

## Audi A8 1994 ➤

### 6-speed Manual Gearbox 01E, Front-Wheel Drive

Gearbox ID	CYB	FRM	EKN						
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Edition 01.1997

Audi

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List of Workshop Manual Repair GroupsList of Workshop Manual  
Repair GroupsList of Workshop Manual Repair Groups

**Audi A8 1994 ➤**

**6-speed Manual Gearbox 01E, Front-Wheel Drive**

## Repair Group

00 - Technical data

30 - Clutch

34 - Controls, Housing

35 - Gears, Shafts

39 - Final drive, Differential



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

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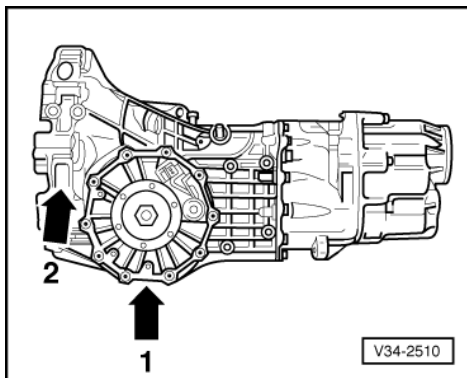
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## 00 - Technical data

### 1 - Gearbox identification

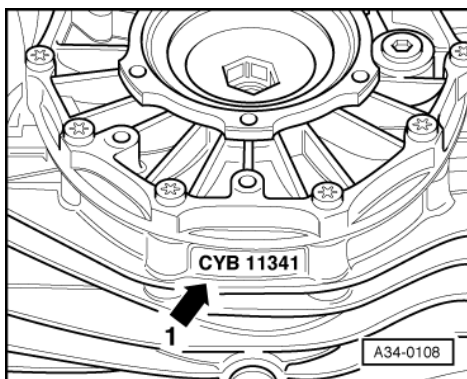
#### 1.1 - Gearbox identification

The 6-speed manual gearbox 01E is installed in Audi A8 vehicles from 01.97 onwards in conjunction with with the 6-cylinder turbo-diesel engine. Allocation=>Page **2** .



-> Location on gearbox

- ◆ Code letters and serial number -arrow 1-.
- ◆ Manual gearbox 01E -arrow 2-.



-> Code letters and gearbox consecutive serial number -arrow 1-

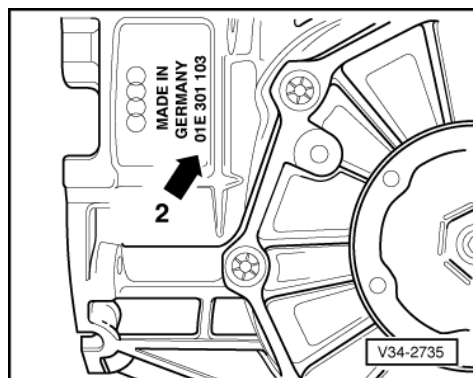
Example:	CYB	11341
	Code letters	Gearbox consecutive serial number

Additional information included here is related to production.

**Note:**

*The gearbox code letters are also included on the vehicle data stickers.*

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-> Manual gearbox 01E -arrow 2-

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

Manual gearbox		6-speed 01E; front-wheel drive
Code letters		CYB
Manufactured	from to	10.96
Allocation	Model Engine	Audi A8 1994 ä V6 - 2.5 ltr - 110 kW turbo-diesel
Ratios: Z2 :Z1=i	Final drive	31 : 8 = 3.875
	1st gear	30 : 8 = 3.750
	2nd gear	35 : 17 = 2.059
	3rd gear	33 : 25 = 1.320
	4th gear	28 : 30 = 0.933
	5th gear	27 : 37 = 0.730
	6th gear	24 : 40 = 0.600
	Reverse gear	28 : 11 = 3.455

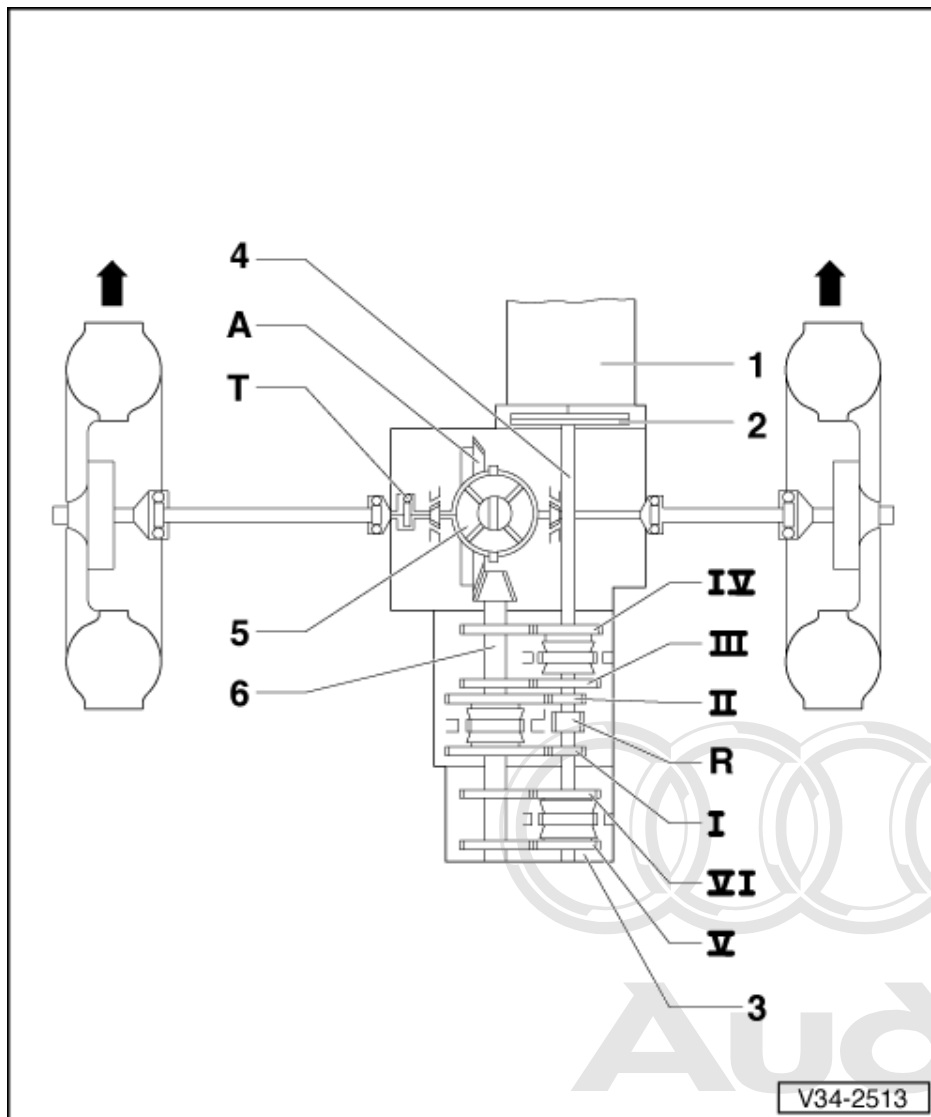
Code letters	CYB
Speedometer	Electronic
Capacity	2.4 litres
Specification	Gear oil G 052 911 A SAE 75 W 90 (synthetic oil)
Clutch mechanism	Hydraulic
Clutch plate diameter	240 mm 1)
Drive shaft flange diameter	130 mm
Overall ratio i <sub>ov</sub> in top gear	2.325

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1) With dual-mass flywheel

## 2 - Transmission layout

### 2.1 - Transmission layout

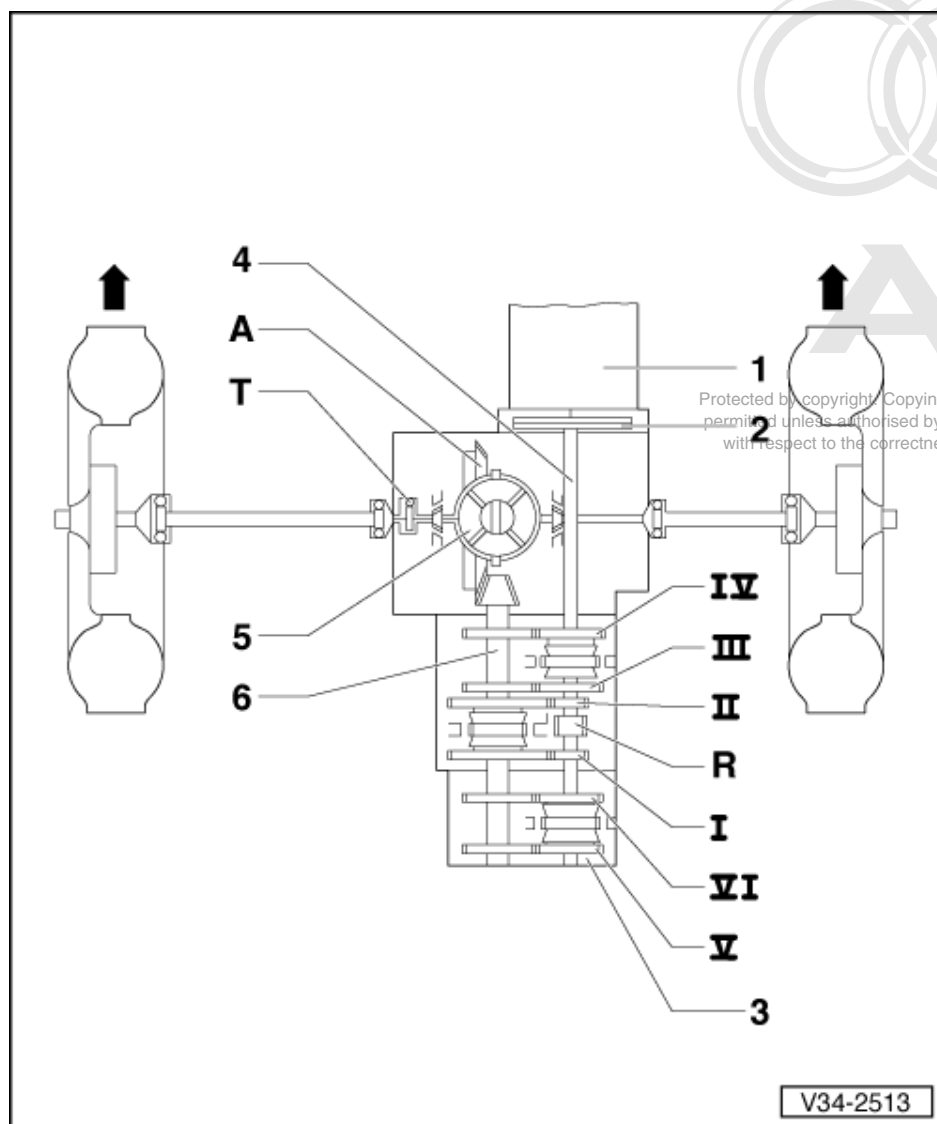


- 1 Engine
- 2 Clutch
- 3 Gearbox
- 4 Input shaft (main shaft)
- 5 Differential
- 6 Drive pinion (output shaft)

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**Note:**

*Arrows point in forward direction of travel.*



- I - 1st gear
- II - 2nd gear
- III - 3rd gear
- IV - 4th gear
- V - 5th gear
- VI - 6th gear
- R - Reverse gear
- A - Final drive
- T - Speedometer drive, electronic

### 3 - Calculating transmission ratios "i"

#### 3.1 - Calculating transmission ratios "i"

##### 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

Example:	6th gear	Final drive
Drive gear	ZG1 = 40	ZA1 = 8
Driven gear	ZG2 = 24	ZA2 = 31

Calculating:
iG = 24 : 40 = 0.600
iA = 31 : 8 = 3.875
iov = (24 : 40) x (31 : 8) = 0.600 x 3.875 = 2.325

## 4 - Repair instructions

### 4.1 - 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 should always be observed when carrying out repair work.

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.

#### Contact corrosion

Contact corrosion may be produced if fasteners not approved by AUDI AG (screws/bolts, nuts, washers rivets, plugs, grommets, adhesives, etc.) are used.

For this reason, the manufacturer installs only fasteners with a special surface coating, as well as electrically non-conducting rubber and plastic parts, and adhesives.

The fasteners supplied as Genuine spare parts are identified by their greenish colour.

If doubt exists as to whether used parts can be re-installed, always install 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.

#### Special tools

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

=> Booklet; Special tools, Workshop equipment

#### Gearbox

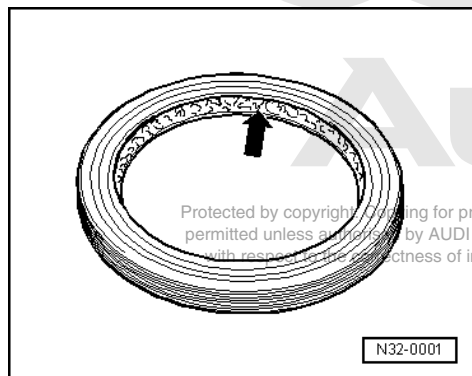
- ◆ When fitting a new gearbox the oil level must be checked and oil added if necessary => Page 55 .
- ◆ Capacities and specifications => from Page 2 .
- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.



- ♦ When installing gearbox, ensure dowel sleeves are correctly seated.

#### O-rings, seals, gaskets

- ♦ Always renew O-rings, seals and gaskets.



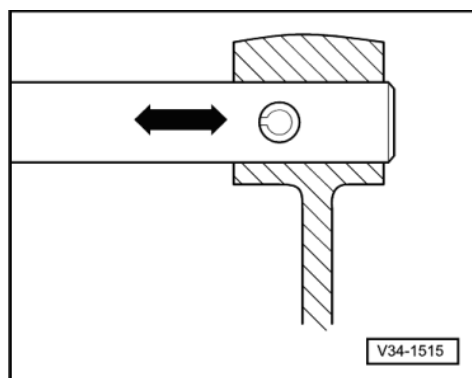
- ♦ After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.
- ♦ Thoroughly clean housing joint surfaces before assembling.
- ♦ -> Before installing radial shaft oil seals, lightly oil outer edge and fill space between sealing lips -arrow- with grease.
- ♦ The open side of the oil seals faces toward the side with fluid filling.
- ♦ When replacing oil seal, 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.
- ♦ After renewing seals and gaskets, check oil level in gearbox  
=>Page 55 .

#### Sealants

- ♦ Thoroughly clean housing joint surfaces before applying sealing paste.
- ♦ Apply sealing paste AMV 188 200 03 evenly and not too thick.
- ♦ Breather holes must remain free of sealing paste.

#### Locking elements

- ♦ Always renew circlips.
- ♦ Do not over-tension circlips.



- ♦ Circlips must be properly seated in the base of the groove.
- ♦ -> Renew spring pins. Position: the slit in the pin should be in line with the line of force.

#### Note:

*The spring pin or roll pin which secures the selector fork to the selector rail for 5th and 6th gear may only be removed and installed using special tool 3276.*

### Nuts, bolts

- ◆ Loosen nuts or bolts in the opposite sequence to the sequence specified for tightening.
- ◆ Nuts and bolts which secure covers and housings should be slackened and tightened crosswise in stages if no tightening sequence is specified.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.
- ◆ Always renew self-locking nuts and bolts.
- ◆ 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.
- ◆ Mark needle bearings of 1st to 6th speed sliding gears when removing, this ensures that when installing, the same installation position can be guaranteed.
- ◆ Grease needle bearing for gearbox input shaft in 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 and 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.
- ◆ Inspect for burrs and signs of damage. Install only shims which are in perfect condition.

### 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.

### 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 installing, check 1st to 6th speed gears for axial clearance of 0.15 ... 0.35 mm and check that they rotate/slide freely.

### 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.
- ◆ If the clutch has burnt out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the gearbox in order to reduce the smell of burnt linings.

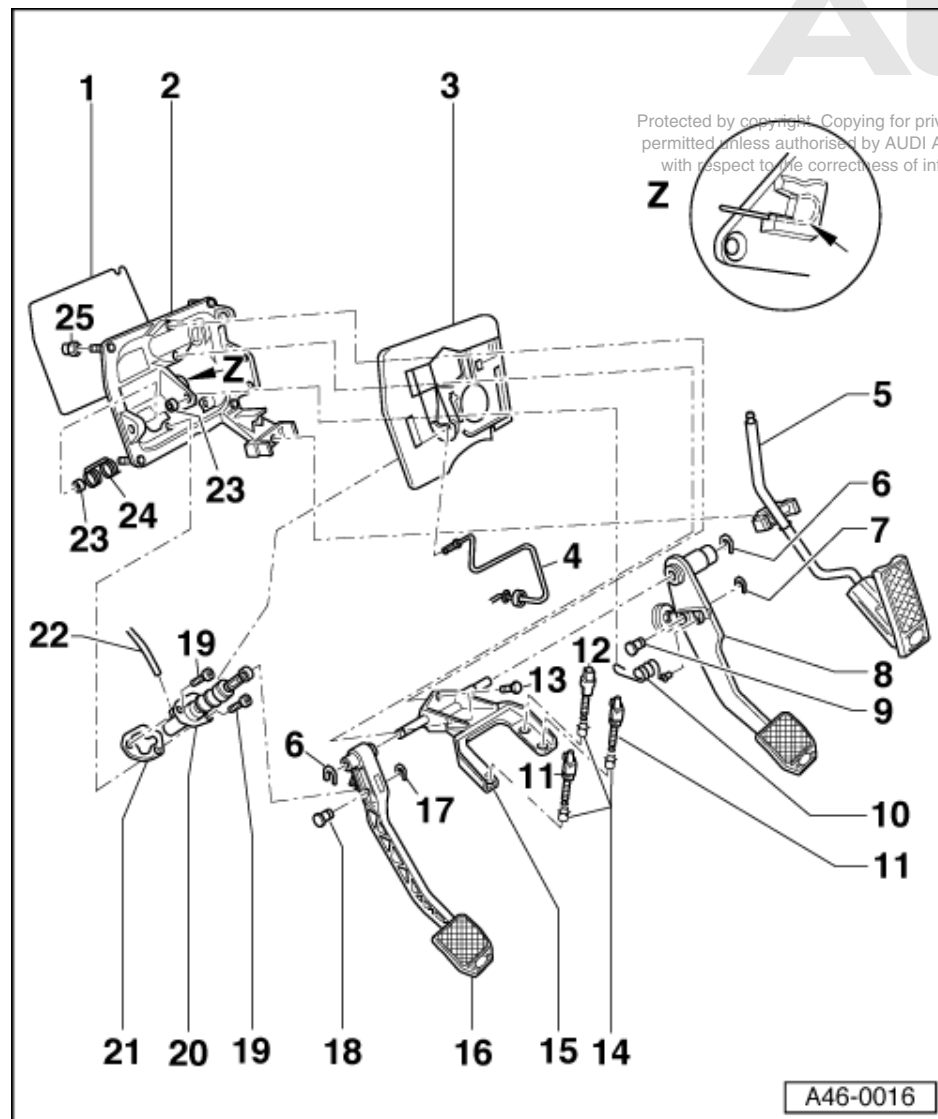
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## 30 - Clutch

### 1 - Servicing clutch mechanism

#### 1.1 - Servicing clutch mechanism



#### 1.2 - Assembly overview, pedal cluster

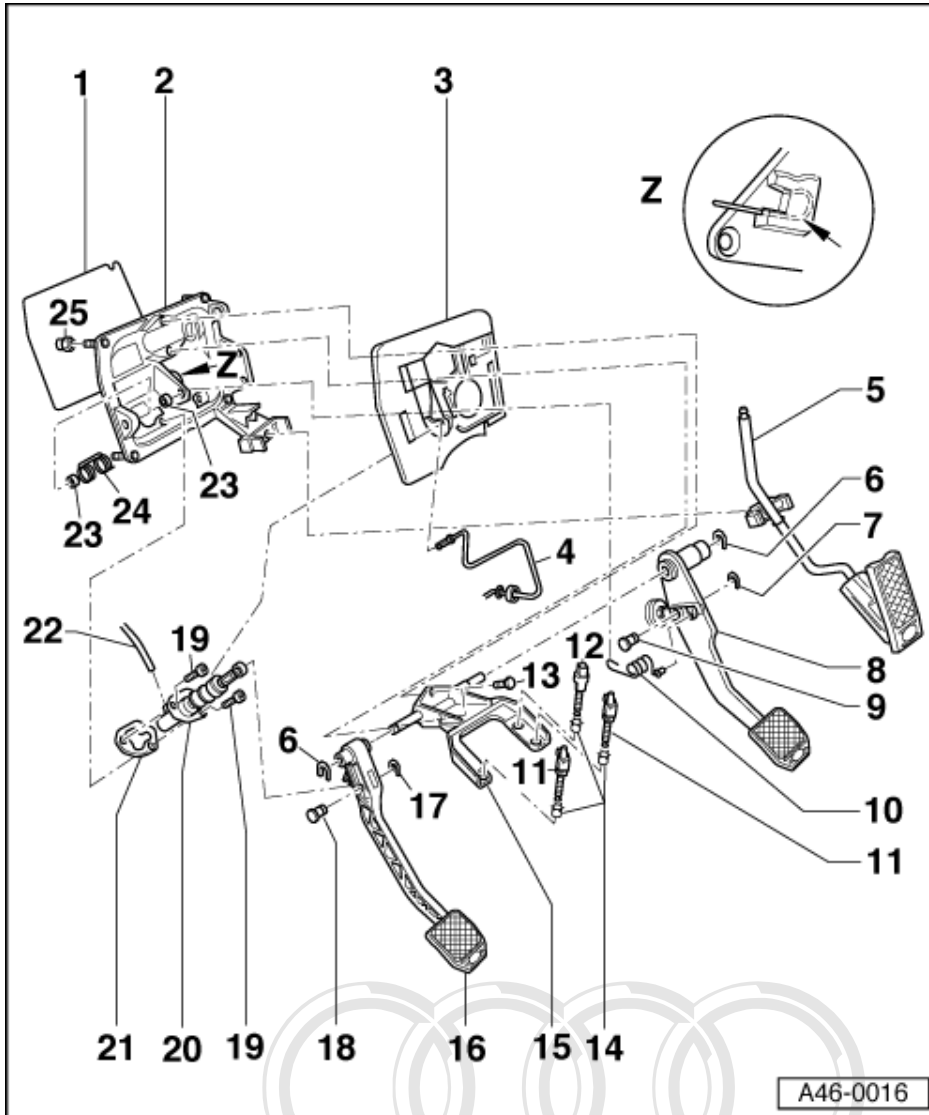
##### Notes:

- ♦ Grease all moving parts with polycarbamide grease G 052 142 A2 before assembling.

- ♦ The clutch pedal travel must not be restricted by additional floor coverings.

#### 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

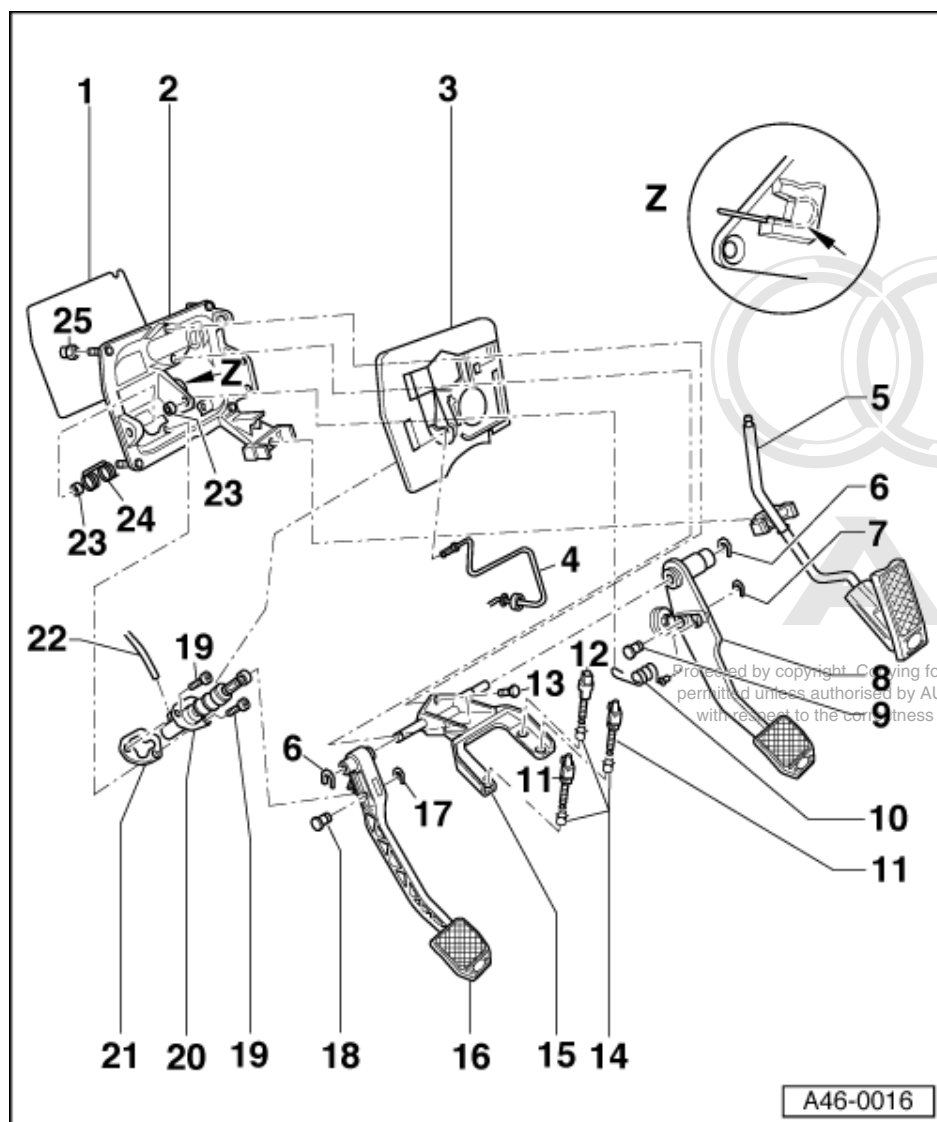
#### 4 Pipe

- ♦ For clutch master cylinder
- ♦ With pipe union nut
- ♦ 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**

- ◆ Always renew
- ◆ Fit onto mounting bracket shaft

**7 Circlip**

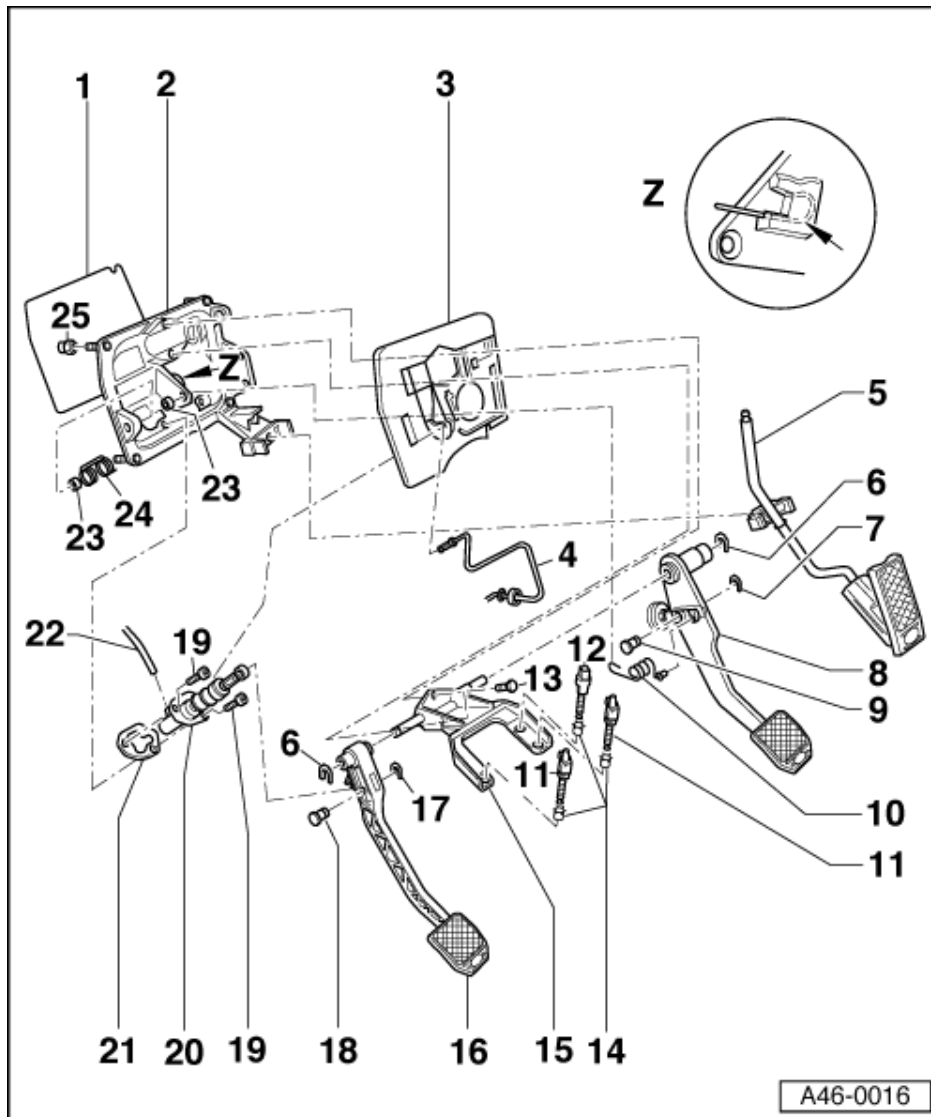
- ◆ Always renew
- ◆ Fit onto pin

**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**

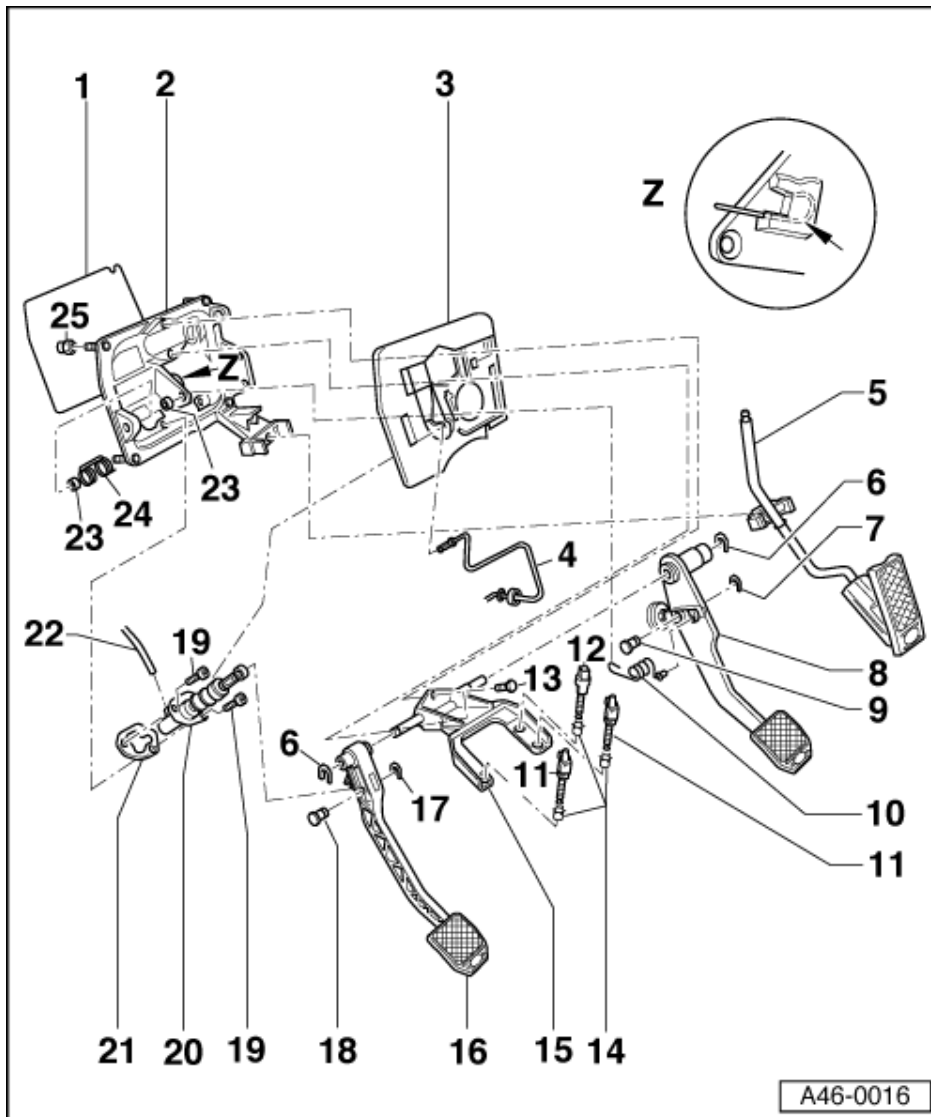
- ♦ Insert into mounting bracket

**15 Bearing 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 located in position via adjustment of push rod joint at master cylinder.
- ♦ Fit onto mounting bracket shaft
- ♦ Removing and installing  
=> Page 14

#### 17 Circlip

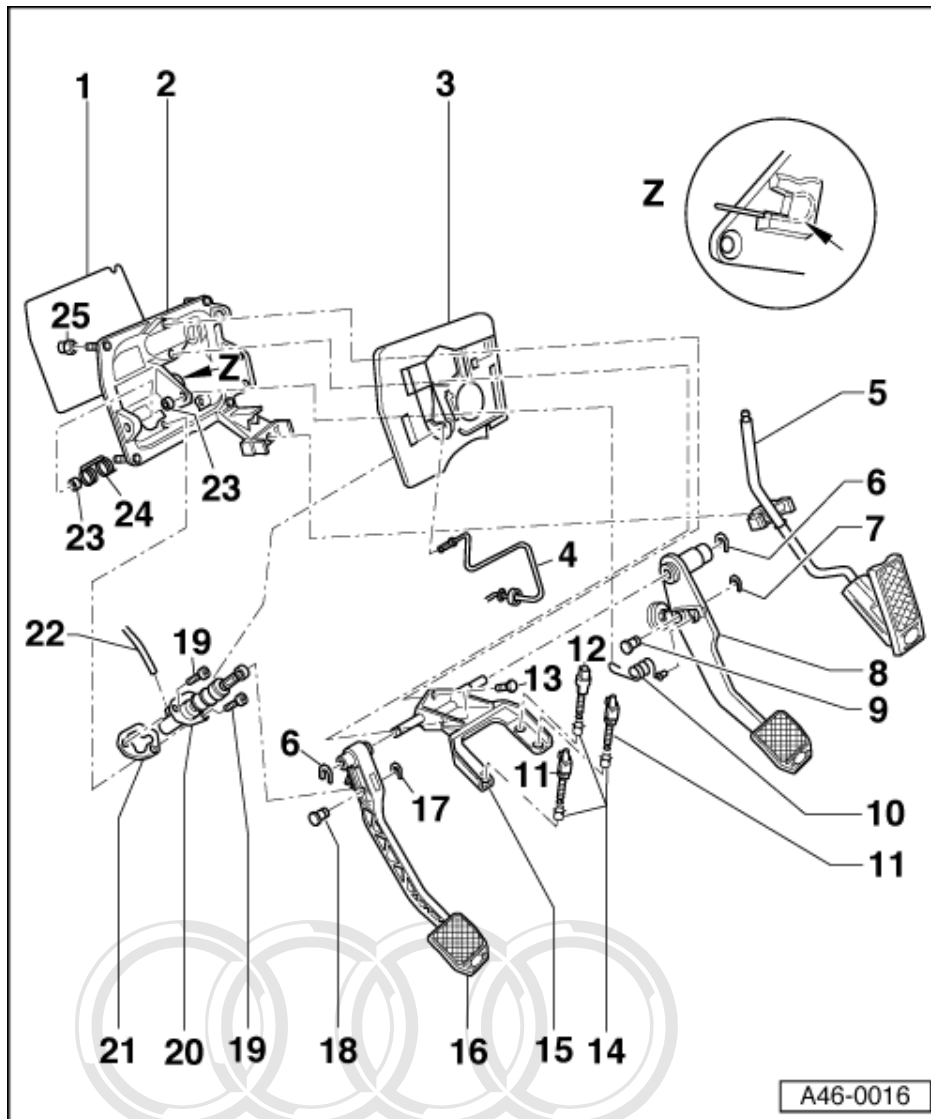
- ♦ Always renew
- ♦ Fit onto pin

#### 18 Pin

- ♦ Insert into clutch pedal and master cylinder

#### 19 Bolt - 20 Nm





#### 20 Master cylinder

- ◆ Renew if leaking
- ◆ Removing and installing  
=> page 14
- ◆ Adjusting push rod joint=>Fig. 1

#### 21 Gasket

- ◆ Insert between pedal bracket and master cylinder

#### 22 Supply hose

- ◆ Fit onto master cylinder

#### 23 Bearing bush

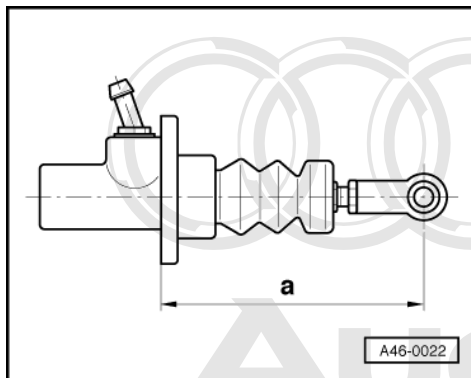
- ◆ Renew if damaged

#### 24 Coil spring

- ◆ Do not grease
- ◆ Removing and installing  
=> page 14

#### 25 Hexagon nut - 20 Nm

- ◆ Always renew



-> Fig.1 Adjusting push rod joint

When master cylinder is renewed measure distance **a** and adjust as necessary.

- To adjust, turn push rod joint
- Distance  $a = 114.5 \pm 0.5$  mm
- When measuring this distance, the push rod joint must be at right angles to the seating surface of the clutch master cylinder.

**Notes:**

*If the push rod joint is properly adjusted and the clutch pedal fails to return by itself, this can be caused by:*

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

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

#### Removing

- Remove mounting bracket -item **11** .

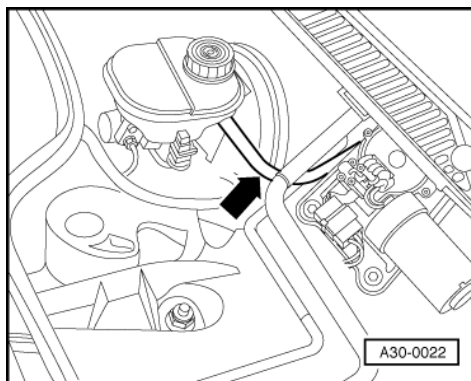
=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing mounting bracket

- 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

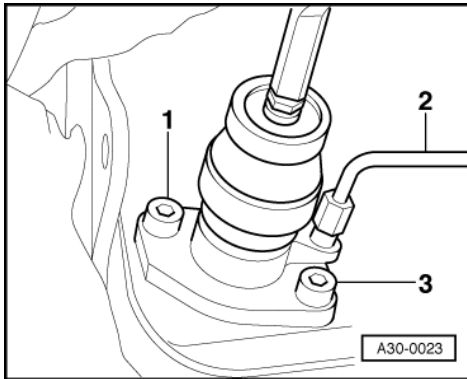


## Removing

When performing the following steps, ensure that no brake fluid spills into the plenum chamber or onto the gearbox below.

- -> Fit clamp (special tool 3094) on supply hose -arrow- going to master cylinder.
- On vehicles with air conditioner, remove the cover panel above the windscreen wiper motor and remove wiper motor

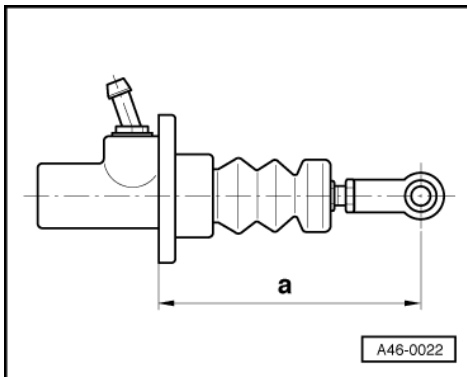
=> Electrical system; Repair group 92; Servicing windscreen wiper system Servicing windscreen wiper system



- Pull supply hose -arrow- off master cylinder together with elbow.
- Disconnect master cylinder from clutch pedal.
- -> 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:



- -> If master cylinder is renewed, check distance -a- at push rod joint and adjust as necessary.
  - Distance  $a = 114.5 \pm 0.5$  mm
- Renew gasket behind master cylinder.
- Install master cylinder.
- Connect clutch pedal to master cylinder

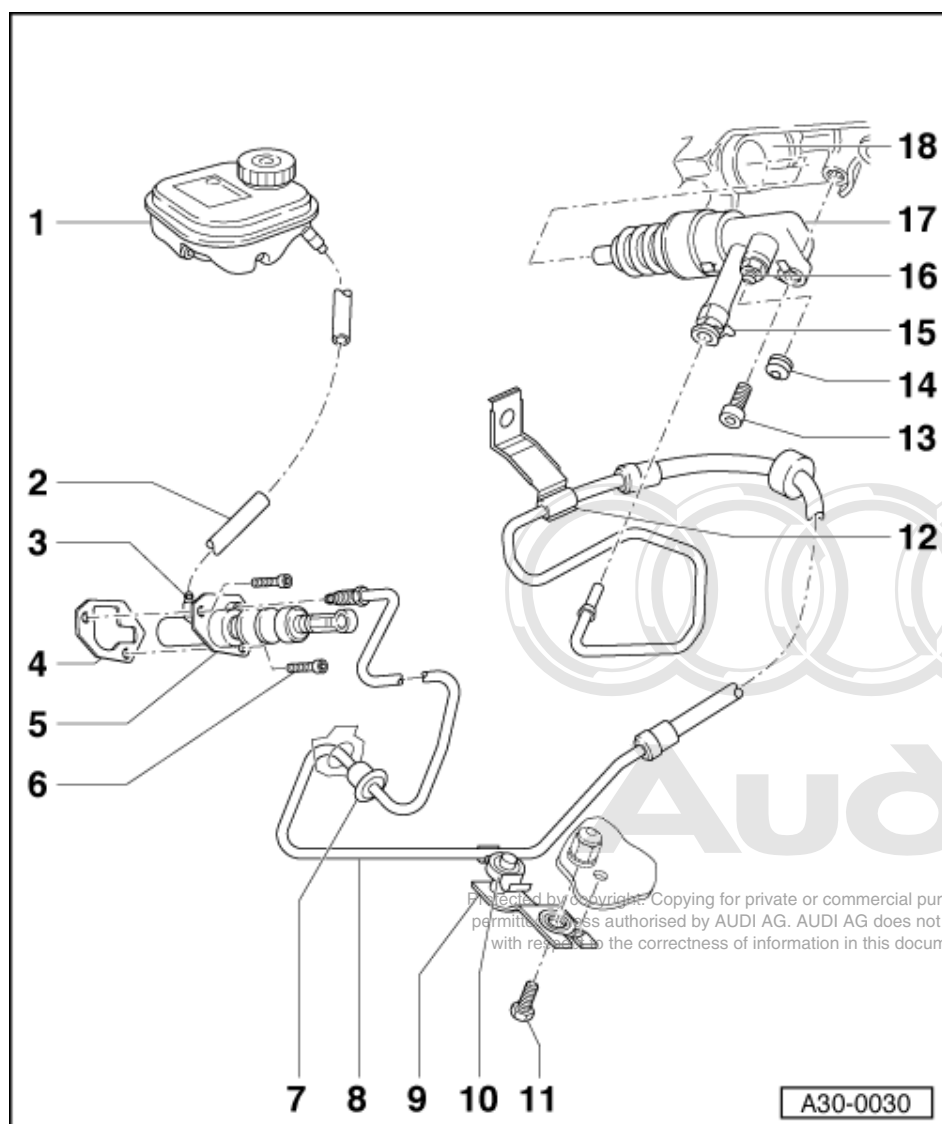
=> Running Gear, Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Installing mounting bracket Removing and installing pedal cluster Installing mounting bracket

- Insert elbow (with supply hose) in master cylinder. Make sure that elbow is fully engaged in rubber plug.
- Bleed clutch system => page 20 .

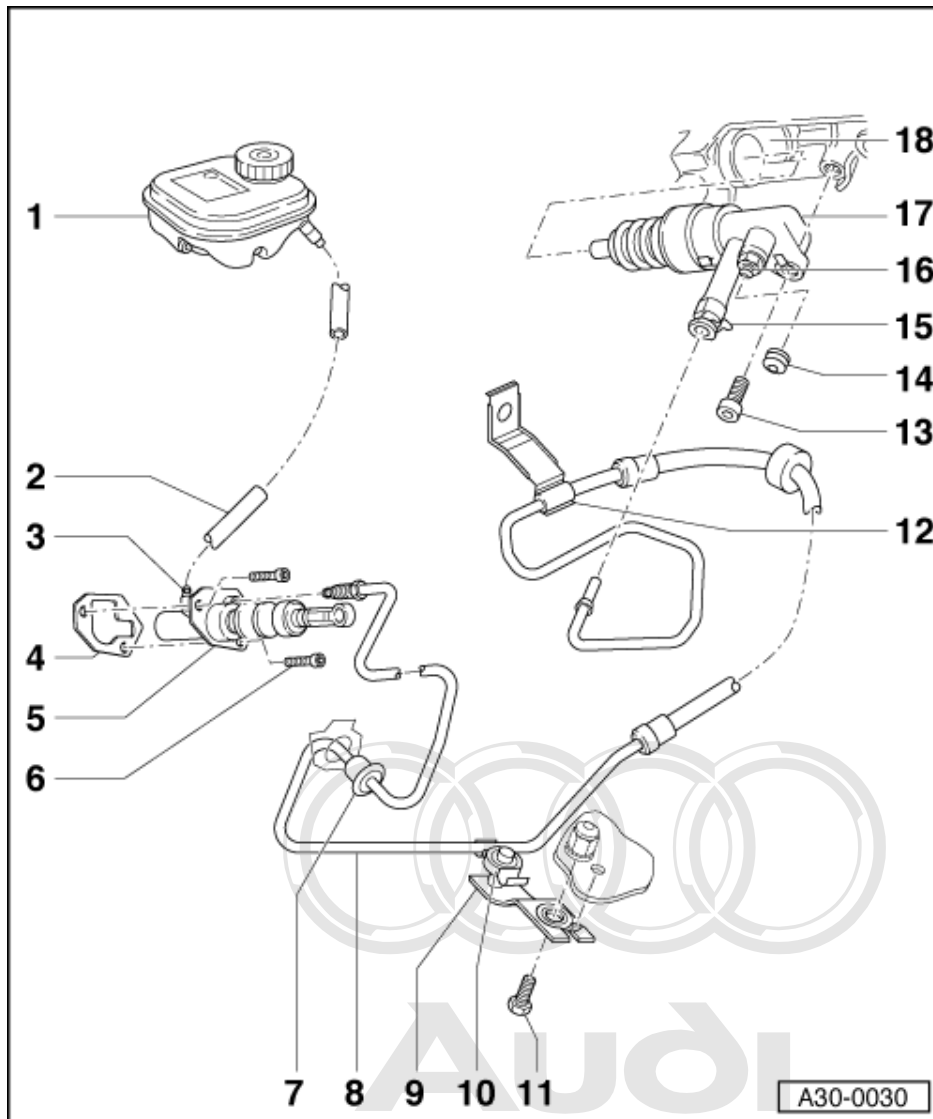
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## 1.5 - Assembly overview, hydraulics



- 1 Brake fluid reservoir
- 2 Supply hose
  - ♦ For master cylinder
- 3 Elbow
  - ♦ With rubber plug
  - ♦ When removing master cylinder, pull elbow out from rubber plug
- 4 Gasket
- 5 Master cylinder
  - ♦ Renew if leaking
  - ♦ If renewed, adjust push rod joint=>Page 14 , Fig. 1

**6 Bolt - 20 Nm**

- ♦ For securing master cylinder to pedal bracket

**7 Grommet****8 Hose/metal pipe**

- ♦ With pipe union nut
- ♦ 15 Nm

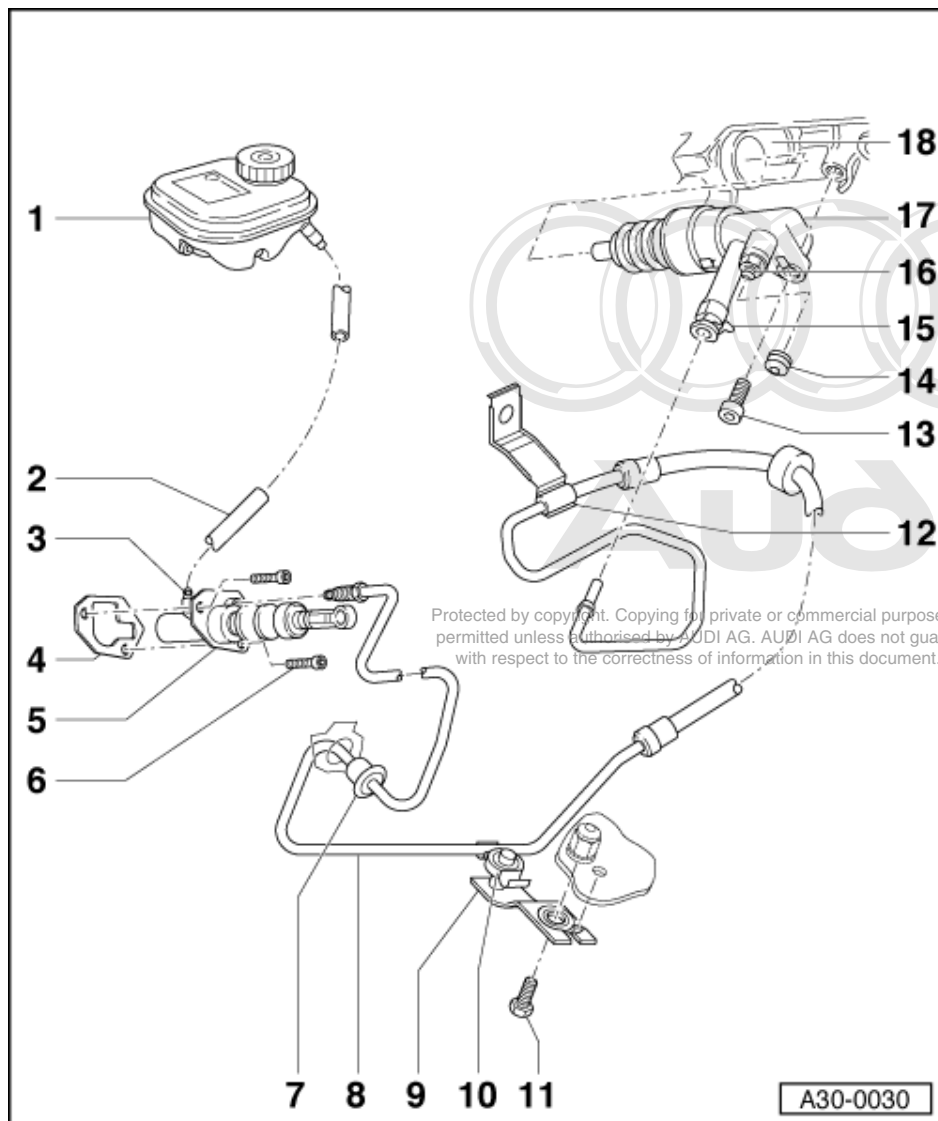
**9 Bracket**

- ♦ For clutch pipe

**10 Retaining clip****11 Bolt - 25 Nm****12 Bracket**

- ♦ For clutch pipe
- ♦ Secured on gearbox with engine/gearbox securing bolts

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**13 Hexagon socket head bolt**

- 20 Nm

- ♦ For securing slave cylinder to gearbox housing
- ♦ Self-locking
- ♦ Always renew

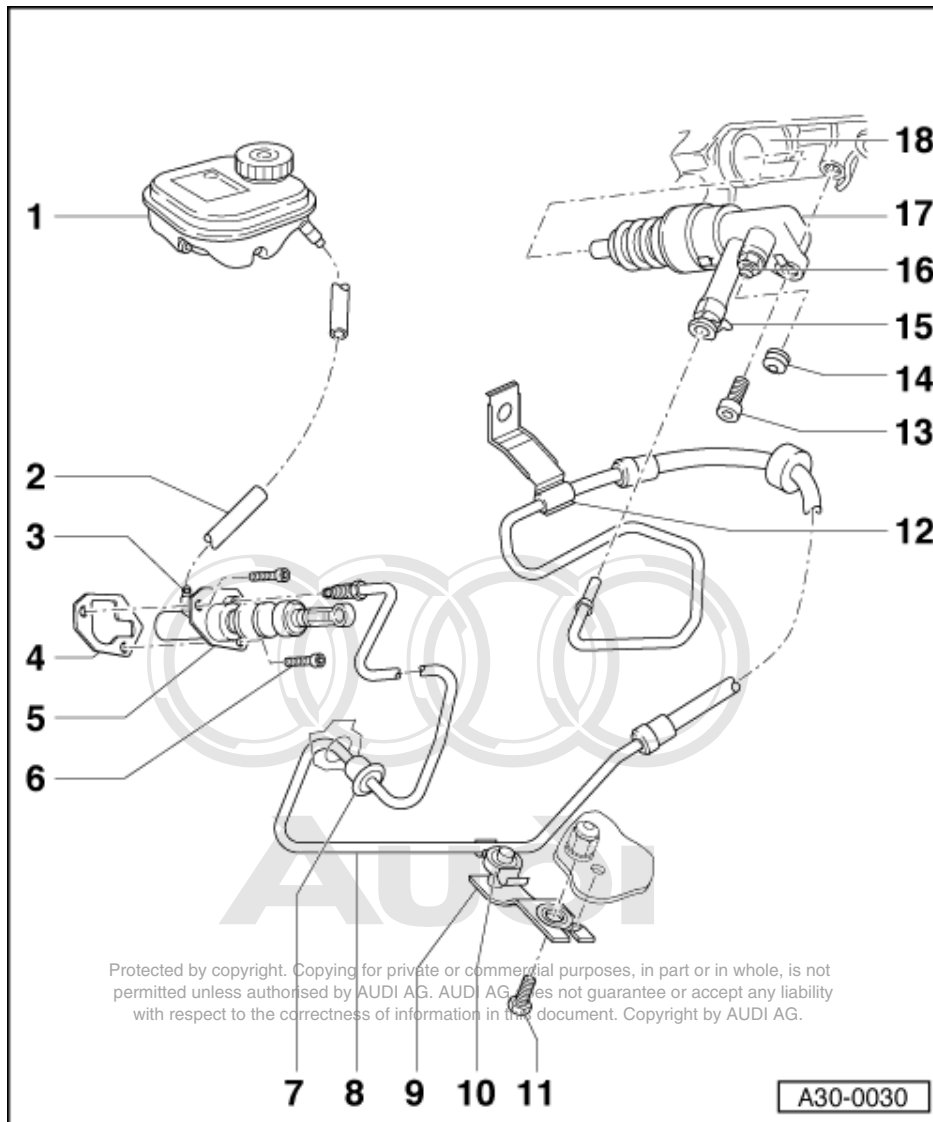
**14 Dust cap**

**15 Retaining clip**

- ♦ To disconnect pipe, pull out retaining clip=>Fig 1 .

**16 Bleed valve**

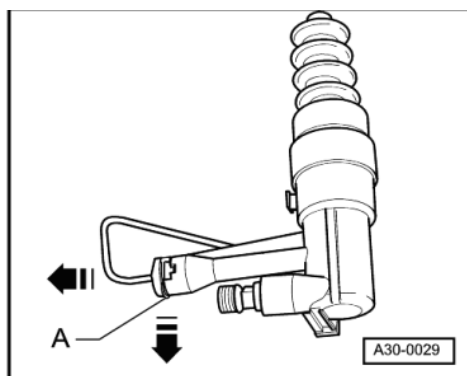
- ♦ Bleeding => page 20



#### 17 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
- ◆ Installing => Fig. 25
- ◆ After working on hydraulic clutch mechanism, bleed slave cylinder => Page 20

#### 18 Gearbox





-> Fig. 1 Disconnecting pipe from clutch slave cylinder

### Removing

- To disconnect pipe, use a screwdriver to lever out retaining clip -A- until it clicks. The pipe can then be pulled out.

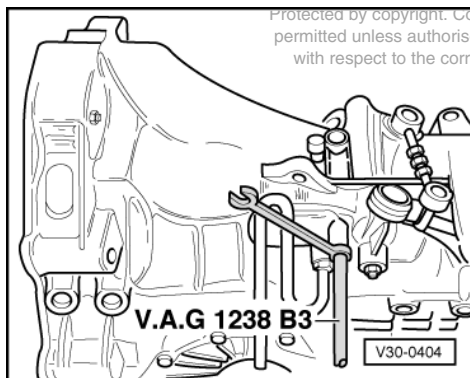
### Installing

- Press in retaining clip -A- as far as it will go.
- Push pipe into slave cylinder until it engages audibly.

## 1.6 - Bleeding clutch system

### Notes:

- ♦ 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 only with a brake bleeding unit.
  - Working pressure 2.5 bar
- Use bleeder hose V.A.G 1238 B3 (670 mm long) for bleeding.
- Connect bleeder hose to collector bottle of brake bleeding unit.



- -> Fit ring spanner and hose V.A.G 1238 B3 onto bleed valve and open bleed valve.

### Note:

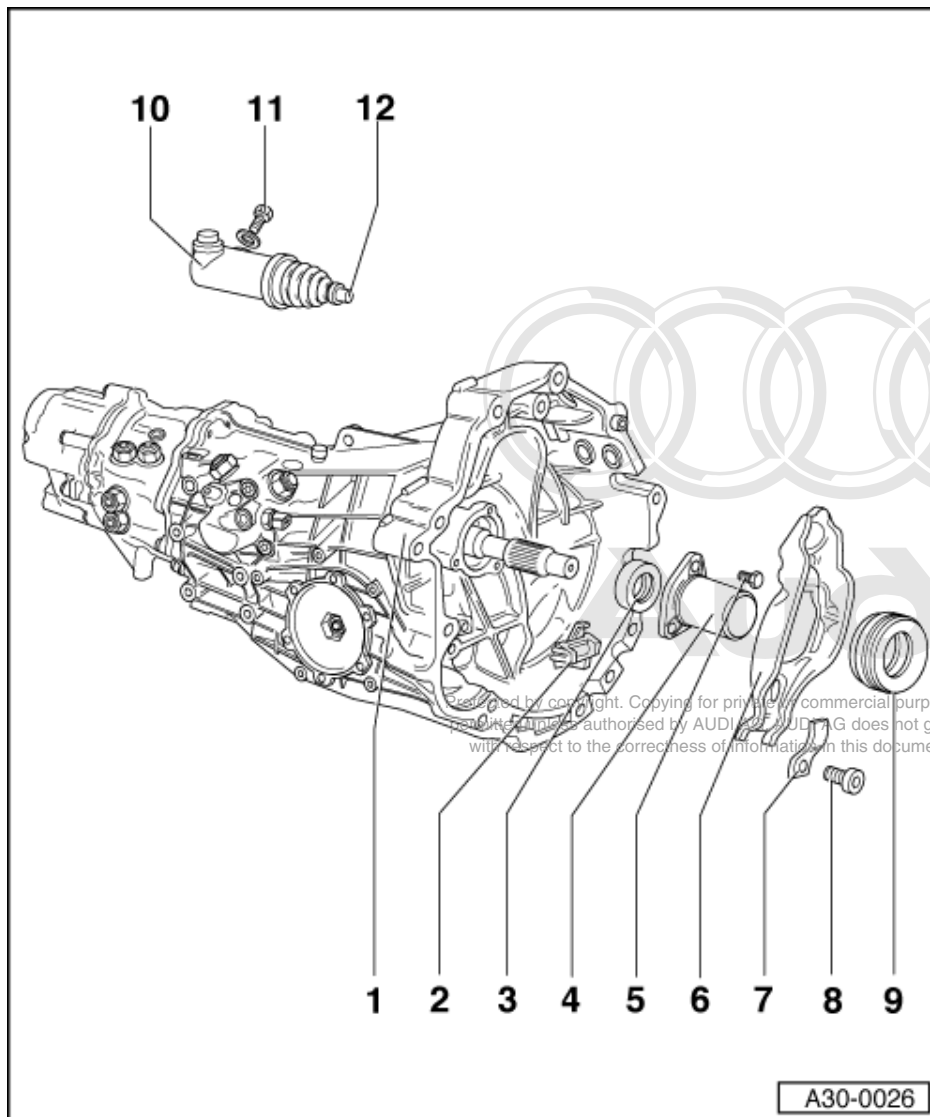
*Ensure bleeder hose is correctly fitted during bleeding operation.*

- After completing bleeding operation, depress clutch pedal several times.
- Bleed system again if necessary.

