Audi A8 1994 ➤

6-Speed manual gearbox 01E Four-wheel drive									
Gearbox ID	DGV								

Edition 10.1996

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

Audi A8 1994 ➤

6-Speed manual gearbox 01E Four-wheel drive

Repair Group

00 - Technical data

30 - Clutch

34 - Controls, Housing

35 - Gears, Shafts

39 - Final drive, Differential rear

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.

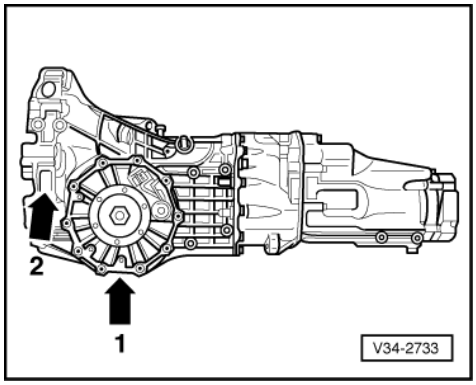
Contents

00 - Technical data

1 - Gearbox identification

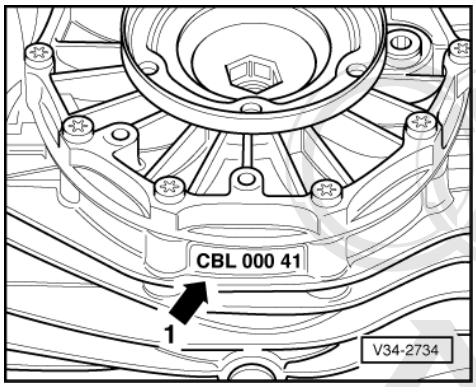
1.1 - Gearbox identification

The 6-speed manual gearbox 01E 4WD is fitted to the Audi S8 from 07.96. Allocation => Page 2 .



-> Location on gearbox

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



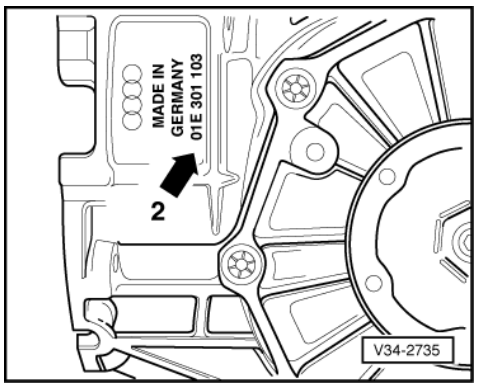
-> Code letters and gearbox consecutive serial number -arrow 1-

Example:	CBL 000 41
	Code letters / Gearbox consecutive serial number

Additional data depends on manufacture.

Note:

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



-> Manual gearbox 01E -arrow 2-

2 - Code letters, allocation, ratios, capacities

2.1 - Code letters, allocation, ratios, capacities

Manual gearbox		6-speed 01E 4WD	
Code letters		DGV	
Manufactured	from to	07.96	
Allocation	Model Engine	Audi S8 4.2 l - 250 kW	
Ratio Z2 :Z1=i	Final drive	37 : 9 = 4.111	
	1st gear	28 : 8 = 3.500	
	2nd gear	34 : 18 = 1.889	
	3rd gear	33 : 25 = 1.320	
	4th gear	30 : 29 = 1.034	
	5th gear	30 : 35 = 0.857	
	6th gear	27 : 37 = 0.730	
	Reverse gear	38 : 11 = 3.455	

Code letters	DGV	
Speedometer	Electronic	
Capacities	3.6 litre 1)	
Specification	Gear oil G 052 911 A SAE 75 W 90 (synthetic oil)	
Clutch mechanism	Hydraulic	
Clutch plate diameter	240 mm	
Drive shaft flange	130 mm 2)	
itotal Overall ratio in top gear	3.000	

Rear final drive allocation Code letters	CGV

1) The oil capacity includes 0.3 l for the gearbox oil cooler and oil pipes. When replacing a gearbox the oil cooler and oil pipes must be drained completely.

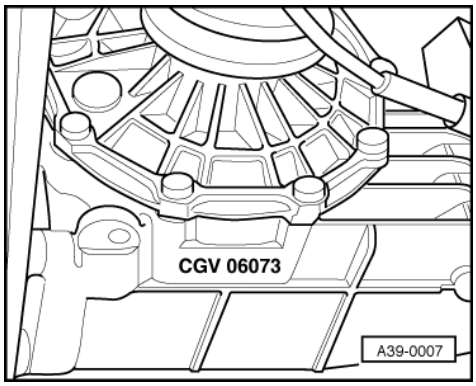
2) For triple roller drive shaft

3 - Identification of rear final drive

3.1 - Identification of rear final drive

The final drive 01R is allocated to the manual gearbox 01E 4WD

Allocation => Page 3



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

Example:	**CGV**	**06**	**07**	**3**
	I	I	I	I
	Code letters	Day	Month	Year (1993) of manufacture

Note:

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

4 - Code letters, allocation, ratios, capacities

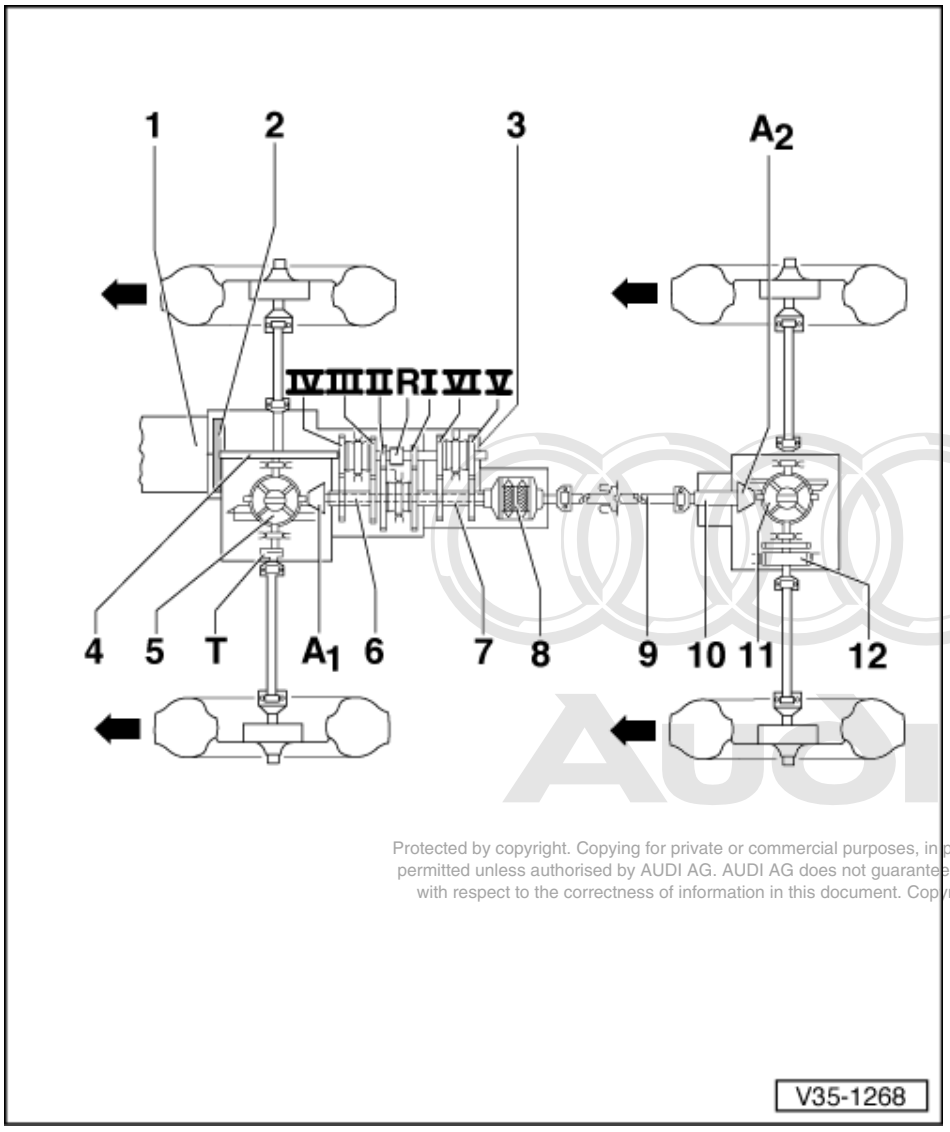
4.1 - Code letters, allocation, ratios, capacities

Rear final drive		**01R**
Code letters		**CGV**
Manufactured	from to	07.96
Allocation	Model Engine	Audi S8 4.2 l - 250 kW
Ratio	Final drive	37 : 9 = 4.111

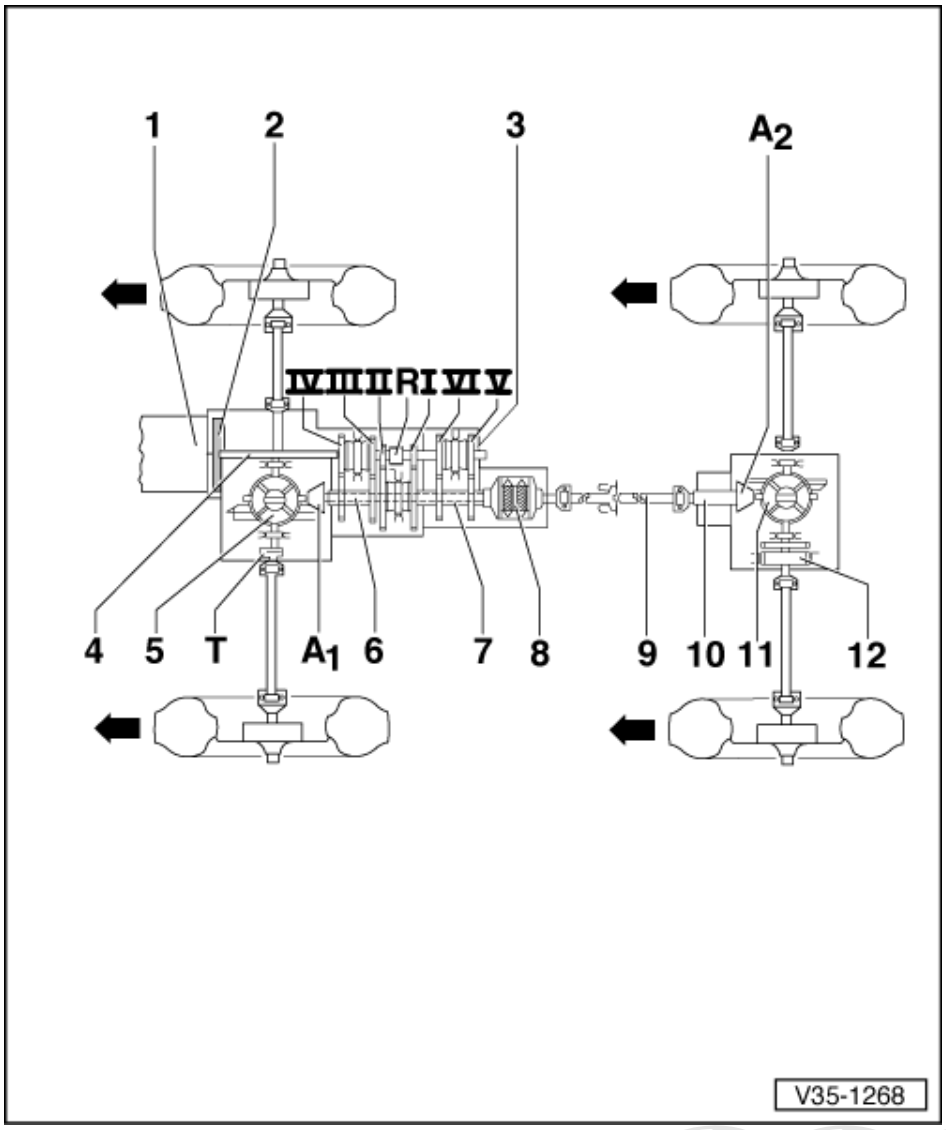
Rear final drive	**01R**	
Capacity	1.5 litre	
Specification	Gear oil GL 5 SAE 90 (MIL-L 2105 B)	
Drive shaft flange diameter	108 mm	
Manual gearbox allocation Code letters	DGV	

5 - Transmission layout

5.1 - Transmission layout



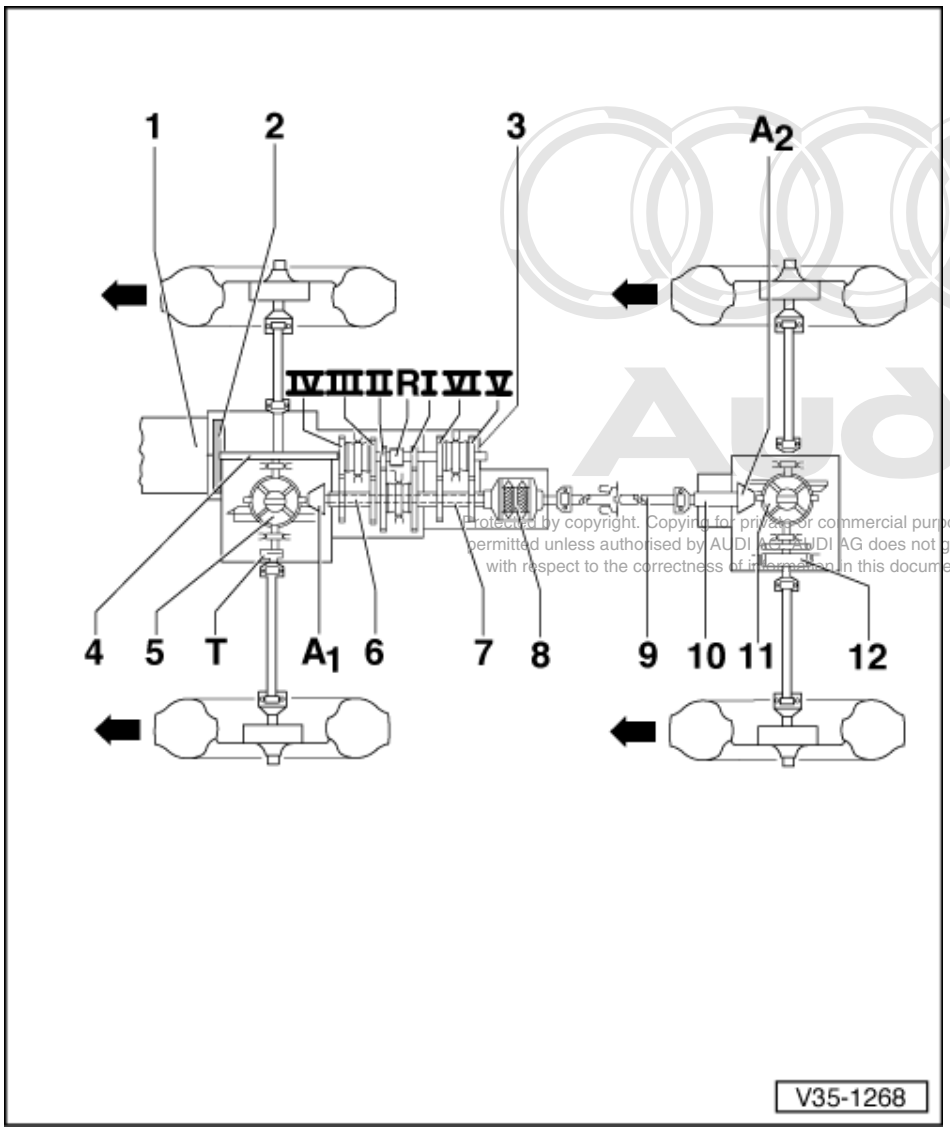
1 Engine
2 Clutch
3 Gearbox
4 Input shaft (main shaft)
5 Front differential
6 Front drive pinion (output shaft)
7 Hollow shaft
8 Torsen differential



9 Propshaft
10 Rear drive pinion
11 Rear differential
12 Differential lock (not installed)

Note:

Arrows point in forward direction of travel.



I - 1st gear
II - 2nd gear
II - 3rd gear
IV - 4th gear
V - 5th gear
VI - 6th gear
R - Reverse gear
A1 - Front final drive
A2 - Rear final drive
T - Speedometer drive, electronic

6 - Calculations

6.1 - Calculations

6.2 - 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	=	Final drive ratio	ZA2:ZA1
itotal	=	Total ratio	iG x iA

Example:

	6th gear	Final drive
Drive gear	ZG1 = 37	ZA1 = 9
Driven gear	ZG2 = 27	ZA2 = 37

Calculating:

iG = 27 : 37 = 0.730
iA = 37 : 9 = 4.111
itotal = (27 : 37) x (37 : 9) = 0.730 x 4.111 = 3.000

6.3 - Calculating speed "V"

V	=	**n : itotalx UA x 0.06**
n	=	Engine speed (rpm)
itotal	=	Total ratio
UA	=	Dynamic tyre roll circumference (m)
V	=	Speed (km/h)

Example:

V = n : itotalx UA x 0.06

V = 1000 : 3.100 x 1.93 x 0.06 = 37 km/h

The road speed at an engine speed of 1000 rpm in 5th gear is 37 km/h.

7 - Notes regarding engine output test, brake test, tow-starting and towing

7.1 - Notes regarding engine output test, brake test, tow-starting and towing

- Engine output and brake test

=> Special Information; Transmission; No. 8

- Tow-starting and towing

=> Booklet; Maintenance

8 - Repair instructions

8.1 - 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 also, naturally apply when carrying out vehicle repairs.

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

Special tools

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

=> Booklet; Special tools, Workshop equipment

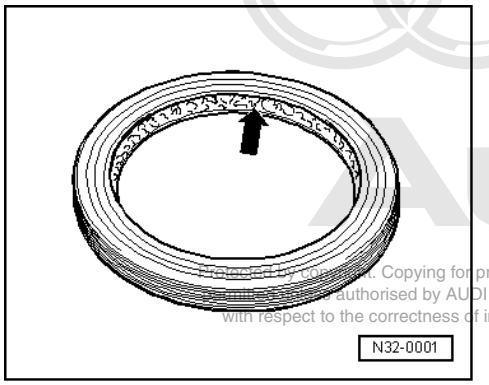
Gearbox

- When exchanging the manual gearbox, drain oil cooler and oil pipes completely.
- When exchanging the manual gearbox or rear final drive, check oil level and top-up if necessary => Page 207 .
- Capacities and specifications => from Page 3 .

- Thoroughly clean all connections and the surrounding area before disconnecting.
- When installing gearbox, ensure dowel sleeves are correctly seated.

O-rings, seals, gaskets

- Always renew O-rings, seals and gaskets.



- After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.
- Thoroughly clean housing joint surfaces before assembling.
- -> Before installing radial shaft oil seals, lightly oil outer edge and fill space between sealing lips -arrow- with grease.
- The open side of the oil seals faces toward the side with fluid filling.
- When replacing oil seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).
- Lightly oil O-rings before installing; this prevents the rings being crushed when inserting.

- Check oil level after renewing gaskets and seals =>Page 207 .

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.
- Always renew roll pins.

Note:

The roll pins for securing the selector fork/selector rail for 5th/6th gear must only be assembled or dismantled using the special tool =>Page 88 .

Nuts, bolts

- Loosen nuts or bolts, opposite to tightening sequence.
- 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 rear of crankshaft.
- Lubricate all bearings in gearbox housing with gear oil before installing.
- Heat inner races of taper roller bearings to approx. 100 °C before installing. Press in onto stop when installing so there is no axial clearance.
- Do not interchange the outer or inner races of bearings of the same size.
- Always replace the taper roller bearings on one shaft together and use new bearings from a single manufacturer.
- Taper roller bearings for output shaft and differential in manual gearbox and in final drive are low friction bearings. Do not additionally treat new taper roller bearings with oil when measuring frictional torque. These bearings are treated with a special oil by the manufacturer 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.

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.

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.

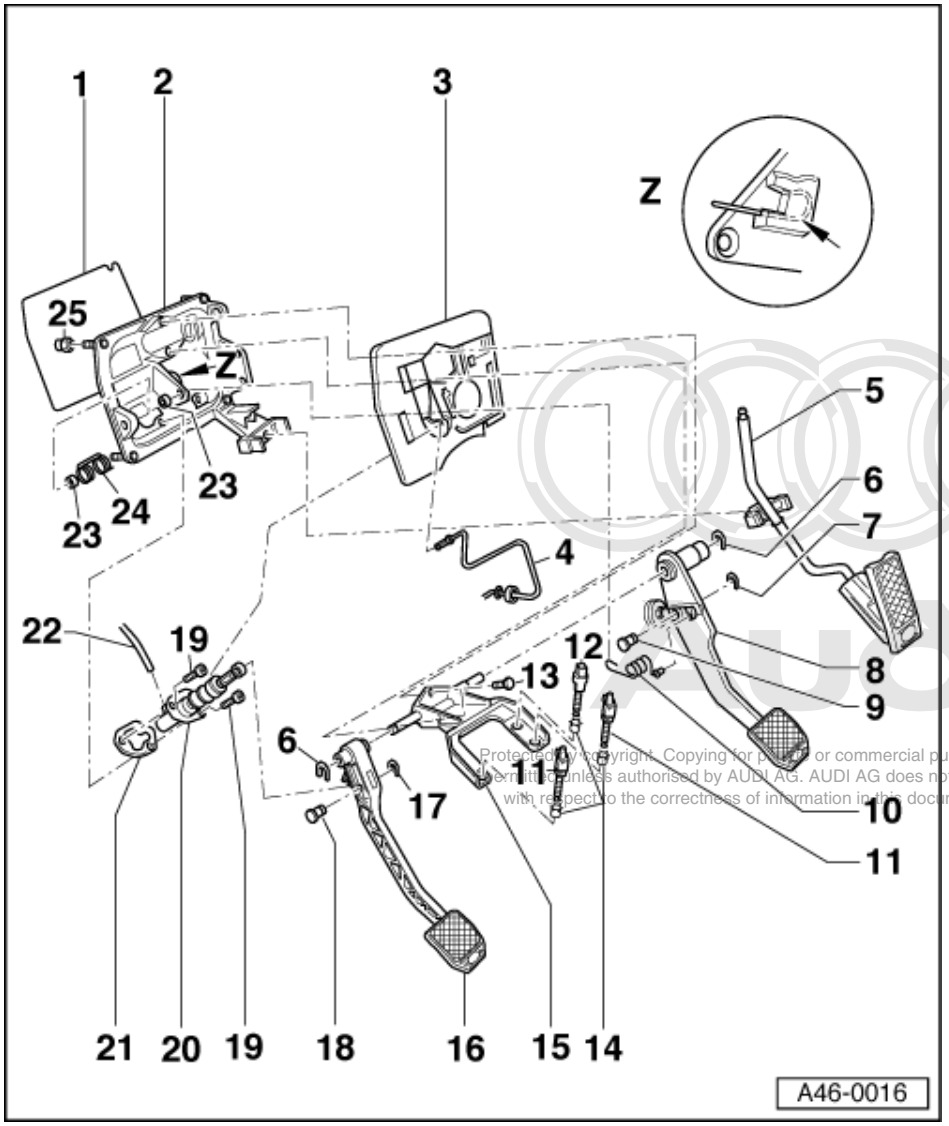
Sliding gears

- After installing, check 1st to 6th speed sliding gears for axial clearance of 0.15 ... 0.35 mm and check that they rotate freely.

30 - Clutch

1 - Servicing clutch mechanism

1.1 - Servicing clutch mechanism



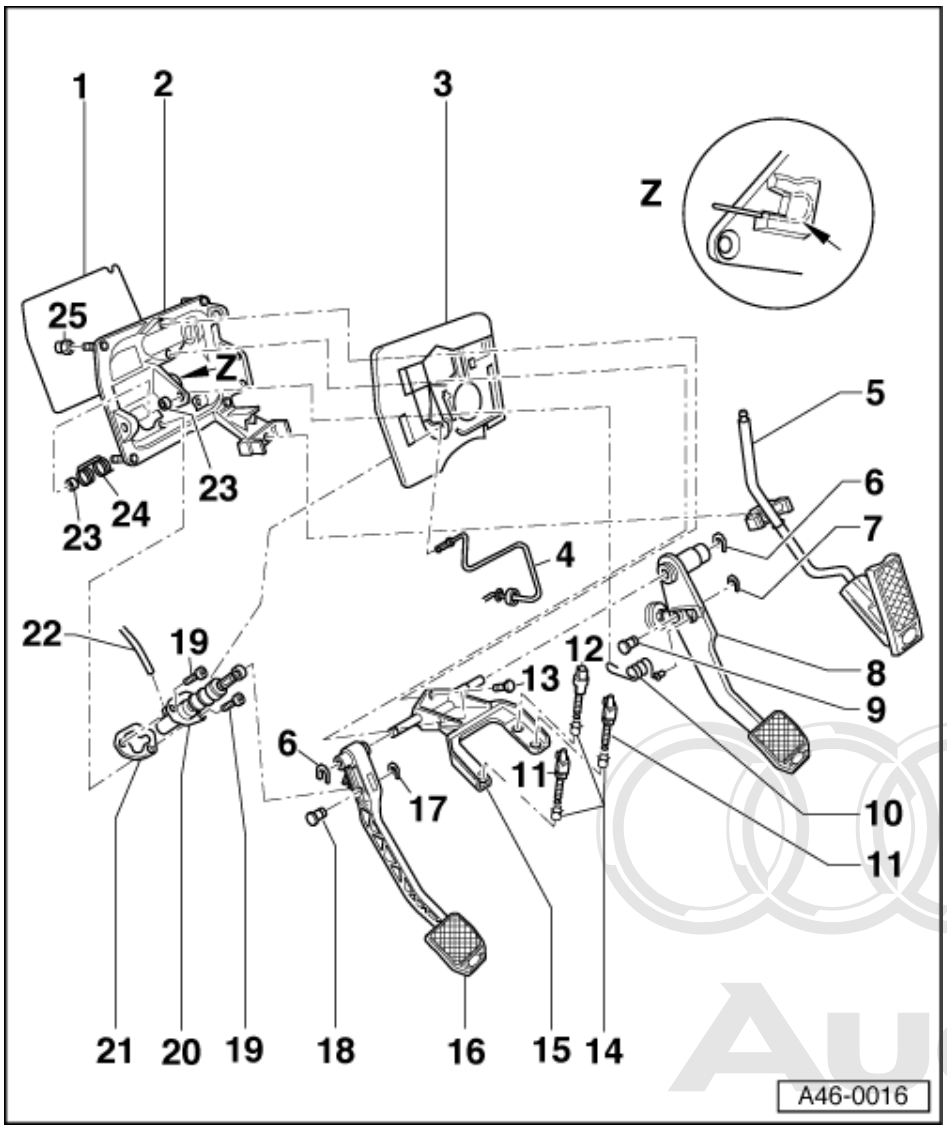
1.2 - Assembly overview, pedal cluster

Notes:

- Grease all bearing points 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

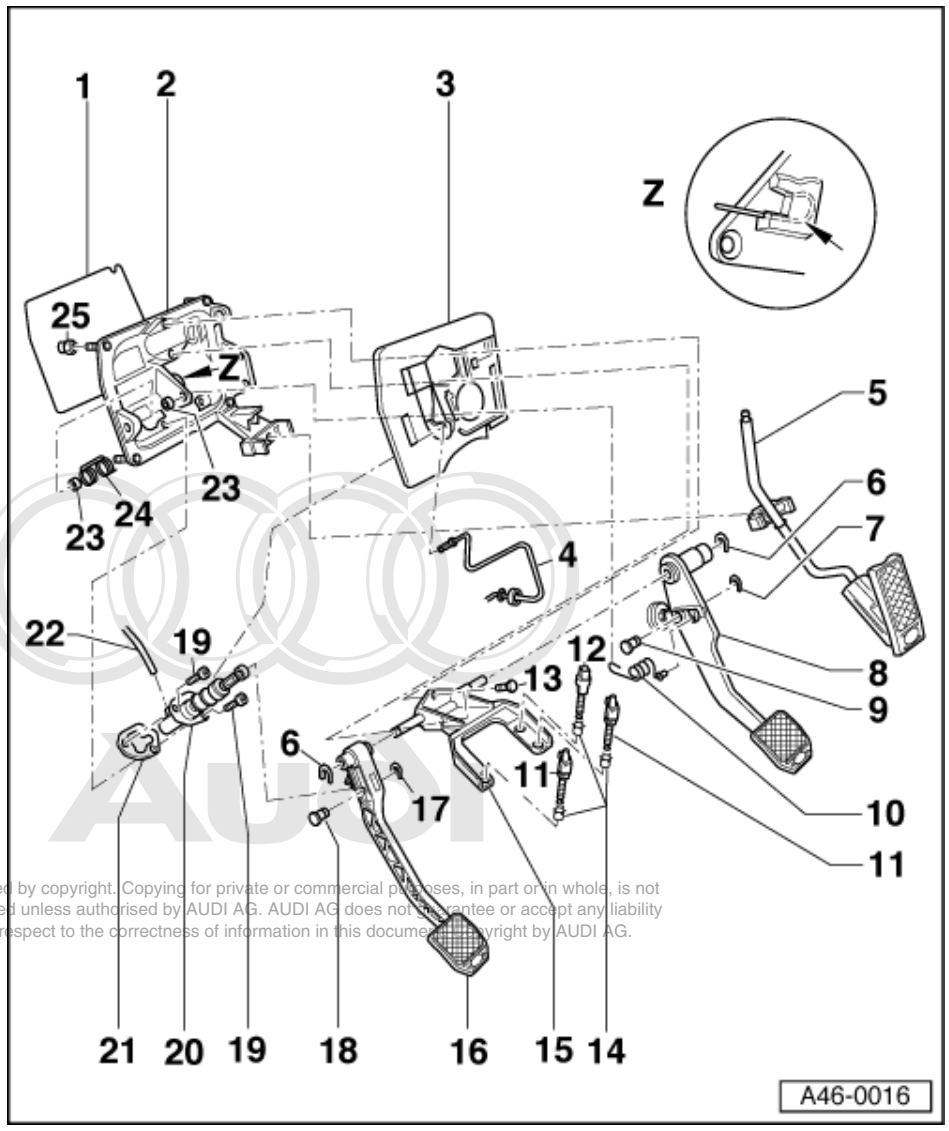
4 Pipe

- 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

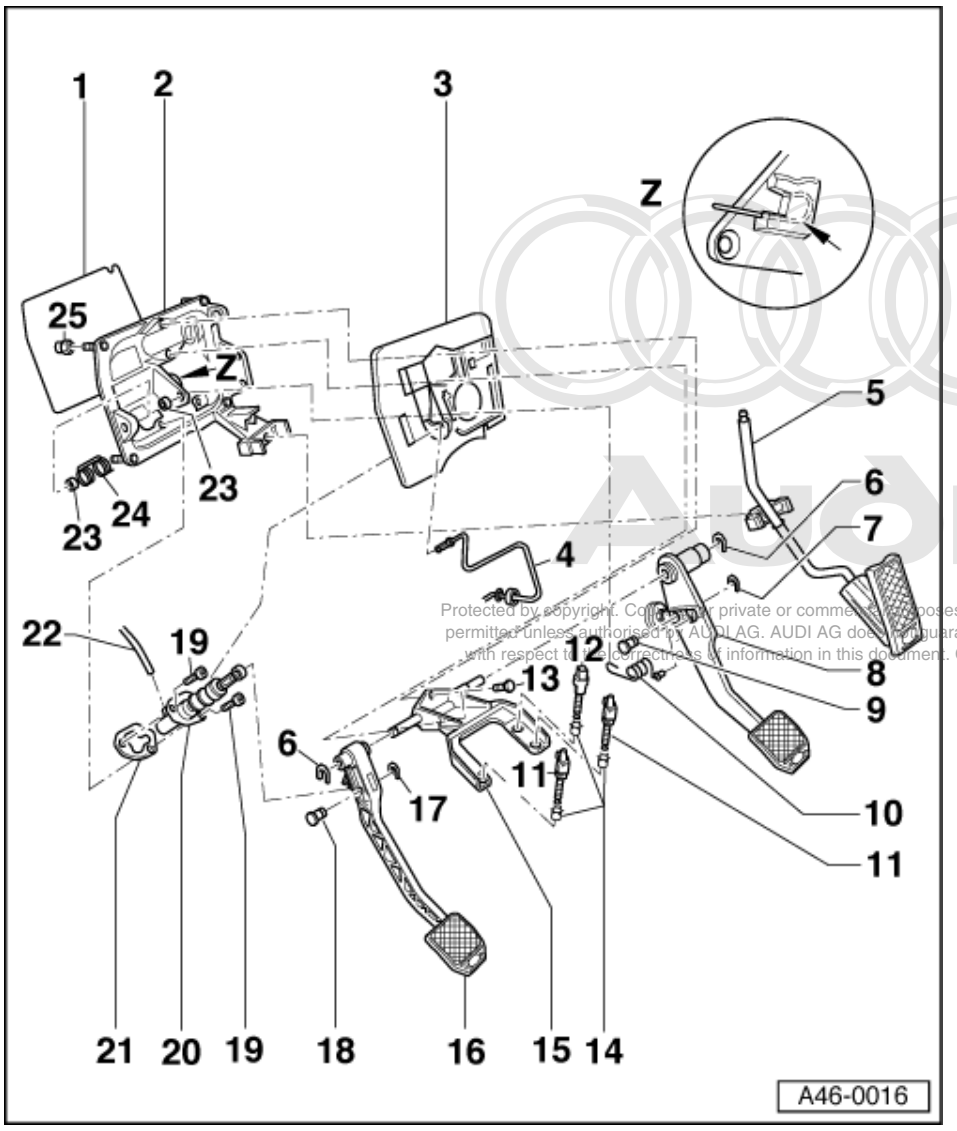
8 Brake pedal

- 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 Breather valve

- For cruise control system

12 Brake light switch

13 Bolt - 20 Nm

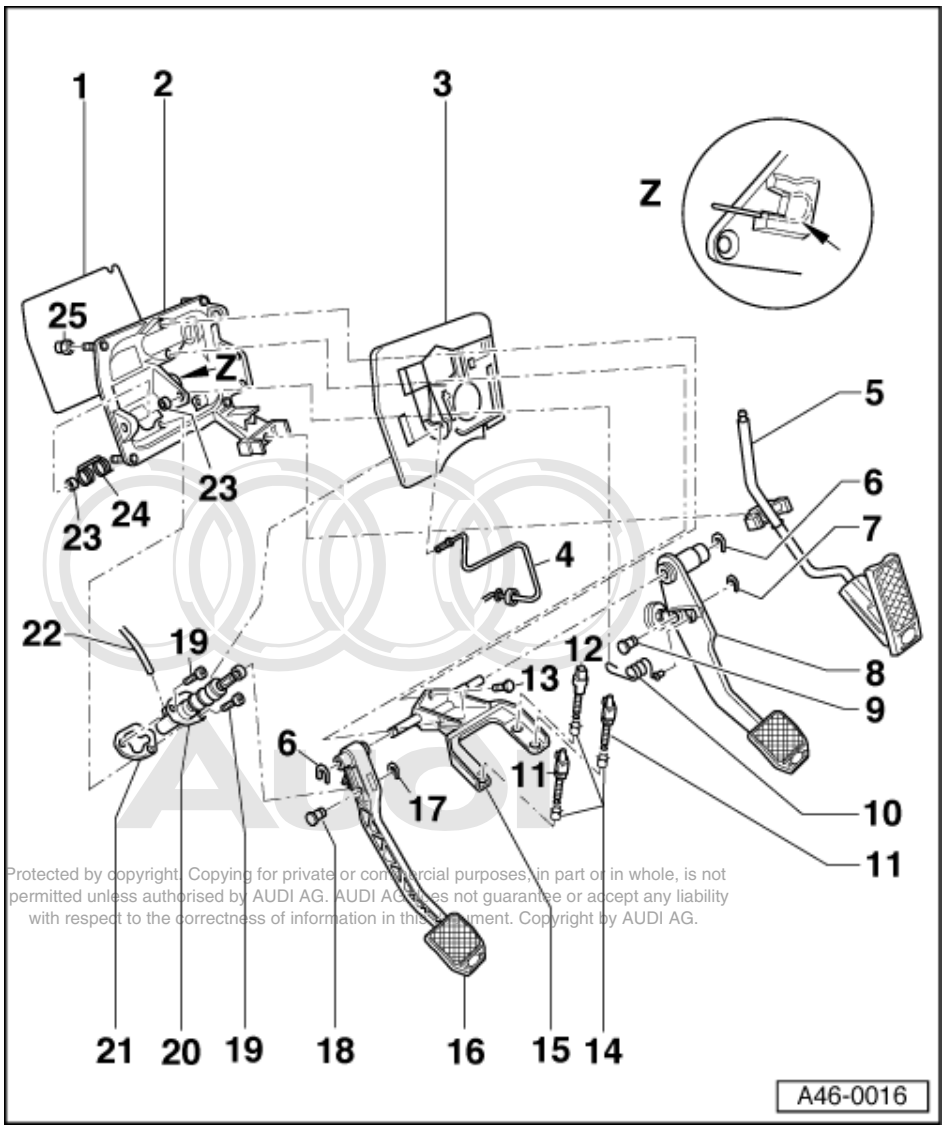
14 Clip

- 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



16 Clutch pedal

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

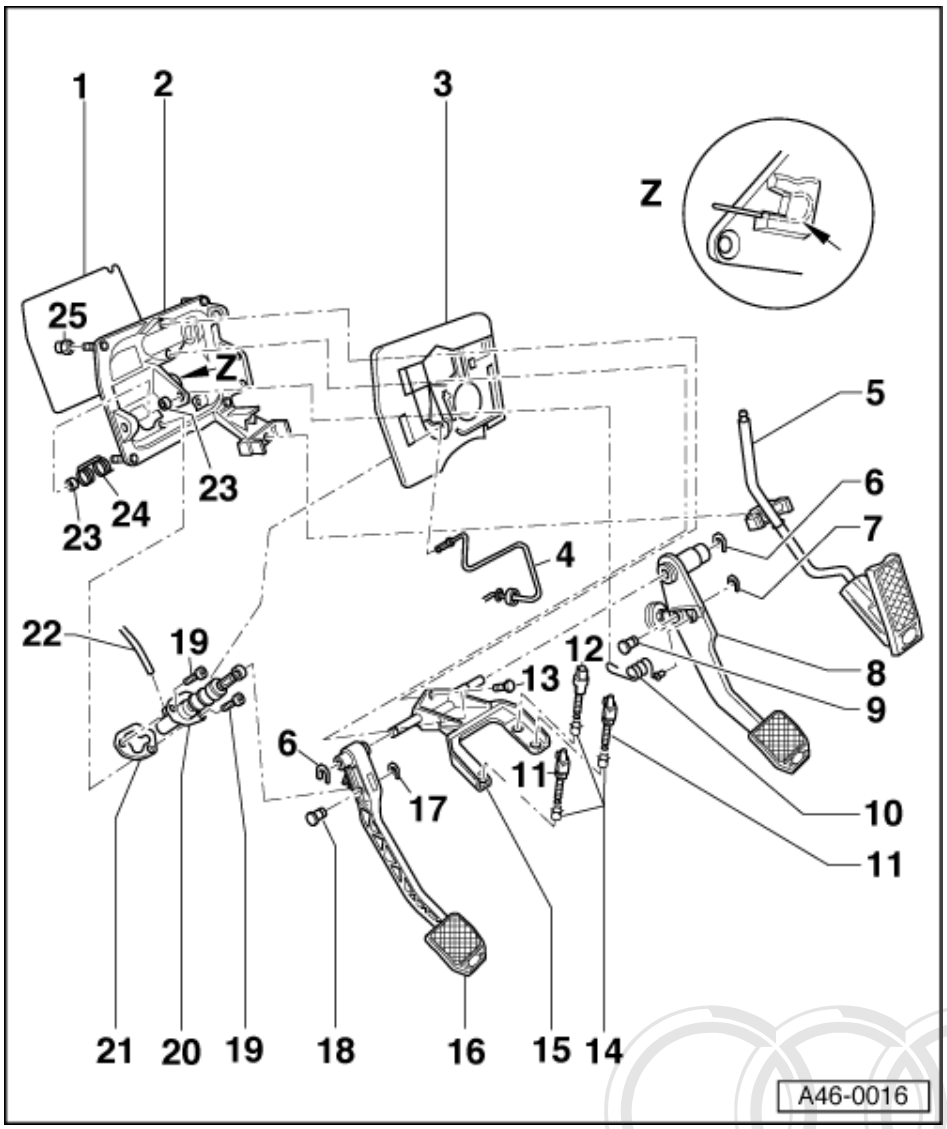
17 Circlip

- 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 17
- Adjusting plastic clevis => Fig. 1

21 Gasket

- Insert between pedal bracket and master cylinder

22 Supply hose

- Fit onto master cylinder

23 Bearing bush

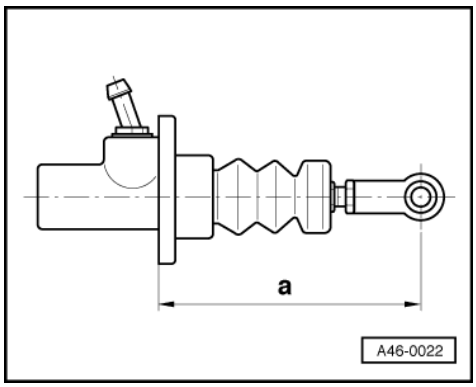
- Renew if damaged

24 Coil spring

- Do not grease
- Removing and installing => page 17

25 Hexagon nut - 20 Nm

- Always renew



-> Fig.1 Adjusting plastic clevis

- Turn plastic clevis to adjust.
  - Dimension a = 114.5 ± 0.5 mm
  - When measuring, the plastic clevis must be at right angles to the contact surface of the clutch master cylinder.

Notes:

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

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

1.3 - Removing and installing clutch pedal and coil spring

Removing

- Remove mounting bracket -item 14 .

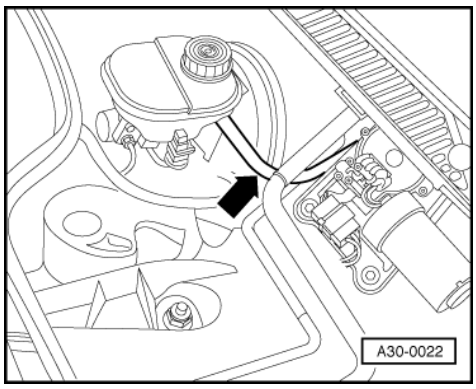
=> Running Gear Front and 4WD; Repair Group 46; Removing and installing pedal cluster; Removing mounting bracket Removing and installing pedal cluster Removing mounting bracket

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

Installing

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

1.4 - Removing and installing master cylinder

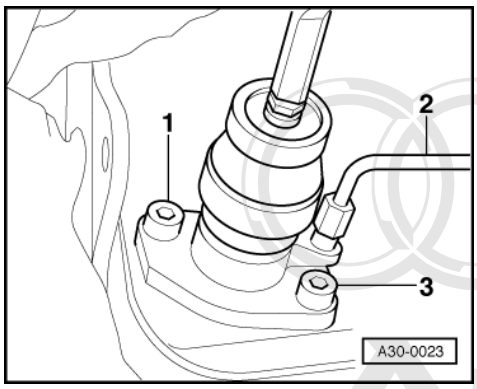


Removing

- Remove mounting bracket -item 14 .

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

- -> Clamp supply hose -arrow- for master cylinder and pull off master cylinder.



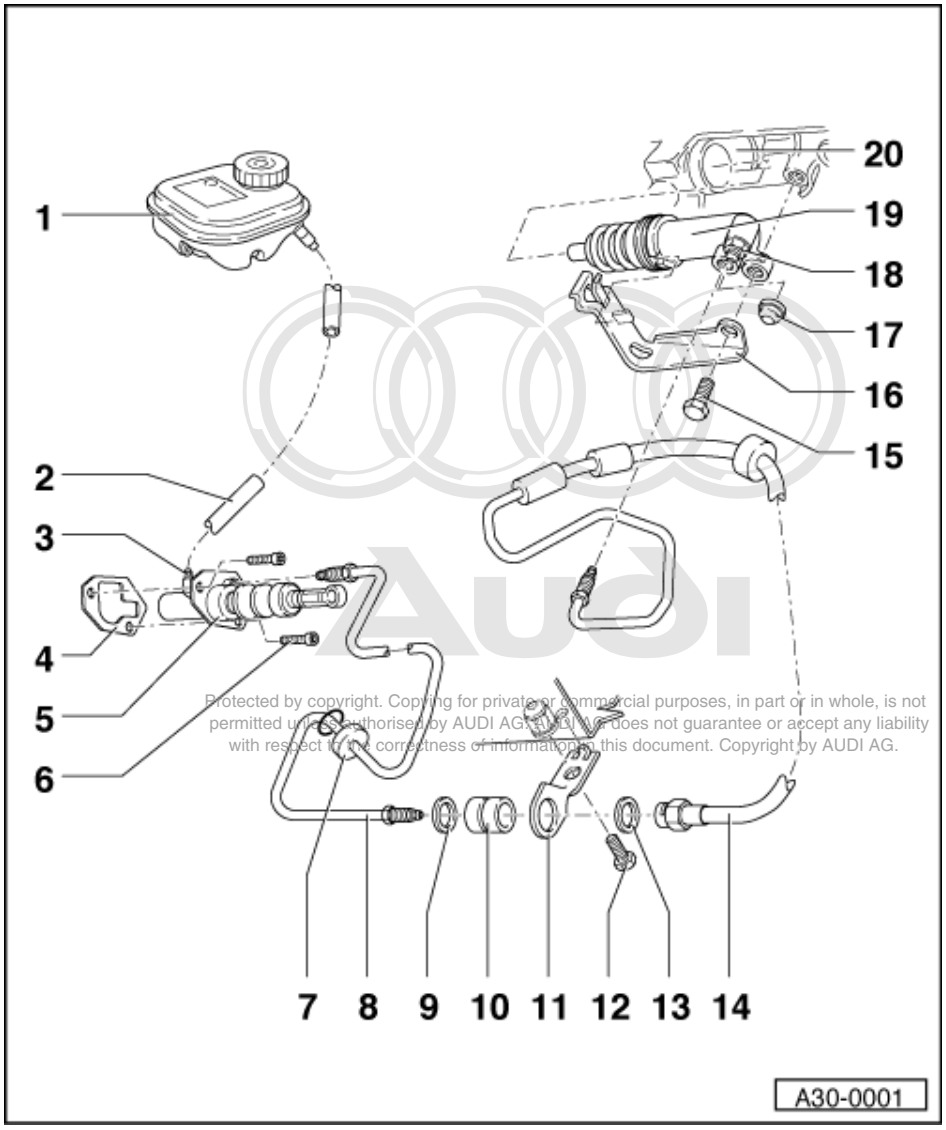
- -> Detach pipe -2- on master cylinder.
- Remove bolts -1- and -3-.
- Pull cylinder inwards.

Installing

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

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

1.5 - Assembly overview, hydraulics



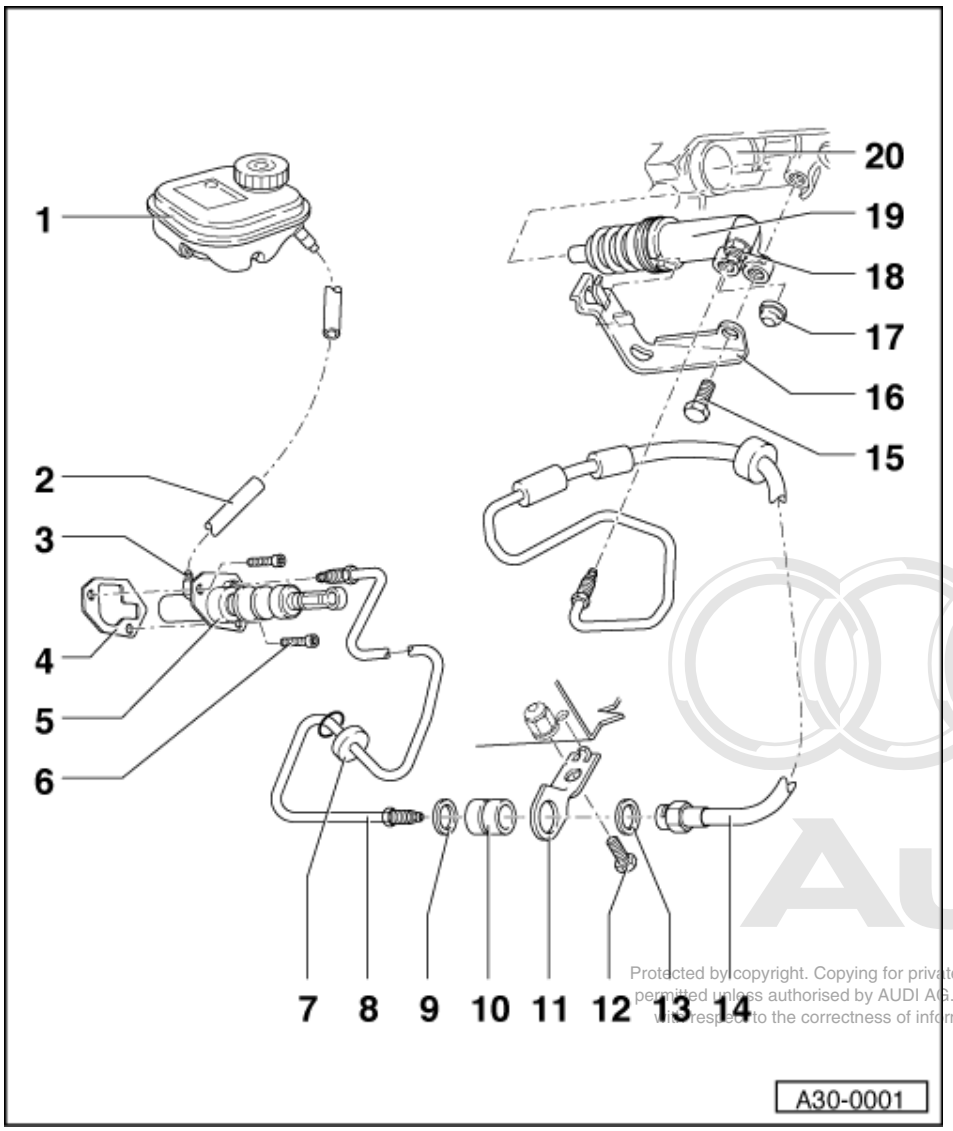
1 **Brake fluid reservoir**

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



6 Bolt - 20 Nm
- For securing master cylinder to pedal bracket

7 Grommet

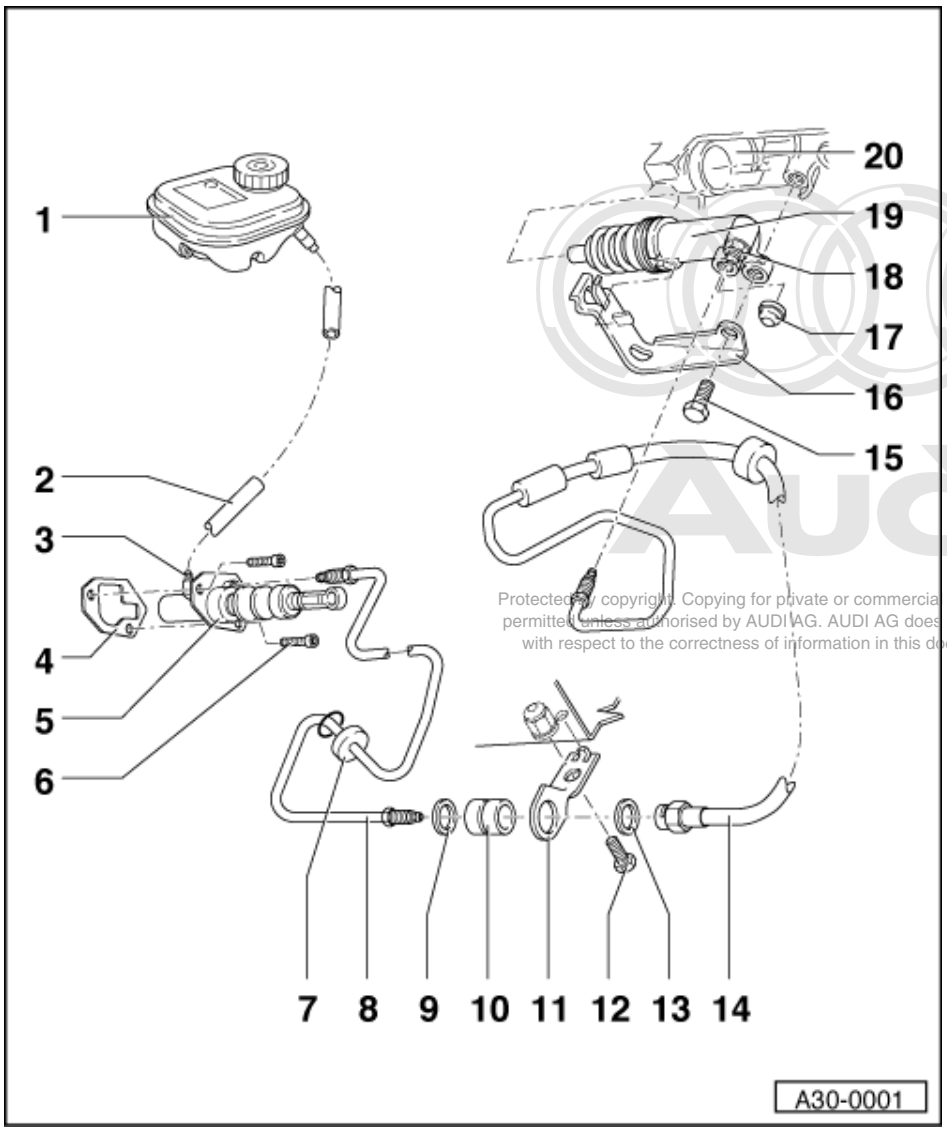
8 Pipe
- With pipe union nut
- 15 Nm

9 Washer

10 Bush

11 Bracket
- For clutch pipe

12 Bolt - 25 Nm



13 Washer

14 Hose/metal pipe

- With pipe union nut
- 15 Nm

15 Bolt - 25 Nm

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

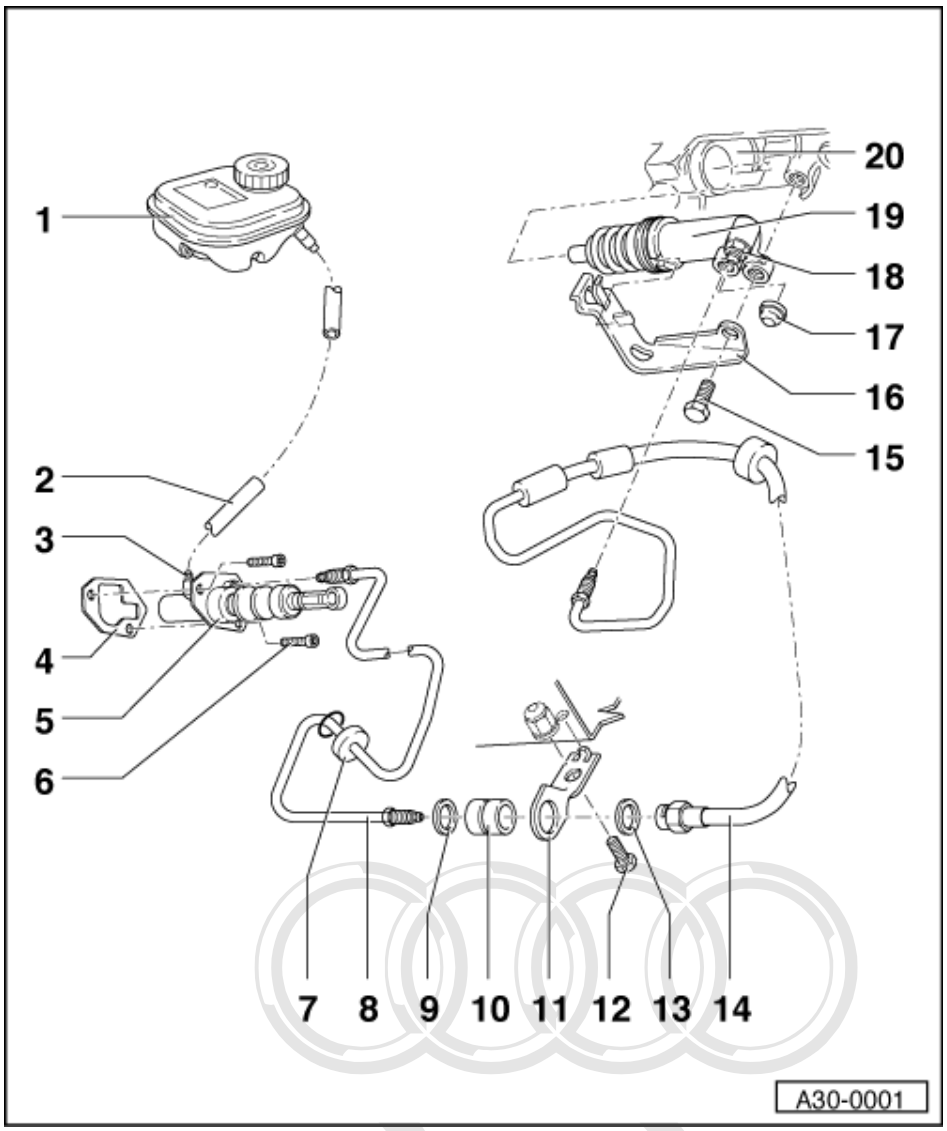
16 Bracket

- For clutch pipe

17 Dust cap

18 Bleed valve

- Bleeding => page 22



19 Slave cylinder

- Do not depress clutch pedal after removing slave cylinder
- On slave cylinders with plastic support ring, grease outer surface of ring when installing
- Installing => Fig. 28
- After working on hydraulic clutch mechanism, bleed slave cylinder => Page 22

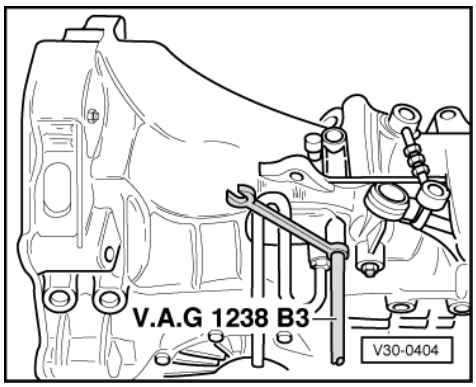
20 Gearbox

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 pressure hose of brake bleeding unit collector bottle.



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

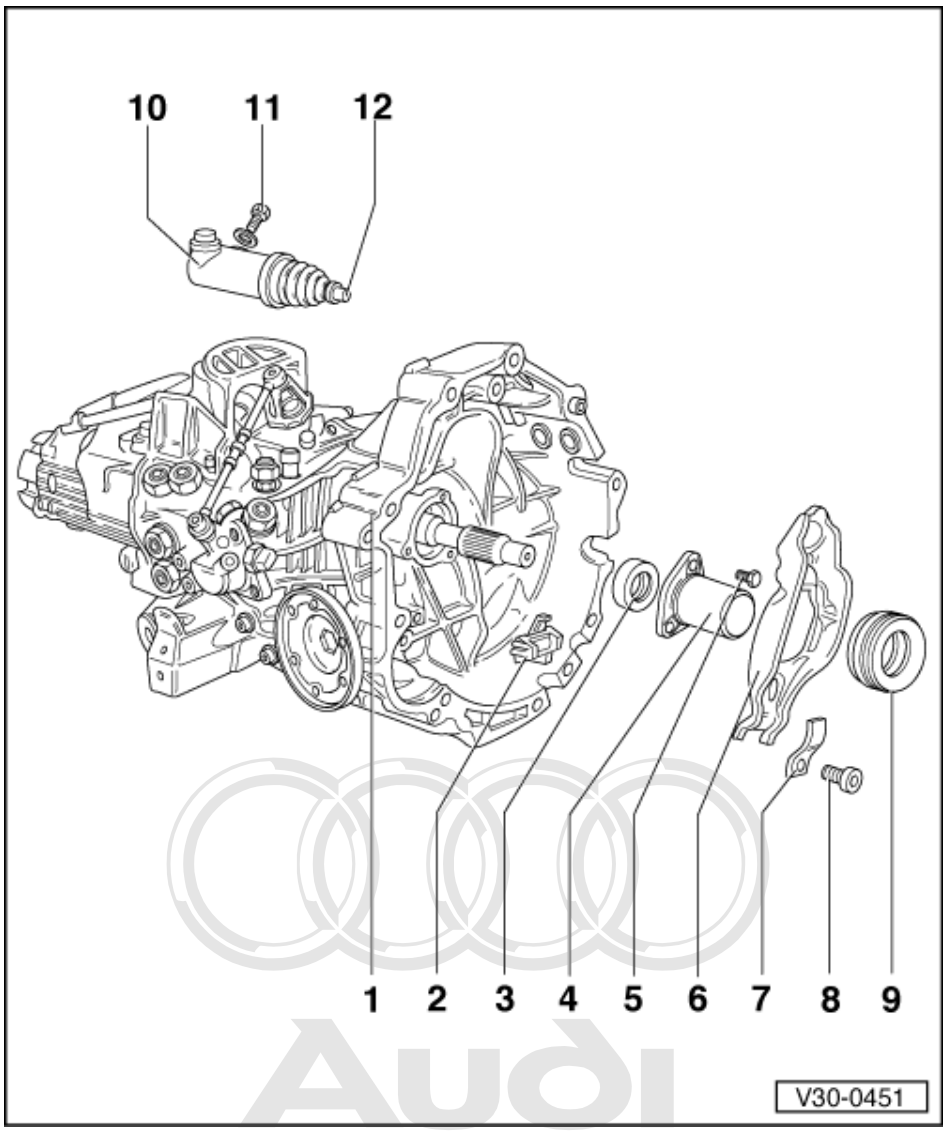
Note:

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

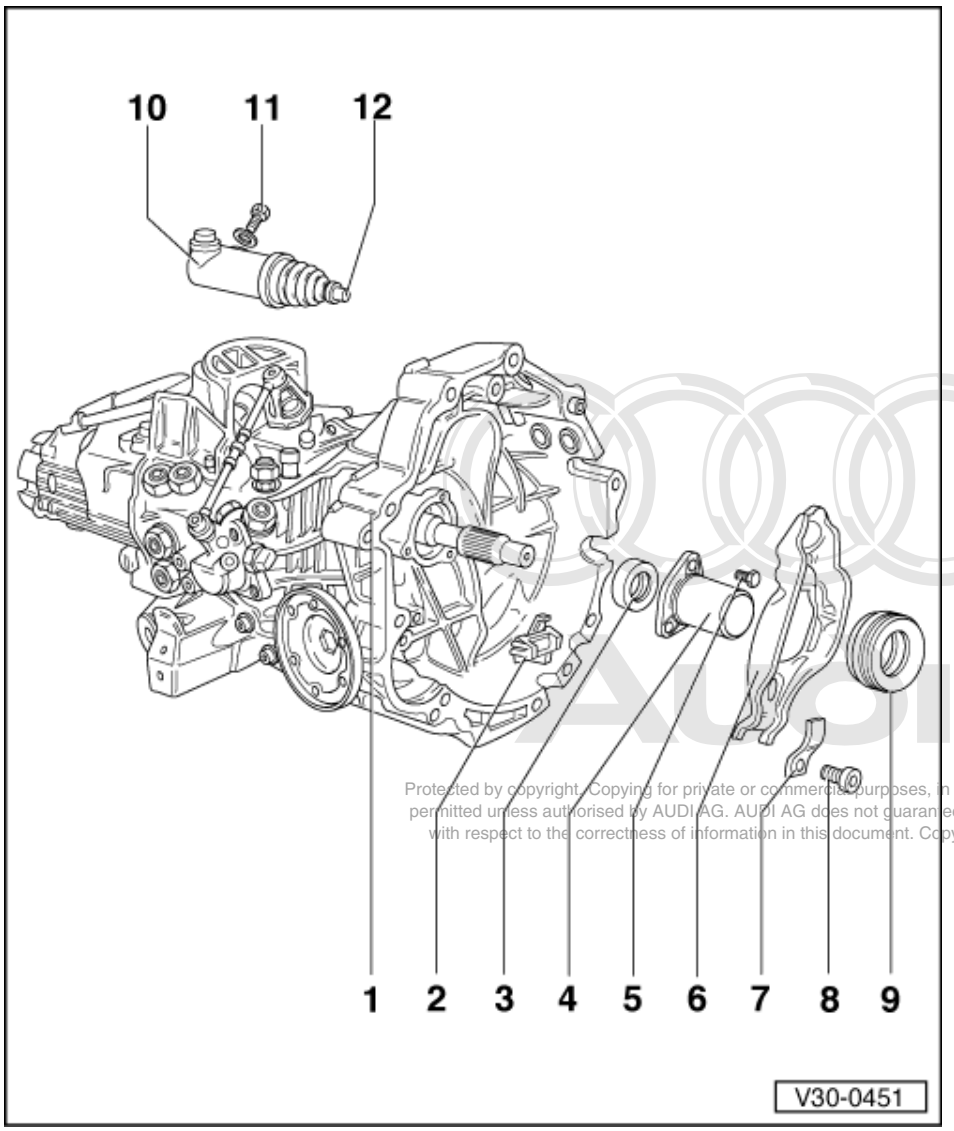
3 Shaft seal

- For input shaft
- Removing => Fig. 1
- Installing => Fig. 2
- Insertion depth 3.5 mm

4 Guide sleeve

5 Bolt - 15 Nm

- Qty. 3



6 Clutch release lever

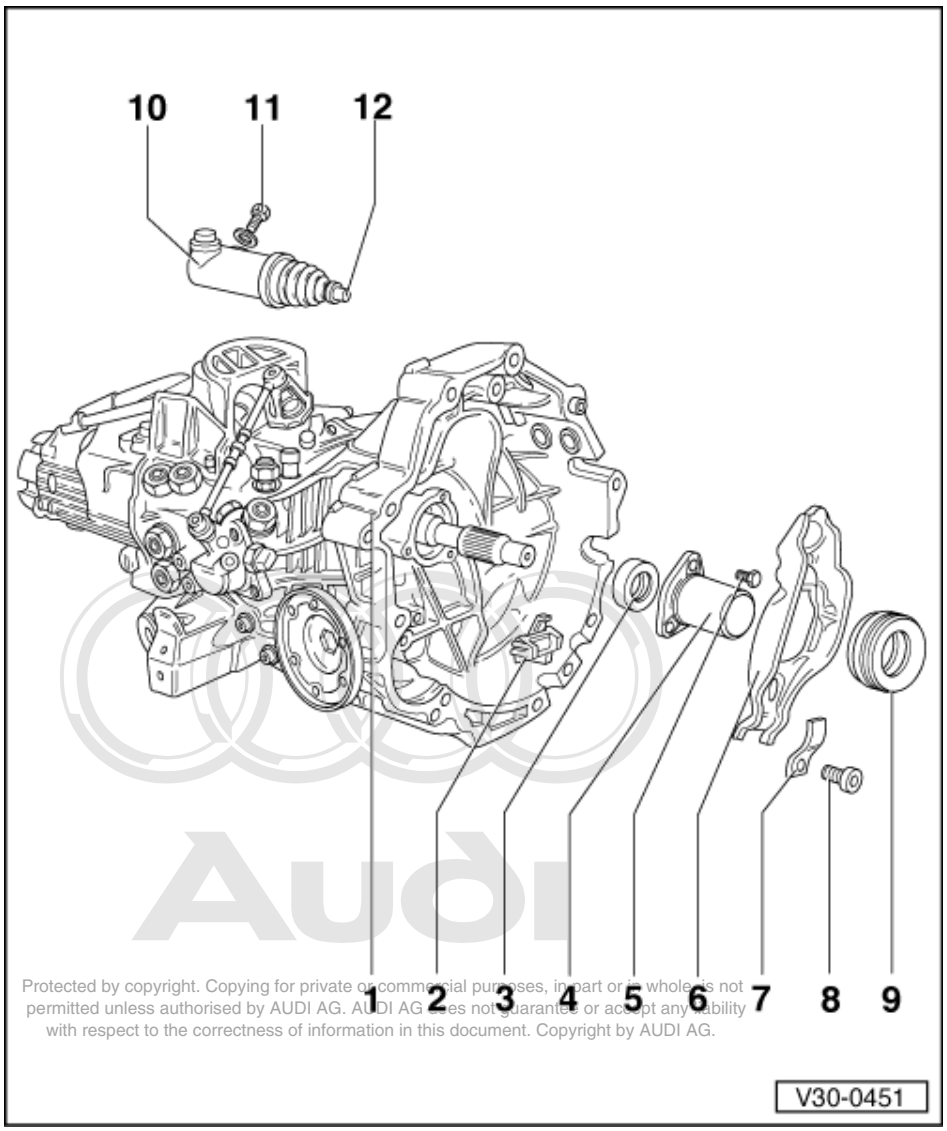
- Must engage in the lugs in intermediate piece when installed => Fig. 3
- Before installing, coat clutch slave cylinder push rod contact surface with a thin layer of copper grease, e.g. 381 351 TE

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



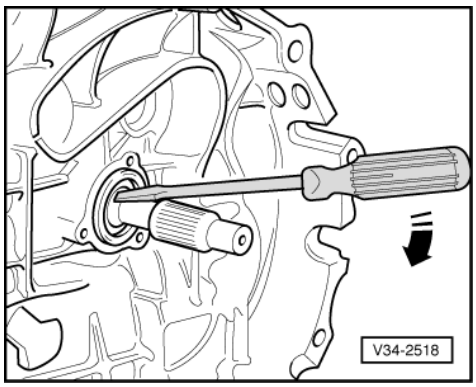
10 Clutch slave cylinder

- Bleeding clutch system => Page 22
- 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

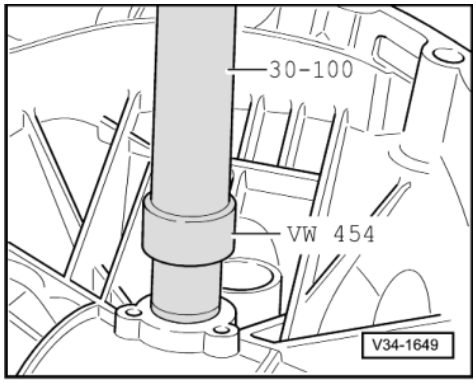


-> Fig.1 Removing shaft seal for input shaft

- Lever seal out carefully with a screwdriver.

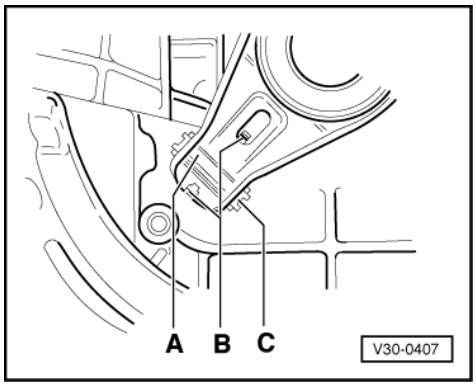
Note:

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



-> Fig.2 Installing shaft seal for input shaft

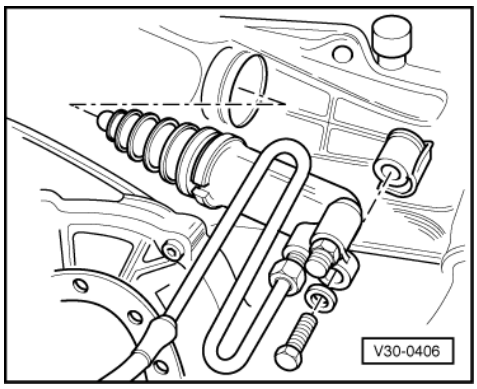
- Pack space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over input shaft splines.
- Drive on seal for input shaft.
  - Insertion depth: 3.5 mm
- Remove protective hose.



-> Fig.3 Installing clutch release lever

- Insert clutch release lever -A- into intermediate piece -C- and engage (locking device -B- is visible).

- Insert leaf spring (-item 25) to 25 Nm.



-> Fig.4 Installing clutch slave cylinder

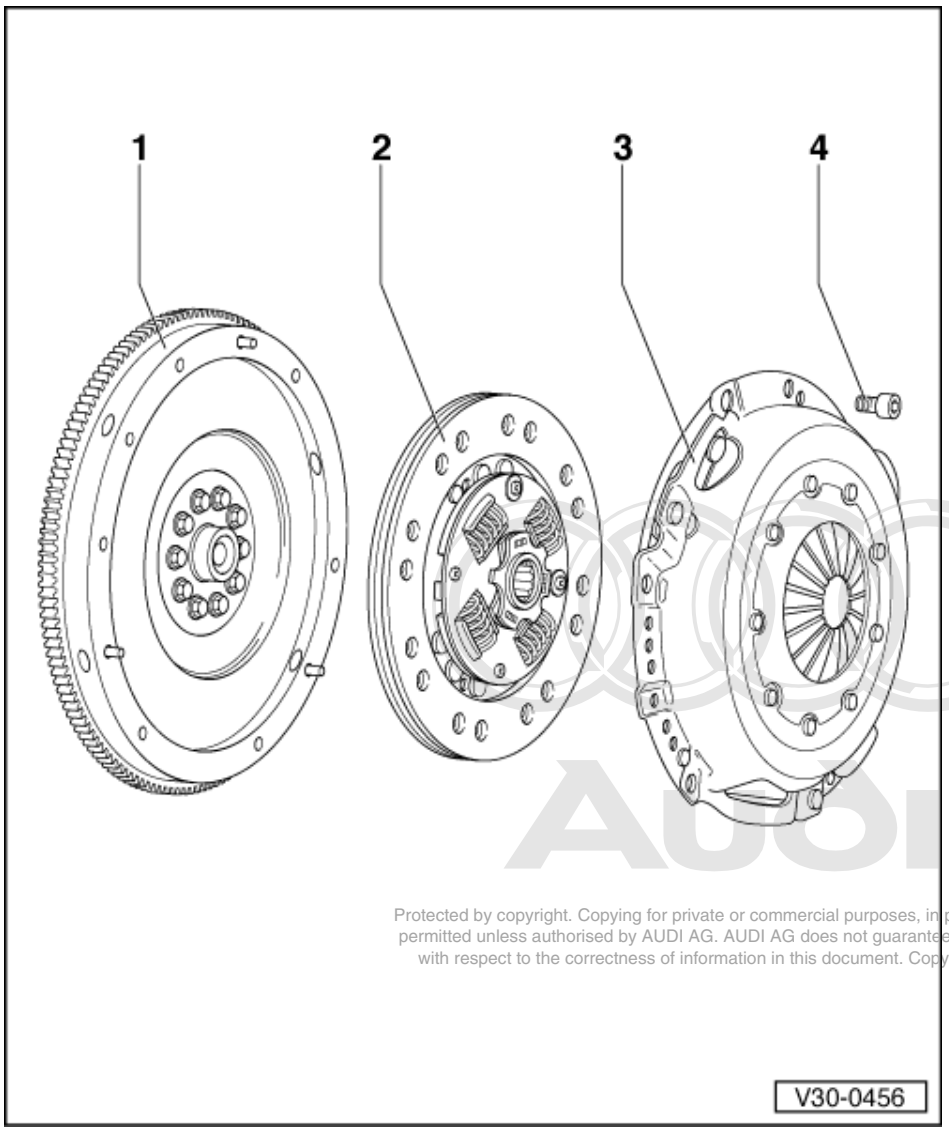
- When inserting the clutch slave cylinder into the mounting hole of the gearbox housing, keep it as far as possible in line with the direction of operation of the push rod.

Notes:

- 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



- Remove gearbox to work on clutch => page 50 .

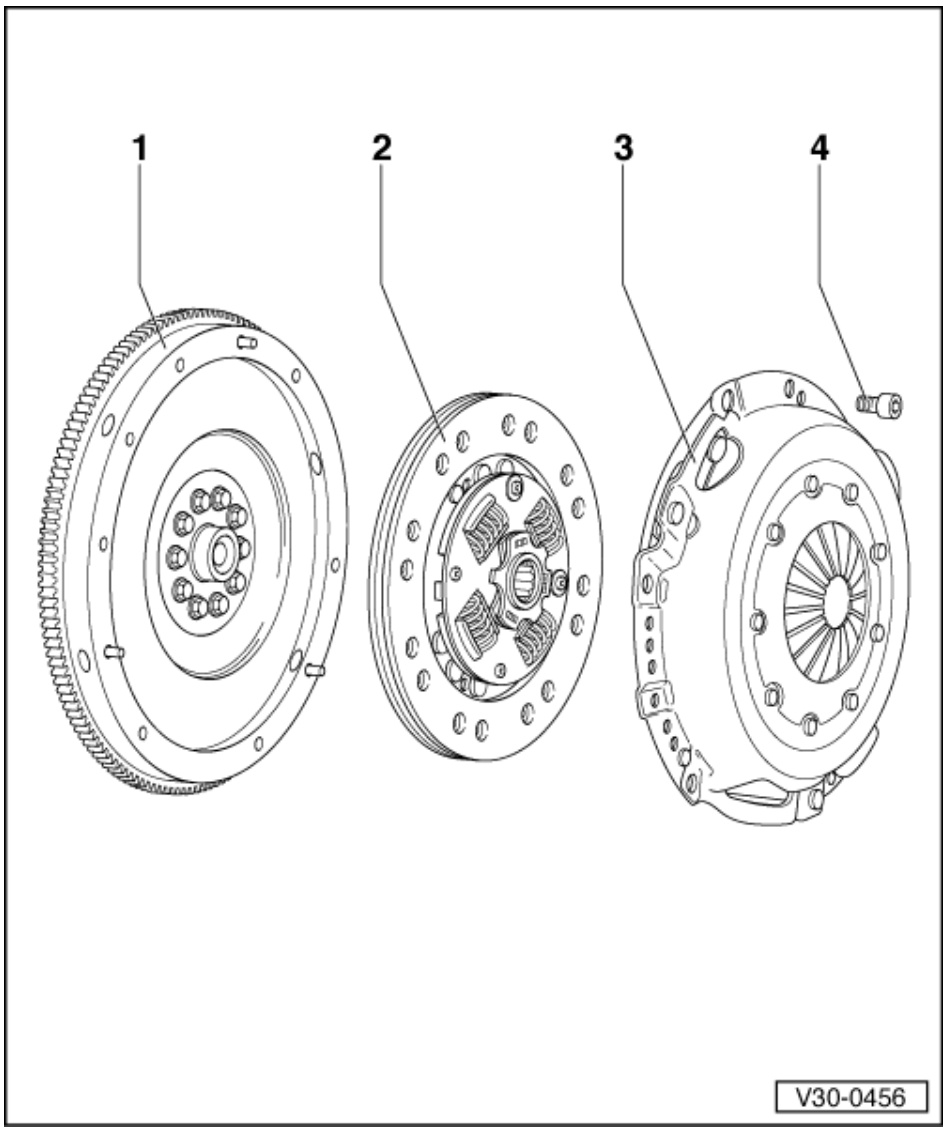
1 Flywheel

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

=> 8-cylinder Engine, Mechanics; Repair Group 15; Servicing valve gear; Servicing flywheel Servicing valve gear Servicing flywheel

- Removing and installing needle bearing in flywheel

=> 8-cylinder Engine, Mechanics; Repair Group 15; Servicing valve gear; Servicing flywheel Servicing valve gear Servicing flywheel



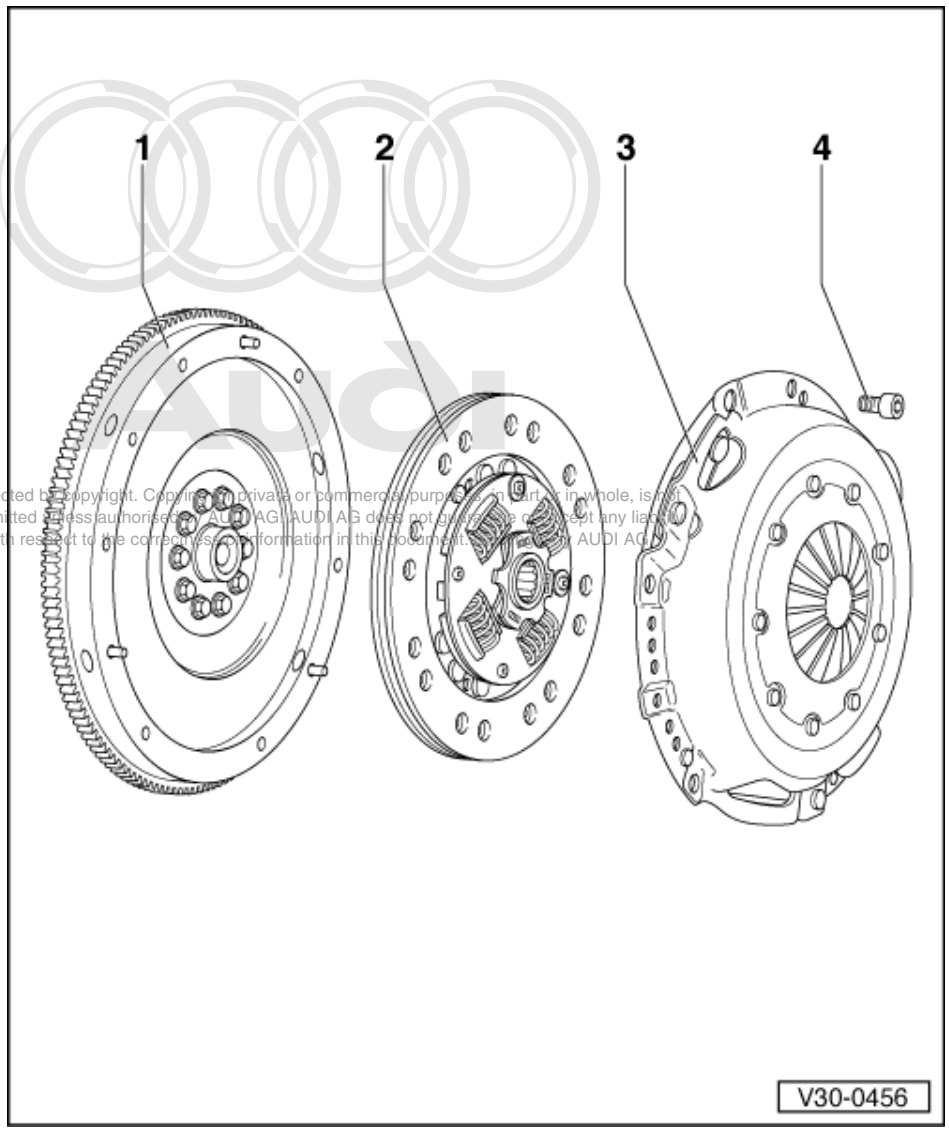
2 Clutch plate

- Installation position: Spring pack (coil springs) towards pressure plate or gearbox
- Centring => Fig. 1
- Do not grease
- => Notes
- Clutch plate diameter => from page 2

Notes:

- 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



3 Pressure plate

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

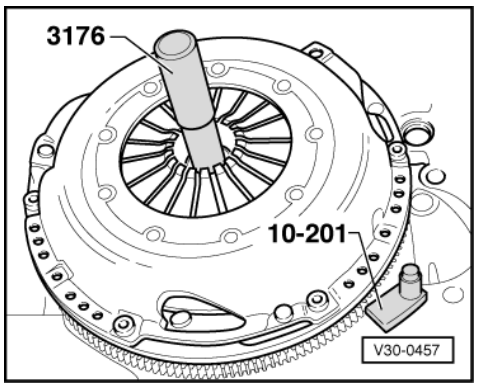
Notes:

- 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

4 Bolt - 25 Nm

- Tighten in stages and diagonally

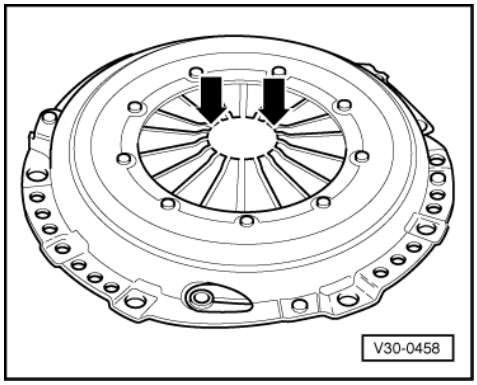


-> Fig.1 Removing and installing clutch

- 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:

- Pressure plate must make full contact with flywheel. Only then insert securing bolts.
- Do not on any account force pressure plate down by tightening the bolts, otherwise pressure plate centring holes and flywheel centring pins will be damaged.

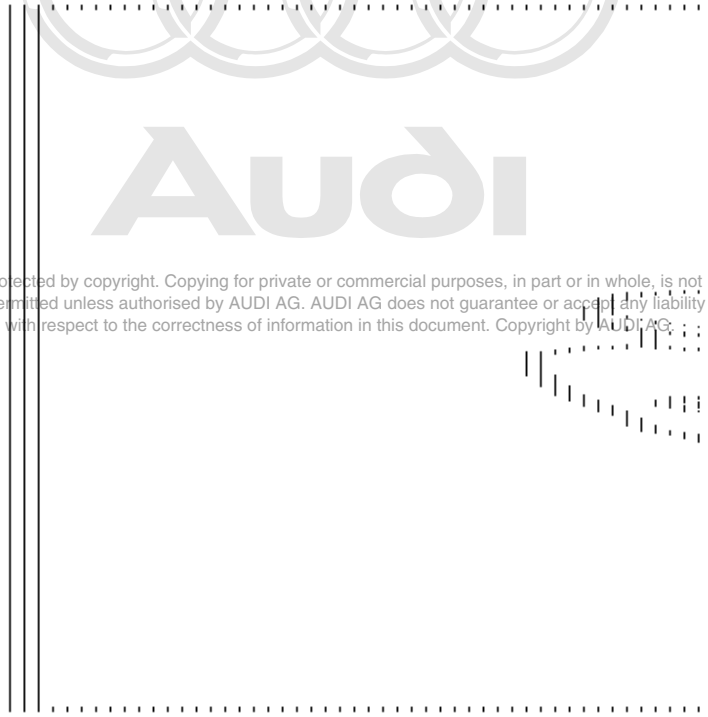


-> Fig.2 Checking ends of diaphragm spring

- 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).



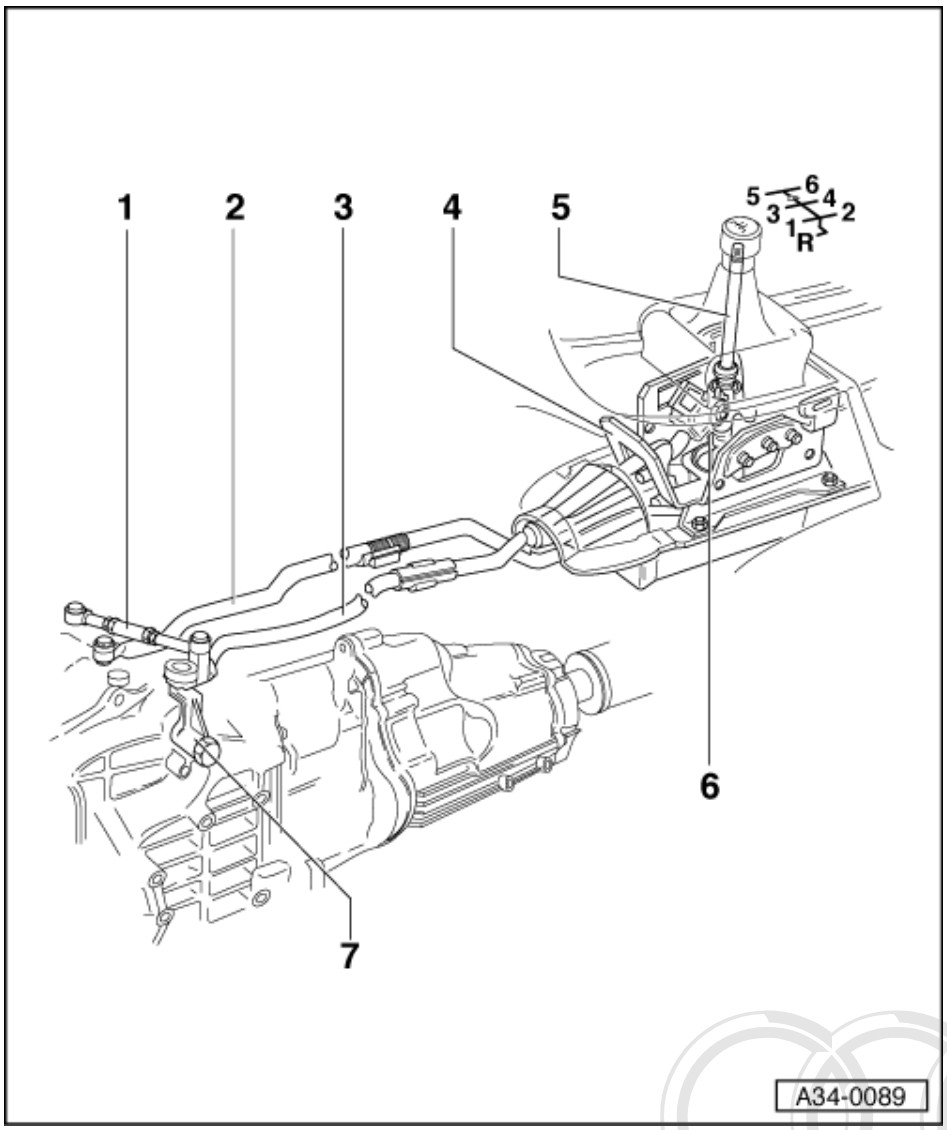
-> Fig.3 Checking spring connection and riveted fastenings

- 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-.

