

Audi A8 1994 ➤

5-Speed manual gearbox 012/01W, Front-wheel drive

Gearbox ID	CPF	CUR	CVE	DAF	DDM	DPF			
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Edition 03.1998

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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A8 1994 ➤

5-Speed manual gearbox 012/01W, Front-wheel drive

Repair Group

00 - Technical data

30 - Clutch

34 - Controls, Housing

35 - Gears, Shafts

39 - Final drive, Differential



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

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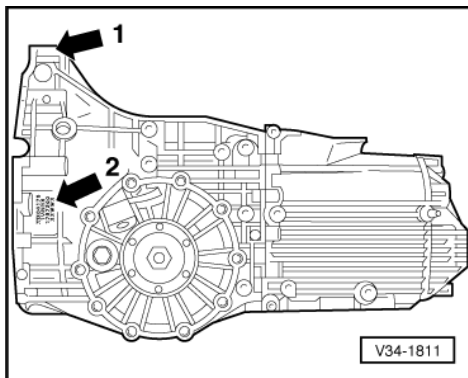
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00 - Technical data

1 - Gearbox identification

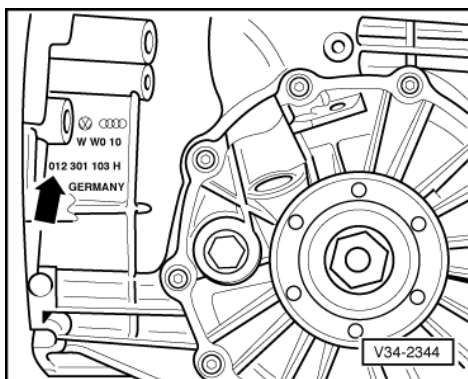
1.1 - Gearbox identification



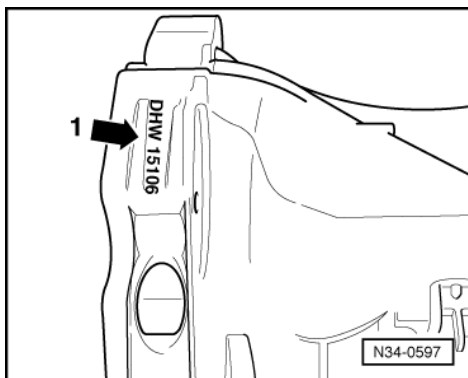
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-> Location on gearbox

Code letters and date of manufacture (arrow 1)
 Manual gearbox 012 / 01W (arrow 2)



-> Manual gearbox 012 / 01W (arrow)





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

Example:	DHW	15	10	6
	Code letters Day Month			Year (1996) of manufacture

Additional information is related to production.

Note:

The gearbox code letters are also shown on the vehicle identification plates.

1.2 - Code letters, gearbox allocation, ratios, capacities

Manual gearbox		5-speed 012/01W front-wheel drive		
Code letters		CPF	CUR	CVE
Manufactured	from	06.94	06.94	08.94
	to	07.95	06.96	03.96
Allocation	Model	Audi A8 1994 ►	Audi A8 1994 ►	Audi A8 1994 ►
	Engine	2.8 ltr - 128 kW	2.8 ltr - 128 kW	2.8 ltr - 128 kW
Ratios Z2 : Z1 = i	Final drive	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889
	1st gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	35 : 19 = 1.842	35 : 19 = 1.842	35 : 19 = 1.842
	3rd gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th gear	35 : 34 = 1.029	35 : 34 = 1.029	35 : 34 = 1.029
	5th gear	31 : 37 = 0.838	31 : 37 = 0.838	31 : 37 = 0.838
	Reverse gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444

Code letters	CPF	CUR	CVE
Speedometer	electronic		
Capacity	2.25 litres		
Specification	Gear oil G 052 911 A SAE 75 W 90 (synthetic oil)		
Clutch actuation	hydraulic	hydraulic	hydraulic
Clutch plate dia.	240 mm	240 mm	240 mm
Drive shaft flange dia.	130 mm 1)	130 mm 1)	130 mm 1)
Polygon bearings	2)	2)	2)
Overall ratio iov. in top gear	3.258	3.258	3.258

- 1) Drive shaft with triple roller joint
- 2) With or without polygon bearings, depending on production date

Manual gearbox		5-Speed 012/01W front-wheel drive		
Code letters		DAF	DDM	DPF
Manufactured	from	07.95	04.96	07.96
	to	03.96	07.96	

Manual gearbox		5-Speed 012/01W front-wheel drive		
Allocation	Model	Audi A8 1994 ►	Audi A8 1994 ►	Audi A8 1994 ►
	Engine	2.8 l - 120 kW 3)	2.8 l - 142 kW	2.8 l - 142 kW
Ratios Z2 : Z1 = i	Final drive	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889
	1st gear	34 : 9 = 3.778	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	37 : 17 = 2.176	35 : 18 = 1.944	35 : 18 = 1.944
	3rd gear	40 : 28 = 1.429	39 : 30 = 1.300	38 : 31 = 1.226
	4th gear	36 : 33 = 1.091	35 : 34 = 1.029	33 : 35 = 0.943
	5th gear	32 : 36 = 0.889	31 : 37 = 0.838	30 : 38 = 0.789
	Reverse gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444

3) For China, CIS

Code letters	DAF	DDM	DPF
Speedometer	electronic		
Capacity	2.25 litres		
Specification	Gear oil G 052 911 A SAE 75 W 90 (synthetic oil)		
Clutch actuation	hydraulic	hydraulic	hydraulic
Clutch plate dia.	240 mm	240 mm	240 mm
Drive shaft flange dia.	130 mm 1)	130 mm 1)	130 mm 1)
Polygon bearings	yes	yes	yes
Overall ratio iov. in top gear	3.457	3.258	3.070

