necessary.

#### Fine adjustment

- If the gear stick setting is incorrect it can be adjusted as follows:
  - Slacken nuts for ball housing.
  - Move gear stick with ball housing to the right towards 5th/reverse gate as far as the stop in the gearbox, and hold in this position.
  - When doing this push the ball housing to the left against the gear stick.
  - Then hold gear stick and ball housing in this position and tighten.
  - Fit covers and gear stick knob.

### 1.5 - Servicing short-travel selector mechanism



Contact corrosion  
 Notes => Page

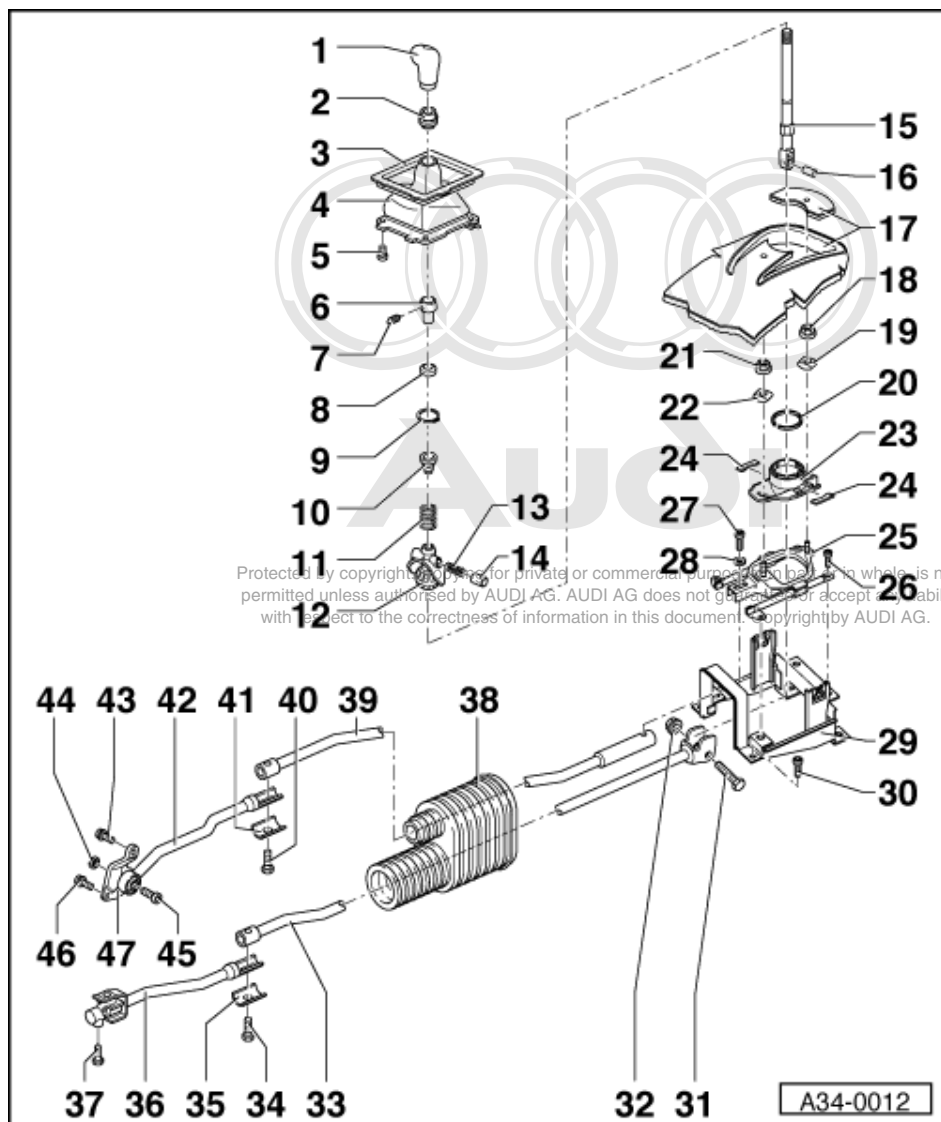
**Notes:**



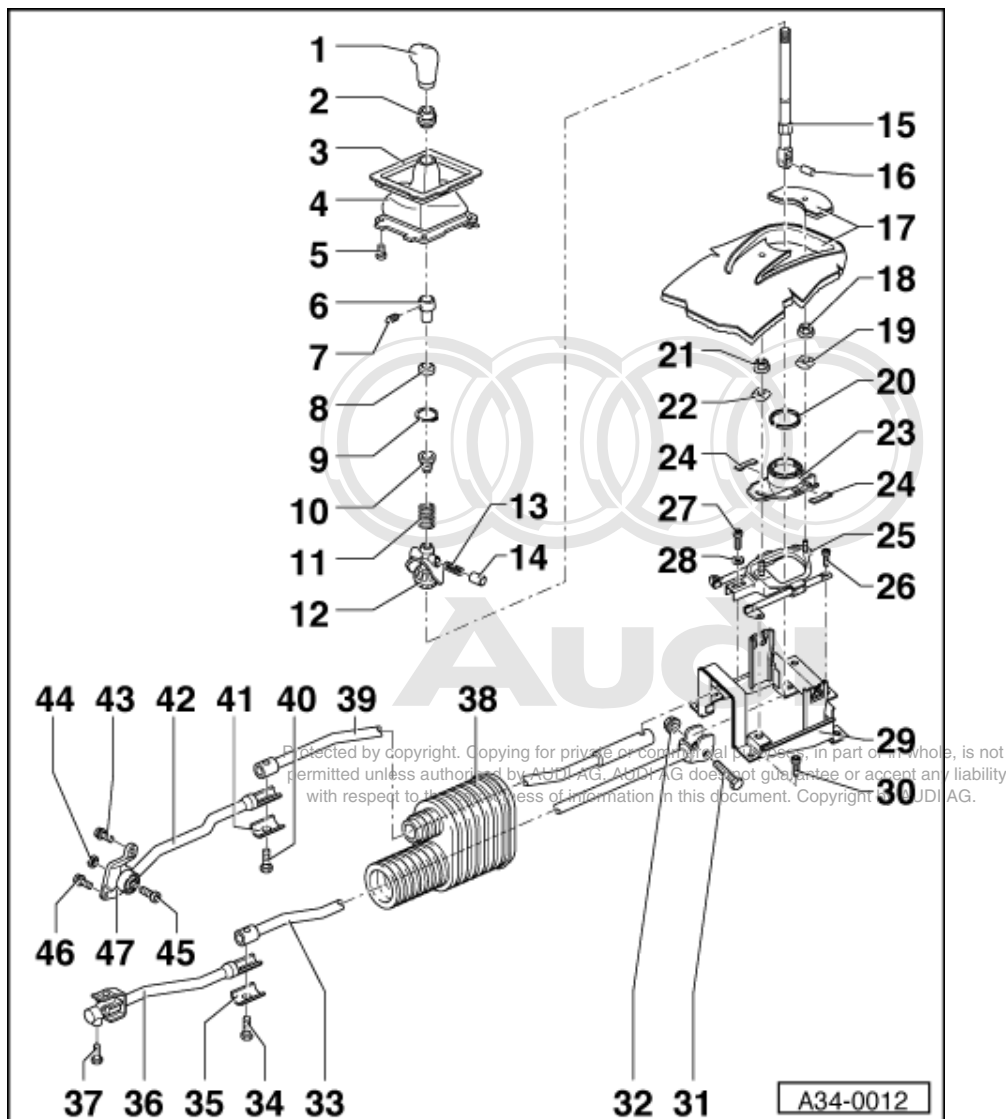
- ♦ Adjusting gear selector mechanism  
=>Page 45 .
- ♦ Remove centre console before removing selector mechanism

=> General body repairs; Repair group 70; Dash panel; Removing and installing centre console and handbrake lever trim Dash panel Removing and installing centre console and handbrake lever trim

- 1 Gear stick knob
- 2 Bush
- 3 Retaining frame



- 4 Cover
  - ♦ Detach trim on left and right of centre console in order to remove securing bolts
- 5 Bolt
- 6 Bush
- 7 Securing bolt
- 8 Sealing collar
- 9 Circlip
  - ♦ Do not open out too far when fitting
- 10 Spacer bush
- 11 Spring



#### 12 Ball stop

- ♦ Insert spring and bush in the ball stop and assemble on the gear stick so that the spring and bush are on the right when looking forwards.
- ♦ Install ball stop before fitting circlip (Item 20)

#### 13 Spring

#### 14 Bush

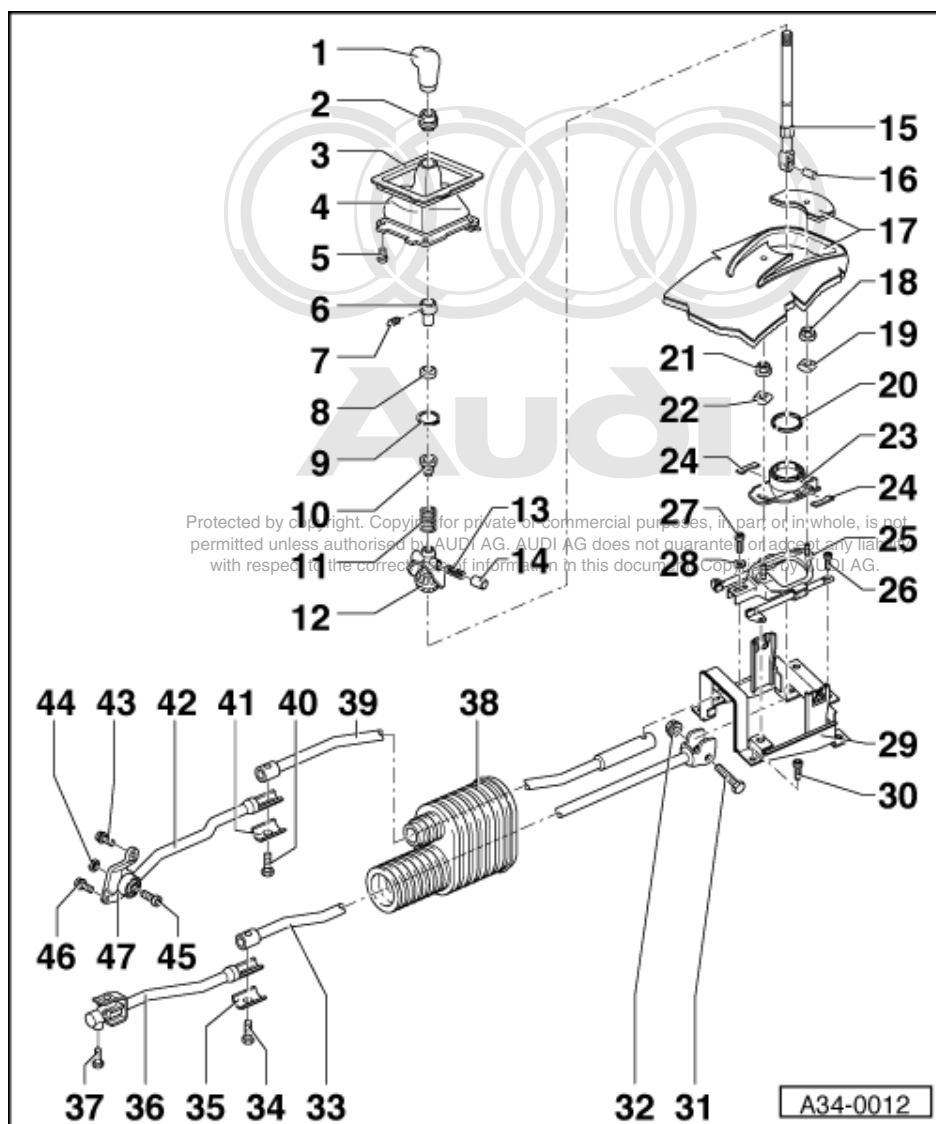
- ♦ Fitting position: The rounded end faces the gear stick

#### 15 Gear stick

- ♦ Can only be fitted into ball housing in one position

#### 16 Spacer

#### 17 Noise insulation



18 Nut - 10 Nm

19 Connector

20 Circlip

- ◆ Renew
- ◆ Remove before removing the ball stop
- ◆ Installation position: rounded side faces towards ball housing (Item **23**)

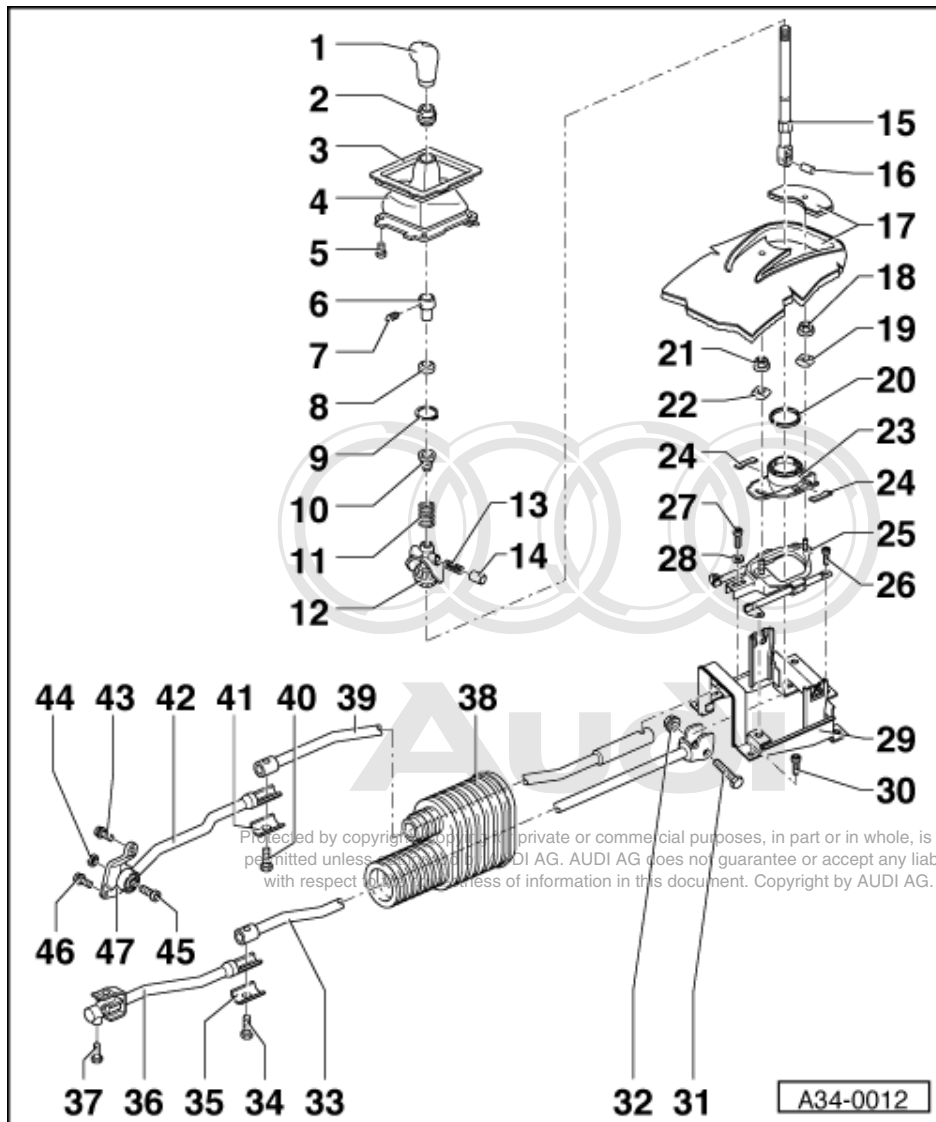
21 Nut - 25 Nm

22 Connector

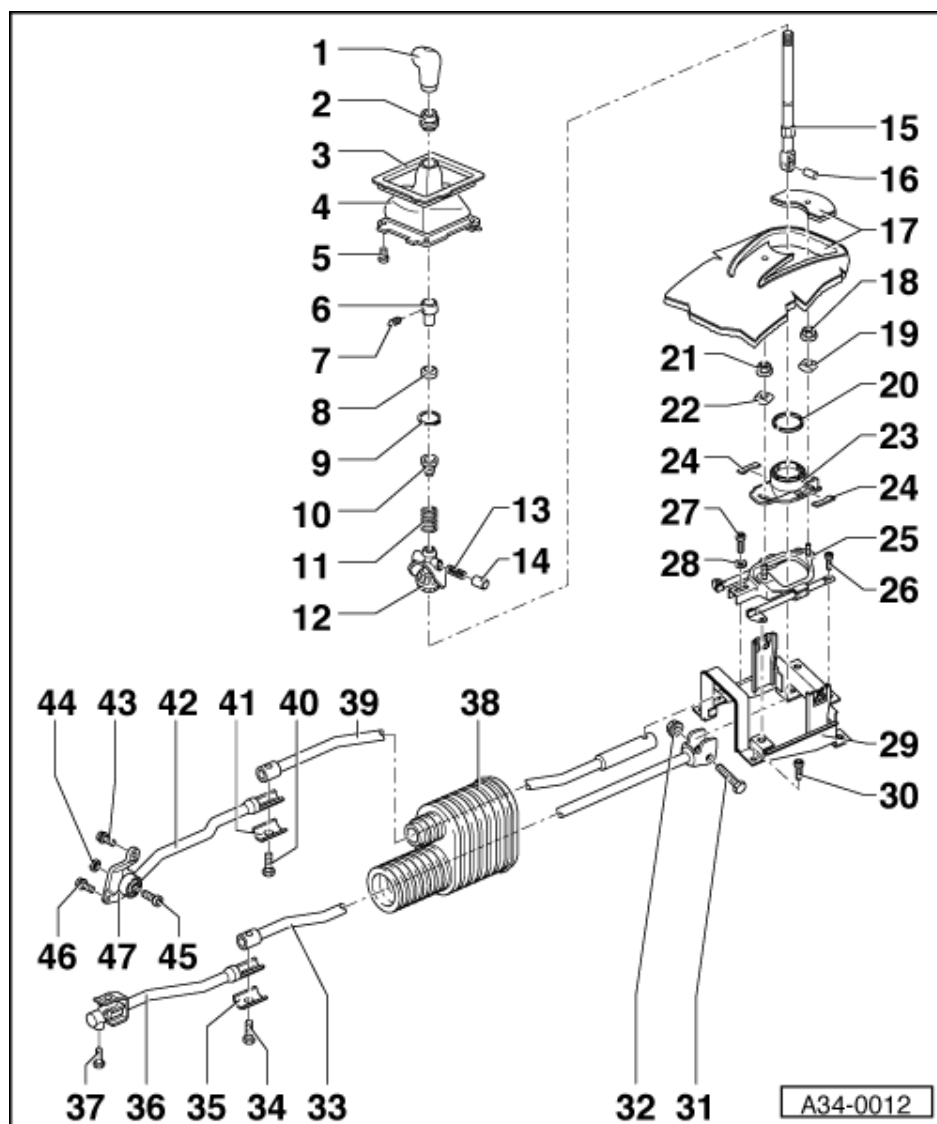
23 Ball housing

- ◆ Limit pieces for ball stop on left and right must be engaged
- ◆ Installation position: reverse detent faces left





- 24 Buffer  
25 Slide  
    ♦ Mounting for ball housing (Item 23)  
26 Bolt - 10 Nm  
27 Bolt - 25 Nm  
28 Washer  
29 Console  
30 Bolt - 10 Nm  
31 Bolt  
32 Nut - 10 Nm  
    ♦ Self-locking  
    ♦ Renew  
33 Rear selector rod

**34 Bolt - 25 Nm**

- ◆ Before slackening bolt, take off and push back heat shield

**35 Clamp****36 Front selector rod**

- ◆ With selector joint

**37 Bolt - 20 Nm**

- ◆ Self-locking
- ◆ Renew

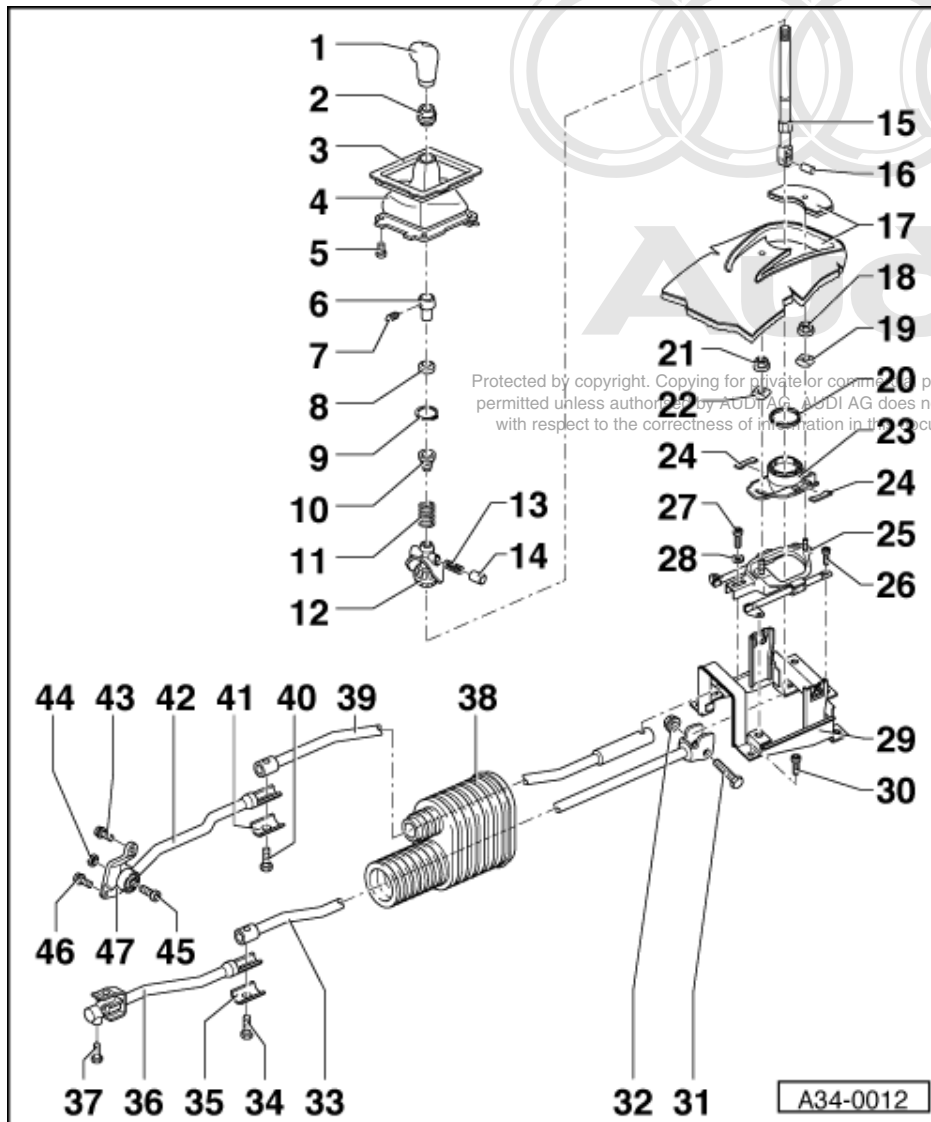
**38 Bellows**

- ◆ Carefully pull over selector rod and push rod

**39 Rear push rod****40 Bolt - 25 Nm**

- ◆ Before slackening bolt, take off and push back heat shield

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- 41 Clamp
- 42 Front push rod
- 43 Bolt - 40 Nm
- 44 Nut - 40 Nm
- 45 Bolt
- 46 Bolt - 40 Nm
- 47 Bracket for push rod

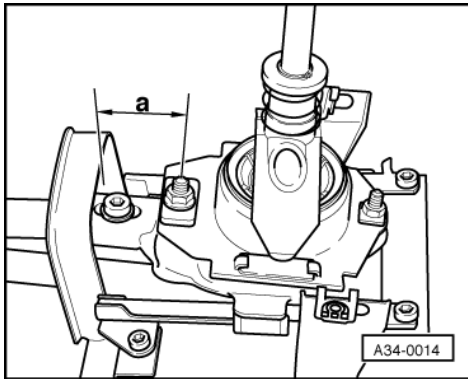
## 1.6 - Adjusting short-travel selector mechanism

### *Requirements:*

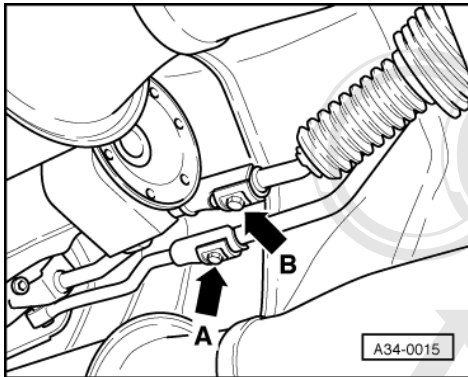
- ◆ All components of selector mechanism must be in proper condition.
  - ◆ Linkage must move freely.
  - ◆ Gearbox, clutch and clutch mechanism must be in proper condition.
  - ◆ Gearbox in neutral.
- Remove gear stick knob and cover.



- Remove noise insulation.

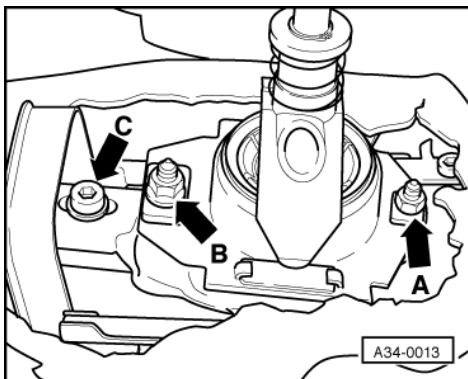


- -> Check distance -a-.
- Distance  $a = 28 \pm 1$  mm
- If necessary, adjust the gear selector mechanism as follows:

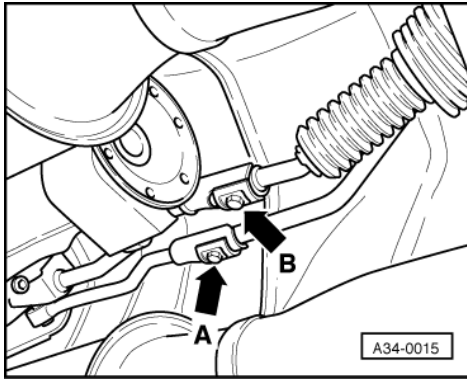


- -> Slacken bolt -arrow A- slightly.
- Adjust slide to distance -a- , => Fig. A34-0014, Page 46 .
- Distance  $a = 28 \pm 1$  mm
- Tighten the bolt to 25 Nm.

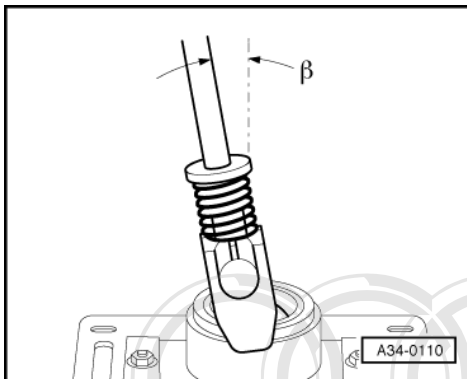
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- -> Slacken nuts -arrow A- and -arrow B-.
- Set ball housing bearing to horizontal position (as seen facing forwards).
- Tighten nut -arrow B- to 25 Nm and nut -arrow A- to 10 Nm.



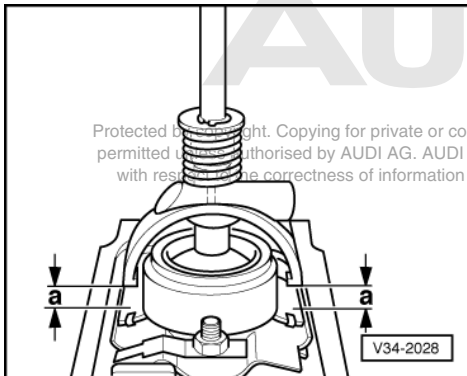
- -> Slacken bolt -arrow B-.



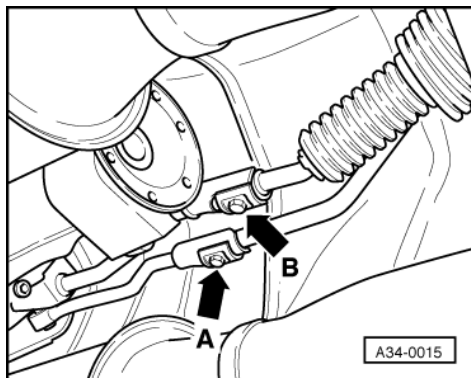
- -> Set gear stick at an angle of approx. 5° to the rear (angle  $\beta$ )

**Note:**

*The illustration shows the gear stick from the right.*



- -> Distance -a- between ball stop buffers and ball housing should be equal on both sides.
- Hold the gear stick in this position (second mechanic required).



- Tighten selector rod bolt (arrow B) to 25 Nm.

**Note:**

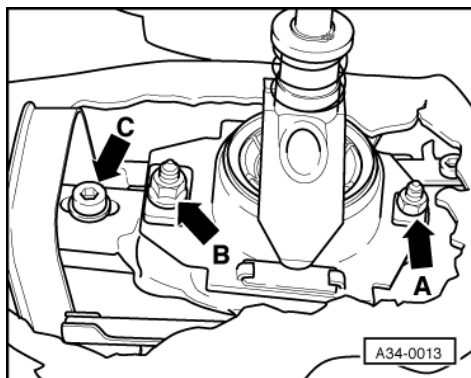
*The gear stick must remain in the same position while the bolt is being tightened.*

## 1.7 - Checking gear stick adjustment

- The gear stick lever must rest in the 3rd/4th gear gate when gearbox is in neutral.
- Operate clutch.
- Check that all gears can be engaged.
- Check operation of reverse gear lock.
- Move gear stick into 5th/reverse gate and pull towards reverse gear position (but do not press down gear stick).
  - The amount of travel until contact is made with reverse gear stop should be 5 ... 10 mm (measured at gear stick knob).
- Take gear stick out of reverse gate (without pushing towards the centre).
  - The gear stick should return by itself from the 5th/reverse gate into the 3rd/4th gate.
- Check fine adjustment if necessary.

### Fine adjustment

- If the gear stick setting is incorrect it can be adjusted as follows:



- -> Loosen ball housing nuts -arrow A- and -arrow B-.
- Move gear stick with ball housing to the right towards 5th/reverse gate as far as the stop in the gearbox, and hold in this position.
- When doing this push the ball housing to the left against the gear stick.
- Then hold gear stick and ball housing in this position and tighten.
- Fit noise insulation, covers and gear stick knob.

## 2 - Removing and installing gearbox

### 2.1 - Removing and installing gearbox

#### Special tools, testers and auxiliary items

- ◆ Gearbox jack V.A.G 1383 A
- ◆ Gearbox support 3282
- ◆ Adjustment plate 3282/10
- ◆ Assembling appliance 3139
- ◆ Grease G 000 100

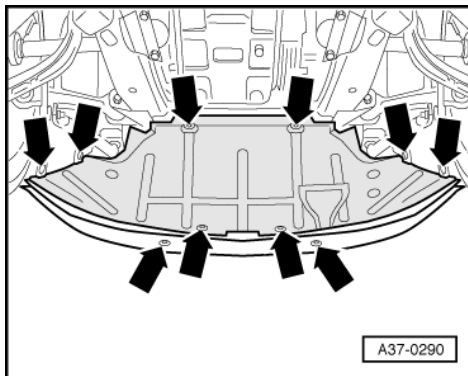
### 2.2 - Removing

Contact corrosion. Notes => Page 7 .

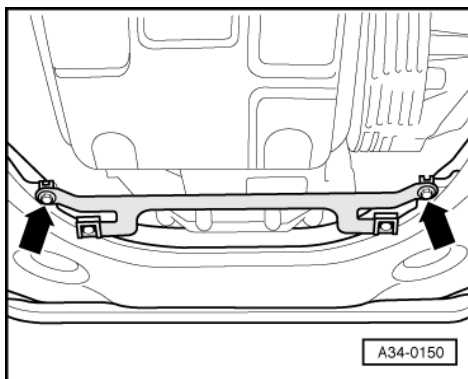
#### Notes:

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- ◆ It is not necessary to support the engine with the engine support bracket when lowering the gearbox out of the vehicle (removing and installing gearbox).
- ◆ The torque reaction support on the engine does not have to be detached.
- Obtain radio code on vehicles with coded radio.
- Disconnect earth strap on battery (on right of luggage compartment) with ignition switched off.



- Unclip both Lambda probe cables at connections, (Lambda probes remain installed).
- Unscrew securing nuts on front exhaust pipes (left and right) accessible from above.
- Unscrew engine/gearbox securing bolts accessible from above.
- -> Remove noise insulation -arrows-.



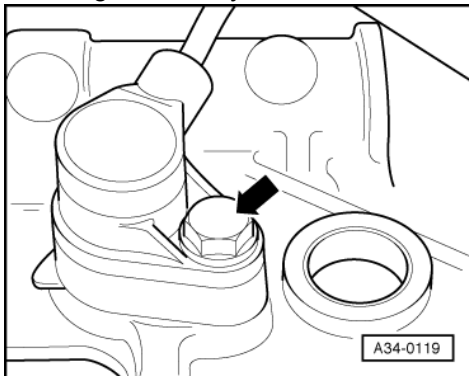


- -> Unbolt bracket for noise insulation -arrows-.
- Remove heat shields for drive shafts.
- Unbolt drive shafts from flanges on gearbox.

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

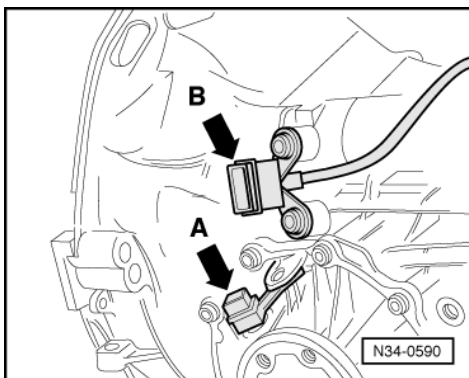
- Slacken clamps on exhaust system and push clamps towards catalytic converter.
- Remove front exhaust pipes (left and right) with catalytic converters.

=> 6-cylinder engine, Mechanics; Repair group 26; Removing and installing exhaust system Removing and installing exhaust system



=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system

- -> If installed, unbolt engine speed sender -G28 (arrow) from front left side of gearbox.

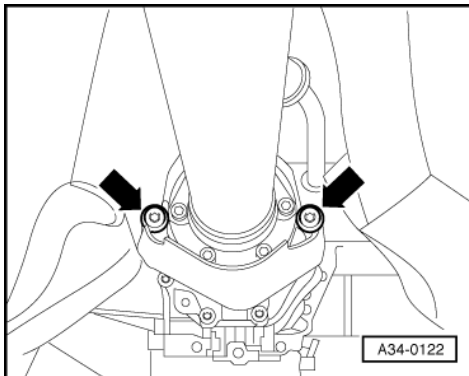


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- -> Pull connector off sender for speedometer -arrow A-.
- Pull connector off reversing light switch -arrow B-.
- Unbolt starter and pull it out slightly.

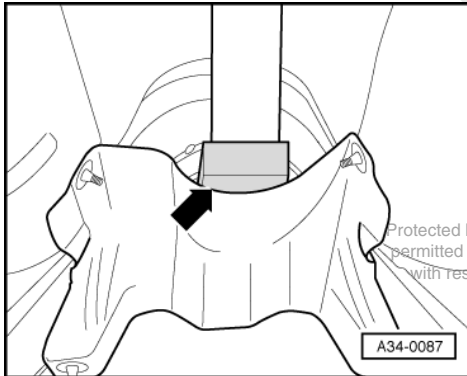
**Note:**

*Starter cables do not have to be disconnected.*

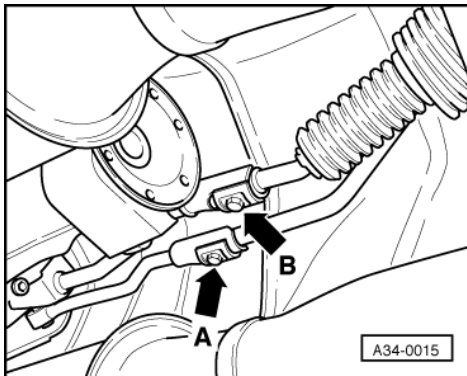




- -> Remove heat shield for propshaft from cover for Torsen differential -arrows-.

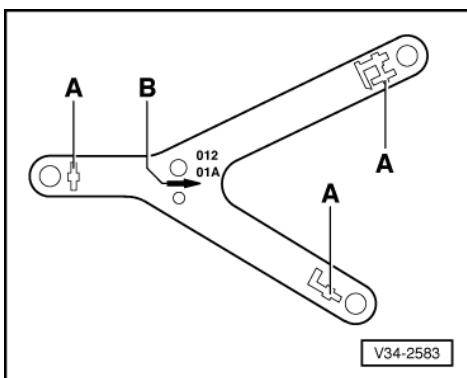


- -> Unbolt propshaft at gearbox and using a wooden wedge -arrow- press upwards against heat shield.
- Unscrew selector rod securing bolt at gearbox and pull selector joint off selector shaft.



**Notes:**

- ♦ -> On vehicles with short-travel selector mechanism (03.96 ➤), mark relative positions of front and rear push rods -arrow A- before slackening securing bolt.
- ♦ The selector rod must be disconnected at the gearbox, and not at the connection -arrow B-.



- -> Set up gearbox support 3282 for removing manual gearbox 01A (four-wheel drive) with adjustment plate 3282/10 and attach to gearbox jack V.A.G 1383 A.

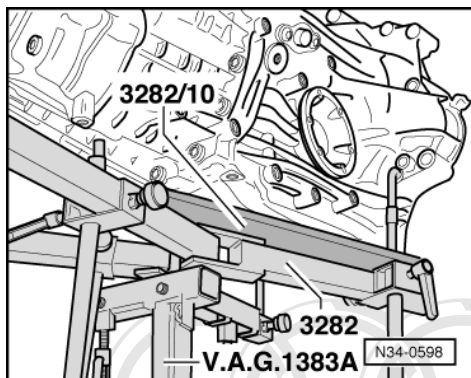
A - Attachments

**Notes:**

- ♦ Attachments -A- are shown in schematic form; arrow -B- points in the direction of travel.



- ♦ Adjustment plate 3282/10 only fits in one position.

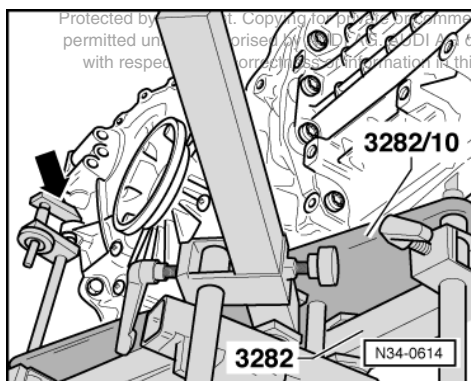


- -> Run gearbox jack V.A.G 1383 A with gear support 3282 in under the gearbox and take up the weight of the gearbox.

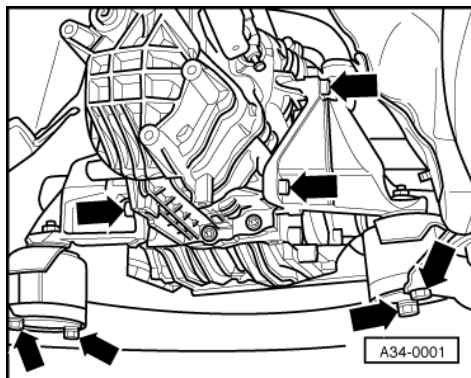
**Note:**

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

- Support gearbox with gear jack V.A.G 1383 A.



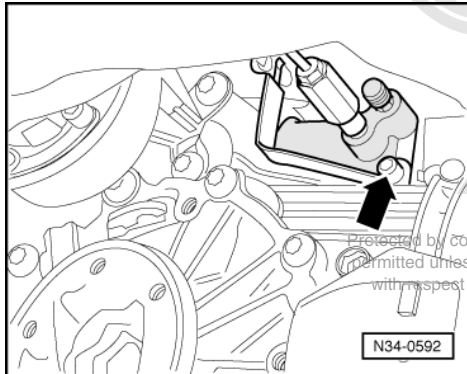
- -> Align adjustment plate parallel to gearbox and lock safety support (arrow) on gearbox.
- Remove heat shield above gearbox support.



- -> Unbolt right and left gearbox supports complete with bonded rubber mountings -arrows- from gearbox and subframe.
- Remove remaining engine/gearbox securing bolts.
- Press gearbox off dowel sleeves and lower carefully with gearbox jack V.A.G 1383 A just far enough for access to the slave cylinder.

**Note:**

*When lowering gearbox ensure hydraulic pipe/hose to slave cylinder is not damaged.*



- -> Remove clutch slave cylinder (arrow) and secure with wire, do not disconnect pipe.

**Note:**

*Do not depress clutch pedal after removing slave cylinder.*

- Lower gearbox completely.

**Note:**

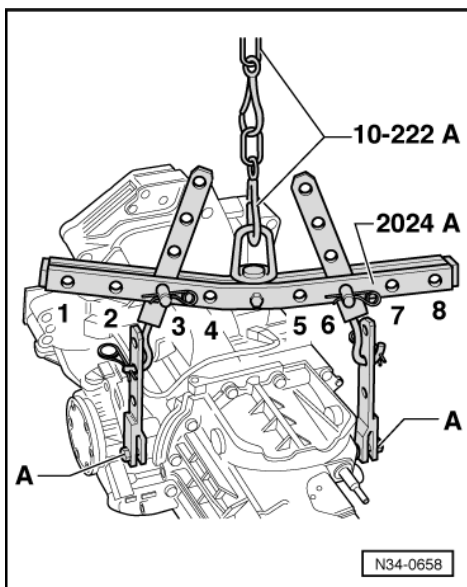
*When lowering gearbox ensure there is sufficient clearance to drive shafts.*

## 2.3 - Transporting the gearbox

### Special tools, testers and auxiliary items

- ◆ Lifting tackle 2024 A
- ◆ Workshop crane V.A.G 1202 A
- ◆ Special hook from 10-222 A

The gearbox can be transported using lifting tackle 2024 A in conjunction with the special hook from 10-222 A.





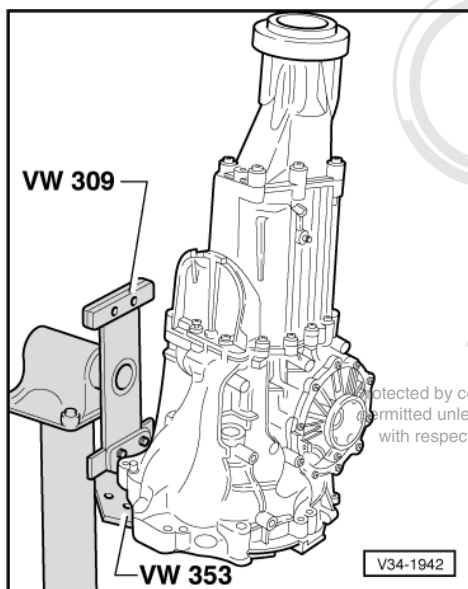
- -> Bolt on extension bars from lifting tackle 2024 A with two bolts -A- (M10 x 50).
- Hook on lifting tackle 2024 A and lift slightly with workshop crane.
- Attach the two lifting bars with the fourth hole in the bars in positions -3- and -6- on lifting tackle 2024 A.

The hook attachments and locating pins on the lifting tackle must be secured with locking pins.

## 2.4 - Securing gearbox to engine and gearbox support

### Special tools, testers and auxiliary items

- ♦ Retaining plate VW 309
- ♦ Gearbox support VW 353
- ♦ Engine and gearbox support VW 540

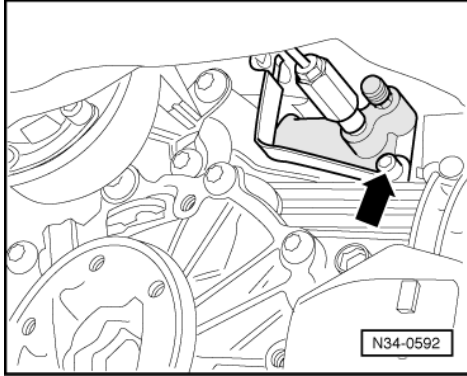


- -> To perform repairs, secure the gearbox to engine and gearbox support VW 540 with gearbox support VW 353 and retaining plate VW 309.

## 2.5 - Installing

Installation is carried out in the reverse order, when doing this note the following:

- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Do not grease guide sleeve.
- Check clutch release bearing for wear, renew if necessary.
- Coat push rod contact surface on clutch release lever with a thin layer of copper grease, e.g. Z 381 351 TE.
- Before installing, use a tap to clean out locking fluid left in the threads of the clutch slave cylinder mounting on the gearbox and the selector lever/selector rod connection.
- Check whether dowel sleeves for aligning engine/gearbox are fitted in cylinder block, install if necessary.
- Renew all self-locking nuts.



- -> Lift gearbox until clutch slave cylinder with bracket for pipe/hose can be installed (arrow).
- Fit intermediate plate between gearbox and engine onto engine dowel sleeves.
- Ensure that the intermediate plate is correctly positioned on engine.
- Install lower engine/gearbox securing bolts and bolts for starter; when doing this install starter.

=> Electrical system; Repair group 27; Removing and installing starter Removing and installing starter

- Before installing, use a tap to clean threads in flange shaft for propshaft on gearbox to remove traces of locking compound.
- Renew gaskets on drive shafts and on front of propshaft => Page 173 .
- Bolt on propshaft=>Page 172 .
- Check adjustment of selector rod; adjust if necessary  
=>Page 45 .

- Align exhaust system free of stress

=> 6-cylinder engine, Mechanics; Repair group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

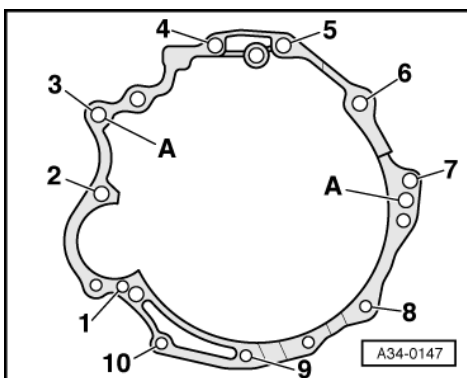
=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system; Stress-free alignment of exhaust system Removing and installing parts of exhaust system Stress-free alignment of exhaust system

- Check oil level in gearbox =>Page 56 .
- After connecting battery, enter anti-theft code for radio

=> Radio operating instructions

- Close windows fully using electric window switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.

### Tightening torques



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-> Engine/gearbox mountings

Item No.	Bolt	Nm
1	M10 x 135	45
2	M12 x 130	65
3, 4, 5	M12 x 67	65
6	M12 x 90 1)	65
7	M12 x 80	65
8, 9, 10	M10 x 45	45

1) Bolt with washer

A, B: centring sleeves

Component		Nm
Drive shaft to flange shaft	M8	45
	M10	77
Clutch slave cylinder to gearbox		25
Heat shields over the drive shafts to gearbox		20
Selector joint to gearbox		20
Front push rod to rear push rod		25
Gearbox support to subframe		40
Gearbox support to gearbox mounting	M10	40
Gearbox mounting to body	M8	25
	M10	40
Propshaft to gearbox		55
Heat shield for propshaft to Torsen differential cover		25

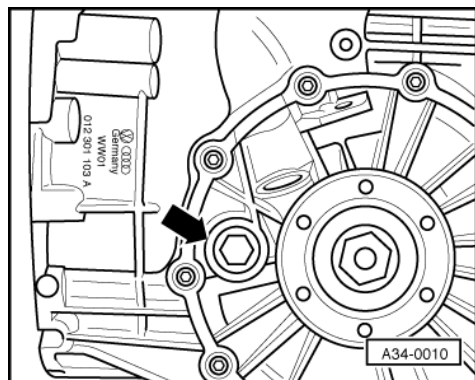
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## 3 - Checking gearbox oil level in gearbox

### 3.1 - Checking gearbox oil level in gearbox

#### Notes:

- ♦ The oil filler plug is on the left of the gearbox below the speedometer sender; it may be concealed by the heat shield for the drive shaft.
- ♦ To loosen the oil drain plug, use special tool 3357.



- -> To check oil level, unscrew oil filler plug (arrow).
- Specification: oil level up to lower edge of filler hole
- Top up gearbox oil if necessary. Specification => from Page 2 .

- Fit oil filler plug.

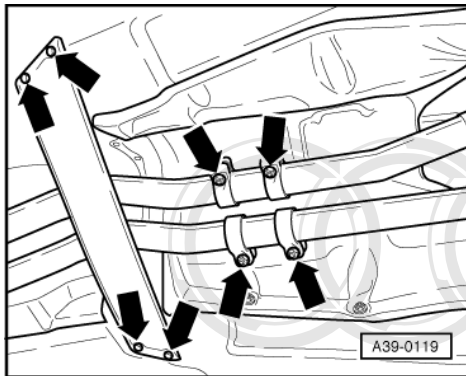
#### Tightening torque

Component	Nm
Oil filler plug	25

## 4 - Removing and installing cover with Torsen differential

### 4.1 - Removing and installing cover with Torsen differential

- Gearbox installed

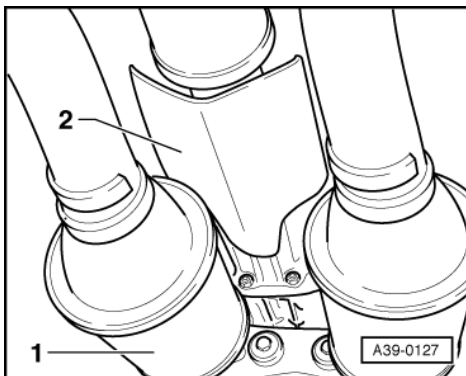


#### Removing

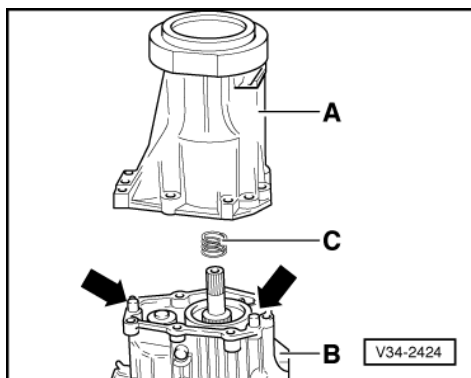
- -> Remove cross member -left arrows-.
- Remove front left exhaust pipe with catalytic converter and rear section of exhaust system (rearward of clamps -arrows-);

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=> 6-Cylinder engine; Mechanics; Repair group 26; Removing and installing exhaust system Removing and installing exhaust system

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system



- -> Unbolt heat shield for propshaft -2- from cover for Torsen differential.
- Unbolt propshaft from gearbox=>Page 175 and tie-up on selector linkage.
- Place drip tray underneath and drain gearbox oil.



- -> Unbolt cover -A- with Torsen differential from gearbox cover -B-.

**Note:**

*Shown in illustration with gearbox removed.*

- Remove spring -C- from drive pinion.

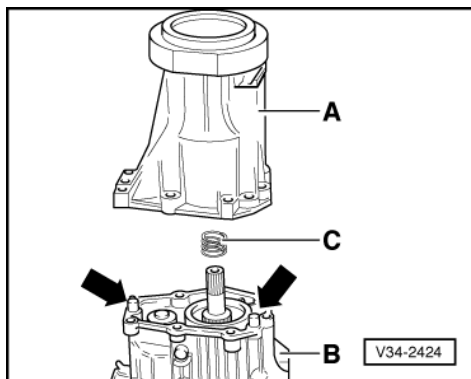
Removing and installing Torsen differential in cover=>Page **77** .

Servicing cover=>Page **77** .

**Installing**

Installation is carried out in the reverse order, when doing this note the following:

- Clean the sealing surface and coat with AMV 188 000 02.



- -> Check that dowel sleeves for cover -A- are fitted in gearbox cover -B- (arrows).
- Fit spring -C- onto hollow shaft over drive pinion.
- Bolt on propshaft=>Page **172** .
- Top up gearbox oil and check oil level in gearbox => Page **56** .

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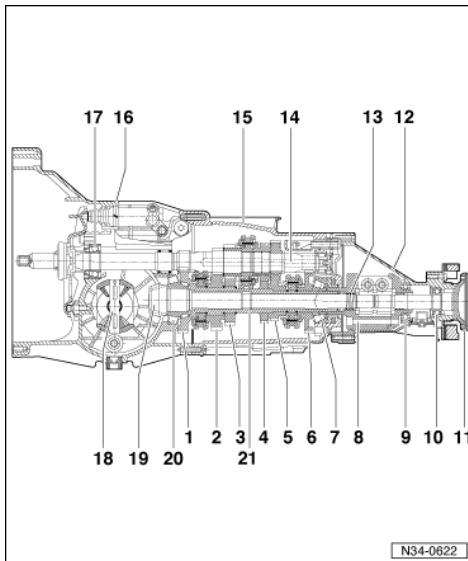
**Tightening torques**

Component	Nm
Cover with Torsen differential to gearbox	25
Propshaft to gearbox	55
Heat shield for propshaft to Torsen differential cover	25



## 5 - Dismantling and assembling gearbox

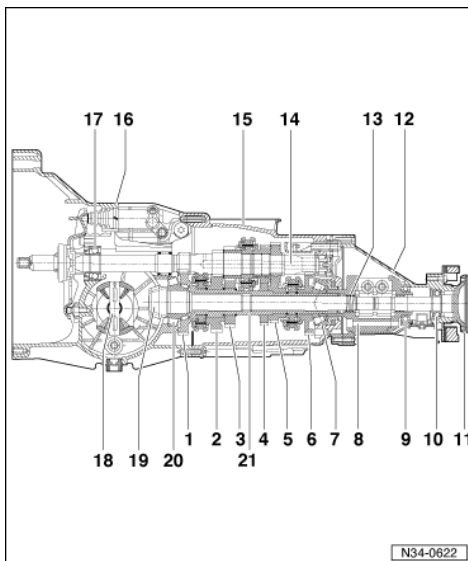
### 5.1 - Dismantling and assembling gearbox



Sequence =>Page **69** .

### 5.2 - Gearbox overview

- 1 1st gear
- 2 2nd gear
- 3 3rd gear
- 4 4th gear
- 5 5th gear
- 6 Reverse gear
  - ♦ Removing and installing reverse idler gear=>Page **128**
- 7 Taper roller bearing
  - ♦ Adjusting => from Page **154**



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## 8 Torsen differential

- ♦ Can be serviced only by manufacturer
- ♦ Removing and installing with cover  
=> Page 57

## 9 Bearing

## 10 Bearing

## 11 Flange shaft

## 12 Cover for Torsen differential

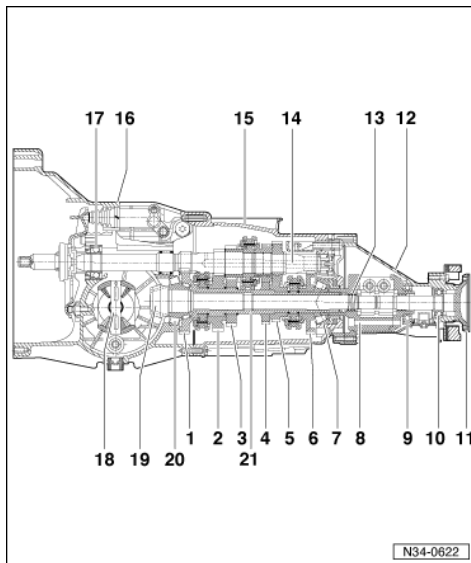
## 13 Spring

- ♦ Between Torsen differential and hollow shaft

## 14 Input shaft

- ♦ Dismantling and assembling  
=> Page 93

## 15 Gearbox cover



## 16 Gearbox housing

## 17 Bearing

- ♦ Adjusting  
=> Adjusting input shaft, Page 105

## 18 Differential

- ♦ Removing and installing  
=> Page 137
- ♦ Dismantling and assembling  
=> Page 141

## 19 Drive pinion

- ♦ Dismantling and assembling hollow shaft and drive pinion => Page 107

## 20 Radial taper roller bearing

- ♦ Adjusting => from Page 154

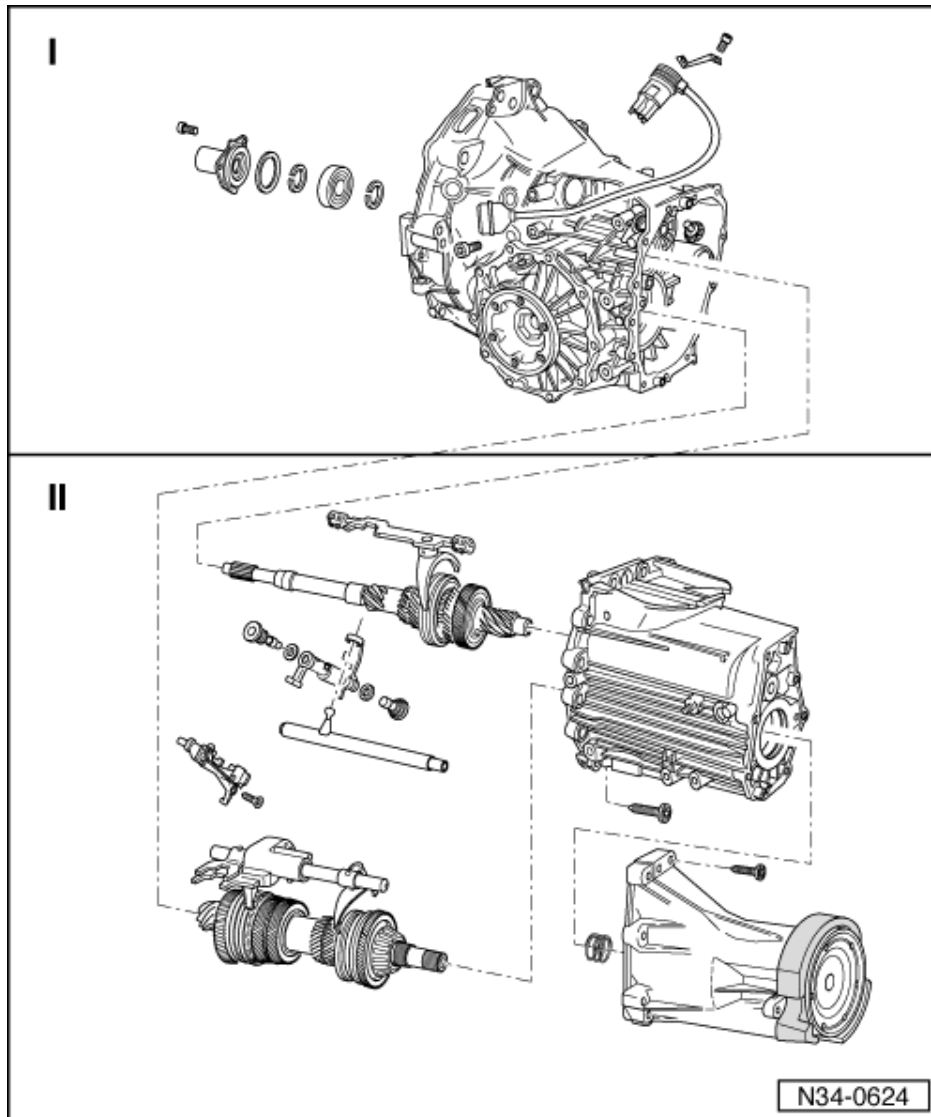
## 21 Hollow shaft

- ♦ Dismantling and assembling hollow shaft and drive pinion => Page 107



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### 5.3 - Assembly overview



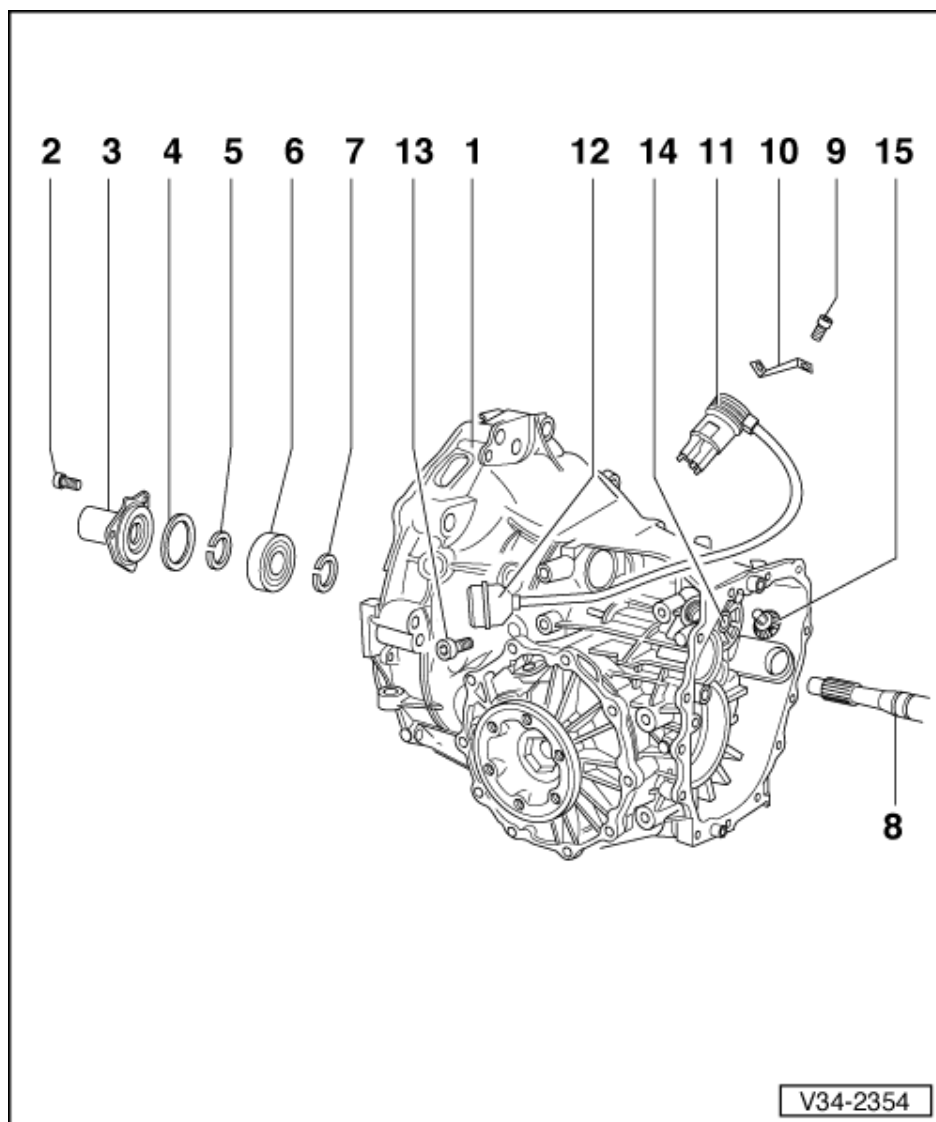
- I - Removing and installing input shaft ball bearing and multi-function sender=>Page 62  
II - Removing and installing input shaft, drive pinion, hollow shaft, selector rods, gearbox cover and cover with Torsen differential=>Page 66



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## 5.4 - Removing and installing input shaft ball bearing and multi-function sender



### 1 Gearbox housing

- ◆ With differential and flange shafts
- ◆ Removing and installing flange shafts=>Page 130
- ◆ Removing and installing differential=>Page 137
- ◆ Removing and installing speedometer sender and drive wheel =>Page 135
- ◆ Breather installation position => Fig. 1

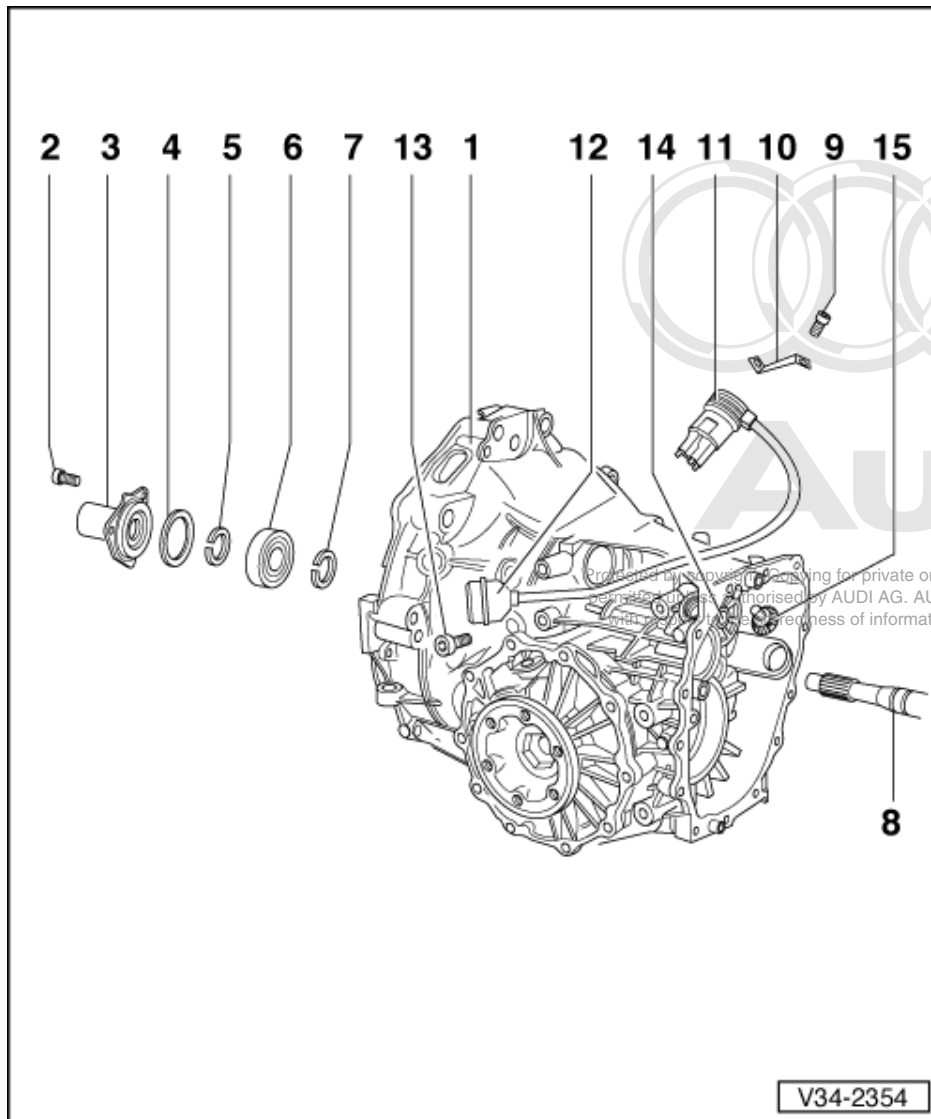
### 2 Torx socket head bolt, -35 Nm

- ◆ Self-locking
- ◆ Renew

### 3 Guide sleeve

- ◆ With O-ring and oil seal for input shaft => Page 24

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**4 Dished washer**

- ♦ Smaller diameter (convex side) faces guide sleeve

**5 Circlip**

- ♦ Determining thickness => adjusting input shaft, Page 105

**6 Ball bearing**

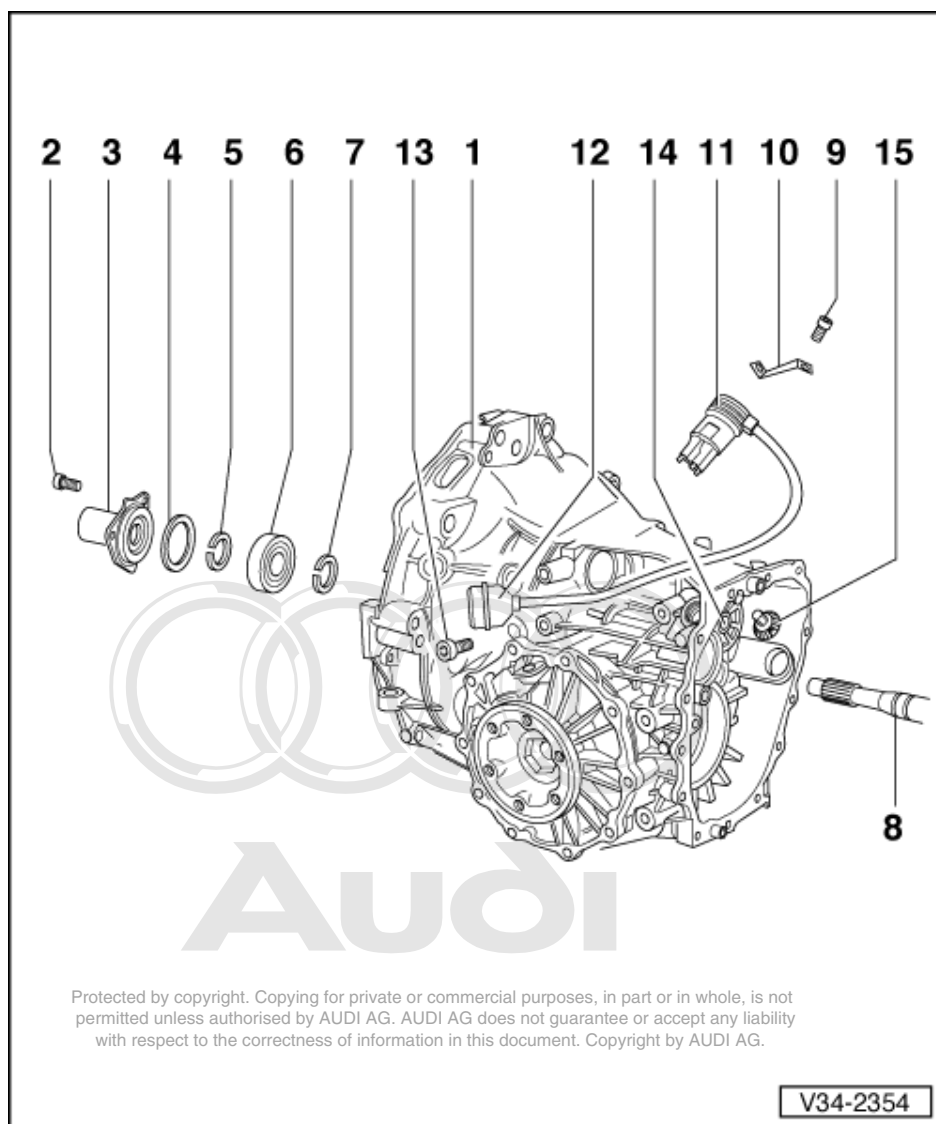
- ♦ Removing and installing  
=>Page 69

**7 Circlip**

- ♦ Determining thickness => adjusting input shaft, Page 105

**8 Input shaft**

- ♦ Removing and installing  
=> Page 66
- ♦ Dismantling and assembling  
=> Page 93
- ♦ Adjusting =>Page 105
- ♦ Servicing input shaft bearings  
=> Page 93



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V34-2354

**9 Bolt - 25 Nm**

**10 Locking plate**

- ♦ For multi-function sender

**11 Multi-function sender**

**12 Connector**

- ♦ For multi-function sender

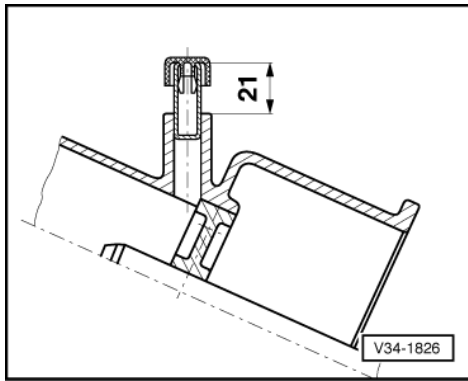
**13 Bolt - 10 Nm**

**14 Cover for selector shaft**

- ♦ Removing and installing  
=> Page **85**

**15 Locking unit for 5th gear and reverse gear**

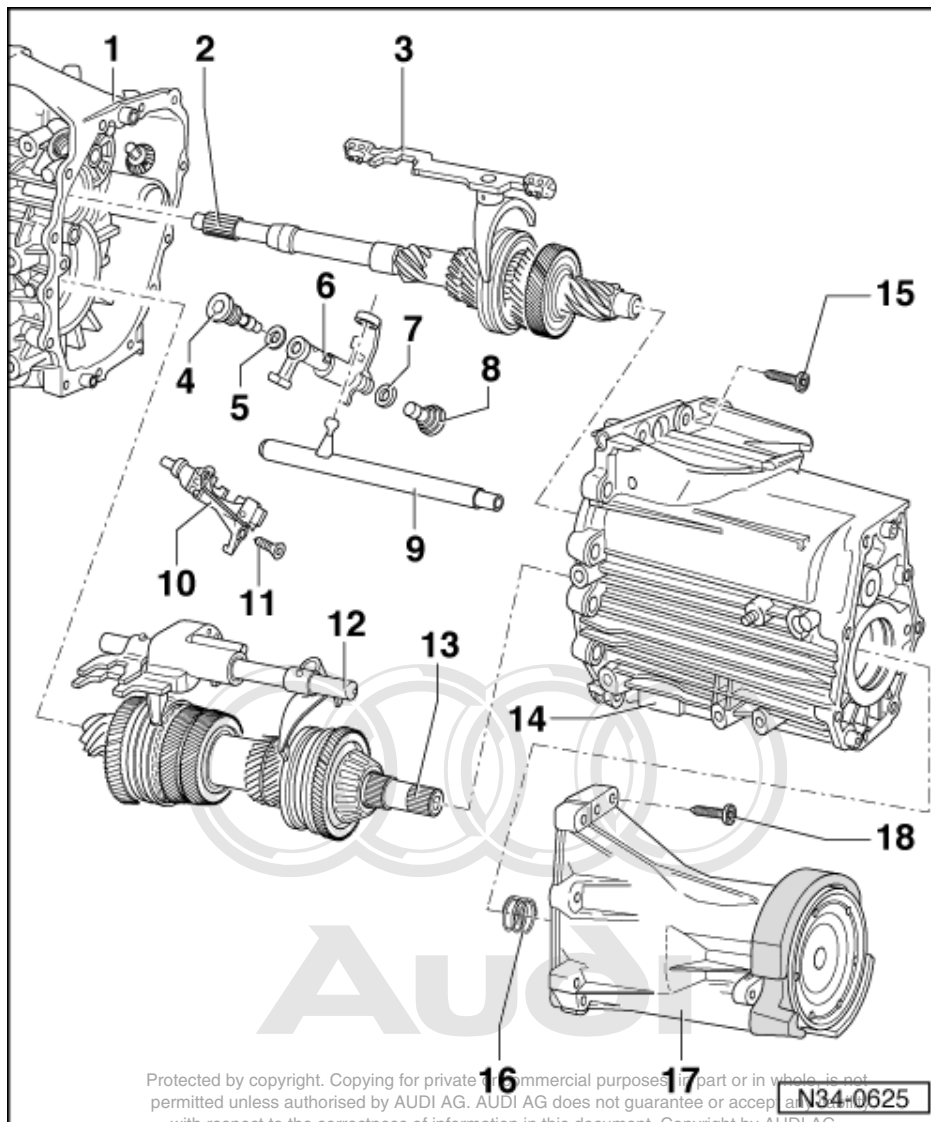
- ♦ Removing and installing  
=> Page **90**



-> Fig.1 Breather installation position

After pressing in, the breather must project 21 mm out of housing.