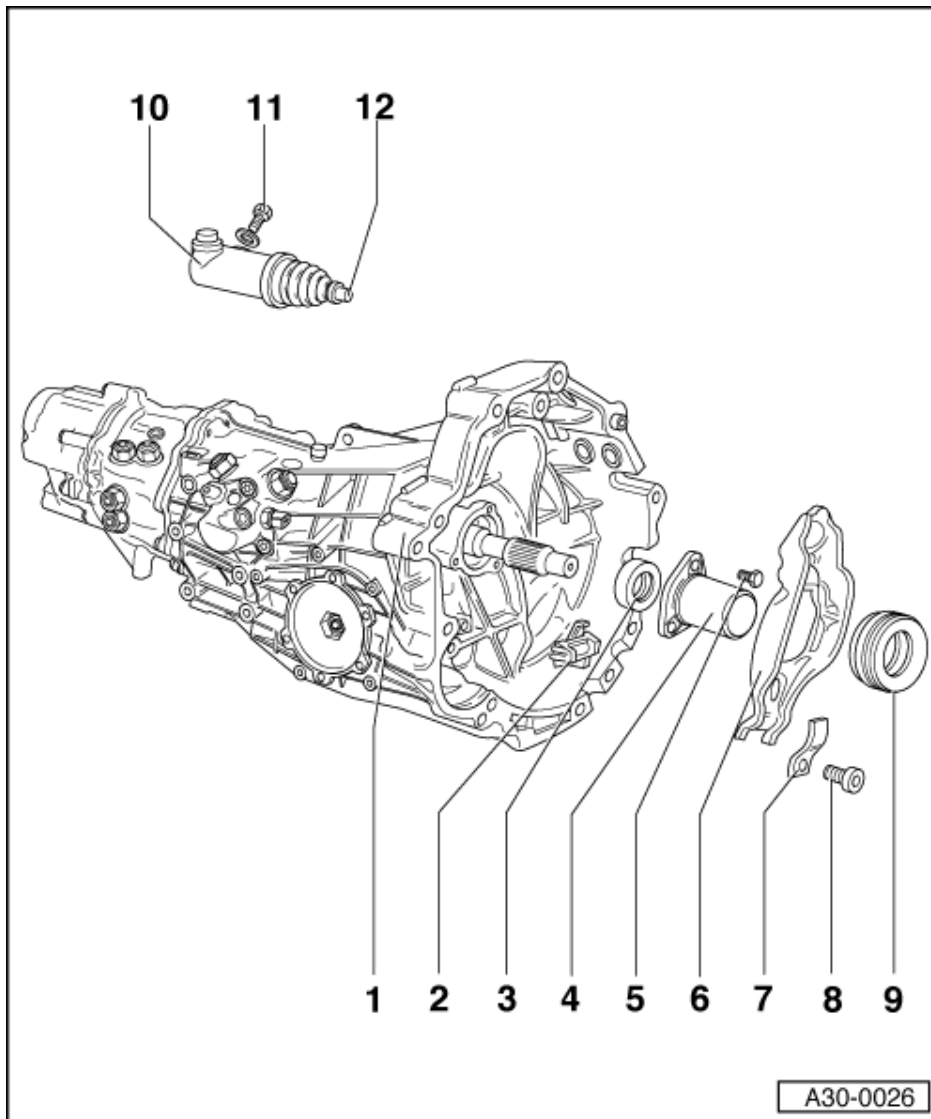


## 2 - Servicing clutch release mechanism

### 2.1 - Servicing clutch release mechanism



- 1 Gearbox
- 2 Intermediate piece
  - ◆ Renew if damaged
- 3 Shaft seal
  - ◆ For input shaft
  - ◆ Removing => Fig. 1
  - ◆ Installing => Fig. 2
  - ◆ Pressing-in depth (factory): 3.5 mm
  - ◆ Pressing-in depth (repairs): 4.5 mm
- 4 Guide sleeve
- 5 Bolt - 15 Nm
  - ◆ Qty. 3



**6 Clutch release lever**

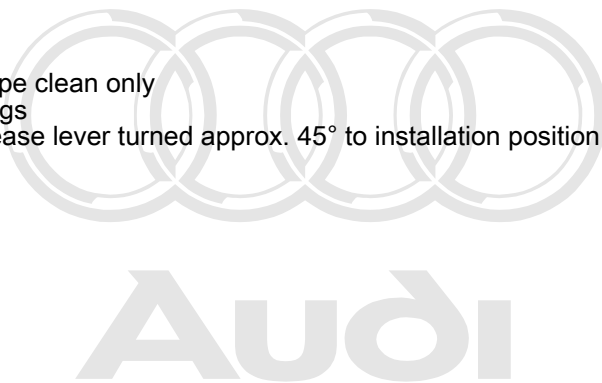
- ◆ Must engage in the lugs in intermediate piece when installed => Fig. 3
- ◆ Before installing, coat clutch slave cylinder push rod contact surface with a thin layer of copper grease, e.g. 381 351 TE

**7 Leaf spring**

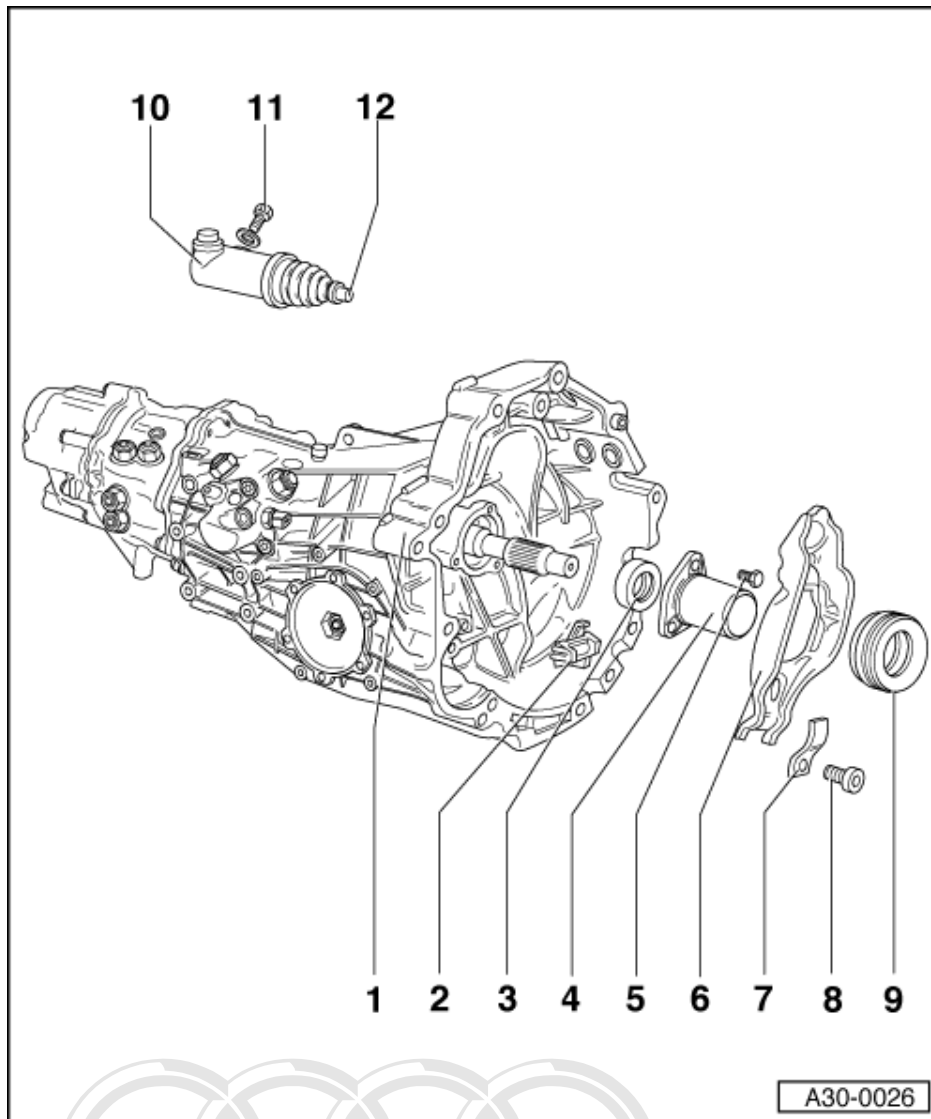
**8 Bolt - 25 Nm**

**9 Release bearing**

- ◆ Do not wash out, wipe clean only
- ◆ Renew noisy bearings
- ◆ Fit bearing onto release lever turned approx. 45° to installation position and engage by turning into position



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#### 10 Clutch slave cylinder

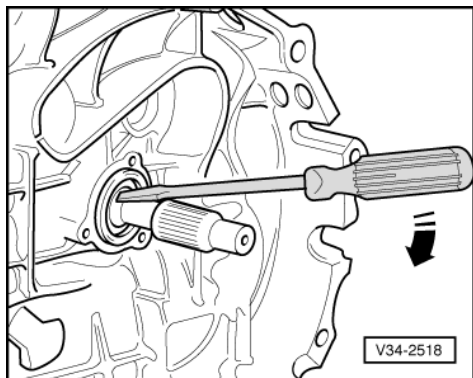
- ◆ Bleeding clutch system  
=> Page 20
- ◆ Installing => Fig. 4
- ◆ When installing, push on until the securing bolt can be fitted
- ◆ To aid installation, the securing bolt with pointed end listed in parts catalogue may be used

#### 11 Bolt - 25 Nm

- ◆ Self-locking
- ◆ Always renew

#### 12 Push rod

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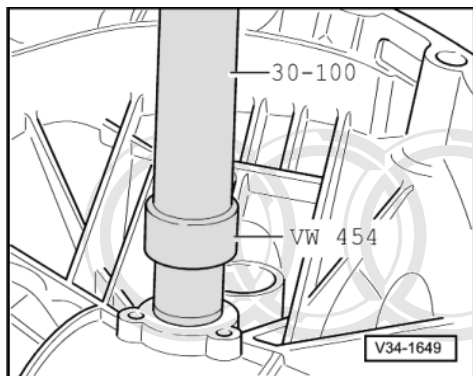


-> Fig.1 Removing shaft seal for input shaft

- Lever seal out carefully with a screwdriver.

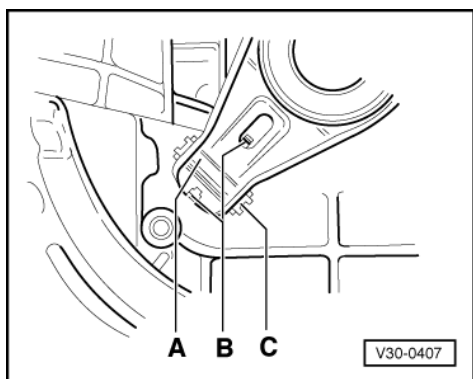
**Note:**

*Do not damage contact surface of shaft seal on input shaft.*



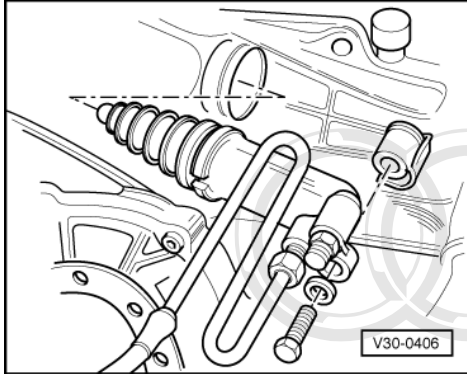
-> Fig.2 Installing shaft seal for input shaft

- Pack space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over input shaft splines.
- Drive on seal for input shaft.
- Pressing-in depth when fitted at factory: 3.5 mm
- Pressing-in depth after repair work: 4.5 mm
- Remove protective hose.



-> **Fig.3 Installing clutch release lever**

- Before installing clutch release lever, coat contact surface for slave cylinder push rod with a thin layer of copper paste.
- Insert clutch release lever -A- into intermediate piece -C- and engage (locking device -B- is visible).
- Insert leaf spring (-item **22** ) to 25 Nm.



-> **Fig.4 Installing clutch slave cylinder**

- When inserting the clutch slave cylinder into the mounting hole of the gearbox housing, keep it as far as possible in line with the direction of operation of the push rod.

**Notes:**

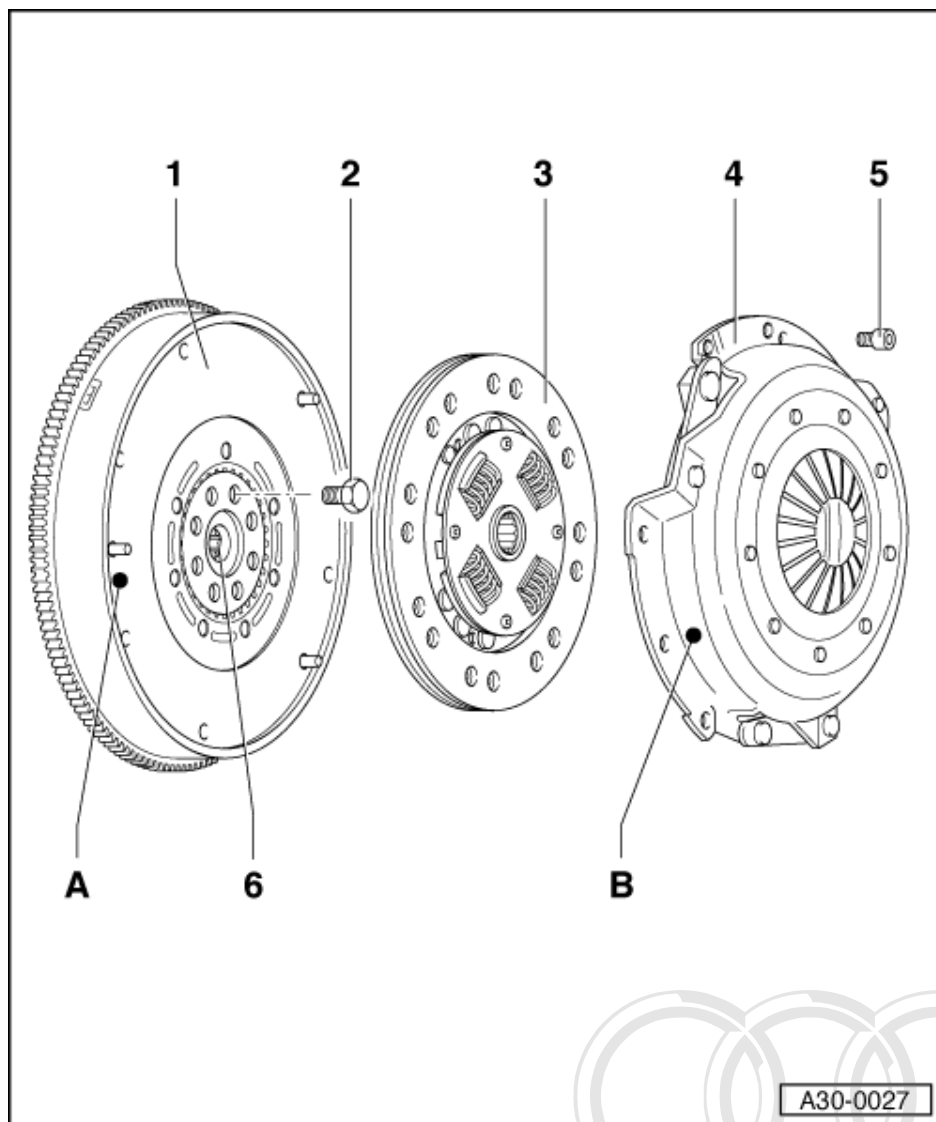
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- ◆ If the clutch slave cylinder is inserted off-line there is a danger that the push rod will be guided past the clutch release lever.
- ◆ To ease assembly, engage 6th gear before installing clutch slave cylinder.
- ◆ Pre-tension the clutch slave cylinder far enough for the securing bolt to be easily inserted.
- ◆ Always renew securing bolt. To aid installation, the securing bolt with pointed end listed in parts catalogue may be used.



### 3 - Servicing clutch

#### 3.1 - Servicing clutch



**Note:**

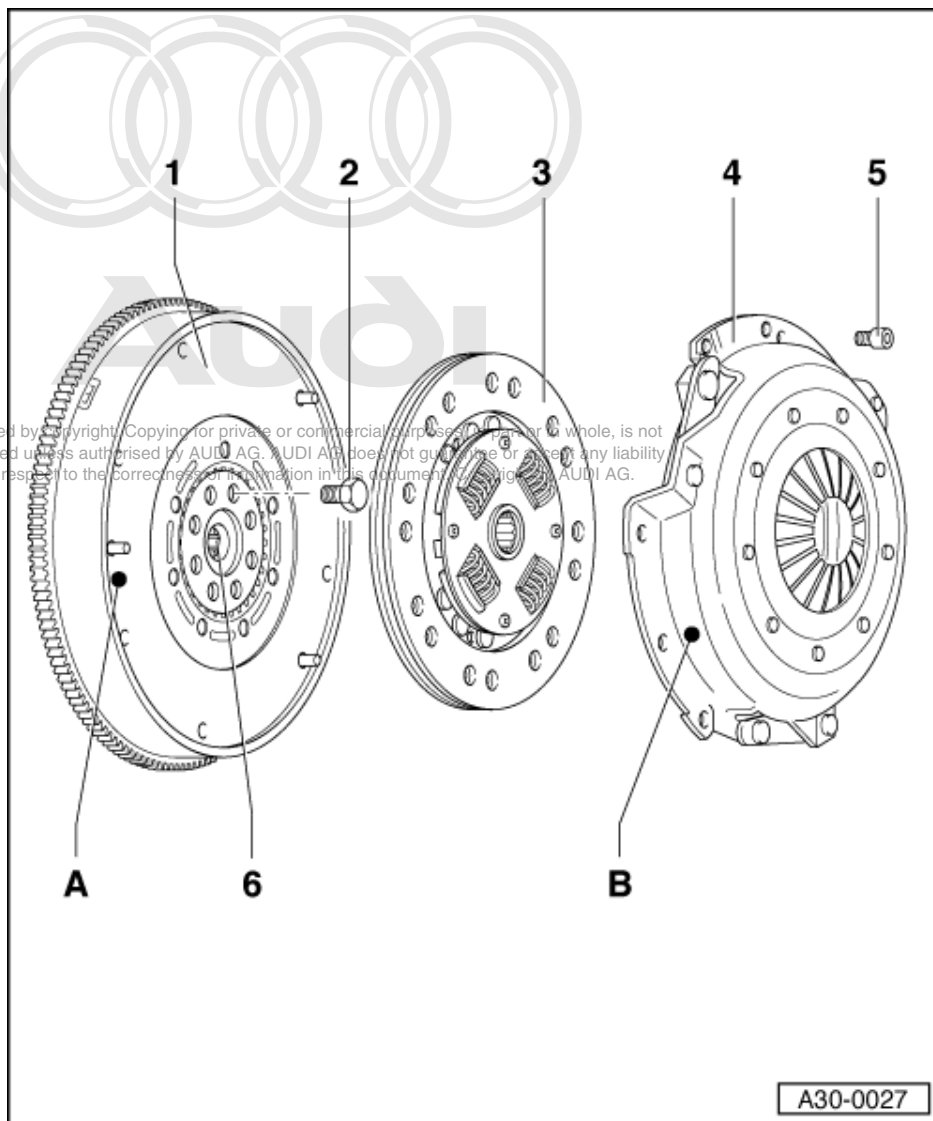
General repair instructions=>Page 5

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

#### 1 Dual-mass flywheel

- ◆ White marking -A- must be aligned with marking -B- on pressure plate
- ◆ Ensure centring pins are tightly seated
- ◆ Contact surface for clutch lining must be free of grooves, oil and grease
- ◆ Removing and installing

=> 6-cylinder diesel direct injection engine (TDI), Mechanics; Repair group 13; Crankcase group; Removing and installing flywheel Crankcase group Removing and installing flywheel



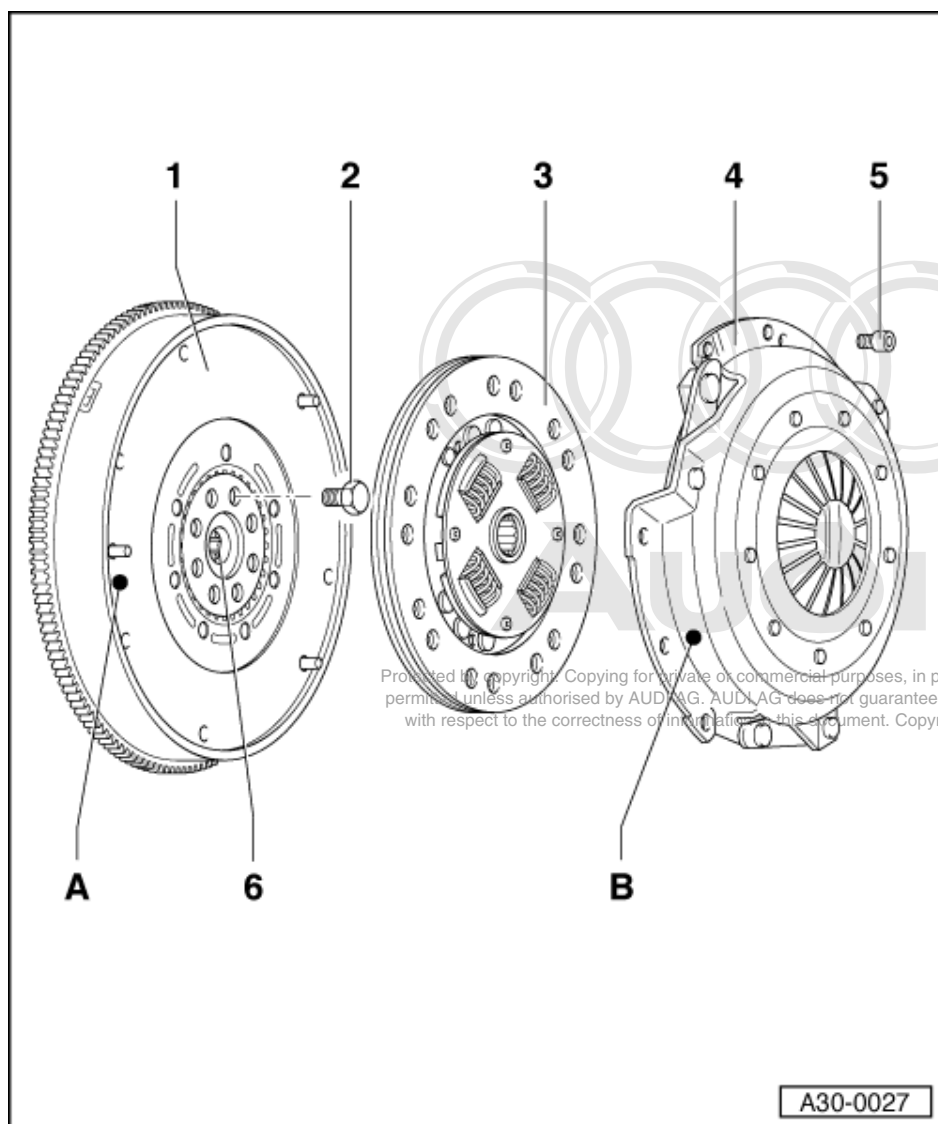
**2 Bolt, 60 Nm + turn 90°further**

- ◆ Always renew

=> 6-cylinder diesel direct injection engine (TDI), Mechanics; Repair group 13; Crankcase group; Removing and installing flywheel Crankcase group Removing and installing flywheel

**3 Clutch plate**

- ◆ Install with spring pack (coil springs) or the word "Getriebeseite" (gearbox side) towards pressure plate and gearbox
- ◆ Centring => Fig. 1
- ◆ Do not grease
- ◆ => Notes
- ◆ Clutch plate diameter  
=> from Page 2

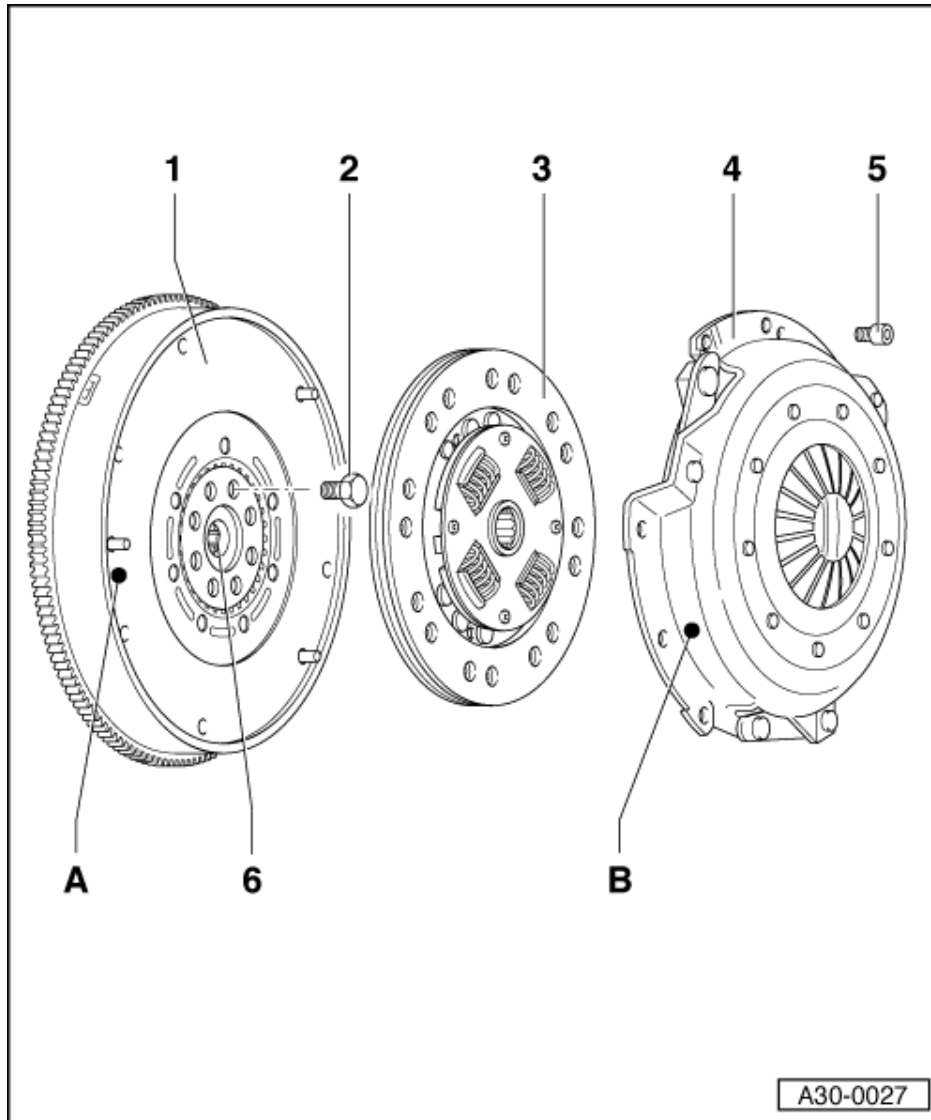


**Notes:**

- ♦ 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.
- ♦ Clean input shaft splines and if clutch plate is to be reused, the hub splines, remove corrosion and apply only a very thin coating of grease G 000 100 to splines. Then move clutch plate back and forth on input shaft until the hub moves freely on shaft. Excess grease must be removed.
- ♦ Before renewing clutch plate

=> Fault Finding Programme No. 9 - Faults on clutch and clutch mechanism





#### 4 Pressure plate

- ◆ Removing and installing => Fig. 1
- ◆ White marking -B- must be aligned with marking -A- on flywheel
- ◆ Checking ends of diaphragm spring => Fig. 2
- ◆ Checking spring connection and riveted fastenings => Fig. 3
- ◆ => Notes

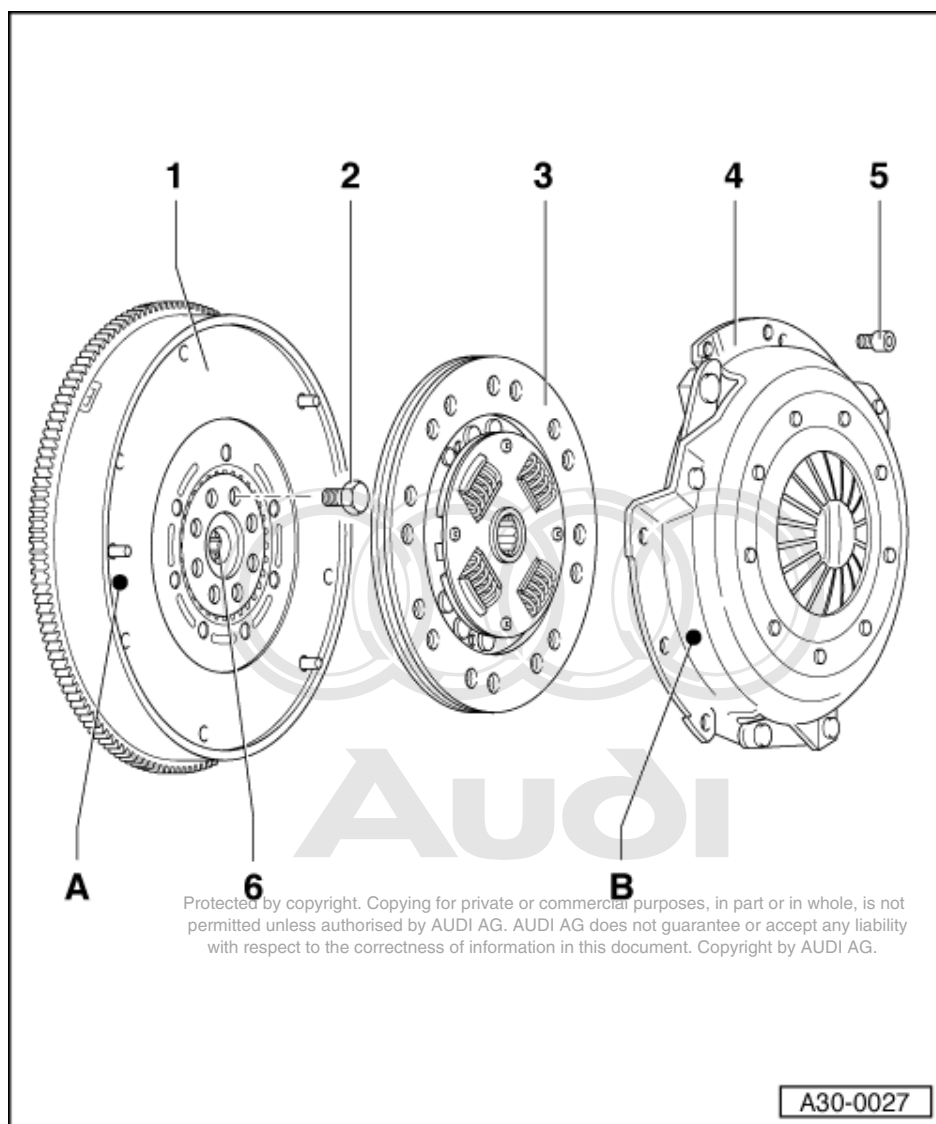
#### Notes:

- ◆ Pressure plates are protected against corrosion and greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.
- ◆ Before renewing pressure plate

=> Fault Finding Programme No. 9 - Faults on clutch and clutch mechanism

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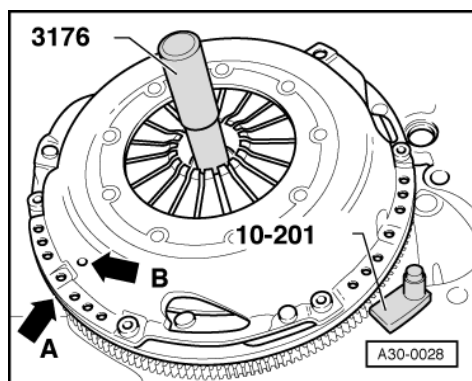
**5 Bolt - 25 Nm**

- ♦ Tighten in stages and diagonally

**6 Needle roller bearing**

- ♦ Removing and installing

=> 6-cylinder diesel direct injection engine (TDI), Mechanics; Repair group 13; Crankcase group; Removing and installing flywheel Crankcase group Removing and installing flywheel

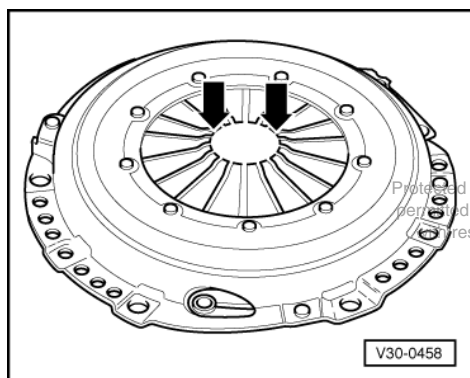


-> Fig.1 Removing and installing clutch

- Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" (gearbox side) towards pressure plate and gearbox
- When assembling, make sure that white marking -A- on the dual-mass flywheel is aligned with white marking -B- on the pressure plate.
- Loosen and tighten bolts in stages and diagonally - 25 Nm.
- Reverse position of counter-hold tool 10-201 when removing.
- Use mandrel 3176 to centre clutch plate.

**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.

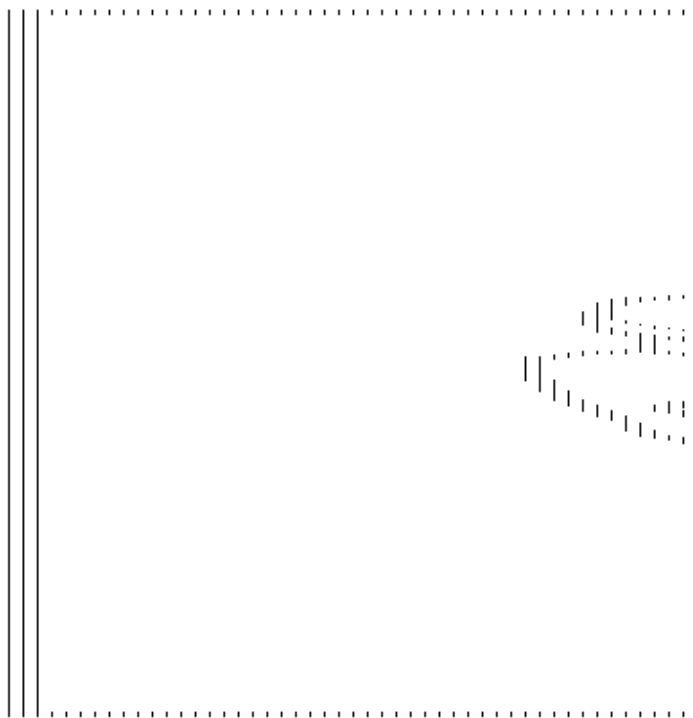


-> Fig.2 Checking ends of diaphragm spring

- ◆ 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-.

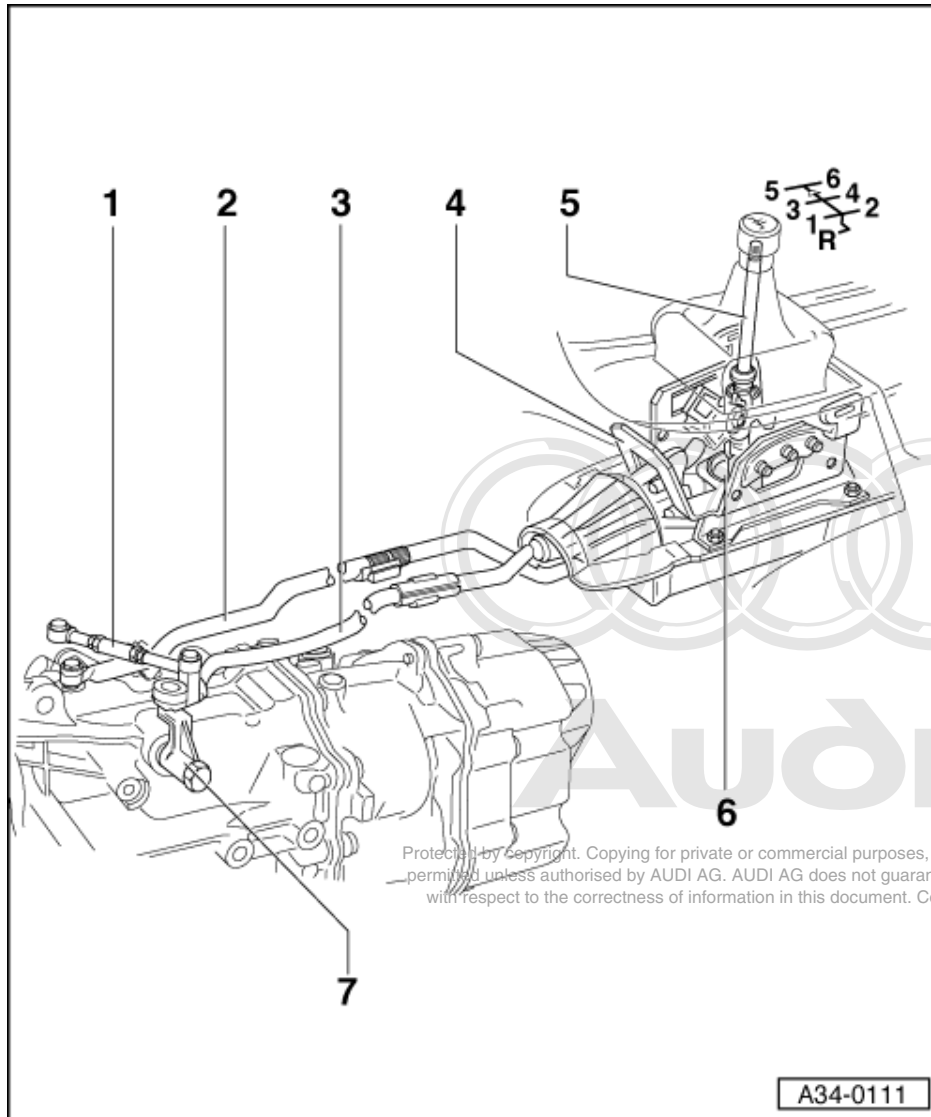


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## 34 - Controls, Housing

### 1 - Servicing selector

#### 1.1 - Servicing selector



#### 1.2 - Servicing selector mechanism

**Note:**

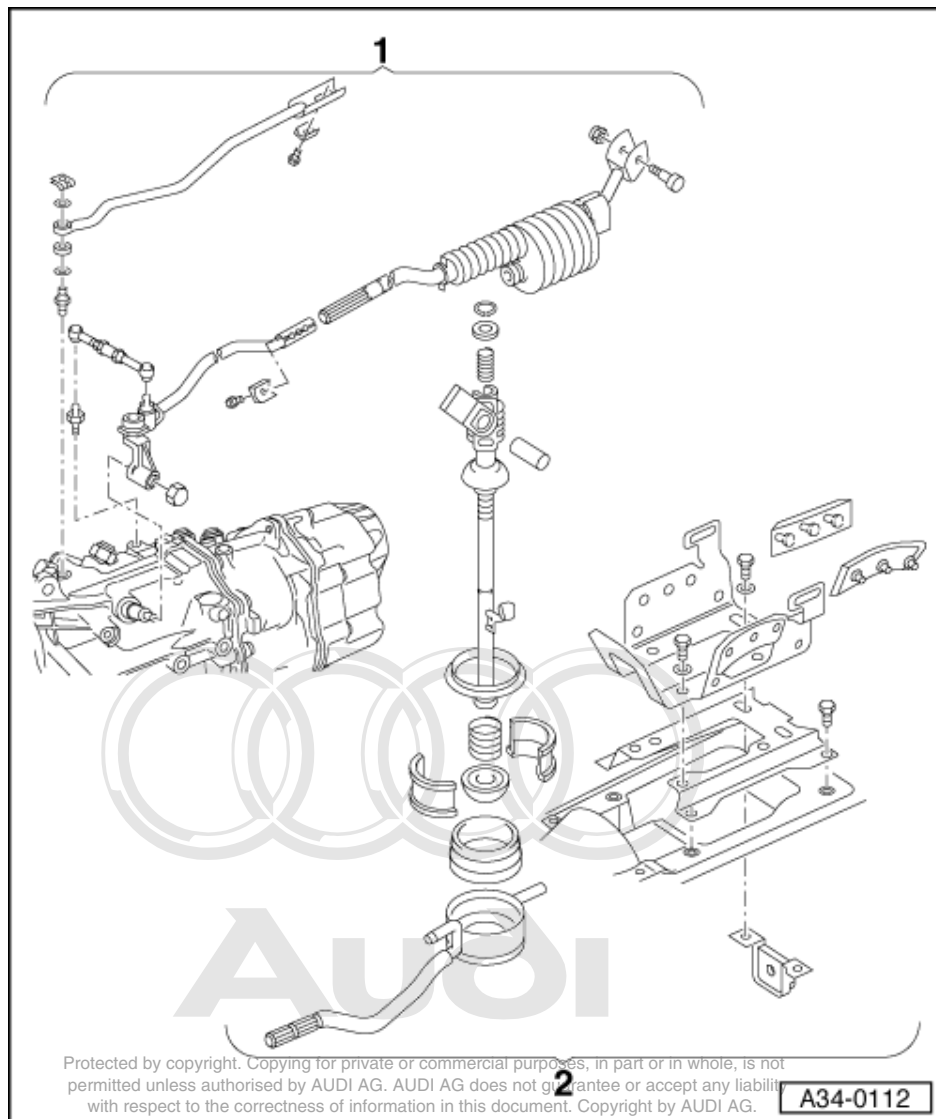
General repair instructions=>Page **5**

- 1 Connecting rod
- 2 Push rod
- 3 Selector rod
- 4 Stop



- 5 Gear stick
- 6 Gear stick mounting
- 7 Selector lever on gearbox

### 1.3 - Dismantling and assembling selector mechanism



**Note:**

*Grease all joints and moving surfaces with polycarbamide grease G 052 142 A2.*

- ♦ Removing and installing selector rods  
=>Page 42 .
- ♦ Removing and installing push rods  
=>Page 43 .
- ♦ Adjusting and checking  
selector mechanism => Page 46 .

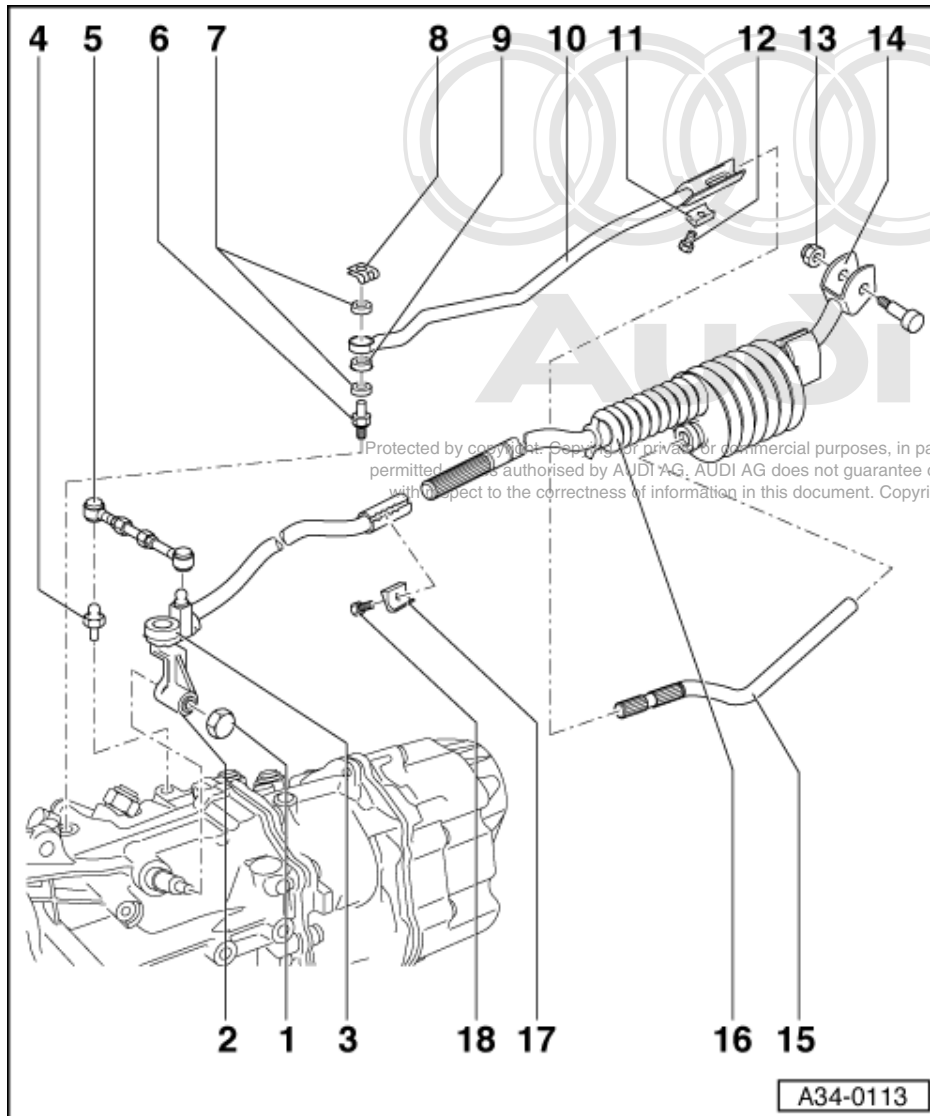
#### 1 Selector rod and front push rod

- ♦ Servicing => Page 35

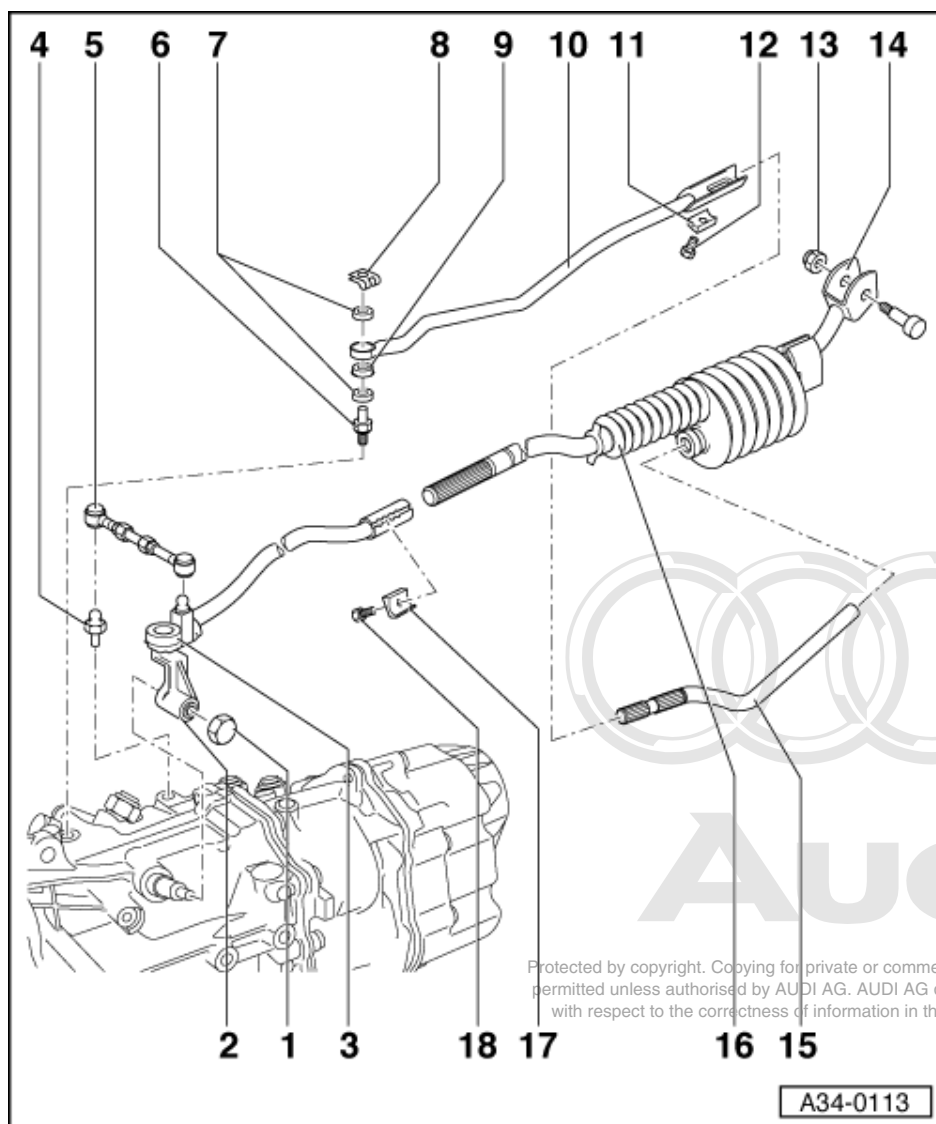
#### 2 Gear stick and rear push rod

♦ Servicing => Page 38

## 1.4 - Servicing selector rod and front push rod



- 1 Cap nut - 25 Nm
- 2 Selector lever on gearbox
  - ♦ Dismantle together with front selector rod
- 3 Front selector rod
  - ♦ Dismantle together with selector lever -item 2 -
  - ♦ Do not dismantle from selector lever -item 2 -
- 4 Ball stud - 15 Nm
- 5 Connecting rod
  - ♦ Adjusting => Page 46



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**6 Trunnion bolt - 40 Nm**

**7 Washer**

**8 Securing clip**

- ♦ Always renew

**9 Bearing**

**10 Front push rod**

- ♦ Removing and installing  
=>Page **43**

**11 Clamp**

**12 Bolt - 25 Nm**

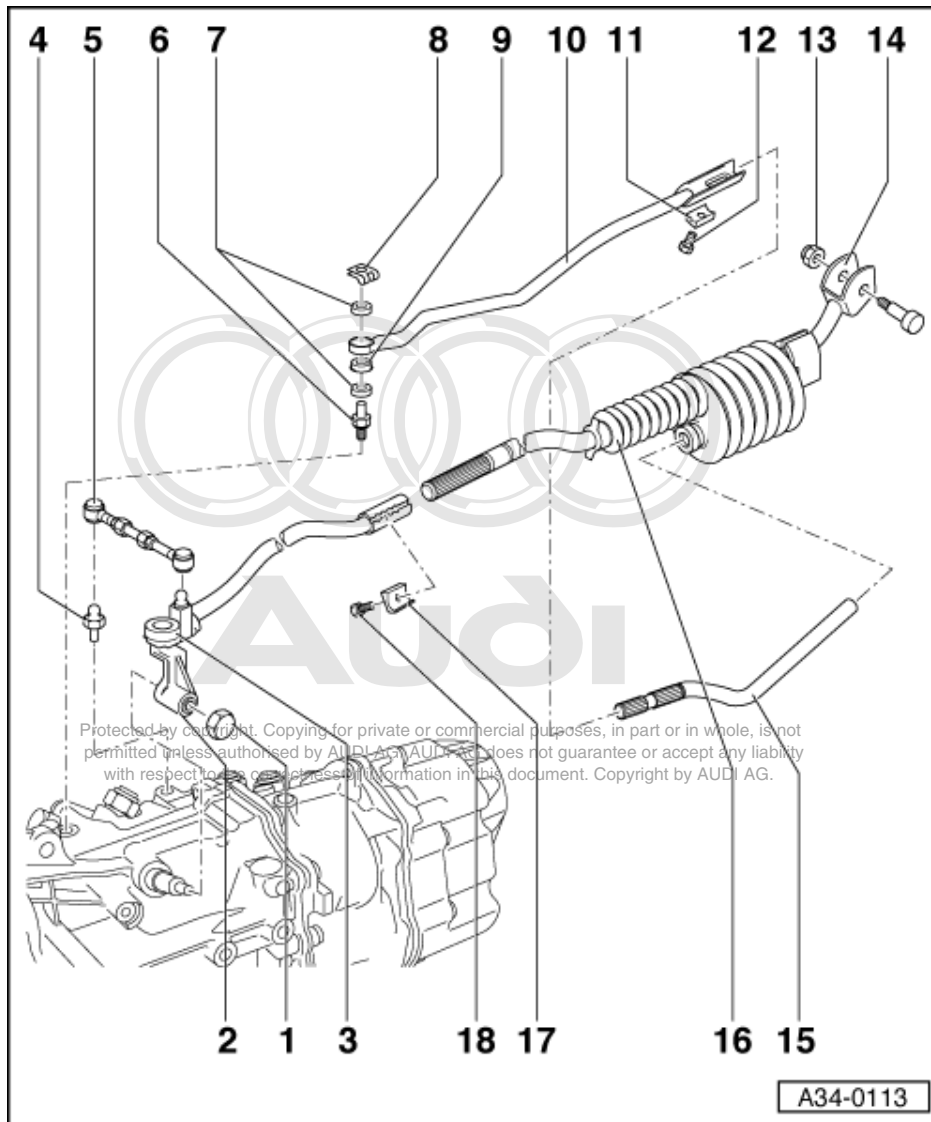
**13 Lock nut - 10 Nm**

- ♦ Always renew

**14 Rear selector rod**

- ♦ Removing and installing  
=>Page **42**





#### 15 Rear push rod

- ♦ Removing and installing  
=>Page 43

#### 16 Boot

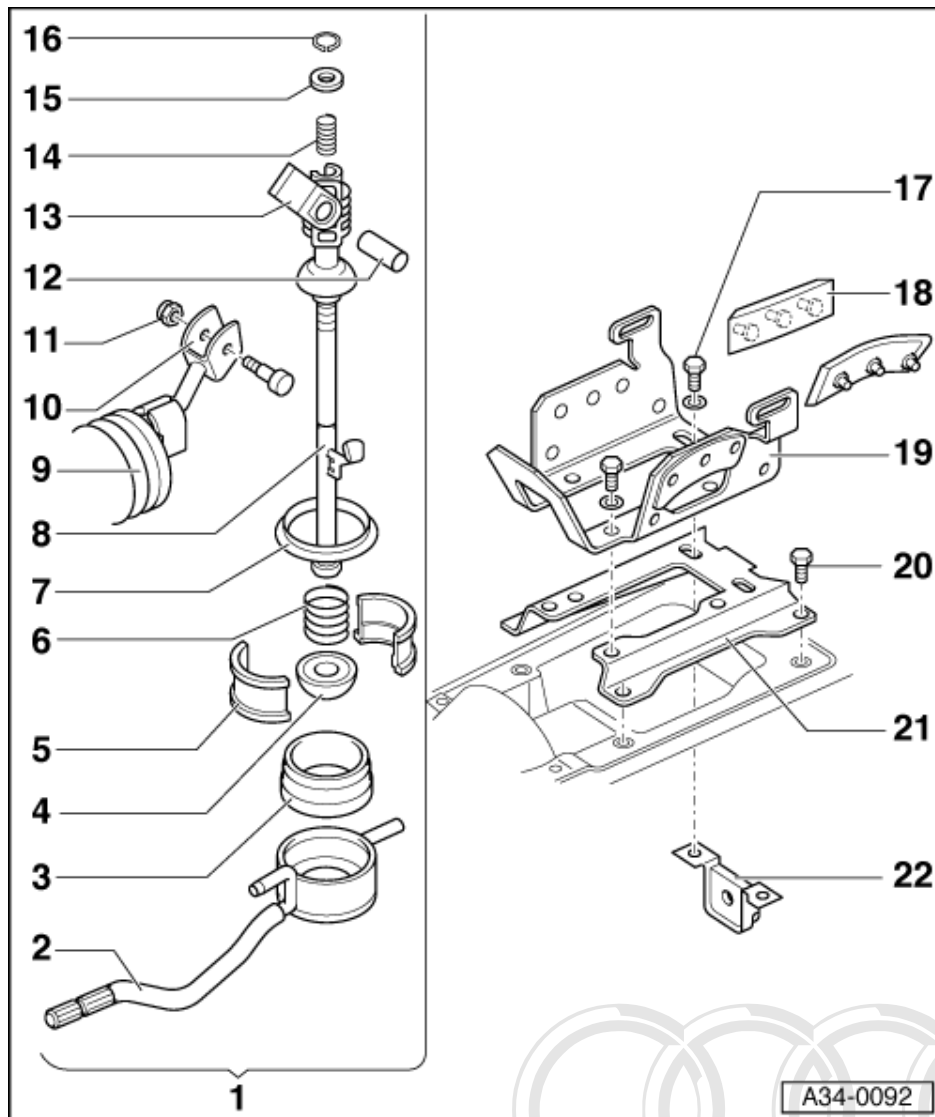
- ♦ Removing and installing  
=>Page 44

#### 17 Clamp

#### 18 Bolt - 25 Nm



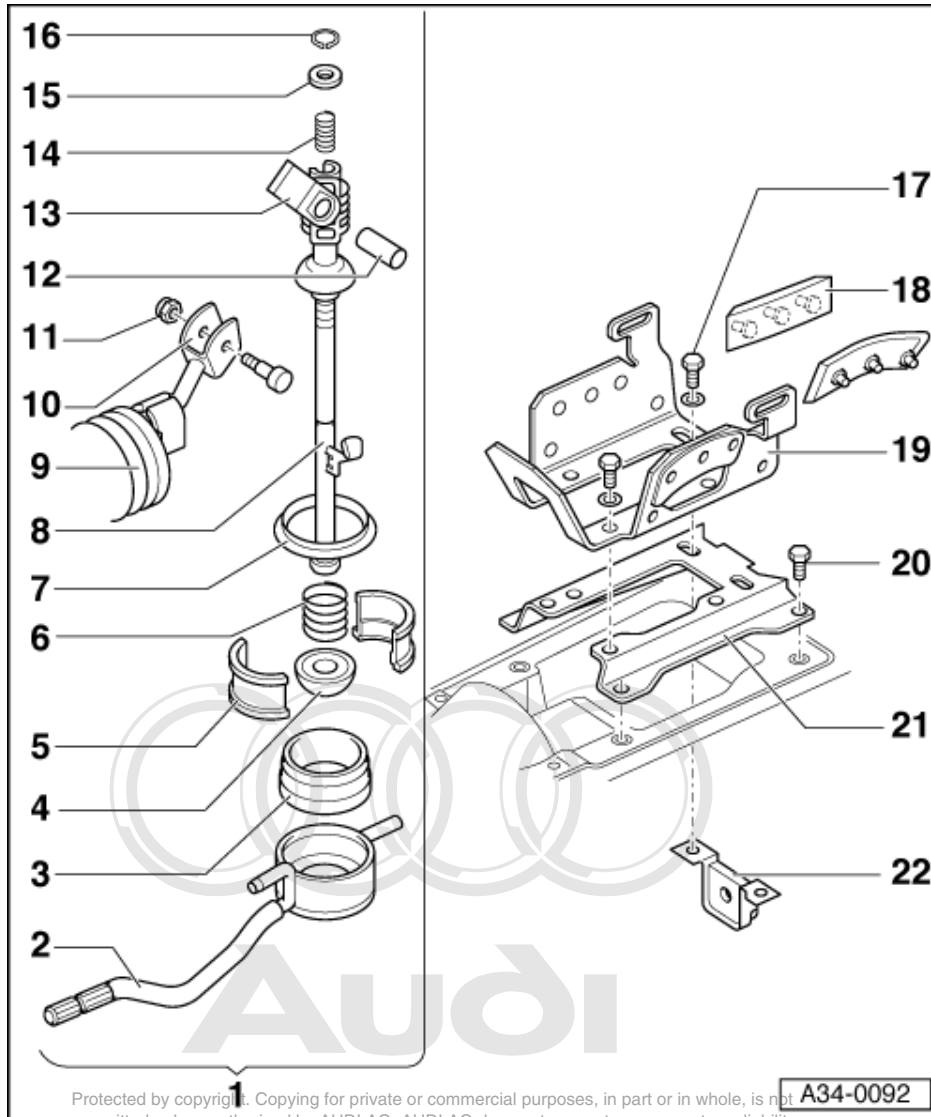
## 1.5 - Servicing gear stick and rear push rod



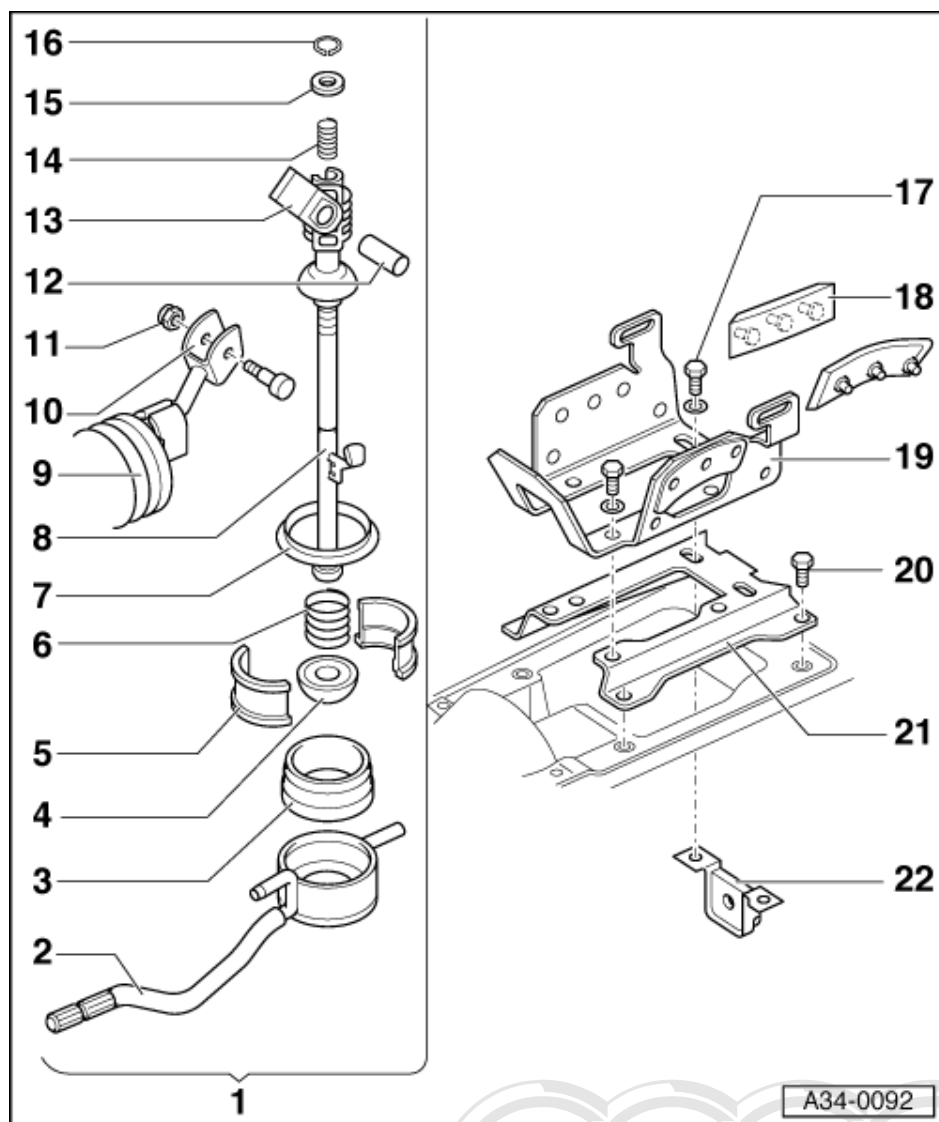
### 1 Gear stick complete

- ◆ Dismantle only to grease
- ◆ Assembling:
  - Pre-assemble rubber guide, shell sections and bottom hemispherical ball.
  - Insert gear stick with spring, intermediate plate and top hemispherical ball into shell sections.
  - Press rubber guide into gear stick mounting.
  - Fit intermediate plate andpeen gear stick mounting at three points so that the intermediate plate is secure => Fig. 1 .
- ◆ Adjusting => Page 46

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- 2 Rear push rod**
- ♦ With gear stick mounting, bearing pin and catch pin
  - ♦ Adjusting => Page 48
- 3 Rubber guide**
- ♦ Installation position: shoulder faces up
- 4 Lower hemispherical ball**
- 5 Shell section**
- 6 Spring**
- 7 Intermediate plate**
- 8 Gear stick**
- ♦ Adjusting=>Page 47
- 9 Boot**



10 Rear selector rod

11 Securing nut - 10 Nm

- ♦ Always renew

12 Tube

13 Guide for gear stick

14 Spring

15 Spacer bush

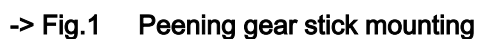
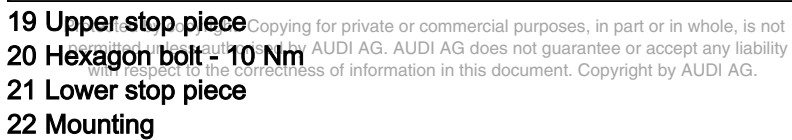
16 Circlip

17 Bolt - 10 Nm

18 Buffer left and right

- ♦ After assembling shorten retaining studs by approx. 7 mm

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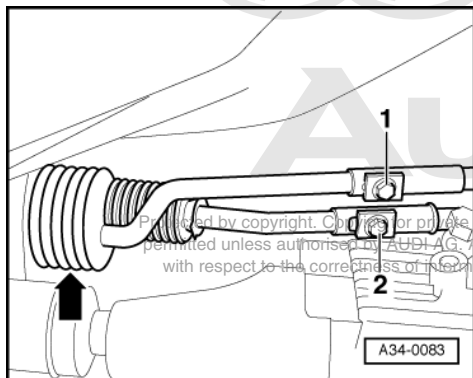


- ## 1.5 - Servicing gear stick and rear push rod **41**



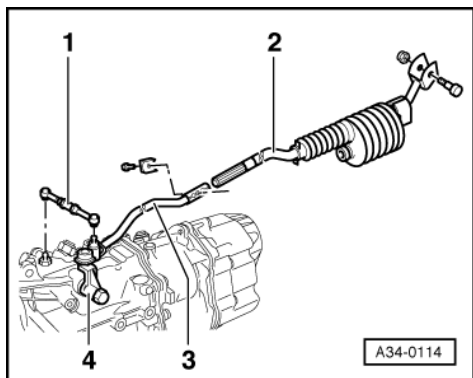
## 1.6 - Removing and installing front and rear selector rods

- Gearbox installed



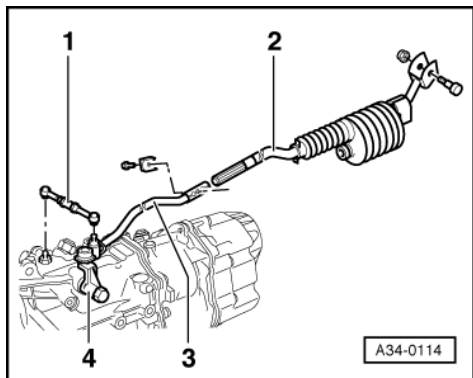
### Removing

- Unscrew gearstick knob.
- Unclip gearstick cover and pull off.
- -> Remove bolt -2- and take off clamp.