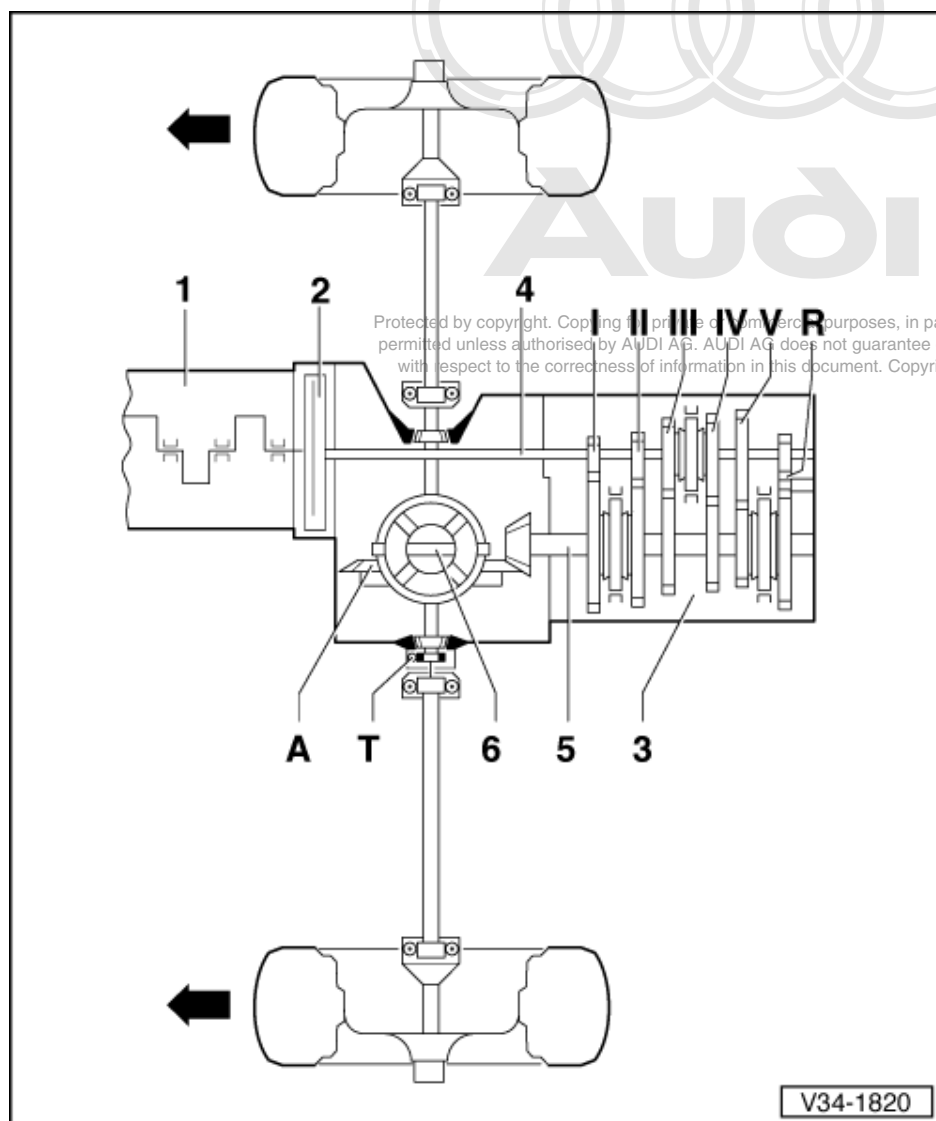
1) Drive shaft with triple roller joint

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2 - Transmission layout

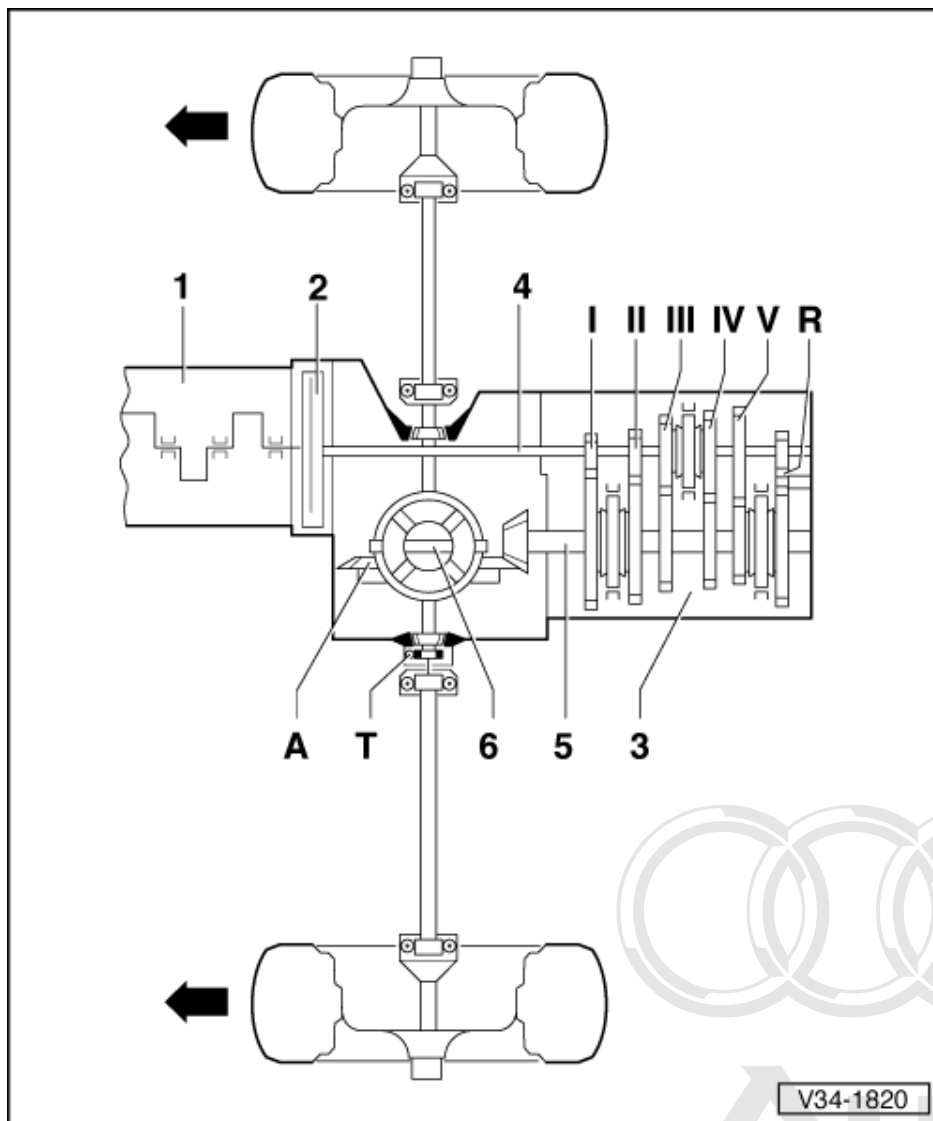
2.1 - Transmission layout



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

Note:

Arrows point in forward direction of travel.



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

Note:

Arrows point in forward direction of travel.

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3 - Calculations

3.1 - Calculations

3.2 - 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 = axle ratio	ZA2 : ZA1
iov = overall ratio	iG x iA

Example:	5th gear	Final drive
Drive gear	ZG1 = 37	ZA1 = 9
Driven gear	ZG2 = 31	ZA2 = 35

Calculating:
iG = 31 : 37 = 0.838
iA = 35 : 9 = 3.889
iov = (31 : 37) x (35 : 9) = 0.838 x 3.889 = 3.259

4 - Repair instructions

4.1 - Repair instructions

4.2 - Contact corrosion

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

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

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

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

Warning!

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

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4.3 - General repair instructions

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

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

Special tools

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

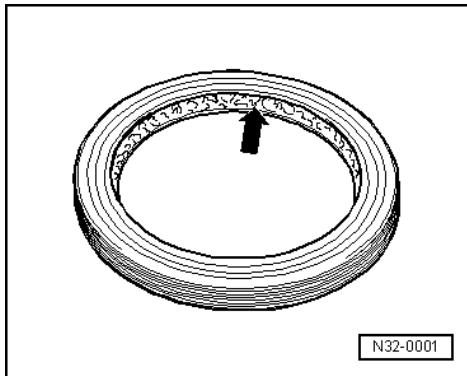
=> Booklet; Special tools, Workshop equipment

Gearbox

- ◆ Select the correct bolts and other components according to the gearbox code letters via the Parts Catalogue=>Page 2 .
- ◆ When fitting a new gearbox the oil level must be checked and oil added if necessary => Page 64 .
- ◆ Capacities and specifications => from Page 2 .
- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.
- ◆ When installing gearbox, ensure dowel sleeves are correctly seated.

O-rings, seals, gaskets

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



- ◆ -> Before installing radial shaft oil seals, lightly oil outer circumference and fill space between sealing lips - arrow- with a small amount of 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.
- ◆ After renewing seals and gaskets, check oil level in gearbox
=>Page 64 .

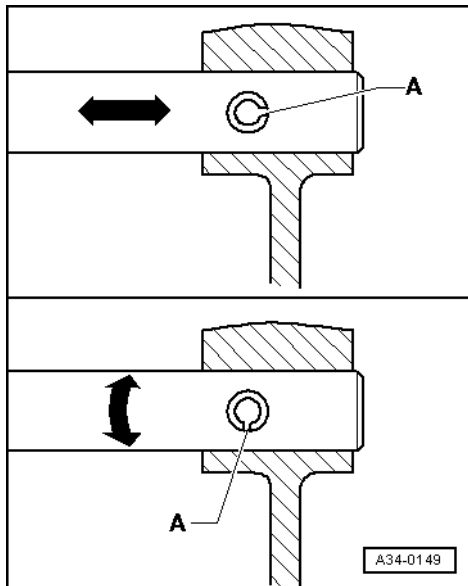
Sealants

- ◆ Thoroughly clean housing joint surfaces before applying sealing paste.
- ◆ Apply sealing paste AMV 188 001 02 or AMV 188 000 02 evenly, and not too thick.
- ◆ Breather holes must remain free of sealing paste.



Locking elements

- ♦ Do not overstretch circlips.
- ♦ Always renew circlips which have been damaged or over-tensioned.
- ♦ Circlips must locate properly in the groove.



- ♦ -> Renew spring pins. Position: slit -A- should be in line with the line of force -arrow-.

Nuts, bolts

- ♦ Loosen nuts or bolts in opposite sequence to the 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 the needle bearings of 1st to 5th speed sliding gears when removing. This ensures the same installation position when re-installing.
- ♦ Grease needle bearing for gearbox input shaft in rear of flywheel.
- ♦ Lubricate all bearings in gearbox housing with gear oil before installing.
- ♦ Heat inner races of taper roller bearings to approx. 100 °C before installing. Press in onto stop when installing so there is no axial clearance.
- ♦ Do not interchange the outer or inner races of bearings of the same size.
- ♦ Always replace the taper roller bearings on one shaft together and use new bearings from a single manufacturer.
- ♦ The taper roller bearings for the output shaft and the differential in the gearbox are low-friction bearings. Do not additionally oil new taper roller bearings when measuring friction torque. The bearings are pre-treated at the factory with a special type of oil for this purpose.

Shims

- ♦ Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain the exact shim thickness required.
- ♦ Inspect for burrs and signs of damage. Install only shims which are in perfect condition.

Synchroniser rings

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

Gears, synchro-hubs, inner races for sliding gears

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

Sliding gears

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

Clutch mechanism

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

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30 - Clutch

1 - Servicing clutch mechanism

1.1 - Servicing clutch mechanism

Warning

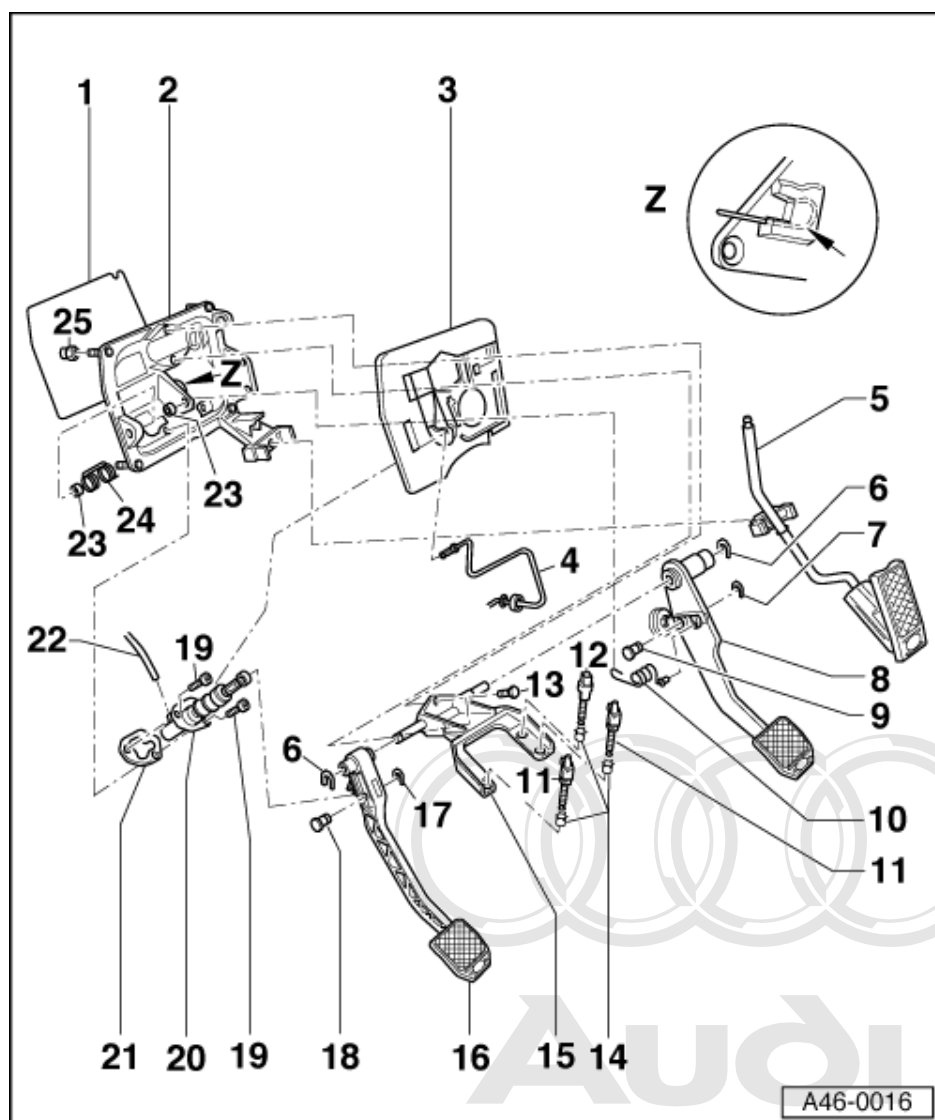
Contact corrosion. Notes => Page 6.