### 5.5 - Removing and installing input shaft, drive pinion, hollow shaft, selector rods, gearbox cover and cover with Torsen differential



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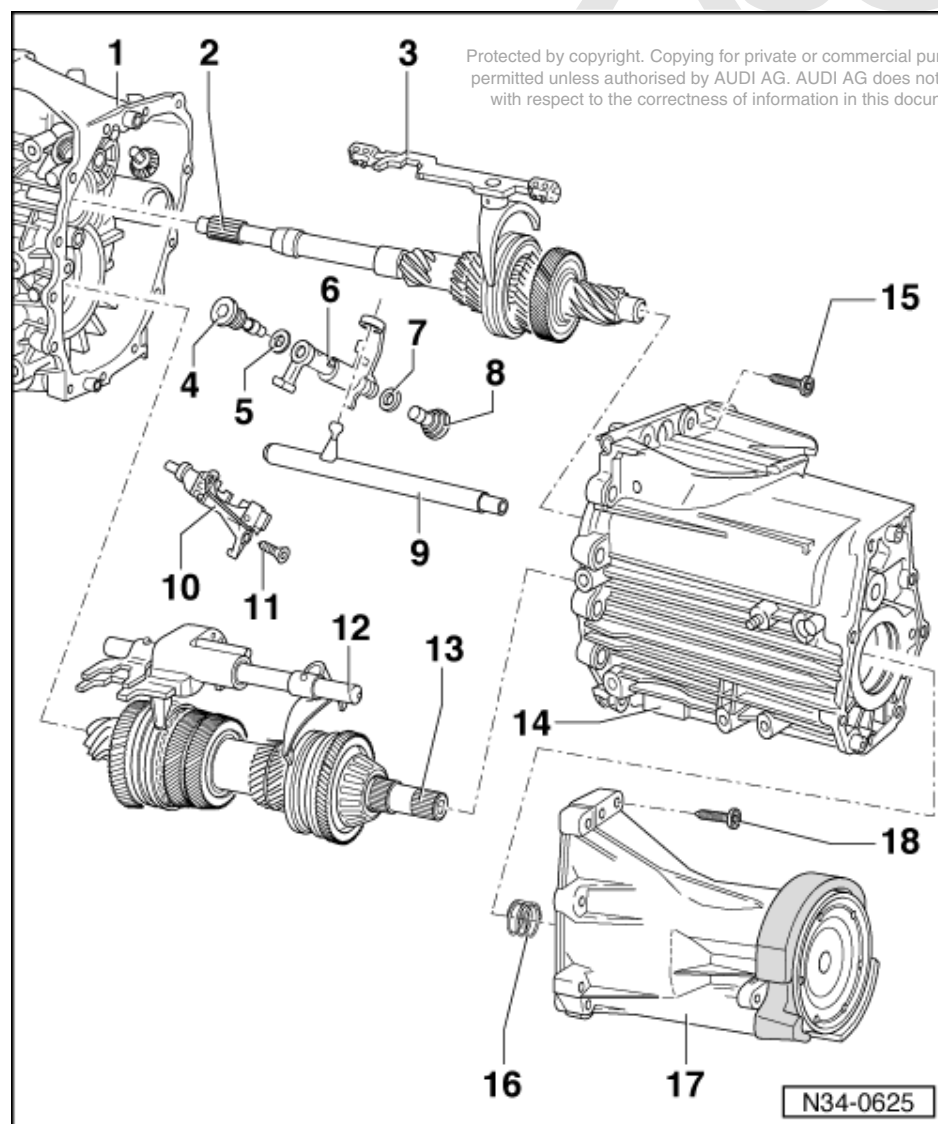
**1 Gearbox housing**

**2 Input shaft**

- ♦ Dismantling and assembling => Page 93
- ♦ Adjusting => Page 105
- ♦ Servicing input shaft bearings  
=> Page 93

**3 Selector rod with selector fork for 3rd and 4th gear**

- ♦ Dismantling and assembling  
=> Page 85
- ♦ Replacing mounting bushes  
=> Page 85



**4 Left stop bolt,**  
40 Nm

**5 Oil seal**

**6 Relay shaft**

- ♦ Installation position => Page 86

**7 Oil seal**

**8 Right stop bolt,**  
40 Nm

**9 Selector shaft**

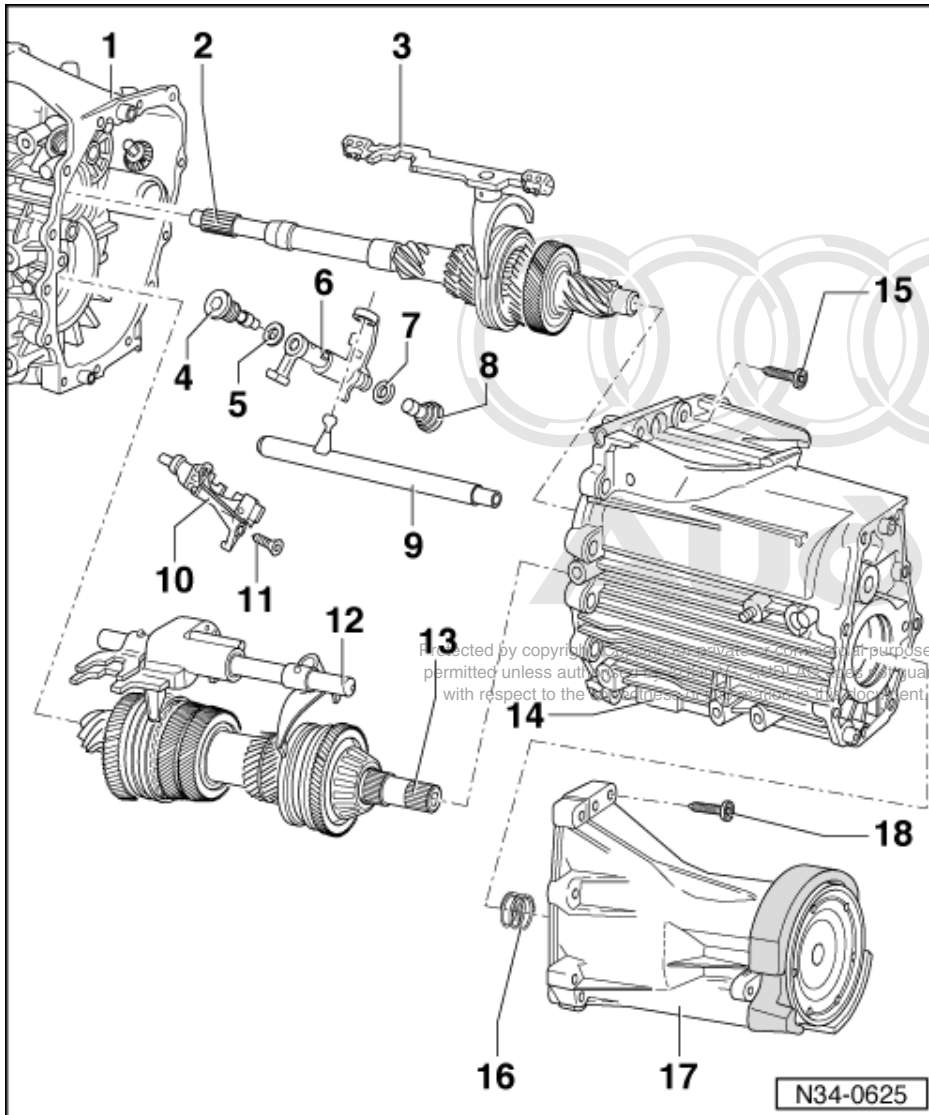
- ♦ Installation position => Page 88
- ♦ Replacing selector shaft oil seal



=> Page 88

## 10 Detent segment

- ♦ Installation position => Page 85



### 11 Torx bolt -25 Nm

- ♦ With shoulder to secure the detent segment spring

### 12 Selector rod with 1st/2nd/5th and reverse gear selector forks

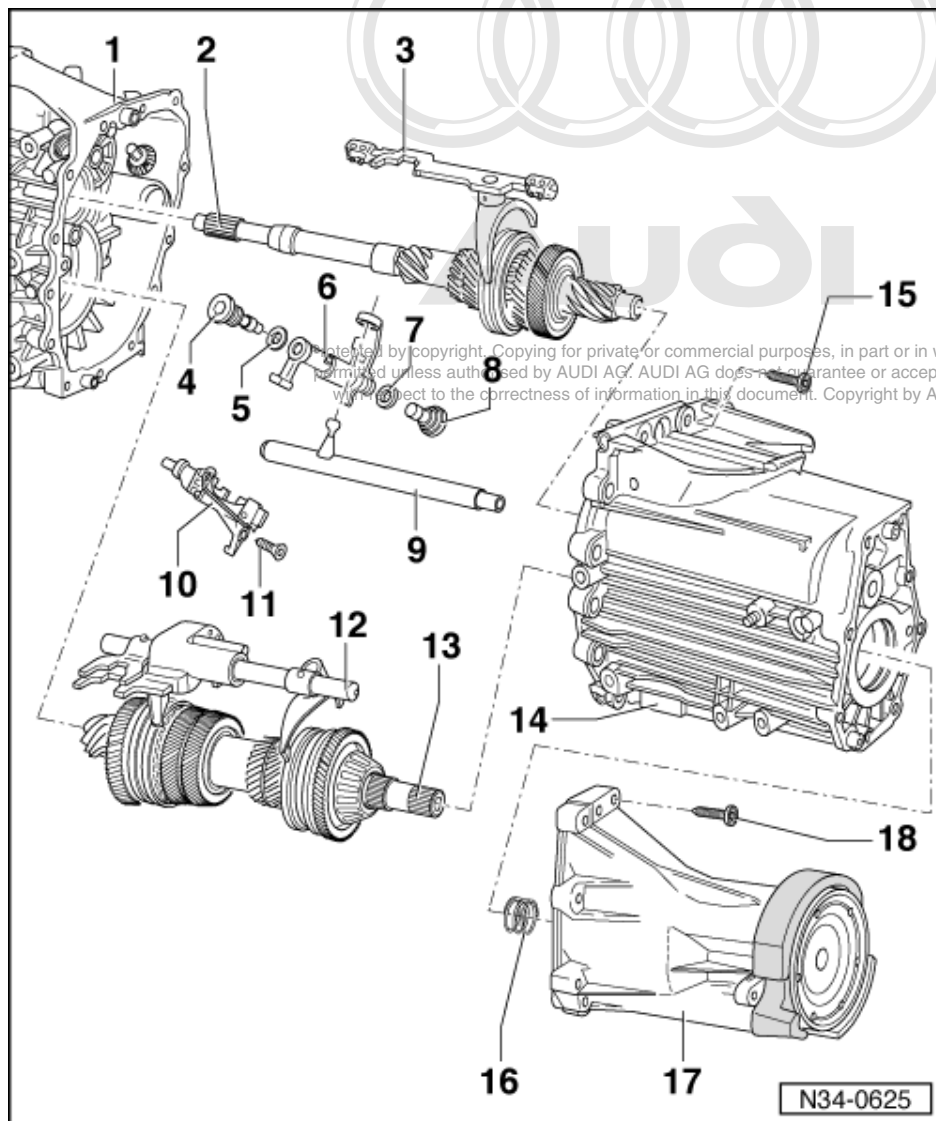
- ♦ Dismantling and assembling  
=> Page 85
- ♦ Removing and installing ball sleeves  
=>Fig. 2, Page 89

### 13 Drive pinion with hollow shaft

- ♦ Dismantling and assembling  
=> Page 107
- ♦ Adjusting=>Page 154
- ♦ Servicing drive pinion and hollow shaft bearings => Page 107

### 14 Gearbox cover

- ♦ Removing and installing oil collector tray=>Fig. 1



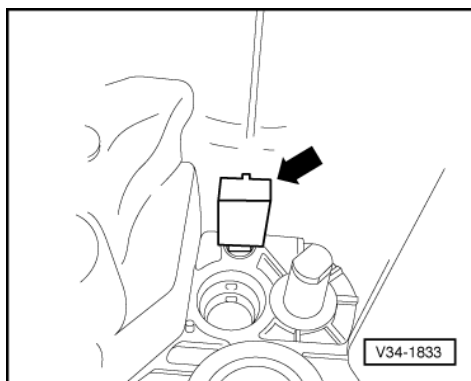
**15 Torx bolt - 22 Nm**

**16 Spring**

**17 Cover with Torsen differential**

- ◆ Removing and installing with gearbox installed => Page [57](#)
- ◆ Removing and installing Torsen differential from cover => Page [77](#)
- ◆ Servicing cover => Page [77](#)

**18 Torx bolt - 22 Nm**



-> Fig.1 Removing and installing oil collector tray

**Removing**

- Turn the oil collector tray -arrow- and then pull out

**Installing**

- Push oil collector tray into the gearbox until it snaps in.
- Position: oil collector tray faces upwards in gearbox cover.

## 5.6 - Removing and installing input shaft ball bearing, multi-function sender, input shaft, drive pinion, selector rods, gearbox cover and cover with Torsen differential

**Special tools, testers and auxiliary items**

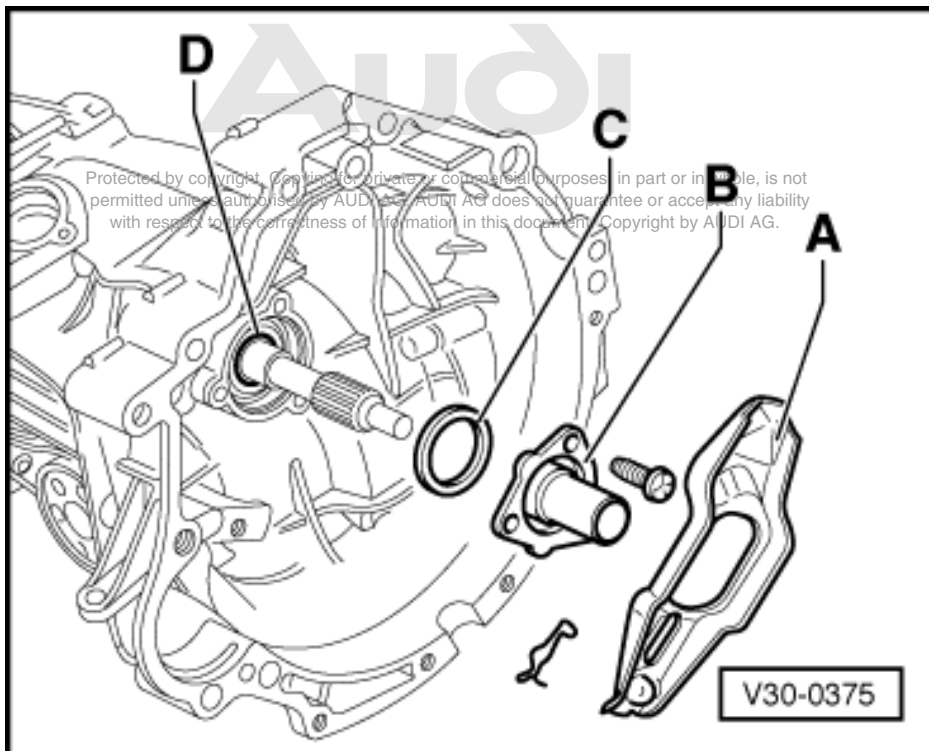
- ◆ Drip tray V.A.G 1306
- ◆ Taper roller bearing extractor V. A. G. 1582
- ◆ Grip V. A. G. 1582/3
- ◆ Retaining plate VW 309
- ◆ Gearbox support VW 353
- ◆ Engine and gearbox support VW 540
- ◆ Pressing-in tool 3235
- ◆ Socket 3357

**Notes:**

- ◆ To remove the above-mentioned components it is not necessary to remove the differential.
- ◆ Removal is only necessary when adjustments have to be carried out => adjustment overview, Page 152 .

**Removing**

- Place drip tray VW 1306 below gearbox.
- Drain gear oil.
- Secure gearbox to engine and gearbox support VW 540  
=>Page 54 .



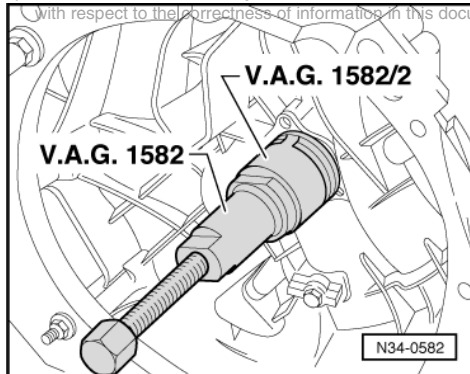


- -> Remove clutch release lever -A- with release bearing.

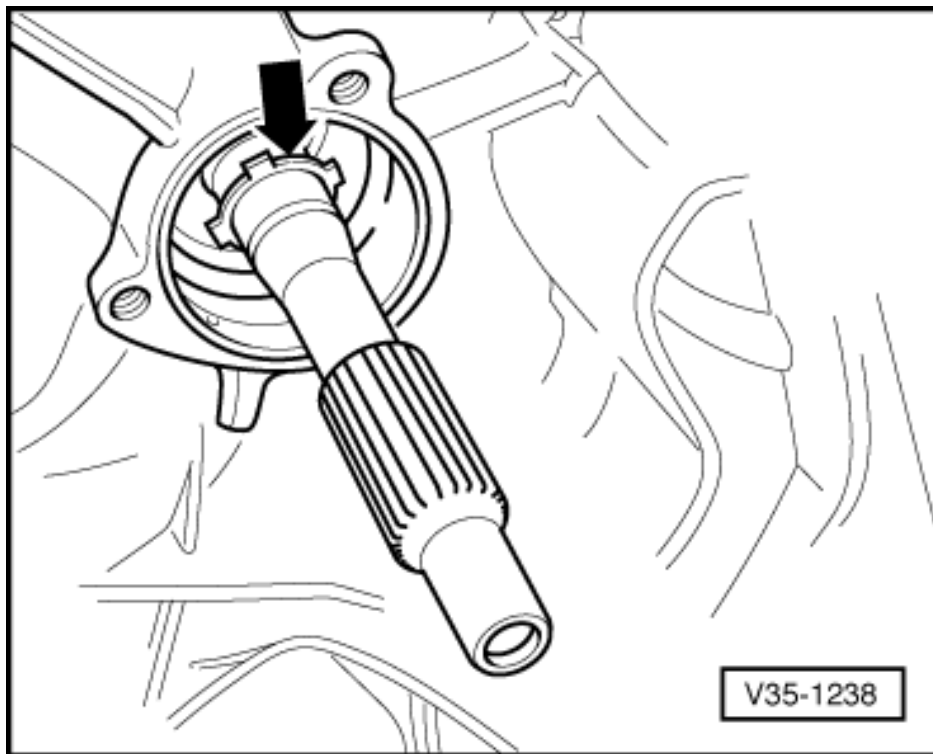
**Notes:**

- ♦ Before pulling off guide sleeve, cover splines on input shaft with a shrink-fit hose to protect oil seal.
- ♦ Removing oil seal in guide sleeve => Page 25 .
- Remove guide sleeve -B-
- Remove dished washer -C-
- Remove circlip -D- in front of input shaft ball bearing.
- If the ball bearing, input shaft or gearbox housing is not to be replaced, note the thickness of the circlip.

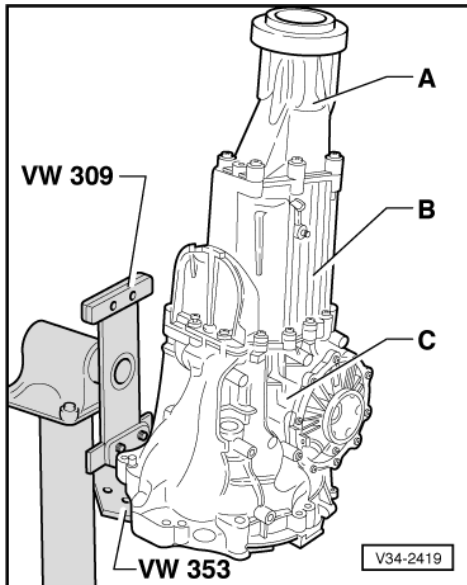
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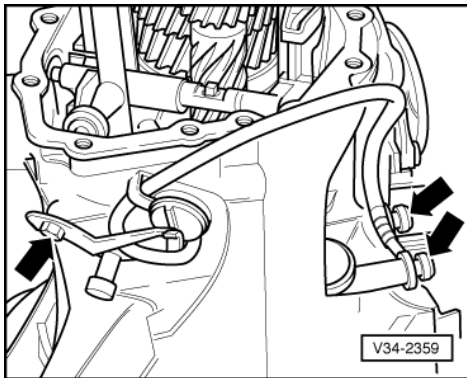
- -> Pull the input shaft ball bearing out of gearbox housing.



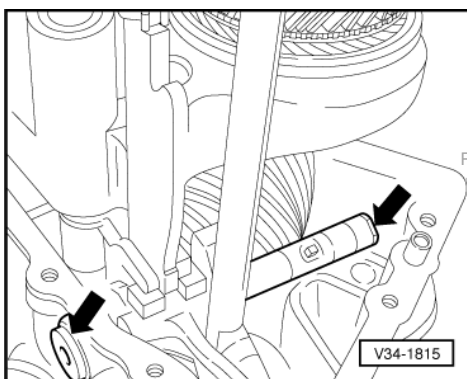
- -> Remove the circlip (arrow) behind the input shaft ball bearing.
- If the ball bearing, input shaft or gearbox housing is not to be replaced, note the thickness of the circlip.



- -> Unbolt cover -A- with Torsen differential from gearbox cover -B-.
- Remove spring from drive pinion.
- Then unbolt gearbox cover -B- from gearbox housing -C-.



- -> Remove bolts (arrows) and pull out the multi-function sender.

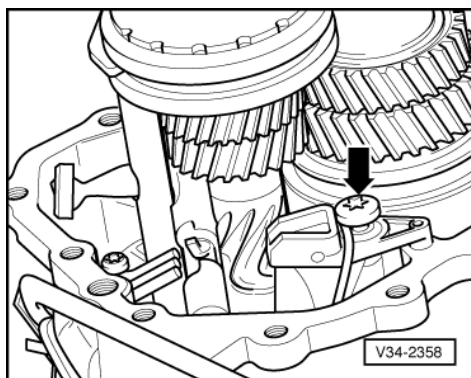


- -> Remove relay shaft bolts (arrows).

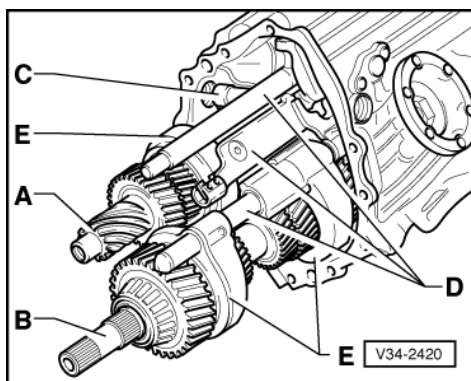


**Audi**

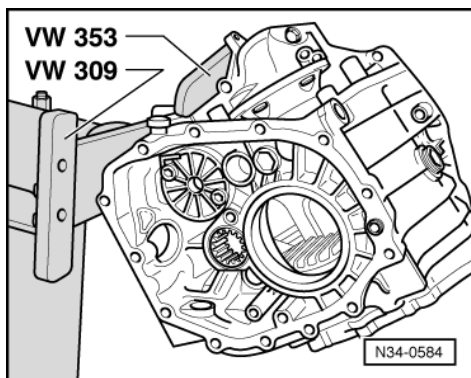
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- -> Unbolt the detent segment (arrow) and swing it out.



- -> The input shaft -A-, the drive pinion -B-, the relay shaft -C-, the selector rods -D- with selector shaft and the selector forks -E- must be carefully pulled out together.



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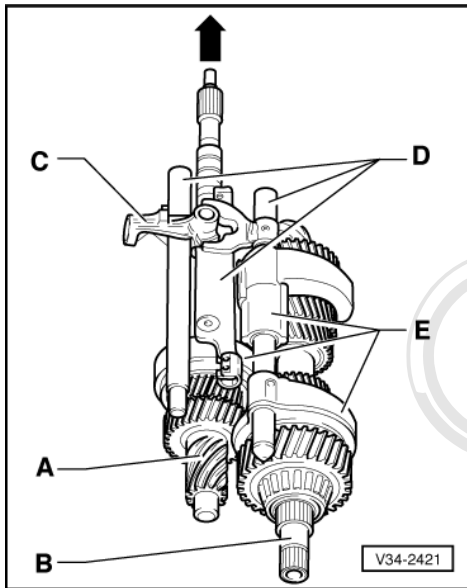
## Installing

### **Note:**

*If the input shaft ball bearing, the input shaft or the gearbox housing are renewed, it is necessary to re-determine the thickness of the circlips for the input shaft =>Page 105, adjusting input shaft.*

- -> Swing the gearbox housing into the position shown. The components listed below can then be fitted more easily.



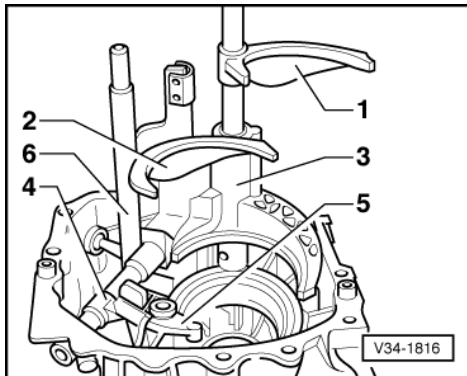


- -> Assemble the input shaft -A-, the drive pinion -B-, the relay shaft -C-, the selector rods -D- with selector shaft and selector forks -E- together.
- Install these components together into the gearbox housing

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**Note:**

*Relay shaft -C- and the selector shaft can also be fitted later if necessary=>Fig. V34-1816, Page 74 .*

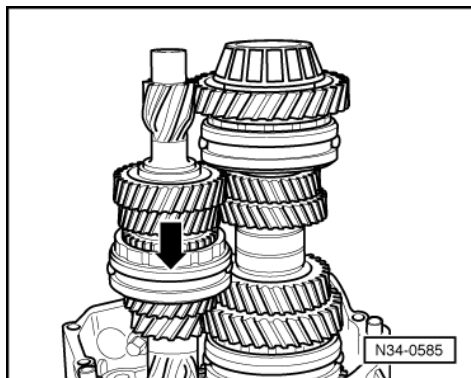


-> Location of gear selector mechanism in gearbox

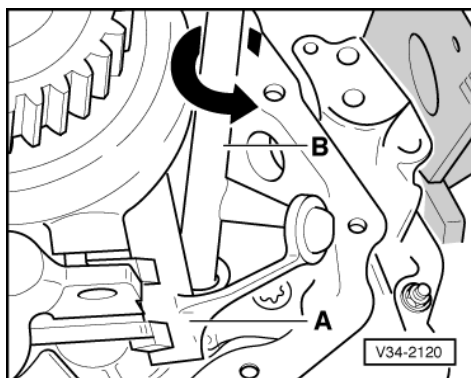
- 1 - Selector fork for 5th gear and reverse gear
- 2 - Selector fork for 3rd gear and 4th gear
- 3 - Selector fork for 1st gear and 2nd gear
- 4 - Relay shaft
- 5 - Detent mechanism
- 6 - Selector shaft

**Note:**

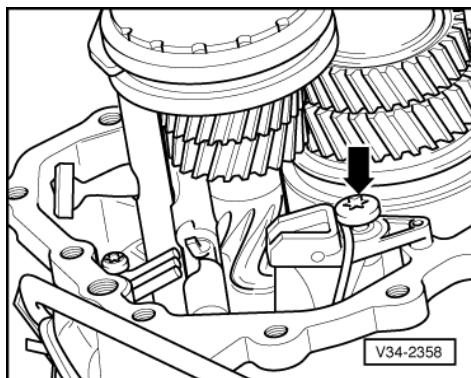
*Shown in illustration with input shaft and drive pinion removed.*



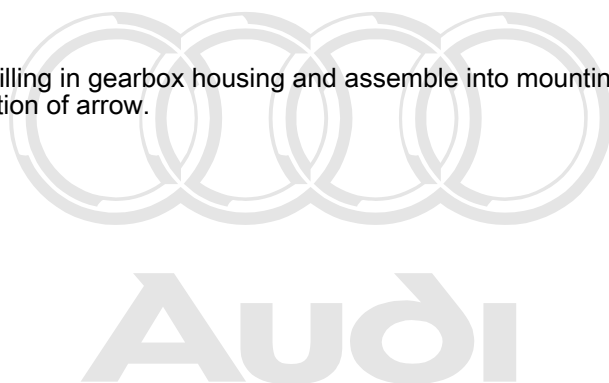
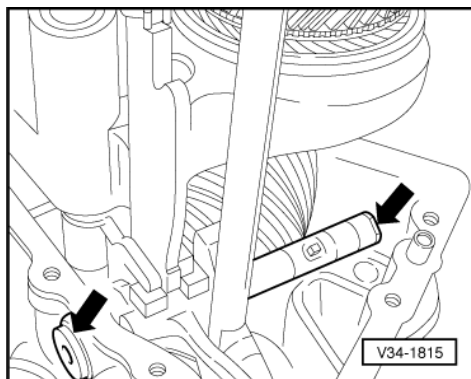
- -> Turn gearbox housing and engage 3rd gear (direction of arrow).



- -> Now install relay shaft -A-.
- Insert selector shaft -B- sideways onto the drilling in gearbox housing and assemble into mounting eye.
- Then turn the selector shaft carefully in direction of arrow.



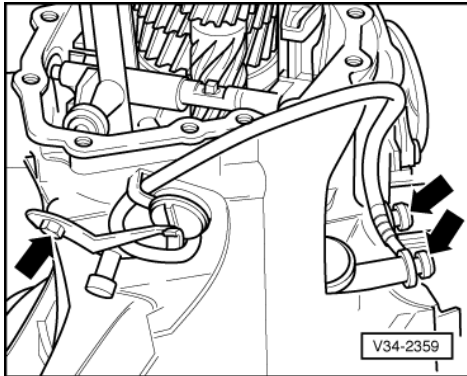
- -> Then insert the detent segment and bolt it tight (arrow).



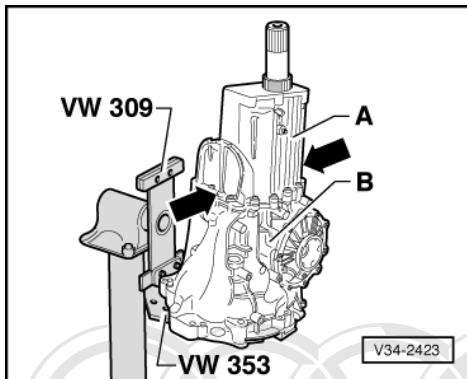
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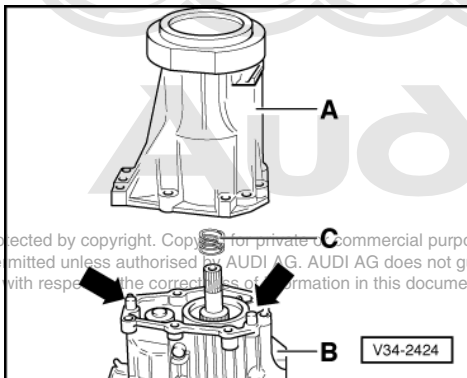
- -> Now insert the relay shaft bolts (arrows).



- Replace O-ring for multi-function sender.
- -> Carefully insert multi-function sender and tighten (arrows).

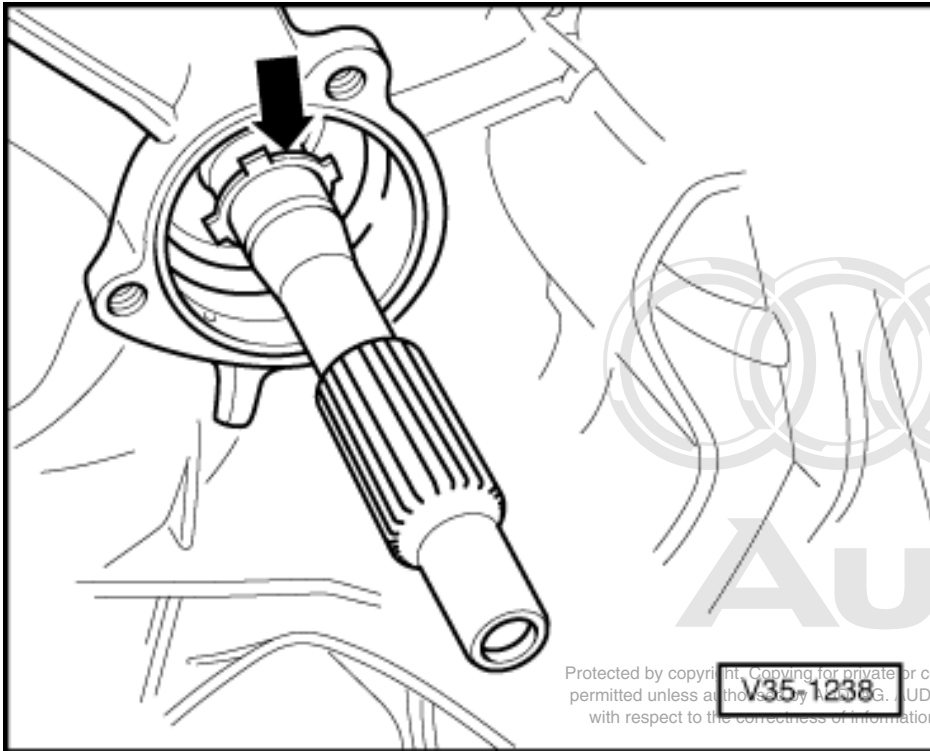


- -> Check that dowel sleeves for gearbox cover -A- are fitted in gearbox housing -B- (arrows).
- Fit gearbox cover onto gearbox housing.

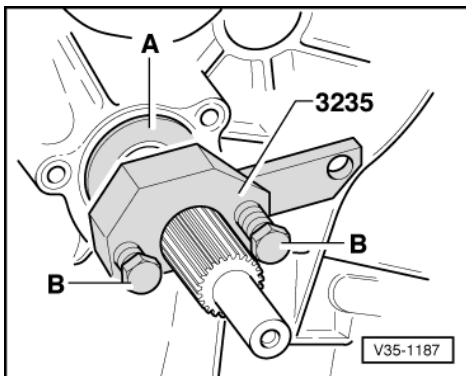


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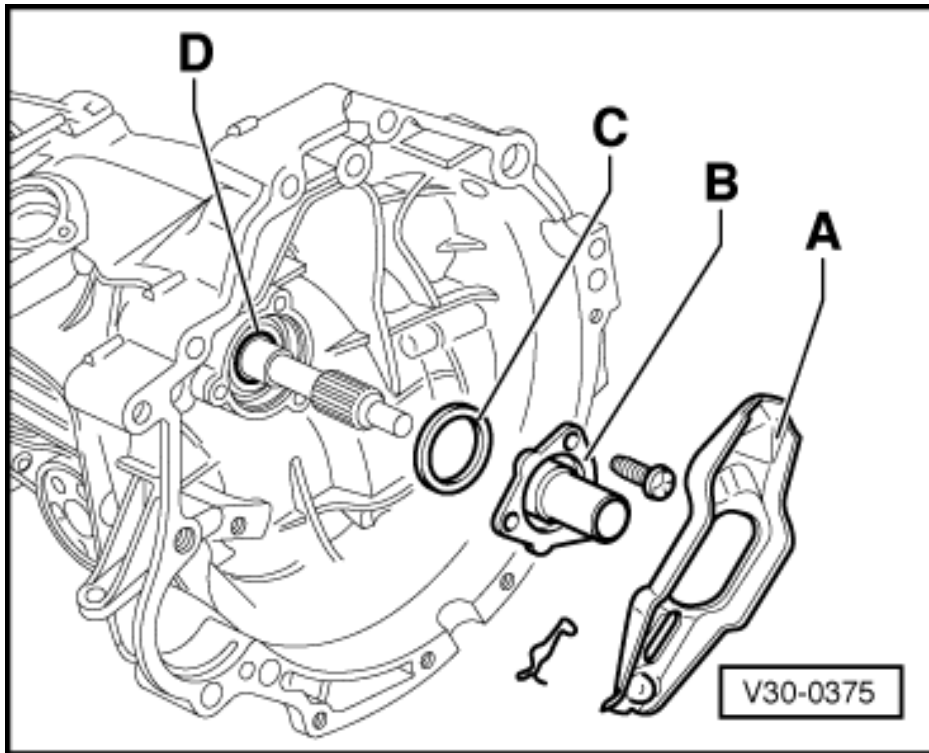
- -> Check that dowel sleeves for cover -A- are fitted in gearbox cover -B- (arrows).
- Fit spring -C-.
- Fit cover with Torsen differential -A- on gearbox cover -B-.



- -> Fit rear input shaft ball bearing circlip (arrow).
- Slide the ball bearing onto the input shaft.
  - Position: closed side of ball cage faces towards gearbox housing.



- -> Press in ball bearing:
  - Slide thrust piece -A- of pressing-in tool onto input shaft.
  - Position pressing-in tool behind splines for clutch plate.
  - Screw in bolts -B- until they make contact.
    - The bolts bear against the indentations in thrust piece -A-.
  - Press in ball bearing onto its seat by alternately tightening the bolts (1/2turn at a time).



- -> Now fit the input shaft ball race front circlip -D-.
- Then fit dished washer -C-.
- Position: convex side towards guide sleeve -B-

**Notes:**

- ◆ Before fitting guide sleeve, cover splines on input shaft with a shrink-fit hose to protect oil seal.
- ◆ Installing oil seal in guide sleeve => Page 25 .
- Fit guide sleeve -B- for release bearing.
- Fit clutch release lever -A- and release bearing.

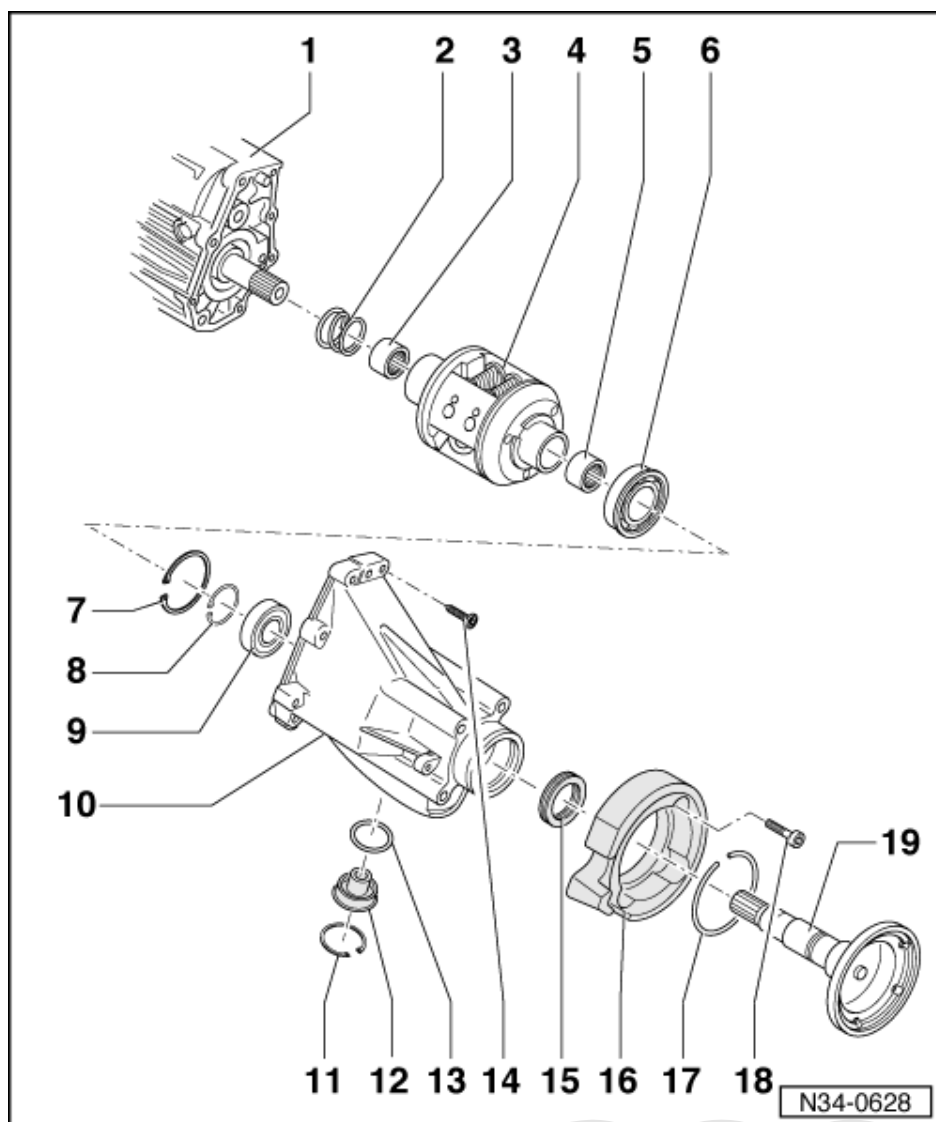
## 6 - Servicing cover for Torsen differential, removing and installing Torsen differential

### 6.1 - Servicing cover for Torsen differential, removing and installing Torsen differential

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#### Special tools, testers and auxiliary items

- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 412
- ◆ Tube VW 416 B
- ◆ Guide pin VW 439
- ◆ Tube VW 519
- ◆ VW 771/15 from multi-purpose tool set VW 771
- ◆ Press tool 40-21
- ◆ Tube 2040
- ◆ Press piece 3002
- ◆ Separating tool Kukko 17/2
- ◆ Internal puller Kukko 21/4



1 Gearbox cover

2 Spring

3 Front needle bearing

- ◆ Removing => Fig. 8
- ◆ Installation position => Fig. 9
- ◆ Pressing in => Fig. 11

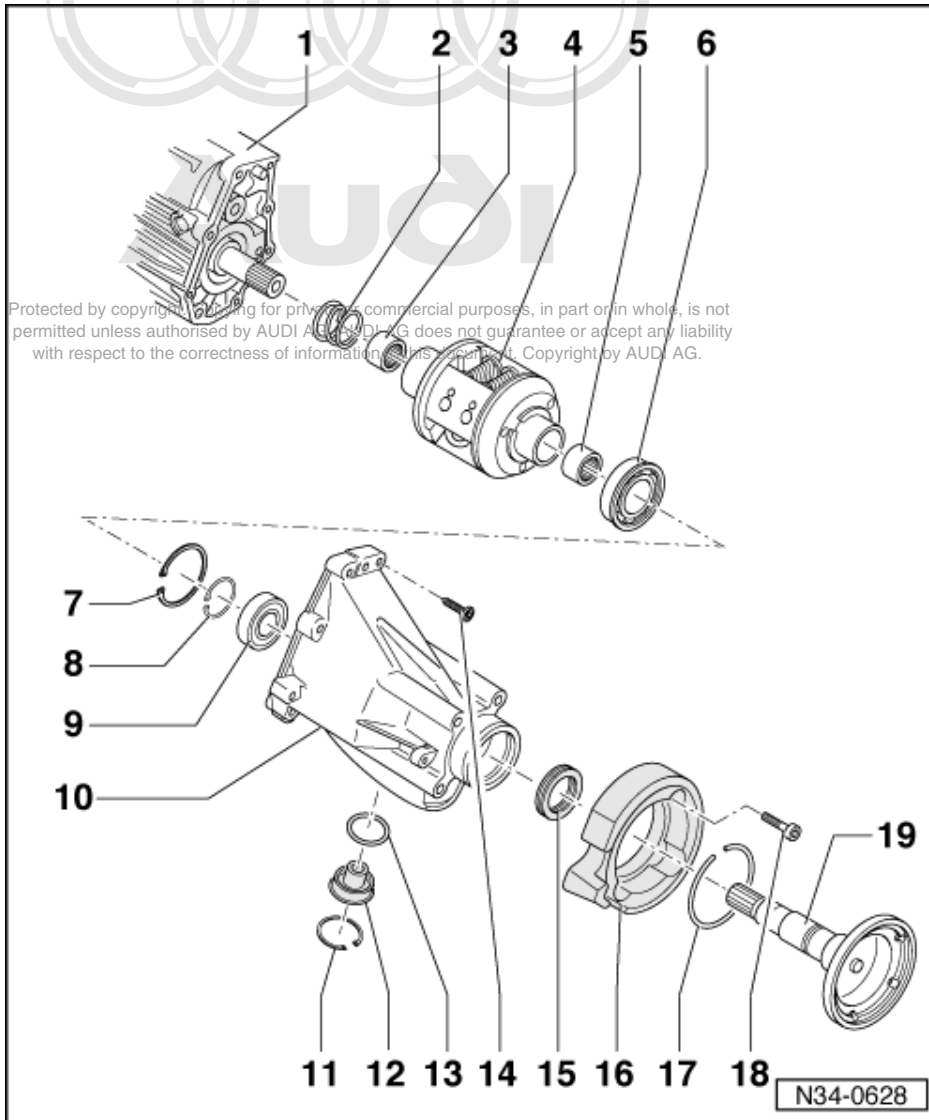
4 Torsen differential

- ◆ Do not dismantle
- ◆ Press out after removing flange shaft  
=> Fig. 3
- ◆ Renew if damaged
- ◆ Pressing in => Fig. 12

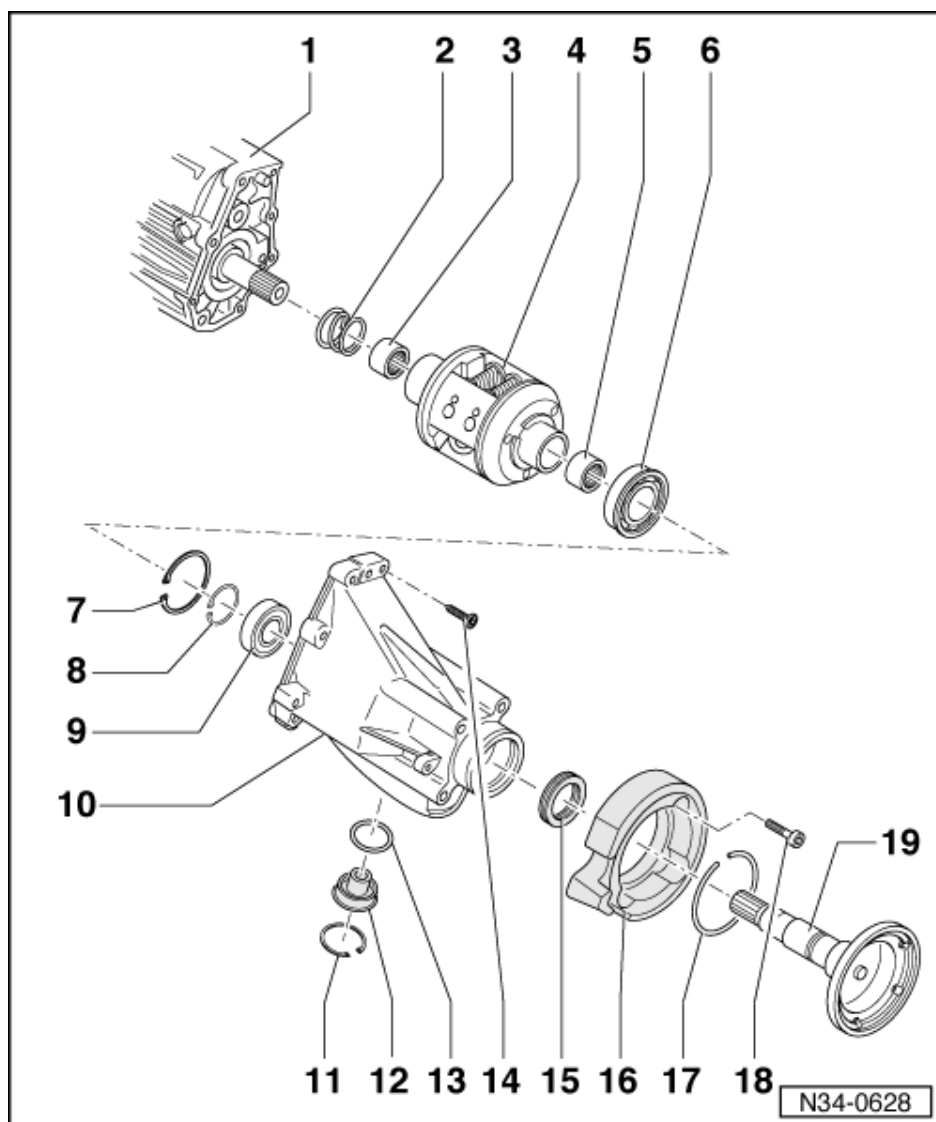
5 Rear needle bearing

- ◆ Removing => Fig. 8
- ◆ Installation position => Fig. 10
- ◆ Pressing in => Fig. 11

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- 6 Ball bearing**
  - ♦ For Torsen differential
  - ♦ Pressing off => Fig. 4
  - ♦ Pressing on => Fig. 5
- 7 Circlip**
- 8 Circlip**
  - ♦ Remove and install together with flange shaft=>Fig. 2
- 9 Bearing**
  - ♦ For flange shaft
  - ♦ Pressing off => Fig. 6
  - ♦ Pressing in => Fig. 7
- 10 Cover**
  - ♦ For Torsen differential
- 11 Circlip**
- 12 Plug**
  - ♦ Removing => Fig. 1

**13 O-ring**

- ◆ Renew
- ◆ Grease when installing

**14 Torx bolt - 22 Nm****15 Oil seal**

- ◆ Pull out with oil seal extractor lever VW 681
- ◆ Knocking in => Fig. 13

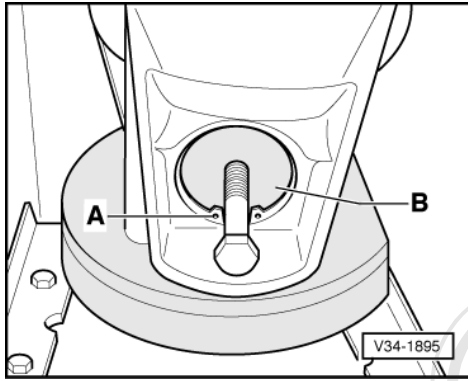
**16 Vibration damper****17 Circlip****18 Torx bolt - 35 Nm**

- ◆ Self-locking
- ◆ Renew

**19 Flange shaft**

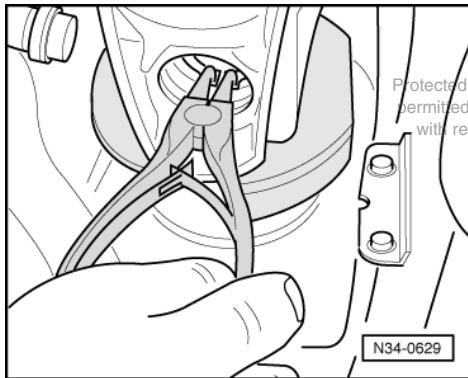
- ◆ Removing and installing=> Fig. 2

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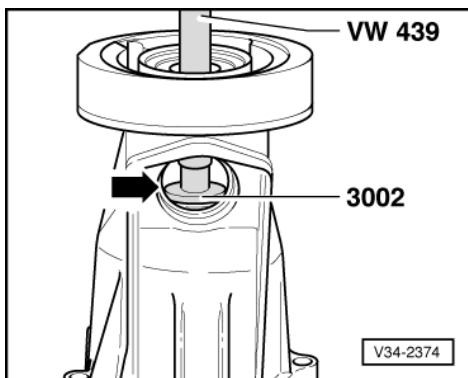
-> Fig.1 Removing plug

- Remove circlip -A-.
- Screw an M8 bolt into thread of plug -B-.
- Pull out plug -B- using bolt.



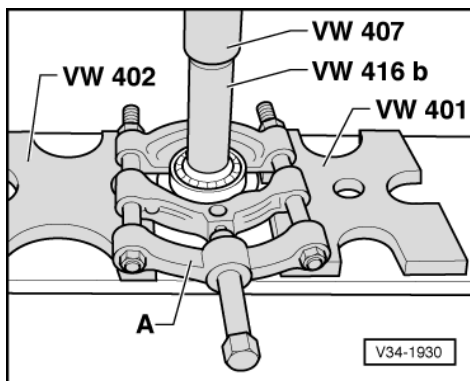
-> Fig.2 Removing and installing flange shaft

- Open out circlip and pull out flange shaft
- When inserting flange shaft, fit circlip at the same time.
  - The circlip must be seated in the base of the groove.



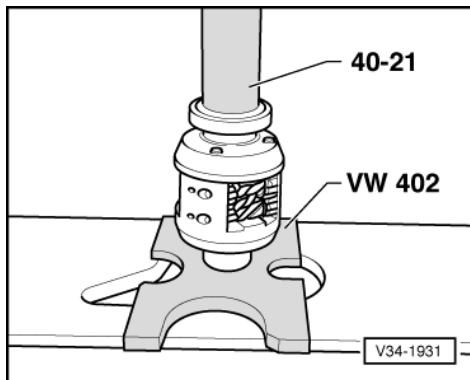
-> Fig.3 Pressing out Torsen differential

- Position thrust piece 3002 directly on Torsen differential through opening (arrow).



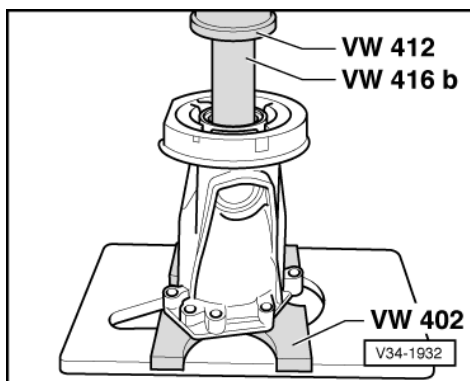
-> Fig.4 Pressing off ball bearing from Torsen differential

A - Separating device 22 ... 115 mm, e.g. Kukko 17/2



-> Fig.5 Pressing ball bearing onto Torsen differential

- Press ball bearing on as far as the stop.

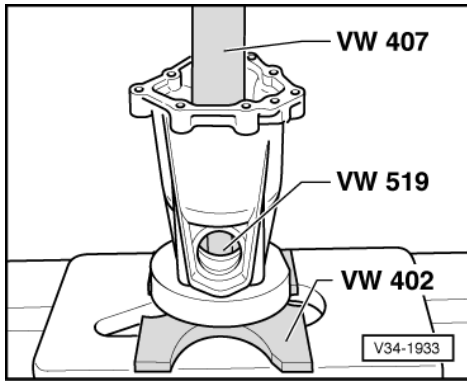


-> Fig.6 Pressing out ball bearing for flange shaft

- Remove circlip before pressing out bearing.

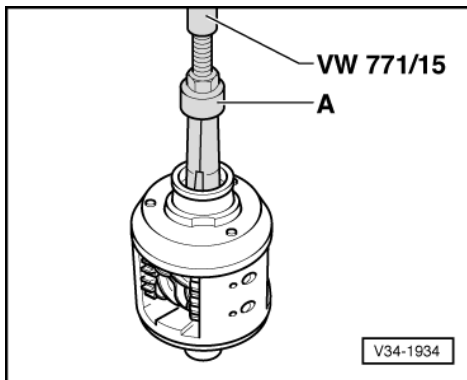






-> Fig.7 Pressing in ball bearing for flange shaft

- Fit circlip after pressing in bearing.

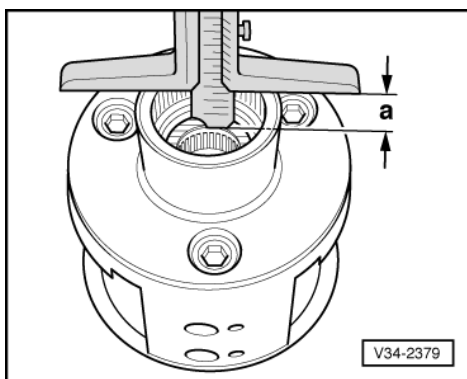


-> Fig.8 Pulling out needle bearing.

A - Internal puller 22 ... 28 mm, e.g. Kukko 21/4

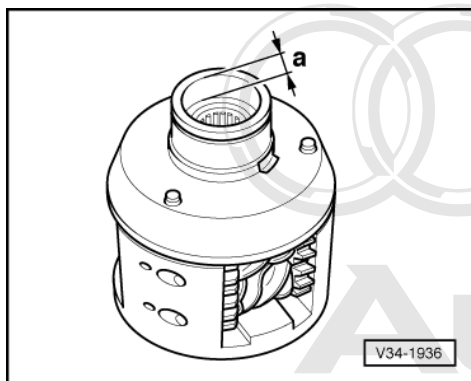
- Both needle bearings in the Torsen differential are removed with the same puller.

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-> Fig. 9 Installation position of front needle bearing

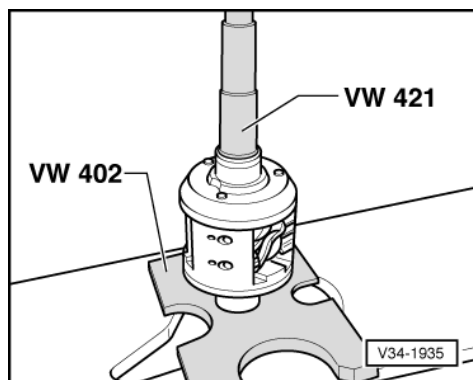
- ◆ Distance a = 32.5 mm



-> Fig.10 Installation position of rear needle bearing

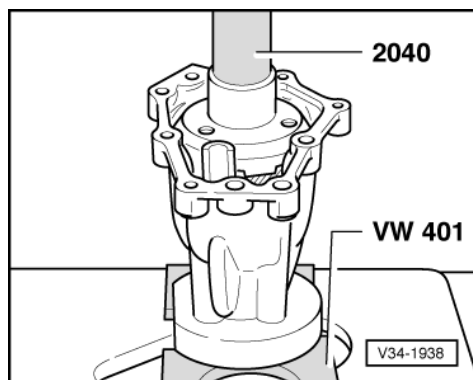
- ♦ Distance  $a = 14 \text{ mm}$

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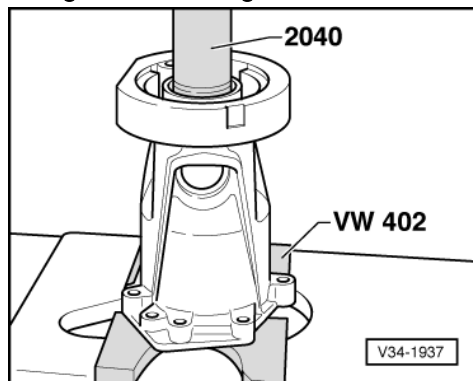


-> Fig.11 Pressing in needle bearing

- Both needle bearings in the Torsen differential are pressed in with the same special tool.