34 - Controls, Housing

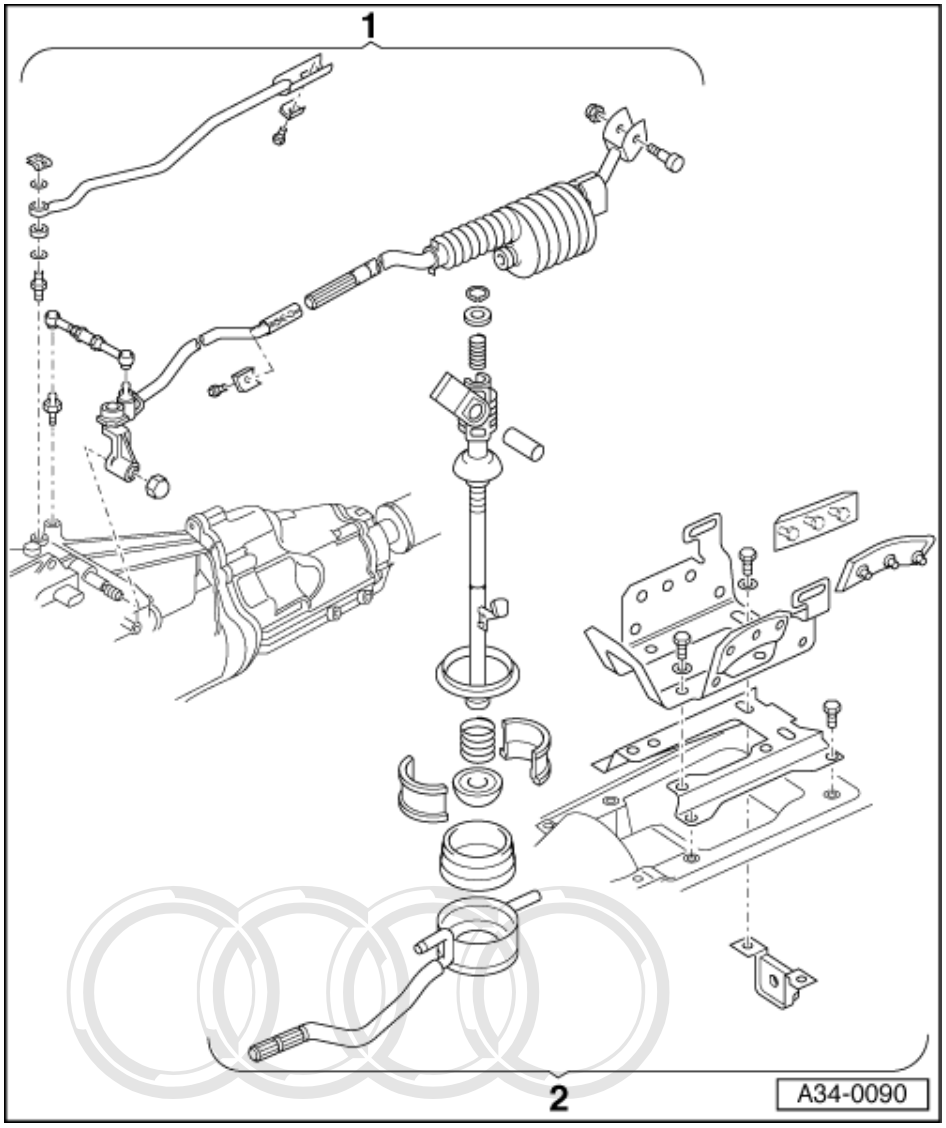
1 - Servicing selector mechanism

1.1 - Servicing selector mechanism



1 Connecting rod
2 Push rod
3 Selector rod
4 Stop
5 Gear stick
6 Gear stick mounting
7 Selector lever on gearbox

1.2 - Dismantling and assembling selector mechanism



Note:

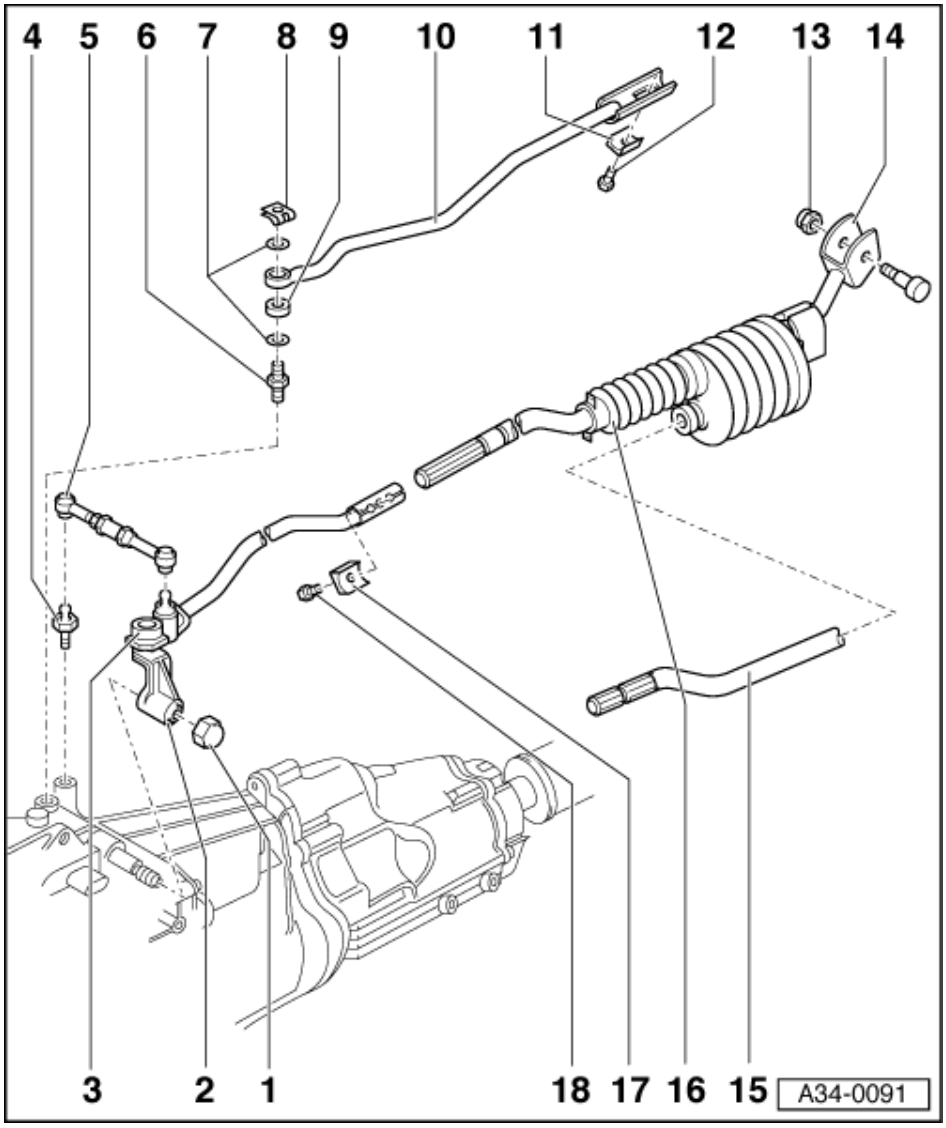
Grease all joints and sliding surfaces with polycarbamide grease G 052 142 A2.

- Removing and installing selector rods => Page 43 .
- Removing and installing push rods => Page 44 .
- Adjusting and checking selector mechanism => Page 47 .

1 **Selector rod and front push rod**
- Servicing => Page 36

2 **Gear stick and rear push rod**
- Servicing => Page 39

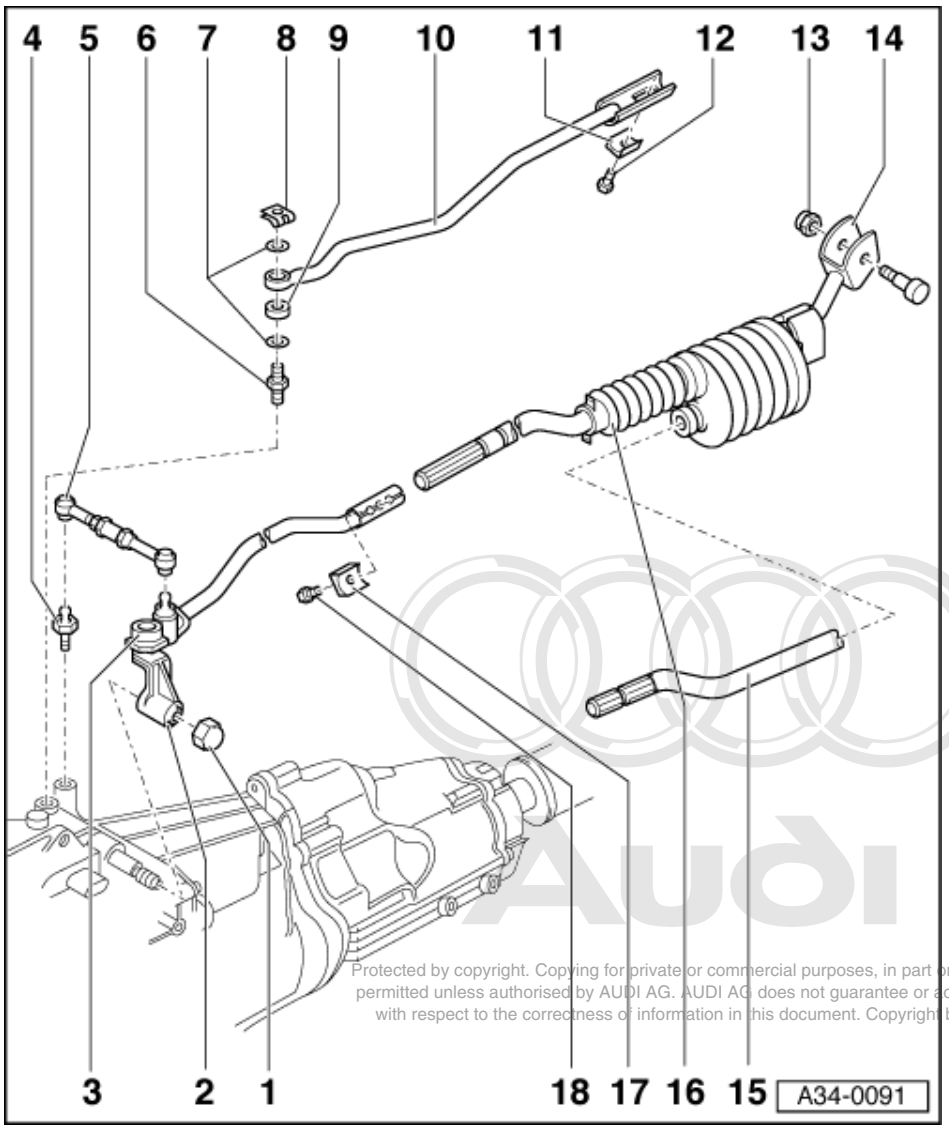
1.3 - Servicing selector rod and front push rod



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 -

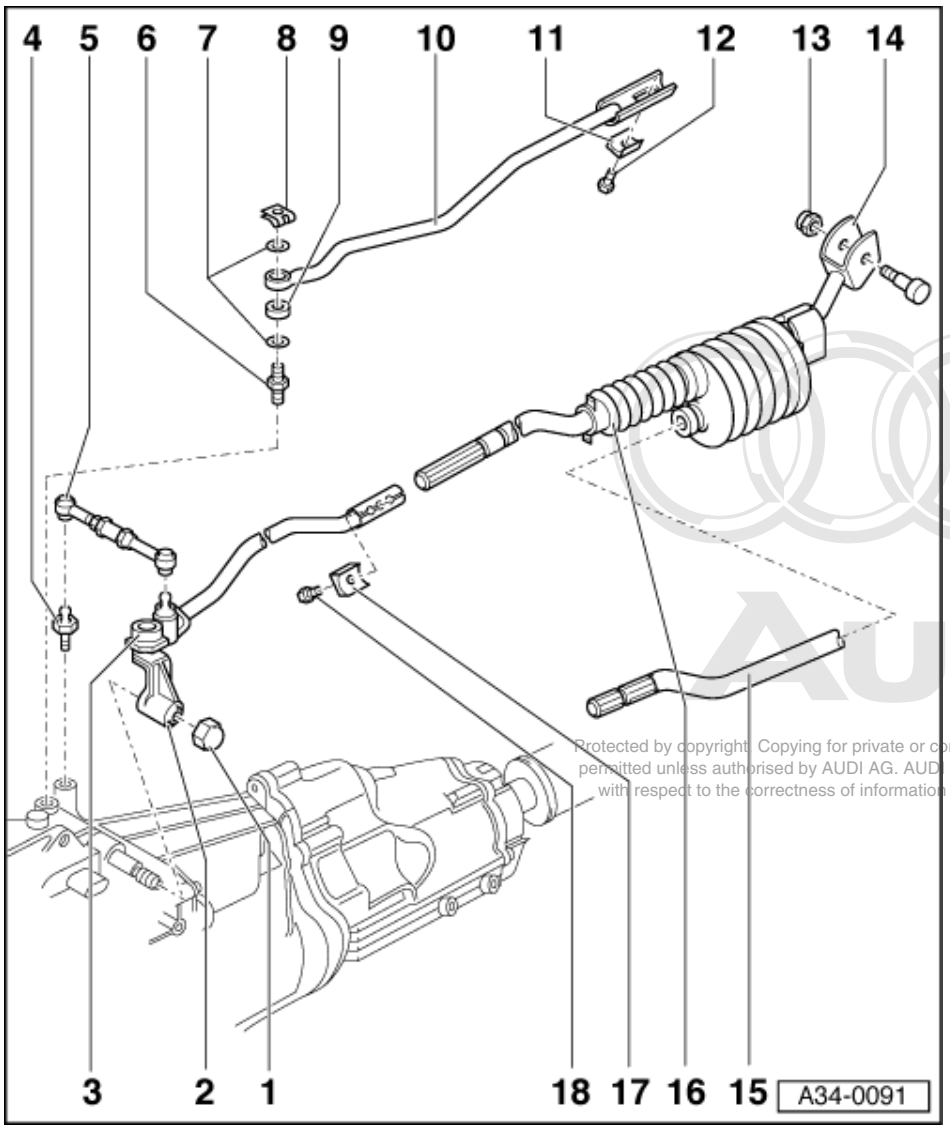
4 Ball stud - 15 Nm
5 Connecting rod
- Adjusting => Page 47



6 Trunion bolt - 40 Nm
7 Washer
8 Securing clip
9 Bearing
10 Front push rod
- Removing and installing =>Page 44

11 Clamp
12 Bolt - 25 Nm
13 Lock nut - 10 Nm
- Always renew

14 Rear selector rod
- Removing and installing =>Page 43



15 Rear push rod

- Removing and installing =>Page 44

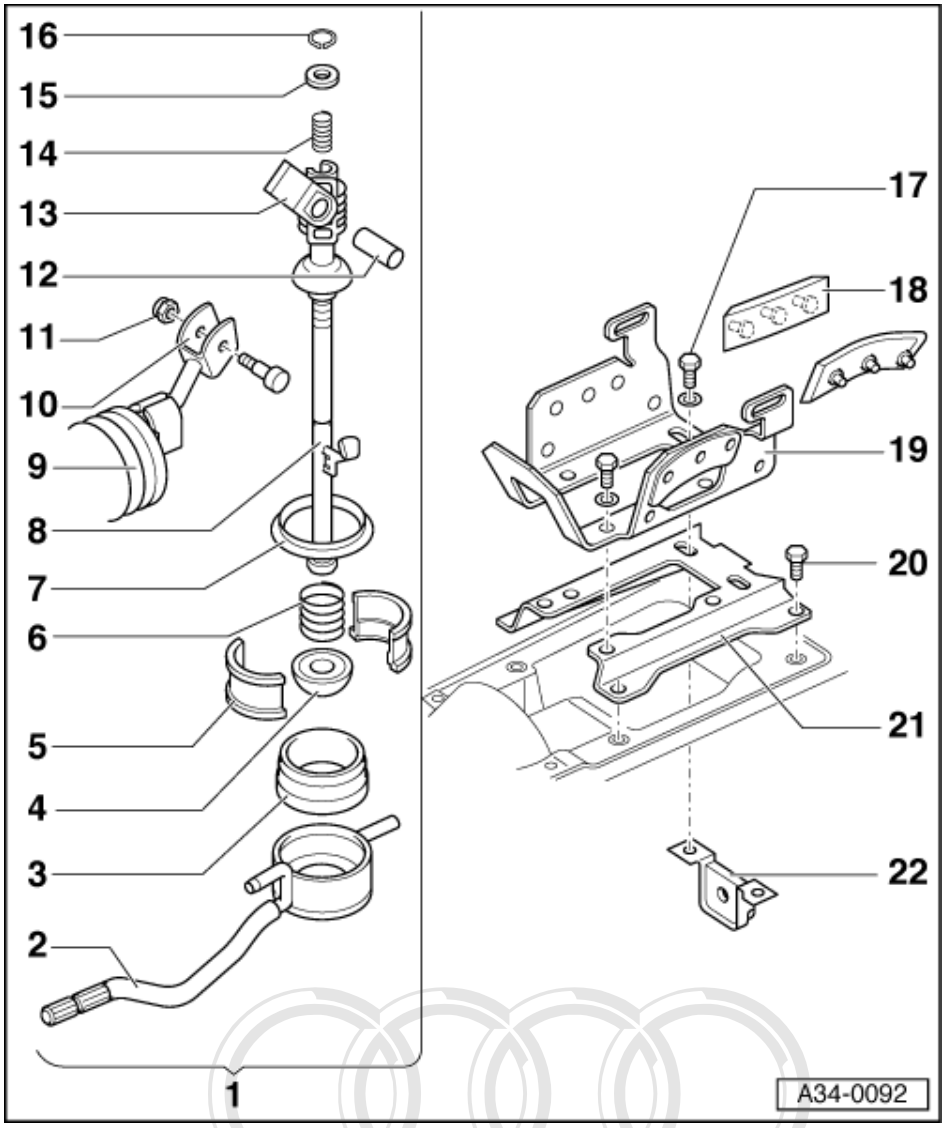
16 Sleeve

- Install boot so that marking lug is on top

17 Clamp

18 Bolt - 25 Nm

1.4 - Servicing gear stick and rear push rod

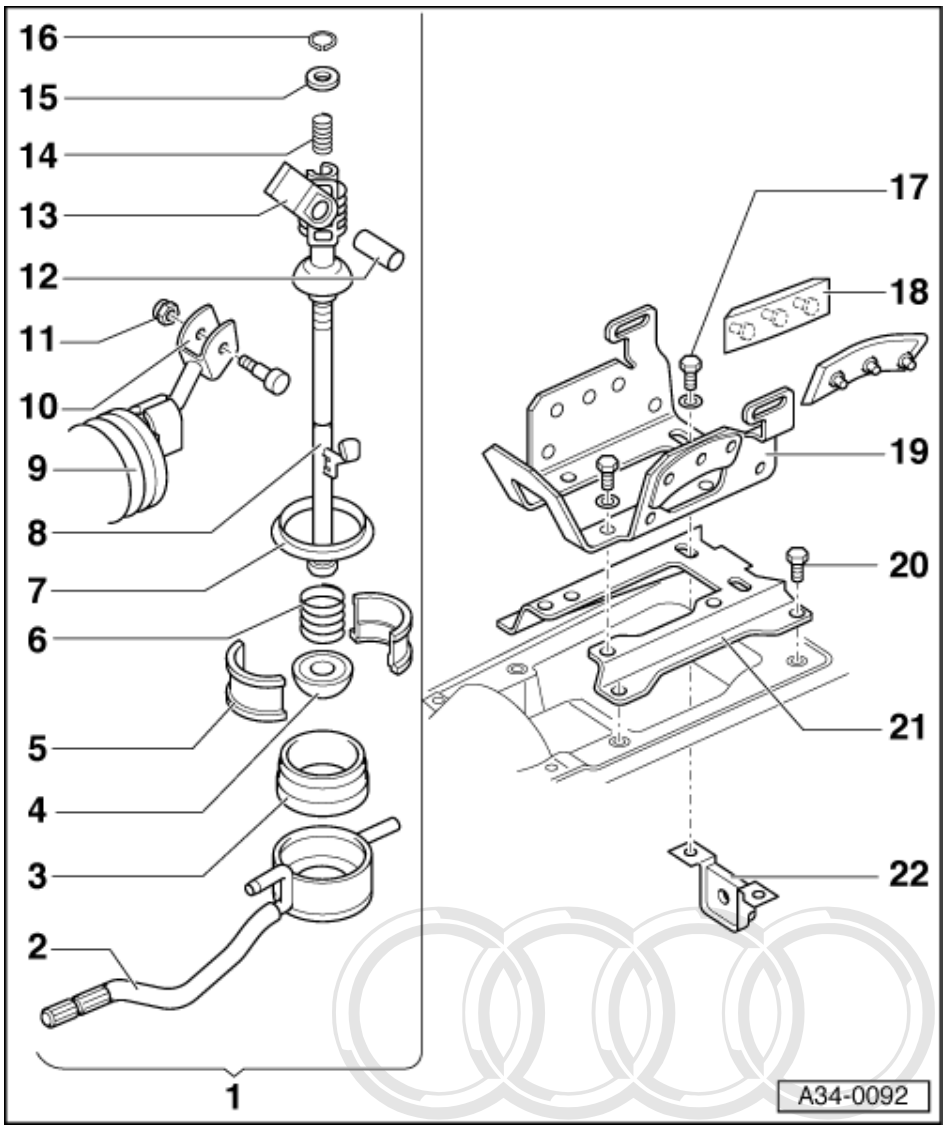


1 Gear stick complete

- 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 and peen gear stick mounting at three points so that the intermediate plate is secure => Fig. 1 .

- Adjusting => Page 47



2 Rear push rod

- With gear stick mounting, bearing pin and catch pin
- Adjusting => Page 49

3 Rubber guide

- Installation position: shoulder faces up

4 Lower hemispherical ball

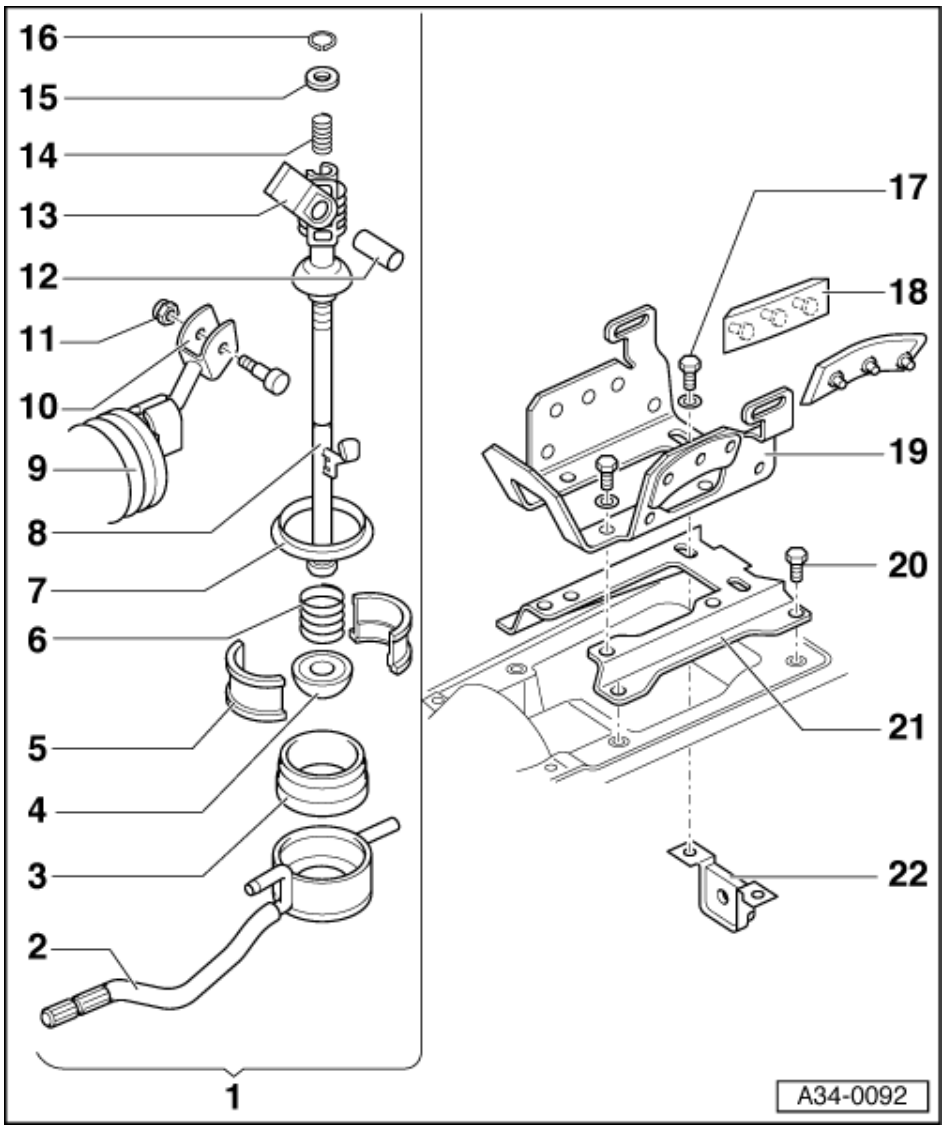
5 Shell section

6 Spring

7 Intermediate plate

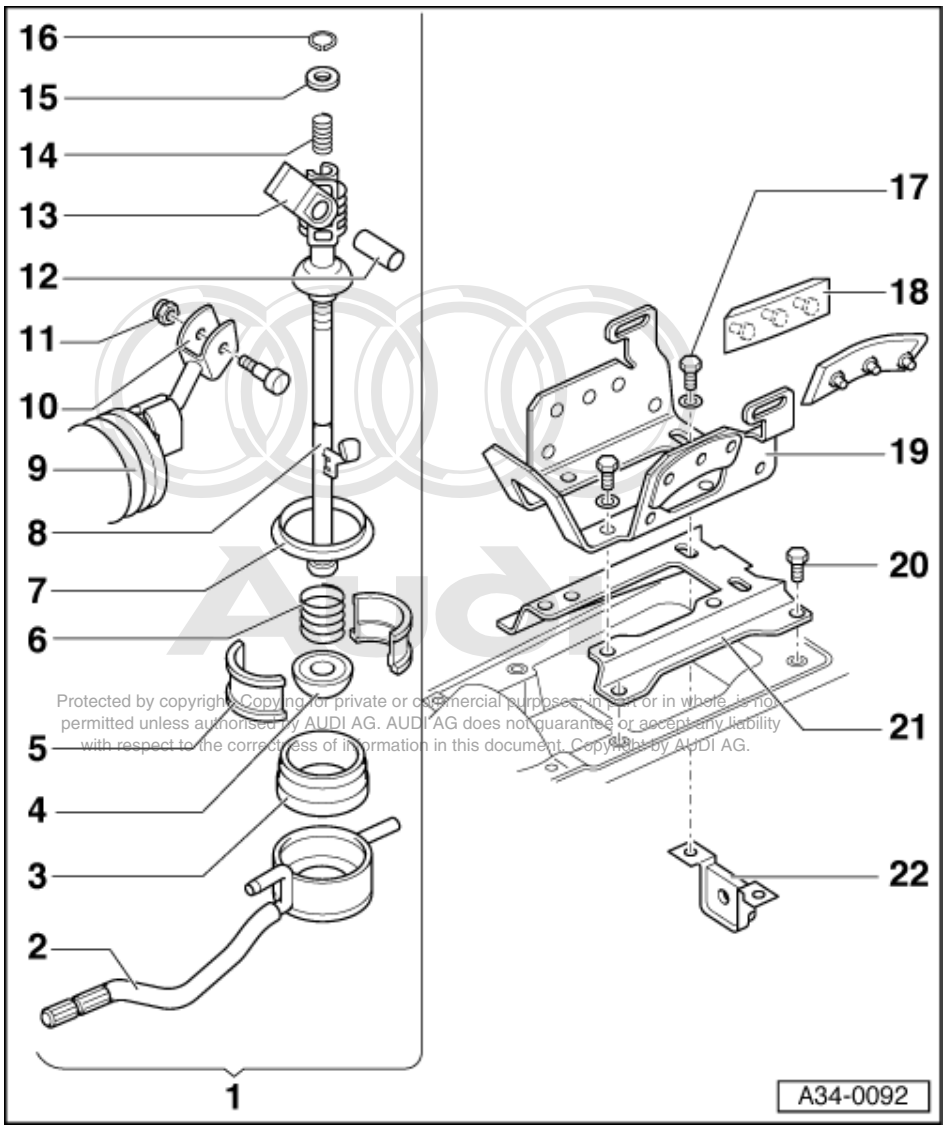
8 Gear stick

9 Sleeve

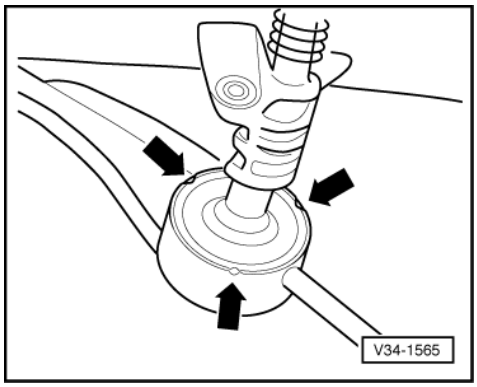


10 Rear selector rod
11 Securing nut - 10 Nm
- Always renew

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



19 Upper stop piece
20 Bolt - 10 Nm
21 Lower stop piece
22 Bearing bracket

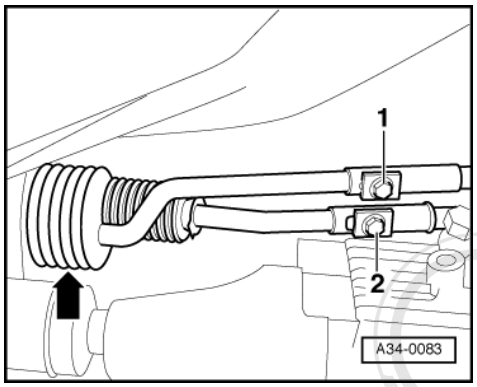


-> Fig.1 Peening gear stick mounting

- Fit intermediate plate and peen gear stick mounting at three points -arrows- so that the intermediate plate is secure.

1.5 - Removing and installing rear selector rod and front selector rod

- Gearbox installed

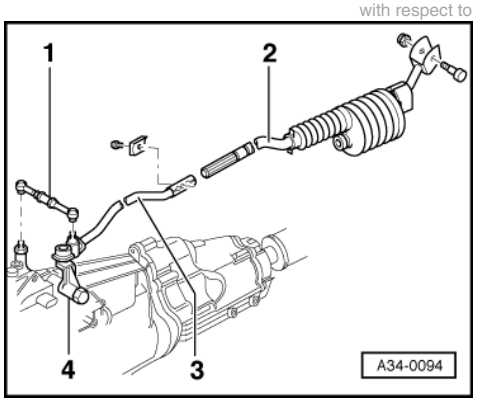


Removing

- Unscrew gearstick knob.
- Unclip gearstick cover and pull off.
- Remove right-hand catalytic converter.

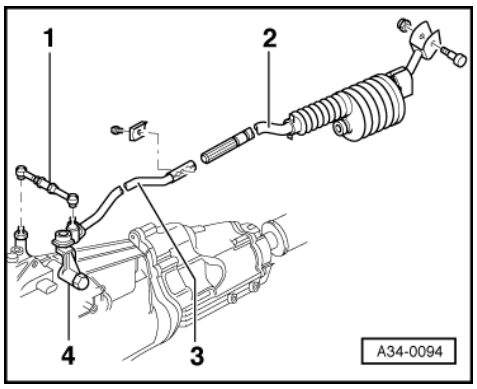
=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system

- -> 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 47 .

1.6 - Removing and installing rear push rod and front push rod

- Gearbox installed

Removing

- Remove centre console

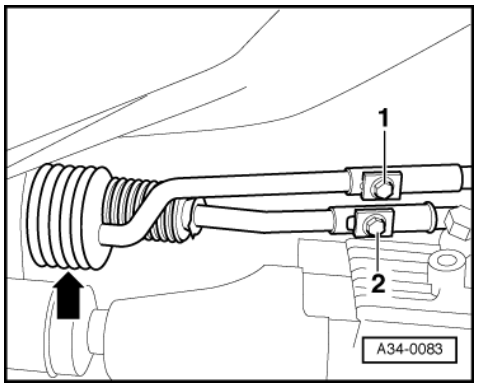
=> General Body Repairs; Repair Group 70; Removing and installing centre console and handbrake trim Removing and installing centre console and handbrake trim

- Remove right-hand catalytic converter

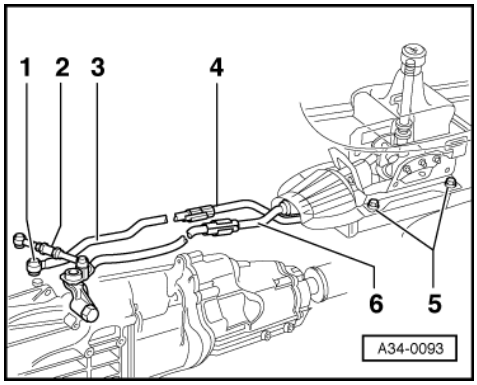
=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system

Note:

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



- -> Remove bolts -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-.

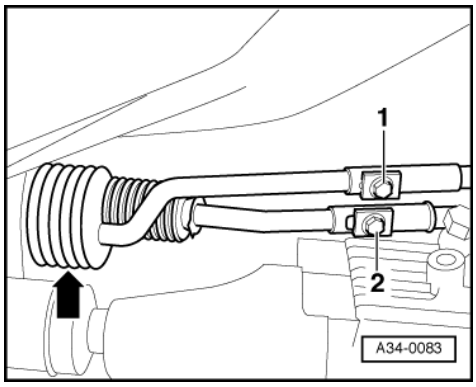
Installing

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

- Renew circlip and ensure it is correctly seated =>page 37 .
- Ensure the boot is correctly seated => Page 45 .
- Adjusting and checking selector mechanism => Page 47 .

1.7 - Removing and installing boot

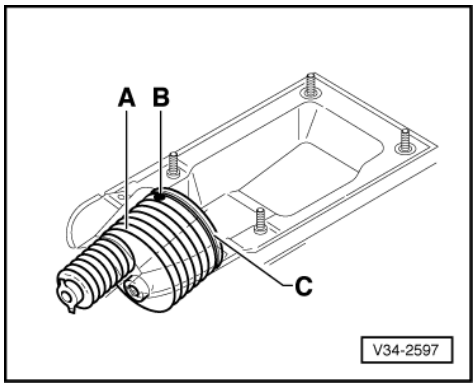
Removing



- Unscrew gearstick knob.
- Unclip gearstick cover and pull off.
- Remove right-hand catalytic converter

=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system

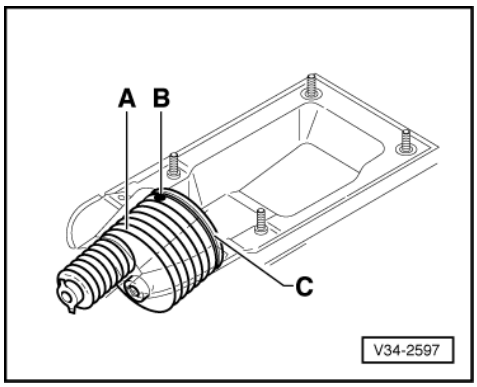
- -> Remove bolts -1- and -2- and take off clamping pieces.



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

Installing

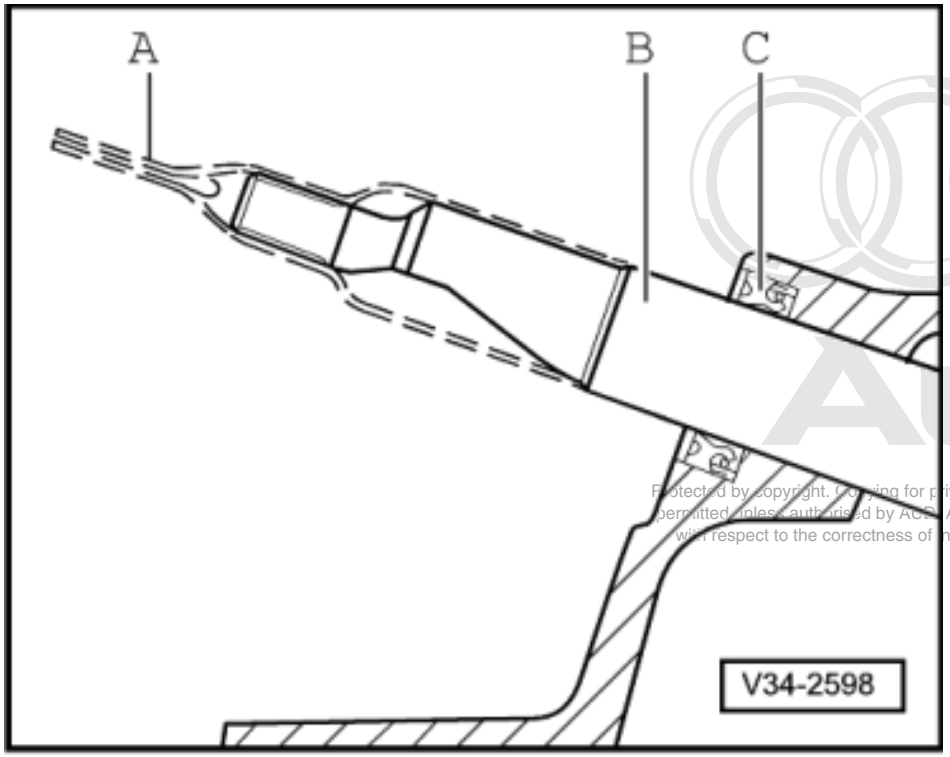
- Push boot on over push rod and selector rod.



- -> Check installation position of boot from vehicle interior.
  - Marking lug -B- is on top
  - Boot edge is correctly clipped-in all around hole -C- in body
- Checking and adjusting selector mechanism => Page 47 .

1.8 - Renewing shaft seal for selector shaft

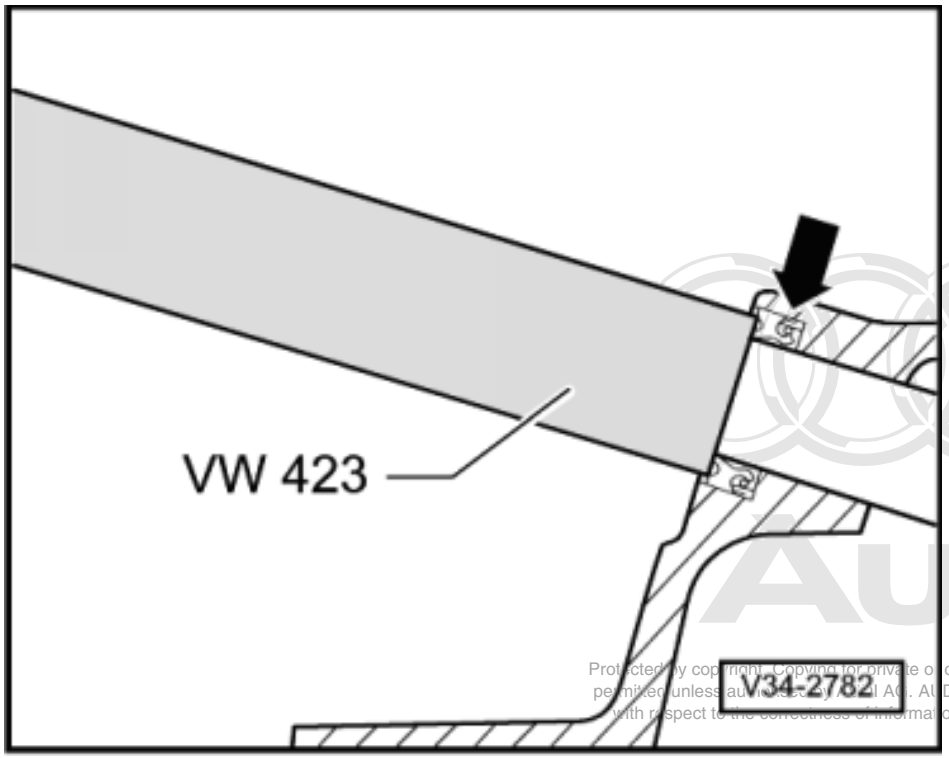
- Gearbox removed but not dismantled



- -> 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 oil seal.
- Fill space between sealing and dust lips with multipurpose grease.
- Always use fitting sleeve to install shaft seal.

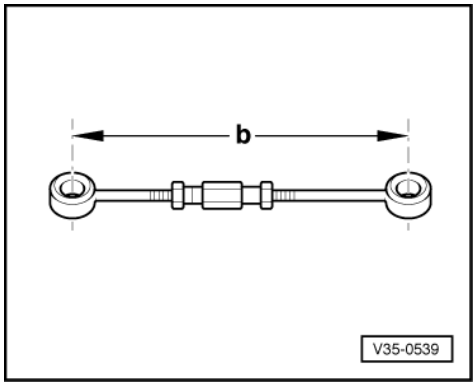


- -> Drive new shaft seal -arrow- into housing onto stop with press piece VW 423.

2 - Adjusting and checking selector mechanism

2.1 - Adjusting and checking selector mechanism

2.2 - Basic adjustment (adjustment instructions)



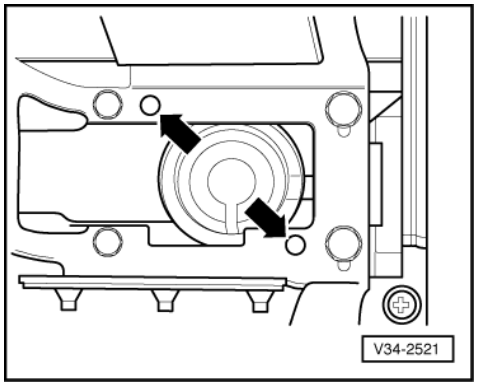
The basic adjustment must be performed if the fine adjustment is not sufficient or if the clamping pieces have been loosened when performing repairs.

- -> Adjust connecting rod, ball sockets must align.
  - Dimension b = 168.5 mm

Note:

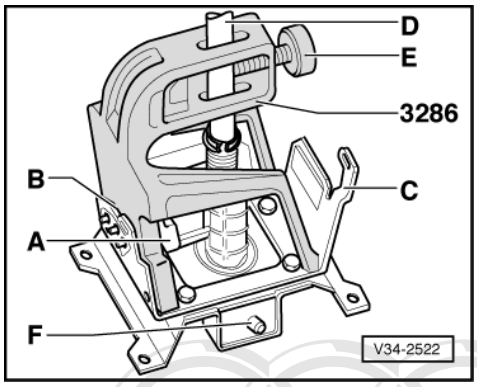
Only adjust connecting rod if dimension "b" is not correct or a new connecting rod is used.

- Removing and installing connecting rod => Page 43 .
- 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.

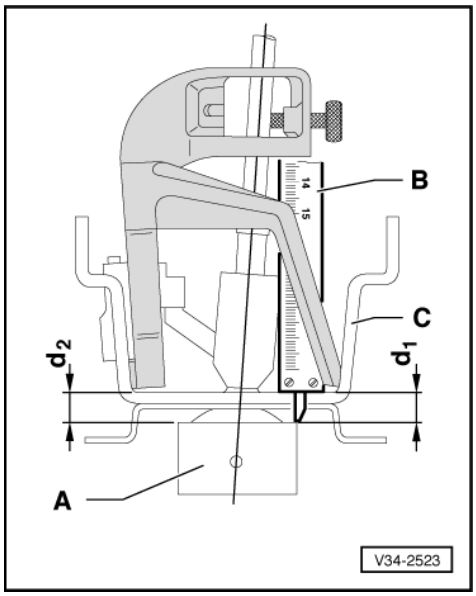
Adjusting gear stick



- -> Fit gear stick jig 3286 onto gear stick -D- and engage.
- 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

Adjusting rear push rod



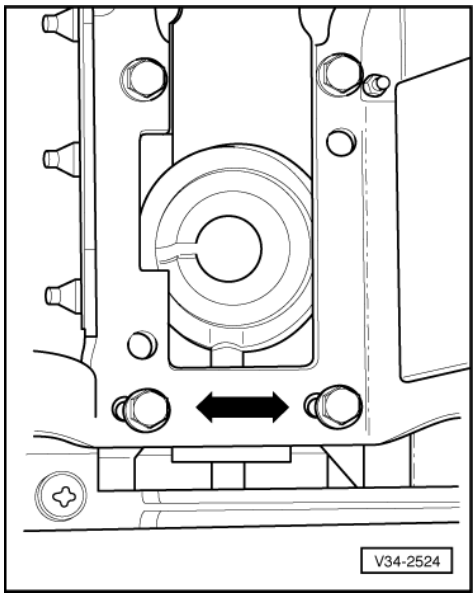
Note:

-> 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 clamp joint of selector and push rods (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
- Check fine adjustment if necessary.

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.

3 - Removing and installing gearbox

3.1 - Removing and installing gearbox

3.2 - Contact corrosion

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

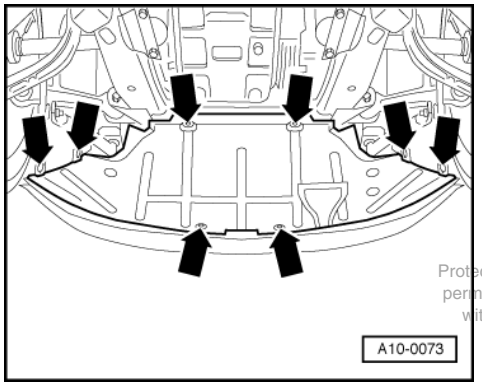
For this reason, the manufacturer installs only connecting elements with a special surface coating, as well as electrically non-conducting rubber and plastic parts, and adhesives.

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

If doubt exists regarding the re-use of parts, as a general rule, always install new parts.

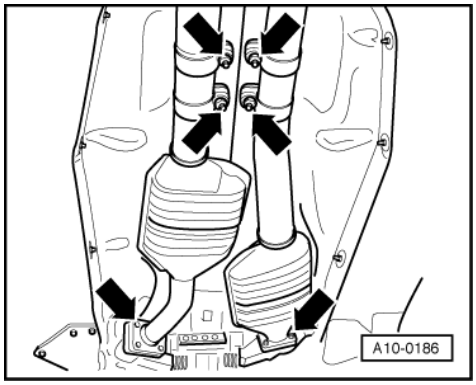
Warning!
- **Use only Genuine Audi A8 Parts.**
- **Accessories must be approved by AUDI**
- **Damage resulting from contact corrosion is not covered by the warranty.**

3.3 - Removing gearbox



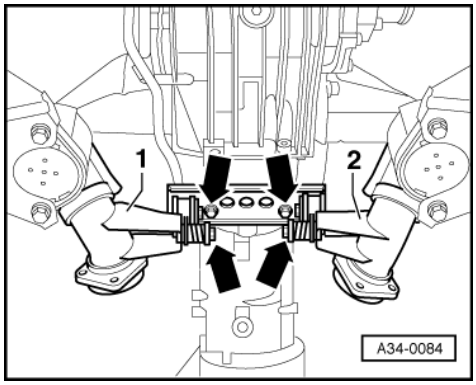
- Obtain radio code on vehicles with coded radio.
- Disconnect earth strap on battery (under rear seat) with ignition switched off.
- Unclip both Lambda probe cables at connections, (Lambda probes remain installed).
- -> Remove noise insulation -arrows-.

- Unscrew retainers for noise insulation.

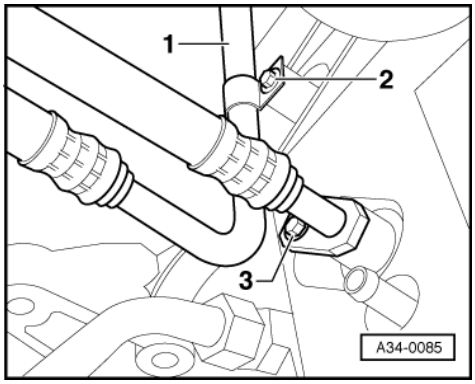


- -> Remove left and right exhaust pipes with catalytic converters -arrows-

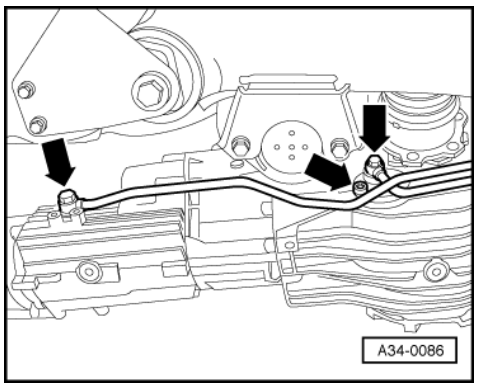
=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system



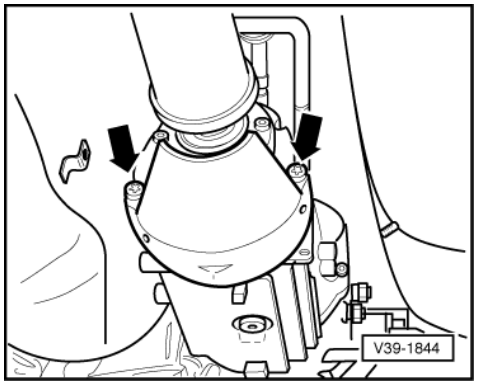
- -> Remove front exhaust pipes -1- and -2- and bracket for exhaust system on gearbox -arrows-. Lambda probes remain installed.
- Remove heat shields for drive shafts.
- Disconnect drive shafts and tie up.
- Pull connector off sender for speedometer.
- Pull off connector on reversing light switch.



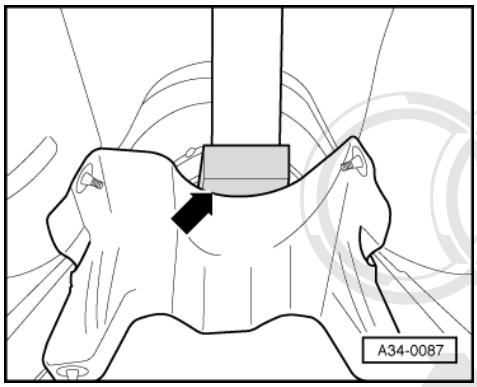
- Remove gearbox speed sender -G38 on left of gearbox and place to side.
- Place drip tray underneath.
- -> Unbolt oil pipe/hose -1- at top of oil cooler and unbolt bracket for oil pipe/hose -2-.
- Unbolt oil pipe/hose -3- at bottom of oil cooler.
- Remove retainer for oil pipes/hoses on engine support and retainer for oil pipes/hoses on lower part of engine/gearbox flange.



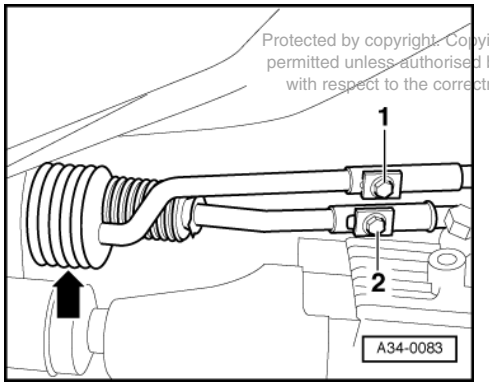
- -> Unbolt oil pipes/hoses on gearbox -arrows-. Seal holes with plugs.



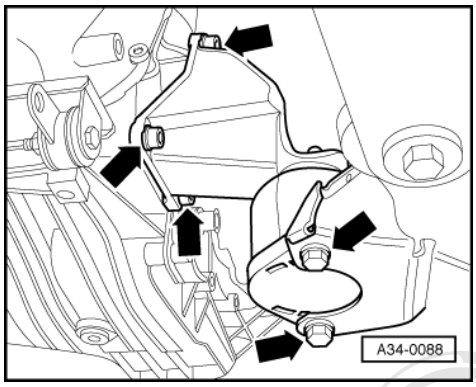
- -> Unbolt heat shield for propshaft from cover for Torsen differential -arrows-.



- -> Unbolt propshaft at gearbox and using a wooden wedge -arrow- press upwards against heat shield.



- -> Slacken bolts -1- and -2-, take off clamping pieces.
- Remove starter motor bolts (starter motor remains installed).
- Place gearbox jack V.A.G 1383 A underneath with universal plate.
- Remove all engine/gearbox connecting bolts from below.



- -> Remove left and right gearbox mountings together with gearbox support -arrows-.
- Press gearbox off dowel sleeves and carefully lower with V.A.G 1383 A.
- Lower gearbox slightly until the slave cylinder is just accessible.

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.

3.4 - Installing

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

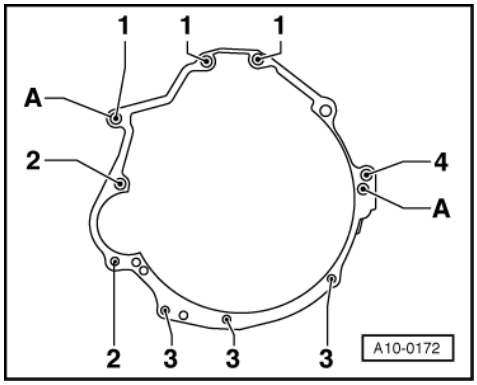
- The threaded holes in the flange shafts for the propshaft as well as the threaded hole for securing the clutch slave cylinder must be cleaned with a tap to remove all residues of locking fluid before installing.
- Check that dowel sleeves for centring engine/gearbox are fitted in gearbox flange, insert if necessary =>Page 54 .
- Clean splines of input shaft and clutch plate hub and coat with a extremely thin layer of grease =>Page 30 .
- The gearbox must be installed before installing the clutch slave cylinder with bracket for pipe/hose. Bracket must sit in clutch slave cylinder groove =>Page 28 .
- Always fit new gaskets to the connecting points of the propshaft =>Page 199 and drive shafts.
- Securing propshaft to gearbox =>Page 204 .

- Renew seals on oil pipes/hoses.
- Adjust selector and push rods after installing =>from Page 47 .
- Align exhaust system free of stress

=> 8-cylinder engine, Mechanics; Repair Group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

- Check oil level in gearbox =>Page 60 .

Tightening torques



-> Securing engine to gearbox

Item	Bolt	Qty.	Nm
1	M12 x 75	3	65
2	M12 x 110	2	65
3	M10 x 45	3	45
4	M12 x 90	1	65

A: centering sleeves

Component	Nm
Clutch slave cylinder to gearbox	25
Gearbox support to gearbox housing	40
Front of sub-frame to body	110 + 90° 1)
Gearbox support to gearbox mounting	40
Drive shaft to flange shaft M10	80
Heat shield for drive shaft	25
Banjo bolt to oil pump cover 2)	25
Banjo bolt to end cover 2)	25
Angled bracket for return pipe/hose to oil pump cover	25

1) Renew bolts

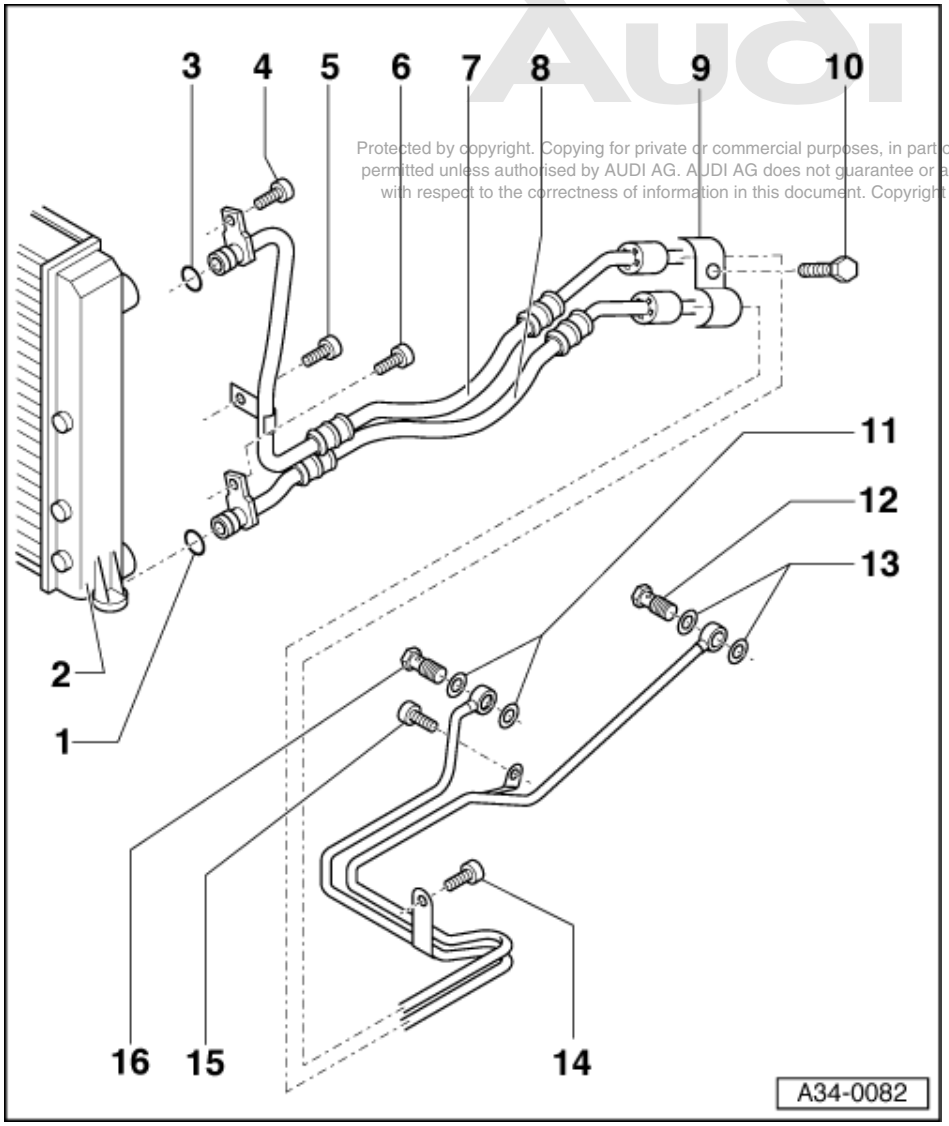
2) Renew seals

Component	Nm
Retainer for oil pipe/hose to engine support	10
Oil pipe/hose to oil cooler	5
Rear angled bracket for oil supply pressure pipe/hose to oil pan	25
Selector rod and push rod clamping piece	25
Propshaft to gearbox	55
Heat shield for propshaft to gearbox	25
Catalytic converter to support hanger	25
Front exhaust pipe to exhaust manifold	25

Component	Nm
Cross-member to body	40

4 - Removing and installing oil pressure pipes/hoses

4.1 - Removing and installing oil pressure pipes/hoses



1 **O-ring**
- Always renew

2 **Oil cooler**
- Installation position: in radiator

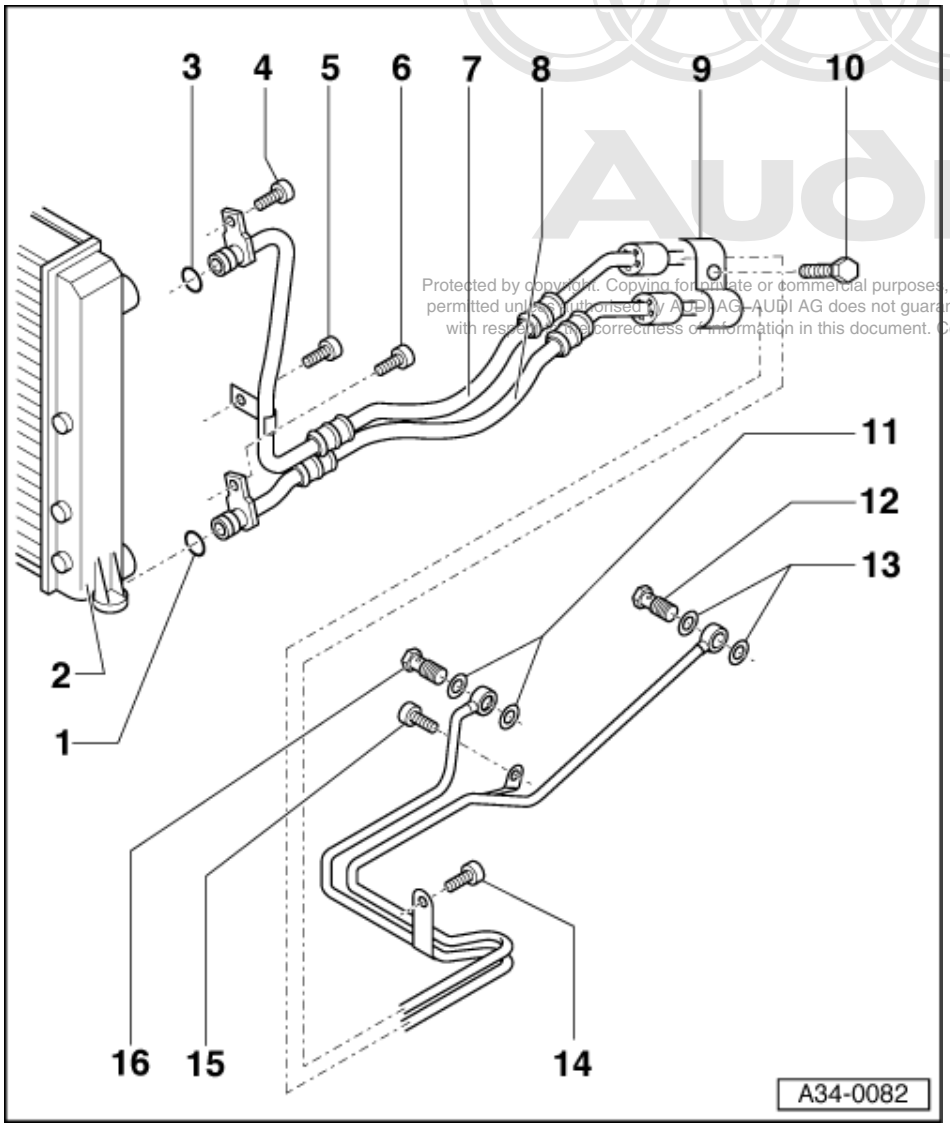
3 **O-ring**
- Always renew

4 **Combi-bolt M6 x 15 - 5 Nm**
- Oil pressure pipe/hose to oil cooler

5 **Combi-bolt M6 x 15 - 5 Nm**

6 **Combi-bolt M6 x 15 - 5 Nm**
- Oil pressure pipe/hose to oil cooler

7 **Oil return pressure pipe/hose**



8 Oil supply pressure pipe/hose

9 Retainer

10 Hexagon bolt - 10 Nm

- Self-locking
- Always renew
- Before screwing in new bolt, clean threads on engine support with a tap

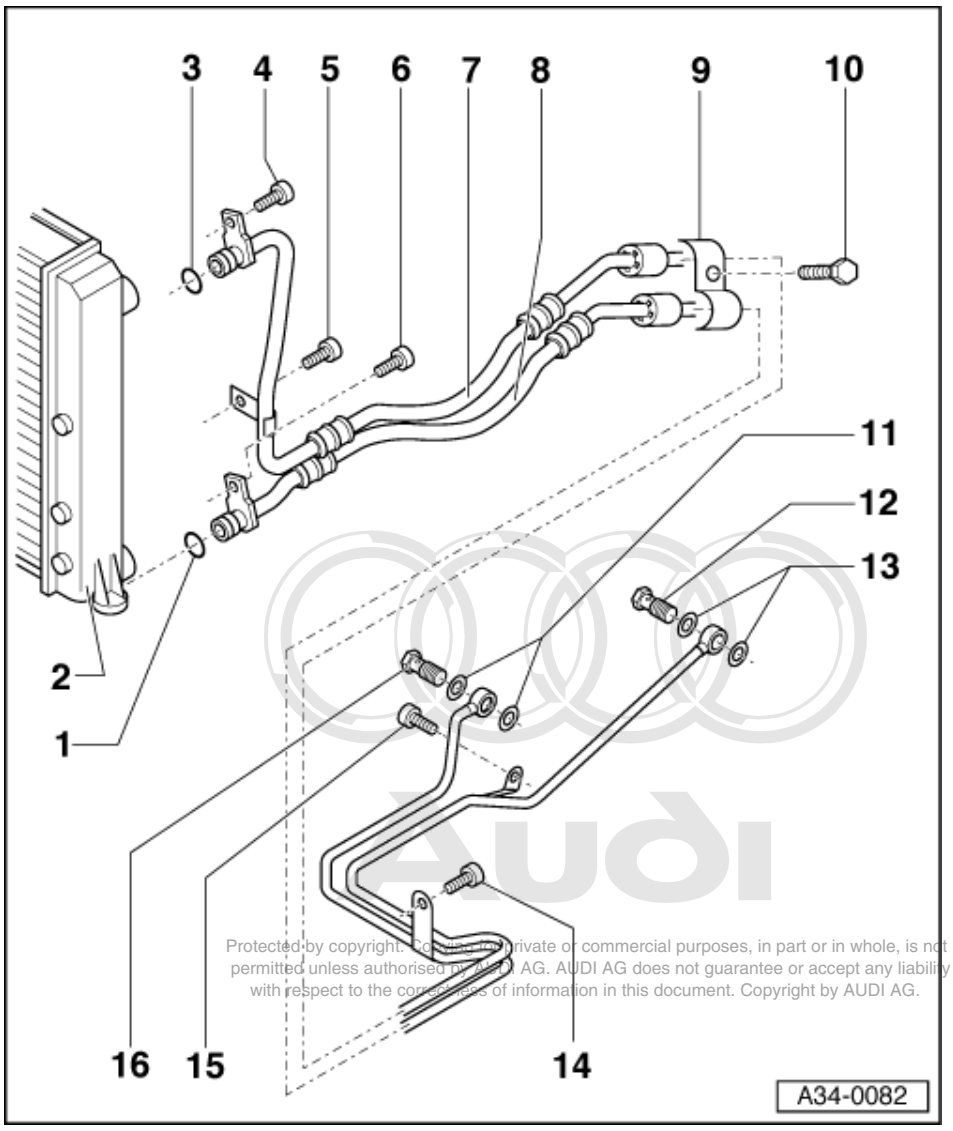
11 Seals

- Always renew

12 Banjo bolt - 25 Nm

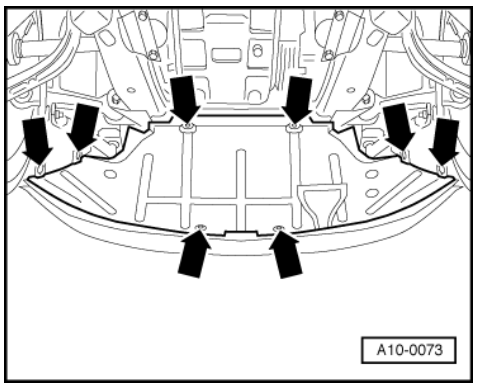
13 Seals

- Always renew



14 Securing bolt - 25 Nm
15 Securing bolt - 25 Nm
16 Banjo bolt - 25 Nm

4.2 - Removing and installing oil pump

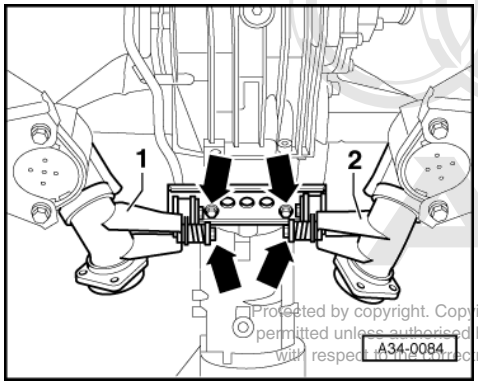


- Gearbox installed

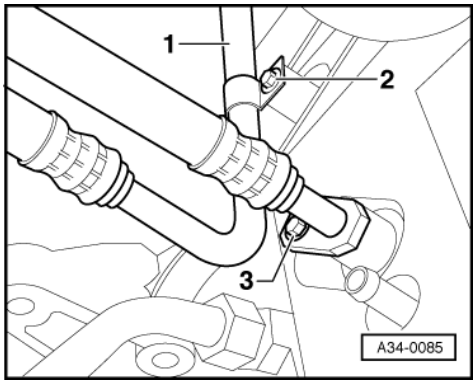
Removing

- -> Remove noise insulation -arrows-.
- Remove right-hand catalytic converter

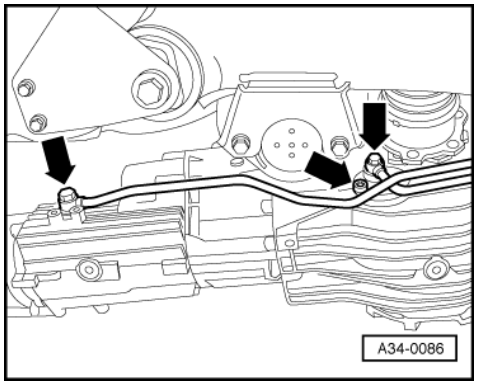
=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system



- -> Remove bracket for exhaust system on gearbox -arrows- and on front exhaust pipes -1- and -2-.



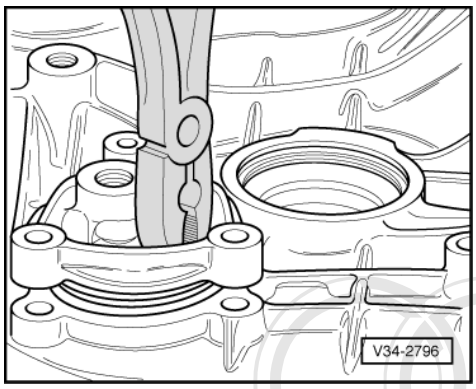
- Place drip tray underneath and drain gearbox oil.
- -> Unbolt oil pipe/hose -1- at top of oil cooler and unbolt bracket for oil pipe/hose -2-.
- Unbolt oil pipe/hose -3- at bottom of oil cooler.
- Remove retainer for oil pipes/hoses on engine support and retainer for oil pipes/hoses on lower part of engine/gearbox flange.



- -> Unbolt oil pipes/hoses on gearbox -arrows-.

- Remove heat shield for right-hand drive shaft.
- Unbolt right-hand drive shaft and tie up.
- Unbolt right-hand flange shaft and pull out =>Page 170 .

- Unscrew securing bolts for oil pump cover.



- -> Take hold of one of the oil pump cover stiffening webs with a pair of pliers and pull out oil pump axially.

Installing

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

- When renewing oil pump ensure drive pinion engages in drive gear.
  - The oil pump cover must make contact over complete housing flange
- Renew O-ring.
- Renew gasket between drive shaft and flange shaft (pull off protective foil and stick gasket onto joint).
- Align exhaust system free of stress.

=> 8-cylinder engine; Mechanics; Repair Group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

- Check oil level in gearbox =>Page 60 .

Tightening torques

Component	Nm
Oil pump cover to gearbox housing	25
Flange shaft to gearbox	10 + 90°
Drive shaft to flange shaft M10	80
Heat shield for drive shaft	25
Banjo bolt to oil pump cover 1)	25
Banjo bolt to end cover 1)	25
Retainer for oil pipes/hoses to engine support	10
Oil pipes/hoses to oil cooler	5
Angled bracket for return pipe/hose to oil pump cover	25
Rear angled bracket for oil supply pressure pipe/hose to oil pan	25
Catalytic converter to support hanger	25
Front exhaust pipe/hose to exhaust manifold	25
Front cross-member under exhaust system to body	25
Oil drain plug	40

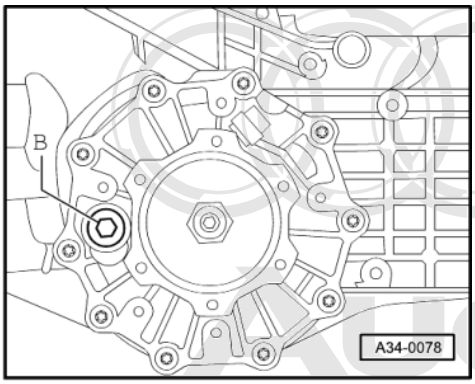
1) Renew seals

5 - Checking oil level in gearbox

5.1 - Checking oil level in gearbox

Notes:

- The vehicle must be absolutely level to check the gearbox oil level, e.g. over a workshop pit or on a 4-column lift. A 2-column lift is not suitable.
- The prescribed oil level is to be adhered to exactly; the gearbox reacts very sensitively to over-filling.



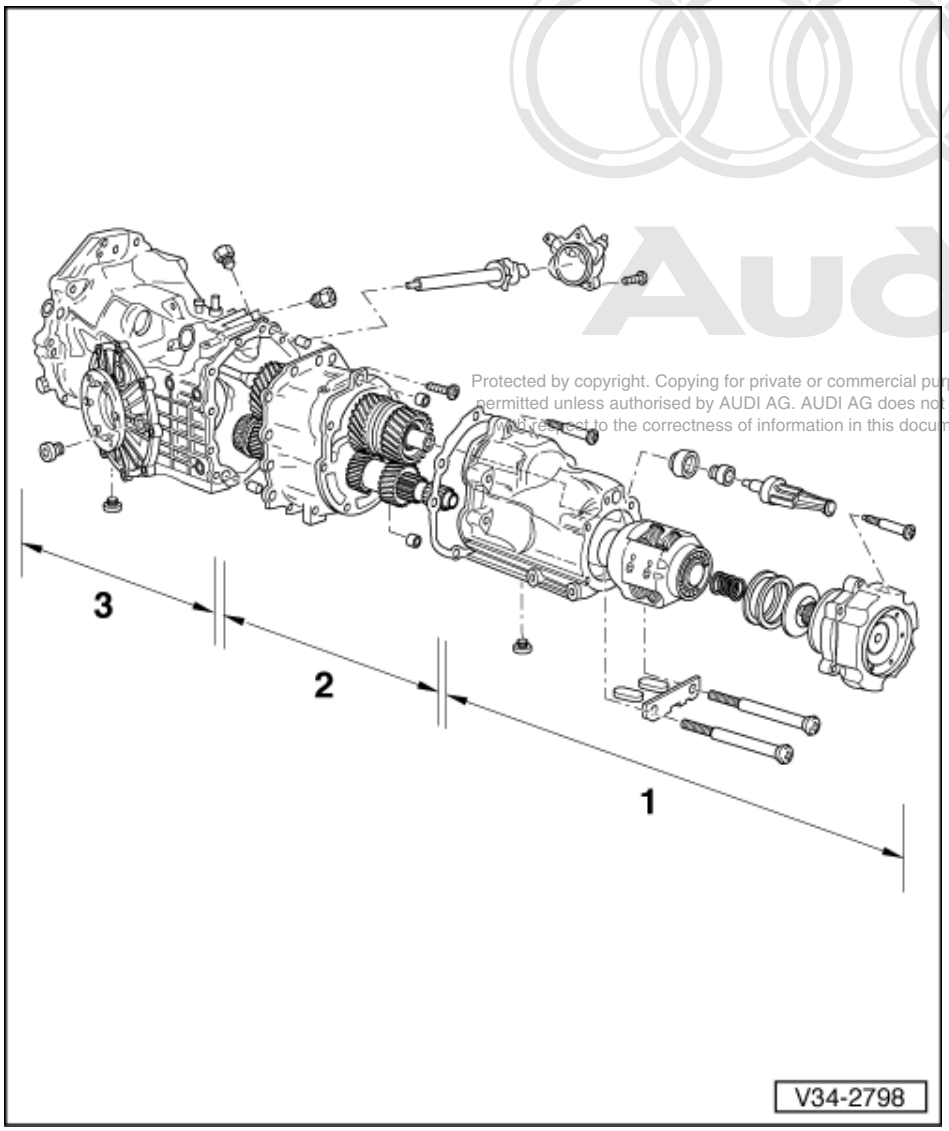
- -> Remove oil filler plug -B- (in front of flange shaft) to check gearbox oil level.
- Check oil level with locally manufactured tool e.g. a piece of angled wire.
  - Specification: oil level 1 mm below lower edge of filler hole
- Top-up gearbox oil if necessary. Specification =>from Page 2 .
- Fit oil filler plug.

Tightening torque

Component	Nm
Oil filler plug	40

6 - Dismantling and assembling gearbox

6.1 - Dismantling and assembling gearbox



Sequence =>Page 74 .