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Notes:

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

1.2 - Assembly overview, pedal cluster

**1 Butyl cord**

- ♦ Always renew

2 Pedal bracket

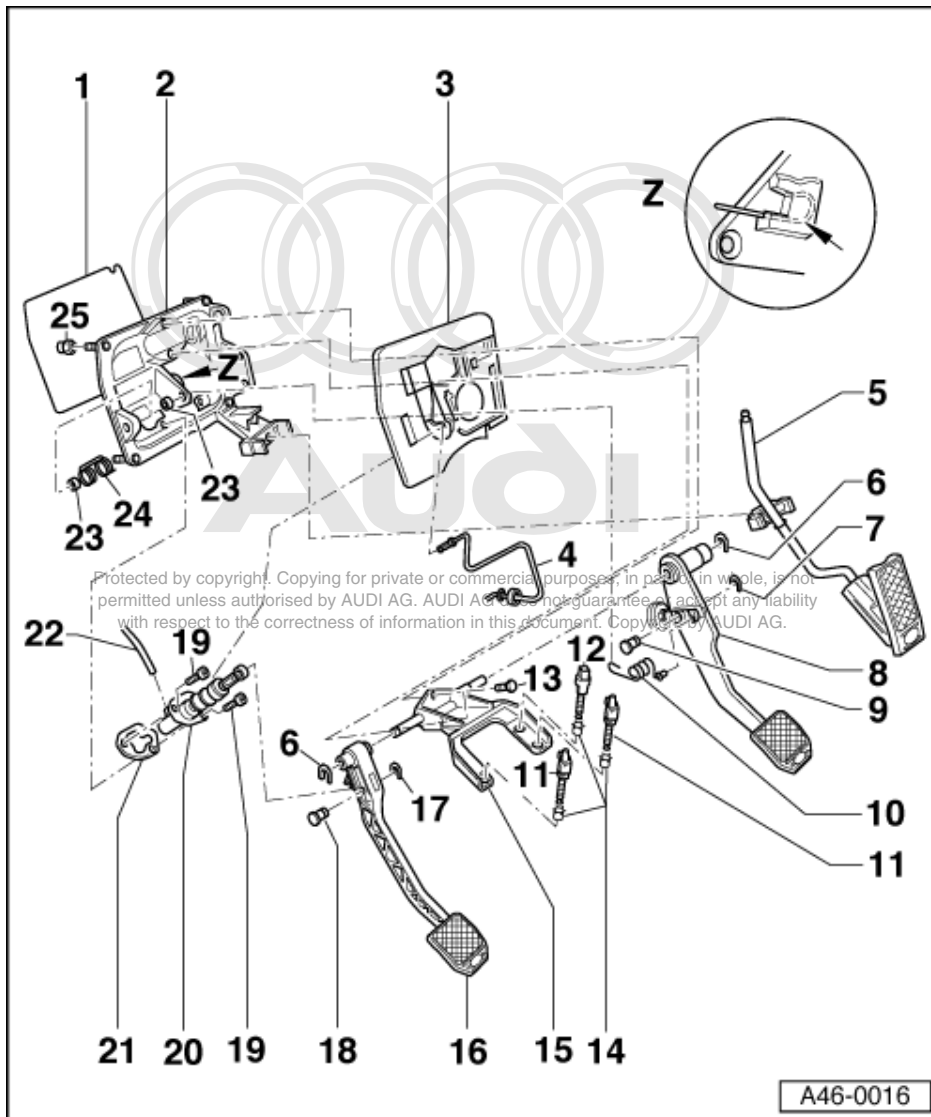
- ♦ Removing and installing

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 46; Assembly overview, pedal cluster for LHD vehicles; Removing and installing pedal cluster for LHD vehicles Assembly overview, pedal cluster for LHD vehicles Removing and installing pedal cluster for LHD vehicles

3 Insulation**4 Pipe**

- ♦ For clutch master cylinder
- ♦ Tighten nut on pipe connection to 15 Nm

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5 Accelerator pedal

- ♦ Removing and installing

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 46; Assembly overview, pedal cluster for LHD vehicles; Removing and installing pedal cluster for LHD vehicles Assembly overview, pedal cluster for LHD vehicles Removing and installing pedal cluster for LHD vehicles