-> Fig.12 Pressing in Torsen differential



➔ Fig.13 Driving in seal

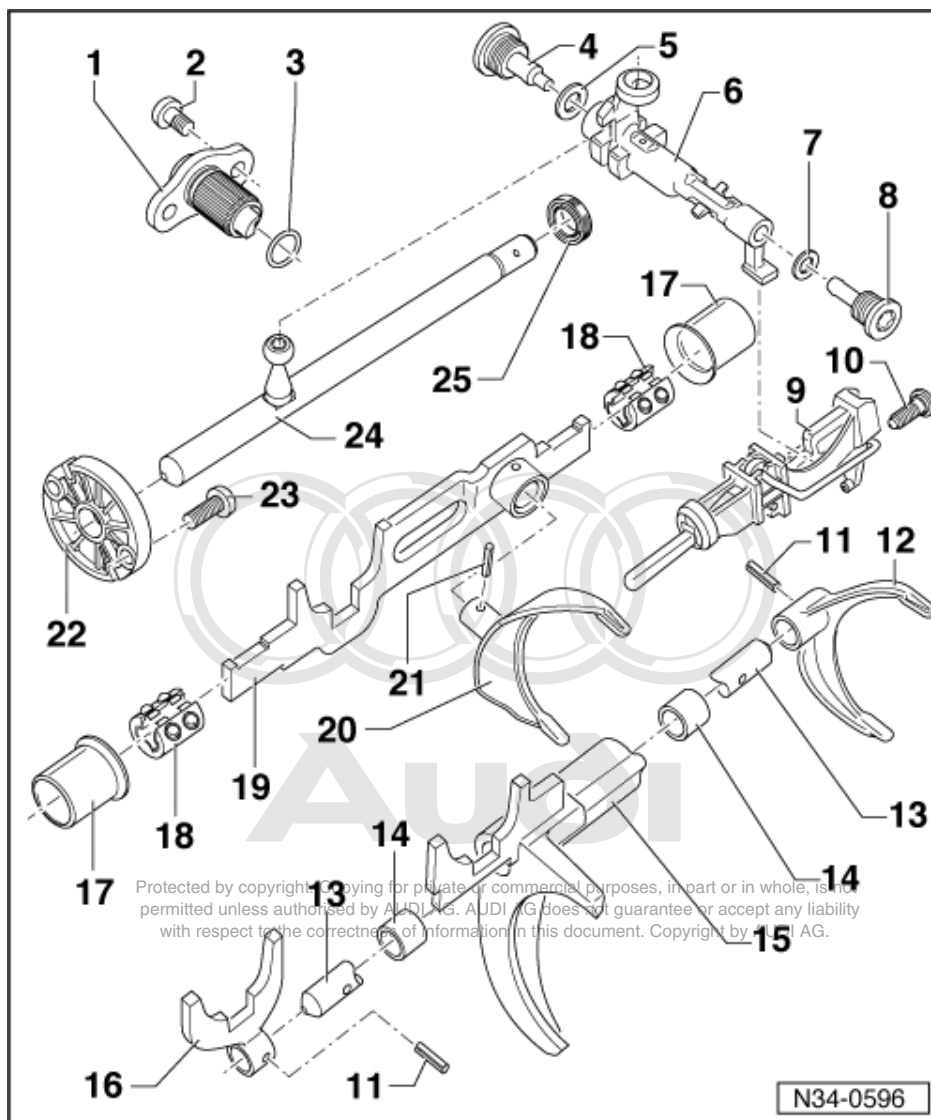
- Fill space between sealing and dust lips with multi-purpose grease.
- Lightly oil outer circumference of seal.
  - Position: 2 mm below surface of cover

## 7 - Dismantling and assembling selector mechanism in gearbox

### 7.1 - Dismantling and assembling selector mechanism in gearbox

#### Special tools, testers and auxiliary items

- ◆ Drift VW 295
- ◆ Adapter VW 295 A
- ◆ Press plate VW 401
- ◆ Tube VW 423
- ◆ Spacer sleeve VW 472/2



**Note:**



*Installation position of the complete selector mechanism in gearbox => Fig. 6*

**1 Locking unit for 5th gear and reverse gear**

- ♦ Removing and installing  
=> Page 90

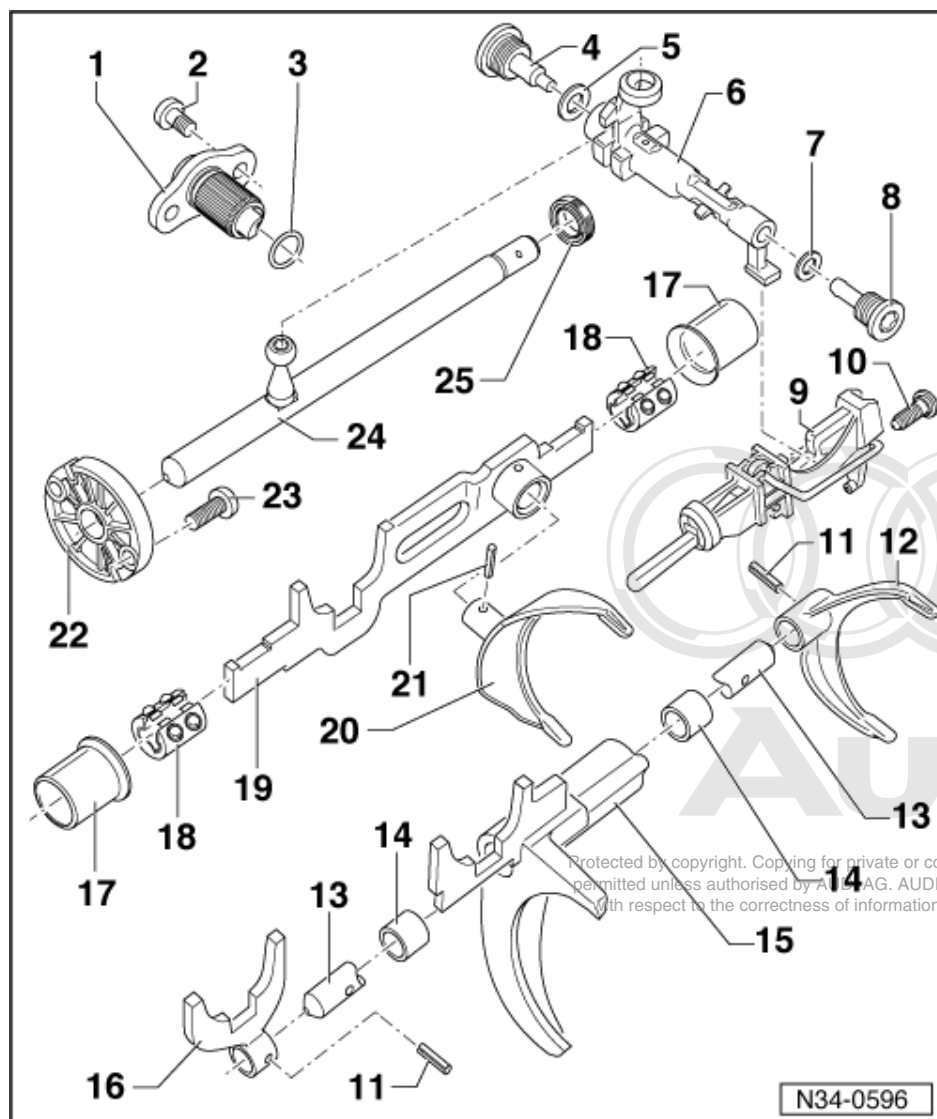
**2 Torx bolt - 10 Nm**

**3 O-ring**

- ♦ Renew

**4 Right stop bolt,  
40 Nm**

**5 Oil seal**



**6 Relay shaft**

**7 Oil seal**

**8 Left stop bolt,  
40 Nm**

**9 Detent segment**

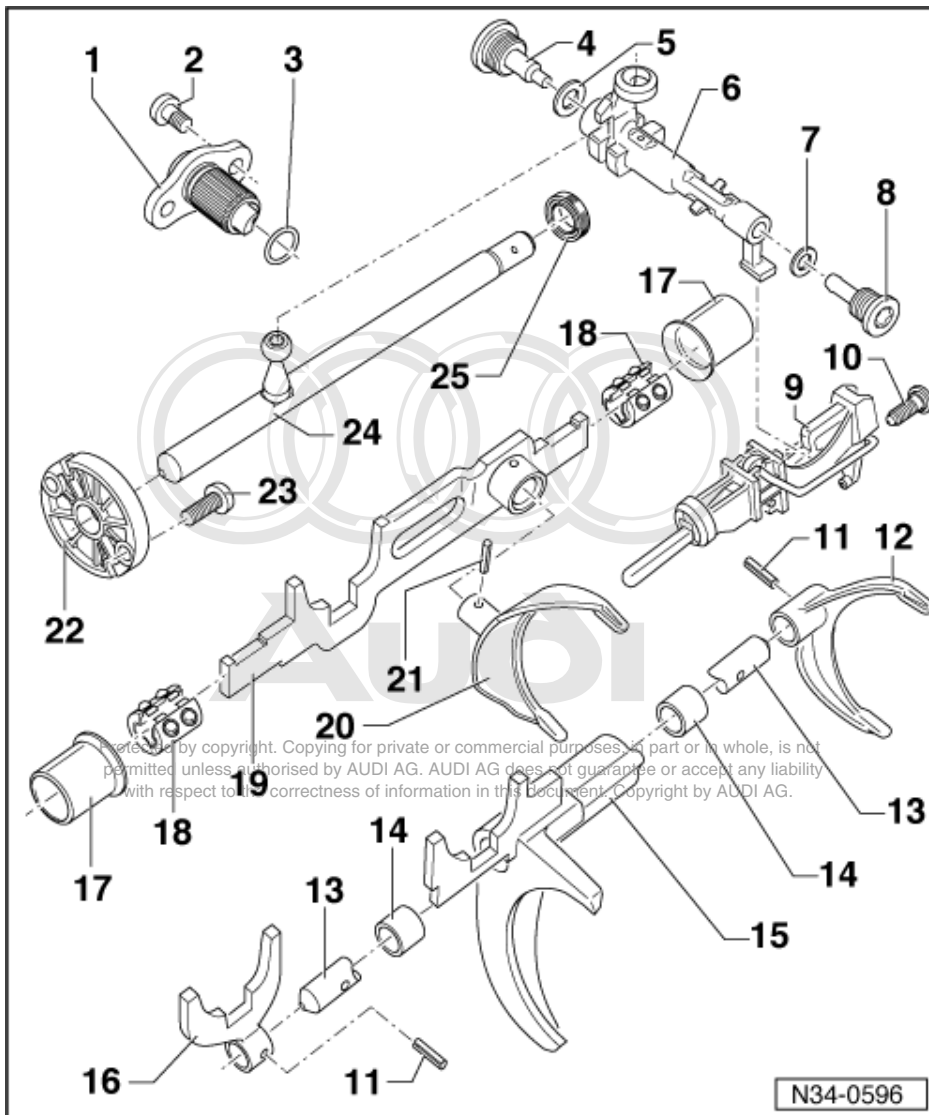
**10 Torx bolt - 25 Nm**

**11 Spring pin**

**12 5th and reverse gear selector fork**

- ♦ Installation position => Fig. 1

**13 Selector rod for 1st and 2nd gear as well as for 5th and reverse gear**



**14 Ball sleeve**

- ♦ Removing and installing=>Fig. 2

**15 Selector fork, 1st and 2nd gear**

**16 Coupling plate**

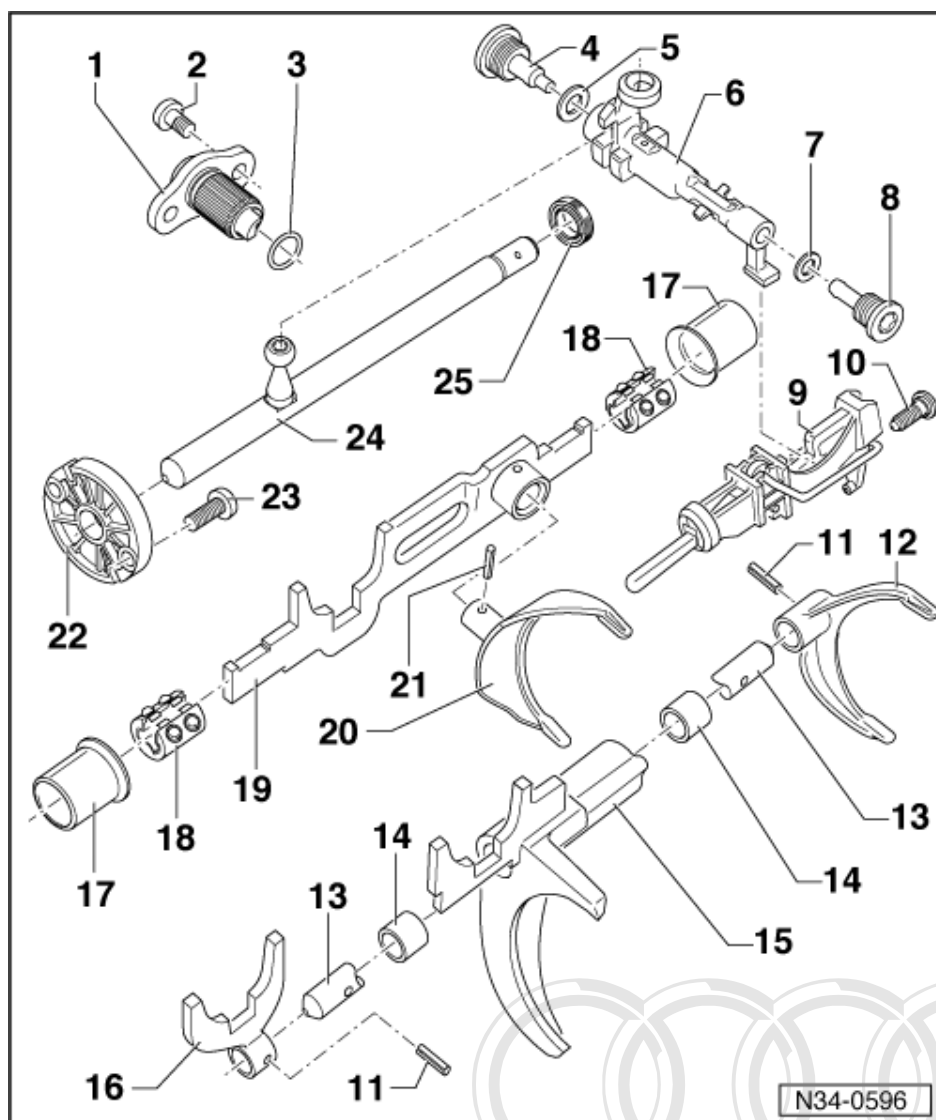
- ♦ Installation position => Fig. 1

**17 Bush**

- ♦ Removing => Fig. 3
- ♦ Installing => Fig. 4

**18 Ball sleeve**

- ♦ Lever off the selector rod with a screwdriver
- ♦ Press onto the selector rod



19 Selector rod for 3rd and 4th gear

20 3rd and 4th gear selector fork

21 Spring pin

22 Cover

- ♦ For selector shaft

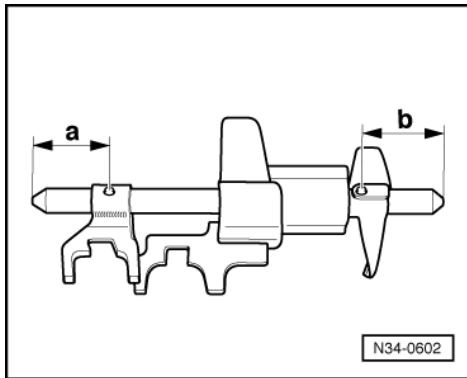
23 Torx bolt - 20 Nm

24 Selector shaft

25 Oil seal

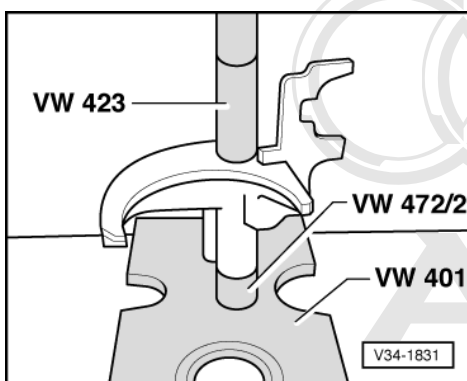
- ♦ Lever out with screwdriver
- ♦ Installation position => Fig. 5

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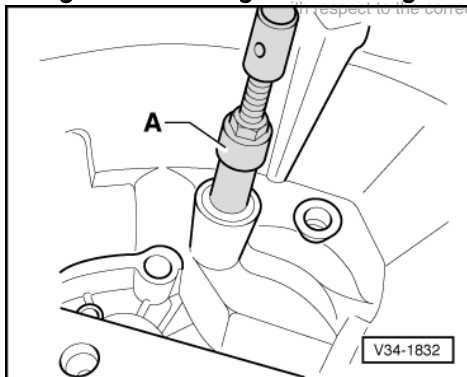


-> Fig.1 Installation position of 5th and reverse gear selector fork and coupling plate for selector rod.

- Distance a = 55 mm
- Distance b = 60 mm

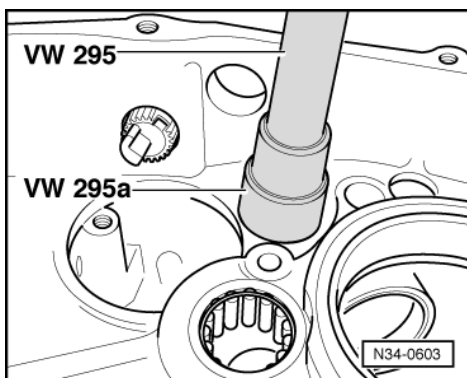


-> Fig.2 Removing and installing ball sleeve



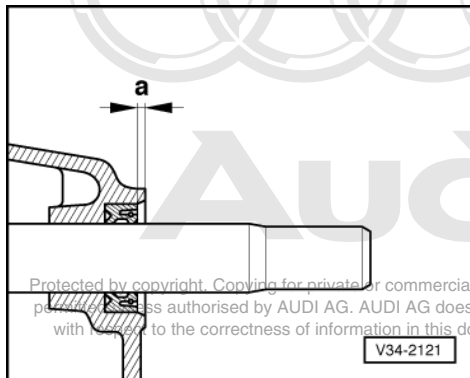
-> Fig.3 Pulling out mounting bush for 3rd and 4th gear selector rod

- A - Internal puller 22 ... 28 mm, e.g. Kukko 21/4, in conjunction with multi-purpose tool VW 771



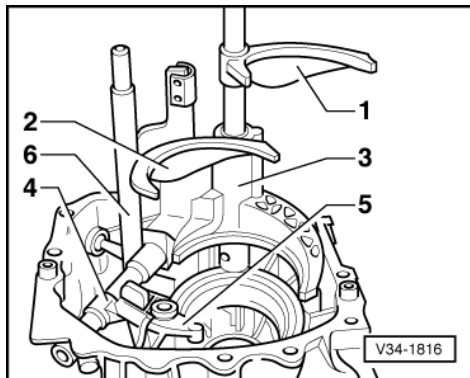


-> Fig.4 Driving in 3rd and 4th gear selector rod mounting bush onto stop



-> Fig.5 Oil seal installation position

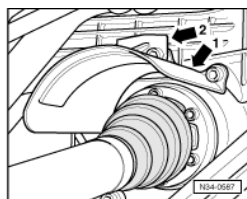
- Fill space between sealing and dust lips with multi-purpose grease.
- Lightly oil outer circumference of seal.
  - Distance a = 1 mm



-> Fig.6 Installation position of complete selector mechanism in gearbox:

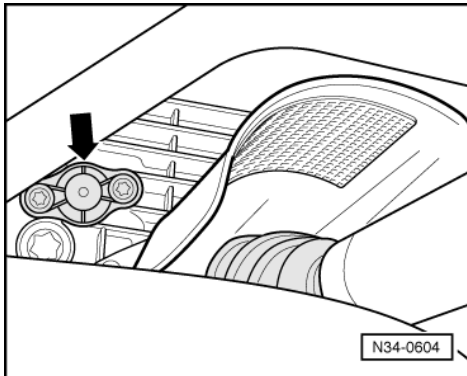
- 1 - Selector fork for 5th gear and reverse gear
- 2 - Selector fork for 3rd gear and 4th gear
- 3 - Selector fork for 1st gear and 2nd gear
- 4 - Relay shaft
- 5 - Detent mechanism
- 6 - Selector shaft

#### Removing and installing locking unit for 5th gear and reverse gear

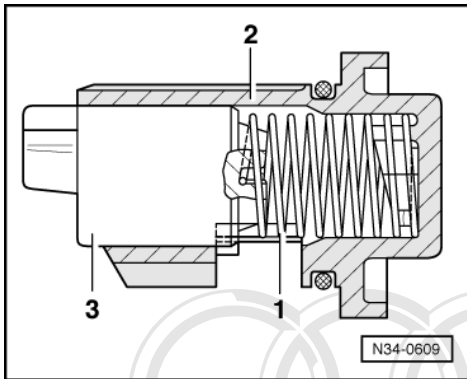


- -> Remove heat shield -arrow -2- above right-hand drive shaft.
- Detach heat shield -arrow -1- above right-hand drive shaft and pivot downwards.



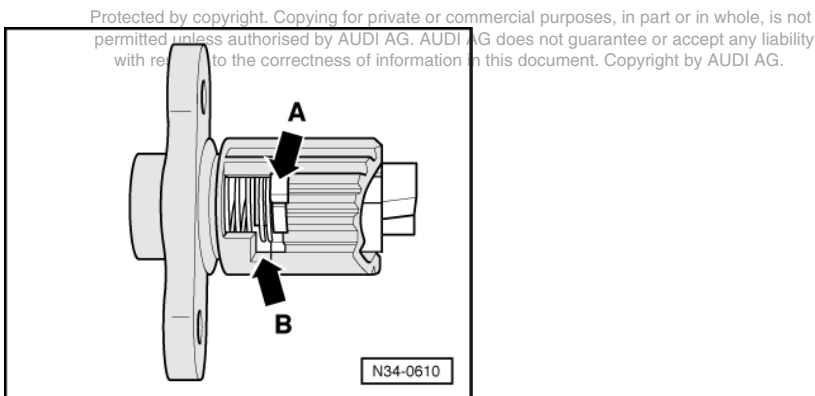


- -> Remove locking unit -arrow-.



#### Assembling locking unit:

- -> Insert spring -1- into housing -2- and, while exerting light pressure, turn spring to the left until it locates in the base of the housing.
- Insert bush -3- onto the spring so that the bent end of the spring locates in the groove.
- Push bush against spring and turn approx. one turn to left, until the lug on the bush aligns with the groove in the housing.
- Press lug on bush onto stop in the groove in the housing.
- Turn bush to right and release.
- The bush will jump into the correct position



-> Installation position of bush:

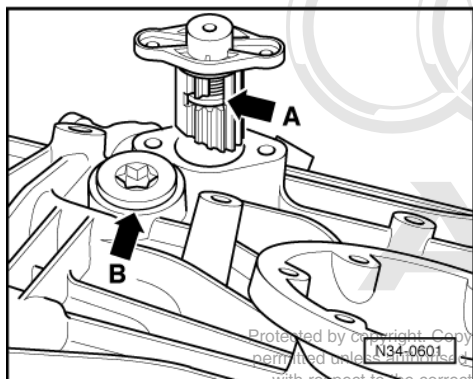
- The lug (arrow -A-) on the bush must always be opposite the groove in the housing (arrow -B-).

Checking installation position:

- Turn bush to left and release.



- The bush should spring back into position; the lug must be against the stop (direction indicated by arrow -A-).



-> Installation position of complete locking unit in gearbox:

The recess (arrow -A-) faces bolt (arrow -B-)

## 35 - Gears, Shafts

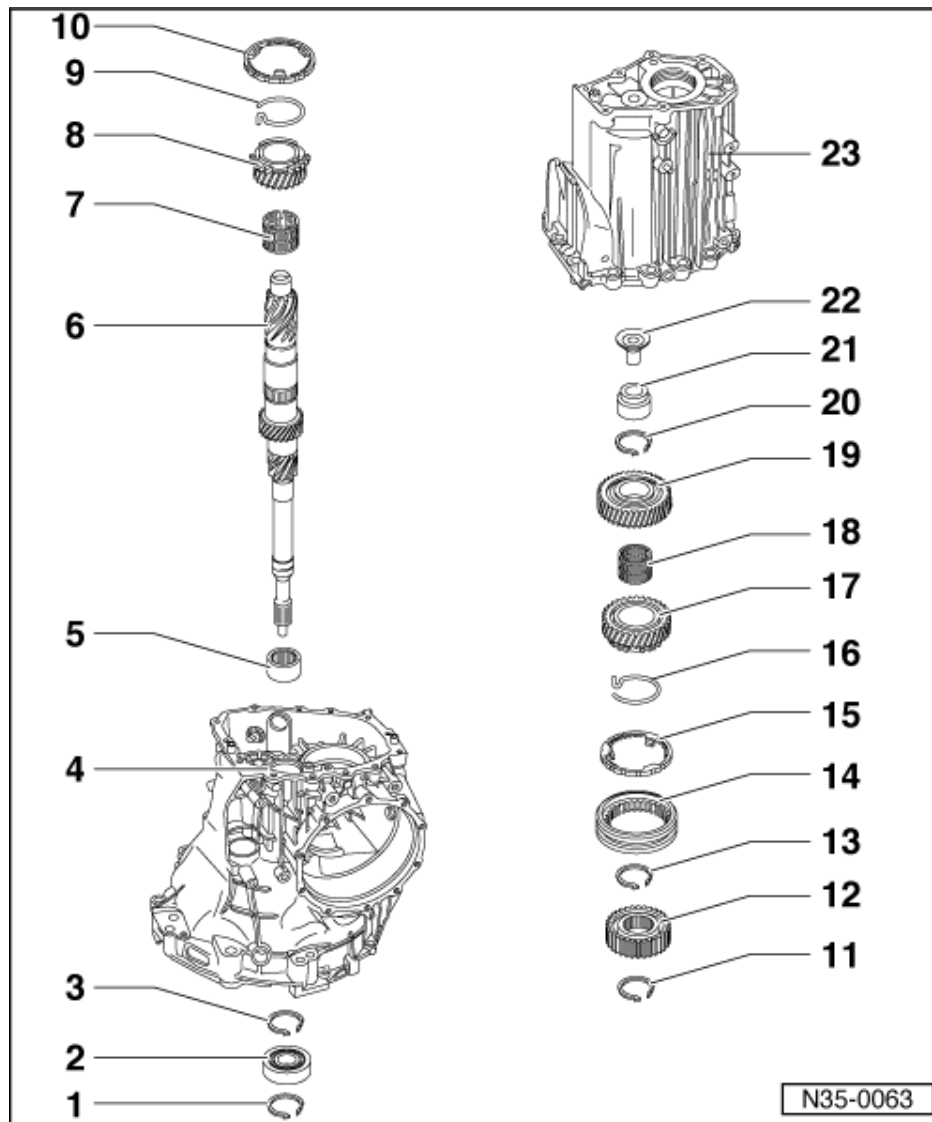
### 1 - Dismantling and assembling input shaft

#### 1.1 - Dismantling and assembling input shaft

##### Special tools, testers and auxiliary items

- ◆ Drift VW 295
- ◆ Adapter VW 295 A
- ◆ Tube VW 416 B
- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 408 A
- ◆ Thrust plate 40-105
- ◆ Separating tool Kukko 17/2

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### Notes:

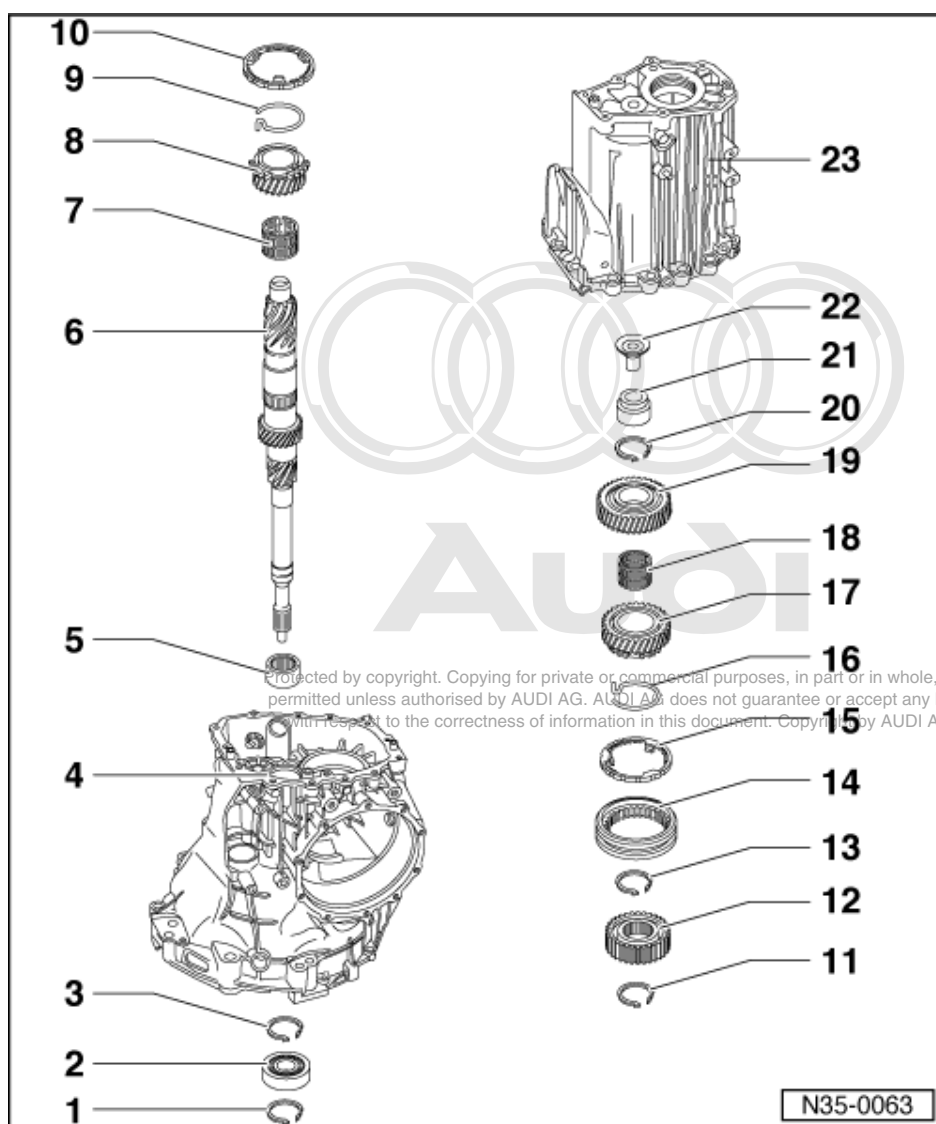
- ♦ When installing the input shaft or new gears, consult technical data  
=>Page 2.
- ♦ If parts are exchanged which will affect the position of the ball bearings, the input shaft must be re-adjusted  
=> Page 105

### 1 Circlip

- ♦ Identification
- ♦ Installation position => Fig. 12 item 1
- ♦ Determining thickness => adjusting input shaft, Page 105

### 2 Ball bearing

- ♦ Removing and installing  
=> Page 69



### 3 Circlip

- ♦ Identification
- ♦ Installation position =>Fig. 12 item 2
- ♦ Determining thickness => adjusting input shaft, Page 105

### 4 Gearbox housing

### 5 Needle roller bearing

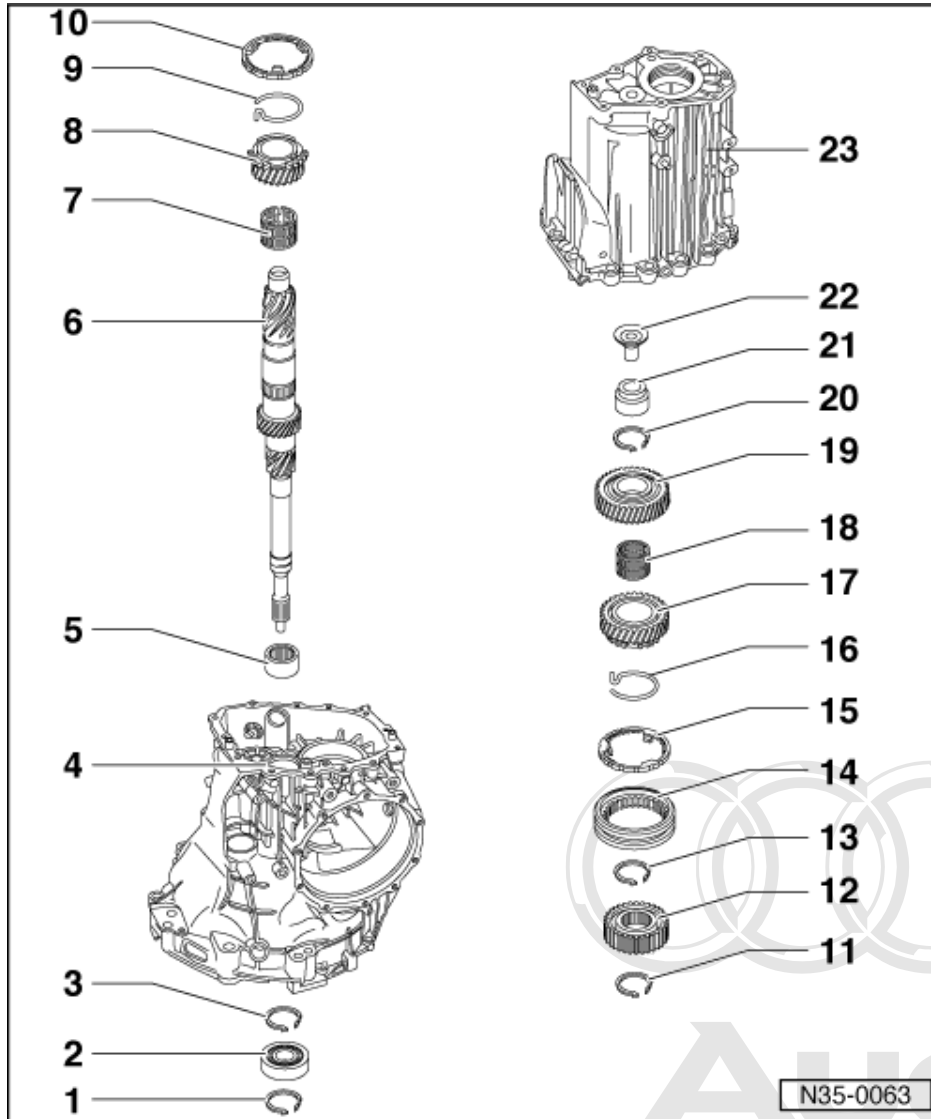
- ♦ Secured with bolt => Fig. 1
- ♦ Removing => Fig. 2
- ♦ Installation position => Fig. 3
- ♦ Pressing in=>Fig. 4

## 6 Input shaft

- ♦ Adjusting => Page 105

## 7 Needle bearing for 3rd gear

## 8 3rd speed sliding gear



## 9 Spring

- ♦ Insert in 3rd speed sliding gear  
=> Fig. 10
- ♦ Allocation of spring to sliding gear

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=> Parts catalogue

## 10 Synchro-ring for 3rd gear

- ♦ Checking for wear  
=> Fig. 11

## 11 Circlip

- ♦ Identification
- ♦ Installation position => Fig. 12 item 3

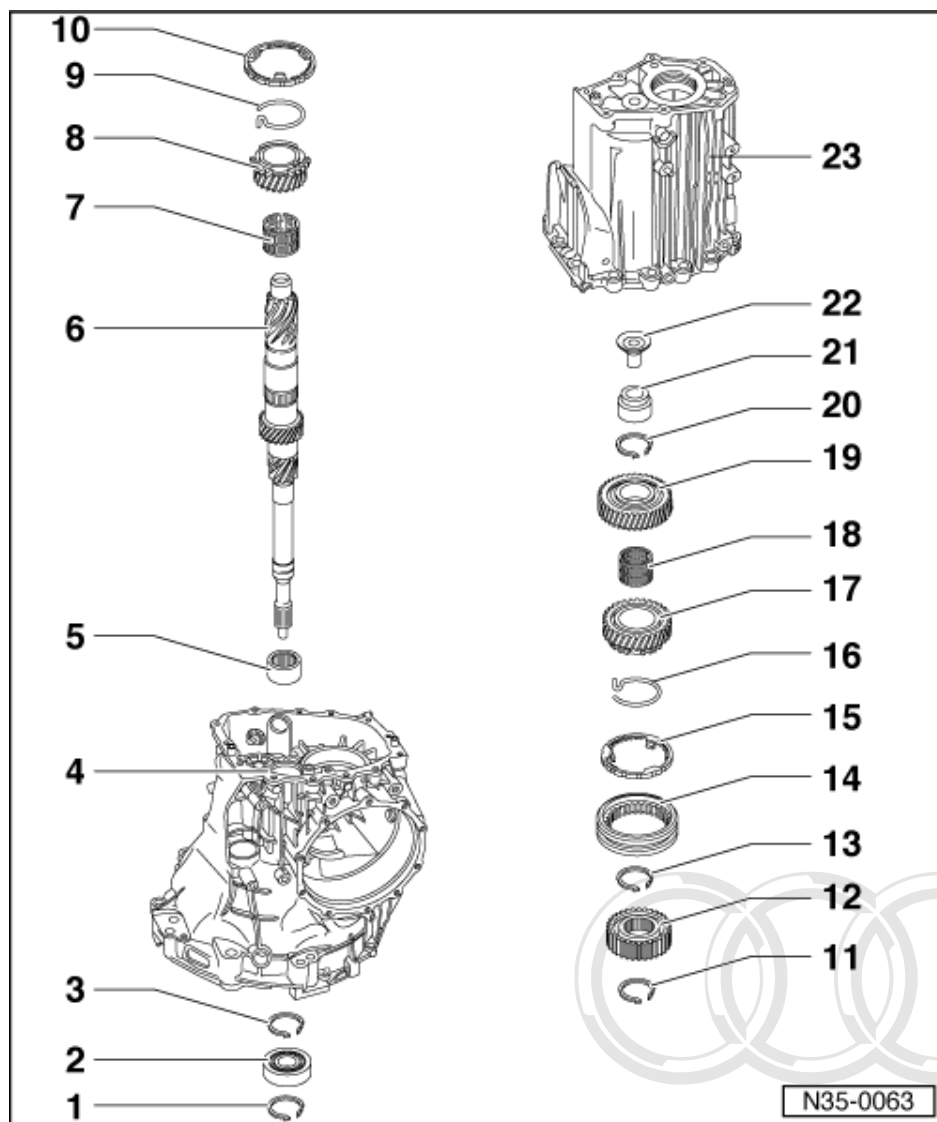
## 12 Synchro-hub for 3rd and 4th gear

- ♦ Shoulder faces to 3rd gear
- ♦ Pressing off => Fig. 9
- ♦ Pressing on => Fig. 14

## 13 Circlip



- ◆ Identification
- ◆ Installation position => Fig. 12 item 4
- ◆ If the synchro hub is replaced redetermine thickness => Fig. 13

**14 3rd and 4th gear locking collar**

- ◆ Installation position => Fig. 15

**15 Synchro-ring for 4th gear**

- ◆ Checking for wear => Fig. 11

**16 Spring**

- ◆ Insert in 4th speed sliding gear  
=> Fig. 10
- ◆ Allocation of spring to sliding gear

=> Parts catalogue

**17 4th speed sliding gear****18 Needle roller bearing**

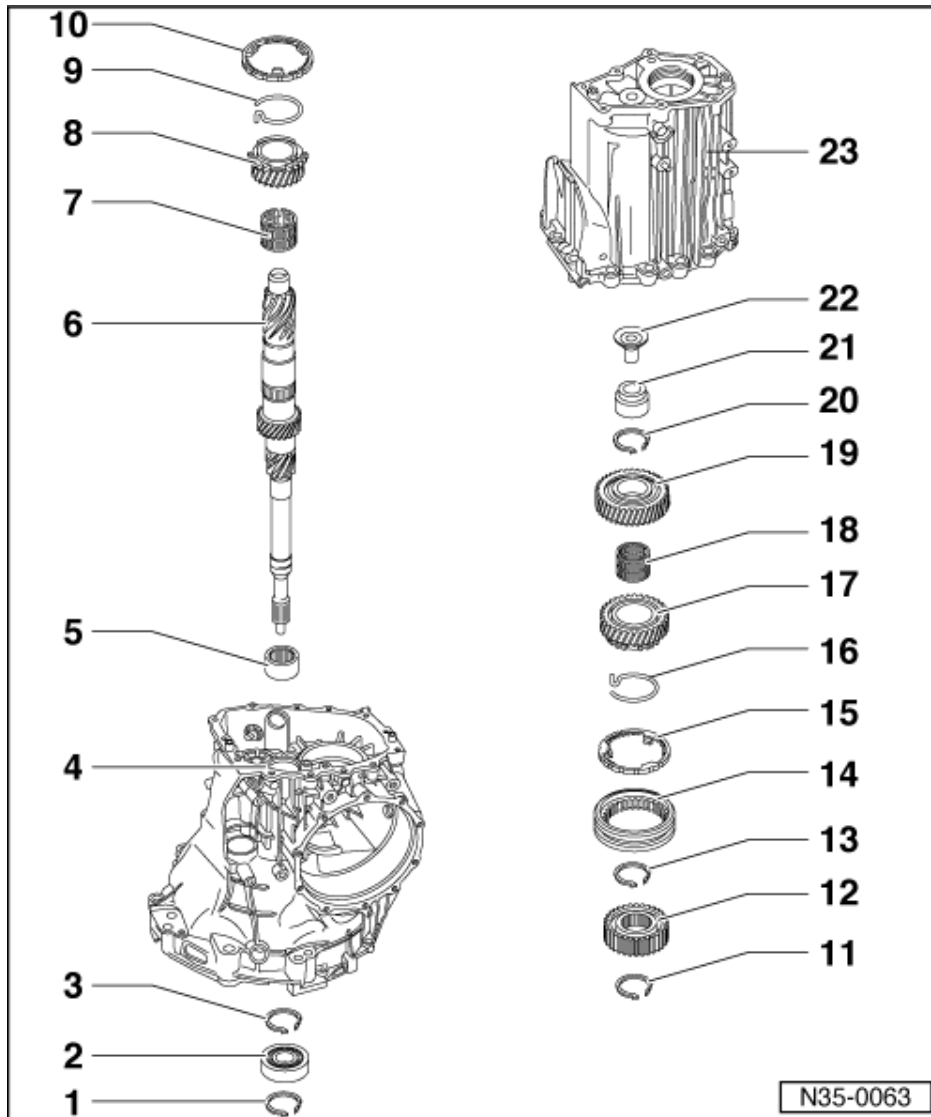
- ◆ For 4th gear

**19 5th gear wheel**

- ◆ Pressing off => Fig. 8

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- ◆ Pressing on => Fig. 16



#### 20 Circlip

- ◆ Identification
- ◆ Installation position => Fig. 12, item 5
- ◆ If the 5th gear wheel is replaced redetermine thickness => Fig. 13

#### 21 Roller sleeve

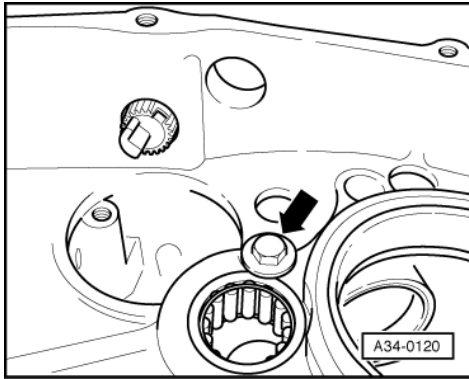
- ◆ Renew
- ◆ Will be damaged when removing
- ◆ Pulling out => Fig. 5
- ◆ Installation position => Fig. 6
- ◆ Driving in => Fig. 7

#### 22 Sleeve

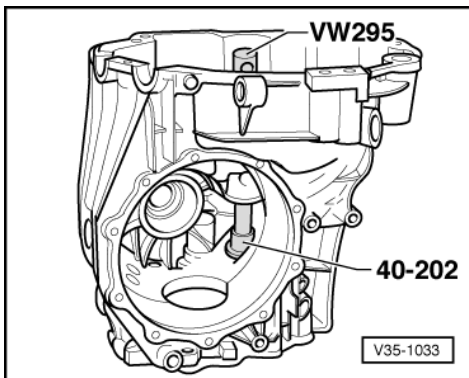
- ◆ Made of plastic

#### 23 Gearbox cover

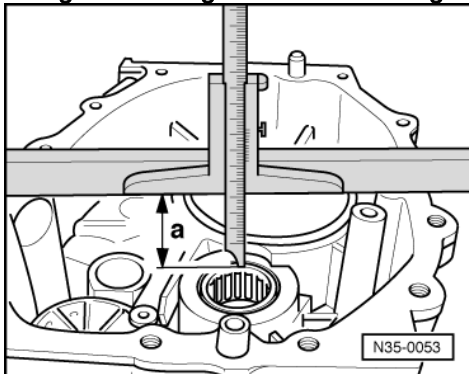
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-> Fig.1 Securing bolt for needle bearing  
- Unscrew securing bolt -arrow-.



-> Fig.2 Driving out needle bearing.

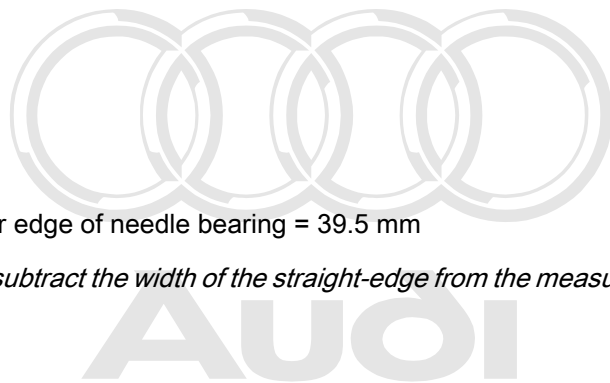
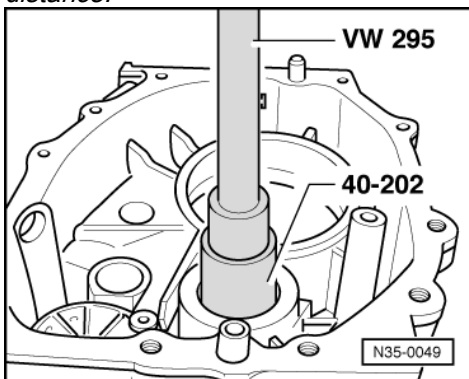


-> Fig.3 Installation position of needle bearing

Distance -a- from lower edge of straight edge to upper edge of needle bearing = 39.5 mm

**Note:**

Measure distance from top edge of straight-edge and subtract the width of the straight-edge from the measured distance.

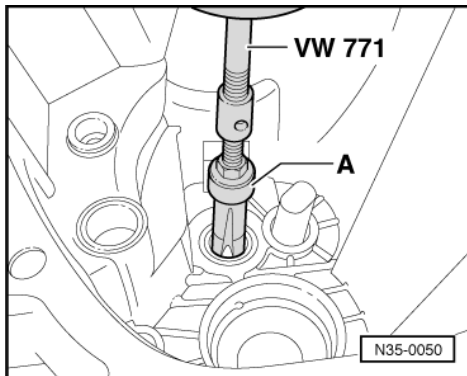


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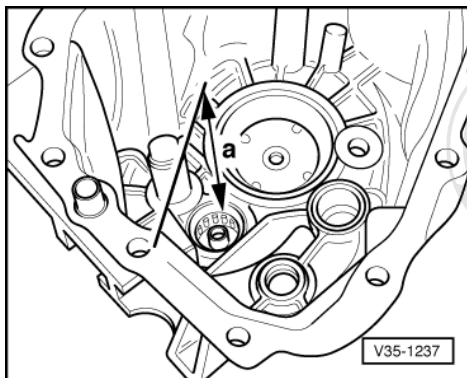
-> Fig.4 Pressing in needle bearing

- Install securing bolt and tighten to 25 Nm.



-> Fig.5 Pulling out roller sleeve

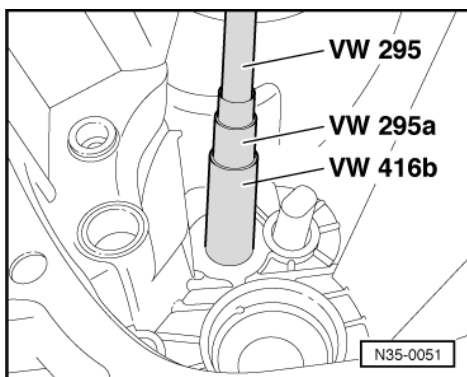
- A - Internal puller 22 ... 28 mm, e.g. Kukko 21/4
- Before fitting internal extractor the plastic sleeve inside the roller sleeve must be destroyed.



-> Fig.6 Installation position of roller sleeve

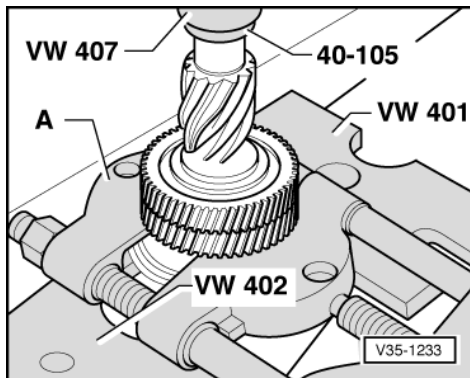
- ◆ Distance a = 216 mm

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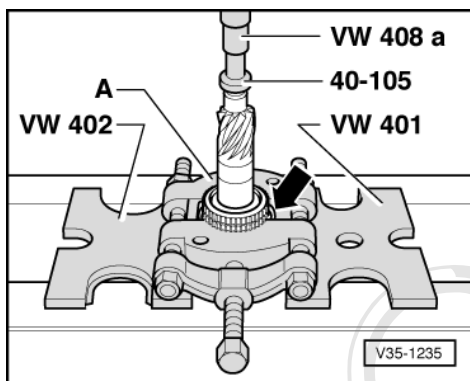
-> Fig.7 Driving in roller sleeve



-> Fig.8 Pressing off 5th gear wheel

- Remove circlip before pressing off.

A - Separating device 22 ... 115 mm, e.g. Kukko 17/2

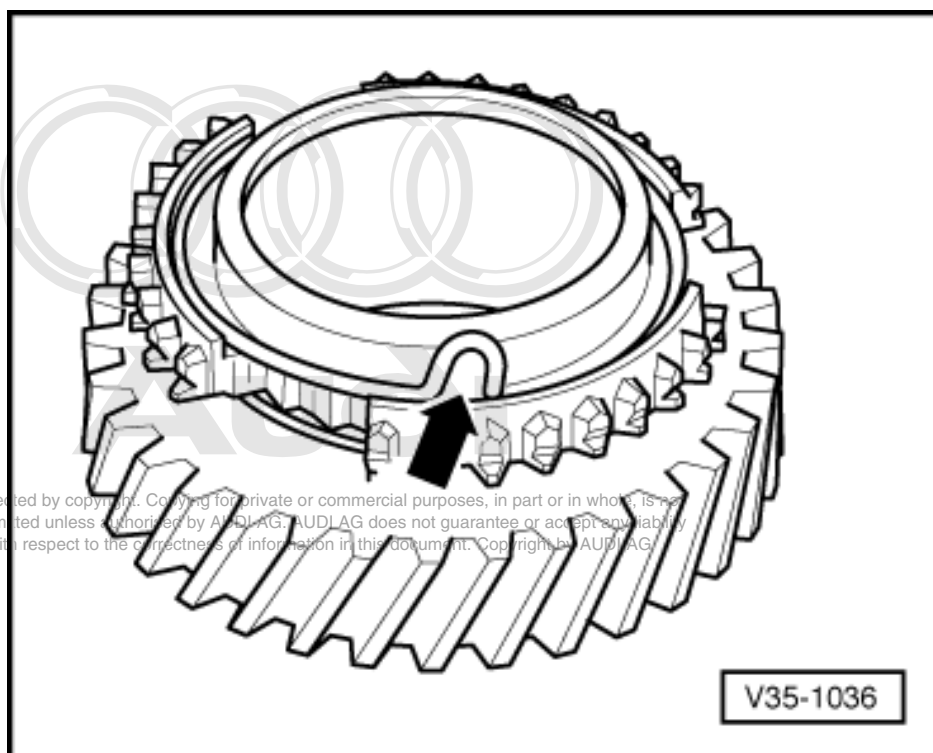


-> Fig.9 Pressing off synchro-hub for 3rd and 4th gear

- Remove circlip before pressing off.
- Press 3rd gear synchro ring (arrow) towards 3rd speed sliding gear, then fit separating device -A-.

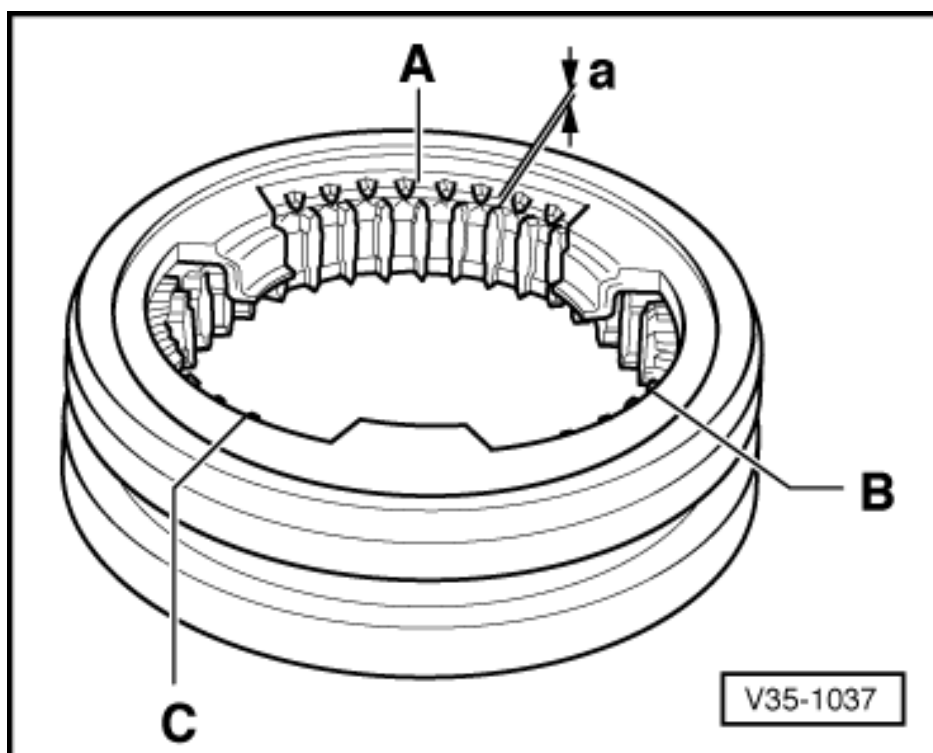
A - Separating device 22 ... 115 mm, e.g. Kukko 17/2

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-> Fig.10 Inserting spring into sliding gear

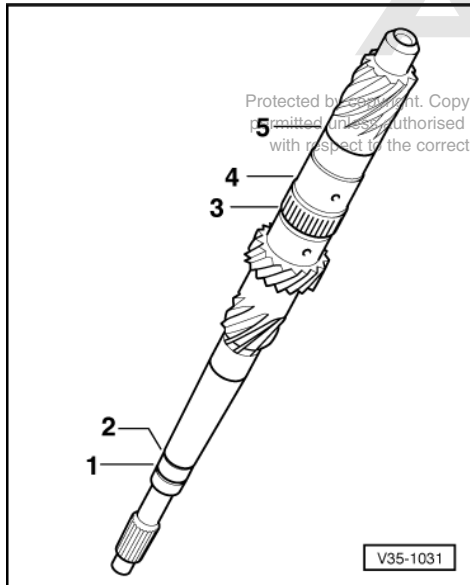
The bent end of the spring (arrow) must be hooked into the hole in the gear wheel.



**-> Fig.11 Checking synchro-ring for wear**

- Press synchro-ring into locking collar and measure gap -a- with a feeler gauge at positions -A-, -B- and -C-.
- Calculate average gap.

The average gap must not be less than 0.5 mm.


**-> Fig.12 Position of circlips**

- ♦ The circlips -1- and -2- secure the input shaft ball bearing.

Determine thickness => adjusting input shaft, Page **105** .

- ♦ The circlip -3- secures the 3rd and 4th gear synchro hub.

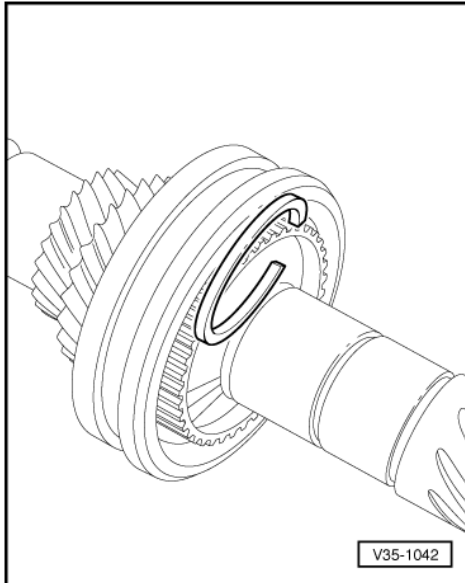
Thickness: 2.00 mm. Identification: brown colour

- ♦ The circlip -4- secures the 3rd and 4th gear synchro hub.

Determine thickness => table on Page **103** .  
Identification: blue colour

- ♦ The circlip -5- secures the 5th gear wheel.

Determine thickness => table on Page **103** .



→ Fig.13 Determining thickness of circlip

- Determine the thickest circlip which will just fit and install it.
- Determine circlip from table. Part No.

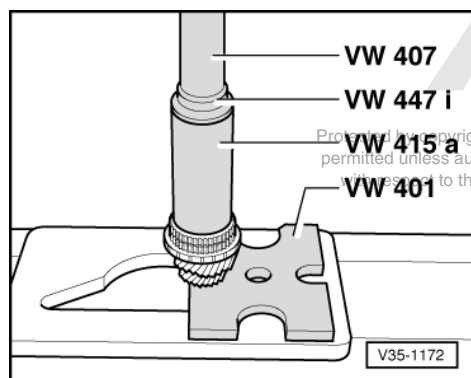
⇒ Parts catalogue

The following circlips are available for synchro-hub for 3rd and 4th gear

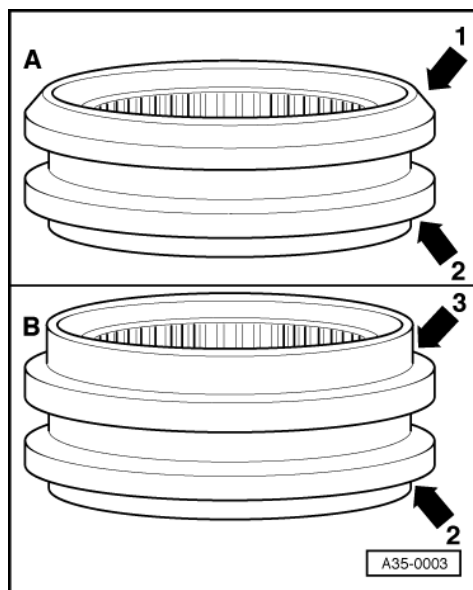
Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

The following circlips are available for 5th gear wheel

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	



-> Fig.14 Pressing on synchro-hub for 3rd and 4th gear



-> Fig.15 Installation position of locking collar

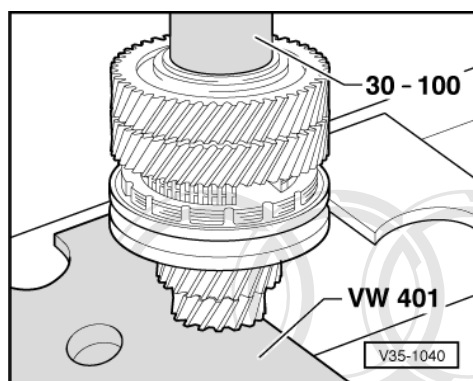
Different types of locking collar are installed: with chamfered surface -A- or with large shoulder -B-.

♦ Installation position:

Chamfered surface -arrow 1- faces towards 4th gear.

Small shoulder -arrow 2- faces towards 3rd gear.

Large shoulder -arrow 3- faces towards 4th gear.



-> Fig.16 Pressing on 5th gear wheel

**Caution**  
Wear protective gloves.

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- Heat 5th gear wheel to approx. 100 °C before pressing on.

♦ Installation position:

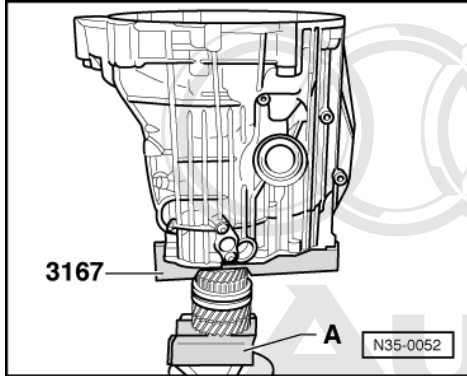
High collar faces towards reverse gear.

## 2 - Adjusting input shaft

### 2.1 - Adjusting input shaft

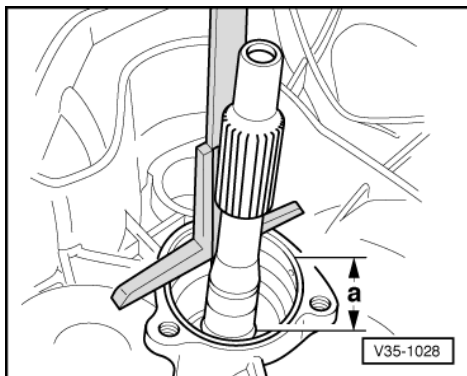
**Note:**

*The input shaft must be readjusted if the gearbox housing, the input shaft or the ball bearing are renewed.*



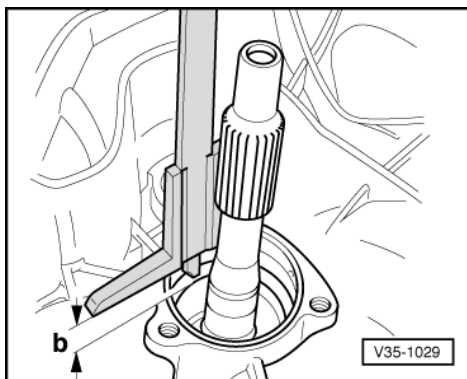
#### Special tools, testers and auxiliary items

- ◆ Distance gauge 3167
  - ◆ Depth gauge
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- -> Clamp input shaft in vice using vice clamps -A-.
  - Place distance gauge 3167 onto 3rd gear wheel.
  - Place gearbox housing over input shaft onto the distance gauge.



#### Calculating dimension "x"

- -> Place depth gauge onto gearbox housing and measure to the lower circlip groove in the input shaft.
- Measurement in the following example: -a- = 28.50 mm





- -> Place depth gauge onto gearbox housing and measure to seating surface for ball bearing.
- Measurement in the following example: -b- = 26.80 mm

**Determining circlip behind the input shaft ball bearing****Formula:**

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

**Example:**

Dimension "a"	28.50 mm
- Dimension "b"	26.80 mm
= Dimension "x"	1.70 mm
(thickness of circlip)	

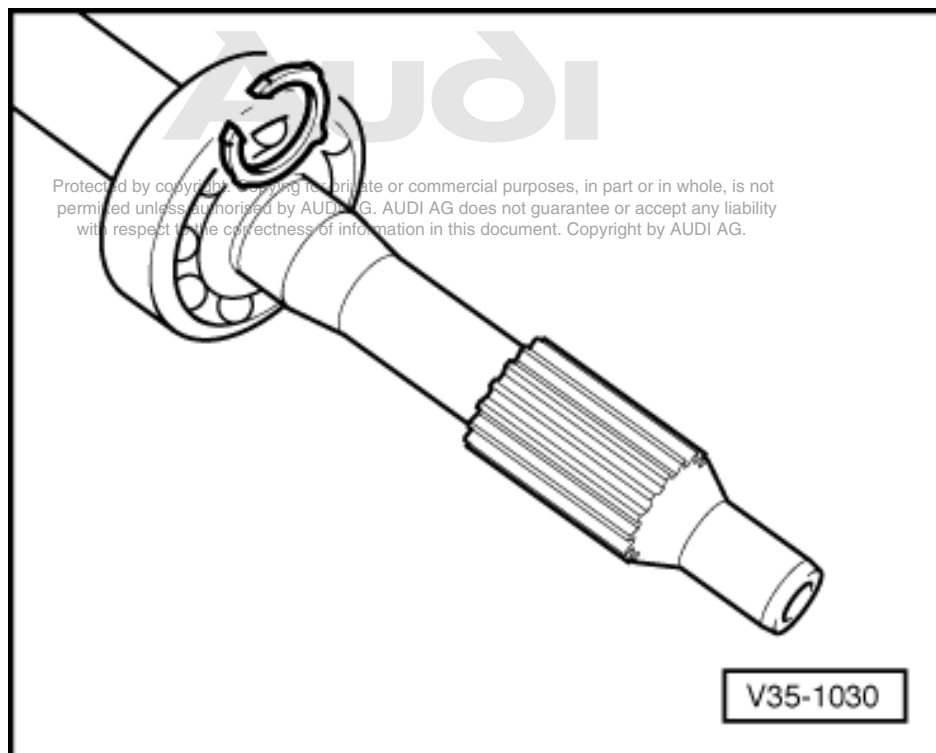
- Determine circlip from table. Part No.

**=> Parts catalogue****Circlips available**

Dimension "x"	Thickness (mm)
1.48 ... 1.56	1.54
1.57 ... 1.65	1.63
1.66 ... 1.74	1.72
1.75 ... 1.83	1.81
1.84 ... 1.92	1.90
1.93 ... 2.01	1.99
2.02 ... 2.10	2.08
2.11 ... 2.20	2.17

**Determining the circlip in front of input shaft ball bearing**

- Knock rear circlip (as calculated) and ball bearing onto the input shaft with fitting sleeve 30 - 100.





- -> Determine the thickest circlip which will still fit.
- Determine circlip as accurately as possible from table. Part No.

=> Parts catalogue

#### Circlips available

Circlip thickness (mm)		
1.45	1.72	1.99
1.54	1.81	2.08
1.63	1.90	2.17

## 3 - Dismantling and assembling drive pinion and hollow shaft

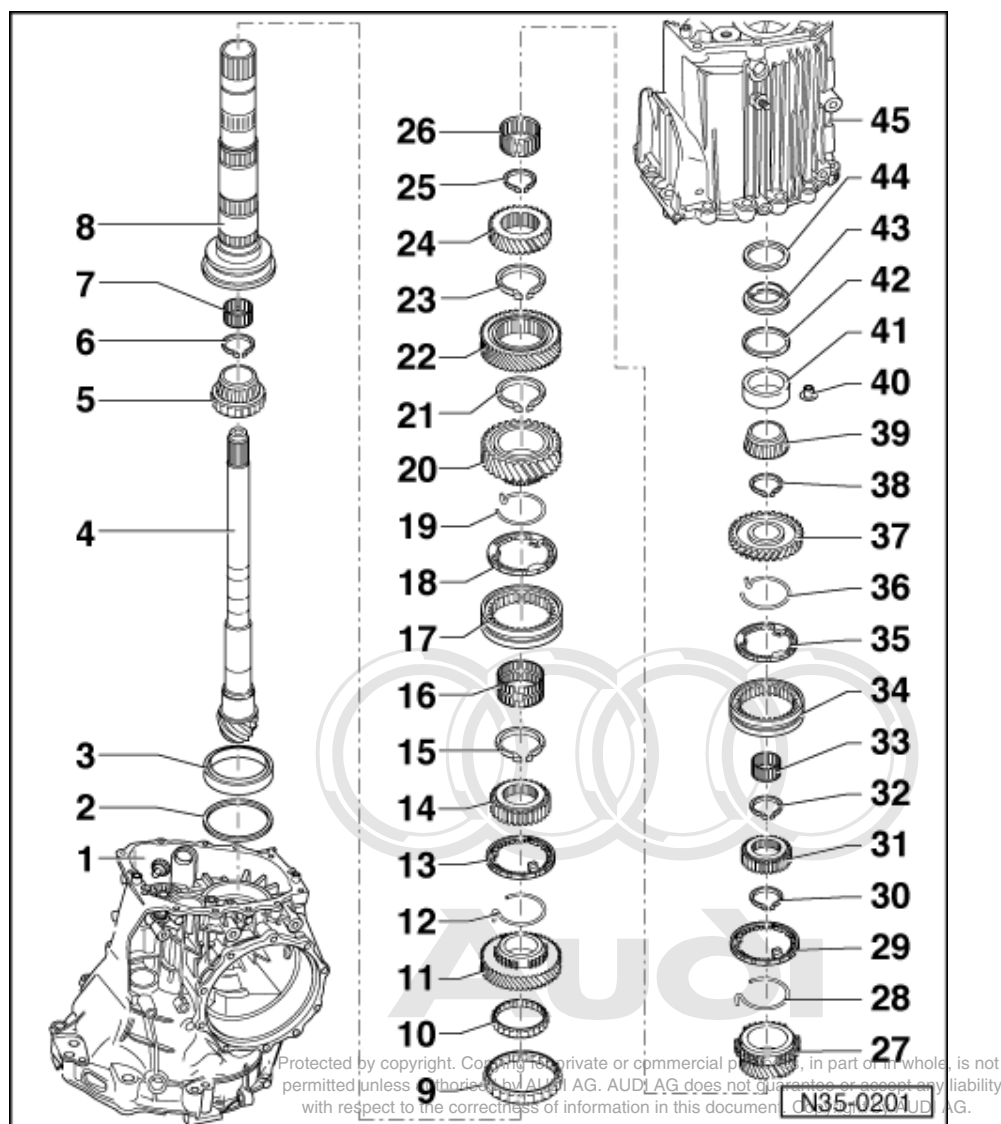
### 3.1 - Dismantling and assembling drive pinion and hollow shaft

#### Special tools, testers and auxiliary items

- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 411
- ◆ Press tool VW 412
- ◆ TubeVW 415 A
- ◆ TubeVW 416 B
- ◆ TubeVW 418 A
- ◆ Thrust ring VW 429
- ◆ Thrust plate VW 447 i
- ◆ Thrust pad VW 454
- ◆ Tube VW 519
  
- ◆ Support 40-103
- ◆ Tube 2010
- ◆ Thrust pad 3062
- ◆ Fitting tool 3128
- ◆ Multi-purpose tool VW 771
- ◆ Separating tool Kukko 17/2
- ◆ Internal puller Kukko 21/1



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### Notes:

- ♦ When installing new gear wheels or the final drive set consult technical data=>Page 2 .
- ♦ Adjustments are required when renewing components marked 1) => Adjustment overview, Page 152 .