- -> Unscrew rear selector rod -2- from selector lever and slide forwards over the push rod catch pin.
- Guide out rear selector rod.
- Lever connecting rod -1- off front selector rod -3-.
- Remove selector lever -4- at gearbox and pull out front selector rod.

### Installing



- -> First attach front selector rod -3- with selector lever to gearbox, connect to rear selector rod -2- and bolt onto gear stick.
- When installing front and rear selector rods ensure the boot is correctly seated.
- Press on connecting rod -1- using an assembly lever.

- Adjusting and checking selector mechanism => Page 46 .

## 1.7 - Removing and installing front and rear push rods

- Gearbox installed

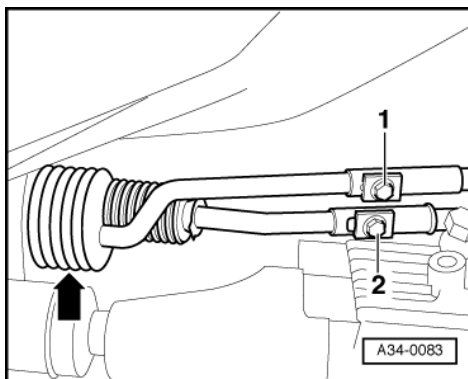
### Removing

- Remove centre console

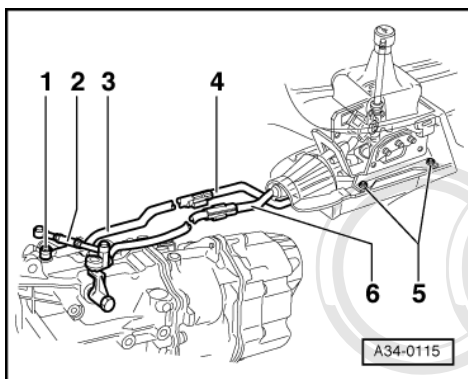
=> General Body Repairs; Repair Group 70; Removing and installing centre console and handbrake trim Removing and installing centre console and handbrake trim

### Note:

*The rear push rod is removed complete with selector lever and rear selector rod.*



- -> Slackenbolts -1- and -2- and take off clamping pieces.



- -> Unscrew bolts -5- for lower stop piece.
- Take out rear push rod -4-, gear stick, rear selector rod -6- and boot upwards.
- Lever off connecting rod -2-, remove circlip -1-.
- Take off front push rod -3-.

### Installing

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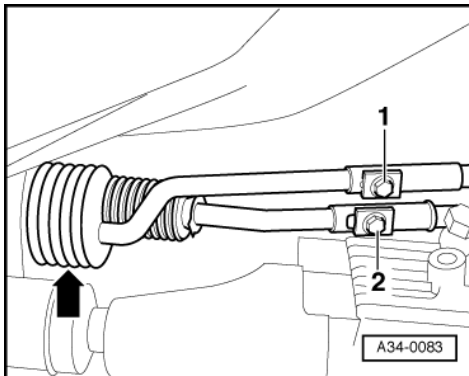
Installation is carried out in the reverse order, when doing this note the following:

- Renew circlip and ensure it is correctly seated =>page 36 .
- Ensure that boot is correctly seated=>Page 44 .
- Adjusting and checking selector mechanism => Page 46 .

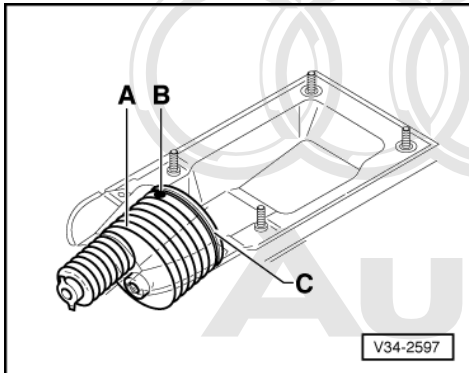


## 1.8 - Removing and installing boot

### Removing



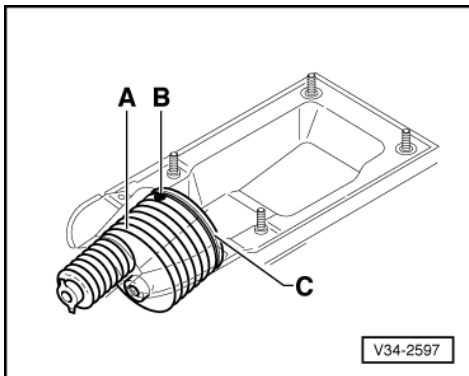
- Unscrew gearstick knob.
- Unclip gearstick cover and pull off.
- -> Remove bolts -1- and -2- and take off clamping pieces.



- -> Under vehicle, pull out boot A over push rod and selector rod.
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### Installing

- Push boot on over push rod and selector rod.

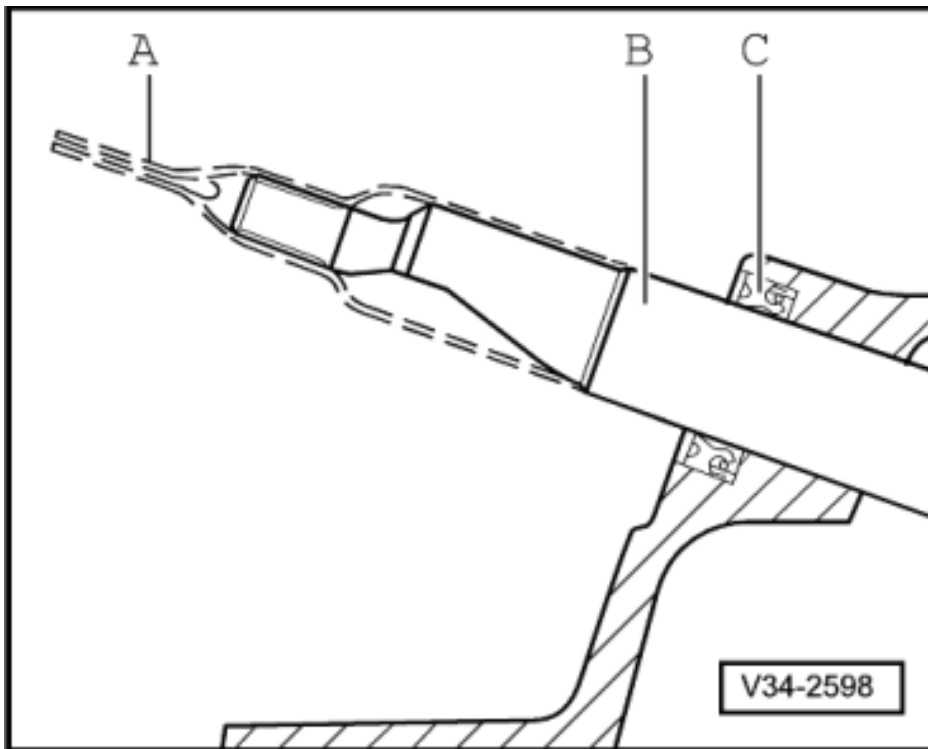


- -> Check installation position of boot from vehicle interior.
- Marking lug -B- is on top
- Rim of boot is correctly clipped-in all around hole -C- in body
- Checking and adjusting selector mechanism => Page 46 .



## 1.9 - Renewing shaft seal for selector shaft

- Gearbox removed but not dismantled



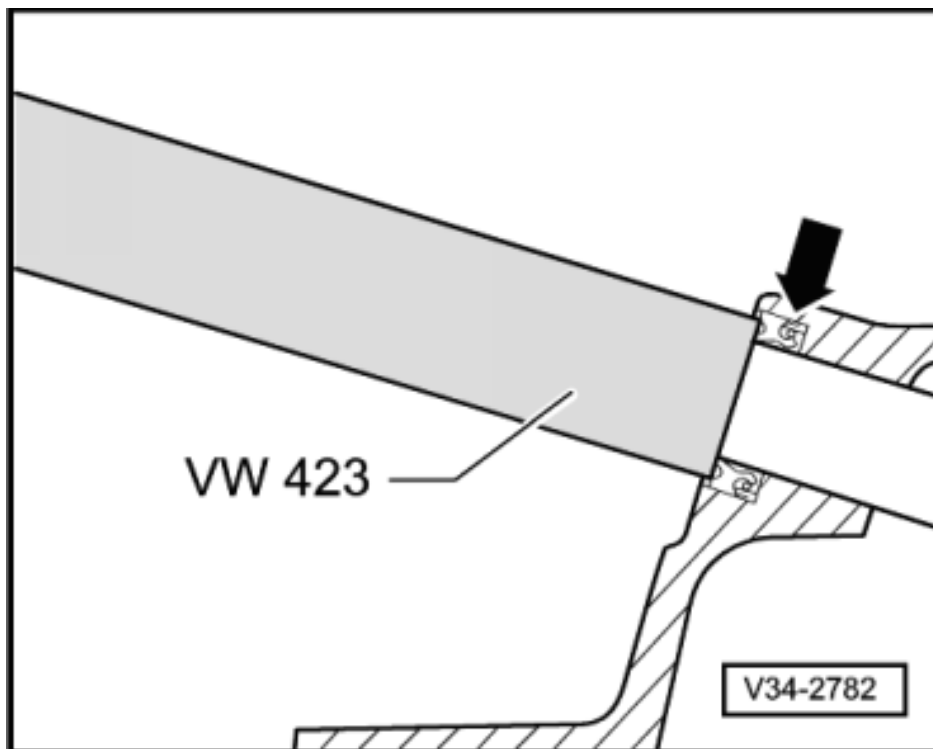
- -> Carefully lever out shaft seal -C- with a small screwdriver.
- Slide assembly sleeve -A-, Part No. 01E 311 120, over selector shaft -B-.

### **Notes:**

- ◆ Lightly lubricate outer circumference of seal.
- ◆ Fill space between sealing and dust lips with multipurpose grease.
- ◆ Always use fitting sleeve to install shaft seal.

  
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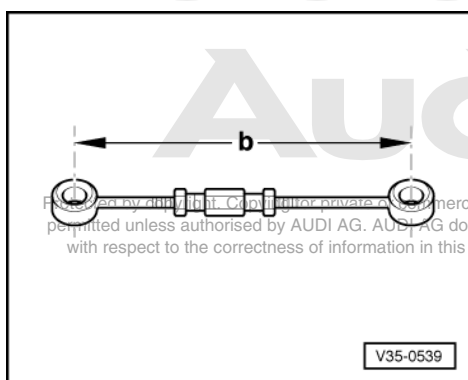


- -> Drive new shaft seal -arrow- into housing onto stop with press piece VW 423.

## 2 - Adjusting and checking selector mechanism

### 2.1 - Adjusting and checking selector mechanism

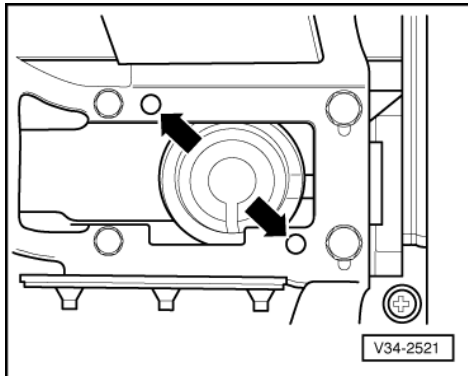
### 2.2 - Basic adjustment (adjustment instructions)



The basic adjustment must be performed if the fine adjustment is not sufficient or if the clamping pieces have been loosened when performing repairs.

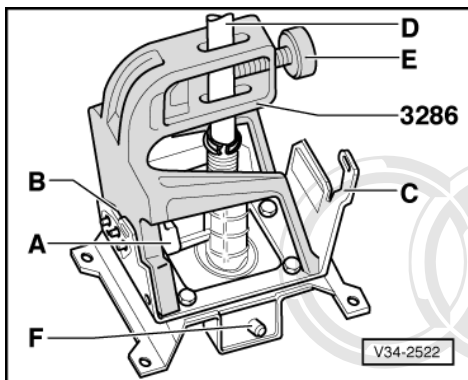
- -> Adjust connecting rod, ball sockets must align.
  - Dimension  $b = 168.5 \text{ mm}$
- Removing and installing connecting rod=>Page 42 .
- Unscrew gear stick knob.

- Unclip gear stick cover and pull off.



- -> Centring holes -arrows- of upper and lower stop pieces align.
- Tighten bolts to 10 Nm.
- Position gearstick in neutral position in 3rd/4th gear gate.
- Install clamps for selector and push rods so that they can still be turned and moved relative to one another easily.
- Adjust gear stick and rear push rod.

#### Adjusting gear stick

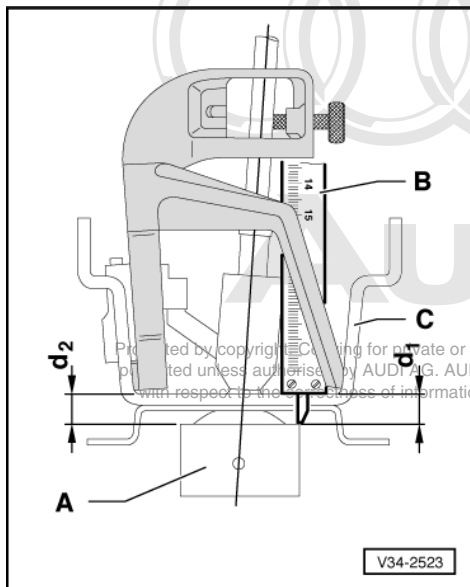


- Fit gear stick jig 3286 over gear stick -D- and snap into position.
- Insert gear stick jig 3286 on left-hand side into free holes and then into holes on right-hand side of upper stop piece -C-.
- Tighten knurled screw -E- lightly until the stop head -A- lies against the gear stick jig 3286.

B - Left stop buffer

F - Bearing pin

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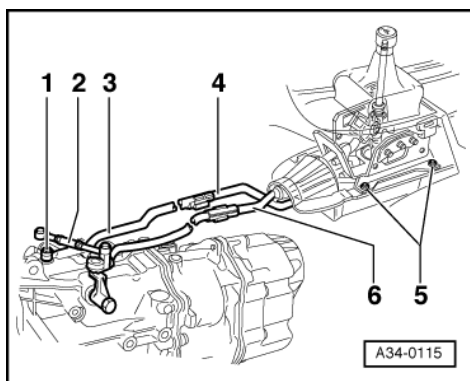


### Adjusting rear push rod

#### **Note:**

-> When adjusting the rear push rod the gear stick mounting -A- is aligned with the upper stop piece -C-.

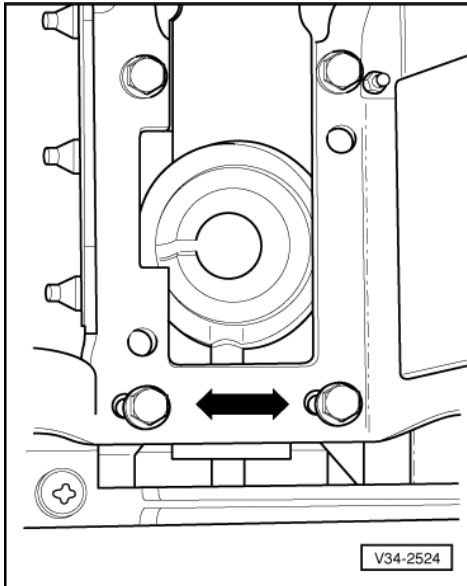
- Determine distances d1 and d2 on left and right-hand edges of gear stick mounting -A- with caliper gauge -B-.
- Align gearshift mounting so that difference between d1 and d2 is no greater than 1 mm.



- -> Tighten clamps on selector rods and push rods to 25 Nm.
- After turning back knurled screw, take gear stick jig 3286 out of upper stop piece.

## 2.3 - Checking gear stick adjustment

- Engage 2nd gear and push gear stick to the left against the stop.
- Reduce pressure on gear stick until it moves back to pressure point.
  - Return spring travel must be 3 ... 9 mm, measured at gear stick knob
- Check that all gears can be engaged.



- Check operation of reverse gear lock.
  - It must be possible to move the gear stick, without pushing and without force, forwards from the reverse gear lock to the 3rd/4th gear plane
- If adjustment of selector mechanism is OK, fit gear stick cover and gear stick knob.
- If adjustment of selector mechanism is not OK, check fine adjustment.

## 2.4 - Fine adjustment instructions

- -> If the return spring travel is not correct, perform a correction in the lateral direction by moving sideways in the elongated holes -arrow- of the upper stop piece.

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## 3 - Removing and installing gearbox

### 3.1 - Removing and installing gearbox

### 3.2 - Contact corrosion

Contact corrosion may be produced if fasteners not approved by AUDI AG (screws/bolts, nuts, washers rivets, plugs, grommets, adhesives, etc.) are used.

For this reason, the manufacturer installs only fasteners with a special surface coating, as well as electrically non-conducting rubber and plastic parts, and adhesives.

The fasteners supplied as Genuine spare parts are recognisable by their greenish colour.

If doubt exists as to whether used parts can be re-installed always install new parts.

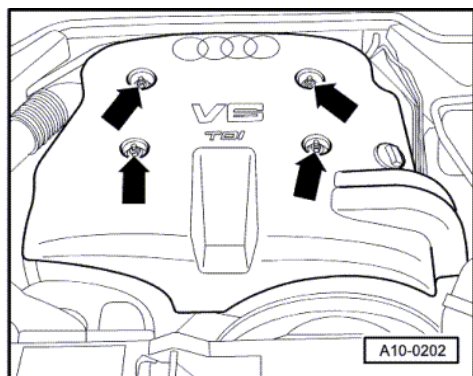
#### Warning!

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



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

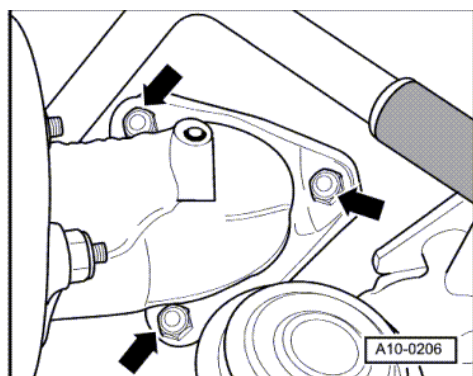
- ♦ Gearbox support 3282
- ♦ Adjustment plate 3282/12



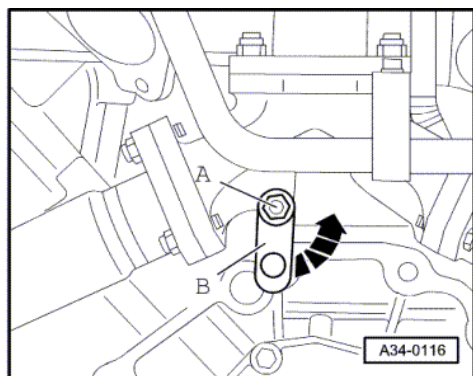
- ♦ Gearbox jack V.A.G 1383 A

### Removing

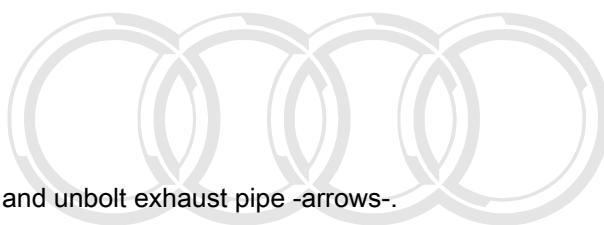
- Obtain radio code on vehicles with coded radio.
- Switch off ignition and disconnect battery earth strap (in luggage compartment).
- -> Unbolt noise insulation cover above cylinder head cover -arrows-.



- -> Remove heat shield above turbocharger and unbolt exhaust pipe -arrows-.

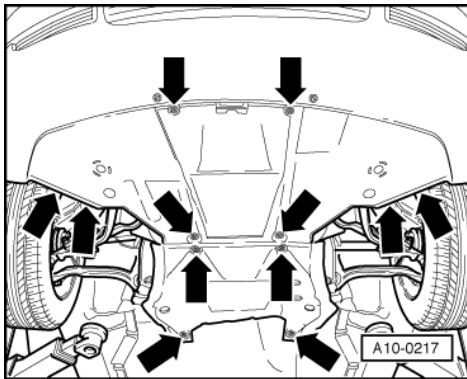


- Remove engine/gearbox securing bolts which are accessible from above.
- -> Slacken bolt -A- slightly and pivot strut -B- to the side in the direction indicated (arrow). Then tighten bolt -A- again lightly.



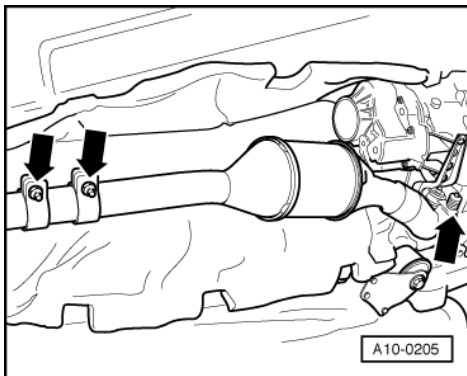
Audi

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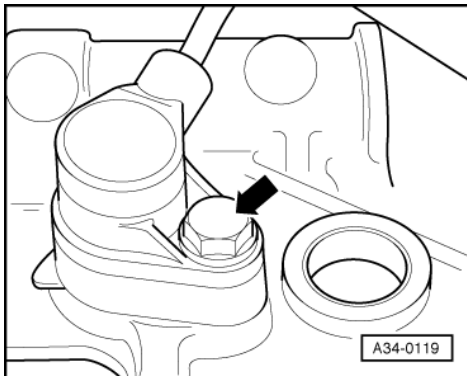


- -> Remove noise insulation panel (2 sections) -arrows-
- Unbolt mounting for noise insulation.

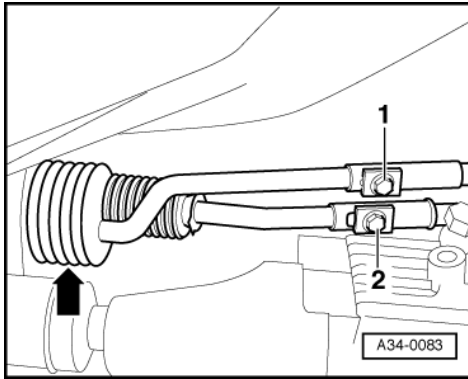
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- -> Remove exhaust pipe complete with catalytic converter -arrows-
- Detach heat shield for left inner joint from gearbox.
- Detach drive shafts (left and right), lift clear and secure with wire or similar.



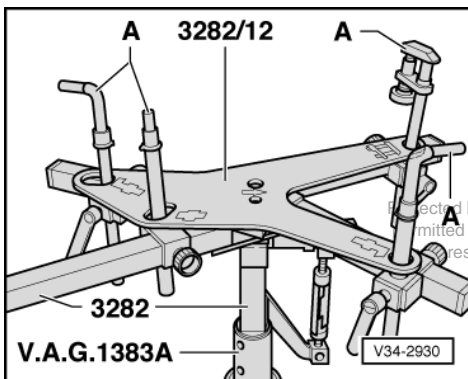
- -> Remove engine speed sender -G28 from left-hand side of gearbox -arrow- and place to one side.
- Pull connector off sender for speedometer.
- Pull off connector on reversing light switch.
- Remove starter and place to one side in engine compartment.
- Remove all but one of the engine/gearbox securing bolts from below (one bolt is left in place to hold the engine and gearbox together).



- -> Slacken bolts -1- and -2-, take off clamping pieces.
- Engage 3rd gear and disconnect selector rod.

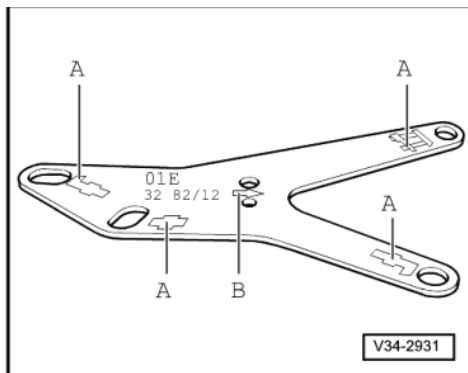
**Note:**

*The selector rod can be disconnected by pulling back the gear stick towards 4th gear.*



- -> Set up gearbox support 3282 with adjustment plate 3282/12 for removal of manual gearbox 01E (front-wheel drive) and place on gearbox jack V.A.G 1383 A.

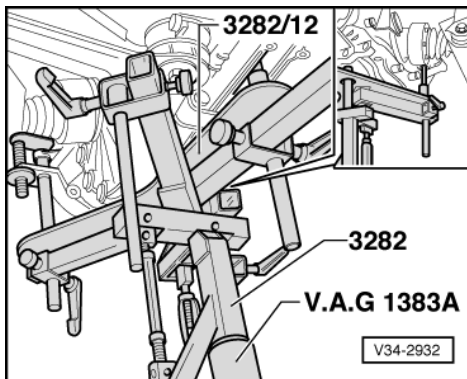
A - Attachments



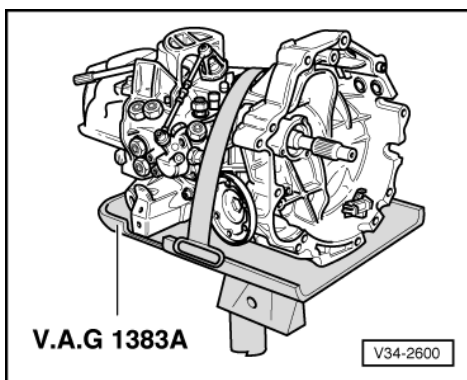
**Notes:**

- ♦ -> The positions for the attachments are indicated by symbols (-A-). Arrow -B- points in the direction of travel.
- ♦ Adjustment plate 3282/12 can only be fitted in one position.
- ♦ The elongated holes in adjustment plate 3282/12 allow for different versions of the gearbox housing and gearbox cover.





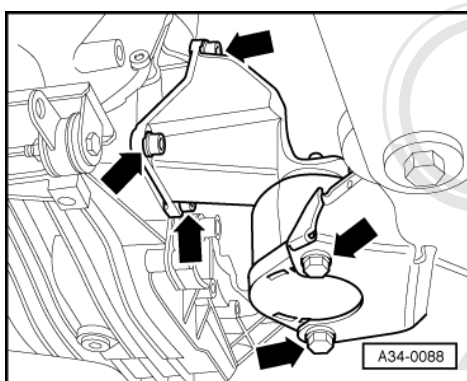
- -> Run gearbox jack V.A.G 1383 A with gearbox support 3282 in under the gearbox and take up the weight of the gearbox.
- Secure gearbox to gearbox support 3282.



**Note:**

*If gearbox support 3282 is not available, the gearbox can be removed and installed using gearbox jack V.A.G 1383 A.*

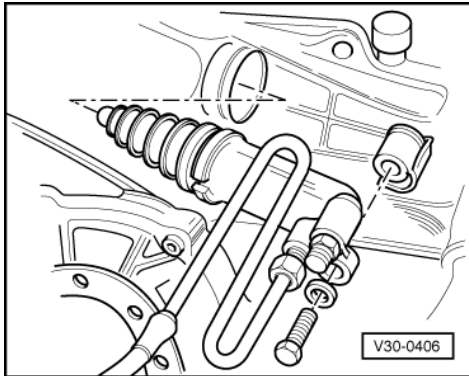
- -> Support gearbox with gearbox jack V.A.G 1383 A.



- -> Remove left and right gear box mountings together with gearbox support -arrows-
- Remove the last remaining engine/gearbox securing bolt.
- 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 slave cylinder, do not open pipe/hose system.

**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.

**Installing**

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

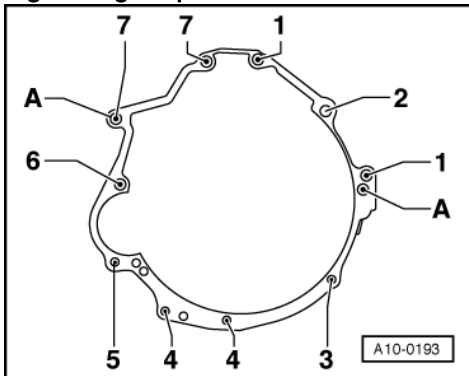
**Important**

To prevent contact corrosion, use only the approved nuts, bolts and washers, etc. These fasteners have a special coating and are identified by a green colouring.

- Renew all seals and gaskets.
- Renew all self-locking nuts.
- Check whether dowel sleeves for aligning gearbox with engine are in the gearbox flange. Insert if necessary => Page 54 .
- 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 and renew if necessary.
- Lightly lubricate push rod contact surface on release lever with copper grease.
- Install clutch slave cylinder after installing gearbox => Page 25 .
- Ensure sufficient clearance between front exhaust pipe and subframe, and align exhaust system so it is free of stress

=> 6-cylinder diesel direct injection engine (TDI), Mechanics; Repair group 26; Removing and installing parts of the exhaust system; Stress-free alignment of exhaust system Removing and installing parts of the exhaust system Stress-free alignment of exhaust system

- Check oil level in gearbox => Page 55 .
- Adjust selector mechanism => Page 46 .

**Tightening torques**

- -> Engine/gearbox securing points (illustration shows gearbox flange)

No.	Bolt	Qty.	Nm
1	M 12 x 80	2	65
2	M 12 x 90	1	65
3	M 10 x 50	1	45
4	M 10 x 45	2	45
5	M 10 x 135	1	65
6	M 12 x 110	1	65
7	M 12 x 87	2	65

Dowel sleeves -A- for aligning.

Component	Nm
Clutch slave cylinder to gearbox	20
Gearbox support to gearbox	45
Gearbox mounting to subframe	40
Engine speed sender -G28	10
Drive shaft to flange shaft M10	80
Heat shield for drive shaft	25
Clamping piece for selector rod and push rod	25
Catalytic converter to mounting lugs	25
Front exhaust pipe to turbocharger	25
Heat shield to turbocharger	10
Double clamp for exhaust pipe	40
Bracket for noise insulation to body	25

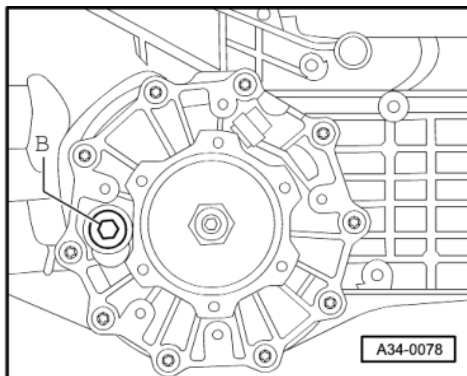
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## 4 - Checking gearbox oil level

### 4.1 - Checking gearbox oil level

#### Notes:

- ♦ The vehicle must be absolutely horizontal when checking the gearbox oil level. Use an inspection pit or a four-pillar hoist where possible.
- ♦ The oil level must be exactly as specified; the gearbox reacts very sensitively to over-filling.



- -> Remove oil filler plug -B- (in front of flange shaft) to check gearbox oil level.



**Specification:** oil level up to bottom of filler hole

- Fit oil filler plug.

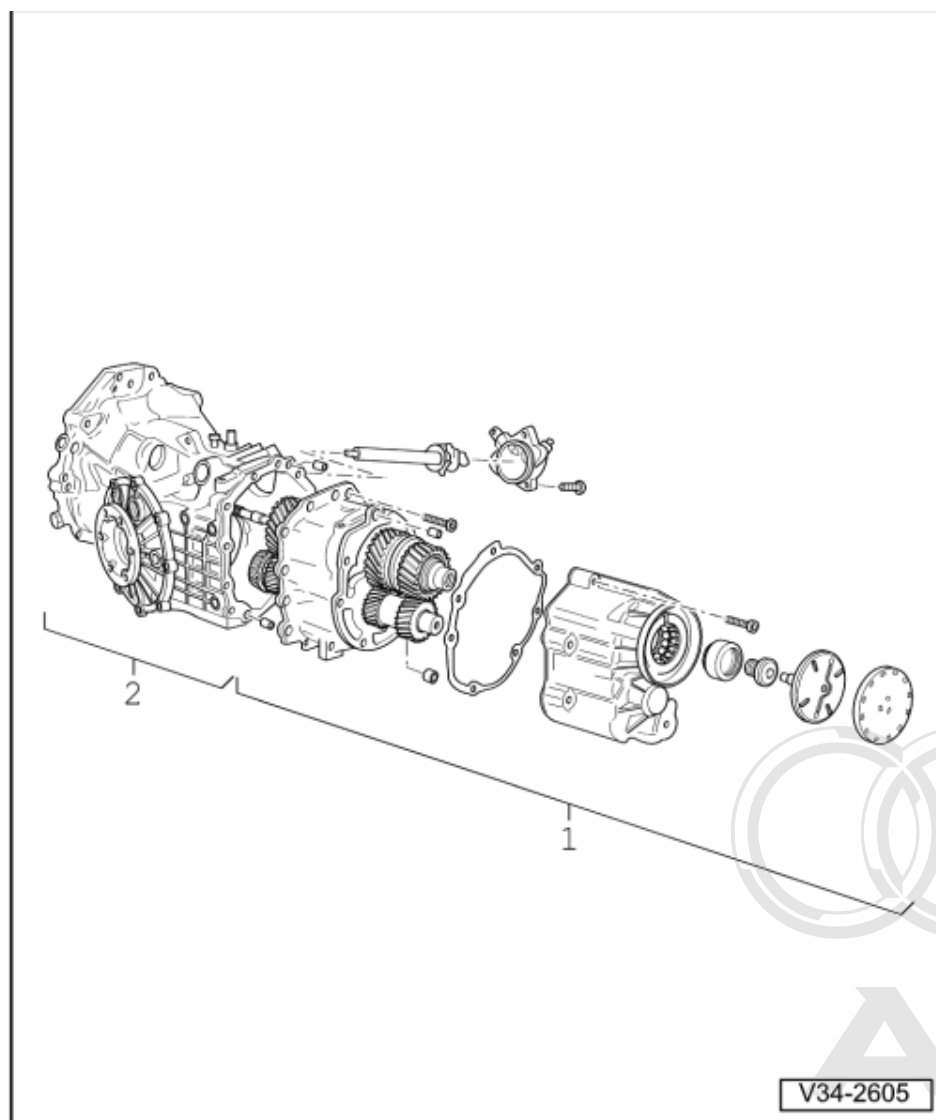
#### Tightening torque

Component	Nm
Oil filler plug	40

- Top up with oil if necessary.  
Specification => from Page **2**.

## 5 - Dismantling and assembling gearbox

### 5.1 - Dismantling and assembling gearbox



Work sequence=> Page **65**.

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**Note:**

General repair instructions =>Page 5

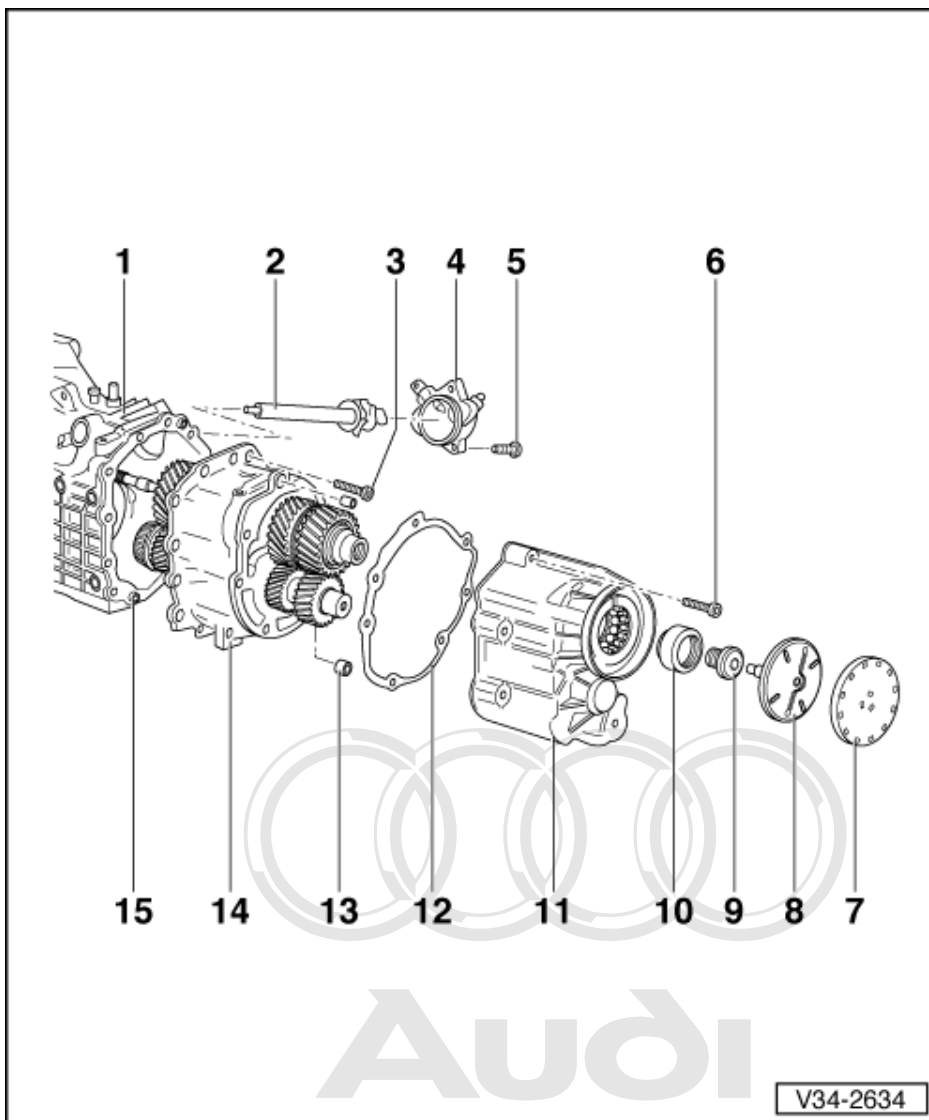
**1 Gear cluster/bearing plate and end cover**

- ♦ Removing and installing  
=>Page 57
- ♦ Removing and installing 5th and 6th gears => Page 60
- ♦ Removing and installing input shaft, drive pinion and internal selector mechanism from bearing plate  
=> Page 62

**2 Gearbox housing with differential**

- ♦ Servicing gearbox housing  
=> Page 101
- ♦ Removing and installing differential => Page 144

**5.2 - Removing and installing gear cluster/bearing plate and end cover**



**1 Gearbox housing**

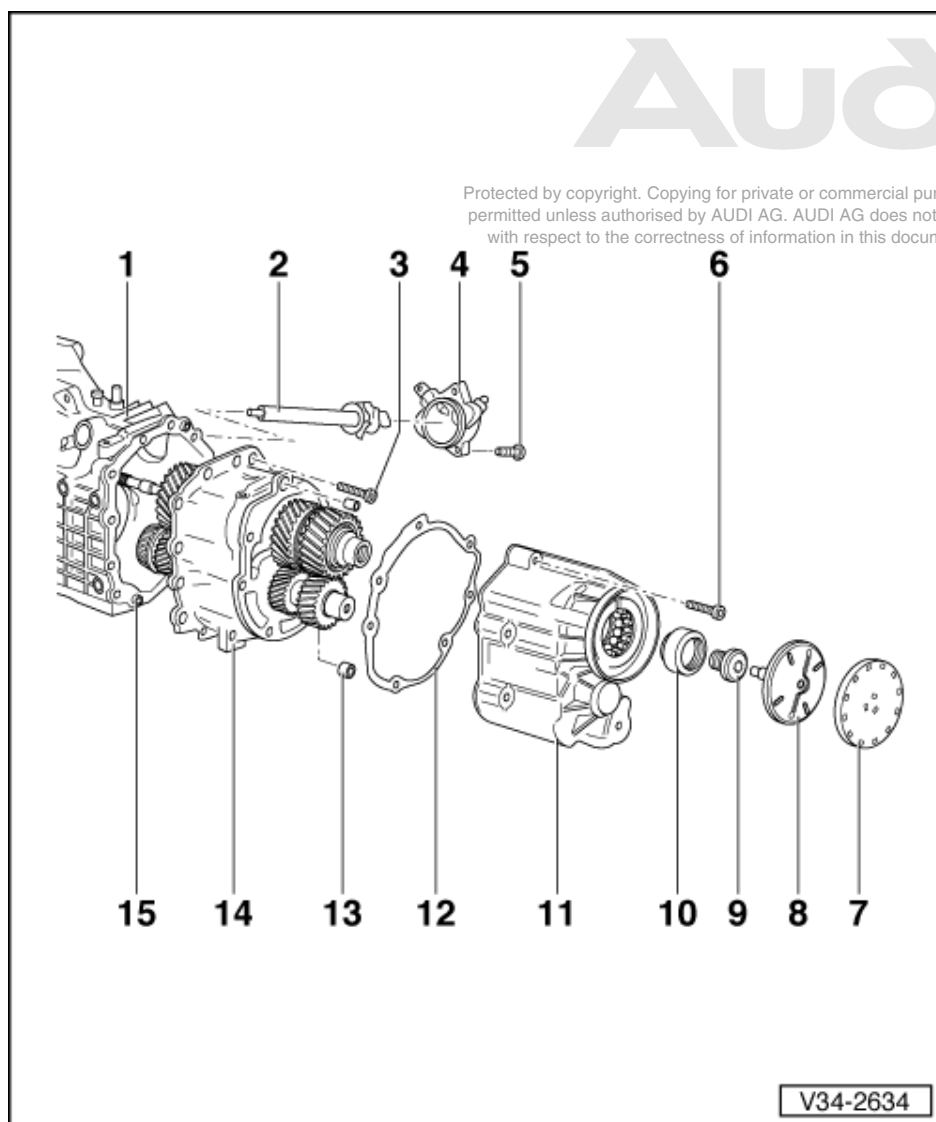
**2 Selector shaft with selector cylinder**

- ♦ Removing =>Page 66
- ♦ Installing =>Page 82
- ♦ Dismantling and assembling  
=>Page 115



### 3 Bolt - 25 Nm

- ◆ Without washer
- ◆ Qty. 12



### 4 Cover for selector shaft

- ◆ Removing =>Page 66
- ◆ Installing =>Page 82

### 5 Bolt - 25 Nm

- ◆ Without washer
- ◆ Qty. 3

### 6 Bolt - 25 Nm

- ◆ Qty. 7

### 7 Sealing cap

- ◆ Removing => Page 65

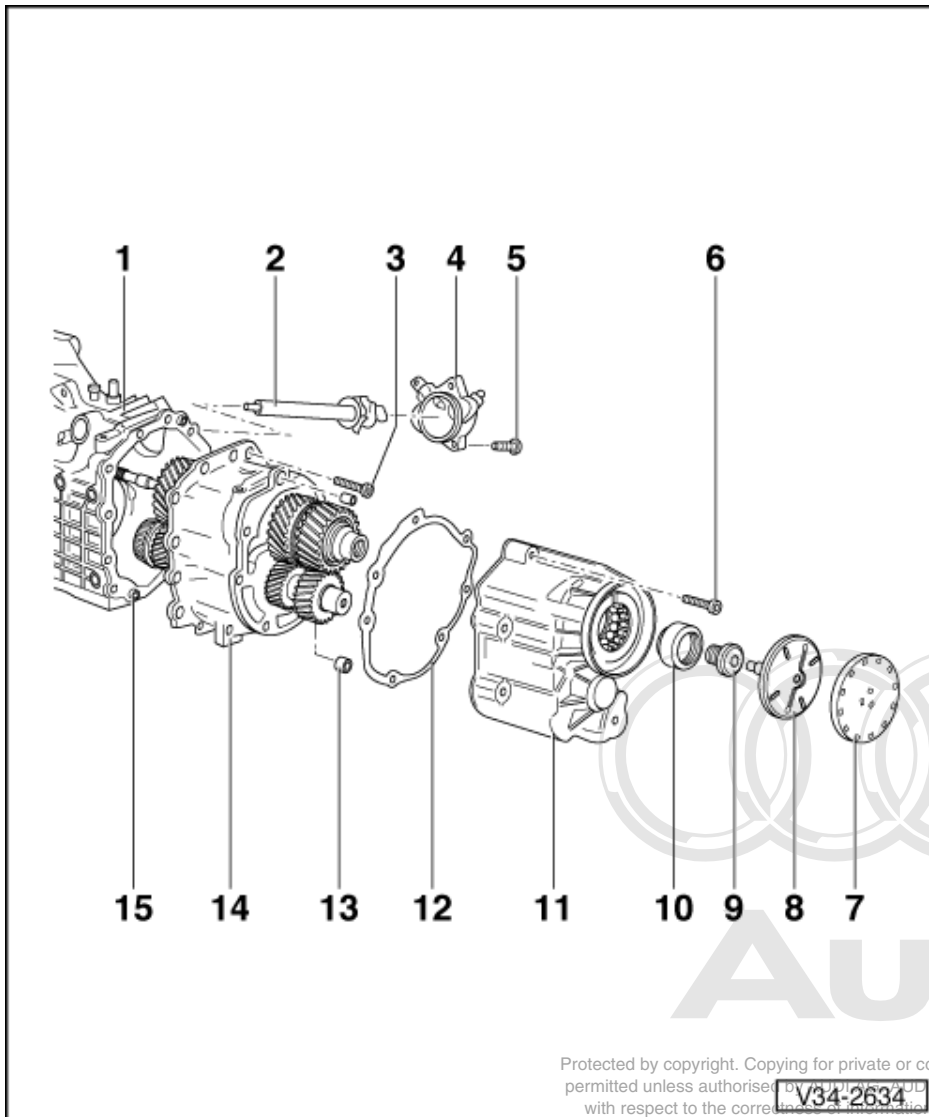
### 8 Oil collector

- ◆ Removing => Page 65

### 9 Multi-point socket head bolt - 150 Nm

- ◆ Removing =>Page 67

♦ Installing =>Page 80



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#### 10 2nd inner race for four-point bearing

- ♦ Removing =>Page 66
- ♦ Installing =>Page 82

#### 11 End cover

- ♦ Cannot be removed without also removing the gear cluster / bearing plate
- ♦ Servicing =>Page 83

#### 12 Gasket

- ♦ Always renew

#### 13 Dowel sleeve

- ♦ Qty. 2

#### 14 Gear cluster/bearing plate

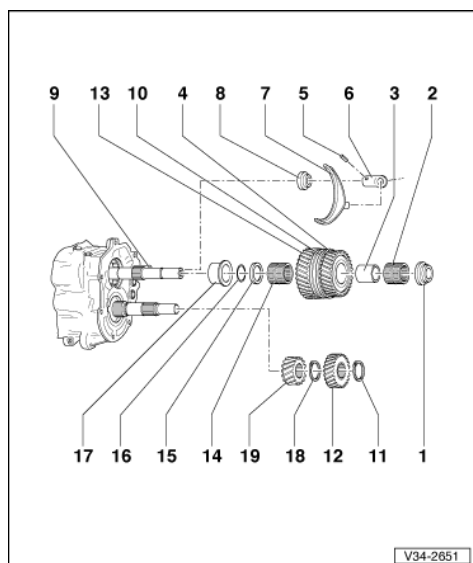
- ♦ Removing and installing 5th and 6th gears => Page 60

#### 15 Dowel sleeve

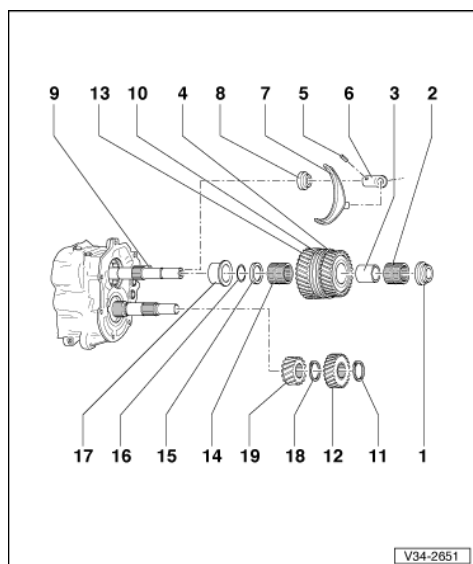
- ♦ Qty. 2



### 5.3 - Removing and installing 5th and 6th gears



- 1 1st inner race for four-point bearing
  - ♦ Pulling off =>Page 68
  - ♦ Installing =>Page 79
- 2 Needle bearing for 5th gear
- 3 Inner race for 5th speed sliding gear
  - ♦ Pulling off =>Page 69
  - ♦ Driving on =>Page 79
- 4 5th speed sliding gear
  - ♦ Pulling off =>Page 68
  - ♦ Installing =>Page 79



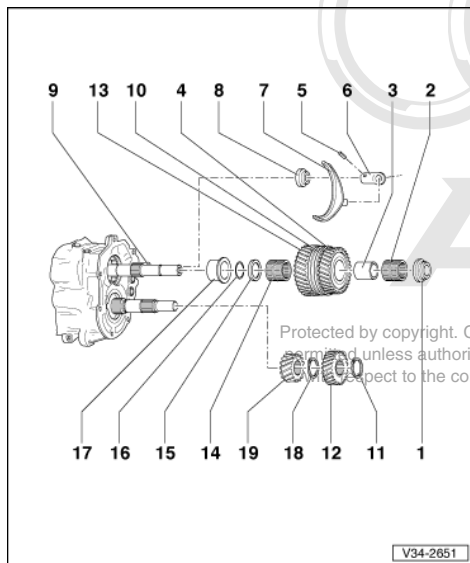
- 5 Spring pin
  - ♦ Pressing out =>Page 68
  - ♦ Pressing in =>Page 78
- 6 Follower
  - ♦ Only renew complete with selector rod for 5th and 6th gear -item 9 -
  - ♦ Pulling off =>Page 69
- 7 Selector fork for 5th and 6th gear
  - ♦ Can be renewed individually
- 8 Spacer



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- ♦ Not fitted in 6-speed gearboxes
- ♦ Install with wider end facing bearing flange



#### 9 Selector rod for 5th and 6th gear

- ♦ Only renew complete with follower -item 6 -
- ♦ Removing =>Page 68
- ♦ Installing =>Page 75

#### 10 Locking collar/synchro-ring for 5th and 6th gears

- ♦ Removing =>Page 69
- ♦ Installing =>Page 77

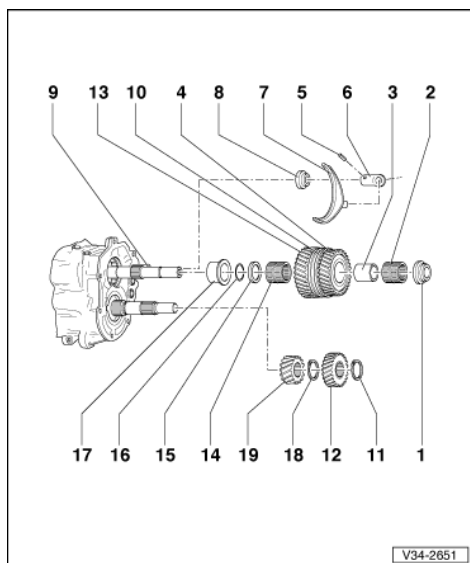
#### 11 Circlip

#### 12 5th speed gear

- ♦ Pulling off =>Page 68
- ♦ Pressing on =>Page 79

#### 13 6th speed sliding gear

- ♦ Pull off together with synchro-hub and inner race for 5th gear  
=>Page 69



#### 14 Needle bearing for 6th gear

#### 15 Thrust washer for needle bearing for 6th gear

- ♦ Installation position: grooves face circlip, smooth face contact surface towards needle bearing

#### 16 Circlip

#### 17 Inner race for cylinder roller bearing



- ♦ Take off by hand =>Page 70

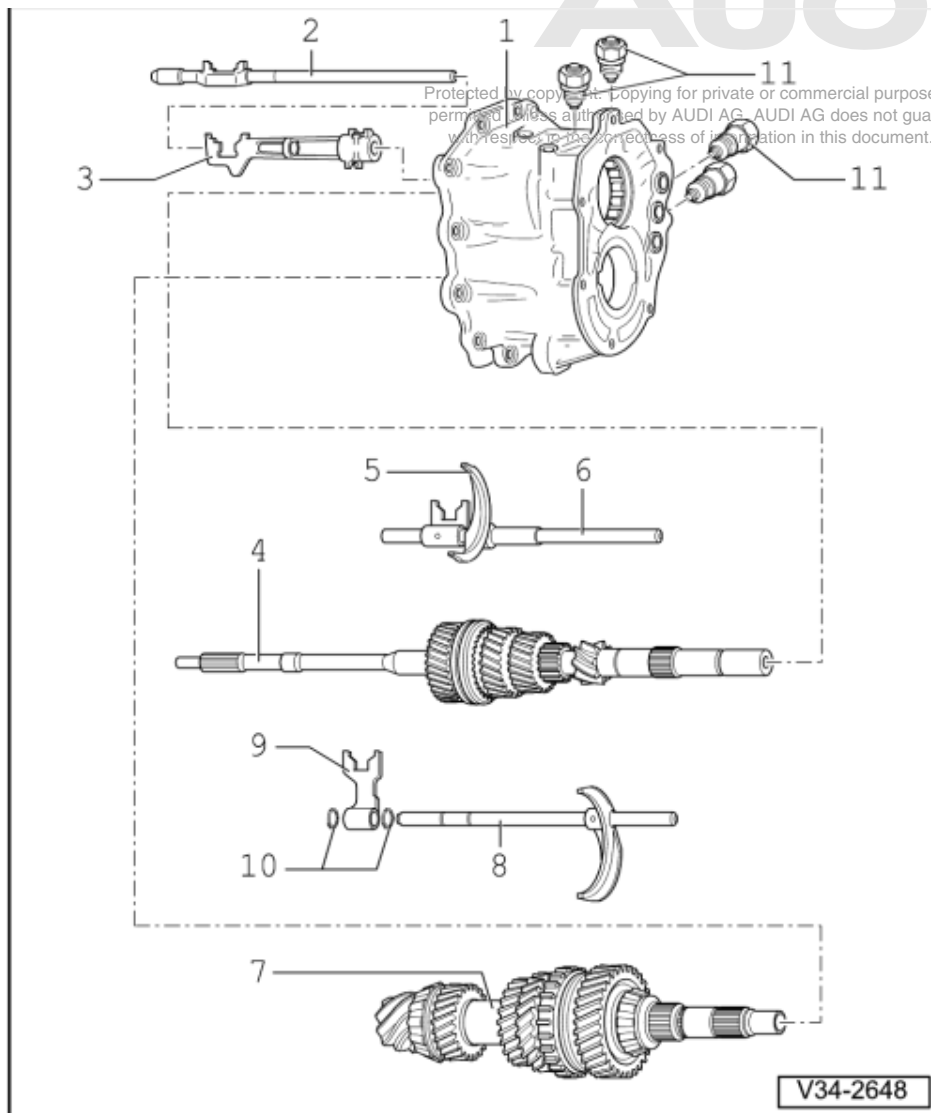
#### 18 Circlip

- ♦ Re-determining thickness  
=>Page 72

#### 19 6th speed gear

- ♦ To press off, remove bearing plate =>Page 70
- ♦ Pressing off =>Page 71
- ♦ Pressing on =>Page 73

### 5.4 - Removing and installing input shaft, drive pinion and internal selector mechanism from bearing plate



#### 1 Bearing plate

- ♦ Servicing =>Page 90

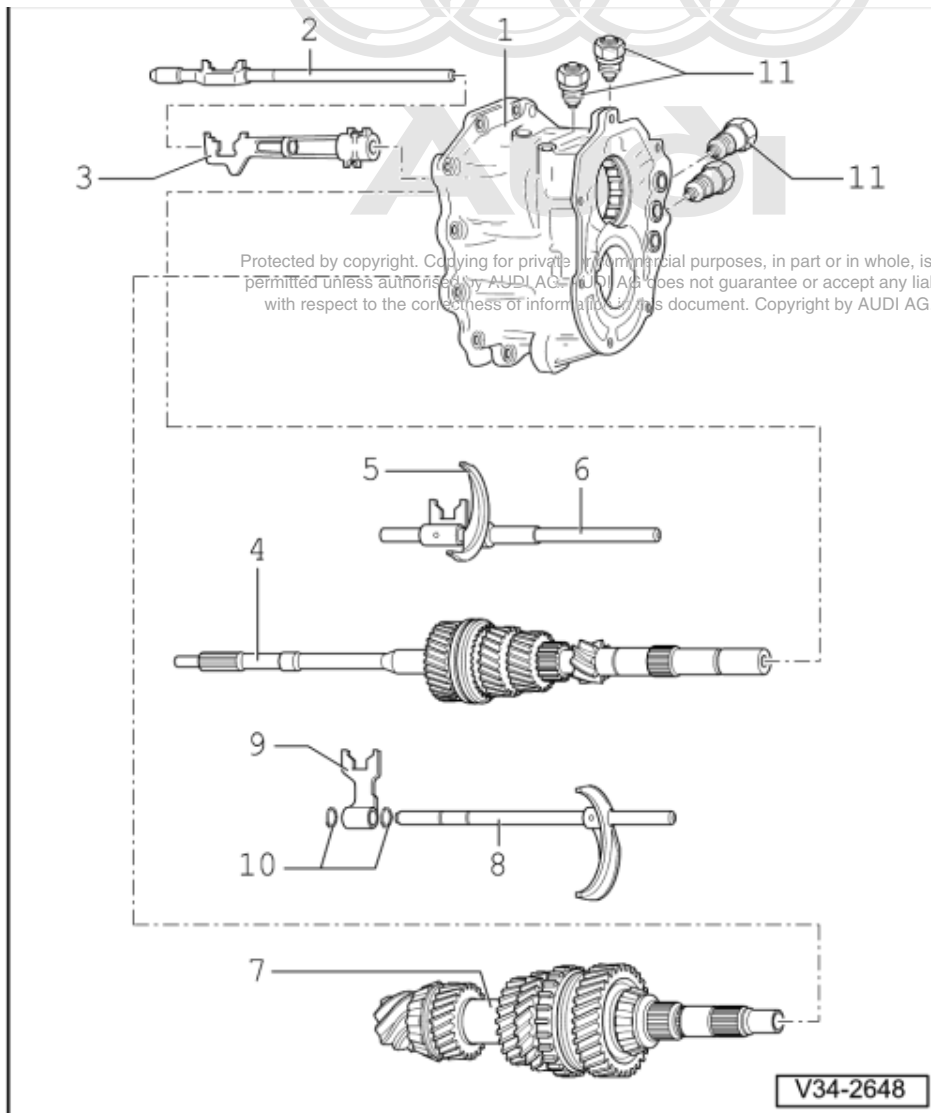
#### 2 Selector rod for 5th and 6th gear

- ♦ Only renew together with follower for 5th and 6th gears  
=> Page 60

#### 3 Follower for reverse gear

- ♦ Pulling out ball sleeve => Page 95

- ♦ Driving in ball sleeve => Page 95



#### 4 Input shaft

- ♦ Dismantling and assembling  
=>Page 118

#### 5 Selector fork for 3rd and 4th gear

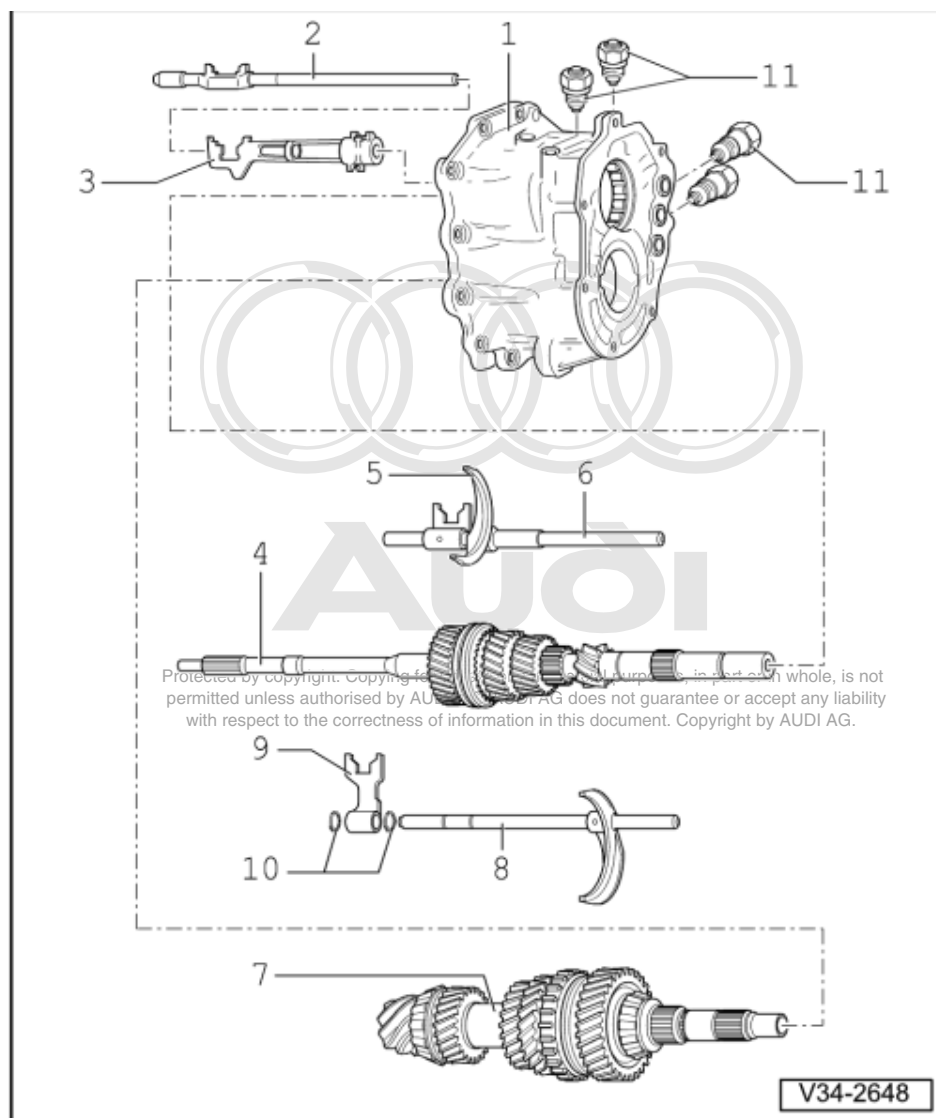
- ♦ Can be replaced individually
- ♦ Installation position: rib towards follower

#### 6 Selector rod for 3rd and 4th gear

- ♦ Only renew complete with follower for 3rd and 4th gear

#### 7 Drive pinion

- ♦ Dismantling and assembling  
=>Page 129



**8 Selector rod for 1st and 2nd gear**

- ◆ Only renew together with selector fork for 1st and 2nd gear (secured together by means of a pin)

**9 Follower for 1st and 2nd gear**

- ◆ Can be replaced individually

**10 Circlip**

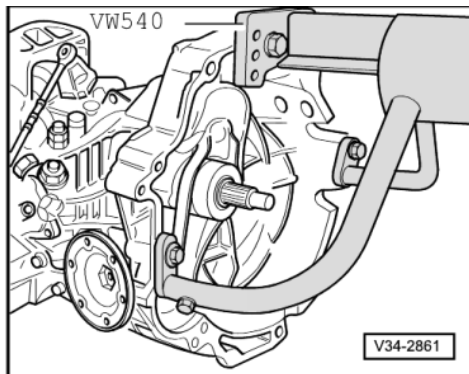
- ◆ Qty. 2

**11 Locking bolts**

- ◆ Qty. 4
- ◆ For aluminium bolt: 50 Nm
- ◆ For steel bolt: 70 Nm
- ◆ Mark fitting locations of aluminium and steel bolts; do not interchange when installing

## 6 - Removing and installing end cover, input shaft and drive pinion - work sequence

### 6.1 - Removing and installing end cover, input shaft and drive pinion - work sequence



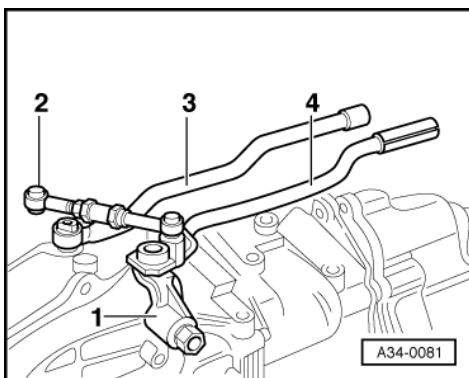
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#### Note:

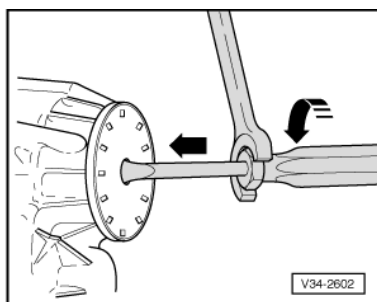
General repair instructions =>Page 5.