6 Circlip

- ♦ Renew
- ♦ Fit onto mounting bracket shaft

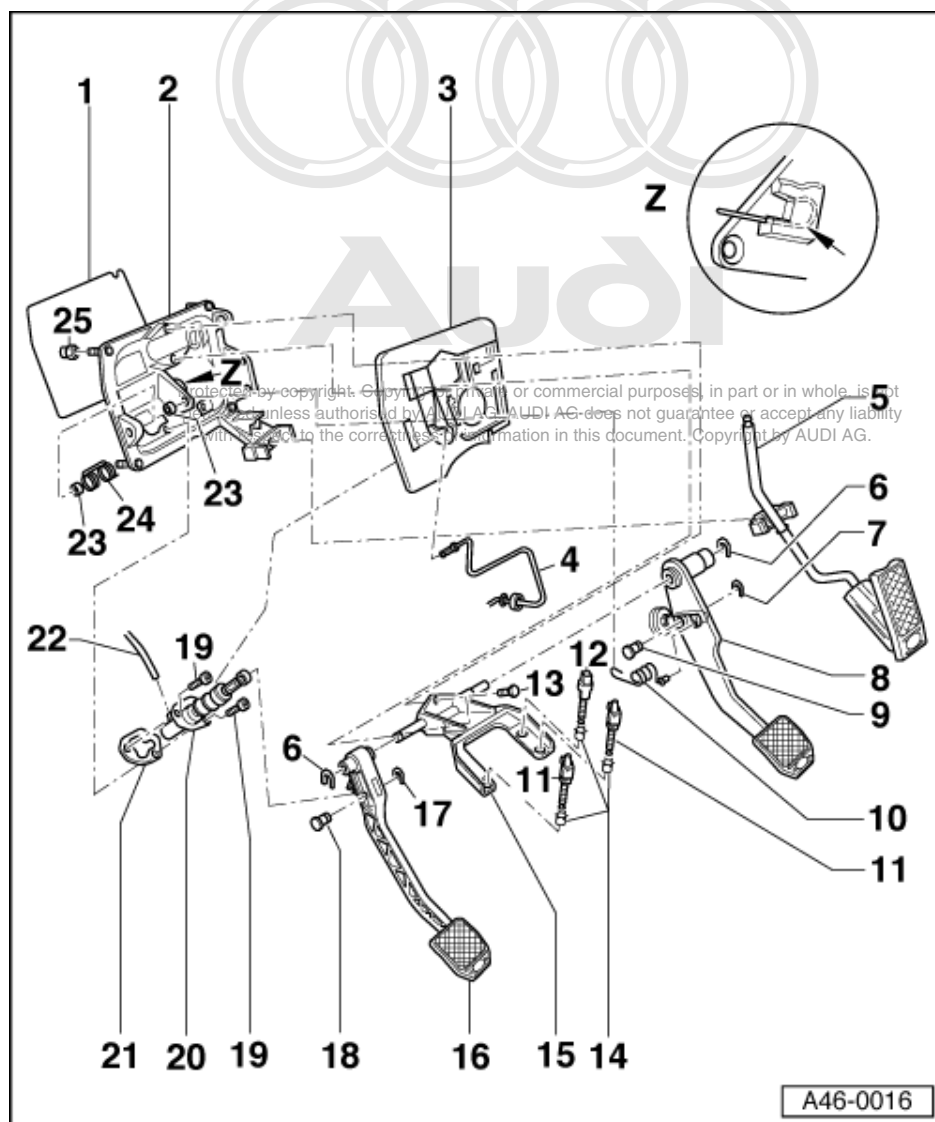
7 Circlip

- ♦ Renew
- ♦ Fit onto pin

8 Brake pedal

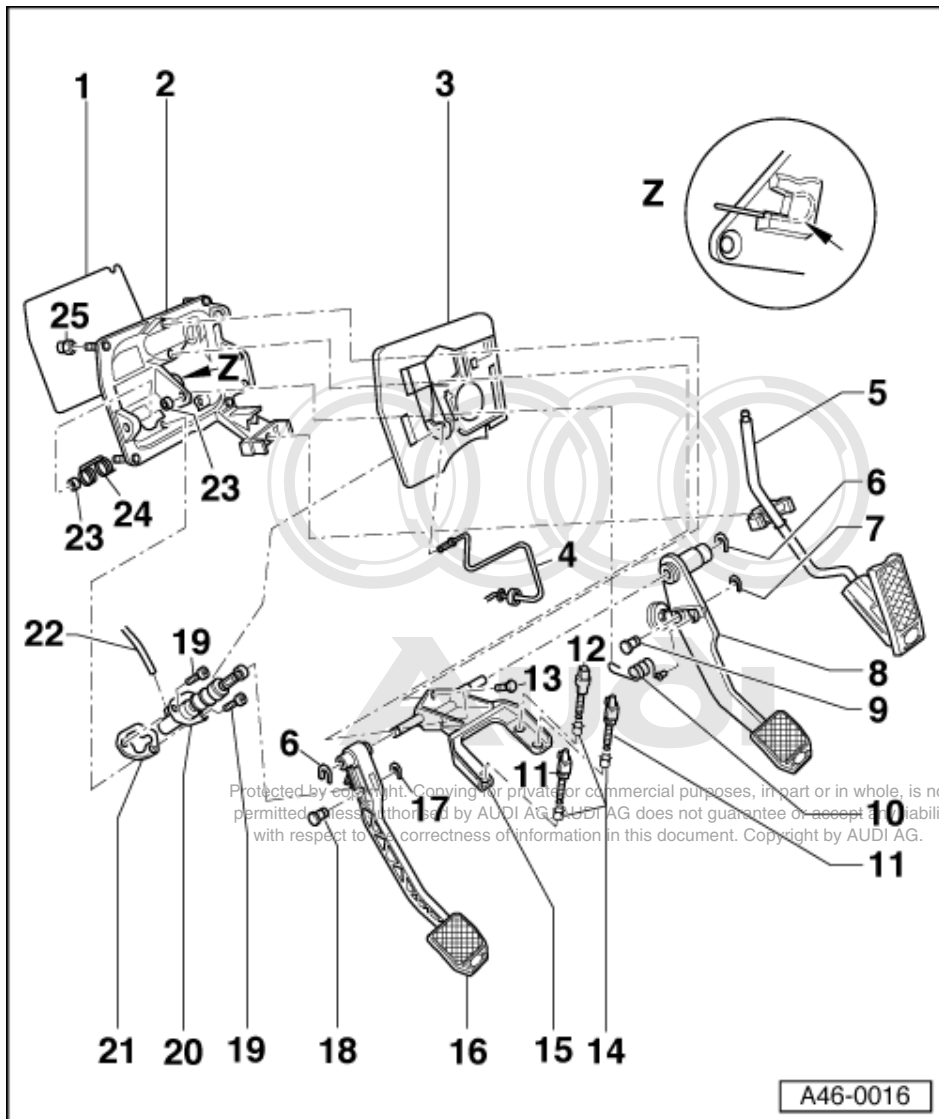
- ♦ Removing and installing

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 46; Assembly overview, pedal cluster for LHD vehicles; Removing and installing pedal cluster for LHD vehicles Assembly overview, pedal cluster for LHD vehicles Removing and installing pedal cluster for LHD vehicles



- 9 Pin
 10 Coil spring
 11 Breather valves
 ♦ For cruise control system
 12 Brake light switch
 13 Bolt - 20 Nm
 14 Clip
 ♦ Renew
 ♦ Insert into mounting bracket
 15 Bearing bracket
 ♦ Removing and installing

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 46; Assembly overview, pedal cluster for LHD vehicles; Removing and installing pedal cluster for LHD vehicles Assembly overview, pedal cluster for LHD vehicles Removing and installing pedal cluster for LHD vehicles



16 Clutch pedal

- ♦ Is fixed in position by adjusting the plastic clevis
- ♦ Fit onto mounting bracket shaft
- ♦ Removing and installing
=>Page 16

17 Circlip

- ♦ Renew
- ♦ Fit onto pin

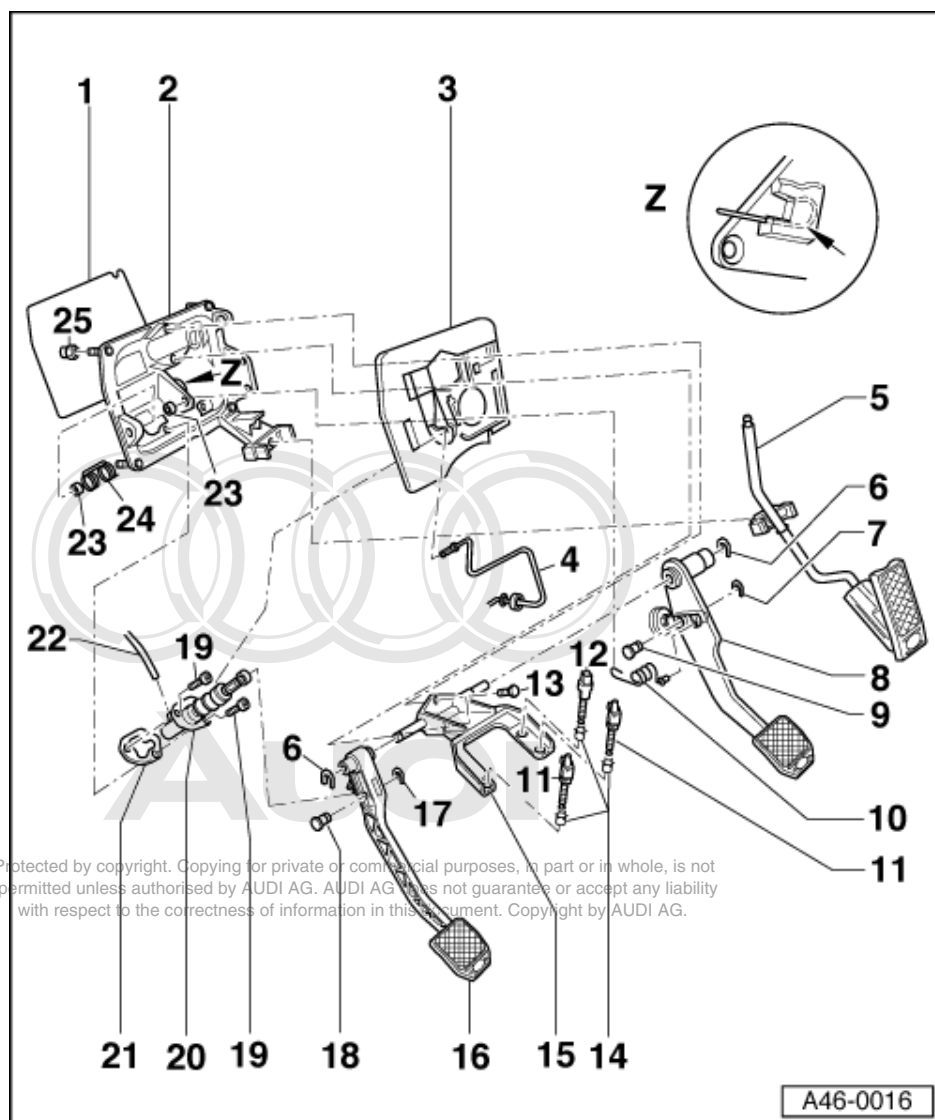
18 Pin

- ♦ Insert into clutch pedal and master cylinder

19 Bolt - 20 Nm

20 Master cylinder

- ♦ Renew if leaking
- ♦ Removing and installing
=>Page 20
- ♦ Adjusting plastic clevis=>Fig. 16



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21 Gasket

- ♦ Replace
- ♦ Insert between pedal bracket and master cylinder

22 Supply hose

- ♦ Fit onto master cylinder

23 Bearing bush

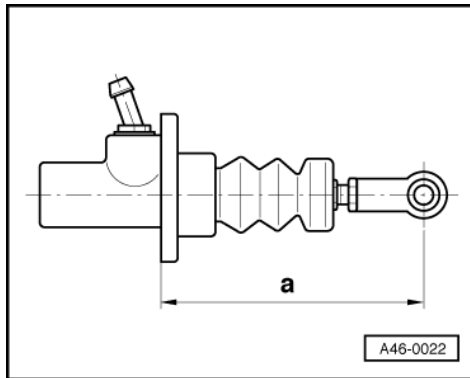
- ♦ Replace if damaged

24 Coil spring

- ♦ Do not grease
- ♦ Removing and installing
=>Page 16
- ♦ Press into pedal bracket as far as stop
=> Inset Z

25 Hexagon nut - 20 Nm

- ♦ Replace



-> Fig.1 Adjusting plastic clevis

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

Notes:

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

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

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1.3 - Removing and installing clutch pedal and coil spring

Removing

- Remove mounting bracket -item **13** .