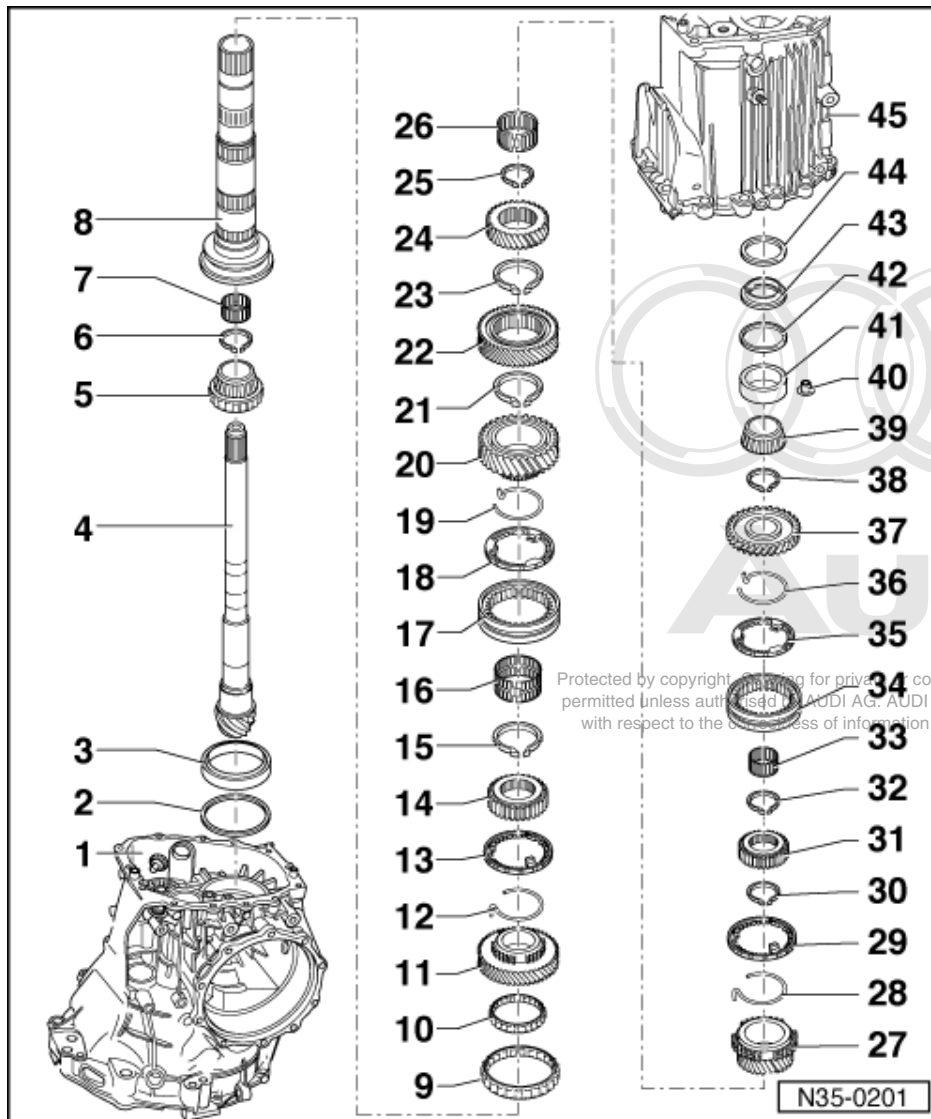
### 1 Gearbox housing

### 2 Shim "S3"

- ♦ Adjustment overview => Page 152

### 3 Double taper roller bearing outer race 1)

- ♦ Renew together with Item 5
- ♦ Pulling out => Fig. 1
- ♦ Pressing in => Fig. 3



#### 4 Drive pinion1)

- ♦ Is mated with crown wheel, always renew together as a set
- ♦ Adjusting crown wheel and pinion shaft => Page 150

#### 5 Double taper roller bearing inner race1)

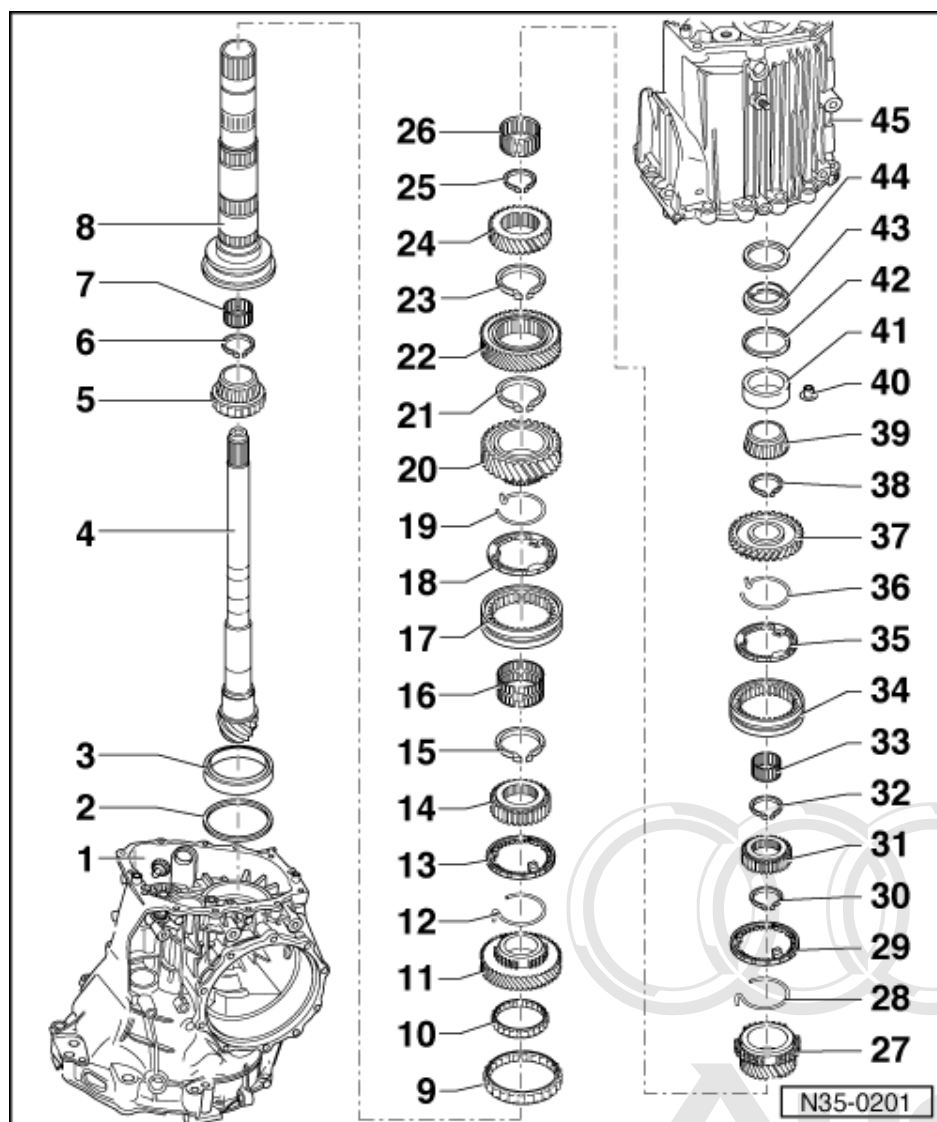
- ♦ Renew
- ♦ Will be damaged when removing
- ♦ Pressing off => Fig. 2
- ♦ Pressing on => Fig. 4

#### 6 Circlip

- ♦ Redetermine thickness if double taper roller bearing is replaced  
=>Fig. 5

#### 7 Needle roller bearing

- ♦ For drive pinion in hollow shaft
- ♦ Lubricate with MoS2 grease



8 Hollow shaft 1)

9 Needle bearing for 1st gear

10 Needle bearing for 1st gear

11 1st speed sliding gear

12 Spring

- ♦ Insert in 1st speed sliding gear  
=> Fig. 16
- ♦ Allocation of spring to gear

=> Parts catalogue

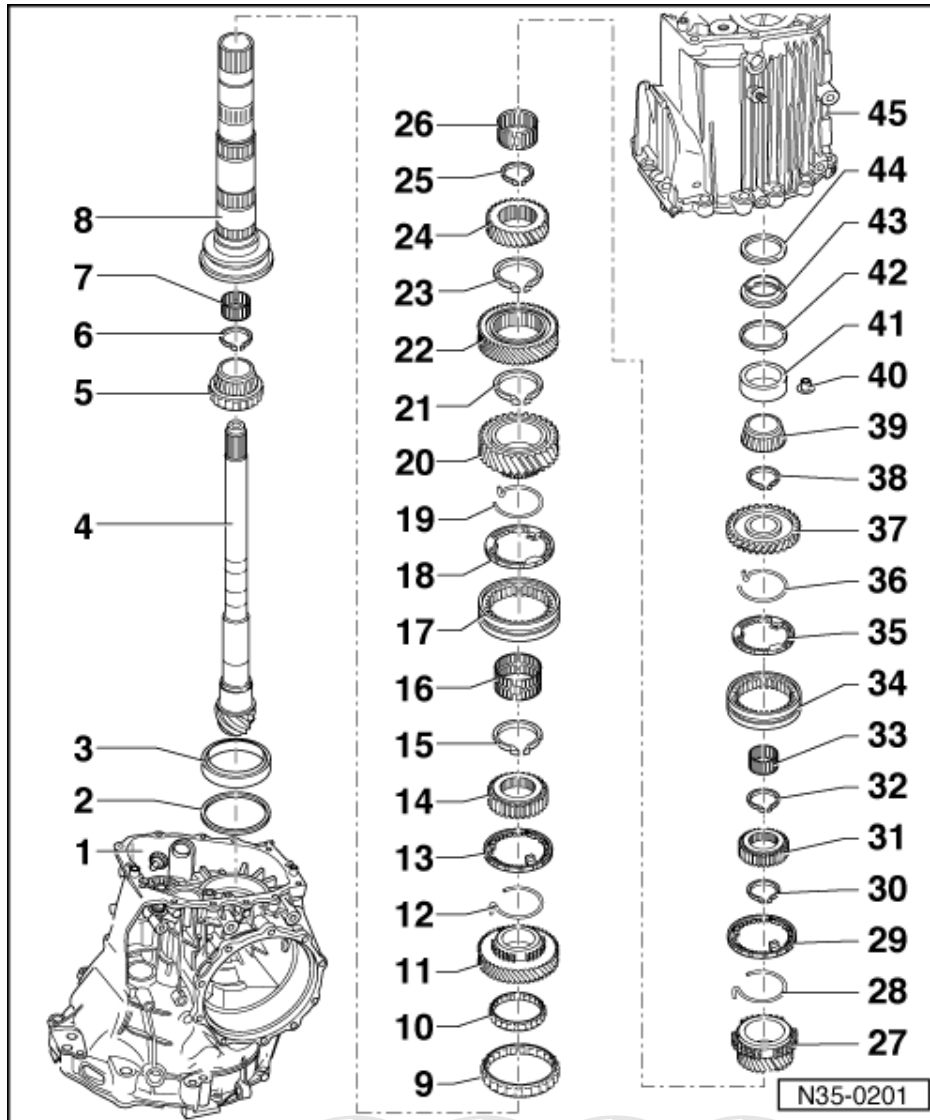
13 Synchro-ring for 1st gear

- ♦ Checking for wear  
=> Fig. 17

14 Synchro-hub for 1st and 2nd gear

- ♦ Pressing off=> Fig. 14
- ♦ Pressing on => Fig. 18

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#### 15 Circlip

- ◆ Identification
- ◆ Installation position => Fig. 15, item 1
- ◆ Redetermine thickness if synchro hub is replaced => Fig. 5

#### 16 Needle roller bearing

- ◆ For 2nd gear

#### 17 Locking collar for 1st and 2nd gear

- ◆ Installation position => Page 19

#### 18 Synchro-ring for 2nd gear

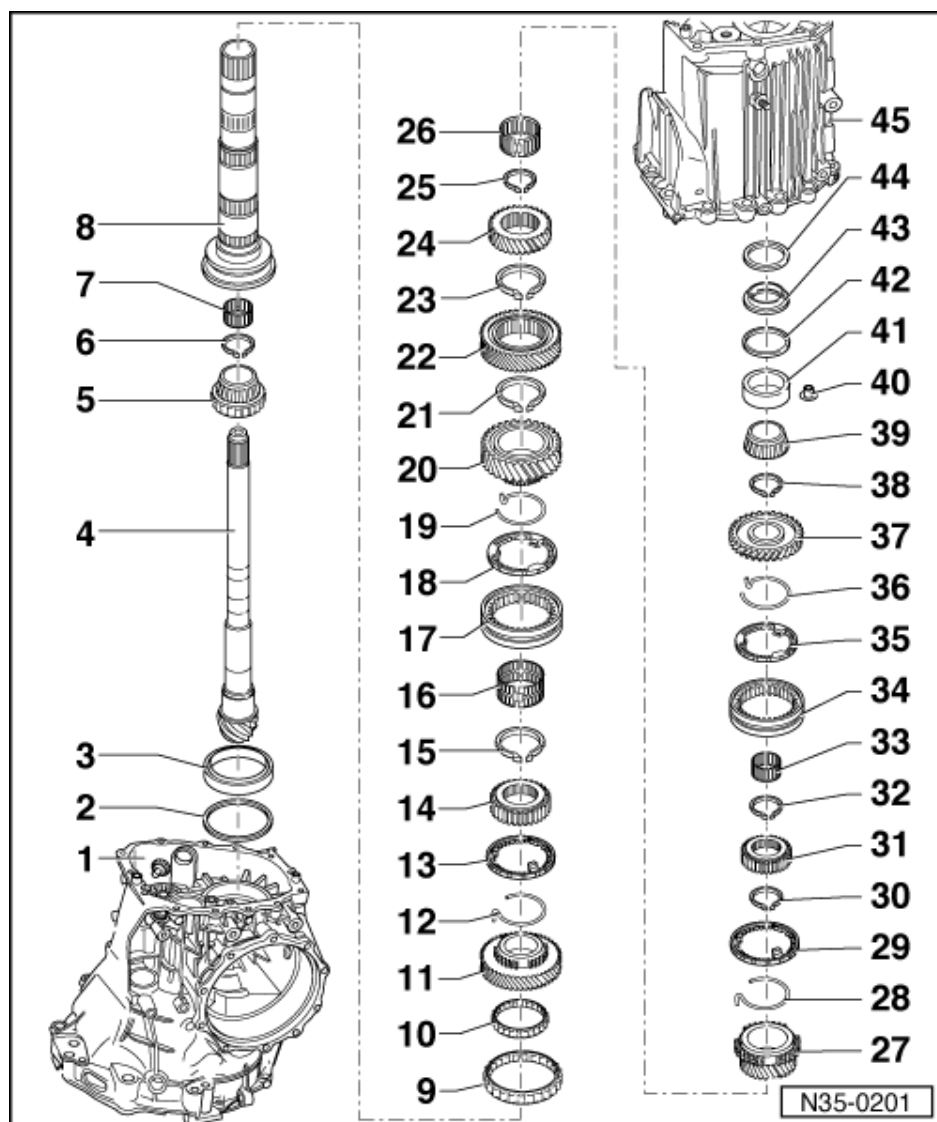
- ◆ Checking for wear  
=> Fig. 17

#### 19 Spring

- ◆ Insert in 2nd speed sliding gear  
=> Fig. 16
- ◆ Allocation of spring to gear

=> Parts catalogue

#### 20 2nd speed sliding gear

**21 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15, item 2

**22 3rd gear wheel**

- ◆ Pressing off => Fig. 13
- ◆ Pressing on => Fig. 20

**23 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15, item 3
- ◆ Redetermine thickness if 3rd gear wheel is replaced=>Fig. 5

**24 4th gear wheel**

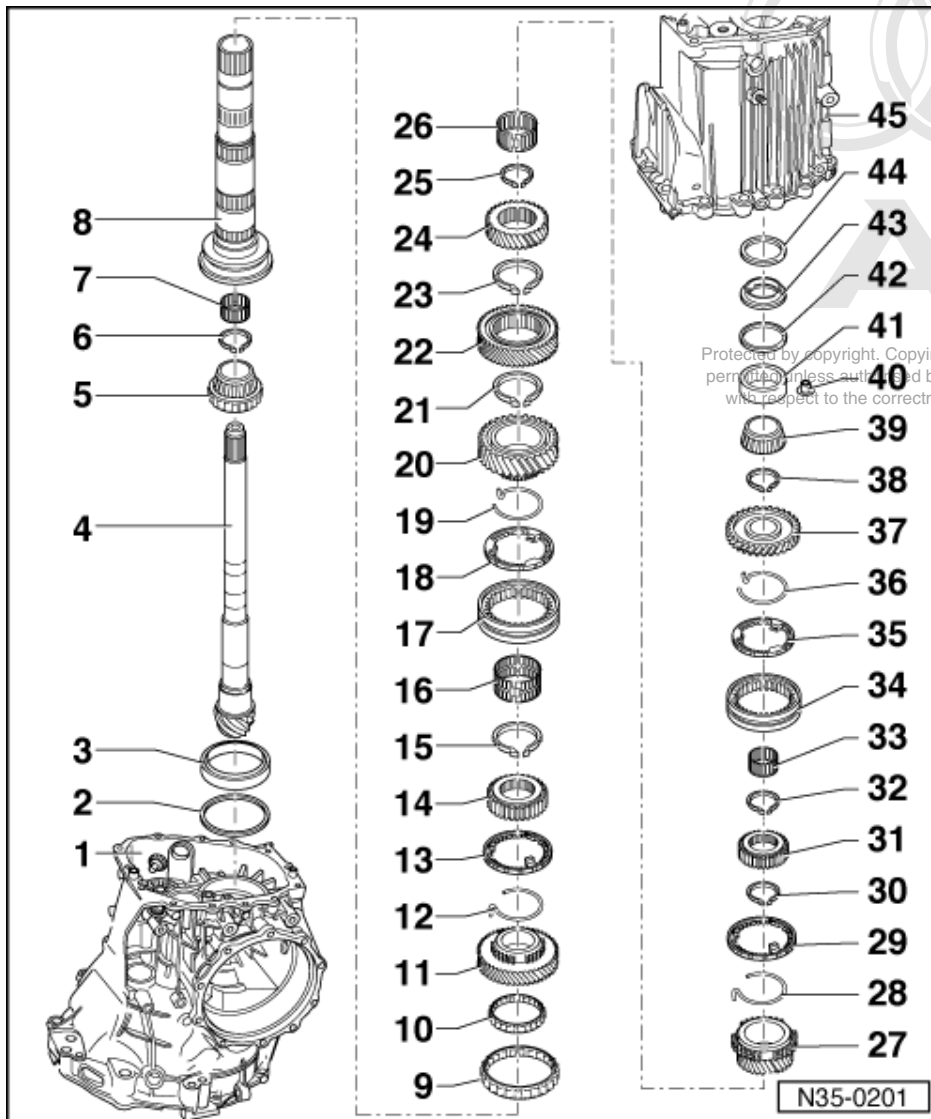
- ◆ Pressing off => Fig. 12
- ◆ Pressing on => Fig. 21

**25 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15, item 4
- ◆ Redetermine thickness if 4th gear wheel is replaced =>Fig. 5





**32 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15, item 6
- ◆ Redetermine thickness if synchro hub is replaced => Fig. 5

**33 Needle roller bearing**

- ◆ For reverse gear

**34 5th and reverse gear locking collar**

- ◆ Installation position => Fig. 23

**35 Reverse gear synchro-ring**

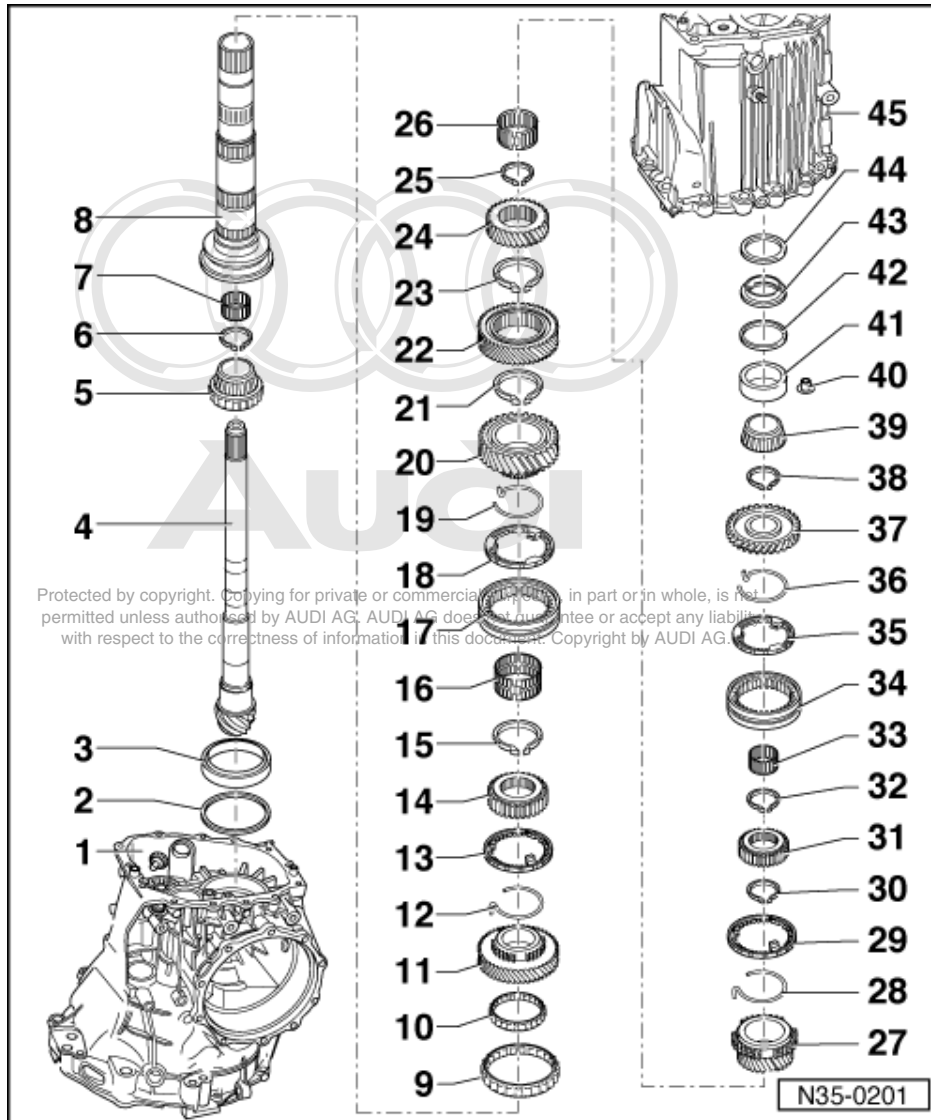
- ◆ Checking for wear  
=> Fig. 17

**36 Spring**

- ◆ Insert in reverse sliding gear  
=> Fig. 16
- ◆ Allocation of spring to gear

=> Parts catalogue





### 37 Reverse sliding gear wheel

### 38 Circlip

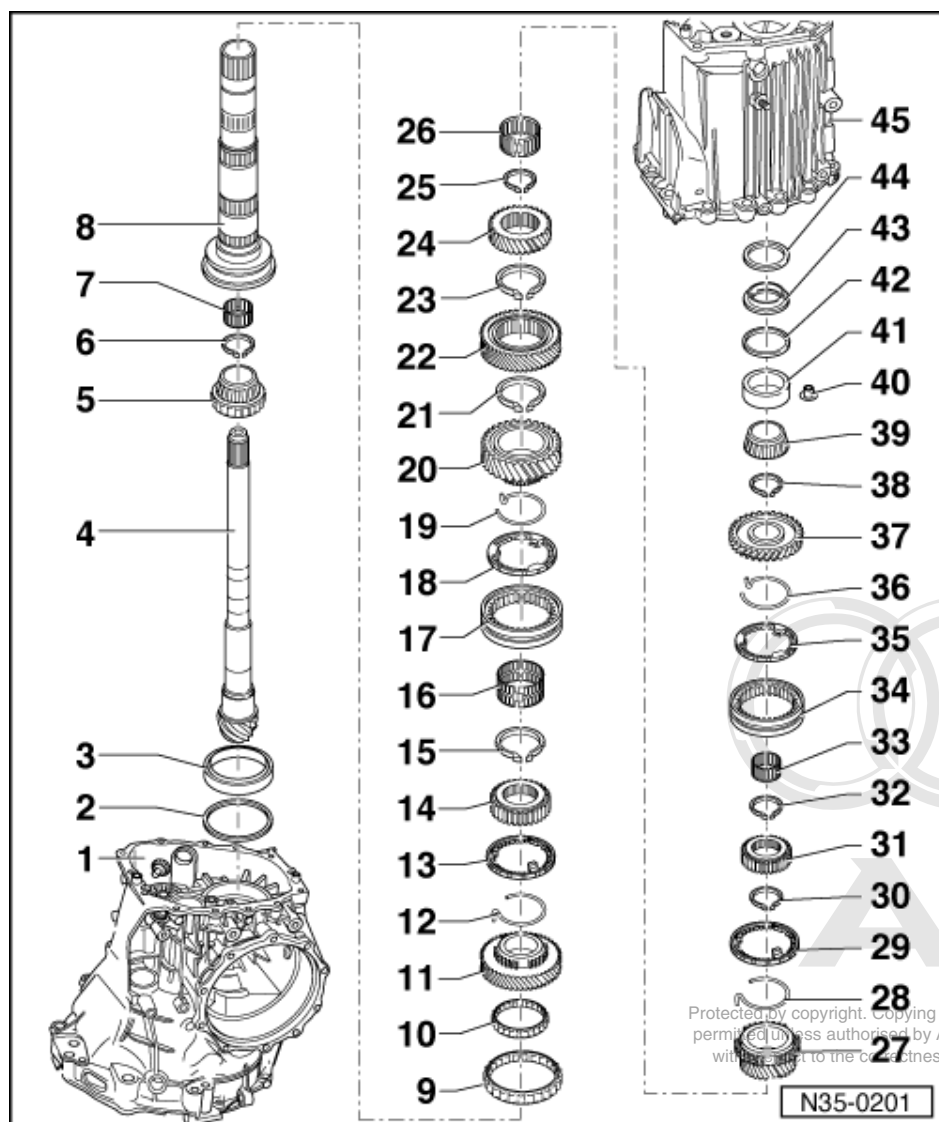
- ◆ Identification
- ◆ Installation position => Fig. 15, item 7

### 39 Inner race for taper roller bearing 1)

- ◆ Pressing off => Fig. 9
- ◆ Pressing on => Fig. 10

### 40 Bush

- ◆ To secure small taper roller bearing outer race
- ◆ Pulling out => Fig. 6
- ◆ Need not be fitted after the small taper roller bearing has been replaced

**41 Outer race for taper roller bearing 1)**

- ◆ Pressing out => Fig. 7
- ◆ Pressing in => Fig. 8

**42 Shim "S4"**

- ◆ Adjustment overview => Page 152

**43 Ring**

- ◆ Holds rubber washer
- ◆ Allocation

=&gt; Parts catalogue

**44 Rubber washer**

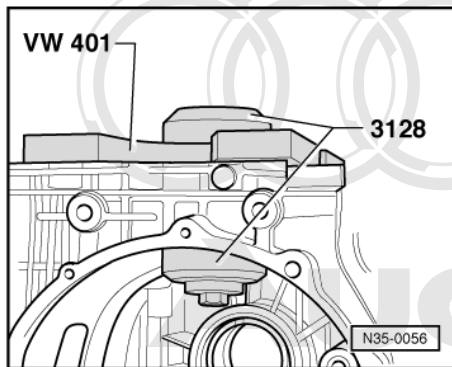
- ◆ Compensates length variations
- ◆ Allocation

=&gt; Parts catalogue

**45 Gearbox cover**

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N35-0201

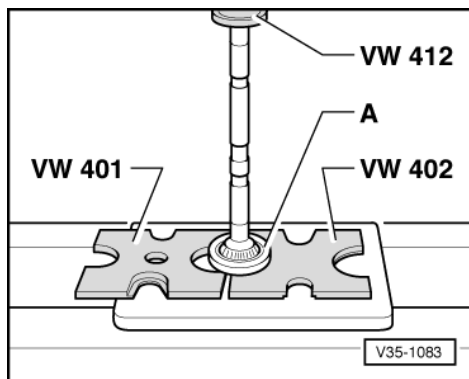


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-> **Fig.1 Pulling out double taper roller bearing outer race**

- Remove differential=>Page **137**
- Place pressure piece of puller 3128 below the outer race.
- Fit threaded part of puller 3128 with pressure plate VW 401 onto gearbox housing.

When tightening the bolt the outer race will be pulled out of the housing.

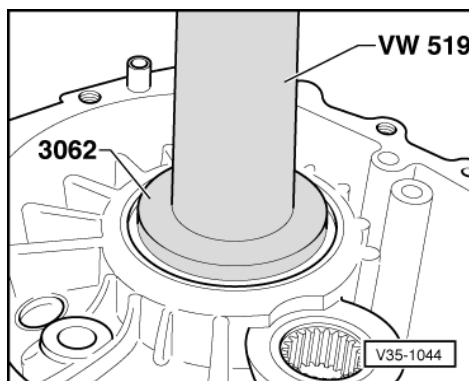


-> **Fig.2 Pressing off double taper roller bearing inner race**

- Remove circlip before pressing off.
- The outer race -A- must be fitted to press off the inner race.

**Note:**

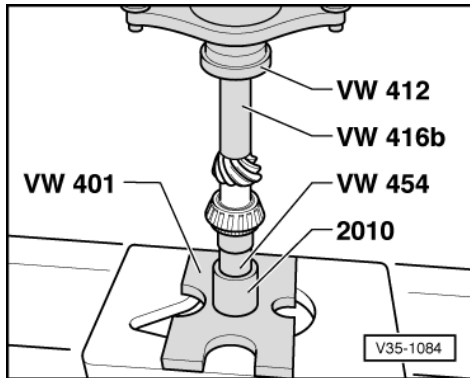
*The inner race of the double taper roller bearing is destroyed when pressed off.*





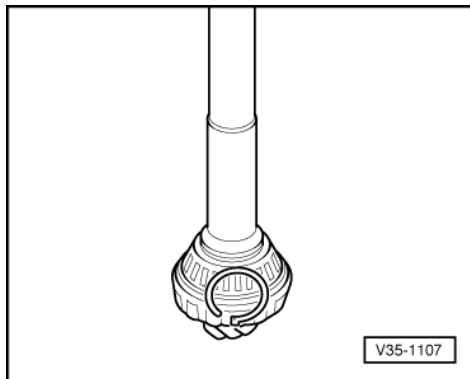
-> Fig.3 Pressing in double taper roller bearing outer race

The smaller diameter of the thrust pad 3062 faces outer race.



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

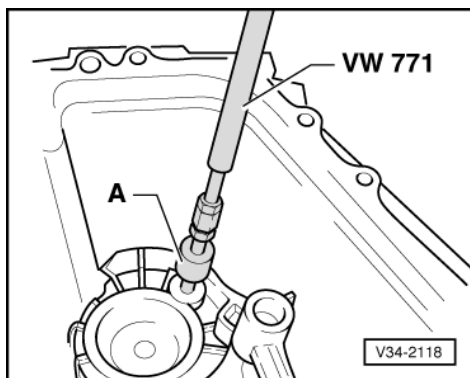


-> Fig.5 Determining thickness of circlip

- Determine the thickest circlip which will still fit and install it.
- The circlips for the synchro-hubs, needle bearings and individual gear wheels should be determined as for the double taper roller bearing shown.

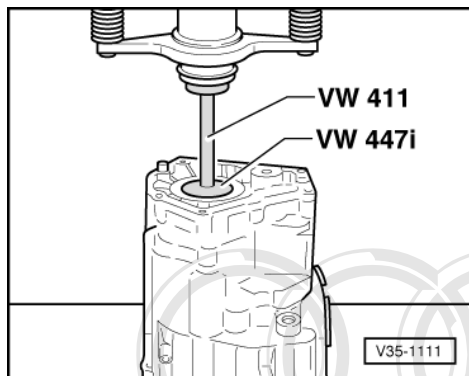
Circlips available and part numbers:

=> Parts catalogue



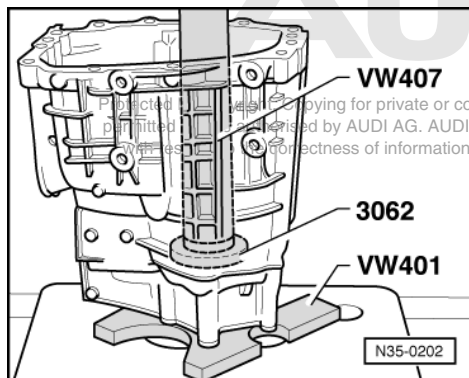
-> Fig.6 Pulling out securing bush for small taper roller bearing outer race

A - Internal puller 12 ... 14.5 mm, e.g. Kukko 21/1

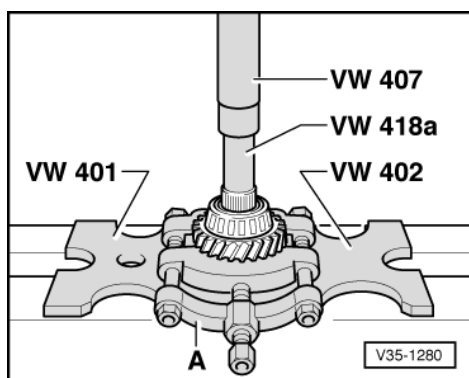


-> Fig.7 Pressing out taper roller bearing outer race

- The outer race is pressed out together with the ring -item 116 .



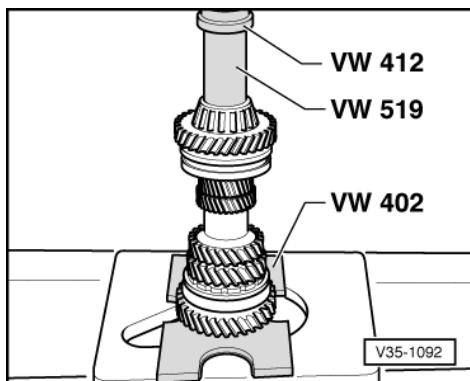
-> Fig.8 Pressing in taper roller bearing outer race



-> Fig.9 Pressing off taper roller bearing inner race

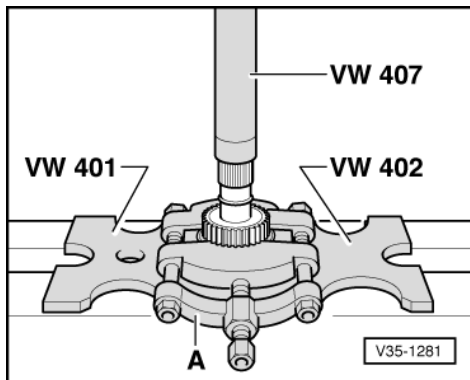
- Press off inner race with reverse gear sliding gear

A - Separating device 22 ... 115 mm, e.g. Kukko 17/2



-> Fig.10 Pressing on taper roller bearing inner race

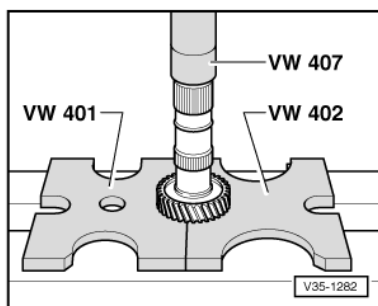
- Fit circlip before pressing on inner race.



-> Fig.11 Pressing off 5th gear and reverse gear synchro hub

- Remove circlip before pressing off.
- Press off synchro-hub with 5th speed sliding gear

A - Separating device 22 ... 115 mm, e.g. Kukko 17/2

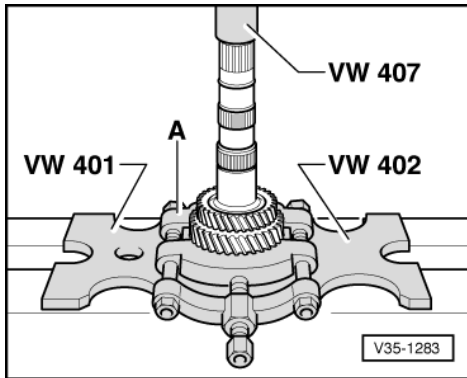


-> Fig.12 Pressing off 4th gear wheel

- Remove circlip before pressing off.



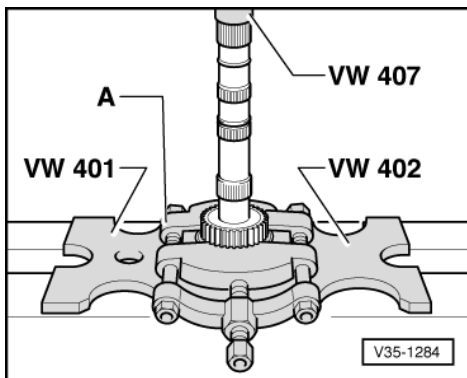
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→ Fig.13 Pressing off 3rd gear wheel

- Remove circlip before pressing off.
- Press 3rd gear wheel off with 2nd speed sliding gear

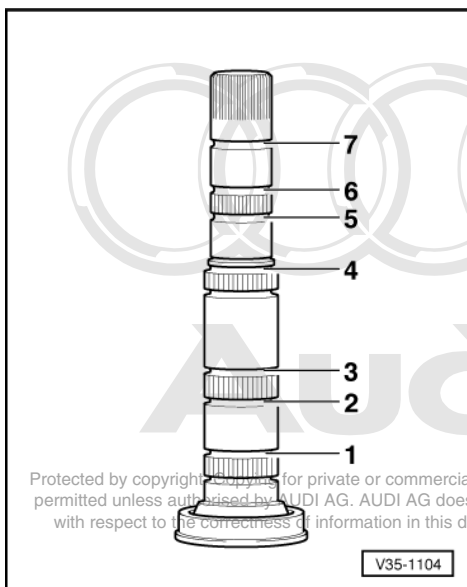
A - Separating device 22 ... 115 mm, e.g. Kukko 17/2



→ Fig.14 Pressing off 1st and 2nd gear synchro-hub

- Remove circlip before pressing off.
- Press synchro-hub off with 1st speed sliding gear

A - Separating device 22 ... 115 mm, e.g. Kukko 17/2





## -&gt; Fig.15 Position of circlips

- The circlips for the synchro-hubs, needle bearings and individual gear wheels should be determined as shown in Fig. 5 .

- ♦ Circlip -1- secures the 1st and 2nd gear synchro-hub.

Identification: colour blue

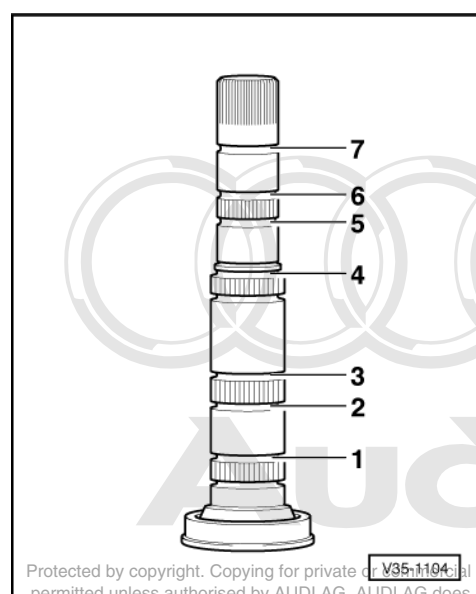
Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

- ♦ Circlip -2- secures the needle bearing/ 2nd speed sliding gear.

Thickness: 2.50 mm. Identification: colour blue

- ♦ Circlip -3- secures the 3rd gear wheel.

Circlip thickness (mm)		
1.90	1.98	2.06
1.94	2.02	



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- ♦ Circlip -4- secures the 4th gear wheel.

Circlip thickness (mm)		
1.86	1.94	
1.90	1.98	

- ♦ -> Circlip -5- secures the needle bearing/ 5th speed sliding gear.

Thickness 2.00 mm. Identification: colour brown

- ♦ Circlip -6- secures the synchro-hub for 5th and reverse gear.

Identification: colour blue

Circlip thickness (mm)		
1.90	1.96	2.02



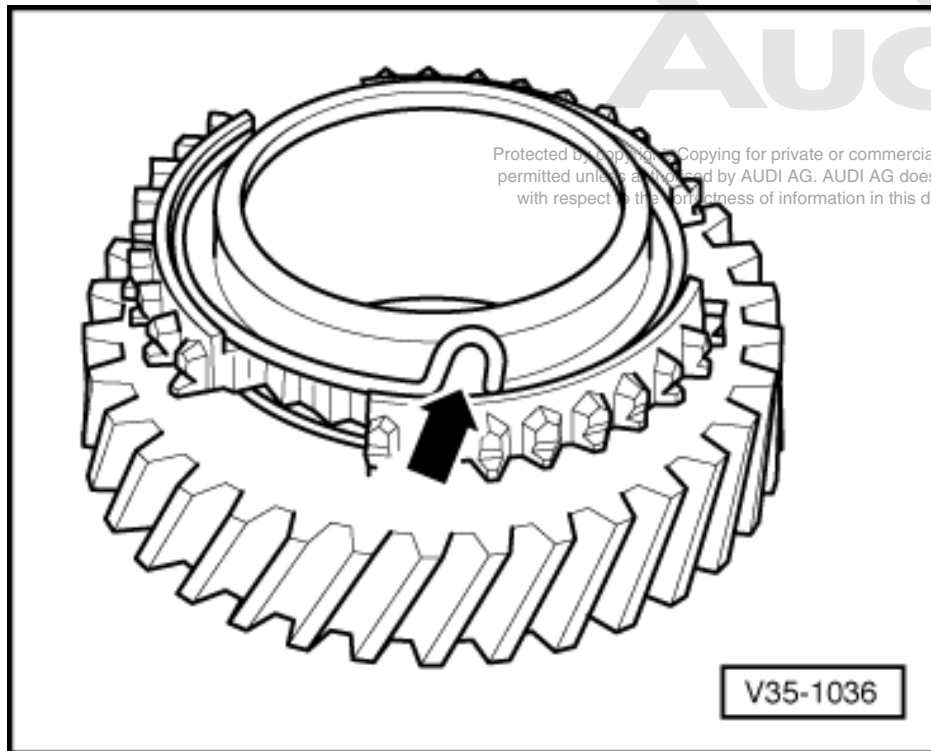
Circlip thickness (mm)		
1.93	1.99	2.05

- ♦ Circlip -7- secures needle bearing for reverse sliding gear.

Thickness 2.50 mm.

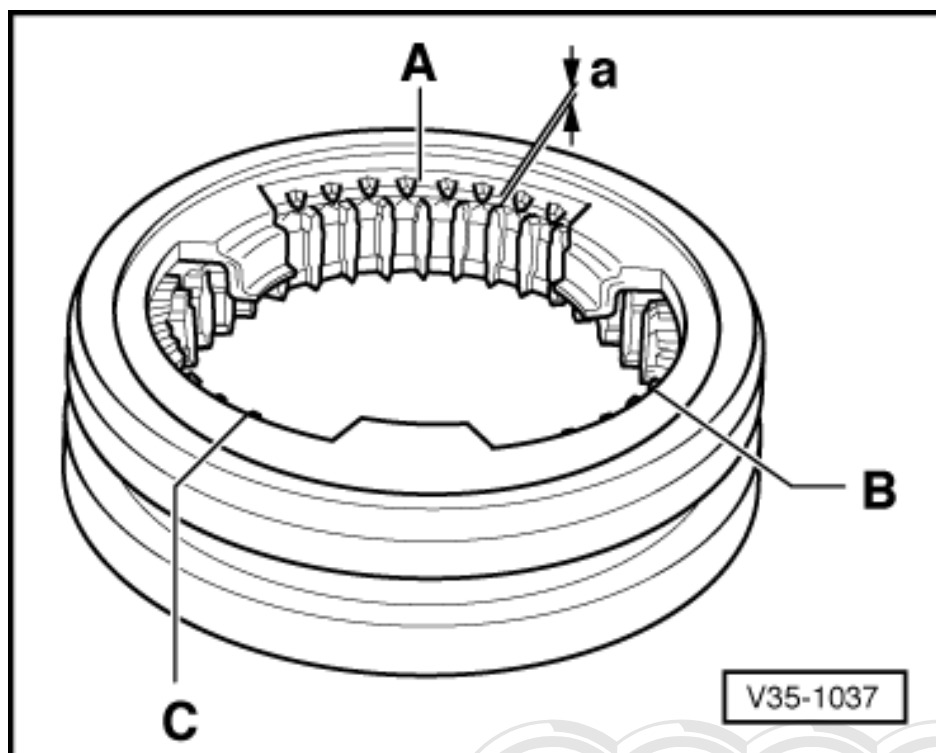
- Determine circlips according to table. Part numbers

=> Parts catalogue



-> Fig.16 Inserting spring in sliding gear

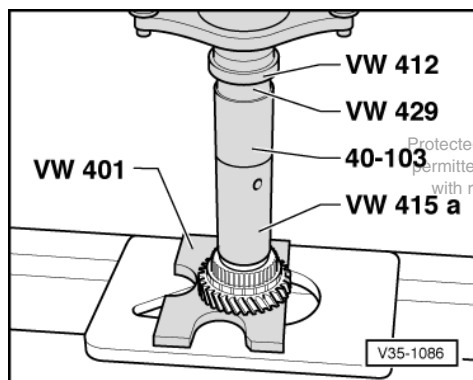
The bent end of the spring (arrow) must be hooked into the hole in the gear wheel.



→ Fig.17 Checking synchro-ring for wear

- Press synchro-ring into locking collar and measure gap -a- with a feeler gauge at positions -A-, -B- and -C-.
- Calculate average gap.

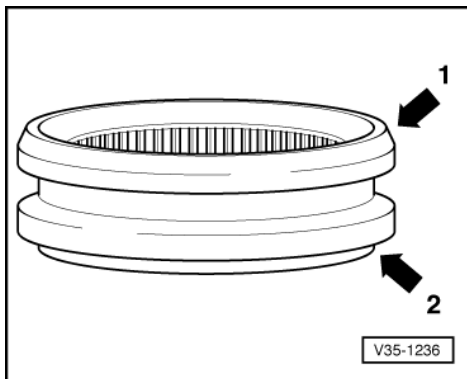
The average gap must not be less than 0.5 mm.



→ Fig.18 Pressing on 1st and 2nd gear synchro-hub

- ♦ Installation position:

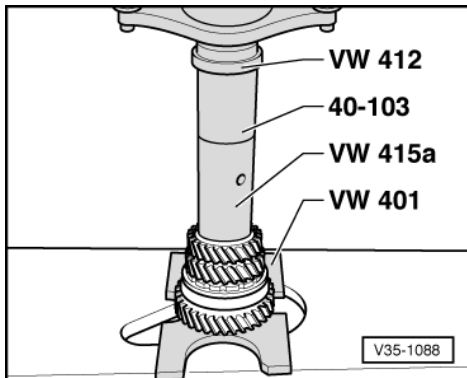
High inside collar faces towards 2nd gear.



-> Fig.19 Installation position of locking collar for 1st and 2nd gear

- ◆ Installation position:

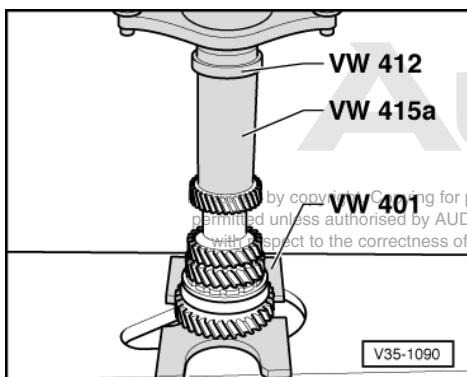
Chamfered surface -arrow 1- faces towards 2nd gear.  
Shoulder -arrow 2- faces towards 1st gear.



-> Fig.20 Pressing on 3rd gear wheel

- ◆ Installation position:

Groove on gear wheel faces towards 4th gear.

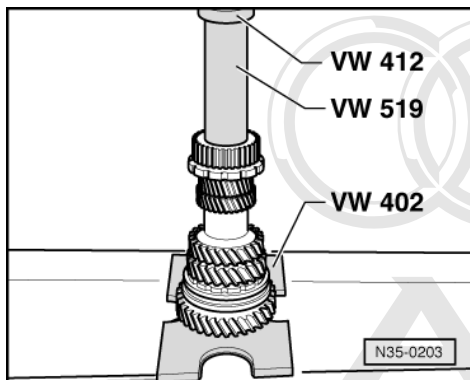


-> Fig.21 Pressing on 4th gear wheel

- ◆ Installation position:



High inside collar faces towards 3rd gear.

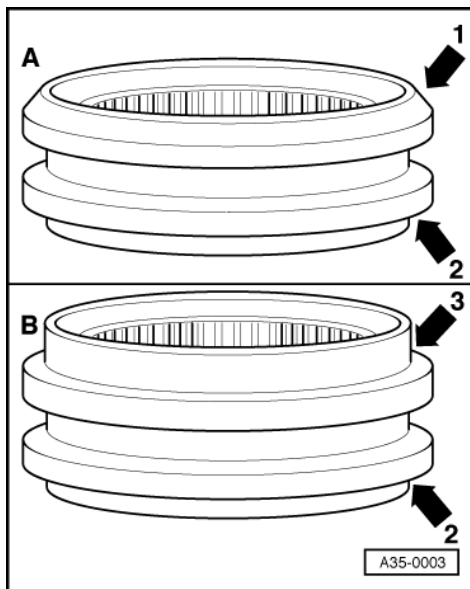


-> Fig.22 Pressing on 5th gear and reverse gear synchro-hub

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- ♦ Installation position:

High inside collar faces towards 5th gear.

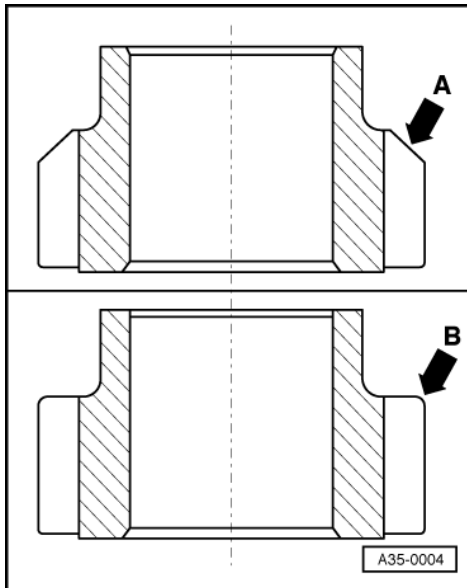


-> Fig.23 Installation position of locking collar for 5th and reverse gear

Different types of locking collar are installed: with chamfered surface -A- or with large shoulder -B-.

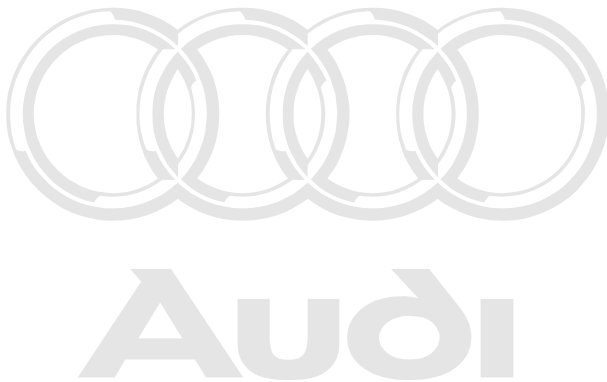
- ♦ Make sure locking collar is correct version for reverse gear wheel  
=>Fig. 24
- ♦ Installation position:

Chamfered surface -arrow 1- faces towards reverse gear.  
Small shoulder -arrow 2- faces towards 5th gear.  
Large shoulder -arrow 3- faces towards reverse gear.



-> Fig.24 Selecting correct locking collar for reverse gear wheel

A Reverse gear wheel with chamfered surface	Both types of locking collar can be installed (with chamfered surface or with large shoulder)
B Reverse gear wheel without chamfered surface	Install only locking collar with large shoulder; not locking collar with chamfered surface

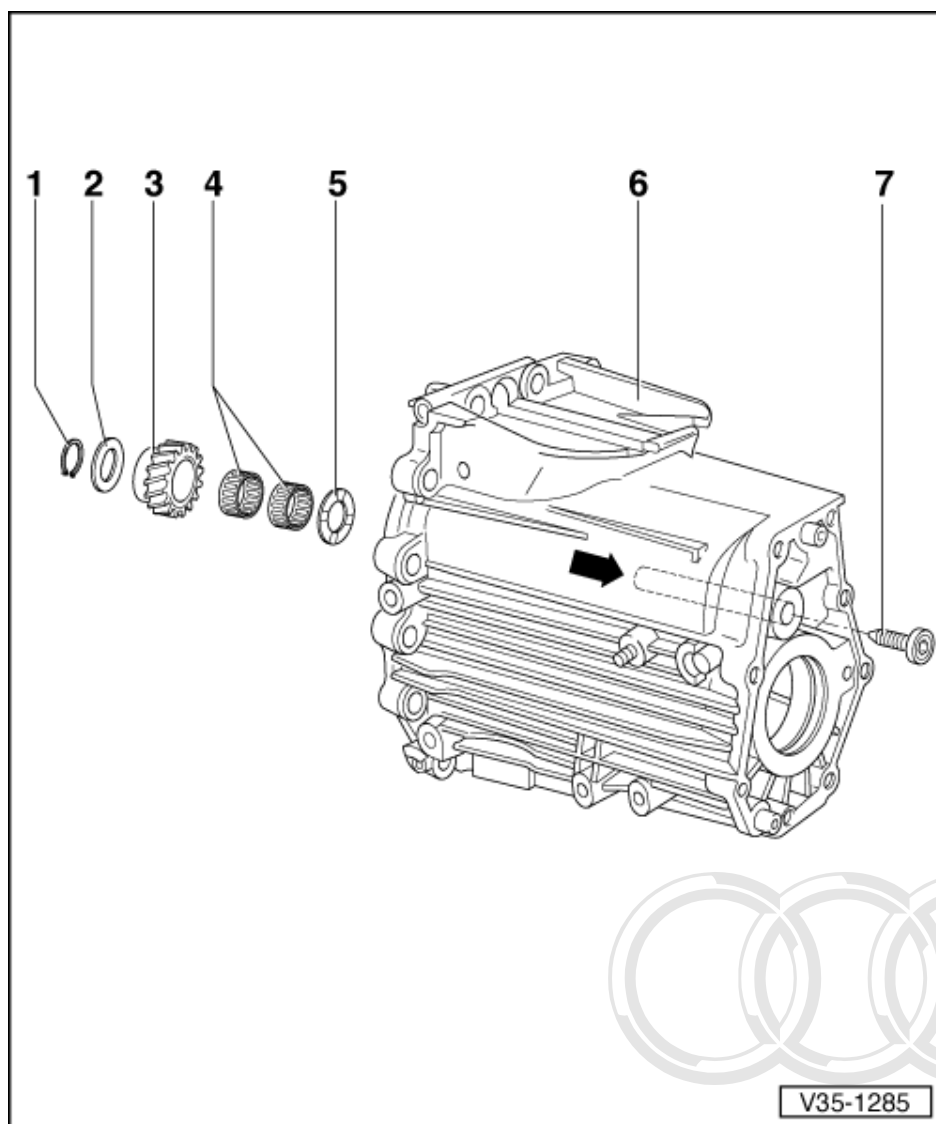


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## 4 - Removing and installing reverse gear wheel

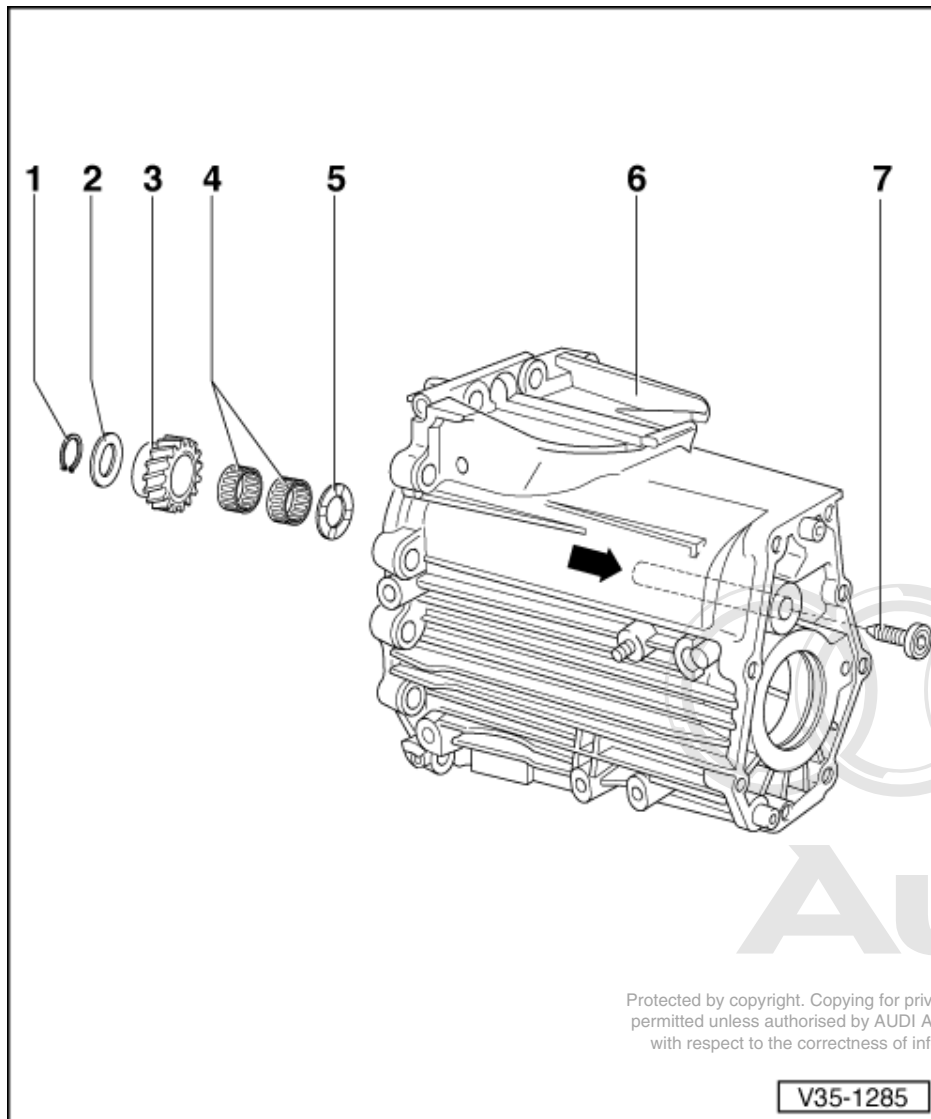
### 4.1 - Removing and installing reverse gear wheel



V35-1285

- 1 Circlip
- 2 Support plate
- 3 Reverse gear wheel
  - ♦ Different versions; allocation  
=>Fig. 127
- 4 Needle roller bearing
- 5 Thrust washer

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#### 6 Gearbox cover

- ◆ With reverse gear shaft (arrow)
- ◆ To remove the reverse gear wheel it is not necessary to remove the reverse gear shaft.
- ◆ The reverse gear shaft is not available as a replacement part.

#### 7 Torx bolt - 25 Nm

- ◆ Serves as an additional method of securing the reverse gear shaft



## 39 - Final drive, Differential rear

### 1 - Renewing seal for flange shaft

#### 1.1 - Renewing seal for flange shaft

- Gearbox installed
- Observe general repair instructions  
=> Page 8 .

#### Special tools, testers and auxiliary items

- ♦ Drip tray V.A.G 1306
- ♦ Drift VW 195
- ♦ Drift VW 295
- ♦ Extractor lever VW 681

#### Notes:

- ♦ Removing and installing oil seal on left-hand side is illustrated below.
- ♦ Procedure for removing oil seal on left and right-hand sides is identical.
- ♦ Exhaust system does not have to be removed.
- ♦ Gearboxes with code letters CSU and CVT have flange shafts without polygon bearings.
- ♦ A spacer ring is fitted between the polygon bearing and the differential sun wheel on flange shafts with 30 mm spline diameter=>Page 131 .

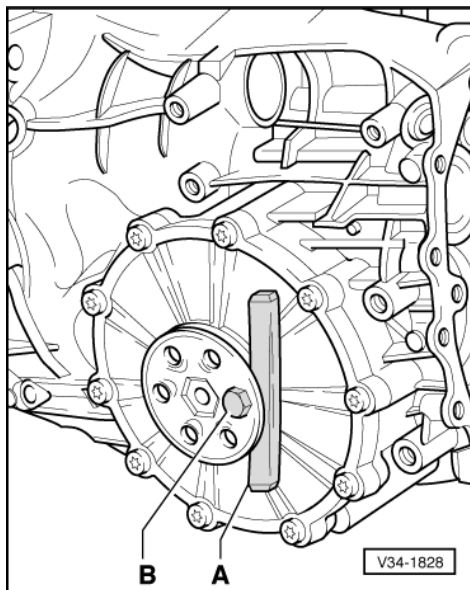
#### Removing

- Remove heat shield for drive shaft.
- Unbolt drive shaft from flange on gearbox.

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

- Turn steering to left onto full lock stop.
- Tie-up drive shaft as high as possible. Do not damage paint on drive shaft.

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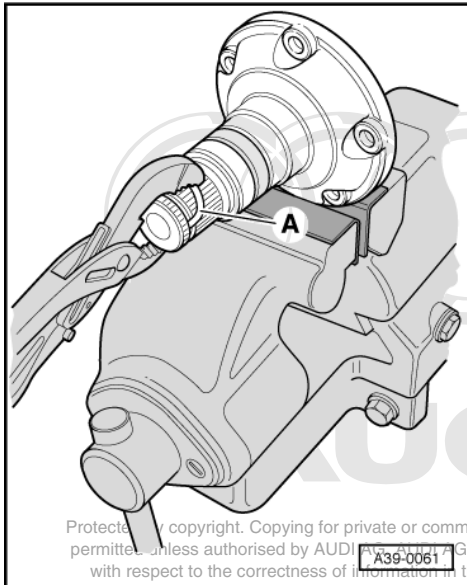




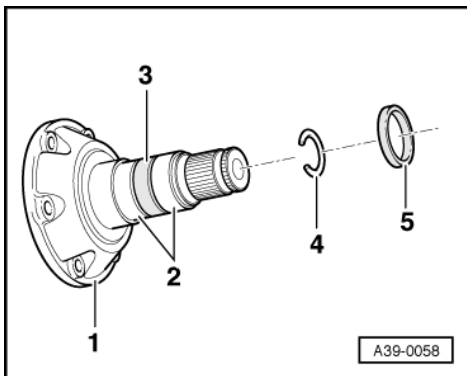
- Place drip tray VW 1306 below gearbox.
- -> Place a chisel or distance piece -A- under the flange shaft and pull flange shaft out of the sun wheel by turning bolt -B-.

**Note:**

*If the flange shaft does not come out easily, turn flange shaft and insert a bolt in the opposite hole to assist removal.*



- -> Always renew flange shaft circlip.
- Clamp flange shaft in vice, using vice clamps. Use new circlip -A- to press old circlip out of groove in flange shaft.
- Pull out flange shaft oil seal with VW 681.



**-> Assembling flange shaft with polygon bearing**

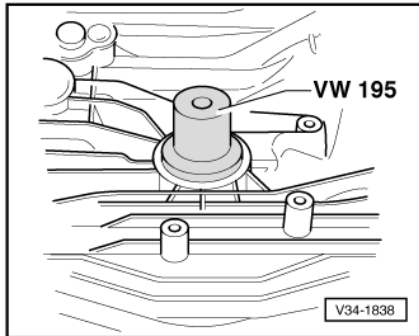
- 1 - Flange shaft
- 2 - Needle bearing (polygon bearing)
- 3 - Spacer ring
- 4 - Circlip
- 5 - Spacer ring - additionally fitted on shafts with 30 mm spline diameter

**Notes:**

- ◆ If the polygon bearings do not run smoothly with the flange shaft removed, this does indicate that the bearings are defective. A test for noisy bearings can only be performed with the bearings installed.
- ◆ Inspect for signs of damage to polygon bearings (such as cracking in outer race).
- ◆ The polygon bearings can only be replaced together with the flange shaft.

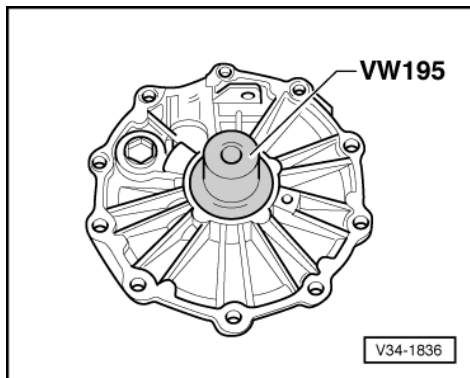


- ♦ A spacer ring -5- is fitted between the polygon bearing and the differential sun wheel on flange shafts with 30 mm spline diameter.



### Installing

- Fill space between sealing lip and dust lip with multi-purpose grease.
- Lightly oil outer circumference of seal.
- -> Knock new oil seal for right-hand flange shaft in 5.5 mm below outer surface of housing; keep seal straight when installing.



- -> Knock new oil seal for left-hand flange shaft in 5.5 mm below outer surface of cover; keep seal straight when installing.
- Knock flange shaft in with drift VW 295.
- Bolt drive shaft to flange shaft.
- Fit drive shaft heat shields.
- Check oil level in gearbox =>Page 56 .

### Tightening torques

Component		Nm
Drive shaft to flange shaft	M8	45
	M10	77
Drive shaft heat shields		20

## 2 - Renewing oil seal for flange shaft/propshaft

### 2.1 - Renewing oil seal for flange shaft/propshaft

- Gearbox installed

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- Observe general repair instructions

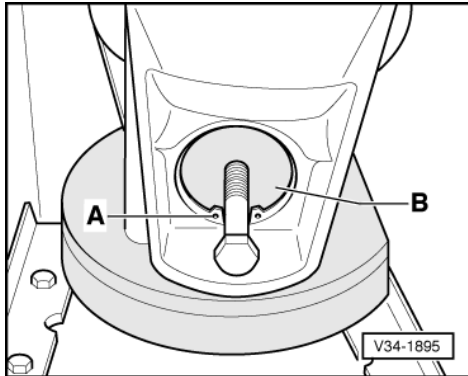
=> Page 8.

#### Special tools, testers and auxiliary items

- ◆ Drip tray V.A.G 1306
- ◆ Extractor lever VW 681
- ◆ Mandrel 30-505
- ◆ Installing tool 30-506 B

#### Removing

- Disconnect propshaft from gearbox  
=>Page 175 and tie up on selector linkage.
- Place drip tray V.A.G 1306 underneath and drain gearbox oil.

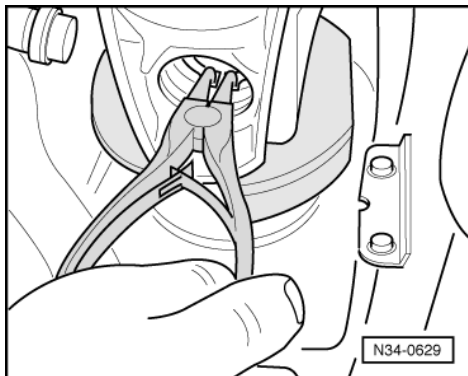


- Place container V.A.G 1306 below sealing cap.

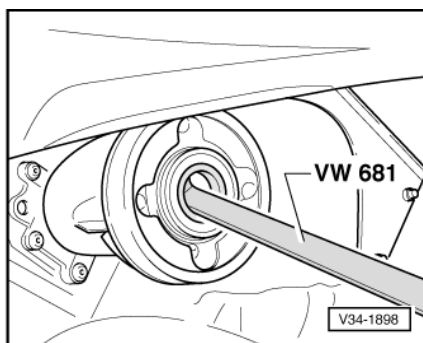
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#### Note:

- > Oil flows out when sealing cap -B- is removed.
- Remove circlip -A-.
- Screw an M8 bolt into thread of sealing cap.
- Pull out sealing cap using bolt.



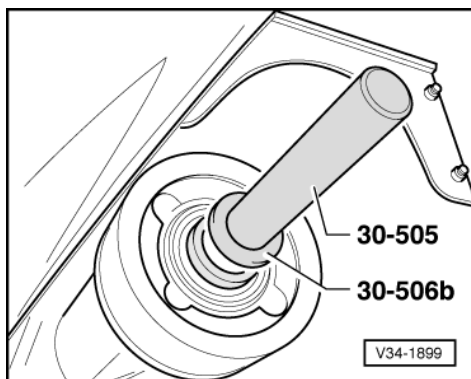
- -> Open out circlip and pull out flange shaft.



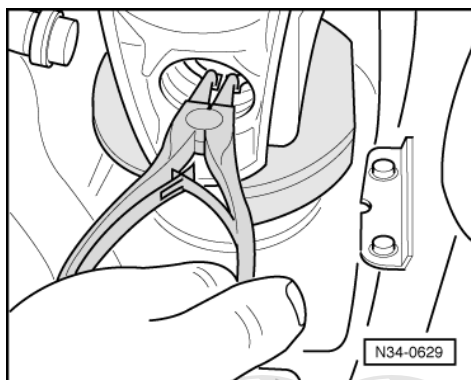


- -> Pull out flange shaft oil seal with VW 681.

### Installing



- Fill space between sealing and dust lips with multi-purpose grease.
- Lightly oil outer circumference of seal.
- -> Knock new flange shaft oil seal in 2 mm below housing outer surface; do not cant seal when doing this.
- Install flange shaft.



- -> When inserting flange shaft, fit circlip at the same time.
- The circlip must be seated in the base of the groove.
- Fit a new O-ring for the sealing cap.
- Fit sealing cap and secure in position.
- Bolt on propshaft=>Page 178 .
- Top up gearbox oil in gearbox and check oil level => Page 56 .
- Align exhaust system free of stress

=> 6-Cylinder engine, Mechanics; Repair group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system; Stress-free alignment of exhaust system Removing and installing parts of exhaust system Stress-free alignment of exhaust system

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Component	Nm
Propshaft to gearbox	55
Heat shield for propshaft to cover for Torsen differential	25

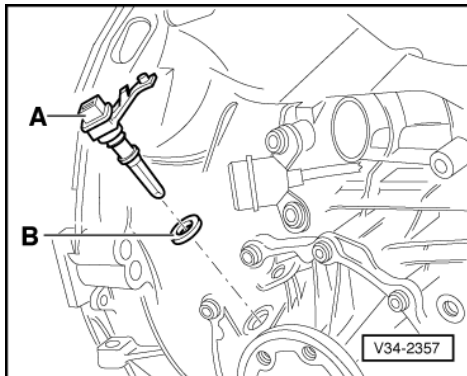
### 3 - Removing and installing speedometer sender and drive wheel

#### 3.1 - Removing and installing speedometer sender and drive wheel

- Gearbox installed
- Observe general repair instructions  
=> Page 8.