1 Bearing housing, Torsen differential and end cover

- Removing and installing
  =>Page 62

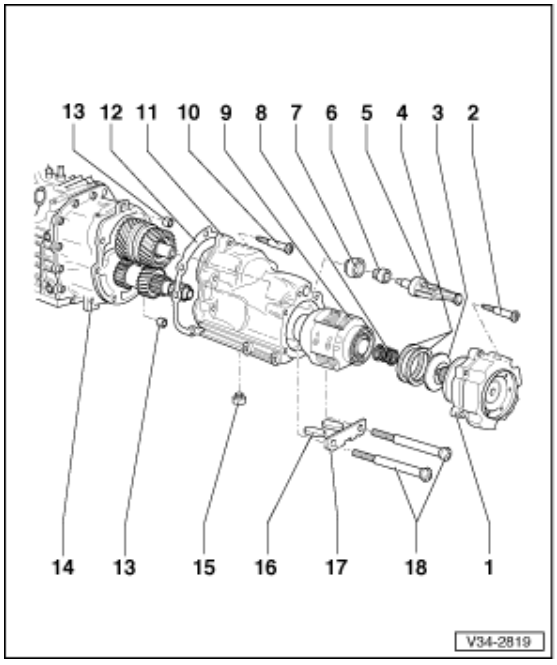
2 Gearbox and selector shaft

- Removing and installing
  =>Page 64

3 Differential

- Removing and installing
  =>Page 170

6.2 - Removing and installing bearing housing, Torsen differential and end cover

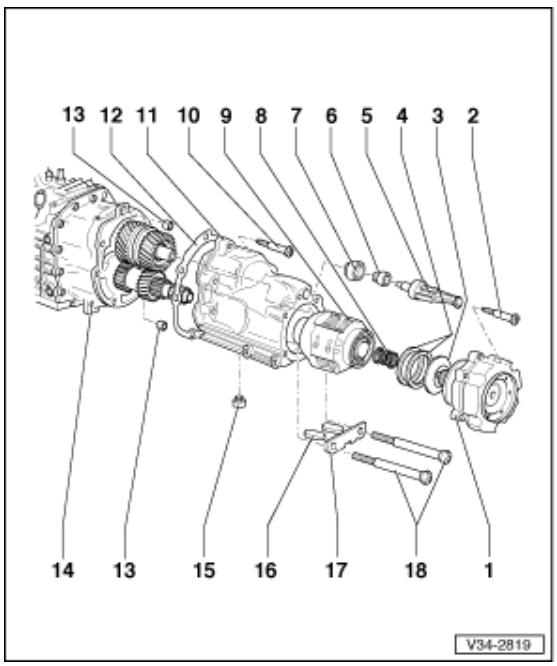


1 Bearing housing
- Dismantling and assembling =>Page 96

2 Bolt M8 x 60 - 25 Nm
- Qty. 6

3 Dished spring
- Installation position: larger diameter (concave side) faces shims

4 Washer
- Qty. 2 or 3
- Re-determining shims =>Page 93



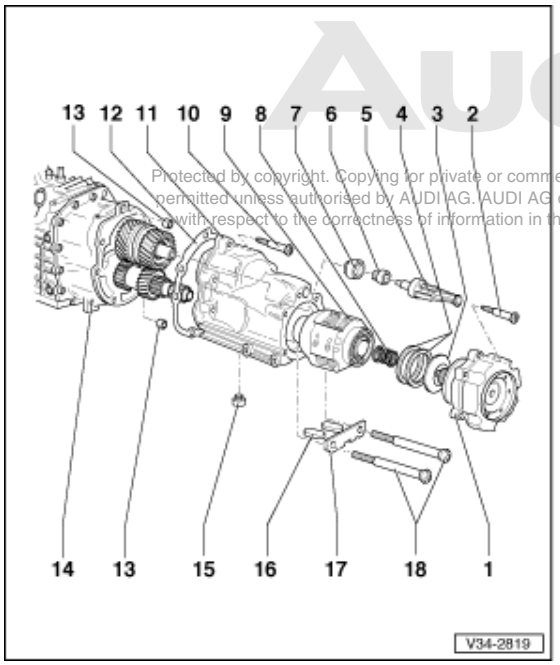
5 Oil collector
- Removing =>Page 75
- Installing =>Page 92
- Dismantling and assembling

=>Page 92

6 Multi-point socket head bolt - 150 Nm
- Removing =>Page 77
- Installing =>Page 92

7 2nd inner race for taper roller bearing for input shaft
- Removing =>Page 77
- Installing =>Page 91

8 Spring



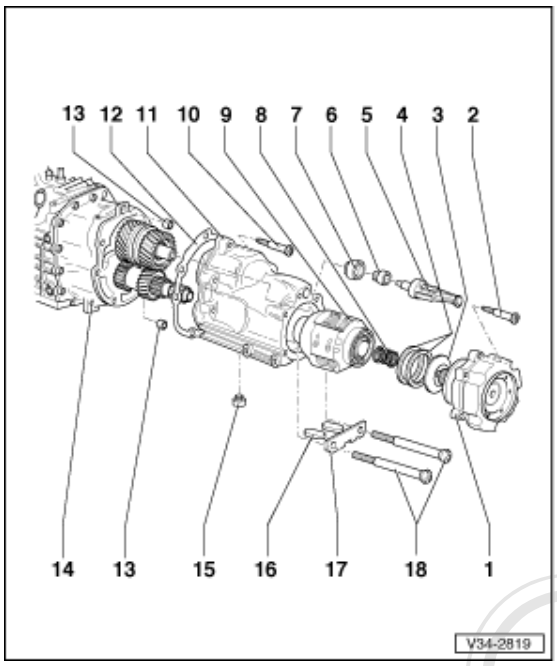
9 Torsen differential
- Can be serviced only by manufacturer
- Servicing bearings for Torsen differential =>Page 101

10 Bolt M8 x 60 - 25 Nm
- Qty. 5

11 End cover
- Servicing =>Page 105

12 Gasket
- Always renew

13 Dowel sleeve
- Qty. 2



14 Gearbox

- Removing and installing
  =>Page 50

15 Oil drain plug - 40 Nm

16 Magnet

- Qty. 2
- Clean

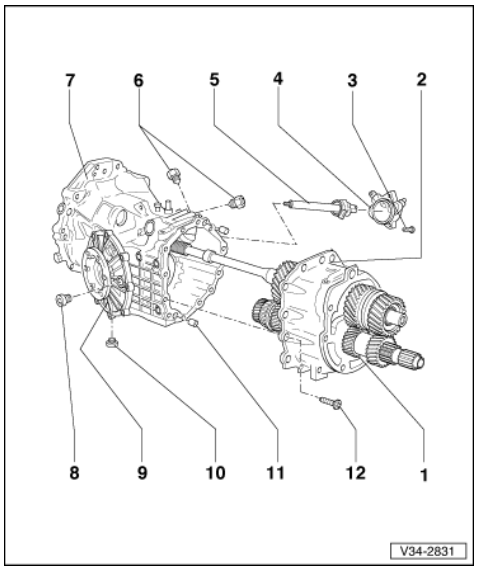
17 Support plate

- Installation position: lugs face magnets

18 Bolts M8 x 140 - 25 Nm

- Qty. 2

6.3 - Removing and installing gearbox and selector shaft



1 5th and 6th gear

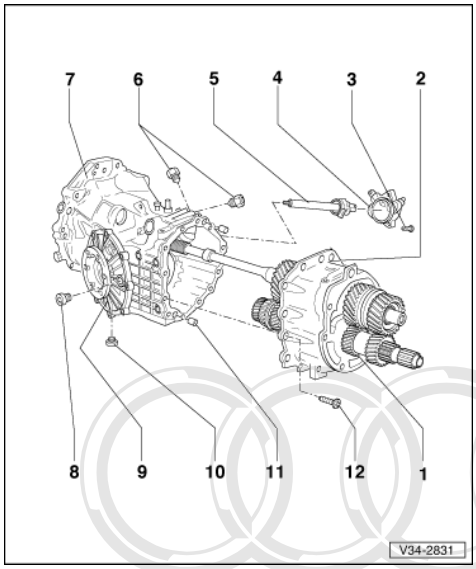
- Gearbox remains flanged to gearbox housing
- Removing and installing
  =>Page 67

2 Bearing plate complete

- Removing and installing input shaft, drive pinion, hollow shaft and internal selector mechanism =>Page 71

3 Bolt M8 x 20 - 25 Nm

- Qty. 3
- Inserted with sealing paste AMV 188 200 03



4 Cover for selector shaft

- Removing =>Page 76
- Installing =>Page 93

5 Selector shaft complete

- Removing =>Page 76
- Installing =>Page 93
- Dismantling and assembling =>Page 136

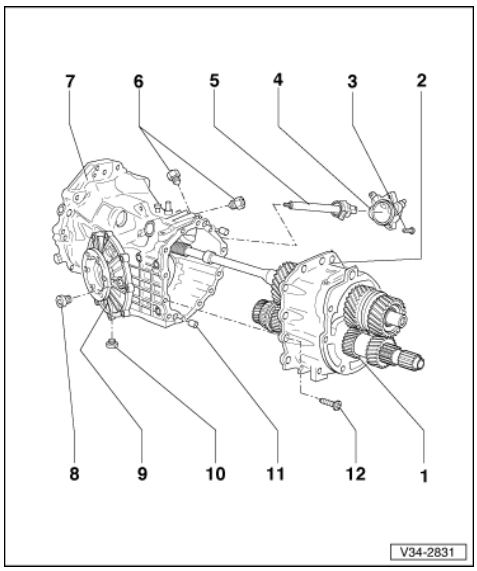
6 Locking bolt

- For aluminium bolt: 50 Nm
- For steel bolt: 70 Nm

7 Gearbox housing

- Servicing =>Page 121

8 Oil filler plug - 40 Nm



9 Differential

- Removing and installing
  =>Page 170

10 Oil drain plug - 40 Nm

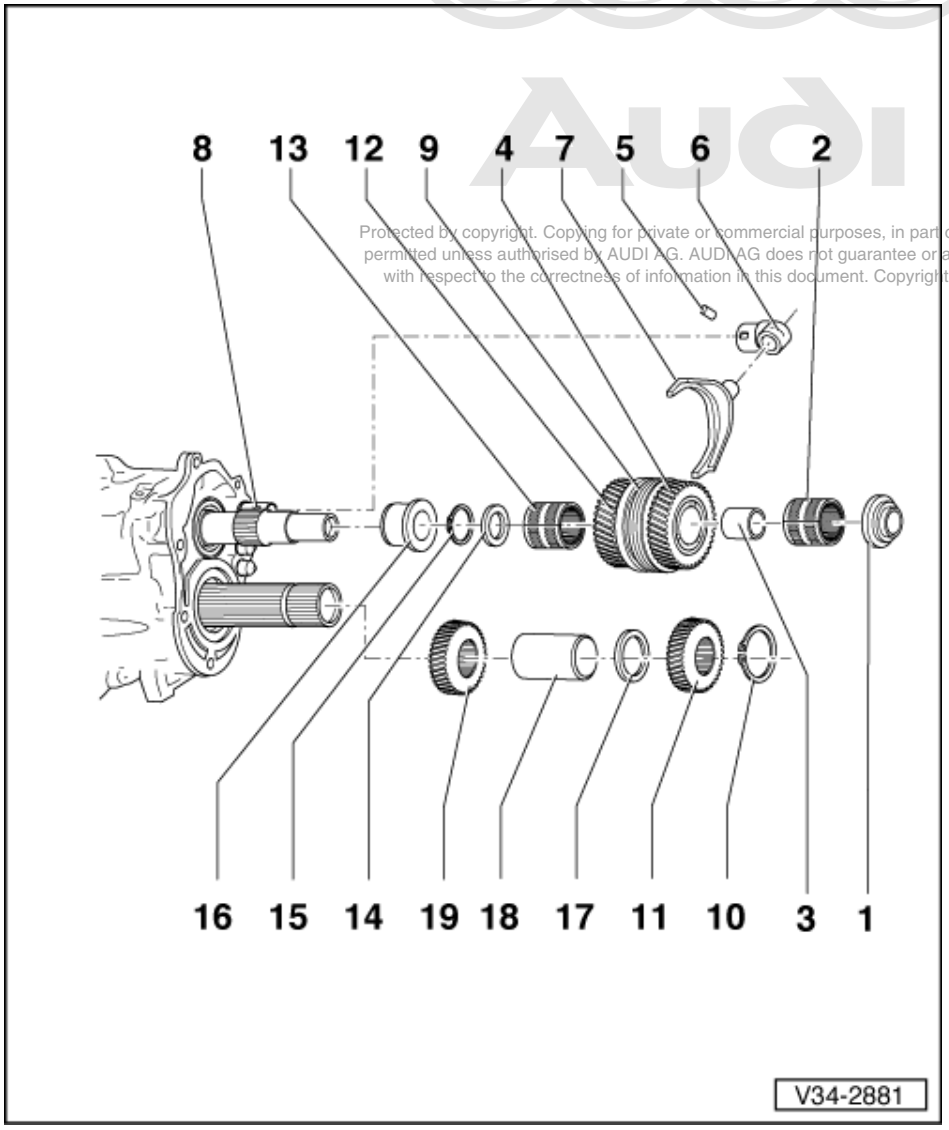
11 Dowel sleeves

- Qty. 2

12 Bolt M8 x 35 - 25 Nm

- Qty. 12

6.4 - Removing and installing 5th and 6th gear



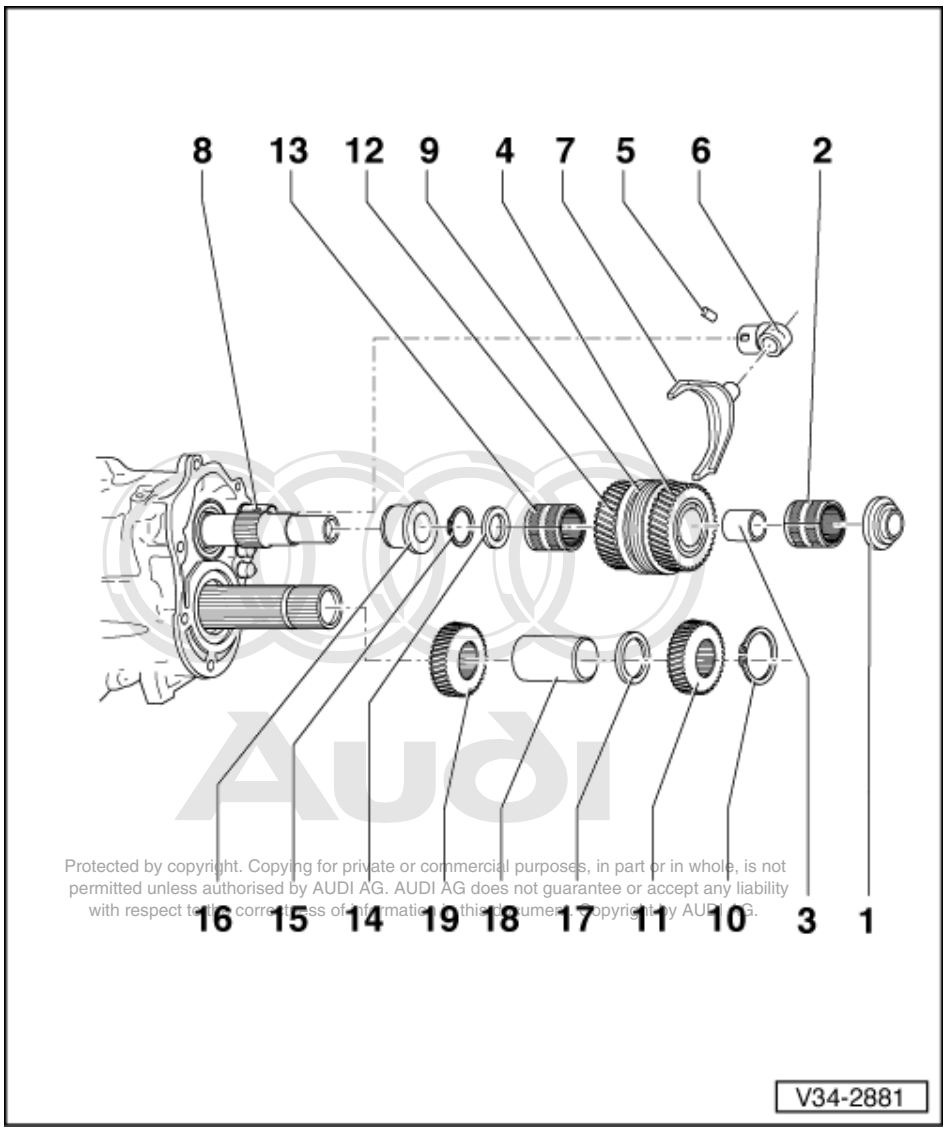
1 1st inner race for taper roller bearing for input shaft
- Pulling off =>Page 78
- Installing =>Page 91

2 Needle bearing for 5th gear

3 Inner race for 5th speed sliding gear
- Pulling off =>Page 79
- Driving on =>Page 90

4 5th speed sliding gear
- Pulling off =>Page 78
- Installing =>Page 90

5 Roll pin
- Pressing out =>Page 78
- Pressing in =>Page 88



6 Follower

- Only renew complete with selector rod for 5th and 6th gear -item 8 -
- Pulling off =>Page 79
- Fitting =>Page 88

7 Selector fork for 5th and 6th gear

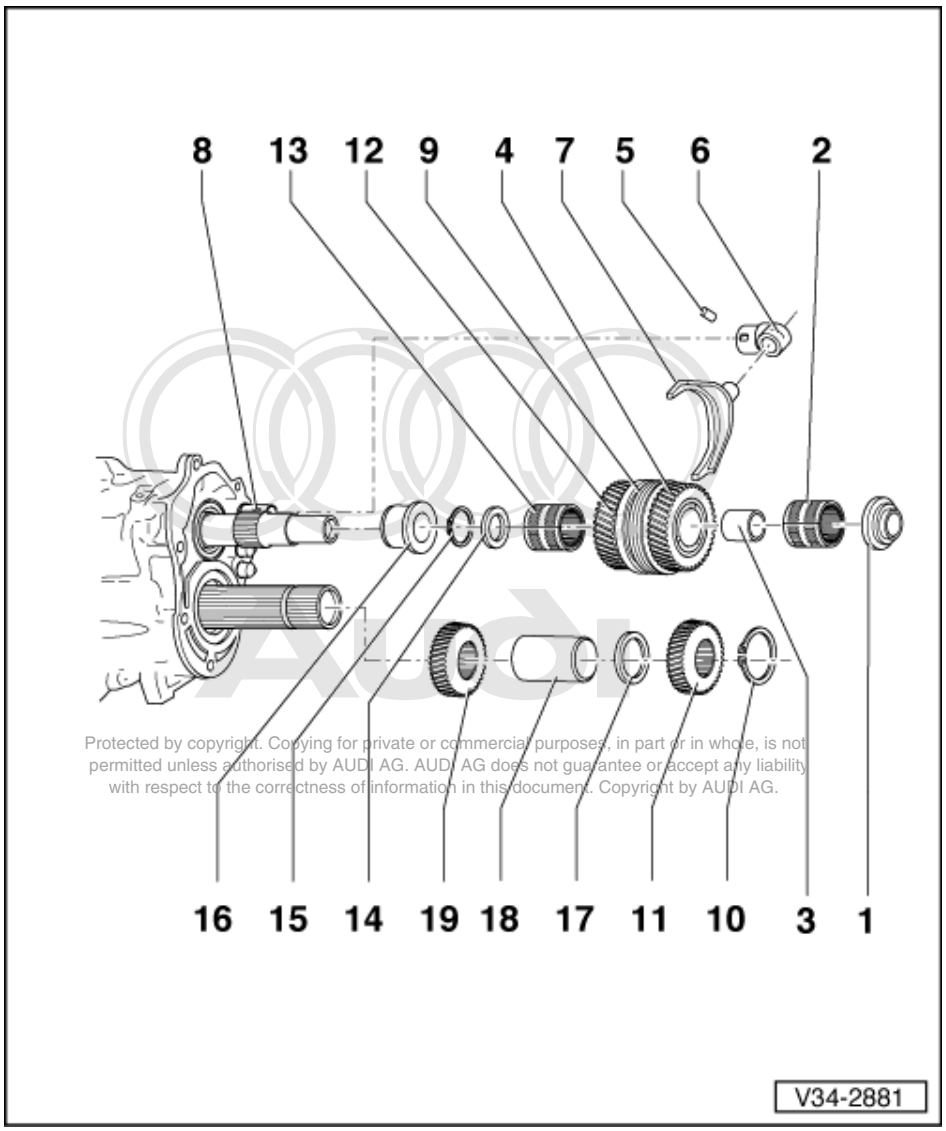
- Can be renewed individually

8 Selector rod for 5th and 6th gear

- Only renew complete with follower -item 6 -
- Removing =>Page 78
- Installing =>Page 85

9 Locking collar, synchro-ring, synchro-hub for 5th and 6th gear

- Removing =>Page 79
- Installing =>Page 88



10 Circlip

- Re-determining =>Page 90

11 5th speed gear

- Pulling off =>Page 78
- Pressing on =>Page 90

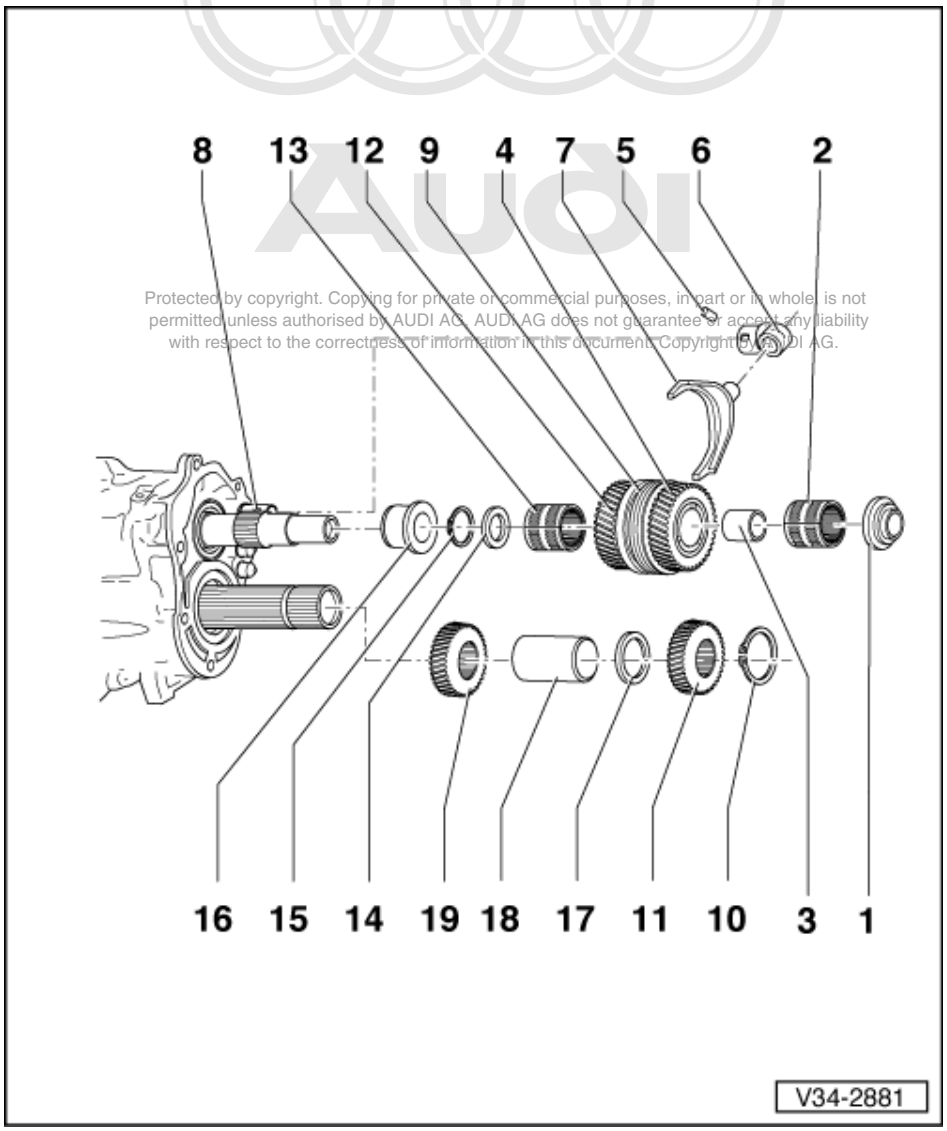
12 6th speed sliding gear

- Pull off together with synchro-hub and inner race for 5th gear =>Page 79

13 Needle bearing for 6th gear

14 Thrust washer for needle bearing for 6th gear

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



15 Circlip

16 Inner race for cylinder roller bearing

- Take off by hand =>Page 80

17 Washer

- Re-determining =>Page 89

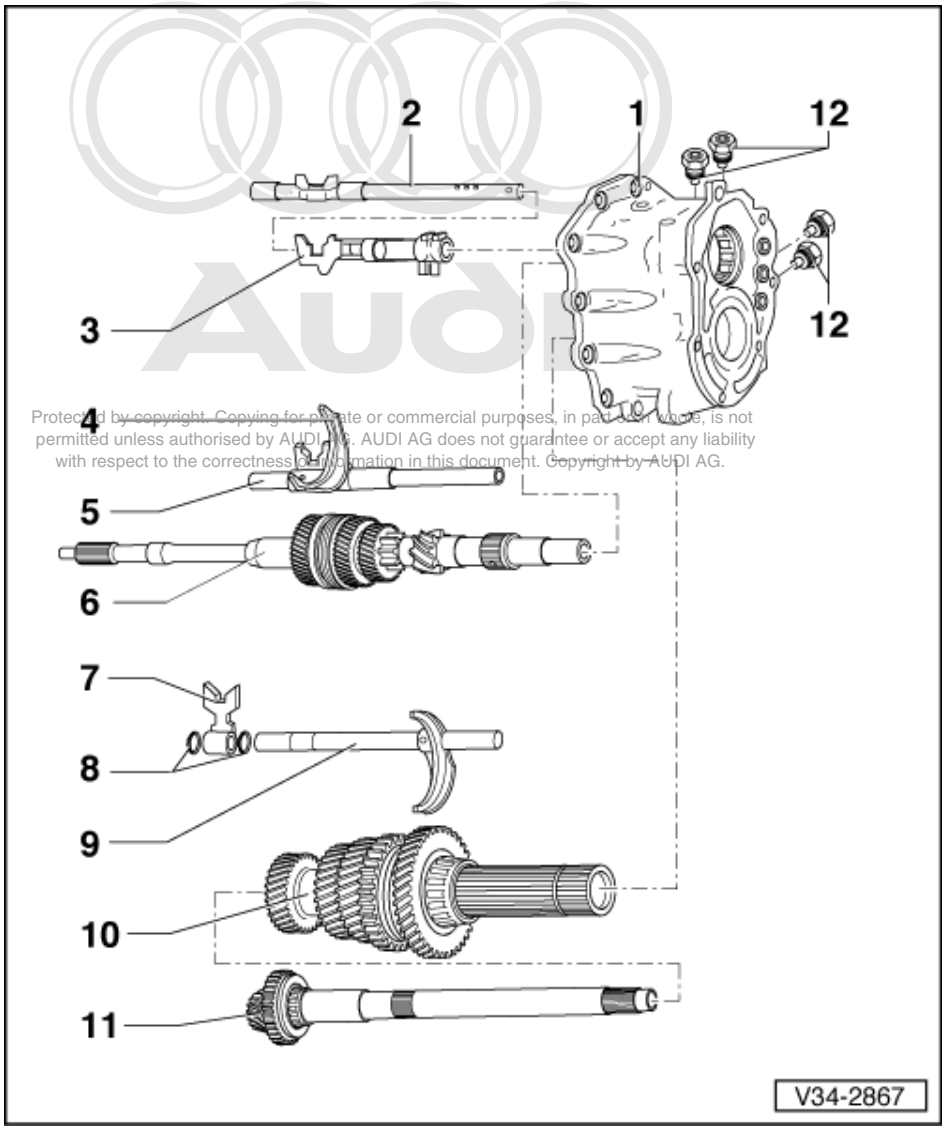
18 Spacer sleeve

- Length 39.6 mm

19 6th speed gear

- To press off, remove bearing plate =>Page 80
- Pressing off =>Page 82
- Pressing on =>Page 83

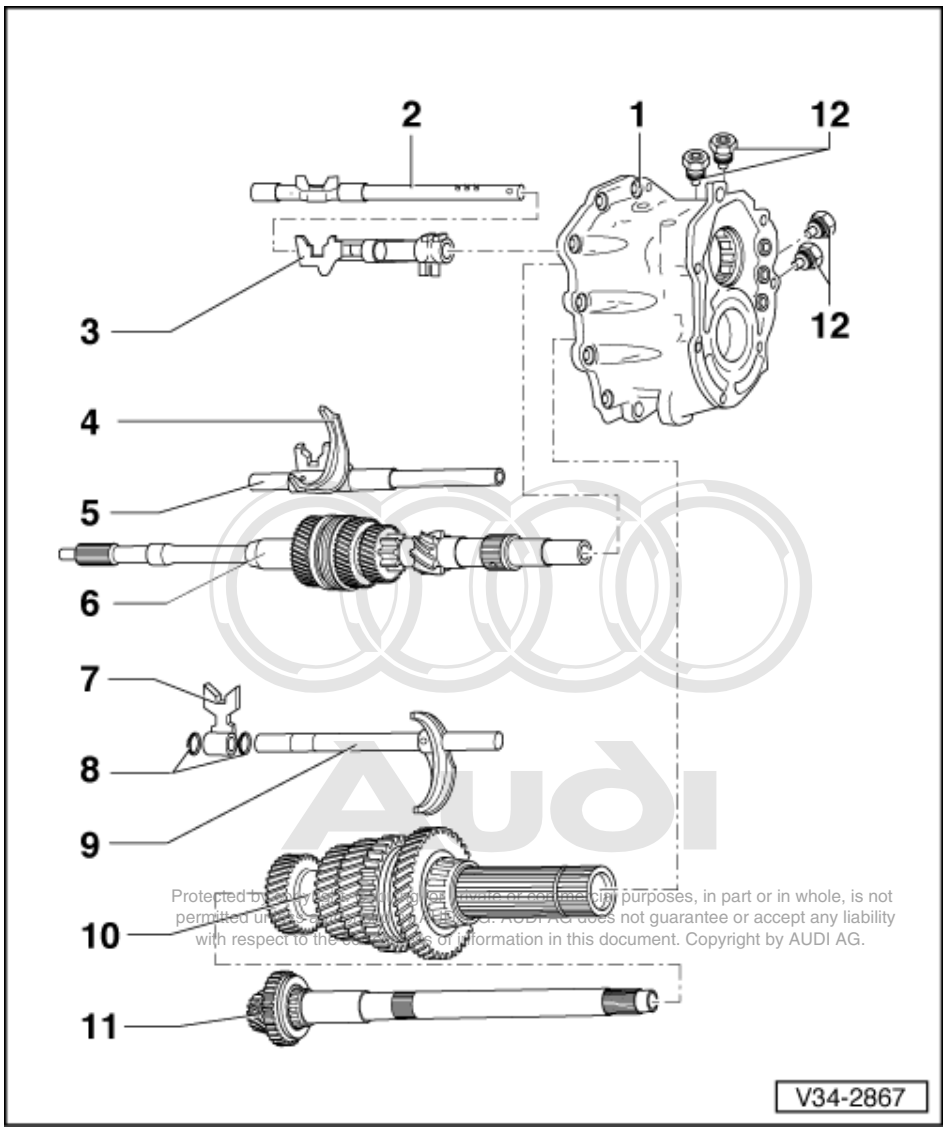
6.5 - Removing and installing input shaft, drive pinion, hollow shaft and internal selector mechanism from bearing plate



1 **Bearing plate**
- Servicing =>Page 111

2 **Selector rod for 5th and 6th gear**
- Only renew complete with follower for 5th and 6th gear =>Page 68

3 **Follower for reverse gear**
- Pulling out ball sleeve =>Fig. 115
- Driving in ball sleeve =>Fig. 116



4 Selector fork for 3rd and 4th gear

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

5 Selector rod for 3rd and 4th gear

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

6 Input shaft

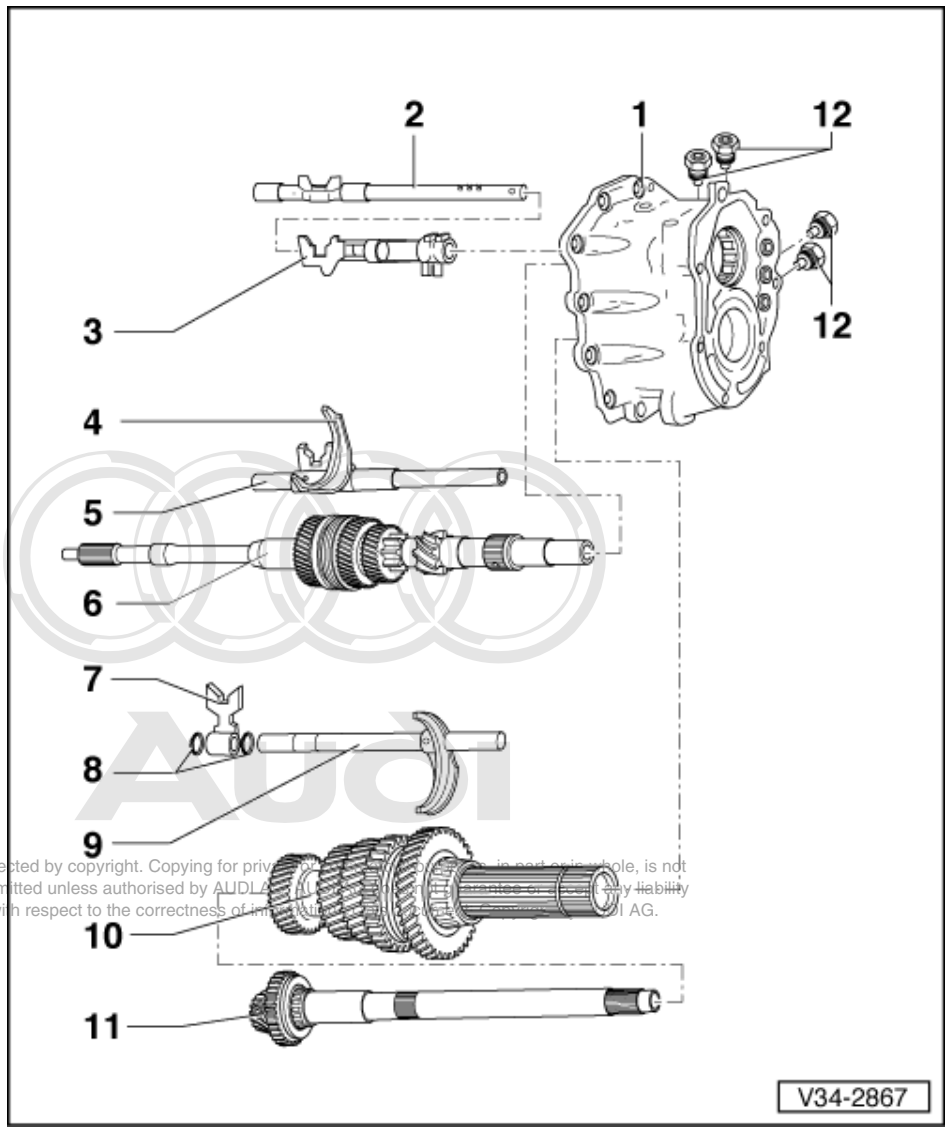
- Dismantling and assembling
  =>Page 139

7 Follower for 1st and 2nd gear

- Can be replaced individually

8 Circlip

- Qty. 2



9 Selector rod for 1st and 2nd gear

- Only remove complete with pinned selector fork for 1st and 2nd gear

10 Hollow shaft

- Dismantling and assembling =>Page 149

11 Drive pinion

- Dismantling and assembling =>Page 149

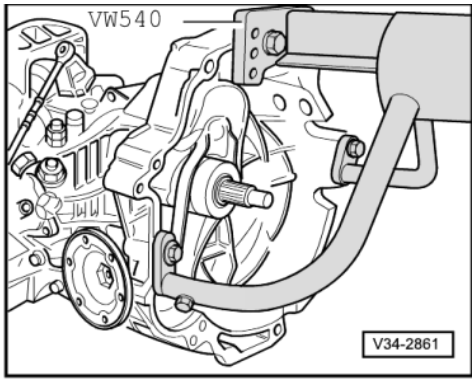
12 Locking bolts

- Qty. 4
- For aluminium bolt: 50 Nm
- For steel bolt: 70 Nm

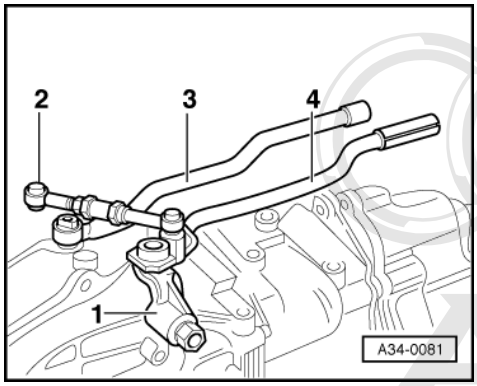
7 - Removing and installing bearing housing, Torsen differential, end cover, internal selector mechanism, input shaft, drive pinion and hollow shaft - Sequence

7.1 - Removing and installing bearing housing, Torsen differential, end cover, internal selector mechanism, input shaft, drive pinion and hollow shaft -Sequence

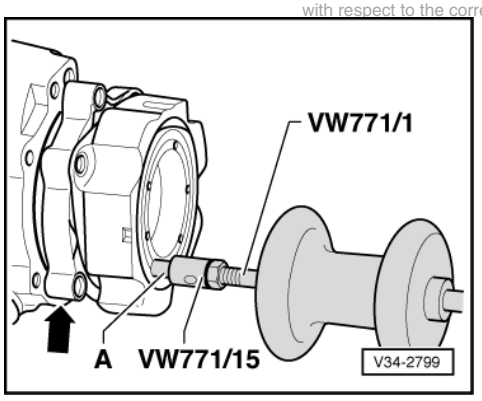
7.2 - Removing



- -> Secure gearbox in assembly stand VW 540.
- Place a drip tray underneath, drain gearbox oil (2 oil drain plugs).
- Remove release bearing, clutch release lever and guide sleeve =>Page 24 .

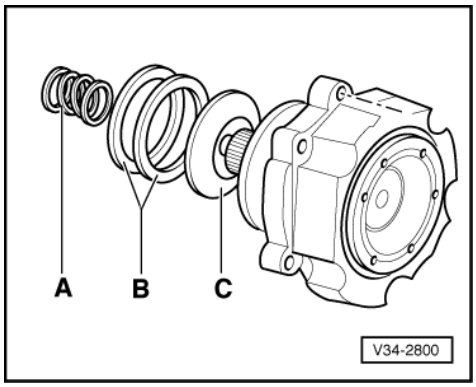


- -> Remove connecting rod -2- and front push rod -3-.
- Pull front selector -4- together with selector lever -1- off selector shaft after removing hexagon nut =>Page 36 .



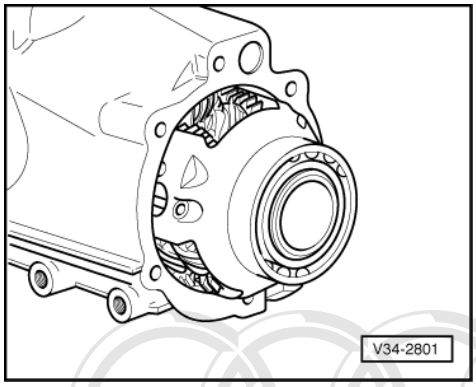
- -> Remove bearing housing -arrow- and pull off.

A - M8/M10 stud

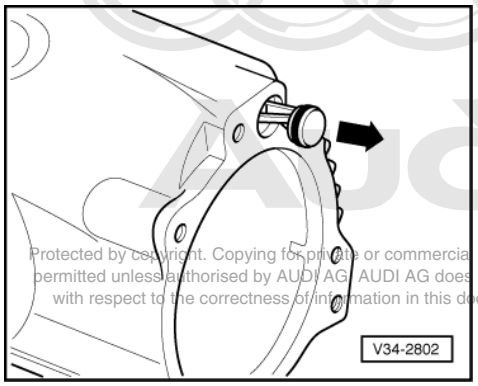


-> When pulling off, the bearing housing is pressed slightly off the end cover by the spring -A-.

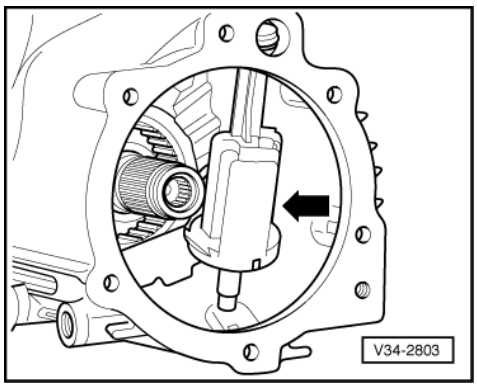
- When removing the bearing housing, note position of spring plate -C-:
  - Outer diameter (concave side) towards shims
- Remove shims -B-, note thickness re-determine if necessary =>Page 93 .



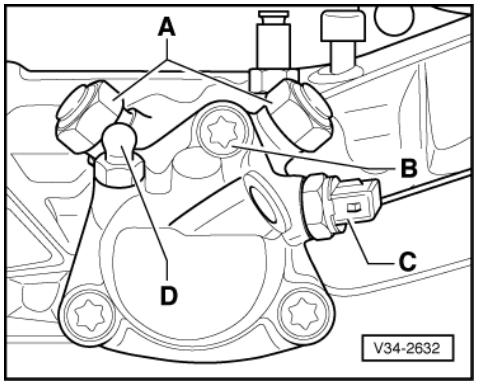
- -> Pull Torsen differential out of end cover.



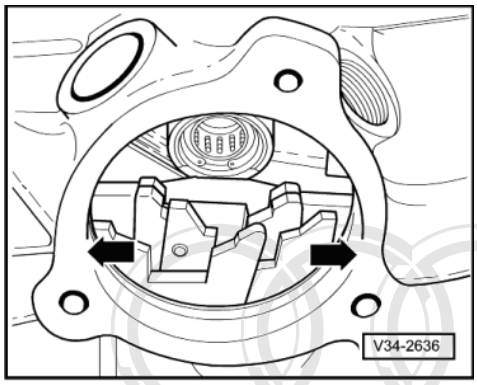
- -> Pull oil collector out of end cover -arrow- until it moves freely.



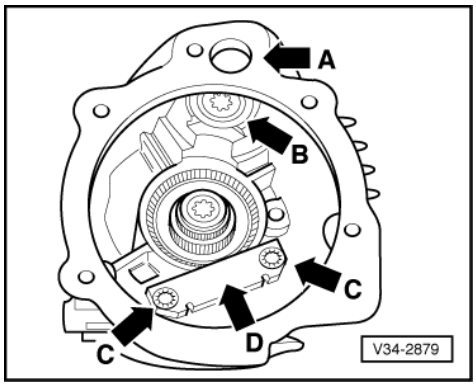
- -> Swing oil collector -arrow- down and guide out through hole in end cover.
- Remove oil collector.



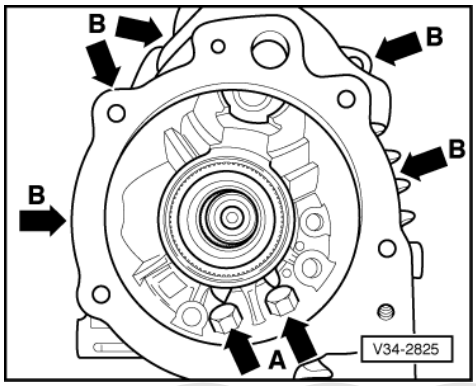
- -> Remove locking bolts -A- for selector shaft from gearbox housing.
- Remove 3 bolts -B- for cover for selector shaft, take off cover.
- Pull out selector shaft.



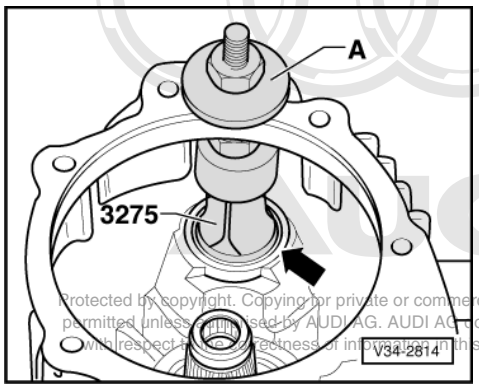
- -> Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear) do this by moving 2 selector plates -arrows-.



- -> Loosen and unscrew multi-point socket head bolt -arrow B- in input shaft through hole -arrow A- in end cover.
- Remove 2 securing bolts -arrow C- for end cover for gearbox at supporting plate for needle bearings -arrow D-.
- Take out supporting plate.



- -> Remove the 2 magnets -arrows A- and clean.
- Loosen the 5 bolts -arrows B- for securing end cover for gearbox and remove.



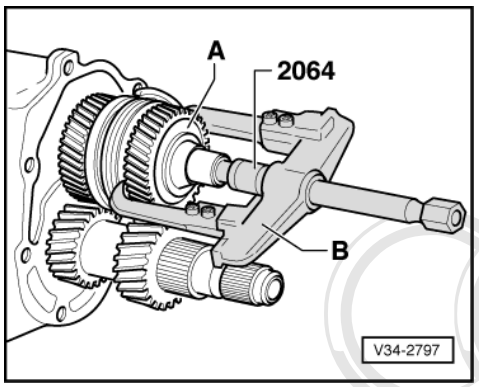
- -> Pull 2nd inner race for ball bearing for input shaft from input shaft.

A - Washer

Note:

The internal extractor 3275 grips the circumferential groove of the inner race -arrow- during the pulling operation.

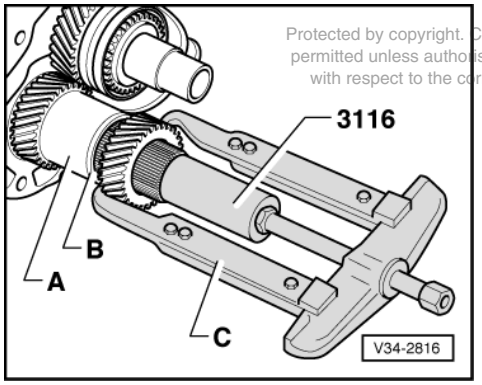
- Take off end cover together with end cover/bearing plate gasket.
- Pull dowel sleeves out of bearing plate.



- -> Pull off 5th speed sliding gear with spring together with 1st inner race -A- for ball bearing for input shaft.

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

- Take off 5th gear synchro-ring.



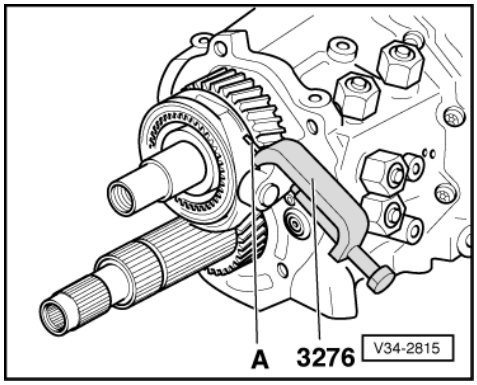
- Take off circlip for 5th speed gear.
- -> Pull off 5th speed gear, to do this, block hollow shaft by engaging 2 gears =>Page 76 .

Note:

Use only hexagon bolt of tensioning sleeve 3116, length 50 mm.

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

- Remove shim -B- for 5th speed gear, note thickness and re-determine if necessary =>Page 89 .
- Take off spacer sleeve -A-.

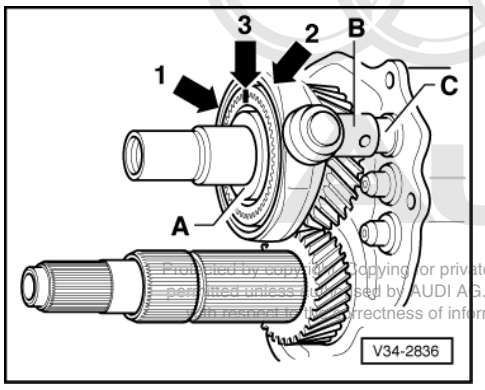


- -> Press out roll pin -A- for selector fork for 5th and 6th gear.

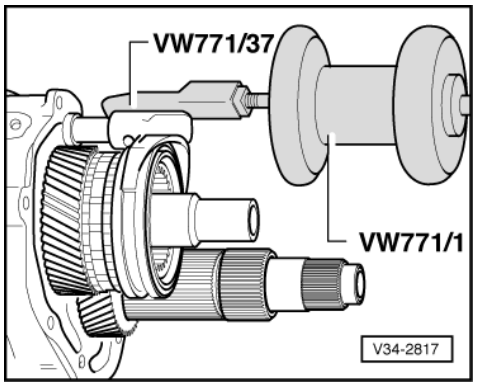
Note:

Do not drive out roll pin, otherwise selector rod bearing will be damaged.

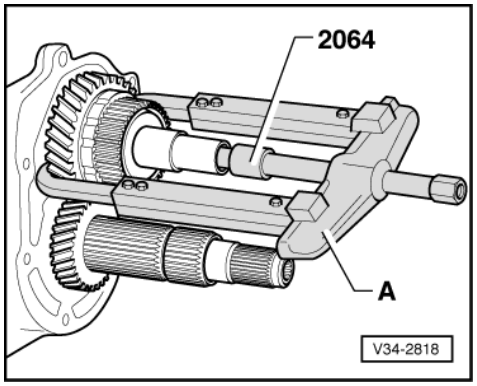
- Pull selector rod on follower together with selector fork for 5th and 6th gear and locking collar as far as possible away from bearing plate (until stop is felt).



- -> Mark installation position -arrow 3- of locking collar for 5th and 6th gear -arrow 1- and synchro-hub -A- (paired).

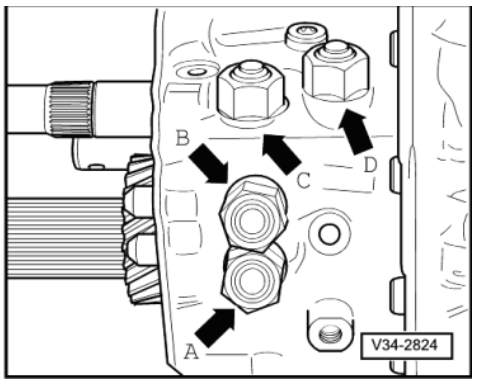


- -> Pull follower together with selector fork and locking collar off selector rod.



- -> 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.

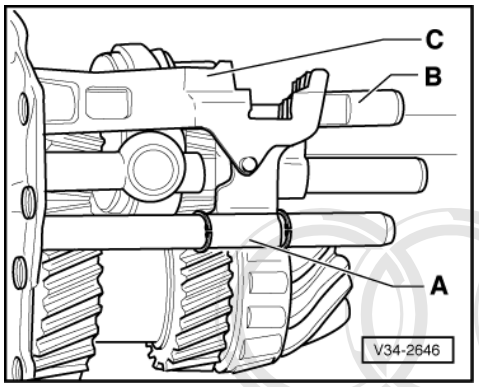
A - Two arm puller, e.g. Kukko 20/10 with 200 mm long hooks



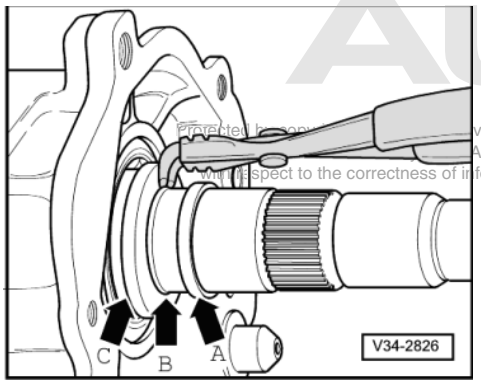
- -> Unscrew selector rod locking bolts.

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

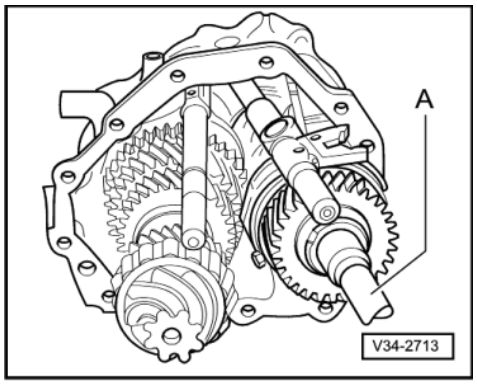
- Drive out dowel sleeves on bearing plate and remove bearing plate from gearbox housing.
- Secure drive pinion relative to hollow shaft e.g. hose tie, to prevent it falling out.
- Separate bearing plate with input shaft, with drive pinion and hollow shaft and with inner selector mechanism from gearbox housing.



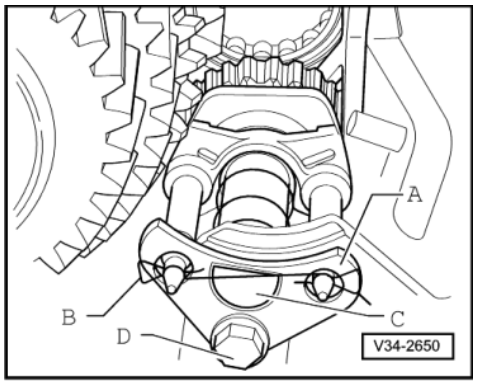
- -> Remove circlip from selector rod for 1st and 2nd gear and take off follower -A-.
- Pull out selector rod -B- for 5th and 6th gear.
- Remove follower -C- for reverse gear.



- -> 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).



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

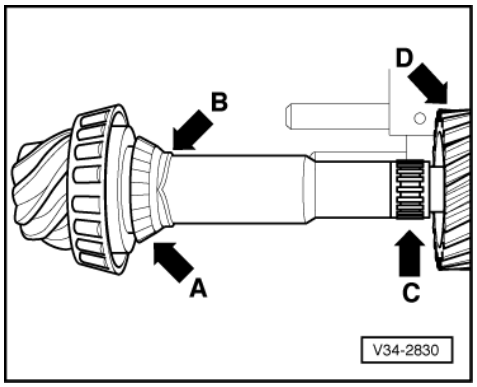


- -> Unscrew hexagon bolt -D-, take off spring clasp -B- and retaining plate -A-, pull out shaft -C- for reverse idler gear.
- Take out spring, synchro-ring and reverse idler gear.
- Take off relay lever for reverse gear.

Removing and installing reverse gear =>Page 112.

Notes:

- Drive pinion and hollow shaft can be removed complete if the 6th speed gear can be easily levered off.

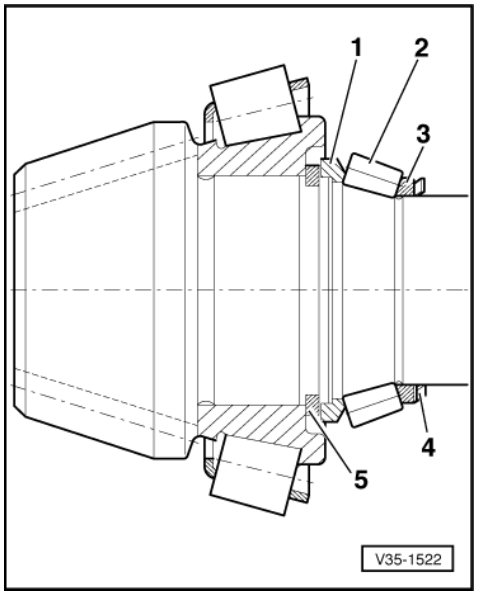


- If it is necessary to press off the 6th speed gear, the drive pinion must be pulled out of the hollow shaft.

- Remove drive pinion circlip.
- -> Pull drive pinion out of hollow shaft -D-, when doing this catch the taper rollers -A- (Qty. 23).
- Take off corrugated spring -B- and needle ring -C-.

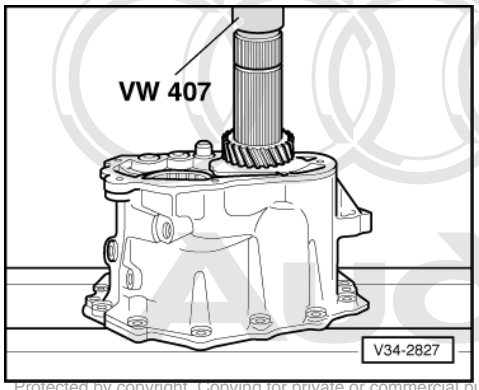
Note:

Carefully protect bearings from dirt, clean if necessary.



- -> Check bearing to ensure it is complete:

  1 - Flange ring (tapered contact surface to tapered rollers)
  2 - Tapered rollers (Qty. 23) with larger diameter facing towards drive pinion head
  3 - Support ring (tapered contact surface to tapered rollers)
  4 - Corrugated spring
  5 - Circlip for tapered roller bearing for drive pinion



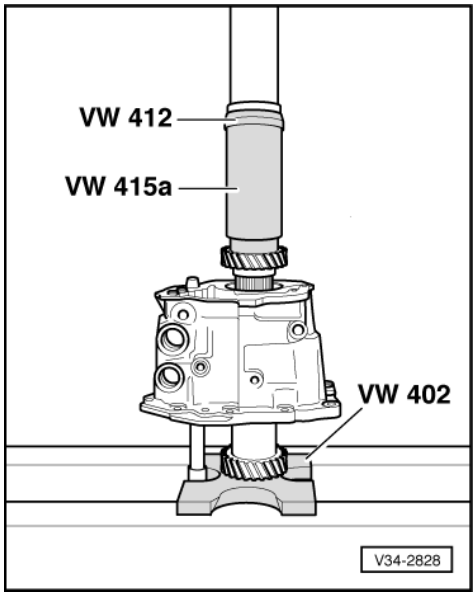
- -> Press off 6th speed gear.

Note:

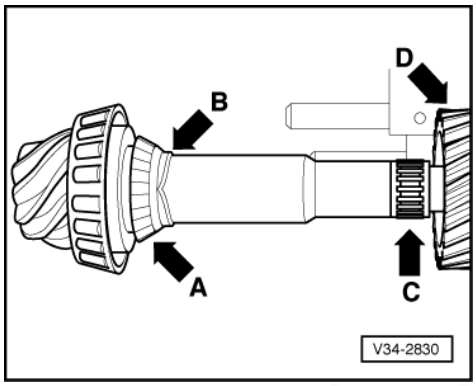
Because of the type of fit, it may be possible to press gear off easily.

- Take hollow shaft or drive pinion and hollow shaft with selector rod and selector fork for 1st and 2nd gear out of the bearing plate.

7.3 - Installing

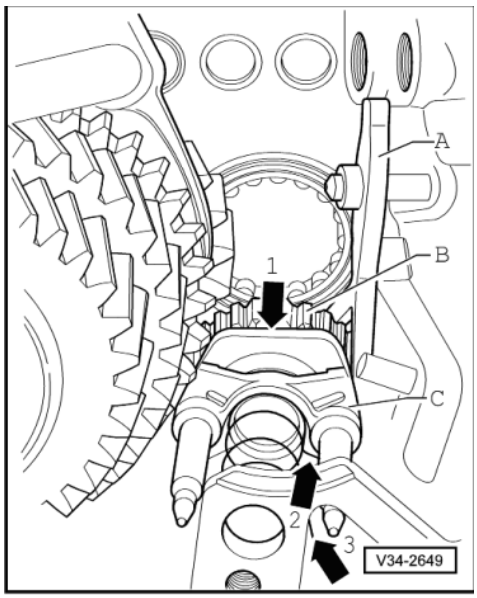


- Fit hollow shaft with selector fork and selector rod for 1st and 2nd gear (without follower) into bearing plate.
- -> Heat 6th gear to approx. 120 °C and fit on.
  - Installation position: shoulder towards taper roller bearing
- Press onto stop; ensure there is no play.
- Grease drive pinion/hollow shaft taper roller bearing with multi-purpose grease before inserting.
  - Allocation =>Page 82

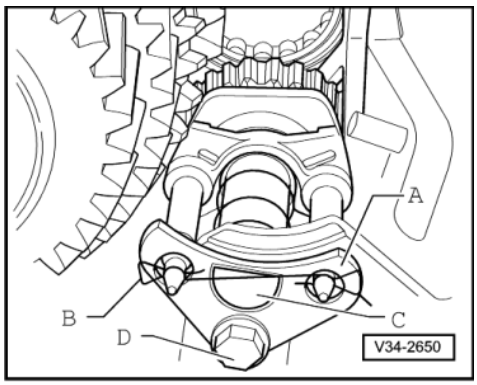


A - -> Flange ring, tapered rollers (Qty. 23), and support ring
B - Corrugated spring
C - Needle ring
D - Hollow shaft

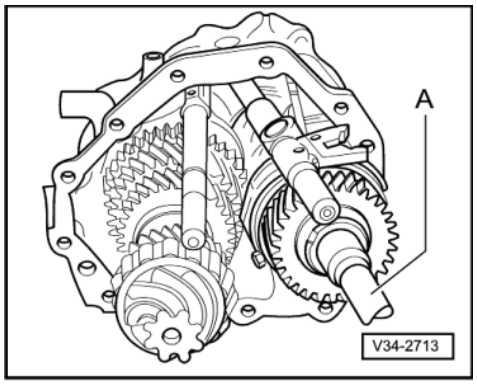
- Oil needle bearing well.
- Insert drive pinion into hollow shaft and secure with hose tie to prevent slipping out.



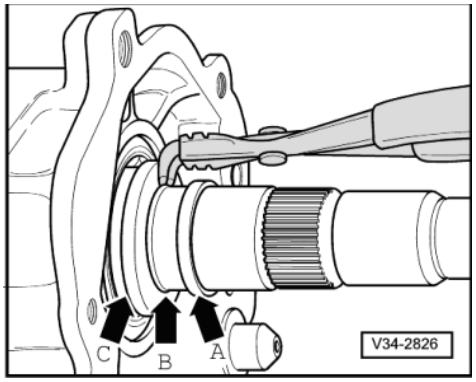
- -> Fit relay lever -A- for reverse gear onto bolt for relay lever. Watch position of pin when doing this (limits relay lever travel to synchro-ring).
- Insert sliding gear -B- and engage relay lever with groove on sliding gear.
- Insert synchro-ring -C-.
  - Installation position: position flat on 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-



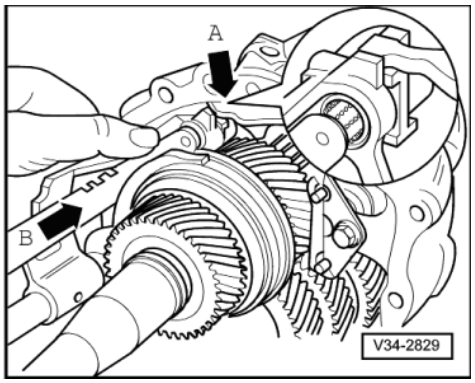
- -> Insert shaft -C-.
- Fit retaining plate -A-.
  - Installation position: chamfers of holes for locking pins of the synchro-ring face bearing plate
- Insert spring clasp -B- into locking pins of the synchro-ring.
- Renew self-locking nut -D- and tighten to 25 Nm.



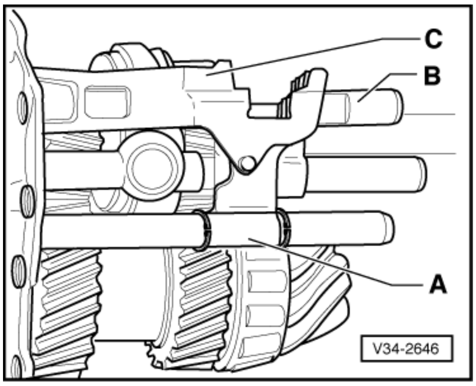
- -> Slide input shaft -A- with selector rod and selector fork for 3rd and 4th gear at an angle into the bearing plate.
  - Selector fork installation position: rib towards follower
    =>Page 72



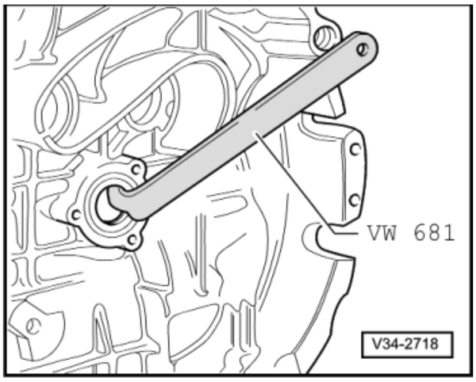
- -> Slide inner race -arrow C- for cylinder roller bearing onto main shaft at flange for end cover (clearance fit).
- Fit circlip -arrow B- using right-angled circlip pliers.



- -> 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.
- Oil all bearings of input shaft and drive pinion/hollow shaft in gearbox housing and bearing flange as well as the selector rods with gear oil.

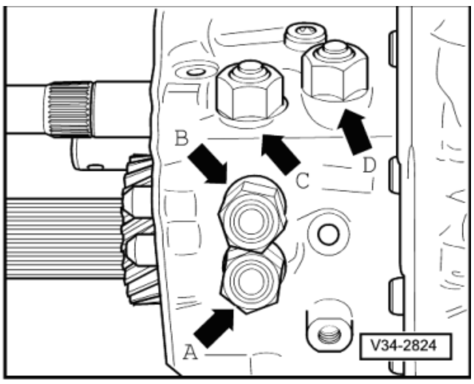


- -> Lever used seal for input shaft carefully out of gearbox housing with VW 681.
- Coat sealing surfaces between bearing plate and gearbox housing with sealing paste AMV 188 200 03.
- Insert complete bearing plate into gearbox housing.

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 12 bolts using diagonal sequence.



- -> Screw in locking bolts for selector rods.

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

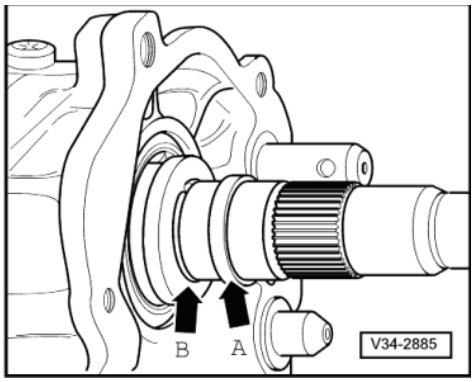
D - Reverse gear

Note:

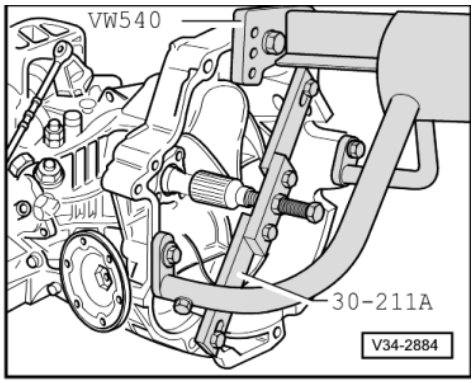
Observe differing tightening torques:

for aluminium locking bolts - 50 Nm,

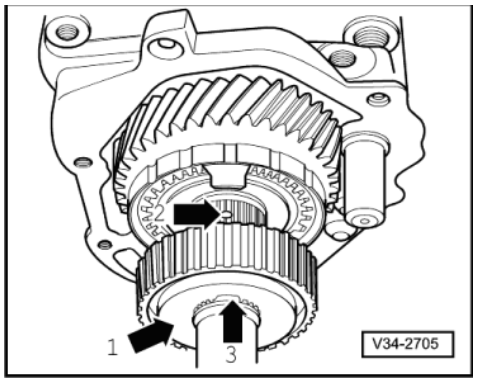
for steel locking bolts - 70 Nm.



- -> 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

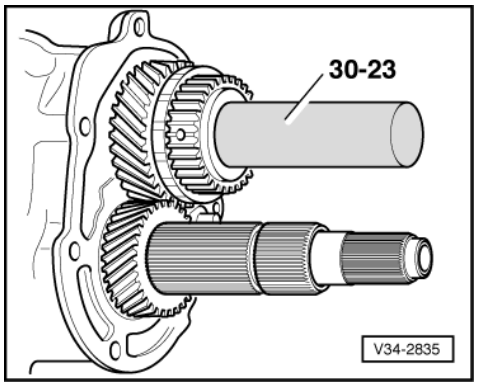


- -> Support input shaft with support bridge 30-211 A.

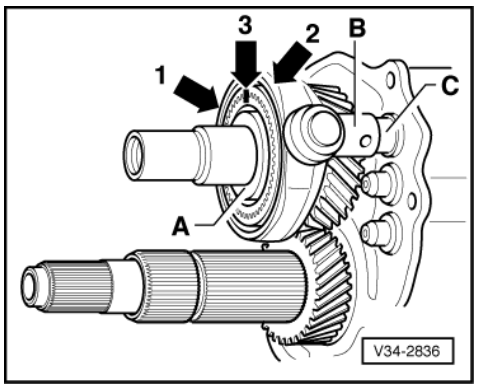


-> Installation position of synchro-hub for 5th and 6th gear:

- 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



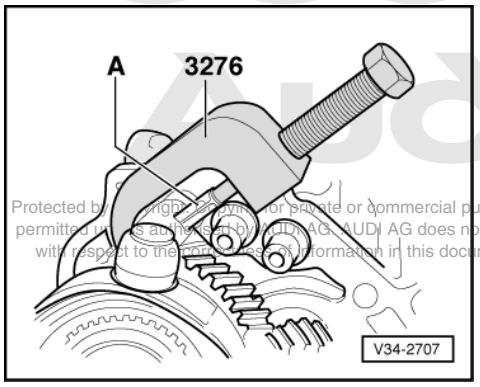
- -> Heat synchro-hub for 5th and 6th gear to approx. 100 °C, fit and drive on; ensure there is no play.
- Check 6th speed sliding gear for axial play.



- -> Align paired synchro-hub -A- and locking collar for 5th and 6th gear -arrow 1-.
- Fit locking collar -arrow 1- with selector fork -arrow 2- onto synchro-hub -A- as well as follower for 5th and 6th gear -B- onto selector rod -C- at the same time.

Notes:

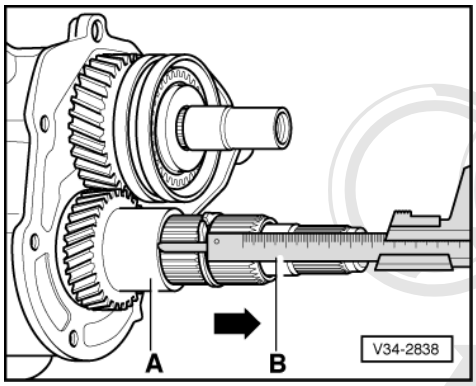
- Selector fork rib -arrow 2- must face towards shaft end.
- When sliding follower onto selector rod for 5th and 6th gear remember holes for roll pin.



- -> Press in roll pin -A- flush.

Note:

Do not drive in roll pin, otherwise selector rod mounting will be damaged.

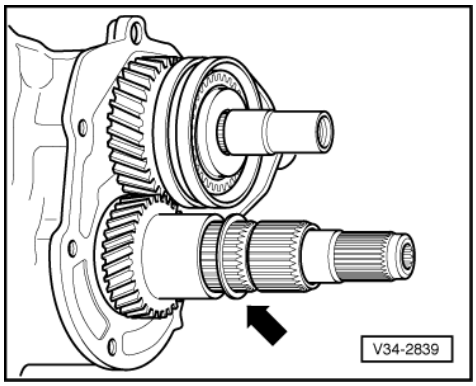


- Re-determining shim for 5th speed gear:
  - -> Fit spacer sleeve -A- (length 39.6 mm) onto hollow shaft.
  - When fitting circlip, push in direction of arrow onto stop.
  - Measure distance between sleeve and fitted circlip with depth gauge -B-.
  - Determine shim from table. Part numbers

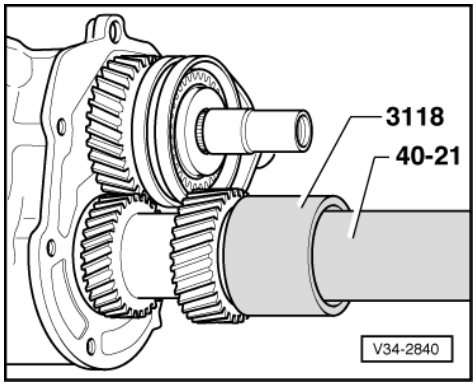
=> Parts catalogue

The following shims are available:

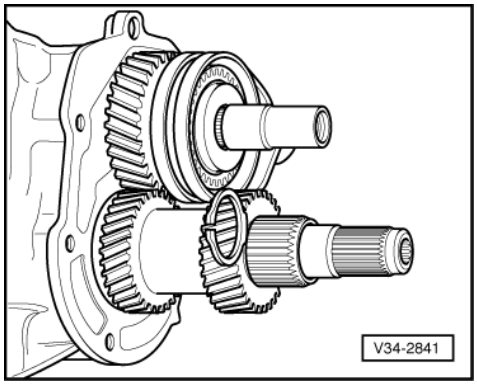
Measured range (mm)	Shim thickness (mm)
31.01 ... 31.11	1.05
31.11 ... 31.21	1.15
31.21 ... 31.31	1.25
31.31 ... 31.41	1.35



- -> Fit shim selected -arrow- onto hollow shaft.



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



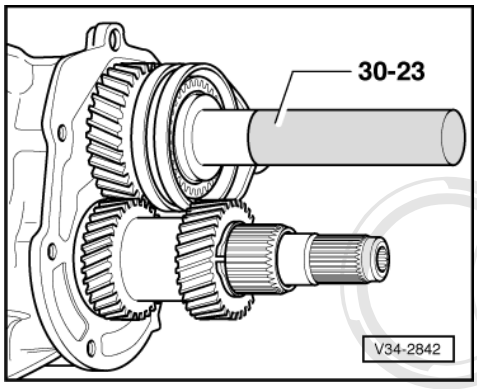
- -> Re-determining circlip for 5th speed gear:
  - Determine the thickest circlip that can still just be fitted.
  - Determine circlip from table. Part numbers

=> Parts catalogue

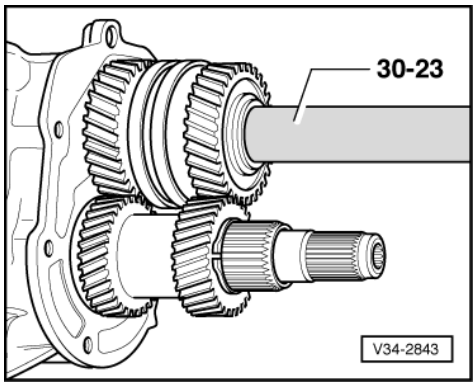
The following circlips are available:

Circlip thickness (mm)		
2.32	2.40	2.48
2.34	2.42	2.50
2.36	2.44	
2.38	2.46	

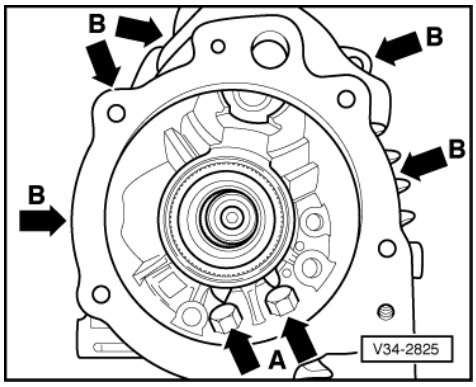
- Fit circlip.



- -> 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 for ball bearing for input shaft to approx. 100 °C, fit onto input shaft and drive onto stop; ensure there is no play.
- Check 5th speed sliding gear for axial clearance.
  - Permissible axial clearance: 0.15 ... 0.35 mm
- Insert dowel sleeves into bearing plate.
- Fit new gasket for end cover.

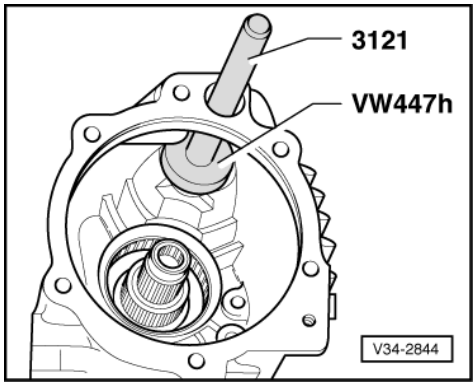


- -> Fit end cover and insert securing bolts -arrows B-.

Note:

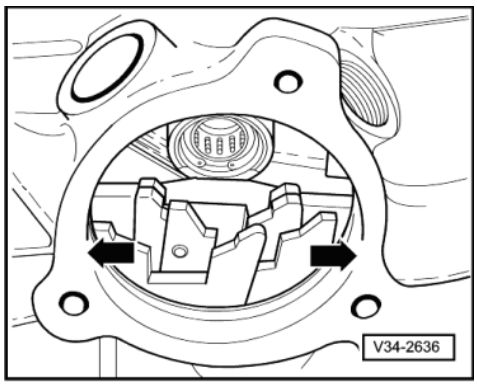
Do not tighten bolts.

- Clean the two magnets -arrows A- and insert.
- Fit support plate and tighten hand tight.
  - Installation position: Lugs towards magnets
- Tighten bolts for end cover using diagonal sequence.

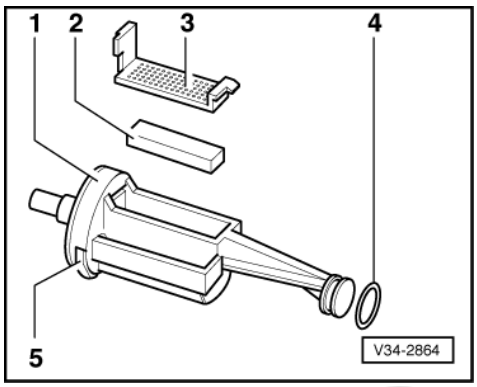


- -> Oil 2nd inner race and with ball contact surface facing towards input shaft ball bearing, drive onto input shaft through hole in end cover.

- Remove support bridge 30-211 A.



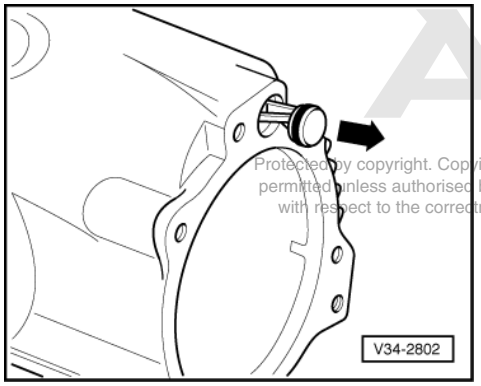
- -> Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear), do this by moving two selector plates -arrows-.
- Tighten multi-point socket head bolt to 150 Nm.



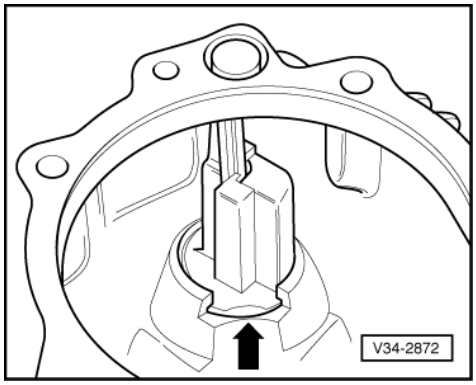
- -> Unclip cover -3- for oil collector from oil collector -1- at longer end with a screwdriver and remove magnet -2-.

4 - O-ring
5 - Positioning segment

- Clean oil collector.
- Assemble oil collector.

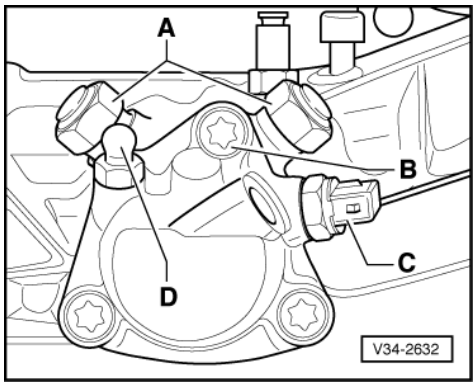


- -> Guide oil collector from interior of end cover with support arm leading through the hole of the end cover -arrow-, until the O-ring can be fitted from outside onto the oil collector.
- Lightly oil new O-ring and fit.

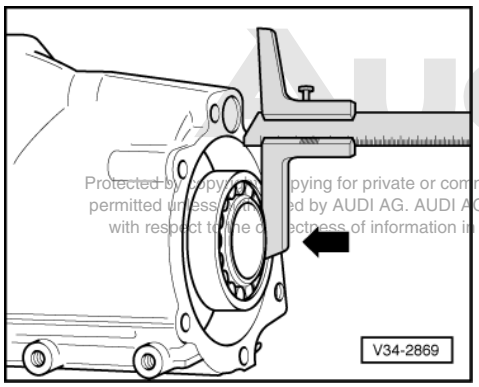


- Insert oil tube of oil collector into input shaft.
- -> Turn oil collector until the positioning segment is located in the machined recess of the end cover -arrow-.
- Press in oil collector onto stop.
- Slide assembly sleeve, Part No. 01E 311 120, onto selector shaft.
- Check neutral position of followers.
  - Selector gates must align

- Install complete selector shaft.



- -> Screw locking bolts -A- for selector shaft into gearbox housing.
  - 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.
- Coat bolts -B- (Qty. 3) with sealing paste AMV 188 200 03 before installing and tighten.

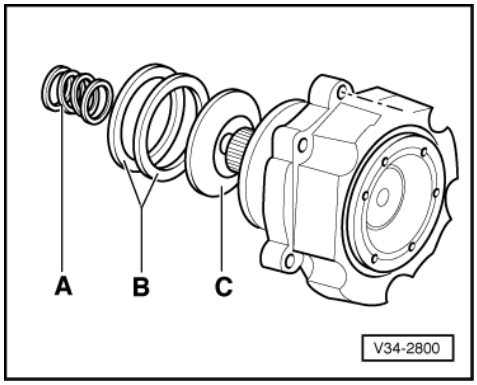


- Slide Torsen differential onto splines of hollow shaft.
- -> Press Torsen differential in direction of arrow, and measure distance between top edge of the bolted end cover and front edge of outer race of ball bearing for Torsen differential.
- Determine required shim(s) from following table. Part numbers

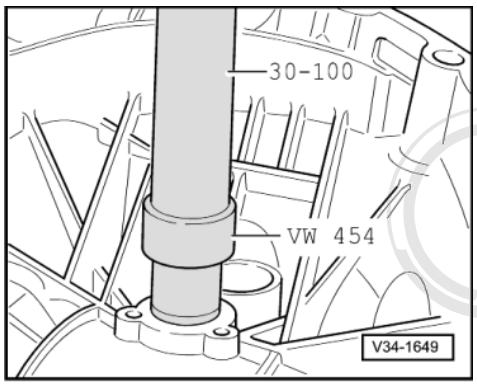
=> Parts catalogue

The following shims are available:

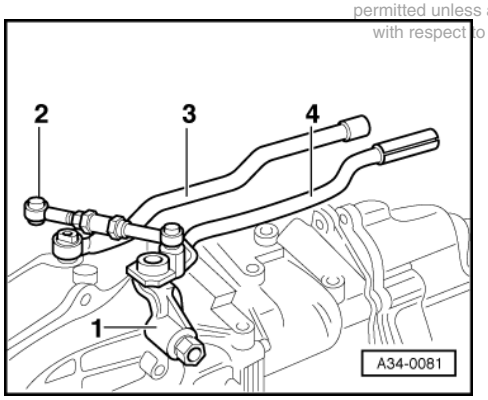
Measured range mm	Qty.	Shim thickness (mm)
7.05 ... 7.30	1 1 1	1.65 1.45 1.20
7.30 ... 7.55	1 1 1	1.65 1.45 0.95
7.55 ... 7.80	1 1 1	1.65 1.45 0.70
7.80 ... 8.05	1 1 1	1.65 1.45 1.05
8.05 ... 8.25	2	1.05
8.25 ... 8.50	1 1	1.65 1.45
8.50 ... 8.75	1 1	1.65 1.20
8.75 ... 9.00	1 1	1.65 0.95
9.00 ... 9.25	1 1	1.65 0.70
9.25 ... 9.50	1 1	1.65 0.45



- -> Insert spring plate -C- into bearing housing.
  - Installation position: larger diameter (concave side) towards the shims.
- Fit shims -B- as determined in table.
- Fit spring -A- to end of flange shaft.
- Lightly oil new O-ring for bearing housing and fit.
- Oil small needle bearing in drive pinion.
- Insert complete bearing housing and pull home evenly.
- Tighten bearing housing using diagonal sequence.



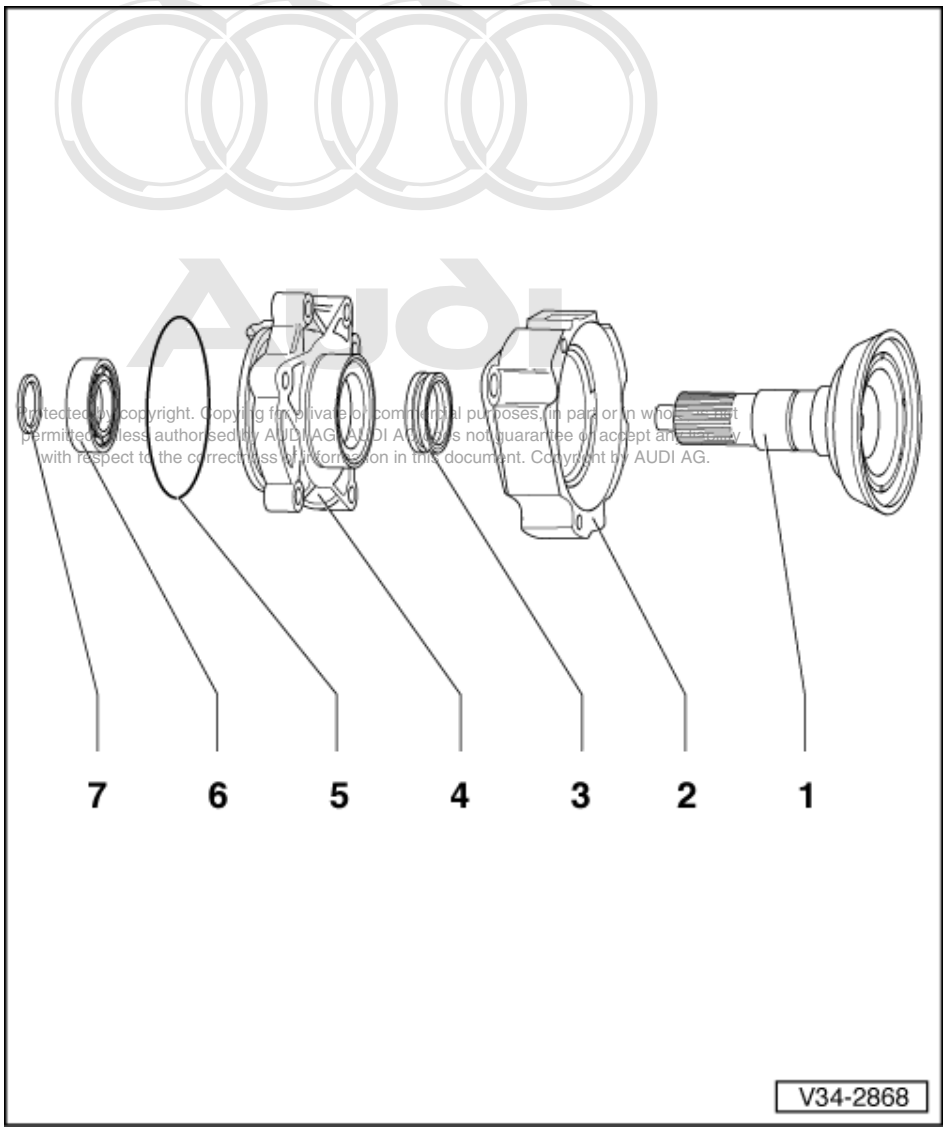
- Fill space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Pull a thin protective hose tightly onto splines of input shaft.
- -> Drive on seal for input shaft.
  - Insertion depth: 3.5 mm
- Remove protective hose.



- Install release bearing, clutch release lever and guide sleeve =>from Page 24 .
- -> Install front selector rod -4- together with selector lever -1- and cap nut =>Page 36 .
- Check that gearbox can be shifted through all gears.
- Install front push rod -3- =>Page 44 .
- Check connecting rod -2- adjustment =>Page 47 .
- Fit connecting rod.
- Check oil level in gearbox =>Page 60 .

8 - Dismantling and assembling bearing housing

8.1 - Dismantling and assembling bearing housing

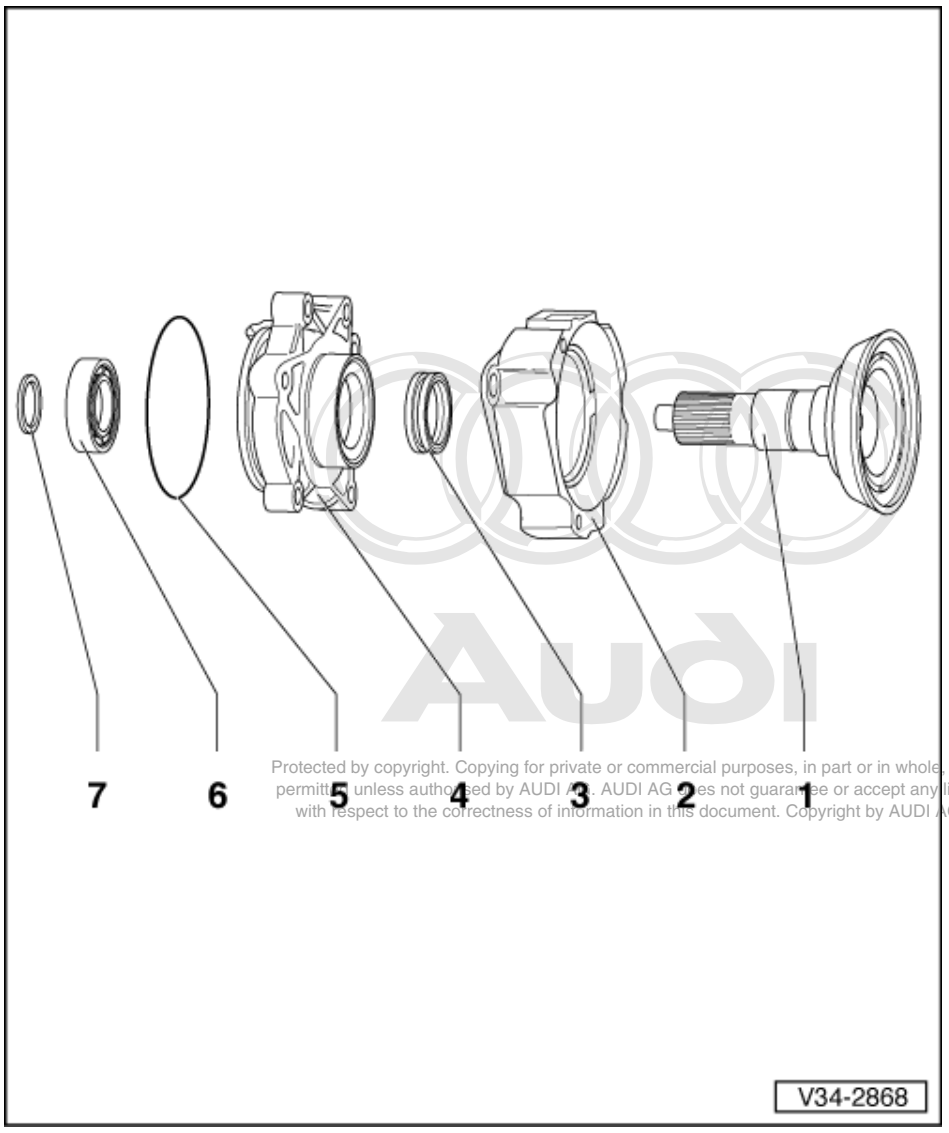


1 **Flange shaft**
- Pressing out =>Fig. 1
- Pressing in =>Fig. 2

2 **Balance weight**
- Pressing off =>Fig. 3
- Pressing on =>Fig. 4

3 **Seal**
- Pulling out =>Fig. 5
- Preparing for installation =>Fig. 6
- Driving in =>Fig. 7

4 **Bearing housing**



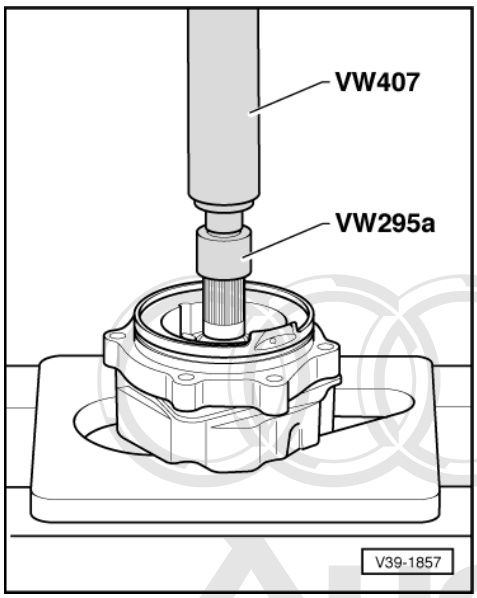
5 O-ring

- Always renew
- Lightly oil before installing

6 Ball bearing for flange shaft

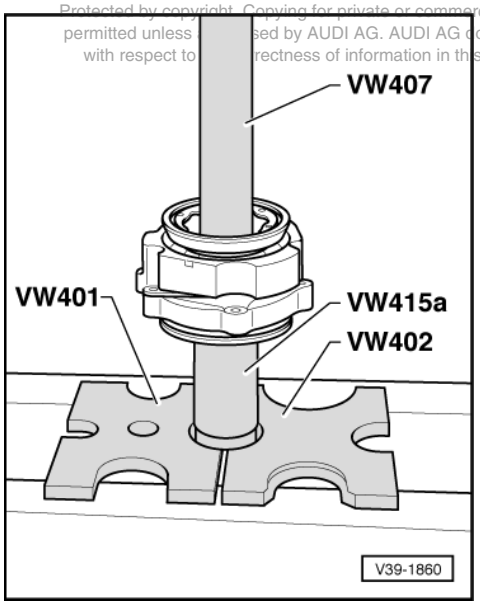
- Pressing off =>Fig. 8
- Pressing in =>Fig.9

7 Circlip



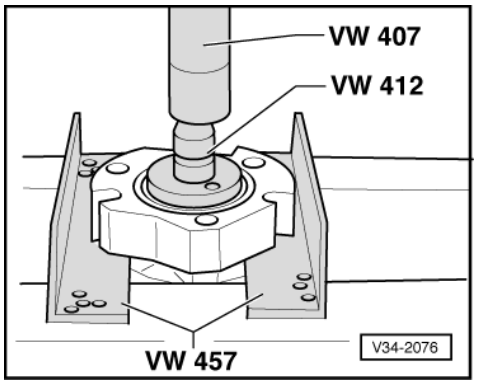
-> Fig.1 Pressing out flange shaft

- Before pressing out flange shaft remove circlip.

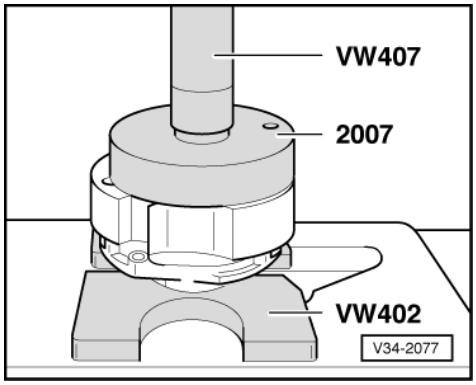


-> Fig.2 Pressing in flange shaft

- Before pressing in flange shaft, press on balance weight => Fig. 4 .
- Fit circlip.



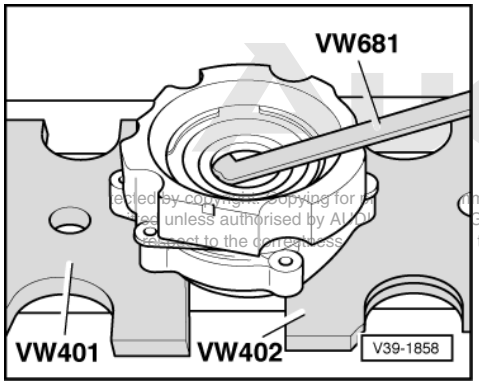
-> Fig.3 Pressing off balance weight



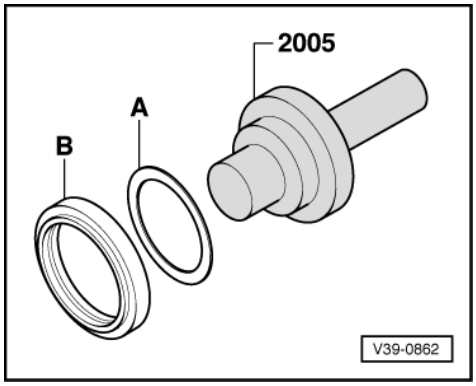
-> Fig.4 Pressing on balance weight

Note:

Note position of holes.



-> Fig.5 Pulling out seal

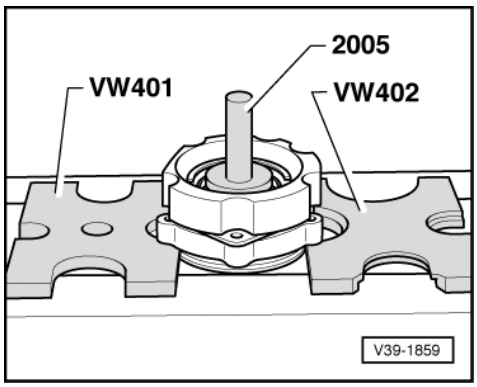


-> Fig.6 Preparing seal for installation

A - Shim Part No. 016 311 391 B (1.7 mm thick)
B - Seal

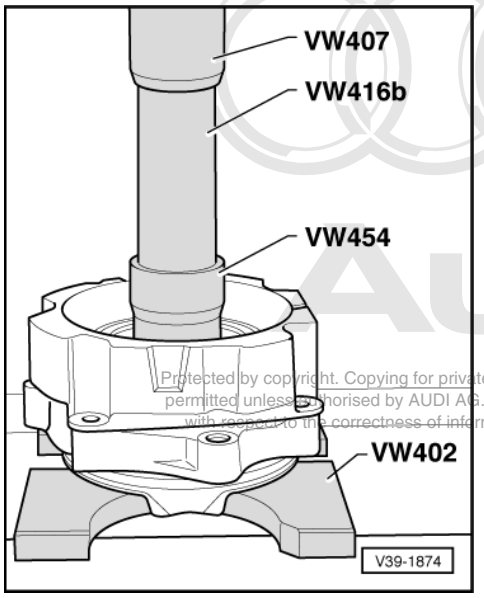
- Fill space between sealing and dust lips with grease.
- Fit shim and seal onto tool one after the other.