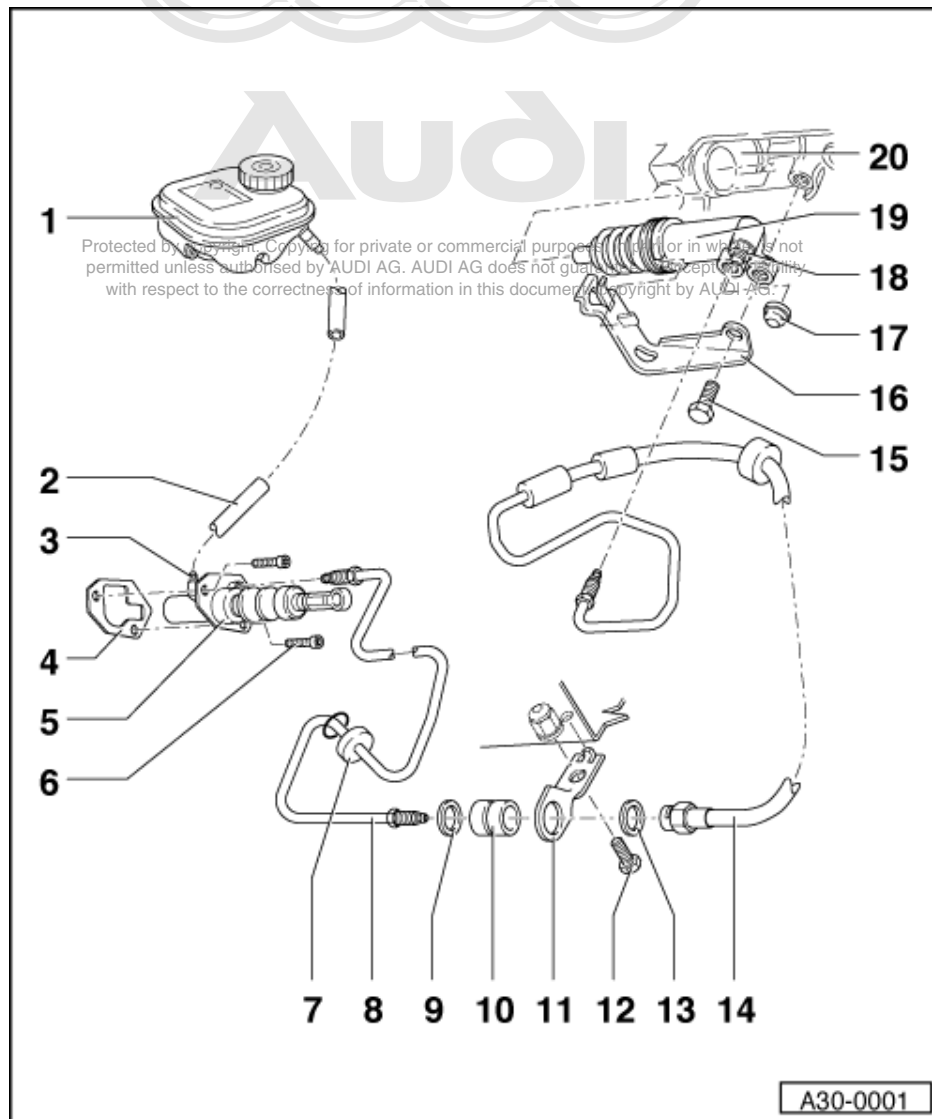
=> Running gear, Front-wheel drive and four-wheel drive; Repair group 46; Assembly overview, pedal cluster for LHD vehicles; Removing and installing pedal cluster for LHD vehicles Assembly overview, pedal cluster for LHD vehicles Removing and installing pedal cluster for LHD vehicles

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

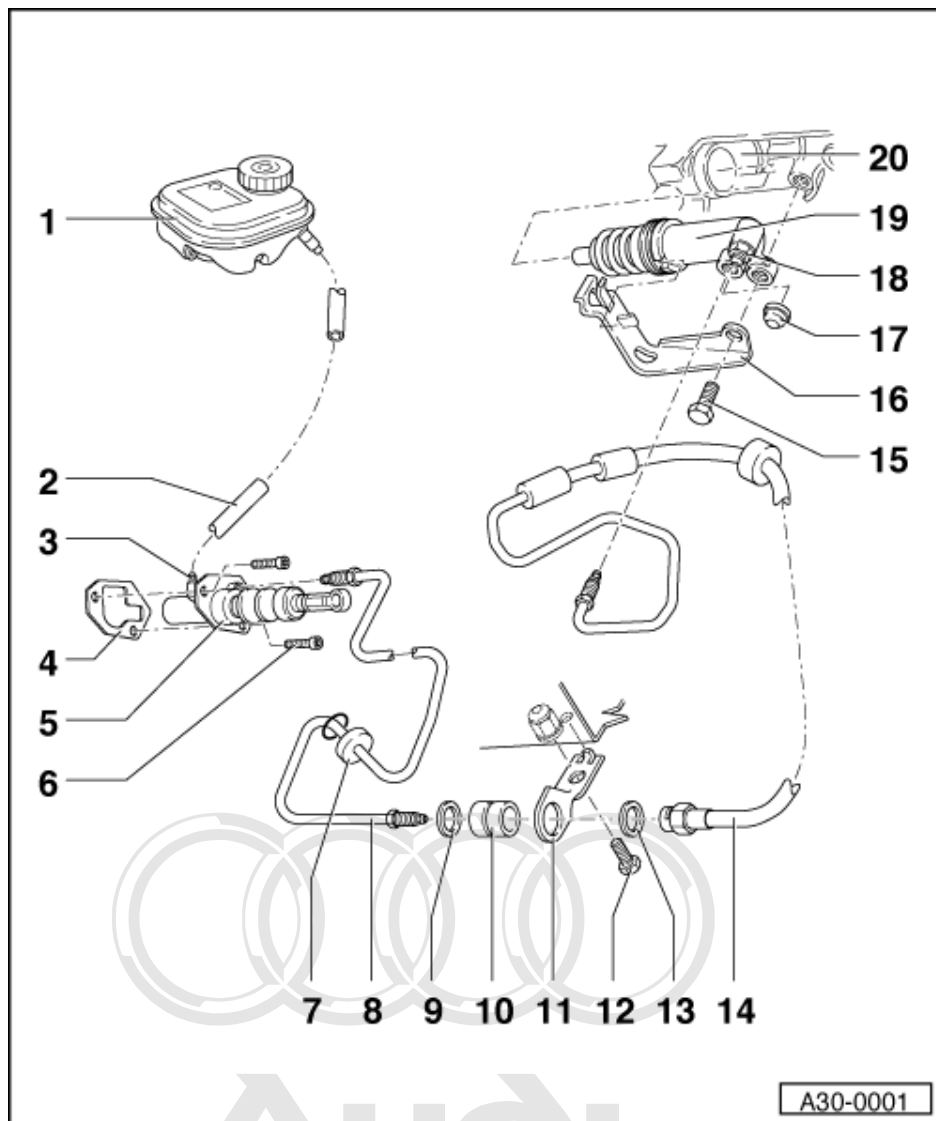
Installing

- 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 - Hydraulic system - general layout



- 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
 - ♦ Replace
 - ♦ Insert between pedal bracket and master cylinder
- 5 Master cylinder
 - ♦ Replace if leaking
 - ♦ Removing and installing
=>Page 20
 - ♦ Adjusting plastic clevis
=>Fig. 16