#### 3.2 - Removing and installing speedometer sender -G22

##### Removing

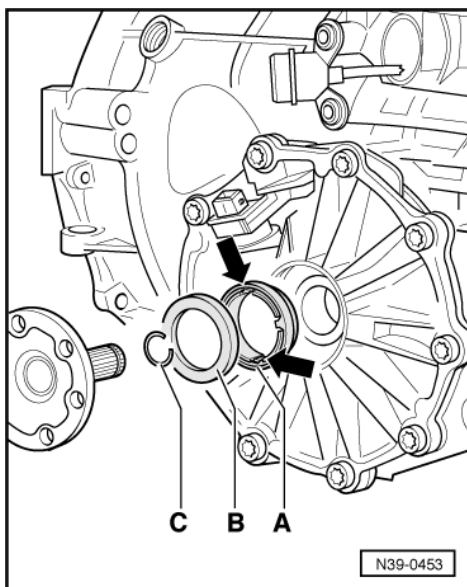


- -> Pull connector off speedometer sender-A-.
- Press retaining clip down, turn sender sideways and pull out upwards.

##### Installing

- When installing renew seal -B-.
- Insert sender and click into place.
- Handle sender carefully. If damaged it is possible that the speedometer will not indicate exactly.

#### 3.3 - Removing and installing speedometer drive wheel



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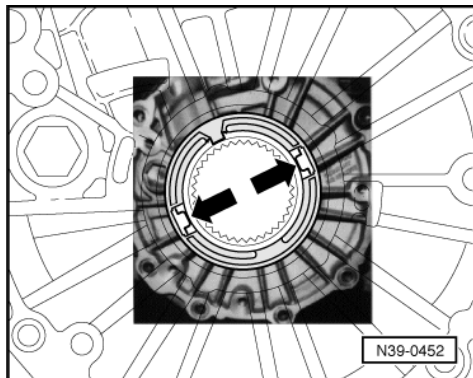


### Special tools, testers and auxiliary items

- ♦ Drip tray V.A.G 1306
- ♦ Drift VW 195
- ♦ Drift VW 295
- ♦ Extractor lever VW 681

### Removing

- -> Remove flange shaft on left side and oil seal -B-  
=>Renewing flange shaft seal, Page 130 .



- Remove speedometer sender => Page 135 .
- -> Press retaining clips in direction of arrows with a screwdriver.
- Remove drive wheel by levering out, alternating between sides.

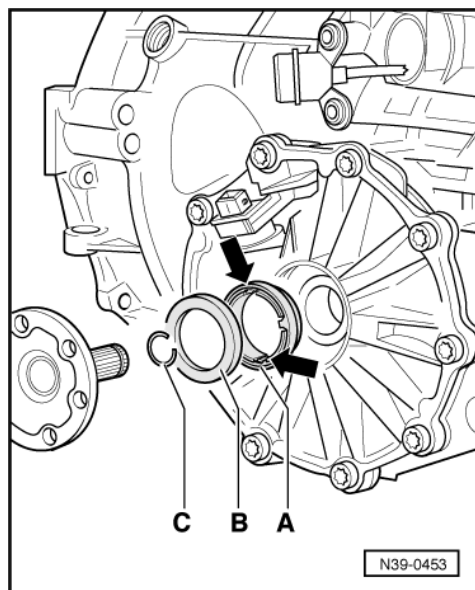
### Installing

Installation is carried out in the reverse order, when doing this note the following:

#### **Note:**

*Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily.*

Installation position:



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-> The drive peg of the drive wheel -A- faces to seal -B- and locates in the groove of the differential.

The retaining clips (arrows) locate in the circumferential groove in differential.

- Always renew seal -B- and circlip -C- =>Page **131** .
- Knock flange shaft in with drift VW 295.
- Top up oil in gearbox and check oil level => Page **56** .

#### Tightening torques

Component		Nm
Drive shaft to flange shaft	M8	45
	M10	77
Drive shaft heat shields		20

## 4 - Removing and installing differential

### 4.1 - Removing and installing differential

#### Special tools, testers and auxiliary items

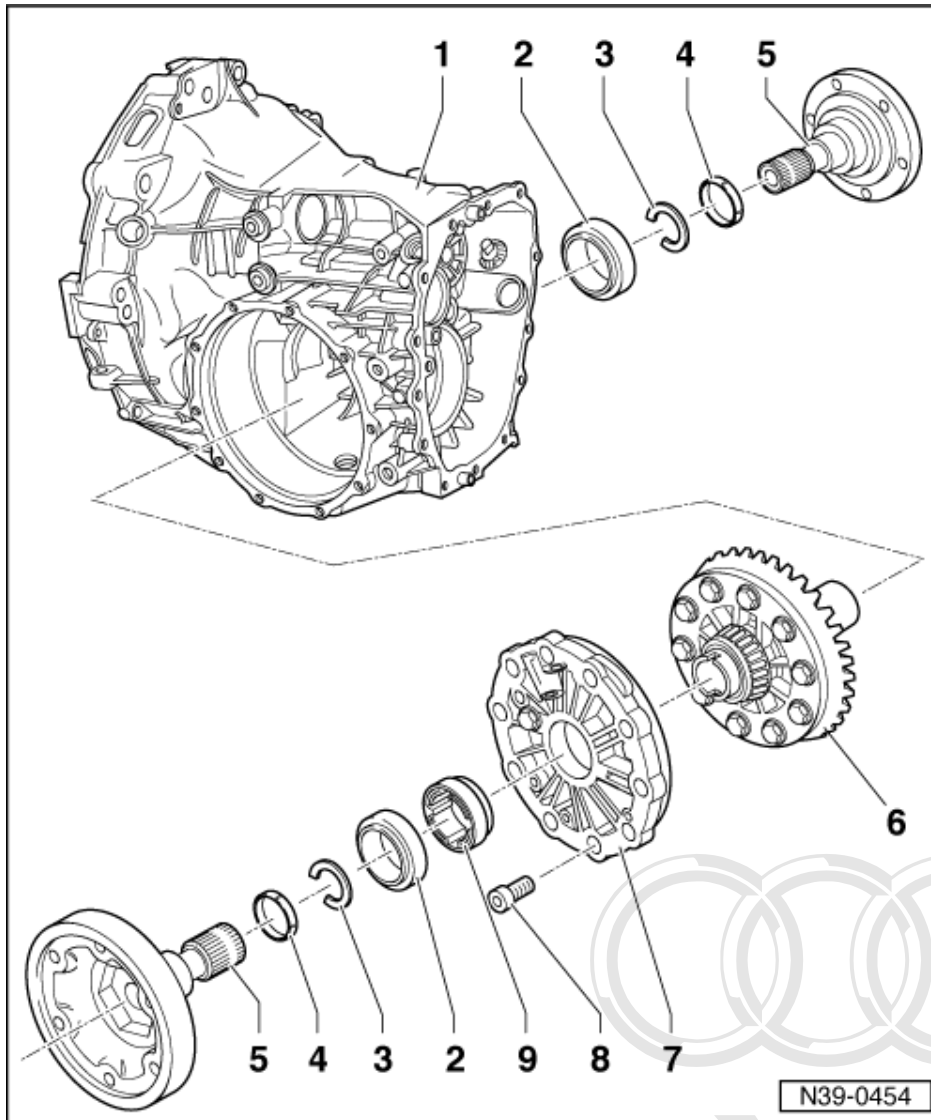
- ◆ Multi-purpose tool VW 771
- ◆ Internal puller Kukko 21/7
- ◆ Socket 3257

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#### Notes:

- ◆ Removing and installing is possible with gearbox installed.
- ◆ The differential can be removed and installed without removing the selector mechanism, input shaft, drive pinion and gearbox cover. These components must be removed if the differential has to be adjusted.
- ◆ Gearboxes with code letters CSU and CVT have flange shafts without polygon bearings.
- ◆ The polygon bearings can only be replaced together with the flange shaft.
- ◆ Inspect polygon bearings for visible damage.
- ◆ If the polygon bearings do not run smoothly with the flange shaft removed, this does indicate that the bearings are defective. A test for noisy bearings can only be performed with bearings installed.
- ◆ A spacer ring=>Fig. **4** , -Item 5- is fitted between the polygon bearing and the differential sun wheel on flange shafts with 30 mm spline diameter.
- ◆ Adjustments are required when replacing components marked 1)  
=>Adjustment overview Page **152** .



**1 Gearbox housing 1)****2 Oil seal**

- ♦ Renew => Page 130

**3 Circlip**

- ♦ Renew
- ♦ Removing and installing  
=>Fig. 1

**4 Spacer ring**

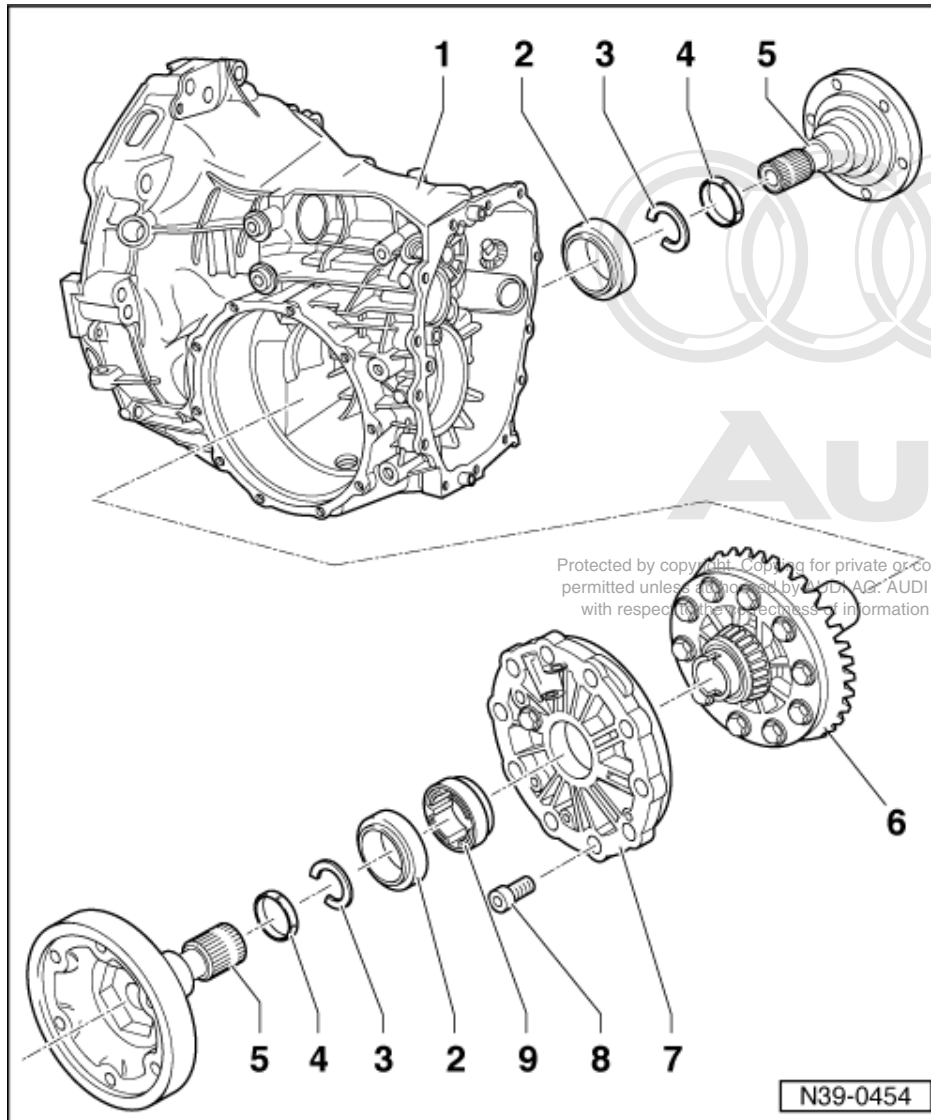
- ♦ Is only fitted with flange shafts with polygon bearings and a spline diameter of 30 mm
- ♦ Removing => Fig. 2
- ♦ Installing => Fig. 3

**5 Flange shaft**

- ♦ Removing and installing  
=> Page 130
- ♦ Assembling flange shaft with polygon bearing=>Fig. 4

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**6 Differential with crown wheel 1)**

- ♦ Can be removed without removing gear cluster
- ♦ Dismantling and assembling  
=> Page **141**

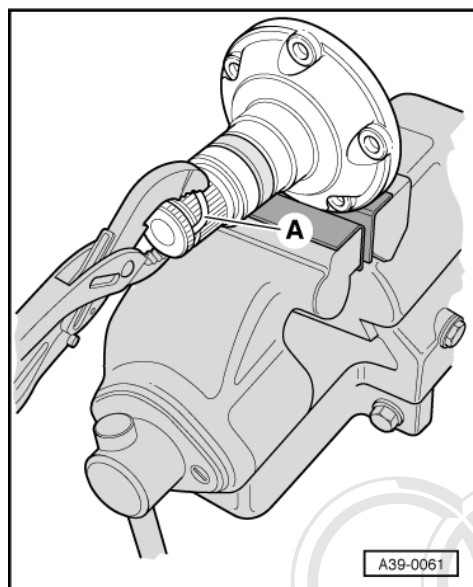
**7 Cover for final drive 1)**

- ♦ Seal with AMV 188 000 02

**8 Torx bolt - 25 Nm**

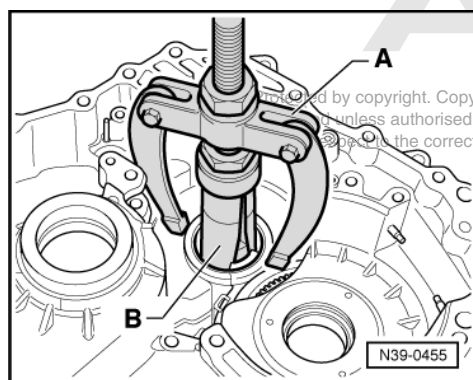
**9 Speedometer drive wheel**

- ♦ Removing and installing  
=>Fig. **136**
- ♦ Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily



-> Fig.1 Removing and installing circlip

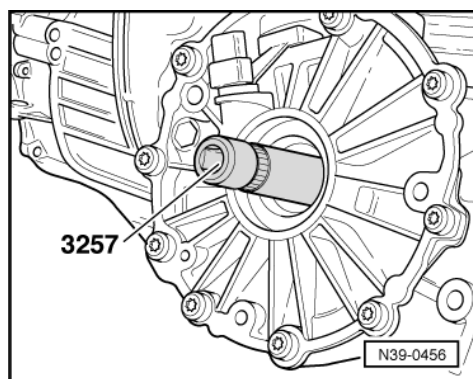
- Clamp flange shaft in vice, using vice clamps. Use new circlip -A- to press old circlip out of groove in flange shaft.



-> Fig.2 Removing spacer ring

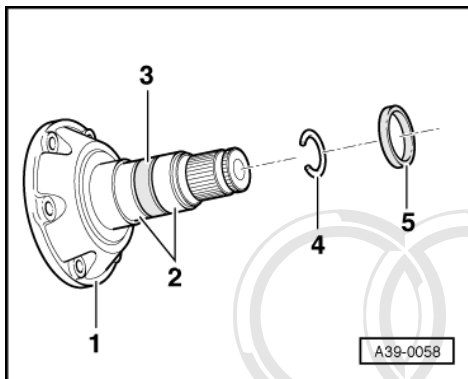
B - Internal puller 18.5 ... 23.5 mm, e.g. Kukko 21/3

- If the spacer ring is tight pull out using the multi-purpose tool VW 771.



-> **Fig.3 Installing spacer ring**

- Drive new spacer ring in onto stop, when doing this do not cant ring.



-> **Fig.4 Assembling flange shaft and polygon bearing**

- 1 - Flange shaft
- 2 - Needle bearing (polygon bearing)
- 3 - Spacer ring
- 4 - Circlip
- 5 - Spacer ring - additionally fitted on shafts with 30 mm spline diameter

**Note:**

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*The needle bearing (polygon bearing) does not turn easily when the flangeshaft is removed. This does not indicate that the bearing is defective.*

## 5 - Dismantling and assembling differential

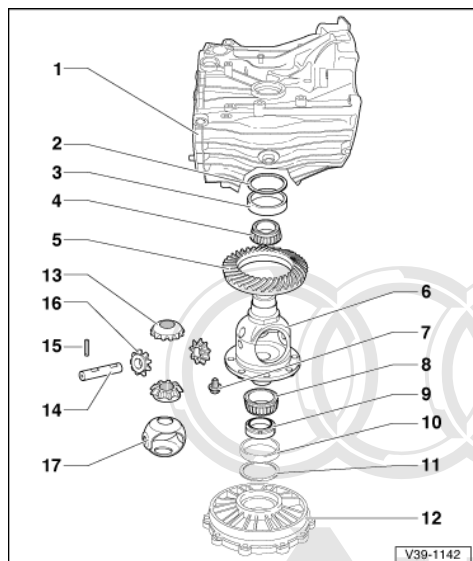
### 5.1 - Dismantling and assembling differential

#### Special tools, testers and auxiliary items

- ◆ Drift VW 295
- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 408 A
- ◆ Thrust plate VW 447 H
- ◆ Thrust plate VW 447 i
- ◆ Thrust piece VW 472/1
- ◆ Thrust pad VW 511
- ◆ Thrust plate 30-11
- ◆ Thrust plate 30-205
- ◆ Press tool 40-21
- ◆ Thrust plate 40-105
- ◆ Drift 3138
- ◆ Sleeve 3144
- ◆ Tube 3296
- ◆ Sealant AMV 188 000 02
- ◆ Two-arm puller Kukko 20/10 or Kukko 44/2
- ◆ Two-arm puller Kukko 204/2

**Notes:**

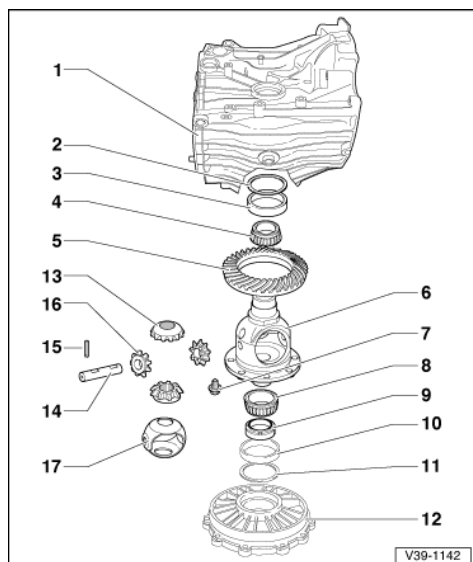
- ♦ Removing and installing differential=>Page 137 .
- ♦ Renew both taper roller bearings together.
- ♦ Adjustments are required when replacing components marked 1)  
=>Adjustment overview Page 152 .

**1 Gearbox housing 1)****2 Shim "S2"**

- ♦ Note thickness
- ♦ Adjustment overview=> Page 152

**3 Outer race for small taper roller bearing 1)**

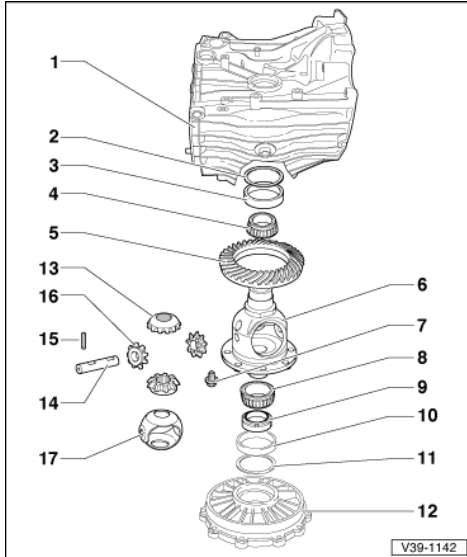
- ♦ Taper roller bearings are identical on left and right (but not in gearbox with code letters CSU)
- ♦ Driving out => Fig. 1
- ♦ Drive in with VW 472/1 and VW 408a=>Fig. 2
- ♦ Drive in with VW 295 and 30-205 on gearboxes with code letters CSU.

**4 Inner race for small taper roller bearing 1)**

- ♦ Taper roller bearings are identical on left and right (but not in gearbox with code letters CSU)
- ♦ Pull off with 3296=>Fig. 3
- ♦ Pressing on => Fig. 4
- ♦ Press on with press tool 40-21 on gearboxes with code letters CSU

**5 Crown wheel 1)**

- ♦ Is mated to drive pinion (pinion set)
- ♦ Allocate according to gearbox code using parts catalogue => Page 2
- ♦ Drive off housing with a drift  
=> Fig. 9
- ♦ Fit to differential housing  
=> Fig. 10



#### 6 Differential housing 1)

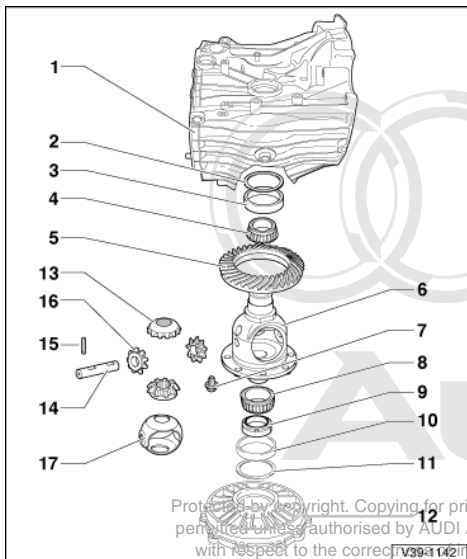
- ♦ Allocate according to gearbox code using parts catalogue => Page 2

#### 7 Bolt, 60 Nm + turn 45°further (1/8turn)

- ♦ Renew
- ♦ Lightly tighten bolts then tighten diagonally to correct torque

#### 8 Inner race for large taper roller bearing 1)

- ♦ Taper roller bearings are identical on left and right (but not in gearbox with code letters CSU)
- ♦ Pulling off => Fig. 5
- ♦ Press on with 3296=>Fig. 4
- ♦ Press on with press tool 40-21 on gearboxes with code letters CSU



#### 9 Speedometer drive wheel

- ♦ Removing and installing  
=>Page 136
- ♦ Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily.

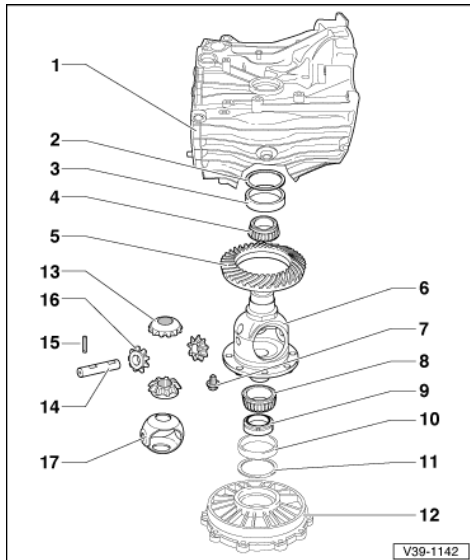
#### 10 Outer race for large taper roller bearing 1)



- ◆ Taper roller bearings are identical on left and right (but not in gearbox with code letters CSU)
- ◆ Knocking out => Fig. 7
- ◆ Drive in with VW 472/1 and VW 408a=>Fig. 8
- ◆ Drive in with VW 511 and VW 295 on gearboxes with code letters CSU

#### 11 Shim "S1"

- ◆ Note thickness
- ◆ Adjustment overview => Page 152



#### 12 Cover for final drive 1)

- ◆ Seal with AMV 188 000 02

#### 13 Sun wheel

- ◆ Installing => Fig. 11

#### 14 Shaft for planet pinions

- ◆ Knock out with drift after removing spring pin

#### 15 Spring pin

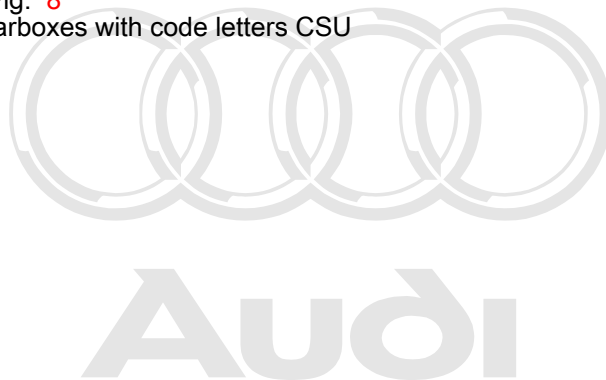
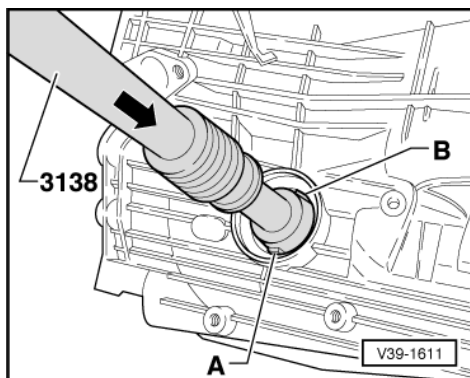
- ◆ For securing planet pinion axis shaft
- ◆ Version with annular groove:  
removing and installing => Fig. 12
- ◆ Version without annular groove:  
knock out with drift

#### 16 Planet pinion

- ◆ Installing => Fig. 11

#### 17 One-piece thrust washer

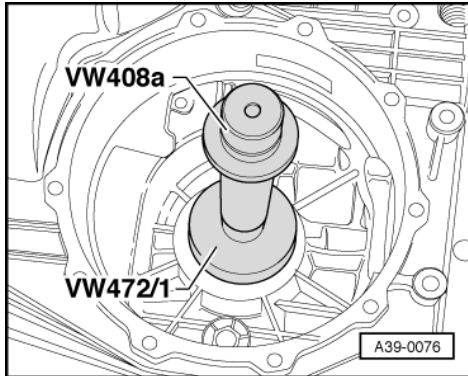
- ◆ Coat with gearbox oil when installing



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-> Fig.1 Driving outer race for small taper roller bearing out of gearbox housing

- Turn webs -A- and -B- out until they sit on the outer race within the recess in gearbox.
- After removing check shims for damage.

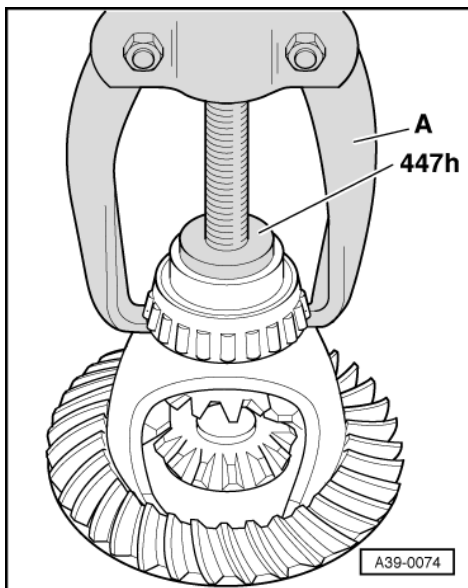


-> Fig.2 Driving small taper roller bearing outer race into gearbox housing

- Press piece VW 472/1 is fitted with the cone in the outer race.

**Note:**

*Use thrust plate 30-205 and drift VW 295 in gearboxes with code letters CSU.*



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

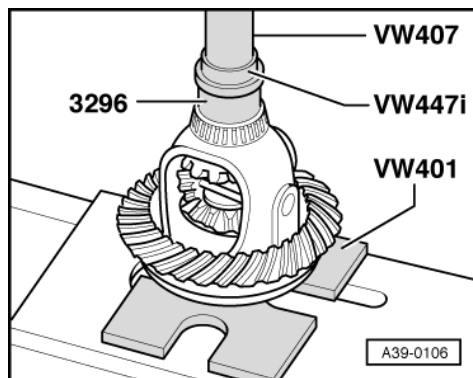
A - Two-arm puller, e.g. Kukko 20/10 or Kukko 44/2

**Notes:**

- ◆ If using a puller with small-diameter spindle, also fit thrust plate 30-11 between thrust plate 447 H and puller.
- ◆ Use thrust plate 40-105 on gearboxes with code letters CSU.
- ◆ There is a slot under the bearing seat in the differential housing for applying puller -A-.



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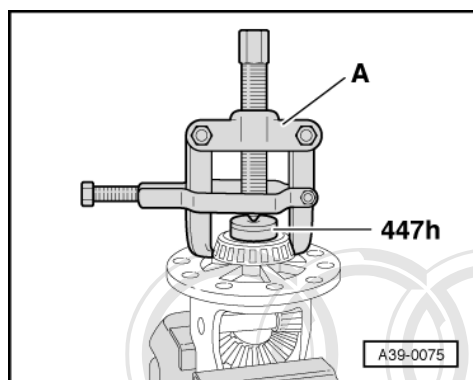
-> Fig.4 Pressing on small taper roller bearing inner race

- Heat bearing to approx. 100 °C, fit in position and press home.

Caution  
Wear protective gloves.

**Note:**

Use press tool 40-21 on gearboxes with code letters CSU.



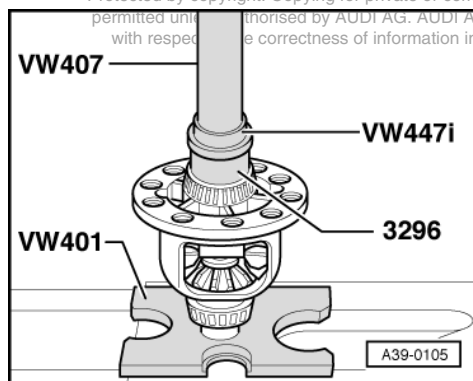
-> Fig.5 Pulling off large taper roller bearing inner race

- A - Two-arm puller, e.g. Kukko 204/2

**Notes:**

- ♦ If using a puller with small-diameter spindle, also fit thrust plate 30-11 between thrust plate 447 H and puller.
- ♦ Use thrust plate 40-105 on gearboxes with code letters CSU.
- ♦ There is a slot under the bearing seat in the differential housing for applying puller -A-.

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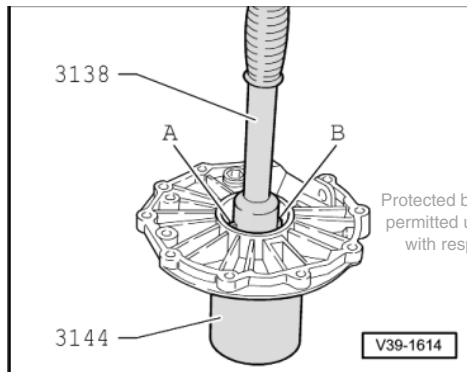
-> **Fig.6 Fitting inner race for large taper roller bearing**

- Heat bearing to approx. 100 °C, fit in position and press home.

**Caution**  
Wear protective gloves.

**Note:**

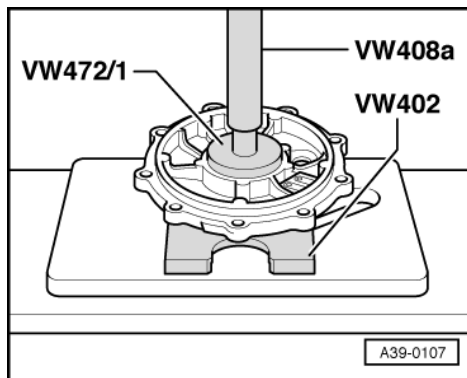
*Use press tool 40-21 on gearboxes with code letters CSU.*



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-> **Fig.7 Knocking large taper roller bearing outer race out of cover**

- Turn webs -A- and -B- out until they sit on the outer race within the recess in gearbox.
- After removing check shims for damage.

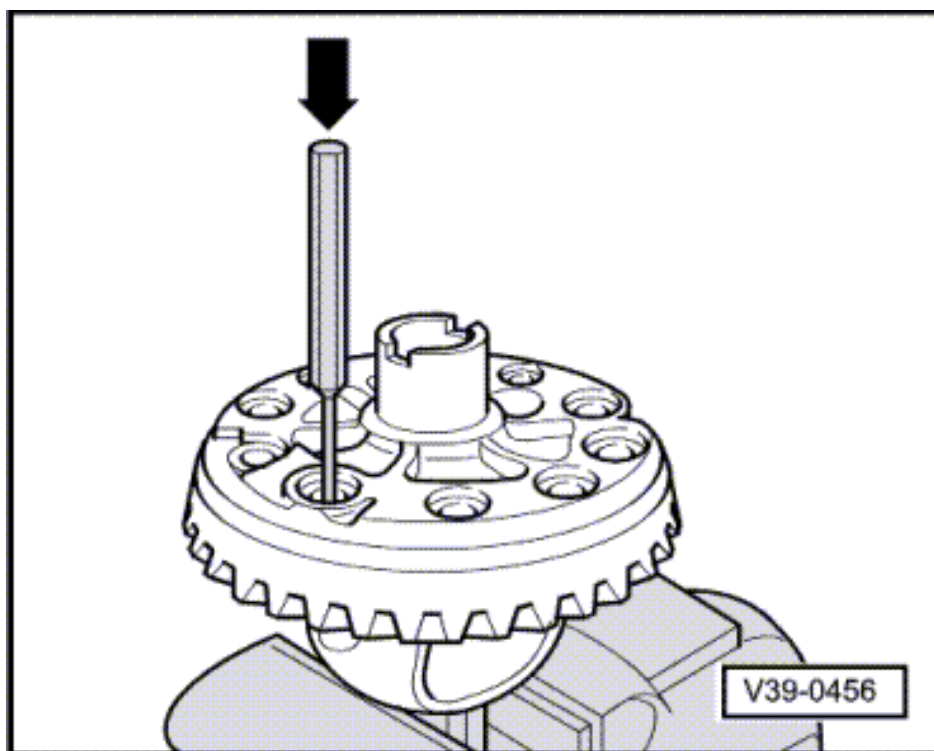


-> **Fig.8 Driving large taper roller bearing outer race into cover**

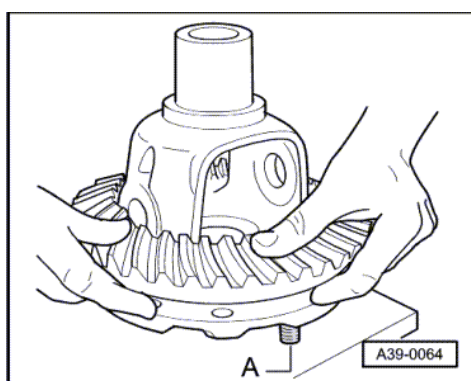
- Press piece VW 472/1 is fitted with the cone in the outer race.

**Note:**

*Use thrust pad VW 511 and drift VW 295 on gearboxes with code letters CSU.*



-> Fig.9 Driving crown wheel off housing

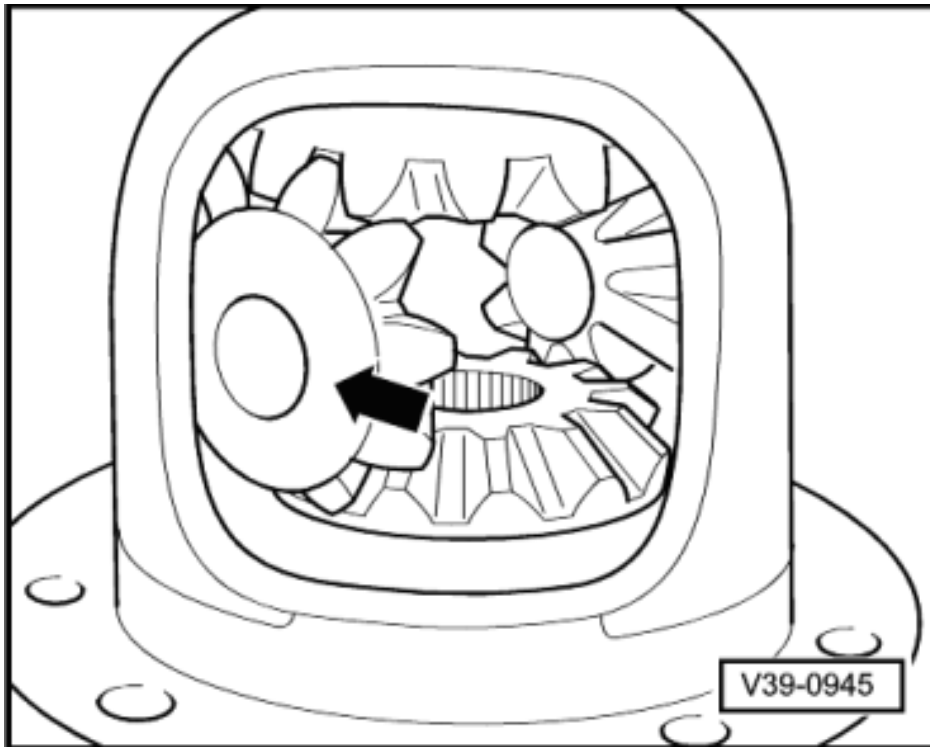


-> Fig.10 Heating crown wheel to approx. 100 °C and installing

- When fitting crown wheel, guide with centralizing pins -A- (local manufacture).

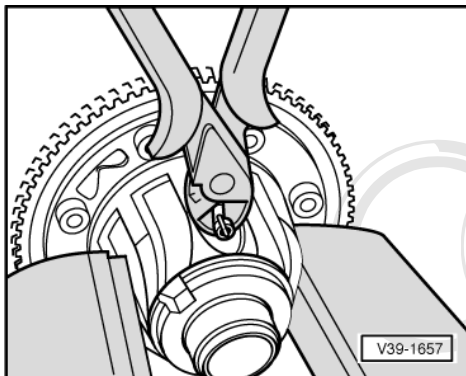
Caution  
Wear protective gloves.

- Allow the crown wheel to cool off slightly before inserting the bolts. Then tighten to specified torque.



-> Fig.11 Installing sun wheels and planet pinions

- Lubricate one-piece thrust washer with gearbox oil and install.
- Insert sun wheels.
- Insert planet pinions spaced 180° apart, and then rotate into place -arrow-.
- Drive planet pinion shaft into final position and secure.



-> Fig.12 Removing and installing spring pin

#### Removing

- Spring pin with annular groove: pull out using side-cutting pliers.
- Spring pin without annular groove: knock out from behind using a punch.

#### Installing

- Drive in spring pin as far as the stop.



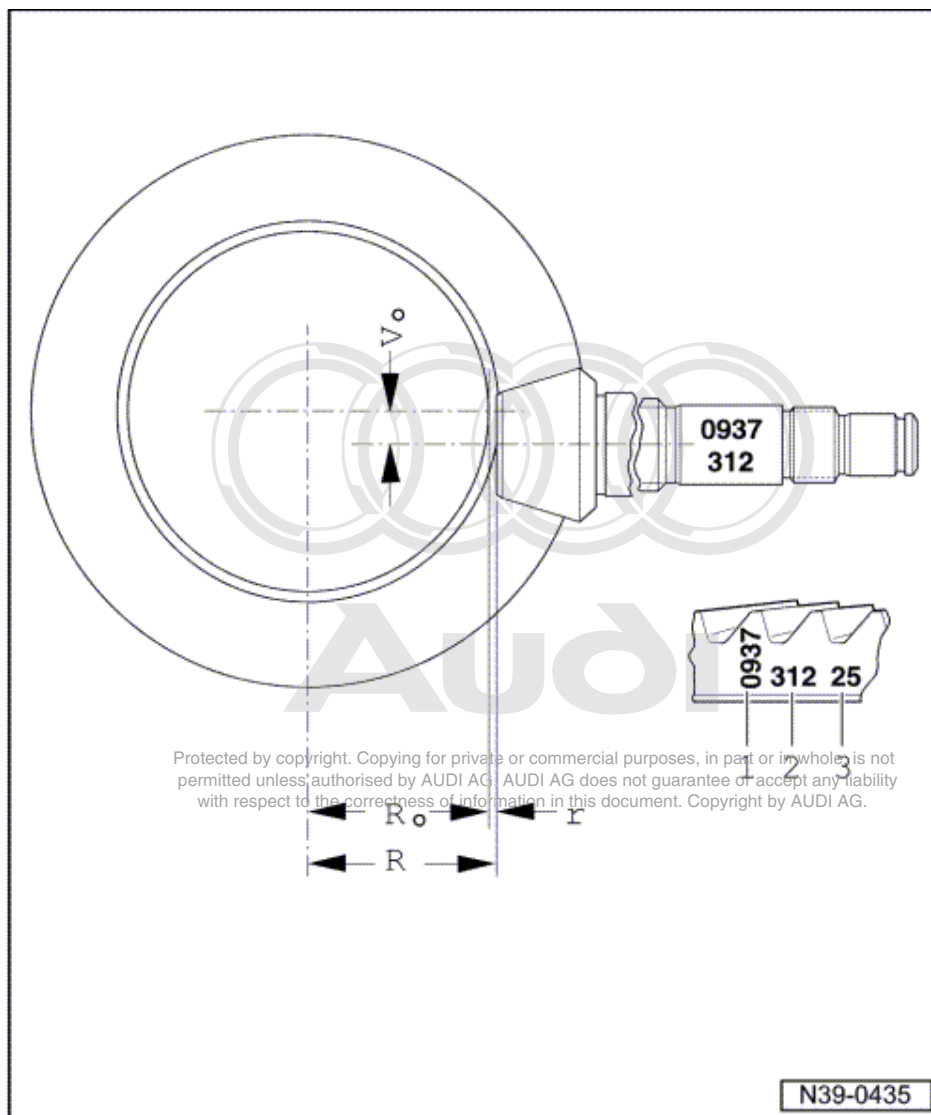
## 6 - Adjusting drive pinion and crown wheel

### 6.1 - Adjusting drive pinion and crown wheel

#### General notes:

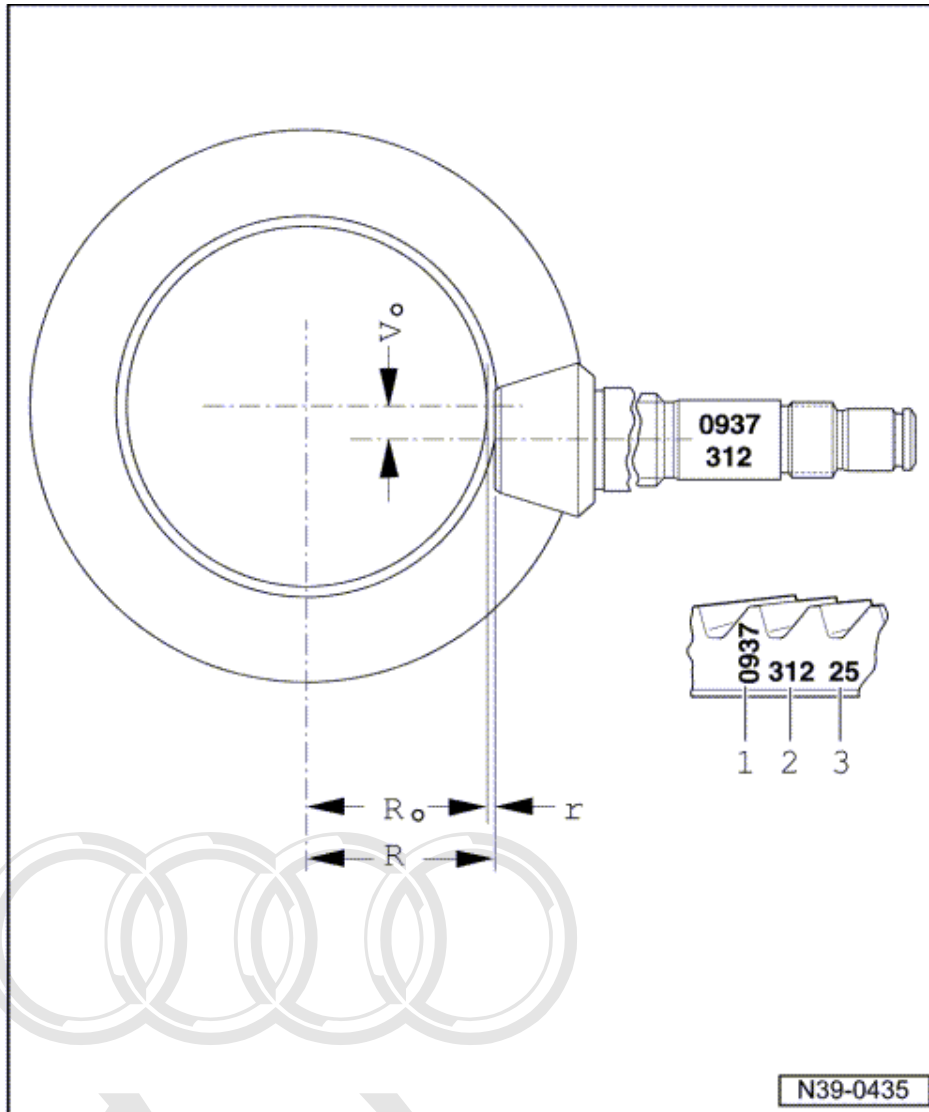
- ♦ Careful adjustment of the drive pinion and crown wheel is important for the service life and smooth running of the final drive. For this reason, the drive pinion and crown wheel are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions 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.
- ♦ The deviation (tolerance) "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) may only be replaced together as a matched pair.
- ♦ Observe the general repair instructions for taper roller bearings and shims.
- ♦ The frictional torque measurement is only used as a final check to make sure that the adjustment is correct.

### 6.2 - Adjusting and marking of gear sets



- 1 Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.
- 2 Pairing number (312) of final drive set.
- 3 Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies  $r = 0.25 \text{ mm}$

$R_o$  - Length of test machine master gauge used.  
 $R_o$  - Crown wheel  $\varnothing 170 \text{ mm} = 54.95 \text{ mm}$

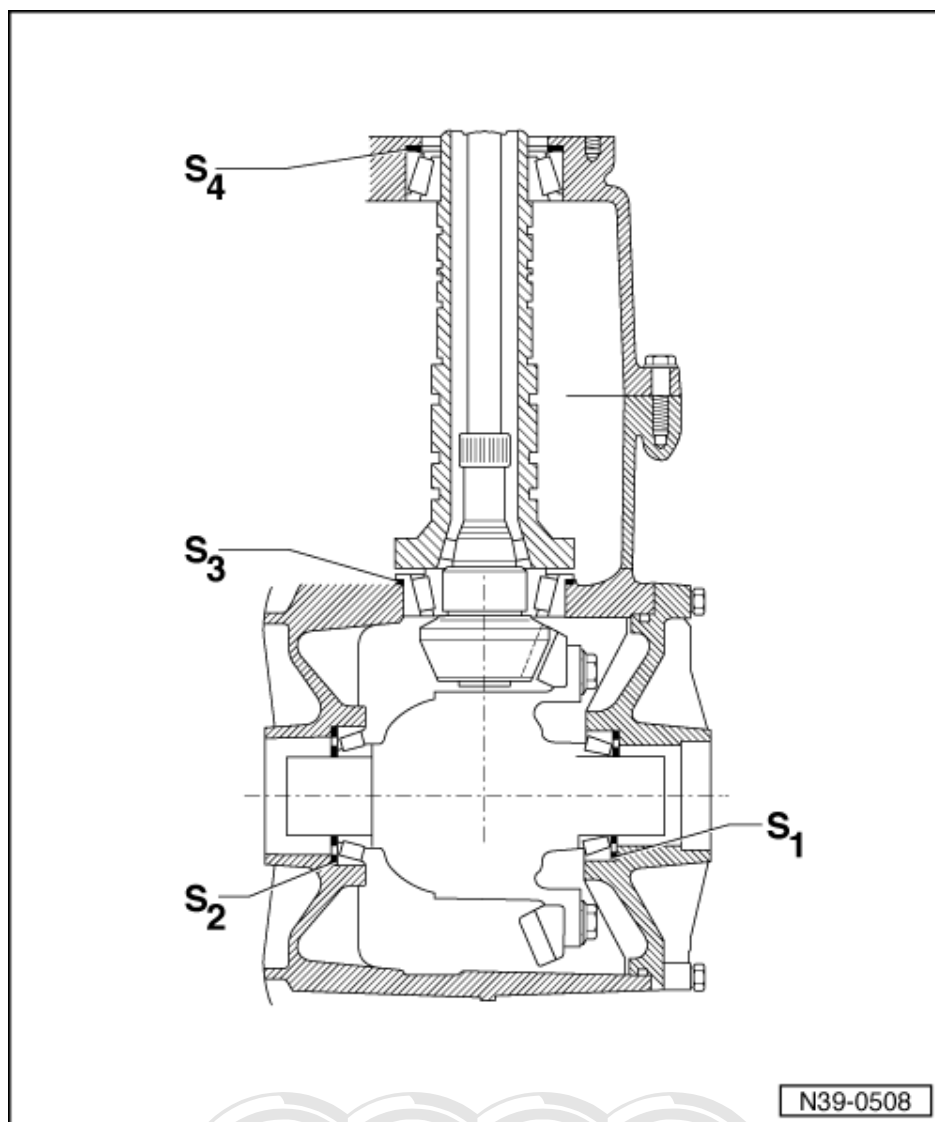


$R$  - Actual distance between crown wheel axis and face of drive pinion in position of quietest running for this gear set.  
 $V_o$  - Hypoid offset

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### 6.3 - Position of shims



**Note:**

Adjustment overview when renewing individual components of gearbox =>Page 152.

- S1 - Shim for crown wheel in cover for differential
- S2 - Shim for crown wheel in gearbox housing
- S3 - Shim for drive pinion in gearbox housing
- S4 - Shim for drive pinion in gearbox cover

### 6.4 - Adjustment overview

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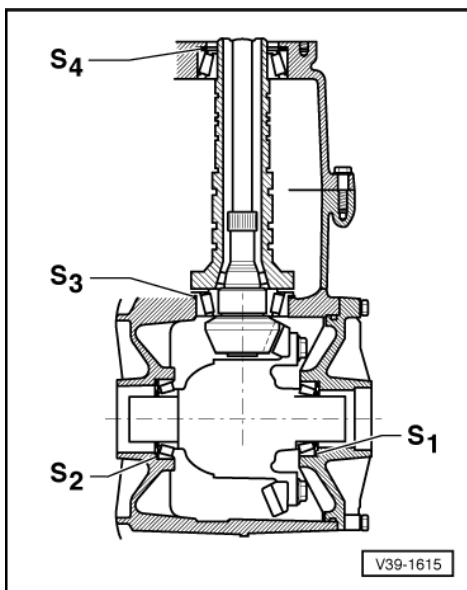
**Note:**

*If repairs have been carried out to the gearbox, it is only necessary to adjust the drive pinion, crown wheel or final drive set if components have been renewed which have a direct effect on the adjustment of the final drive. Refer to the following table to avoid unnecessary adjustments:*

Part renewed: ▼	to be adjusted:			
	Crown wheel "S1"+"S2" 1) => Page 165	Drive pinion "S3"+"S4" 1) using deviation "r" => Page 154	Drive pinion "S4" 1) => Page 163	Backlash measurement => Page 169
Gearbox housing 3)	X	X		X
Gearbox cover			X	
Differential housing	X			X
Double taper roller bearing for drive pinion and hollow shaft		X		X
Taper roller bearing for differential	X			X
Final drive set 2)	X	X		X
Cover for differential	X			X

- 1) Shims; installation position => Page 152 .
- 2) Drive pinion and crown wheel; only renew together.
- 3) If the gearbox housing is renewed the input shaft must also be adjusted => Page 105 , adjusting input shaft.

## 6.5 - Recommended sequence for readjusting final drive set



-> If the drive pinion and crown wheel have to be readjusted, the following sequence is recommended for maximum efficiency:

- 1.) Determine total shim thickness "Stotal" for "S1" + "S2" (sets preload for taper roller bearings for differential) => from Page 165 .
- 2.) Determine total shim thickness "Stotal" for "S3" + "S4" (sets preload for taper roller bearings for drive pinion) => from Page 154 .

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- 3.) Distribute total shim thickness "Stotal" for "S3" + "S4" so that the distance from centre of crown wheel to face of drive pinion is the same as distance "R" which was determined during production => from Page 161 .
- 4.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash between crown wheel and drive pinion is maintained => from Page 170 .

**Note:**

Overview of components and shims =>Page 152 .

## 6.6 - Adjusting drive pinion

(Adjusting drive pinion and hollow shaft)

Repairs after which the drive pinion must be adjusted => table on Page 152 .

### Special tools, testers and auxiliary items

- ♦ Lever VW 296
- ♦ Press plate VW 401
- ♦ Press tool VW 407
- ♦ Universal mandrel VW 385/1
- ♦ 2 x centring disc VW 385/3
- ♦ Measuring plunger VW 385/14
- ♦ Measuring plate VW 385/17
- ♦ Master gauge VW 385/30
- ♦ End dimension plate VW 385/33
- ♦ Drive pinion clamp VW 386 A
- ♦ Universal dial gauge bracket VW 387
  
- ♦ Measuring lever VW 388
- ♦ Tube VW 519
- ♦ Crown wheel adjusting appliance VW 521/4
- ♦ Crown wheel adjusting appliance VW 521/12
- ♦ Fitting tool VW 792
- ♦ Thrust pad 3062
- ♦ Torque gauge 0 ... 600 Ncm
- ♦ Dial gauge
- ♦ Dial gauge extension 6.5 mm

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

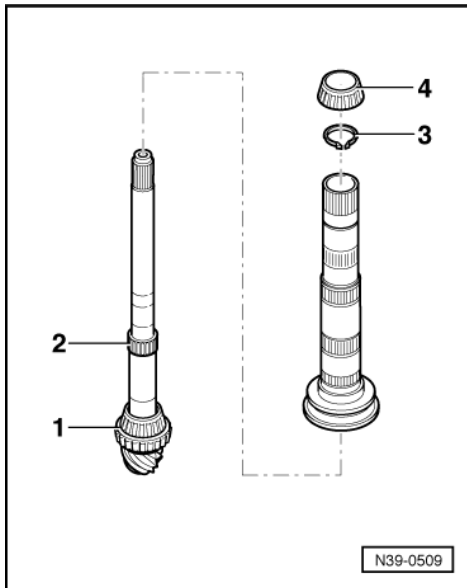
(Setting preload of taper roller bearing for drive pinion with hollow shaft)

- Differential removed



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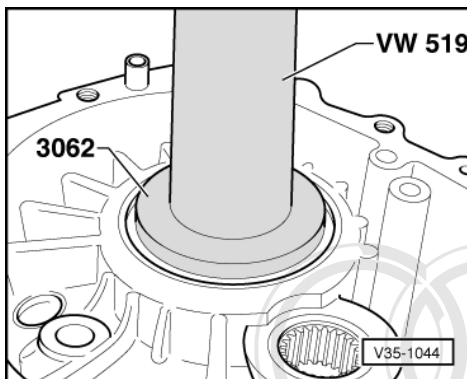




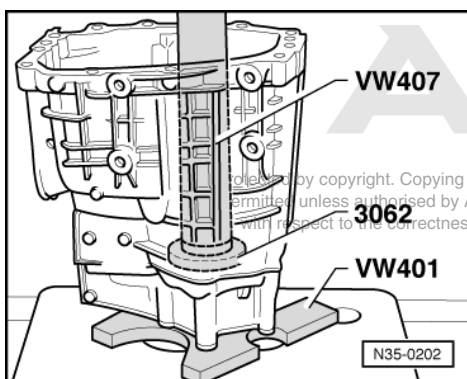
- -> Press double taper roller bearing inner race -1- onto drive pinion and secure in place => from Page 107 .
- Fit needle bearing -2-.
- Fit circlip -3- onto hollow shaft and press on taper roller bearing inner race -4- => from Page 107 .
- Fit drive pinion in hollow shaft.

**Note:**

The hollow shaft is shown in the illustration without gears. The adjustment of the drive pinion can be performed either with or without the gears fitted.



- -> Fit double taper roller bearing outer race for drive pinion in gearbox housing without shims => Fig. 118 .

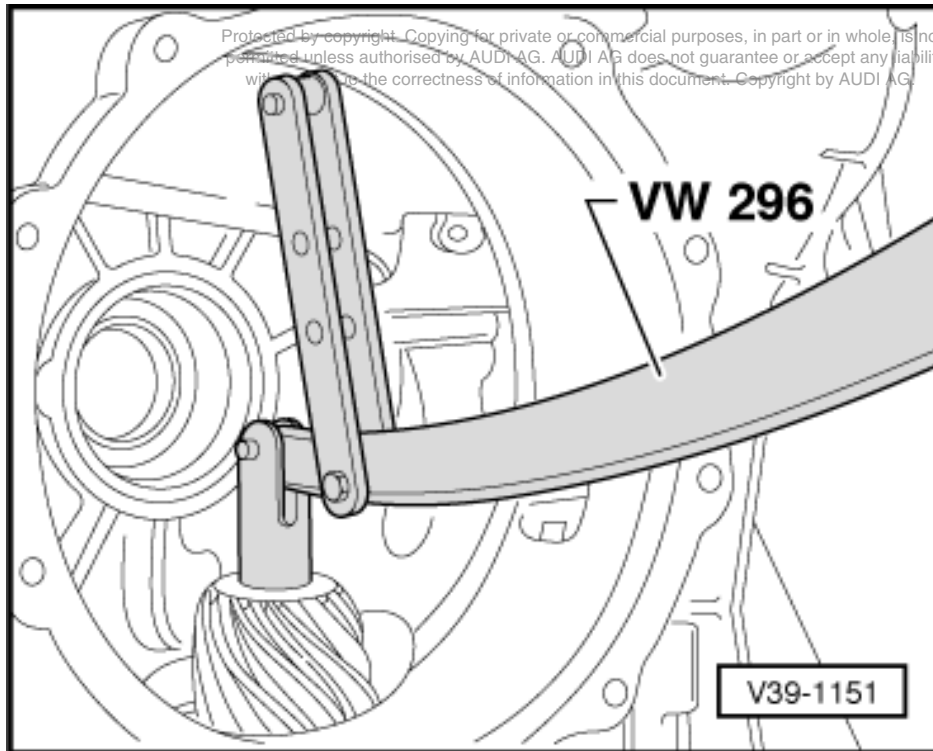


- -> Fit taper roller bearing outer race for drive pinion in gearbox cover with shim "S4\*" (1.0 mm thick) => Fig. 119 .

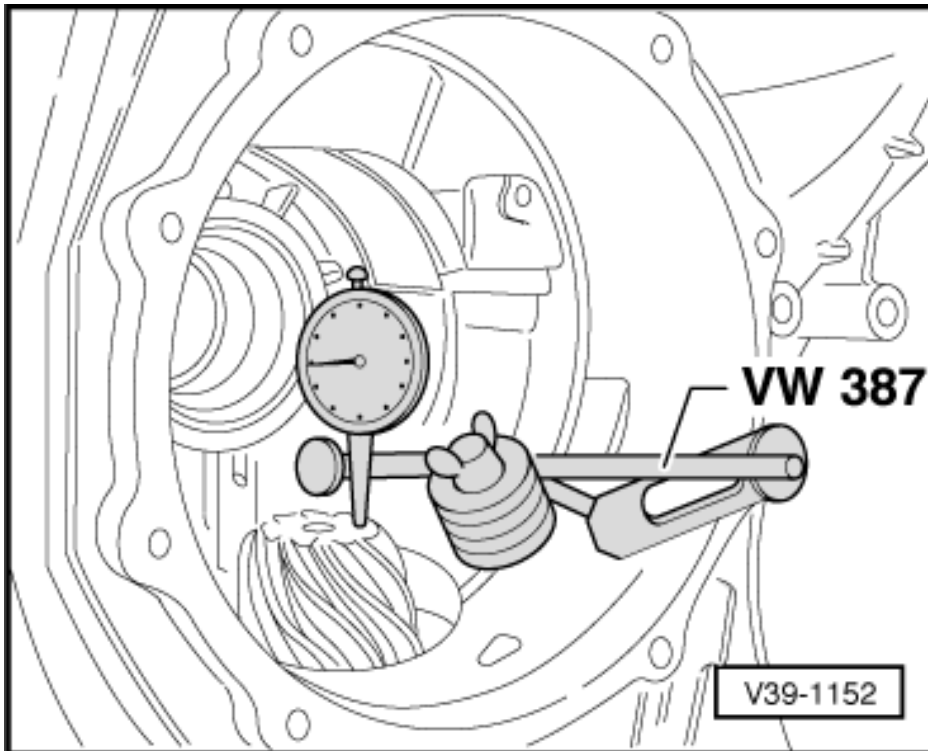


**Notes:**

- ♦ A shim "S4" with a thickness of 1.0 mm is fitted for initial measurements. It is referred to below as "S4\*". When measurement "e" has been determined, the correct shim "S4" with the final thickness will be installed in place of "S4\*".
- ♦ When taking measurements, always fit the rubber washer together with the ring for the rubber washer => Page 116 .
- Fit fully assembled drive pinion with hollow shaft into gearbox housing.



- Fit gearbox cover and tighten bolts to 22 Nm.
- Turn gearbox so that the gearbox cover is downwards.
- -> Press down on face of drive pinion with lever VW 296 until the taper roller bearing outer race contacts gearbox cover.
- While still maintaining pressure, rotate the drive pinion 5 turns in each direction in relation to the hollow shaft to settle the double taper roller bearing.
- Then rotate the drive pinion together with the hollow shaft 5 turns in each direction to settle the taper roller bearing.

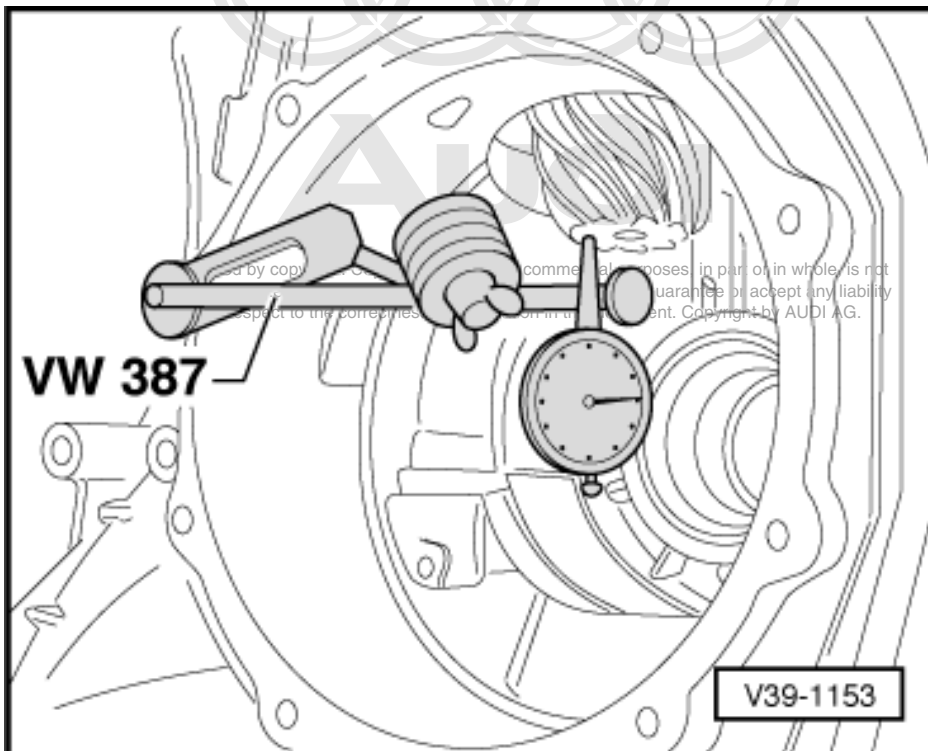


- -> Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) to "0" with 1 mm preload.

**Note:**

*The dial gauge extension must contact the machined surface on the face of the pinion.*

- Turn gearbox 180° so that the gearbox cover is upwards.



- Rotate drive pinion together with hollow shaft 5 turns in each direction to settle the taper roller bearing. The measurement will otherwise not be correct.
- -> Read off and note the play indicated on the dial gauge.



- Measurement in example: 0.45 mm

**Note:**

If the measurement has to be repeated, first rotate the drive pinion with hollow shaft again 5 turns in each direction to settle the taper roller bearing. Then set the dial gauge to "0" again with 1 mm preload.

**Formula:**

$$\text{"Stotal"} = \text{"S4*"} + \text{measurement} + \text{bearing preload}$$

**Example:**

Inserted shim "S4*"	1.00 mm
+ Measurement (example)	0.45 mm
+ Bearing preload (constant)	0.15 mm
= Total shim thickness "Stotal" for "S3" + "S4"	1.60 mm

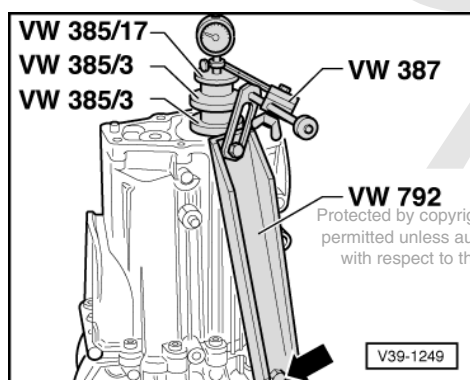
**Determining thickness of shim "S3"****Formula:**

$$\text{"S3*"} = \text{"Stotal"} - \text{"S4*"} =$$

**Example:**

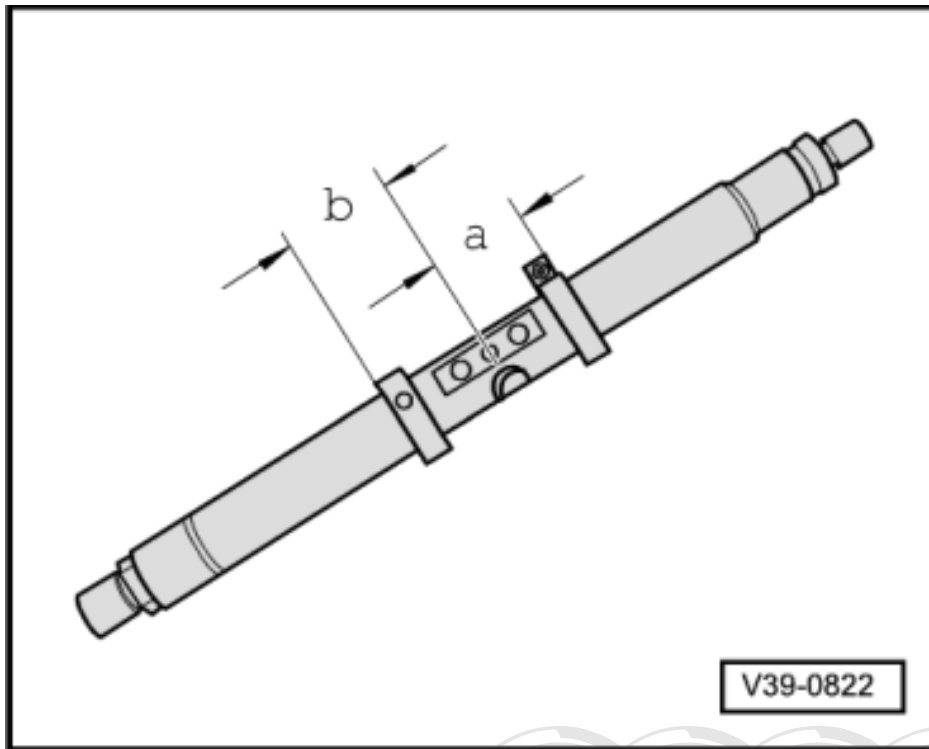
Total shim thickness "Stotal" for "S3" + "S4"	1.60 mm
- Inserted shim "S4*"	1.00 mm
= Thickness of shim "S3"	0.60 mm

- Remove double taper roller bearing outer race, fit shim "S3\*" in gearbox housing and install outer race again => Fig. 118.
- Insert completely assembled drive pinion into gearbox housing again.
- Fit gearbox cover and tighten bolts to 22 Nm.
- To settle the taper roller bearings: rotate drive pinion together with hollow shaft 5 turns in each direction, then rotate drive pinion separately in relation to hollow shaft 5 turns in each direction.



- -> Fit measuring tools and secure with bolt (arrow) to gearbox housing.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.
- Loosen gearbox cover bolts and turn drive pinion several times.
- If the correct shims have been selected the dial gauge will now indicate the following value:
  - 0.05 ... 0.15 mm
- Tighten gearbox cover bolts again to 22 Nm.
- Remove measuring tools.
- To settle the taper roller bearings: rotate drive pinion together with hollow shaft 5 turns in each direction, then rotate drive pinion separately in relation to hollow shaft 5 turns in each direction.