### 6.2 - Removing

- -> Secure gearbox in assembly stand VW 540.
- Place drip tray underneath and drain gearbox oil.
- Remove release bearing, clutch release lever and guide sleeve =>Page 21.



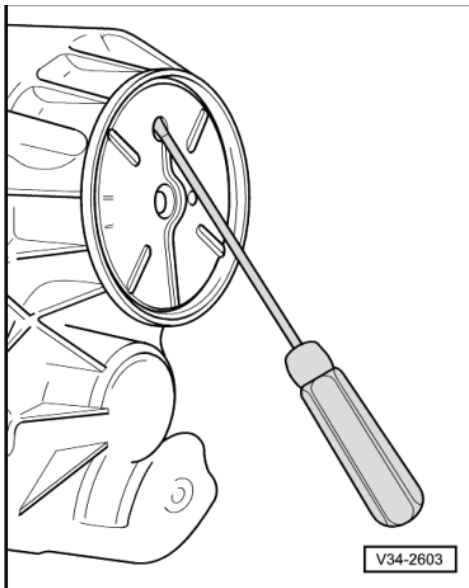
- -> Remove connecting rod -2- and front push rod -3-.
- Pull front selector -4- together with selector lever -1- off selector shaft after removing hexagon nut =>Page 35.



- Pierce rubber in centre of sealing cap with a large screwdriver.

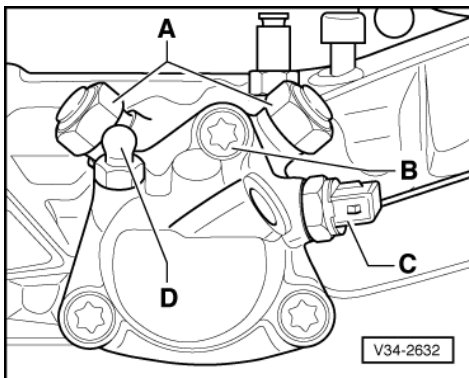


- -> Insert screwdriver sideways between sealing cap and oil collector and push in until it touches the edge. Then turn screwdriver to lever off sealing cap.

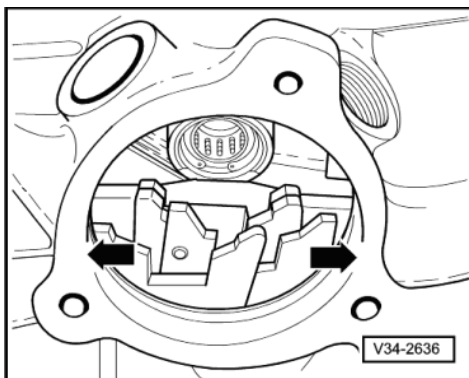


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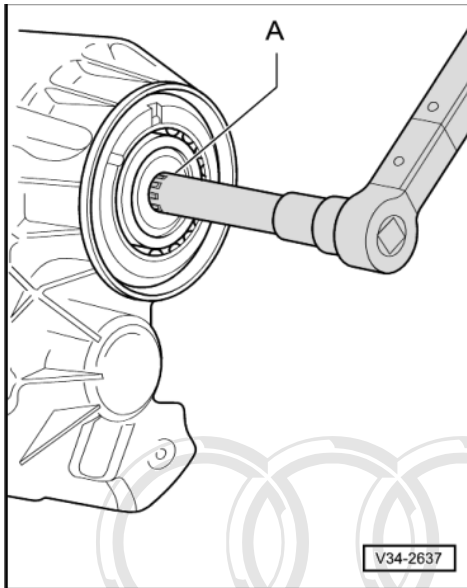
- -> Insert screwdriver into hole and lever off oil collector.



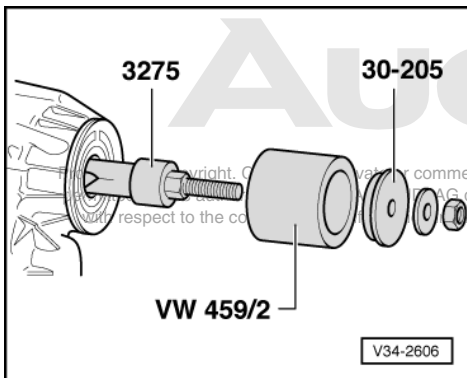
- -> Remove locking bolts -A- for selector shaft from gearbox housing.
- Mark fitting locations of aluminium and steel bolts. (Bolts must not be interchanged when installing.)
- Remove 3 bolts -B- for cover for selector shaft, take off cover.
- Pull out selector shaft.



- -> Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear) do this by moving 2 selector plates - arrows-.



- -> Unscrew multi-point socket head bolt -A- for input shaft.

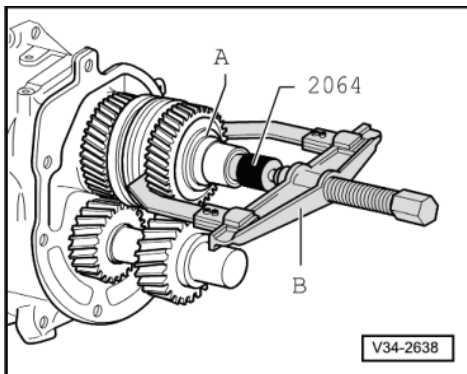


- -> Pull off 2nd inner race for four-point bearing for input shaft.

**Note:**

*Internal puller 3275 engages in a circular groove in the inner race when pulling off.*

- Remove bolts securing end cover to bearing plate.

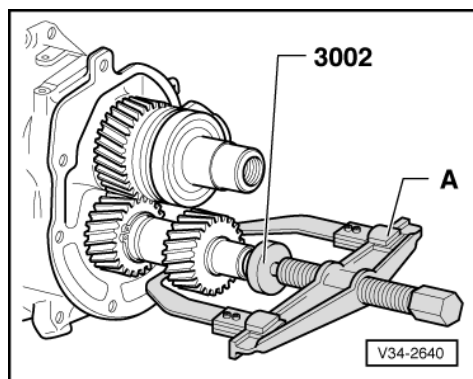


- Take off end cover together with end cover/bearing plate gasket.
- -> Pull off 5th speed sliding gear and spring together with 1st inner race -A- for four-point bearing for input shaft.



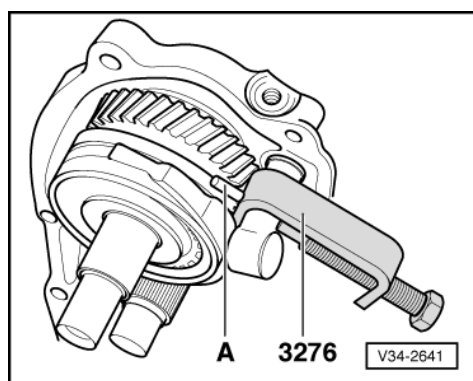
B - Two arm puller, e.g. Kukko 20/10

- Take off 5th gear synchro-ring.



- Take off circlip for 5th speed gear.
- Lock input shaft in position by engaging two gears => Page 67 .
- -> Pull off 5th speed gear.

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



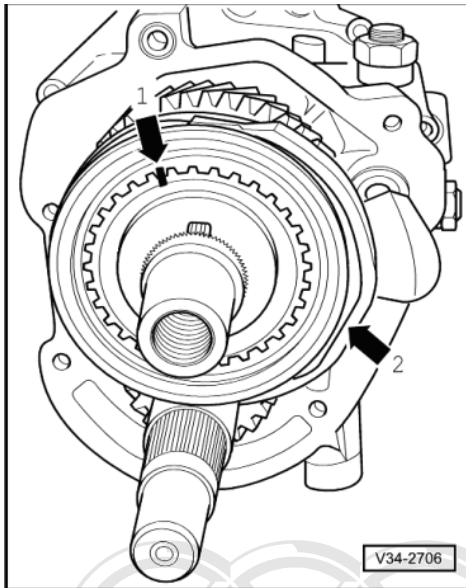
- -> Press out roll pin for 5th and 6th gear selector fork.
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**Note:**

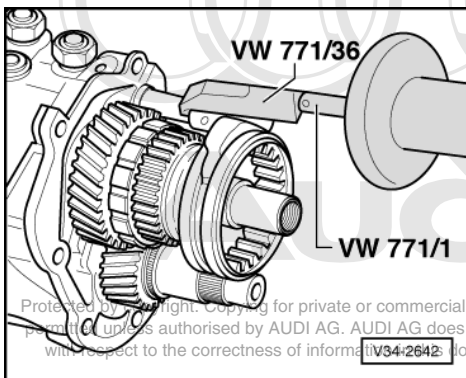
*Do not drive out roll pin as this would damage the selector rod bearing.*

- Pull selector rod on follower together with selector fork for 5th and 6th gear and locking collar as far as possible away from bearing plate (until stop is felt).

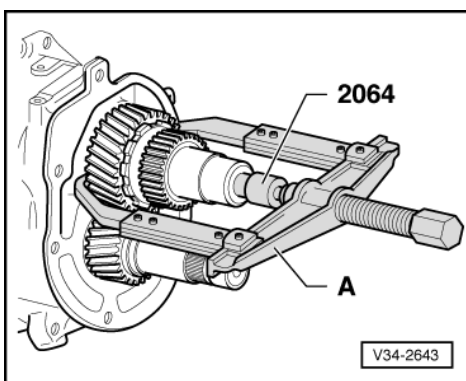




- -> Mark relative positions of locking collar for 5th and 6th gears and synchro-hub (paired) -arrow 1-.

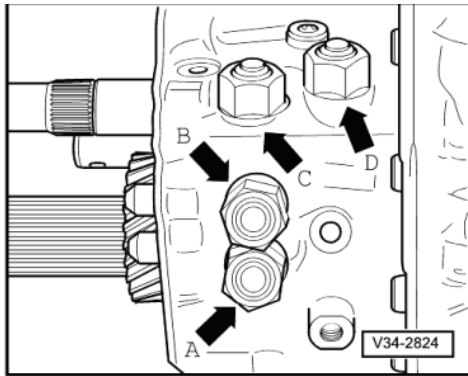


- -> Pull follower together with selector fork and locking collar off selector rod.



- -> Pull off 6th speed sliding gear, synchro-ring for 6th gear, synchro-hub for 5th and 6th speed gears and inner race for 5th speed sliding gear.

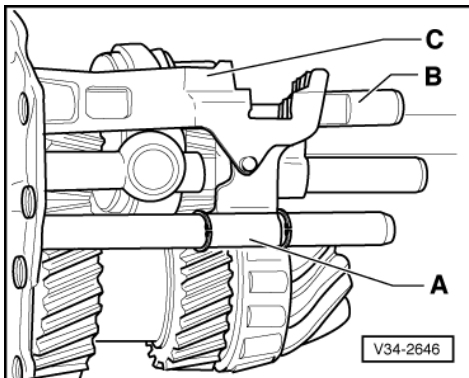
A - Two arm puller, e.g. Kukko 20/10 with 200 mm long hooks



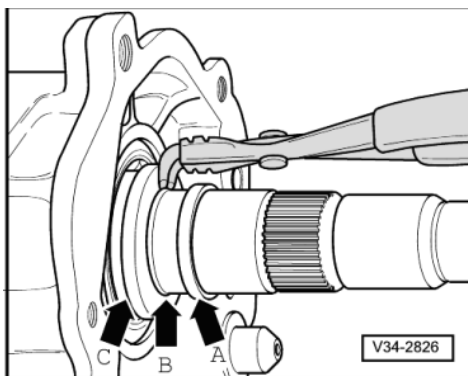
- ➔ Unscrew selector rod locking bolts.

- A - 1st and 2nd gear
- B - 3rd and 4th gear
- C - 5th and 6th gear
- D - Reverse gear

- Mark fitting locations of aluminium and steel bolts. (Bolts must not be interchanged when installing.)
- Drive out dowel sleeves on bearing plate and remove bearing plate from gearbox housing.
- Separate bearing plate, drive pinion and internal selector mechanism (as a single unit) from gearbox housing.



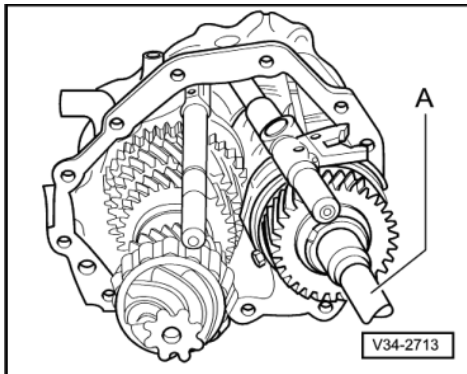
- ➔ Remove circlip from selector rod for 1st and 2nd gear and take off follower -A-.
- Pull out selector rod -B- for 5th and 6th gear.
- Remove follower -C- for reverse gear.



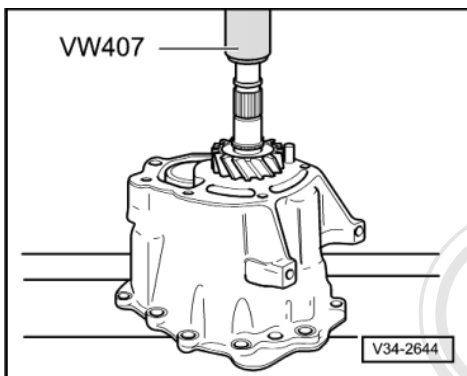
- ➔ Pull thrust washer -arrow A- for needle bearing for 6th gear off shaft.
- Use right-angled circlip pliers to remove circlip -arrow B- for inner race for cylinder roller bearing.
- Take out inner race -arrow C- for cylinder roller bearing (not a press fit).



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- ➔ Take input shaft -A- with selector rod and selector fork for 3rd and 4th gear out at an angle from bearing plate.



- Remove circlip for 6th speed gear.
- ➔ Press off 6th speed gear.

**Note:**

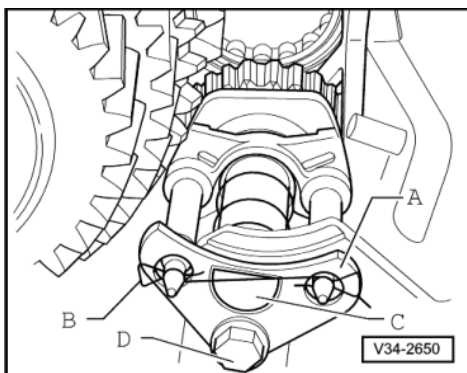
*Because of the type of fit, it may be possible to press gear off easily.*

- Remove drive pinion from bearing plate together with selector rod and selector fork for 1st and 2nd gears.

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**Note:**

*For repair work involving only the drive pinion or input shaft it is not necessary to remove the reverse gear.*



- Take off relay lever for reverse gear.
- ➔ Unscrew hexagon bolt -D-, take off spring clasp -B- and retaining plate -A-, pull out shaft -C- for reverse idler gear.
- Take out spring, synchro-ring and reverse idler gear.



Removing and installing reverse gear =>Page 91 .

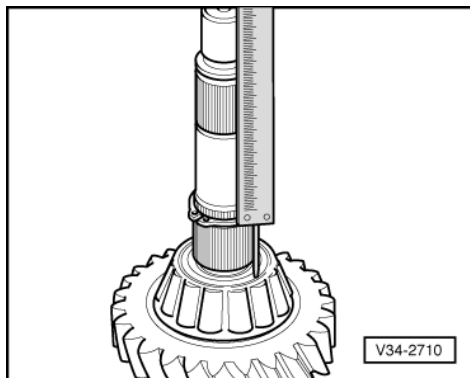
## 6.3 - Installing

Re-determining thickness of circlips for drive pinion taper roller bearing and 6th speed gear.

### **Note:**

*The thickness of the circlips for the drive pinion taper roller bearings and 6th speed gear must now be re-determined (this step is only required if the drive pinion or drive pinion taper roller bearings have been renewed.) The following measurement (=>up to Page 73 ) is not necessary if neither the drive pinion nor the taper roller bearings have been renewed.*

- Press on taper roller bearing onto stop.
- Insert a circlip of any thickness into the groove.



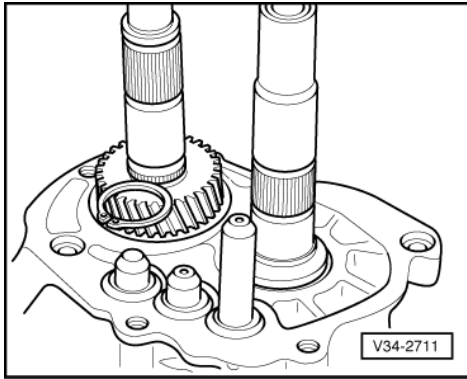
- -> Push up circlip and measure gap between taper roller bearing inner race and circlip in upper groove using depth gauge.
- Remove circlip (only used for measuring purposes).
- Determine thickness of first circlip according to the following table. Part No.:

=> Parts catalogue

Measured gap range (mm)	Circlip thickness (mm)
32.44 ... 32.53	1.66
32.54 ... 32.62	1.75
32.63 ... 32.71	1.84
32.72 ... 32.80	1.93
32.81 ... 32.89	2.02
32.90 ... 32.98	2.11
32.99 ... 33.07	2.20
33.08 ... 33.16	2.29

- Fit first circlip.
- Press on 6th speed gear onto stop=>Page 73 .
  - Installation position: shoulder towards bearing plate

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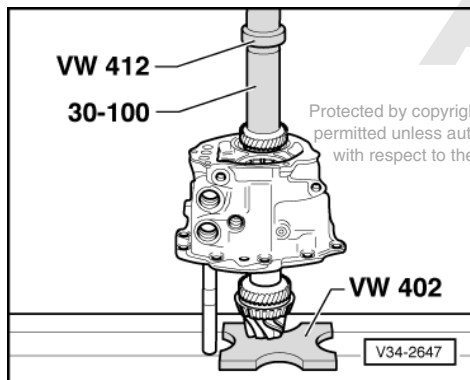
- -> Determine the thickest circlip (2nd circlip) which can still just be fitted, and fit it on 6th speed gear.
  - Specified axial clearance: max. 0.05 mm
  - Select the required circlip thickness from the following table.
- Part Nos.:

=> Parts catalogue

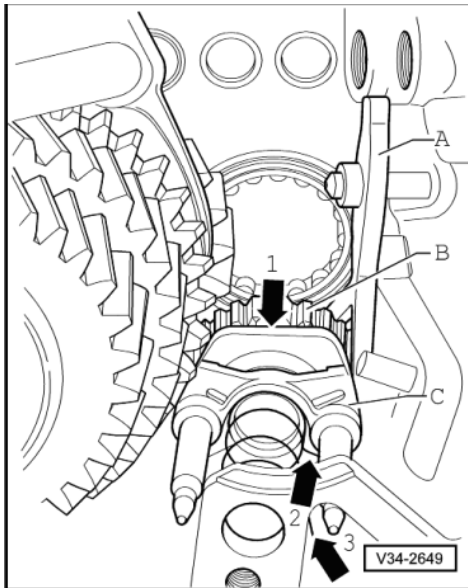
Circlip thickness (mm)		
2.11	2.20	2.29
2.14	2.23	
2.17	2.26	

#### Installing input shaft and drive pinion

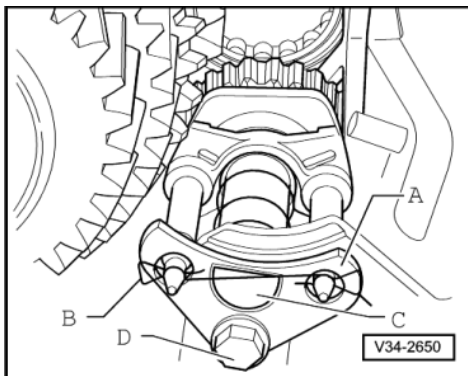
- Insert drive pinion into bearing plate together with selector fork and selector rod for 1st and 2nd gears (without follower).
- Fit 1st circlip above taper roller bearing.



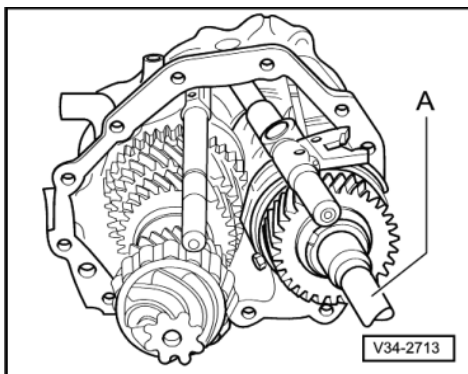
- -> Heat 6th gear to approx. 120 °C and fit on.
- Installation position: shoulder towards taper roller bearing
- Press onto stop with drift sleeve 30-100.
- Fit 2nd circlip above 6th speed gear.



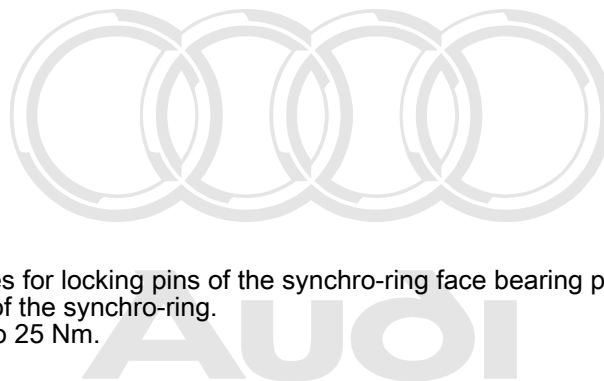
- -> Fit relay lever -A- for reverse gear over relay lever bolt.
- Insert sliding gear -B- and engage relay lever with groove on sliding gear.
- Insert synchro-ring -C-:
  - Installation position: position flat on circumference of synchro-ring towards input shaft (not as yet fitted) -arrow 1-
- Insert spring.
  - Installation position: hook single angled end into recess on synchro-ring -arrow 2-. Turn double angled end anti-clockwise and hook into opening in bearing plate -arrow 3-



- -> Insert shaft -C-.
- Fit retaining plate -A-:
  - Installation position: chamfers of holes for locking pins of the synchro-ring face bearing plate
- Insert spring clasp -B- into locking pins of the synchro-ring.
- Renew self-locking nut -D- and tighten to 25 Nm.

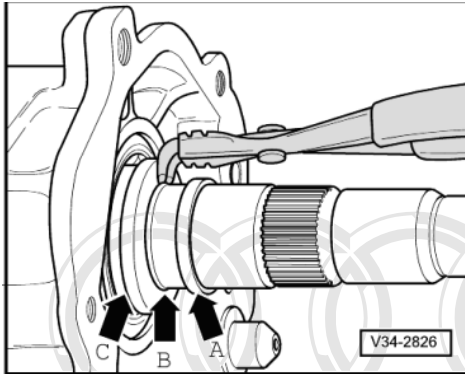


- -> Slide input shaft -A- with selector rod and selector fork for 3rd and 4th gear at an angle into the bearing plate.
  - Selector fork installation position: rib towards follower

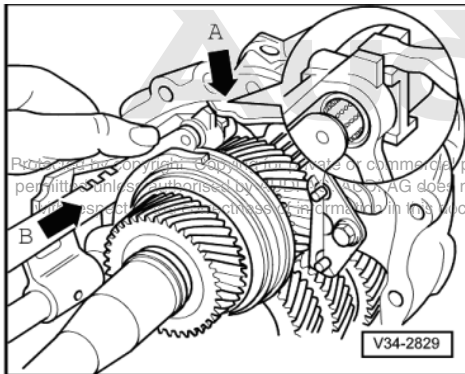


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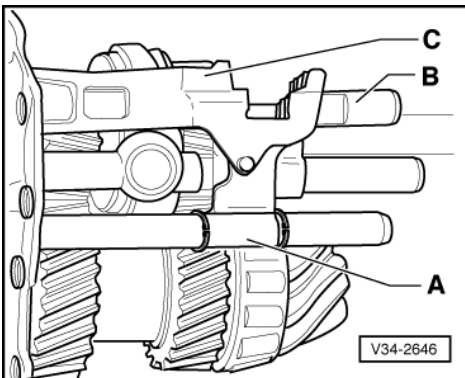
=>Page 63



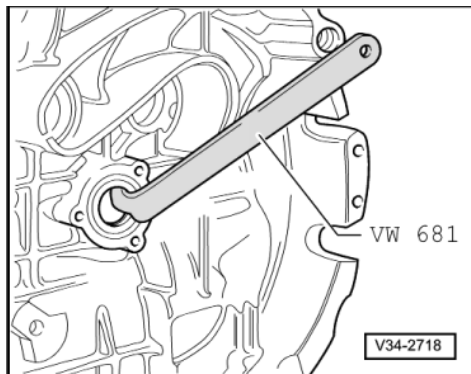
- -> Slide cylinder roller bearing inner race -arrow C- onto input shaft at flange for end cover (clearance fit).
- Fit circlip -arrow B- using right-angled circlip pliers.



- -> Engage recess in follower for reverse gear with the free end of relay lever -arrow A-.
- Slide selector rod for 5th and 6th through follower for reverse gear in direction of -arrow B-.



- -> Slide follower -A- for 1st and 2nd gear onto selector rod and secure with circlips.
- Lubricate selector rods and all bearings of input shaft and drive pinion in gearbox housing and on bearing flange with gear oil.

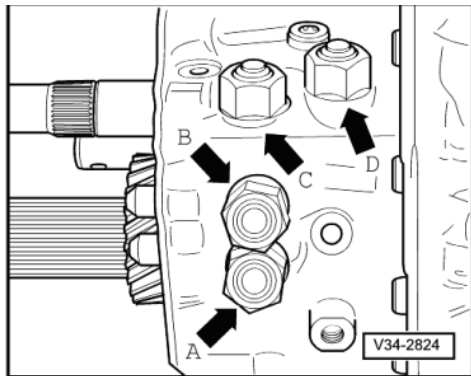


- -> Lever used seal for input shaft carefully out of gearbox housing with VW 681.
- Coat sealing surfaces between bearing plate and gearbox housing with sealing paste AMV 188 200 03.
- Insert complete bearing plate into gearbox housing.

**Note:**

*When inserting the complete bearing plate, ensure that the selector rods align with their mounting points.*

- Drive in 2 dowel sleeves for bearing flange/gearbox housing.
- Tighten bolts to 25 Nm in diagonal sequence.



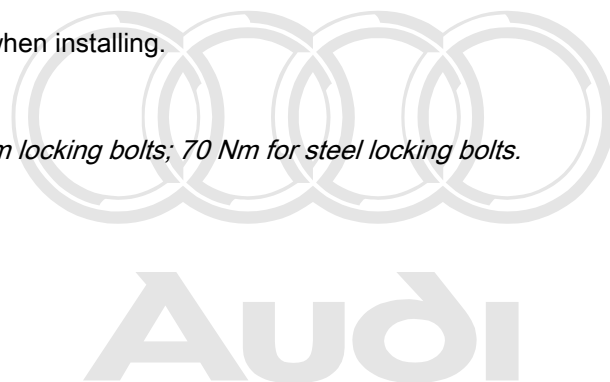
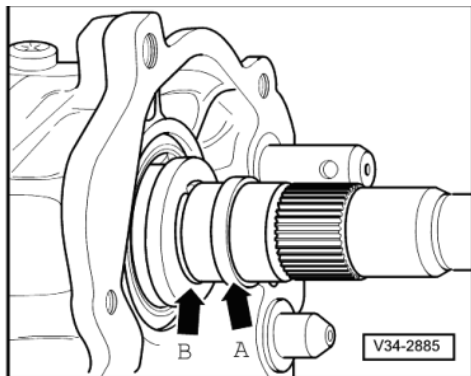
- -> Screw in locking bolts for selector rods.

- A - 1st and 2nd gear
- B - 3rd and 4th gear
- C - 5th and 6th gear
- D - Reverse gear

- Aluminium and steel bolts must not be interchanged when installing.

**Note:**

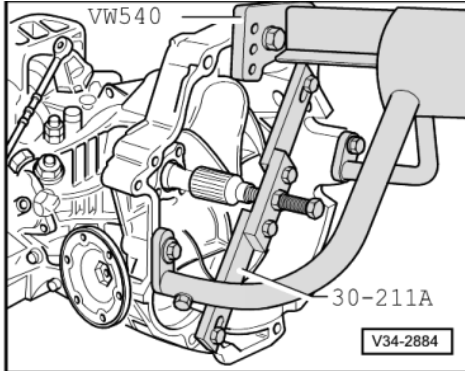
*Observe differing tightening torques: 50 Nm for aluminium locking bolts; 70 Nm for steel locking bolts.*



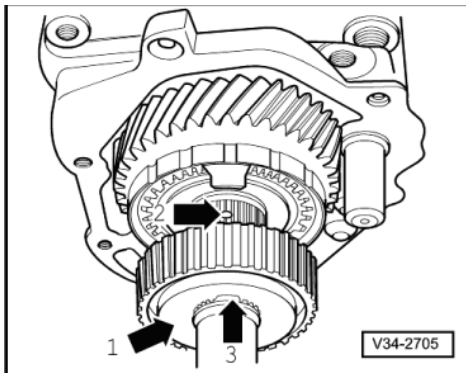
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- -> Fit thrust washer -arrow A- for needle bearing for 6th speed gear.
- Installation position: shoulder towards circlip -arrow B-, smooth contact surface to shaft end
- Oil needle bearing for 6th speed sliding gear with gear oil and fit.
- Slide on 6th speed sliding gear with spring and synchro-ring.
  - Synchro-ring installation position: the lugs of the synchro-ring engage into the recesses below in the sliding gear

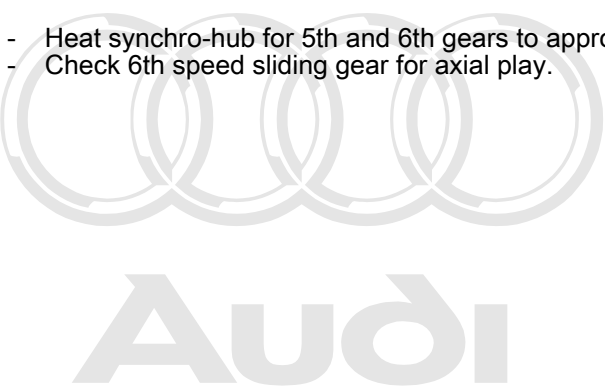


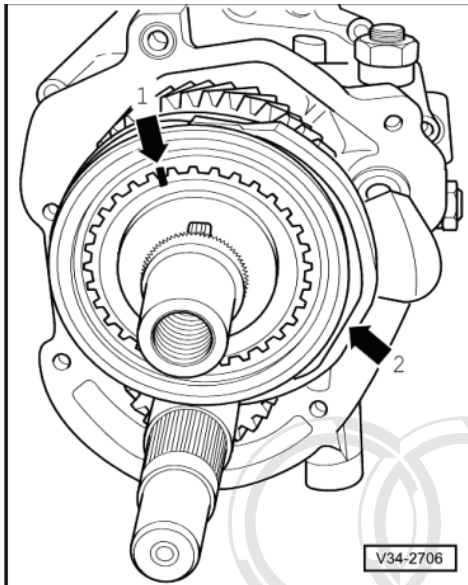
- -> Support input shaft with support bridge 30-211 A.



-> Installation position of synchro-hub for 5th and 6th gear:

- ◆ Side with projecting face -arrow 1- faces shaft end
- ◆ The oil drilling of the input shaft -arrow 2- and the oil groove of the synchro-hub -arrow 3- are in line
- Heat synchro-hub for 5th and 6th gears to approx. 100 °C, fit and drive onto stop so that it is free of play.
- Check 6th speed sliding gear for axial play.



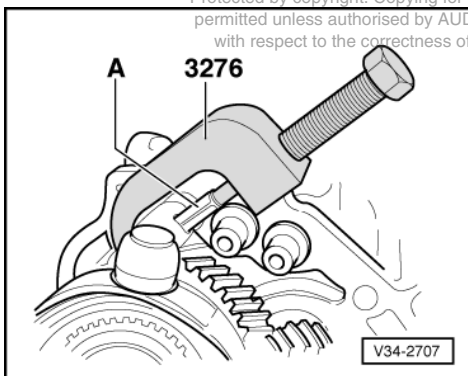


- -> Align markings -arrow 1- on paired synchro-hub and locking collar for 5th and 6th gears.
- Fit locking collar with selector fork -arrow 2- onto synchro-hub, and at the same time fit follower for 5th and 6th gears onto selector rod.

**Notes:**

- ♦ Selector fork rib -arrow 2- must face towards shaft end.
- ♦ Note positions of drillings for roll pin when fitting follower onto selector rod for 5th and 6th gear.

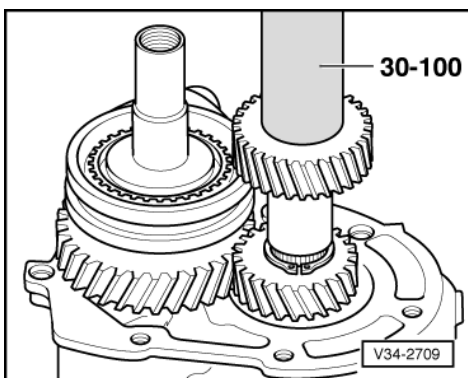
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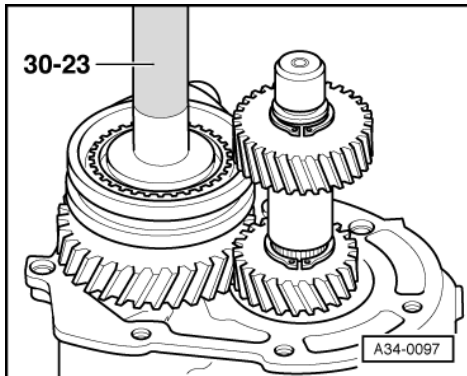
- -> Press in roll pin until it is flush.

**Notes:**

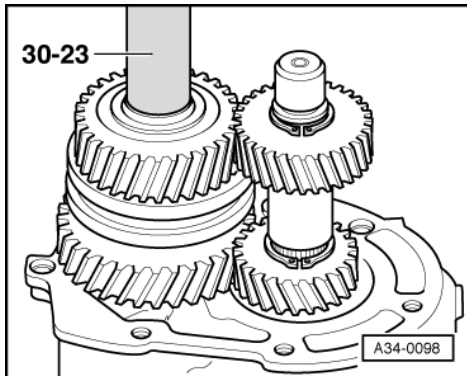
- ♦ The roll pin must not be knocked in as this would damage the selector rod bearing.
- ♦ When fitting the roll pin, the slot must be in line with the direction of force, as shown in the illustration.



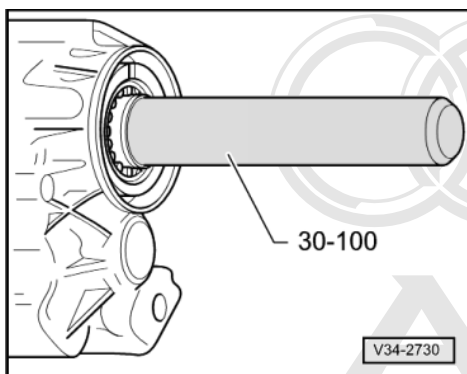
- -> Heat 5th speed gear to approx. 120 °C, fit and drive onto stop free of play.
- Installation position: shoulder towards bearing plate
- Fit circlip.



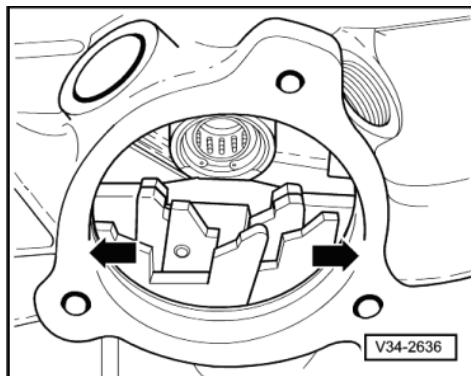
- -> Drive on inner race for 5th speed sliding gear free of axial play.
- Oil needle bearing with gear oil and fit.
- Place synchro-ring for 5th gear in locking collar.
- Slide on 5th speed sliding gear with spring.



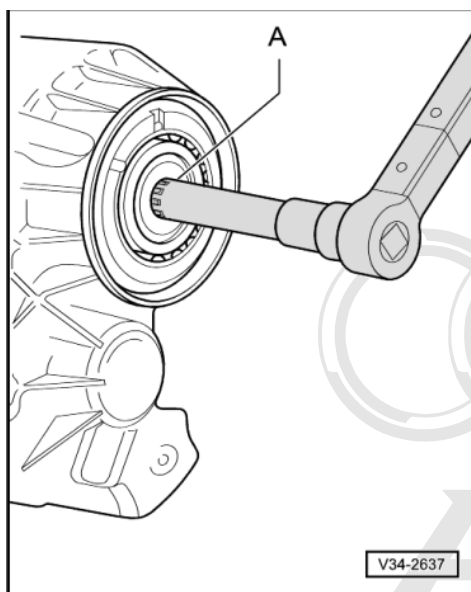
- -> Heat 1st inner race of four-point bearing for input shaft to approx. 100 °C, fit on input shaft and drive onto stop free of play.
- Insert dowel sleeves into bearing plate.
- Fit new gasket for end cover.
- Fit end cover.
- Tighten bolts for end cover using diagonal sequence.



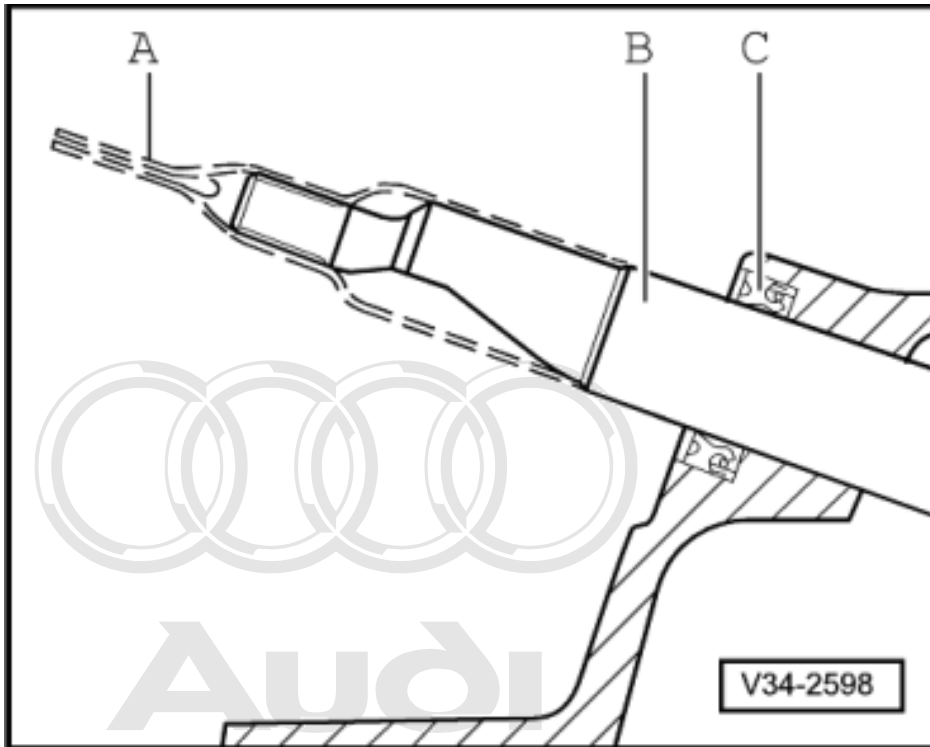
- -> Drive on second inner race of four-point bearing.
  - Remove support bridge 30-211 A
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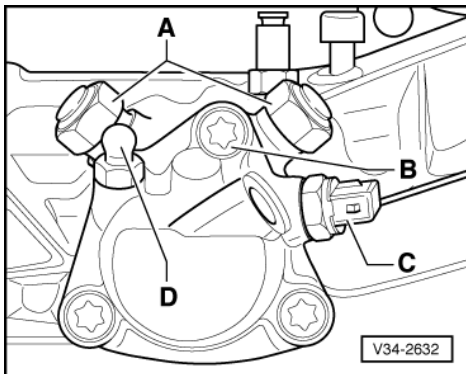
- -> Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear), do this by moving two selector plates -arrows-.



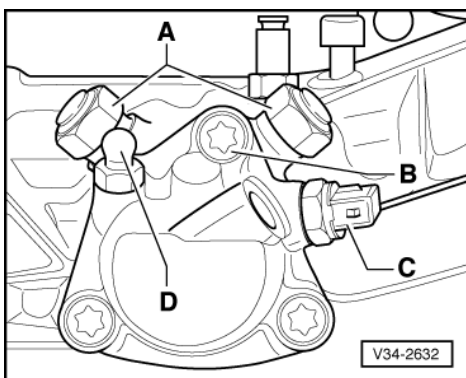
- -> Tighten multi-point socket head bolt -A- to 150 Nm.
- Press on a new oil collector.
- Installation position: large oil holes and projections aligned with groove in end cover
- Press in new sealing cap.



➤ Slide fitting sleeve -A- (Part No. 01E 311 120) onto selector shaft -B-.  
Install complete selector shaft.

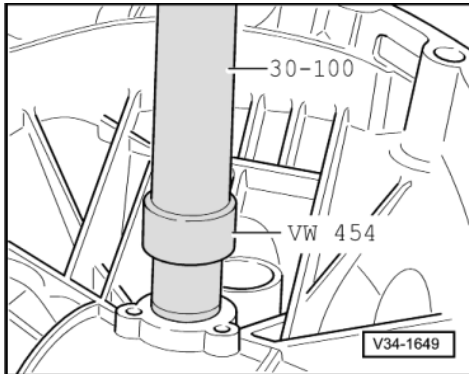


- ➔ Screw locking bolts -A- for selector shaft into gearbox housing.
- Aluminium and steel bolts must not be interchanged when installing.
- Tightening torques:
  - for aluminium locking bolts - 50 Nm
  - for steel locking bolts - 70 Nm

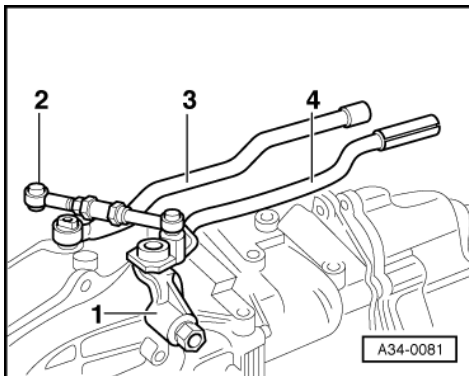




- Lightly oil new O-ring for cover for selector shaft and fit.
- Fit cover for selector shaft.
- -> Apply sealing paste AMV 188 200 03 to bolts -B- (3x), then fit and tighten bolts.
- Make sure that input and output shafts are able to turn.
  - Shafts will be difficult to turn when parts have been renewed.



- Fill space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Pull a thin protective hose tightly onto splines of input shaft.
- -> Drive on seal for input shaft.
  - Pressing-in depth: 4.5 mm
- Remove protective hose.
- Install release bearing, clutch release lever and guide sleeve =>from Page 21 .

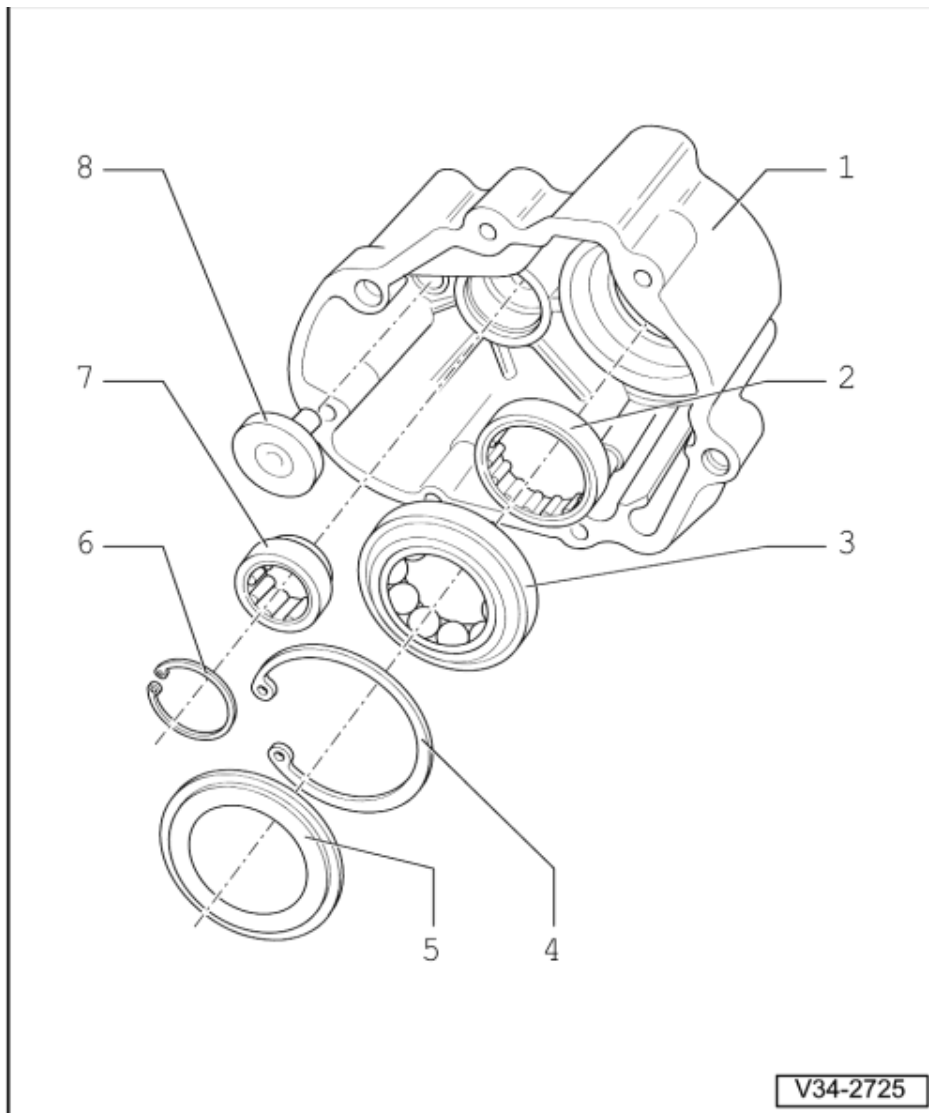


- -> Install front selector rod -4- together with selector lever -1- and cap nut =>Page 35 .
- Check that gearbox can be shifted through all gears.
- Install front push rod -3-=>Page 43 .
- Check connecting rod -2- adjustment =>Page 46 .
- Fit connecting rod.
- Check oil level in gearbox => Page 55 .

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## 7 - Servicing end cover

### 7.1 - Servicing end cover



**Note:**

General repair instructions =>Page 5.

**1 End cover**

- ◆ If renewed, re-determine thickness of circlip -item 4 -

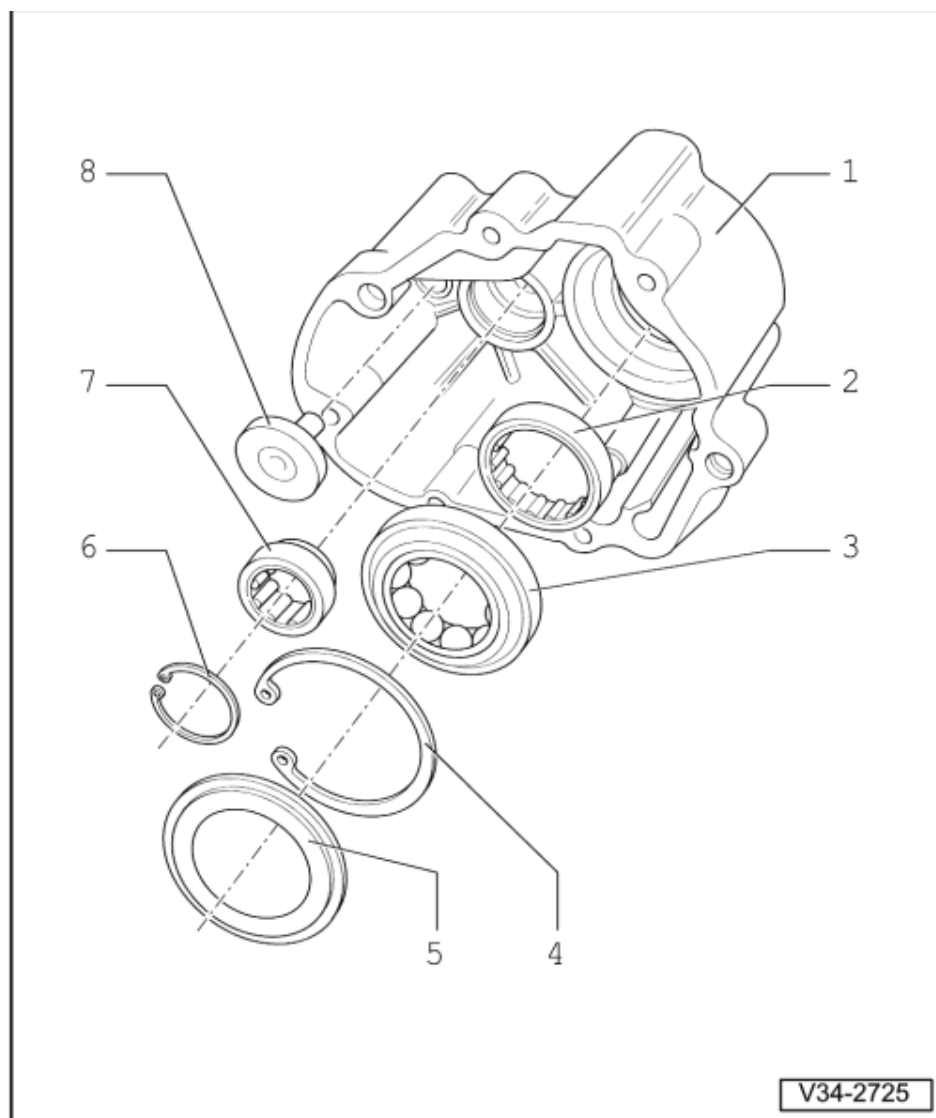
**2 Cylinder roller bearing for input shaft**

- ◆ Pressing out => Fig. 1
- ◆ Pressing in flush => Fig. 2

**3 Four-point bearing for input shaft**

- ◆ Removing =>Fig. 3
- ◆ Installing =>Fig. 4
- ◆ If renewed, re-determine thickness of circlip -item 4 -

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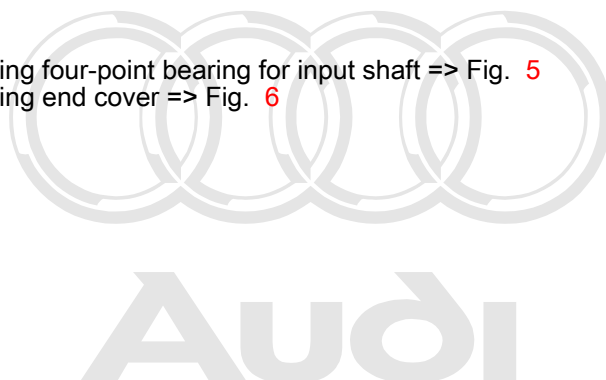
**4 Circlip**

- ◆ Re-determining thickness  
=> Page 87
- ◆ Installing => Fig. 4

**5 Baffle plate**

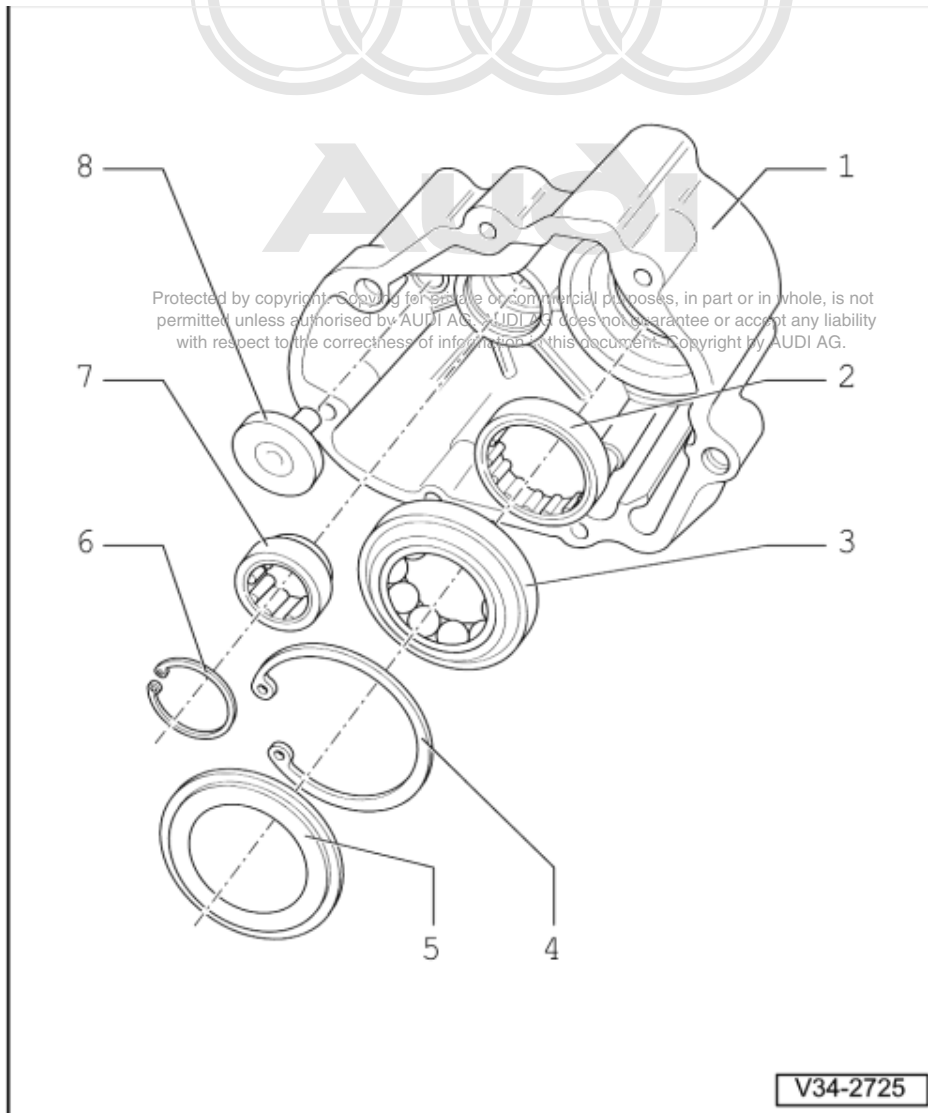
- ◆ Always renew
- ◆ Removing => Fig. 3
- ◆ Installing and peening in position when renewing four-point bearing for input shaft => Fig. 5
- ◆ Installing and peening in position when replacing end cover => Fig. 6

**6 Circlip**



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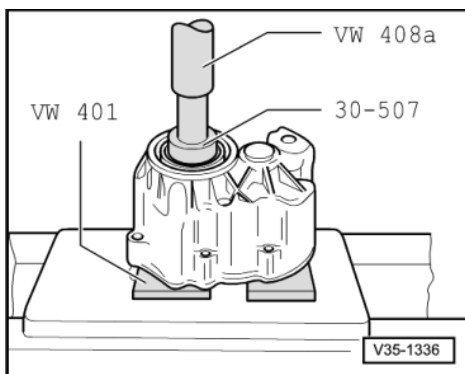


### 7 Roller sleeve for drive pinion

- ◆ Becomes damaged when removed
- ◆ Always renew
- ◆ Removing => Fig. 7
- ◆ Driving in => Fig. 8
- ◆ Installation position => Fig. 9

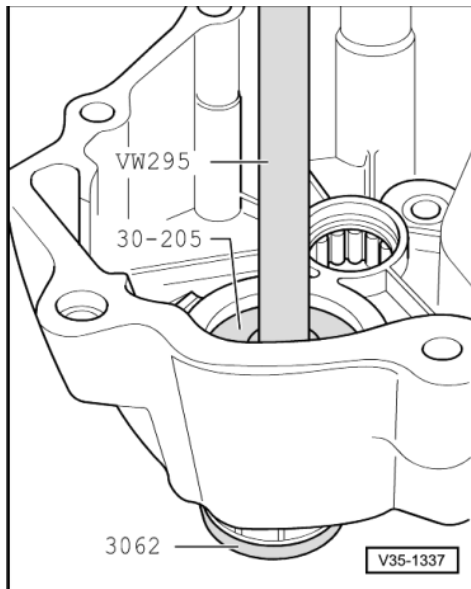
### 8 Magnet

- ◆ Drive in, for example with press tool VW 408 A





-> Fig.1 Pressing cylinder roller bearing for input shaft out of end cover

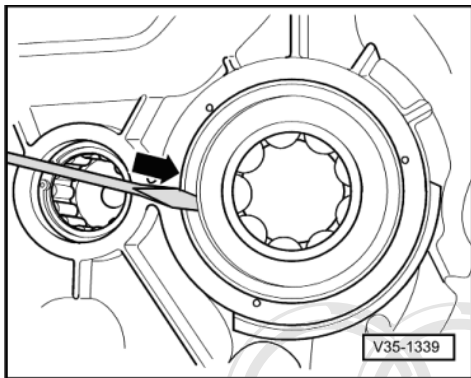


-> Fig.2 Pressing cylinder roller bearing for input shaft into end cover

- ◆ Place thrust plate 30-205 onto bearing with recessed side facing upwards.

**Note:**

*To press in the cylinder roller bearing, place thrust pad 3062 under the seating collar for the cylinder roller bearing on the end cover.*

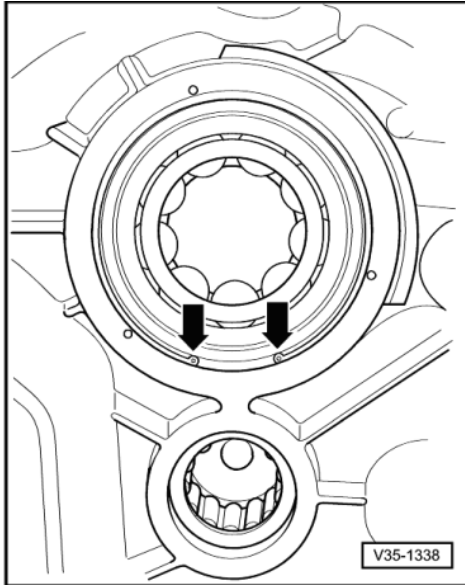


-> Fig.3 Removing four-point bearing for input shaft from end cover

- Position screwdriver as illustrated, drive into baffle plate -arrow- and lever out.
- Remove circlip.
- Take out bearing, remove peening indentations if necessary.



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-> Fig.4 Installing four-point bearing for input shaft in end cover

Installation position of circlip:

- ♦ Ends of circlip -arrows- towards roller sleeve for drive pinion

**Note:**

*The thickness of the circlip must be re-determined if the bearing or the end cover are replaced.*

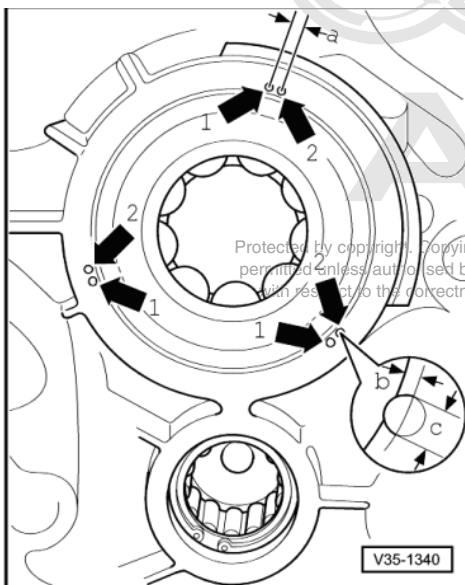
- Determining thickness of circlip for four-point bearing for input shaft:
  - Press outer race of four-point bearing onto stop.
  - Determine the thickest circlip that can still just be fitted.
  - Axial play: max. 0.08 mm
  - Determine circlip from table. Part numbers

=> Parts catalogue

**Circlips available**

Circlip thickness (mm)	
2.55	2.65
2.60	2.70

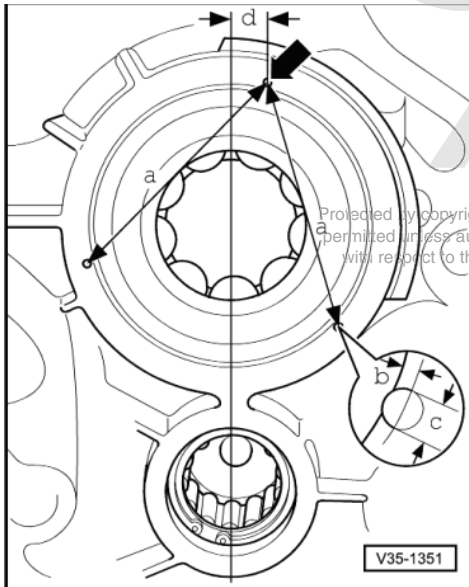
- Fit circlip.