- Installation position: open side of seal towards bearing housing

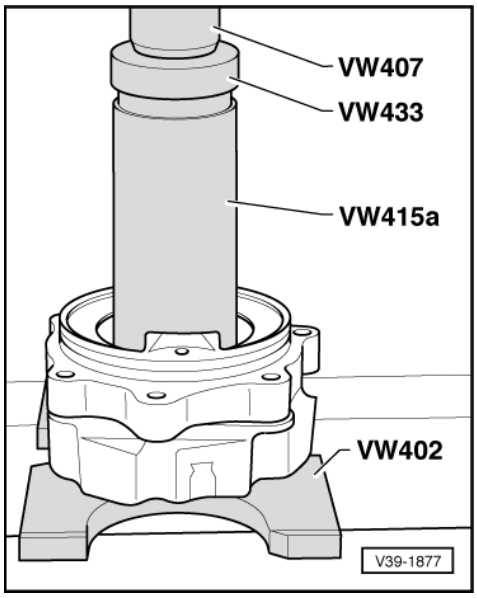


-> Fig.7 Driving in seal

- Remove shim.



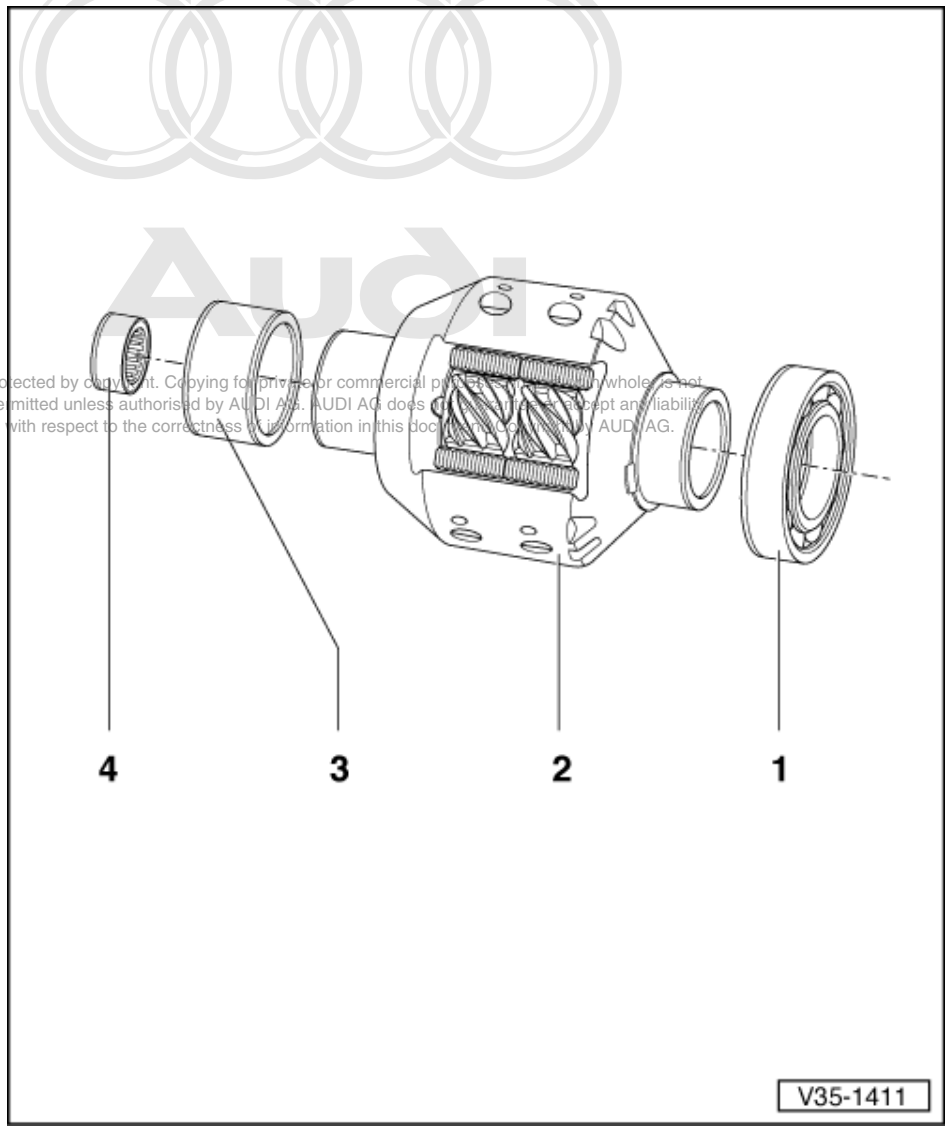
-> Fig.8 Pressing out ball bearing for flange shaft



-> Fig.9 Pressing in ball bearing for flange shaft

9 - Servicing bearings for Torsen differential

9.1 - Servicing bearings for Torsen differential

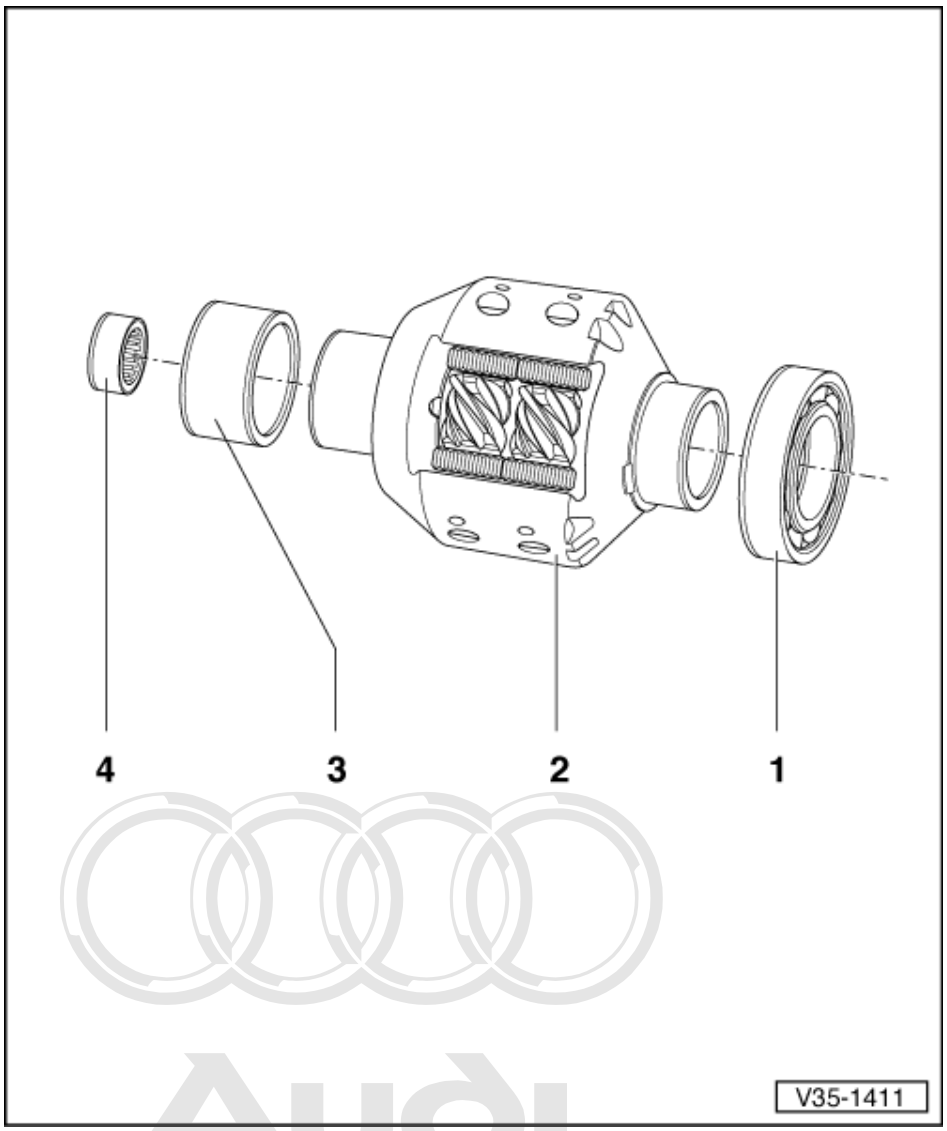


1 Ball bearing for Torsen differential
- Pressing off => Fig. 1
- Pressing on => Fig. 2

2 Torsen differential
- Can only be serviced by manufacturer

3 Inner race for needle bearing for Torsen differential
- Pulling off => Fig. 3
- Pressing on => Fig. 4

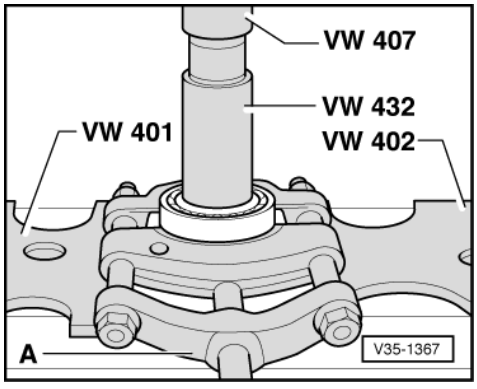
4 Needle bearing for drive pinion/Torsen differential
- Pulling out => Fig. 5
- Pressing in => Fig. 6



Note:

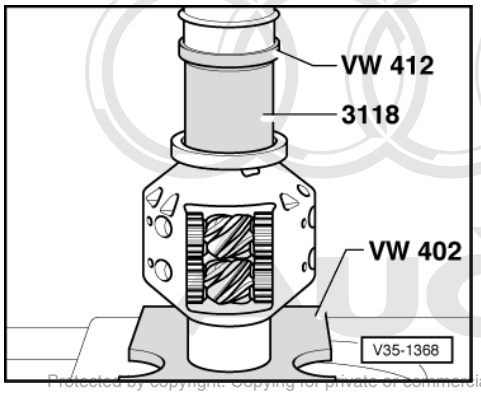
The shims for the Torsen differential must be re-determined after replacing the following parts =>Page 94 :

- End cover
- Inner race for needle bearing
- Torsen differential
- Ball bearing for Torsen differential



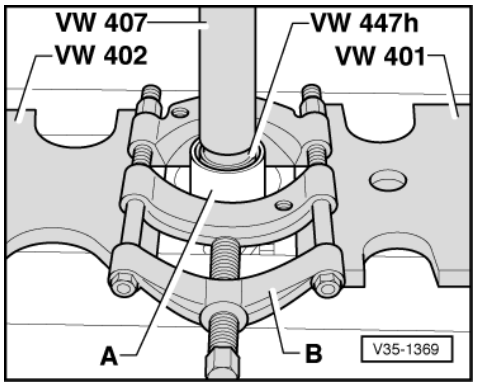
-> Fig.1 Pressing off ball bearing for Torsen differential

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



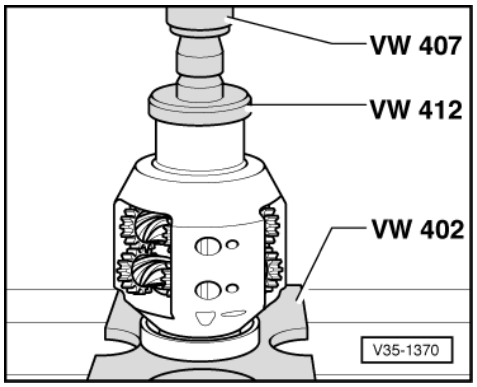
-> Fig.2 Pressing on ball bearing for Torsen differential

- Press piece 3118 with shoulder towards press tool VW 412

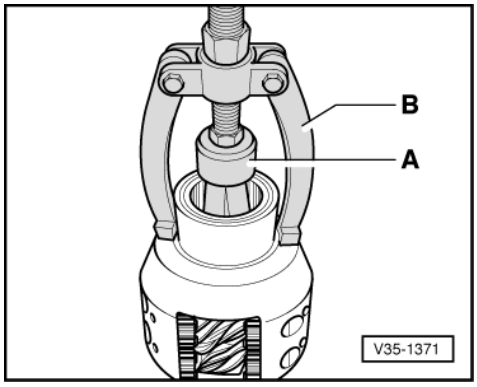


-> Fig.3 Pulling off inner race for needle bearing for Torsen differential

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

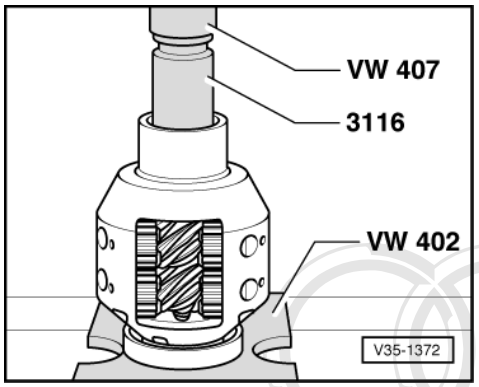


-> Fig.4 Pressing on inner race for needle bearing for Torsen differential



-> Fig.5 Pulling out needle bearing for drive pinion/Torsen differential

A - Internal puller 30 ... 37 mm, e.g. Kukko 21/5
B - Counter support, e.g. Kukko 22/1

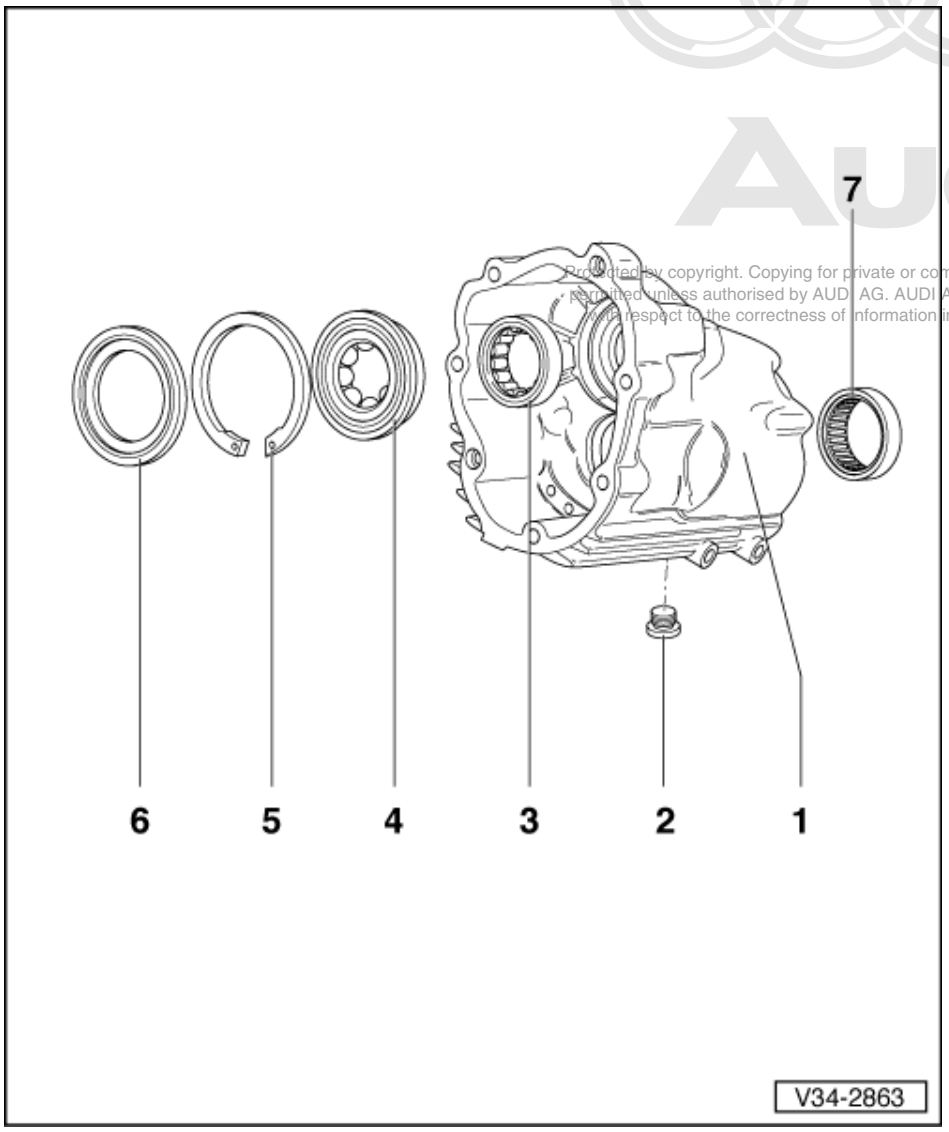


-> Fig.6 Pressing in needle bearing for drive pinion/Torsen differential

- Press in needle bearing so it is flush on the inside.

10 - Servicing end cover

10.1 - Servicing end cover



1 End cover

- If renewed:
- Re-determine thickness of circlip -item 5 -.
- Re-determining shims for Torsen differential => Page 94 .

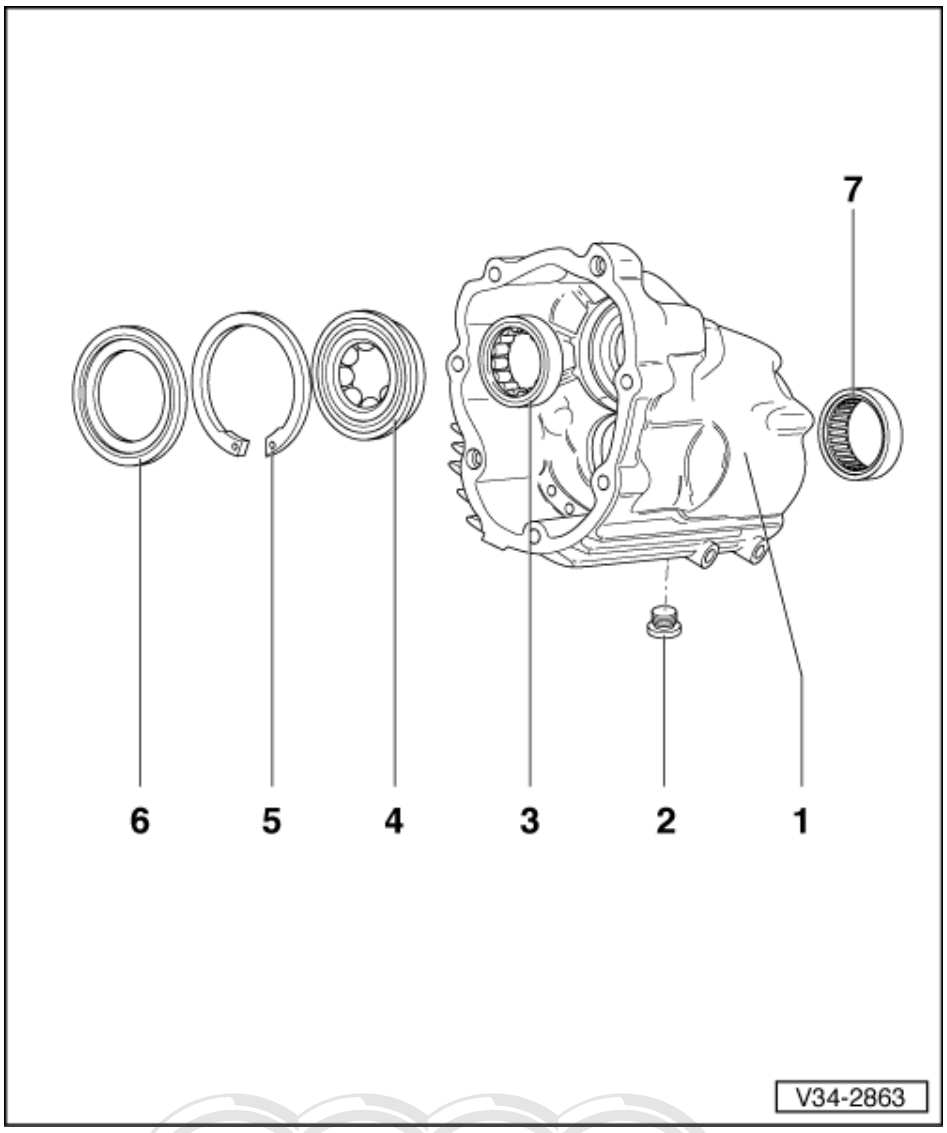
2 Oil drain plug - 40 Nm

3 Cylinder roller bearing for input shaft

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

4 Ball bearing for input shaft

- Removing =>Fig. 3
- Installing =>Fig. 4
- If renewed, re-determine thickness of circlip -item 5 -



5 Circlip

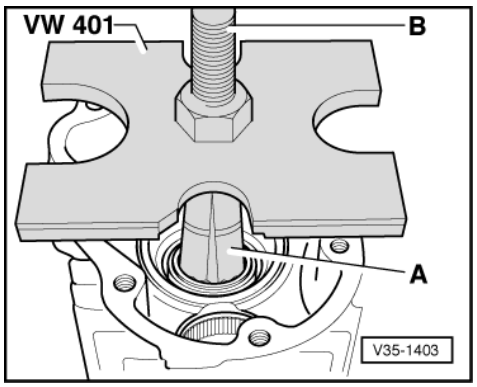
- Re-determine thickness
  => Page 108
- Installing =>Fig. 4

6 Baffle plate

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

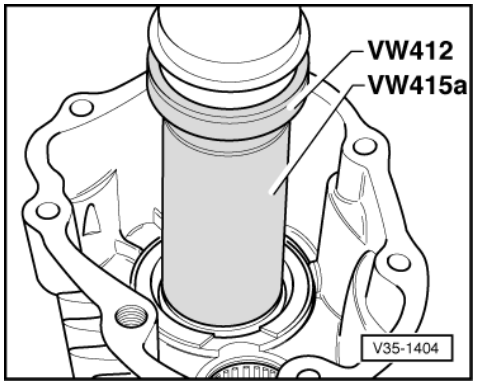
7 Needle bearing for Torsen differential

- Pulling out =>Fig.
- Driving in => Fig. 8



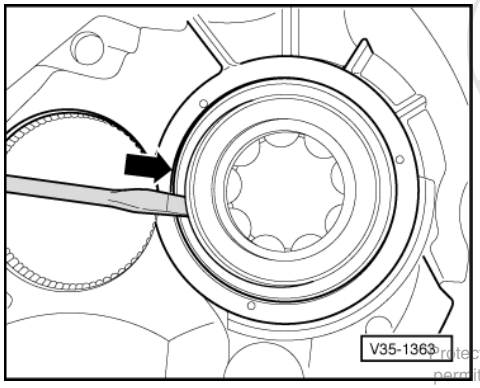
-> Fig.1 Pulling cylinder roller bearing for input shaft out of end cover

A - Internal puller 37 ... 46 mm, e.g. Kukko 21/6
B - Spindle from counter support Kukko 22/2



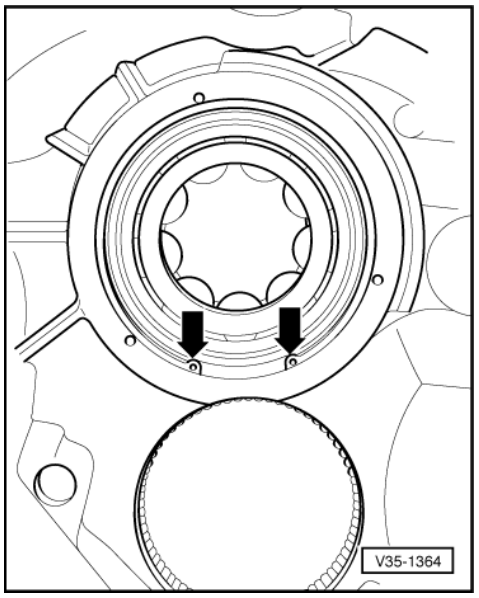
-> Fig.2 Pressing cylinder roller bearing for input shaft flush into end cover

- Tube VW 415a with shoulder towards press tool VW 412



-> Fig.3 Removing ball 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.



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

Installation position of circlip:

- Ends of circlip -arrows-, point towards needle bearing

Note:

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

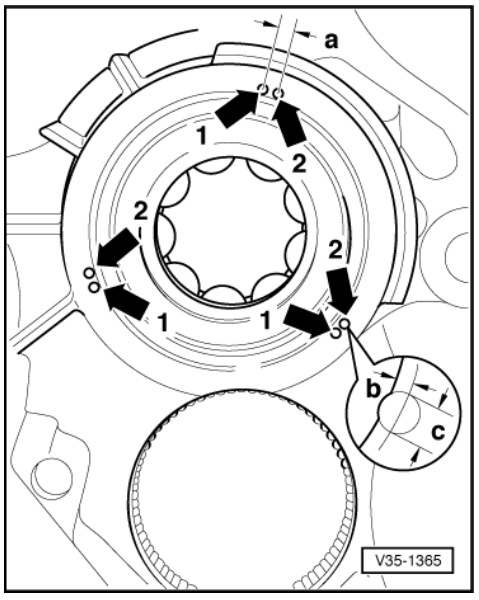
- Determining circlip for ball bearing for input shaft:
  - Press ball bearing outer race onto stop.
  - Determine the thickest circlip that can still just be fitted.
  - Axial play: max. 0.08 mm
  - Determine circlip from table. Part numbers

=> Parts catalogue

The following circlips are available:

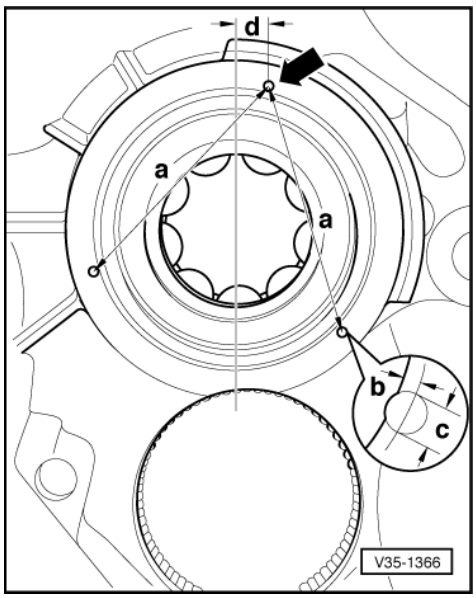
Circlip thickness (mm)	
2.55	2.65
2.60	2.70

- Fit circlip.



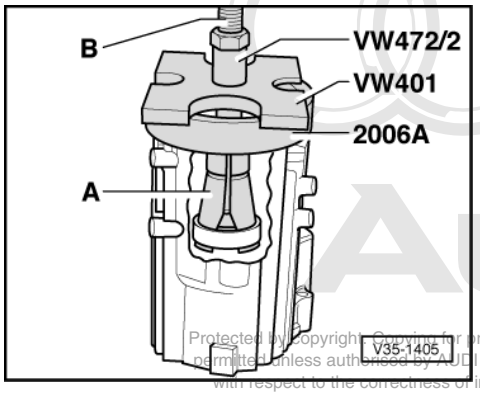
-> Fig.5 Peening baffle plate in position when renewing ball bearing for input shaft

- 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 diameterof peening positions:
  - Dimension b = 2 mm
  - Dimension c = 3 mm



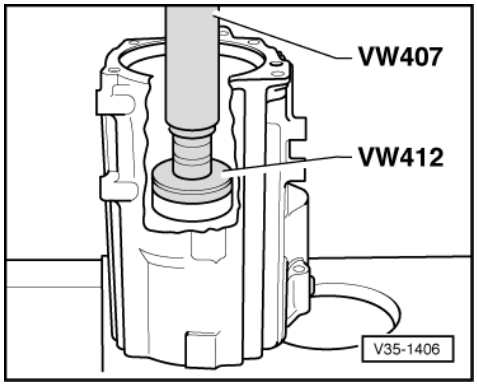
-> Fig.6 Peening baffle plate in position when renewing end cover

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert baffle 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 needle bearing for Torsen differential out from end cover

A - Internal puller 46 ... 58 mm, e.g. Kukko 21/7
B - Spindle from counter support Kukko 22/2

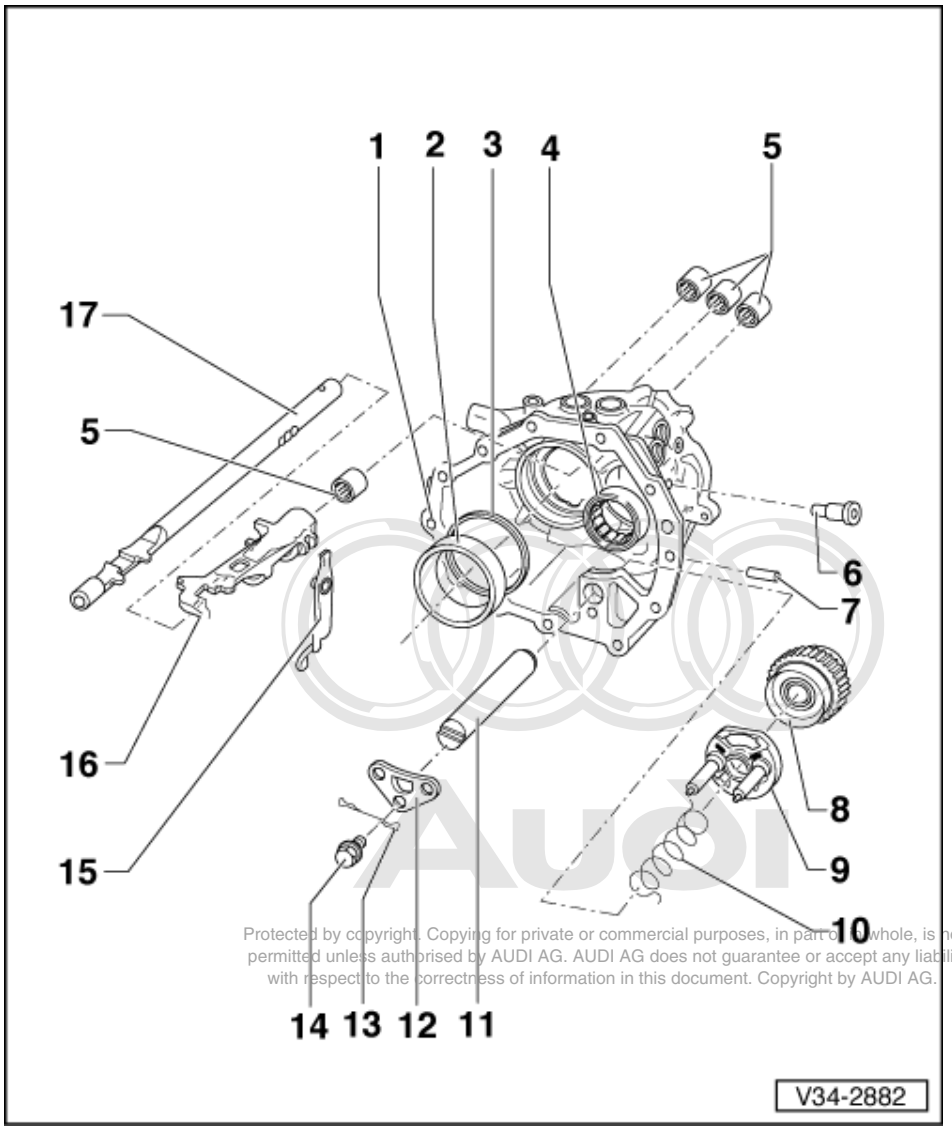


-> Fig.8 Driving needle bearing for Torsen differential flush into end cover

- Fit press plate VW 412 onto bearing with shoulder facing up.

11 - Servicing bearing plate

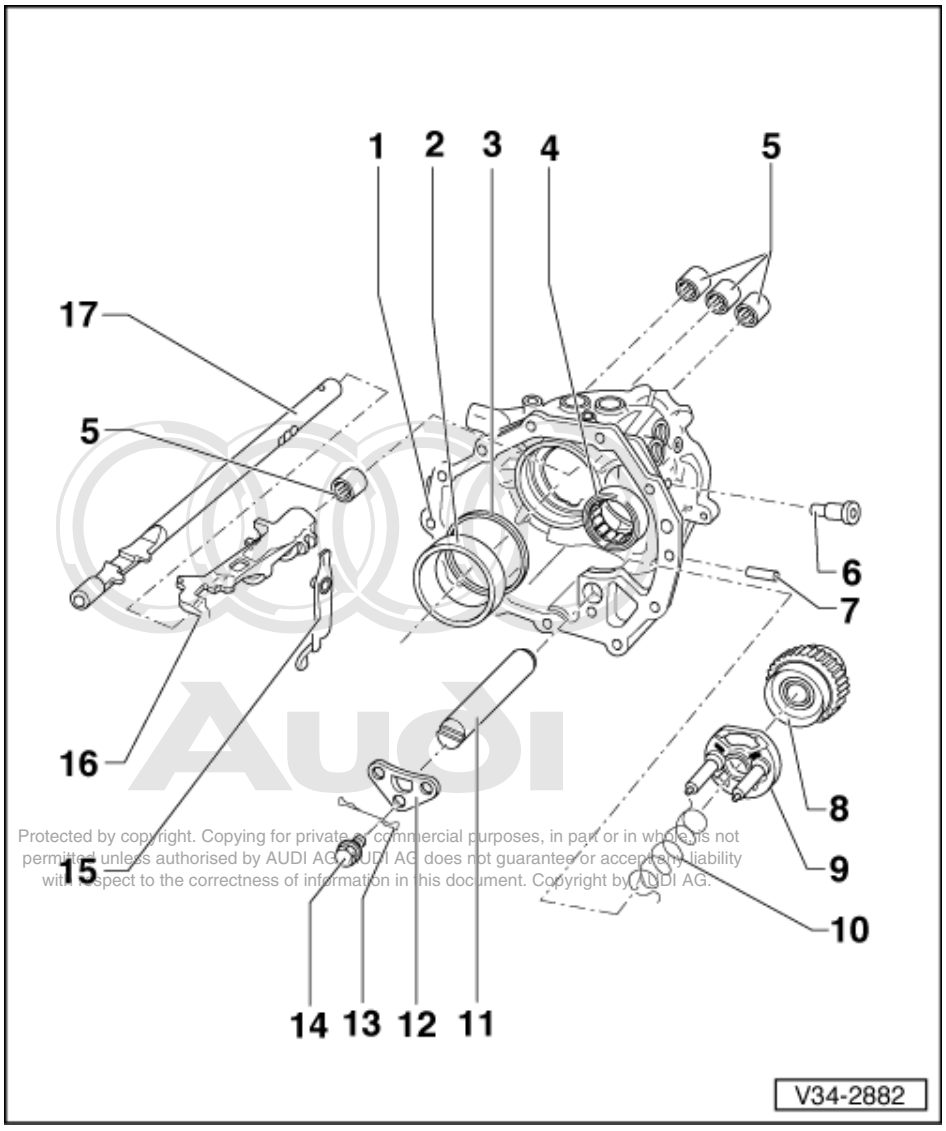
11.1 - Servicing bearing plate



1 Bearing plate
- If replacing, re-determine shim "S4"

2 Outer race for taper roller bearing for drive pinion
- Driving out => Page 162
- Pressing in => Page 162
- If replacing, re-determine shim "S4"

3 Shim "S4"
- Adjustment overview => Page 184
- Re-determining => Page 118



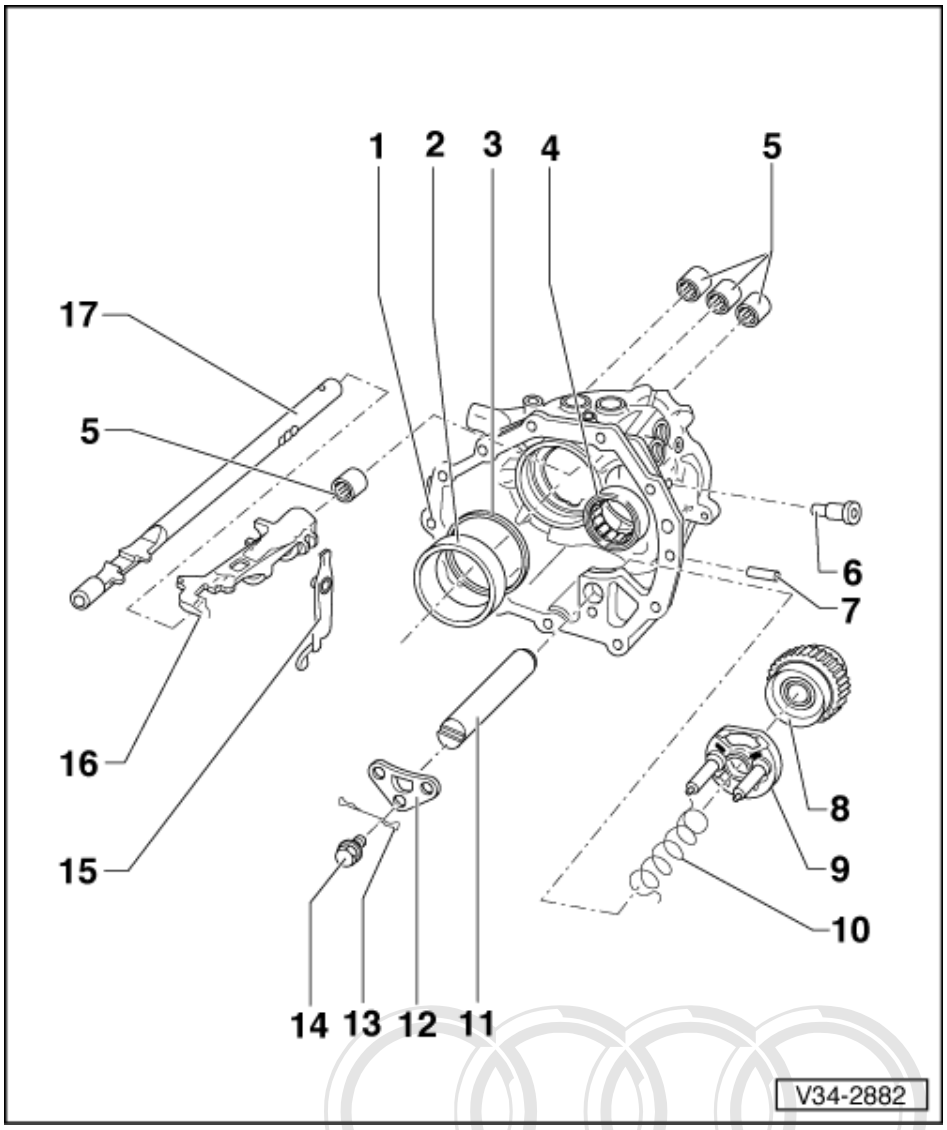
4 Cylinder roller bearing for input shaft
- Pressing out => Fig. 5
- Pressing in => Fig. 6
- Measuring insertion depth =>Fig. 7

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

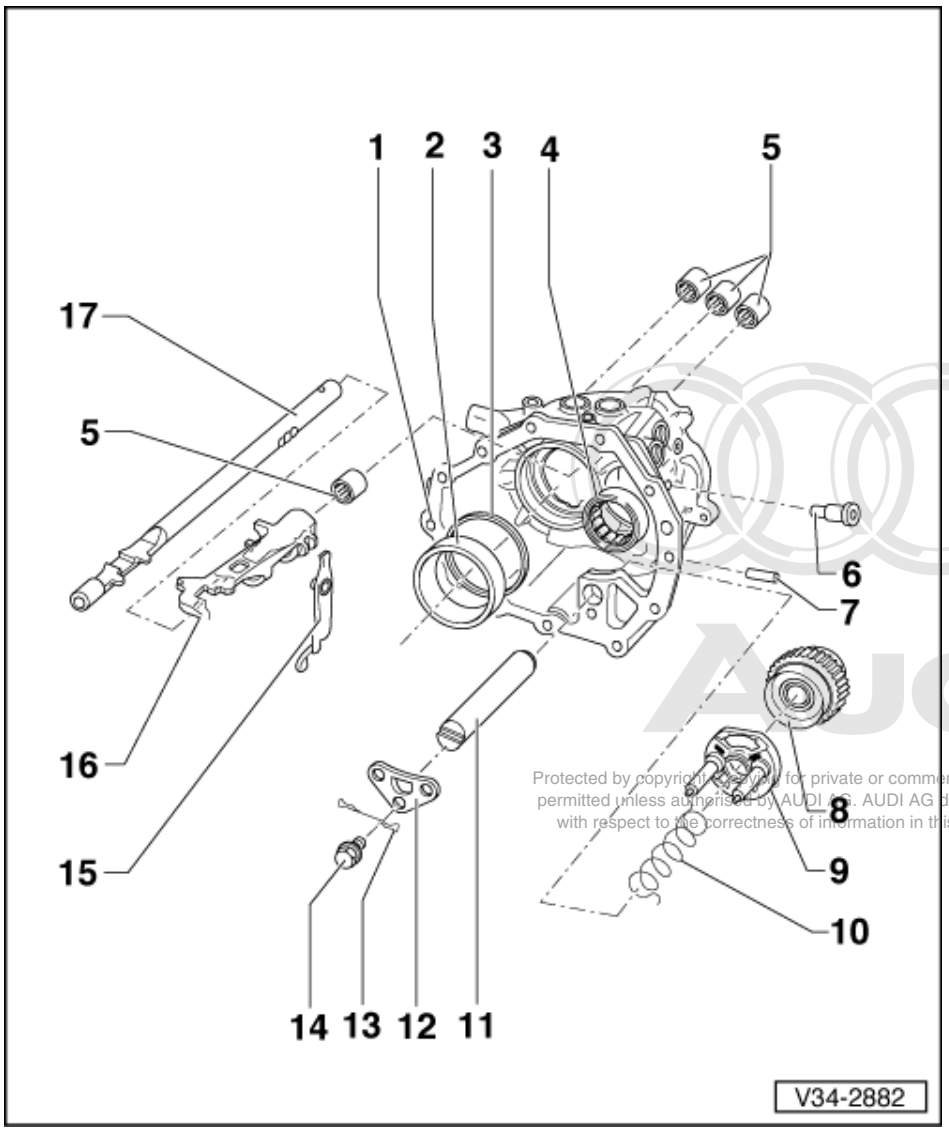


9 Synchro-ring for reverse gear

- With locking pins
- Checking for wear => Fig. 2
- Installation position: position flat on synchro-ring circumference to face input shaft => Page 84

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

12 Retaining plate

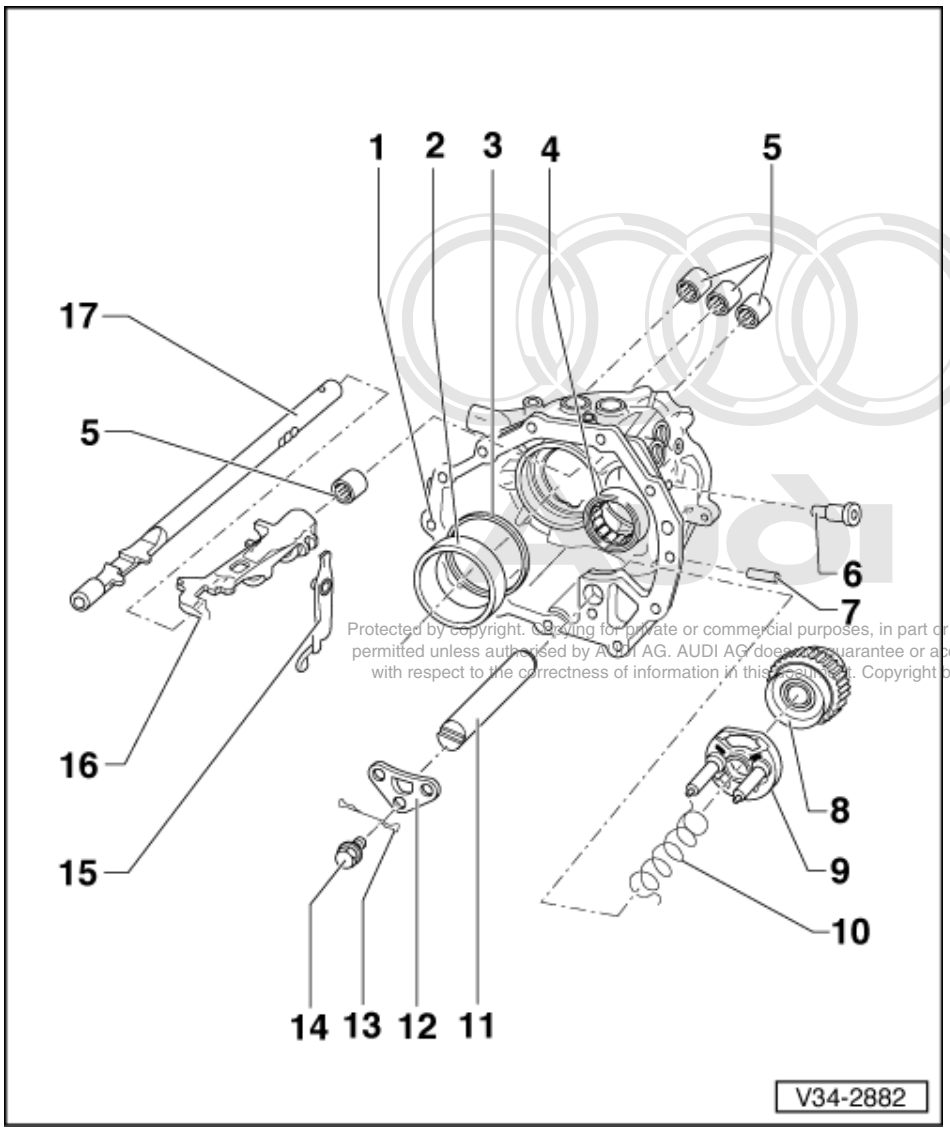
- Installation position: the chamfers of the holes for the locking pins of the synchro-ring towards bearing plate=> Page 84

13 Spring clasp

14 Bolt - 25 Nm

- Self-locking
- Always renew

15 Relay lever for reverse gear

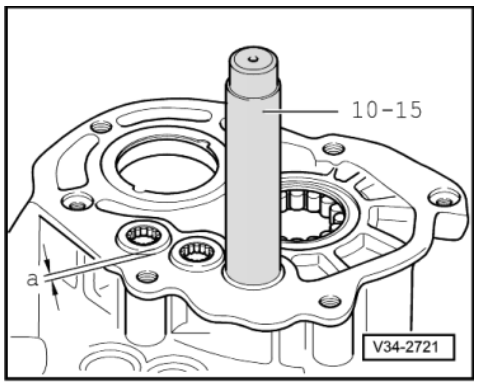


16 Follower for reverse gear

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

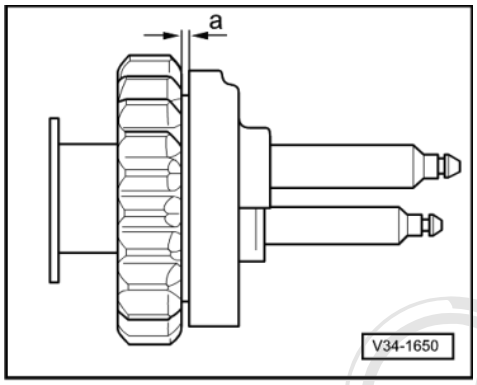
17 Selector rod for 5th and 6th gear

- Renew only complete with follower => Page 68



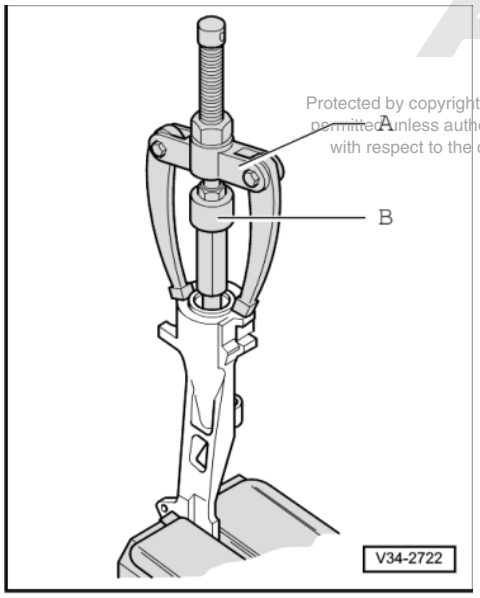
-> Fig.1 Removing and driving in ball sleeve for selector rods

- Insertion depth a = 2.5 mm



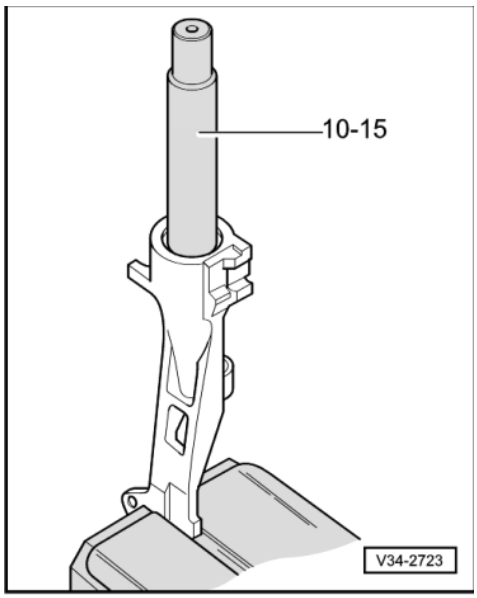
-> Fig.2 Checking synchro-ring for wear

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

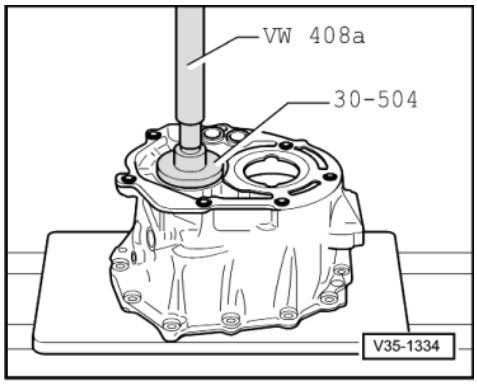


-> Fig.3 Pulling ball sleeve out of follower for reverse gear

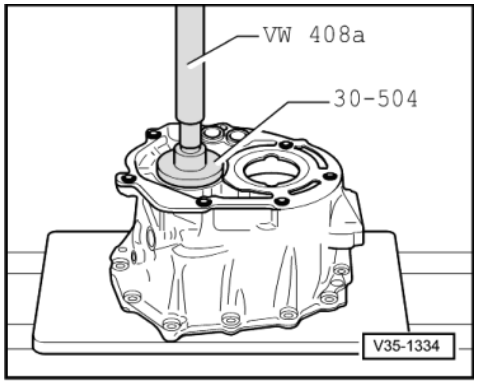
A - Counter support, e.g. Kukko 22/1
B - Internal puller 18.5 ... 23.5 mm, e.g. Kukko 21/3



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

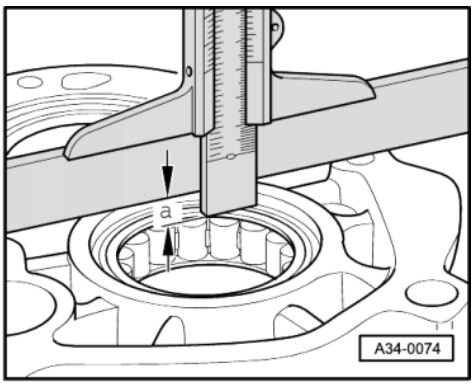


-> Fig.5 Pressing cylinder roller bearing for input shaft out of bearing plate



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

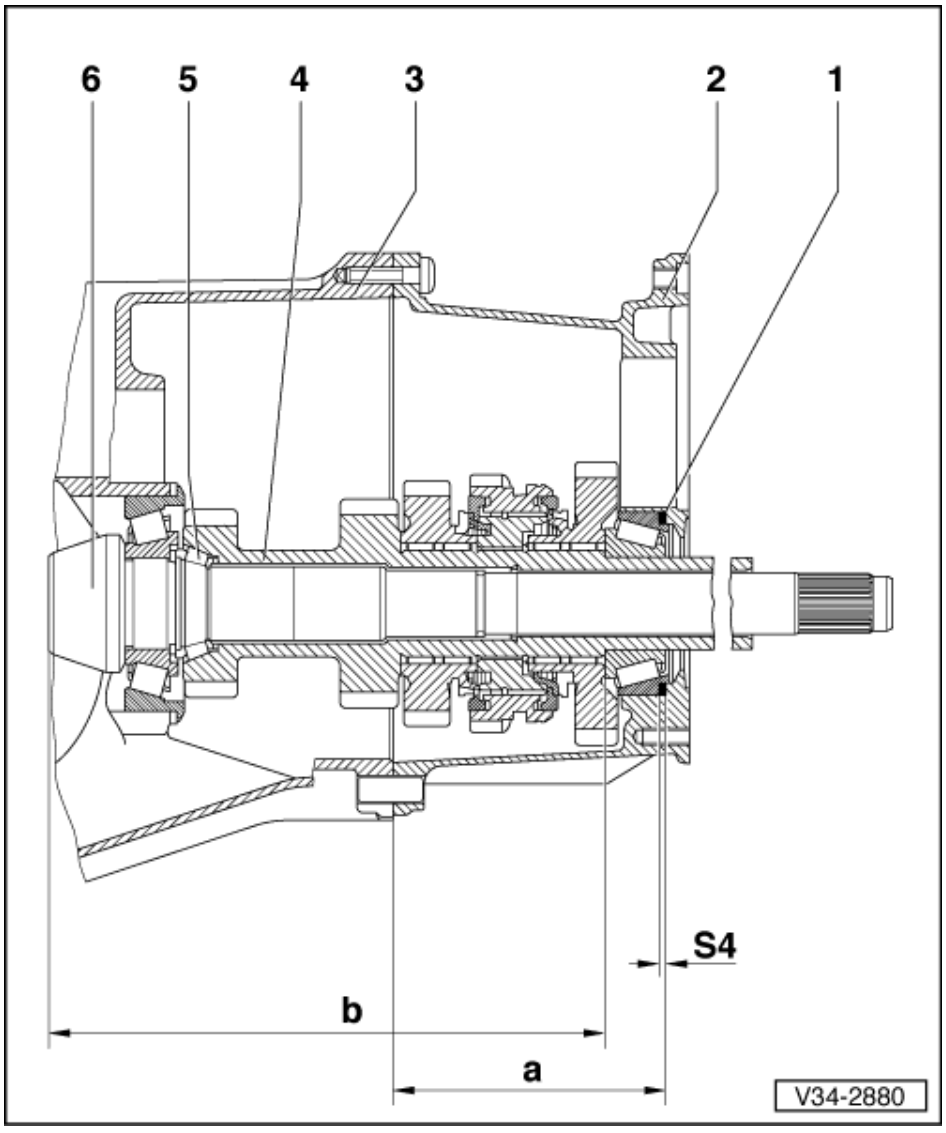
- Measuring insertion depth =>Fig. 7 .



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

- Dimension a = 7 mm

11.2 - Re-determining shim "S4"

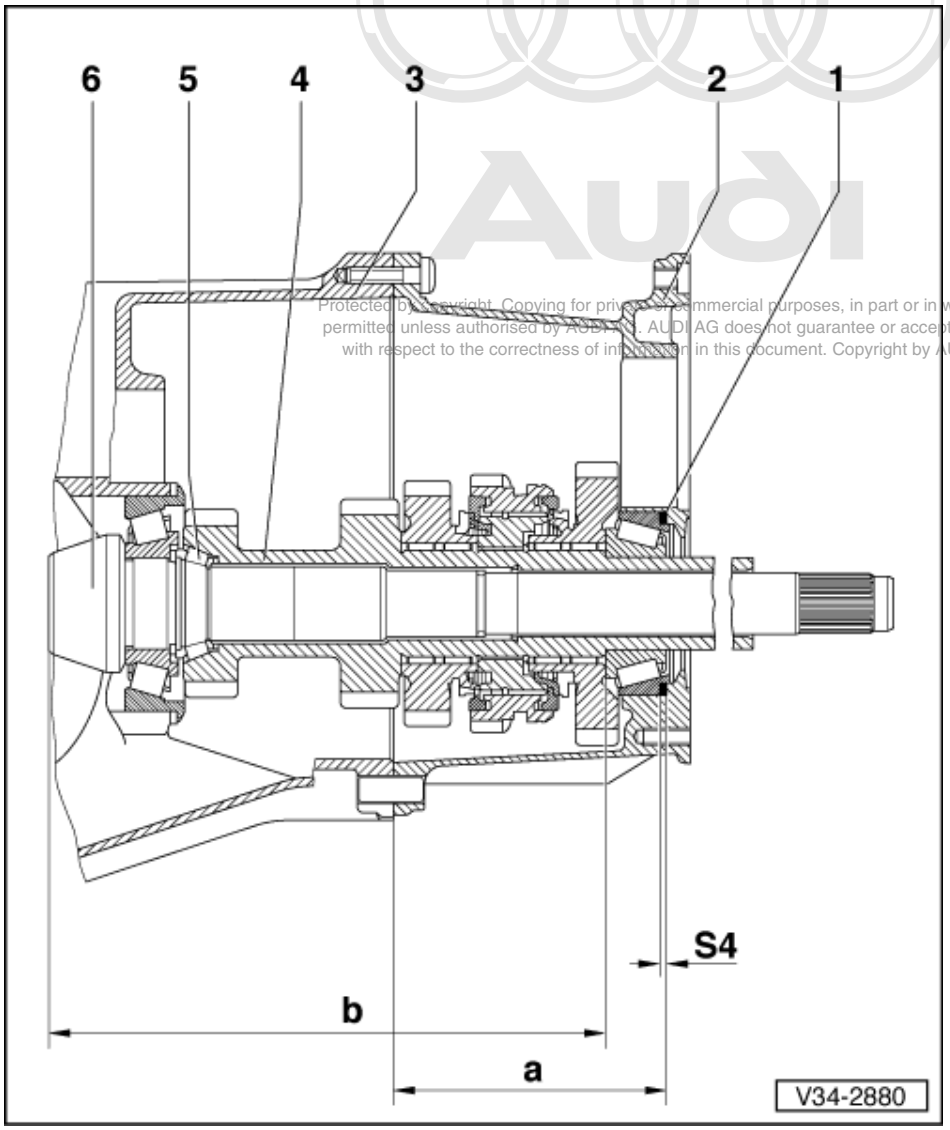


This adjustment is necessary when renewing following components:

- Bearing plate => Page 119
- Hollow shaft => Page 120

This adjustment re-creates the preload of the taper rollers for the drive pinion and hollow shaft.

1 Shim "S4"
2 Bearing plate
3 Gearbox housing
4 Hollow shaft



5 Drive pinion/hollow shaft taper roller bearing
6 Drive pinion

a - Bearing plate housing depth
b - Dimension from drive pinion head to contact shoulder of taper roller bearing on hollow shaft

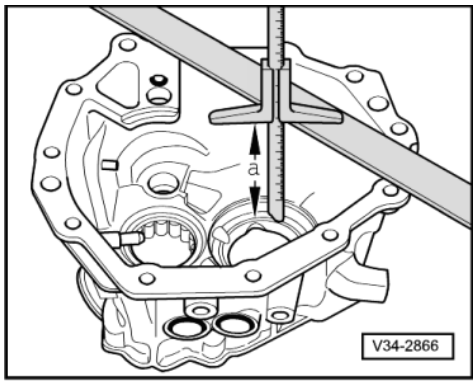
- Taper roller bearing (drive pinion/hollow shaft) preloaded to 10 Nm

S4 - Thickness of shim "S4"

Note:

When replacing the drive pinion (final drive set), observe adjustment overview

=>Page 184 .



Determining shim when replacing bearing plate

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

Example:

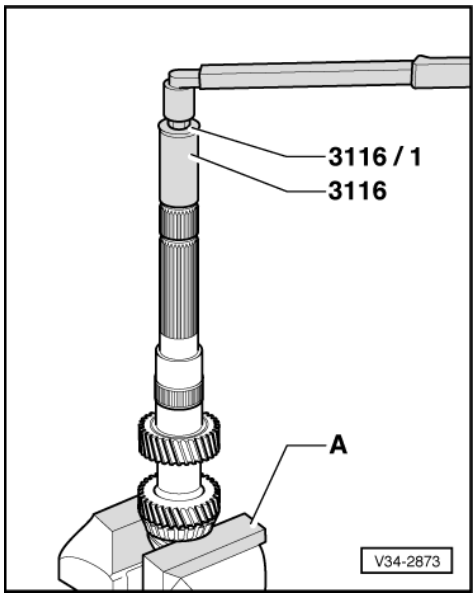
	Depth "a" old bearing plate	124.40 mm
	Depth "a" new bearing plate	124.65 mm
=	Difference	0.25 mm

- 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

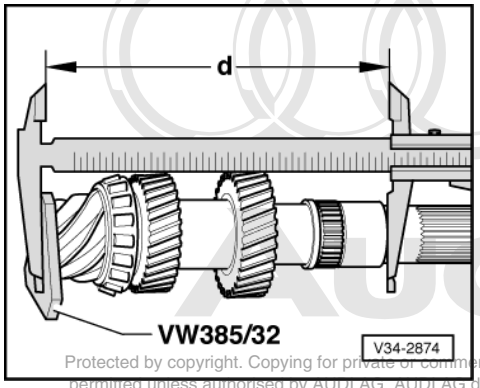
Available shims =>Table Page 120 .



Determining shim when replacing hollow shaft

- -> Tighten tensioning sleeve to exactly 10 Nm.

A - Vice clamps



- -> Fit end measuring plate VW 385/32 onto drive pinion head and measure dimension "d".
  - Upper measuring point is the contact shoulder for inner race of small taper roller bearing

  Example: 248.50 mm

- Install new hollow shaft and measure dimension "d" again.

  Example: 248.70 mm

- Determine difference:

Dimension "d", old hollow shaft	248.50 mm
Dimension "d", new hollow shaft	248.70 mm
= Difference	0.20 mm

- Install a correspondingly thinner shim "S4" if dimension "d" of new hollow shaft is greater.
- Install a correspondingly thicker shim "S4" if dimension "d" of new hollow shaft is less.
- Determine shim(s) from table: part numbers

=> Parts catalogue

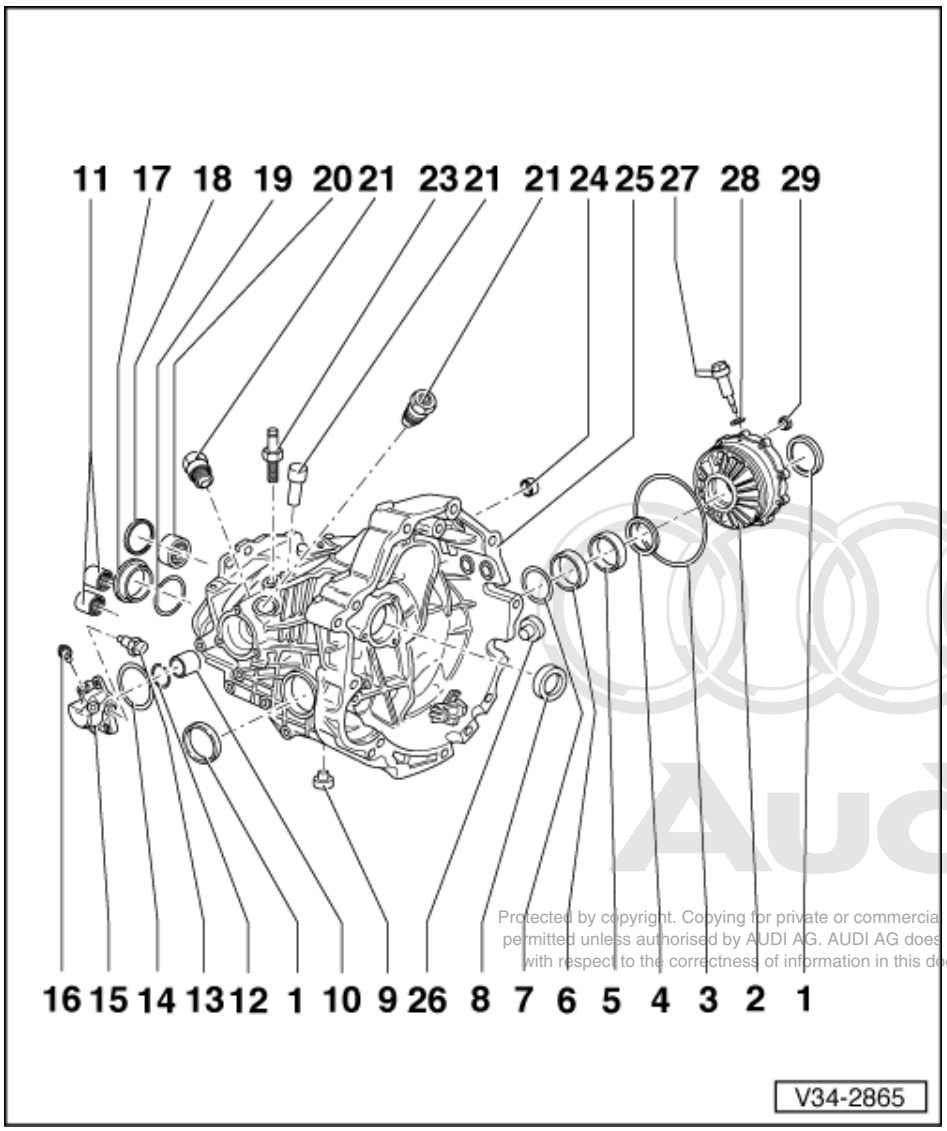
Available shims for "S4"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	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.

12 - Servicing gearbox housing

12.1 - Servicing gearbox housing



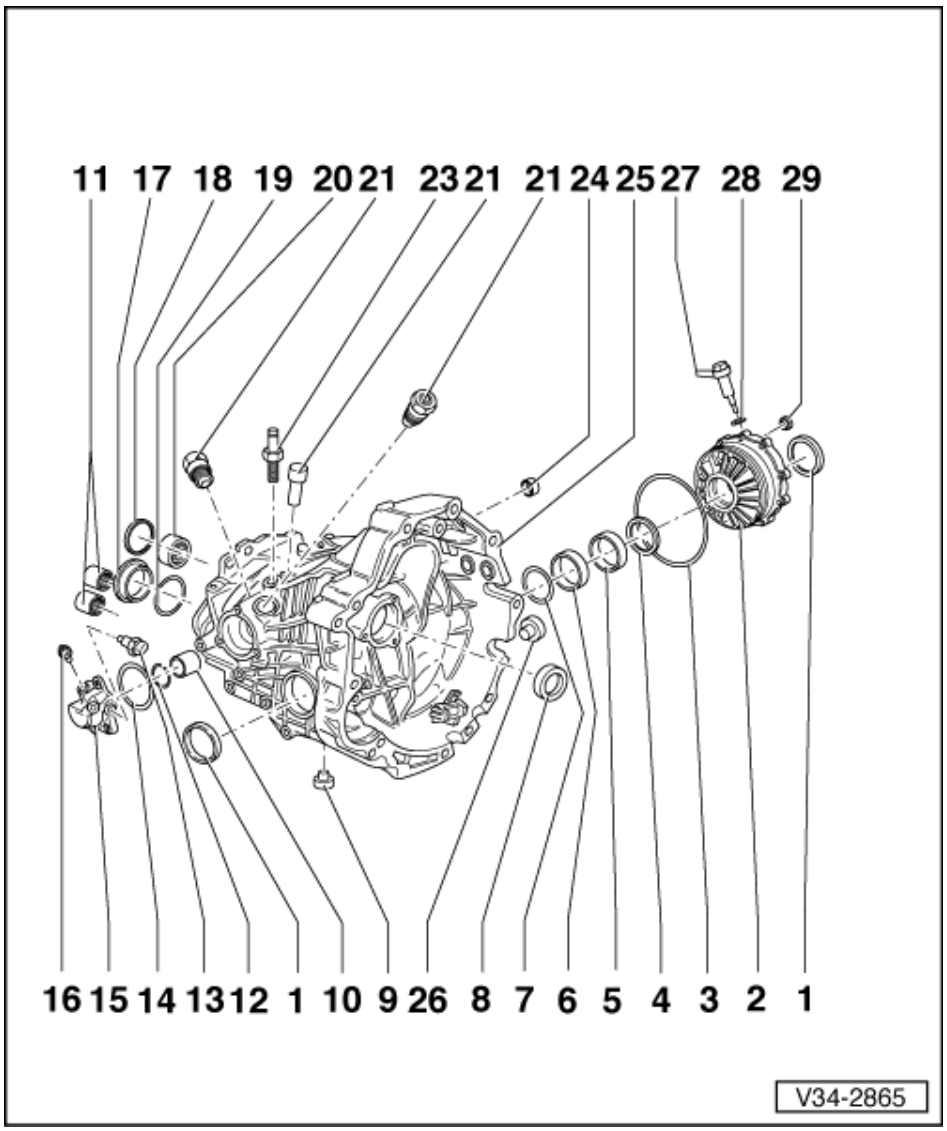
Notes:

- General repair instructions =>Page 8 .
- Adjustments are required when replacing components marked 1) =>adjustment overview Page 184 .

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 163

2 Cover for final drive 1)



3 O-ring

- For cover for final drive
- Always renew

4 Shim "S1"

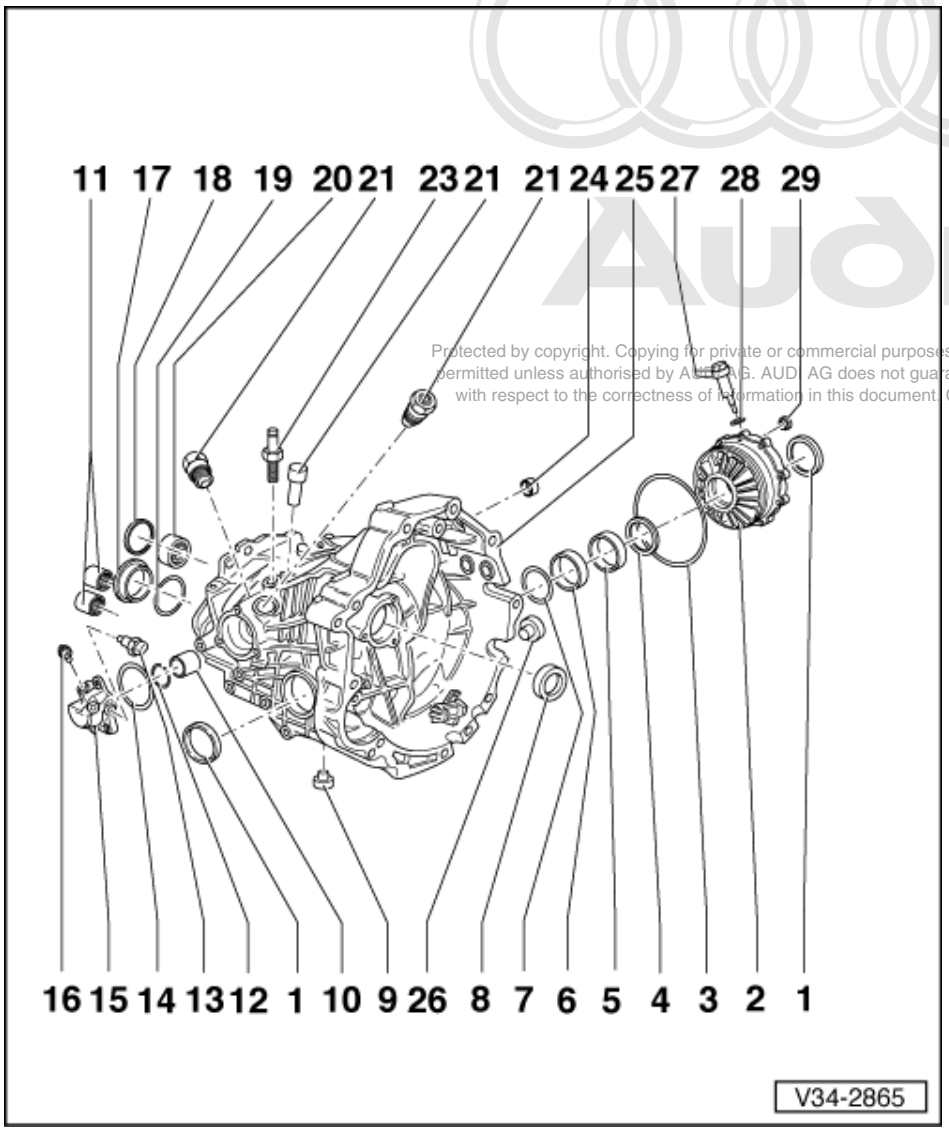
- Note thickness
- Adjustment overview => Page 184

5 Outer race for large taper roller bearing 1)

- For differential
- Driving out and driving in => Page 182

6 Outer race for small taper roller bearing 1)

- For differential
- Driving out and driving in => Page 181



7 Shim "S2"

- Note thickness
- Adjustment overview => Page 184

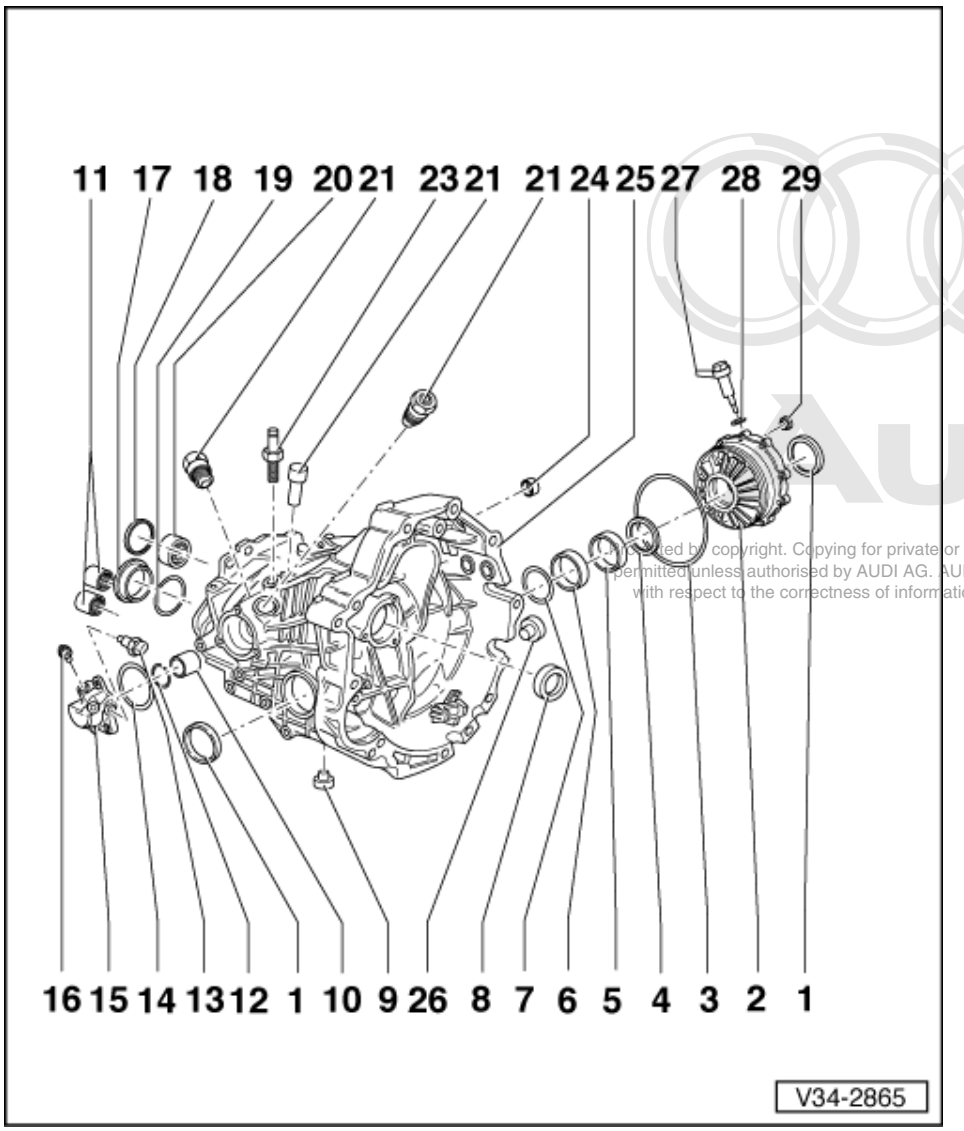
8 Seal

- 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

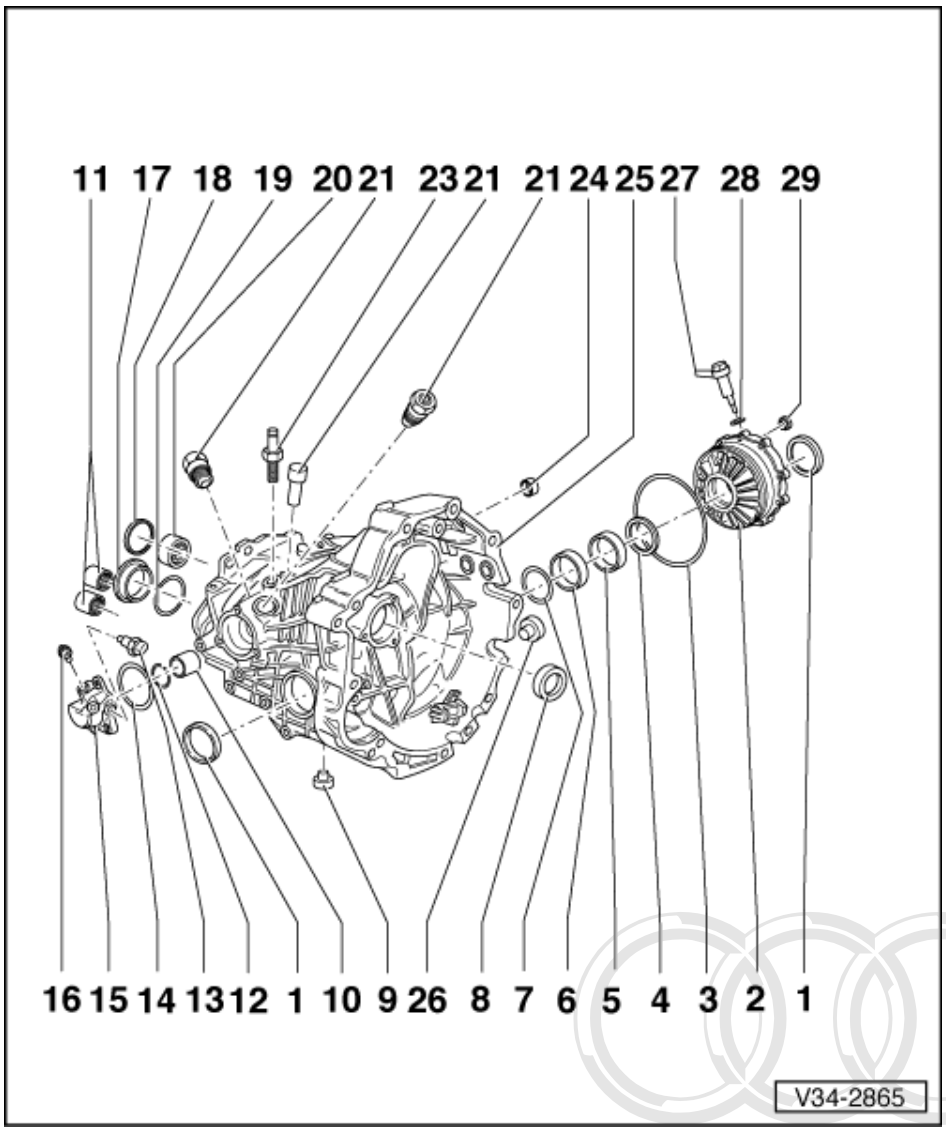
13 Switch for reversing lights - 20 Nm

14 O-ring

- For cover for selector shaft
- Always renew

15 Cover for selector shaft

- Removing =>Page 76
- Installing =>Page 93



16 Ball stud - 20 Nm

- For connecting rod

17 Outer race for large taper roller bearing 1)

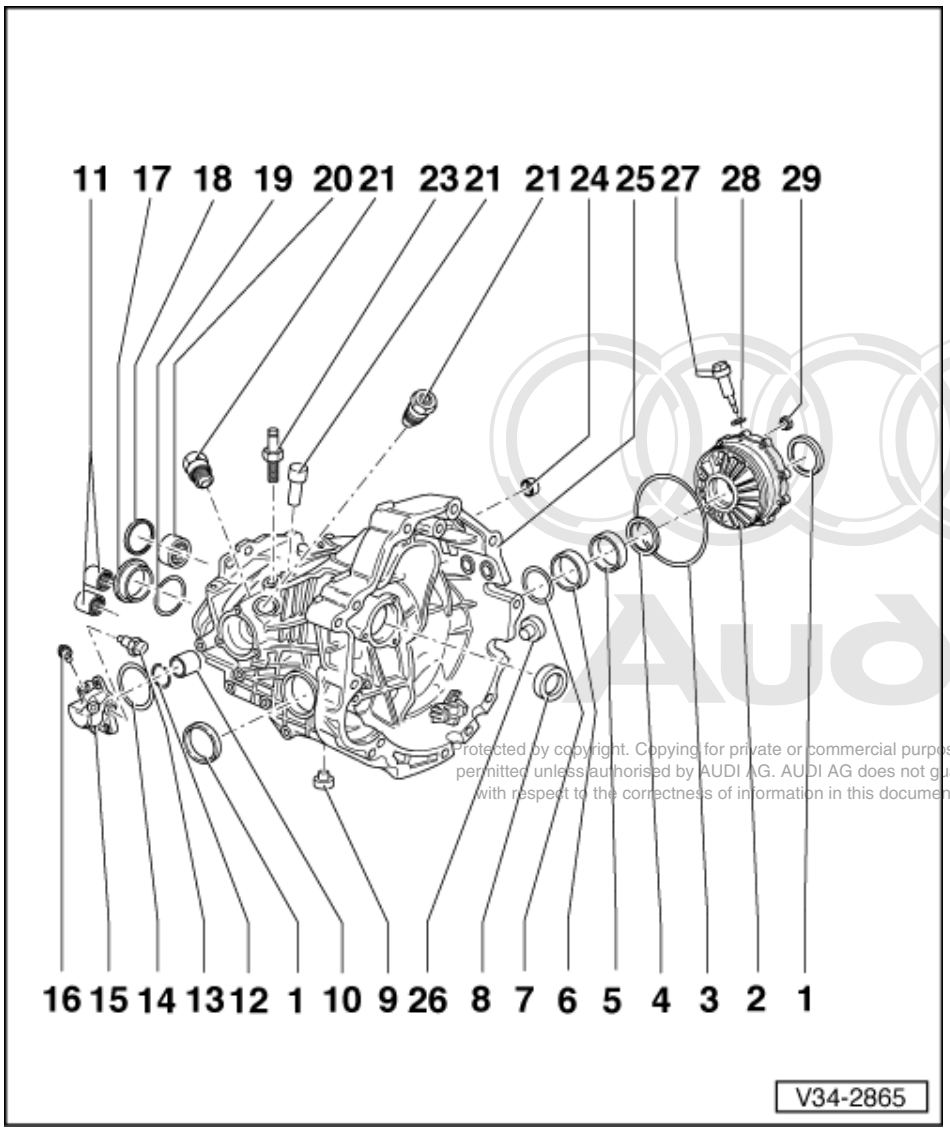
- For drive pinion
- Pulling out =>Fig. 157
- Pressing in => Fig. 158

18 Circlip

- Removing =>Fig. 15

19 Shim "S3"

- Note thickness
- Adjustment overview => Page 184



20 Needle bearing

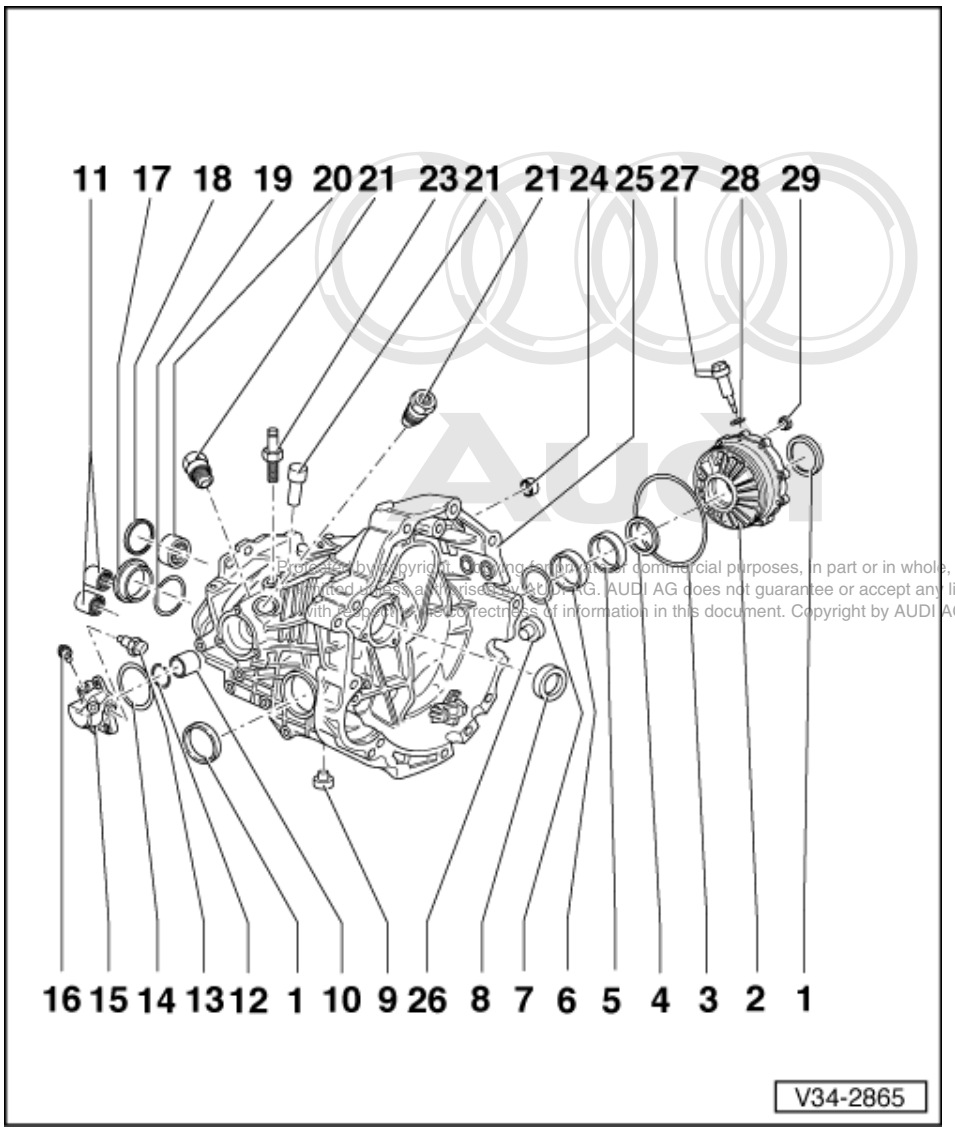
- For input shaft
- Pulling out => Fig. 12
- Driving in => Fig. 13
- Measuring insertion depth => Fig. 14

21 Locking bolt

- For selector shaft
- Removing =>Page 76
- Installing =>Page 93
- Tightening torques:
  For aluminium bolt: 50 Nm
  For steel bolt: 70 Nm

22 Trunnion bolt - 40 Nm

- For push rod



23 Breather

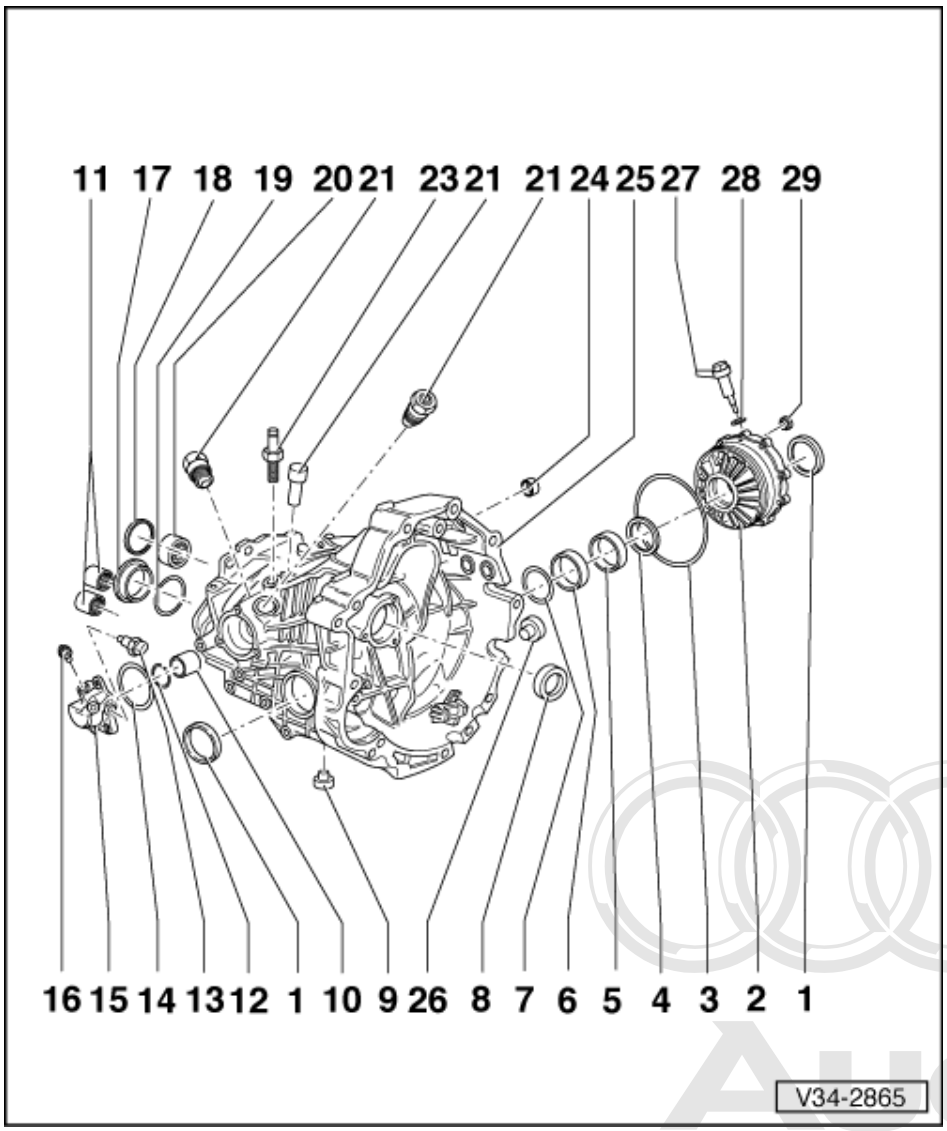
- Insertion depth of sleeve => Fig. 11
- Clip cap on

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)

- With oil baffle plate
- Installation position of baffle plate
  => Fig. 16



26 Magnet

- Clean
- When renewing gearbox housing drive in with e.g. press tool VW 408 A

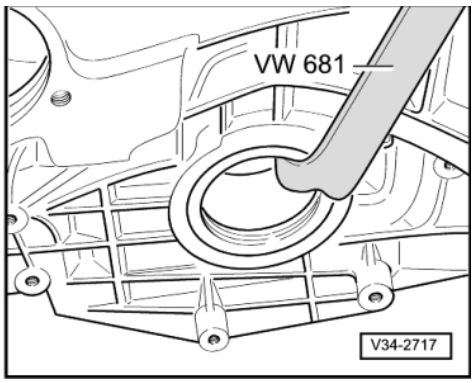
27 Sender for speedometer -G22

- Renewing => Page 164

28 O-ring

- Always renew

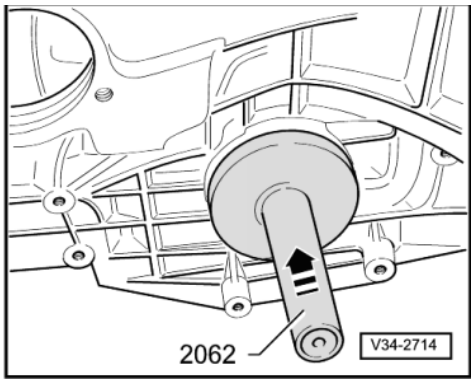
29 Oil filler plug - 40 Nm



-> 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.