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

- 7 Grommet**

- 8 Pipe**
♦ With pipe union nut
♦ Tighten pipe union nut to 15 Nm

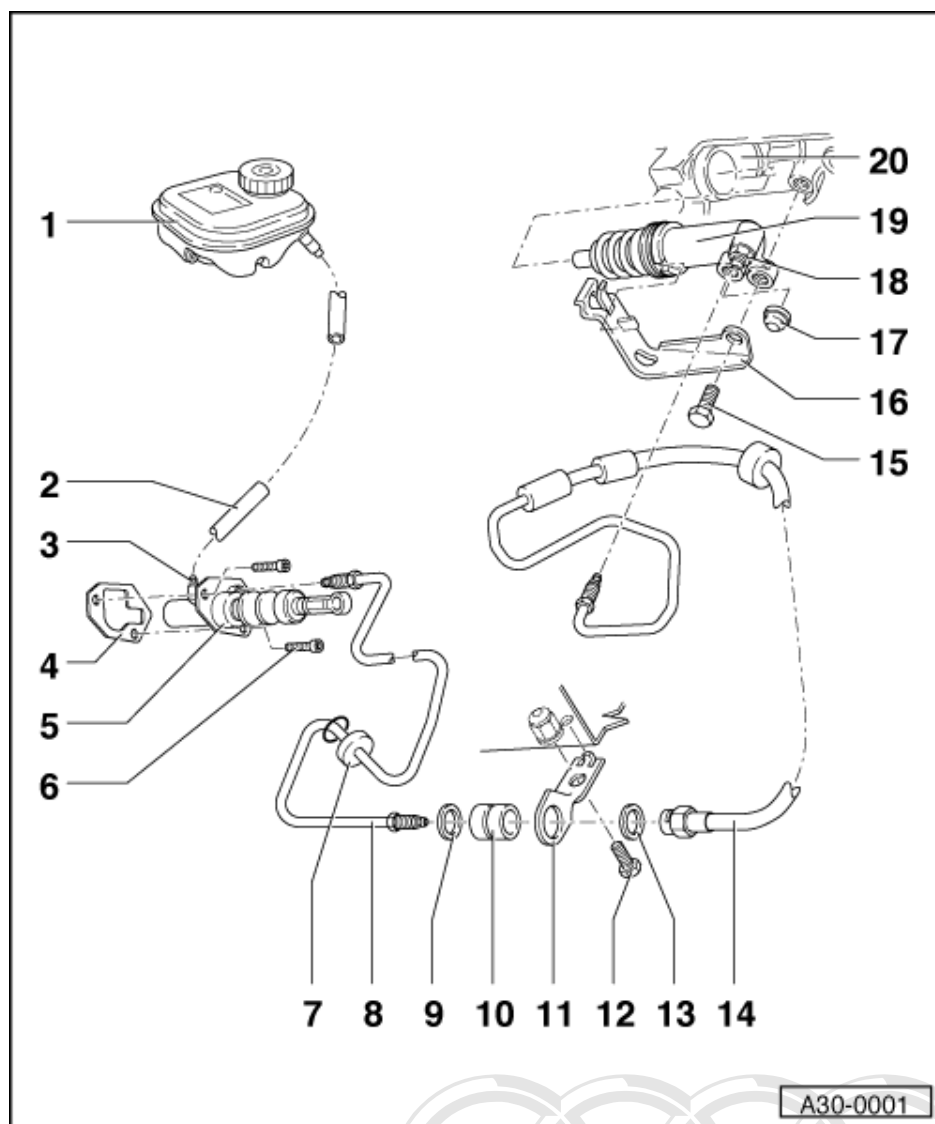
- 9 Washer**

- 10 Bush**

- 11 Bracket**

- ♦ For pipe

- 12 Bolt - 25 Nm**

**13 Washer****14 Hose/metal pipe**

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

15 Bolt

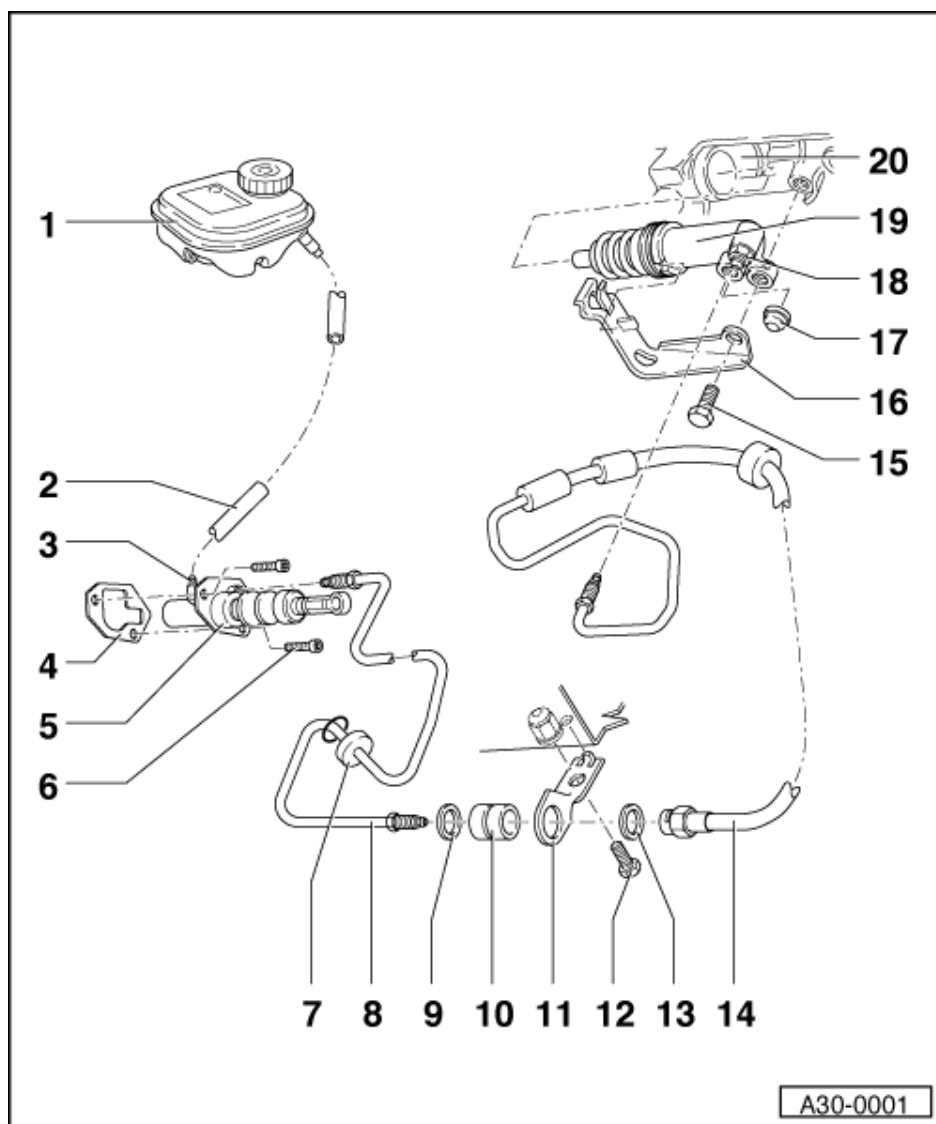
- ♦ Hexagon head bolt: apply locking fluid D 185 400 A2 and tighten to 25 Nm
- ♦ Self-locking hexagon socket head bolt: replace bolt and tighten to 20 Nm

16 Bracket for hose/pipe assembly

- ♦ Engage on clutch slave cylinder

17 Dust cap

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18 Bleed valve

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

19 Slave cylinder

- ◆ Do not operate clutch pedal after slave cylinder has been removed.
- ◆ Installing => Fig. 27
- ◆ On slave cylinders with plastic support ring, grease outer surface of ring when installing
- ◆ After working on hydraulic clutch mechanism, bleed slave cylinder => Page 22

20 Gearbox

1.5 - Removing and installing master cylinder

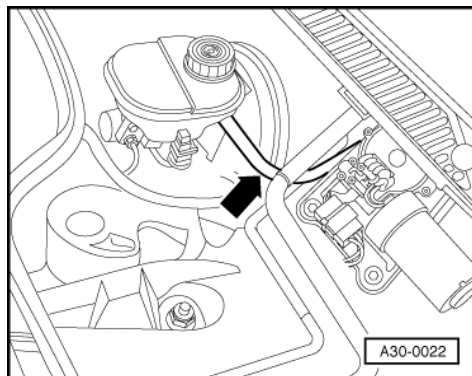
Special tools, testers and auxiliary items

- ◆ Hose clamp 3094

Removing

Notes:

- ♦ Make sure that no brake fluid escapes into the plenum chamber or onto the gearbox below. If this does happen, clean the affected areas thoroughly.

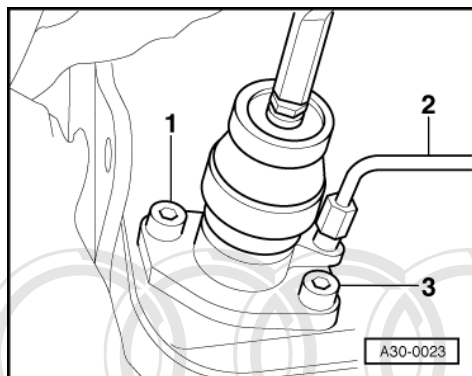


- ♦ When performing work in the footwell, put cloths on the carpet to protect it from possible brake fluid spills.

- Remove mounting bracket -item 13 .

=> Running Gear, Front-wheel drive and four-wheel drive; Repair Group 46; Assembly overview, pedal cluster for LHD vehicles; Removing and installing pedal cluster for LHD vehicles. Assembly overview, pedal cluster for LHD vehicles Removing and installing pedal cluster for LHD vehicles.

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



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

Installing

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

Replace gasket.

Bleed clutch system after installing master cylinder

=>Page 22 .

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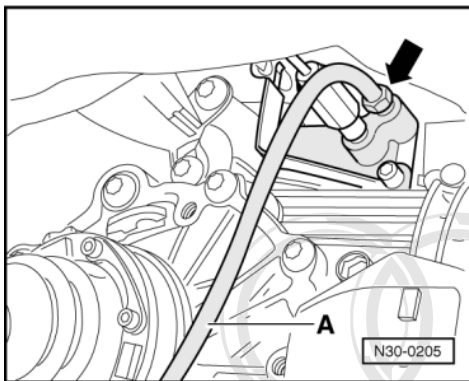
1.6 - Bleeding clutch system

Special tools, testers and auxiliary items

- ♦ Brake filler and bleeder unit V.A.G 1238 B or V.A.G 1869

Notes:

- ♦ When performing the following steps, make sure that no brake fluid escapes onto the gearbox.
- ♦ The clutch system must be bled after performing work on hydraulic clutch mechanism.
- ♦ Top-up brake fluid reservoir to "max." marking with brake fluid before bleeding clutch system.
- Pull clutch pedal back to its normal position.
- Connect brake filling and bleeding appliance V.A.G 1238 B or V.A.G 1869, but do not switch on at this stage.



- -> Connect bleed hose -A- to slave cylinder (arrow) and open bleed valve.
- Connect bleeder hose to pressure hose of fluid collector bottle.
- Switch on bleeder appliance and allow about 100 cm³ of brake fluid to drain out.
 - Working pressure 2.5 bar

Note:

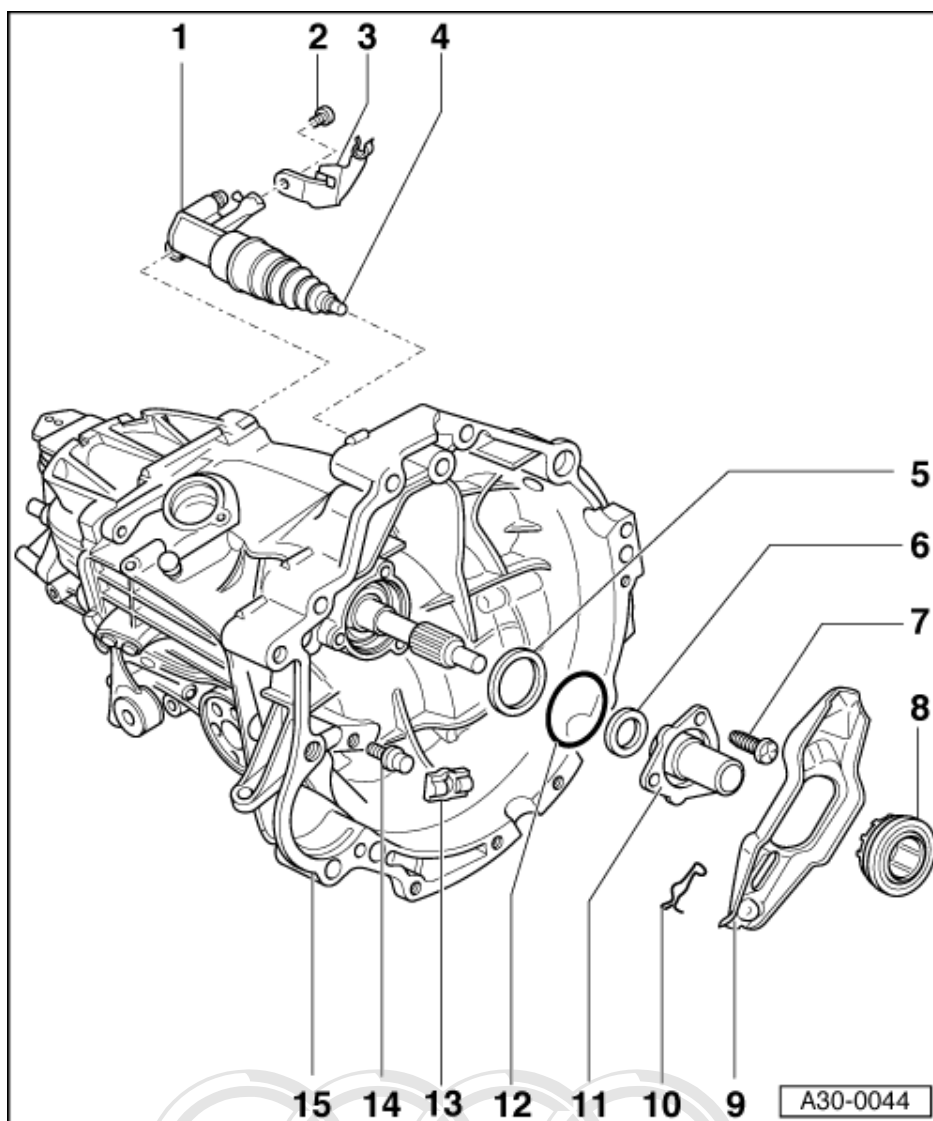
Ensure bleeder hose is correctly fitted during bleeding operation.