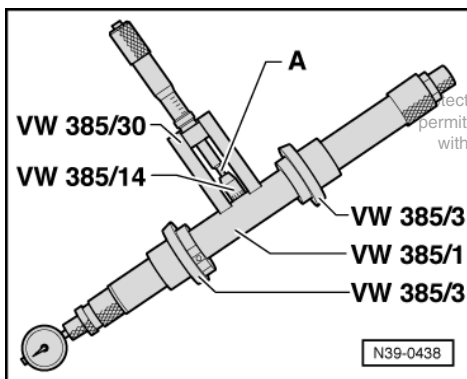
## Determining measurement "e"



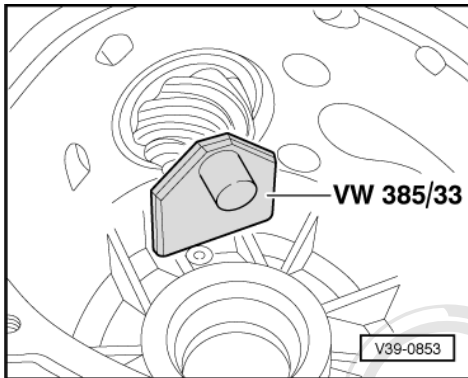
### Note:

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

- -> Set adjustment rings of universal mandrel VW 385/1 to the following measurements:
  - Distance a = 35 mm
  - Distance b = 75 mm



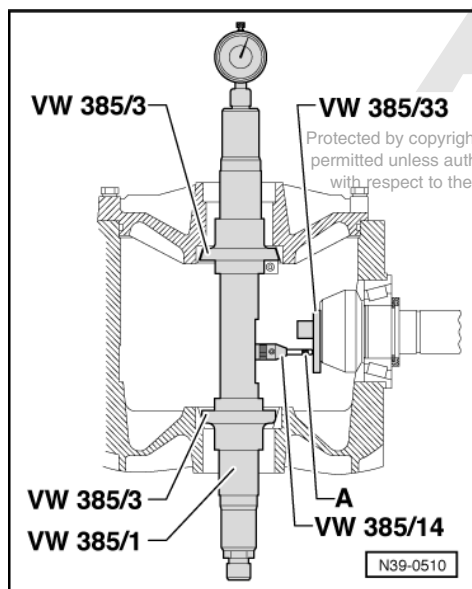
- -> Assemble universal mandrel VW 385/1 as illustrated:
  - Dial gauge extension -A-, 6.5 mm long
  - Master gauge VW 385/30
  - Set master gauge VW 385/30 to  $R_o = 54.95$  mm (for 170 mm dia. crown wheel) and fit on universal mandrel.
  - Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.



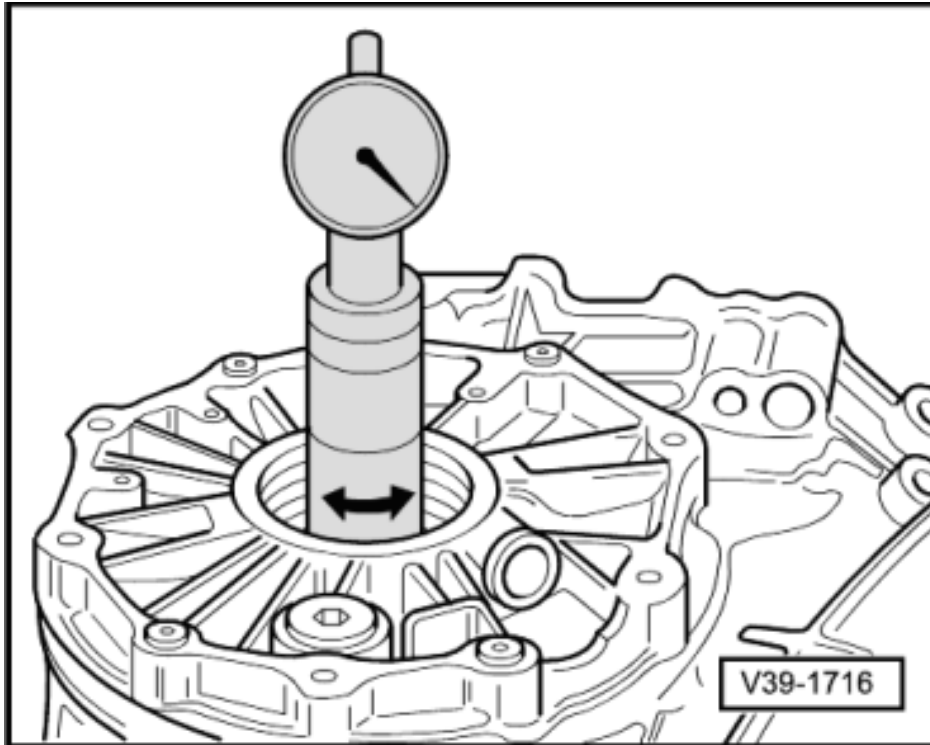
- -> Place end measuring plate on face of drive pinion.

**Note:**

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



- -> Remove master gauge and insert measuring mandrel in the housing.
- Dial gauge extension -A- = 6.5 mm long must be fitted.
- The centring disc 385/3 faces towards cover for final drive
- Fit cover for final drive and tighten 4 bolts to 22 Nm.
- Using the adjustable ring, pull 2nd centring disc VW 385/3 out as far as possible so that the mandrel can still just be turned by hand.



- -> Turn mandrel until the dial gauge plunger tip touches the end measuring plate on drive pinion head, then measure maximum deflection (return point).
- Measurement in following example "e" = 0.26 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.

**Determining thickness of shim "S3"**

**Formula:**  
**"S3"** = **"S3\*" + "r" + "e"**  
 ("e" in black scale)  
 or  
**"S3"** = **"S3\*" + "r" - "e"**  
 ("e" in red scale)

**Notes:**

- ◆ The deviation "r" related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and inscribed on outer circumference of crown wheel.
- ◆ If measurements are obtained on red scale then subtract value "e".
- ◆ If measurements are obtained on black scale then add value "e".

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**Example:**

Shim "S3*" already fitted	0.60 mm
+ Deviation "r"	0.38 mm
- Value measured for "e" (red scale)	0.26 mm
<b>= Thickness of shim "S3"</b>	<b>0.72 mm</b>

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



=> Parts catalogue

The following shims are available for "S3"

Shim thickness (mm) 1)		
0.40	0.55	0.70
0.45	0.60	0.75
0.50	0.65	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

**Determining thickness of shim "S4"**

Formula:

$$\text{"S4"} = \text{"Stotal"} - \text{"S3"}$$

**Example:**

Total shim thickness "Stotal" for "S3" + "S4"	1.60 mm
- Thickness of shim "S3"	0.72 mm
= Thickness of shim "S4"	0.88 mm

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

=> Parts catalogue

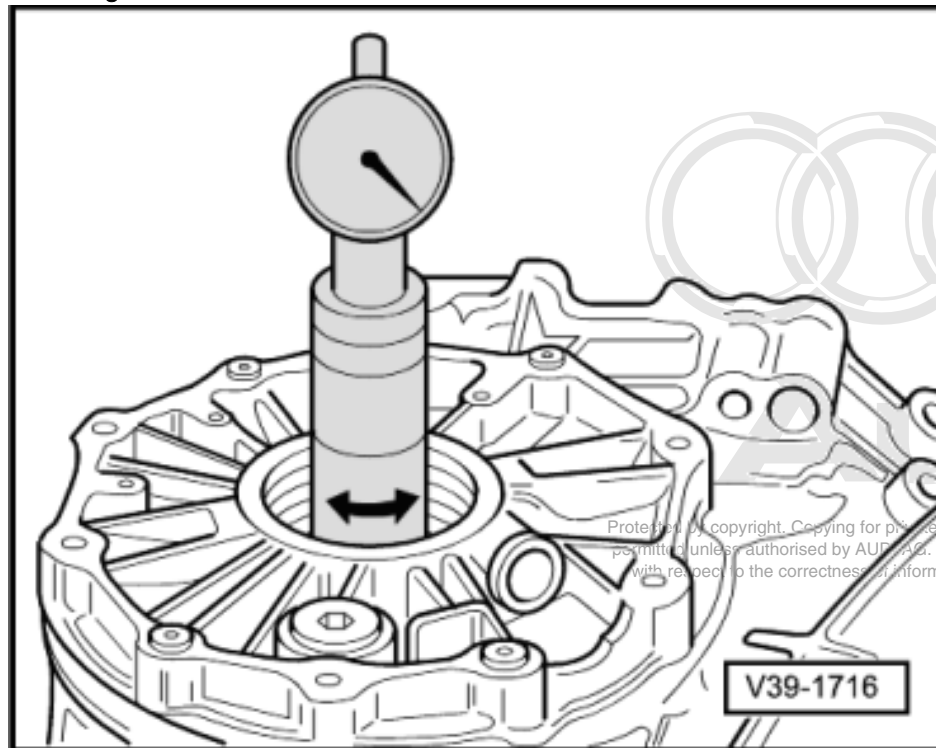
**Available shims for "S4"**

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

**Performing check measurement**

**Checking dimension "r"**





- Install drive pinion and hollow shaft with shims "S3" and "S4" which have been measured.
- Turn hollow shaft against drive pinion five turns in both directions so that the taper roller bearings settle.
- Turn drive pinion with hollow shaft five turns in both directions so that the taper roller bearings settle.
- -> Insert universal mandrel, => "determining measurement 'e'" on Page 159 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  $\pm 0.04$  mm

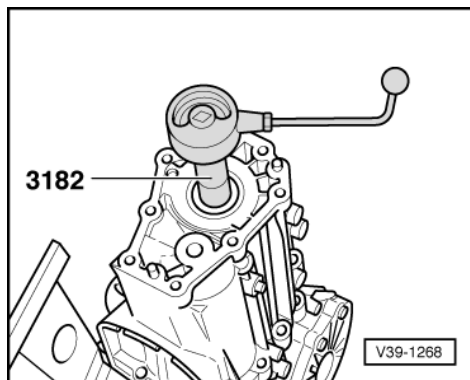
**Note:**

*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.*

**Measuring frictional torque (check)**

**Notes:**

- ♦ Drive pinion/hollow shaft tapered roller bearings are low friction bearings. Therefore the frictional torque has only a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- ♦ Do not additionally oil new tapered roller bearing to perform the frictional torque measurement. These bearings have already been treated with a special oil by the manufacturer.



- -> Fit torque gauge 0 ... 600 Ncm on drive pinion.
- Read off frictional torque.

Frictional torque specification:

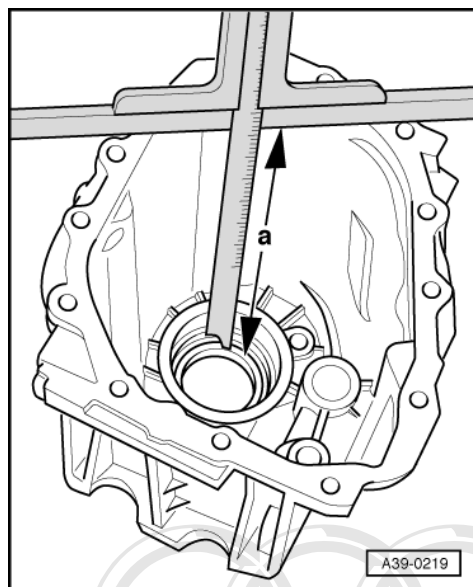
New bearings	Used bearings
150 ... 250 Ncm	30 ... 60 Ncm

## 6.7 - Re-determining "S4" shim when fitting new gearbox cover

**Special tools, testers and auxiliary items**

- ♦ 2 x centring disc VW 385/3
- ♦ Measuring plate VW 385/17
- ♦ Universal dial gauge bracket VW 387
- ♦ Fitting tool VW 792
- ♦ Dial gauge
- ♦ Dial gauge extension
- ♦ Depth gauge (accurate to within 5/100mm or less)

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- Clean housing flange.
- -> Measure difference in depth "a" on old and new gearbox cover.

**Example:**

Depth "a" (old gearbox cover)	257.40 mm
Depth "a" (new gearbox cover)	257.55 mm
= Difference	0.15 mm

- Install thicker shim "S4" if the new gearbox cover is deeper.
- Install thinner shim "S4" if the old gearbox cover is deeper.

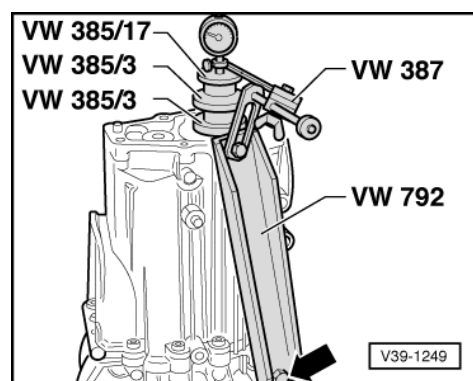
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**Example:**

Previous "S4" shim	0.95 mm
+ Difference	0.15 mm
= New "S4" shim	1.10 mm

Available shims =>Table Page 162 .

- Install taper roller bearing outer race with "S4" shim in gearbox cover =>Fig. 119 .
- Insert completely assembled drive pinion into gearbox housing again.
- Fit gearbox cover and tighten bolts to 22 Nm.
- To settle the taper roller bearings: rotate drive pinion together with hollow shaft 5 turns in each direction, then rotate drive pinion separately in relation to hollow shaft 5 turns in each direction.



- -> Fit measuring tools and secure with bolt (arrow) to gearbox housing.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

- Loosen gearbox cover bolts and turn drive pinion several times.
- If the correct shims have been selected the dial gauge will now indicate the following value:
  - 0.05 ... 0.15 mm

If this reading is not obtained, the adjustment must be corrected.

## 6.8 - Adjusting crown wheel

(Adjusting differential)

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The table on Page 152 lists the repairs after which the crown wheel has to be adjusted.

### Special tools, testers and auxiliary items

- ◆ Dial gauge extension VW 382/10
- ◆ Measuring plate VW 385/17
- ◆ Drive pinion clamp VW 386 A
- ◆ Universal dial gauge bracket VW 387
- ◆ Measuring lever VW 388
- ◆ Press plate VW 402
- ◆ Press tool VW 408 A
- ◆ Thrust piece VW 472/1
- ◆ Crown wheel adjusting appliance VW 521/4
- ◆ Crown wheel adjusting appliance VW 521/12
- ◆ Torque gauge 0 ... 600 Ncm
- ◆ Dial gauge

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

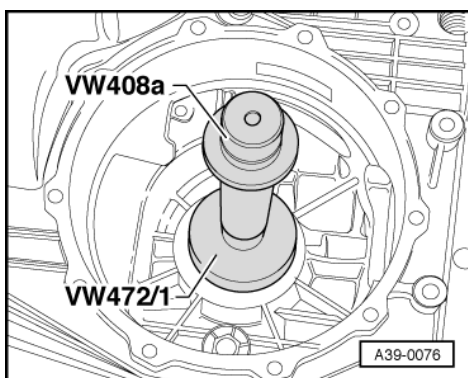
(Setting preload of taper roller bearing for differential)

- Drive pinion removed

#### **Note:**

*If only the taper roller bearings for the differential are being renewed, the crown wheel can be removed from the differential housing so the drive pinion does not have to be removed.*

- Remove seal and outer races of both taper roller bearings for differential.
- Remove shims => Page 141 .

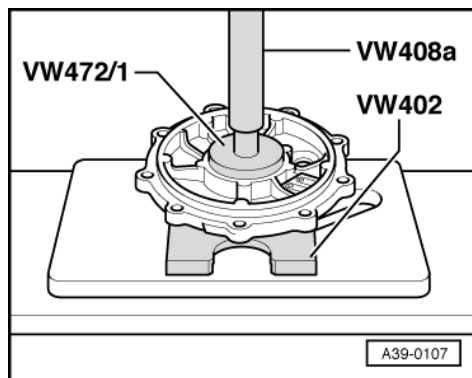


- -> Knock taper roller bearing outer race (small) with shim "S2" into gearbox housing => Fig. 145 . A shim "S2\*" with a thickness of 1.20 mm (two 0.60 mm shims) is used for the initial measurement.



**Note:**

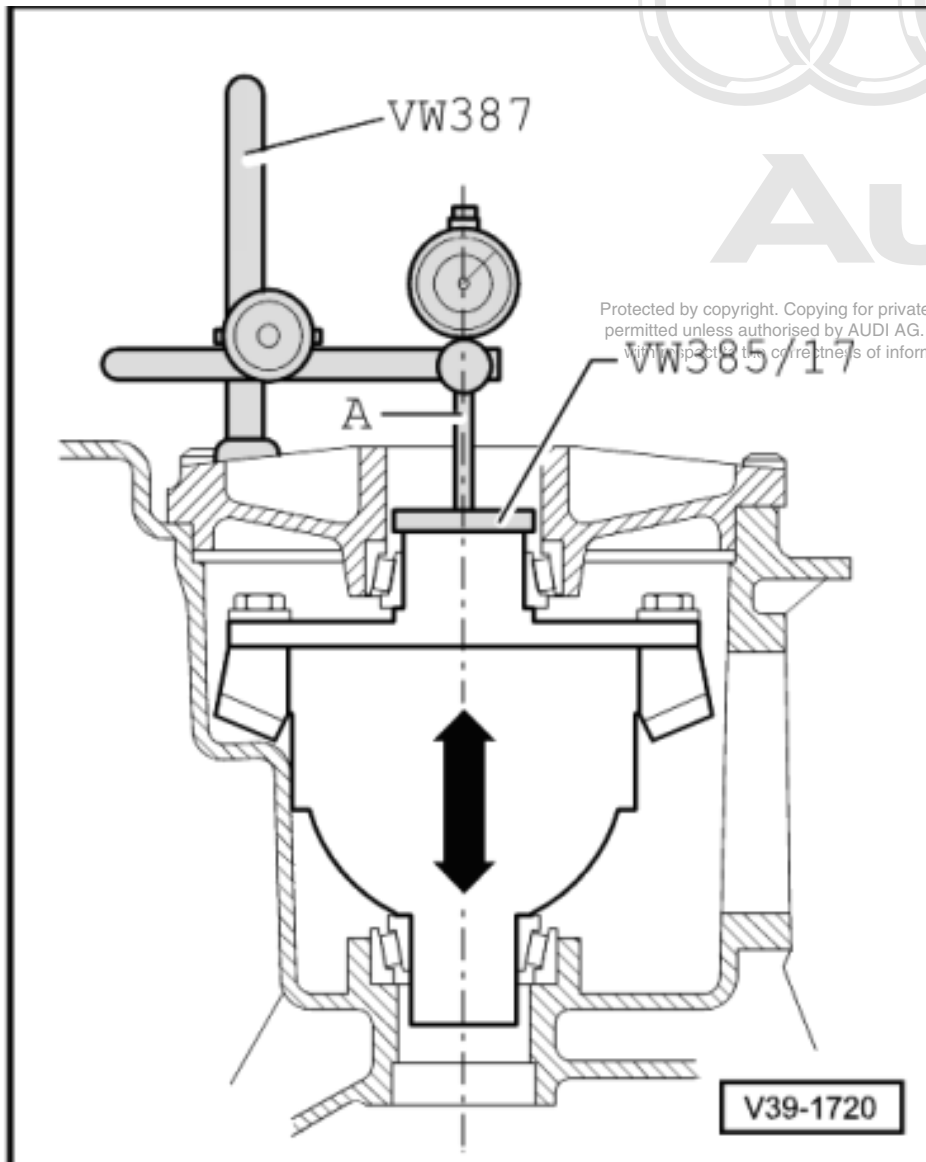
For measurement purposes a shim "S2" of 1.20 mm is initially inserted which is designated "S2\*" in the following. After determining backlash, "S2\*" will be replaced by the correct shim "S2".



- -> Press taper roller bearing outer race into cover for differential without shim "S1" =>Fig. 147 .
- Insert differential without drive wheel for speedometer sender -G22 into gearbox housing. The crown wheel is positioned on the left-hand side (same side as cover for final drive).
- Install cover for differential with 4 bolts (25 Nm).
- Position gearbox so that the cover for differential faces up.



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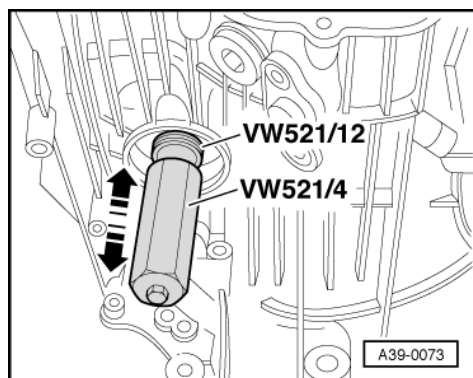


- Turn differential 5 turns in both directions so that the taper roller bearings settle.
- -> Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) -A- to "0" with 2 mm preload.

**Note:**

*The tip of the dial gauge must be positioned on centre of differential.*

- Lift differential, without turning, and read off play on dial gauge.
- Measurement in following example: 0.62 mm.

**Notes:**

- -> To lift the differential, attach special tools VW 521/4 and VW 521/12 on the right of the differential (housing side).
- If the measurement has to be repeated, the drive pinion with hollow shaft must be turned 5 turns in each direction first to settle the taper roller bearings.

**Formula:**

$$\text{"Stotal"} = \text{"S2*"} + \text{measurement} + \text{bearing preload}$$

**Example:**

Inserted shim(s) "S2*"	1.20 mm
+ Measured value	0.62 mm
+ Bearing preload (constant value)	0.30 mm
= Total thickness "Stotal" for "S1" + "S2"	2.12 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 unchanged.

**Formula:**

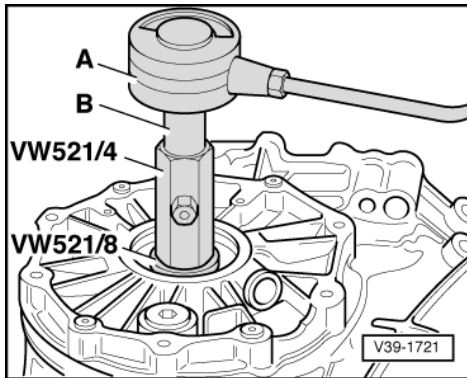
$$\text{"S1*"} = \text{"Stotal"} - \text{"S2*"} =$$

**Example:**

Total thickness "Stotal" for "S1" + "S2"	2.12 mm
- Inserted shim(s) "S2*"	1.20 mm
= Thickness of shim "S1*"	0.92 mm

**Measuring frictional torque (check)****Notes:**

- Differential tapered roller bearings are low friction bearings. Therefore the frictional torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- Drive pinion removed



- -> Fit torque gauge 0 ... 600 Ncm -A- onto differential.

B - Socket

- Read off frictional torque.

Frictional torque specifications:

New bearings	Used bearings
150 ... 350 Ncm	30 ... 60 Ncm

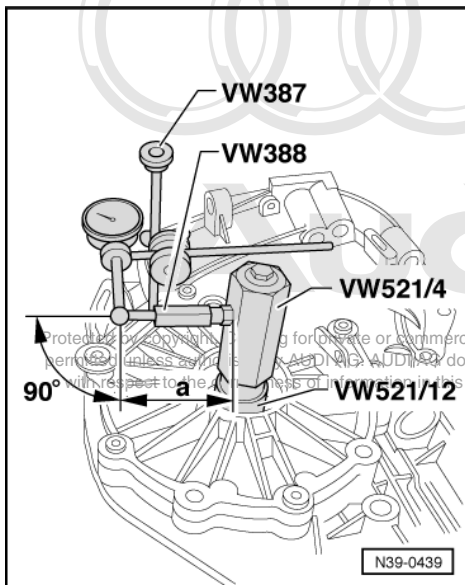
**Note:**

*If the final drive set (drive pinion and crown wheel) is being re-adjusted, the adjustment of the drive pinion should be performed now, and the adjustment checked =>Page **154**.*

**Measuring backlash**

(Position of crown wheel in gearbox housing)

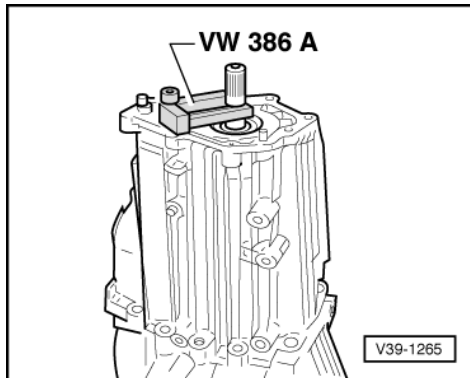
- Drive pinion with shims "S3\*" and "S4\*" fitted
- Install differential.
- Turn the differential 5 turns in each direction to settle the taper roller bearings.



- -> Secure dial gauge retainer VW 387 onto housing.
- Attach crown wheel adjusting device VW 521/4 and VW 521/12.
- Fit dial gauge with dial gauge extension VW 382/10 (6 mm flat).
- Adjust measuring lever VW 388 to distance "a" = 67 mm (for 170 mm dia. crown wheel).



- Determine play between the teeth flanks as follows:
  - Turn crown wheel until it makes contact with a tooth flank (end of backlash travel).
  - Set dial gauge to "0" with 2 mm preload.
  - Turn crown wheel back until lying against an opposite tooth flank (backlash).
- Read off backlash and note value.
- Turn crown wheel through 90° and repeat measurements a further 3 times.

**Notes:**

- ♦ -> If the drive pinion rotates when the differential is turned, fit clamp VW 386 A so that the backlash can be measured exactly.
- ♦ Loosen the clamp in order to turn the crown wheel when repeating the measurement.

**Determining average backlash**

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

**Example:**

1st measurement	0.28 mm
+ 2nd measurement	0.30 mm
+ 3rd measurement	0.30 mm
+ 4th measurement	0.28 mm
= Sum of measured values	1.16 mm

- Result: The average backlash is  $1.16 / 4 = 0.29$  mm

**Note:**

*If the individual measurements differ by more than 0.06 mm from each other, the installation of the crown wheel or the final drive set itself is not correct. Check installation, replace final drive set if necessary.*

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**Determining thickness of shim "S2"****Formula:**

$$\text{"S2"} = \text{"S2*"} - \text{backlash} + \text{lift}$$

**Example:**

Inserted shim "S2*"	1.20 mm
- Average backlash	0.29 mm
+ Lift (constant)	0.15 mm
= Thickness of shim "S2"	1.06 mm

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



=> Parts catalogue

The following shims are available for "S2"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

Determining thickness of shim "S1"

<b>Formula:</b>		
"S1"	=	"Stotal" - "S2"

<b>Example:</b>		
Total shim thickness "Stotal" for "S1" + "S2"		2.12 mm
- Thickness of shim "S2"		1.06 mm
= Thickness of shim "S1"		1.06 mm

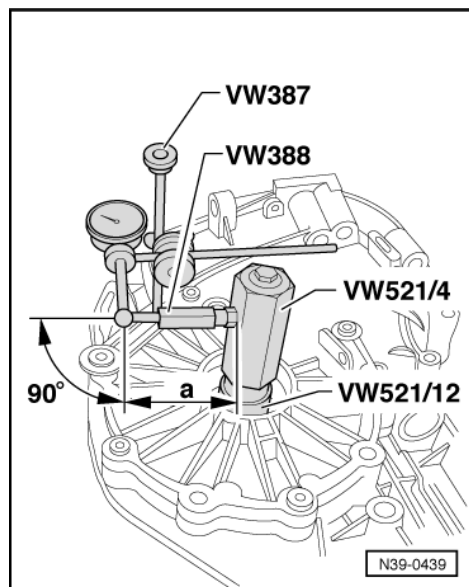
- Determine shim(s) as accurately as possible from table. **Part numbers**

=> Parts catalogue

The following shims are available for "S1"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.





### -> Performing check measurement

- After installing shims "S1" and "S2", turn differential 5 turns in both directions so that the taper roller bearings settle.
- Measure backlash four times on circumference.
  - Specifications: 0.12 ... 0.22 mm

#### **Notes:**

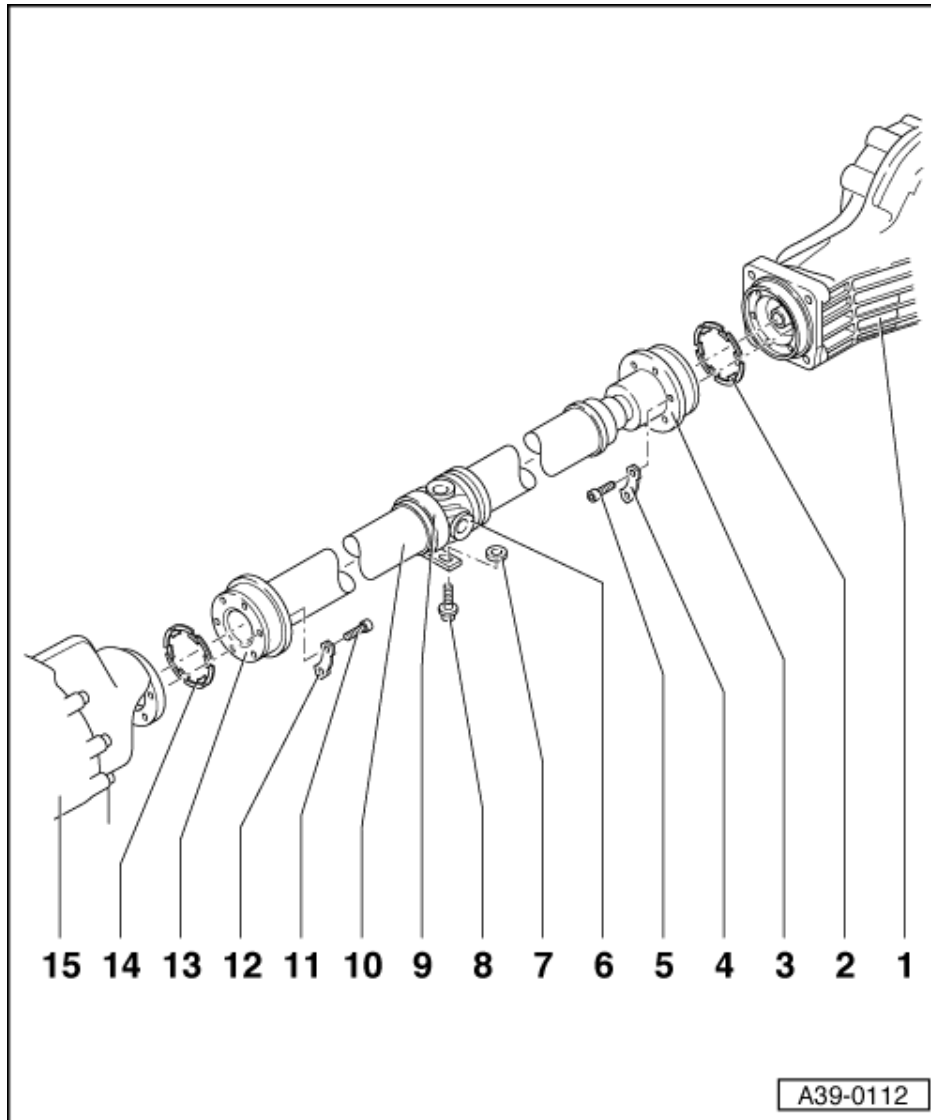
- ♦ If the backlash lies outside the tolerances, the adjustments must be repeated. But the total shim thickness "Stotal" must remain the same.
- ♦ The individual measurements must not differ by more than 0.06 mm from each other.

## 7 - Servicing propshaft

### 7.1 - Servicing propshaft

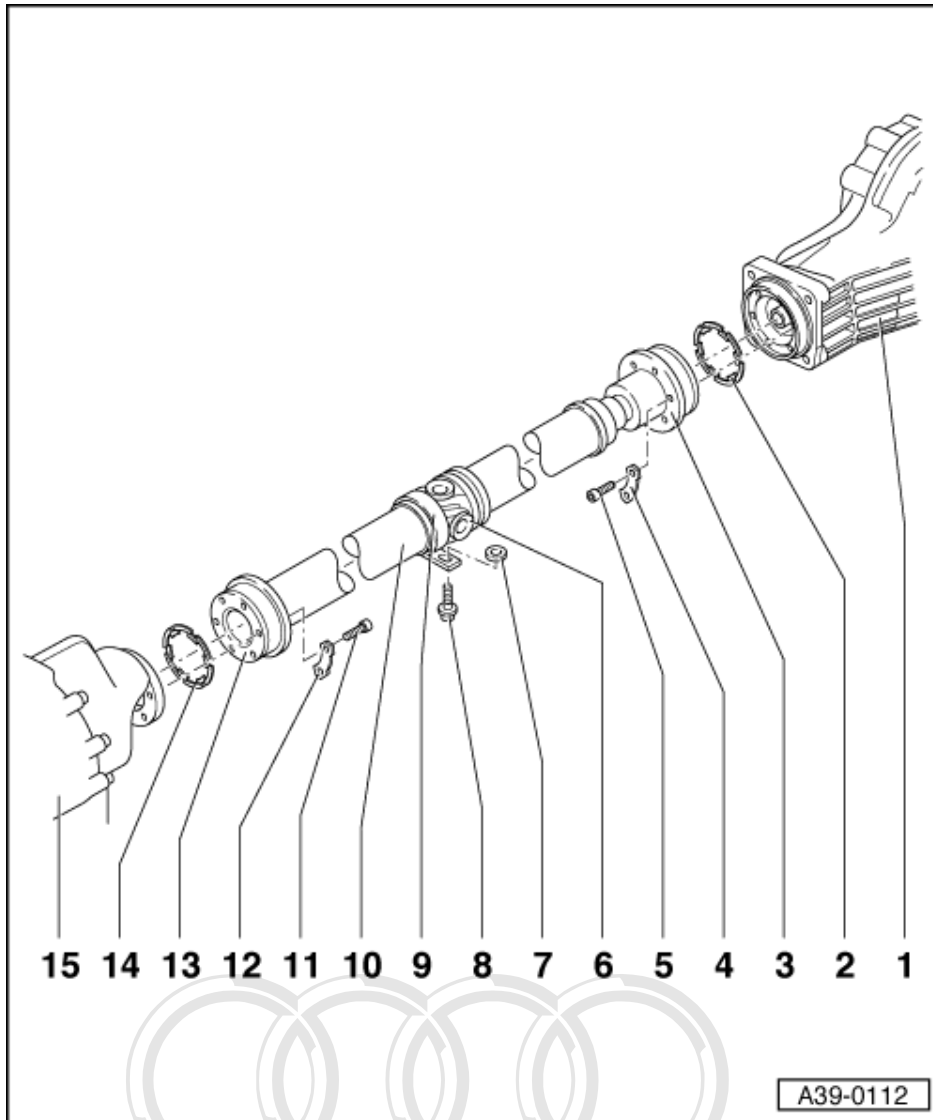
#### **Notes:**

- ♦ Observe general repair instructions=>Page 8 .
- ♦ Do not bend the propshaft more than 25 ° at the central joint, otherwise the universal joint can be damaged.
- ♦ Only store and transport propshaft extended.
- ♦ No repair work can be carried out on the propshaft with the exception of removing, installing and adjusting.
- ♦ If the propshaft is only detached at the gearbox or from rear final drive then the propshaft is to be tied-up or supported at the constant velocity joint.
- ♦ Before removing, mark the position of the rear propshaft joint in relation to the flange on the rear final drive. Reinstall in the same position, otherwise this can cause excessive imbalance, bearing damage and droning noise.
- ♦ If complaints are received (noises, vibrations), it is essential to check whether correct adjustment of the propshaft rectifies the fault before replacing the propshaft.
- ♦ After removing the propshaft from the rear final drive, the additional balance disc (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled.



- 1 Rear final drive
- 2 Gasket
  - ◆ Renew
  - ◆ Pull off backing foil, and stick self-adhesive side of gasket to flange shaft.
- 3 Constant velocity joint
  - ◆ Maximum permissible angle of deflection 8°
- 4 Lock plate
- 5 Hexagon socket head bolt, 55Nm
  - ◆ Self-locking
  - ◆ Renew
  - ◆ The bolt threads in the flange shafts must always be cleaned (e.g. with a thread tap)

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**6 Universal joint**

- ♦ Maximum permissible angle of deflection 25°

**7 Shim**

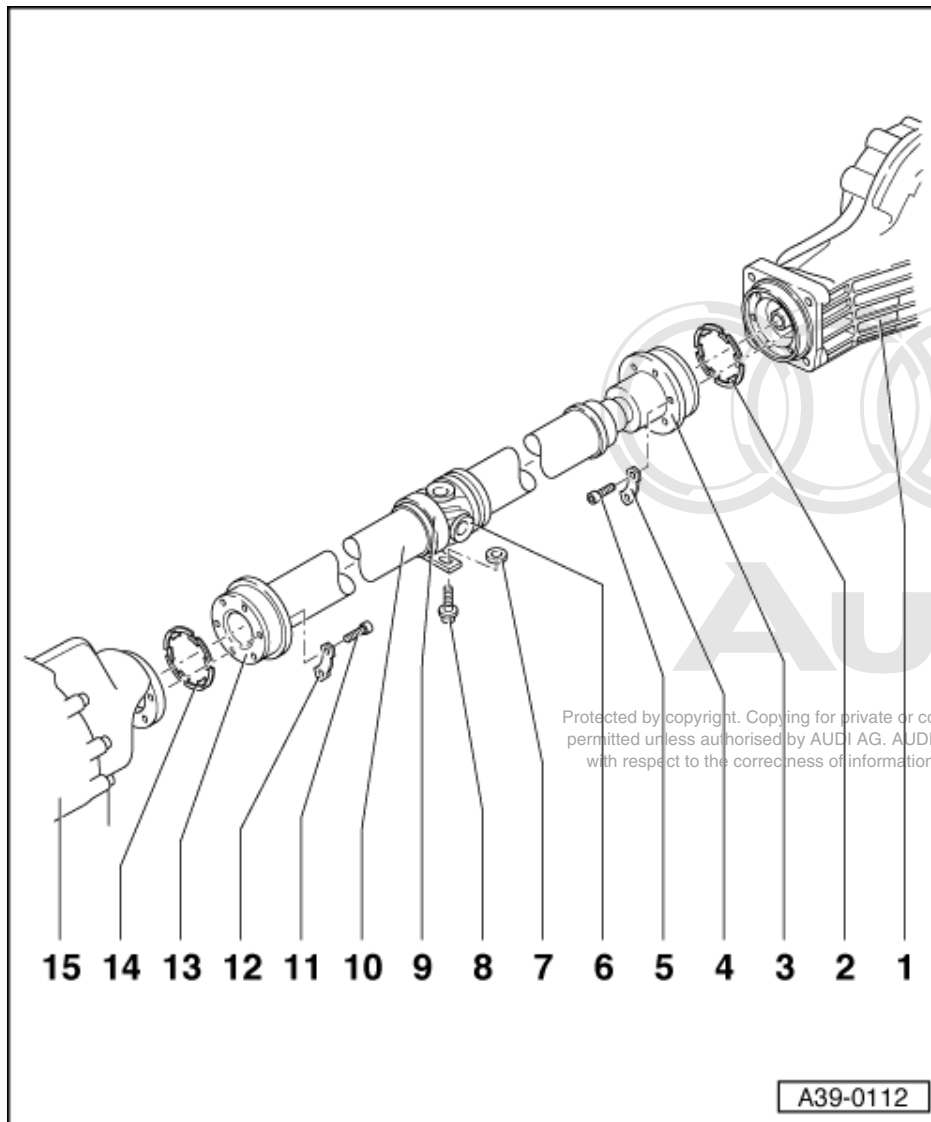
- ♦ Determining thickness => Page 180

**8 Hexagon bolt - 23 Nm****9 Propshaft centre mounting****10 Propshaft**

- ♦ Adjusting => Page 179

**11 Hexagon socket head bolt, 55Nm**

- ♦ Self-locking
- ♦ Renew
- ♦ The bolt threads in the flange shafts must always be cleaned (e.g. with a thread tap)



**12 Lock plate**

**13 Constant velocity joint**

- ♦ Maximum permissible angle of deflection 8°

**14 Gasket**

- ♦ Renew
- ♦ Pull off backing foil, and stick self-adhesive side of gasket to flange shaft.

**15 Gearbox**

## 7.2 - Removing and installing propshaft

### Special tools, testers and auxiliary items

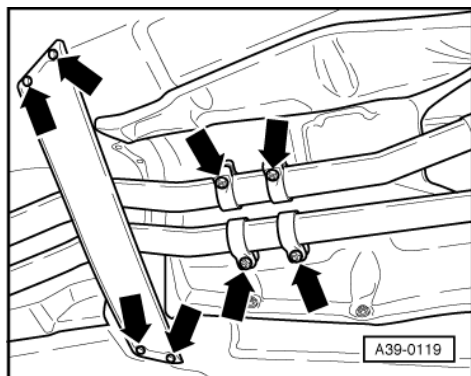
- ♦ Assembly device 3139 with spacers 3139/4

**Caution**  
Contact corrosion. Notes => Page **7** .

- Observe notes => Page **172** .



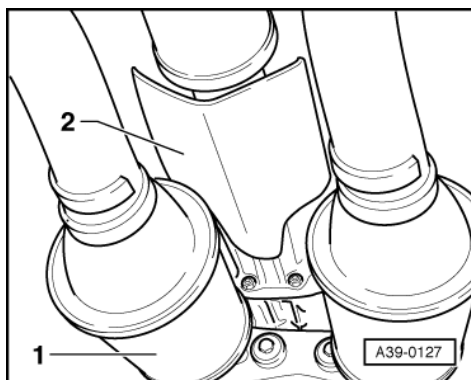
## Removing



- -> Remove cross member, if fitted, and rear exhaust system -arrows-

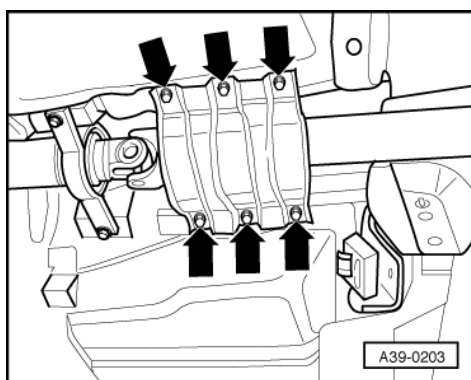
=> 6-Cylinder engine, Mechanics; Repair group 26; Removing and installing exhaust system Removing and installing exhaust system

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system



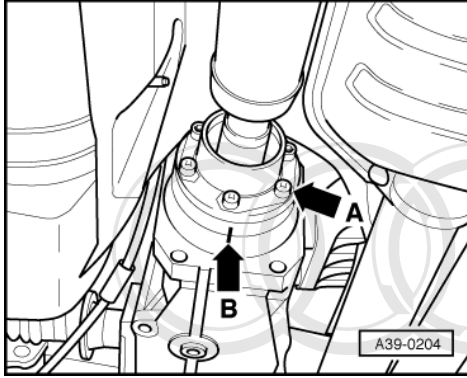
- Remove heat shields above propshaft.
- -> Remove left-hand catalytic converter -1-.
- Remove heat shield for propshaft -2- from cover for Torsen differential.

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- -> Remove tunnel support -arrows-.



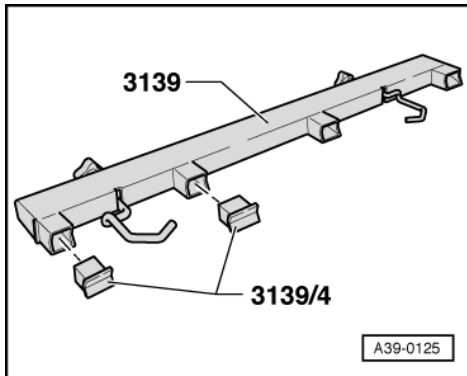


- -> Check whether there is a factory marking (paint) on the propshaft and the drive flange on the rear final drive. If not, mark position of propshaft flange in relation to rear final drive with paint -arrow B-.

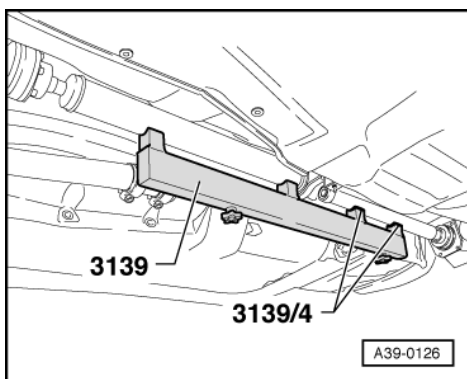
**Note:**

*Only mark if the same propshaft is to be reinstalled.*

- Loosen securing bolts -arrow A- of both propshaft flanges slightly.



- -> Set up the assembly device 3139 with the spacers 3139/4, as shown in the illustration.
- Loosen securing bolts of centre propshaft mounting slightly.



- -> Attach assembly device 3139 and tighten plastic nuts.

**Note:**

*Never fit assembly device onto balance plates.*

- Remove securing bolts of flange to gearbox and to rear final drive as well as securing bolts of centre propshaft mounting.
- Slide propshaft together towards rear final drive. The constant velocity joints move along their axes.



- Guide out propshaft with assembly device past gearbox flange.

**Note:**

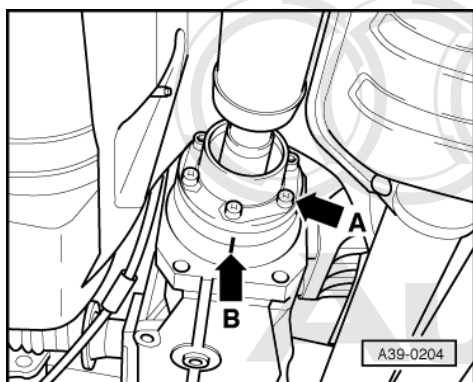
*Only transport and store propshaft in extended position.*

**Installing**

Installation is carried out in the reverse order, when doing this note the following:

**Notes:**

- ♦ It is important to clean out the locking fluid left in the threaded holes in the flange shafts on the gearbox and the rear final drive after removing the propshaft. Otherwise there is a danger that new bolts will seize and then shear when removing them again.
- ♦ The threaded holes can be cleaned with a thread tap.
- ♦ Renew the gaskets on the flange shafts (remove backing foil and stick gaskets onto flange shaft; make sure that the surfaces are free of grease).



- ♦ -> To prevent imbalance, the flanges on the propshaft and on the rear final drive must be installed so that the factory markings (or the markings made on removal) are in alignment -arrow B-.
  - ♦ If a new propshaft is being installed and the factory marking on the rear final drive flange is no longer visible, the radial run-out at the flange for the propshaft must be measured=>Page 193 , and the coloured marking on the propshaft must be aligned with the marking on the flange.
  - ♦ After removing the propshaft from the rear final drive, the additional balance disk (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled. Always renew all flange bolts after dismantling.
  - ♦ Renew propshaft bolts (self-locking).
- Adjust propshaft after installing => Page 179 .
  - Align exhaust system free of stress

=> 6-Cylinder engine, Mechanics; Repair group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system; Stress-free alignment of exhaust system Removing and installing parts of exhaust system Stress-free alignment of exhaust system

**Tightening torques**

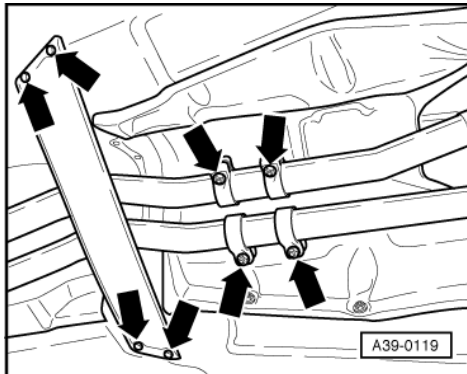
Component	Nm
Propshaft to gearbox (output flange) M8	55
Propshaft to final drive (input flange) M8	55
Propshaft centre mounting to body	23
Heat shield for propshaft to gearbox	23



Component	Nm
Cross member to body	25
Tunnel support to body	25

### 7.3 - Adjusting propshaft

#### Special tools, testers and auxiliary items



- ◆ Assembly device 3139 with spacers 3139/4

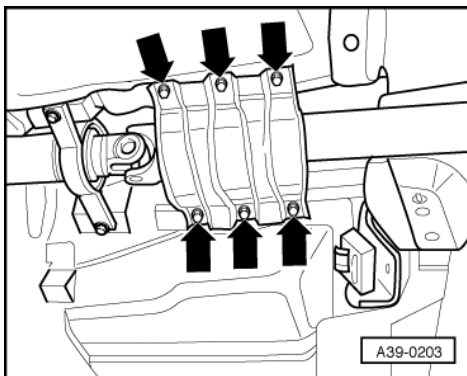
- Observe notes => Page **172**.
- -> Remove cross member, if fitted, and rear section of exhaust system -arrows-

=> 6-Cylinder engine, Mechanics; Repair group 26; Removing and installing exhaust system Removing and installing exhaust system

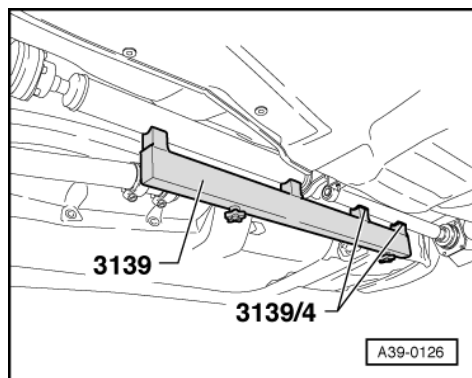
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=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system

- Remove heat shields above propshaft.



- -> Remove tunnel support -arrows-.

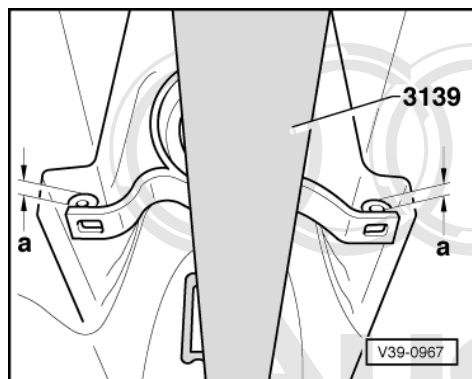


- -> Attach assembly device 3139 and tighten plastic nuts.

**Note:**

*Never fit assembly device onto balance plate.*

- Loosen bolts securing centre propshaft mounting to body.
- Remove securing bolts and shims from centre mounting.



- Align centre propshaft mounting so that distance -a- is the same on both sides.
- -> Measure dimension -a-.
- Determine shim(s) from table Part numbers

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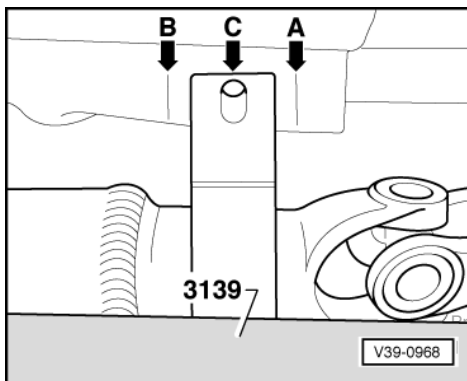
=> Parts catalogue

The following shims are available:

Dimension -a- (mm)	Shim thickness (mm)
0 ... 3.0	-
3.1 ... 5.0	2
5.1 ... 7.0	4
7.1 ... 9.0	6
9.1 ... 11.0	8
11.1 ... 13.0	10

- Install the correct shims on both sides.

### Aligning propshaft longitudinally



- -> Using assembly device, push propshaft towards the rear as far as it will go.
- Mark position of centre mounting on body -arrow A-.
- Using assembly appliance, push propshaft towards the front as far as it will go.
- Mark position of centre mounting on body -arrow B-.
- Align propshaft -arrow C-.
  - The centre mounting must be positioned centrally between the markings -A- and -B-
- Install securing bolts of propshaft centre mounting and previously determined shims and tighten.
- Remove assembly device.
- Install tunnel support.
- Install heat shield above propshaft.

- Align exhaust system free of stress

=> 6-Cylinder engine, Mechanics; Repair group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system; Stress-free alignment of exhaust system Removing and installing parts of exhaust system Stress-free alignment of exhaust system

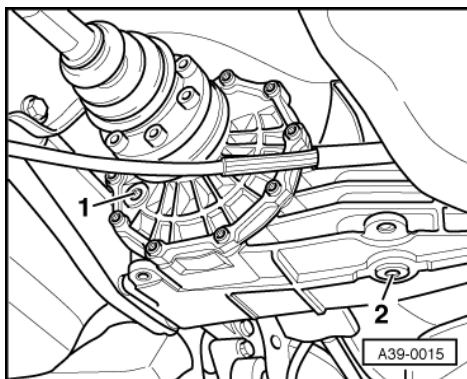
- Install cross member.

### Tightening torques

Component	Nm
Propshaft centre mounting to body	23
Cross member to body	25
Tunnel support to body	25

## 8 - Checking oil level in rear final drive

### 8.1 - Checking oil level in rear final drive





- -> Remove oil filler plug -1- to check final drive oil level.
- Specification: oil level up to lower edge of filler hole
- Top up gear oil if necessary. Specification => Page 4 .
- Fit oil filler plug.

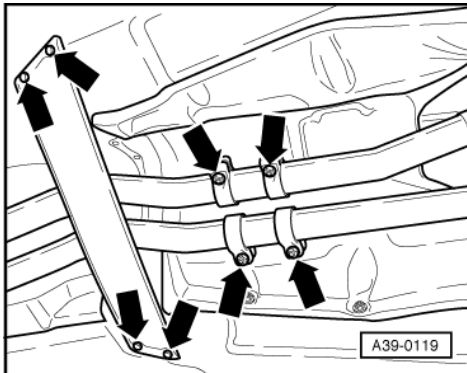
#### Tightening torque

Component	Nm
Oil filler plug	35

## 9 - Removing and installing rear final drive

### 9.1 - Removing and installing rear final drive

#### Special tools, testers and auxiliary items



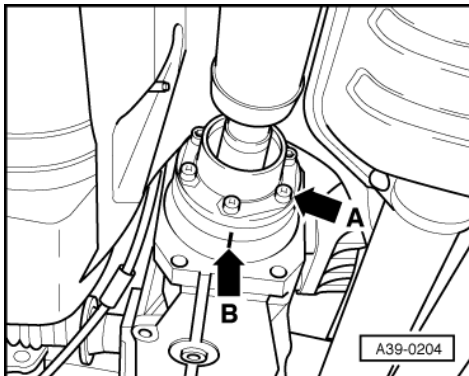
- ♦ Engine/gearbox jack V.A.G 1383 A
- ♦ Universal support V.A.G 1359/2

Contact corrosion. Notes => Page 7 .

#### Removing

- -> Remove cross member, if fitted, and rear section of exhaust system -arrows-

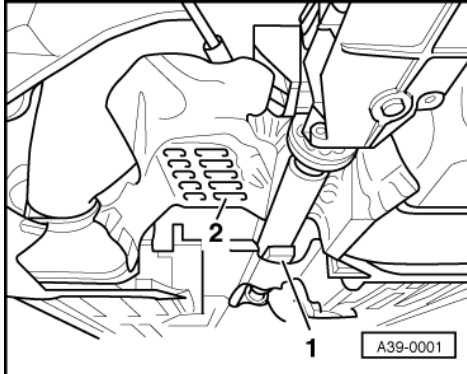
=> 6-Cylinder engine, Mechanics; Repair group 26; Removing and installing exhaust system Removing and installing exhaust system



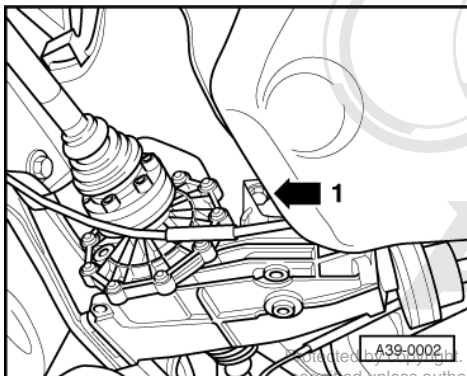
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=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system  
 Removing and installing parts of exhaust system

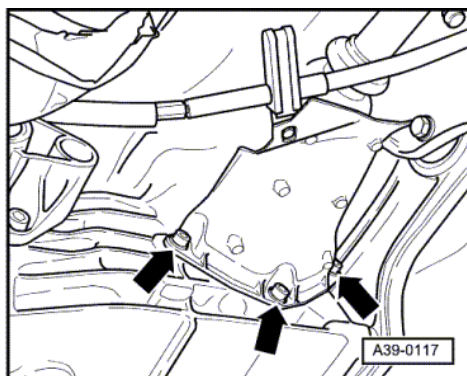
- Remove heat shields above propshaft.
- -> Check whether there is a factory marking (paint) on the propshaft and the drive flange on the rear final drive. If not, mark position of propshaft flange in relation to rear final drive with paint -arrow B-.
- Loosen securing bolts -arrow A- of propshaft to rear final drive.



- -> Support propshaft using a wooden wedge -1-, press upwards against heat shield.
- Remove heat shield -2-.
- Remove securing bolts of propshaft to rear final drive.

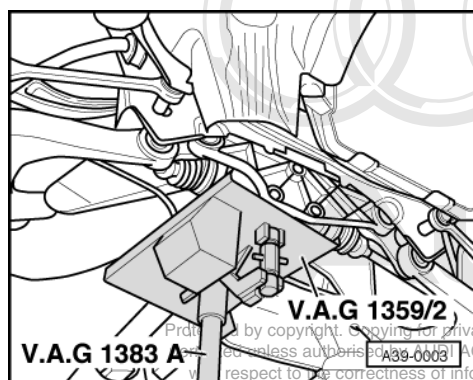


- -> If fitted, detach retainer for handbrake cable -arrow 1-.

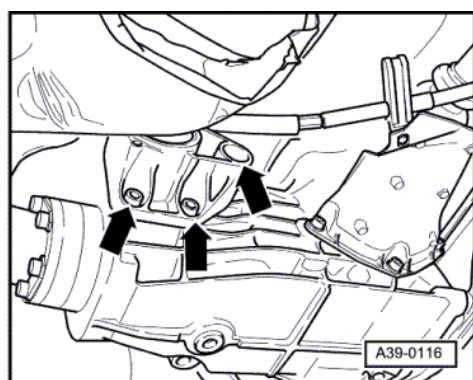


- -> Remove heat shield for left drive shaft -arrows-.
- Detach left and right-hand drive shafts from rear final drive

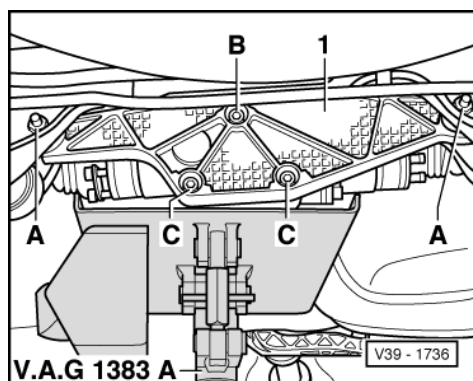
=> Running Gear, Front and 4WD; Repair group 42; Removing and installing drive shaft  
 Removing and installing drive shaft



- -> Support final drive with gearbox jack V.A.G 1383 A and universal support V.A.G 1359/2.
- Secure final drive with a strap.



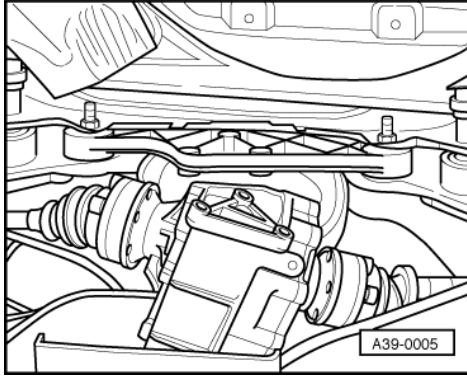
- -> Remove securing bolts -arrows- of left final drive support.



- -> Unscrew securing bolts -B- and -C- of rear cross member on rear final drive.

**Note:**

*The cross member -1- need not be removed.*



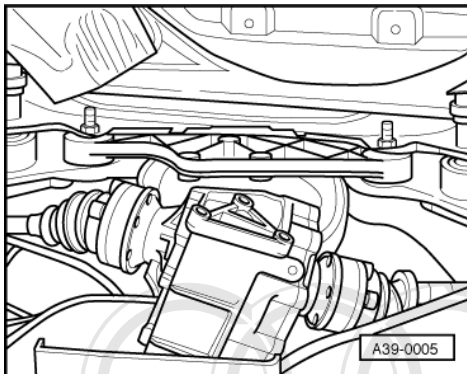
- -> Lower final drive slowly.

### Installing

Installation is carried out in the reverse order, when doing this note the following:

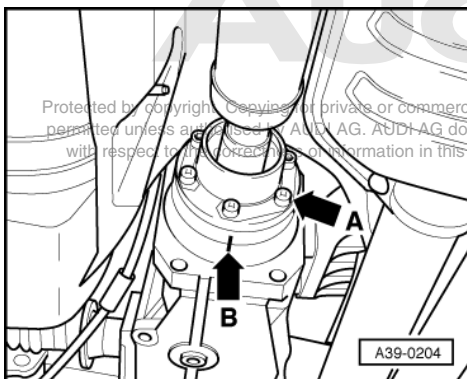
#### Notes:

- ◆ Always renew self-locking nuts.
- ◆ It is important to clean out the locking fluid left in the threaded holes in the flange shaft on the rear final drive after removing the propshaft. Otherwise there is a danger that new bolts will seize and then shear when removing them again.
- ◆ The threaded holes can be cleaned with a thread tap.
- ◆ Renew the gasket on the flange shaft (remove backing foil and stick gasket onto flange shaft). Surface must be free of grease.
- ◆ Renew propshaft bolts (self-locking).



- -> Raise final drive with gearbox jack until both drive shafts can be connected.
- Lightly tighten securing bolts for drive shafts.
- Lift final drive and bolt to cross member and final drive support.
- Bolt on propshaft=>Page 178 .

#### Notes:





- ♦ -> To prevent imbalance, the flanges on the propshaft and on the rear final drive must be installed so that the factory markings (or the markings made on removal) are in alignment -arrow B-.
- ♦ After removing the propshaft from the rear final drive, the additional balance disk (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled. Always renew all flange bolts after dismantling.
- ♦ Renew propshaft bolts (self-locking).

- Check gear oil in rear final drive => Page **181** .

- Align exhaust system free of stress

=> 6-Cylinder engine, Mechanics; Repair group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system; Stress-free alignment of exhaust system Removing and installing parts of exhaust system Stress-free alignment of exhaust system

### Tightening torques

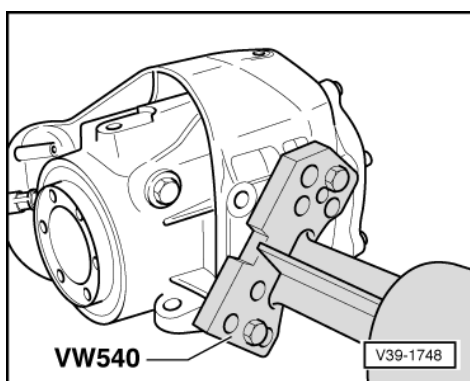
Component	Nm
Final drive support (front) to final drive	40
Rear cross member to final drive	55
Drive shaft to final drive	M8 40
	M10 77
Propshaft to final drive	55
Cross member to body	25
Heat shield for drive shaft (left)	25
Retainer for handbrake cable	25

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## 9.2 - Securing rear final drive to engine and gearbox support

### Special tools, testers and auxiliary items

- ♦ Engine/gearbox support VW 540



- -> Secure complete rear final drive to engine and gearbox support VW 540.



## 10 - Renewing flange shaft oil seals

### 10.1 - Renewing flange shaft oil seals

- Rear final drive removed

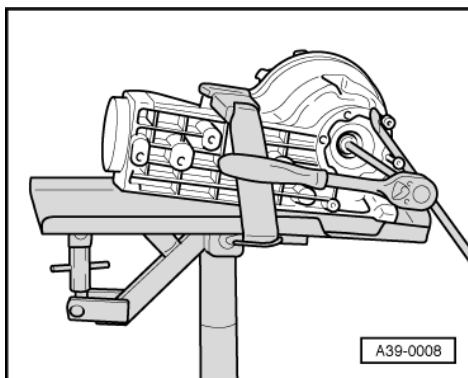
#### Special tools, testers and auxiliary items

- ♦ Drip tray V.A.G 1306
- ♦ Mandrel 2062

#### Note:

*The procedure is identical for left and right-hand seals.*

#### Removing

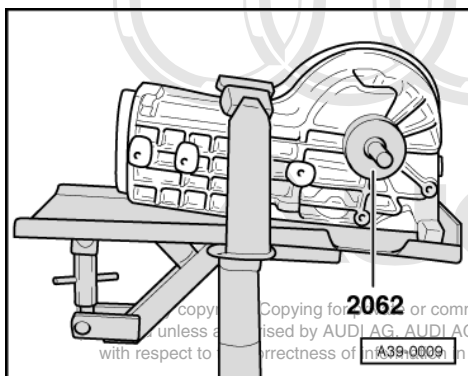


- -> Remove flange shaft. To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Place drip tray underneath to collect oil.
- Pull out flange shaft using the bolts already screwed in.
- Lever out seals for flange shaft using a suitable lever.
- Clean seat for oil seal.

#### Installing

Installation is carried out in the reverse order, when doing this note the following:

- Moisten outer circumference of seal with gear oil.
- Fill space between sealing lip and dust lip with multi-purpose grease.



- -> Install oil seal onto stop with drift 2062, do not cant seal when doing this.
- Drive in flange shaft and tighten.



## Tightening torque

Component	Nm
Flange shaft to final drive	25

- Install rear final drive=>Page **185** .
- Top-up gear oil in rear final drive and check oil level => Page **181** .

## 11 - Removing and installing seal for propshaft flange

### 11.1 - Removing and installing seal for propshaft flange

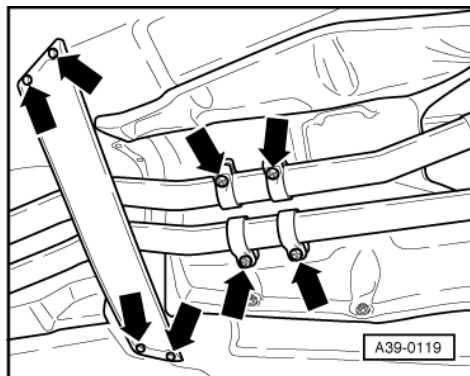
#### *Note:*

*The seal can be replaced with the rear final drive remaining installed. But the final drive must be lowered.*

#### Special tools, testers and auxiliary items

- ♦ Drip tray V.A.G 1306
- ♦ Engine/gearbox jack V.A.G 1383 A
- ♦ Universal support V.A.G 1359/2
- ♦ Fitting appliance VW 391
- ♦ Multi-purpose tool VW 771
- ♦ Punch 3026
- ♦ Retainer 3028
- ♦ Drift sleeve 3143
- ♦ Depth gauge
- ♦ Locking fluid D000 600

#### Removing



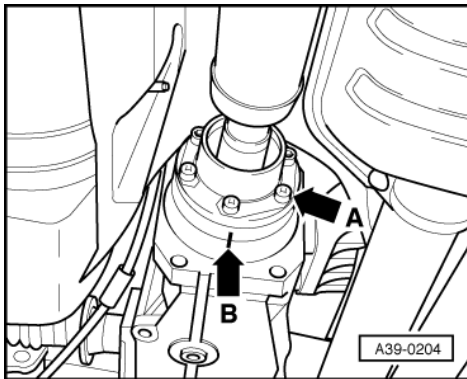
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- -> Remove cross member, if fitted, and rear section of exhaust system -arrows-

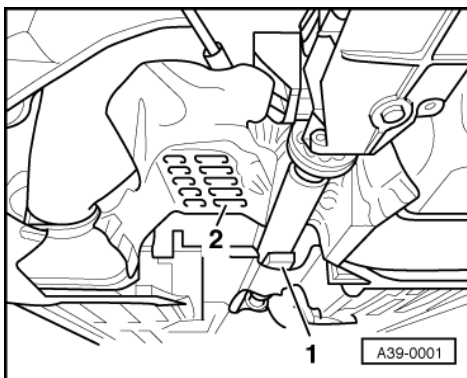
=> 6-Cylinder engine, Mechanics; Repair group 26; Removing and installing exhaust system Removing and installing exhaust system

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system

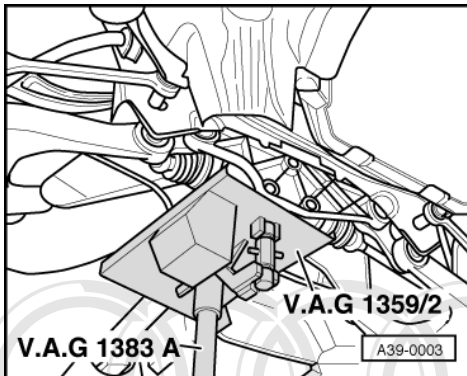
- Place drip tray V.A.G 1306 underneath and drain oil.
- Remove heat shields above propshaft.



- -> Check whether there is a factory marking (paint) on the propshaft and the drive flange on the rear final drive. If not, mark position of propshaft flange in relation to rear final drive with paint -arrow B-.
- Loosen securing bolts -arrow A- of propshaft to rear final drive.



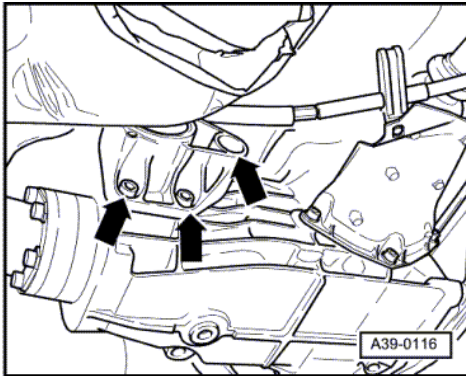
- -> Support propshaft using a wooden wedge -1-, press upwards against heat shield -2-.
- Remove securing bolts of propshaft to rear final drive.



- -> Support final drive with gearbox jack V.A.G 1383 A and universal support V.A.G 1359/2.