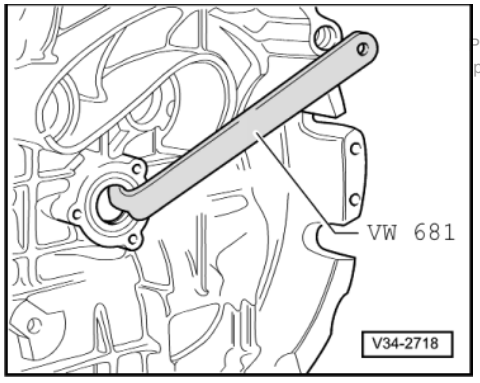


-> Fig.2 Driving in seal for flange shaft

- Insertion depth: 5.5 mm

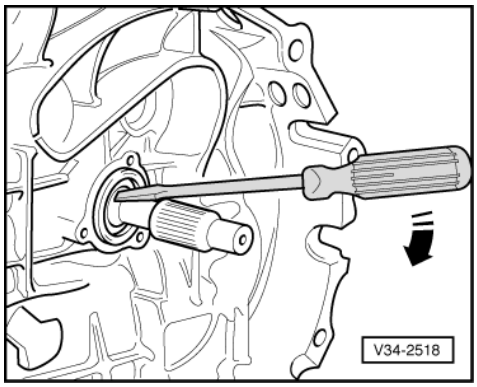
Notes:

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



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

- Lever out seal carefully with VW 681.

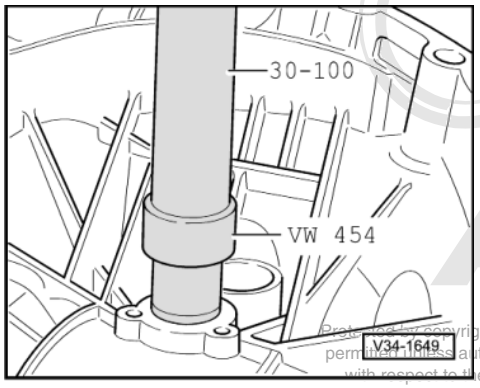


-> Fig.4 Removing seal for input shaft when gearbox is not dismantled

- Lever out seal carefully with a screwdriver.

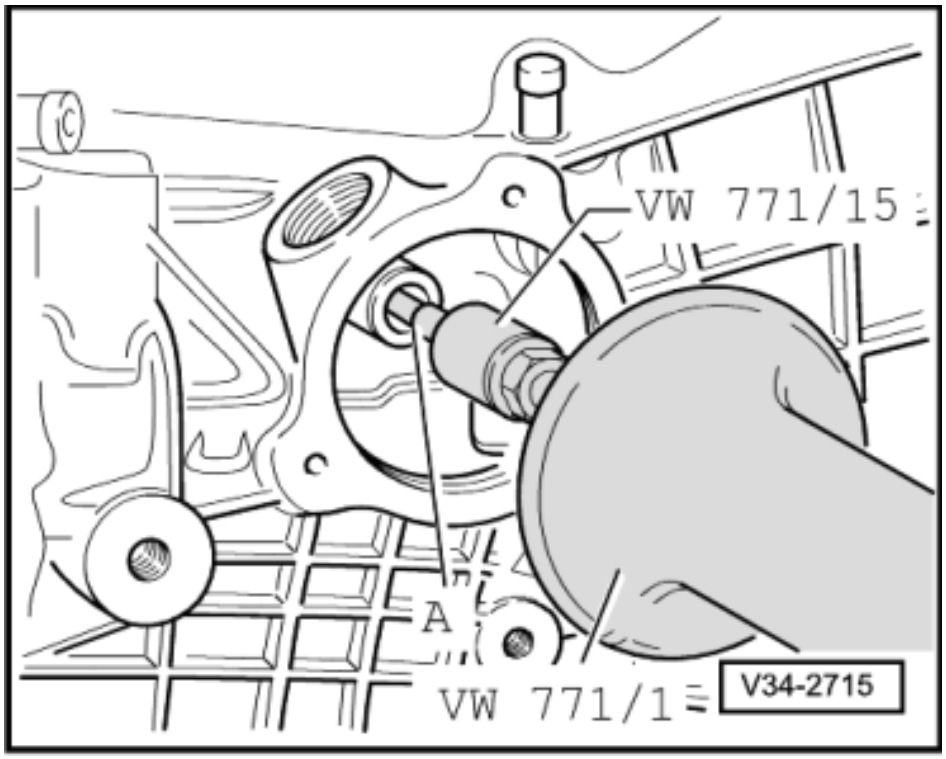
Note:

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



-> Fig.5 Driving in seal for input shaft

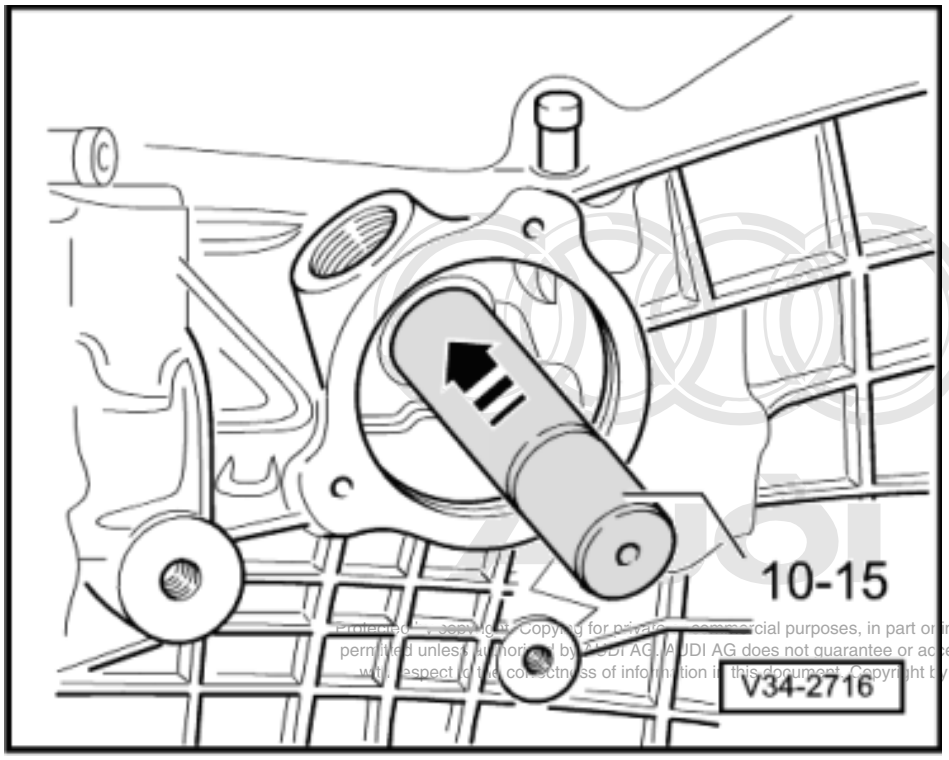
- Fill space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over splines of input shaft.
- Drive in seal for input shaft.
  - Insertion depth: 3.5 mm
- Remove protective hose.



-> Fig.6 Pulling out ball sleeve

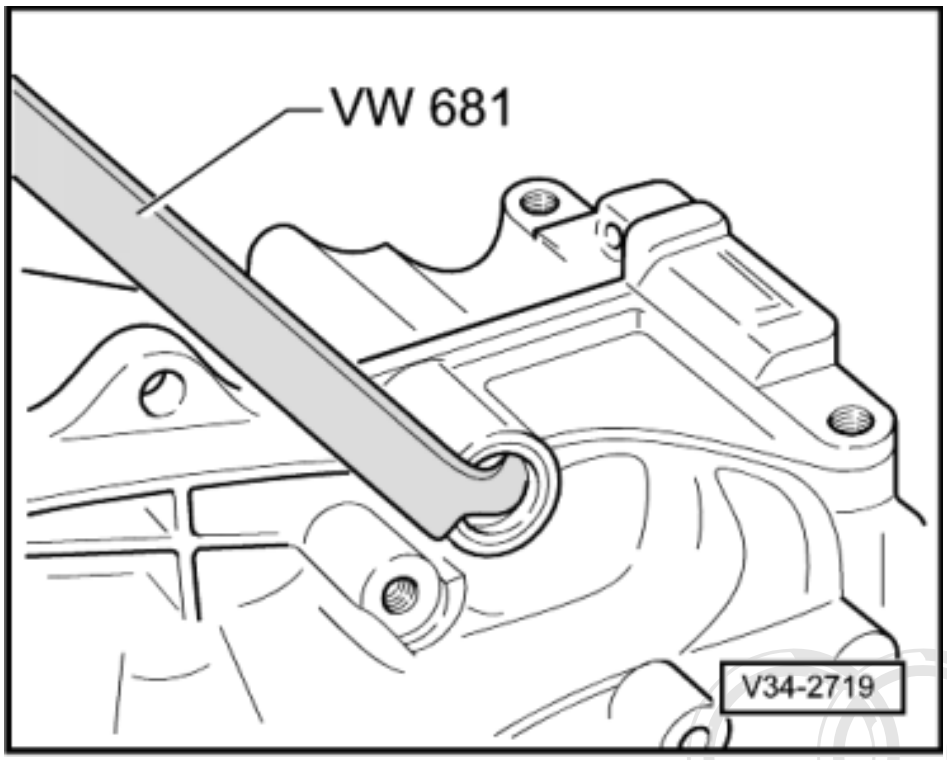
- Remove circlip.

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



-> Fig.7 Driving in ball sleeve

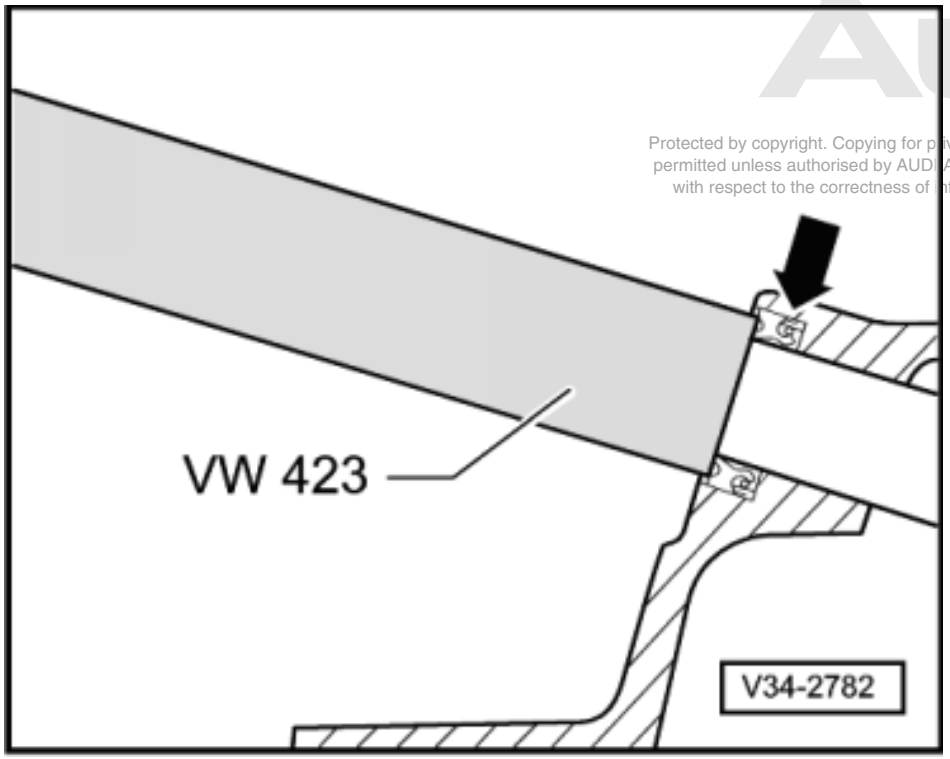
- Drive in onto stop.



-> Fig.8 Pulling out seal for selector shaft

Note:

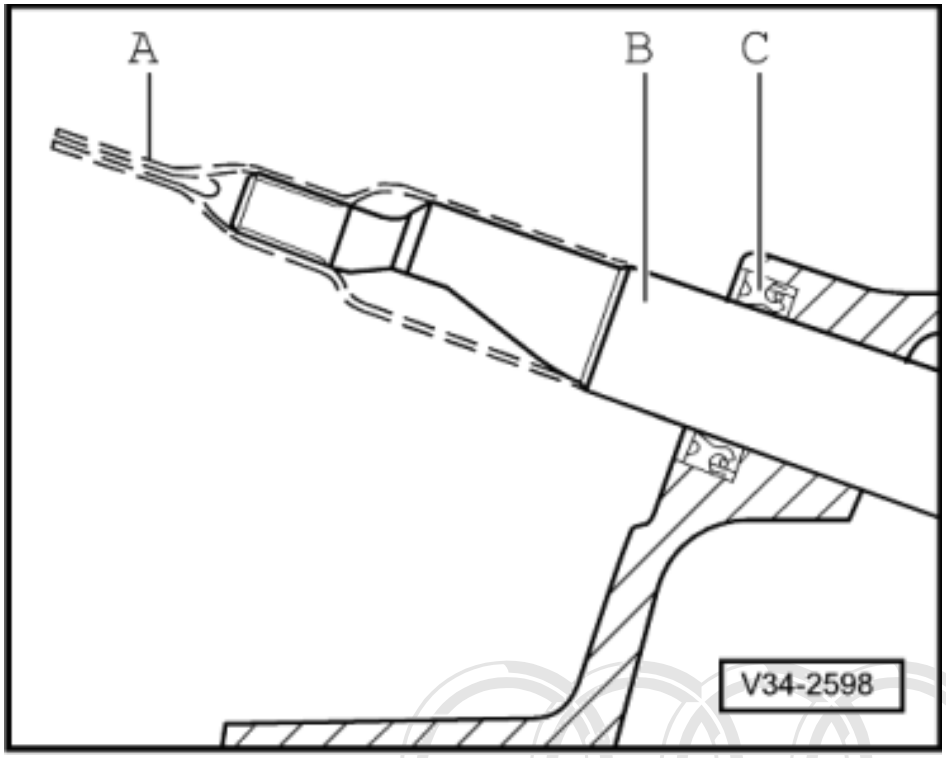
With gearbox removed but not dismantled, carefully lever out seal without damaging the shaft with a screwdriver.



-> 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.

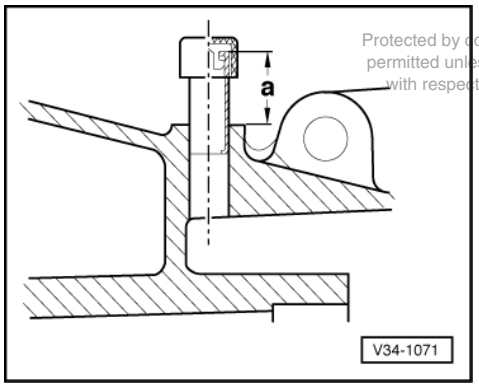


-> Fig.10 Installing seal and selector shaft with assembly sleeve

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

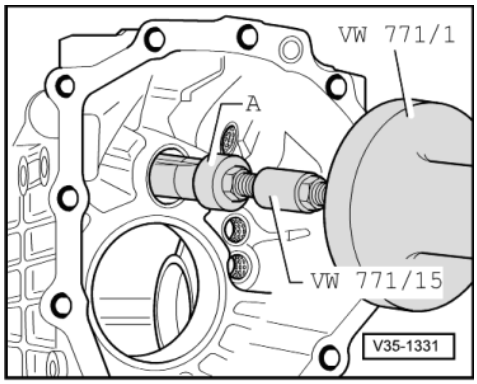
Note:

The selector shaft -B- is angled to ease removal of selector lever from gearbox.



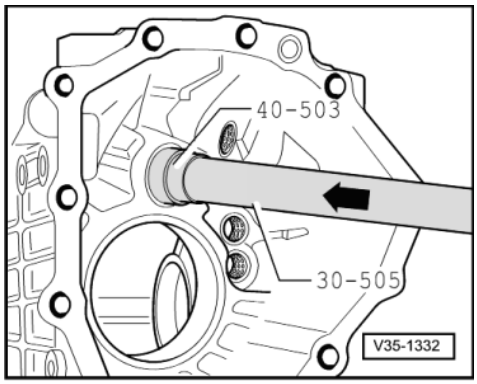
-> Fig.11 Insertion depth of breather sleeve

- Dimension a = 21 mm



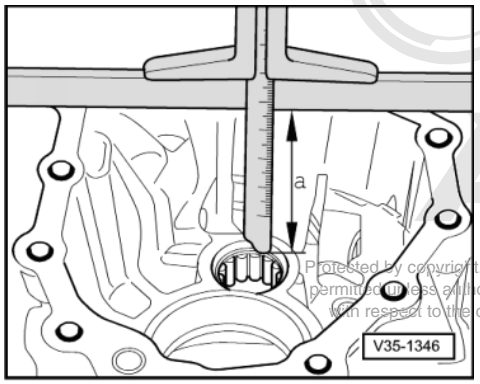
-> Fig.12 Pulling needle bearing out of gearbox housing

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



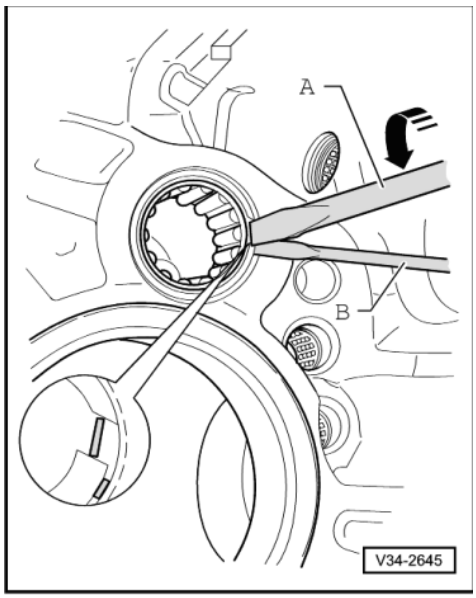
-> Fig.13 Driving needle bearing into gearbox housing

- Installation position: inscription on bearing faces tool
- Insertion depth => Fig. 14



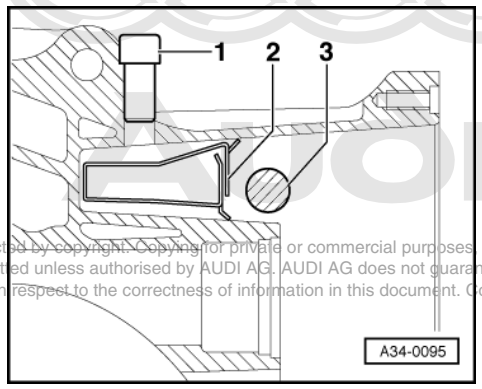
-> Fig.14 Insertion depth of needle bearing

- Dimension a = 105 mm



-> Fig.15 Removing circlip

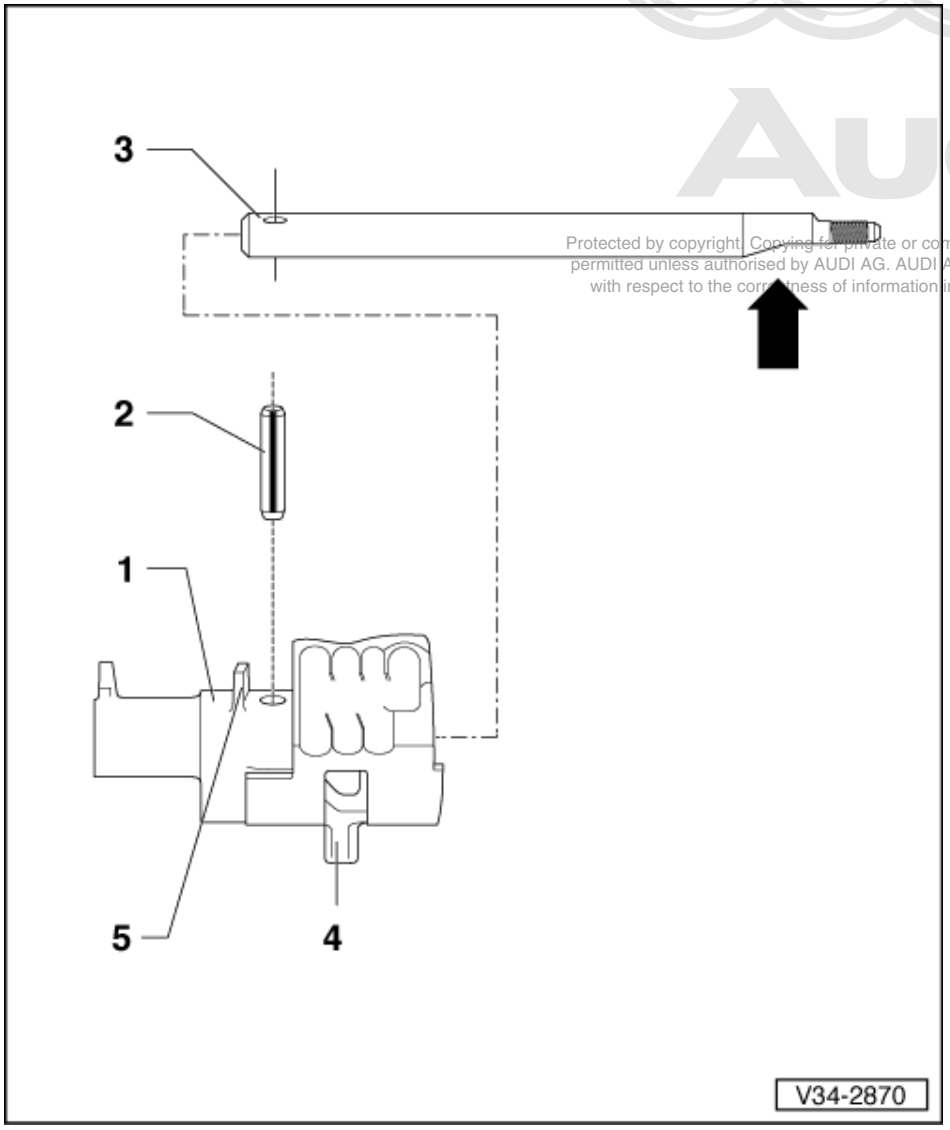
- Lift circlip out of the groove by turning one end of the circlip with a screwdriver -A-.
- Secure this end with a screwdriver -B-.
- Lever circlip out further by repositioning screwdriver -A-.



-> Fig.16 Installation position of oil baffle plate

1 - Breather
2 - Oil baffle plate
3 - Selector shaft

12.2 - Dismantling and assembling selector shaft complete

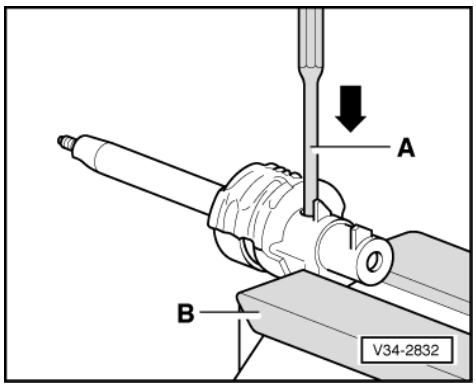


1 Selector cylinder
2 Roll pin
- Driving out and driving in flush => Fig. 1

3 Selector shaft
- Driving out => Fig. 2
- Driving in => Fig. 3
- Installation position: flat (arrow) and selector finger -item 4 - face in same direction

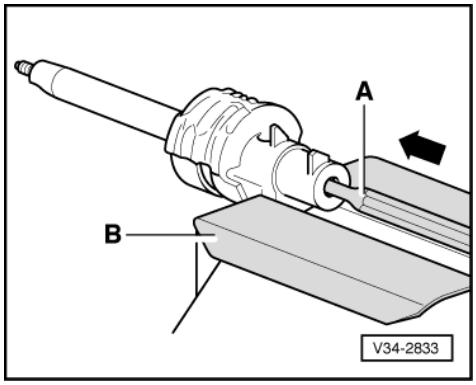
4 Selector finger
- Observe installation position in relation to -item 3 -

5 Cam for reversing light switch



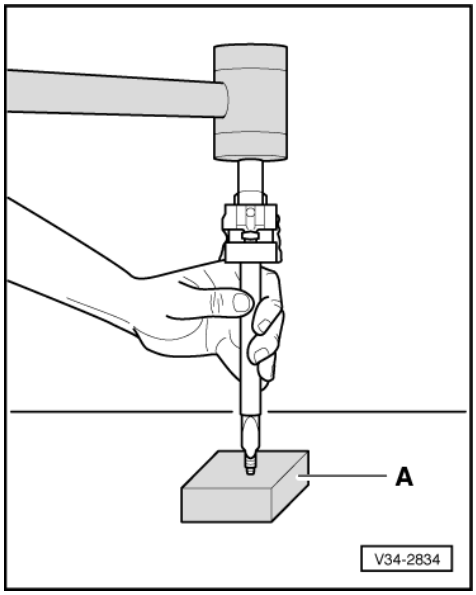
-> Fig.1 Driving out and driving in roll pin flush

A - Drift
B - Vice clamps



-> Fig.2 Driving out selector shaft

A - Drift
B - Vice clamps



-> Fig.3 Driving in selector shaft

A - Wooden block

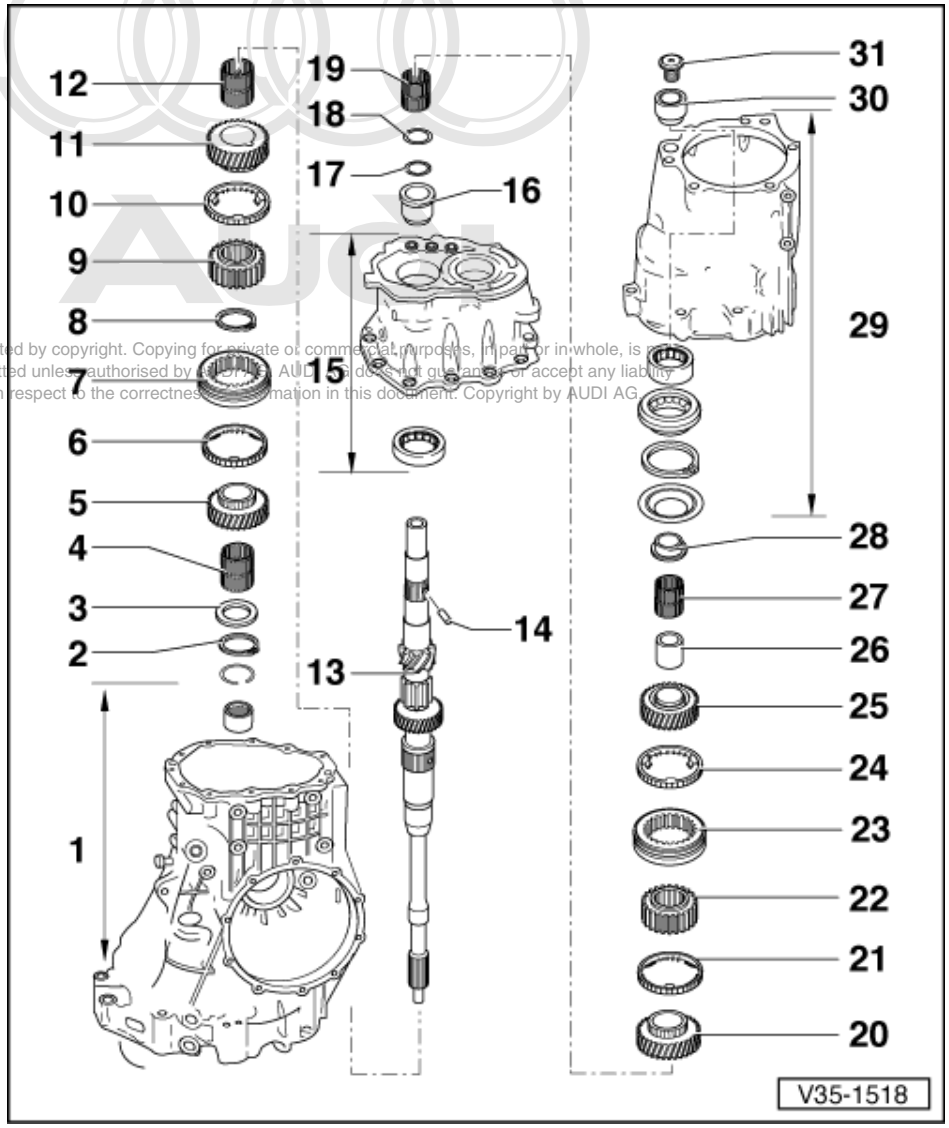
Notes:

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

35 - Gears, Shafts

1 - Dismantling and assembling input shaft

1.1 - Dismantling and assembling input shaft



Note:

When installing new gears => technical data, page 2 .

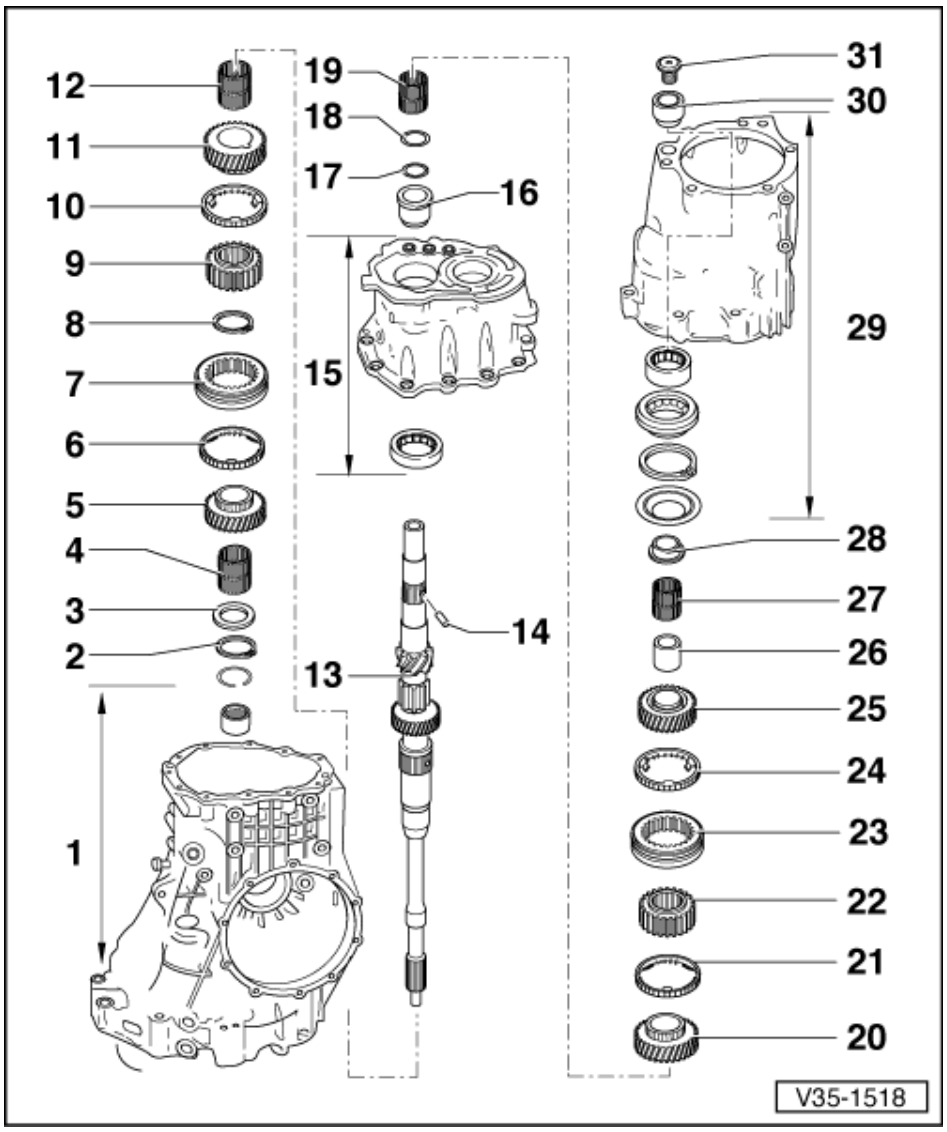
1 Gearbox housing
- Servicing => Page 121

2 Circlip

3 Thrust washer

4 Needle bearing for 4th gear
- Mark before removing
- Do not interchange with needle bearing for 3rd gear

- Oil with gear oil before installing



5 4th speed sliding gear

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

6 Synchro-ring for 4th gear

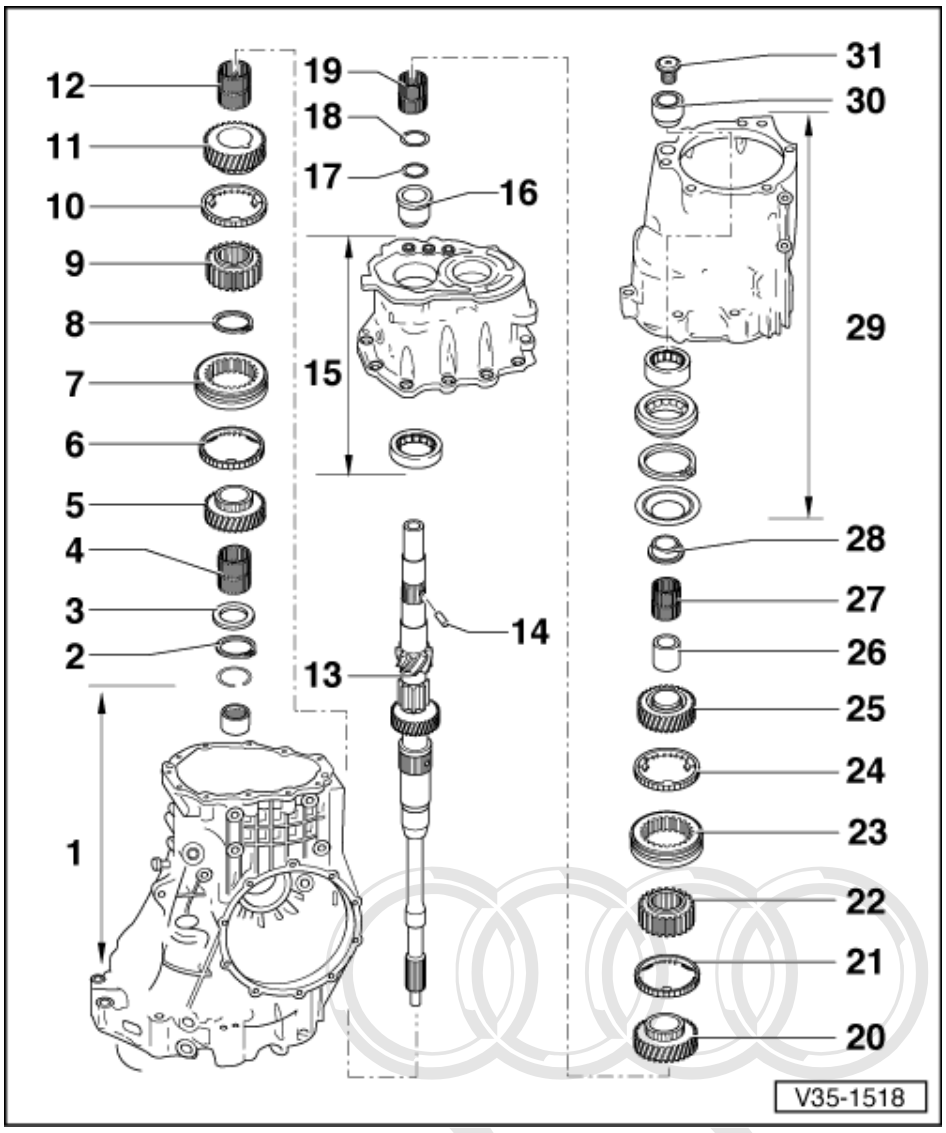
- Checking for wear => Fig. 2

7 Locking collar

- Paired with synchro-hub
- Mark before removing => Page 79

8 Circlip

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



9 Synchro-hub for 3rd and 4th gear

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

10 Synchro-ring for 3rd gear

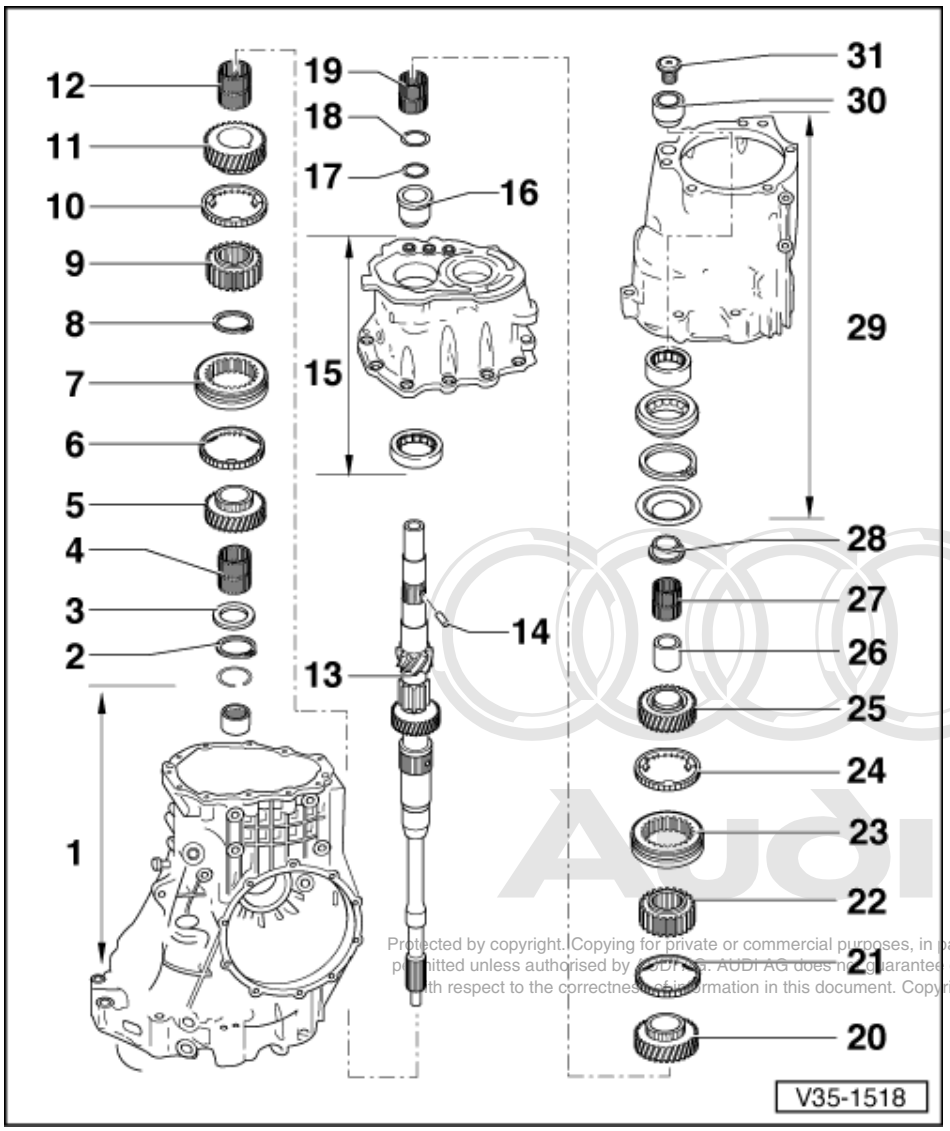
- Coated with molybdenum
- Checking for wear => Fig. 2

11 3rd speed sliding gear

- Before installing, insert spring => Fig. 1
- After pressing on -item 9 -, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

12 Needle bearing for 3rd gear

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



13 Input shaft

14 Spring pin

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

15 Bearing plate

- Servicing => Page 111

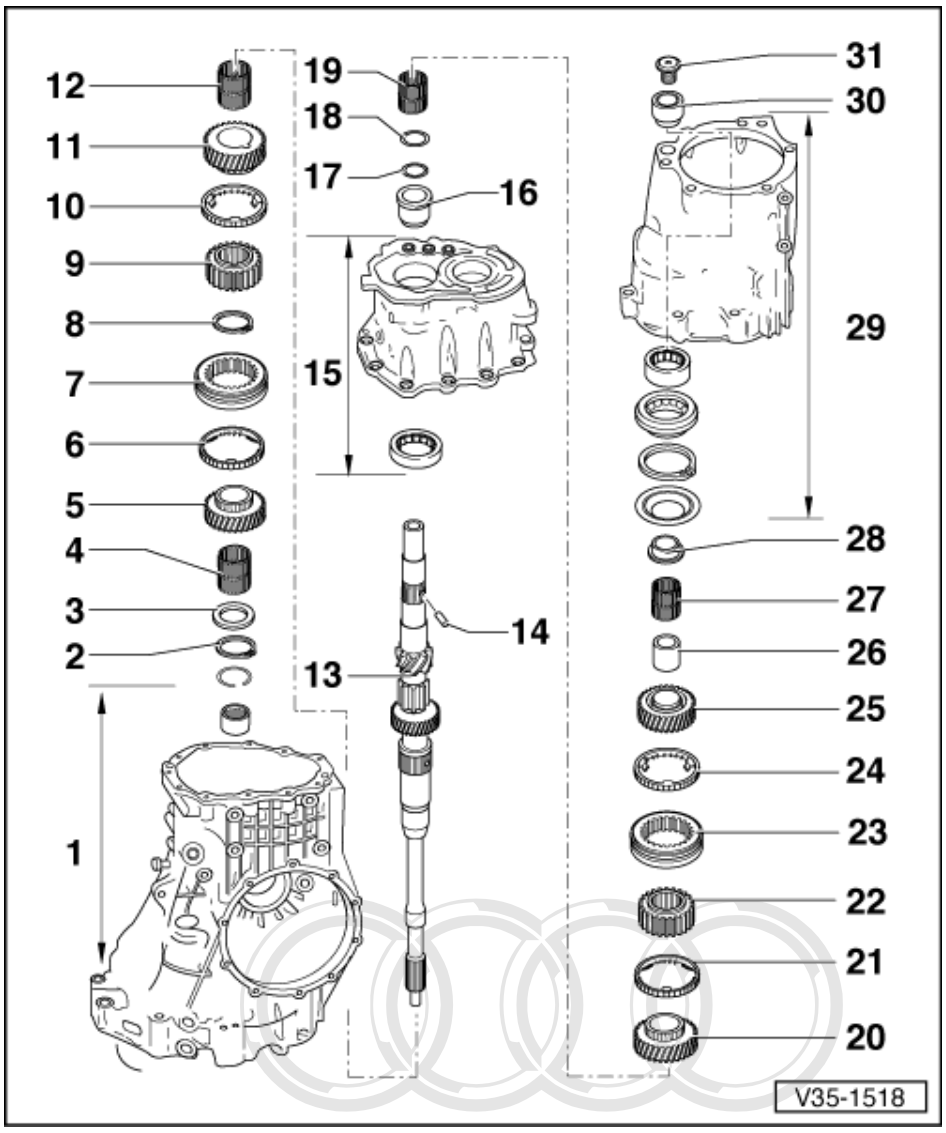
16 Inner race for cylinder roller bearing

- Take off and fit by hand

17 Circlip

18 Thrust washer for needle bearing for 6th gear

- Installation position: shoulder towards circlip, smooth contact surface towards needle bearing
  => Page 87



19 Needle bearing for 6th gear

- Oil with gear oil before installing

20 6th speed sliding gear

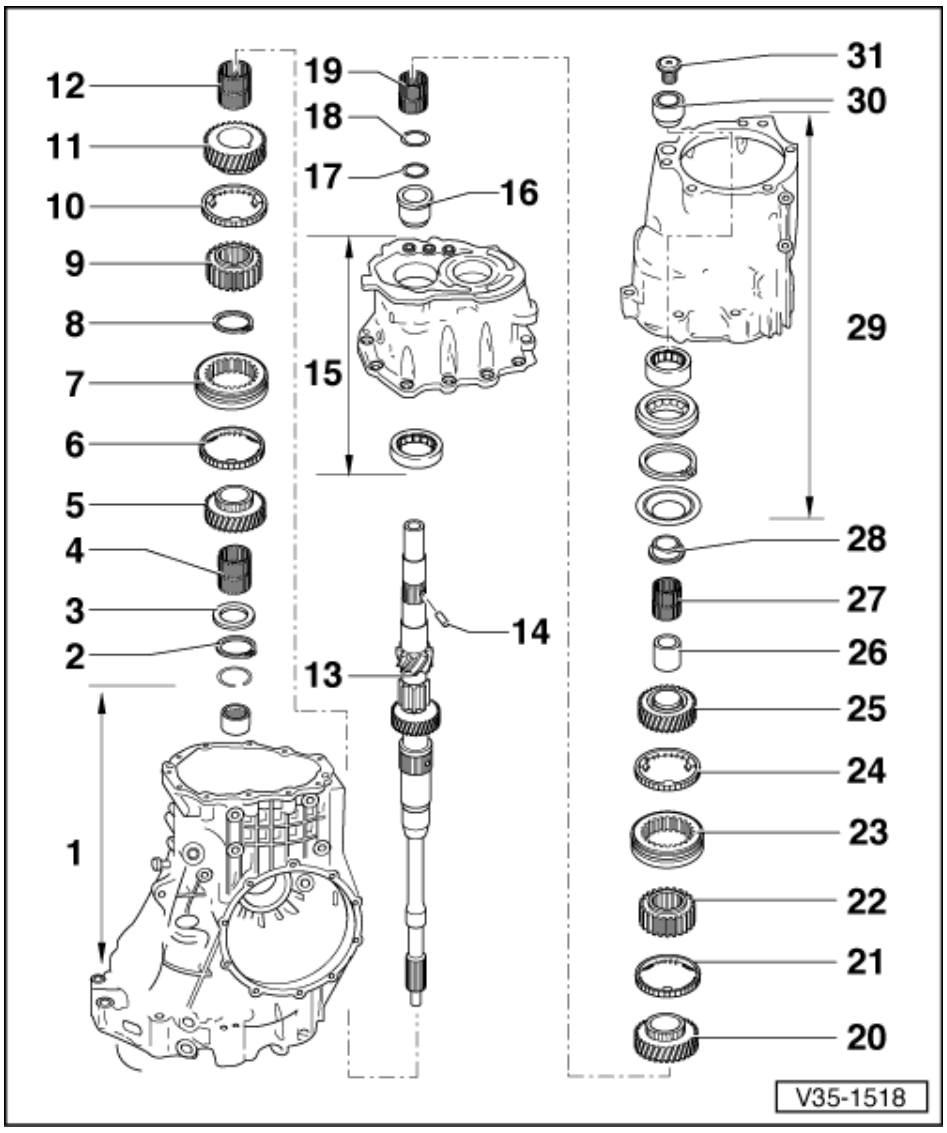
- Before installing, insert spring => Fig. 1
- After installing, check axial clearance => Page 88

21 Synchro-ring for 6th gear

- Checking for wear => Fig. 2

22 Synchro-hub for 5th and 6th gear

- Pulling off => Page 79
- Driving on => Page 88
- Installation position: projecting hub towards 5th speed sliding gear



23 Locking collar

- Paired with synchro-hub
- Mark before removing => Page 79

24 Synchro-ring for 5th gear

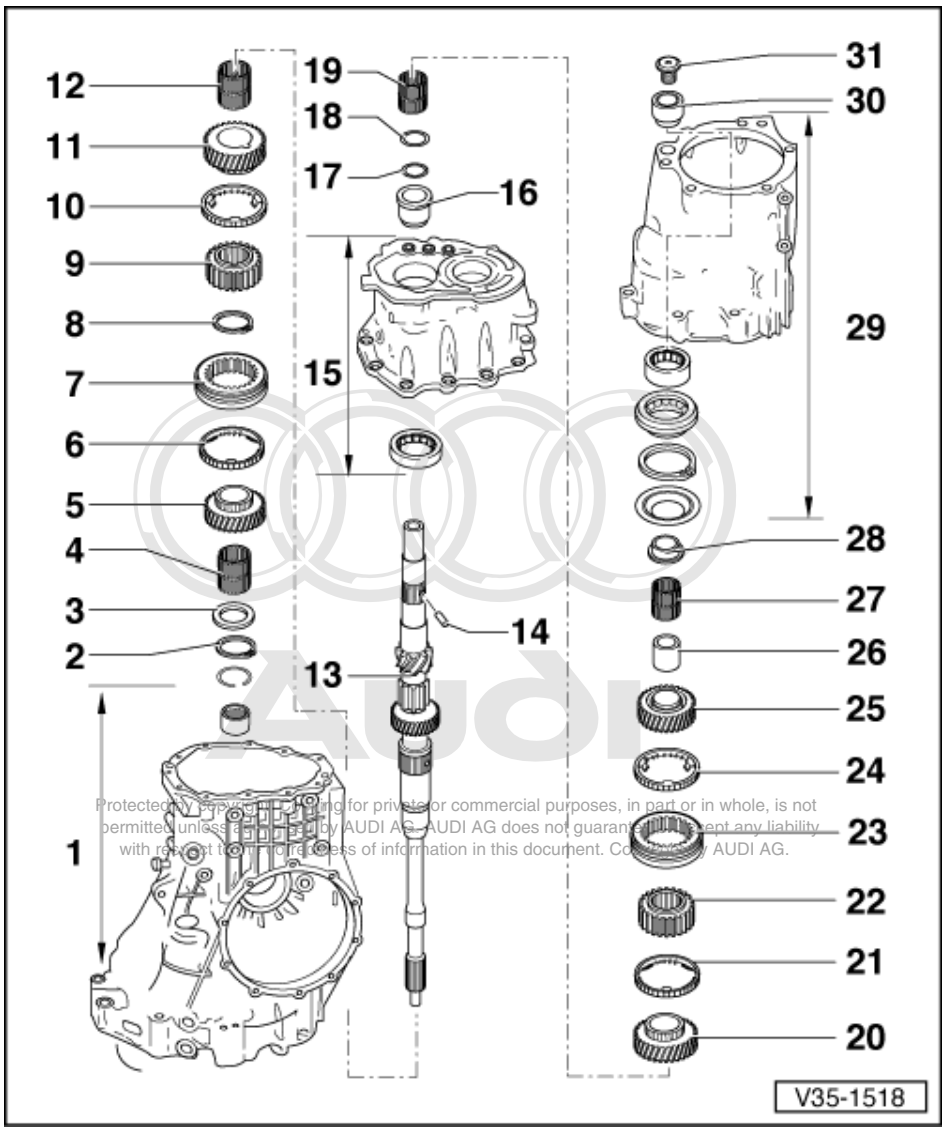
- Checking for wear => Fig. 2

25 5th speed sliding gear

- Before installing, insert spring => Fig. 1
- After installing, check axial clearance => Page 91

26 Inner race for 5th speed sliding gear

- Pulling off => Page 79
- Driving on => Page 90



27 Needle bearing for 5th gear

- Oil with gear oil before installing

28 1st inner race for tapered roller bearing for input shaft

- Pulling off => Page 78
- Driving on =>Page 91

29 End cover

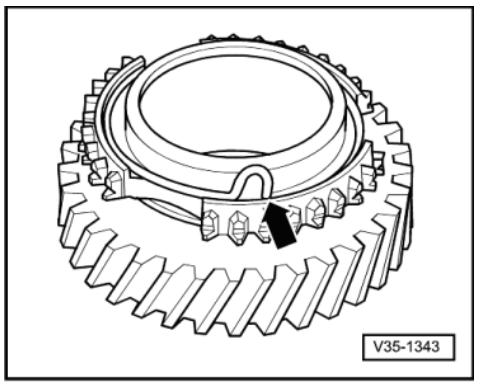
- Servicing => Page 105

30 2nd inner race for tapered roller bearing for input shaft

- Pulling off => Page 77
- Driving on => Page 91

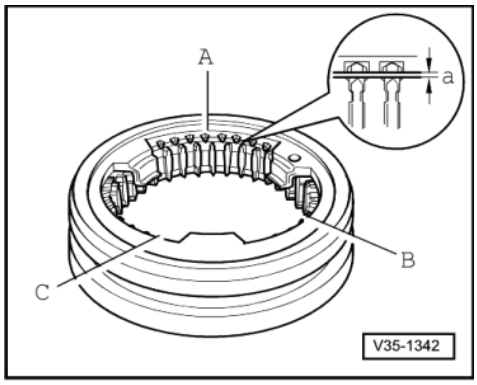
31 Multi-point socket head bolt - 150 Nm

- Loosening and tightening => Page 77



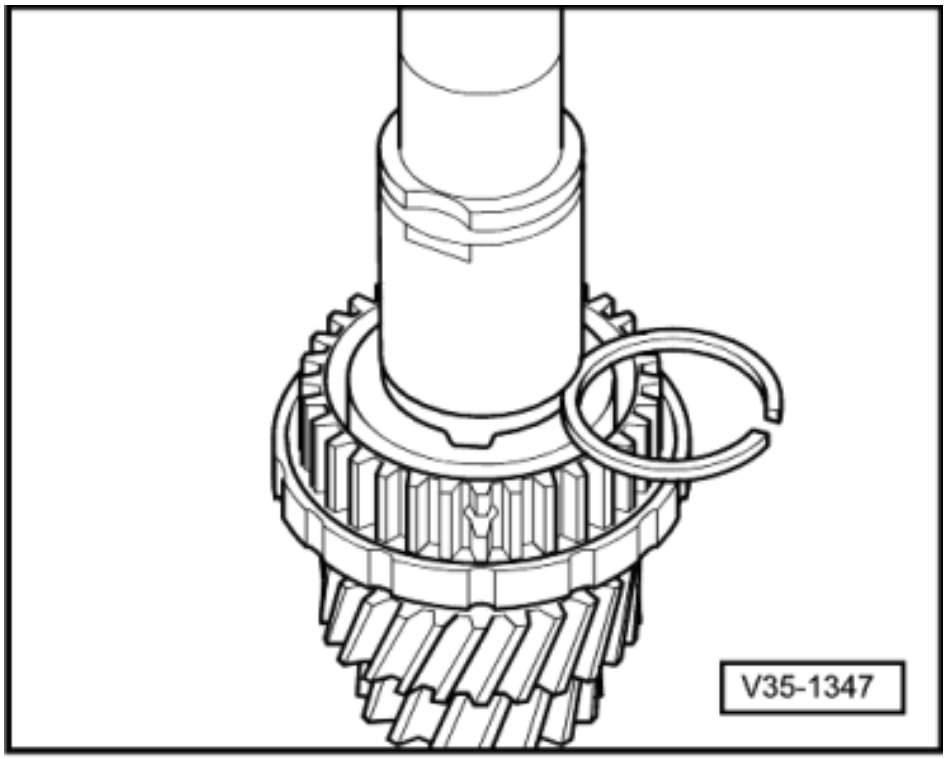
-> Fig.1 Inserting spring in sliding gear

- 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 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.

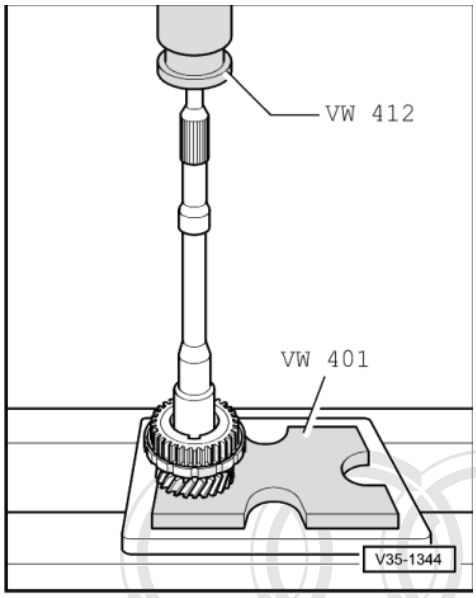
- Determine circlip from table. Part No.

=> Parts catalogue

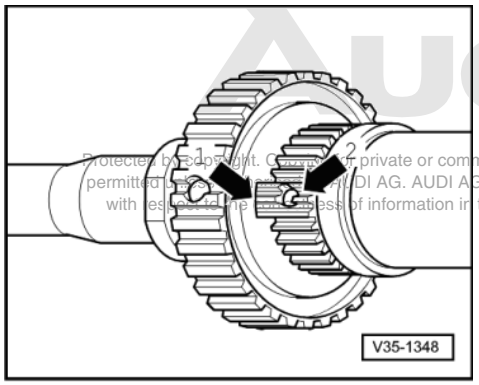
The following circlips are available:

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

- Fit circlip.

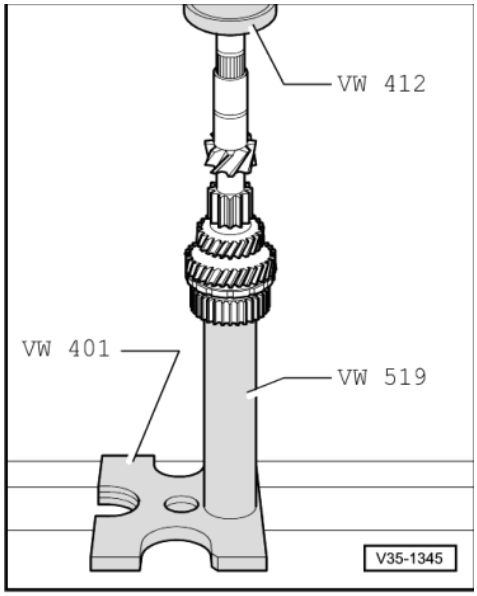


-> Fig.4 Pressing off synchro-hub for 3rd and 4th gear



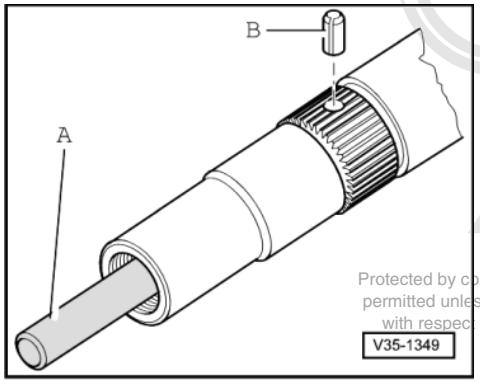
-> Fig.5 Synchro-hub installation position

- 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.

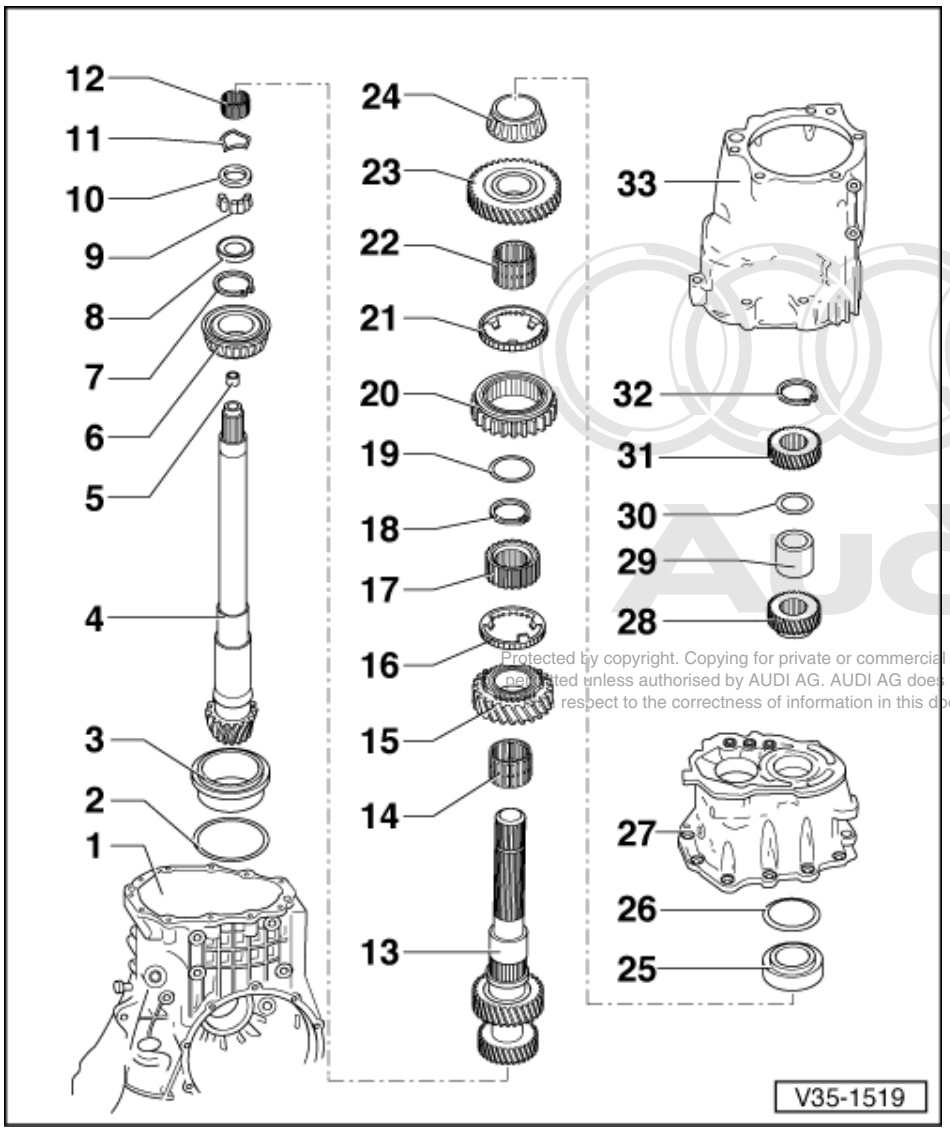


-> Fig.7 Driving spring pin into input shaft

- 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 and hollow shaft

2.1 - Dismantling and assembling drive pinion and hollow shaft

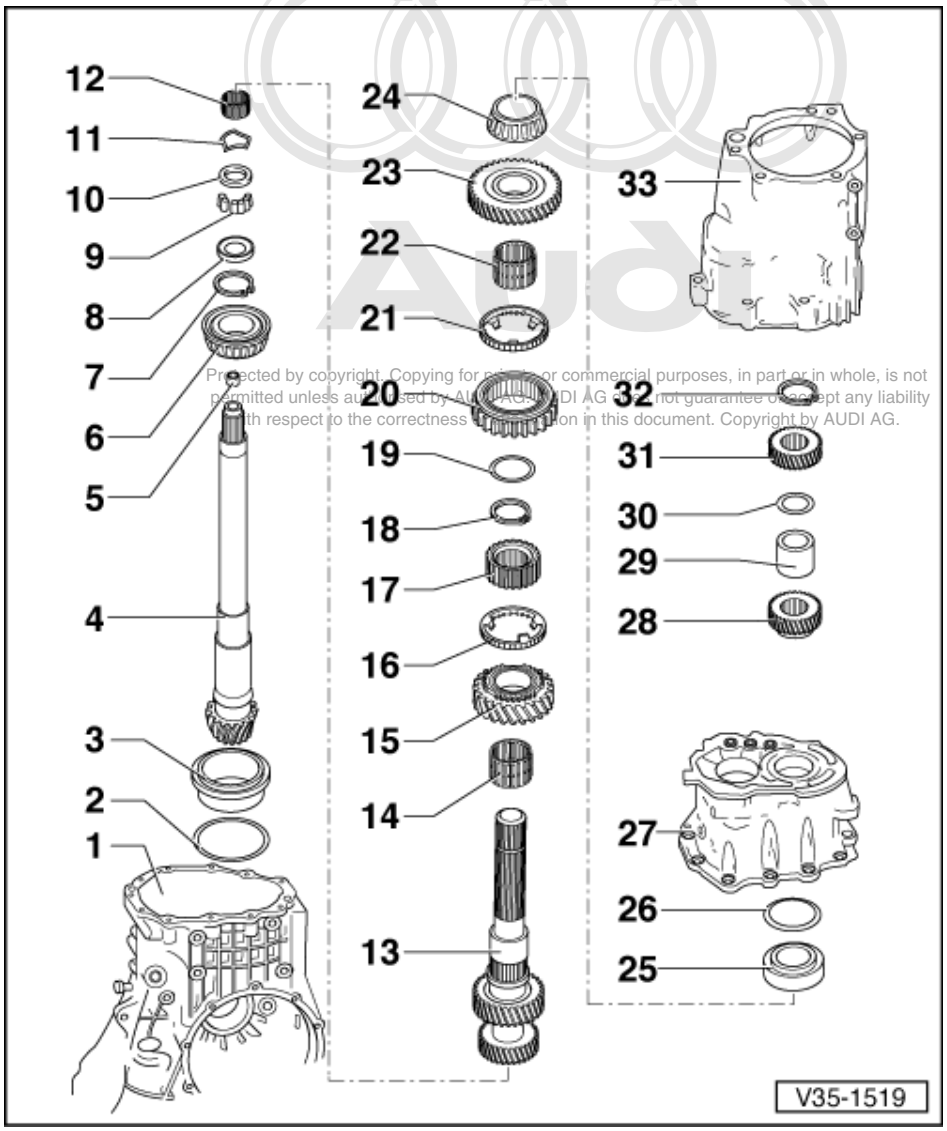


Notes:

- When installing new gears or final drive set => Technical data,Page 2 .
- Adjustments are required when renewing components marked 1) => Adjustment overview, Page 184 .

1 Gearbox housing
- Servicing => Page 121

2 Shim "S3"
- Adjustment overview => Page 184



3 Outer race for large taper roller bearing 1)

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

4 Drive pinion 1)

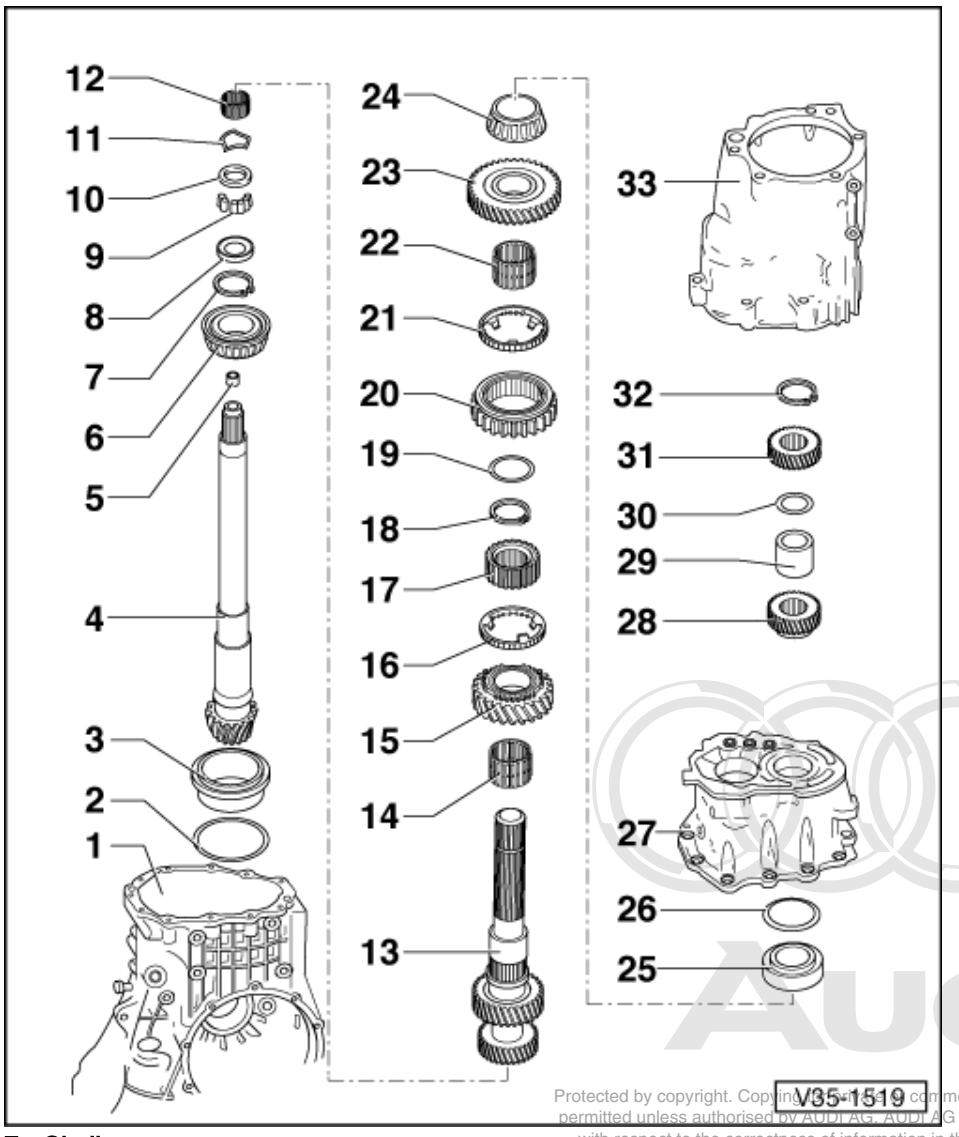
- Paired with crown wheel (final drive set)

5 Needle bearing for flange shaft/drive pinion

- Pulling out => Fig. 4
- Driving in => Fig. 5

6 Inner race for large taper roller bearing 1)

- Pressing off => Fig. 6
- Pressing on => Fig. 7
- Low friction bearing; do not oil when measuring frictional torque



7 Circlip
- Re-determining => Fig. 8

8 Flange ring
- Installation position => Page 82

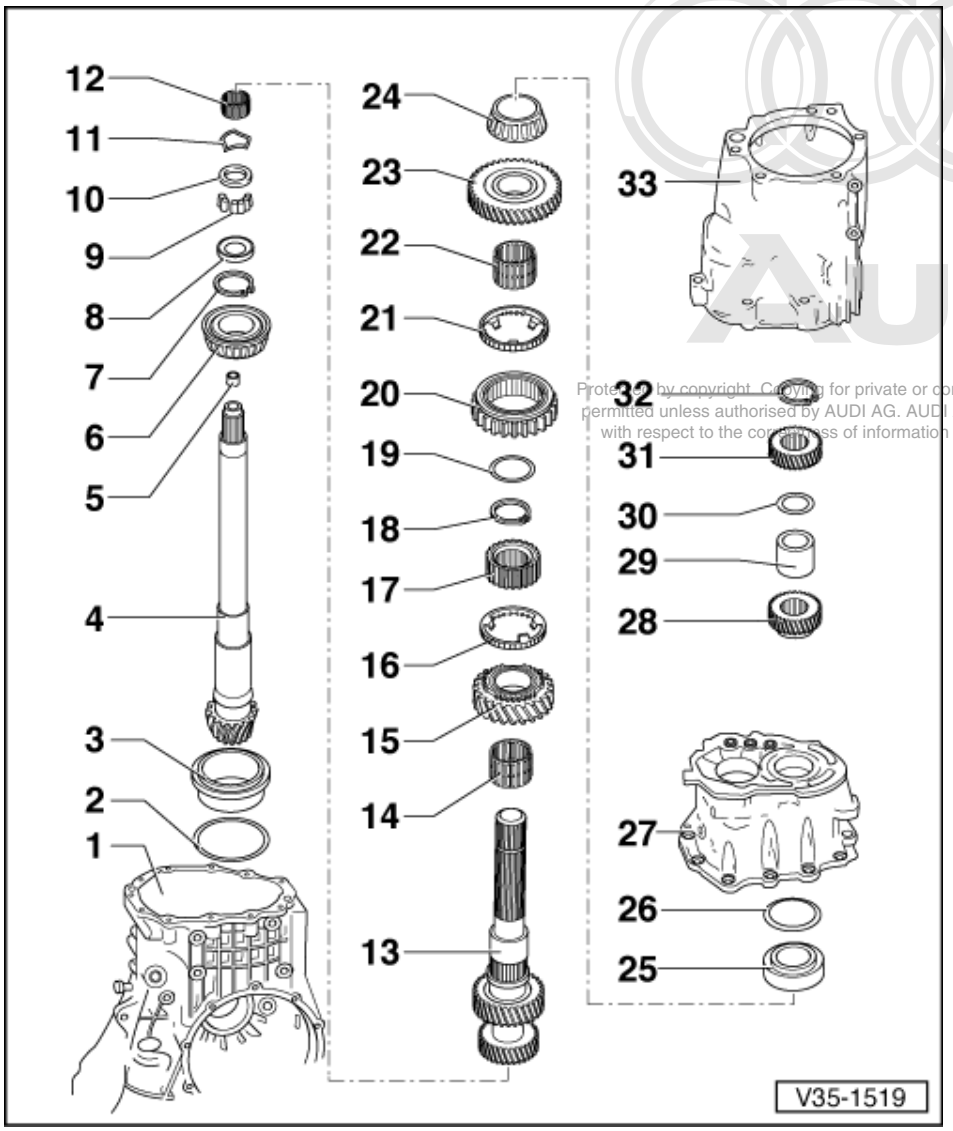
9 Tapered rollers
- Qty. 23
- Installation position => Page 82

10 Support ring
- Installation position => Page 82

11 Corrugated spring

12 Needle bearing for drive pinion/hollow shaft
- Oil before installing

13 Hollow shaft with 3rd and 4th speed gears 1)



14 Needle bearing for 2nd speed sliding gear

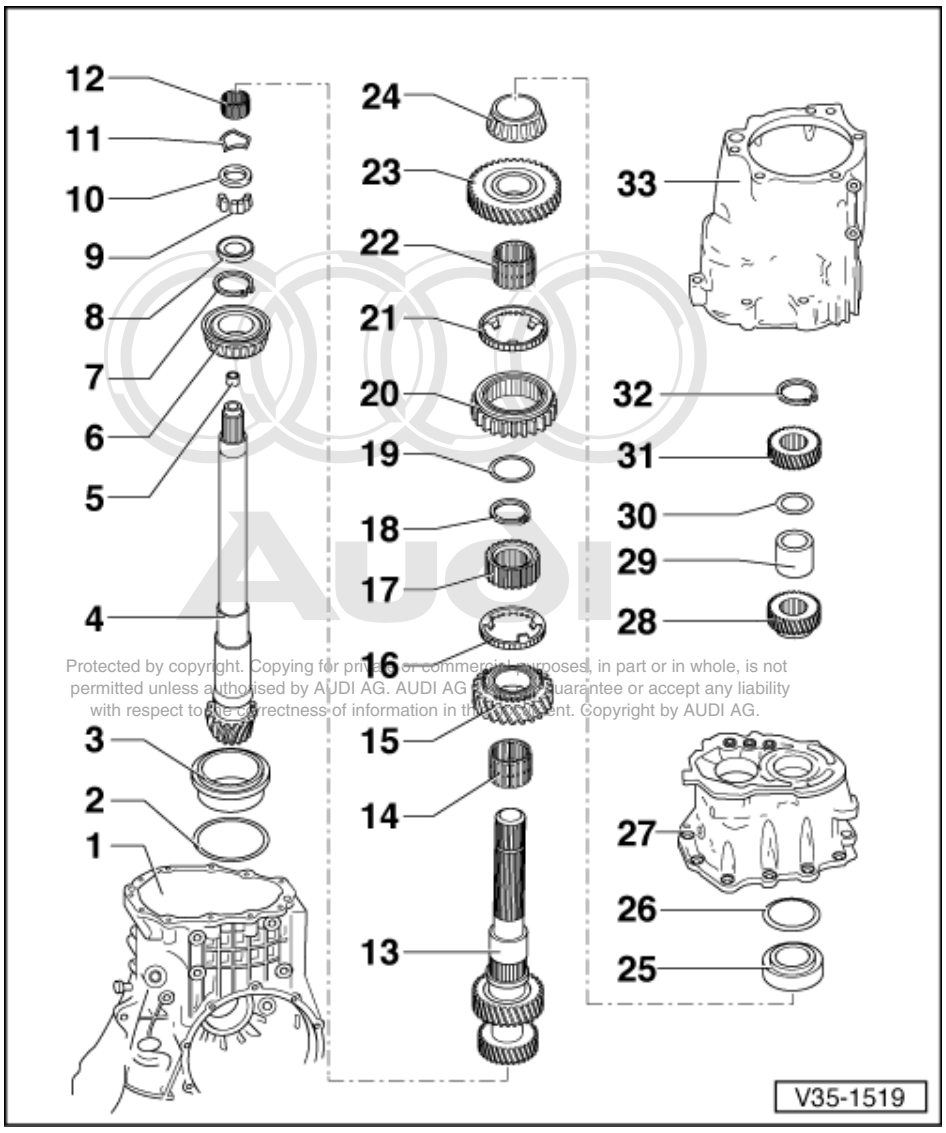
- Split
- Oil with gear oil before installing

15 2nd speed sliding gear

- Pressing off => Fig. 12
- 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)

16 Synchro-ring for 2nd gear

- Coated with Molybdenum
- Checking for wear => Fig. 146



17 Synchro-hub for 1st and 2nd gear

- Pressing off => Fig. 12
- Pressing on => Fig. 13
- Installation position: flush hub towards 2nd speed sliding gear

18 Circlip

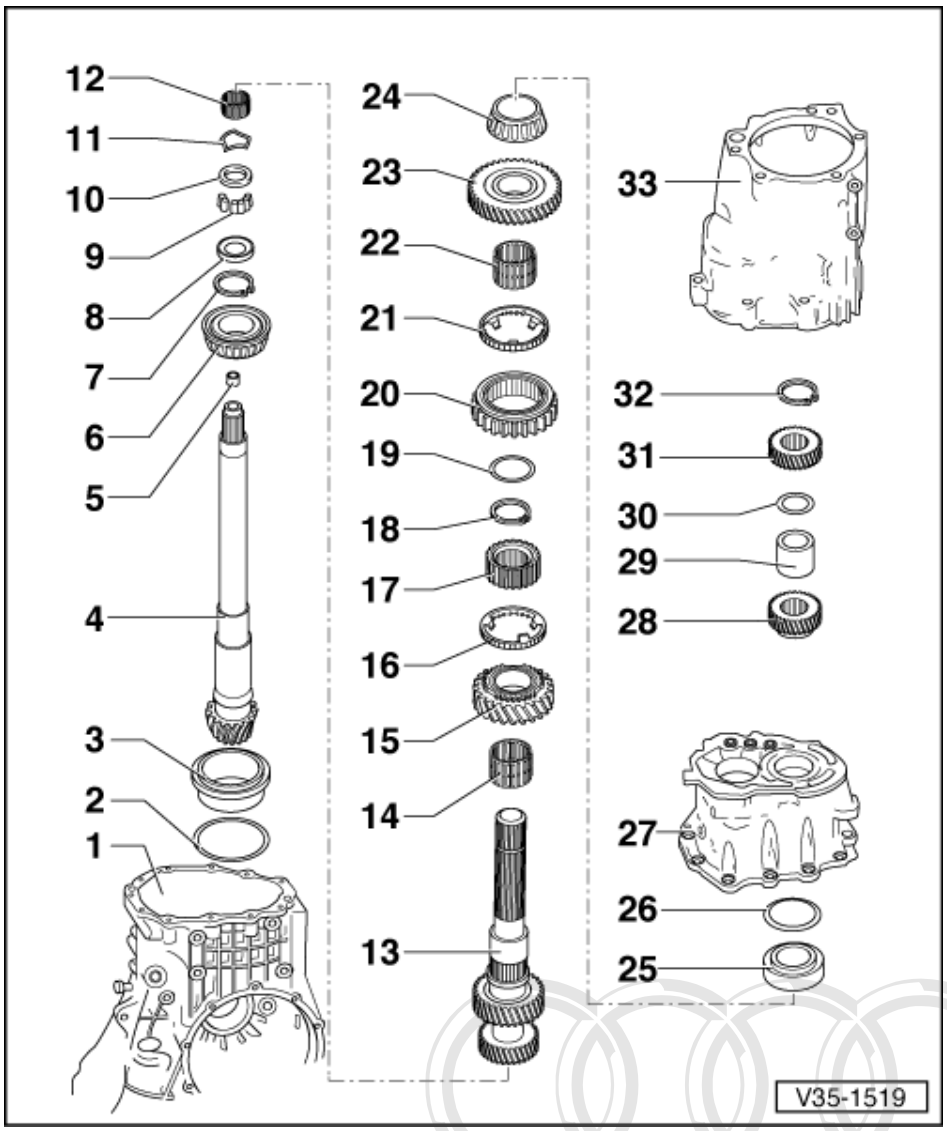
- Removing and installing => Fig. 11
- Re-determining => Fig. 8

19 Washer

- Removing and installing => Fig. 11

20 Locking collar for 1st and 2nd gear

- Installation position: splines for reverse gear towards synchro-ring for 2nd gear



21 Synchro-ring for 1st gear

- Checking for wear => Fig. 146

22 Needle bearing for 1st speed sliding gear

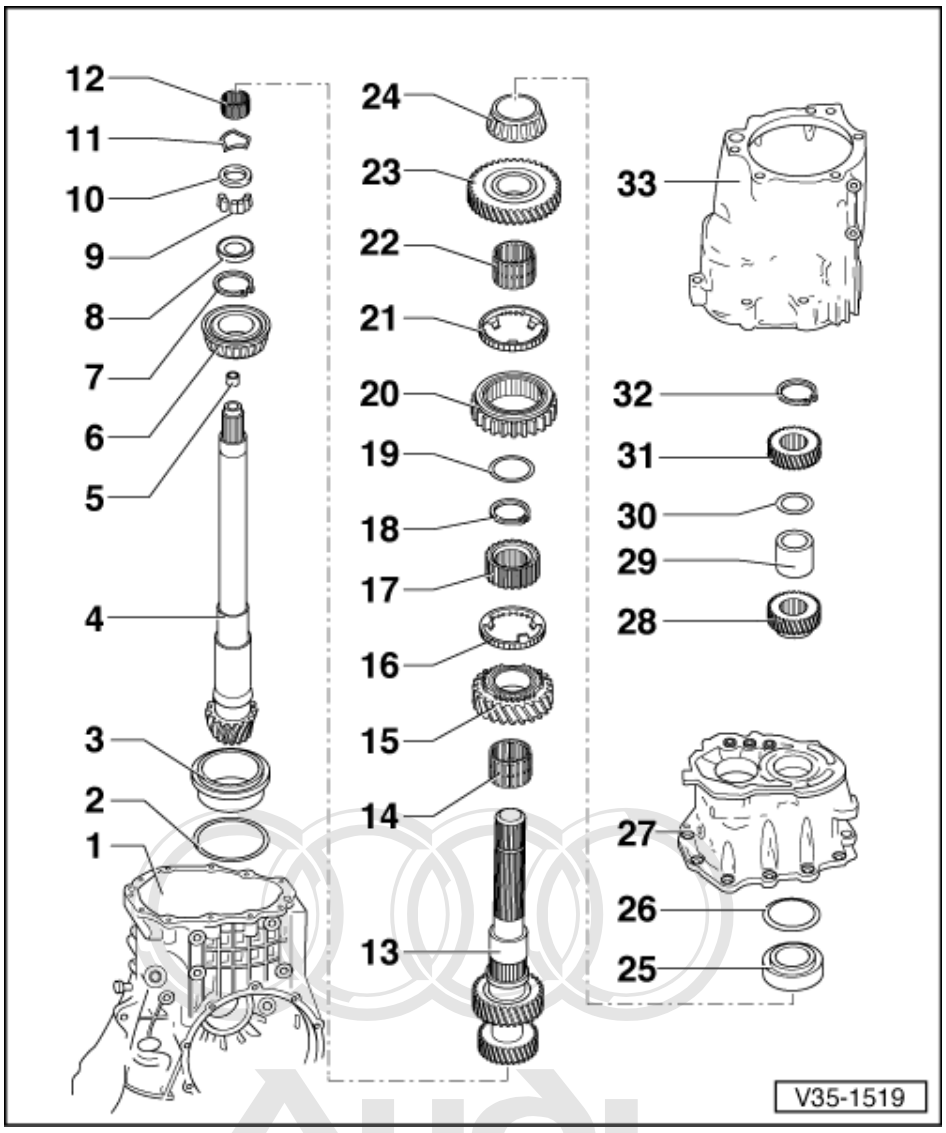
- Oil with gear oil before installing

23 1st speed sliding gear

- Before installing, insert spring => Fig. 146
- After pressing on -item 24 -, check axial clearance

24 Inner race for small taper roller bearing 1)

- Pressing off=> Fig. 9
- Pressing on => Fig. 10
- Low friction bearing; do not oil when measuring frictional torque



25 Outer race for small taper roller bearing 1)

- Driving out => Fig. 15
- Pressing in => Fig. 16

26 Shim "S4"

- Adjustment overview => Page 184

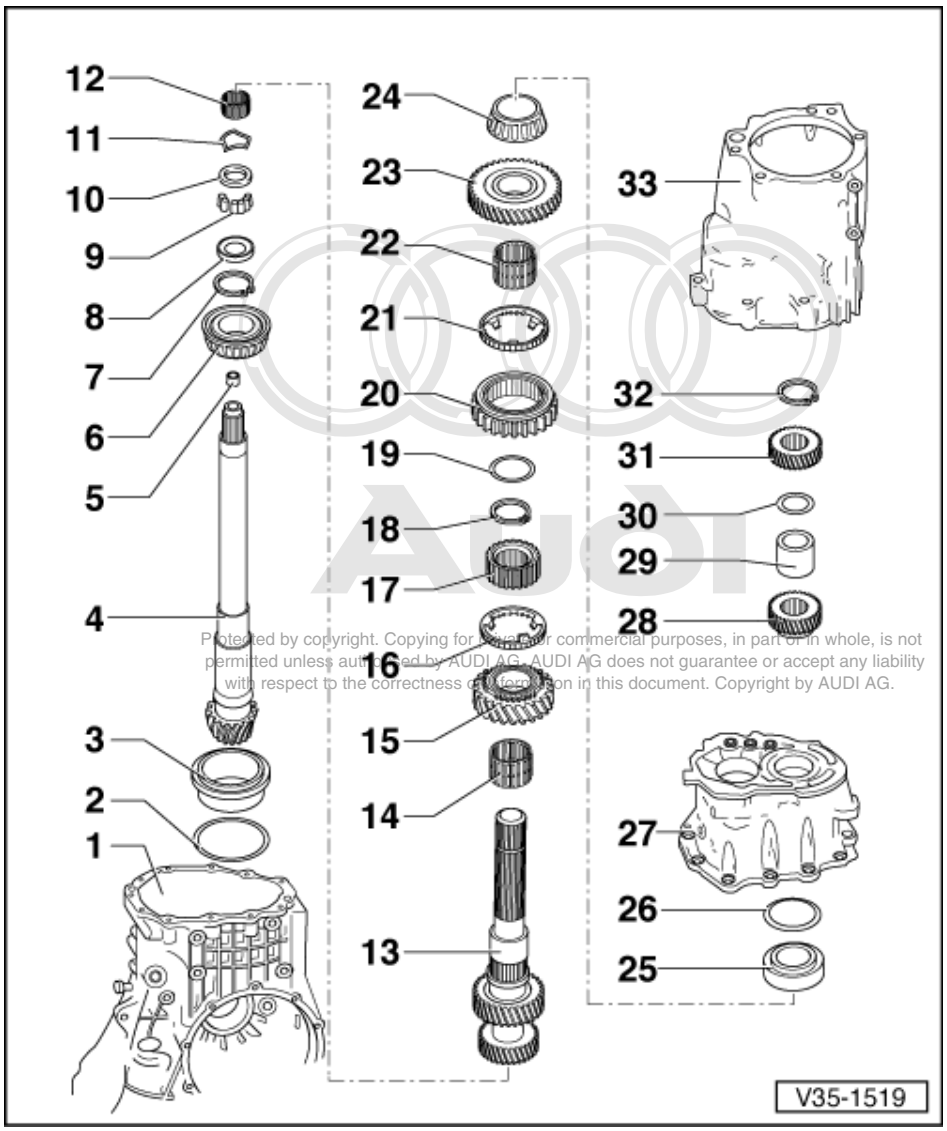
27 Bearing plate 1)

- Servicing => Page 111

28 6th gear wheel

- Pressing off => Page 82
- Pressing on => Page 83
- Installation position: shoulder towards inner race for small taper roller bearing

29 Spacer sleeve



30 Shim

- Re-determining =>Page 89

31 5th gear wheel

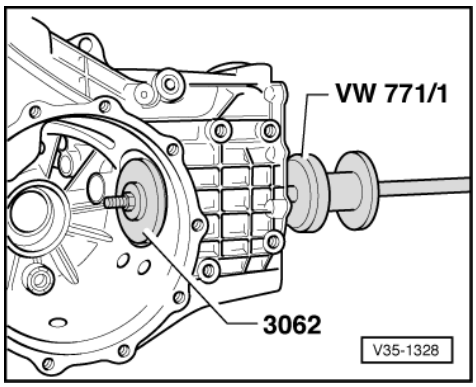
- Pulling off => Page 78
- Driving on => Page 90

32 Circlip for 5th gear wheel

- Re-determining => Page 90

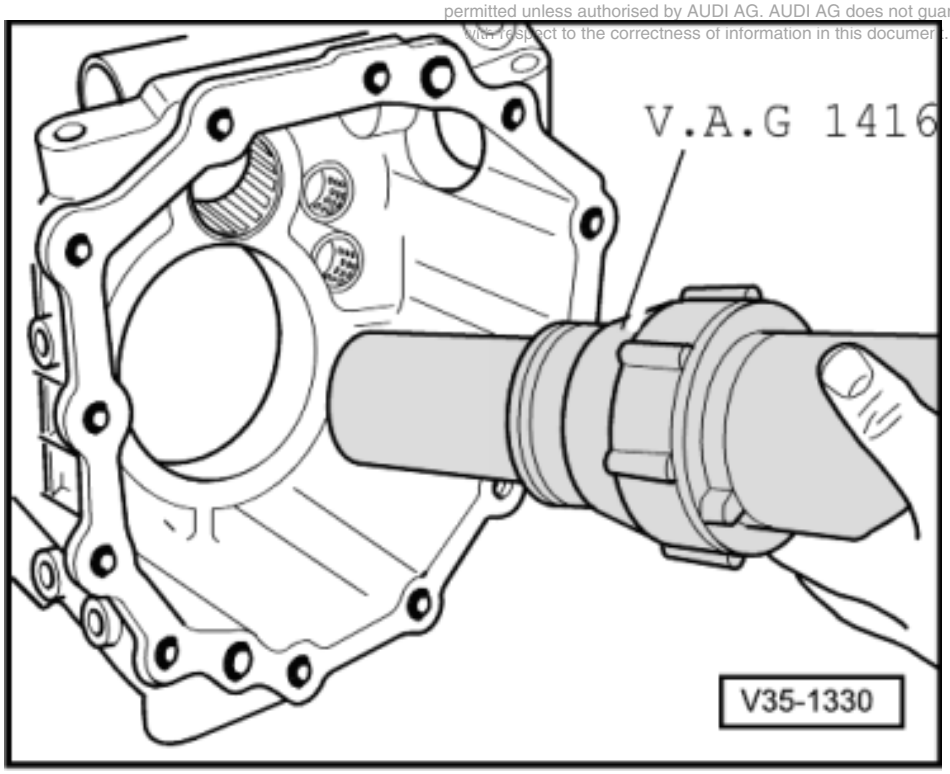
33 End cover

- Servicing => Page 105



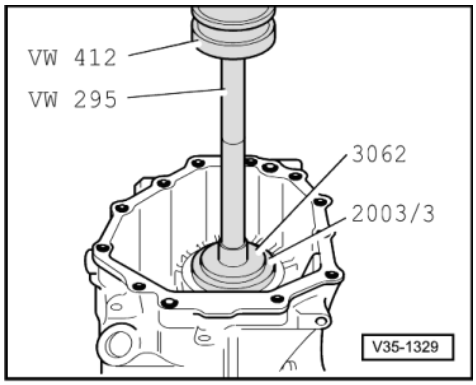
-> Fig.1 Pulling out outer race for large taper roller bearing

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



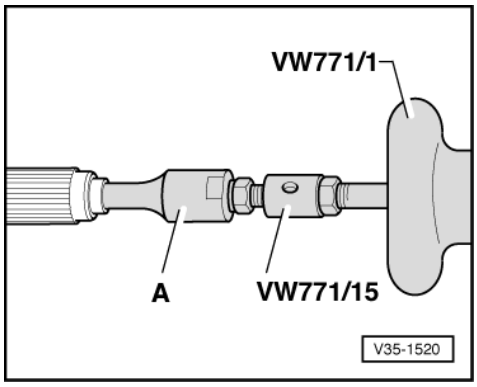
-> Fig.2 Heating gearbox housing to insert the outer race for large taper roller bearing

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



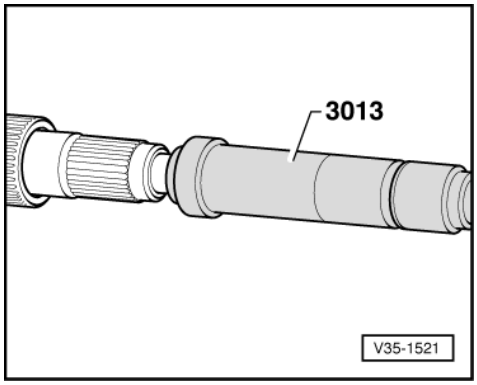
-> Fig.3 Inserting outer race for large taper roller bearing in gearbox housing and pressing home

- 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.