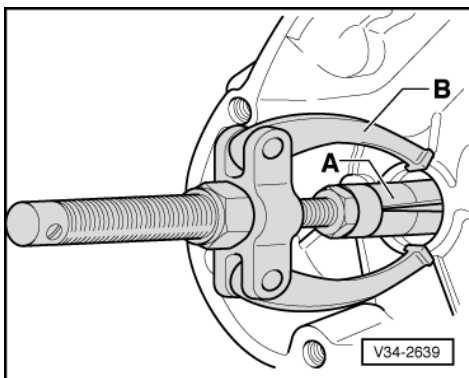
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**-> Fig.5 Peening baffle plate in position when renewing four-point bearing for input shaft**

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert baffle plate.
- First peen at points marked with -arrows 1-.
- Then peen at points marked with arrows 2- at distance -a- from first position.
  - Dimension a = 5 mm
- Observe position and diameter of peening positions:
  - Dimension b = 2 mm
  - Dimension c = 3 mm

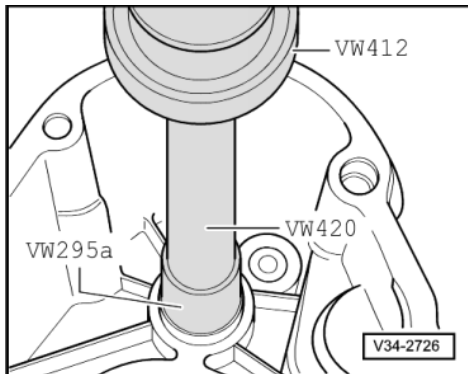

**-> Fig.6 Peening baffle plate in position when renewing end cover**

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert dust plate.
- Peen in first peening point -arrow- at distance -d- from the centre line of the two shafts.
  - Dimension d = 10 mm
- Observe position and diameter of peening positions.
  - Dimension b = 2 mm
  - Dimension c = 3 mm
- Peen in second and third peening points in same manner at distance -a-.
  - Dimension a = 70 mm


**-> Fig.7 Pulling roller sleeve for drive pinion out of end cover**

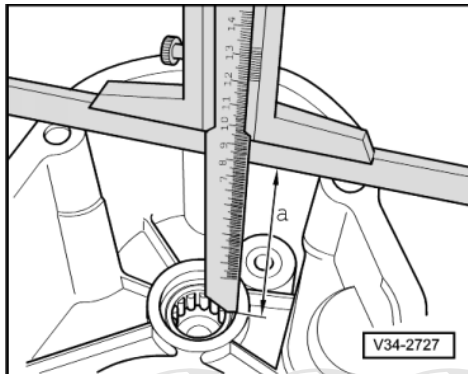
- Remove circlip.

- A - Internal puller 22 ... 28 mm, e.g. Kukko 21/4
- B - Counterhold, e.g. Kukko 22/1



-> Fig.8 Driving roller sleeve for drive pinion into end cover

- Note installation position => Fig. 9 .



-> Fig.9 Installation position of roller sleeve for drive pinion

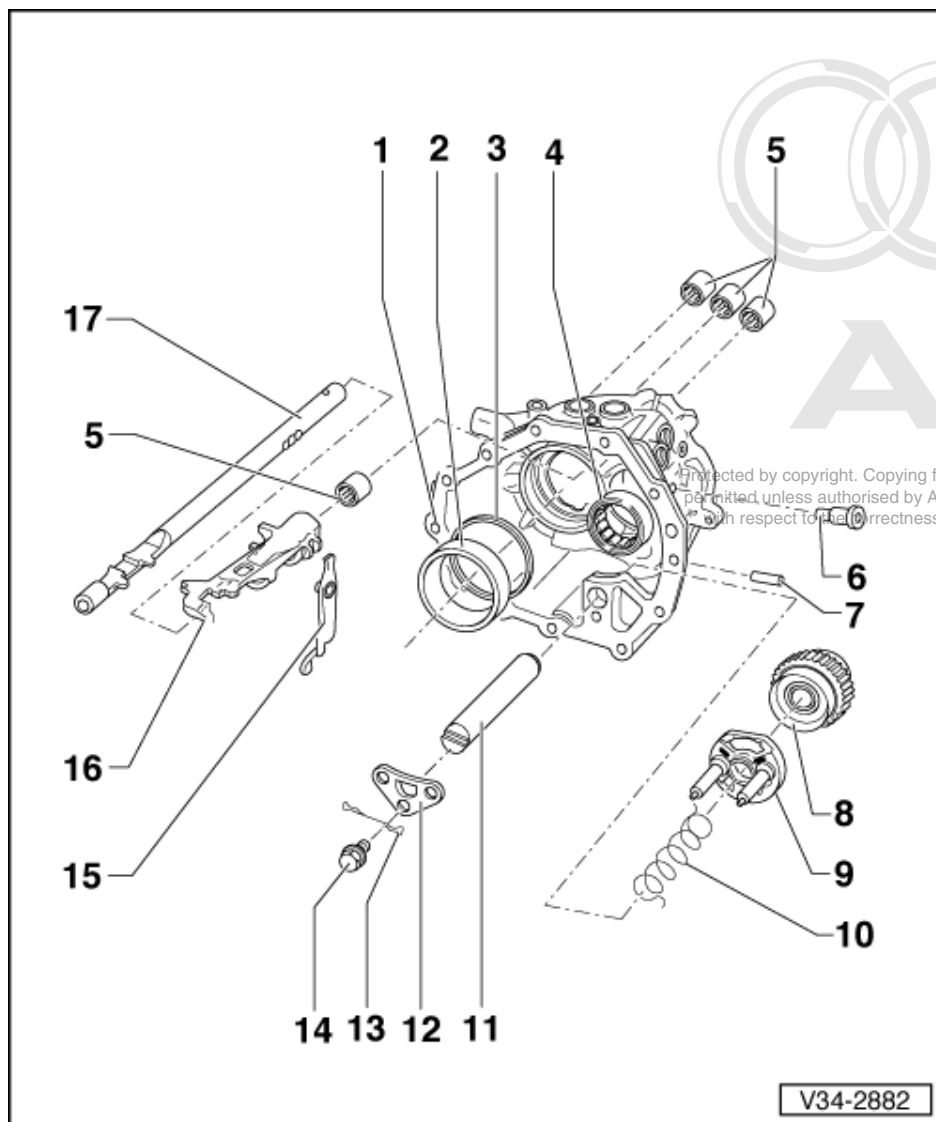
- ◆ Dimension a = 98.6 mm

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## 8 - Servicing bearing plate

### 8.1 - Servicing bearing plate



#### Note:

General repair instructions => Page 5

#### 1 Bearing plate

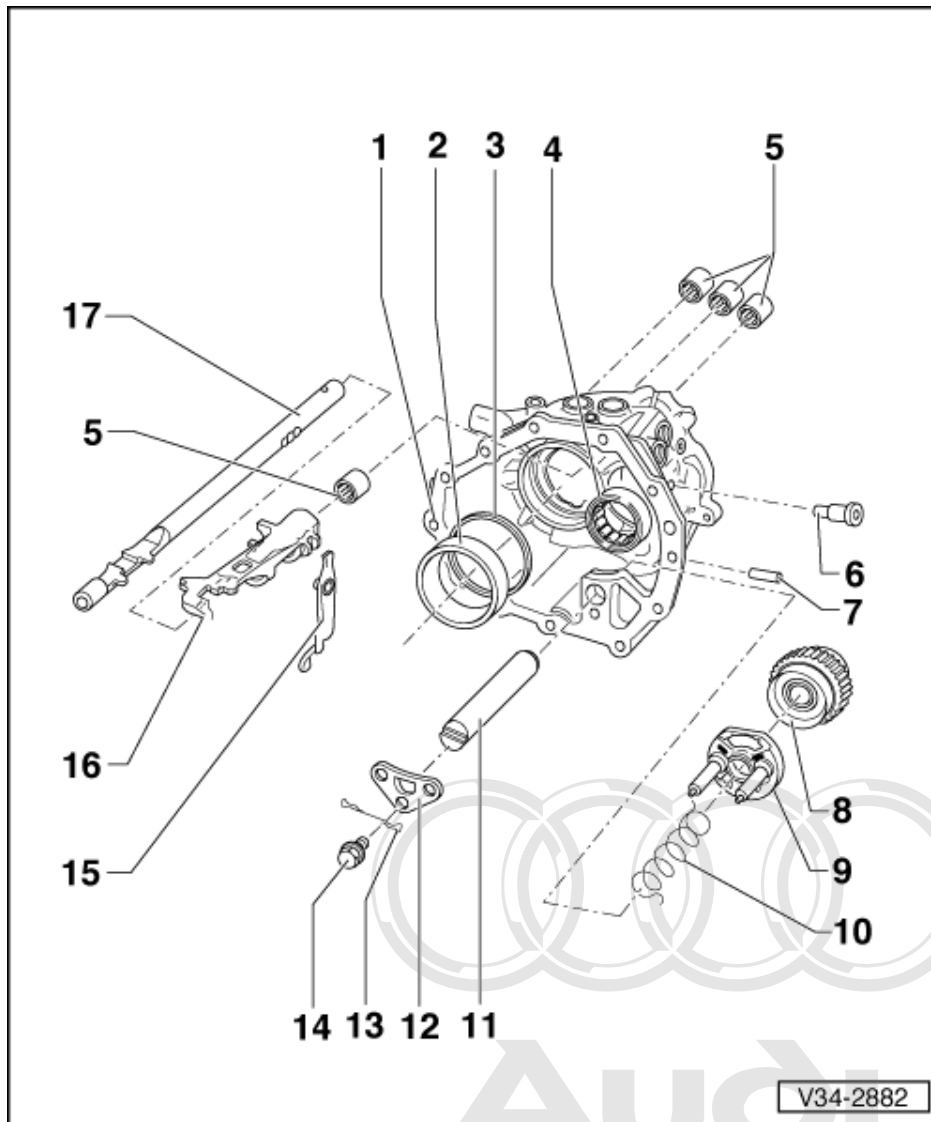
- ♦ If replacing, re-determine shim "S4"

#### 2 Outer race for taper roller bearing for drive pinion

- ♦ Driving out => Fig. 141
- ♦ Pressing in => Fig. 141
- ♦ If replacing, re-determine shim "S4"

#### 3 Shim "S4"

- ♦ Adjustment overview => Page 158
- ♦ Re-determining => Page 97



#### 4 Cylinder roller bearing for input shaft

- ◆ Pressing out => Fig. 5
- ◆ Pressing in => Fig. 6
- ◆ Measuring insertion depth => Fig. 7

#### 5 Ball sleeve

- ◆ For selector rods
- ◆ Removing and installing => Fig. 1
- ◆ Always renew

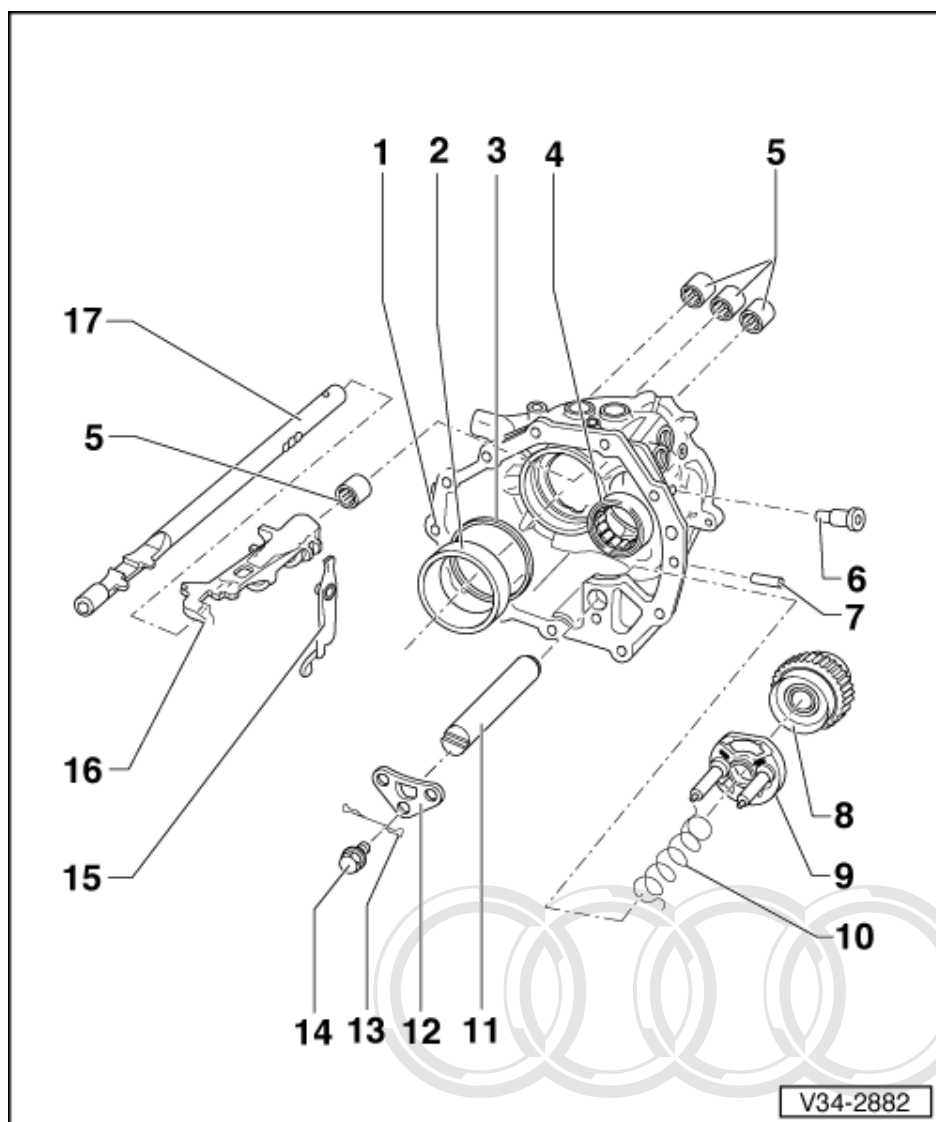
#### 6 Bolt - 35 Nm

- ◆ For relay lever

#### 7 Dowel pin (7 x 28)

- ◆ Press in flush

#### 8 Sliding gear for reverse gear

**9 Synchro-ring for reverse gear**

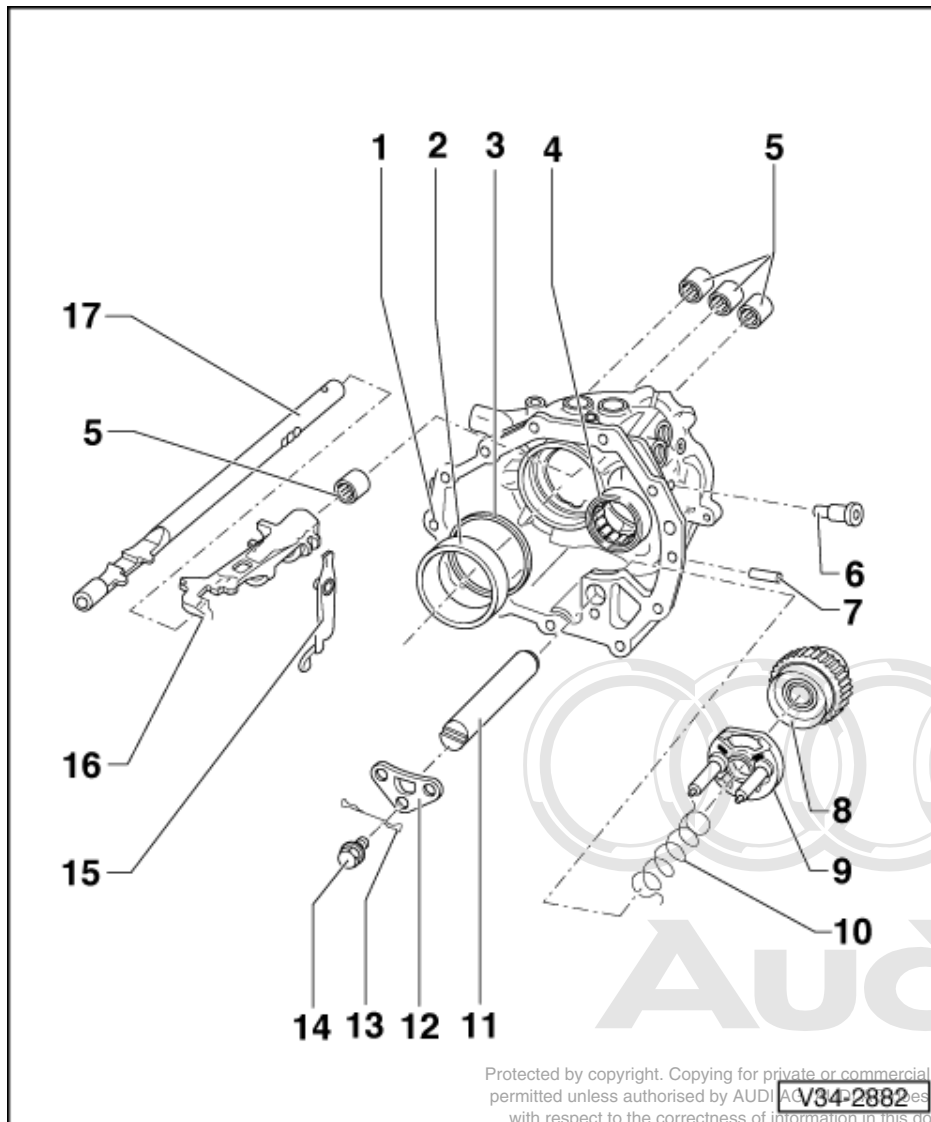
- ◆ With locking pins
- ◆ Checking for wear => Fig. 2
- ◆ Installation position: position flat on synchro-ring circumference to face input shaft => Page 74

**10 Spring**

- ◆ Installation position: hook single angled end into recess on synchro-ring. Turn double angled end anti-clockwise and insert into opening on bearing plate.

**11 Shaft for reverse sliding gear**





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## 12 Retaining plate

- ♦ Installation position: the chamfers of the holes for the locking pins of the synchro-ring towards bearing plate=> Page 74

## 13 Spring clasp

## 14 Bolt - 25 Nm

- ♦ Self-locking
- ♦ Always renew

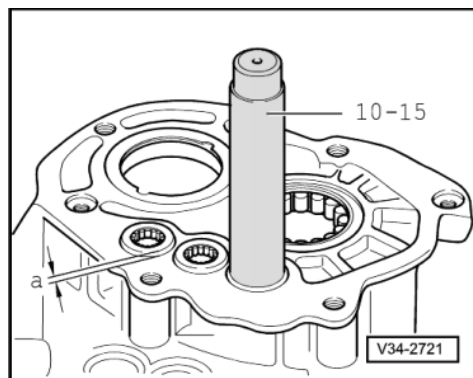
## 15 Relay lever for reverse gear

## 16 Follower for reverse gear

- ♦ Pulling out ball sleeve => Fig. 3
- ♦ Driving in ball sleeve => Fig. 4

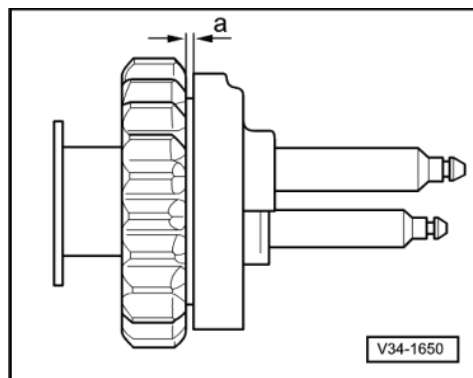
## 17 Selector rod for 5th and 6th gear

- ♦ Only renew together with follower  
=> Page 60



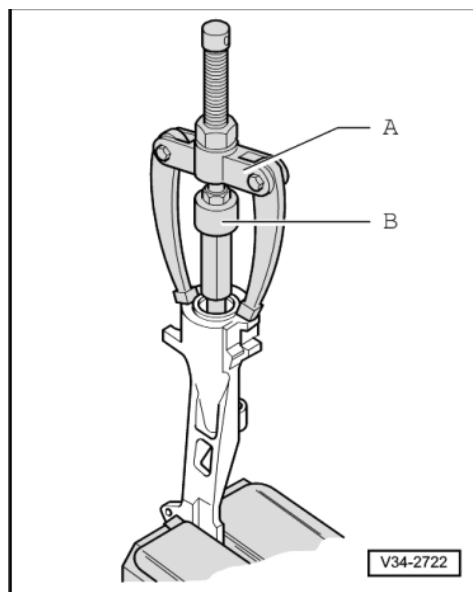
-> Fig.1 Driving in and driving out ball sleeves for selector rods

- ♦ Install ball sleeve with the inscribed side (thicker metal) facing the drift.
- ♦ Insertion depth  $a = 2.5 \text{ mm}$



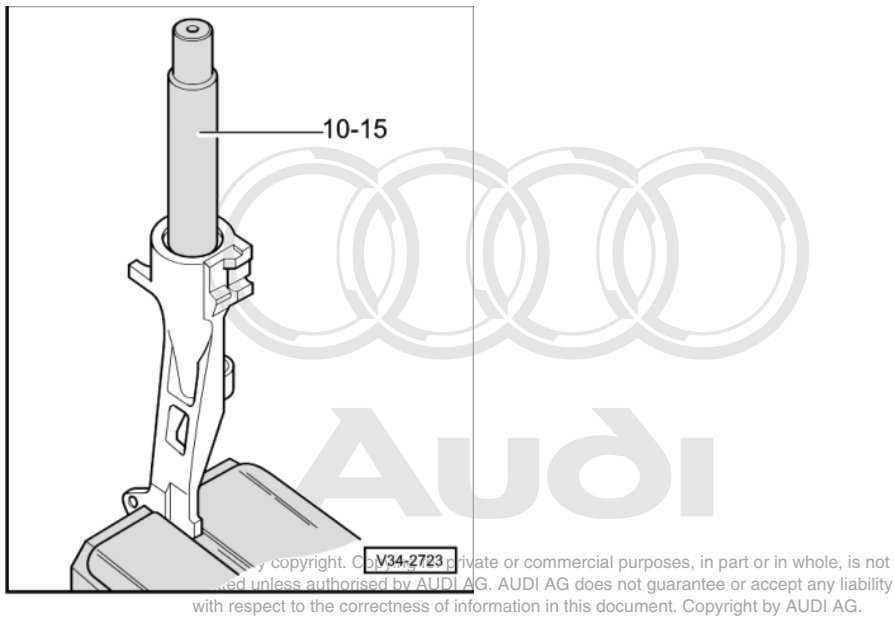
-> Fig.2 Checking synchro-ring for wear

- Press synchro-ring onto cone of the gear.
- Measure gap "a" with a feeler gauge:
  - Dimension, new:  $0.75 \dots 2.3 \text{ mm}$
  - Wear limit:  $0.2 \text{ mm}$



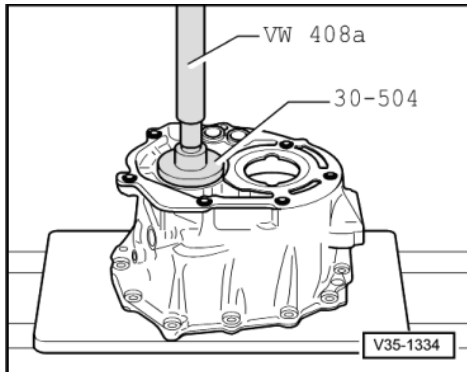
-> Fig.3 Pulling ball sleeve out of follower for reverse gear

- A - Counter support, e.g. Kukko 22/1
- B - Internal puller 18.5 ... 23.5 mm, e.g. Kukko 21/3

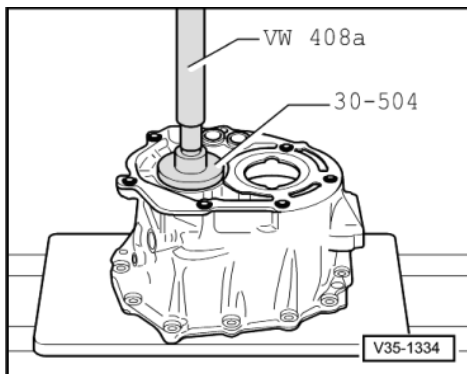


-> Fig.4 Driving ball sleeve flush into follower for reverse gear

- ♦ Install ball sleeve with the inscribed side (thicker metal) facing the drift.



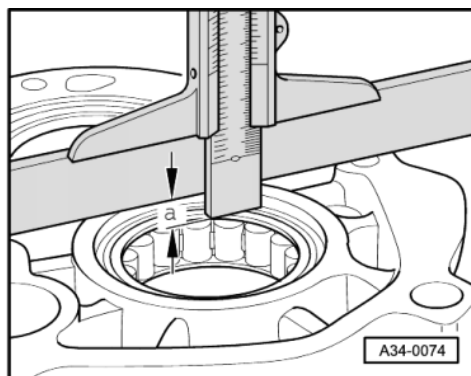
-> Fig.5 Pressing cylinder roller bearing for input shaft out of bearing plate





-> Fig.6 Pressing cylinder roller bearing for input shaft into bearing plate

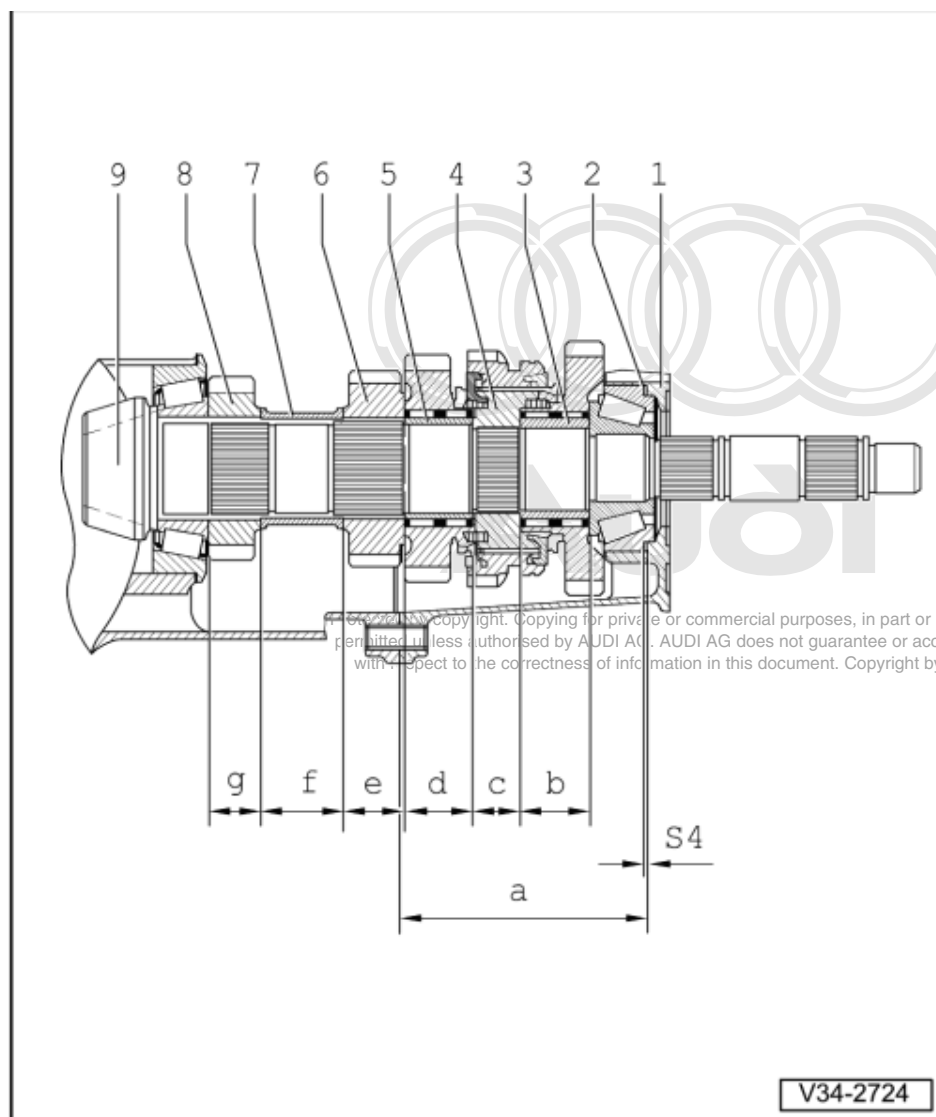
- Measuring insertion depth =>Fig. 7 .



-> Fig.7 Measuring insertion depth of cylinder roller bearing for input shaft

♦ Insertion depth  $a = 7 \text{ mm}$

## 8.2 - Re-determining shim "S4"

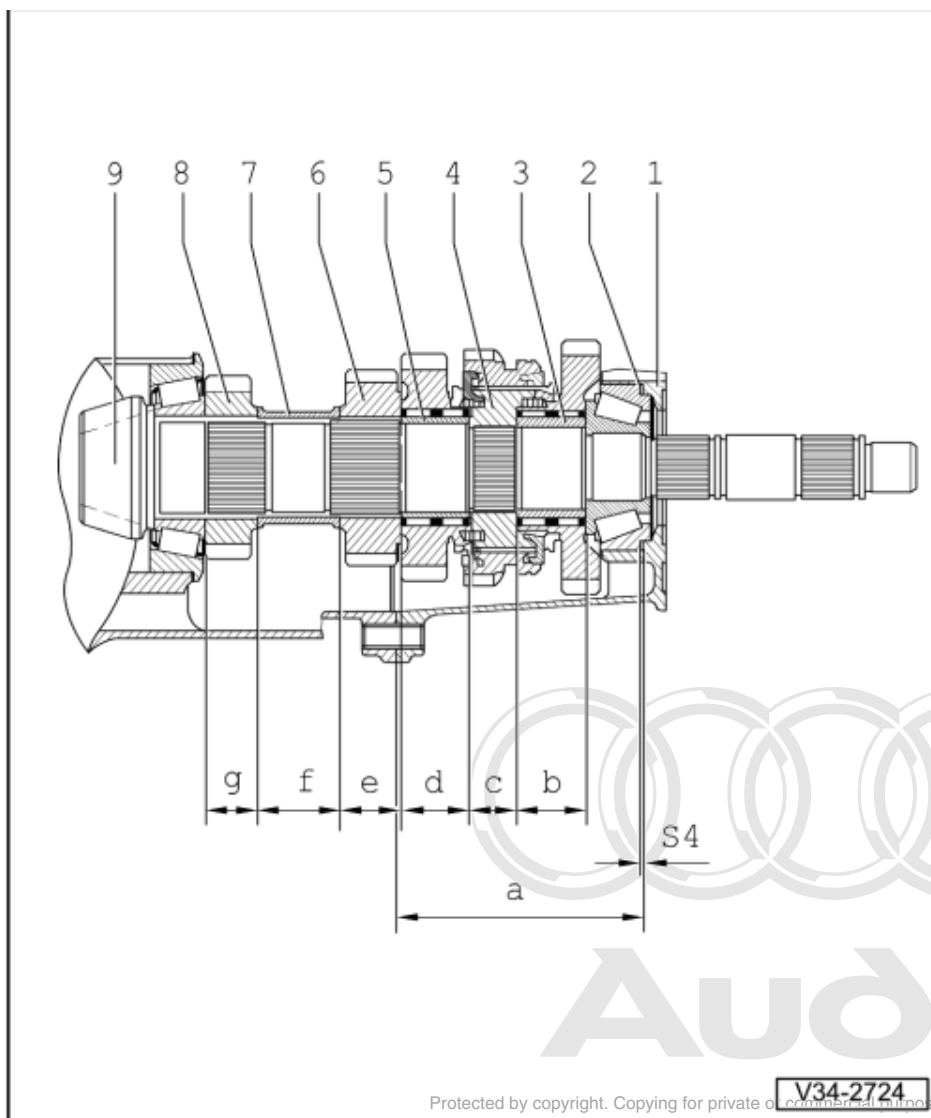


This procedure must be carried out when renewing the following components:

Bearing plate - needle bearing inner race for 1st speed sliding gear - synchro-hub for 1st and 2nd speed gears  
 - needle bearing inner race for 2nd speed sliding gear - 3rd speed gear - spacer sleeve - 4th speed gear.

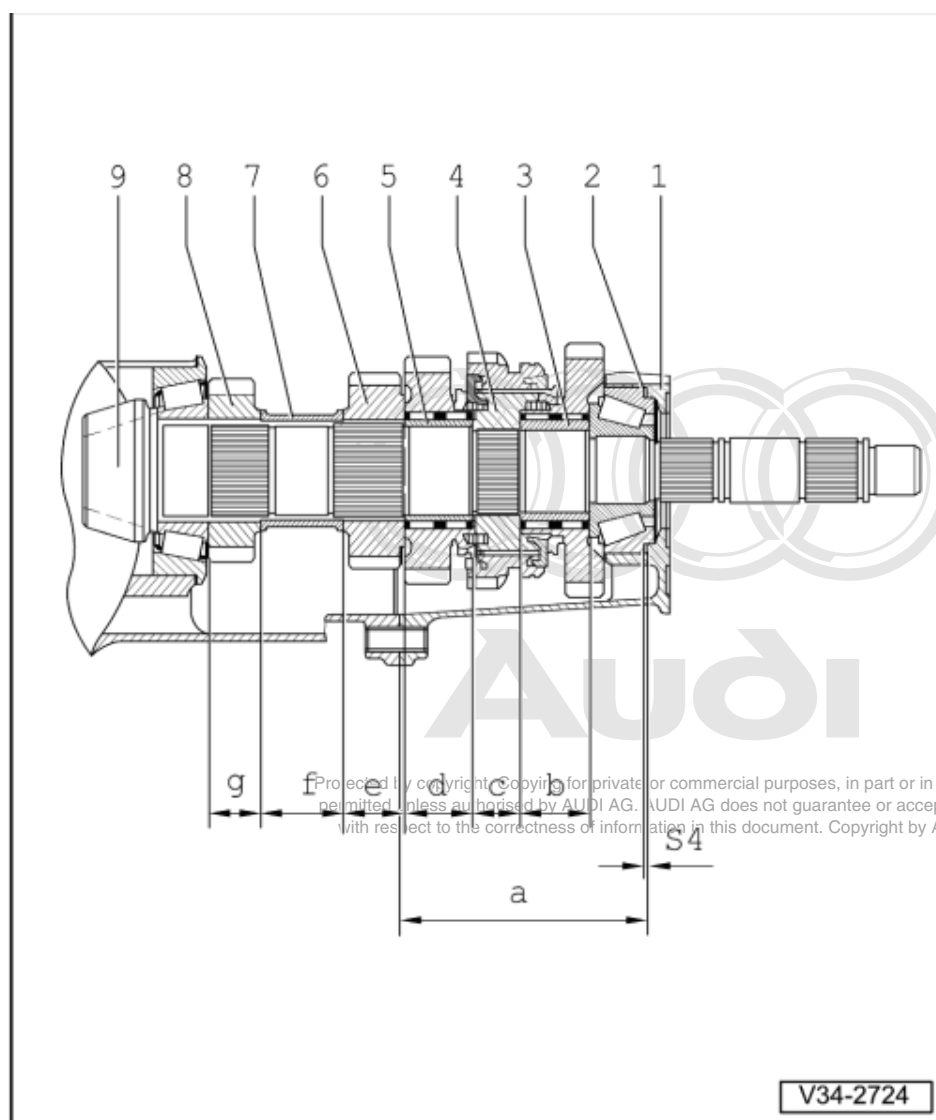
The procedure restores the required preload of the taper roller bearings for the drive pinion.

- 1 Bearing plate
- 2 Shim "S4"
- 3 Needle bearing inner race for 1st speed sliding gear



- 4 Synchro-hub for 1st and 2nd speed gears
- 5 Needle bearing inner race for 2nd speed sliding gear
- 6 3rd gear wheel
- 7 Spacer sleeve
- 8 4th gear wheel
- 9 Drive pinion

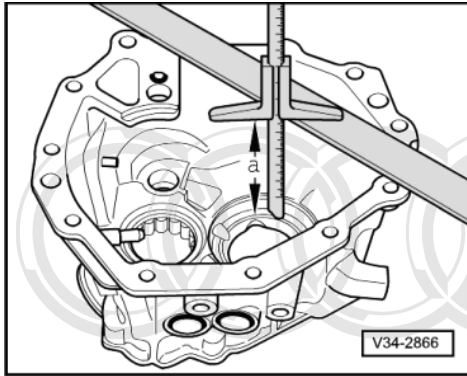
- a - Bearing plate housing depth
- b - Length of needle bearing inner race for 1st speed sliding gear
- c - Length of centre of synchro-hub for 1st and 2nd speed gears



- d - Length of needle bearing inner race for 2nd speed sliding gear
- e - Length of 3rd gear wheel
- f - Length of spacer sleeve
- g - Length of 4th gear wheel
- S4 - Thickness of shim "S4"

**Note:**

When replacing the drive pinion (final drive set), observe adjustment overview =>Page 158.



### A - Determining thickness of shim when renewing bearing plate

- -> Measure difference of depth "a" on old and new bearing plates

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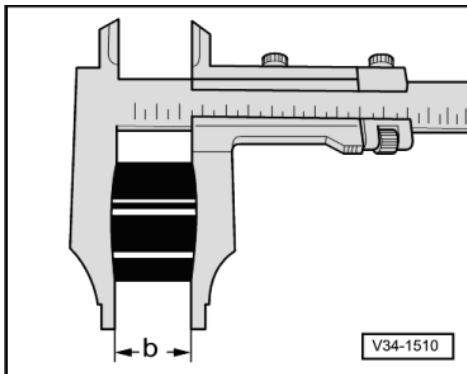
Depth "a" of old bearing plate	118.40 mm
Depth "a" of new bearing plate	118.65 mm
= Difference	0.25 mm

- If the new bearing plate is deeper, install a thicker "S4" shim.
- If the old bearing plate is deeper, install a thinner "S4" shim.

### Example:

Previous "S4" shim	0.95 mm
+ Difference	0.25 mm
= New "S4" shim	1.20 mm

Available shims => Table Page **100** .



### B - Determining thickness of shim when renewing needle bearing for 1st speed gear

- -> Measure length "b" on both old and new needle bearing inner races and calculate the difference.

### Example:

Length "b" on old inner race	33.35 mm
Length "b" on new inner race	33.40 mm
= Difference	0.05 mm

- If the old inner race is longer, install a thicker "S4" shim.



- If the old inner race is shorter, install a thinner "S4" shim.

Available shims =>Table Page **100** .

### C - Determining thickness of shim when renewing items **4 ... 8** ,

Page **97**

- Calculate the differences between the remaining pairs of dimensions ("c" to "g", =>from Page **97** ) on the old and new components in the same way and determine the thickness of shim "S4".

- Determine shim(s) from table: part numbers

=> Parts catalogue

Available shims for "S4"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	1.25
0.55	0.75	
0.60	0.80	

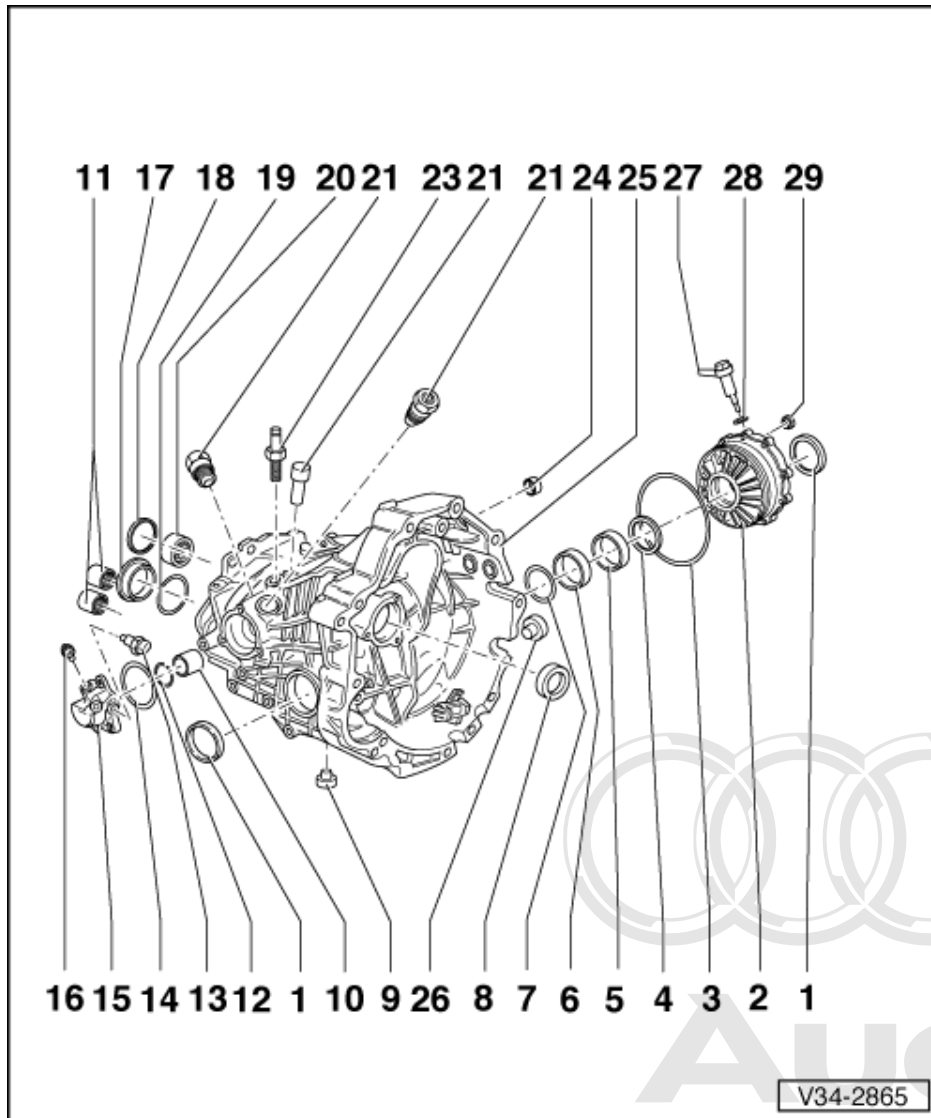
1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

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## 9 - Servicing gearbox housing

### 9.1 - Servicing gearbox housing



#### Notes:

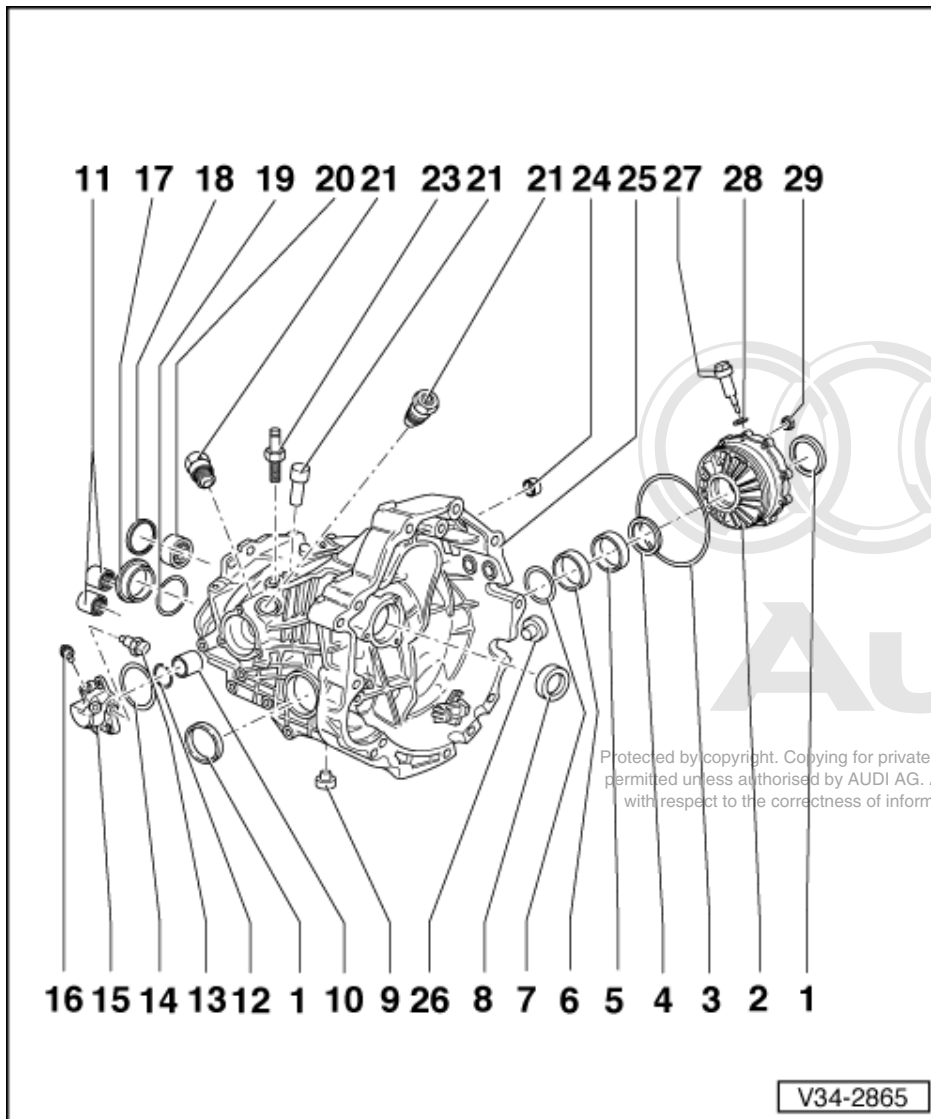
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- ♦ General repair instructions =>Page **5**
- ♦ Adjustments are required when replacing components marked 1) =>adjustment overview Page **158** .

#### 1 Seal

- ♦ For flange shaft
- ♦ Pulling out => Fig. **1**
- ♦ Driving in => Fig. **2**
- ♦ Fill space between sealing lips with multi-purpose grease
- ♦ Renewing with gearbox installed => Page **142**

#### 2 Cover for final drive 1)

**3 O-ring**

- ◆ For cover for final drive
- ◆ Always renew

**4 Shim "S1"**

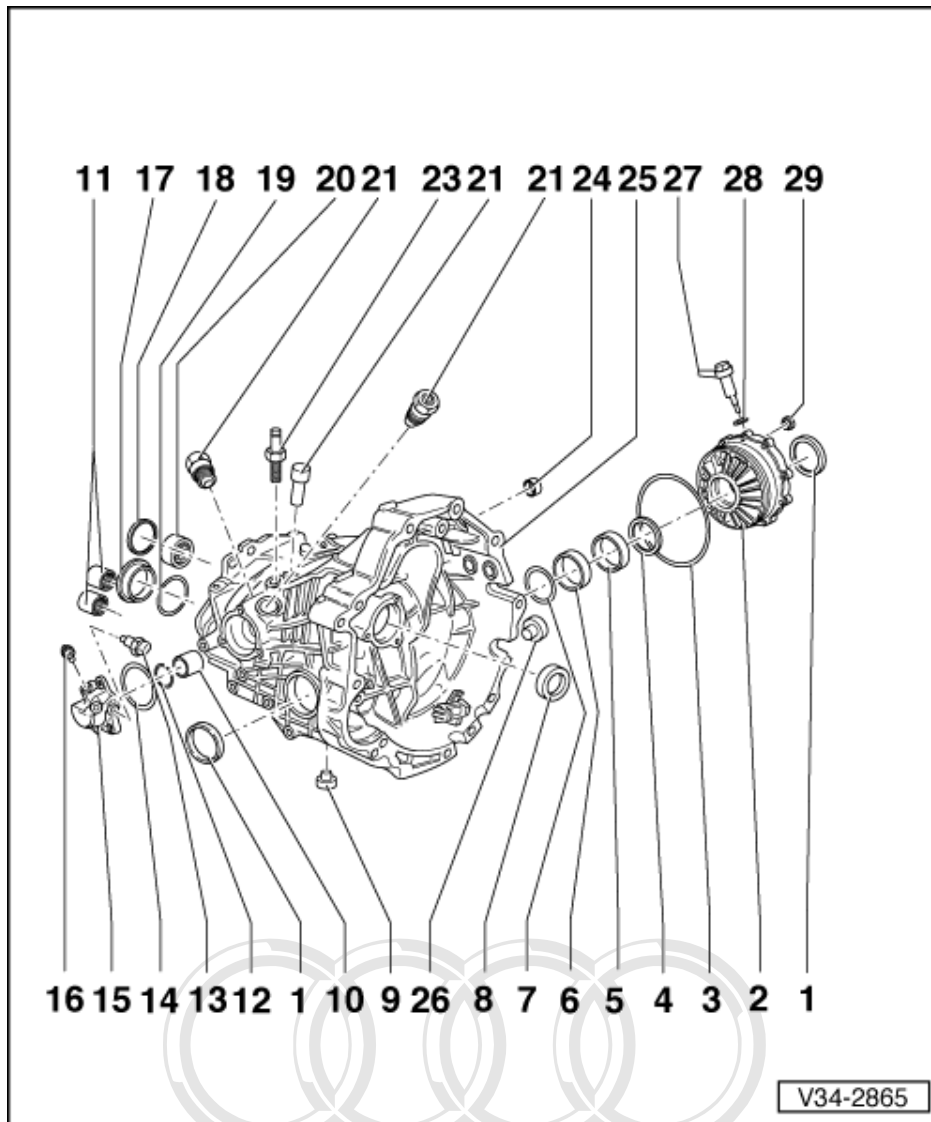
- ◆ Note thickness
- ◆ Adjustment overview => Page 158

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

- ◆ For differential
- ◆ Driving out and driving in  
=> Page 156

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

- ◆ For differential
- ◆ Driving out and driving in  
=> Page 155



#### 7 Shim "S2"

- ♦ Note thickness
- ♦ Adjustment overview => Page 158

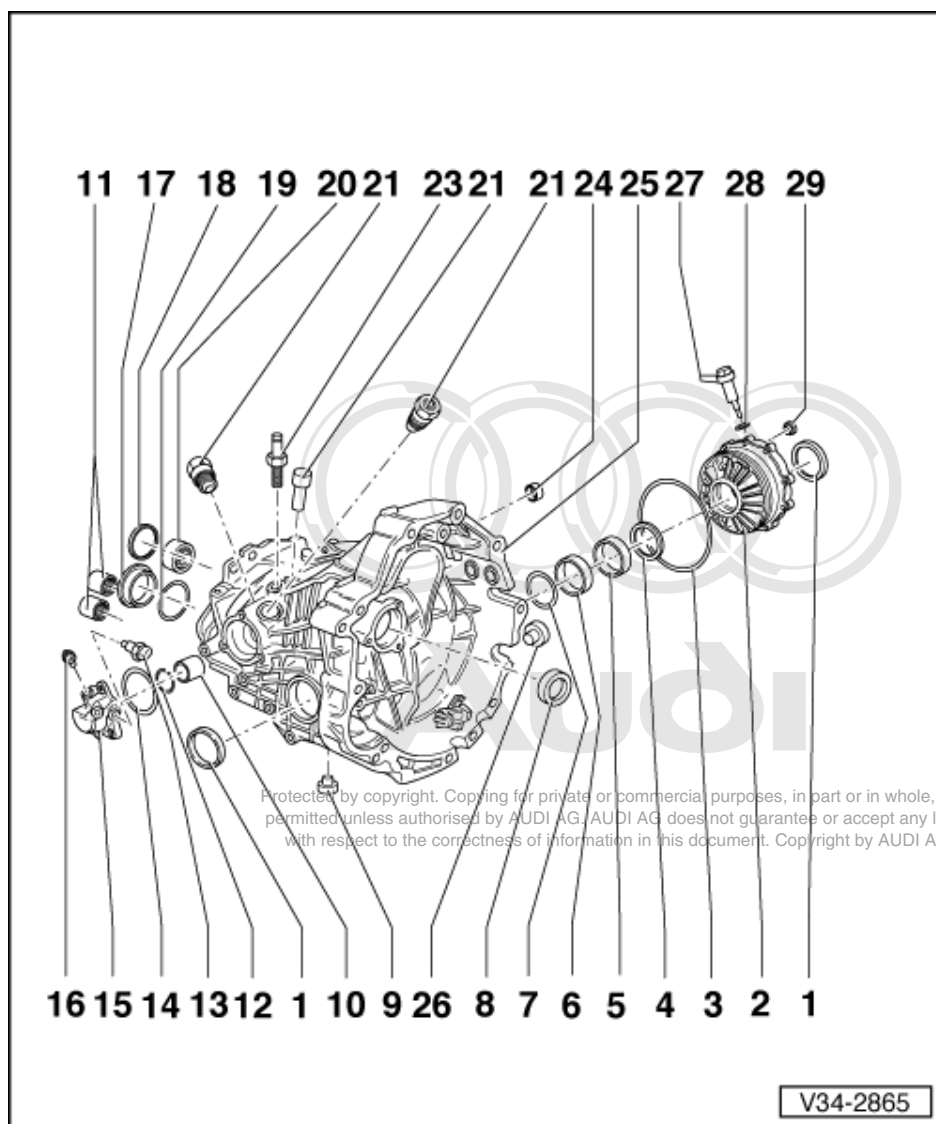
#### 8 Seal

- ♦ For input shaft
- ♦ Levering out => Fig. 3
- ♦ Driving in => Fig. 5
- ♦ Always renew when removing input shaft
- ♦ Renewing when gearbox is not dismantled => Fig. 4 and Fig. 5

#### 9 Oil drain plug - 40 Nm

#### 10 Ball sleeve

- ♦ For selector shaft
- ♦ Always renew
- ♦ Pulling out => Fig. 6
- ♦ Driving in => Fig. 7



**11 Ball sleeves**

- ♦ For selector shafts
- ♦ Always renew
- ♦ Pulling out, as -item 10 -, => Fig. 6
- ♦ Driving in, as -item 10 -, => Fig. 7

**12 Circlip**

- ♦ Installation position: eyes facing up

**13 Reversing light switch**

- ♦ Removing and installing => Page 12

**14 O-ring**

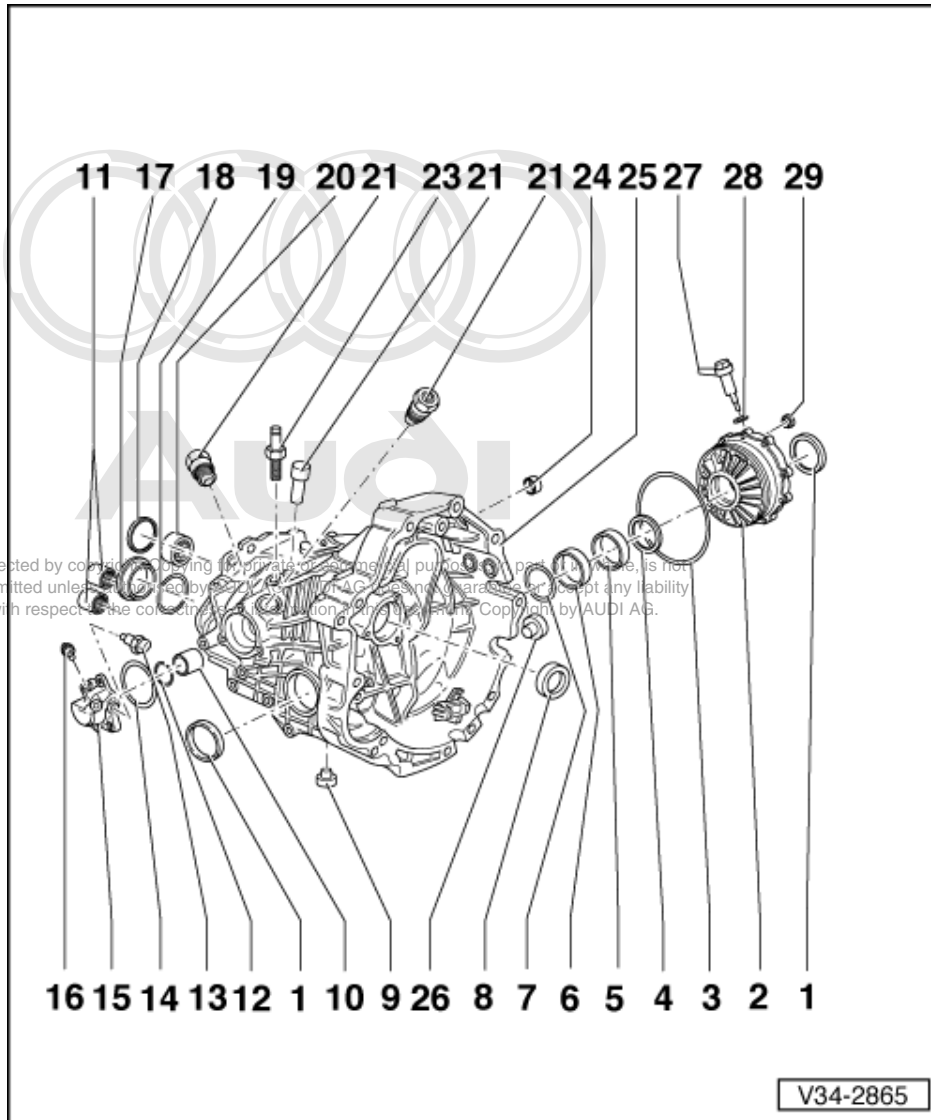
- ♦ For cover for selector shaft
- ♦ Always renew

**15 Cover for selector shaft**

- ♦ Removing =>Page 66
- ♦ Installing =>Page 82

**16 Ball stud - 20 Nm**

- ♦ For connecting rod



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

- ◆ For drive pinion
- ◆ Pulling out => Fig. 136
- ◆ Pressing in => Fig. 137

**18 Circlip**

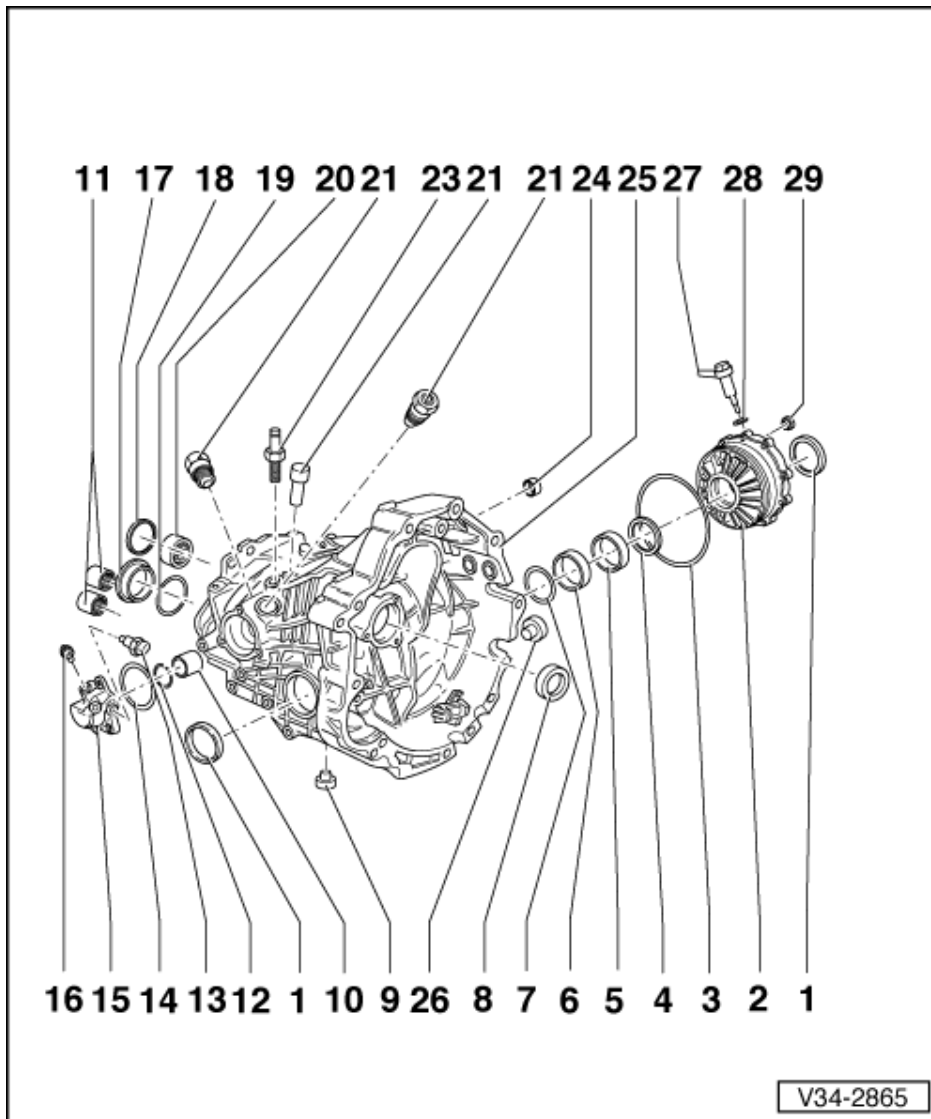
- ◆ Removing => Fig. 16

**19 Shim "S3"**

- ◆ Note thickness
- ◆ Adjustment overview => Page 158

**20 Needle bearing for input shaft**

- ◆ For input shaft
- ◆ Pulling out => Fig. 13
- ◆ Driving in => Fig. 14
- ◆ Measuring insertion depth => Fig. 15

**21 Locking bolt**

- ◆ For selector shaft
- ◆ Removing =>Page 66
- ◆ Mark positions of aluminium and steel bolts; bolts must not be interchanged when refitting
- ◆ Installing =>Page 81
- ◆ Tightening torques:
  - For aluminium bolt: 50 Nm
  - For steel bolt: 70 Nm

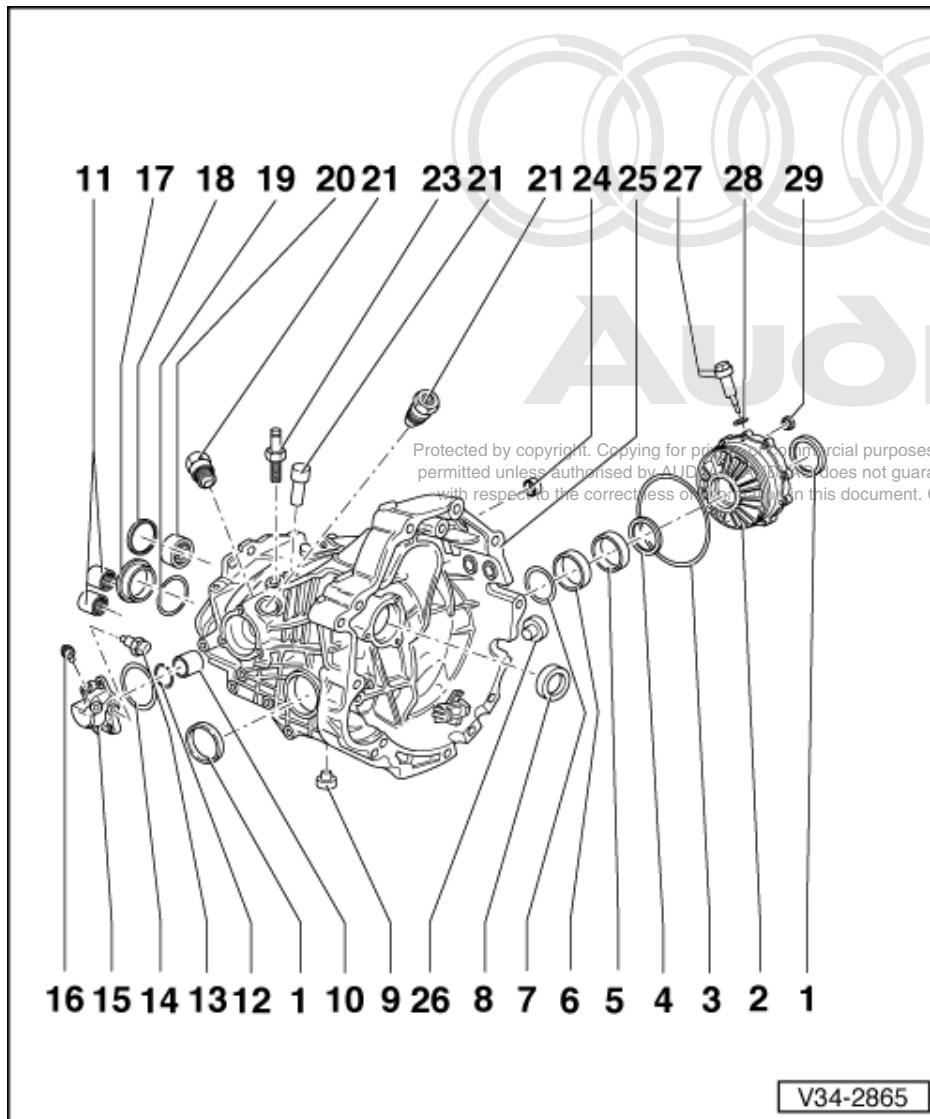
**22 Trunnion bolt - 40 Nm**

- ◆ For push rod

**23 Breather**

- ◆ Insertion depth of sleeve => Fig. 11
- ◆ Clip cap on

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#### 24 Seal for selector shaft

- ♦ Can be renewed when gearbox is removed but not dismantled
- ♦ Always renew
- ♦ Pulling out => Fig. 8
- ♦ Driving in => Fig. 9
- ♦ Always use assembly sleeve for installing => Fig. 10

#### 25 Gearbox housing 1)

#### 26 Magnet

- ♦ Clean
- ♦ Drive in (for example, with press tool VW 408 A) when renewing gearbox

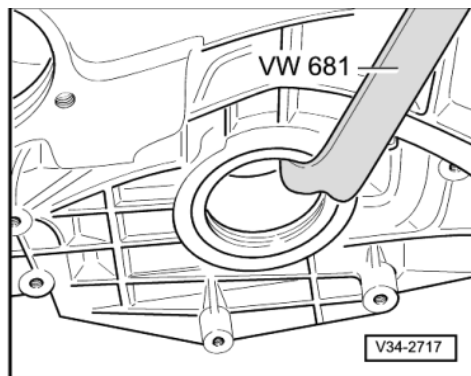
#### 27 Sender for speedometer -G22

- ♦ Renewing => Page 143

#### 28 O-ring

- ♦ Always renew

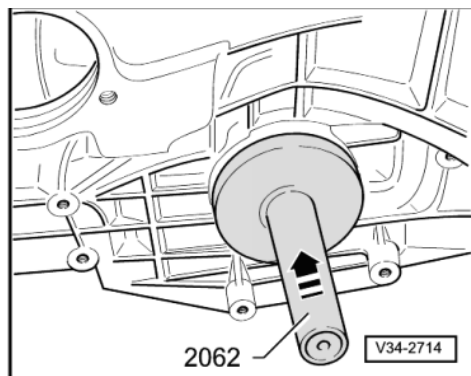
#### 29 Oil filler plug - 40 Nm



-> Fig.1 Pulling out seal for flange shaft

**Notes:**

- ♦ Illustrated, removing oil seal on right-hand side.
- ♦ Procedure for removing oil seal on left and right-hand sides is identical.