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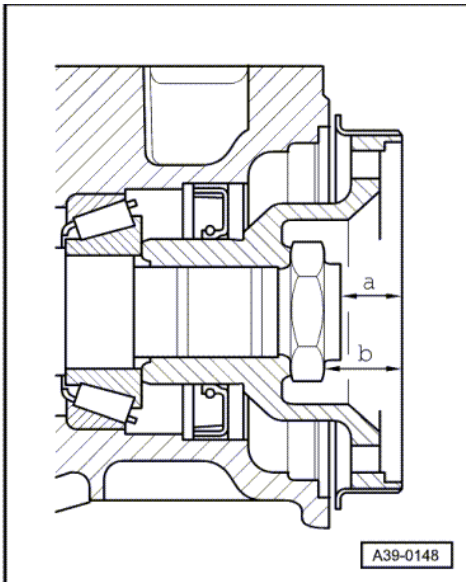


- -> Remove securing bolts -arrows- of left final drive support.

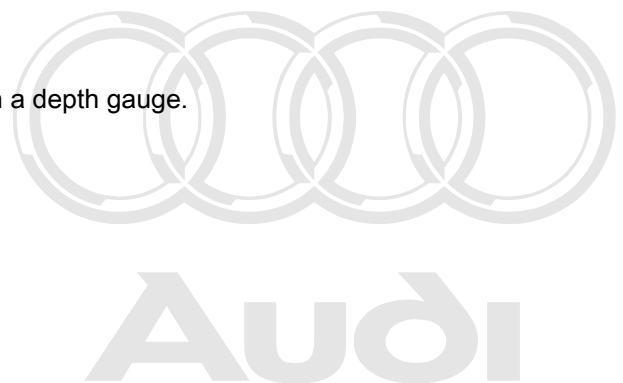
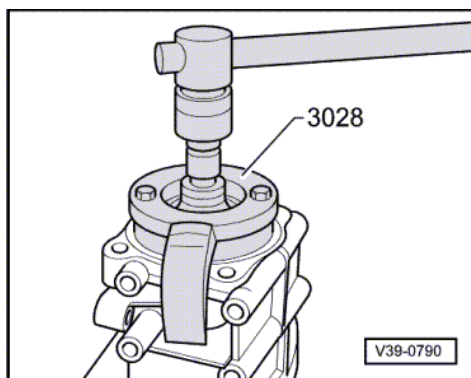
**Note:**

*The rear final drive/cross member securing bolts are not loosened.*

- To ease removing and installing, lower rear final drive slightly at front.



- Mark position of drive pinion retaining nut with paint.
- -> To check when assembling, measure the following with a depth gauge.
  - Dimension a = distance flange/drive pinion
  - Dimension b = distance flange/drive pinion nut

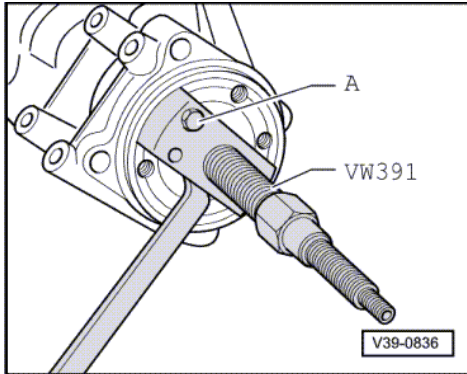


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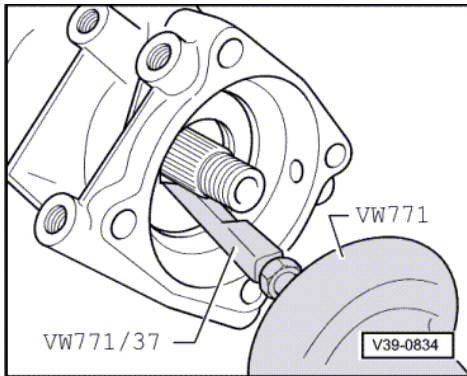
**Note:**

*Illustrations show the final drive removed for the following work sequence.*

- -> Fit counter-hold tool 3028 and remove drive pinion nut.



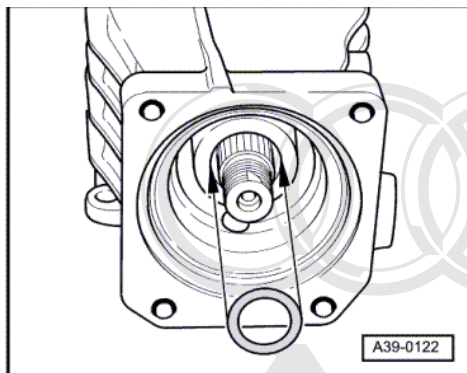
- -> Pull off flange with removal tool VW 391.
- Screw two M8 x 30 hexagon bolts -A- into flange.



- -> Pull out seal.

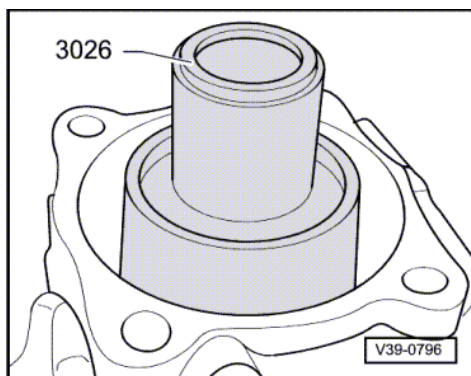
**Installing**

Installation is carried out in the reverse order, when doing this note the following:

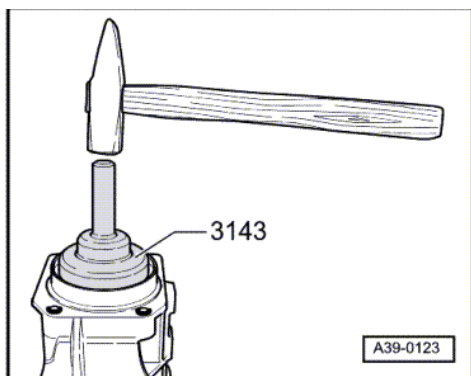


- -> Renew O-ring between drive pinion bearing and flange.
- Lightly oil O-ring before installing.

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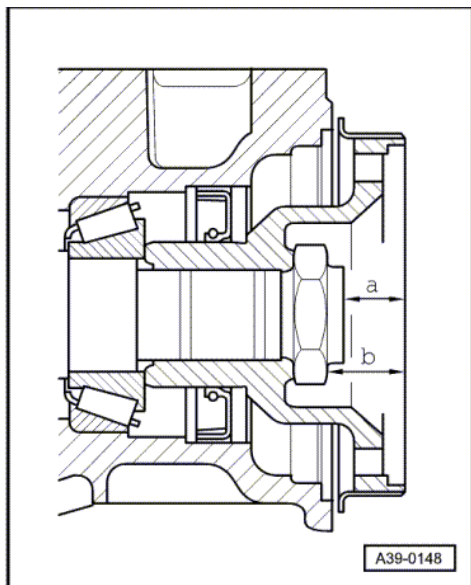
- Moisten outer circumference of seal with gear oil.
- Fill space between sealing and dust lips with multipurpose grease.
- -> Drive in seal for propshaft flange onto stop with drift 3026.



- -> Drive propshaft flange onto drive pinion until retaining nut can be fitted.
- Clean drive pinion nut and threads on drive pinion of oil and grease residues. Thinly coat threads with locking fluid D 000 600.

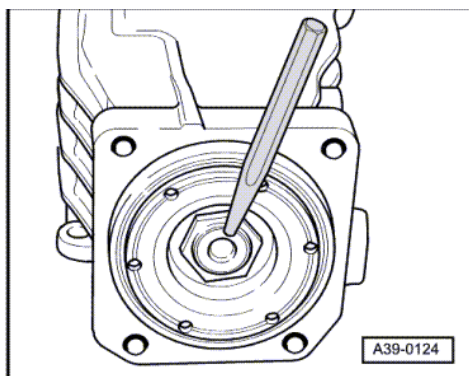
**Note:**

*Use the originally fitted hexagon nut to secure the flange on the drive pinion, otherwise it will not be possible to reproduce the original installation position.*



- Tighten drive pinion nut exactly onto previously marked position.
- -> To ensure that the assembly is correct, perform check measurement dimensions -a- and -b-.

- Maximum permissible deviation from original measurements:  $\pm 0.5$  mm



- -> Secure hexagon nut in position.
- Bolt final drive to final drive support.
- Renew gasket on propshaft flange and tighten propshaft securely.

#### Notes:

- ◆ After removing the propshaft, it is important to clean any remaining locking compound out of the threads in the flange shaft on the rear final drive. If this is neglected, the new bolts can seize when they are screwed in and shear off later if they have to be removed.
- ◆ The threaded holes can be cleaned with a thread tap.
- ◆ After removing the propshaft from the rear final drive, the additional balance disc (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled.
- ◆ Renew propshaft bolts (self-locking).
- If there is a factory marking on the propshaft, measure the radial run-out at the propshaft flange=>Page 193 and align the paint marking on the propshaft with the new marking on the flange.
- If there was no factory marking (paint) on the propshaft and the position of the propshaft in relation to the propshaft flange was therefore marked on removal, reinstall the propshaft in the same position=>Page 178 .
- Top-up gear oil in rear final drive and check oil level => Page 181 .
- Align exhaust system free of stress

=> 6-Cylinder engine, Mechanics; Repair group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

=> 6-Cylinder engine (5-valve), Mechanics; Repair group 26; Removing and installing parts of exhaust system; Stress-free alignment of exhaust system Removing and installing parts of exhaust system Stress-free alignment of exhaust system

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#### Tightening torques

Component	Nm
Oil drain/filler plug	35
Final drive support (front) to final drive	40
Propshaft to final drive	55
Cross member to body	25

## 11.2 - Measuring radial run-out at propshaft flange and marking

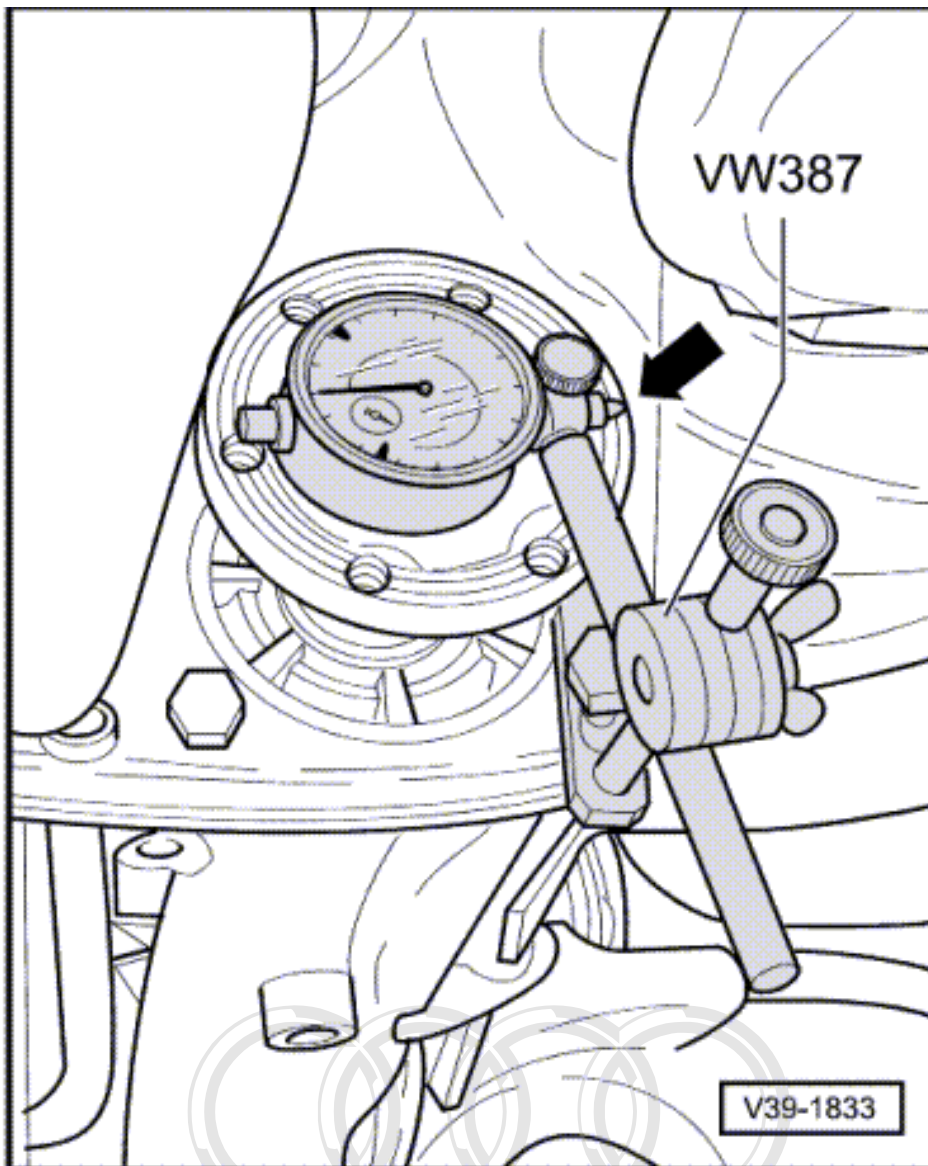
#### Special tools, testers and auxiliary items

- ◆ Universal dial gauge bracket VW 387





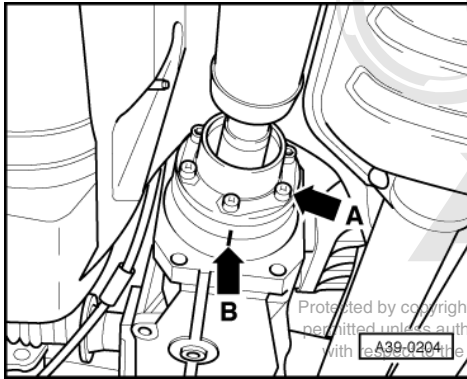
- ♦ Dial gauge



**Notes:**

- ♦ The radial run-out must always be measured when drive pinion or propshaft flange are removed.
- ♦ The radial run-out can be measured when rear final drive is installed but the propshaft must be disconnected at rear final drive. Observe notes =>Page 172 .
- -> Secure universal dial gauge retainer VW 387 with dial gauge to cross member/final drive bolted joint.
- Position dial gauge on ground circumference arrow in propshaft flange and set to "0" with a preload of 1 mm.
- Turn differential via both rear wheels (left and right flange shaft) at same time in one direction until the propshaft flange has turned once completely.
- Mark the position of greatest radial run-out on flange exterior (equates to greatest distance from rotational axis).
- Remove old marks on propshaft flange.



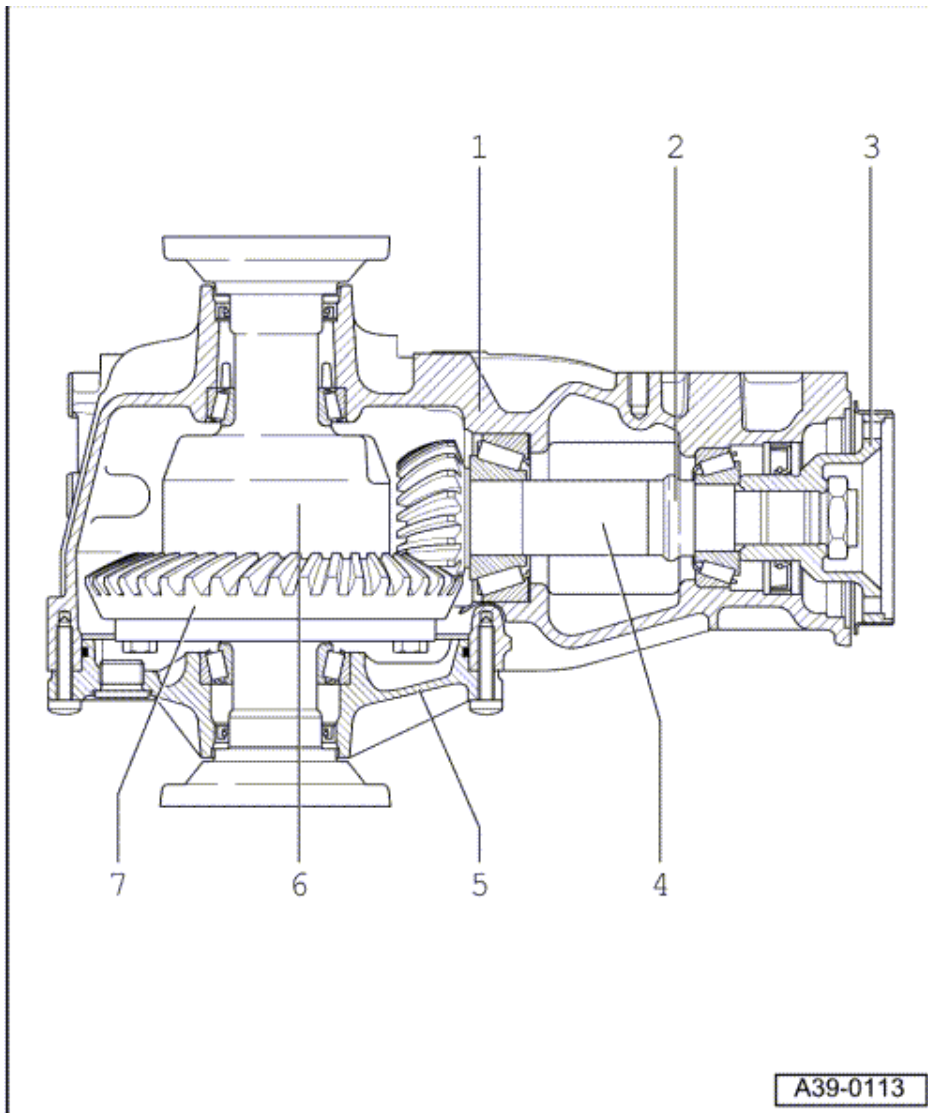


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- -> When installing the propshaft, the marking on the propshaft flange must be aligned with the marking on the rear final drive -arrow -B-.

## 12 - Dismantling and assembling rear final drive

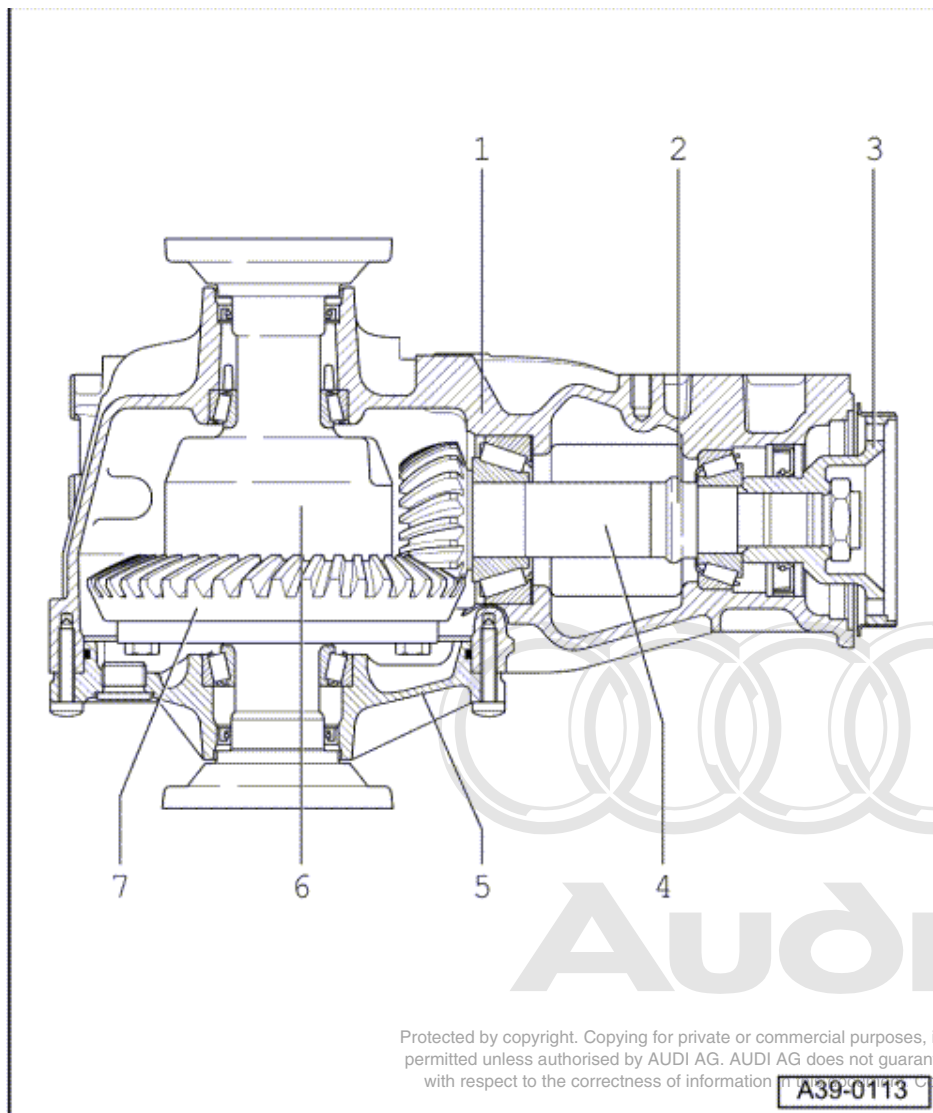
### 12.1 - Dismantling and assembling rear final drive





## 12.2 - Overview of final drive

- 1 Final drive housing
- 2 Spacer sleeve
  - ♦ Renew
- 3 Flange for propshaft
  - ♦ Removing and installing
    - => Page 212
- 4 Drive pinion
  - ♦ Is mated with crown wheel, always renew together as a set
  - ♦ Removing and installing
    - => Page 212



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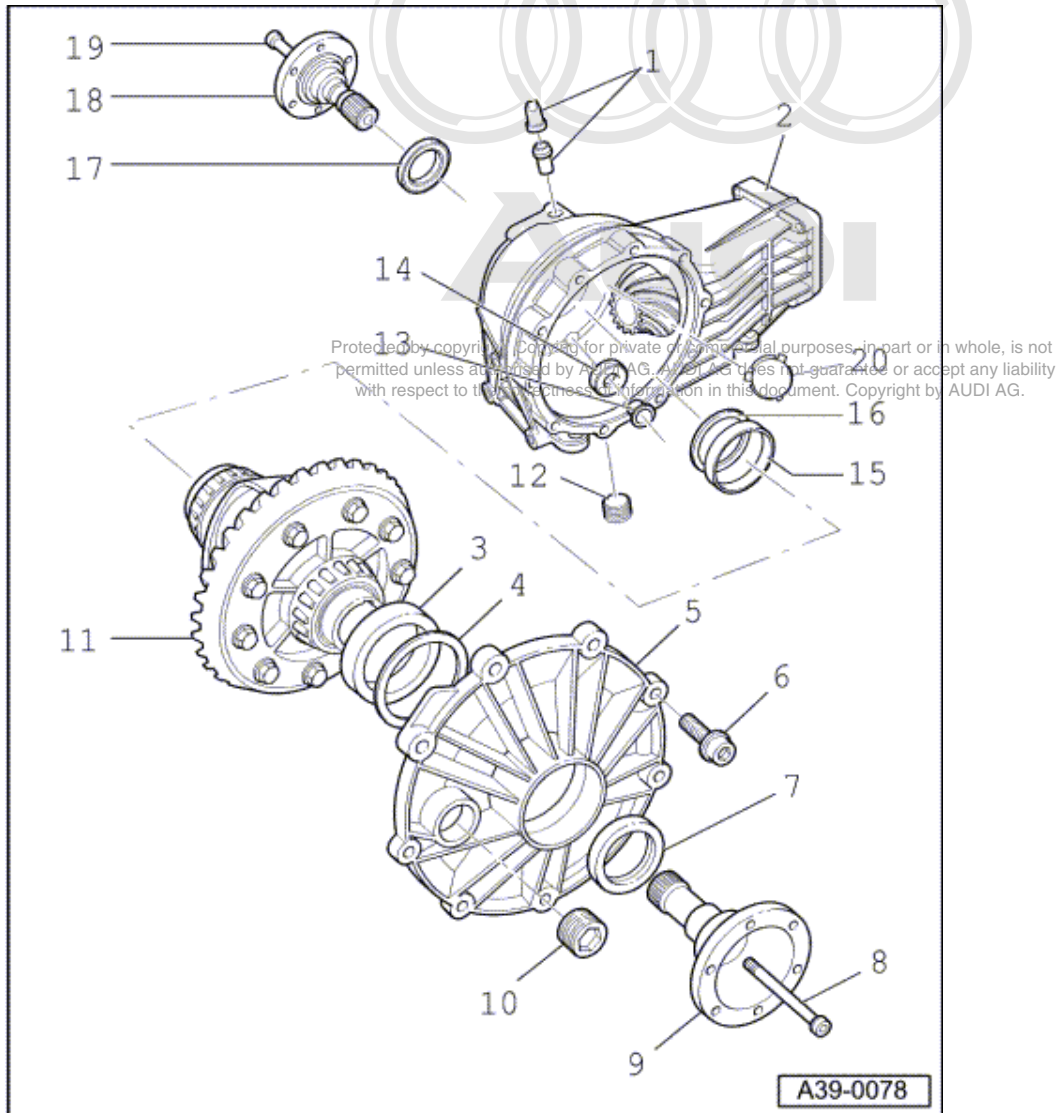
A39-0113

- 5 Cover for final drive
- 6 Differential
  - ♦ Must be removed before dismantling drive pinion
  - ♦ Removing and installing
    - => Page 197
  - ♦ Dismantling and assembling
    - => Page 203
- 7 Crown wheel

- ♦ Is mated to drive pinion (final drive set)
- ♦ Removing and installing  
=> Page **203**

## 13 - Removing and installing differential

### 13.1 - Removing and installing differential



#### Notes:

- ♦ General repair instructions =>Page **8**.
- ♦ Secure final drive to engine and gearbox support=>Page 39-95.
- ♦ Adjustments are required when replacing components marked 1)  
=>Adjustment overview Page **225**.

#### 1 Breather sleeve

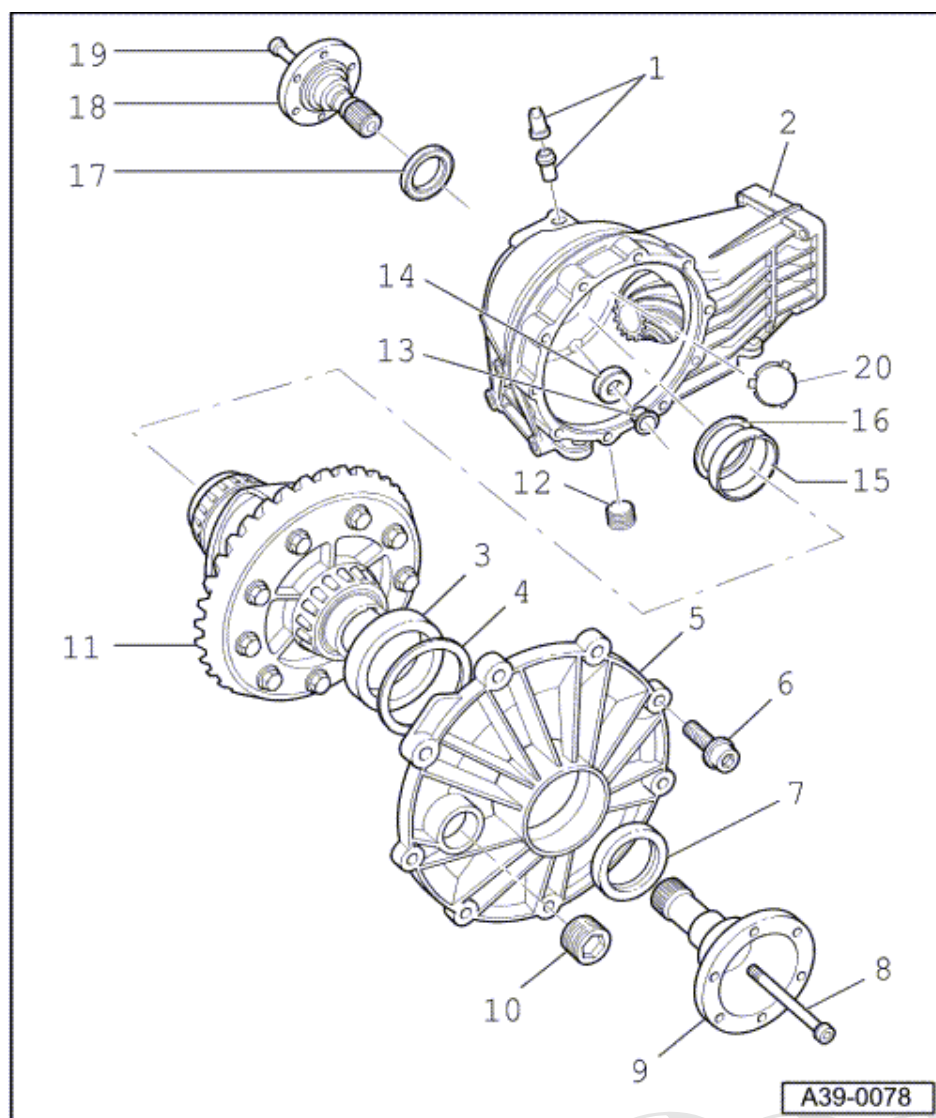
- ♦ With rubber valve
- ♦ Installation position => Fig. **3**

#### 2 Final drive housing 1)

- ♦ With drive pinion
- ♦ Removing and installing drive pinion



=&gt; Page 212

**3 Outer race for large taper roller bearing 1)**

- ♦ Driving out  
=>Fig. 210
- ♦ Driving in  
=>Fig. 210

**4 Shim "S1"**

- ♦ Note thickness
- ♦ Adjustment overview  
=> Page 225

**5 Cover for final drive 1)**

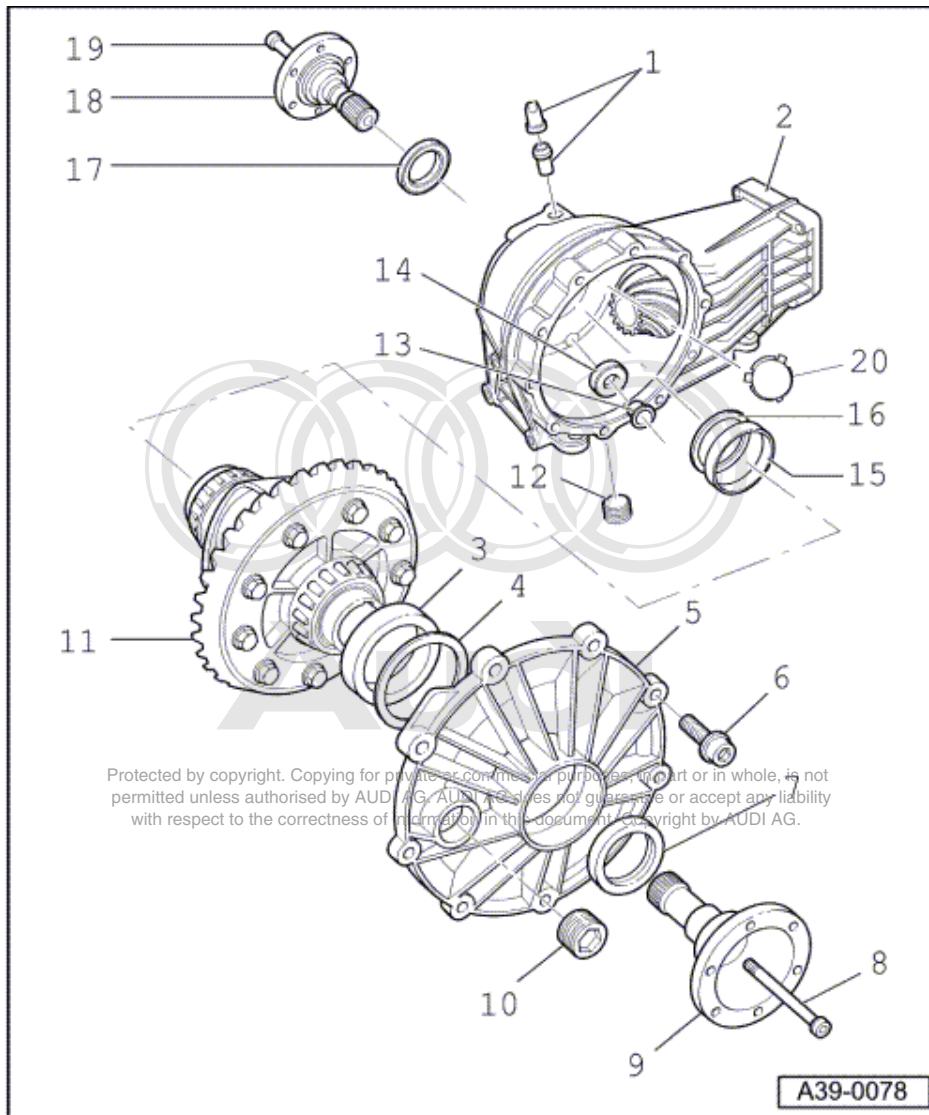
- ♦ With seal
- ♦ Renew O-ring
- ♦ Lubricate O-ring with oil when installing

**6 Torx bolt - 25 Nm****7 Seal, right**

- ♦ Renewing => Page 187

**8 Hexagon socket head bolt, 25 Nm**

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#### 9 Flange shaft, right

- ◆ Removing and installing  
=>Fig. 1

#### 10 Oil filler plug - 35 Nm

#### 11 Differential with crown wheel 1)

- ◆ Dismantling and assembling  
=> Page 203

#### 12 Oil drain plug - 35 Nm

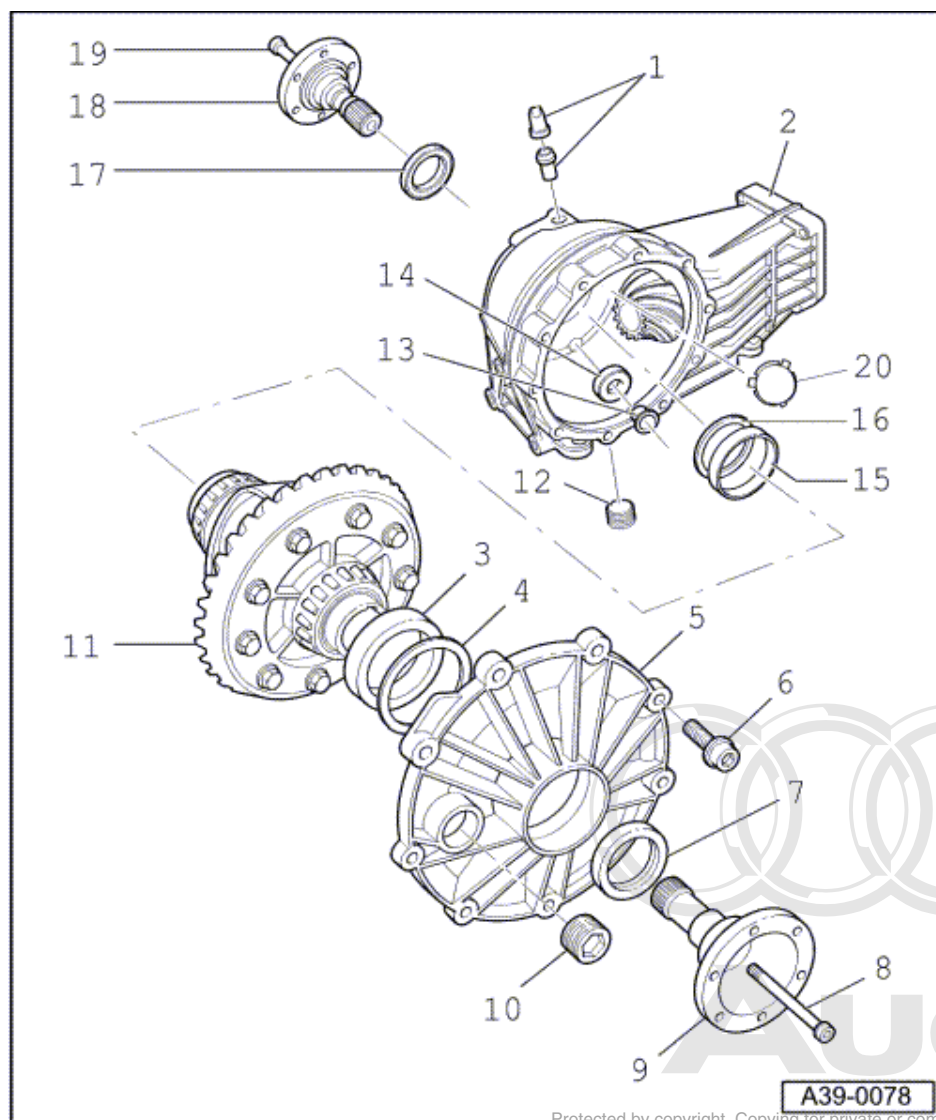
#### 13 Bush

- ◆ Holds magnet in position
- ◆ Knock-in onto stop

#### 14 Magnet

#### 15 Outer race for small taper roller bearing 1)

- ◆ Removing and installing  
=> Page 203



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**16 Shim "S2"**

- ◆ Note thickness
- ◆ Adjustment overview  
=> Page **225**

**17 Seal, left**

- ◆ Renewing => Page **187**

**18 Flange shaft, left**

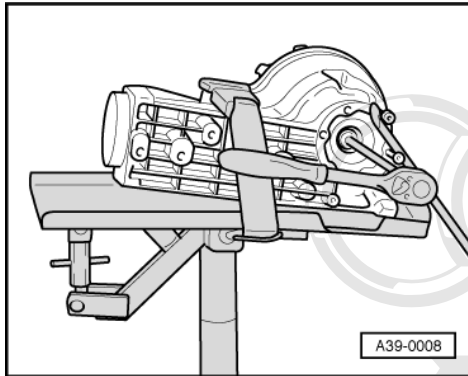
- ◆ Removing and installing  
=> Fig. **1**

**19 Hexagon socket head bolt,  
25 Nm**

**20 Cover**

- ◆ Installing => Fig. **2**

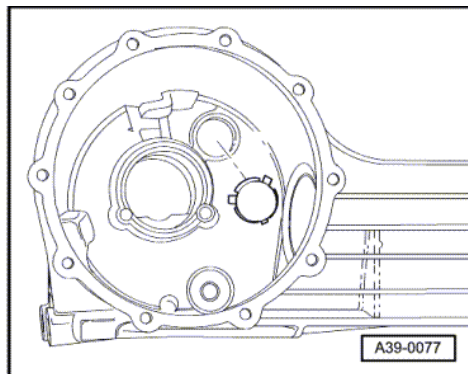




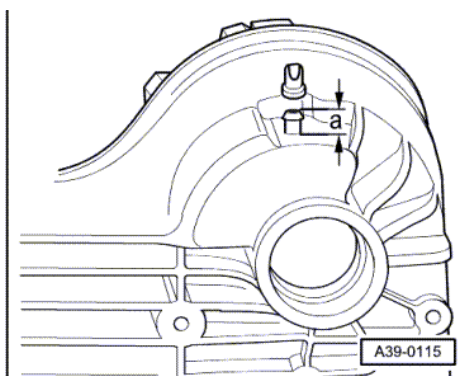
-> Fig.1 Removing and installing flange shaft

- To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Pull out flange shaft using the bolts already screwed in.

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-> Fig.2 Press cover onto stop



-> Fig.3 Position of breather sleeve

The breather sleeve should project 13 mm (distance "a") out of the housing after pressing in.

The slot in the rubber valve should be in line with the direction of travel.

### Removing and installing differential

- Rear final drive removed

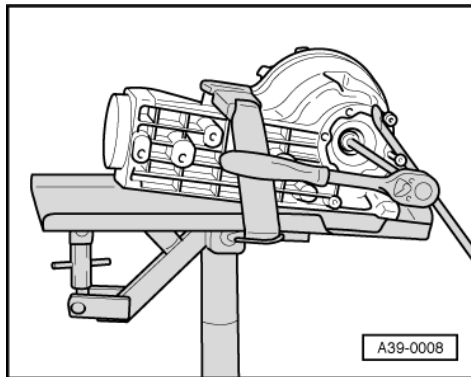


### Special tools, testers and auxiliary items

- ♦ Drip tray V.A.G 1306

### Removing

- Secure complete rear final drive to engine and gearbox support VW 540=>Page 186 .
- Place drip tray V.A.G 1306 underneath and drain oil.



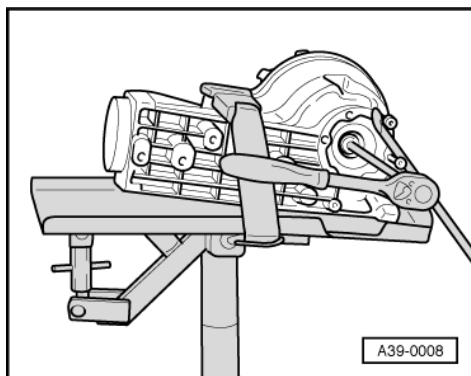
- -> Remove left and right-hand flange shafts.
- To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Mark flange shafts (for left and right sides).
- Pull out flange shaft using the bolts already screwed in.
- Unscrew securing bolts from cover for final drive.
- Take cover for final drive off axle housing and remove differential.

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### Installing

Installation is carried out in the reverse order, when doing this note the following:

- Insert differential.
- Renew O-ring for cover for final drive and oil when installing.
- Fit cover for final drive on final drive housing and tighten in diagonal sequence to 25 Nm.
- Fit new flange shaft oil seals
- =>Page 187 .
- Fill space between sealing and dust lips with multipurpose grease.



- -> Install flange shafts and tighten.
- Top-up gear oil in rear final drive and check oil level => Page 181 .

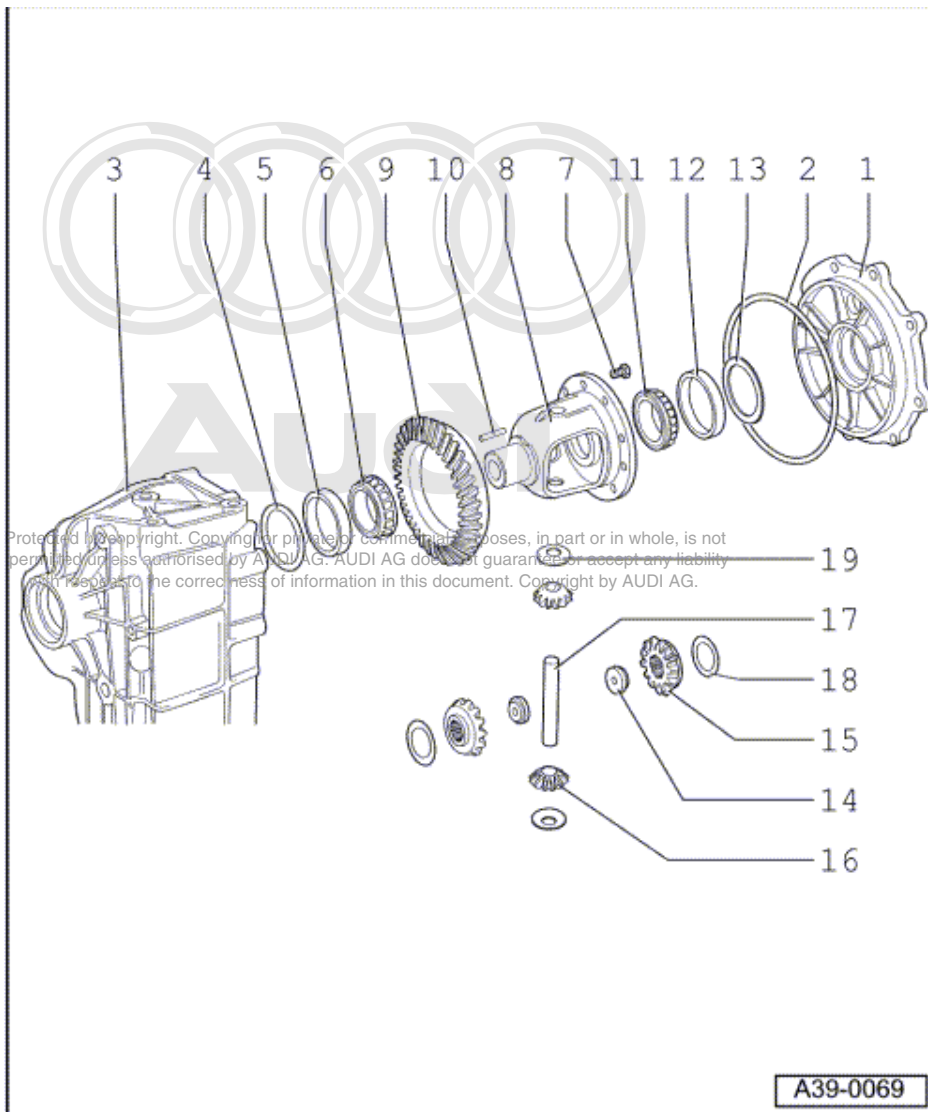


## 14 - Dismantling and assembling differential

### 14.1 - Dismantling and assembling differential

#### Special tools, testers and auxiliary items

- ◆ Drift VW 295
- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 408 A
- ◆ Press tool VW 412
- ◆ Press tool VW 442
- ◆ Press tool 40-21
- ◆ Thrust plate 40-105
- ◆ Thrust pad 2050
- ◆ Drift 3138
- ◆ Tapered roller bearing puller V.A.G 1582 and V.A.G 1582/6
- ◆ Two-arm puller Kukko 44/2



#### Notes:



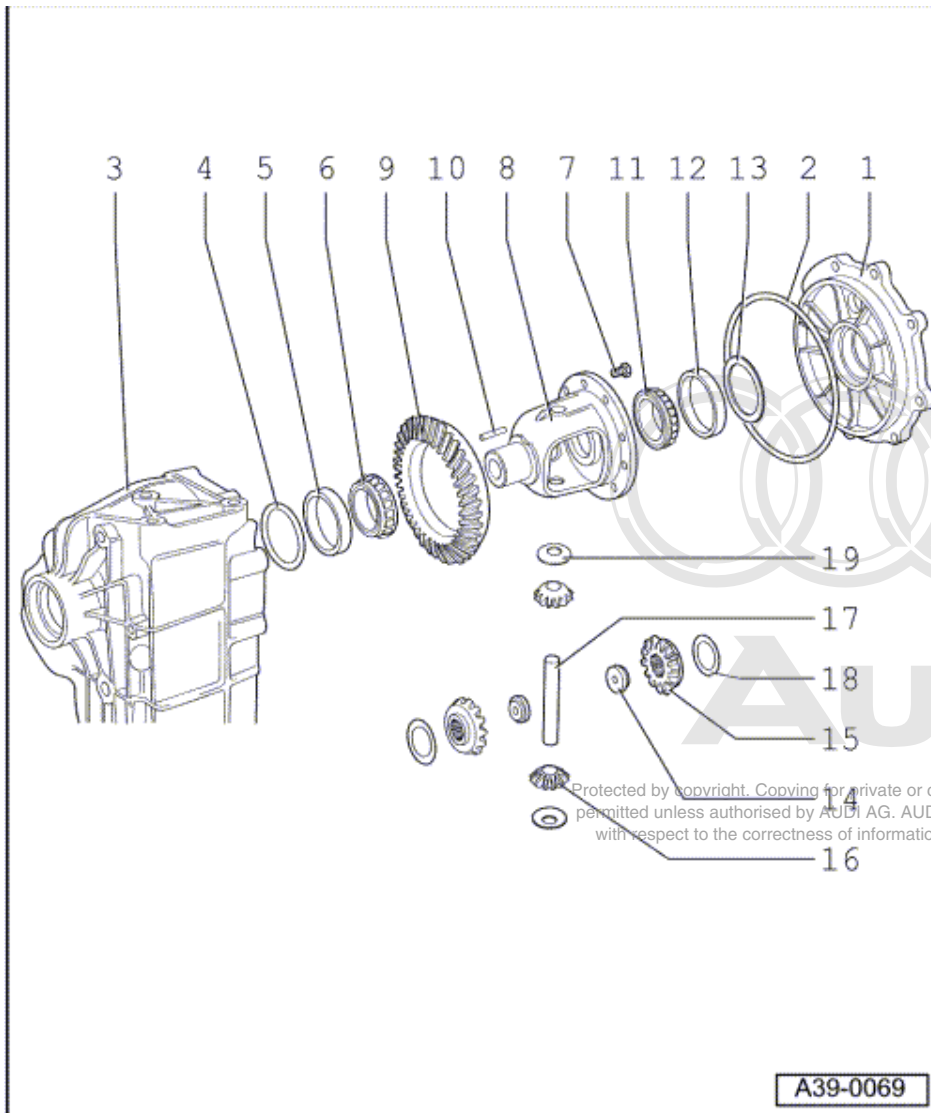
- ♦ General repair instructions =>Page **8** .
- ♦ Replace both taper roller bearings of the differential together. Use same make if possible.
- ♦ Adjustments are required when replacing components marked 1)  
=>Adjustment overview Page **225** .

**1 Cover for final drive 1)**

**2 O-ring**

- ♦ Renew
- ♦ Insert with oil

**3 Final drive housing 1)**



**4 Shim "S1"**

- ♦ Note thickness
- ♦ Adjustment overview  
=> Page **225**

**5 Outer race for small taper roller bearing 1)**

- ♦ Knocking out => Fig. **1**
- ♦ Pressing in=>Fig. **2**

**6 Inner race for small taper roller bearing 1)**

- ♦ Pulling out => Fig. **3**
- ♦ Pressing in => Fig. **4**

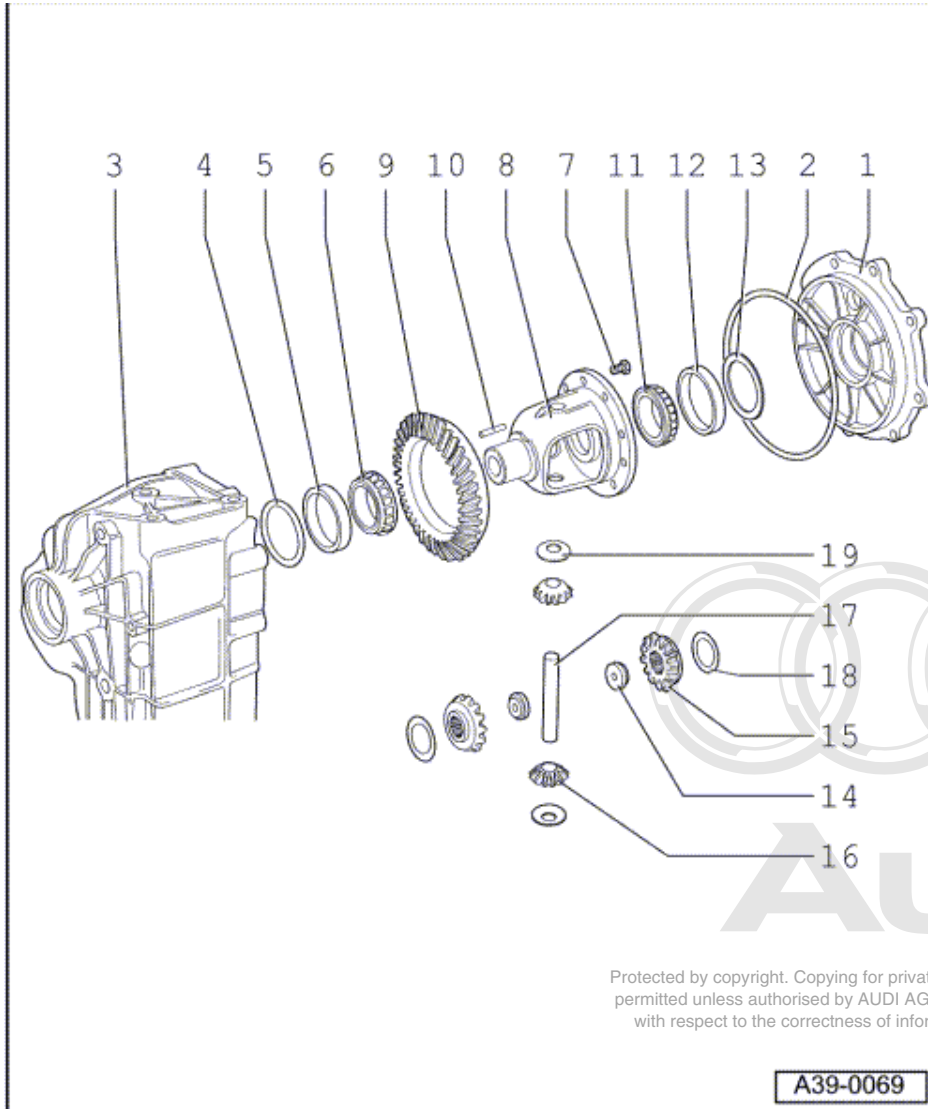
**7 Bolt - 60 Nm + turn 45°further**

- ♦ Renew

- ◆ Allocation

=> Parts catalogue

- ◆ Lightly tighten bolts then tighten diagonally to correct torque



## 8 Differential housing 1)

### 9 Crown wheel 1)

- ◆ Paired with drive pinion (final drive set)
- ◆ Select correct version according to code letters

=> Parts catalogue

- ◆ Drive off housing with a punch  
=> Fig. 9
- ◆ Installing on differential housing  
=> Fig. 10

## 10 Spring pin

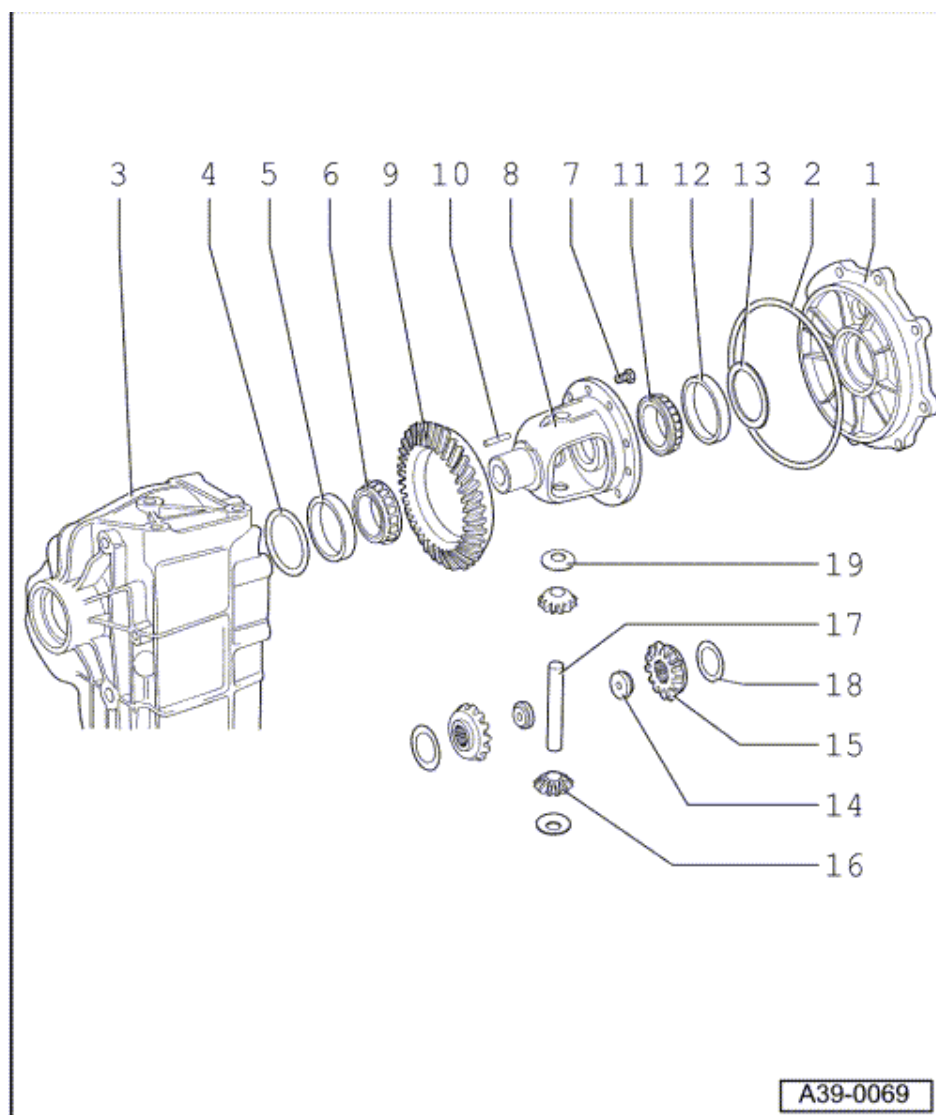
- ◆ For securing planet pinion axis shaft
- ◆ Drive in flush

## 11 Inner race for large taper roller bearing 1)

- ◆ Pulling off => Fig. 5



- ◆ Pressing on => Fig. 6



## 12 Outer race for large taper roller bearing 1)

- ◆ Driving out => Fig. 7
- ◆ Pressing in => Fig. 8

## 13 Shim "S2"

- ◆ Note thickness
- ◆ Adjustment overview  
=> Page 225

## 14 Threaded piece

## 15 Sun wheel

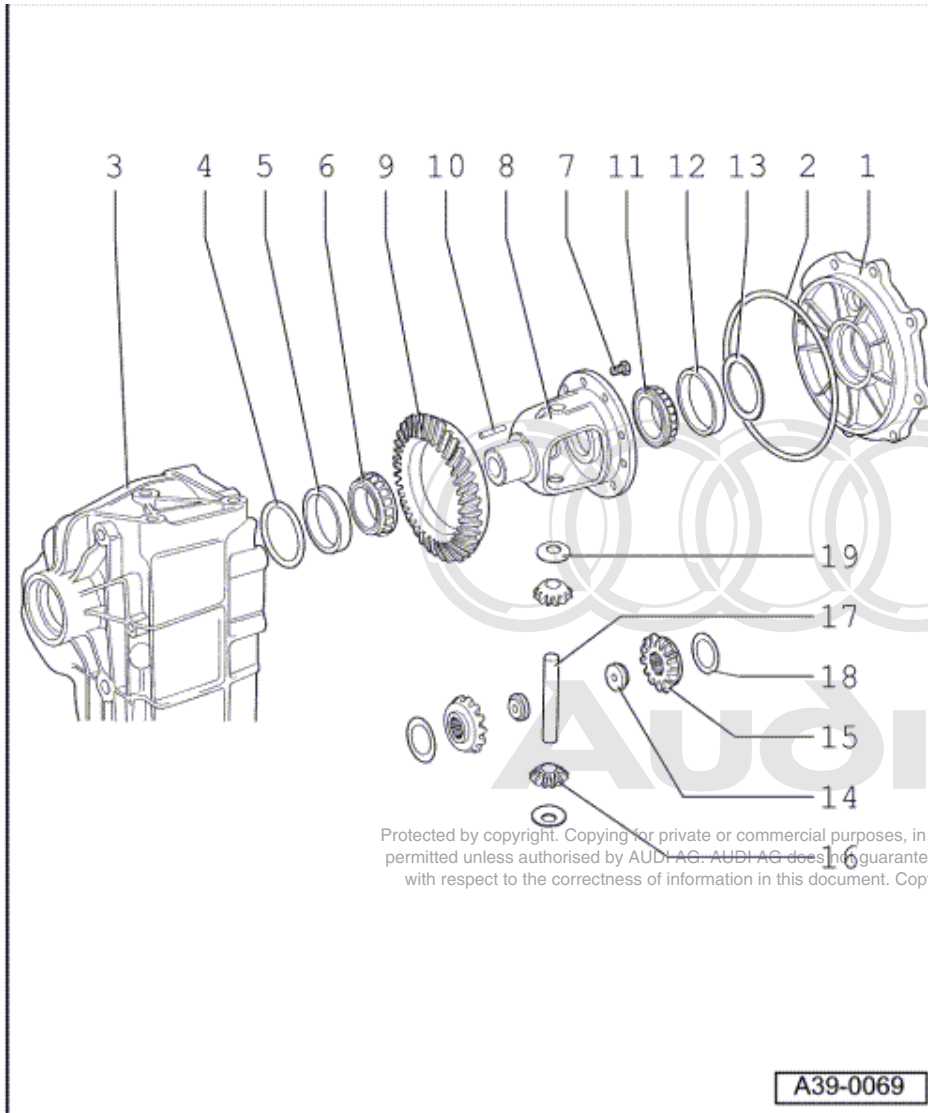
- ◆ Installing => Fig. 11
- ◆ Adjusting => Fig. 12

## 16 Planet pinion

- ◆ Installing => Fig. 11



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#### 17 Planet pinion axis shaft

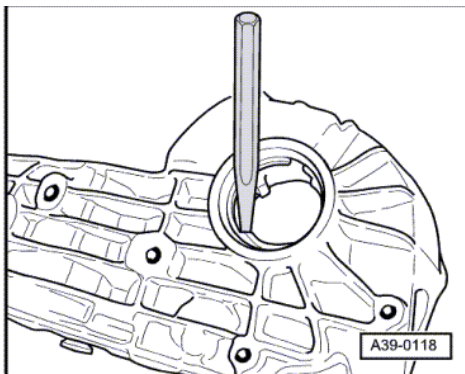
- ◆ Knock out with drift
- ◆ Drive in carefully so that the thrust washers are not damaged
- ◆ Secure with spring pin -item 10 -

#### 18 Shim

- ◆ Re-determining thickness => Fig. 12

#### 19 Thrust washer

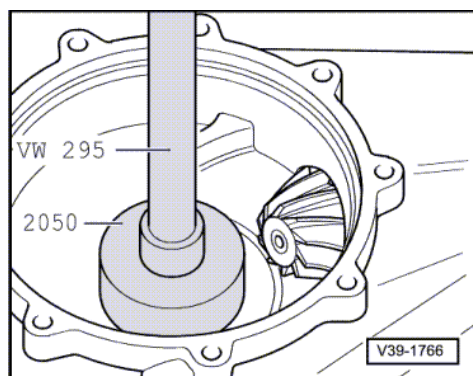
- ◆ Check for cracks.



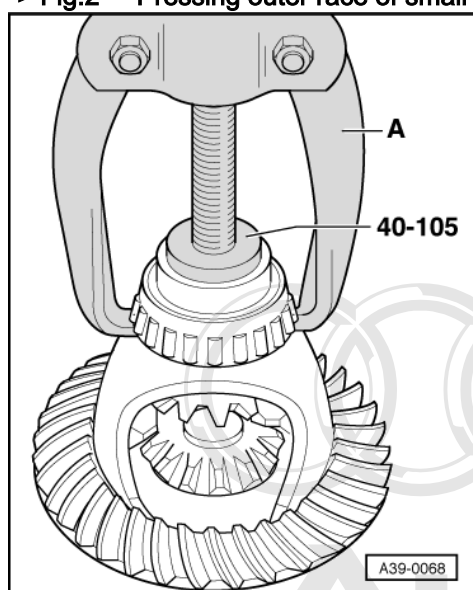


-> Fig.1 Knocking outer race of small taper roller bearing out of housing

- After removing check shims for damage.

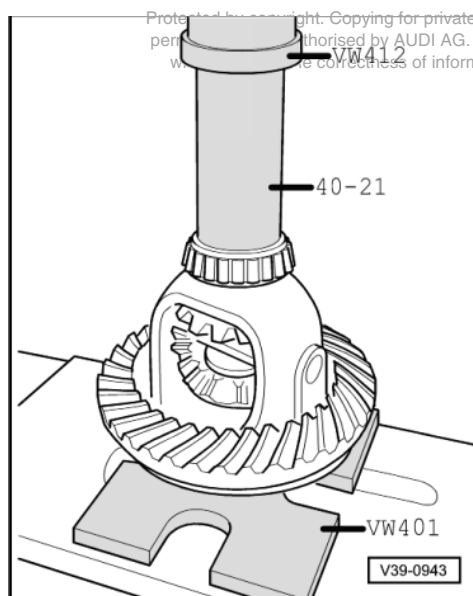


-> Fig.2 Pressing outer race of small taper roller bearing into housing (press against stop)



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

- A - Two arm puller, e.g. Kukko 44/2

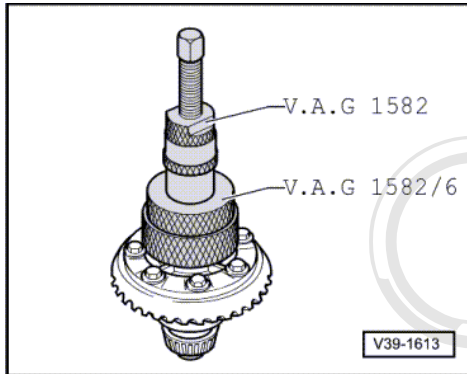




-> **Fig.4 Pressing on inner race for small taper roller bearing**

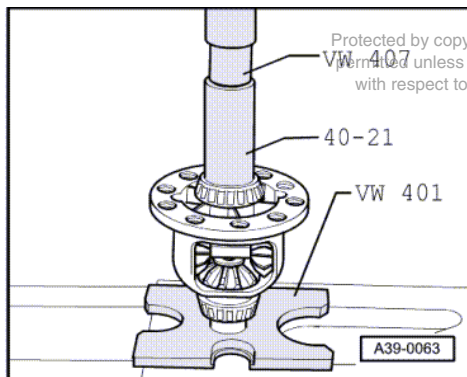
- Heat bearing to approx. 100 °C, fit in position and press home.

**Caution**  
Wear protective gloves.



-> **Fig.5 Pulling off inner race for large taper roller bearing**

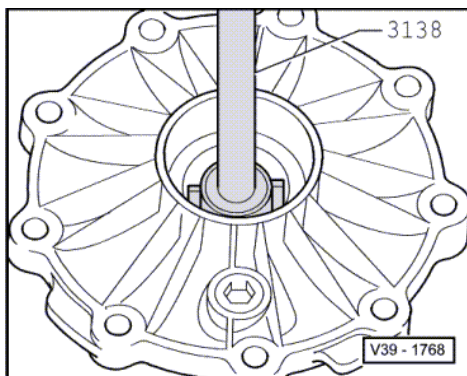
- Before fitting the extractor position press piece 40-105 on differential housing.



-> **Fig.6 Pressing on inner race for large taper roller bearing**

- Heat bearing to approx. 100 °C, fit in position and press home.

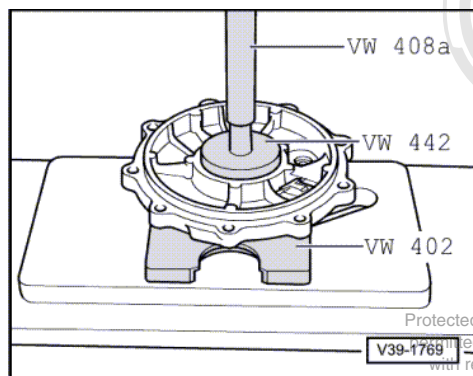
**Caution**  
Wear protective gloves.



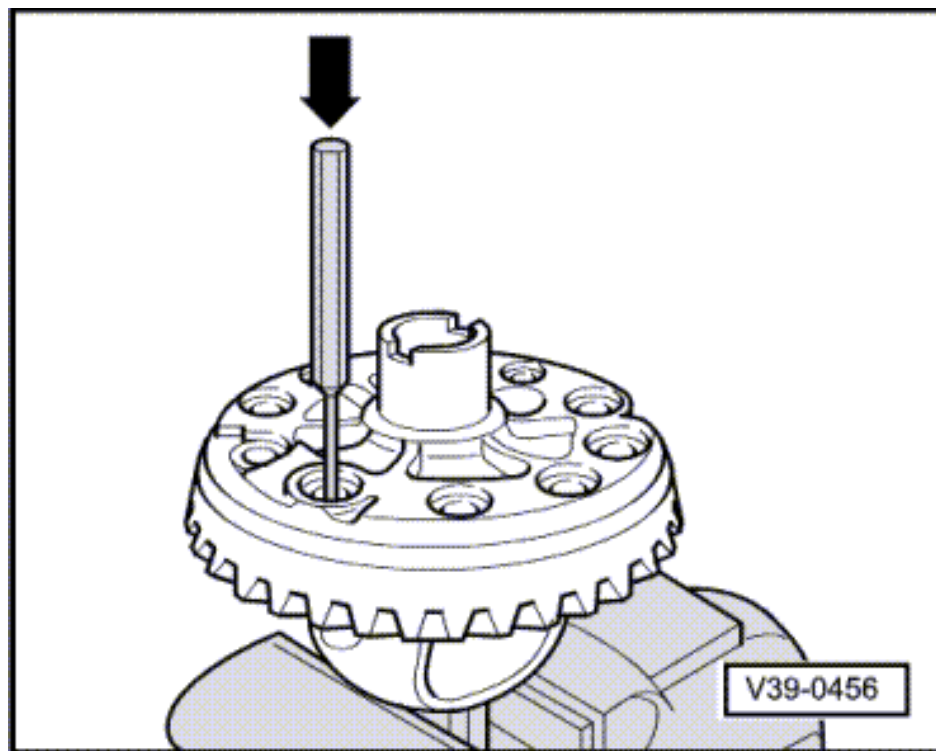


-> Fig.7 Driving outer race for large taper roller bearing out of cover

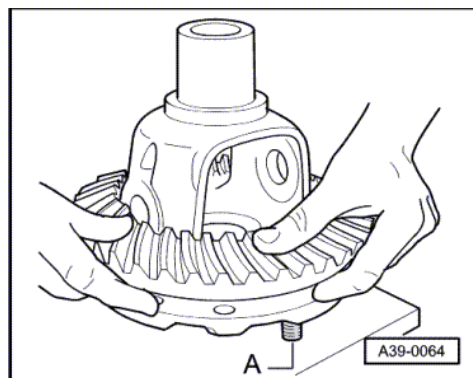
- After removing check shims for damage.