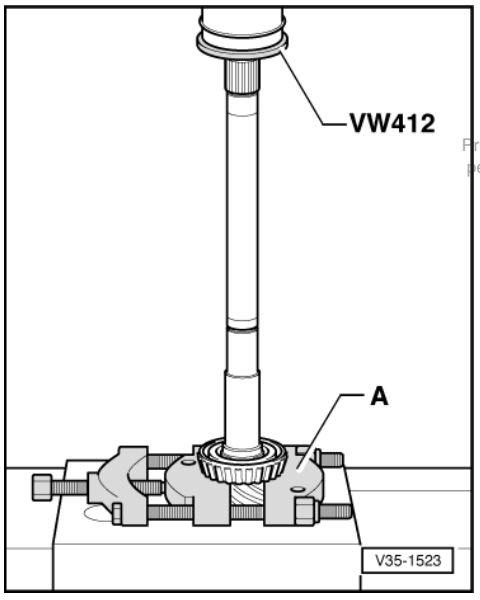


-> Fig.4 Pulling out needle bearing for flange shaft/drive pinion

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



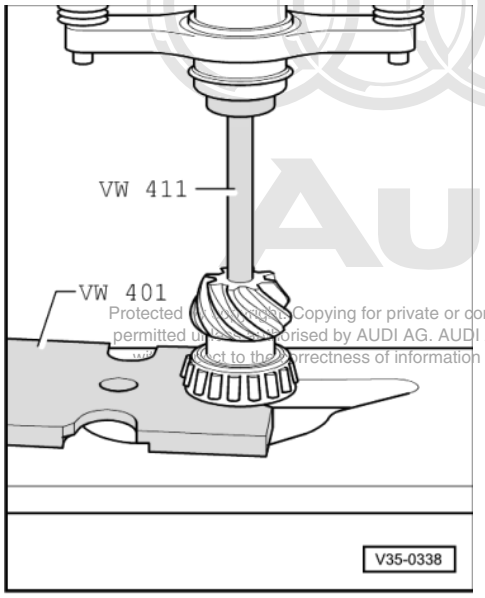
-> Fig.5 Driving needle bearing for flange shaft/ drive pinion in flush



-> Fig.6 Pressing off inner race for large taper roller bearing

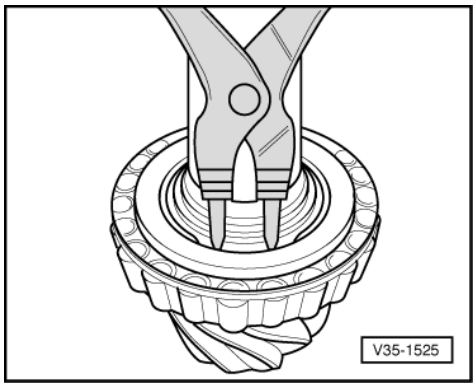
A - Separating device 22 ... 115 mm, e.g. Kukko 17/2

- Bearing is destroyed when pressing off



-> Fig.7 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.8 Determining circlip for large taper roller bearing for drive pinion

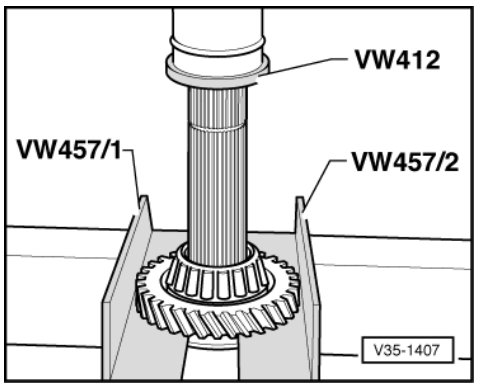
- Determine the thickest circlip that can still just be fitted.
- Determine circlip from table. Part numbers

=> Parts catalogue

The following circlips are available:

Circlip thickness (mm)		
2.34	2.40	2.46
2.36	2.42	2.48
2.38	2.44	

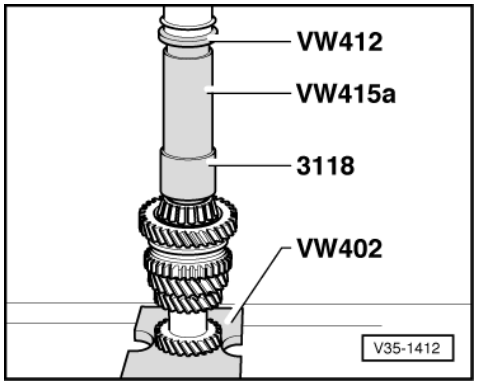
- Fit circlip.



-> Fig.9 Pressing off inner race of small taper roller bearing for drive pinion together with 1st speed sliding gear

Note:

Do not press off together with 1st and 2nd gear synchro-hub and 2nd speed sliding gear.

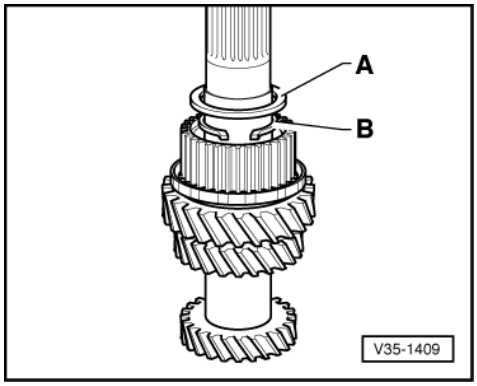


-> Fig.10 Pressing on inner race for small taper roller bearing for drive pinion together with 1st speed sliding gear

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

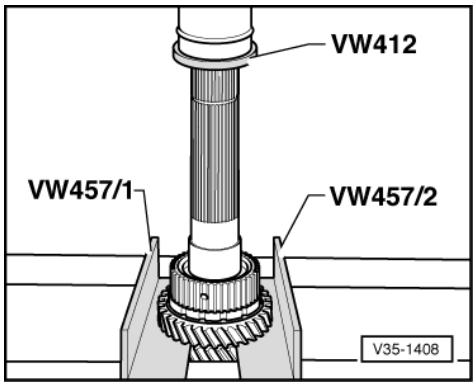
Notes:

- With shoulder of thrust piece 3118 facing downwards, press only onto bearing inner race.
- Position stepped shoulder of tube VW 415 A facing up towards press tool VW 412.
- After pressing on, check axial clearance of 1st speed sliding gear.



-> Fig.11 Removing and installing circlip for synchro-hub and shim for 1st speed sliding gear

- Removing, take off shim -A- then circlip -B-.
- Installing, fit circlip -B- then shim -A-.

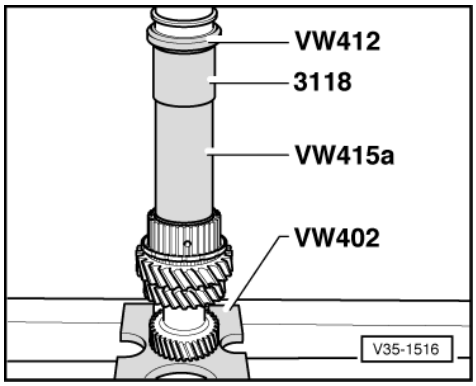


-> Fig.12 Pressing off 2nd speed sliding gear with synchro-hub for 1st and 2nd gear

- Take off locking collar for 1st and 2nd gear and synchro-ring for 1st gear.
- Remove shim and circlip for synchro-hub
- Press off 2nd speed sliding gear together with synchro-hub for 1st and 2nd gear.

Note:

Do not press off together with 1st speed sliding gear and inner race for small taper roller bearing.



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

- Install needle bearing (split), sliding gear with spring and synchro-ring for 2nd gear.
- Oil needle bearing.
- Heat synchro-hub to approx. 100 °C and fit.
- Press home ensuring there is no axial play.

Notes:

- Position tube VW 415 a with shoulder towards synchro-hub.
- Position thrust pad 3118 with stepped shoulder towards press tool VW 412.

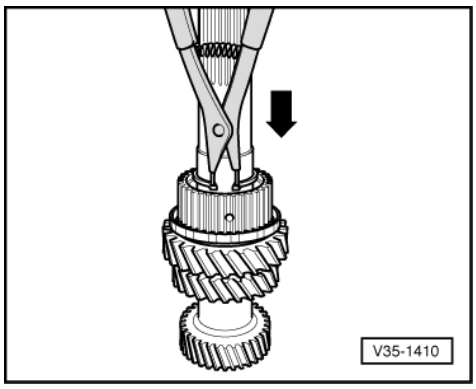


Fig.14 -> Determining thickness of circlip for synchro-hub for 1st and 2nd gear

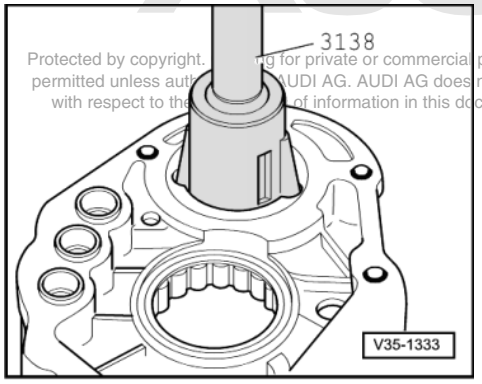
- Determine the thickest circlip that can still just be fitted.
- Determine circlip from table. Part No.

=> Parts catalogue

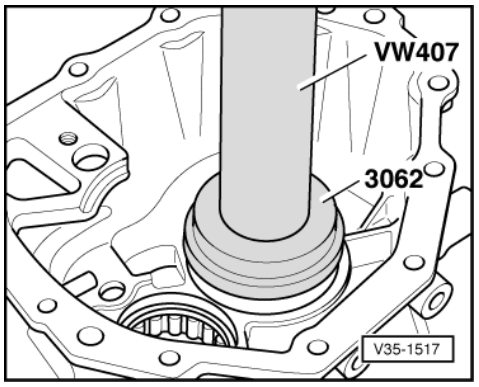
The following circlips are available:

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

- Fit circlip in direction of arrow onto synchro-hub.



-> Fig.15 Driving out outer race for small taper roller bearing



-> Fig.16 Pressing in outer race for small taper roller bearing

- Insert shim "S4" into bearing flange behind bearing seat.
- Position stepped shoulder of thrust pad 3062 towards press tool VW 407.
- Press outer race for small taper roller bearing onto stop.

39 - Final drive, Differential rear

1 - Renewing seal for flange shaft

1.1 - Renewing seal for flange shaft

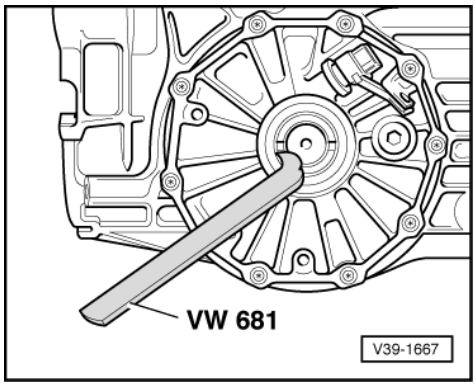
- Gearbox installed

Notes:

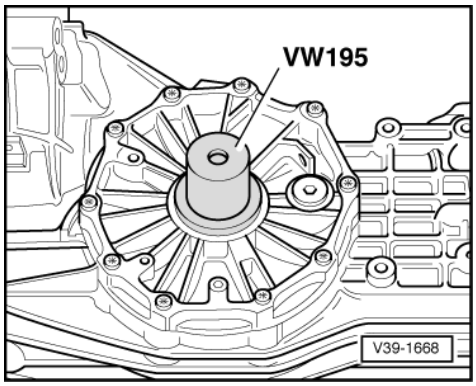
- Illustrated, removing and installing oil seal on left-hand side.
- Procedure for removing oil seal on left and right-hand sides is identical.

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.
  - Insertion depth: 5 mm
- Install flange shaft and drive shaft.

Tightening torques

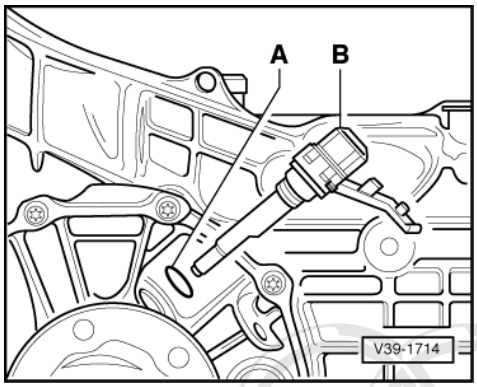
Component	Nm
Flange shaft to gearbox	10 + 90°+ (1/4 turn)
Drive shaft to flange shaft	80

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

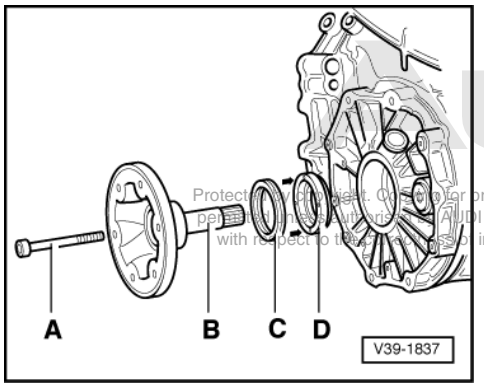
- Gearbox installed

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.

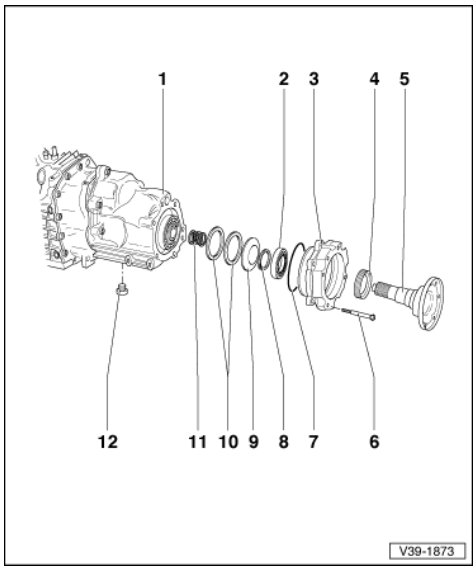
Installing:

- Install drive wheel for speedometer sender so that the follower lugs -arrows- face toward the seal.

- Follower lugs engage in differential housing grooves.
- Renew seal for flange shaft and install flange shaft => Page 163 .
- Check oil level in gearbox => Page 60 .

3 - Renewing seal and grooved ball bearing for flange for propshaft on gearbox

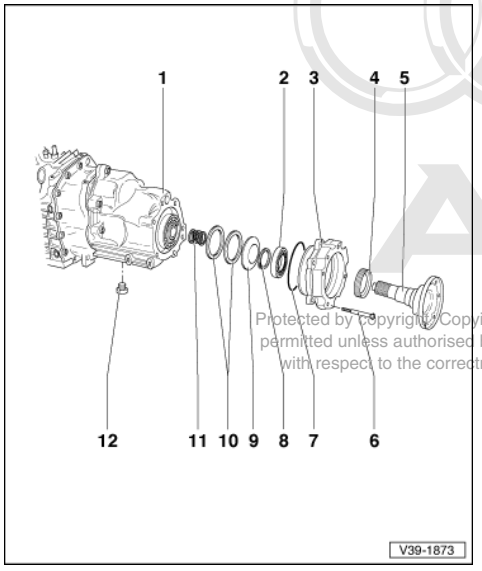
3.1 - Renewing seal and grooved ball bearing for flange for propshaft on gearbox



- Gearbox installed

1 Gearbox
2 Grooved ball bearing
3 Bearing housing on balance weight
4 Seal
- Driving in => Page 168

5 Flange shaft



6 Bolt - 25 Nm
- Qty. 6

7 O-ring
- Always renew

8 Circlip
9 Spring plate
- Mark installation position when removing: larger diameter (concave side) towards shims -item 10

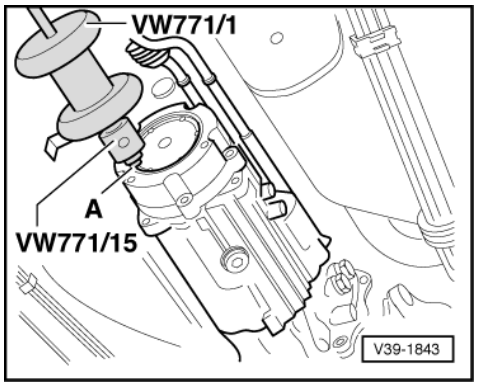
10 Shims
11 Spring
12 Oil drain plug - 40 Nm

Removing

- Disconnect front propshaft => Page 202 and tie-up on selector rods.
- Place a drip tray underneath.
- Unscrew rear oil drain plug (on end cover) and drain gearbox oil.
- Unscrew securing bolts for bearing housing.

Note:

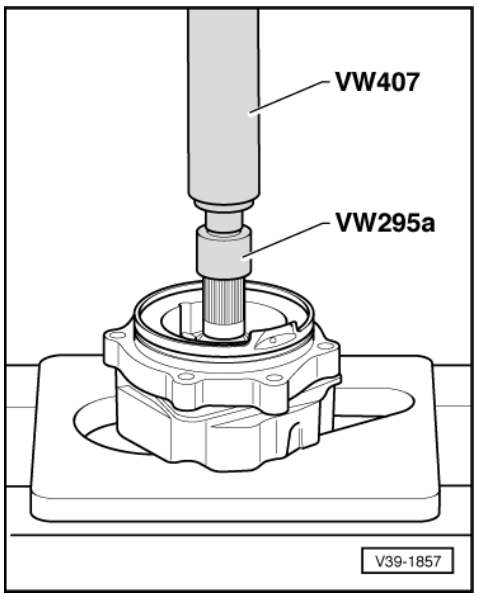
Bearing housing is pressed slightly off end cover by coil spring when securing bolts are loosened.



- -> Pull flange shaft together with bearing housing and balance weight off end cover.

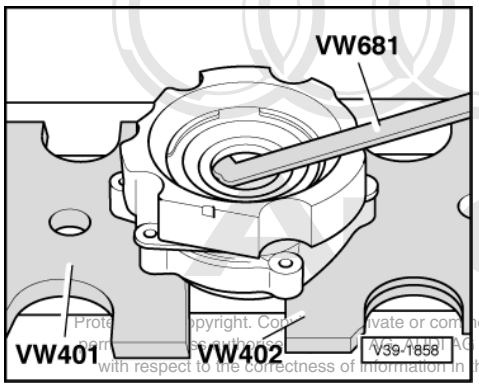
A - M8/M10 stud

- Take off bearing housing.

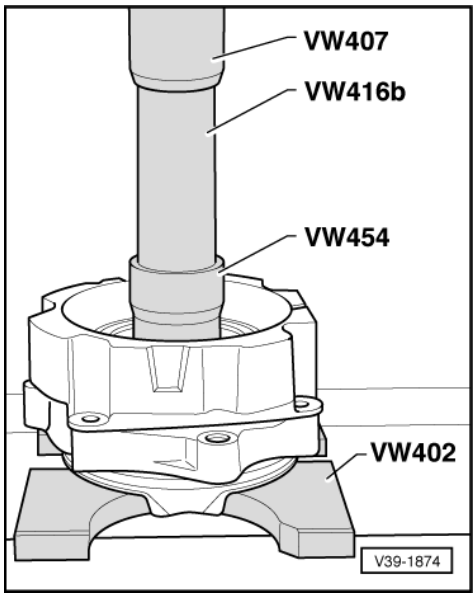


- Take circlip off flange shaft.

- -> Press out flange shaft.

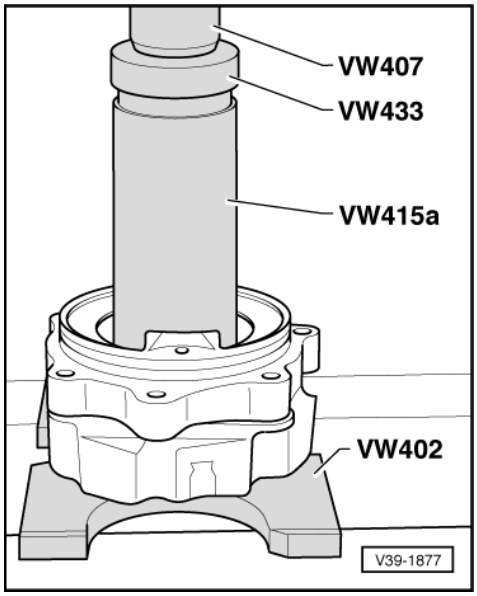


- -> Pull out seal for flange shaft.
- Thoroughly clean seal seat.

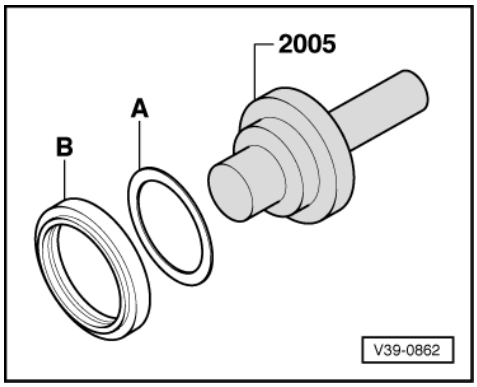


- -> Press out grooved ball bearing.

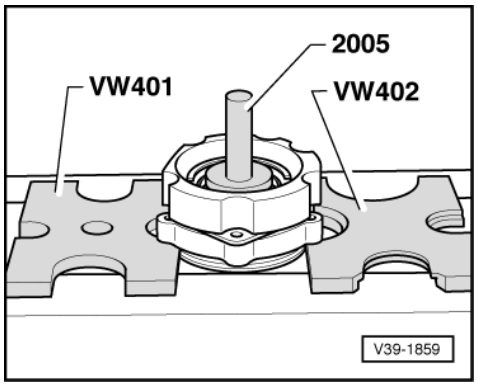
Installing



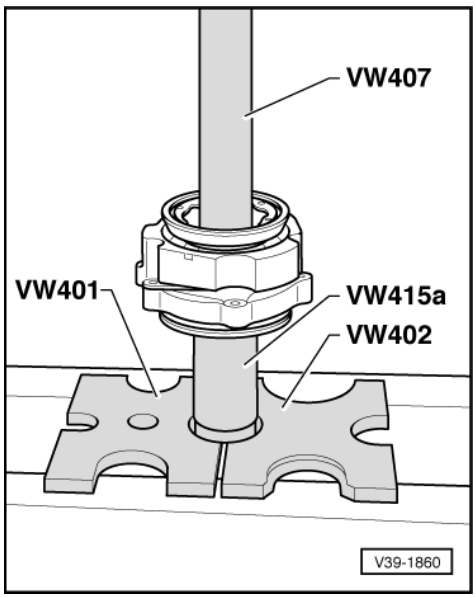
- -> Press grooved ball bearing in bearing housing.



- -> Lightly oil outer circumference of seal -B-.
- Fill space between sealing lips with grease.
- Fit seal with shim -A-, Part No. 016 311 391 B (1.7 mm thick) onto punch 2005.
  - Installation position: open side of seal towards gearbox



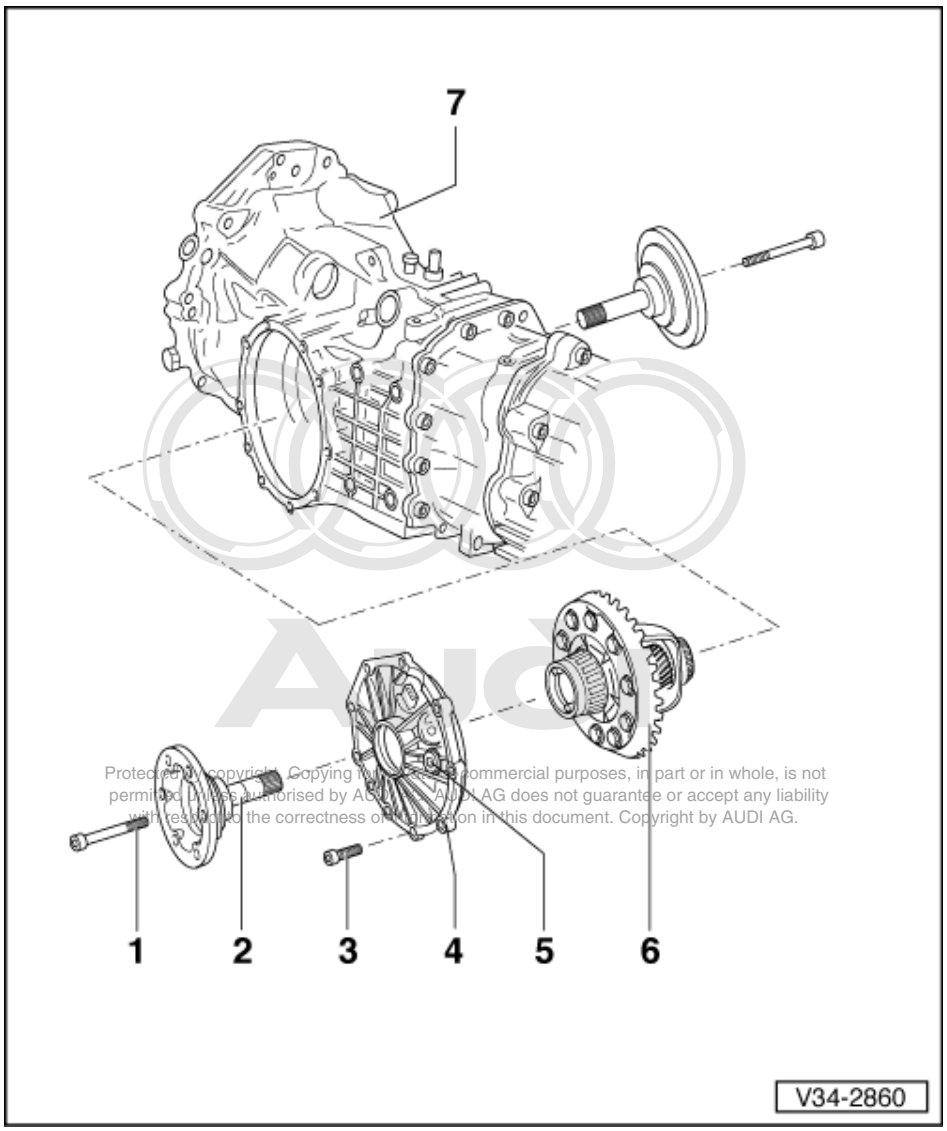
- -> Drive in seal for flange shaft.
- Remove shim after driving in.



- -> Press in flange shaft.
- Fit circlip onto flange shaft.
- Lightly oil O-ring and fit into bearing housing groove.
- Insert spring plate and shims into bearing housing.
  - Installation position: => Page 166
- Slide coil spring onto flange shaft.
- Tighten securing bolts for bearing housing in diagonal sequence and in stages.
- Install propshaft => Page 205 .
- Check oil level in gearbox => Page 60 .

4 - Removing and installing differential

4.1 - Removing and installing differential

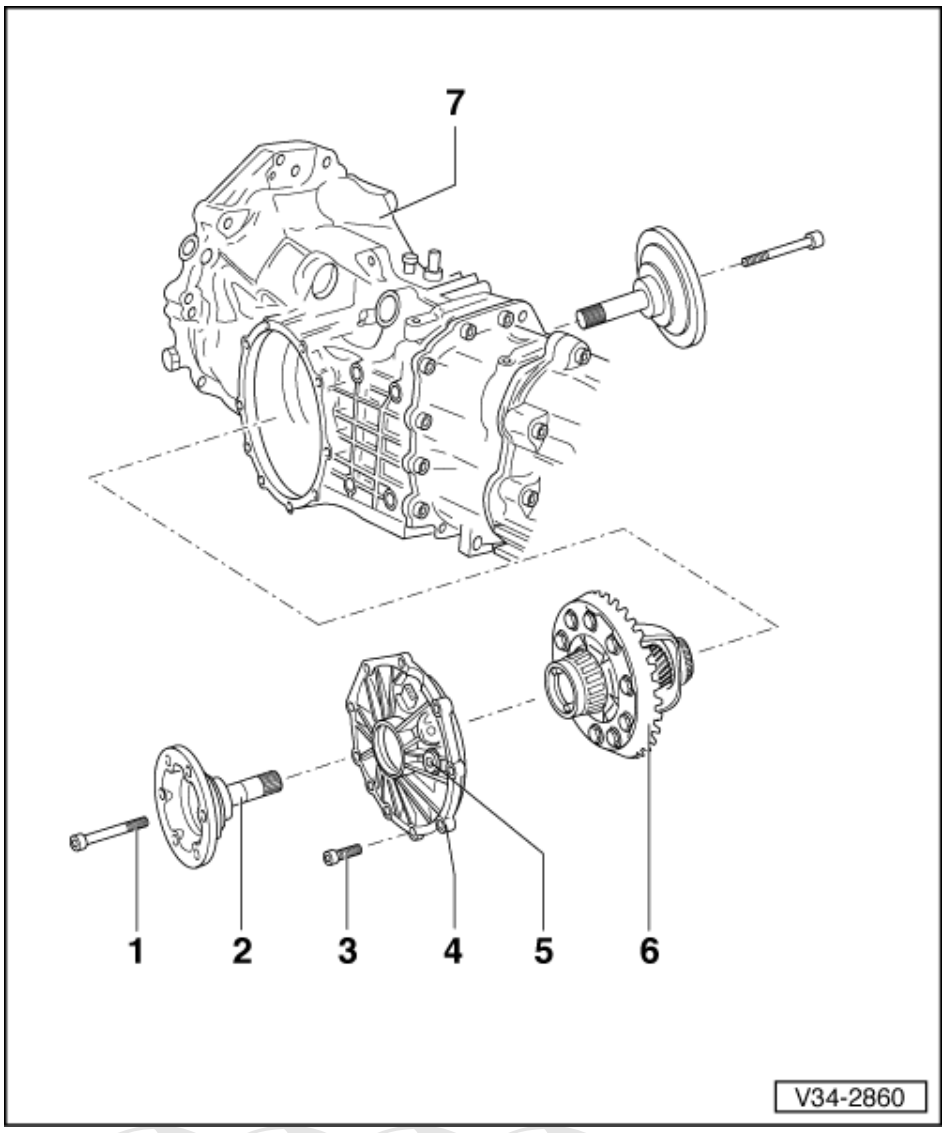


Note:

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

1 **Bolt - 10 Nm + 1/4turn (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 164
- If renewed: adjust crown wheel => Page 192

5 Oil filler plug - 40 Nm

- Checking oil level in gearbox => Page 60

6 Differential

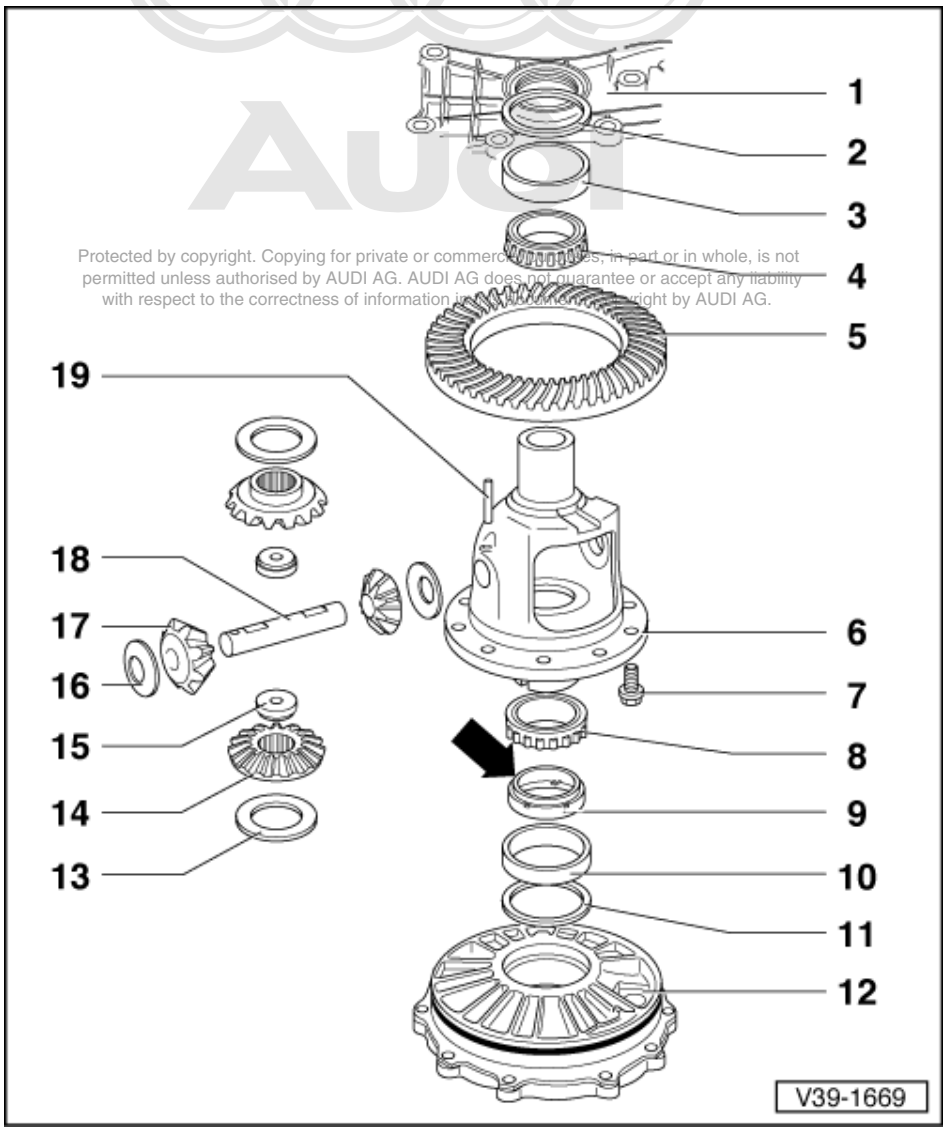
- Dismantling and assembling => Page 172
- If renewed: adjust crown wheel => Page 192

7 Gearbox housing

- Servicing => Page 121

5 - Dismantling and assembling differential

5.1 - Dismantling and assembling differential

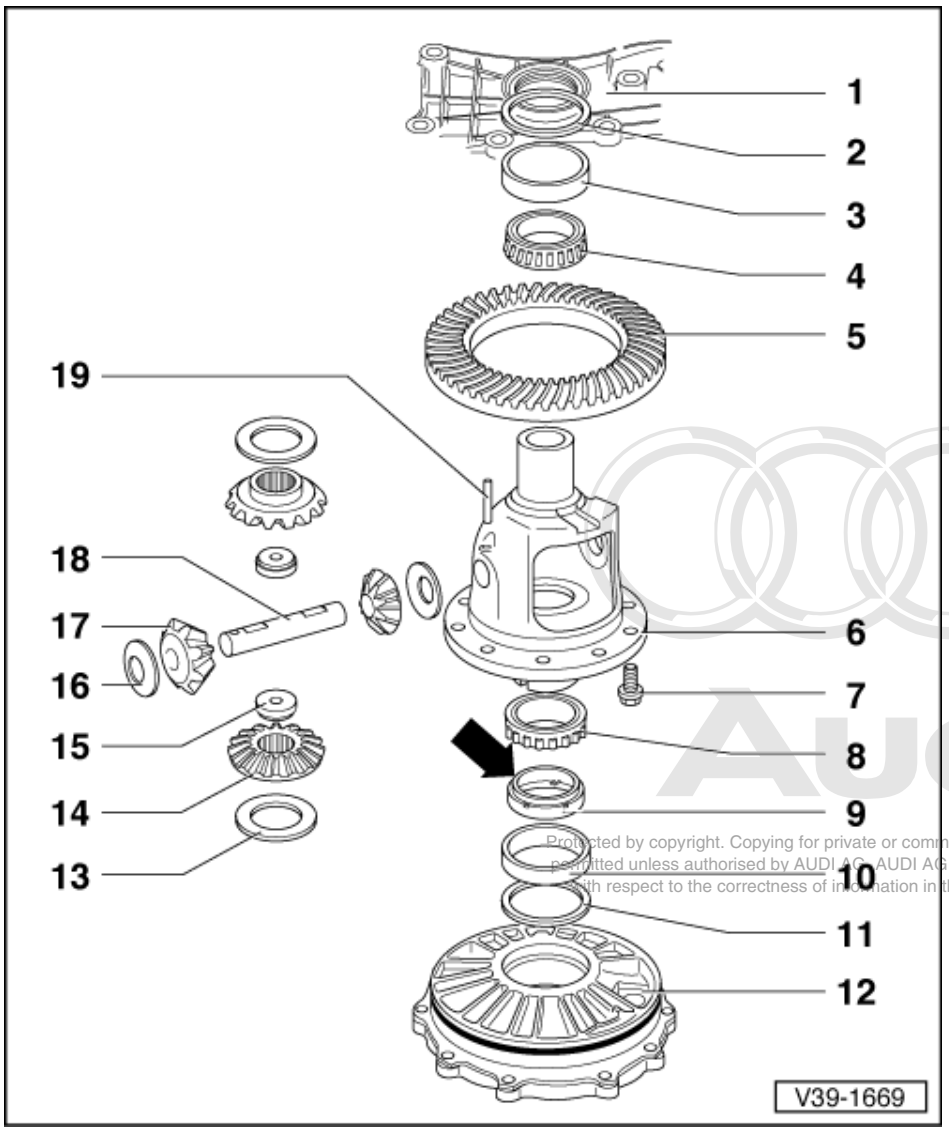


Notes:

- Removing and installing differential
  =>Page 170 .
- Adjustments are required when replacing components marked 1) =>adjustment overview Page 184 .

1 **Gearbox housing 1)**

2 **Shim "S2"**
- Note thickness
- Adjustment overview => Page 184



3 Outer race for small taper roller bearing 1)

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

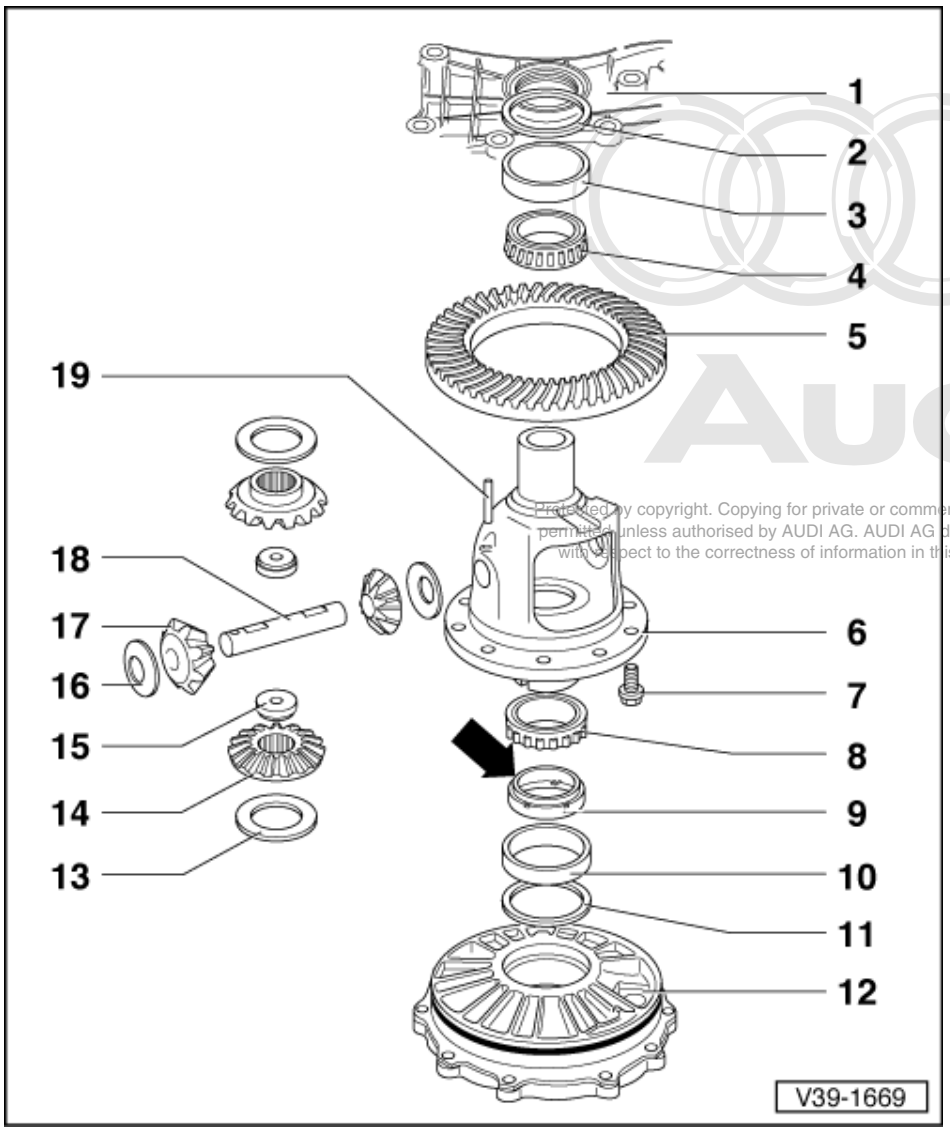
4 Inner race for small taper roller bearing 1)

- 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 + 1/8 turn (45°) further

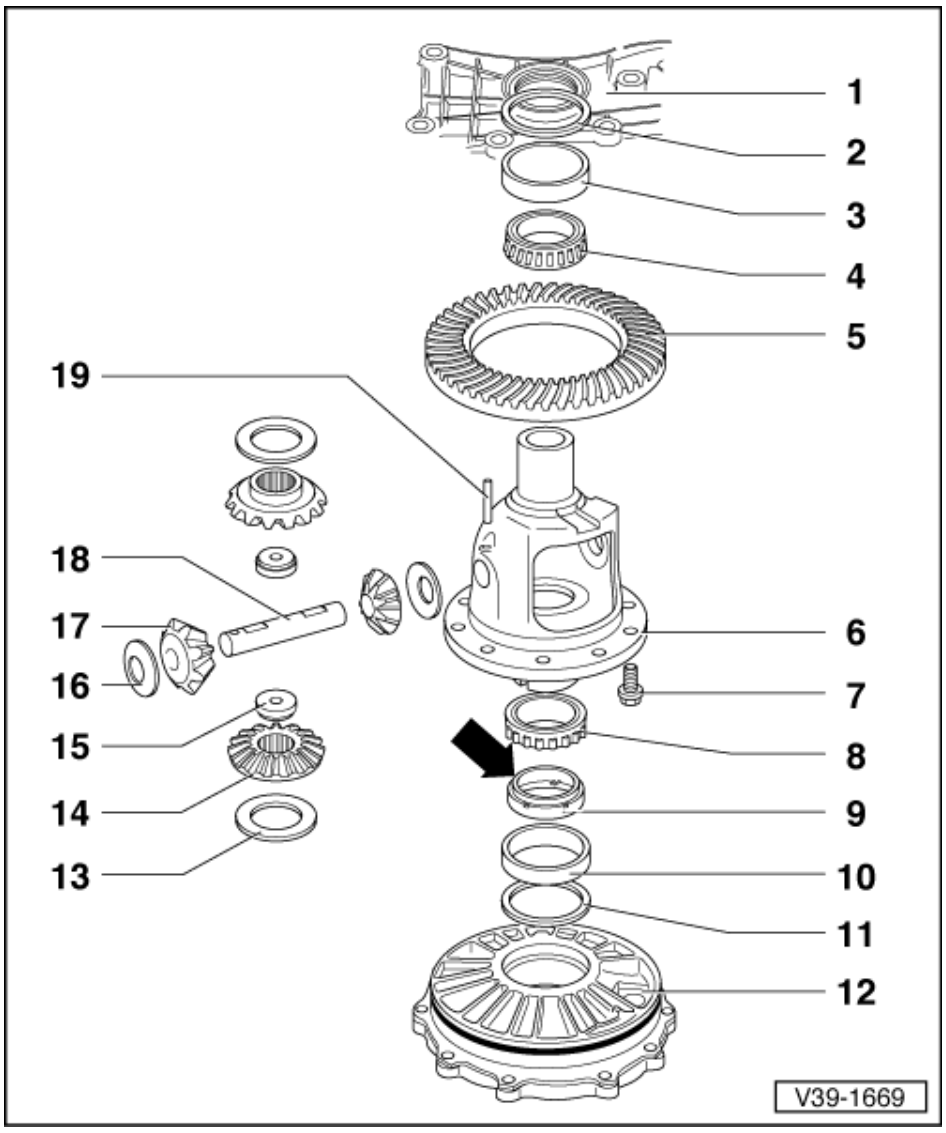
- Always renew
- Use only genuine bolts

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 164
- Installation position: shoulder -arrow- towards differential



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 184

12 Cover for final drive 1)

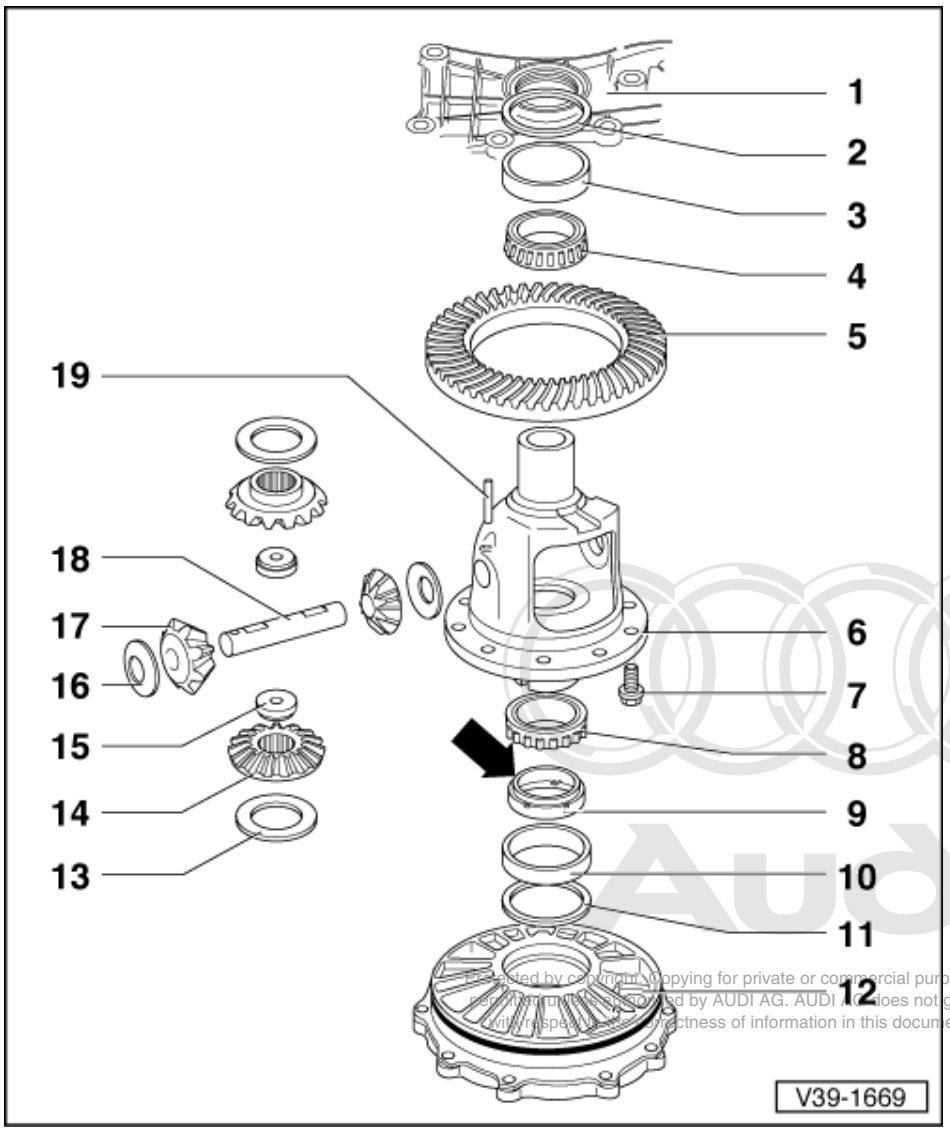
- With O-ring
- Renew O-ring
- Oil O-ring before installing

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

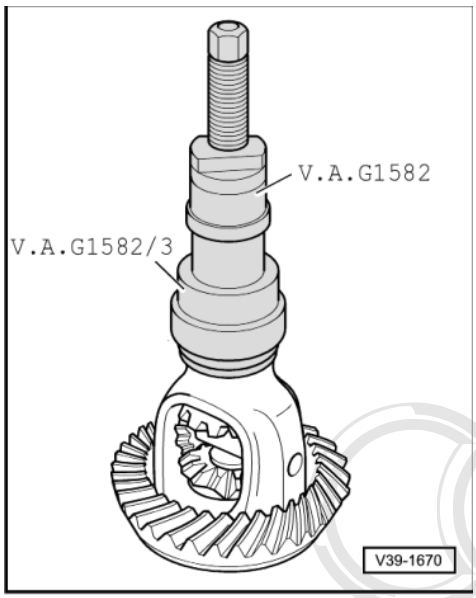
- Installing => Fig. 7

18 Shaft for planet wheels

- After removing, drive out spring pin with a drift
- Before driving in, align thrust washers

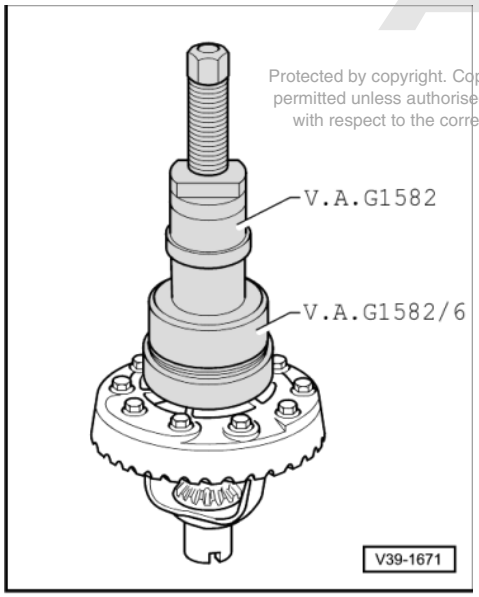
19 Spring pin

- Drive in flush



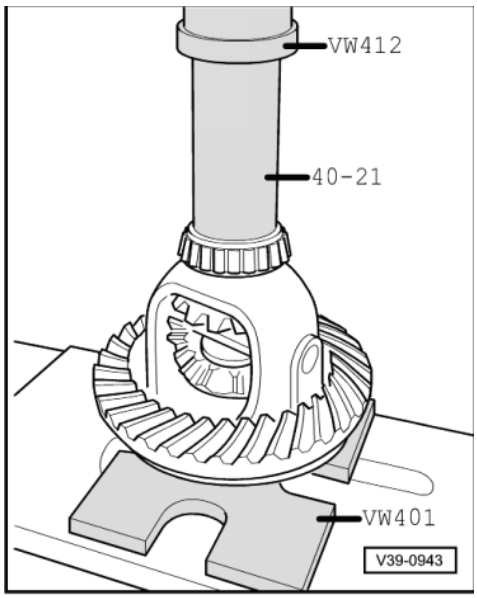
-> Fig.1 Pulling inner race for small taper roller bearing out of housing

- Fit thrust plate 40-105 before fitting puller.



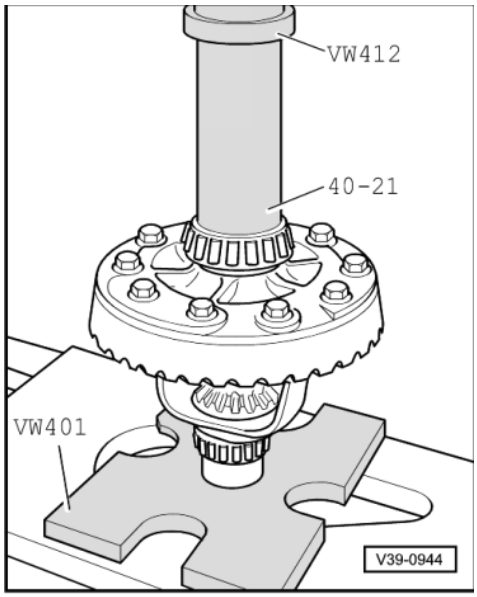
-> Fig.2 Pulling inner race for large taper roller bearing off housing

- Fit thrust plate 40-105 before fitting puller.



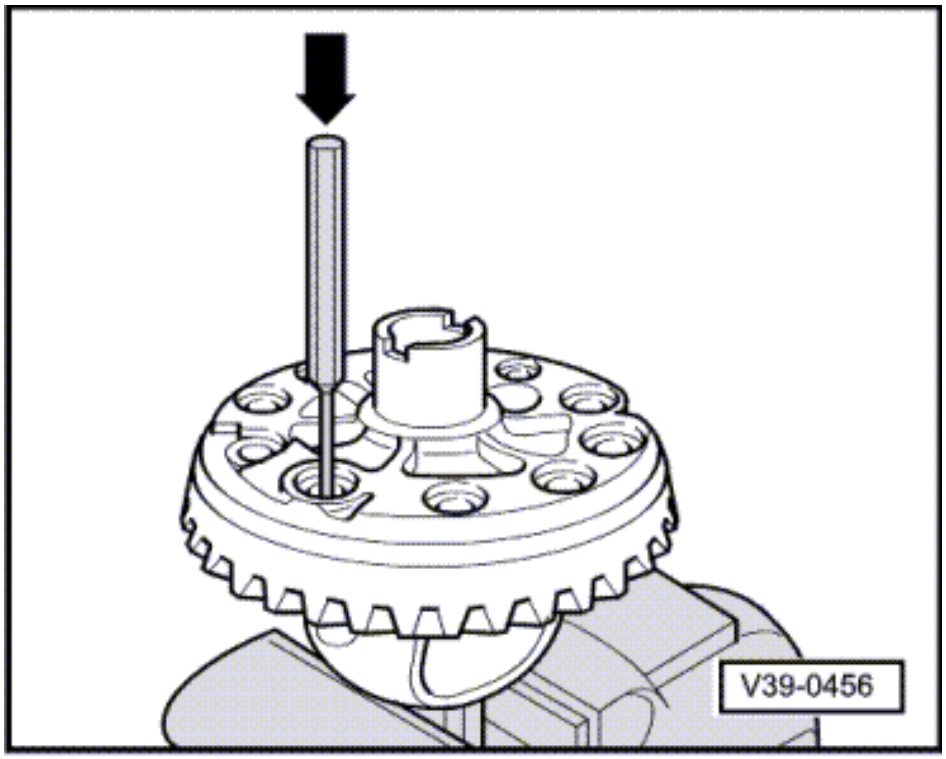
-> Fig.3 Pressing on inner race for small taper roller bearing

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

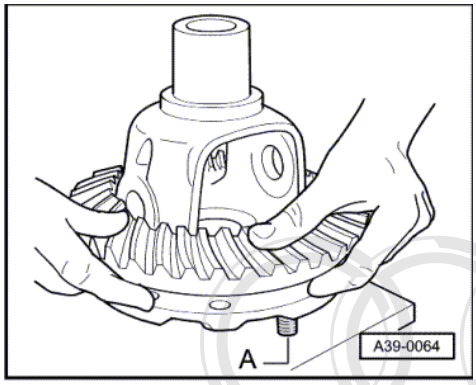


-> Fig.4 Pressing on inner race for large taper roller bearing

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

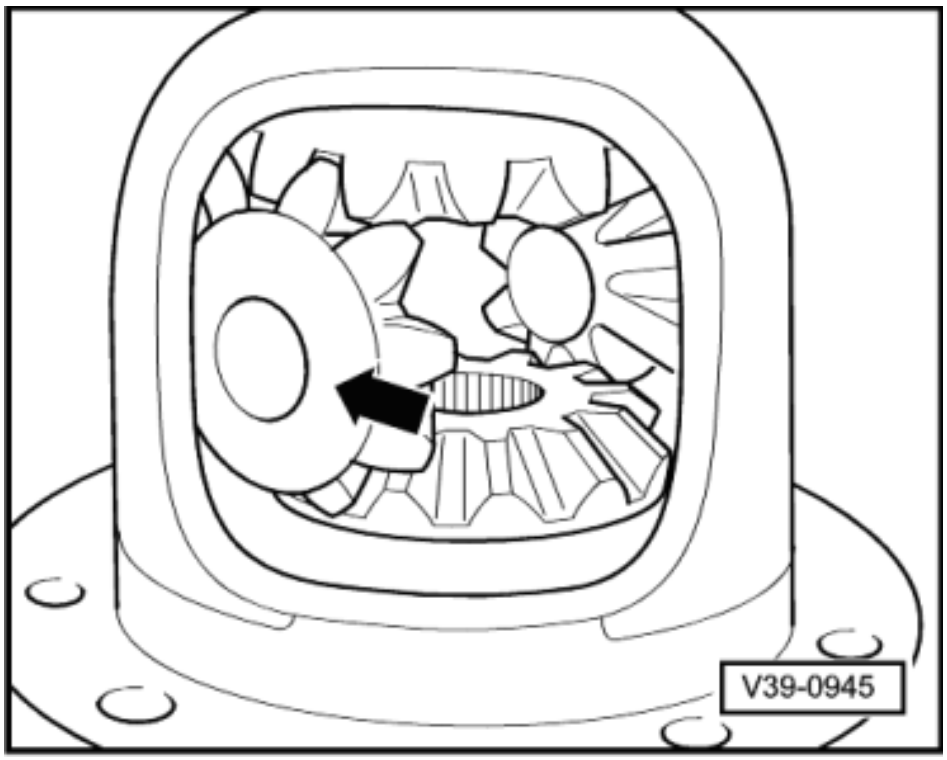


-> Fig.5 Driving crown wheel off housing



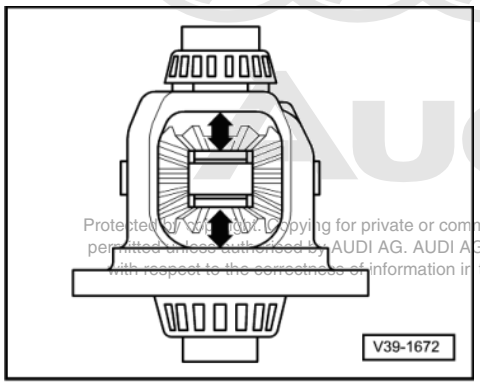
-> Fig.6 Installing crown wheel

- Use 2 centring pins -A- (local manufacture) as a guide.
- Heat crown wheel to approx. 100 °C and install.



-> 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 spaced 180° apart and rotate into position -arrow-.
- Insert threaded pieces.
  - Installation position: stepped shoulder towards sun wheels
- Position thrust washers so that they align with holes in differential.
- Drive in shaft and secure with spring pin.



-> Fig.8 Adjusting planet wheels and sun wheels

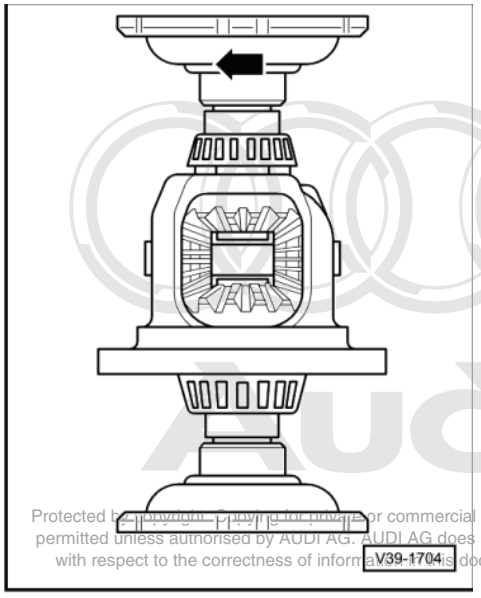
- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet wheels with thrust washers and press in shaft.

Note:

Do not now interchange bevel gears and thrust washers!

- Press planet wheels outwards and check play of sun wheels by hand -arrows-.
- Adjust play by inserting an appropriate shim => Page 181 .

- Specification: max. 0.10 mm



Note:

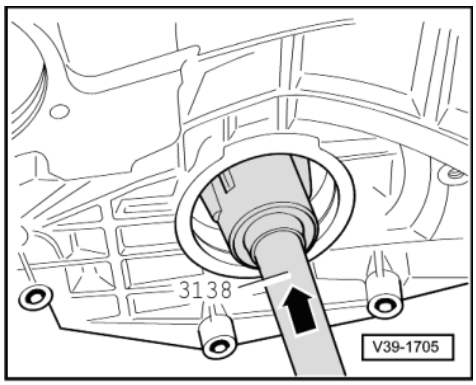
-> The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears -arrow-.

- 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

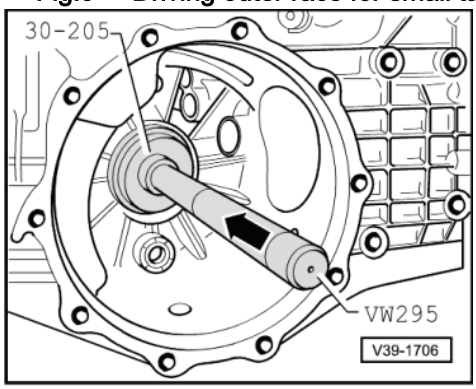
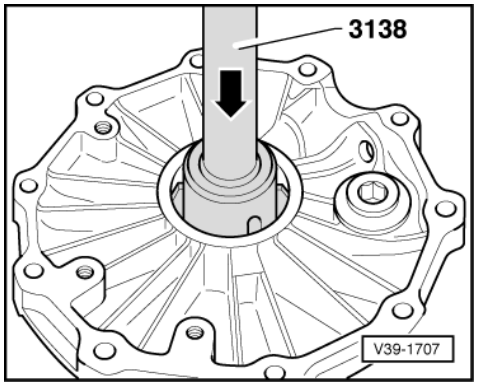
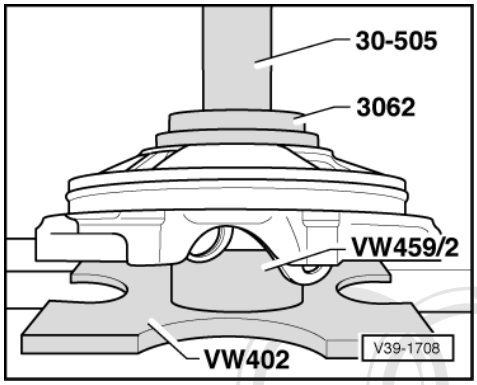


Fig.10 -> Driving outer race for small taper roller bearing into gearbox housing



-> 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

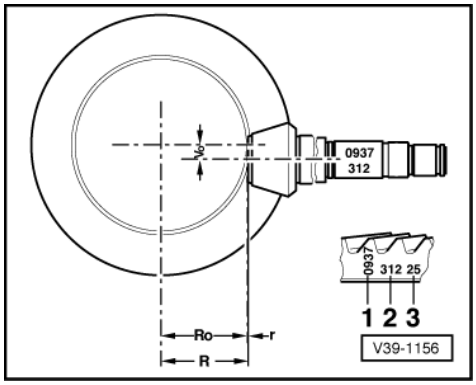
6 - Adjusting drive pinion and crown wheel

6.1 - Adjusting drive pinion and crown wheel

General notes:

- Careful adjustment of the drive pinion and crown wheel is important for the service life and smooth running of the final drive. For this reason, the drive pinion and crown wheel are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the drive pinion in an axial direction and at the same time lifting the crown wheel out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.
- The object of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine in production.
- The deviation (tolerance) "r", which is related to the master gauge "Ro", is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the crown wheel. The final drive set (drive pinion and crown wheel) may only be replaced together as a matched pair.
- Observe the general repair instructions for taper roller bearings and shims.
- The frictional torque measurement is only used as a final check to make sure that the adjustment is correct.

6.2 - Adjustment and markings of final drive set



-> Identification

1 =	"0937" indicates Oerlikon final drive set with a ratio of 37 : 9
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
Ro =	Length of master gauge used on special test machine
	"Ro" = 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 = Ro + r
Vo =	Hypoid offset

6.3 - 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 "Stotal" for "S1" +"S2" (sets preload for taper roller bearings for differential) => from Page 193 .

2.) Determine total shim thickness "Stotal" for "S3" + "S4" (sets preload for taper roller bearings for drive pinion) => from Page 186 .

3.) Distribute total shim thickness "Stotal" for "S3" + "S4" so that the distance from centre of crown wheel to face of drive pinion is the same as distance "R" which was determined during production => from Page 190 .

4.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash between crown wheel and drive pinion is maintained => from Page 197 .

Note:

Overview of components and shims =>Page 185 .

6.4 - Adjustment overview

Note:

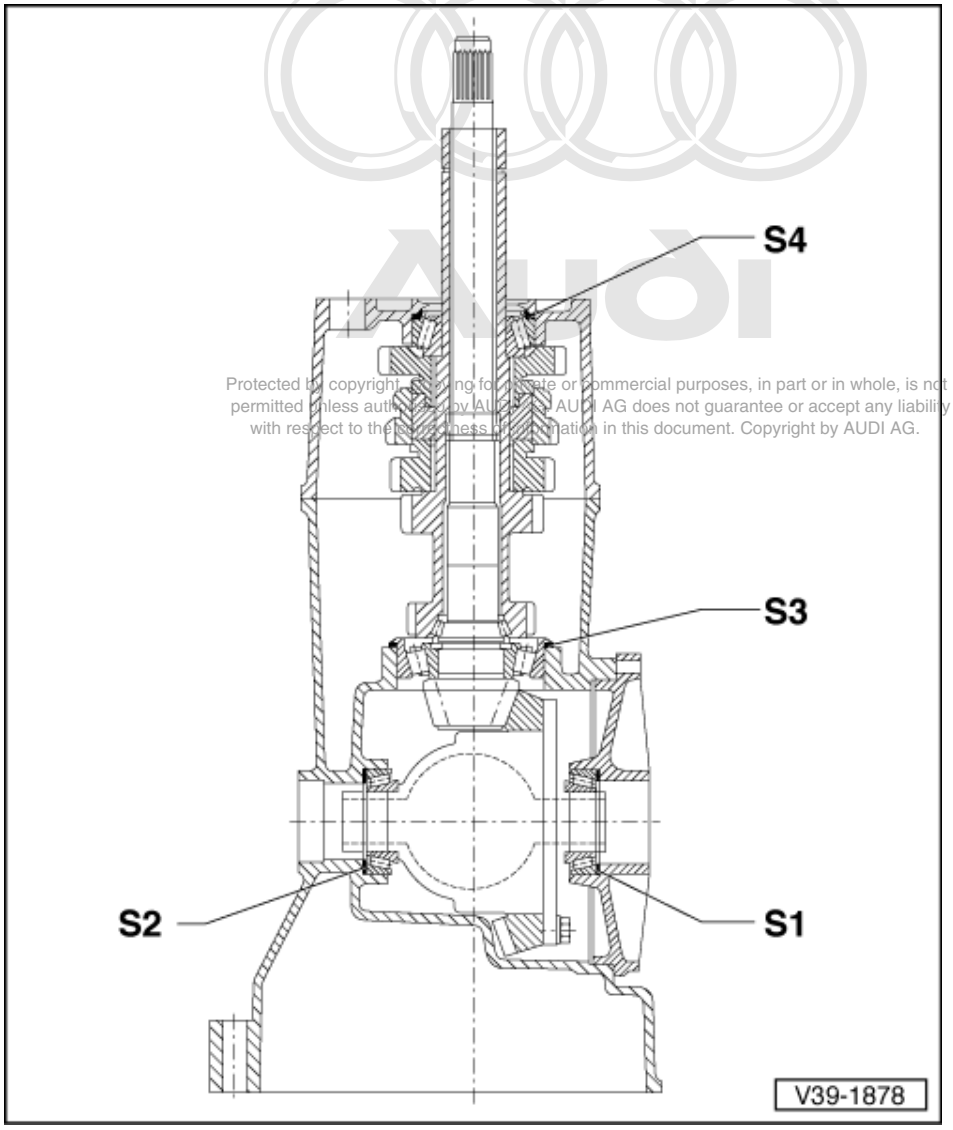
If repairs have been carried out to the gearbox, it is only necessary to adjust the drive pinion, crown wheel or final drive set if components have been renewed which have a direct effect on the adjustment of the final drive. Refer to the following table to avoid unnecessary adjustments:

Parts renewed: ▼	to be adjusted:			
	Crown wheel "S1"+"S2" 1) => Page 192	Drive pinion "S3"+"S4" 1) via deviation "r" => Page 186	Drive pinion "S4" 1) => Page 118	Backlash Check => Page 196
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
Hollow shaft			X	X
Cover for differential	X			X

1) Shims; installation position => Page 185 .

2) Drive pinion and crown wheel; only renew together.

6.5 - Position of shims



Note:

Adjustment overview when renewing individual components of gearbox

=>Page 184 .

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

7 - Adjusting drive pinion

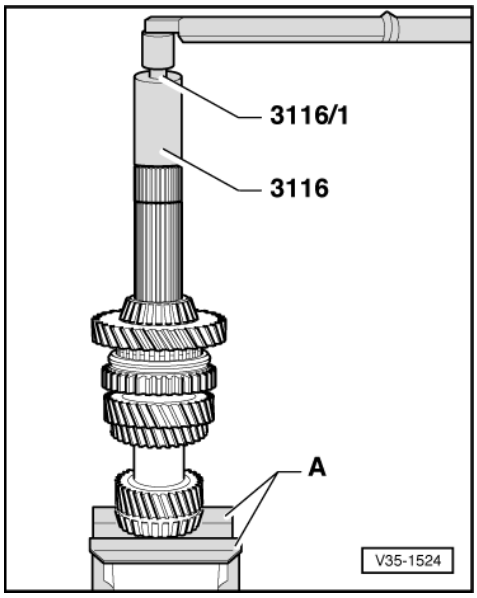
7.1 - Adjusting drive pinion

(Adjusting drive pinion and hollow shaft)

Repairs after which the drive pinion must be adjusted => table on Page 184 .

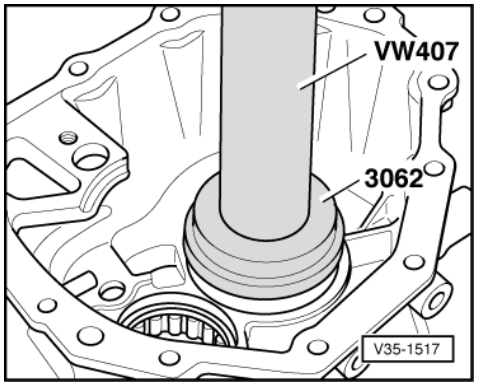
Determining total shim thickness "Stotal" for shims "S3" + "S4"

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



- Differential removed

- -> Clamp drive pinion in a vice using clamps -A-.
- Insert taper rollers with grease, assemble drive pinion and hollow shaft.
- Turn hollow shaft against drive pinion five turns in both directions so that the taper roller bearings settle.
- Preload drive pinion/hollow shaft to 10 Nm, hold hollow shaft when doing this.
- Insert outer race for taper roller bearing for drive pinion into gearbox housing without shims => Fig. 158 .

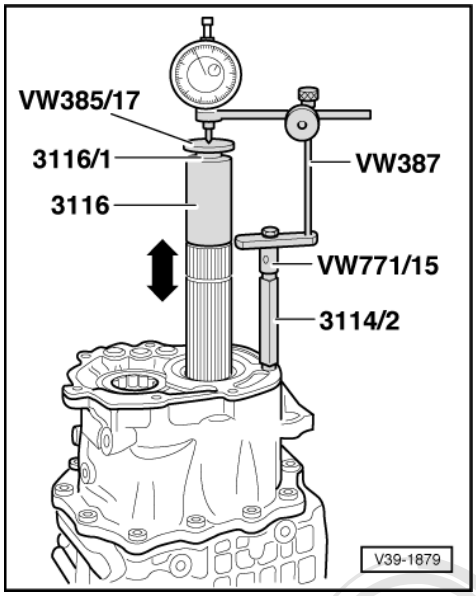


- -> Insert outer race for taper roller bearing for drive pinion with shim "S4*" (1.0 mm thick) into bearing plate.

Note:

For measurement purposes a shim "S4" of 1.0 mm is initially inserted which is designated "S4" After determining dimension "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 to 25 Nm.
- Turn drive pinion with hollow shaft five turns in both directions so that the taper roller bearings settle.
- -> Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) 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 measurement has to be repeated, the drive pinion with hollow shaft must be turned 5 turns in each direction to settle the taper roller bearings. Set dial gauge again to "0" with 2 mm preload.

Formula:
"Stotal" = "S4*" + measurement + bearing preload

Example:		
	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*"

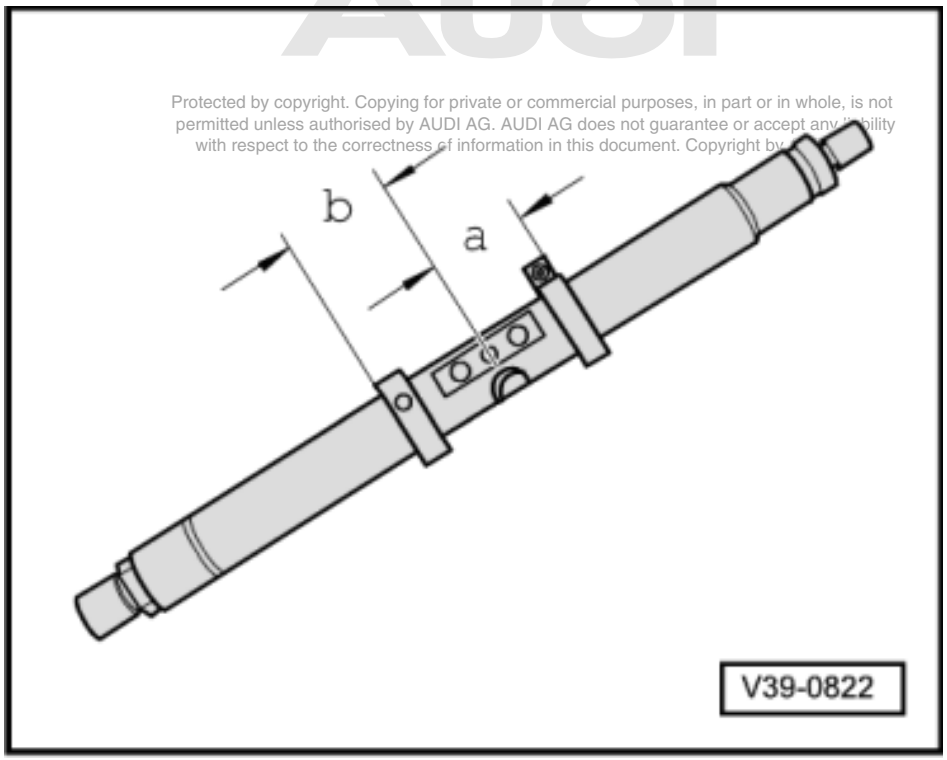
Formula:
"S3*" = "Stotal" - "S4*"

Example:

	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. 158 .
- Insert completely assembled drive pinion into gearbox housing again.
- Fit bearing plate with dowel sleeves and tighten securing bolts to 25 Nm.
- Turn drive pinion with hollow shaft five turns in both directions to settle the taper roller bearing.

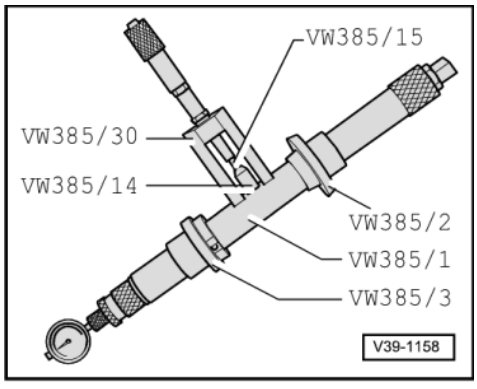
Determining dimension "e"



Note:

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

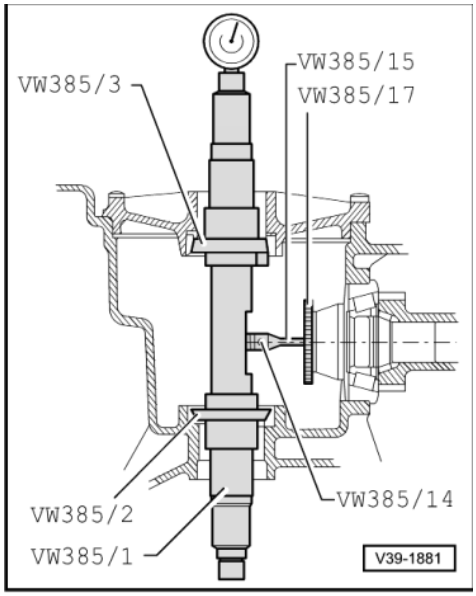
- -> Set adjustment rings of universal mandrel VW 385/1 to the following measurements:
  - Dimension a = 65 mm
  - Dimension b = 55 mm



- -> 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 Ro = 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 (Ro = 59.65 mm).