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- Close bleeder screw. Tightening torque: 4.5 Nm
- Depress clutch pedal several times after completion of bleeding process.
- Bleed system again if necessary.

2 - Servicing clutch release mechanism

2.1 - Servicing clutch release mechanism



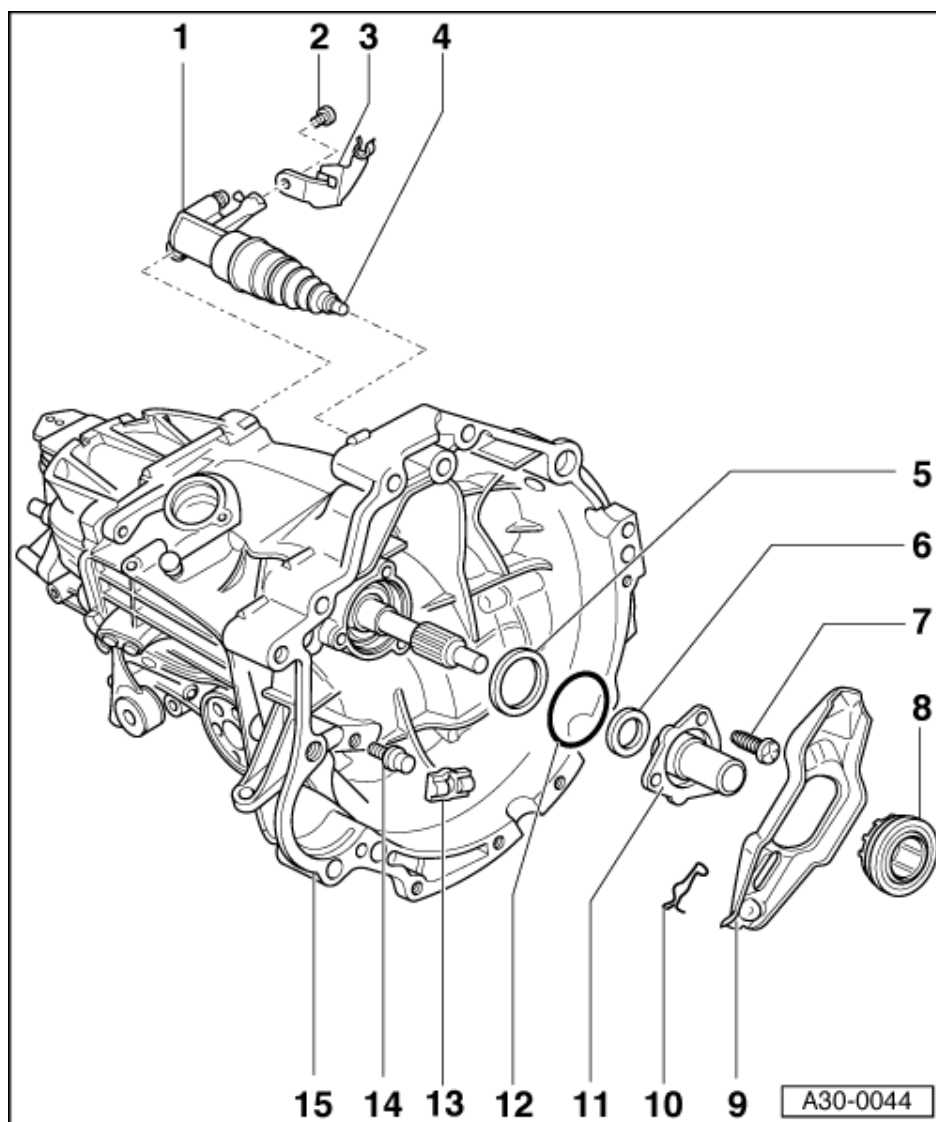
1 Slave cylinder

- ◆ Do not operate clutch pedal after slave cylinder has been removed.
- ◆ Installing => Fig. 27
- ◆ When installing, press in so that securing bolt can be fitted easily.

2 Bolt

- ◆ Hexagon head bolt: apply locking fluid D 185 400 A2 and tighten to 25 Nm.
- ◆ Self-locking hexagon socket head bolt: replace bolt and tighten to 20 Nm.

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3 Bracket for hose/pipe assembly

- ◆ Engage on clutch slave cylinder

4 Plunger

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

5 Dished washer

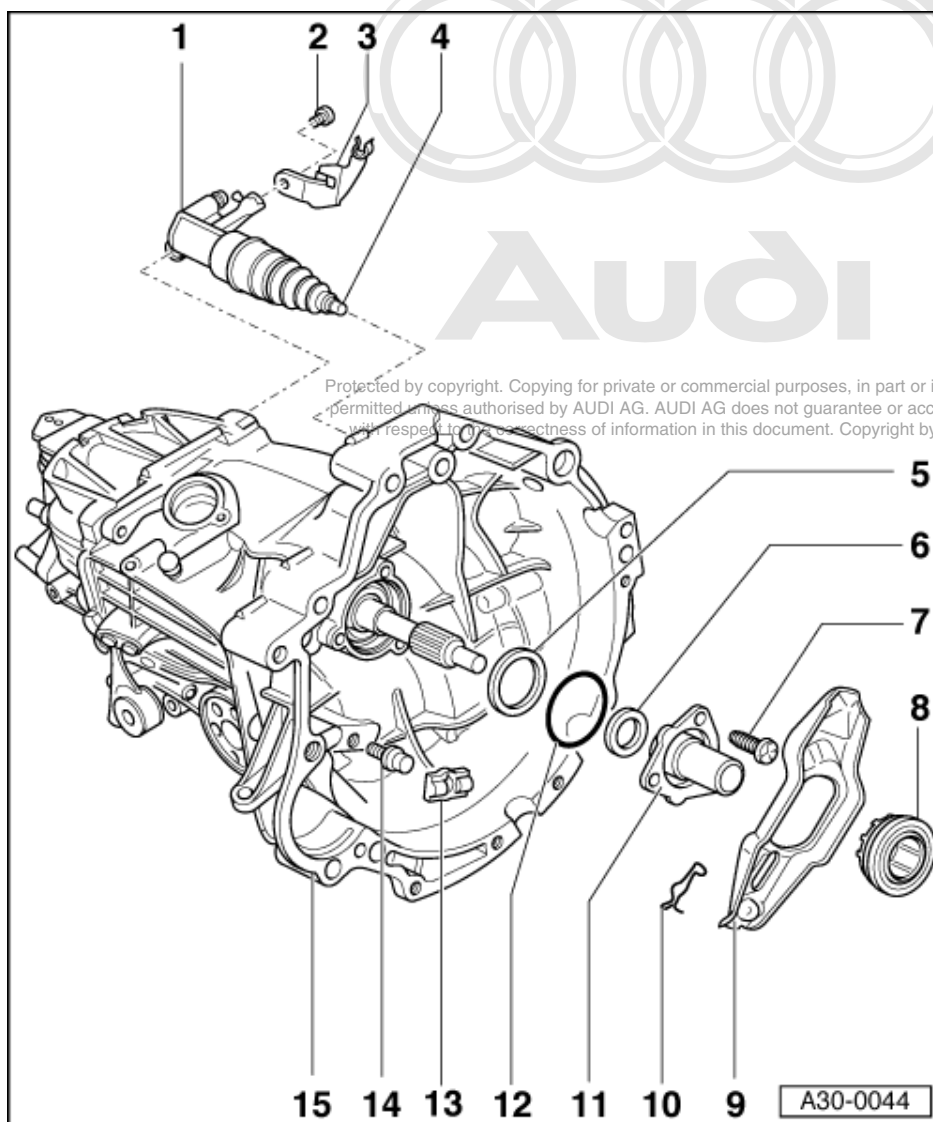
- ◆ Smaller diameter (convex side) to guide sleeve

6 Input shaft oil seal

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



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7 Torx socket head bolt,
35 Nm