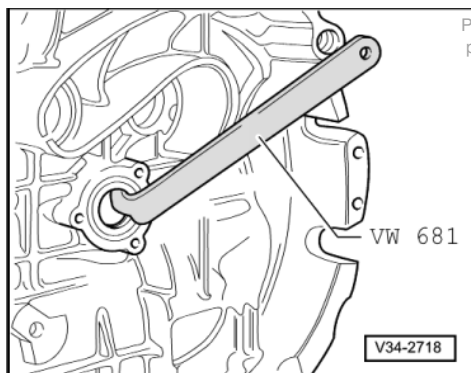


-> Fig.2 Driving in seal for flange shaft

- ♦ Driving-in depth: 6.5 mm

**Notes:**

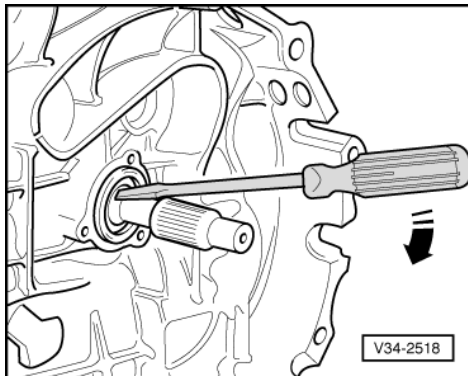
- ♦ Illustrated, installing oil seal on right-hand side.
- ♦ The procedure is the same for both sides (left and right).



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-> Fig.3 Levering out seal for input shaft when gearbox is dismantled

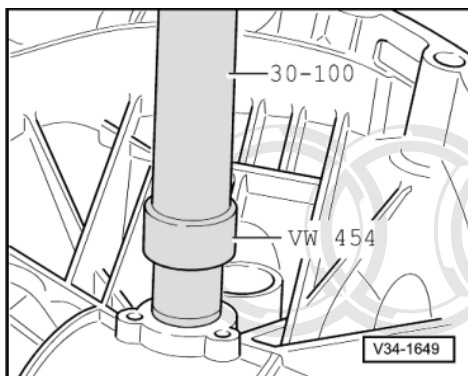


-> Fig.4 Removing seal for input shaft when gearbox is not dismantled

- Lever out seal carefully with a screwdriver.

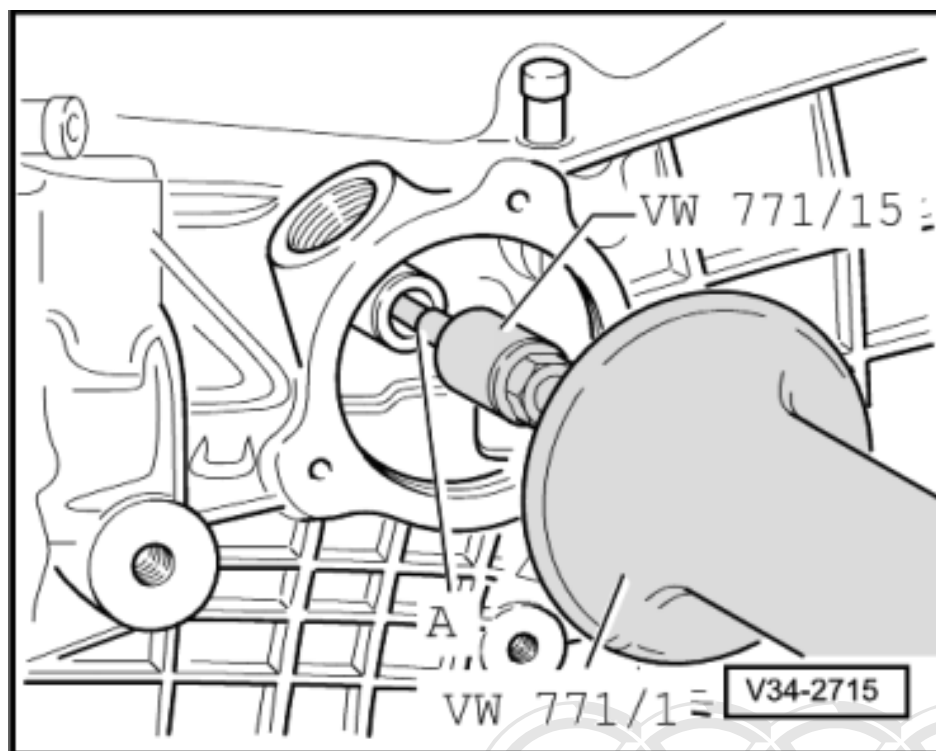
**Note:**

*Do not damage bearing surface on input shaft for shaft seal.*



-> Fig.5 Driving in seal for input shaft

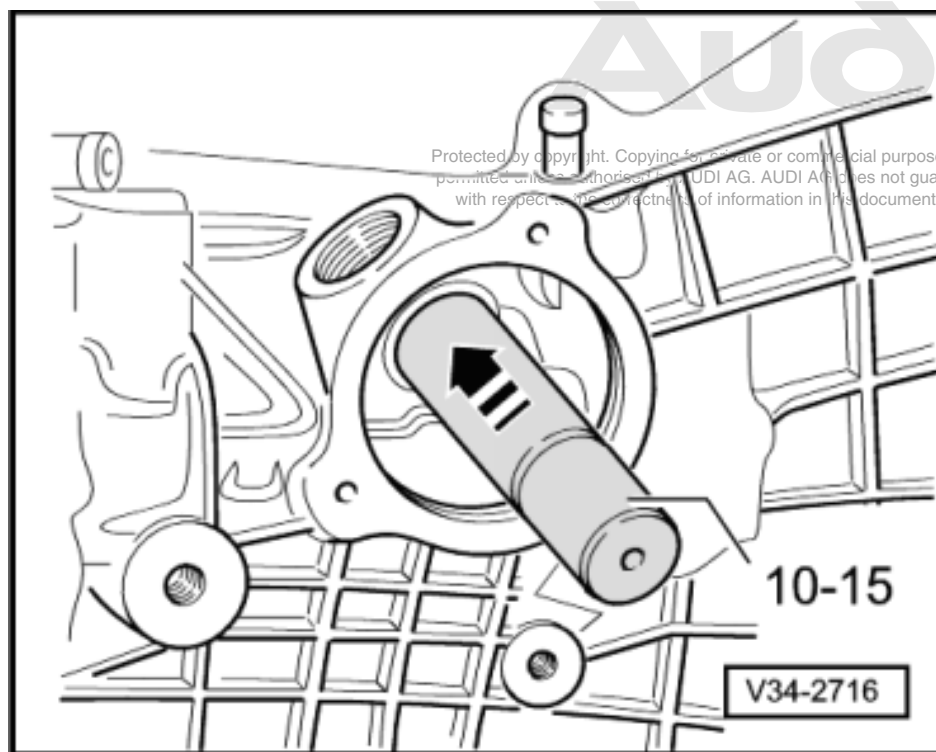
- Fill space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over splines of input shaft.
- Drive in seal for input shaft:
  - Driving-in depth: 4.5 mm
- Remove protective hose.



-> Fig.6 Pulling out ball sleeve

- Remove circlip.

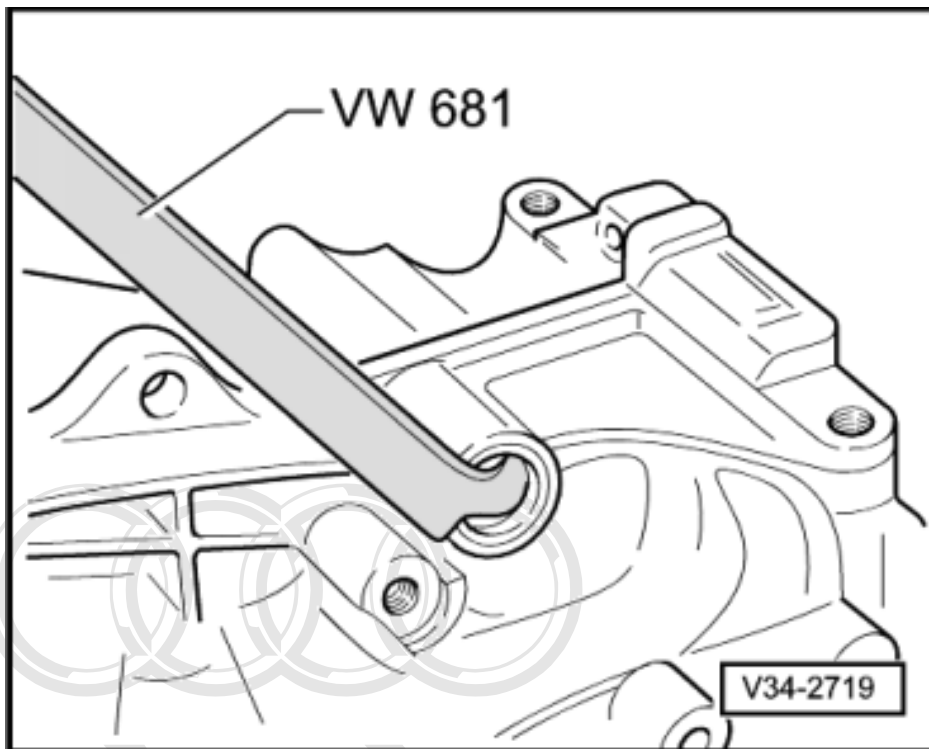
A - Internal puller 14.5 ... 18.5 mm, e.g. Kukko 21/2



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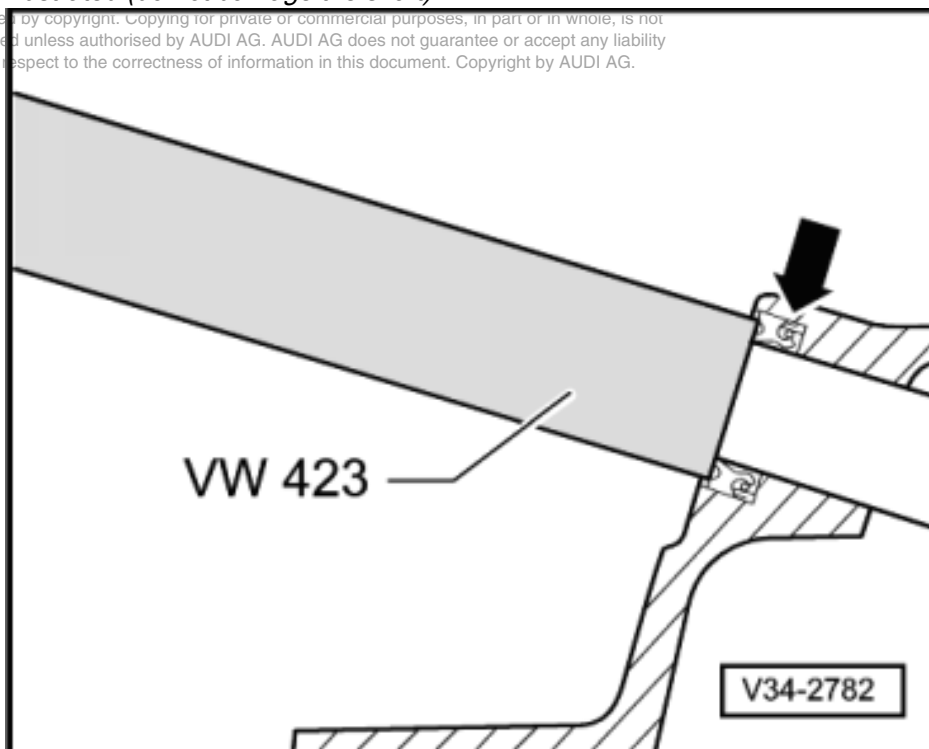
**-> Fig.7 Driving in ball sleeve**

- Install ball sleeve with the inscribed side (thicker metal) facing the drift.
- Drive in onto stop.
- Fit circlip.

**-> Fig.8 Pulling out seal for selector shaft****Note:**

*With gearbox removed but not dismantled, carefully lever out the seal using a screwdriver or the special tool illustrated (do not damage the shaft).*

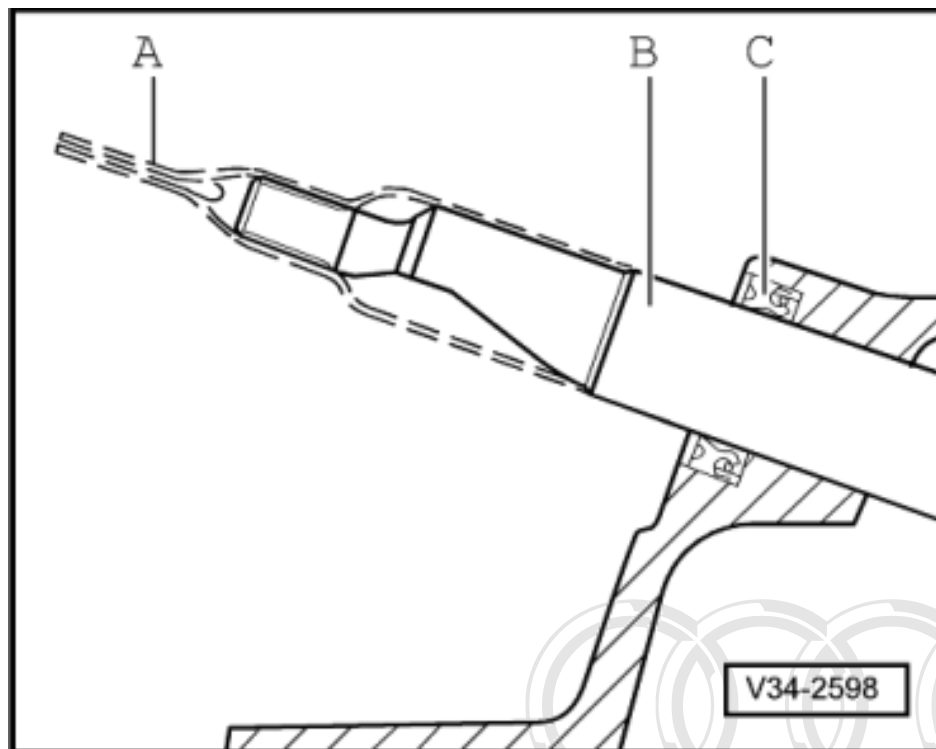
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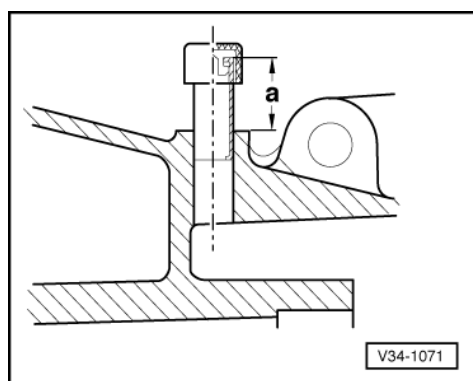
-> Fig.9 Driving in seal for selector shaft

- Selector shaft installed or removed
- Fill space between sealing lip and dust lip with multi purpose grease.
- Pull assembly sleeve onto selector shaft => Fig. 10 .
- Drive seal into housing onto stop.



-> Fig.10 Installing seal and selector shaft with assembly sleeve

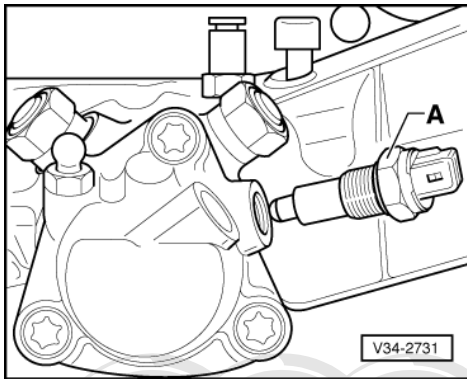
- To avoid damaging the seal -C- always use assembly sleeve -A-, Part No. 01E 311 120, to install seal or selector shaft.



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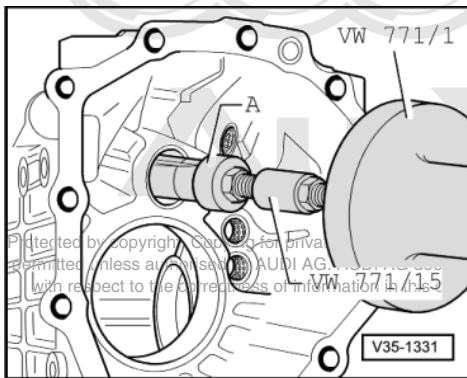
-> Fig.11 Insertion depth of breather sleeve

- ♦ Dimension a = 21 mm



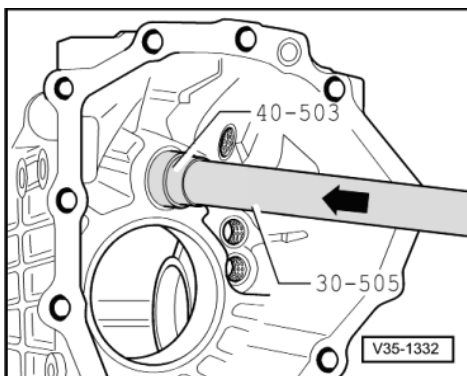
➔ Fig.12 Removing and installing reversing light switch

- Tighten reversing light switch -A- to 20 Nm when installing.



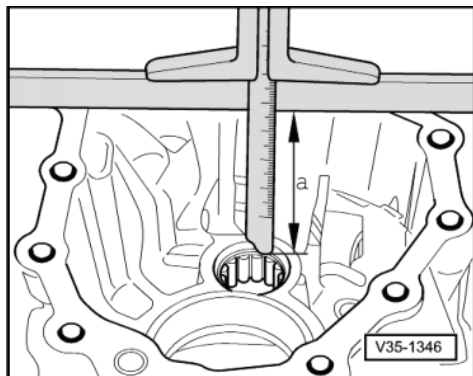
➔ Fig.13 Pulling needle bearing out of gearbox housing

- A - Internal puller 30 ... 37 mm, e.g. Kukko 21/5



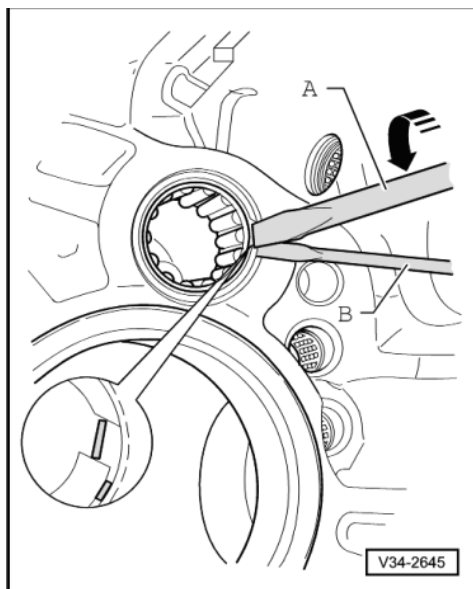
➔ Fig.14 Driving needle bearing into gearbox housing

- ♦ Installation position: inscription on bearing faces tool
- ♦ Insertion depth => Fig. 15



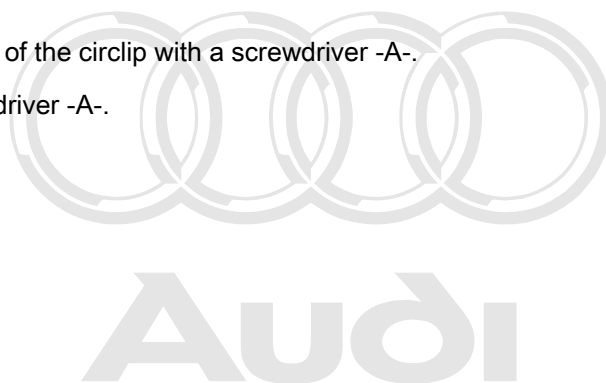
-> Fig.15 Insertion depth of needle bearing

- ♦ Dimension a = 105 mm



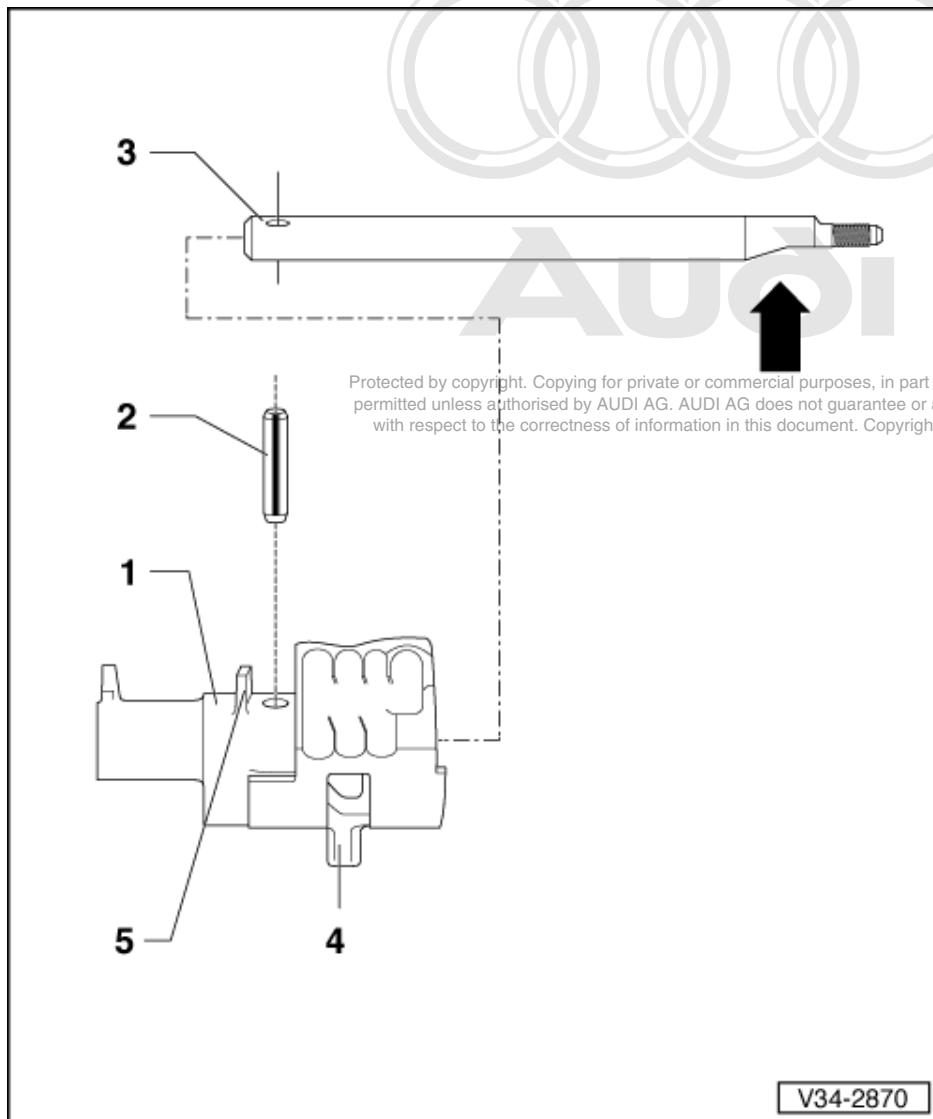
-> Fig.16 Removing circlip

- Lift circlip out of the groove by turning one end of the circlip with a screwdriver -A-.
- Secure this end with a screwdriver -B-.
- Lever circlip out further by repositioning screwdriver -A-.

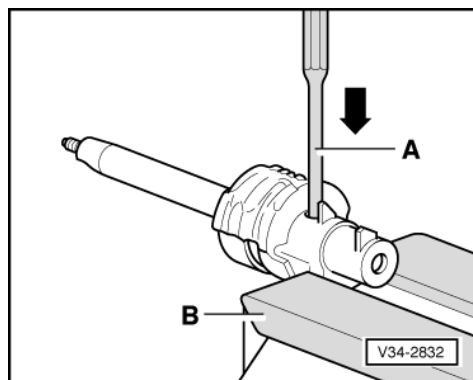


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## 9.2 - Dismantling and assembling selector shaft complete

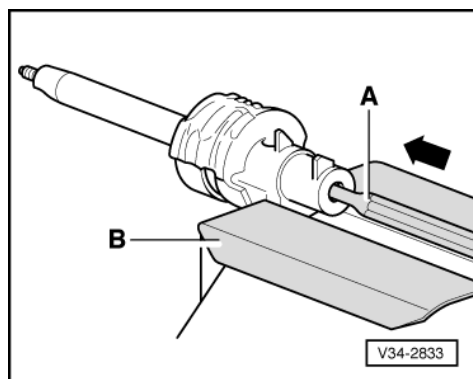


- 1 Selector cylinder**
  - ♦ For 6-speed gearbox
- 2 Spring pin**
  - ♦ Driving out and driving in => Fig. 1
  - ♦ Installation position: slot must be in line with direction of force
- 3 Selector shaft**
  - ♦ Driving out => Fig. 2
  - ♦ Driving in => Fig. 3
  - ♦ Installation position: flat (arrow) and selector finger -item 4 - face in same direction
- 4 Selector finger**
  - ♦ Observe installation position in relation to -item 3 -
- 5 Cam for reversing light switch**



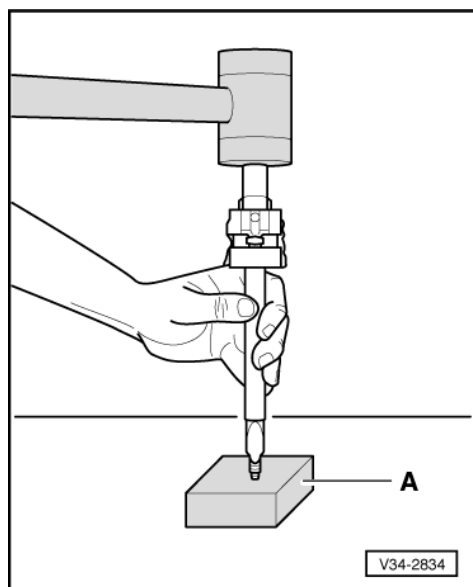
-> Fig.1 Driving out spring pin and driving in flush

- A - Drift
- B - Vice clamps



-> Fig.2 Driving out selector shaft

- A - Drift
- B - Vice clamps



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-> Fig.3 Driving in selector shaft

A - Wooden block

**Notes:**

- ♦ Bring holes into alignment.
- ♦ Flat on selector shaft and selector finger point in same direction.



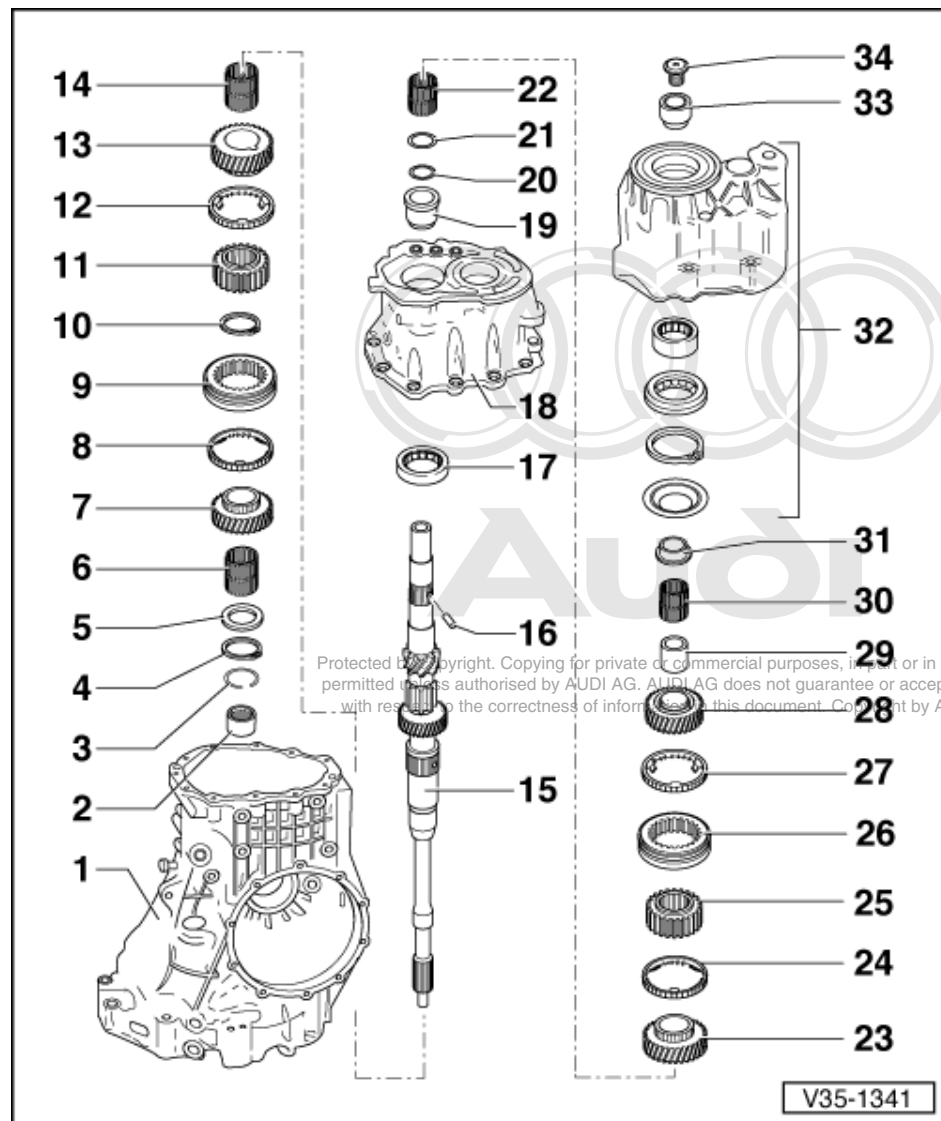
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## 35 - Gears, Shafts

### 1 - Dismantling and assembling input shaft

#### 1.1 - Dismantling and assembling input shaft



#### Notes:

- ♦ General repair instructions => Page 5
- ♦ When installing new gears => Technical data, Page 2

#### 1 Gearbox housing

- ♦ Servicing => Page 101

#### 2 Needle bearing for input shaft

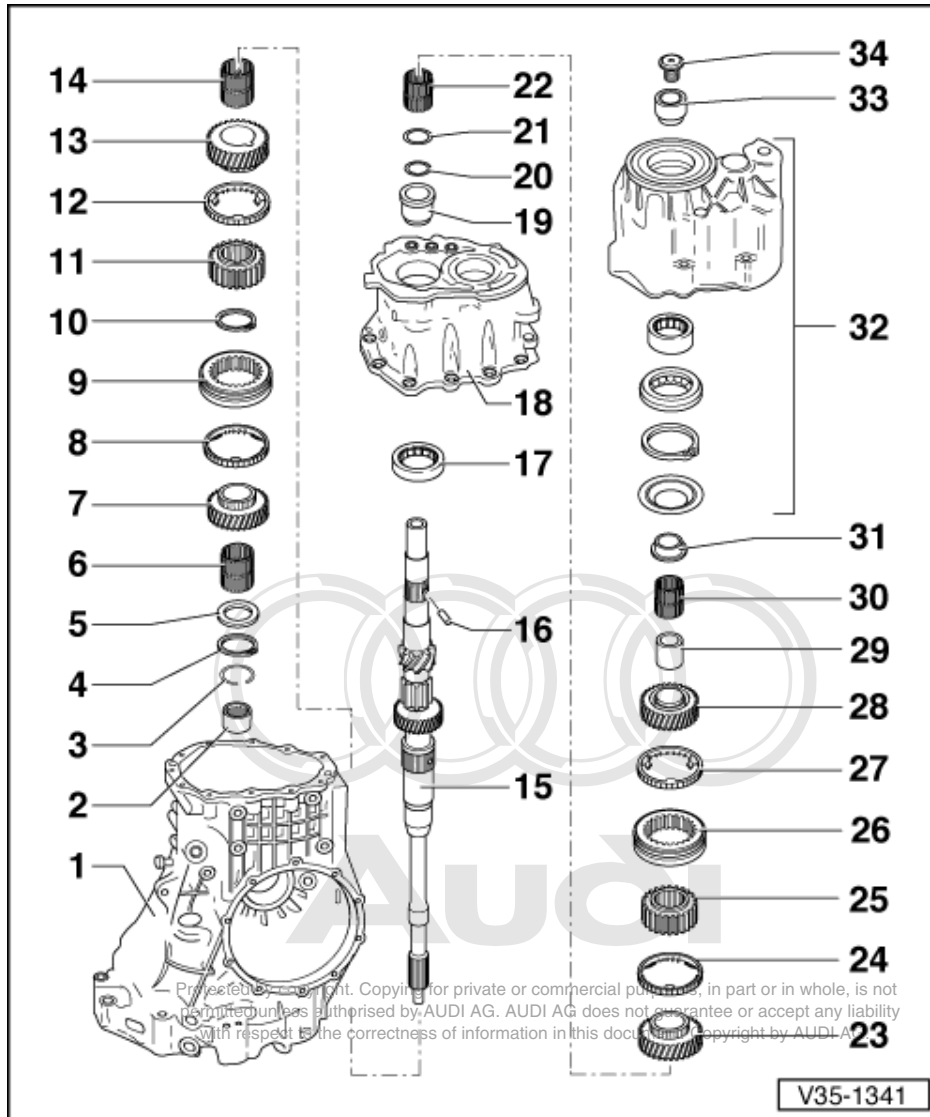
- ♦ Pulling out => Fig. 113
- ♦ Driving in => Fig. 113

#### 3 Circlip

- ♦ For needle bearing

#### 4 Circlip

- ♦ For input shaft



#### 5 Thrust washer

#### 6 Needle bearing for 4th gear

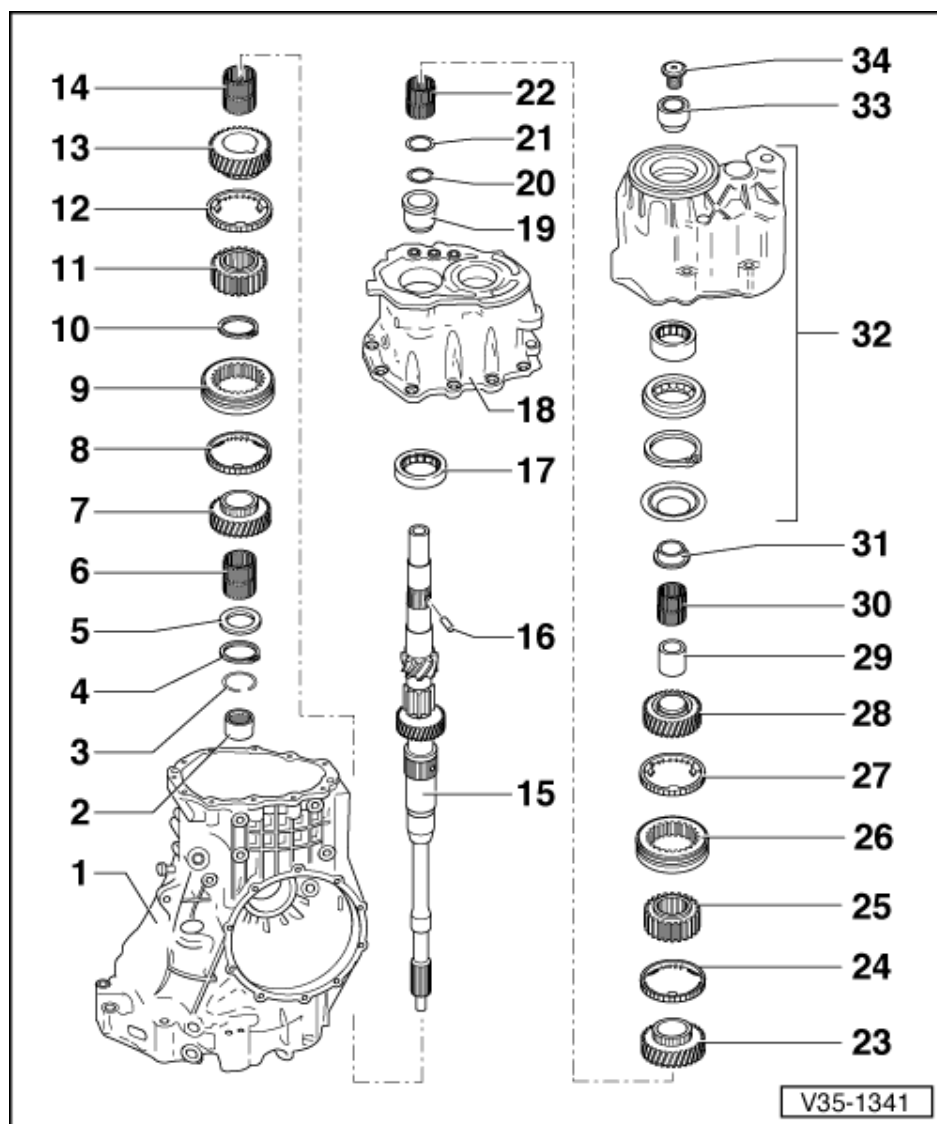
- ♦ Mark before removing
- ♦ Do not interchange with needle bearing for 3rd gear
- ♦ Oil with gear oil before installing

#### 7 4th speed sliding gear

- ♦ Before installing, insert spring  
=> Fig. 1
- ♦ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

#### 8 Synchro-ring for 4th gear

- ♦ Checking for wear => Fig. 2

**9 Locking collar**

- ◆ Paired with synchro-hub
- ◆ Mark before removing => Page 69

**10 Circlip**

- ◆ Re-determine thickness when renewing synchro-hub => Fig. 3
- ◆ Installation position: ends align with groove of synchro-hub

**11 Synchro-hub for 3rd and 4th gear**

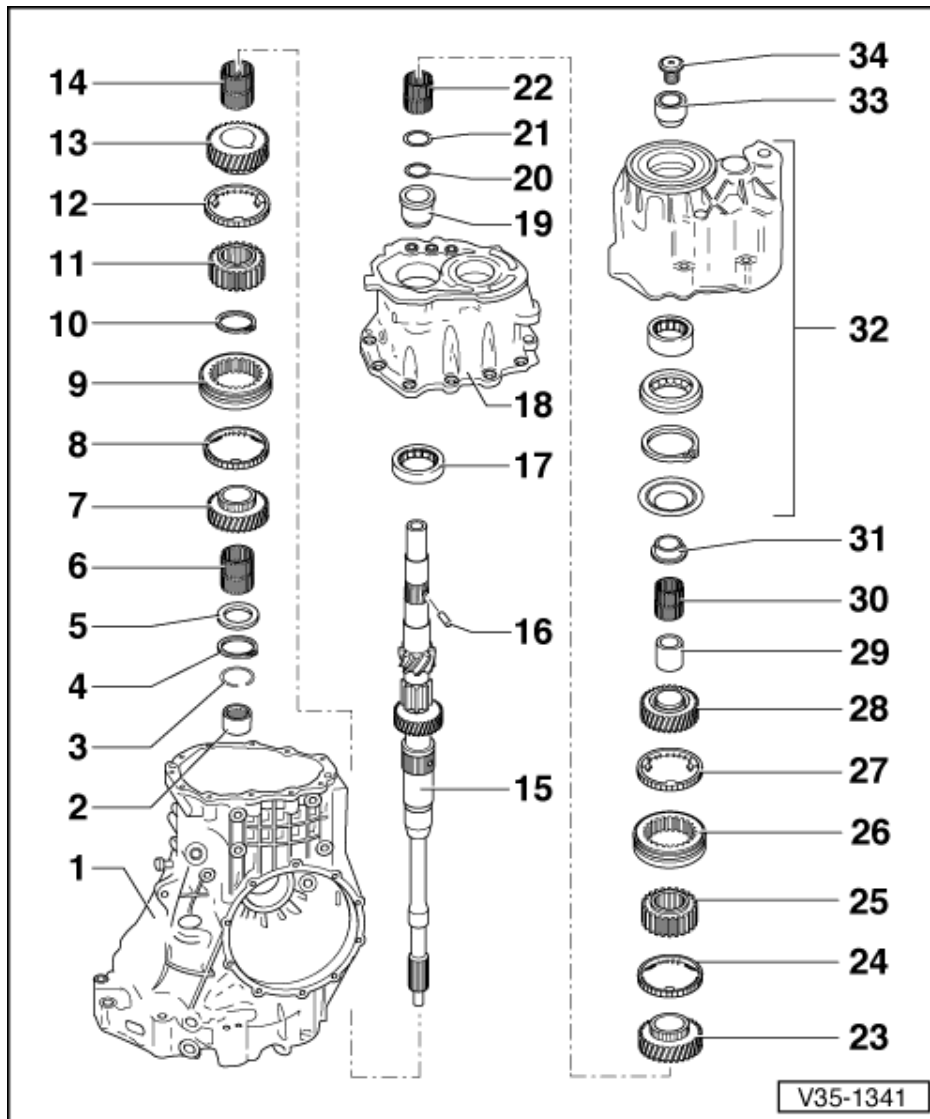
- ◆ Pressing off => Fig. 4
- ◆ Installation position: => Fig. 5
- ◆ Pressing on => Fig. 6

**12 Synchro-ring for 3rd gear**

- ◆ Checking for wear => Fig. 2
- ◆ Synchro-ring with molybdenum coating



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**13 3rd speed sliding gear**

- ◆ Before installing, insert spring  
=> Fig. 1
- ◆ After pressing on -item 11-, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

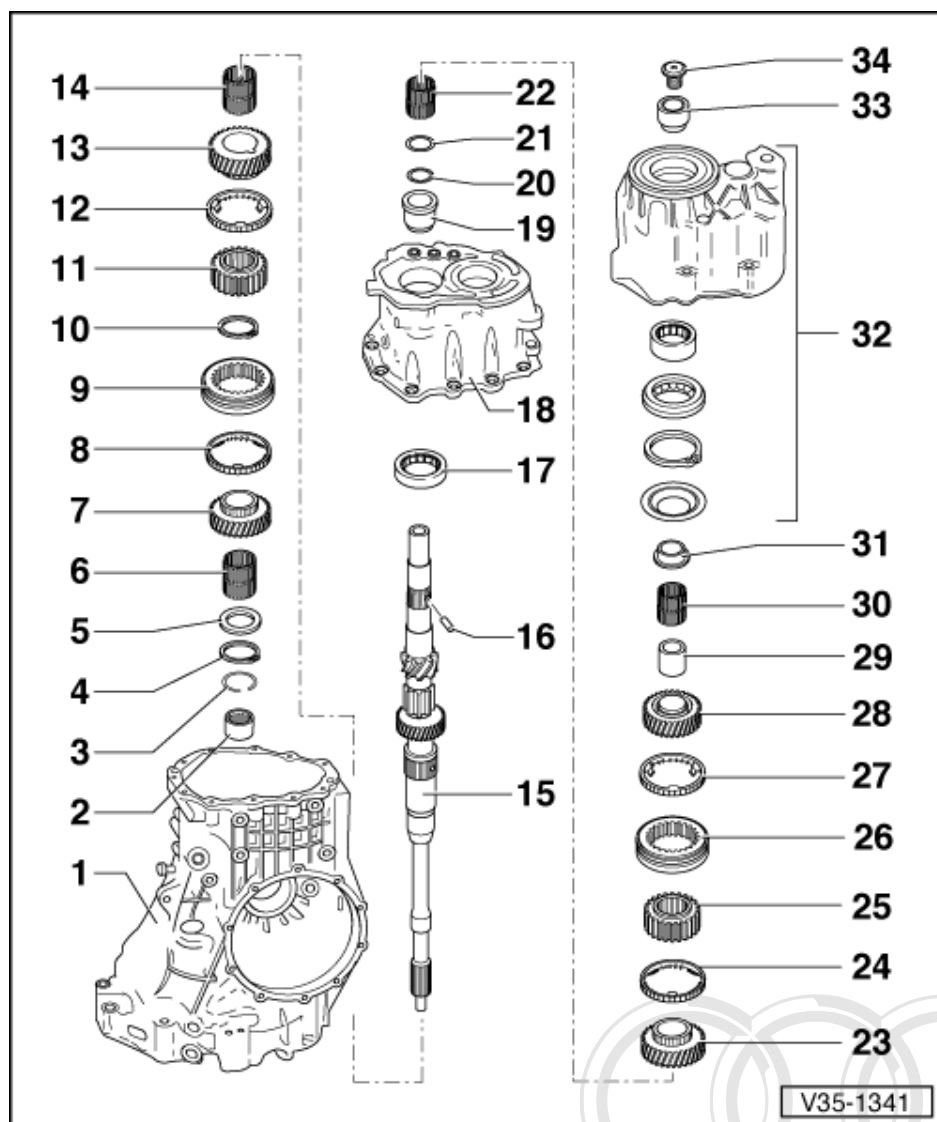
**14 Needle bearing for 3rd gear**

- ◆ Mark before removing
- ◆ Do not interchange with needle bearing for 4th gear
- ◆ Oil with gear oil before installing

**15 Input shaft****16 Spring pin**

- ◆ Always renew
- ◆ Drive in when renewing input shaft  
=> Fig. 7

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**17 Cylinder roller bearing for input shaft**

- ♦ Pressing out => Fig. 95
- ♦ Pressing in => Fig. 96

**18 Bearing plate**

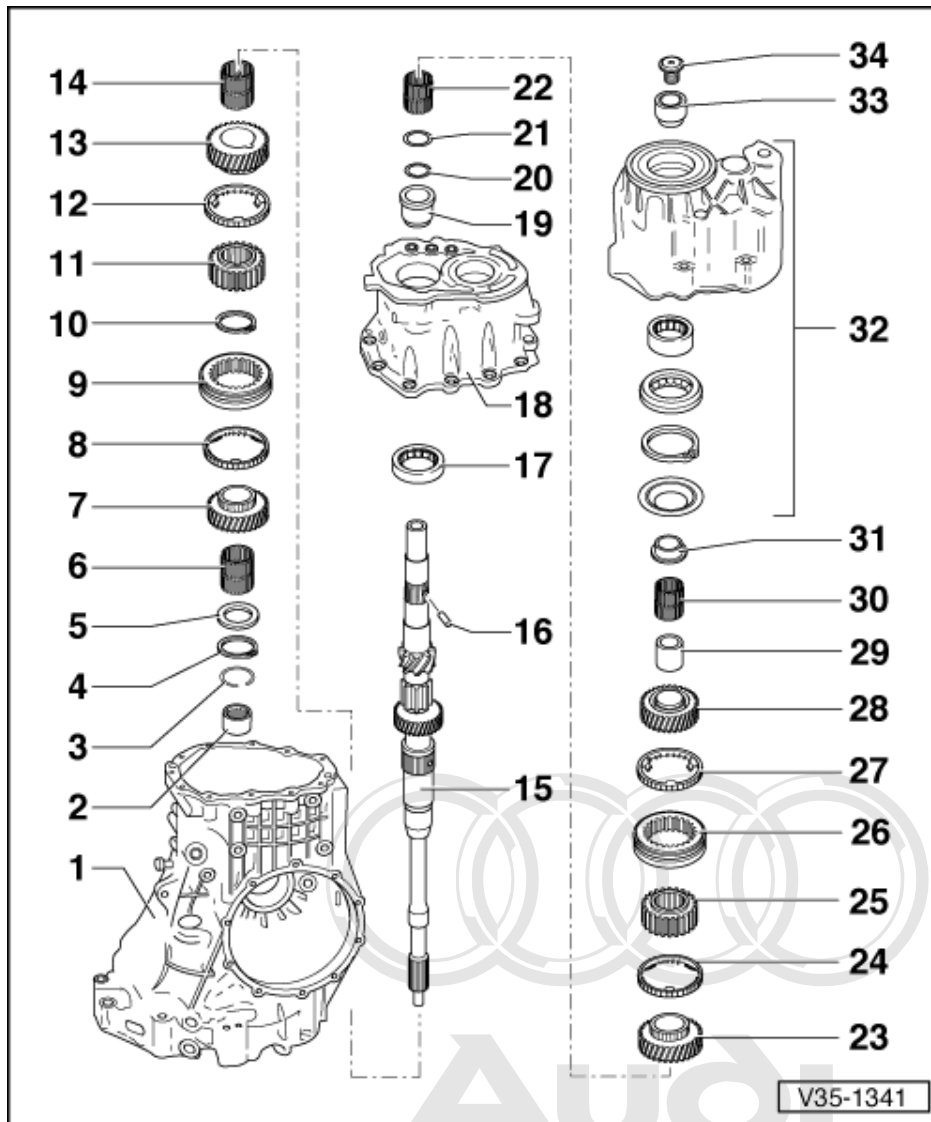
- ♦ Servicing => Page 90

**19 Inner race for cylinder roller bearing**

- ♦ Take off and fit by hand

**20 Circlip****21 Thrust washer for needle bearing for 6th gear**

- ♦ Installation position: shoulder towards circlip, smooth contact surface towards needle bearing => Page 77



#### 22 Needle bearing for 6th gear

- ♦ Oil with gear oil before installing

#### 23 6th speed sliding gear

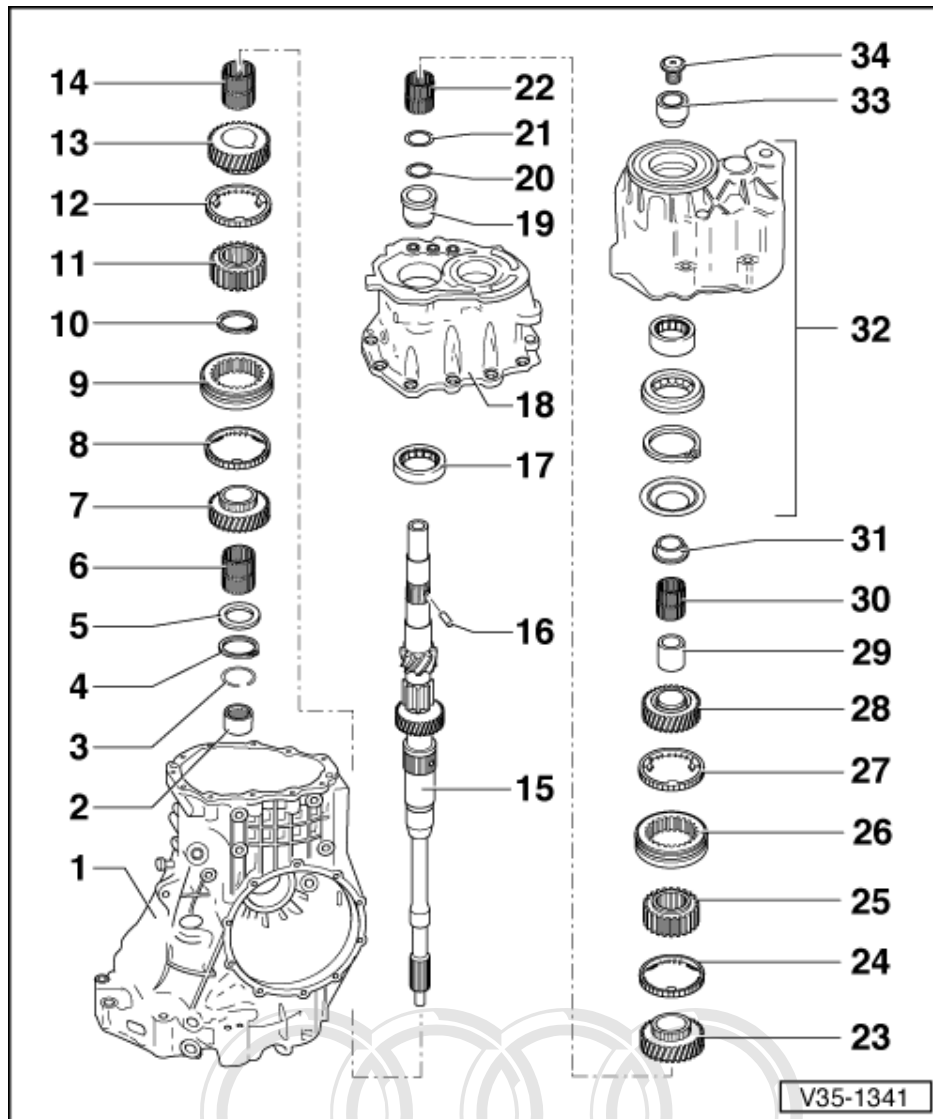
- ♦ Before installing, insert spring  
=> Fig. 1
- ♦ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

#### 24 Synchro-ring for 6th gear

- ♦ Checking for wear => Fig. 2

#### 25 Synchro-hub for 5th and 6th gear

- ♦ Pulling off => Page 69
- ♦ Driving on => Page 77
- ♦ Installation position: projecting hub towards 5th speed sliding gear

**26 Locking collar**

- ◆ Paired with synchro-hub
- ◆ Mark before removing => Page 69

**27 Synchro-ring for 5th gear**

- ◆ Checking for wear => Fig. 2

**28 5th speed sliding gear**

- ◆ Before installing, insert spring => Fig. 1
- ◆ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

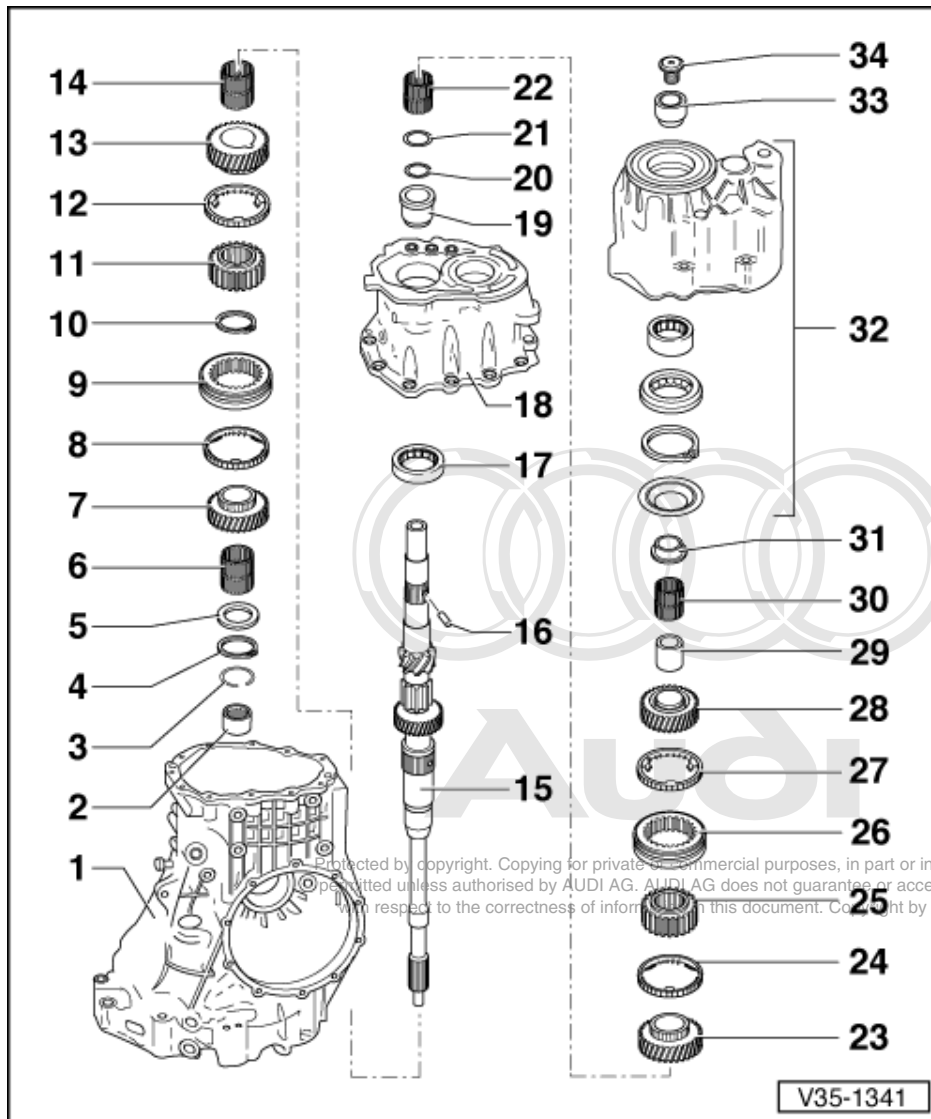
**29 Inner race for 5th speed sliding gear**

- ◆ Pulling off => Page 69
- ◆ Driving on => Page 79

**30 Needle bearing for 5th gear**

- ◆ Oil with gear oil before installing





### 31 1st four-point bearing inner race for input shaft

- ♦ Pulling off => Page 68
- ♦ Driving on => Page 79

### 32 End cover

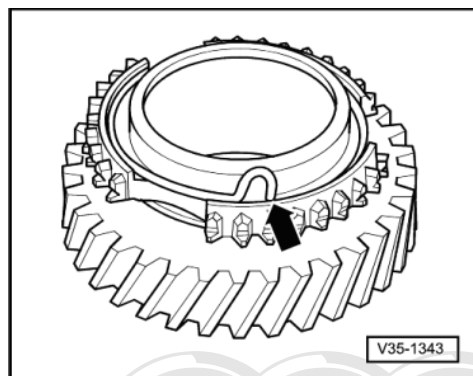
- ♦ Servicing => Page 83

### 33 2nd four-point bearing inner race for input shaft

- ♦ Pulling off => Page 67
- ♦ Driving on => Page 79

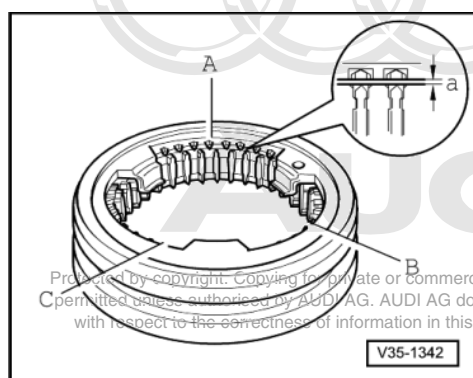
### 34 Multi-point socket head bolt - 150 Nm

- ♦ Loosening and tightening  
=> Page 67



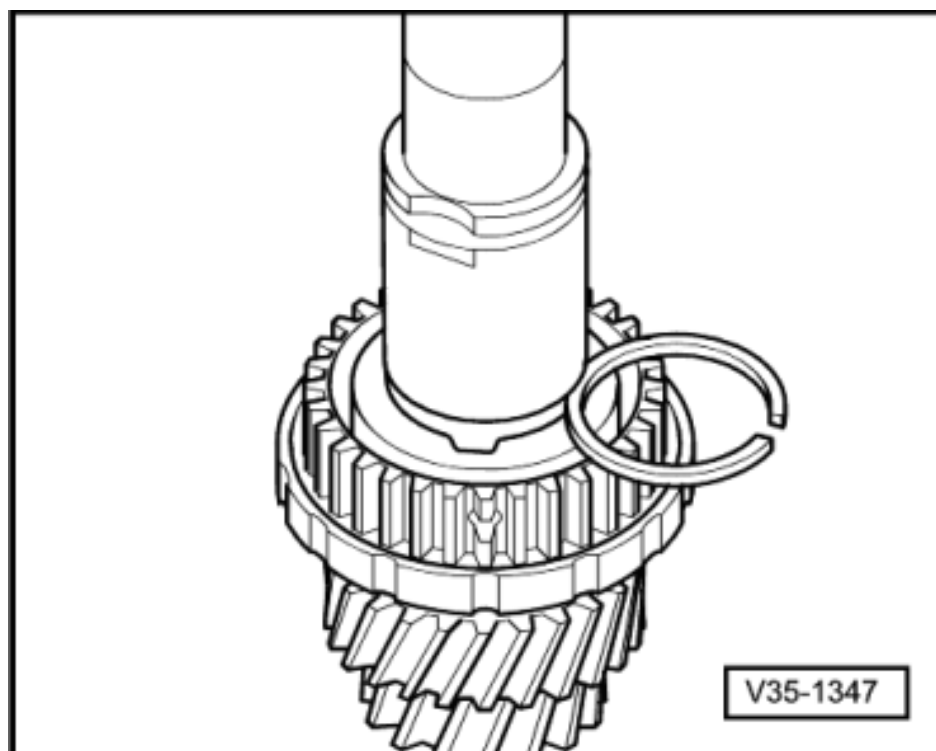
-> Fig.1 Inserting spring in sliding gear

- Insert spring -arrow- in sliding gear, hook angled end into hole.