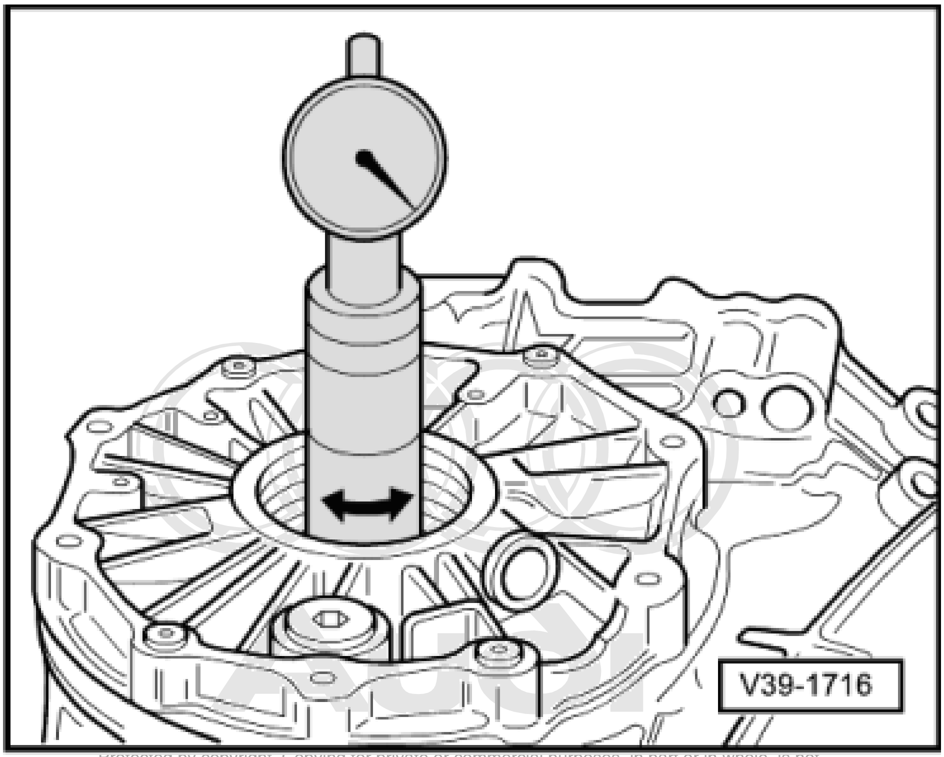
-> Arrangement of measuring equipment when determining dimension "e"

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

Notes:

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

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"

Formula:
"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

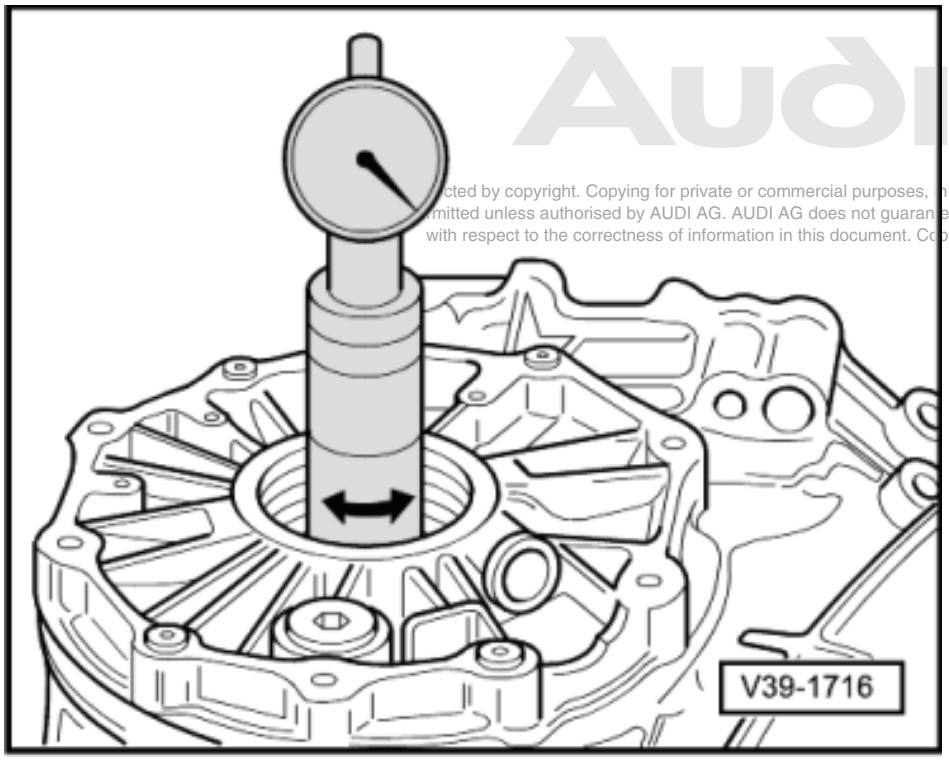
The following shims are available for "S4"

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 dimension "e"' on Page 188 and perform check measurement.
- Read off dial gauge anti-clockwise (red scale).
  - If the shims have been correctly selected, the deviation "r" (marked on outer circumference of crown wheel) must be shown - within a tolerance of ± 0.04 mm

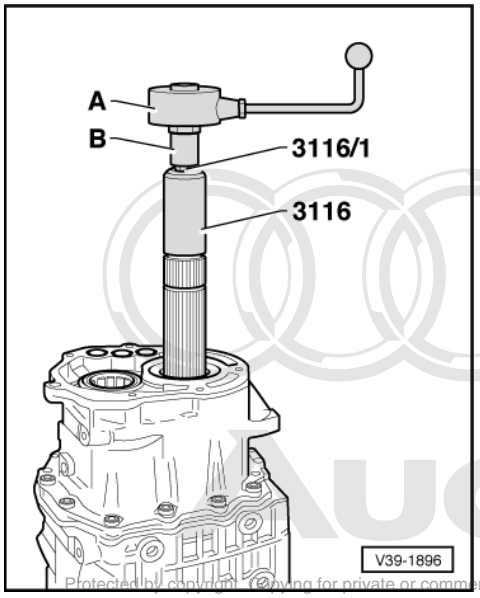
Note:

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

Measuring frictional torque (check)

Notes:

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



- -> Fit torque gauge 0 ... 600 Ncm -A- onto drive pinion.

  B - Socket

- Insert tensioning sleeve 3116.

Frictional torque specification:

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

8 - Adjusting crown wheel

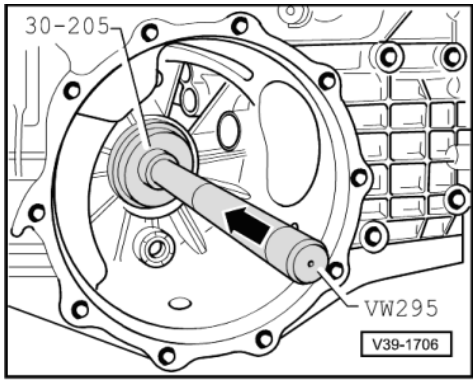
8.1 - Adjusting crown wheel

(Adjusting differential)

Repairs after which the crown wheel must be adjusted => Page 184 .

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

(Setting preload of taper roller bearing for differential)

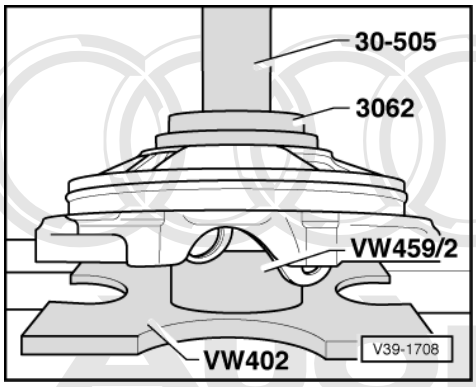


- Drive pinion removed

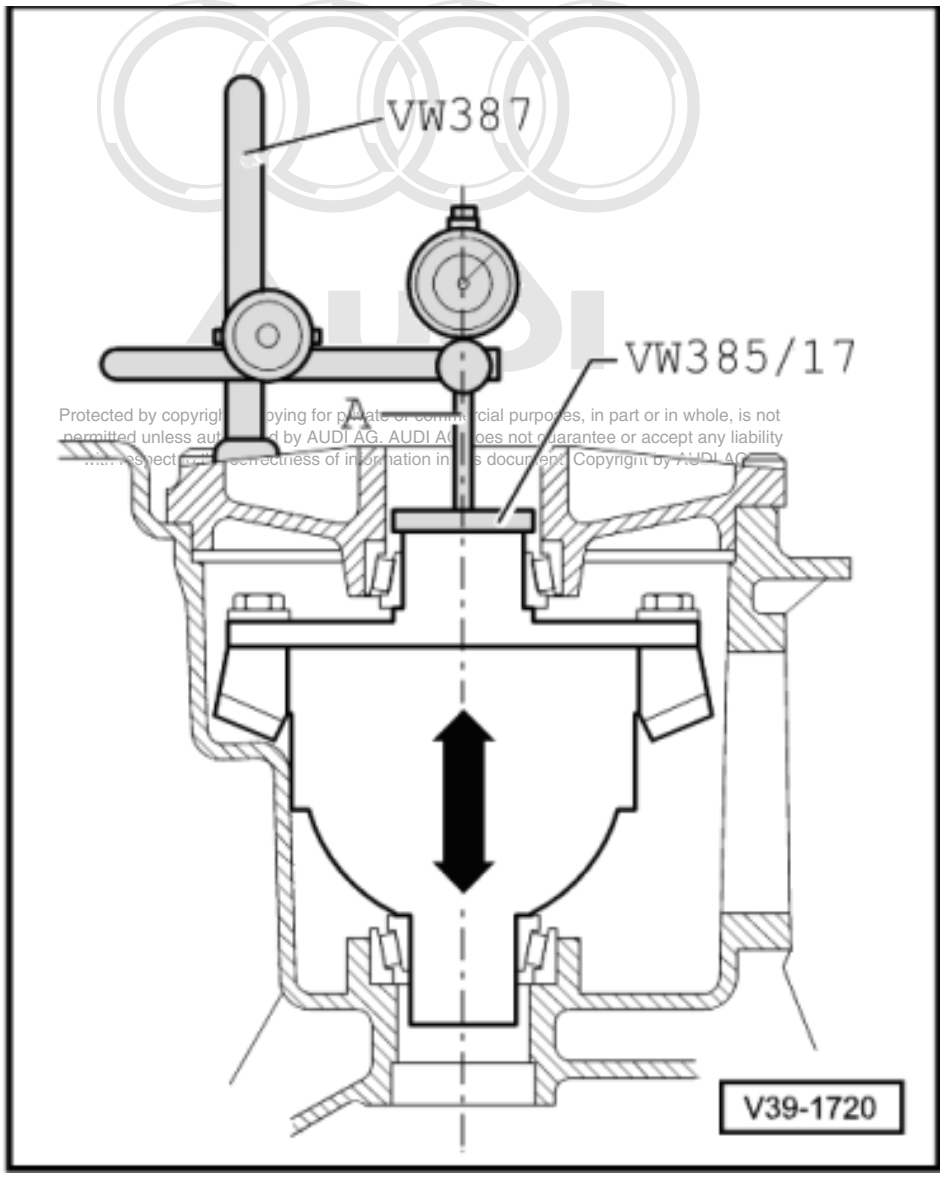
- Remove seal and outer races of both taper roller bearings for differential.
- Remove shims => Page 172 .
- -> Drive outer race for taper roller bearing with shim "S2" into gearbox housing. For measurement purposes an "S2*" shim 1.20 mm thick (2 shims of 0.60 mm) is used.

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.



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

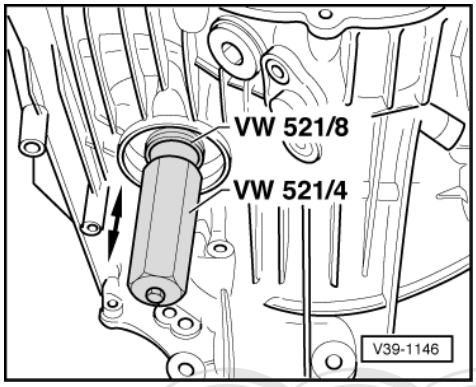
Note:

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

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

• Measurement in following example: 0.62 mm.

Notes:



- -> 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 drive pinion with hollow shaft must be turned 5 turns in each direction first to settle the taper roller bearings.

Formula:
"Stotal" = "S2*" + measurement + 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 preliminary adjustment shim "S1*" will be replaced with the final shim "S1" after determining the backlash.
- The total shim thickness "Stotal" remains unchanged.

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

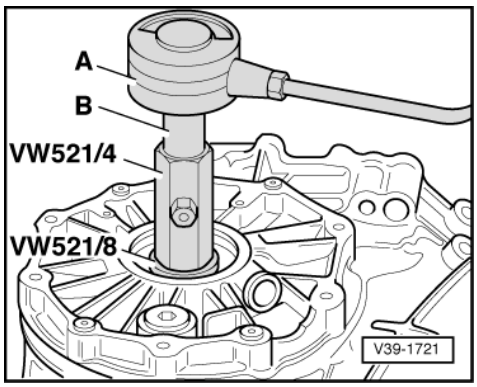
Example:		
	Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm
-	Inserted shim(s) "S2*"	1.20 mm
=	Thickness of shim "S1*"	0.87 mm

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.

Frictional torque specifications:

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

Note:

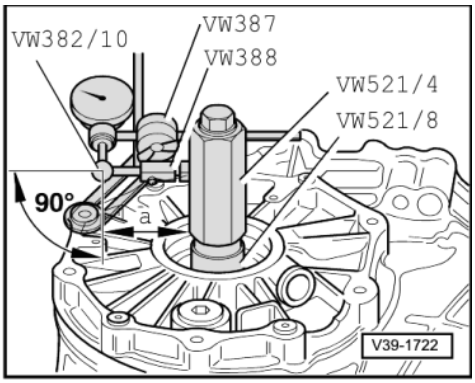
If the final drive set (drive pinion and crown wheel) is being adjusted, perform the adjustment of the drive pinion now and check the adjustment =>Page 186 .

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

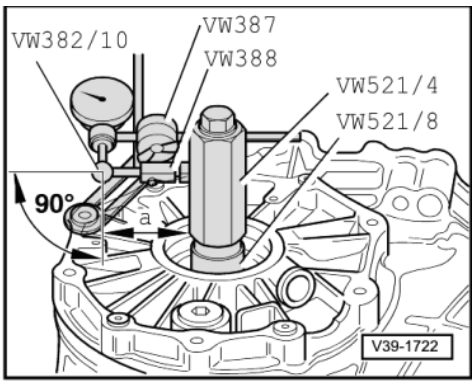
- Determine shim(s) from table. Part numbers

=> 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.
  - Specifications: 0.12 ... 0.22 mm

Notes:

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

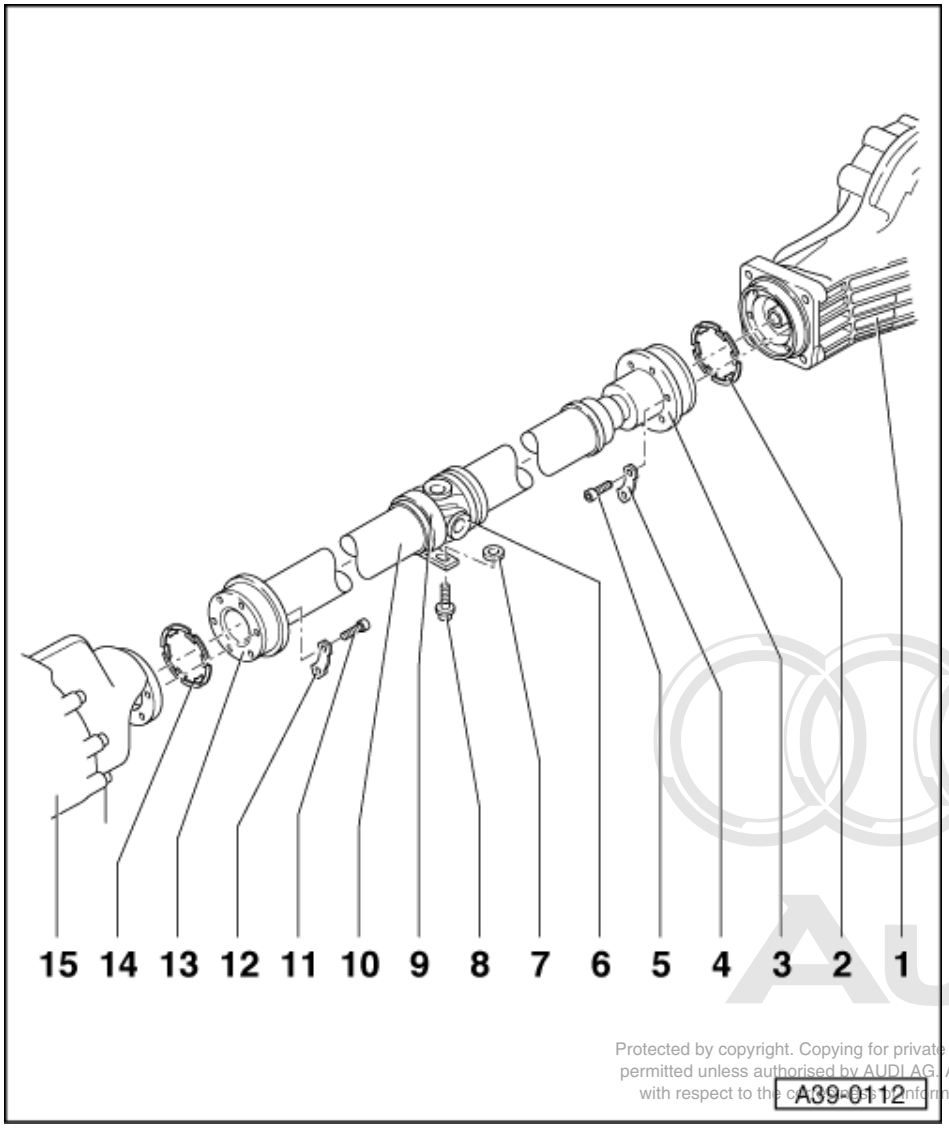
9 - Servicing propshaft

9.1 - Servicing propshaft

Notes:

- Do not bend the propshaft more than 25 °at the central joint, otherwise the universal joint will be damaged.
- Only store and transport propshaft extended.
- Observe General instructions =>Page 8 .
- No repair work can be carried out on the propshaft with the exception of removing, installing and adjusting.
- If the propshaft is only detached at the gearbox or from rear final drive then the propshaft is to be tied-up or supported at the constant velocity joint.
- Work on the propshaft should be carried out on a vehicle hoist.
- If complaints are received (noises, vibrations), it is essential to check whether correct adjustment of the propshaft rectifies the fault before replacing the propshaft.

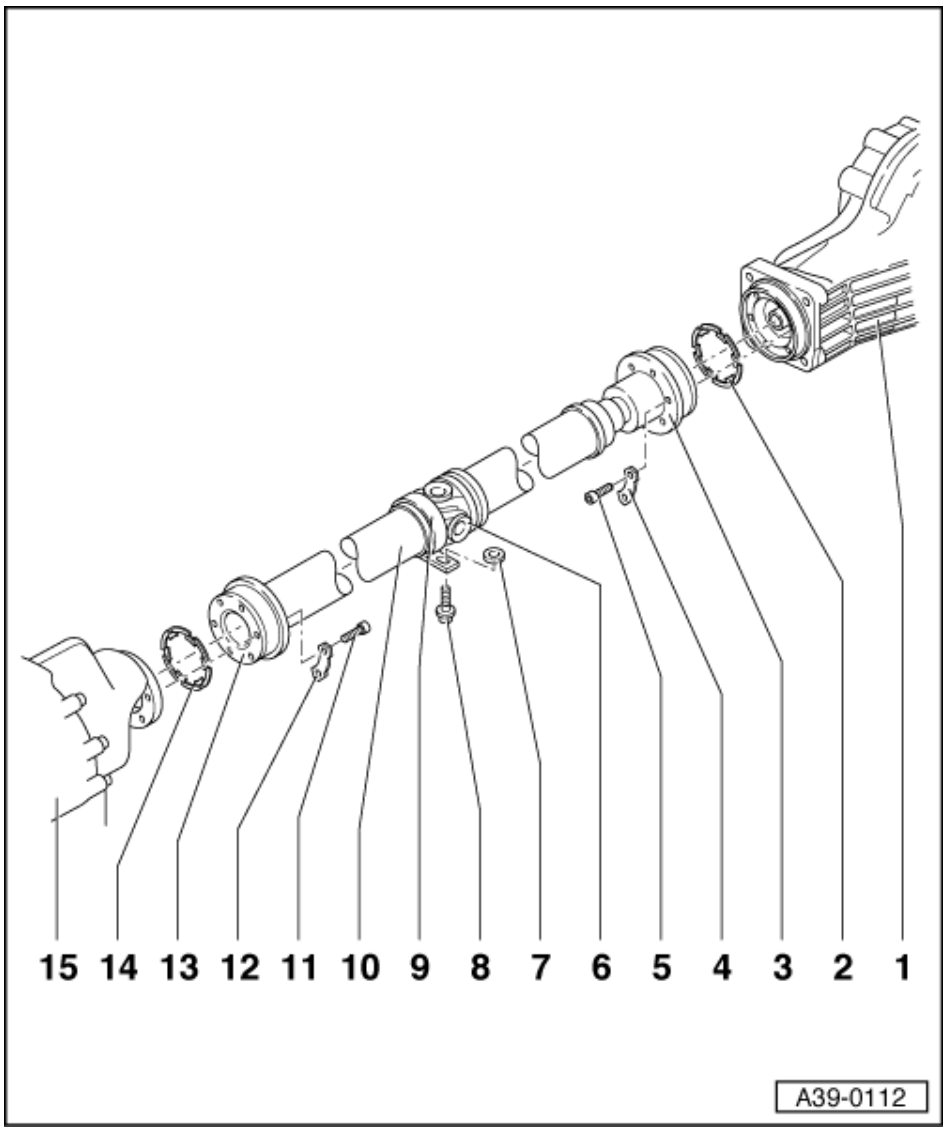
- After removing the propshaft from the rear final drive, the additional balance disc (thick washer) that may be located between the base plate and the bolt head must not be reinstalled. Always renew all flange bolts after dismantling.



1 **Rear final drive**
2 **Gasket**
- Always renew
- Pull off protective foil and stick self-adhesive side onto flange shaft

3 **Constant velocity joint**
- Maximum permissible angle of deflection 8°

4 **Packing plate**
5 **Bolts - 55 Nm**
- Self-locking
- Always renew



6 Universal joint
- Maximum permissible angle of deflection 25°

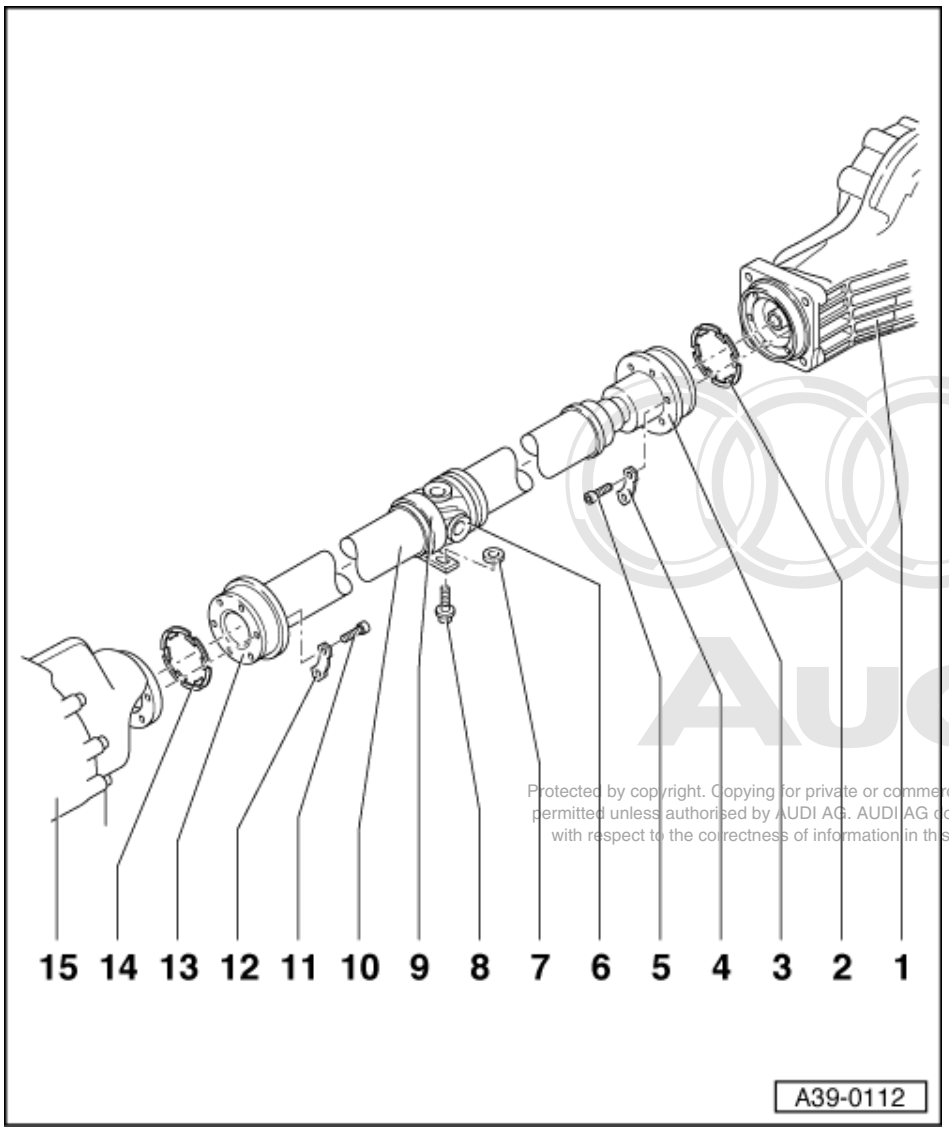
7 Shims
- Adjusting propshaft => Page 205

8 Hexagon bolt - 23 Nm

9 Propshaft centre mounting

10 Propshaft
- Adjusting => Page 205

11 Bolts - 55 Nm
- Self-locking
- Always renew



12 Packing plate

13 Constant velocity joint

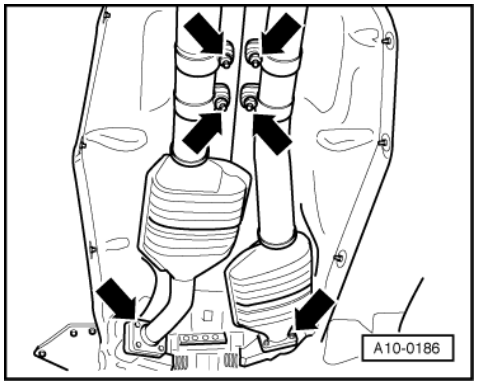
- Maximum permissible angle of deflection 8°

14 Gasket

- Always renew
- Pull off protective foil and stick self-adhesive side onto flange shaft

15 Gearbox

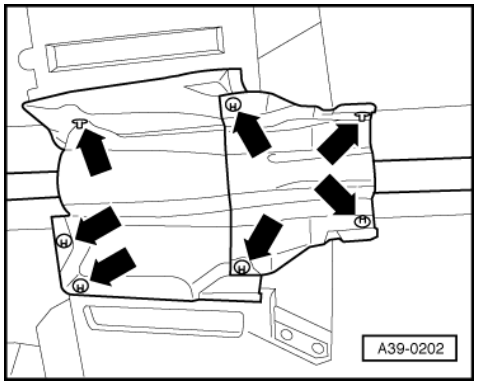
9.2 - Removing and installing propshaft



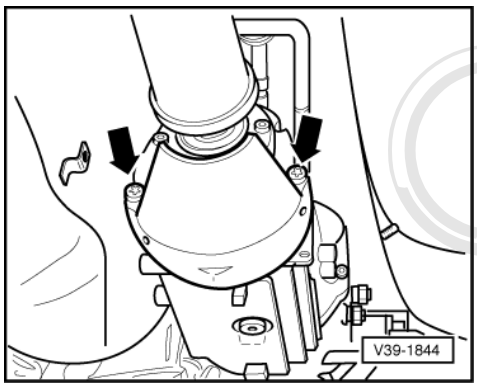
Removing

- Observe notes => Page 198 .
- -> Remove front exhaust pipes with left and right-hand catalytic converters -arrows-.
- Remove cross member and rear exhaust system

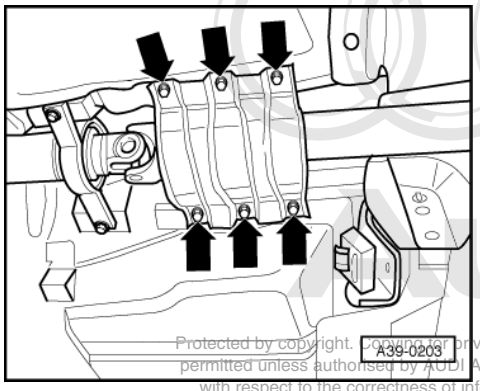
=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system



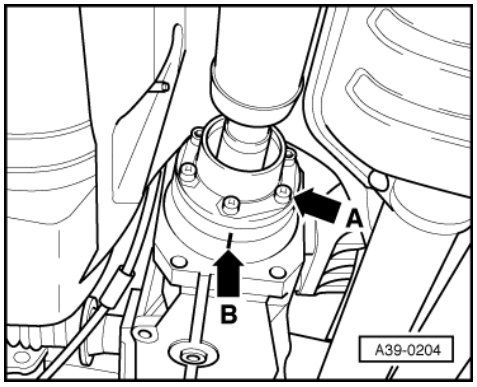
- -> Remove heat shields above propshaft -arrows-.



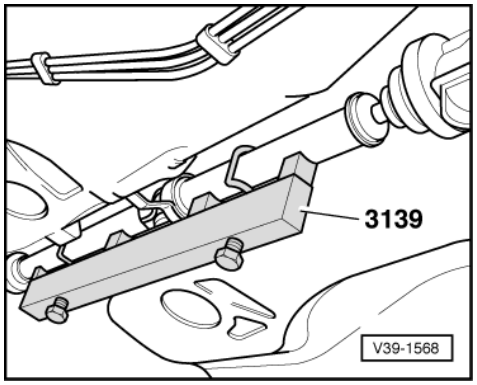
- -> Remove heat shield for propshaft from cover for Torsen differential -arrows-.



- -> Remove tunnel support -arrows-.



- -> Mark position of propshaft flanges to rear final drive with paint -arrow B-, if not already marked.
- Loosen securing bolts -arrow A- of both propshaft flanges slightly.



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

Note:

Never fit assembly device onto balance plates.

- Loosen securing bolts of centre propshaft mounting slightly.

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

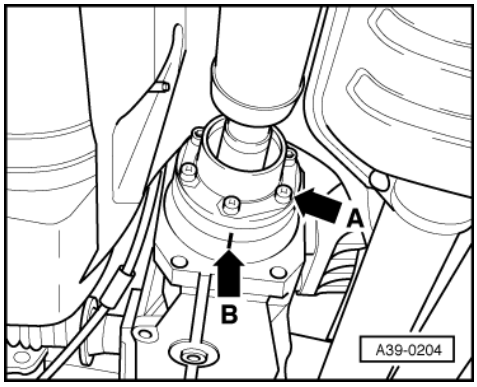
Note:

Only transport and store propshaft when extended.

Installing

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

Notes:



- -> To prevent imbalance, the flanges of the propshaft and the rear final drive must be installed so that the paint markings align -arrow B-.
- Renew gasket between propshaft and input or output shaft (pull off protective foil and stick onto flange shaft.
- It is essential that the locking fluid remaining in the threads in the flange shafts on the gearbox and rear final drive is cleaned out after removing the propshaft. Otherwise there is a danger that the new bolts will seize when they are screwed in and then shear if they have to removed later.
- The threaded holes can be cleaned with a thread tap.
- After removing the propshaft from the rear final drive, the additional balance disk (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled. Always renew all flange bolts after dismantling.
- Renew propshaft bolts (self-locking).

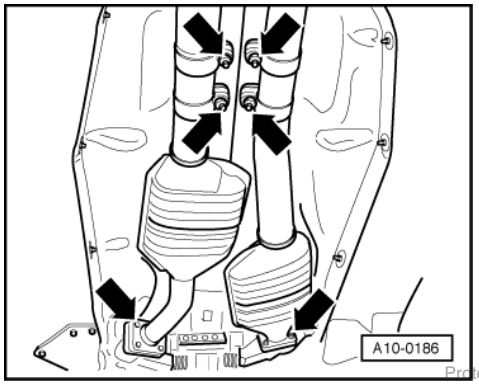
- Adjust propshaft after installing => Page 205 .
- Align exhaust system free of stress

=> 8-cylinder engine, Mechanics; Repair Group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

Tightening torques

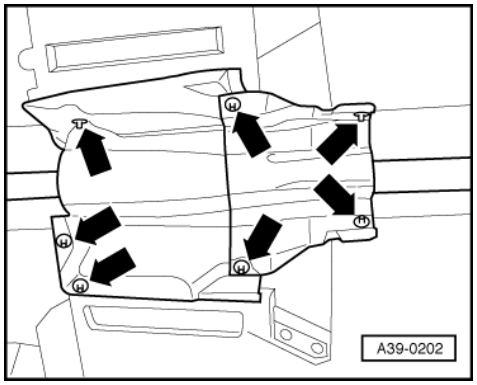
Component	Nm
Propshaft to gearbox (output flange) M8	55
Propshaft to final drive (input flange) M8	55
Propshaft centre mounting to body	23
Heat shield for propshaft to gearbox	23
Cross member to body	25
Tunnel support to body	25

9.3 - Adjusting propshaft

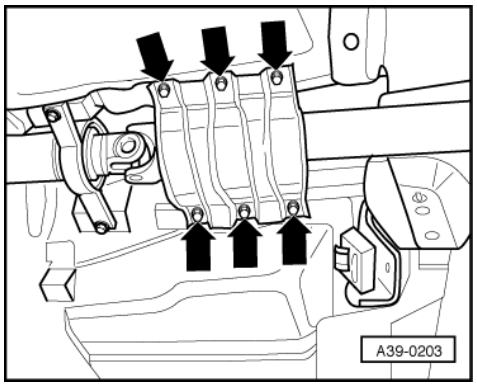


- -> Remove front exhaust pipes with left and right-hand catalytic converters -arrows-.
- Remove cross member and rear exhaust system

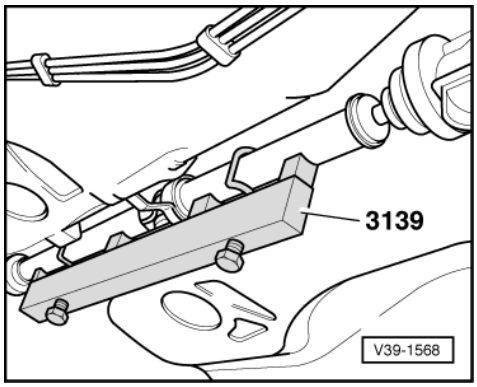
=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system



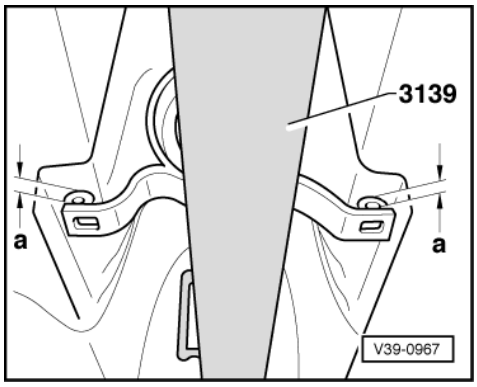
- -> Remove heat shield above propshaft -arrows-.



- -> Remove tunnel support -arrows-.



- -> Attach assembly device 3139 and tighten plastic nuts.
- Loosen bolts securing centre propshaft mounting to body.
- Remove securing bolts and shims from centre mounting.



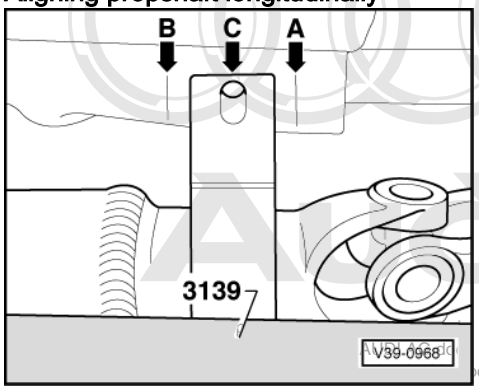
- Align centre propshaft mounting so that the dimension -a- on left-hand side is the same as dimension -a- on right-hand side.
- -> Measure dimension -a-.
- Determine shim(s) from table. Part numbers

=> Parts catalogue

The following shims are available:

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

Aligning propshaft longitudinally



- -> Slide propshaft with assembly device to rear onto stop.
- Mark position of centre mounting on body -arrow A-.
- Slide propshaft with assembly device forwards onto stop.
- Mark position of centre mounting on body -arrow B-.
- Align propshaft -arrow C-.
  - The centre mounting must be positioned centrally between the markings -A- and -B-
- Install securing bolts of propshaft centre mounting and previously determined shims and tighten.
- Remove assembly device.
- Install tunnel support.
- Install heat shield above propshaft.

- Align exhaust system free of stress

=> 8-cylinder engine, Mechanics; Repair Group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

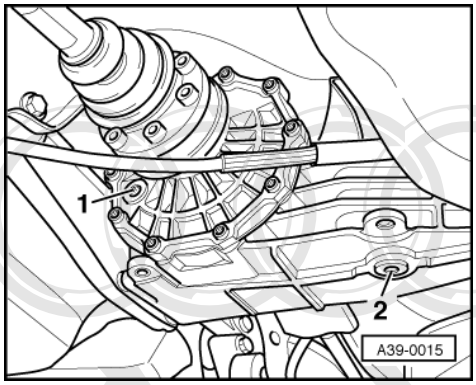
- Install cross member.

Tightening torques

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

10 - Checking oil level in rear final drive

10.1 - Checking oil level in rear final drive



- -> Remove oil filler plug -1- to check final drive oil level.
  - Specification: oil level up to lower edge of filler hole
- Top-up gear oil if necessary. Specification => Page 3 .
- Fit oil filler plug.

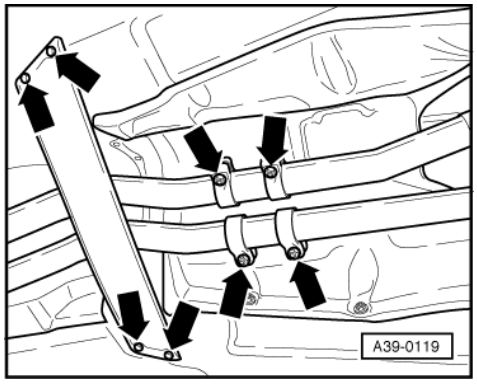
Tightening torque

Component	Nm
Oil filler plug	35

11 - Removing and installing rear final drive

11.1 - Removing and installing rear final drive

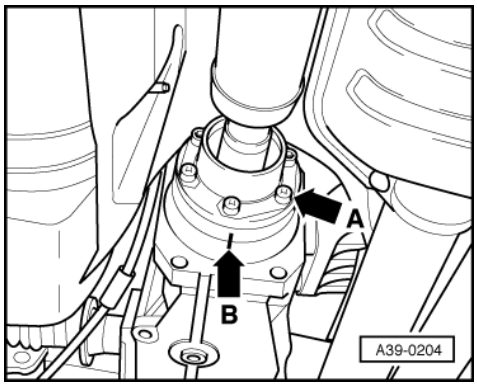
Removing



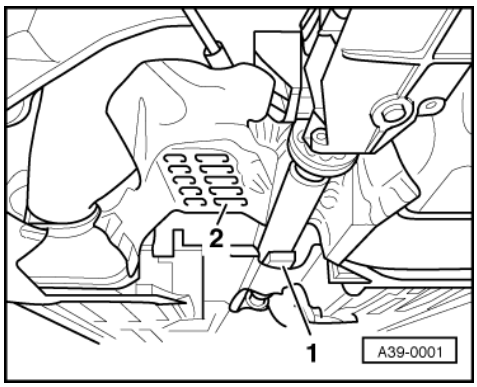
- -> Remove cross member and rear exhaust system -arrows-

=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system

- Remove heat shields above propshaft.

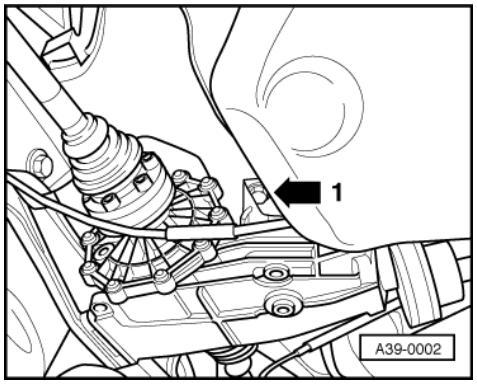


- -> Mark position of propshaft flanges to rear final drive with paint -arrow B-, if not already marked.
- Loosen securing bolts -arrow A- of propshaft to rear final drive.

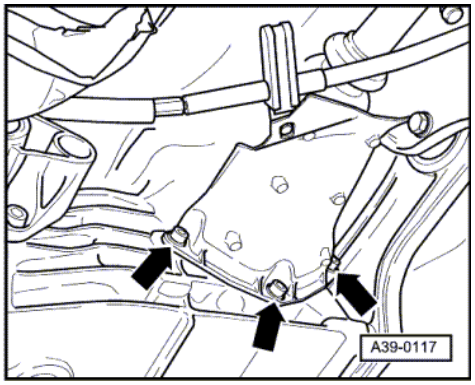


- -> Support propshaft using a wooden wedge -1-, press upwards against heat shield.
- Remove heat shield -2-.

- Remove securing bolts of propshaft to rear final drive.

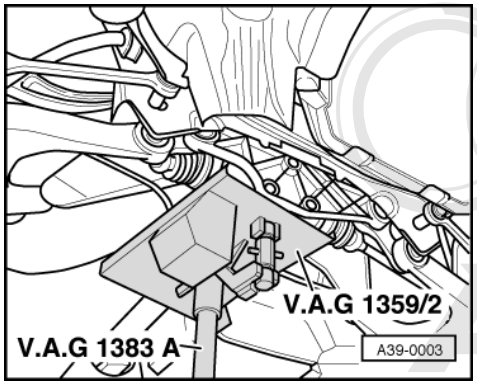


- -> Remove retainer for handbrake cable -arrow 1-.

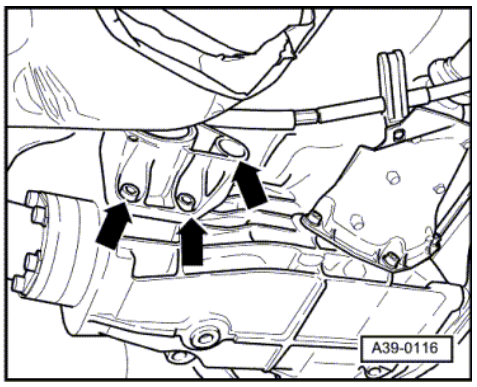


- -> Remove heat shield for left drive shaft -arrows-.
- Detach left and right-hand drive shafts from rear final drive

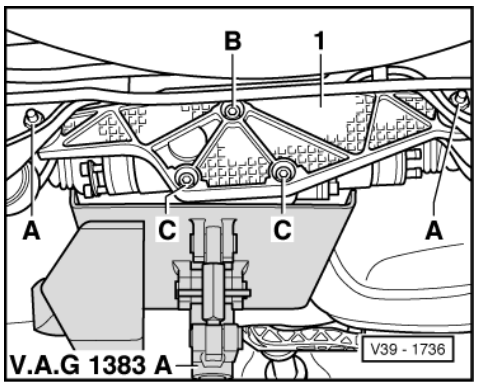
=> Running Gear, Front and 4WD; Repair Group 42; Removing and installing rear suspension; Removing and installing drive shaft and coil spring Removing and installing rear suspension Removing and installing drive shaft and coil spring



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



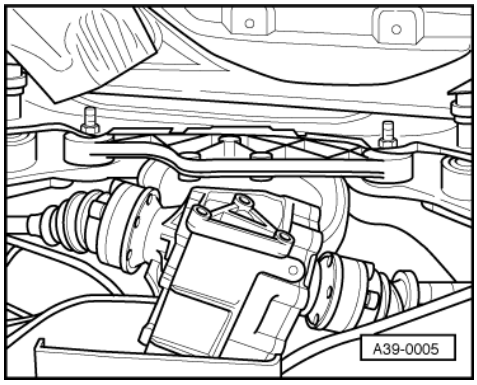
- -> Remove securing bolts -arrows- of left final drive support.



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

Note:

The cross member -1- need not be removed.



- -> Lower final drive slowly.

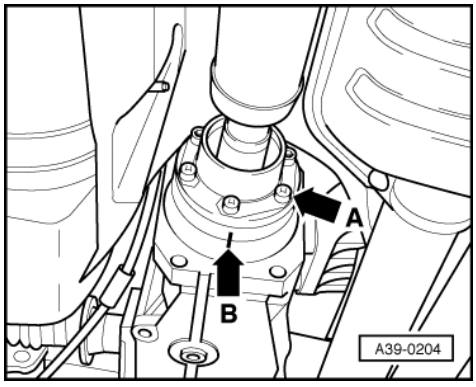
Installing

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

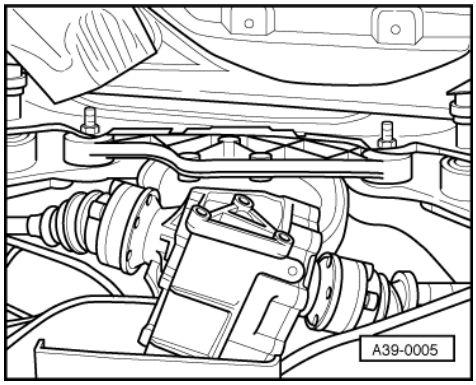
Notes:

- Always renew self-locking nuts.
- It is essential that the residues of locking fluid are cleaned out from the threaded holes in flange shaft on the rear final drive after removing the propshaft. Otherwise there is a danger that new bolts will seize and then shear when removing them again.
- The threaded holes can be cleaned with a thread tap.

- Renew gaskets on flange shafts (pull off protective foil and stick onto flange shaft.
- Renew propshaft bolts (self-locking).



- -> To prevent imbalance, the flanges of the propshaft and the rear final drive must be installed so that the paint markings align -arrow B-. Installing propshaft =>Page 198 .
- After removing the propshaft from the rear final drive, the additional balance disc (thick washer) that may be located between the base plate and the bolt head must not be reinstalled.



- -> Raise final drive with gearbox jack until both drive shafts can be connected.
- Lightly tighten securing bolts for drive shafts.
- Lift final drive and bolt to cross member and final drive support.
- Check gear oil in rear final drive => Page 207 .
- Align exhaust system free of stress

=> 8-cylinder engine, Mechanics; Repair Group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

Tightening torques

Component	Nm
Final drive support (front) to final drive M10	40
Rear cross member to final drive M10	55
Drive shaft to final drive M8	40
Drive shaft to final drive M10	80
Propshaft to final drive M8	55
Cross member to body M8	25
Heat shield for left drive shaft M8	25
Retainer for handbrake cable	25

12 - Removing and installing oil seals for flanged shafts

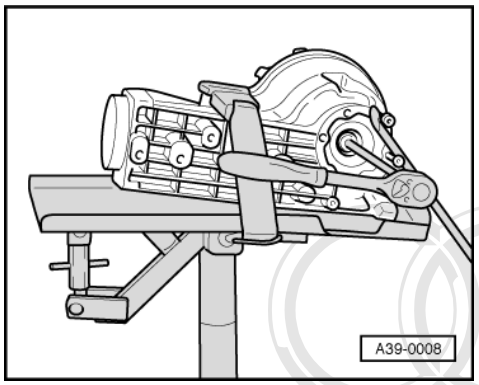
12.1 - Removing and installing oil seals for flanged shafts

- Rear final drive removed

Note:

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

Removing

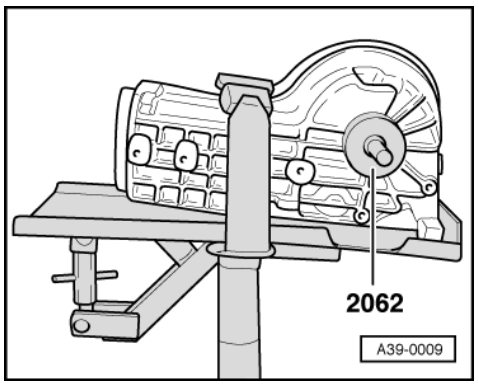


- -> Remove flange shaft. To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Place oil drip tray underneath and pull out flange shaft.
- Pull out flange shaft using the bolts already screwed in.
- Lever out seals for flange shaft using a suitable lever.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

Installing

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

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



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

Tightening torque

Component	Nm
Flange shaft to final drive M8	24

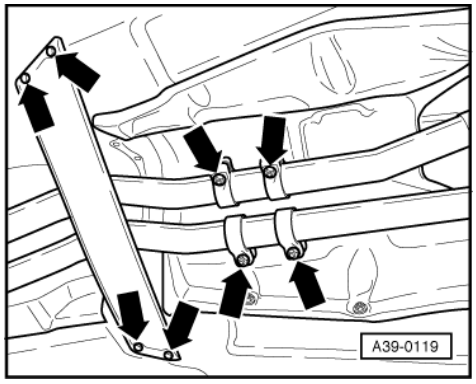
- Install rear final drive => Page 210 .

- Top-up gear oil in rear final drive and check oil level => Page 207 .

13 - Renewing seal for propshaft flange

13.1 - Renewing seal for propshaft flange

Note:



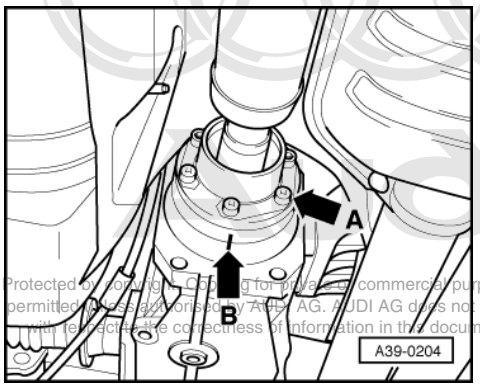
The seal can be replaced with the rear final drive remaining installed. But the final drive must be lowered.

Removing

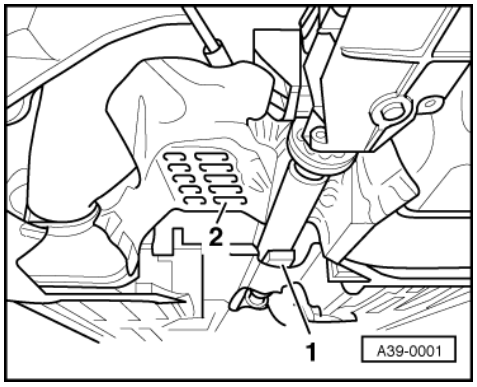
- -> Remove cross member and rear exhaust system -arrows-

=> 8-cylinder engine, Mechanics; Repair Group 26; Removing and installing exhaust system Removing and installing exhaust system

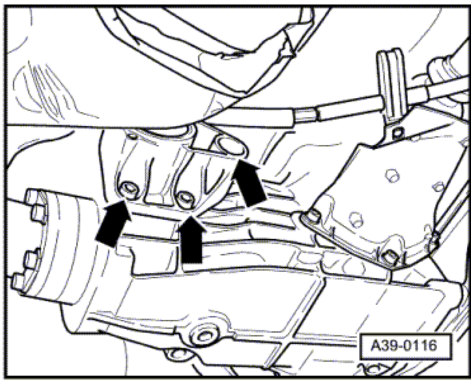
- Place drip tray underneath and drain oil.
- Remove heat shield above propshaft.



- -> Mark position of propshaft flange to rear final drive with paint -arrow B-, if not already marked.
- Loosen securing bolts -arrow A- of propshaft on rear final drive.



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

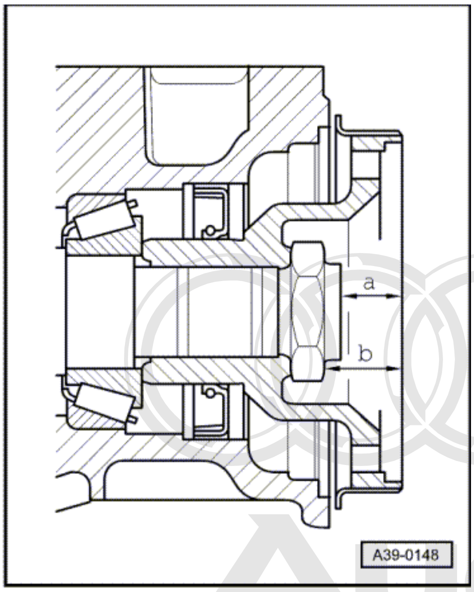


- Support final drive with gearbox jack V.A.G 1383 or V.A.G 1383 A and V.A.G 1359/2.
- -> Remove securing bolts -arrows- of left final drive support.

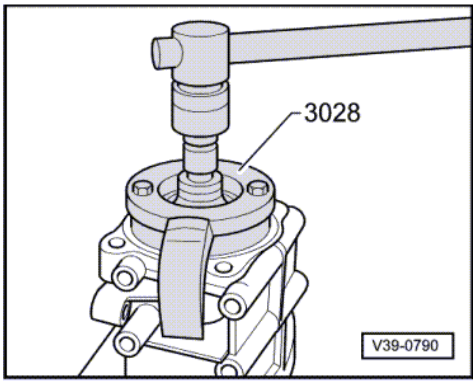
Note:

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

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



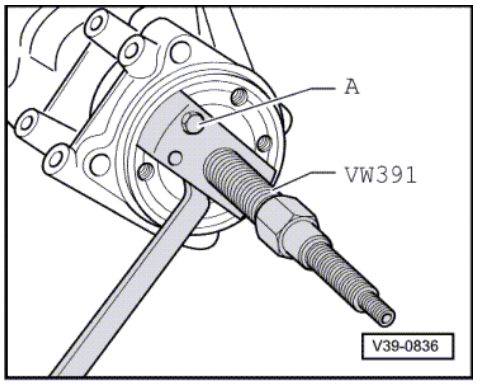
- Mark position of drive pinion nut relative to drive pinion.
- -> To check when assembling, measure the following with a vernier gauge/depth gauge.
  - Dimension a = distance flange/drive pinion
  - Dimension b = distance flange/drive pinion nut



Note:

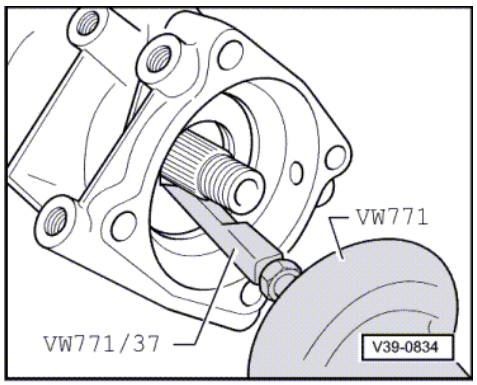
Illustrations show the final drive removed for the following work sequence.

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



- -> Pull off flange with removal tool VW 391.

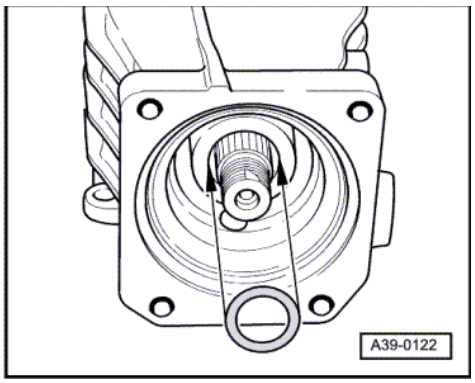
A - Hexagon bolt M8 x 30



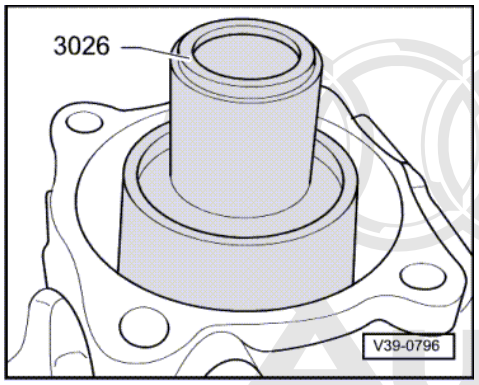
- -> Pull out seal.

Installing

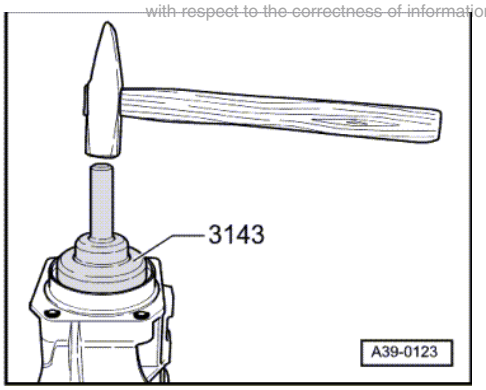
Install in reverse order.



- Observe fitting instructions => Page 210 .
- -> Renew O-ring between drive pinion bearing and flange.
- Lightly oil O-ring before installing.



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

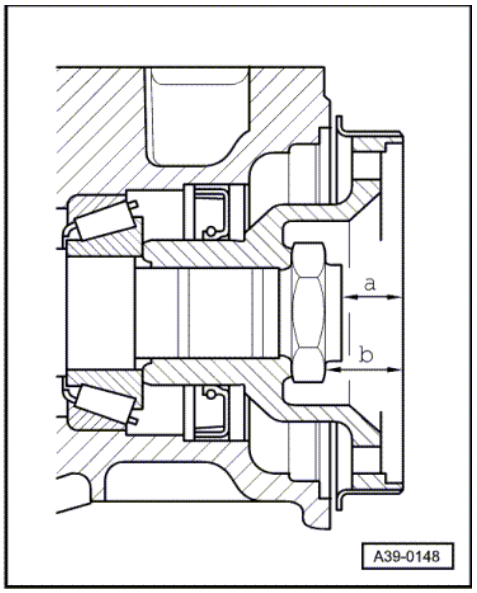


- Clean drive pinion nut and threads on drive pinion of oil and grease residues. Thinly coat threads with locking fluid D 000 600.

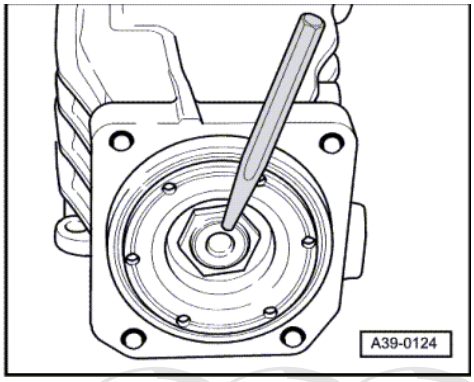
Note:

The same nut must be used again otherwise the original installation position will not be maintained.

- -> -Fit propshaft flange onto drive pinion and assemble with drive sleeve 3143 until the drive pinion nut can be fitted.



- Tighten drive pinion nut exactly onto previously marked position.
- -> To ensure that the assembly is correct, perform check measurement dimensions -a- and -b-.
  - Maximum permissible deviation from original measurements: ±0.5 mm



- -> Peen-over drive pinion nut shoulder.
- Bolt final drive to final drive support.
- Top-up gear oil in rear final drive and check oil level => Page 207 .
- Measure run-out at prop shaft flange and mark => Page 218 .
- Renew gasket on propshaft flange and tighten propshaft securely.
- Align exhaust system free of stress

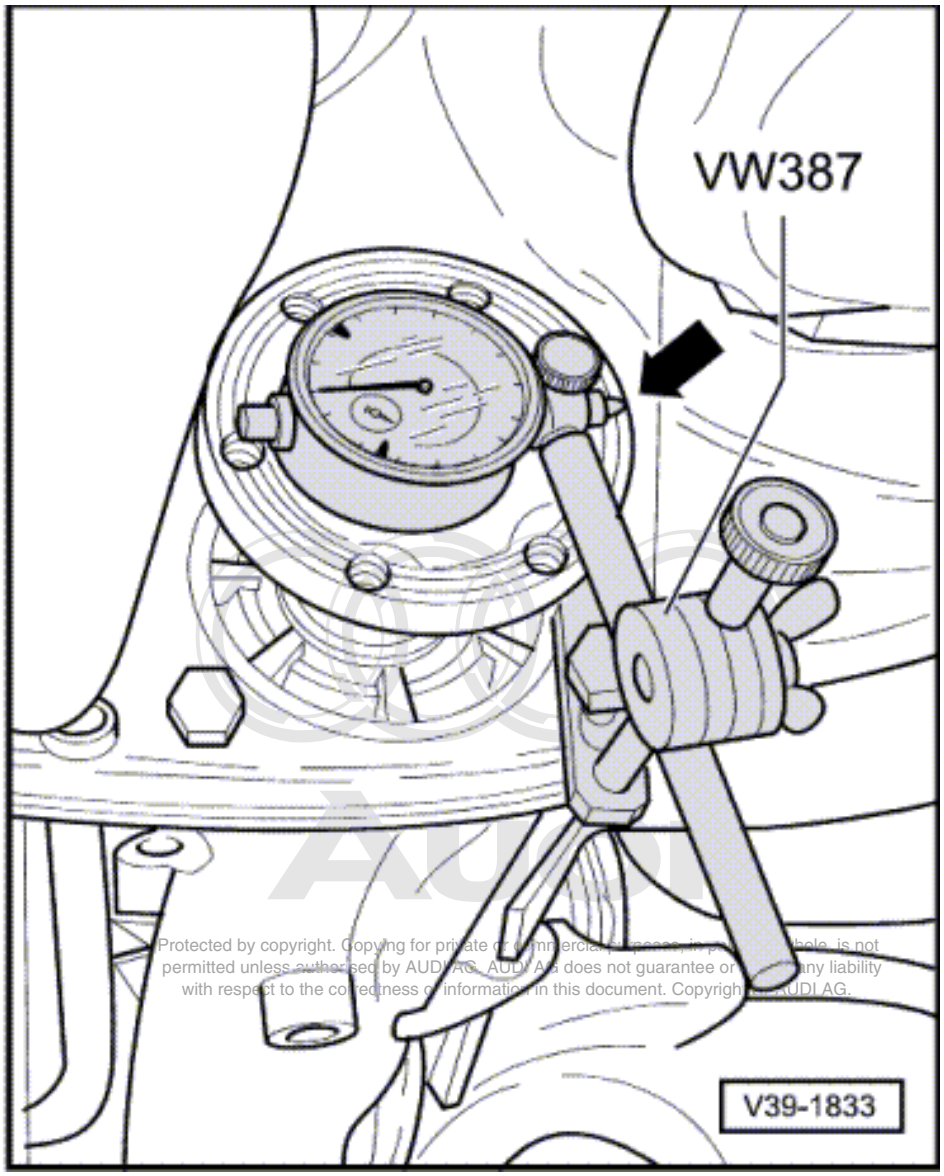
=> 8-cylinder engine, Mechanics; Repair Group 26; Aligning exhaust system free of stress Aligning exhaust system free of stress

Tightening torques

Component	Nm
Oil drain/filler plug	35
Final drive support (front) to final drive M10	40
Propshaft to final drive M8	55
Cross member to body M8	25

13.2 - Measuring radial run-out at propshaft flange and marking

Notes:

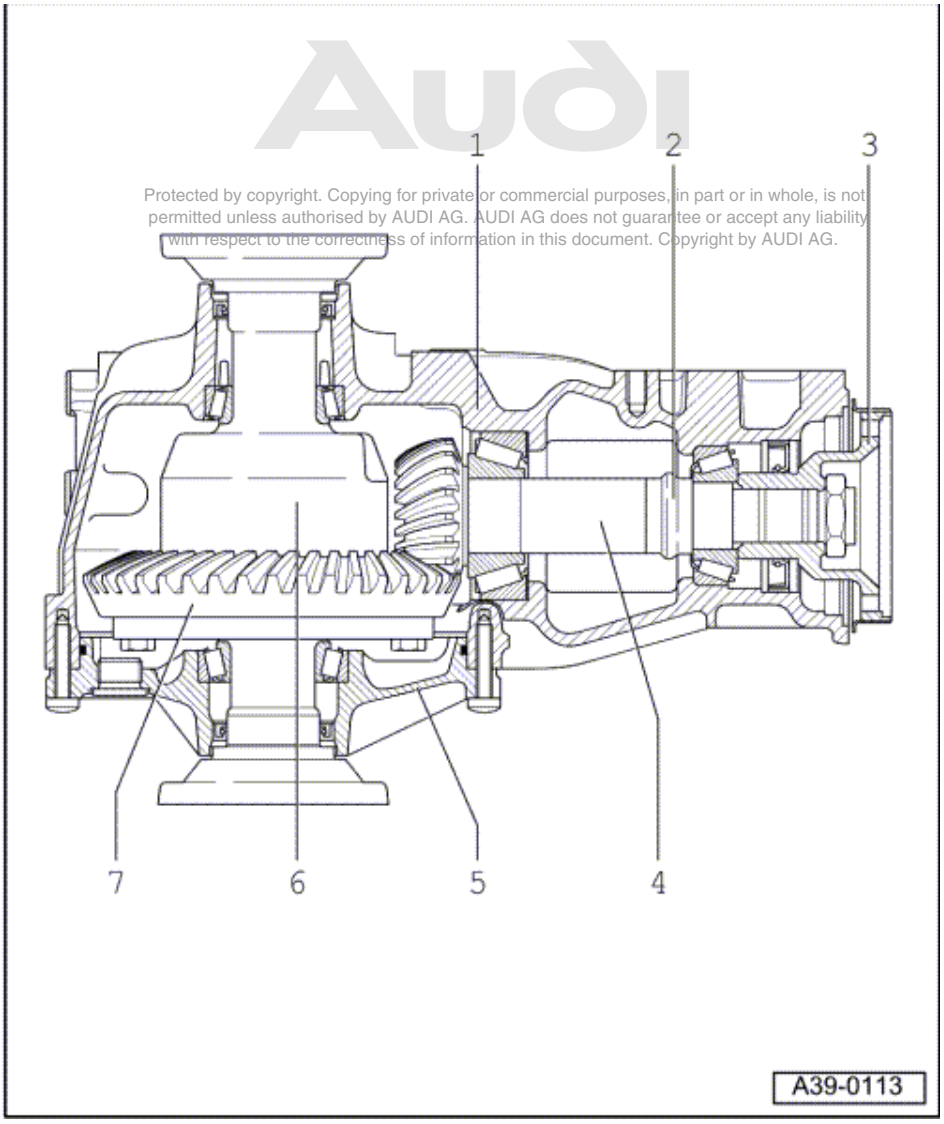


- The radial run-out must always be measured when drive pinion or propshaft flange are removed.
- The radial run-out can be measured when rear final drive is installed but the propshaft must be disconnected at rear final drive. Observe notes =>Page 198 .

- -> Secure universal dial gauge retainer VW 387 with dial gauge to cross member/final drive bolted joint.
- Position dial gauge on ground circumference -arrow- in propshaft flange and set to "0" with a preload of 1 mm.
- Turn differential via both rear wheels (left and right flange shaft) at same time in one direction until the propshaft flange has turned once completely.
- Mark the position of greatest radial run-out on flange exterior (equates to greatest distance from rotational axis).
- Remove old marks on propshaft flange.

14 - Dismantling and assembling rear final drive

14.1 - Dismantling and assembling rear final drive



14.2 - Assembly overview

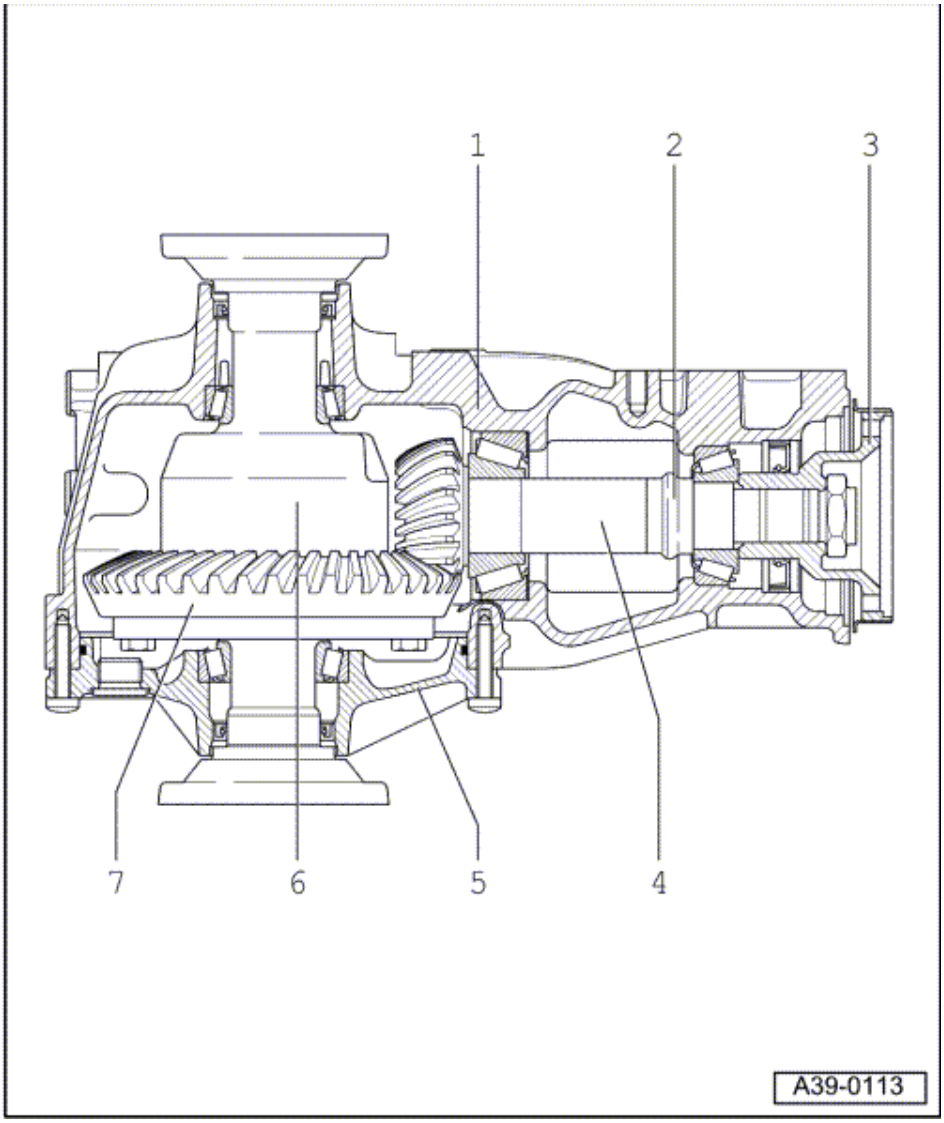
1 **Final drive housing**
- Dismantling and assembling
  => Page 221

2 **Spacer sleeve**
- Always renew

3 **Flange for propshaft**
- Removing and installing
  => Page 239 , -item 2 -

4 **Drive pinion**
- Paired with crown wheel
- Removing and installing

=> Page 238



5 Cover for final drive

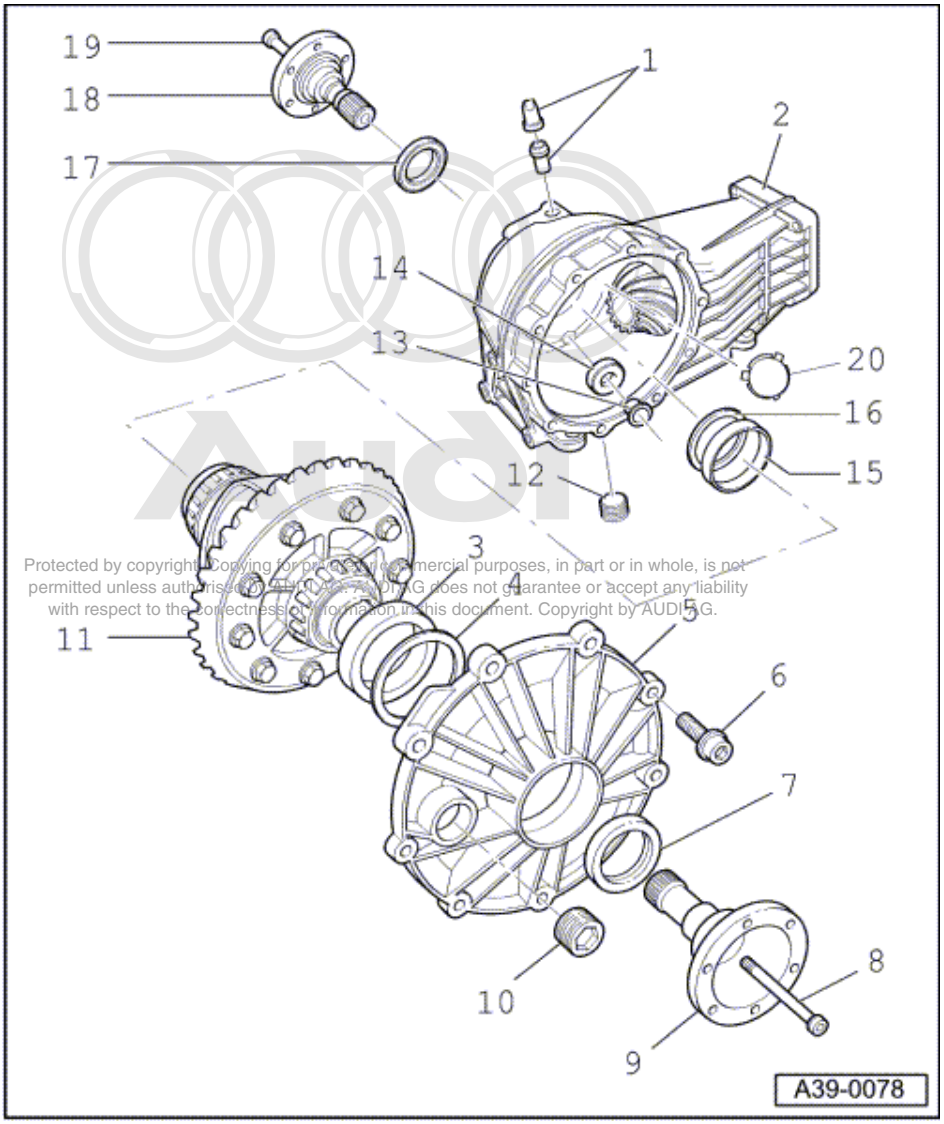
6 Differential

- Must be removed before dismantling drive pinion
- Removing and installing
  => Page 221
- Dismantling and assembling
  => Page 228

7 Crown wheel

- Paired with drive pinion
- Dismantling and assembling
  => Page 228

14.3 - Removing and installing differential



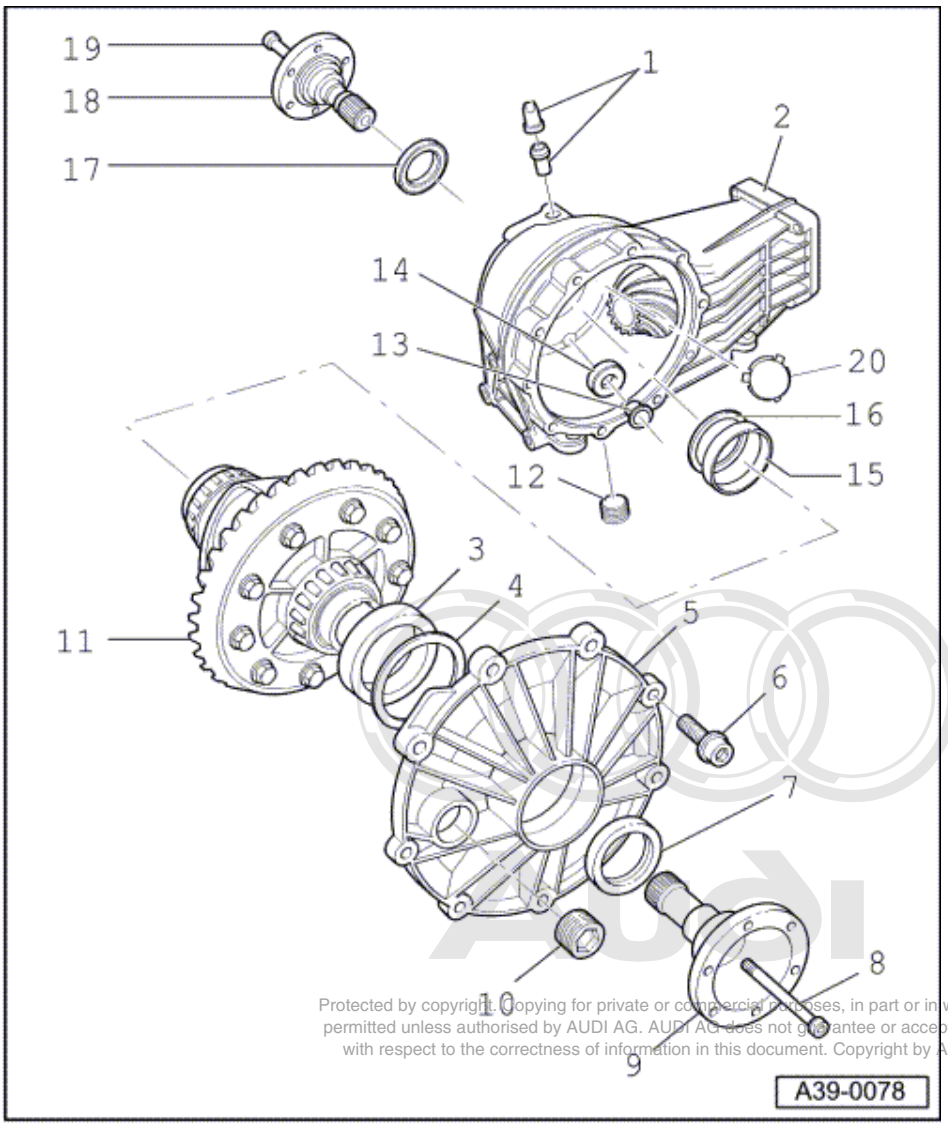
Dismantling and assembling final drive

Notes:

- Secure final drive on a repair stand => Page 226 .
- General repair instructions =>Page 8 .
- Adjustments are required when replacing components marked 1) => adjustment overview Page 249 .

1 Breather

- Insertion depth=>Fig. 1
- Rubber valve installation position: slit in line with direction of travel



2 Final drive housing 1)

- With drive pinion
- Removing and installing drive pinion => Page 238

3 Outer race for large taper roller bearing 1)

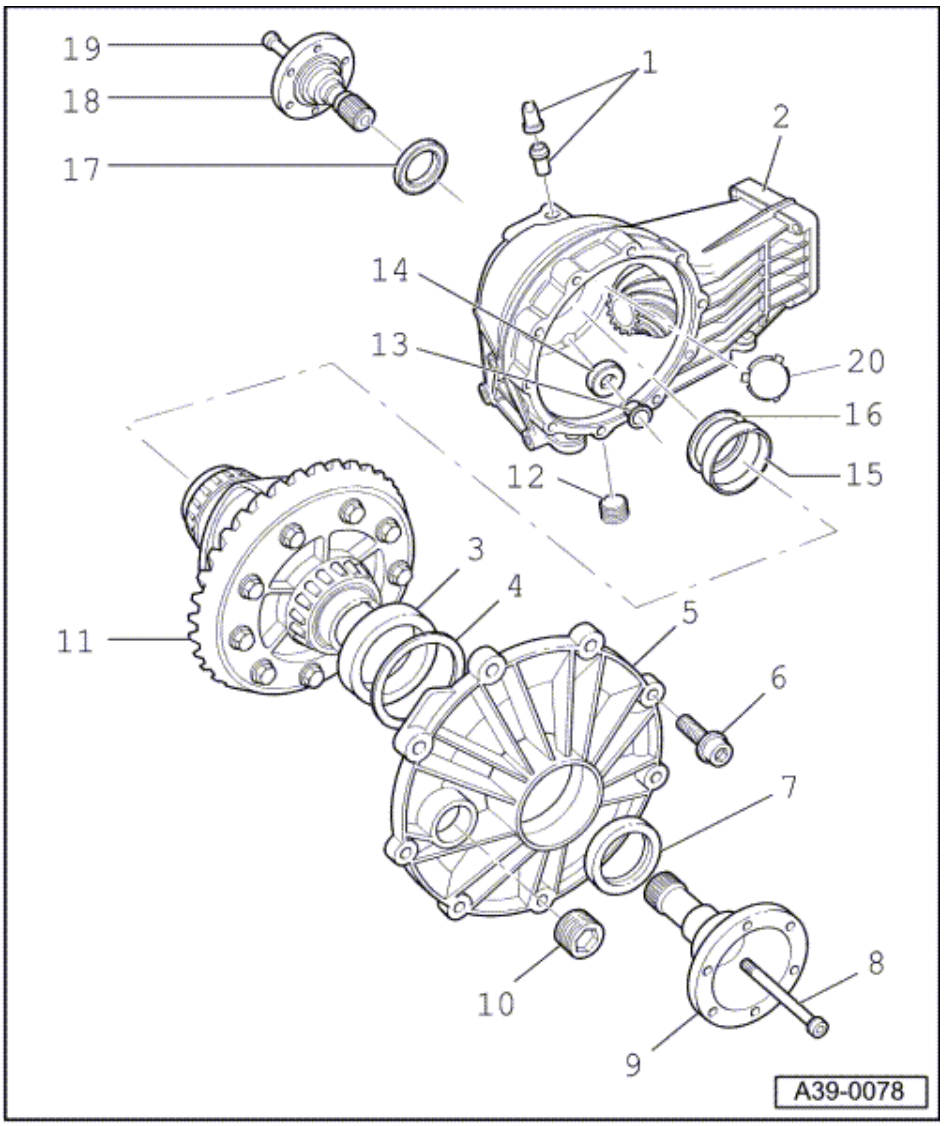
- Driving out and driving in => Fig. 238

4 Shim "S1"

- Note thickness
- Adjustment overview => Page 249

5 Cover for final drive 1)

- With O-ring
- Always renew O-ring



6 Torx bolt - 24 Nm

7 Seal, right

- Removing => Page 212
- Installing=>Page 212

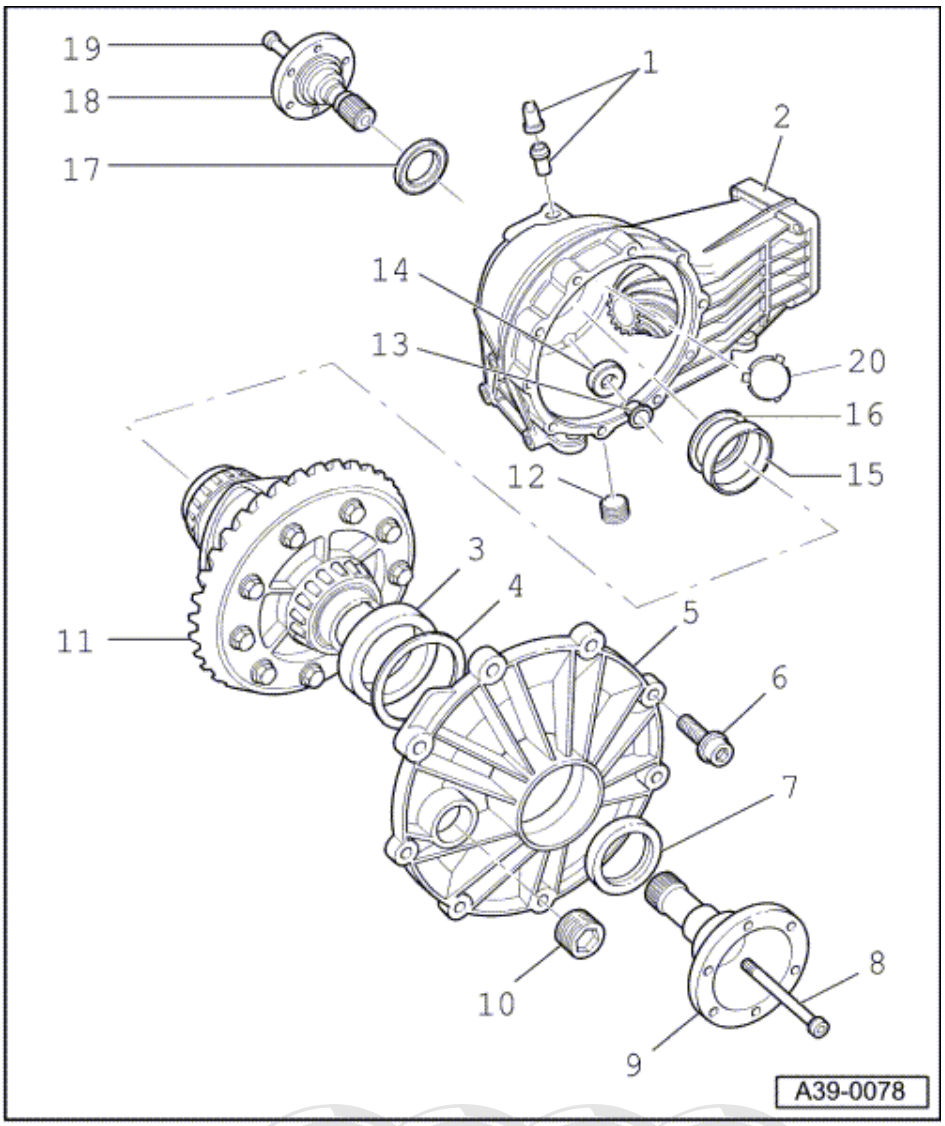
8 Hexagon socket head bolt M8 - 24 Nm

9 Flange shaft, right

10 Oil filler plug - 35 Nm

11 Differential with crown wheel 1)

- Removing => Page 226
- Dismantling and assembling => Page 228



12 Oil drain plug - 35 Nm

13 Retaining bush for magnet

- Drive in onto stop

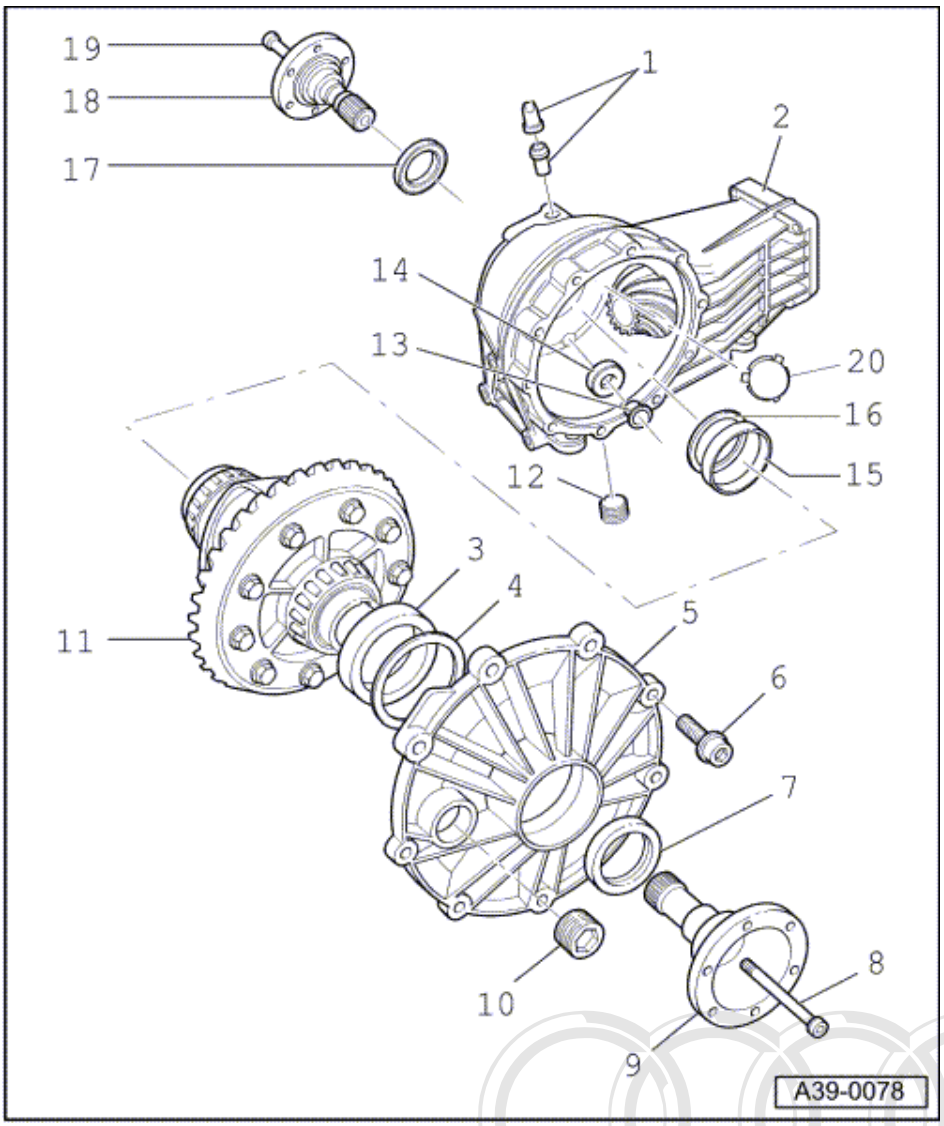
14 Ring magnet

15 Outer race for small taper roller bearing 1)

- Removing and driving in => Fig. 237

16 Shim "S2"

- Note thickness
- Adjustment overview => Page 249



17 Seal, left

- Removing => Page 212
- Installing=>Page 212

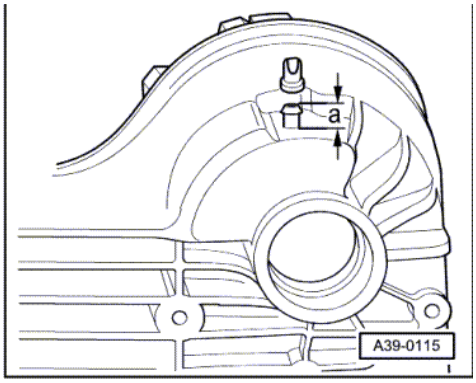
18 Flange shaft, left

- Removing => Page 227

19 Hexagon socket head bolt M8 - 24 Nm

20 Sealing cap

- Installing => Fig. 2

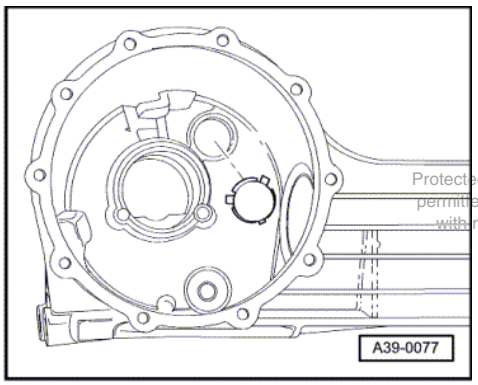


-> Fig.1 Insertion depth for breather sleeve

- Dimension a = 13 mm

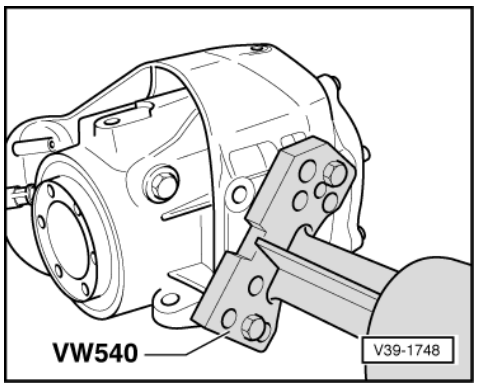
Note:

Rubber valve installation position: slit in line with direction of travel.