-> Fig.8 Pressing outer race for large taper roller bearing into cover



-> Fig.9 Driving crown wheel off housing

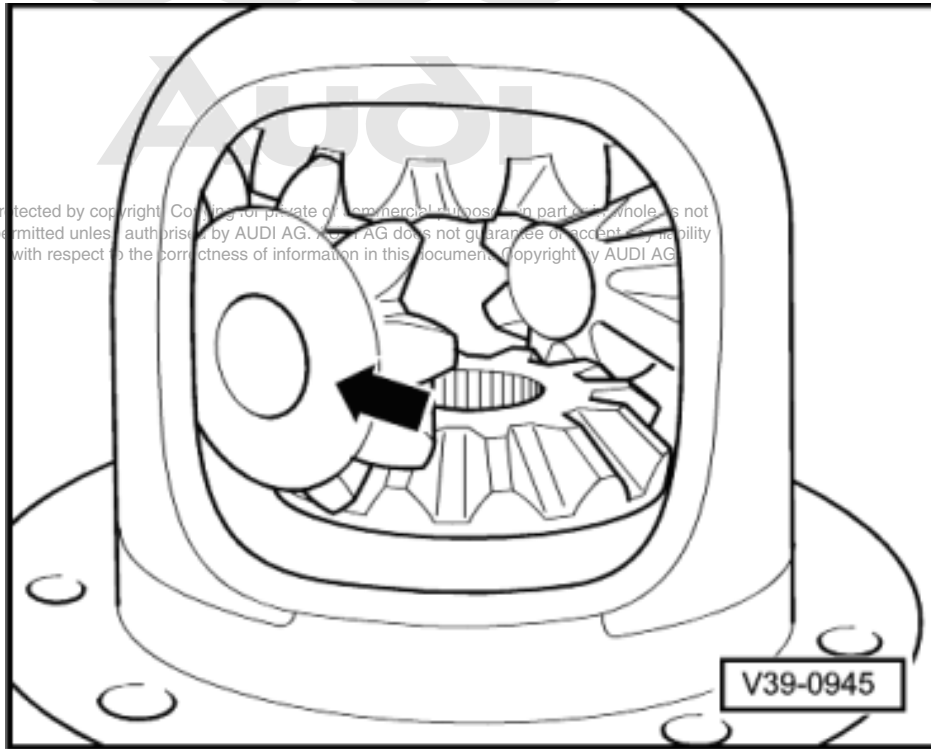




-> **Fig.10 Installing crown wheel**

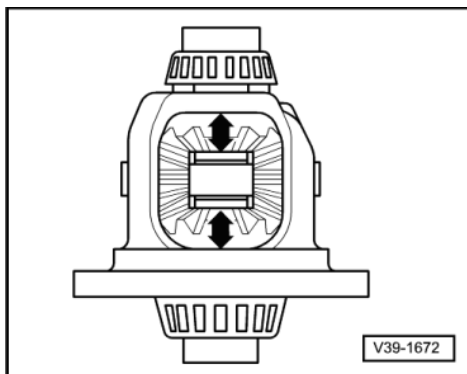
- Use 2 centring pins -A- (local manufacture) as a guide.
- Heat crown wheel to approx. 100 °C and install.

**Caution**  
 Wear protective gloves.



-> **Fig.11 Installing sun wheels and planet pinions**

- If the sun wheels have been renewed, measure and select new shims => Fig. 12 .
- Insert sun wheels with the measured shims.
- Install planet pinions spaced 180° apart, and rotate into position -arrow-.
- Fit and align thrust washers.
- Insert threaded pieces.
- Drive planet pinion shaft into final position and secure.





-> Fig.12 Adjusting differential bevel gears

- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet pinions spaced 180° apart, with thrust washers.

**Note:**

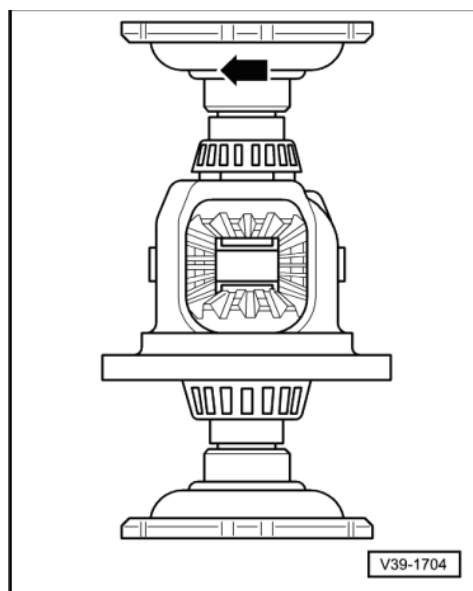
*Do not now interchange bevel gears and thrust washers.*

- Drive in planet pinion axis shaft.
- Press planet pinions outwards.
- Press sun wheels in direction indicated (arrows), and check the amount of play.
- Determine the thickest shims for the sun wheels (on each side) which can still just be inserted.
  - The same thickness of shim should be used on both sides.
- Identify shims according to the table.  
Part numbers.

=> Parts catalogue

The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00



**Note:**

*-> The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears -arrow-.*

## 15 - Removing and installing and dismantling and assembling drive pinion

### 15.1 - Removing and installing and dismantling and assembling drive pinion

#### Special tools, testers and auxiliary items

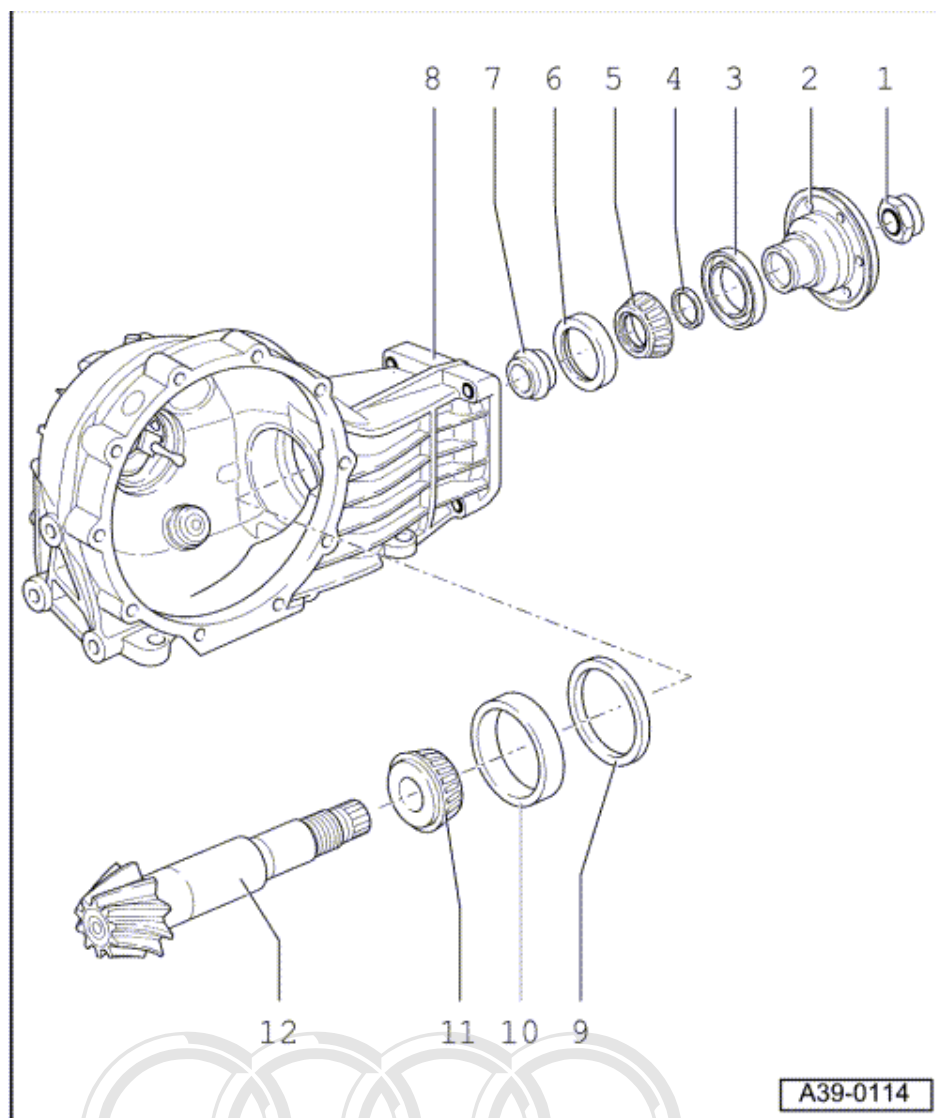
- ♦ Engine/gearbox jack V.A.G 1383 A
- ♦ Universal support V.A.G 1359/2
- ♦ Drive flange fitting appliance VW 391

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- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 408 A
- ◆ Press tool VW 412
- ◆ Support rails VW 457
- ◆ Mandrel VW 460/2
- ◆ Thrust pieces for drive pinion bearing VW 470/1
- ◆ Engine and gearbox support VW 540
- ◆ Multi-purpose tool VW 771 and 771/37
- ◆ Thrust plate 30-205
- ◆ Installing ring 2003/3
  
- ◆ Thrust plate 3005
- ◆ Punch 3026
- ◆ Retainer 3028
- ◆ Thrust pad 3062
- ◆ Drift 3138
- ◆ Drift sleeve 3143
- ◆ Fitting appliance 3253 with 3253/3 and 3253/4
- ◆ Separating tool Kukko 17/2
- ◆ Two-arm puller Kukko 21/7
- ◆ Counter-support Kukko 22/2
- ◆ Torque gauge 0 ... 600 Ncm
- ◆ Socket attachment (long) 36 mm A/F

**Notes:**

- ◆ General repair instructions=>Page 8 .
- ◆ Secure final drive to engine and gearbox support=>Page 39-95.
- ◆ Replace both taper roller bearings together. Use same make if possible.
- ◆ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- ◆ Removing differential=>Page 197
- ◆ Adjustments are required when replacing components marked 1)  
=>Adjustment overview Page 225 .

**1 Nut**

- ◆ Removing => Fig. 1
- ◆ Installing => Fig. 15
- ◆ Measuring friction torque => Fig. 16
- ◆ Securing => Fig. 17

**2 Flange for propshaft**

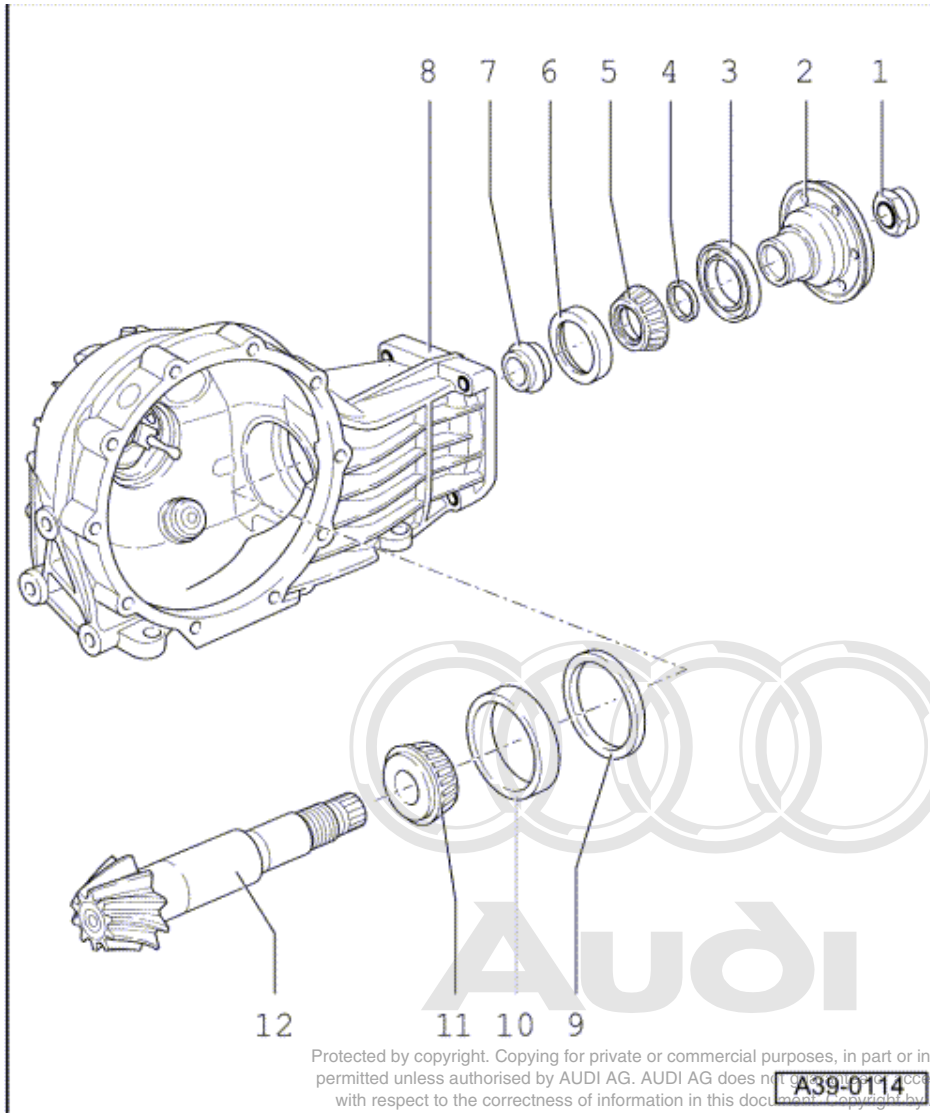
- ◆ Removing => Fig. 2
- ◆ Installing => Fig. 14

**3 Oil seal**

- ◆ Removing => Fig. 2
- ◆ Driving in => Fig. 13

**4 O-ring**

- ◆ Renew
- ◆ Lubricate with gearbox oil when installing => Fig. 12



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#### 5 Inner race for small taper roller bearing 1)

- ◆ Pressing out drive pinion => Fig. 4
- ◆ Installing => Fig. 11

#### 6 Outer race for small taper roller bearing 1)

- ◆ Pulling out => Fig. 5
- ◆ Pressing in => Fig. 10

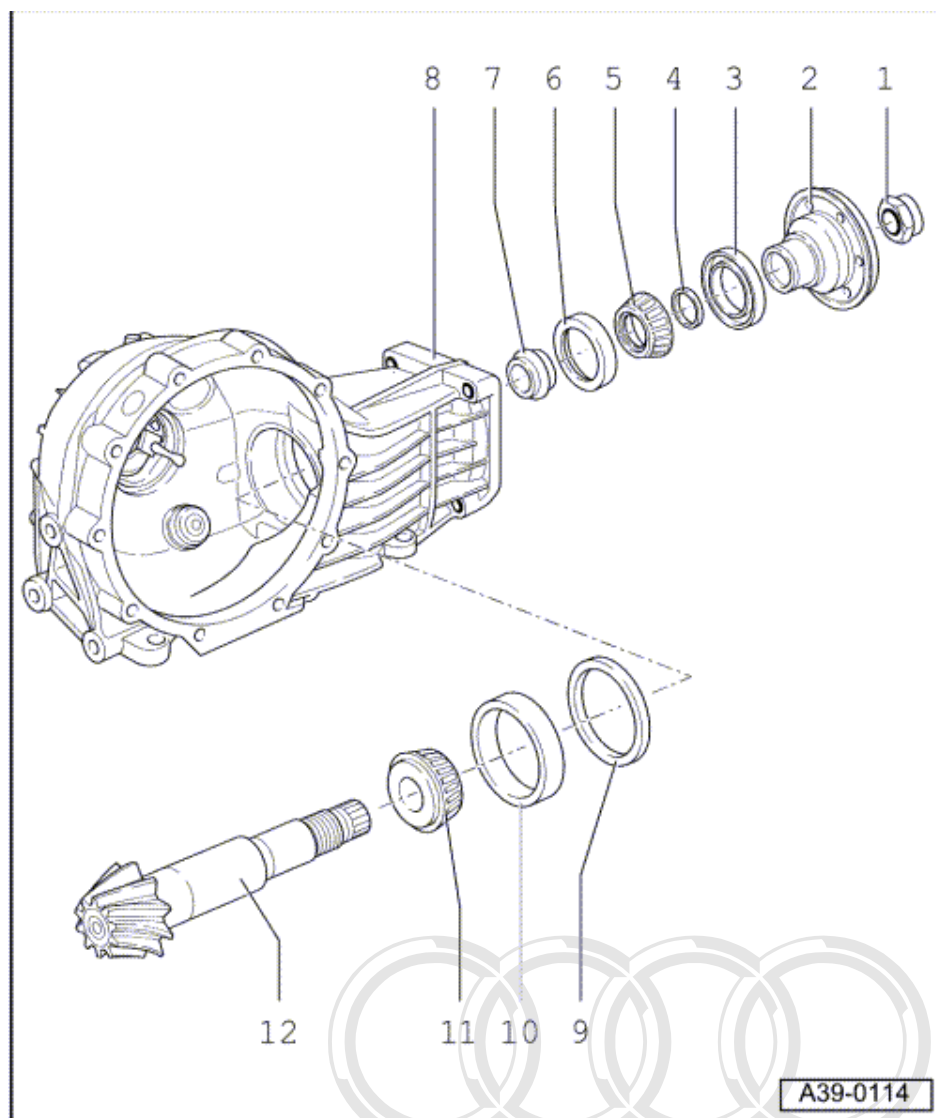
#### 7 Spacer sleeve 1)

- ◆ Renew

#### 8 Final drive housing 1)

#### 9 Shim "S3"

- ◆ Note thickness
- ◆ Adjustment overview  
=> Page 225



**10 Outer race for large taper roller bearing 1)**

- ◆ Driving out => Fig. 6
- ◆ Pulling in => Fig. 9

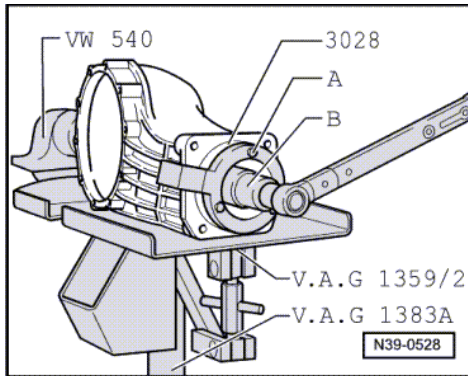
**11 Inner race for large taper roller bearing 1)**

- ◆ Pulling off => Fig. 7
- ◆ Pressing on => Fig. 8

**12 Drive pinion 1)**

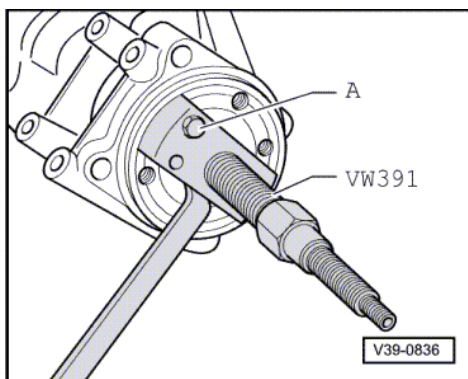
- ◆ Is mated with crown wheel, always renew together as a set

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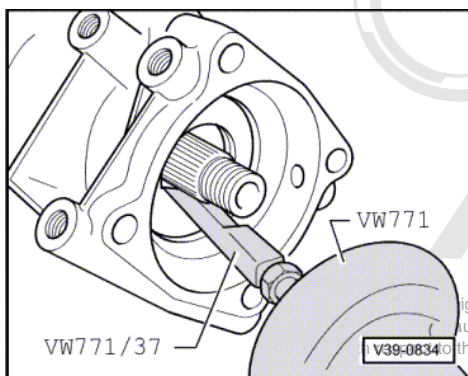
-> Fig.1 Removing nut for drive pinion

- Attach retainer 3028 with two M8 x 30 hexagon bolts -A-.
- B - Socket attachment (long) 36 mm A/F
- The final drive must be supported when loosening the nuts (e.g. using universal support V.A.G 1359/2 in combination with gearbox jack V.A.G 1383 A).



-> Fig.2 Pulling flange for propshaft off drive pinion

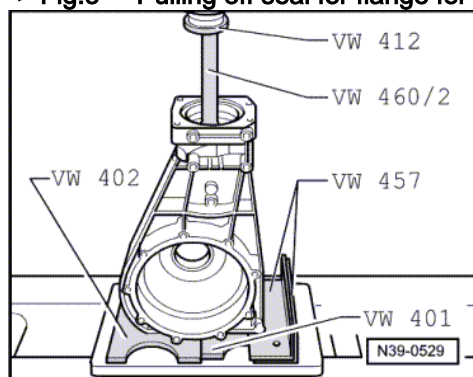
- Screw two M8 x 30 hexagon bolts -A- into the flange.



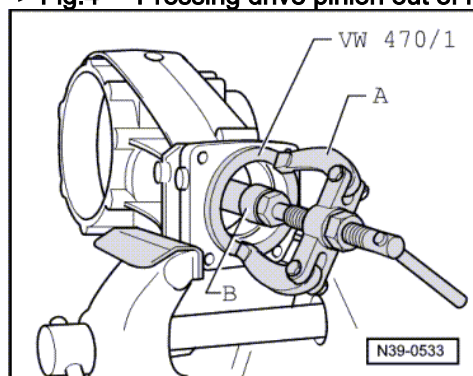
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-> Fig.3 Pulling off seal for flange for propshaft

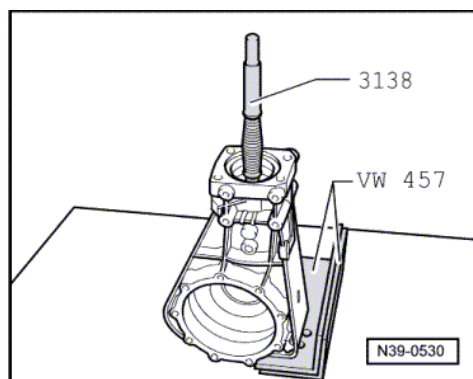


-> Fig.4 Pressing drive pinion out of inner race for small taper roller bearing



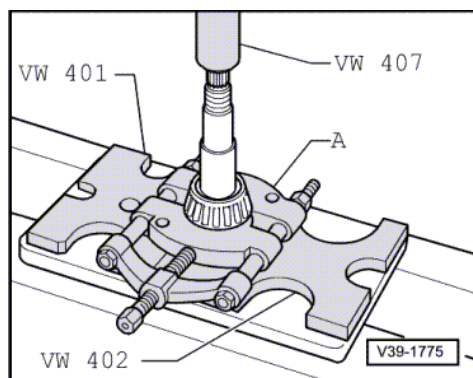
-> Fig.5 Pulling out outer race for small taper roller bearing

- A - Counter support e.g. Kukko 22/2
- B - Internal puller 46 ... 58 mm, e.g. Kukko 21/7



-> Fig.6 Driving out outer race for large taper roller bearing

- After removing check shims for damage.



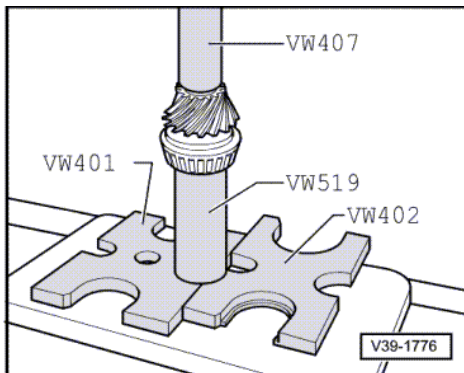
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-> **Fig.7 Pressing inner race for large taper roller bearing off drive pinion**

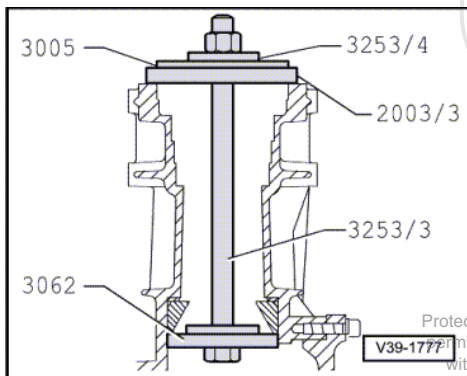
A - Separating device 22 ... 115 mm, e.g. Kukko 17/2



-> **Fig.8 Pressing inner race for large taper roller bearing onto drive pinion**

- Heat bearing to approx. 100 °C, fit in position and press home.

**Caution**  
Wear protective gloves.

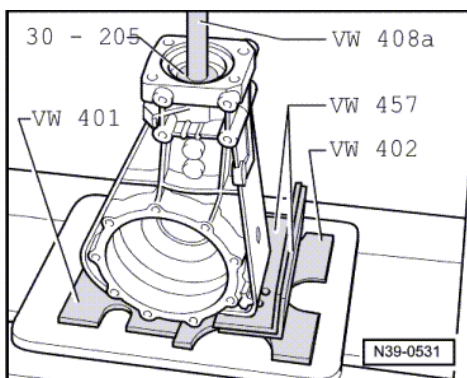


-> **Fig.9 Pulling in outer race for large taper roller bearing**

- Insert predetermined shim "S3" for drive pinion  
=>Page **227** .

**Note:**

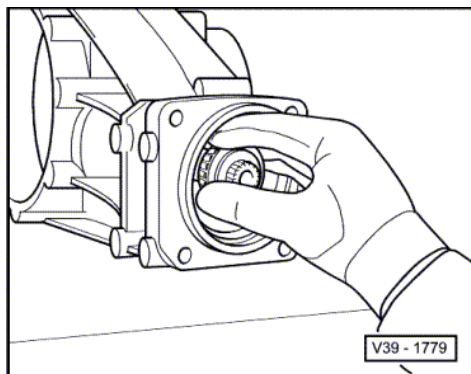
*Inscription "Oben" faces the nut of the puller with thrust washer 3253/4.*





-> Fig.10 Pressing in outer race for small taper roller bearing

- Lubricate outer race with oil and fit using press tool VW 408 A and thrust plate 30-205.



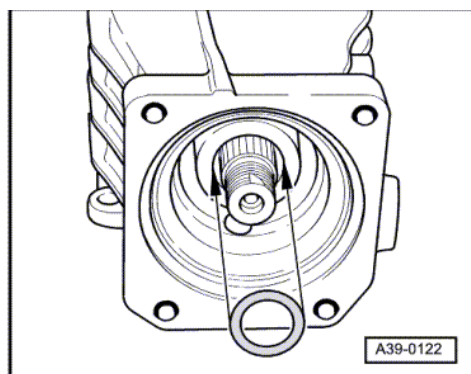
-> Fig.11 Pressing on small taper roller bearing inner race

- Insert drive pinion with new spacer sleeve.

**Caution**  
Wear protective gloves.

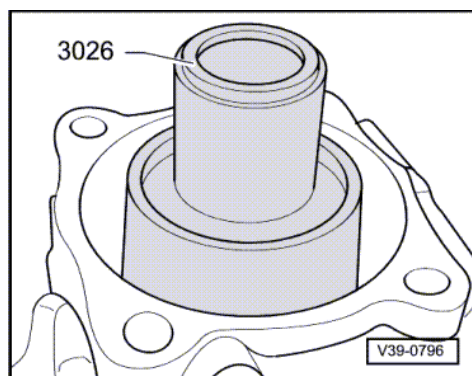
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- Heat inner race for small taper roller bearing to approx. 100 °C and fit onto drive pinion.
- Press up drive pinion and insert bearing with thrust plate 40-21 onto stop.



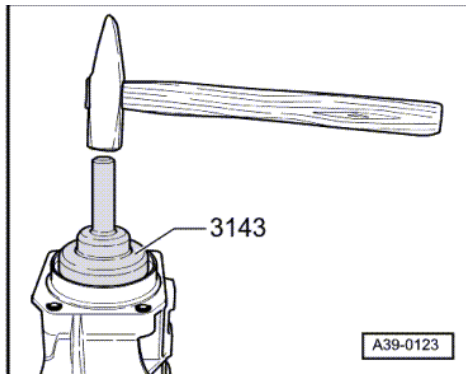
-> Fig.12 Installing O-ring

- Lubricate O-ring with gearbox oil and install.



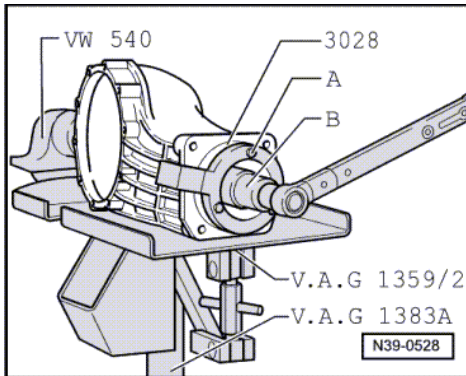
-> **Fig.13 Driving in seal for flange for propshaft**

- Lightly oil outer circumference of seal.
- Fill space between sealing and dust lips with multipurpose grease.
- Drive in seal onto stop with drift 3026.



-> **Fig.14 Installing flange**

- Knock flange for propshaft onto drive pinion until the nut can be fitted.

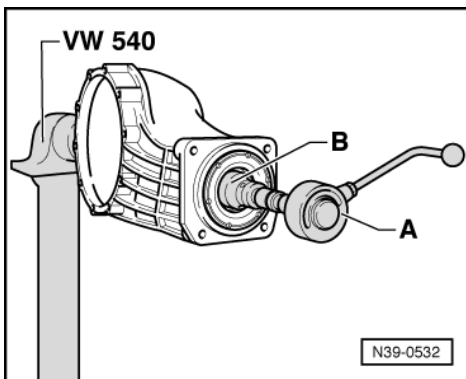


-> **Fig.15 Tightening nut for drive pinion and measuring friction torque**

- Screw in two M8 x 30 hexagon bolts -A-.
- B - Socket attachment (long) 36 mm A/F
- The final drive must be supported when tightening the nut (e.g. using universal gearbox attachment V.A.G 1359/2 in conjunction with gearbox jack V.A.G 1383 A).

**Note:**

*Increase tightening torque slowly and check friction torque at regular intervals, if the specified friction torque is exceeded, the spacer sleeve must be renewed and the adjustment repeated. A spacer sleeve which has been compressed too much cannot be reused.*



**-> Fig.16 Measuring friction torque**

With torque gauge, 0 ... 600 Ncm, commercially available

B - Socket attachment, 36 mm A/F

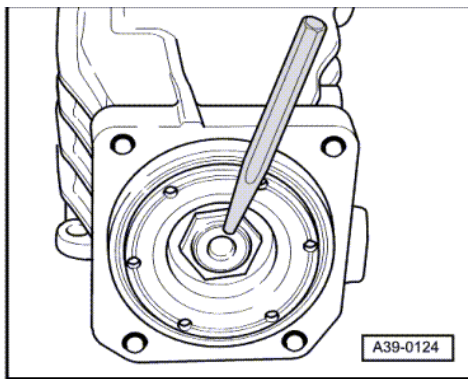
**Note:**

*Use reducer 3/4 " to 1/2 " if necessary.*

- The following frictional torques should be set:

New bearings	Used bearings <sup>1)</sup>
200 ... 250 Ncm	30 ... 60 Ncm

- 1) run at least 50 km (30 miles)

**-> Fig.17 Securing drive pinion nut**

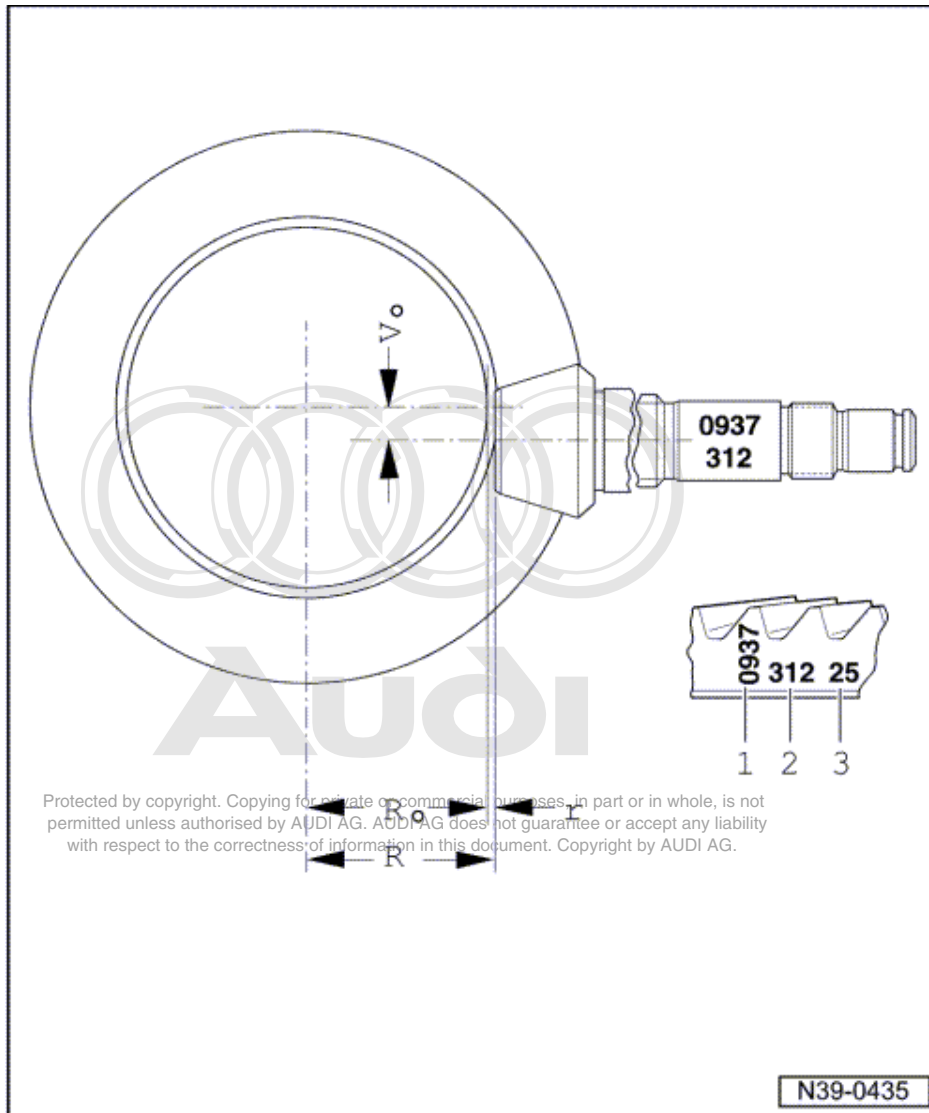
- Peen drive pinion nut with a punch.
- Then measure radial run-out on flange for propshaft and mark => Page 193 .

**16 - Adjusting drive pinion and crown wheel****16.1 - Adjusting drive pinion and crown wheel****General notes:**

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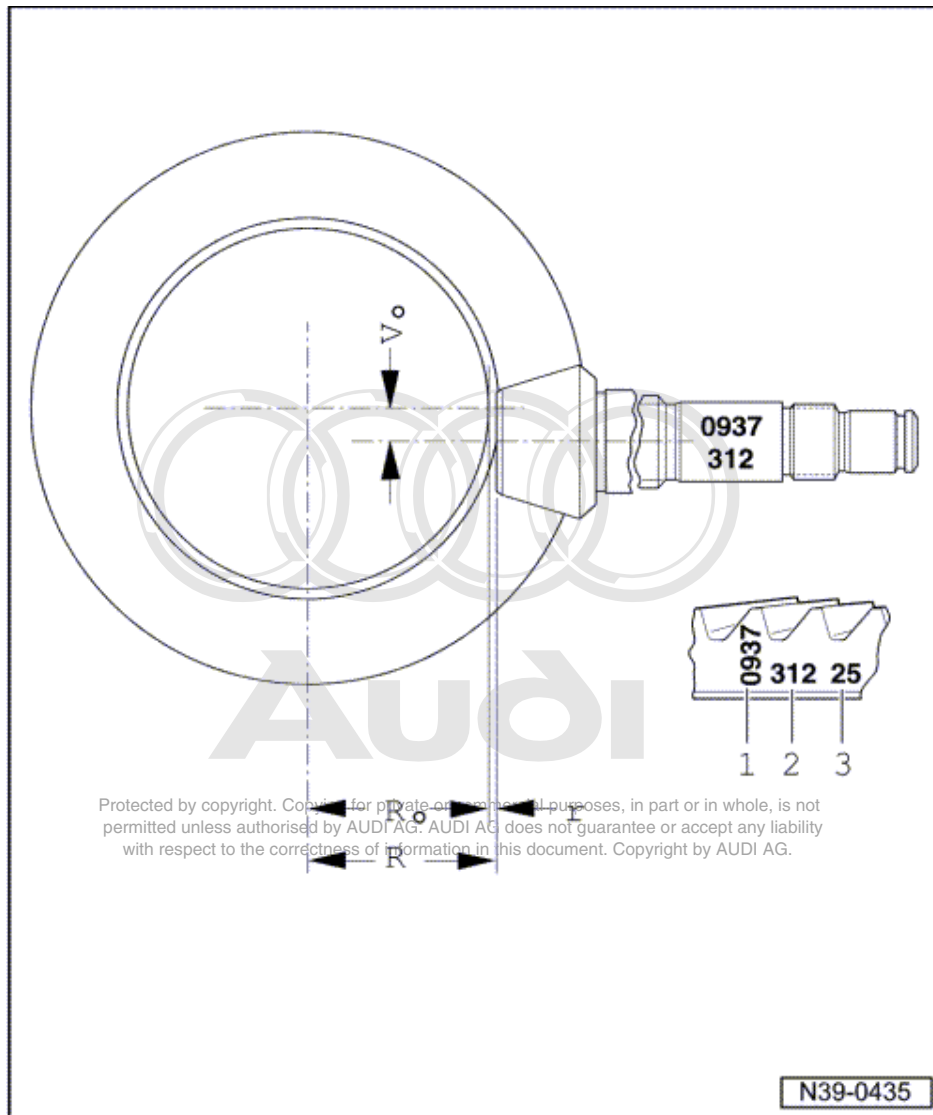
- ♦ Careful adjustment of the drive pinion and crown wheel is important for the service life and smooth running of the final drive. For this reason, the drive pinion and crown wheel are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions 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.
- ♦ The deviation (tolerance) "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) may only be replaced together as a matched pair.
- ♦ Observe the general repair instructions for taper roller bearings and shims.
- ♦ Maximum care and cleanliness are essential for achieving good results when performing repairs and taking measurements.

## 16.2 - Adjusting and marking of gear sets



- 1 Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.
- 2 Gear set pairing number (312).
- 3 Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies  
r = 0.25 mm

Ro - Length of master gauge used for test machine "Ro".  
Ro -Crown wheel = 57.50 mm



**R - Actual distance between centre axis of crown wheel and face of drive pinion at point with quietest running for this gear set.**

$$R = R_o + r$$

**Vo - Hypoid offset**

### 16.3 - Recommended sequence for readjusting final drive set

The following work sequence is recommended to save time when the drive pinion and crown wheel have to be adjusted:

- 1.) Determine total shim thickness "Stotal" for "S1" + "S2" for the specified preload for taper roller bearings for differential.
- 2.) Determine shim thickness "S3" to reproduce the installation position for the drive pinion determined on the test machine in production.
- 3.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash exists between crown wheel and drive pinion.

**Note:**

Overview of components and shims =>Page **226**.

## 16.4 - Adjustment overview

**Note:**

*If repairs have been carried out on the final drive it is only necessary to adjust the drive pinion or final drive set if components have been renewed which have a direct effect on the adjustments of the final drive. Refer to the following table to avoid unnecessary adjustments:*

Part renewed: ▼	to be adjusted:		
	Crown wheel "S1"+"S2" 1) => Page <b>233</b>	Drive pinion "S3" 1) via deviation "r" => Page <b>227</b>	Check backlash => Page <b>235</b>
Final drive housing	X	X	X
Differential housing	X		X
Taper roller bearing for drive pinion		X	X
Taper roller bearing for differential	X		X
Final drive set 2)	X	X	X
Cover for differential	X		X

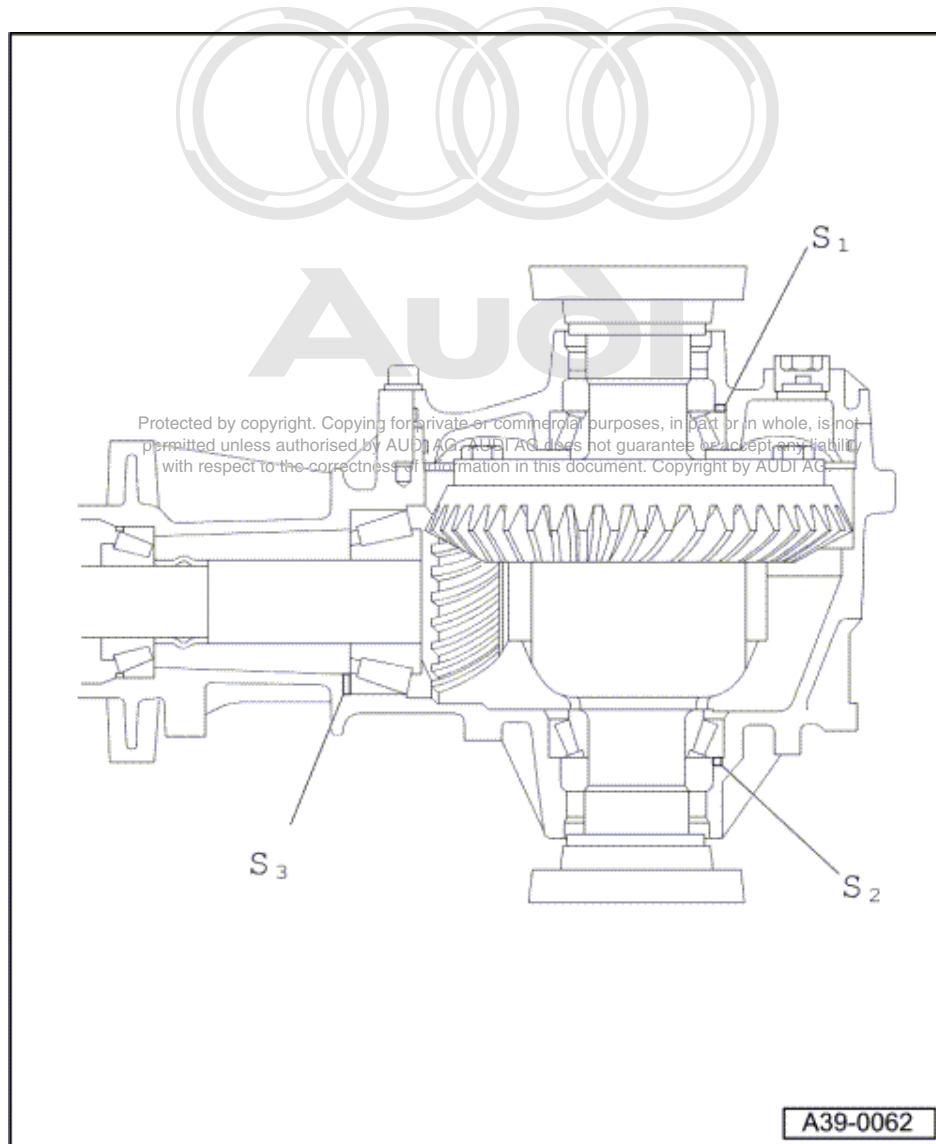
- 1) Shims; installation position => Page **226**.
- 2) Drive pinion and crown wheel; only renew together.

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## 16.5 - Position of shims



### Note:

*Adjustment overview when renewing individual components of final drive*

=>Page **225**.

- S1 - Adjustment shim for crown wheel in cover for final drive**
- S2 - Adjustment shim for crown wheel in final drive housing**
- S3 - Adjustment shim for drive pinion in final drive housing**

### Special tools, testers and auxiliary items

- ♦ Engine/gearbox jack V.A.G 1383 A
- ♦ Universal support V.A.G 1359/2
- ♦ Universal mandrel VW 385/1
- ♦ Centring disc VW 385/2
- ♦ Centring disc VW 385/3
- ♦ Measuring plunger VW 385/14
- ♦ Dial gauge extension VW 385/15
- ♦ Measuring plate VW 385/17
- ♦ Master gauge VW 385/30
- ♦ End dimension plate VW 385/33



- ◆ Universal dial gauge bracket VW 387
- ◆ Measuring lever VW 388
- ◆ Press plate VW 401
- ◆ Press plate VW 402
  
- ◆ Press tool VW 408 A
- ◆ Support rails VW 457
- ◆ Crown wheel adjusting appliance VW 521/4
- ◆ Crown wheel adjusting appliance VW 521/8
- ◆ Engine and gearbox support VW 540
- ◆ Thrust plate 30-205
- ◆ Installing ring 2003/3
- ◆ Thrust plate 3005
- ◆ Retainer 3028
- ◆ Thrust pad 3062
- ◆ Fitting appliance 3253 with 3253/3 and 3253/4
- ◆ Dial gauge extension 30 mm
- ◆ Dial gauge
- ◆ Torque gauge 0 ... 600 Ncm

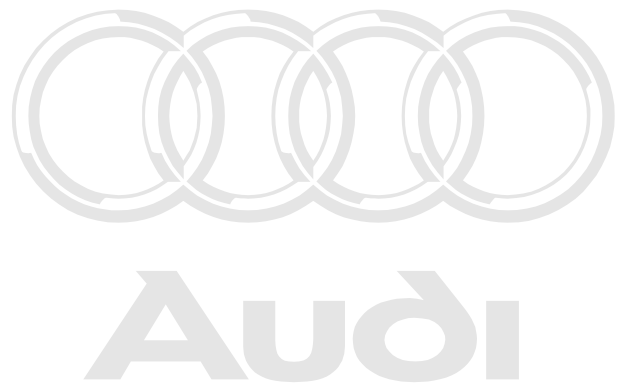
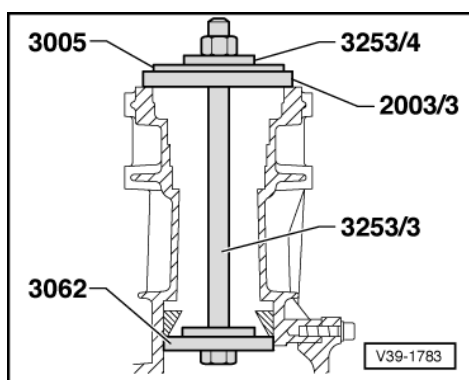
## 16.6 - Adjusting drive pinion

### Notes:

- ◆ Before adjusting drive pinion, adjust crown wheel (determine total shim thickness "Stotal" for shims "S1" + "S2")=>Page 233 .
- ◆ The drive pinion only has to be readjusted if the final drive set (crown wheel and drive pinion), the taper roller bearings for the drive pinion or the final drive housing are renewed. Adjustment overview=>Page 225 .
- ◆ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.

### Determine thickness of shim "S3"

(Setting preload of taper roller bearing for drive pinion)

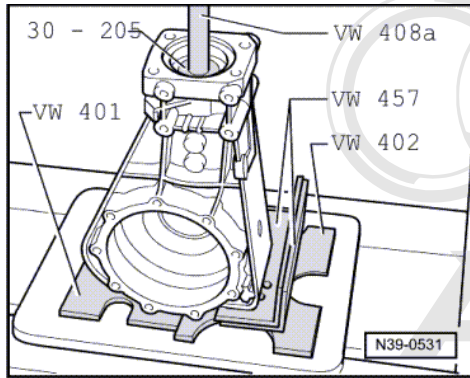


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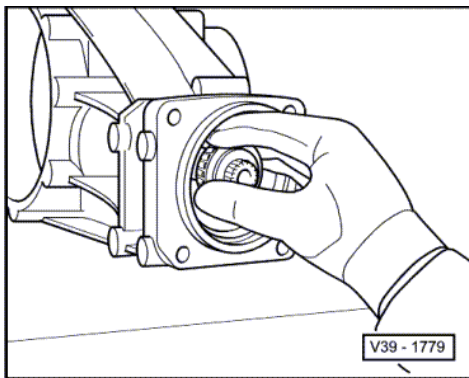
- Mount final drive on repair stand =>Page 186 .
- -> Pull outer race of large taper roller bearing into housing (without shim).

### Note:

*Inscription "Oben" with thrust washer 3253/4 faces the nut of the puller.*



- -> Pull outer race for small taper roller bearing into housing.
- Lubricate outer race with oil and fit using press tool VW 408-A and thrust plate 30-205.

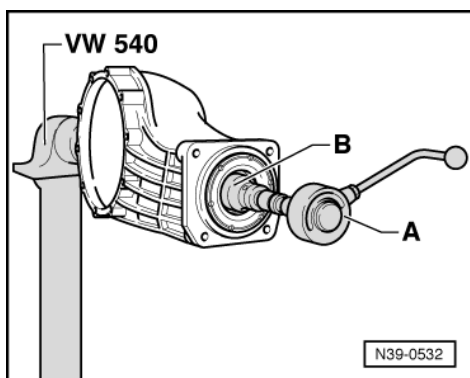


- -> Insert drive pinion without spacer sleeve.
- Heat inner race for taper roller bearing to approx. 100 °C and fit onto drive pinion.

Caution  
Wear protective gloves.

**Notes:**

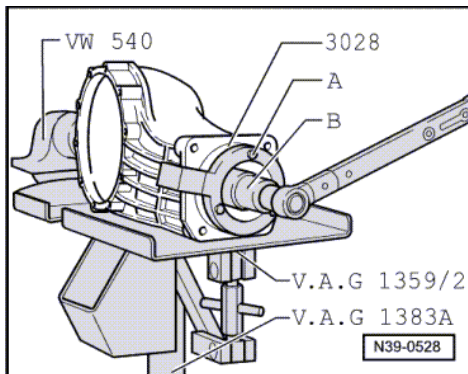
- ♦ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- ♦ Only install spacer sleeve for final frictional torque measurement (after determining shim "S3").



- A - -> Torque gauge, commercially available, 0 ... 600 Ncm
- B - Socket attachment, 36 mm A/F

**Note:**

Use reducer 3/4 " to 1/2 " if necessary.



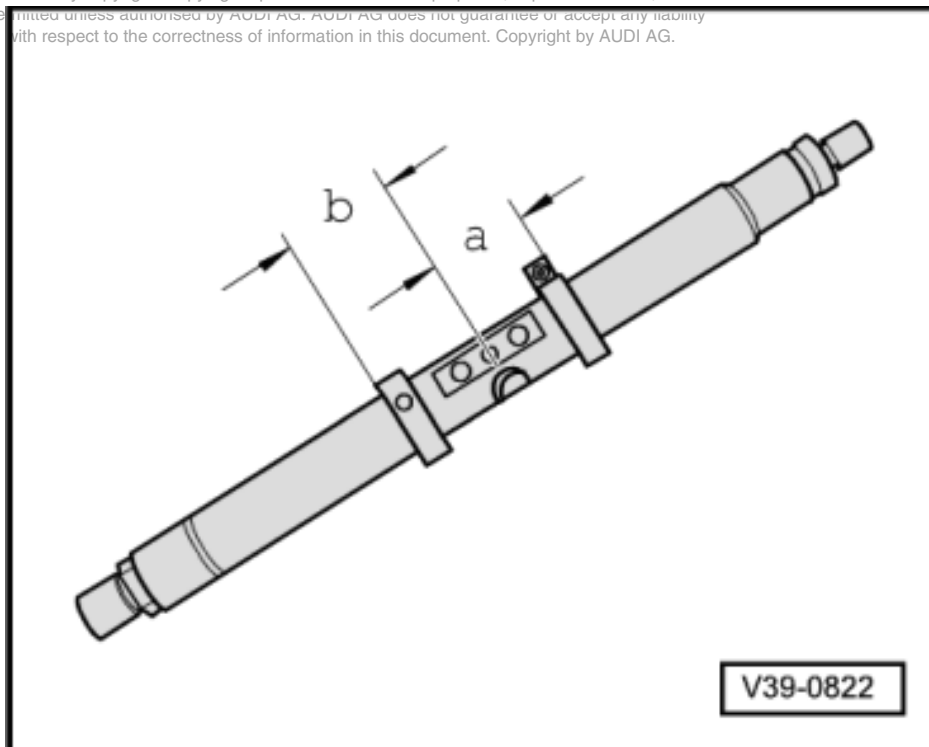
- Attach retainer 3028 with two M8 x 30 hexagon bolts -A-.
- B - Socket attachment (long) 36 mm A/F
- -> Tighten drive pinion nut until the following friction torque is obtained.

New bearings	Used bearings <sup>1)</sup>
200 ... 250 Ncm	30 ... 60 Ncm

1) run at least 50 km (30 miles)

- The final drive must be supported when tightening the nut (e.g. using universal gearbox attachment V.A.G 1359/2 in conjunction with gearbox jack V.A.G 1383 A).

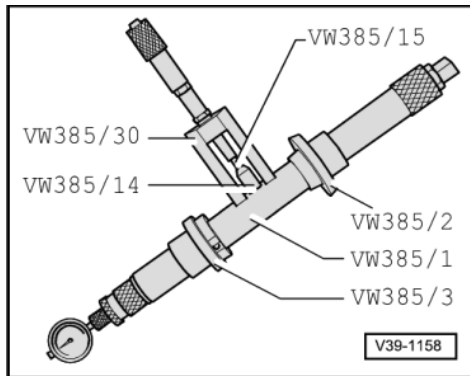
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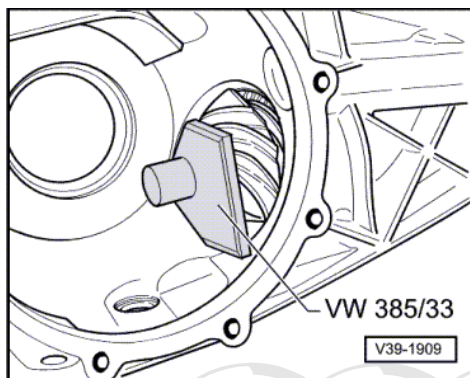
- -> Set adjustment ring of universal mandrel VW 385/1.
- Distance a = 60 mm
- Set sliding adjustment ring.



- Dimension b = 55 mm



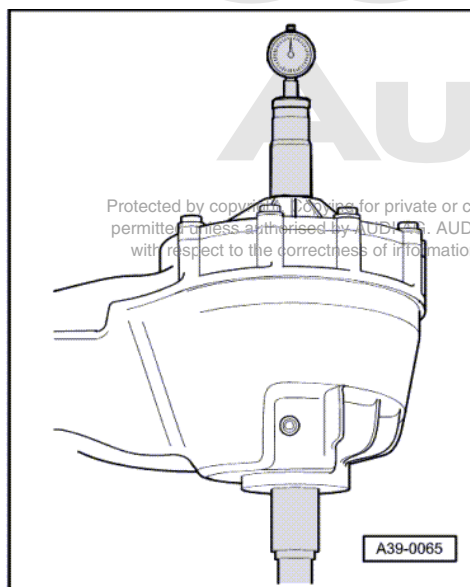
- -> Assemble universal mandrel as illustrated:
  - Dial gauge extension VW 385/15 = 9 mm long
- Set universal master gauge VW 385/30.
  - Ro = 57.50 mm
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.



**Note:**

*Before performing following measurements turn drive pinion at least five turns in both directions, so that the taper roller bearings settle. Otherwise a false reading will be obtained.*

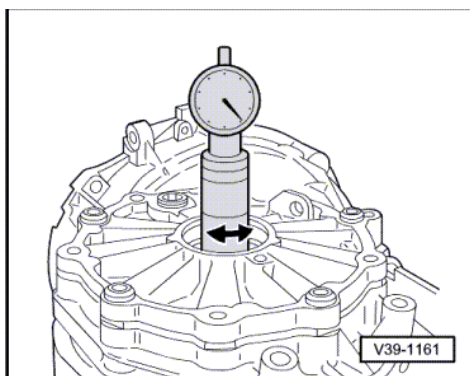
- -> Place end measuring plate VW 385/33 onto drive pinion head.



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- -> Remove master gauge and insert measuring mandrel in the housing.
- The centring disc VW 385/3 faces towards cover for final drive
- Fit cover for final drive and tighten 4 bolts.
- Using the adjustable ring, move 2nd centring disc out as far as possible so that the mandrel can still just be turned by hand.

#### Determining measurement "e"



- -> Turn mandrel until the dial gauge point touches the end measuring plate on drive pinion head, then measure maximum deflection (return point). The measured value is dimension "e" (in red scale).
- Measurement in following example: "e" = 1.60 mm

#### Note:

*Dimension "e" is required to determine thickness of shim "S3".*

- After removing universal mandrel, check once again whether the dial gauge reads "0" with 2 mm preload when master gauge VW 385/30 is in place - otherwise repeat the measurement.

#### Determining shim thickness "S3"

**Formula:**  
**"S3" = "e" - "r"**  
**e** = Measured value  
**r** = Deviation (tolerance): marked on crown wheel in 1/100 mm

<b>Example:</b>	
Determined value "e"	1.60 mm
- Deviation "r"	0.42 mm
= Thickness of shim "S3"	1.18 mm

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

=> Parts catalogue

#### The following shims are available for "S3"

Shim thickness (mm) 1)		
0.95	1.20	1.45
1.00	1.25	1.50
1.05	1.30	1.55
1.10	1.35	
1.15	1.40	



1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

- Remove universal mandrel.
- Remove drive pinion and outer race of large taper roller bearing and install together with measured shims "S3" and spacer sleeve => from Page 217 .
- Install inner race of small taper roller bearing and tighten nut for drive pinion until specified friction torque is obtained=>Fig. 221 .

**Notes:**

- ♦ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- ♦ Increase tightening torque slowly and check friction torque at regular intervals, if the specified friction torque is exceeded, the spacer sleeve must be renewed and the adjustment repeated. A spacer sleeve which has been compressed too much cannot be reused.
- Set to following frictional torques:

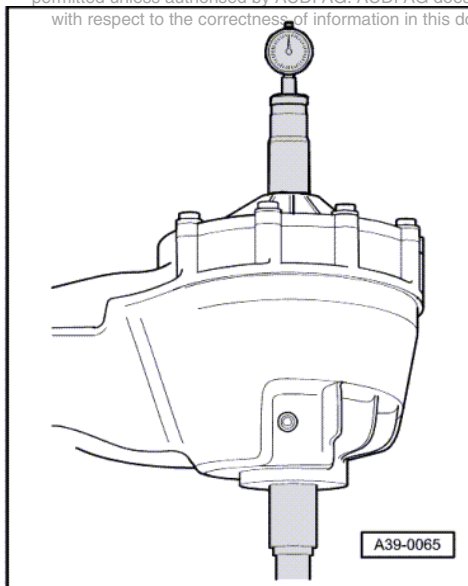
New bearings	Used bearings1)
200 ... 250 Ncm	30 ... 60 Ncm

- 1) run at least 50 km (30 miles)

**Performing check measurement**

**Checking dimension "r"**

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- Turn drive pinion at least 5 turns in both directions.
- > Insert universal mandrel and perform check measurement.
  - If the shims have been correctly selected, the dial gauge should now show the value of "r" as marked on the crown wheel, reading anti-clockwise in the red scale, within a tolerance of  $\pm 0.04$  mm.
- Peen drive pinion nut with a punch.

**Note:**

*The radial run-out at flange for propshaft must be measured and marked=>Page 193 .*

## 16.7 - Adjusting crown wheel

(Adjusting differential)

Repairs after which the crown wheel has to be adjusted

=>Adjustment overview Page 225 .

### Notes:

- ◆ Differential tapered roller bearings are low friction bearings. Therefore the frictional torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- ◆ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.

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

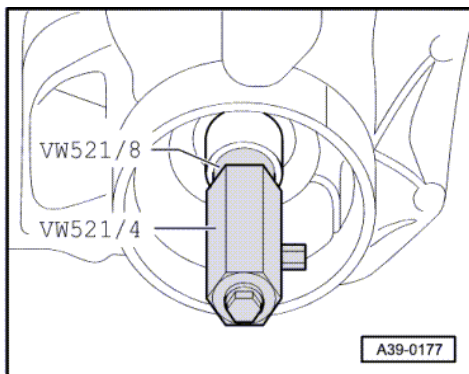
(Setting preload of taper roller bearing for differential)

- Drive pinion removed or crown wheel dismantled from differential housing
- Pull out flange shaft oil seal with lever.
- Remove differential taper roller bearing outer races and take out shims => Page 203 .
- Press outer race of left-hand taper roller bearing for differential (housing side) with shim "S2" into housing =>Page 203 . To perform the measurement use a shim "S2" with a thickness of 1.00 mm (one 0.80 mm shim and one 0.20 mm shim).

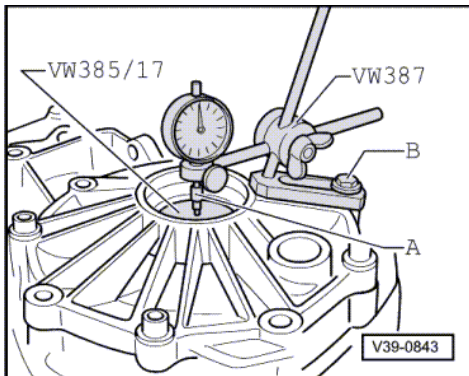
### Note:

For measurement purposes a shim "S2" of 1.0 mm is initially inserted which will be designated "S2\*" in the following. After determining the backlash "S2\*" will be replaced by the correct "S2".

- Knock in outer race of right-hand taper roller bearing for differential (final drive cover side) without shims: =>Page 203 (install as far as the stop).
- Insert differential into housing. The crown wheel is positioned on the right side (cover side).



- Fit cover and tighten bolts to 25 Nm.
- -> Install special tools VW 521/4 and 521/8 onto housing side in differential housing.
- Turn cover side of differential housing upwards.



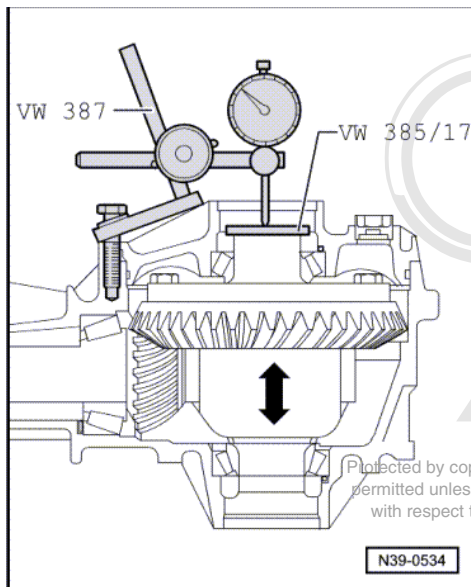




- Turn differential 5 turns in both directions to settle the taper roller bearing.
- Place measuring plate VW 385/17 onto differential.
- -> Fit measuring tools.

- A - Dial gauge extension approx. 30 mm long
- B - Hexagon bolt M8 x 45

- Place dial gauge extension on the centre of the measuring plate VW 385/17.



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- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.
- -> Lift differential without turning; read off play on dial gauge and note.
  - Measurement in following example: 0.50 mm

**Note:**

*If the measurement has to be repeated, the differential must again be turned 5 turns in each direction to settle the taper roller bearing.*

<b>Formula:</b>
<b>"Stotal" = "S2*" + measurement + bearing preload</b>

<b>Example:</b>	
Inserted shim(s) "S2*"	1.00 mm
+ Measured value	0.50 mm
+ Bearing preload (constant)	0.30 mm
= Total shim thickness "Stotal" for shims "S1" + "S2"	1.80 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 unchanged.

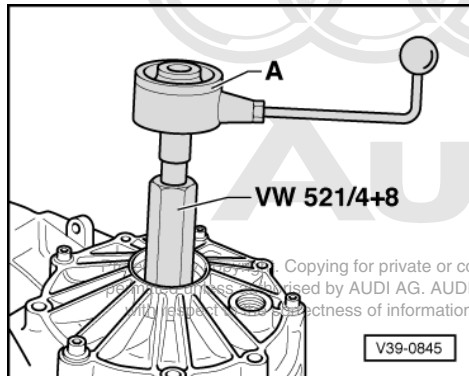
<b>Formula:</b>
<b>"S1*" = "Stotal" - "S2*"</b>

<b>Example:</b>
-----------------



Total shim thickness "Stotal" for shims "S1" + "S2"	1.80 mm
- Inserted shim(s) "S2"	1.00 mm
= Thickness of shim "S1"	0.80 mm

- Determine shim(s) as accurately as possible from table  
=>Page 237 .



#### Measuring frictional torque (check)

- Drive pinion removed
  - Differential fitted with shims "S1" and "S2"
- -> Fit torque gauge 0 ... 600 Ncm -A- onto differential.
  - Read off frictional torque.

Frictional torque specifications:

New bearings	Used bearings 1)
150 ... 300 Ncm	30 ... 60 Ncm

1) run at least 50 km (30 miles)

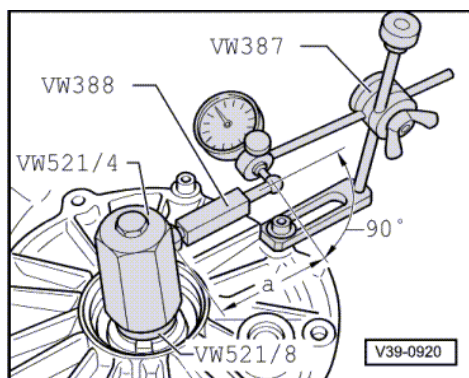
#### Notes:

- ♦ Differential tapered roller bearings are low friction bearings. Therefore the frictional torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- ♦ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- ♦ If the final drive set (drive pinion and crown wheel) is being re-adjusted, the adjustment of the drive pinion should be performed now, and the adjustment checked =>Page 227 .

#### Adjusting backlash

(Positioning crown wheel in final drive housing)

- Drive pinion with shim "S3" installed
  - Differential with shims "S1" + "S2" installed
- Insert differential in final drive housing, install cover and tighten all bolts to 25 Nm.





- Turn differential 5 turns in both directions to settle the taper roller bearings.
- > Assemble measuring equipment.
- Use dial gauge extension VW 382/10 (6 mm flat).
- Set measuring lever VW 388 to dimension "a" = 60 mm.
- Determine play between the teeth flanks 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 lying against an opposite tooth flank (backlash).
  - Read off backlash and note value.
  - Turn crown wheel through 90° and repeat measurements a further 3 times.

**Note:**

*If the individual measurements differ by more than 0.06 mm from each other, the installation of the crown wheel or the final drive set itself is not correct. Check installation, replace final drive set if necessary.*

**Determining average backlash**

Example:	
1st measurement	0.28 mm
+ 2nd measurement	0.30 mm
+ 3rd measurement	0.30 mm
+ 4th measurement	0.28 mm
= Sum of measured values	1.16 mm

- Result: The average backlash is  $1.16 / 4 = 0.29$  mm

**Determining thickness of shim "S2"**

Formula:	
"S2"	= "S2*" - backlash + lift

Example:	
Inserted shim "S2*"	1.00 mm
- Average backlash	0.29 mm
+ Lift (constant)	0.15 mm
= Thickness of shim "S2"	0.86 mm

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

=> Parts catalogue

**The following shims are available for "S2"**

Shim thickness (mm) 1)		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

**Determining thickness of shim "S1"**

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

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Example:
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Total shim thickness "Stotal" for "S1" + "S2"	1.80 mm
- Thickness of shim "S2"	0.86 mm
= Thickness of shim "S1"	0.94 mm

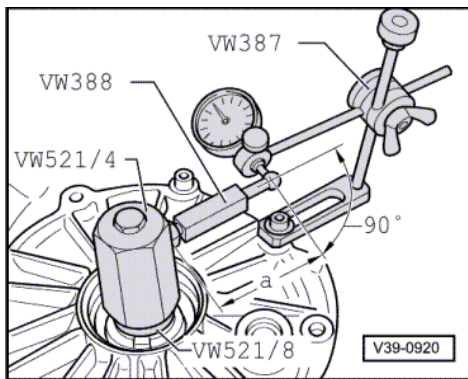
- Determine shim(s) as accurately as possible from table. Part numbers

=> Parts catalogue

**The following shims are available for "S1"**

Shim thickness (mm) 1)		
0.15	0.50	0.90
0.20	0.60	1.00
0.30	0.70	1.20
0.40	0.80	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.



#### -> Performing check measurement

- Drive pinion with shim "S3" installed
- Differential with shims "S1" + "S2" installed
- Turn differential 5 turns in both directions so that the taper roller bearings settle.
- Measure backlash four times on circumference.
  - Specifications: 0.12 ... 0.22 mm

#### **Notes:**

- ◆ If the backlash lies outside the tolerances, the adjustments must be repeated, but the total shim thickness "Stotal" must remain unchanged.
- ◆ The individual measurements must not differ by more than 0.06 mm from each other.

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