-> Fig.2 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-.
- Add together results and divide by three.
- The figure calculated must not be less than 0.5 mm



-> Fig.3 Re-determining thickness of circlip

- Press synchro-hub onto stop.

**Note:**

*Note correct installation position when pressing on =>Fig. 5.*

- Determine the thickest circlip that can still just be fitted.

**Note:**

*The opening of the circlip must align with the groove in the synchro-hub.*

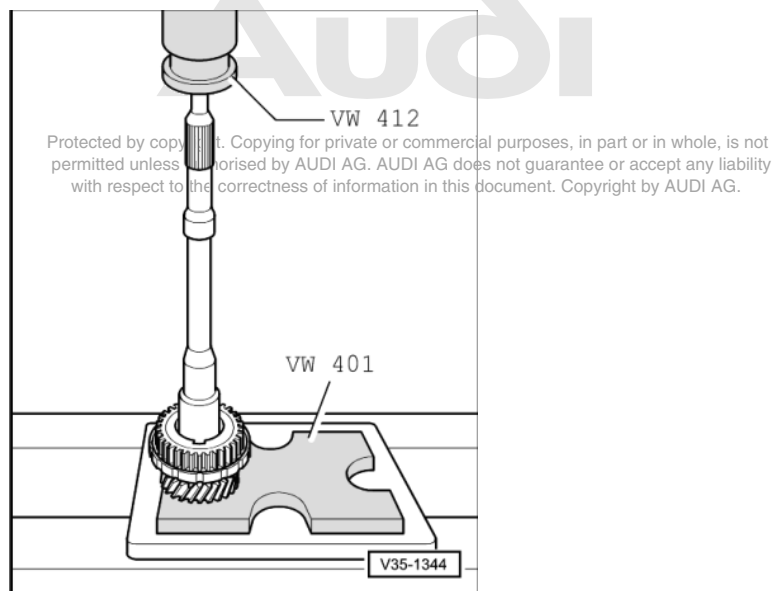
- Determine circlip from table. Part No.

=> Parts catalogue

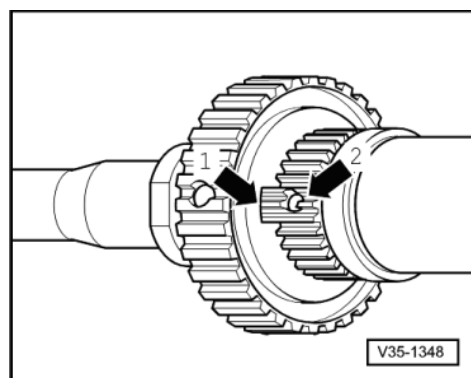
**Circlips available**

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

- Fit circlip.



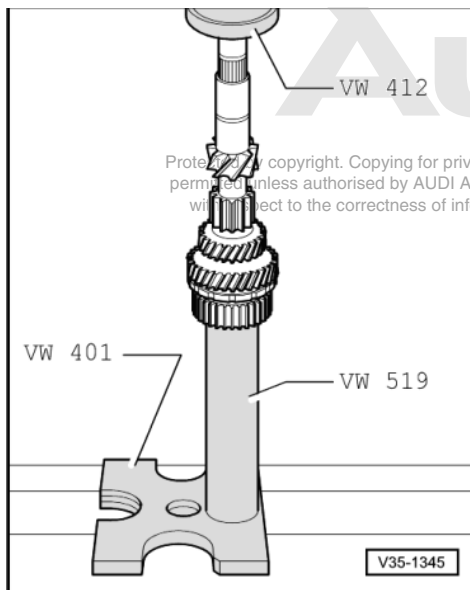
-> Fig.4 Pressing off synchro-hub for 3rd and 4th gear





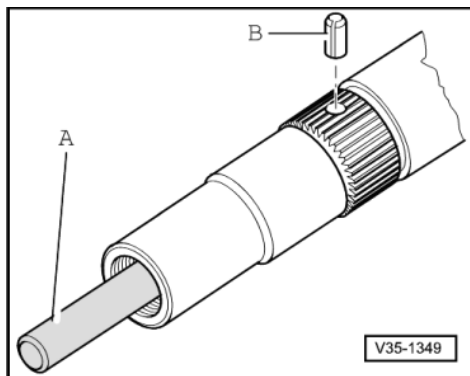
-> Fig.5 Synchro-hub installation position

- ♦ Oil groove in synchro hub -arrow 1- must align with oil drilling -arrow 2- in input shaft



-> Fig.6 Pressing on synchro-hub for 3rd and 4th gear

- Heat synchro-hub to approx. 100 °C, fit and press home.
- Fit circlip.

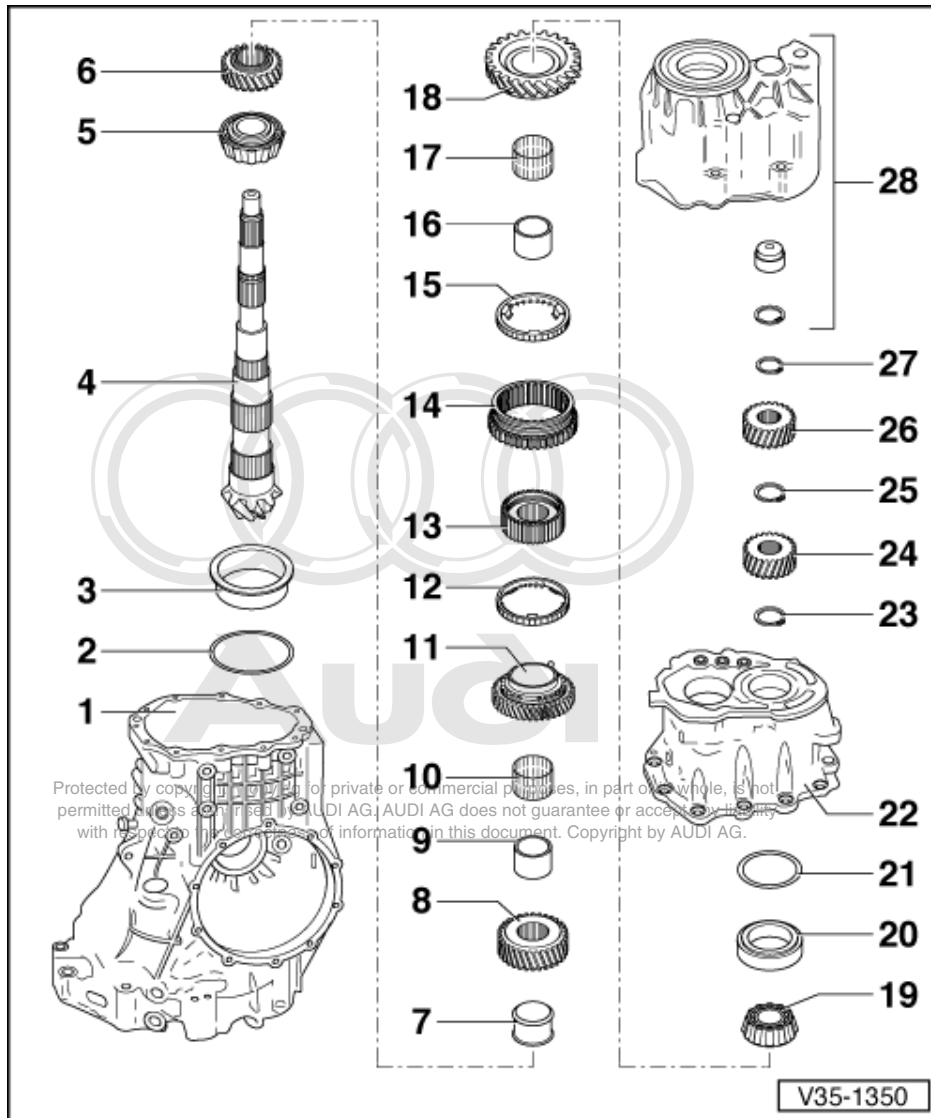


-> Fig.7 Driving spring pin into input shaft

- Guide a 9 mm diameter drift -A- into oil drilling and drive spring pin -B- in until it touches drift.

## 2 - Dismantling and assembling drive pinion

### 2.1 - Dismantling and assembling drive pinion



#### Notes:

- ♦ When installing new gears or a new final drive set (drive pinion and crown wheel)  
=> Technical data, Page 2 .
- ♦ Adjustments are required when renewing components marked 1)  
=> Adjustment overview, Page 158 .

#### 1 Gearbox housing

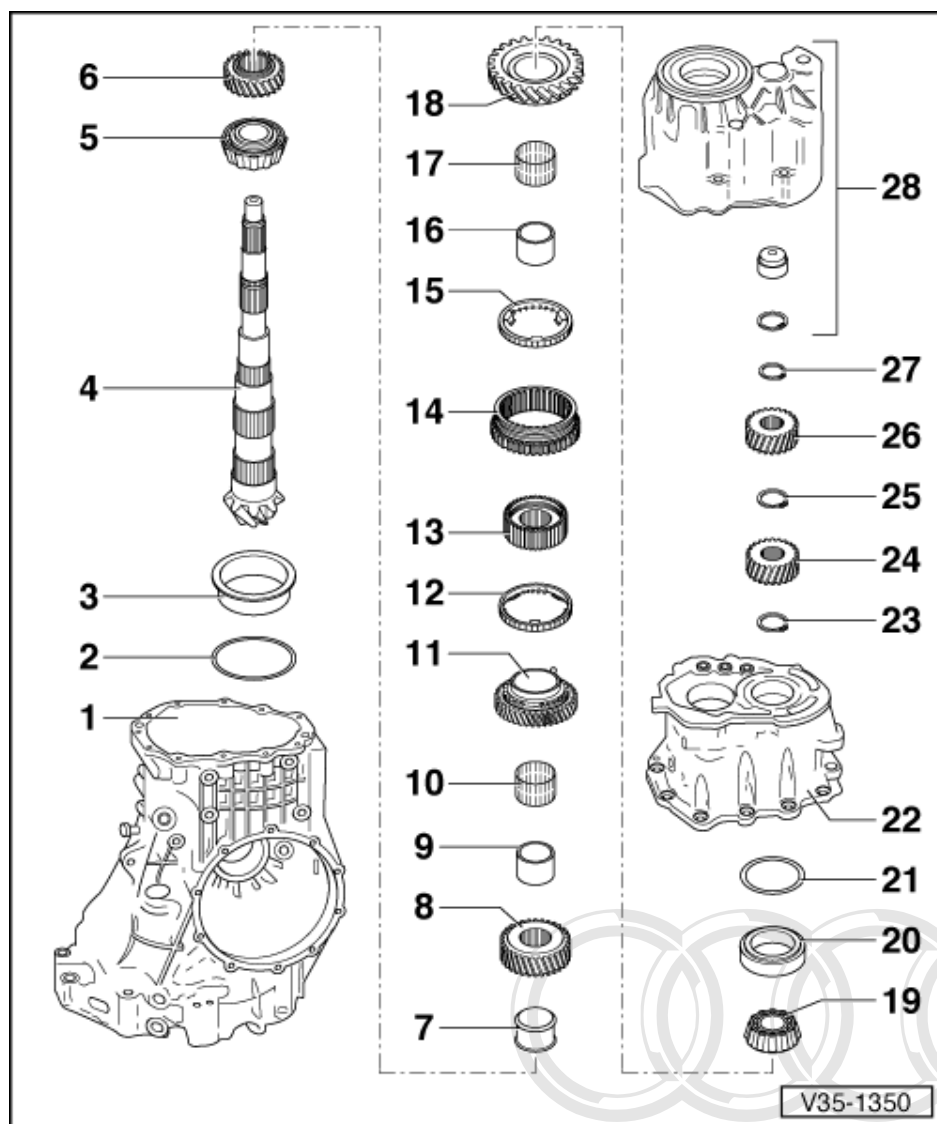
- ♦ Servicing => Page 101

#### 2 Shim "S3"

- ♦ Adjustment overview => Page 158

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

- ♦ Pulling out => Fig. 1
- ♦ Pressing in => Fig. 2 and Fig. 3

**4 Drive pinion 1)**

- ◆ Paired with crown wheel (final drive set)

**5 Inner race for large taper roller bearing 1)**

- ◆ Pressing off => Fig. 8
- ◆ Pressing on => Fig. 9
- ◆ Low friction bearing; do not oil when measuring frictional torque

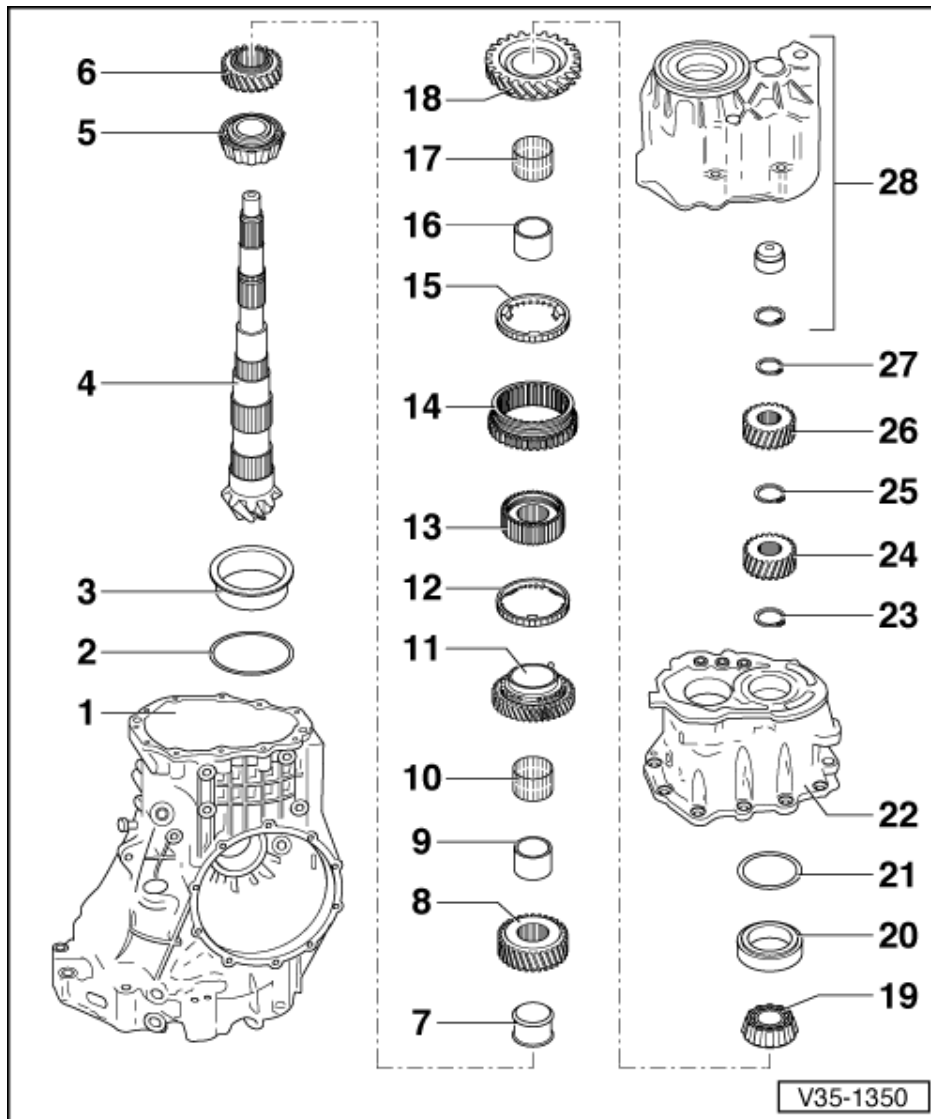
**6 4th speed gear**

- ◆ Pressing off => Fig. 7
- ◆ Pressing on => Fig. 10

**7 Spacer sleeve****8 3rd speed gear**

- ◆ Pressing off together with item 9  
=> Fig. 6
- ◆ Pressing on => Fig. 11

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**9 Inner race for 2nd speed sliding gear**

- ◆ Pressing off together with item 8  
=> Fig. 6
- ◆ Pressing on => Fig. 12

**10 Needle bearing for 2nd speed sliding gear**

- ◆ Lubricate with gear oil before installing

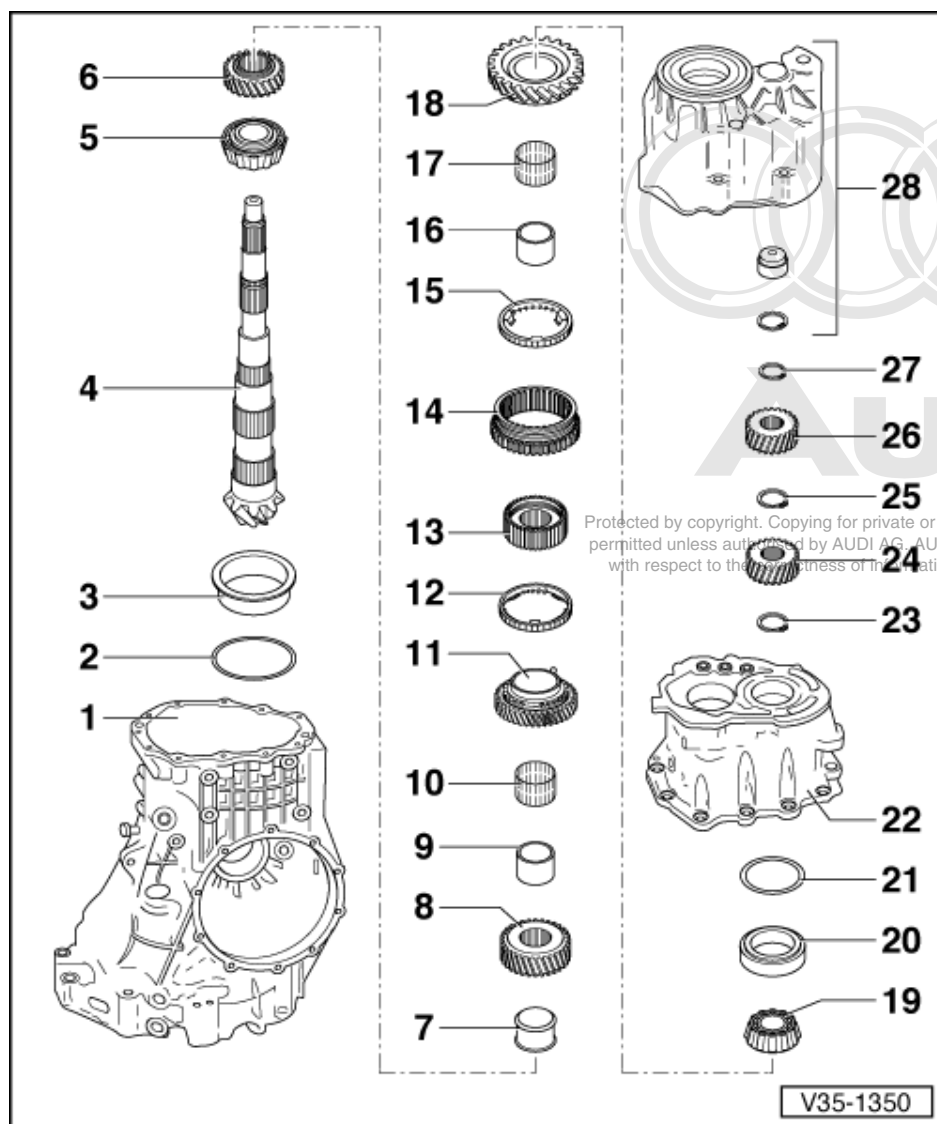
**11 2nd speed sliding gear**

- ◆ Pressing off => Fig. 5
- ◆ Before installing, fit spring and slide needle bearing onto hollow shaft
- ◆ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

**12 Synchro-ring for 2nd gear**

- ◆ Checking for wear => Fig. 126
- ◆ Synchro-ring with molybdenum coating

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**13 Synchro-hub for 1st and 2nd gear**

- ◆ Pressing off => Fig. 5
- ◆ Pressing on => Fig. 13
- ◆ Installation position: flush hub towards 2nd speed sliding gear

**14 Locking collar for 1st and 2nd gear**

- ◆ Installation position: groove for selector fork faces towards 1st speed sliding gear

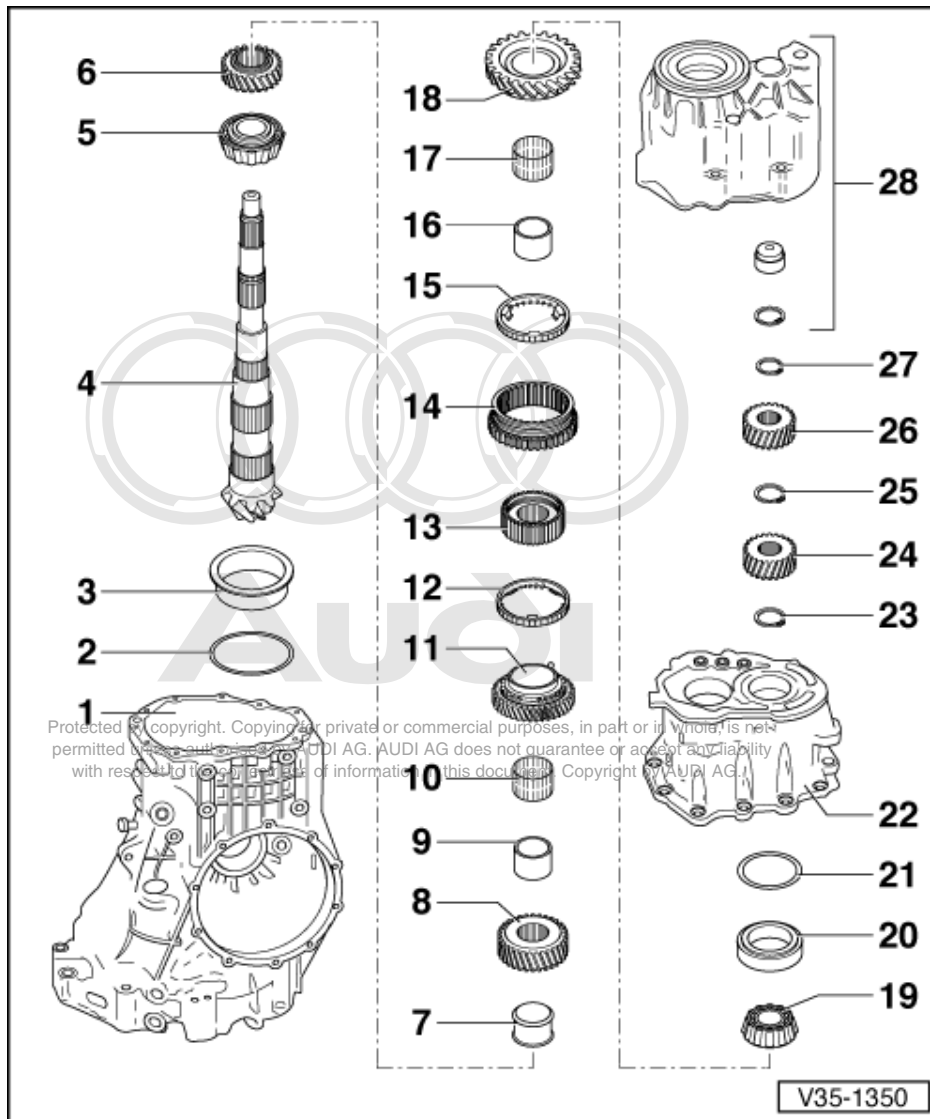
**15 Synchro-ring for 1st gear**

- ◆ Checking for wear => Fig. 126

**16 Inner race for 1st speed sliding gear**

- ◆ Pressing off => Fig. 5
- ◆ Pressing on => Fig. 14



**17 Needle bearing for 1st speed sliding gear**

- ◆ Oil with gear oil before installing

**18 1st speed sliding gear**

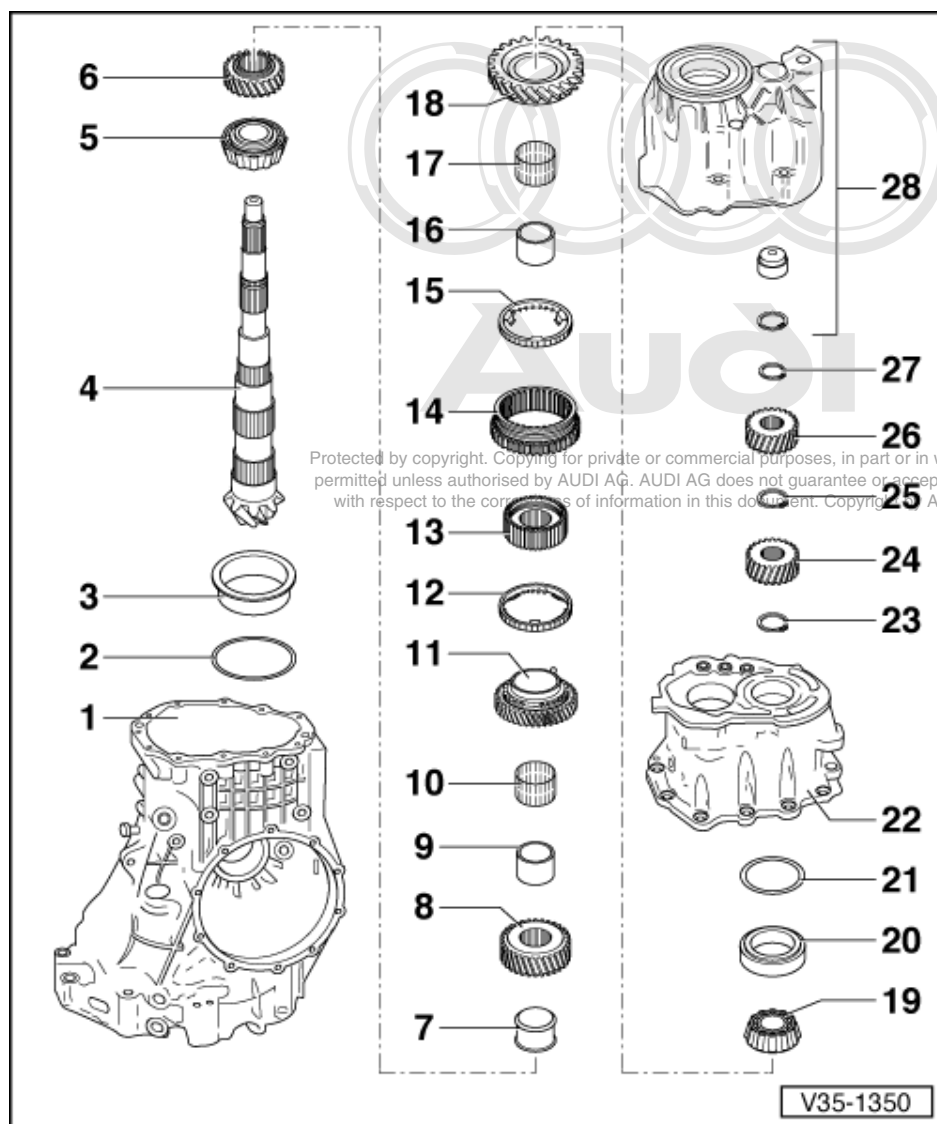
- ◆ Before installing, insert spring  
=> Fig. 126
- ◆ After pressing on -item 19-, check axial clearance using a feeler gauge (0.15 ... 0.50 mm)

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

- ◆ Pressing off=> Fig. 4
- ◆ Pressing on => Fig. 15
- ◆ Low friction bearing; do not oil when measuring frictional torque

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

- ◆ Driving out => Fig. 16
- ◆ Pressing in => Fig. 17

**21 Shim "S4"**

- ♦ Adjustment overview => Page 158

**22 Bearing plate 1)**

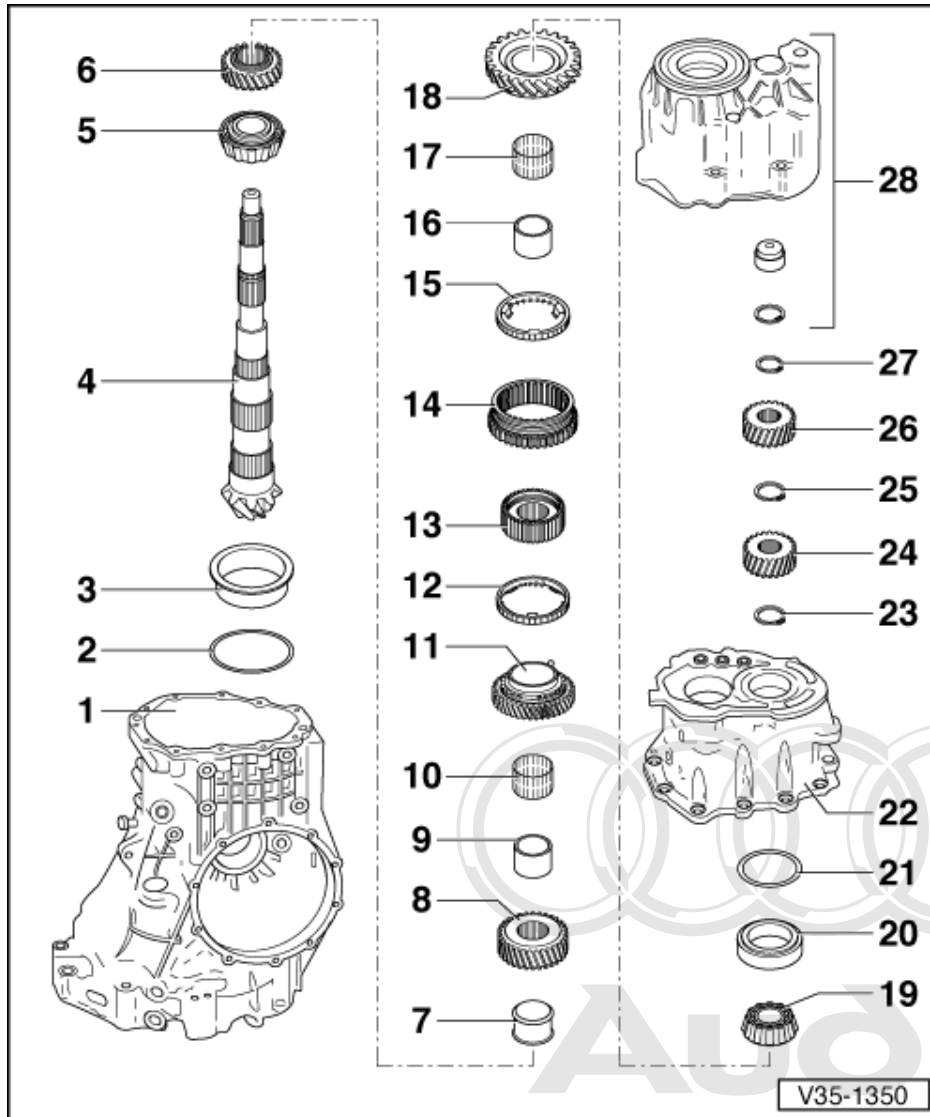
- ♦ Servicing => Page 90

**23 Circlip**

- ♦ Re-determining thickness of circlip in 6-speed gearbox=>Page 72

**24 6th gear wheel**

- ♦ Pressing off => Page 71
- ♦ Pressing on => Page 73
- ♦ Installation position:  
shoulder towards inner race for small taper roller bearing



#### 25 Circlip

- ♦ Re-determining thickness of circlip in 6-speed gearbox => Page 72

#### 26 5th gear wheel

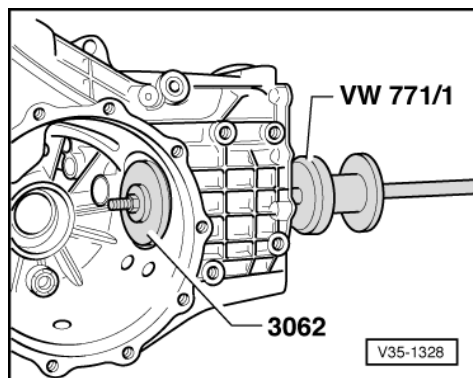
- ♦ Pulling off => Page 68
- ♦ Driving on => Page 79

#### 27 Circlip

#### 28 End cover

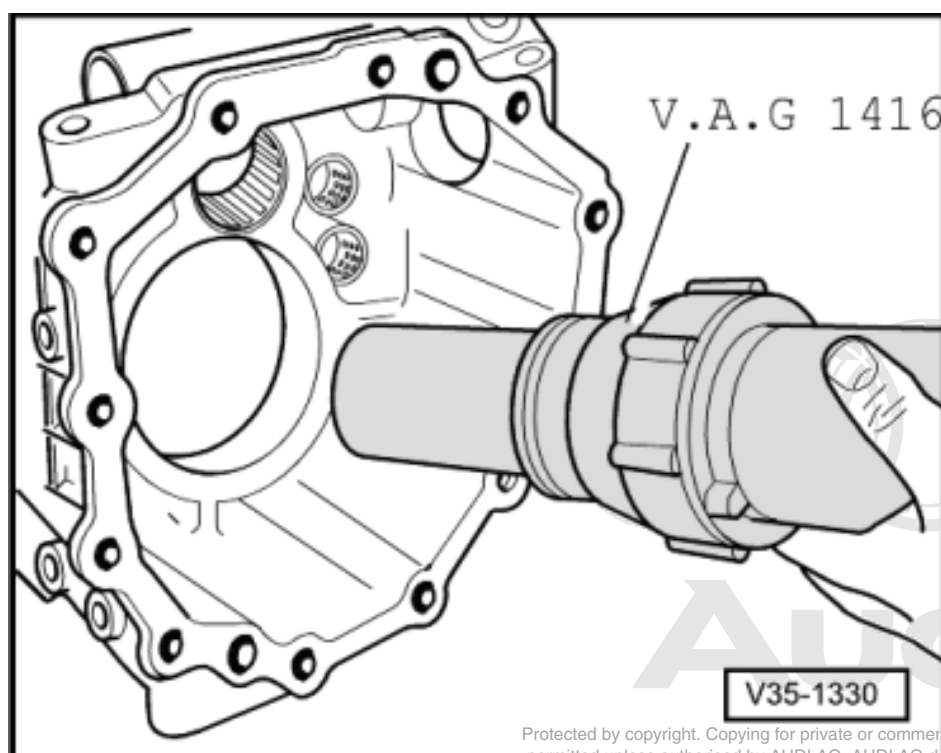
- ♦ Servicing => Page 83

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-> Fig.1 Pulling out outer race for large taper roller bearing

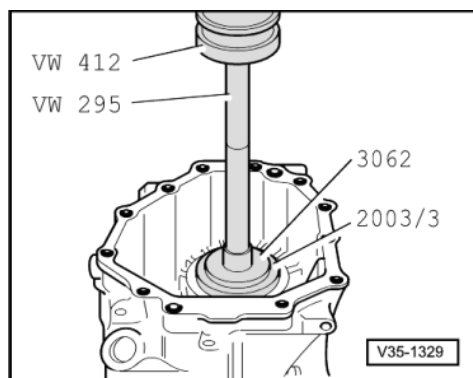
- ♦ Stepped side of thrust pad 3062 rests against the outer race



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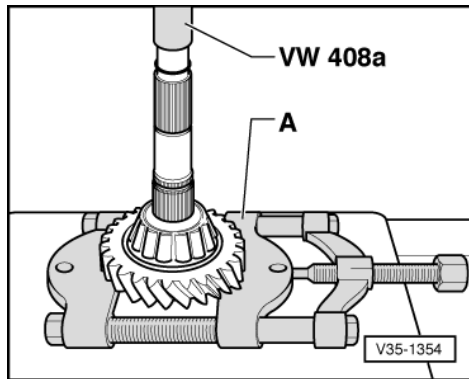
-> Fig.2 Heating gearbox housing in order to fit taper roller bearing outer race

- Heat gearbox housing in area of bearing seat for approx. 15 minutes, to approx. 100 °C, with a hot air blower.



-> Fig.3 Inserting outer race for large taper roller bearing in gearbox housing and pressing home

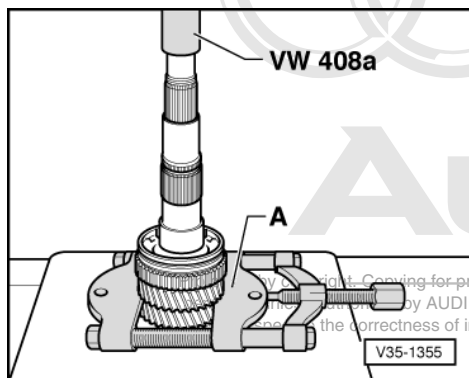
- Insert outer race only after heating gearbox housing and press home for 1 ... 2 minutes under a repair press until a heat exchange has taken place.



-> Fig.4 Pressing off small taper roller bearing for drive pinion

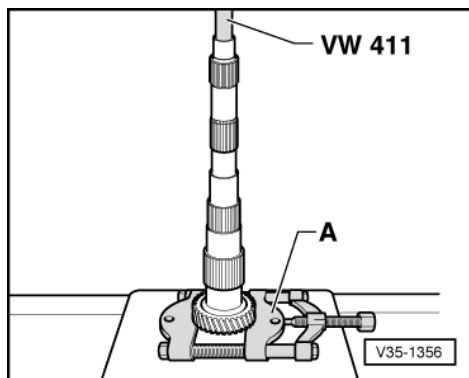
together with 1st speed sliding gear

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



-> Fig.5 Pressing off 2nd speed sliding gear with locking collar/synchro-hub for 1st and 2nd speed gear and inner race for 1st speed sliding gear

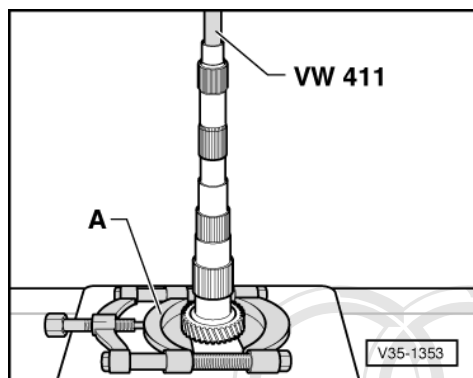
- A - Separating device 22 ... 115 mm, e.g. Kukko 17/2





-> Fig.6 Pressing off 3rd speed gear together with inner race for 2nd speed sliding gear

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

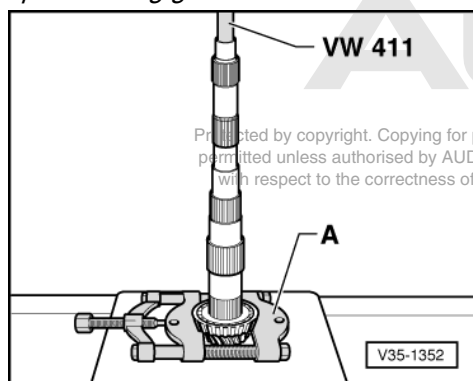


-> Fig.7 Pressing off 4th speed gear

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

**Note:**

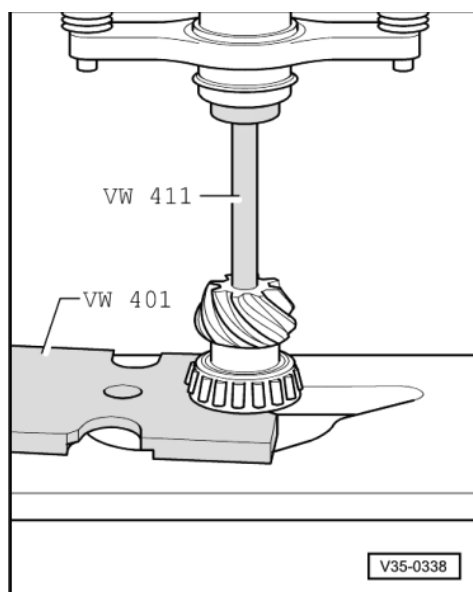
*The 4th speed gear can also be pressed off together with the 3rd speed gear and the inner race for the 3rd speed sliding gear.*



-> Fig.8 Pressing off inner race for large taper roller bearing

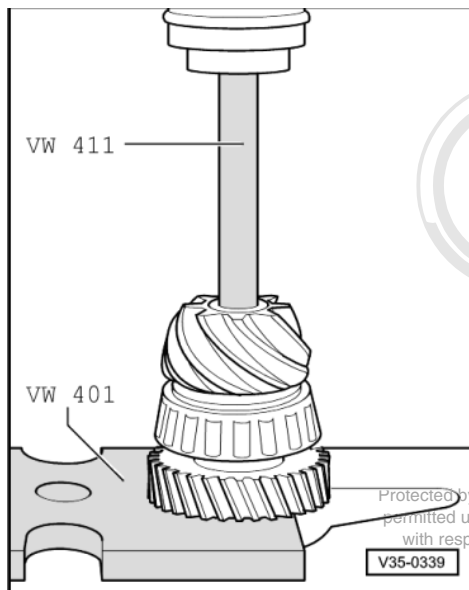
A - Separating device 22 ... 115 mm, e.g. Kukko 17/2

- ♦ Bearing is destroyed when pressing off



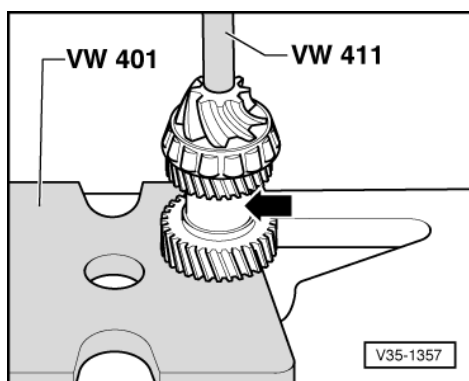
-> Fig.9 Pressing on inner race for large taper roller bearing

- Heat inner race to approx. 100 °C and fit.
- Press home ensuring there is no axial play.



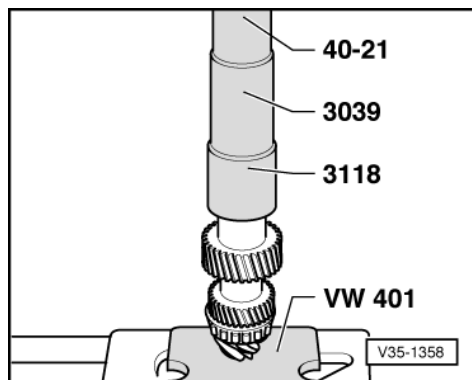
-> Fig.10 Pressing on 4th speed gear

- Heat gear to about 100 °C, fit and press home.
- ♦ Installation position: shoulder towards 3rd speed gear



-> Fig.11 Pressing on 3rd speed gear

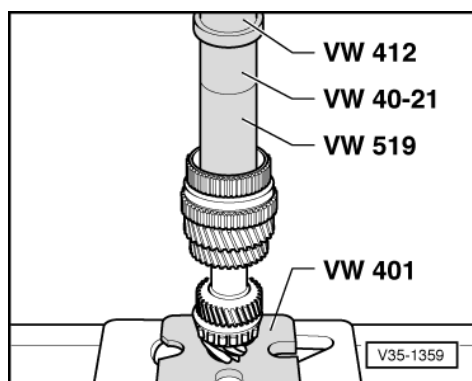
- Insert spacer sleeve -arrow-.
- Heat gear to about 100 °C, fit and press home.
- ♦ Installation position: shoulder towards 4th speed gear



-> Fig.12 Pressing on inner race for 2nd speed sliding gear

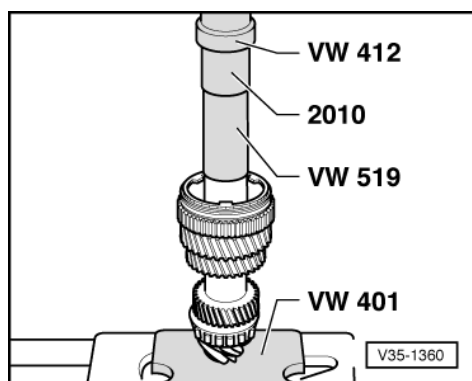
- Heat inner race to approx. 100 °C and fit.
- Press home ensuring there is no axial play.

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-> Fig.13 Fitting 2nd speed sliding gear and pressing on synchro-hub for 1st and 2nd speed gears

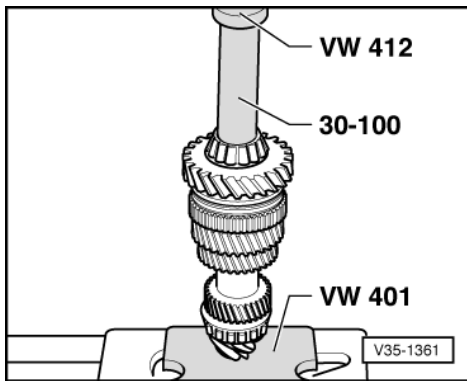
- Oil needle bearing.
- Fit needle bearing, sliding gear (with spring) and synchro-ring for 2nd speed gear.
- Heat synchro-hub to approx. 100 °C and fit.
  - Installation position: flush hub towards 2nd speed sliding gear
- Press home ensuring there is no axial play.



-> Fig.14 Pressing on inner race for 1st speed sliding gear

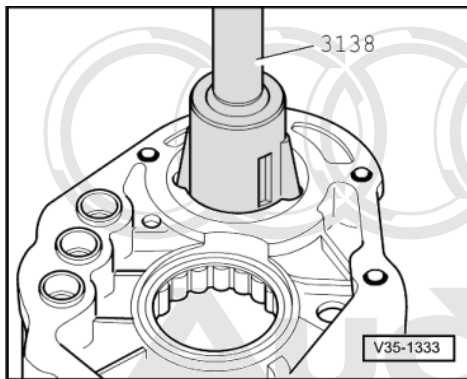
- Heat inner race to approx. 100 °C and fit.
- Press home ensuring there is no axial play.





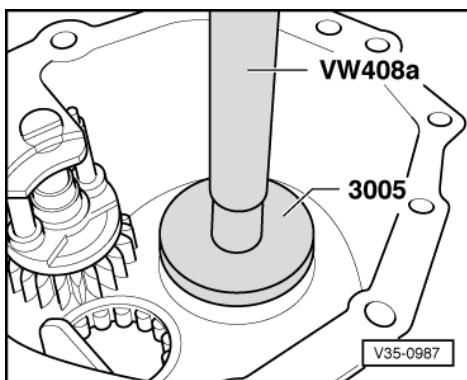
-> Fig.15 Pressing on small taper roller bearing inner race for drive pinion

- Oil needle bearing.
- Fit needle bearing, sliding gear (with spring) and synchro-ring for 1st speed gear.
- Heat inner race to approx. 100 °C and fit.
- Press home ensuring there is no axial play.



-> Fig.16 Driving out outer race for small taper roller bearing

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-> Fig.17 Pressing in outer race for small taper roller bearing

- Insert shim "S4" into bearing flange behind bearing seat.
- Press outer race for small taper roller bearing onto stop.



## 39 - Final drive, Differential

### 1 - Renewing seal for flange shaft

#### 1.1 - Renewing seal for flange shaft

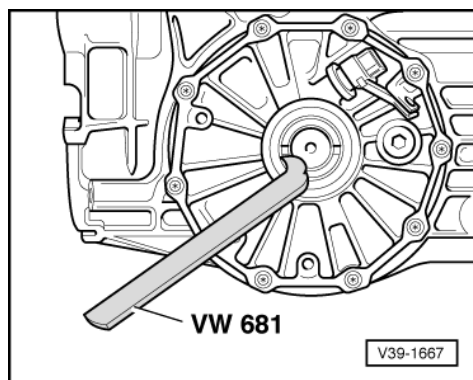
- Gearbox installed

##### Notes:

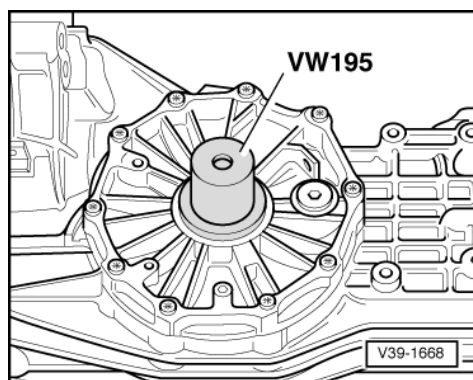
- ♦ Illustrated, removing and installing oil seal on left-hand side.
- ♦ Procedure for removing oil seal on left and right-hand sides is identical.

##### Removing

- Remove heat shield.
- Disconnect drive shaft.
- Place a drip tray underneath.



- Remove flange shaft, secure with a drift to prevent it turning.
- -> Pull seal out with lever VW 681.



##### Installing

- Fill space between sealing and dust lips with multipurpose grease.
- Lightly oil outer circumference of seal.
- -> Drive in seal for flange shaft.
  - Driving-in depth: 6.5 mm
- Install flange shaft and drive shaft.



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## Tightening torques

Component	Nm
Flange shaft to gearbox	10 + 90°1)
Drive shaft to flange shaft	80

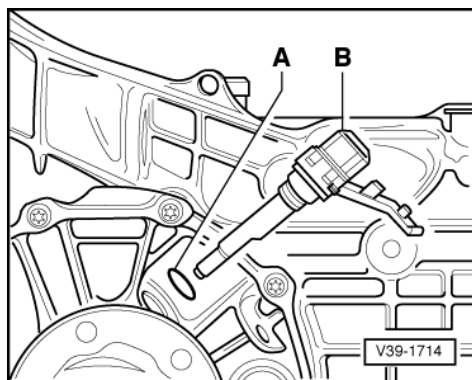
1) 90° = 1/4 turn

## 2 - Removing and installing speedometer sender -G22 and drive wheel for speedometer sender

### 2.1 - Removing and installing speedometer sender -G22 and drive wheel for speedometer sender

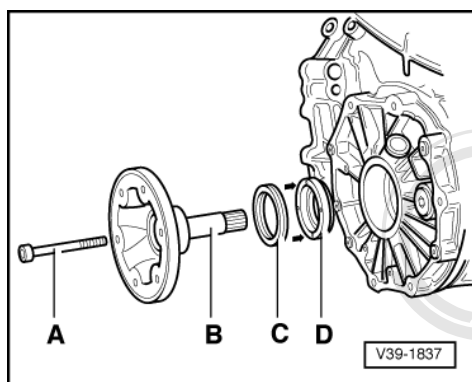
- Gearbox installed

#### Removing and installing speedometer sender -G22



- -> Pull connector off sender -B-.
- Press sender retainer down, turn and pull out sender.
- Renew O-ring -A-.

#### Removing and installing drive wheel for speedometer sender -G22



#### Removing:

- Detach drive shaft from left flange shaft -B-.
- -> Unscrew bolt -A-. Secure flange shaft with a drift to prevent it turning.
- Remove flange shaft and seal -C-.
- Remove drive wheel for speedometer sender -D- by alternately levering out follower lugs -arrows- with a screwdriver.



#### Installing:

- Fit drive wheel for speedometer sender with the retainer clips (arrows) facing the seal.

#### Note:

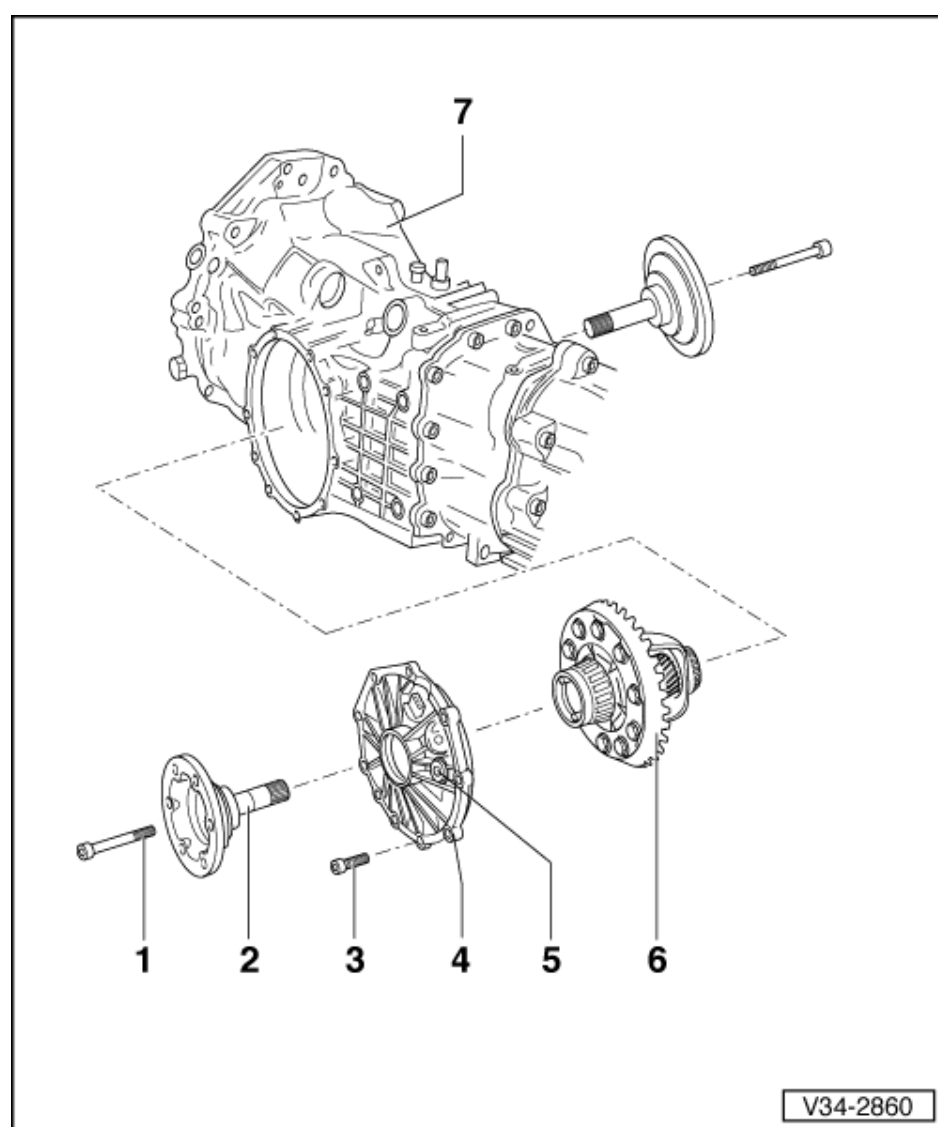
*Do not tilt when installing (risk of breakage).*

- Follower lugs engage in differential housing grooves.
- Renew seal for flange shaft and install flange shaft => Page 142 .
- Check oil level in gearbox => Page 55 .

## 3 - Removing and installing differential

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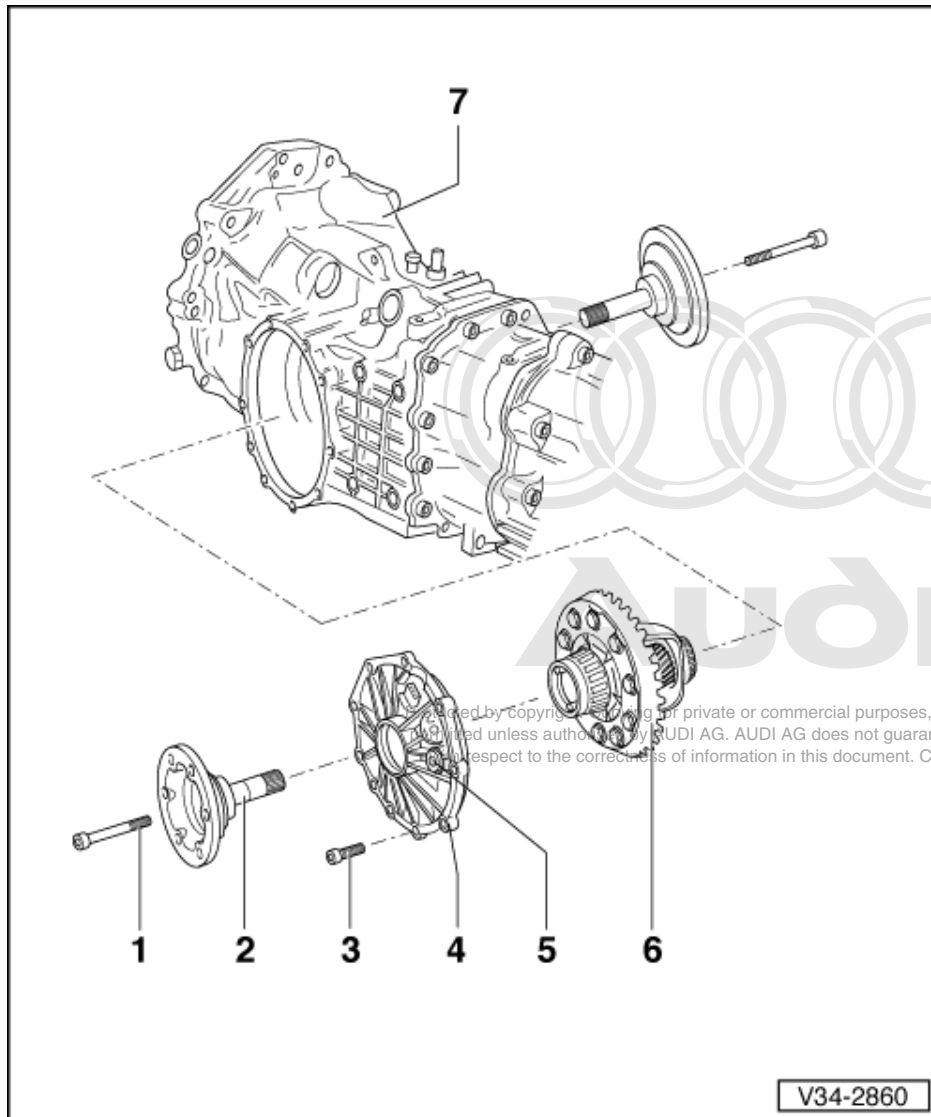
### 3.1 - Removing and installing differential



#### Note:

*Removing and installing is also possible with gearbox installed in vehicle.*

- 1 Bolt -10 Nm + 1/4 turn (90 °) further
- 2 Flange shaft
  - ♦ When removing, secure with a drift to prevent it turning
- 3 Bolt - 25 Nm
  - ♦ Qty. 10
- 4 Cover for final drive
  - ♦ Removing and installing drive wheel for speedometer sender -G22  
=> Page 143
  - ♦ If renewed: adjust crown wheel => Page 165

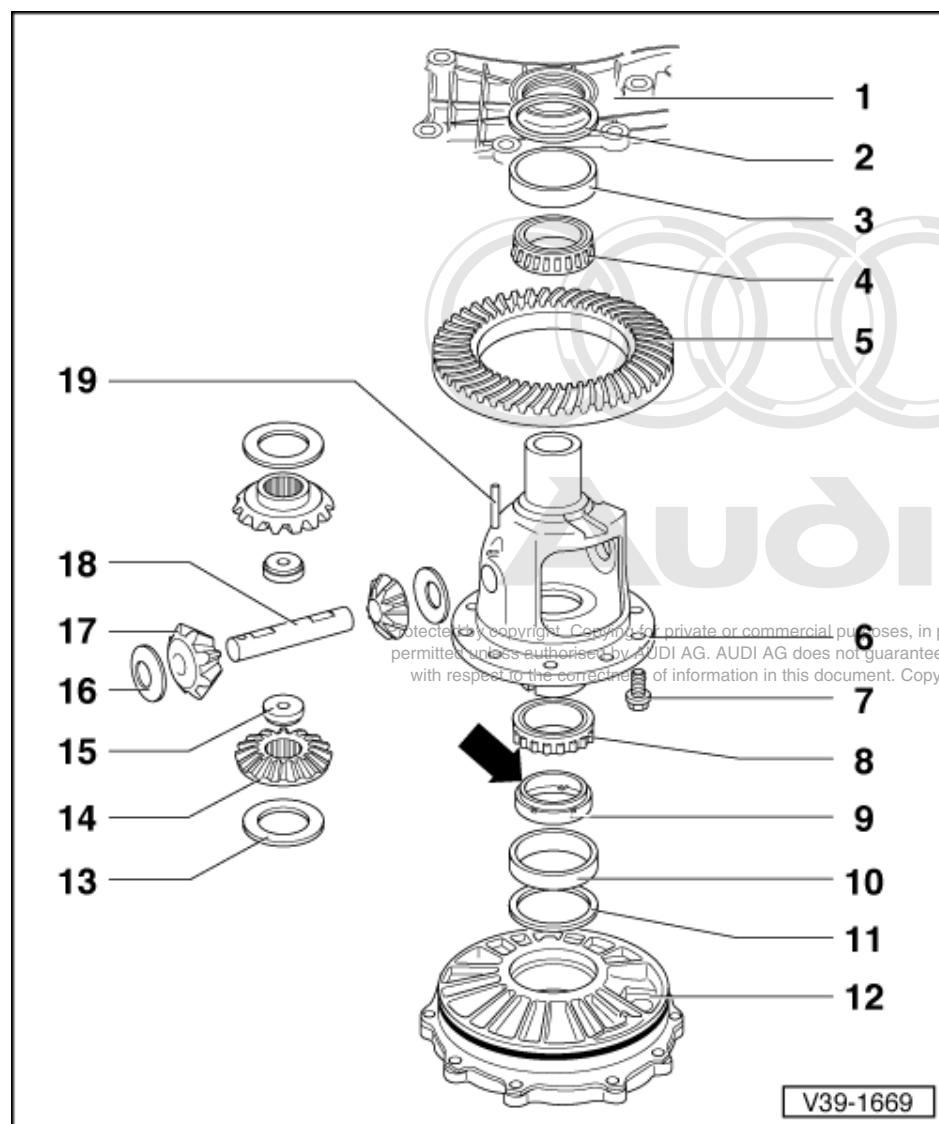


- 5 Oil filler plug - 40 Nm
  - ♦ Checking oil level in gearbox  
=> Page 55
- 6 Differential
  - ♦ Dismantling and assembling  
=> Page 146
  - ♦ If renewed: adjust crown wheel  
=> Page 165
- 7 Gearbox housing
  - ♦ Servicing => Page 101



## 4 - Dismantling and assembling differential

### 4.1 - Dismantling and assembling differential



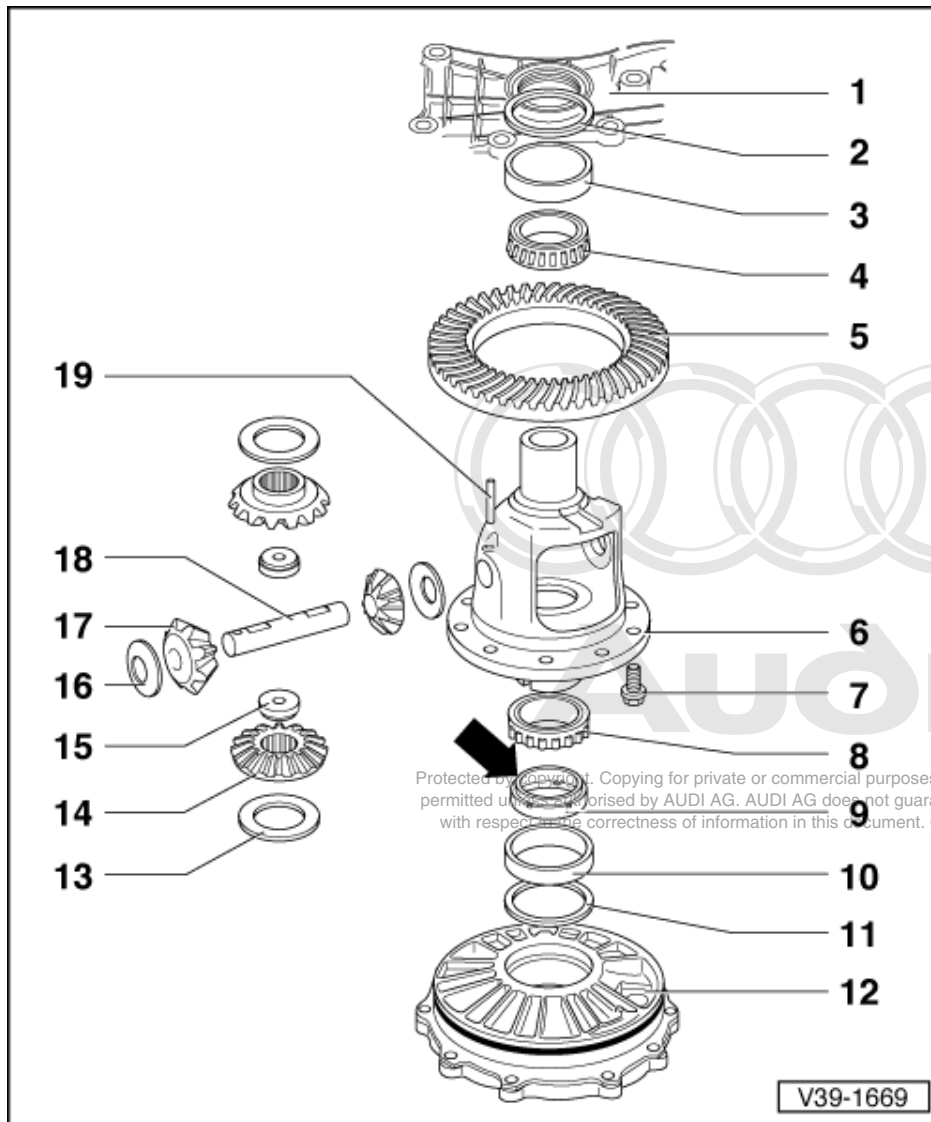
#### Notes:

- ♦ Removing and installing differential  
=>Page 144 .
- ♦ Adjustments are required when replacing components marked 1) =>adjustment overview Page 158 .