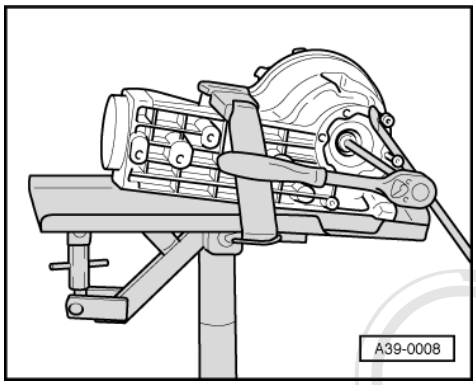
-> Fig.2 Press sealing cap into opening onto stop

Removing



- Rear final drive removed

- -> Secure complete rear final drive on a repair stand with bracket VW 540.
- Place drip tray underneath to collect oil.
- Drain gear oil.

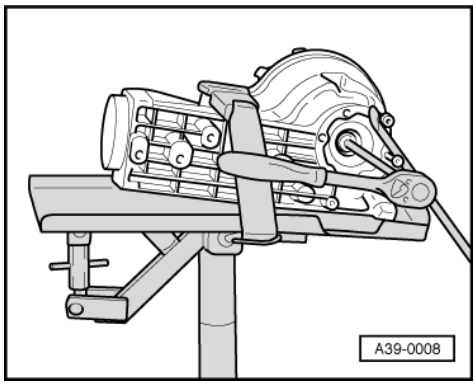


- -> Remove left and right-hand flange shafts.
- To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Mark flange shafts (left and right) and pull out.
- Unscrew securing bolts from cover for final drive.
- Take cover for final drive off axle housing and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

Installing

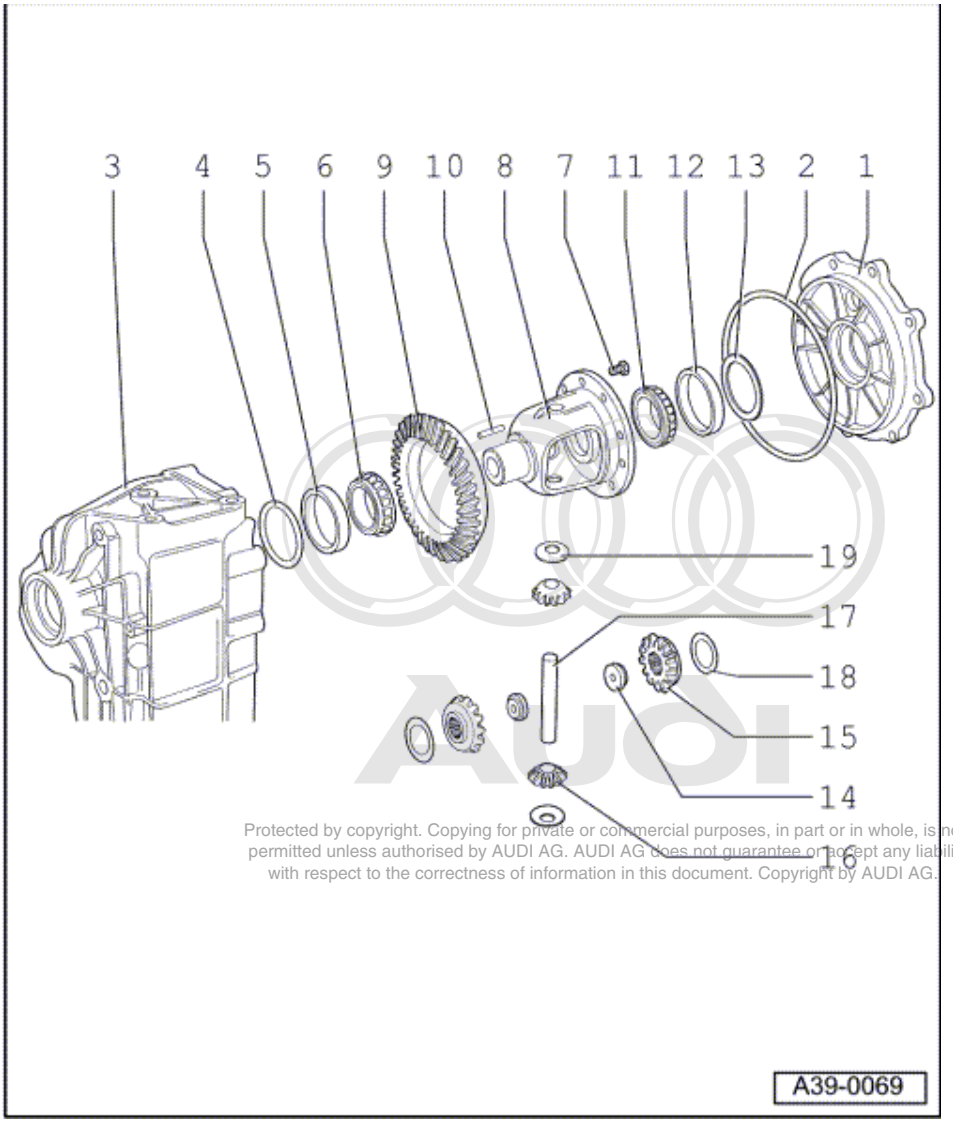
Install in reverse order.

- Insert differential.
- Renew O-ring for cover for final drive and oil when installing.
- Fit cover for final drive onto axle housing and using diagonal sequence tighten to 24 Nm.
- Fill space between sealing and dust lips with multipurpose grease.



- -> Install flange shaft and tighten.
- Top-up gear oil in rear final drive and check oil level => Page 207 .

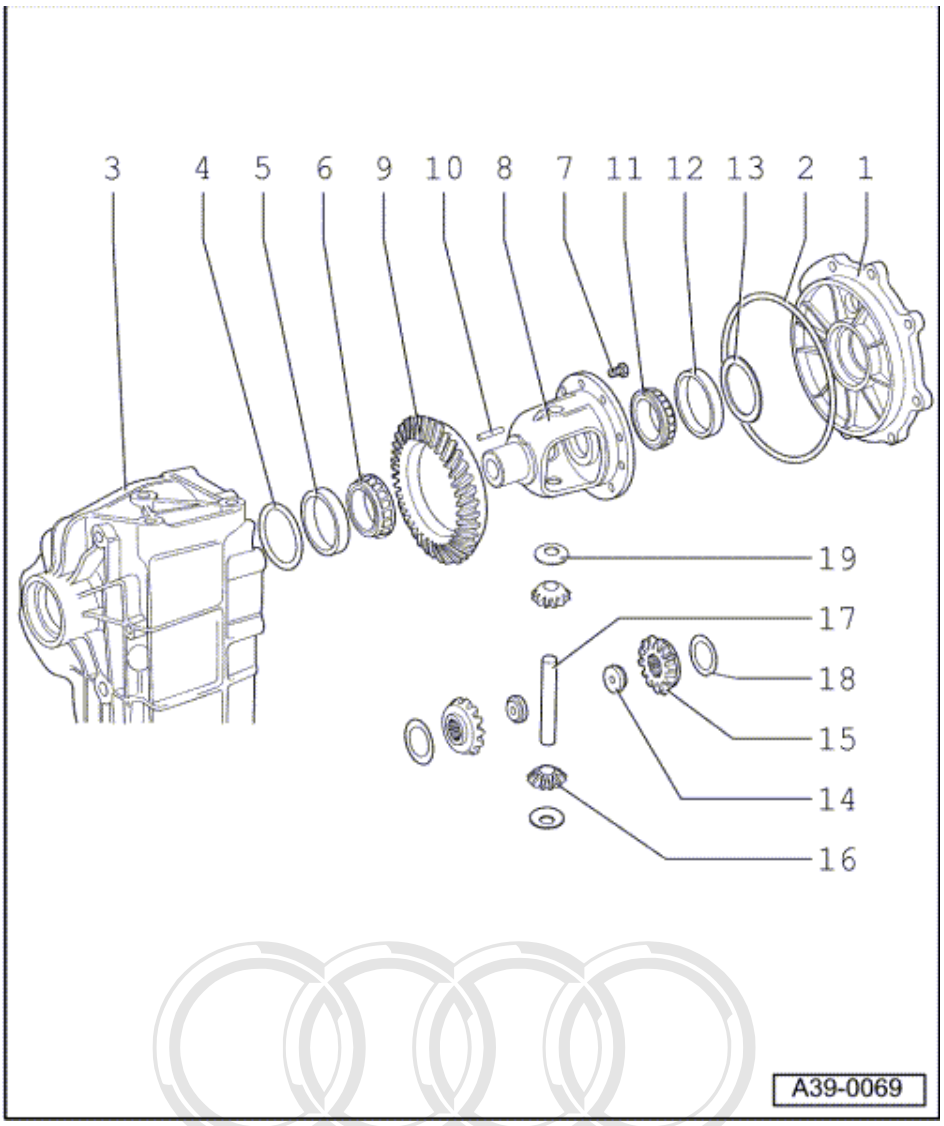
14.4 - Dismantling and assembling differential



Notes:

- General repair instructions =>Page 8 .
- Replace both taper roller bearings of the differential together. Use same make if possible.
- Adjustments are required when replacing components marked 1) => adjustment overview Page 249 .

1 Cover for final drive 1)



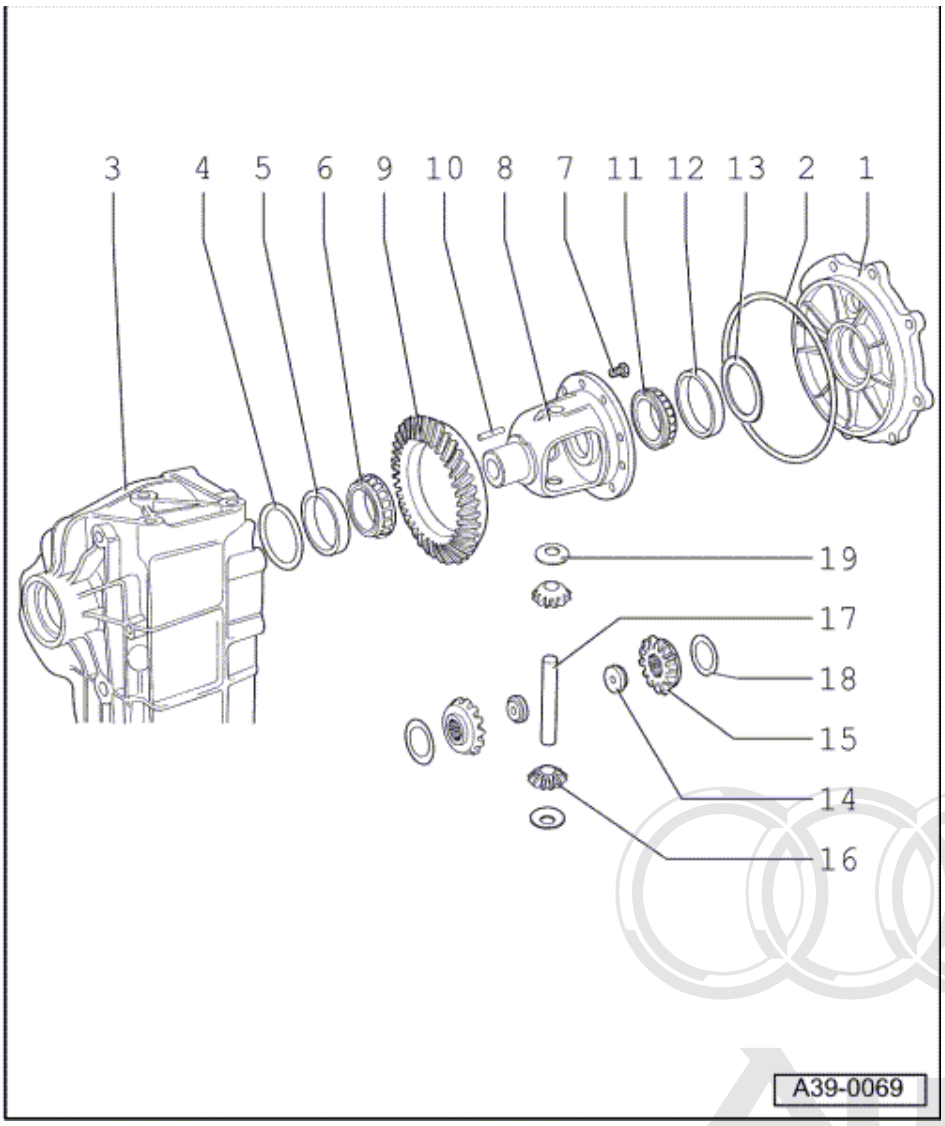
2 O-ring
- For cover
- Always renew
- Oil before installing

3 Final drive housing 1)

4 Shim "S1"
- Note thickness
- Adjustment overview => Page 249

5 Outer race for small taper roller bearing 1)
- Driving out => Fig. 9
- Driving in => Fig. 10

6 Inner race for small taper roller bearing 1)
- Pulling out => Fig. 2
- Pressing in => Fig. 4



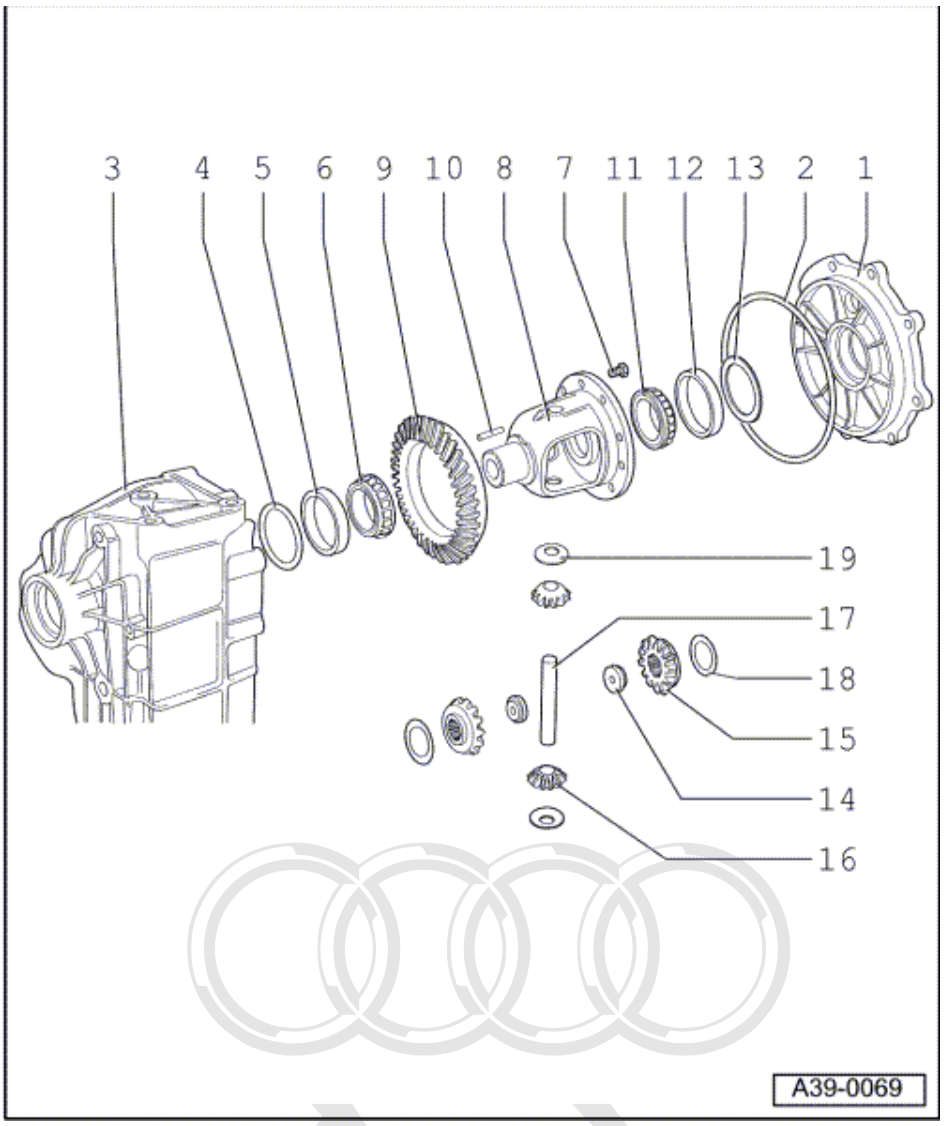
7 Crown wheel bolt

- Always renew
- Use only genuine bolts
- Counter hold, then tighten using diagonal sequence to 60 Nm and then turn 45° further

8 Differential housing 1)

9 Crown wheel 1)

- Paired with drive pinion (final drive set)
- Drive off differential housing with a drift => Fig. 5
- Installing => Fig. 6
- Heat crown wheel to 100 °C when installing



10 Spring pin

- Drive in flush

11 Inner race for large taper roller bearing 1)

- Pulling off => Fig. 1
- Pressing on => Fig. 3

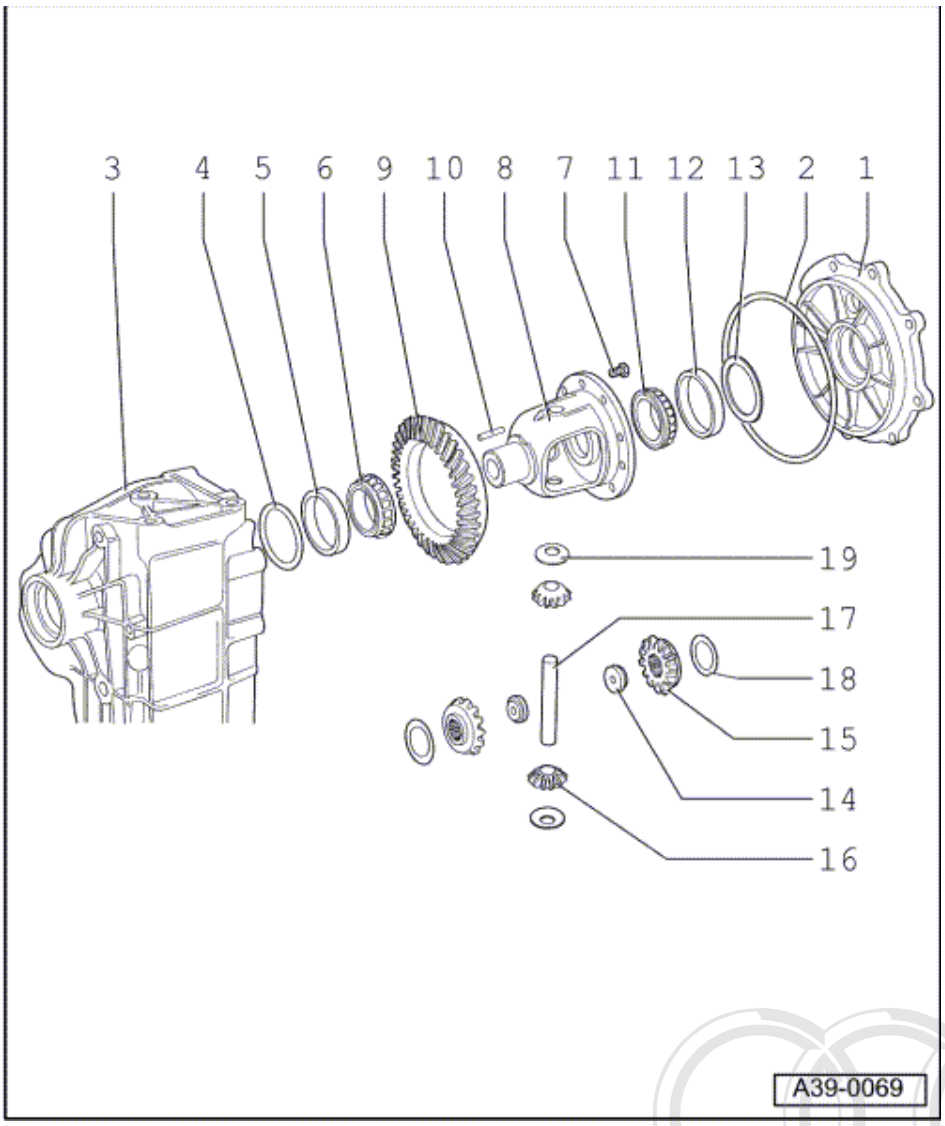
12 Outer race for large taper roller bearing 1)

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

13 Shim "S2"

- Note thickness
- Adjustment overview => Page 249

14 Threaded piece



15 Sun wheels

- Installing => Fig. 7
- Adjusting => Fig. 8

16 Planet wheels

- Installing => Fig. 7

17 Shaft for planet wheels

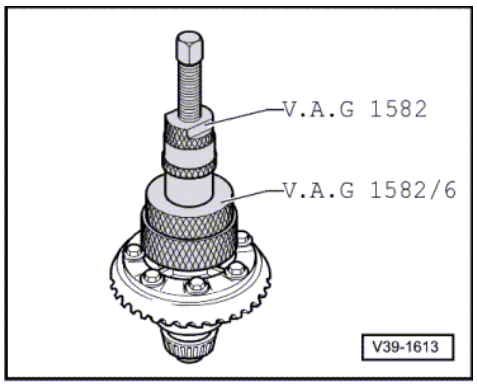
- Drive out with a drift
- Drive in carefully so that the thrust washers are not damaged
- Secure with spring pin -item 10 -

18 Shim

- Re-determining thickness => Fig. 8

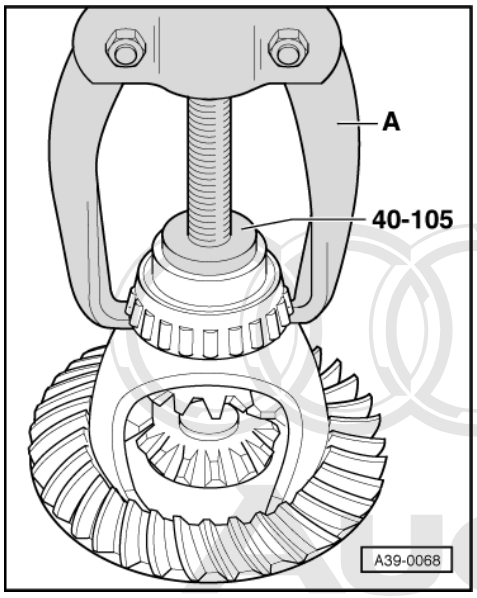
19 Thrust washer

- Check for cracks and chipping



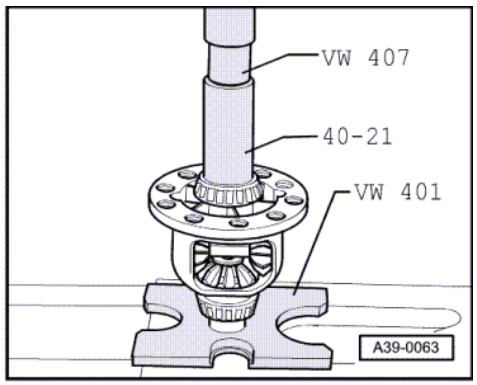
-> Fig.1 Pulling off inner race for large taper roller bearing

- Fit thrust plate 40-105 onto differential housing before fitting puller.



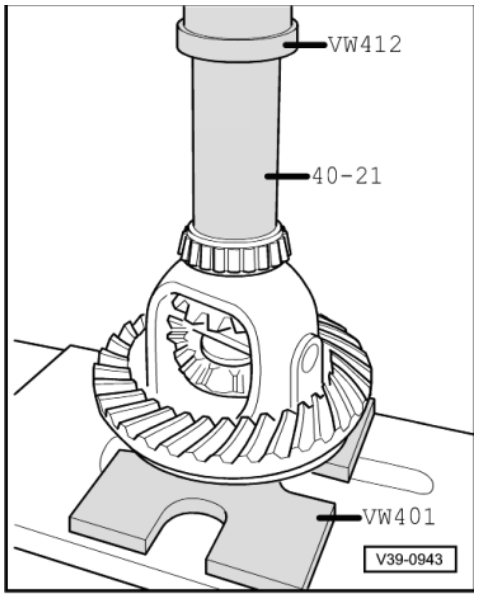
-> Fig.2 Pulling off inner race for small taper roller bearing

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



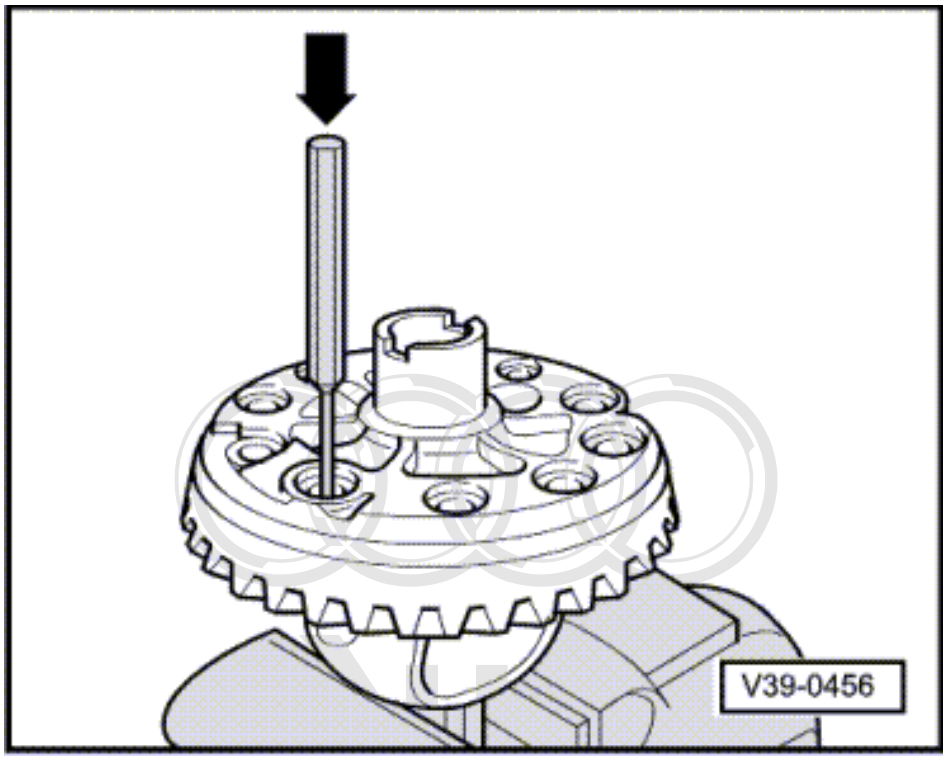
-> Fig.3 Pressing on inner race for large taper roller bearing

- Heat bearing to approx. 100 °C and press home.

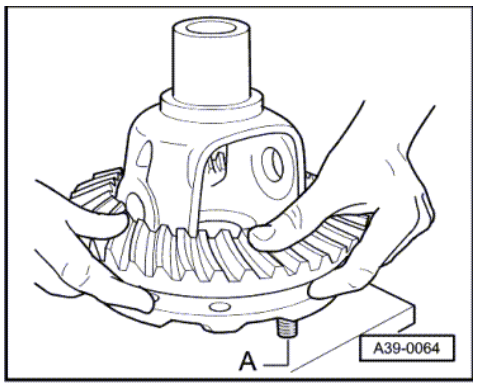


-> Fig.4 Pressing on inner race for small taper roller bearing

- Heat bearing to approx. 100 °C place on and press home.

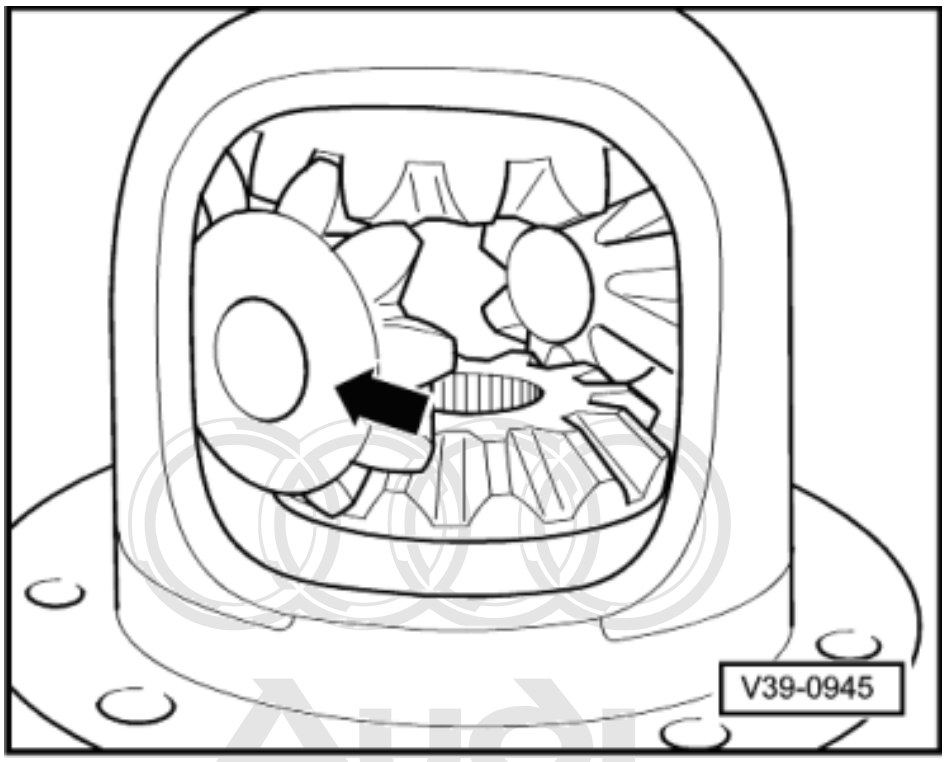


-> Fig.5 Driving crown wheel off housing



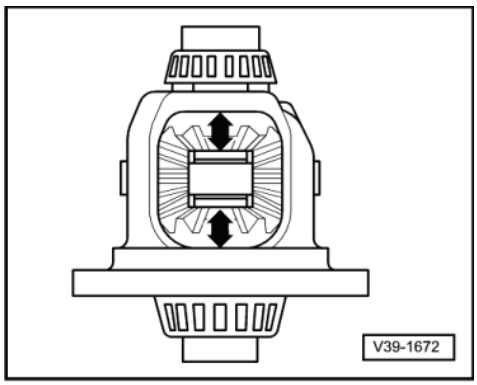
-> Fig.6 Installing crown wheel

- Use 2 centring pins -A- (local manufacture) as a guide.
- Heat crown wheel to approx. 100 °C and install.



-> Fig.7 Installing differential bevel gears

- Insert sun wheels with correct shims => Fig. 8.
- Insert planet wheels spaced 180° apart (stick thrust washers on with a small amount of grease) and rotate into position -arrow-.
- Position thrust washers so that they align with holes in differential.
- Insert threaded pieces.
- Drive in shaft and secure with spring pin.



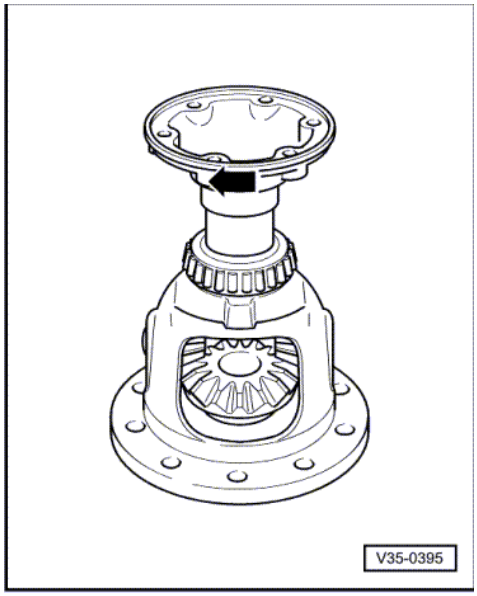
-> Fig.8 Adjusting differential bevel gears

- 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.

- Press planet wheels outwards and check play of sun wheels by hand -arrows-.



- Adjust play by inserting an appropriate shim.
  - 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-.

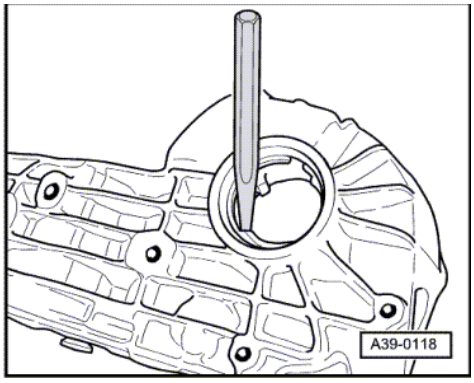
- Determine shim from table. Part numbers

=> Parts catalogue

The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90

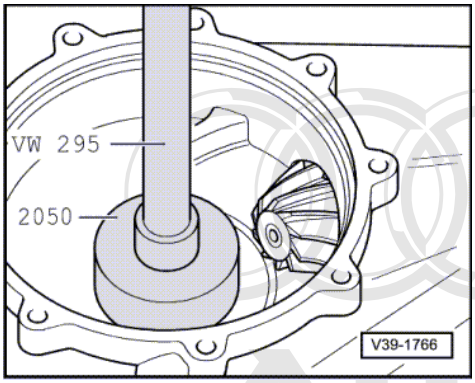
Shim thickness (mm)		
0.60	0.80	1.00



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

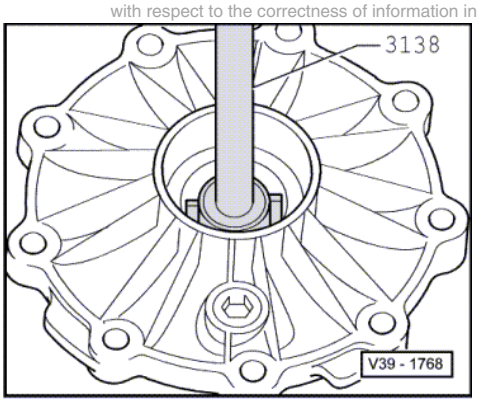
Note:

When removing, there is a possibility that the shim(s) will be damaged.



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

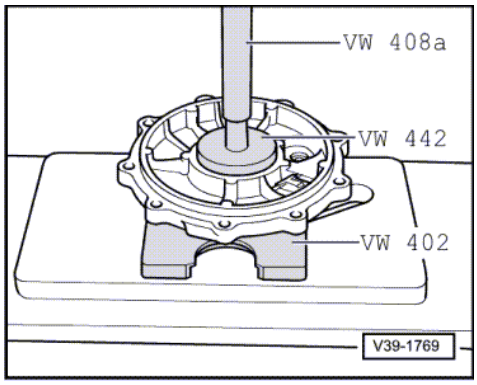
- Position outer race using VW 295 and light even blows with a hammer.
- Then drive in onto stop as shown in illustration.



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

Note:

When removing, there is a possibility that the shim(s) will be damaged.

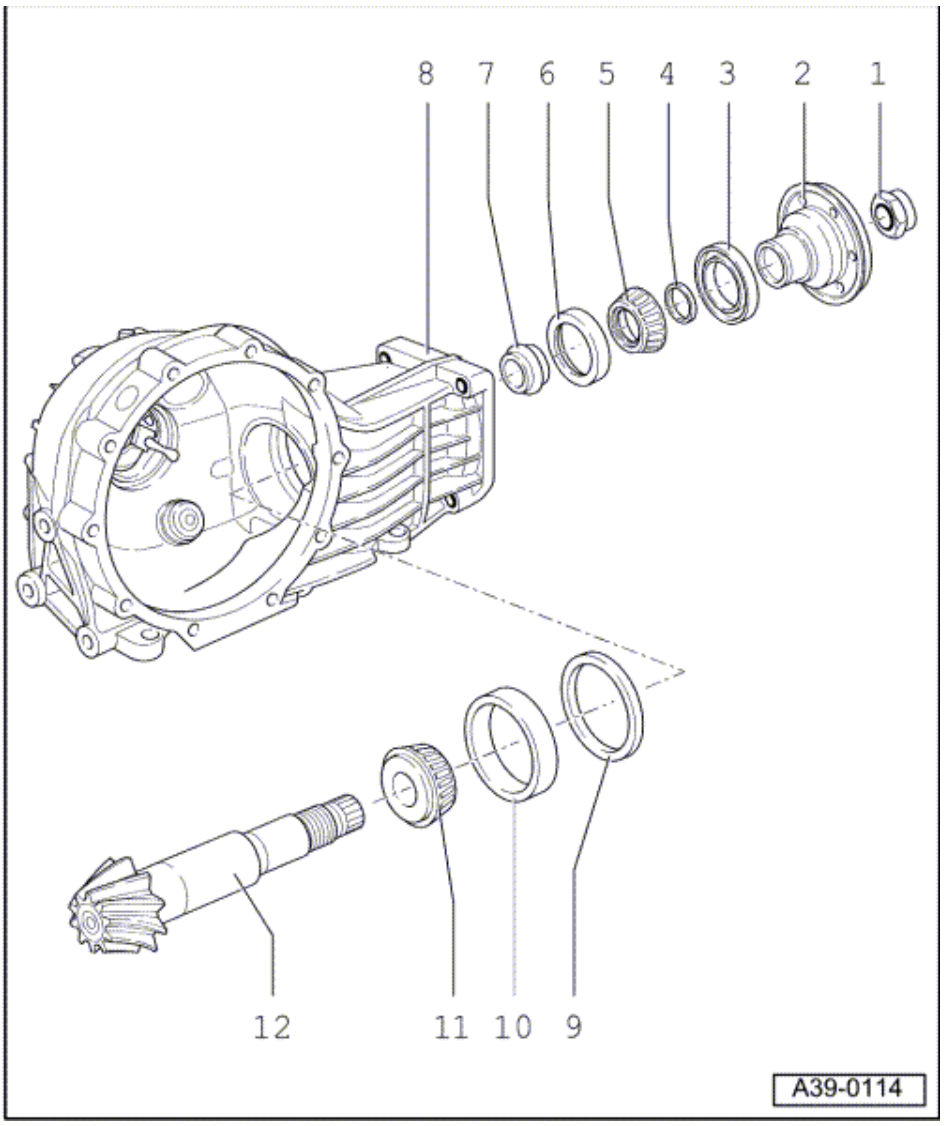


-> Fig.12 Pressing outer race for large taper roller bearing into cover

14.5 - Removing and installing drive pinion

Notes:

- Repair instructions =>Page 8 .
- Secure final drive on a repair stand => Page 226 .
- Replace both taper roller bearings together. Use same make if possible.
- Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- Removing differential => Page 221 .
- Adjustments are required when replacing components marked 1) =>adjustment overview Page 249 .



1 Drive pinion nut

- Loosening => Fig. 1
- Tightening => Fig. 15
- Measuring frictional torque => Fig. 16
- Locking => Fig. 17

2 Flange for propshaft

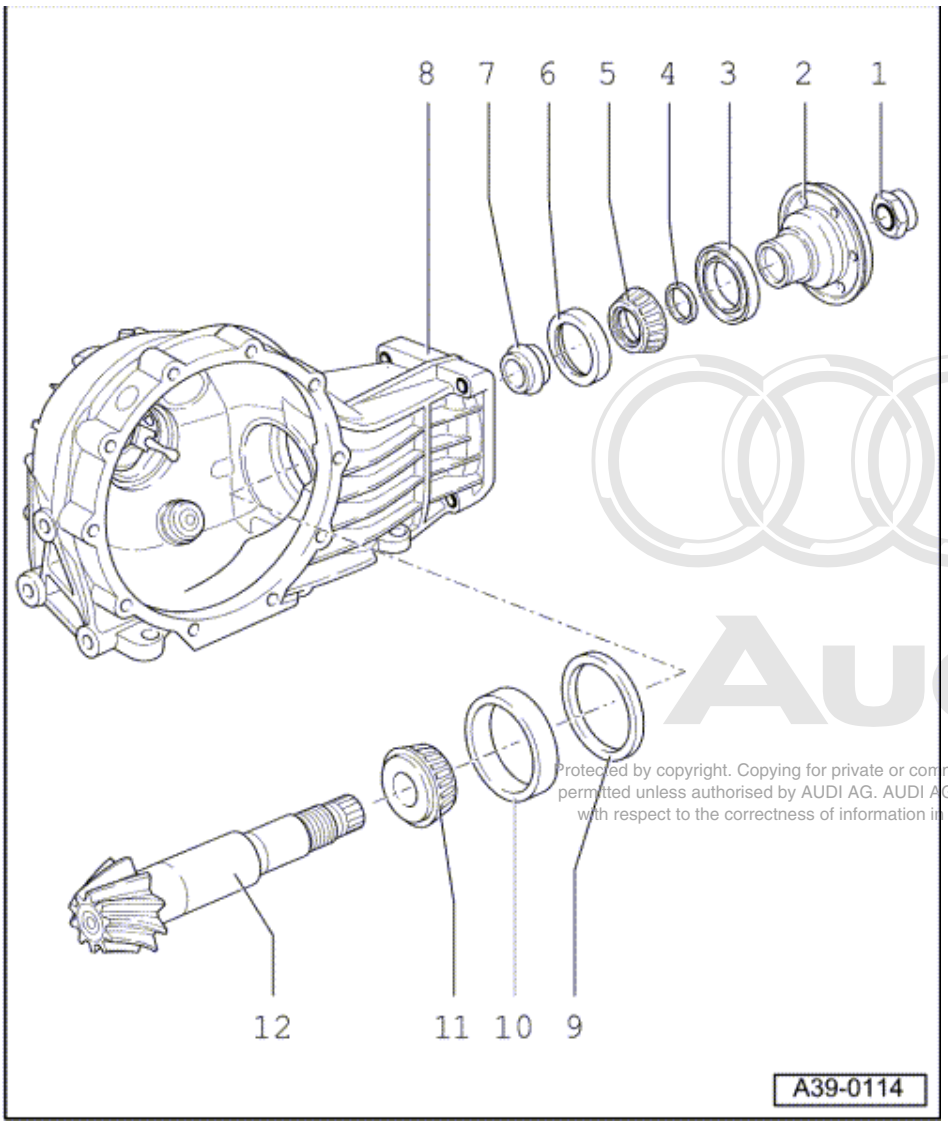
- Removing => Fig. 2
- Installing => Fig. 14
- Measuring radial run-out => Page 218

3 Seal for flange for propshaft

- Removing => Fig. 3
- Driving in => Fig. 13

4 O-ring

- Always renew
- Installing => Fig. 12



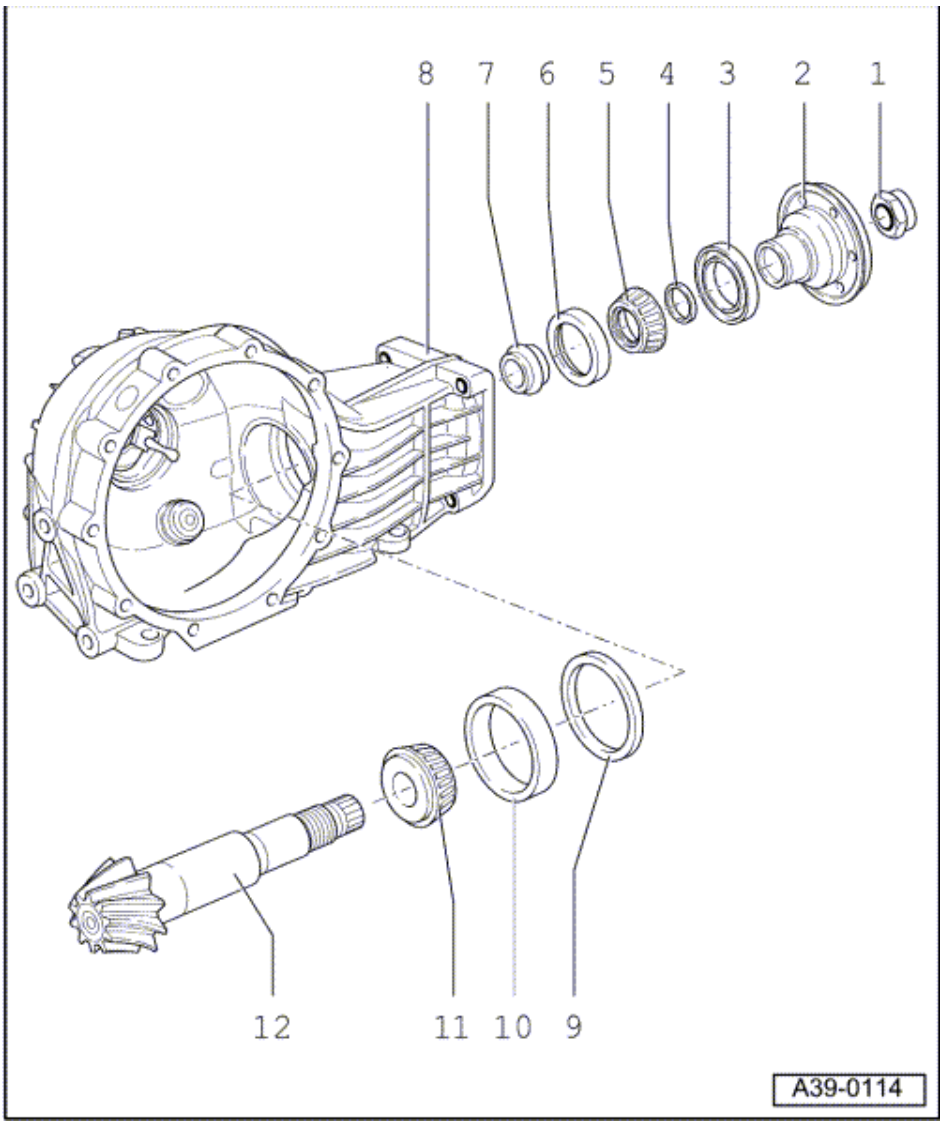
5 Inner race for small taper roller bearing 1)
- Pressing out drive pinion => Fig. 4
- Installing => Fig. 11

6 Outer race for small taper roller bearing 1)
- Pulling out => Fig. 5
- Pressing in => Fig. 10

7 Spacer sleeve 1)
- Always renew

8 Final drive housing 1)

9 Shim "S3"
- Note thickness
- Adjustment overview => Page 249



10 Outer race for large taper roller bearing 1)

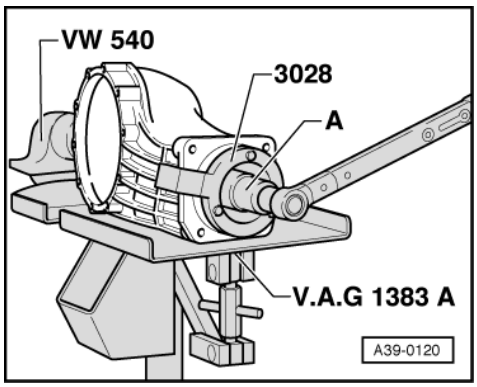
- Driving out => Fig. 6
- Pulling in => Fig. 9

11 Inner race for large taper roller bearing 1)

- Pulling off => Fig. 7
- Pressing on => Fig. 8

12 Drive pinion 1)

- Paired with crown wheel
- Replace only in conjunction with crown wheel

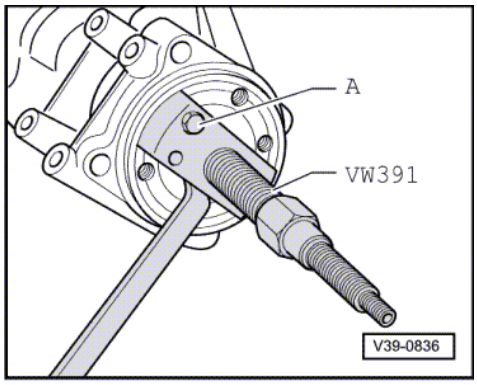


-> Fig.1 Loosening drive pinion nut

- Fit counter hold tool 3028 with securing bolts M8 x 30.

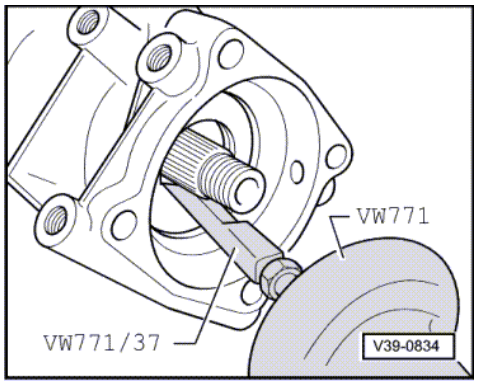
Note:

The final drive must be supported (e.g. with V.A.G 1383 A) when loosening the drive pinion nut otherwise the threaded holes in the housing will be damaged.

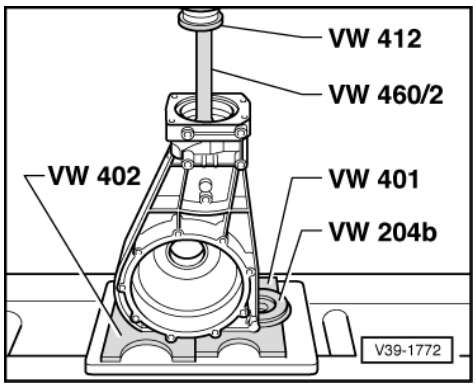


-> Fig.2 Pulling flange for propshaft off drive pinion

A - Hexagon bolt M8 x 30



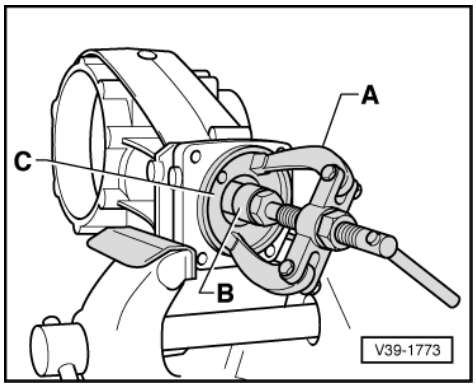
-> Fig.3 Pulling off seal for flange for propshaft



-> Fig.4 Pressing drive pinion out of inner race for small taper roller bearing

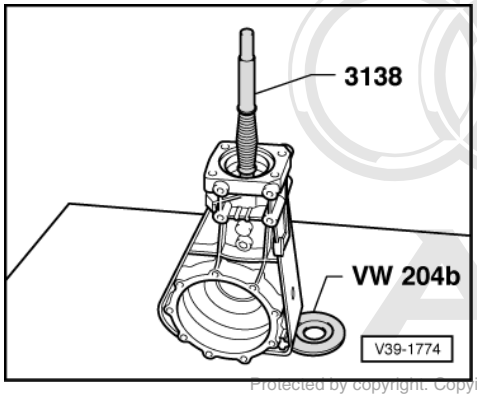
Note:

The illustration shows an incorrect special tool. Use disc 10-9 instead of disc VW 204b illustrated.



-> Fig.5 Pulling out outer race for small taper roller bearing

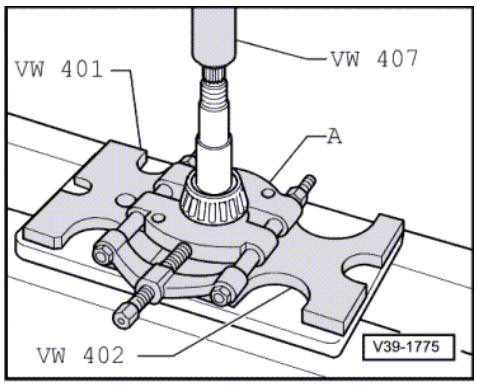
A - Counter support Kukko 22/1
B - Internal puller, e.g. Kukko 21/7, 46 ... 56 mm
C - Disc 10-9



-> Fig.6 Driving out outer race for large taper roller bearing

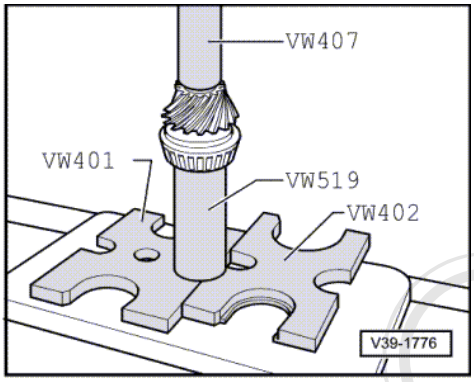
Notes:

- The illustration shows an incorrect special tool. Use disc 10-9 instead of disc VW 204b illustrated.
- When removing, there is a possibility that the shim(s) will be damaged.



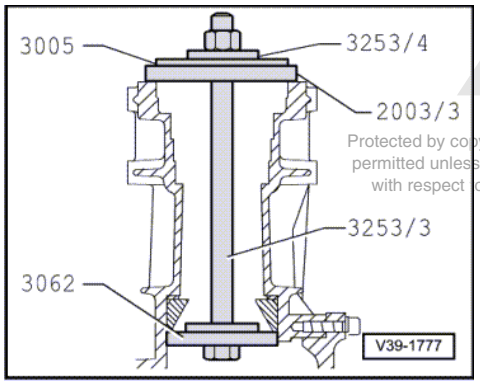
-> Fig.7 Pressing inner race for large taper roller bearing off drive pinion

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



-> Fig.8 Pressing inner race for large taper roller bearing onto drive pinion

- Heat bearing to approx. 100 °C place on and press home.

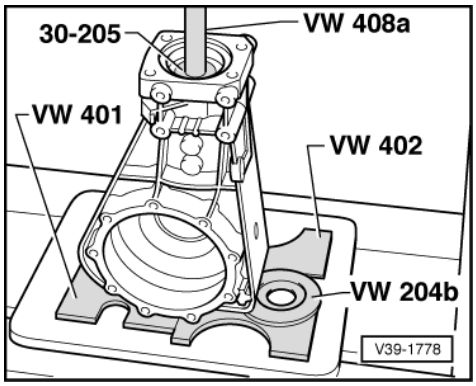


-> Fig.9 Pulling in outer race for large taper roller bearing

- Insert predetermined shim "S3" for drive pinion => Page 249 .

Note:

Inscription "Oben" faces the nut of the puller with thrust washer 3253/4.

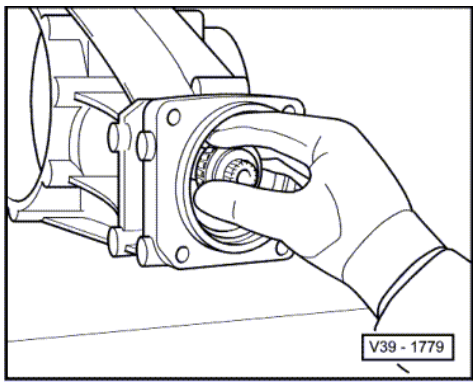


-> Fig.10 Pressing in outer race for small taper roller bearing

- Before pressing in, position bearing outer race evenly with VW 295 and 30-205.

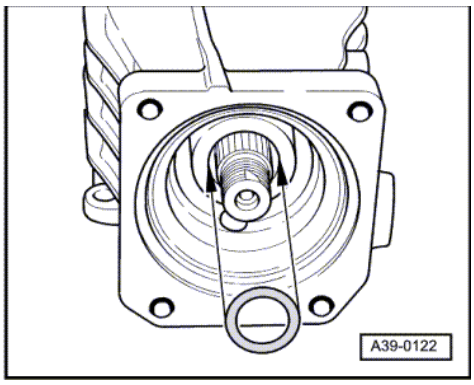
Note:

The illustration shows an incorrect special tool. Use disc 10-9 instead of disc VW 204b illustrated.



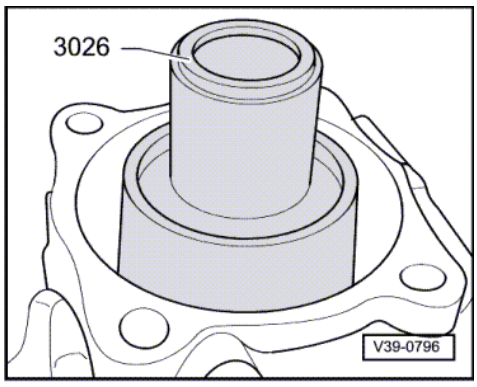
-> Fig.11 Fitting inner race for small taper roller bearing onto drive pinion

- Insert drive pinion with new spacer sleeve.
- Heat inner race for small taper roller bearing to approx. 100 °C and fit onto drive pinion.
- Press up drive pinion and insert bearing with thrust plate 40-21 onto stop.



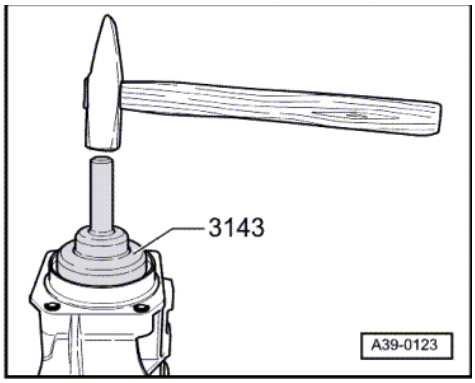
-> Fig.12 Inserting O-ring

- Lightly lubricate O-ring with gear oil.



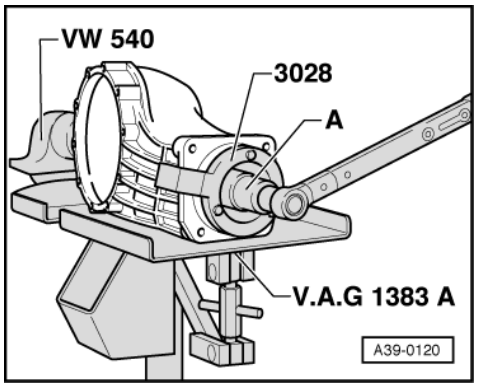
-> Fig.13 Driving in seal for flange for propshaft

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



-> Fig.14 Fitting flange for propshaft onto drive pinion

- Carefully fit flange with drive sleeve 3143 until drive pinion nut can be fitted.

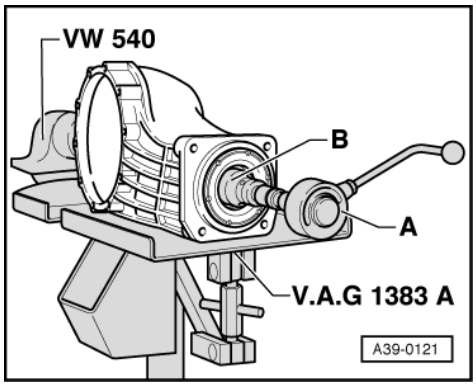


-> Fig.15 Tightening drive pinion nut and setting frictional torque

A - 36 mm socket insert

Notes:

- Only increase tightening torque slowly and read-off frictional torque frequently. If the specified frictional torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. It is not possible to reuse a spacer sleeve that has been excessively compressed.
- The final drive must be supported (e.g. with V.A.G 1383 A) when tightening the drive pinion nut, otherwise the threaded holes in the housing will be damaged.

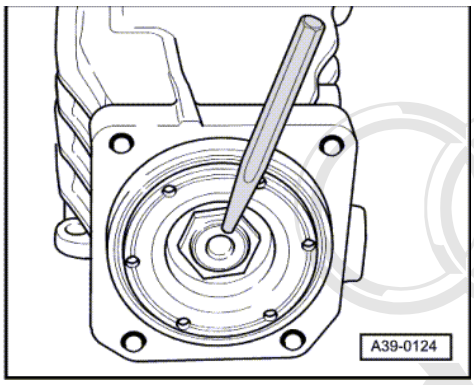


-> Fig.16 Measuring frictional torque

A - Torque gauge, commercially available, 0 ... 600 Ncm
B - 36 mm socket

- The following frictional torques should be set:

New bearings	Used bearings
200 ... 250 Ncm	30 ... 60 Ncm



-> Fig.17 Locking drive pinion nut

- Peen drive pinion nut with a punch.
- Then measure radial run-out on flange for propshaft and mark => Page 218 .

15 - Adjusting drive pinion and crown wheel

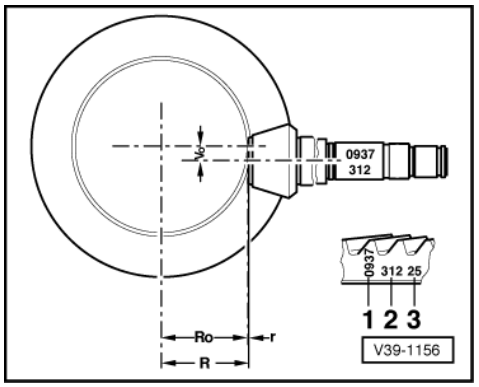
15.1 - Adjusting drive pinion and crown wheel

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.
- Maximum care and cleanliness are essential for achieving good results when performing repairs and taking measurements.

15.2 - Adjustment and markings of final drive set



Service final drive sets

1 =	"0937" indicates Oerlikon final drive set with a ratio of 37 : 9
2 =	No. of matched pair (312): final drive set
3 =	Dimension (tolerance) "r" related to the master gauge of the special test machine used during production. Dimension "r" is always stated in 1/100 mm
	Example: "25" indicates r = 0.25 mm
Ro =	Length of master gauge used on special test machine
	"Ro" = 57.50 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 = Ro + r
Vo =	Hypoid offset

15.3 - Recommended sequence for readjusting final drive set

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

1.) Determine total shim thickness "Stotal" for "S1" + "S2" for the specified preload for taper roller bearings for differential.
2.) Determine total shim thickness "S3" to reproduce the installation position for the drive pinion determined on the test machine in production.

3.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash exists between crown wheel and drive pinion.

Note:

Overview of components and shims =>Page 250 .

15.4 - Adjustment overview

Note:

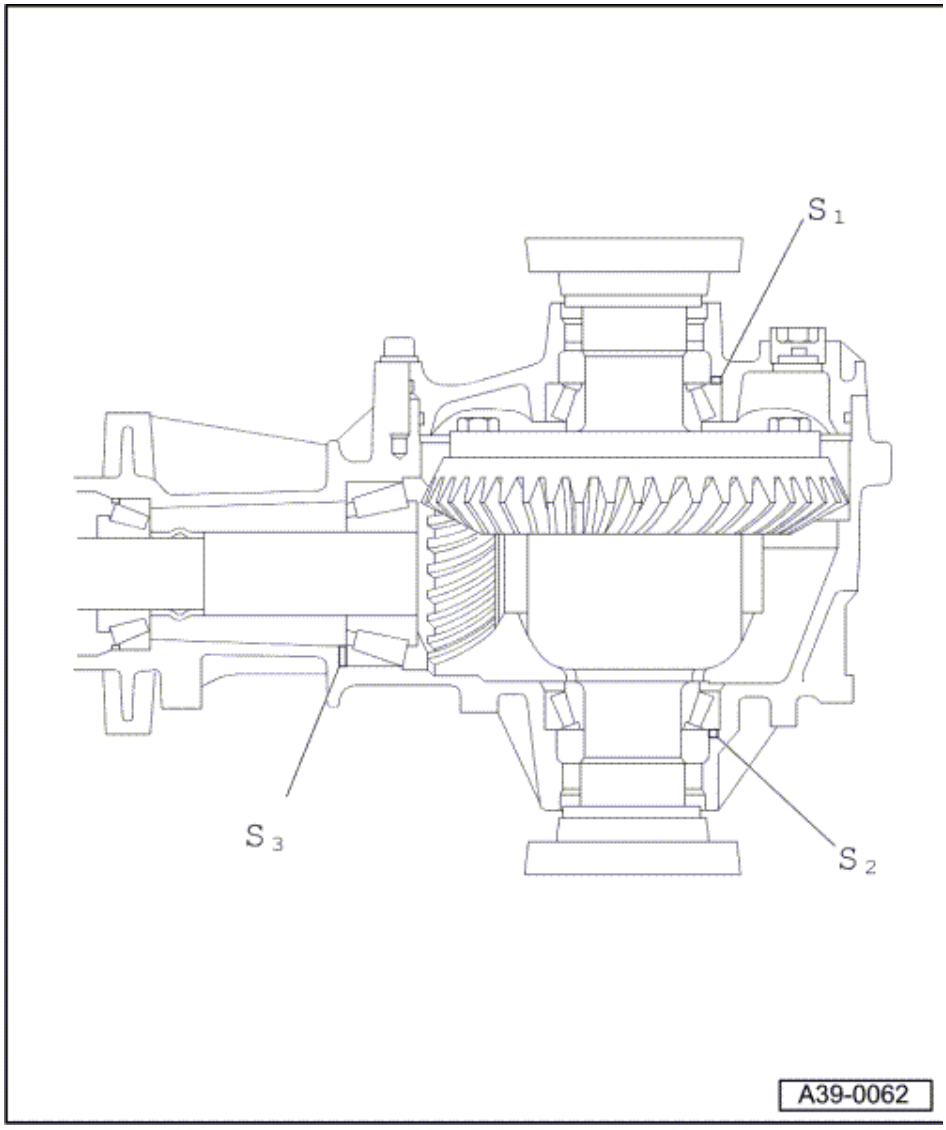
If repairs have been carried out on the final drive it is only necessary to adjust the drive pinion or final drive set if components have been renewed which have a direct effect on the adjustments of the final drive. Refer to the following table to avoid unnecessary adjustments:

	to be adjusted:		
Parts renewed: ▼	Crown wheel "S1"+"S2" 1) => Page 256	Drive pinion "S3" 1) via deviation "r" => Page 250	Backlash 0.12 ... 0.22 mm => Page 259
Final drive housing	X	X	X
Differential housing	X		X
Taper roller bearing for drive pinion		X	X
Taper roller bearing for differential	X		X
Final drive set 2)	X	X	X
Cover for final drive	X		X

1) Shims; installation position => Page 250 .

2) Drive pinion and crown wheel; only renew together.

15.5 - Position of shims



Note:

Adjustment overview when renewing individual components of final drive

=>Page 249 .

S1 - Adjustment shim for crown wheel in cover for final drive
S2 - Adjustment shim for crown wheel in final drive housing
S3 - Adjustment shim for drive pinion in final drive housing

16 - Adjusting drive pinion

16.1 - Adjusting drive pinion

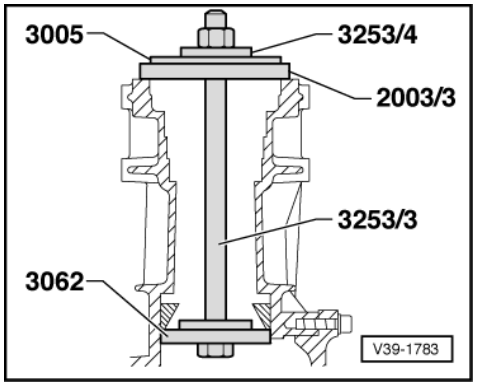
Notes:

- Before adjusting drive pinion, adjust crown wheel (determine total shim thickness "Stotal" for shims "S1" + "S2" => Page 256 .

- Re-adjustment of the drive pinion is only necessary if the final drive set, taper roller bearing for drive pinion or housing for final drive is replaced =>Page 249 .
- Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.

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

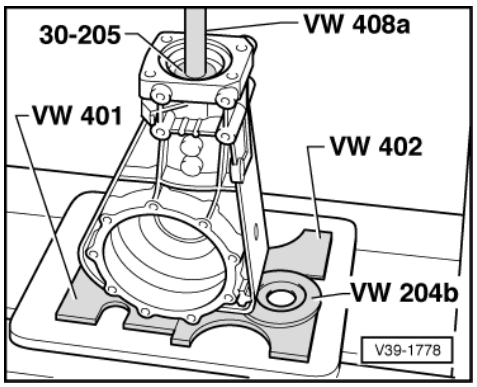
(Setting preload of taper roller bearing for drive pinion)



- Secure final drive on a repair stand.
- -> Pull outer race for large taper roller bearing into housing without shim.

Note:

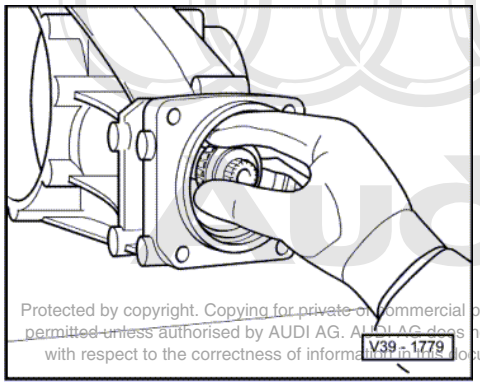
Inscription "Oben" with thrust washer 3253/4 faces the nut of the puller.



- -> Pull outer race for small taper roller bearing into housing.

Notes:

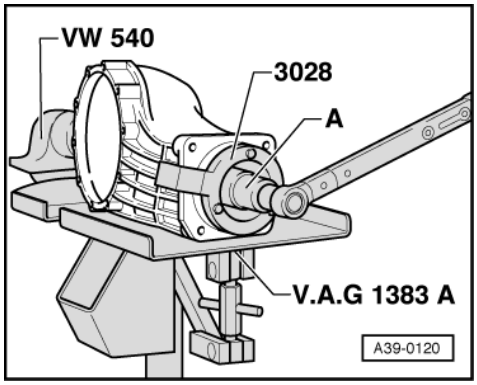
- Oil bearing outer race well and position with VW 295 and 30-205.
- The illustration shows an incorrect special tool. Use disc 10-9 instead of disc VW 204b illustrated.



- -> Insert drive pinion without spacer sleeve.
- Heat inner race for taper roller bearing to approx. 100 °C and fit onto drive pinion.

Notes:

- Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- Only install spacer sleeve for final frictional torque measurement (after determining shim "S3").

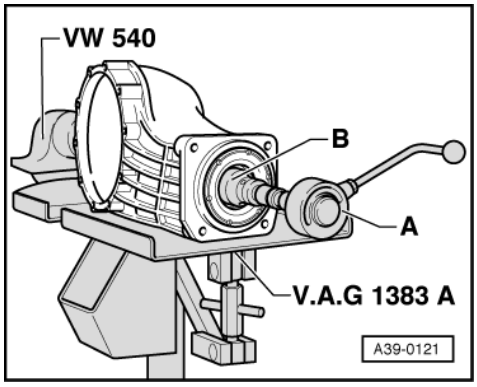


- -> Tighten drive pinion nut until the following friction torque is obtained.

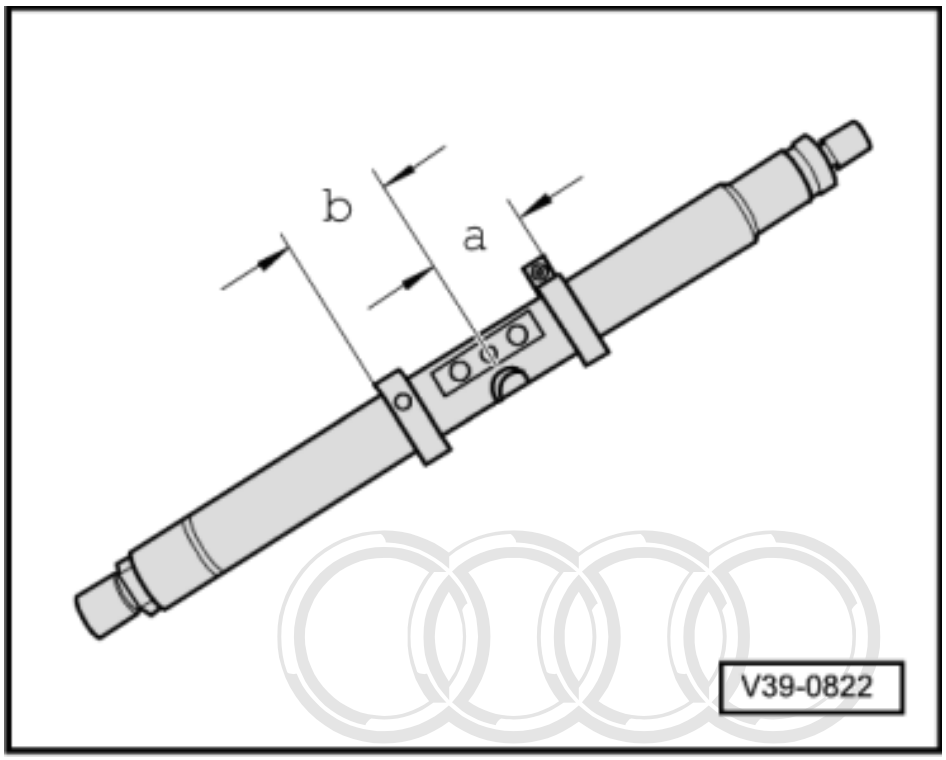
New bearings	Used bearings
200 ... 250 Ncm	30 ... 60 Ncm

Note:

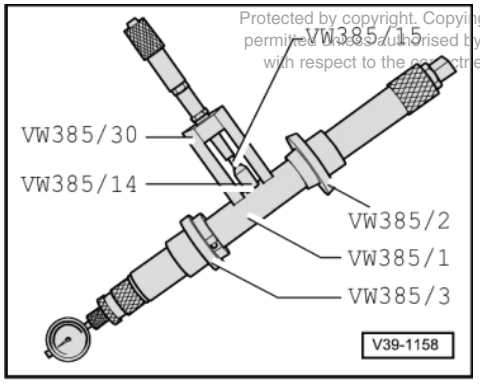
The final drive must be supported (e.g. with V.A.G 1383 A) when tightening the drive pinion nut otherwise the threaded holes in the housing will be damaged.



A - -> Torque gauge, commercially available, 0 ... 600 Ncm
B - 36 mm socket



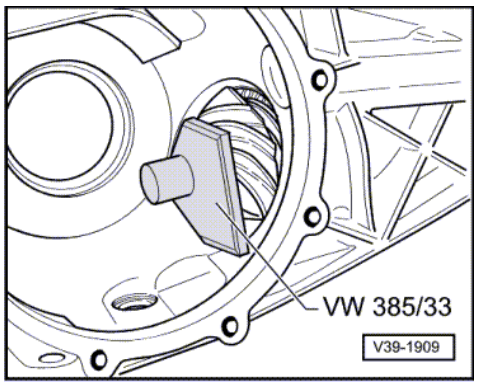
- -> Set adjustment ring of universal mandrel VW 385/1.
  - Dimension "a" = 60 mm
- Set sliding adjustment ring.
  - Dimension "b" = 55 mm



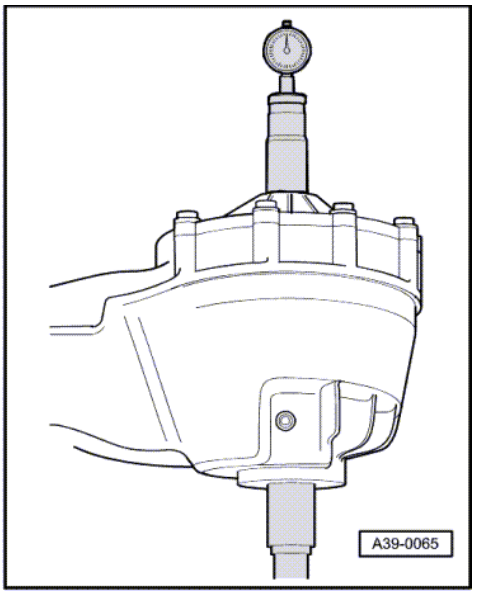
- -> Assemble universal mandrel as illustrated:
  - Dial gauge extension VW 385/15 = 9 mm long
- Set universal master gauge VW 385/30.
  - Ro = 57.50 mm
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

Note:

Before performing following measurements turn drive pinion at least five turns in both directions, so that the taper roller bearings settle. Otherwise a false reading will be obtained.



- -> Place end measuring plate VW 385/33 onto drive pinion head.
- Remove master gauge VW 385/30 and insert mandrel into housing.
  - The centring disc 385/3 faces towards cover for final drive
- Fit cover for final drive and tighten 4 bolts.
- Using the adjustable ring, move 2nd centring disc out as far as possible so that the mandrel can still just be turned by hand.



Determining measurement "e"

- -> Turn mandrel until the dial gauge point touches the end measuring plate on drive pinion head, then measure maximum deflection (return point). The measured value is dimension "e" (in red scale).
  - Measurement in following example: "e" = 1.60 mm

Note:

Dimension "e" is required to determine thickness of shim "S3".

- Then, (after removing universal mandrel) check again that the dial gauge, with master gauge VW 385/30 fitted, indicates "0" with 2 mm preload, otherwise repeat the measurement.

Determining shim thickness "S3"

Formula:
"S3" = "e" - "r"
e = determined value
r = deviation (marked on crown wheel in 1/100 mm)

Example:	
Determined value "e"	1.60 mm
- Deviation "r"	0.42 mm
= Thickness of shim "S3"	1.18 mm

- Determine shim(s) from table. Part numbers

=> Parts catalogue

The following shims are available for "S3"

Shim thickness (mm) 1)		
0.95	1.20	1.45
1.00	1.25	1.50
1.05	1.30	1.55
1.10	1.35	
1.15	1.40	

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

- Remove universal mandrel.

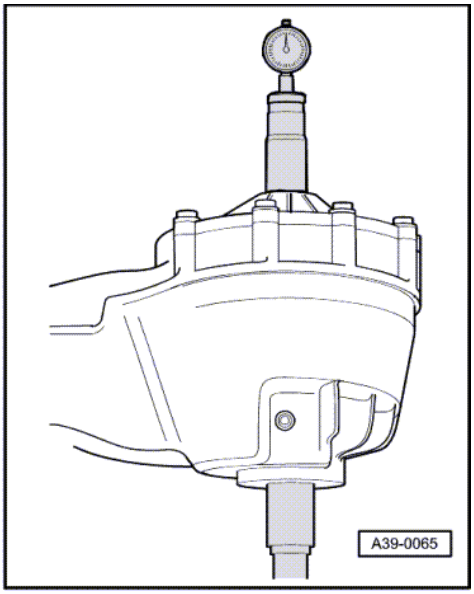
- Remove drive pinion and outer race for large taper roller bearing and reinstall with determined shim(s) and spacer sleeve => Page 238 .
- Insert inner race for small taper roller bearing and tighten drive pinion nut until specified frictional torque is achieved => Page 238 .

Notes:

- Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- Tighten the drive pinion nut slowly and read-off frictional torque frequently. If the specified frictional torque is exceeded, the spacer sleeve must be replaced. It is not possible to reuse a spacer sleeve that has been excessively compressed.

- Set to following frictional torques:

New bearings	Used bearings
200 ... 250 Ncm	30 ... 60 Ncm



Performing check measurement

Checking dimension "r"

- Turn drive pinion at least 5 turns in both directions.
- -> Insert universal mandrel and perform check measurement.
  - If the shims have been correctly selected, the dial gauge, reading anti-clockwise (in red scale), will show the deviation "r" within a tolerance of ± 0.05 mm
- Peen drive pinion nut with a punch.

Note:

The radial run-out at flange for propshaft must always be measured and marked =>Page 218 .

17 - Adjusting crown wheel

17.1 - Adjusting crown wheel

(Adjusting differential)

Repairs after which the crown wheel must be adjusted
=> Page 249 .

Notes:

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

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

(Setting preload of taper roller bearing for differential)

- Drive pinion removed or crown wheel dismantled from differential housing

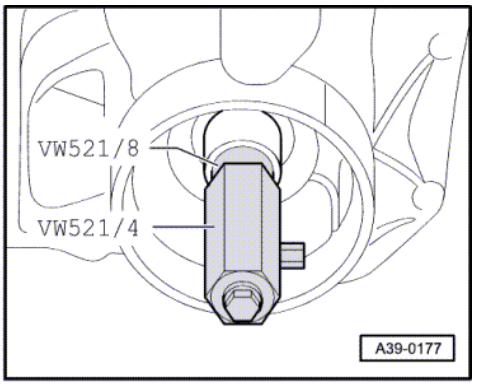
- Remove seal and left and right differential outer races for taper roller bearings and take out shims => Page 238 .

- Drive left outer race for taper roller bearing for differential (housing side) with shim "S2" into final drive housing => Page 237 . For measurement purposes an "S2*" shim 1.00 mm thick (2 shims, 1 of 0.80 mm and 1 of 0.20 mm).

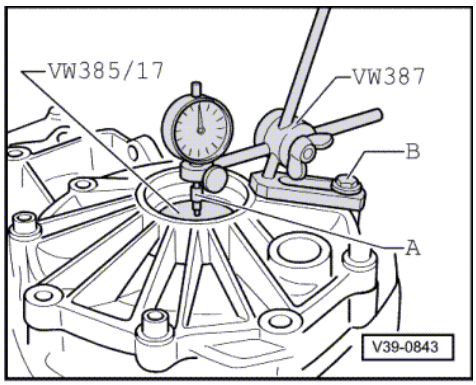
Note:

For measurement purposes a shim "S2" of 1.0 mm is initially inserted which will be designated "S2" in the following. After determining the backlash "S2*" will be replaced by the correct "S2".*

- Drive outer race for right-hand taper roller bearing for differential (cover side) without shim in onto stop => Page 238 .



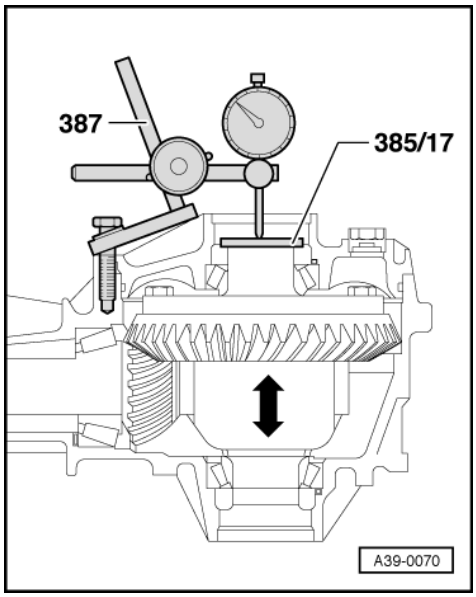
- Insert differential into housing. The crown wheel is positioned on the right side (cover side).
- Fit cover and tighten bolts to 24 Nm.
- -> Install special tools VW 521/4 and 521/8 onto housing side in differential housing.
- Turn cover side of differential housing upwards.



- Turn differential 5 turns in both directions to settle the taper roller bearing.
- Place measuring plate VW 385/17 onto differential.
- -> Assemble measuring tools.

A - Dial gauge extension approx. 30 mm long
B - Hexagon bolt M8 x 45

- Set dial gauge extension onto centre of plate.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.



- -> Lift differential without turning; read off play on dial gauge and note.
  - Measurement in following example: 0.50 mm

Note:

If the measurement has to be repeated, the differential must again be turned 5 turns in each direction to settle the taper roller bearing.

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

Example:	
Inserted shim(s) "S2*"	1.00 mm
+ Measured value	0.50 mm

Example:		
+	Bearing preload (constant)	0.30 mm
=	Total shim thickness "Stotal" for shims "S1" + "S2"	1.80 mm

Determining thickness of shim "S1*"

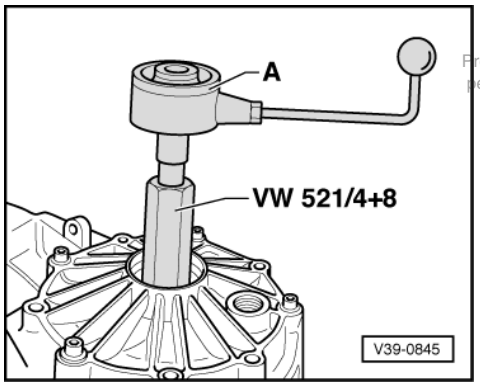
Notes:

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

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

Example:		
	Total shim thickness "Stotal" for shims "S1" + "S2"	1.80 mm
-	Inserted shim(s) "S2*"	1.00 mm
=	Thickness of shim "S1*"	0.80 mm

- Determine shim(s) from table => Page 260 .



Measuring frictional torque (check)

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

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

Frictional torque specifications:

New bearings	Used bearings
150 ... 300 Ncm	30 ... 60 Ncm

Notes:

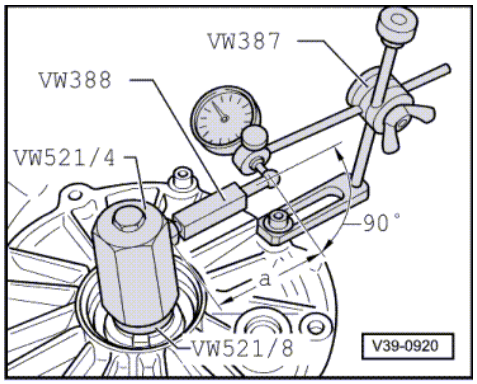
- Differential tapered roller bearings are low friction bearings. Therefore the frictional torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- If the final drive set has been re-adjusted, adjust and check drive pinion =>Page 250 .

Adjusting backlash

(Positioning crown wheel in final drive housing)

- Drive pinion with shim "S3" installed
- Differential with shims "S1*" + "S2*" installed

- Insert differential in final drive housing, install cover and tighten all bolts to 25 Nm.



- Turn differential 5 turns in both directions to settle the taper roller bearings.
- -> Assemble measuring equipment.
- Use dial gauge extension VW 382/10 (6 mm flat).
- Set measuring lever VW 388 to dimension "a" = 60 mm.
- Determine play between the teeth flanks as follows:
  - Turn crown wheel until it makes contact with a tooth flank (end of backlash travel).
  - Set dial gauge to "0" with 1 mm preload.

  - Turn crown wheel back until lying against an opposite tooth flank (backlash).
  - Read off backlash and note value.
  - Turn crown wheel through 90° and repeat measurements a further 3 times.

Note:

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

Determining average backlash

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

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

Determining thickness of shim "S2"

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

Example:		
	Inserted shim "S2*"	1.00 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm

Example:	
= Thickness of shim "S2"	0.86 mm

- Determine shim from table. Part numbers

=> Parts catalogue

The following shims are available for "S2"

Shim thickness (mm) 1)		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

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

Determining thickness of shim "S1"

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

Example:	
Total shim thickness "Stotal" for "S1" + "S2"	1.80 mm
- Thickness of shim "S2"	0.86 mm
= Thickness of shim "S1"	0.94 mm

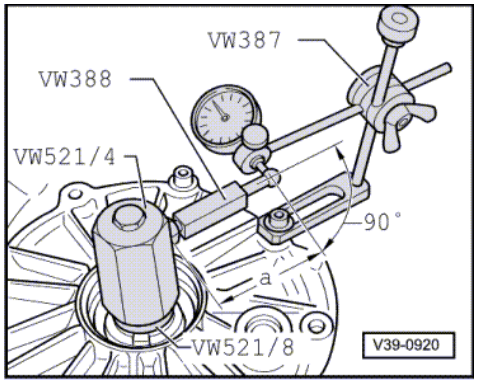
- Determine shim(s) from table. Part numbers

=> Parts catalogue

The following shims are available for "S1"

Shim thickness (mm) 1)		
0.15	0.50	0.90
0.20	0.60	1.00
0.30	0.70	1.20
0.40	0.80	

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



-> Performing check measurement

- Drive pinion with shim "S3" installed
- Differential with shims "S1" + "S2" installed

- Turn differential 5 turns in both directions so that the taper roller bearings settle.
- Measure backlash four times on circumference.
  - Specifications: 0.12 ... 0.22 mm

Notes:

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