#### 1 Gearbox housing 1)

#### 2 Shim "S2"

- ♦ Note thickness
- ♦ Adjustment overview => Page 158



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

- ◆ Driving out => Fig. 9
- ◆ Driving in => Fig. 10

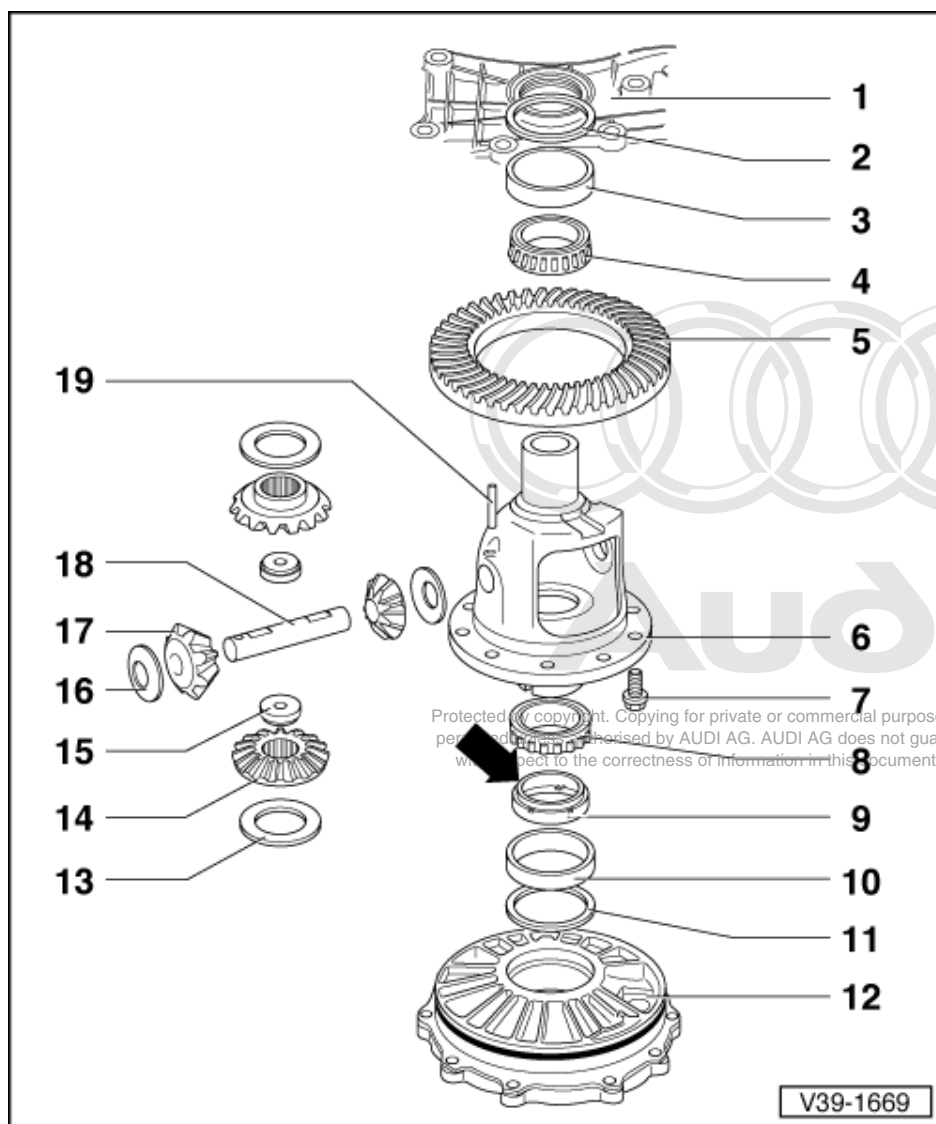
**4 Inner race for small taper roller bearing 1)**

- ◆ Pulling out => Fig. 1
- ◆ Pressing in => Fig. 3
- ◆ Low friction bearing; do not oil when measuring frictional torque

**5 Crown wheel 1)**

- ◆ Paired with drive pinion (final drive set)
- ◆ Removing => Fig. 5
- ◆ Installing => Fig. 6

**6 Differential housing 1)**



**7 Crown wheel bolt - 60 Nm + 45° further**

- ◆ Always renew
- ◆ Use only genuine bolts

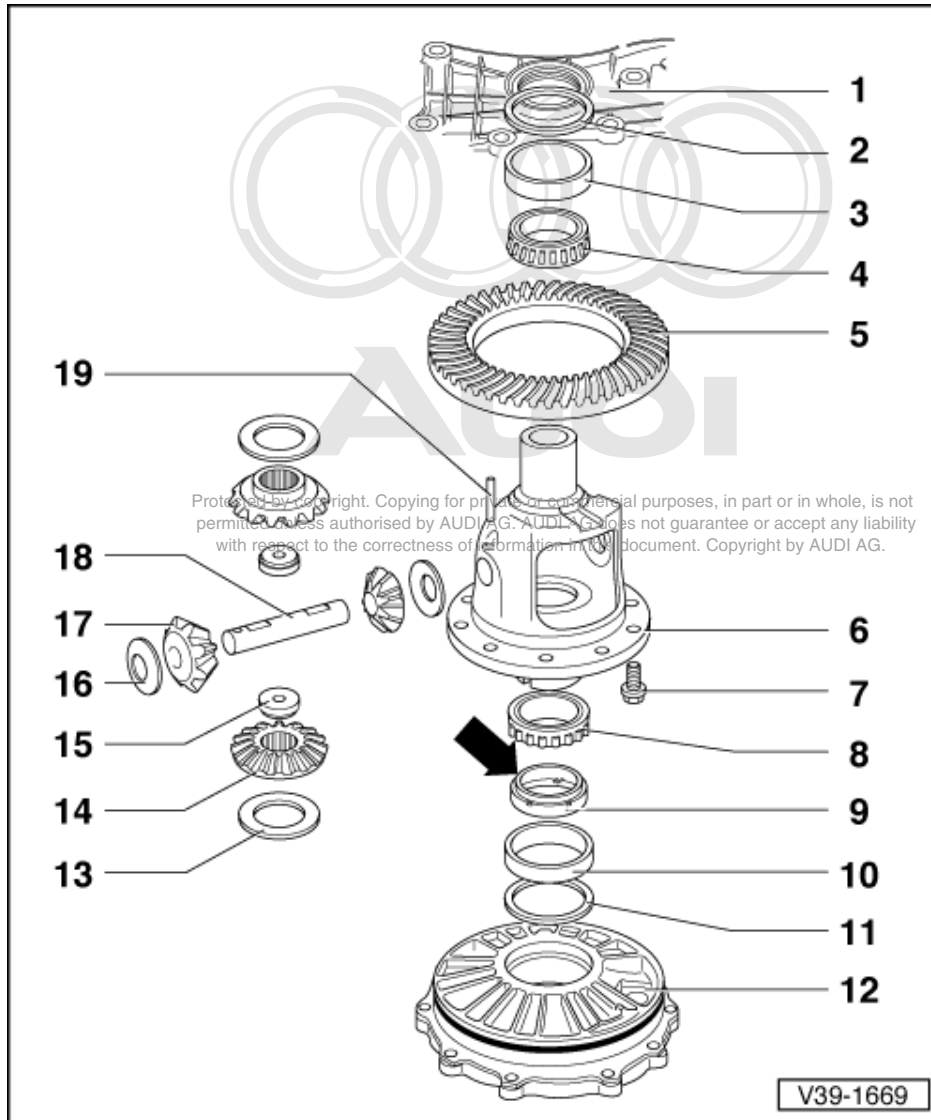
**8 Inner race for large taper roller bearing 1)**

- ◆ Pulling off => Fig. 2
- ◆ Pressing on => Fig. 4
- ◆ Low friction bearing; do not oil when measuring frictional torque

**9 Drive wheel**

- ◆ For speedometer sender
- ◆ Removing and installing => Page 143
- ◆ Installation position: shoulder -arrow- towards differential
- ◆ Do not tilt when installing (risk of breakage)





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

- ♦ Driving out => Fig. 11
- ♦ Driving in => Fig.12

**11 Shim "S1"**

- ♦ Note thickness
- ♦ Adjustment overview => Page 158

**12 Cover for final drive 1)**

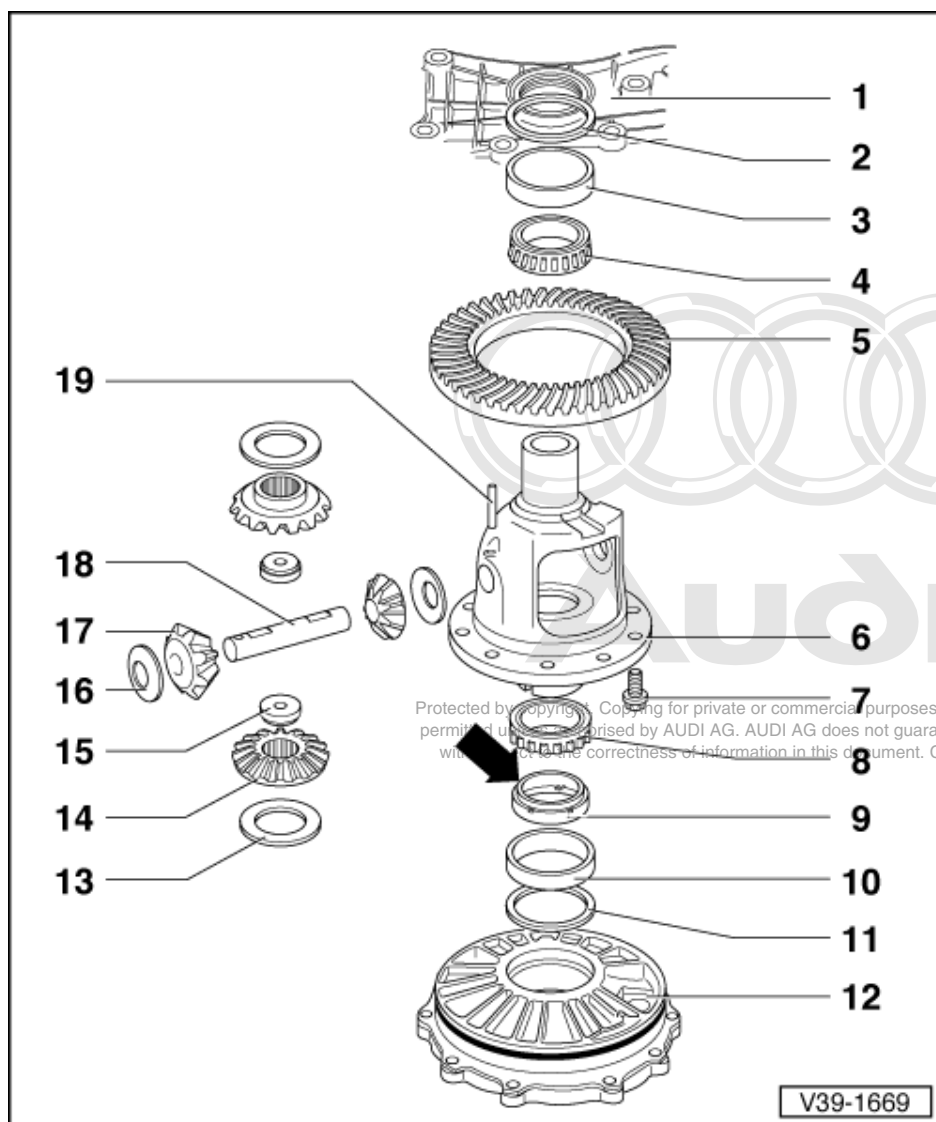
- ♦ With O-ring
- ♦ Renew O-ring
- ♦ Oil O-ring before installing

**13 Shims**

- ♦ Re-determining thickness => Fig. 8

**14 Sun wheels**

- ♦ Adjusting => Fig. 8



**15 Threaded piece**

**16 Thrust washer**

- ◆ Check for cracks and chipping

**17 Planet wheels**

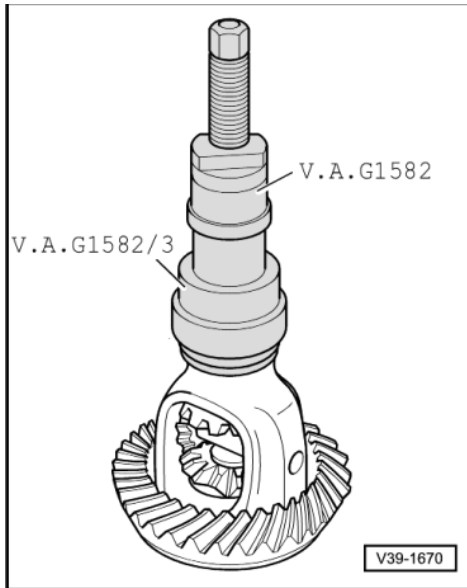
- ◆ Installing => Fig. 7

**18 Shaft for planet wheels**

- ◆ Drive out with drift after removing spring pin
- ◆ Before driving in, align thrust washers

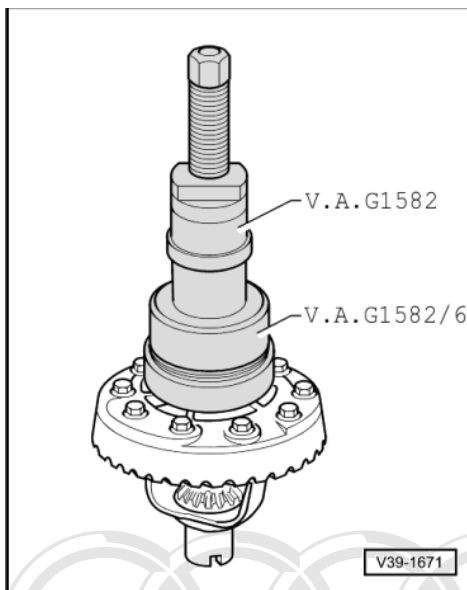
**19 Spring pin**

- ◆ Always renew
- ◆ Drive in flush



-> Fig.1 Pulling inner race for small taper roller bearing out of housing

- Fit thrust plate 40-105 before fitting puller.

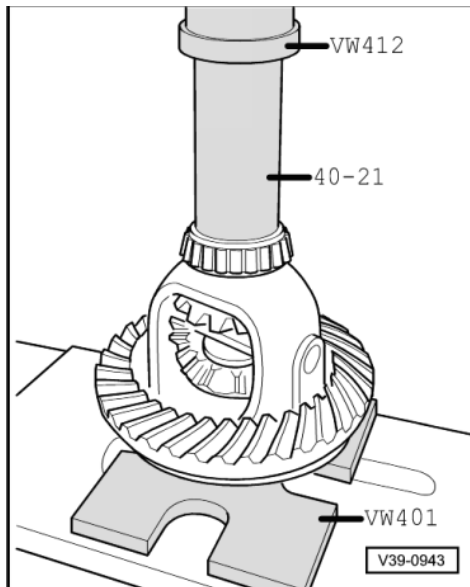


-> Fig.2 Pulling inner race for large taper roller bearing off housing

- Remove drive wheel for speedometer sender.
- Fit thrust plate 40-105 before attaching puller.

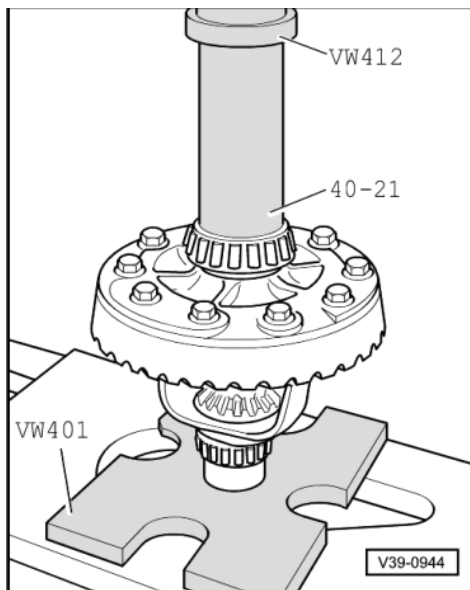
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-> Fig.3 Pressing on inner race for small taper roller bearing

- Heat inner race for small taper roller bearing to approx. 100 °C.
- Fit inner race and press home.

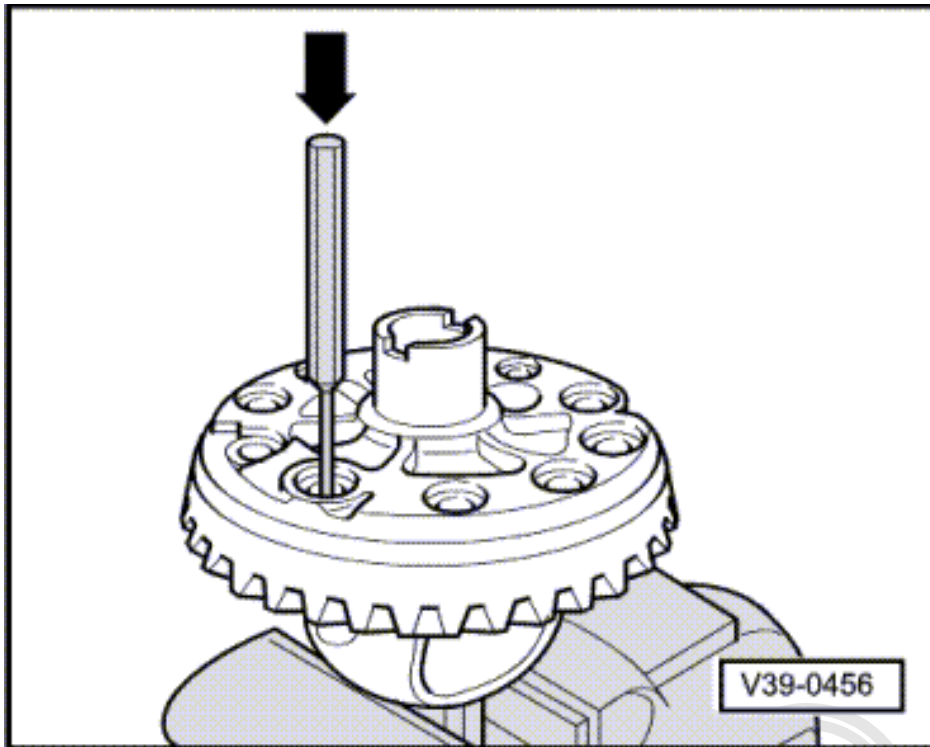


-> Fig.4 Pressing on inner race for large taper roller bearing

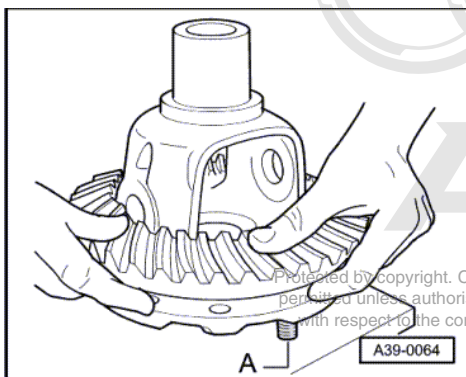
- Heat inner race for large taper roller bearing to approx. 100 °C.
- Fit inner race and press home.
- Fit drive wheel for speedometer sender.



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-> Fig.5 Driving crown wheel off housing

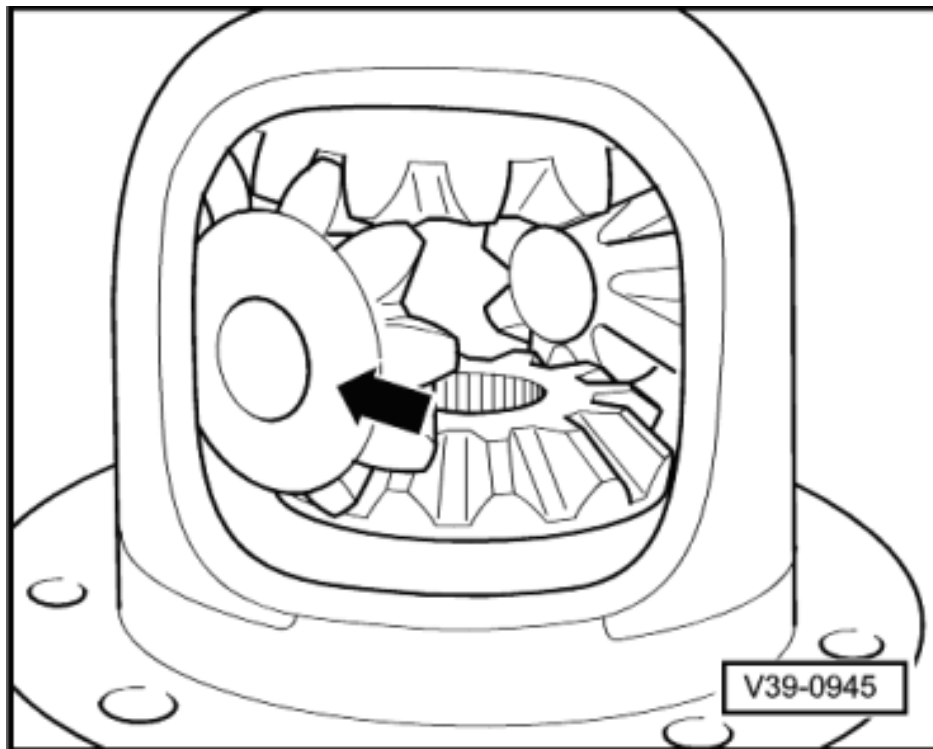


-> Fig.6 Installing crown wheel

- Use 2 centring pins -A- (local manufacture) as a guide.

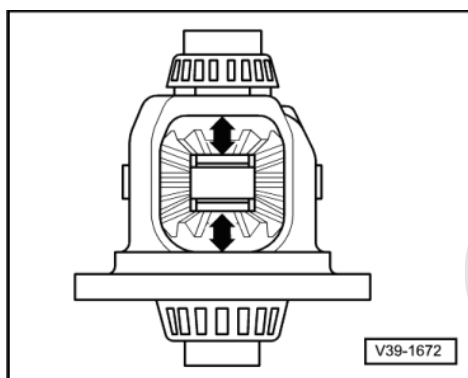
Caution  
Wear protective gloves.

- Heat crown wheel to approx. 100 °C and install.
- Allow the crown wheel to cool off slightly before inserting the bolts. Then tighten to specified torque.



-> Fig.7 Installing planet wheels and sun wheels

- Carefully lever out drive wheel for speedometer sender with a screwdriver.
- Insert thrust washers for planet wheels with a small amount of grease.
- Insert sun wheels with selected shims => Fig. 8 .
- Insert planet wheels turned through 180° and swing into place -arrow-.
- Insert threaded pieces.
  - Installation position: stepped shoulder towards sun wheels
- Align thrust washers with holes.
- Drive in shaft and secure.



-> Fig.8 Adjusting planet wheels and sun wheels

- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet wheels with thrust washers and press in shaft.

**Note:**

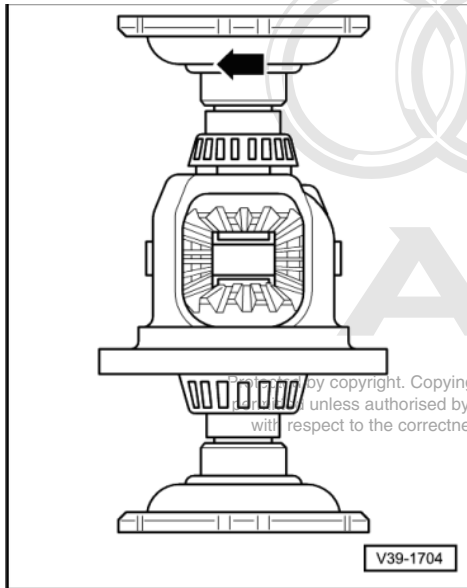
*Do not now interchange bevel gears and thrust washers!*

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- Press planet wheels outwards and check play of sun wheels by hand -arrows-.
- Adjust play by inserting an appropriate shim => Page 155 .

- Specification: max. 0.10 mm

**Note:**



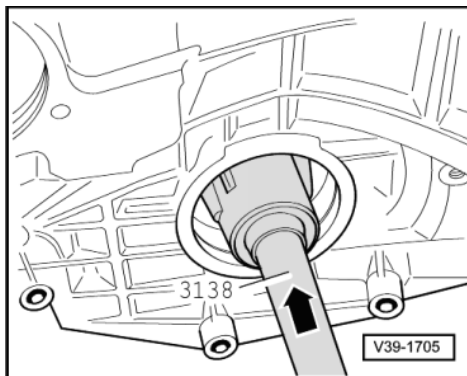
-> The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears -arrow-.

- Determine shim from 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



-> Fig.9 Driving outer race for small taper roller bearing out of gearbox housing

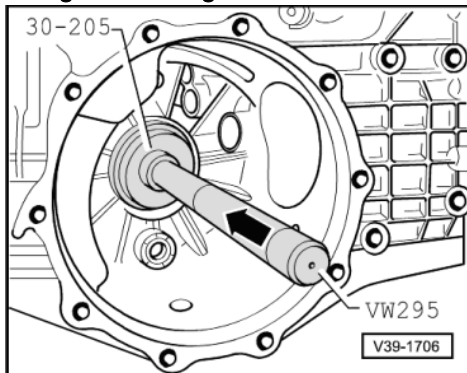
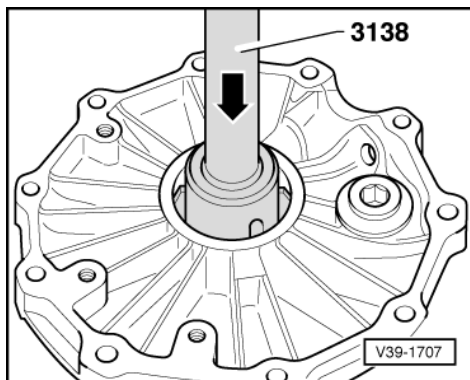
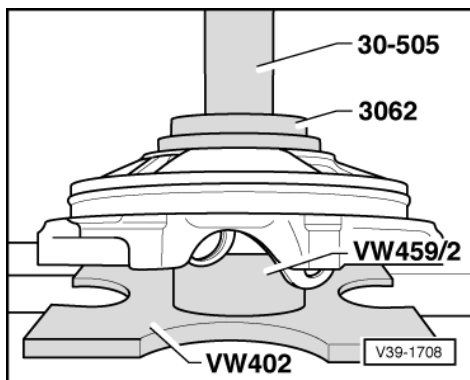


Fig.10 -> Driving outer race for small taper roller bearing into gearbox housing



-> Fig.11 Driving outer race for large taper roller bearing out of cover

- Use suitable base, e.g. VW 470 with recess towards cover.



-> Fig.12 Driving outer race for large taper roller bearing into cover

## 5 - Adjusting drive pinion and crown wheel

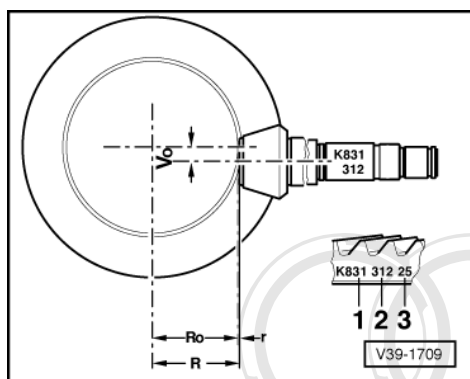
### 5.1 - Adjusting drive pinion and crown wheel

#### 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.



## 5.2 - Adjustment and markings of final drive set



-> Identification

- 1 = "K 831" indicates a Klingelnberg drive pinion with a ratio of 31 : 8
- 2 = No. of matched pair (312) in final drive set
- 3 = Deviation (tolerance) "r" related to the master gauge of the special test machine used during production. Deviation "r" is always stated in 1/100 mm

Example: "25" indicates  $r = 0.25$  mm

$R_o$  = Length of master gauge used on special test machine

" $R_o$ " = 59.65 mm

$R$  = Actual distance between crown wheel axis and face of drive pinion at the point of quietest running for this final drive set

$R = R_o + r$

$V_o$  = Hypoid offset

## 5.3 - Recommended sequence for readjusting final drive set

The following sequence of work is recommended to save time when the drive pinion and crown wheel have to be adjusted:

- 1.) Determine total shim thickness " $S_{total}$ " for " $S_1$ " + " $S_2$ " (sets preload for taper roller bearings for differential) => from Page 166 .
- 2.) Determine total shim thickness " $S_{total}$ " for " $S_3$ " + " $S_4$ " (sets preload for taper roller bearings for drive pinion) => from Page 160 .
- 3.) Distribute total shim thickness " $S_{total}$ " for " $S_3$ " + " $S_4$ " 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 163 .
- 4.) Distribute total shim thickness " $S_{total}$ " for " $S_1$ " + " $S_2$ " so that the specified backlash between crown wheel and drive pinion is maintained => from Page 170 .

**Note:**

Overview of components and shims =>Page **159**.

**5.4 - Adjustment overview****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:

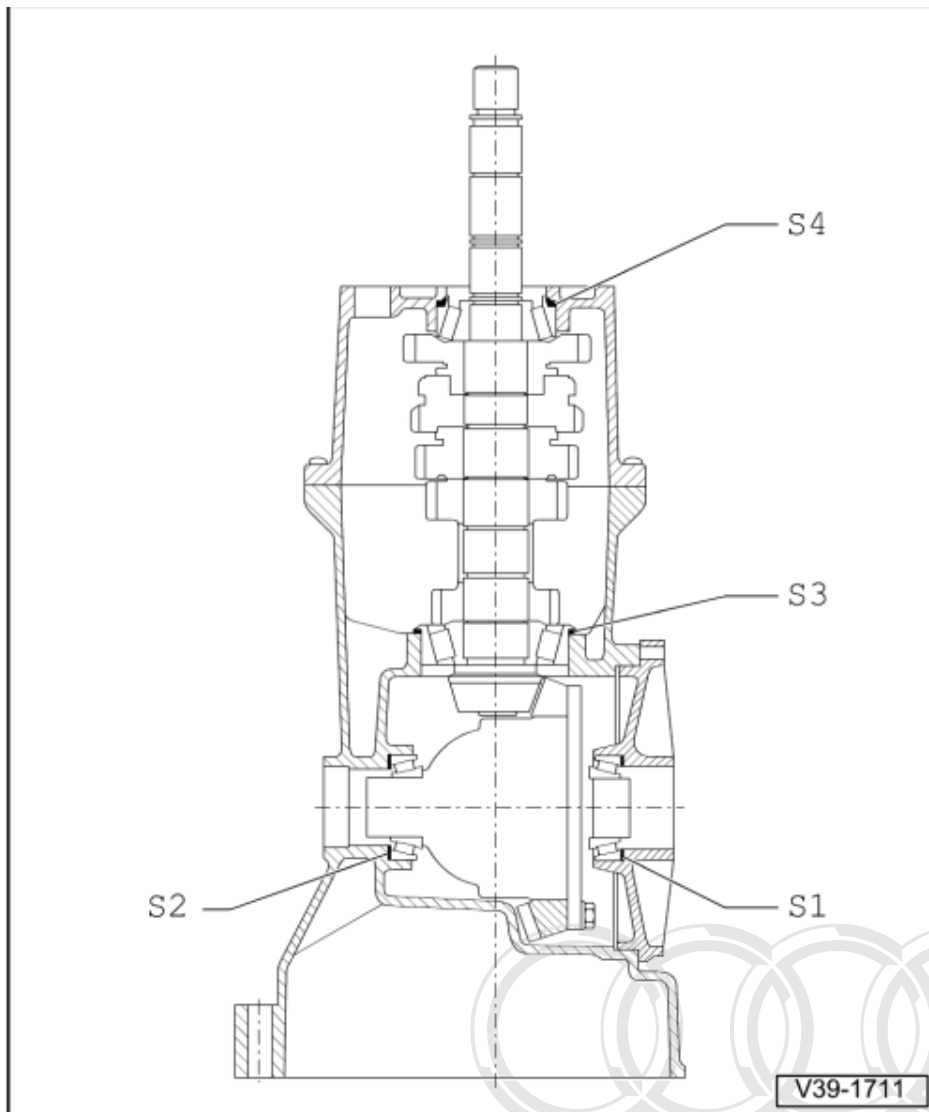
Parts renewed: ▼	to be adjusted:			
	Crown wheel "S1"+"S2" 1) => Page <b>165</b>	Drive pinion "S3"+"S4" 1) via deviation "r" => Page <b>159</b>	Drive pinion "S4" 1) => Page <b>97</b>	Backlash Check => Page <b>169</b>
Gearbox housing	X	X		X
Bearing plate			X	X
Differential housing	X			X
Taper roller bearing 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 **159**.
- 2) Drive pinion and crown wheel; only renew together.



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## 5.5 - Position of shims



### **Note:**

*Adjustment overview when renewing individual components of gearbox =>Page 158 .*

- S1 - Adjustment shim for crown wheel in cover for differential**
- S2 - Adjustment shim for crown wheel in gearbox housing**
- S3 - Adjustment shim for drive pinion in gearbox housing**
- S4 - Adjustment shim for drive pinion in bearing plate**

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## 6 - Adjusting drive pinion

### 6.1 - Adjusting drive pinion

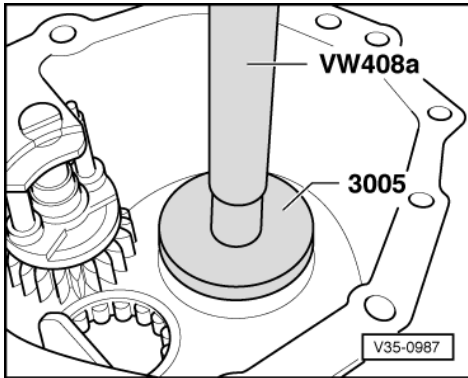
Repairs after which the drive pinion must be adjusted => table on Page 158 .



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

(Setting preload of taper roller bearings for drive pinion)

- Differential removed
- Insert outer race for taper roller bearing for drive pinion into gearbox housing without shims => Fig. 137 .

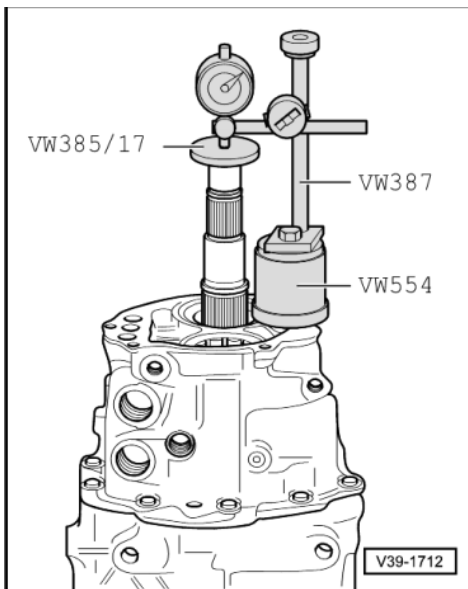


- -> Insert outer race for taper roller bearing for drive pinion with shim "S4\*" (1.0 mm thick) into bearing plate.

#### **Note:**

*For measurement purposes a shim "S4" of 1.0 mm is initially inserted which is designated "S4\*". After determining measurement "e" "S4\*" will be replaced by the correct shim "S4".*

- Insert completely assembled drive pinion in gearbox housing.
- Fit bearing plate with dowel sleeves and tighten bolts to 25 Nm.
- Rotate drive pinion 5 turns in each direction so that the bearing settles.



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- -> Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

#### **Note:**

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

- Lift drive pinion, without turning, and read off play on dial gauge.

- Measurement in example: 0.90 mm

**Note:**

*If the measuring procedure needs to be repeated, the drive pinion must first be rotated 5 turns in each direction again so that the taper roller bearing settles. Reset the dial gauge to "0" with 2 mm preload.*

<b>Formula:</b>	
<b>"Stotal" = "S4*" + measurement + bearing preload</b>	

<b>Example:</b>	
Inserted shim "S4"	1.00 mm
+ Measured value (example)	0.90 mm
+ Bearing preload (constant)	0.15 mm
= Total shim thickness "Stotal" for "S3" + "S4"	2.05 mm

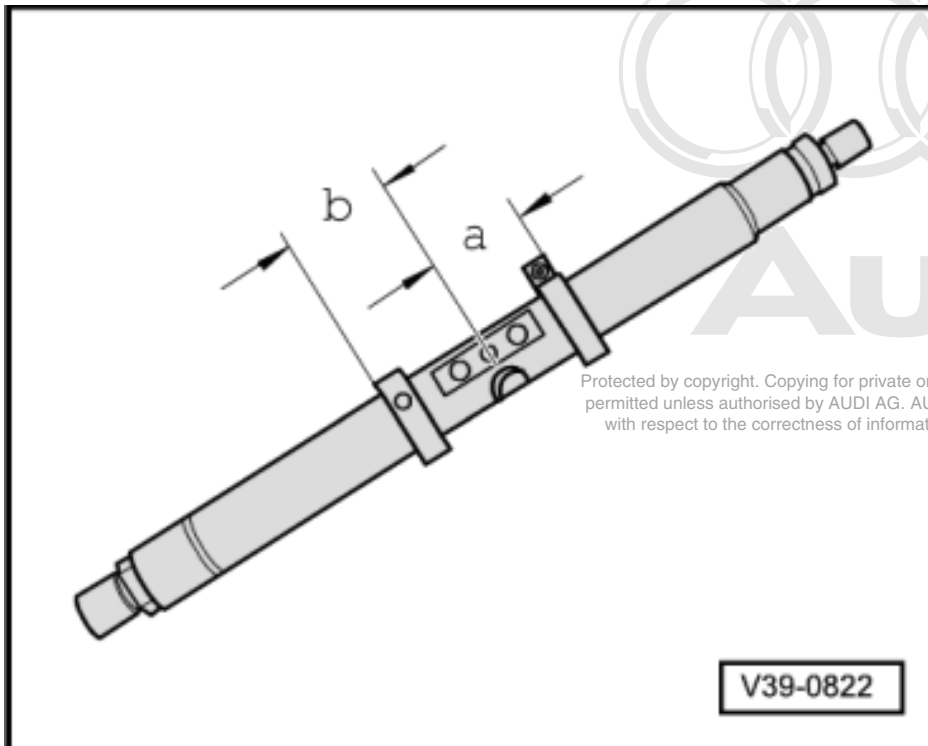
**Determining thickness of shim "S3"**

<b>Formula:</b>	
<b>"S3" = "Stotal" - "S4"</b>	

<b>Example:</b>	
Total shim thickness "Stotal" for "S3" + "S4"	2.05 mm
- Inserted shim "S4"	1.00 mm
= Thickness of shim "S3"	1.05 mm

- Remove outer race for taper roller bearing, insert shim "S3" into gearbox housing and install outer race again => Fig. 137 .
- Insert completely assembled drive pinion into gearbox housing again.
- Fit bearing plate with dowel sleeves and tighten securing bolts to 25 Nm.
- Rotate drive pinion 5 turns in each direction so that the bearing settles.

**Determining measurement "e"**

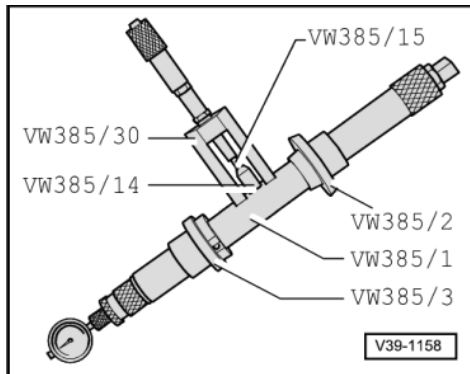




**Note:**

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

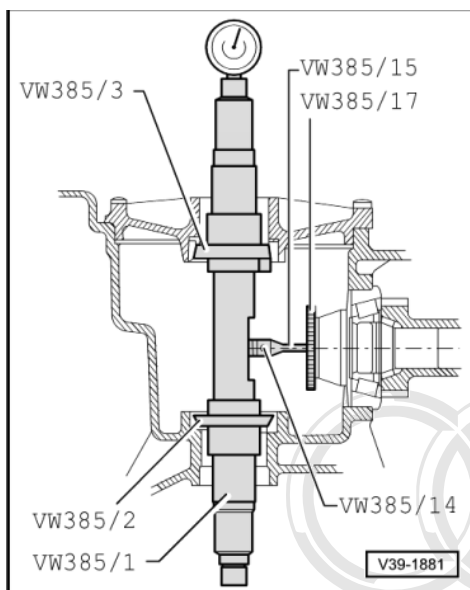
- -> Set adjustment rings of universal mandrel VW 385/1 to the following measurements:
  - Dimension a = 65 mm
  - Dimension b = 65 mm



- -> Assemble universal mandrel VW 385/1 as illustrated:
  - Dial gauge extension VW 385/15, 9.3 mm long
  - Master gauge VW 385/30
- Set master gauge VW 385/30 to  $R_o = 59.65$  mm and fit onto mandrel.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

**Note:**

The gauge VW 385/27 can also be used in place of the master gauge VW 385/30 ( $R_o = 59.65$  mm).



-> Arrangement of measuring equipment when determining dimension "e"

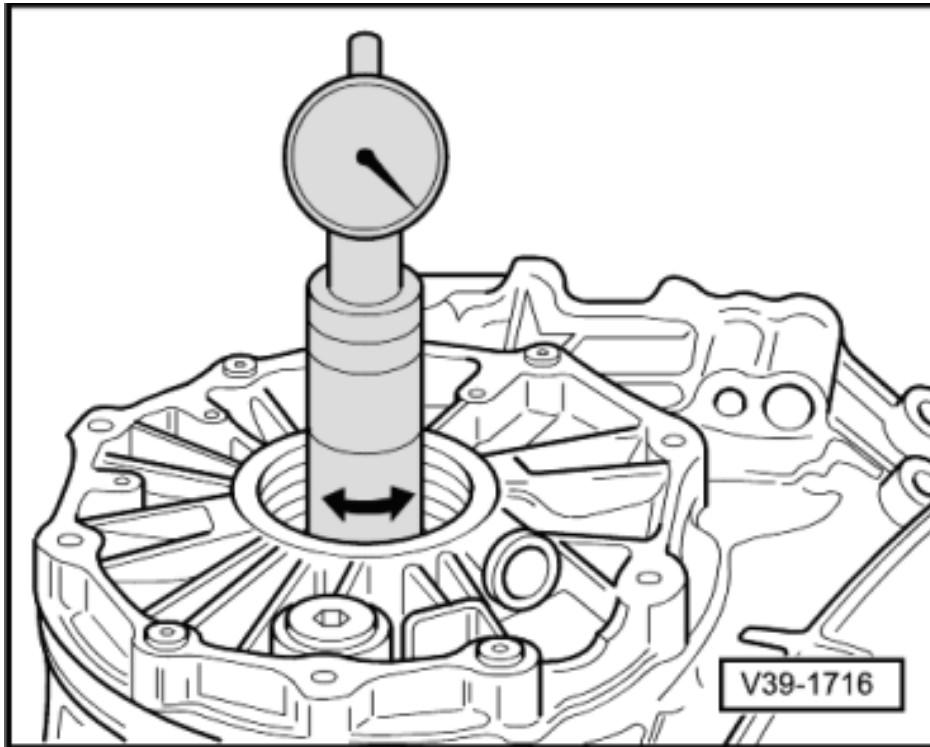
- Place end measuring plate VW 385/17 onto drive pinion head.

**Note:**

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

- Take master gauge off mandrel.
- Insert mandrel into gearbox housing.
  - The centring disc 385/3 faces towards cover for final drive

- Fit cover for final drive and tighten 4 bolts to 25 Nm.
- Using the adjustable ring, pull 2nd centring disc VW 385/2 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" = 0.16 mm (in red scale)

#### Determining thickness of shim "S3"

##### Formula:

$$\text{"S3"} = \text{"S3*"} + \text{"r"} + \text{"e"}$$

("e" in black scale)

or

$$\text{"S3"} = \text{"S3*"} + \text{"r"} - \text{"e"}$$

("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 the outer circumference of the 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:

Inserted shim "S3"	1.05 mm
+ Deviation "r"	0.38 mm
- Determined "e" (in red scale)	0.16 mm
= Thickness of shim "S3"	1.27 mm

- Determine shim(s) from table. Part numbers



=> Parts catalogue

The following shims are available for "S3"

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

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"**

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"S4" = "Stotal" - "S3"

**Example:**

Total shim thickness "Stotal" for "S3" + "S4"	2.05 mm
- Thickness of shim "S3"	1.27 mm
= Thickness of shim "S4"	0.78 mm

- Determine shim(s) from table. Part numbers

=> Parts catalogue

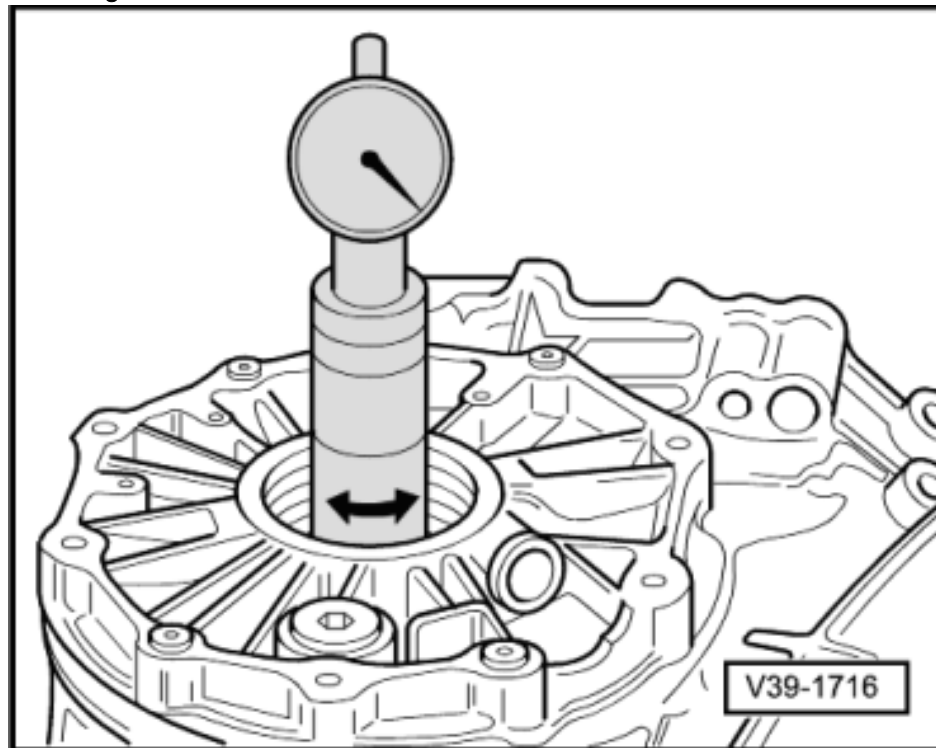
The following shims are available for "S4"

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 with determined shims "S3" and "S4" and turn 5 turns in both directions.
- -> Insert universal mandrel, => "determining measurement 'e'" on Page 161 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

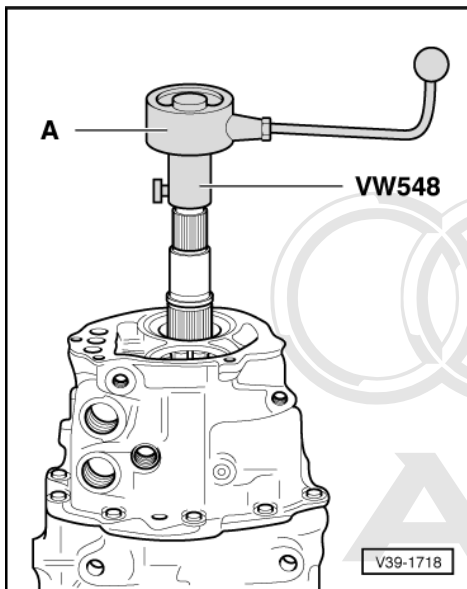
**Note:**

*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:**

- ♦ The taper roller bearings for the drive pinion are low-friction bearings, which means that the frictional torque is only of limited use for checking the adjustment. The only way to make the adjustment accurately is by calculating 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 -A- onto drive pinion.

Frictional torque specification:

New bearings	Used bearings
80 ... 150 Ncm	30 ... 60 Ncm

## 7 - Adjusting crown wheel

### 7.1 - Adjusting crown wheel

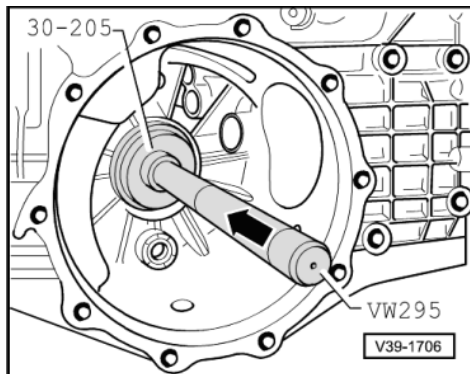
(Adjusting differential)

Repairs after which the crown wheel must be adjusted => Page 158 .



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

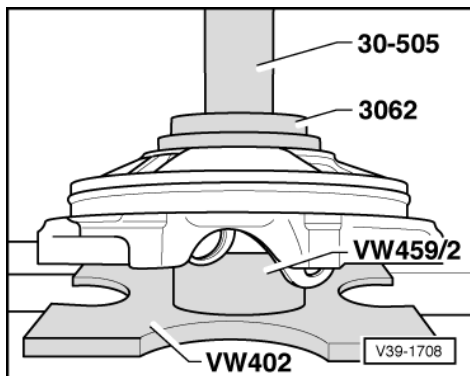
(Setting preload of taper roller bearing for differential)



- Drive pinion removed
- Remove seal and outer races of both taper roller bearings for differential.
- Remove shims => Page 146 .
- -> Drive outer race for taper roller bearing with shim "S2" into gearbox housing. For measurement purposes an "S2\*" shim 1.20 mm thick (2 shims of 0.60 mm) is used.

### Note:

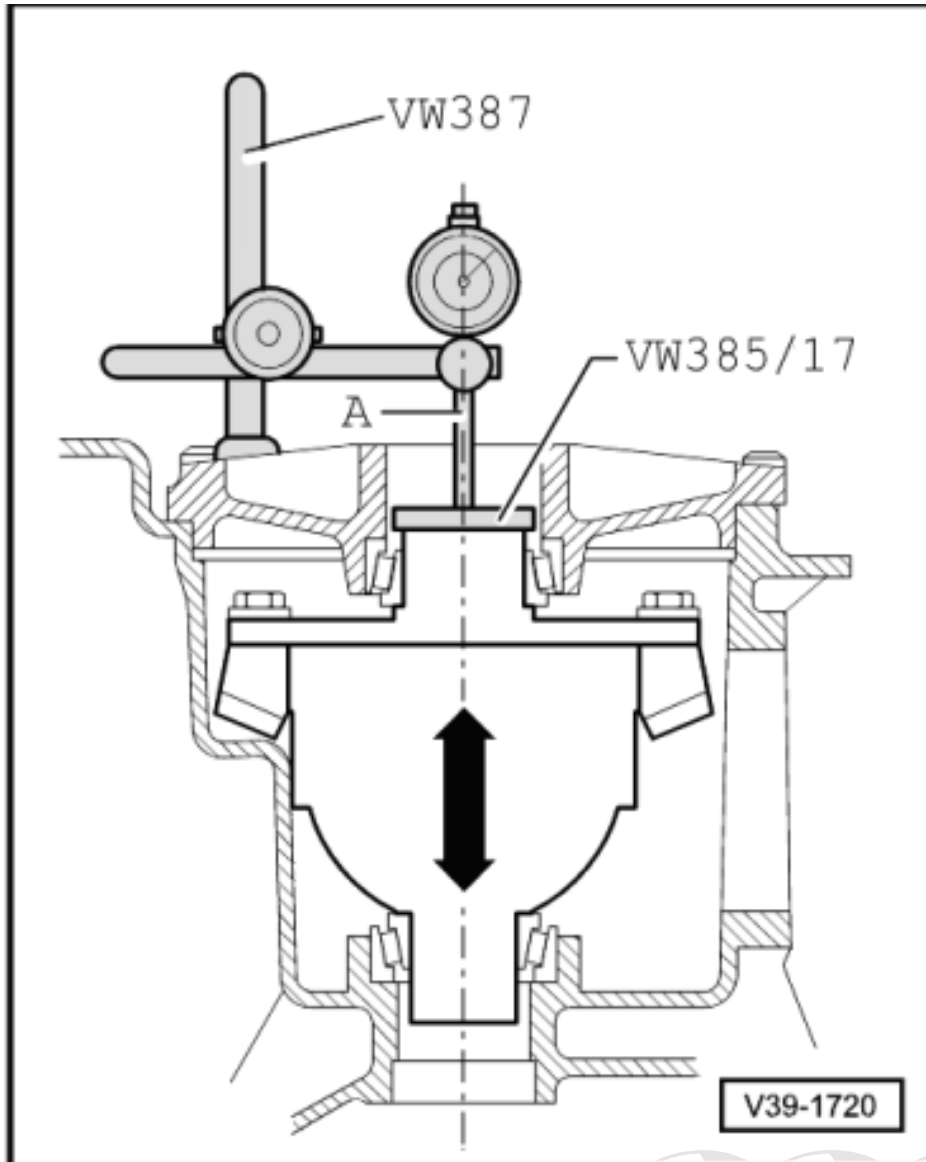
For measurement purposes a shim "S2" of 1.20 mm is initially inserted which is designated "S2\*" in the following. After determining backlash, "S2\*" will be replaced by the correct shim "S2".



- -> Press outer race for taper roller bearing without shim "S1" into cover for differential.
- 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.
- -> Set up measuring tool with 30 mm dial gauge extension -A-.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload

**Note:**

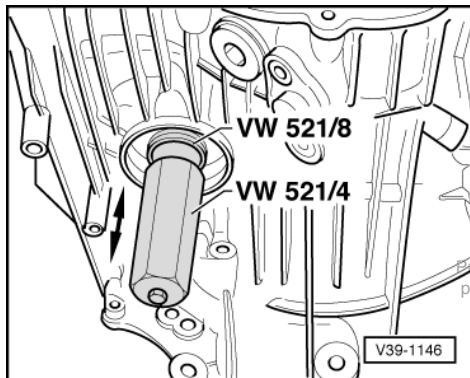
*The tip of the dial gauge must be positioned on centre of differential.*

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

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**Notes:**



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- ♦ -> Secure special tools VW 521/4 and VW 521/8 on right of differential (gearbox side) to lift differential.
- ♦ If the measurement has to be repeated, the differential 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)	0.25 mm
= Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm

**Determining thickness of shim "S1\*"**

**Notes:**

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

**Formula:**

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

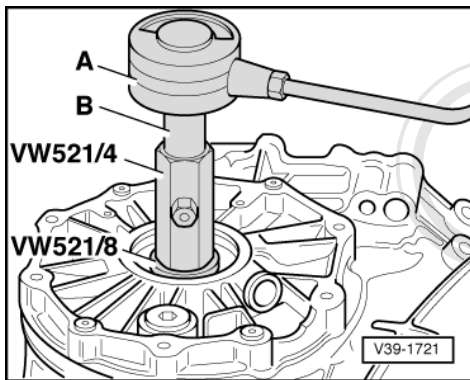
**Example:**

Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm
- Inserted shim(s) "S2*"	1.20 mm
= Thickness of shim "S1*"	0.87 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.

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Frictional torque specifications:

New bearings	Used bearings
200 ... 350 Ncm	30 ... 50 Ncm

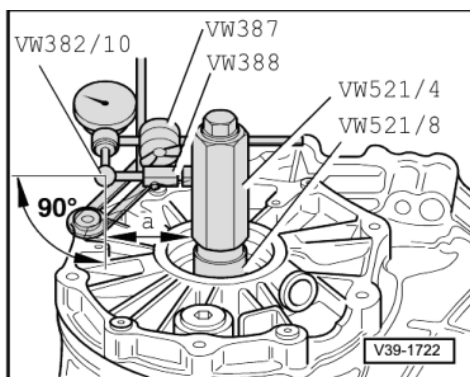
**Note:**

*If the final drive set (drive pinion and crown wheel) is being adjusted, perform the adjustment of the drive pinion now and check the adjustment =>Page 159.*

**Measuring backlash**

(Position of crown wheel in gearbox housing)

- Drive pinion with shims "S3" and "S4" installed
- Install differential.



- Turn the differential 5 turns in each direction to settle the taper roller bearings.
- -> Secure dial gauge retainer VW 387 onto housing.
- Insert adjustment device VW 521/4 and VW 521/8 for crown wheel.
- Fit dial gauge with dial gauge extension VW 382/10 (6 mm flat).
- Set measuring lever VW 388 to dimension a = 79 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 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.

**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**

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

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

- Result: The average backlash is  $1.96 / 4 = 0.49$  mm

**Determining thickness of shim "S2"**

Formula:	
"S2"	= "S2*" - backlash + lift

Example:	
Inserted shim "S2"	1.20 mm
- Average backlash	0.49 mm
+ Lift (constant)	0.15 mm
= Thickness of shim "S2"	0.86 mm

- Determine shim(s) 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"**

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

Example:	
Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm
- Thickness of shim "S2"	0.86 mm

= Thickness of shim "S1"	1.21 mm
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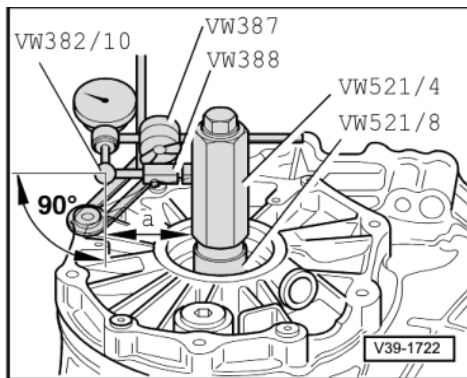
- Determine shim(s) from table. Part numbers

=> 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.

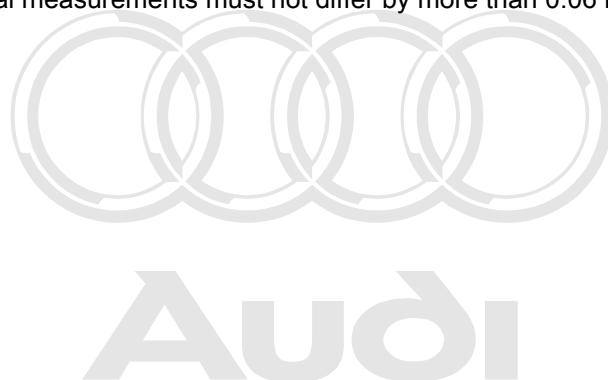


#### -> Performing check measurement

- 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.
  - Specification: 0.12 ... 0.22 mm

#### Notes:

- ◆ If the backlash is outside the tolerance, 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.



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