- ◆ Self-locking
- ◆ Replace

8 Release bearing

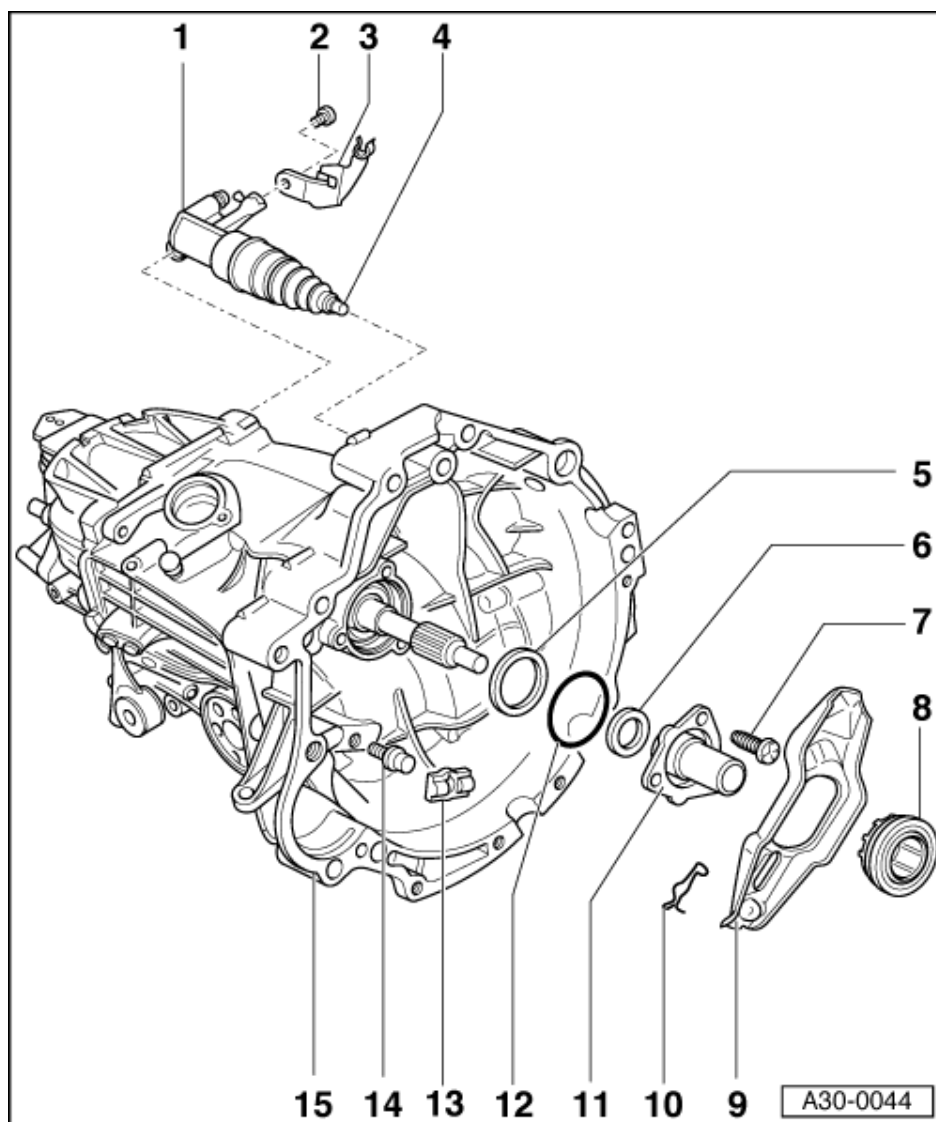
- ◆ Do not wash-out bearing, only wipe
- ◆ Replace noisy bearings

9 Clutch release lever

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

10 Retaining spring

- ◆ Secure to clutch release lever



11 Guide sleeve

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

12 O-ring

- ◆ Renew

13 Intermediate piece

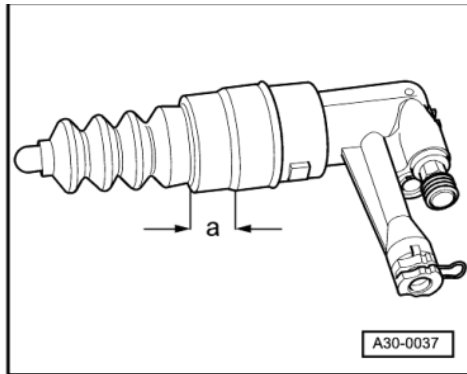
14 Ball stud

- ◆ Tighten to 25 Nm
- ◆ Lubricate with MoS2 grease

15 Gearbox

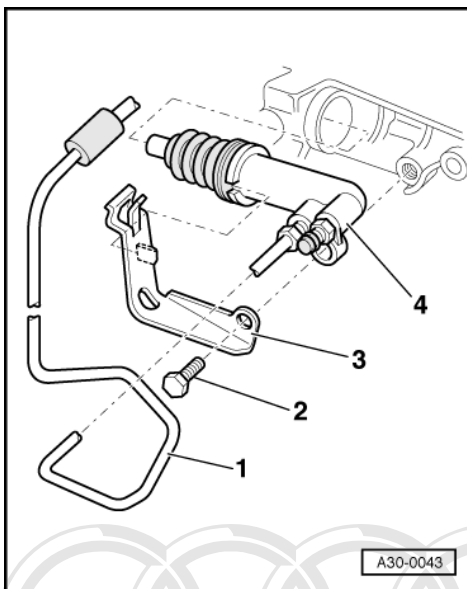


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→ Fig.1 Installing clutch slave cylinder

- Lightly lubricate contact surface for push rod at clutch release lever with copper grease, e.g. Z 381 351 TE.
- Before fitting slave cylinder into gearbox housing, lubricate area -a- on boot with lithium lubricant G 052 150 A2.
- 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.



- → Engage bracket -3- (if fitted) for pressure pipe -1- on slave cylinder and secure with bolt.

Notes:

- ♦ If the clutch slave cylinder -4- is inserted off-line there is a danger that the push rod will be guided past the clutch release lever.
- ♦ Pre-tension the clutch slave cylinder far enough for the securing bolt to be easily inserted.
- ♦ Installing securing bolt -2-
Hexagon bolt: apply locking fluid D 185 400 A2 when installing and tighten to 25 Nm.
Hexagon socket head bolt: renew bolt (self locking) and tighten to 20 Nm.

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3 - Servicing clutch

3.1 - Servicing clutch

Notes:

- ♦ Observe general repair instructions
=>Page 7 .



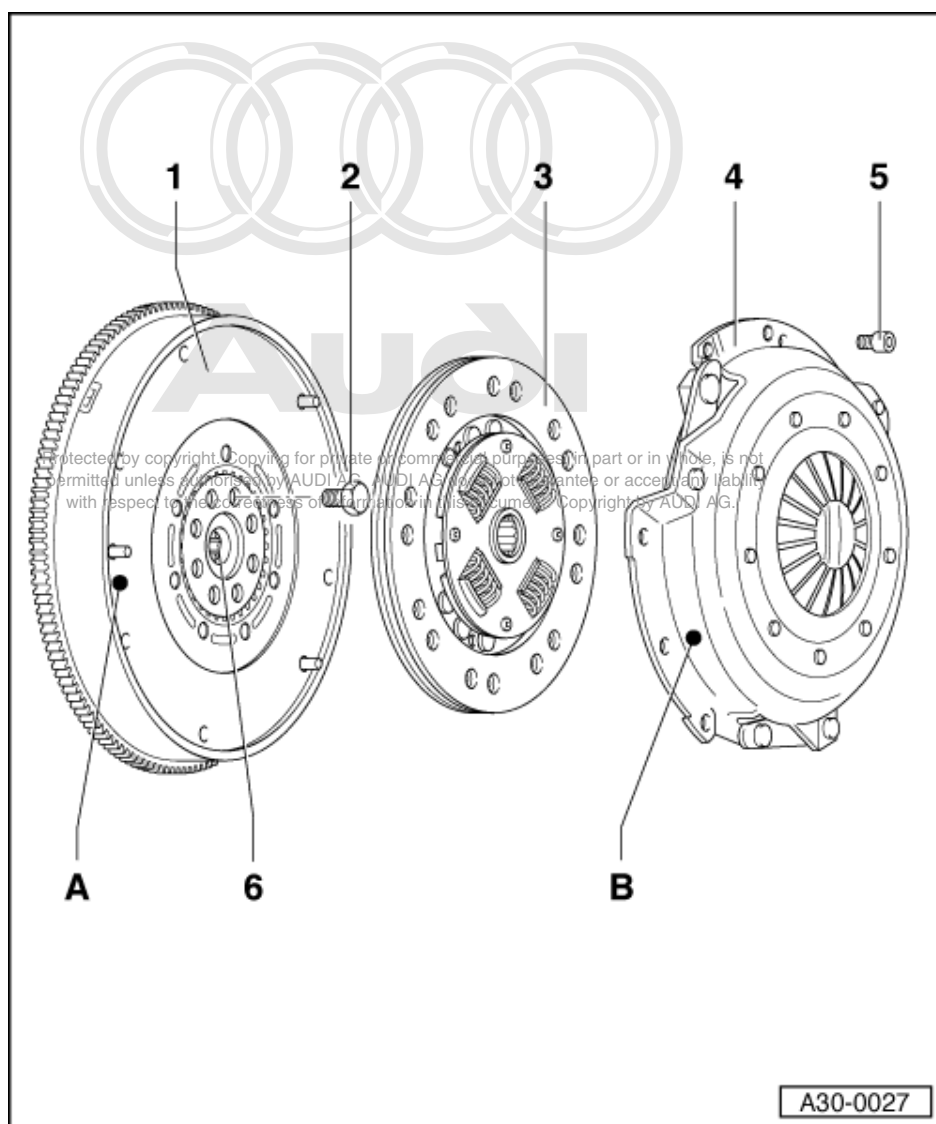
- ♦ Before renewing the clutch plate and pressure plate

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

- ♦ Replace clutch plates and pressure plates if they have damaged or loose rivets.
- ♦ Select the correct clutch plate and pressure plate according to engine code:

=> Parts catalogue

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



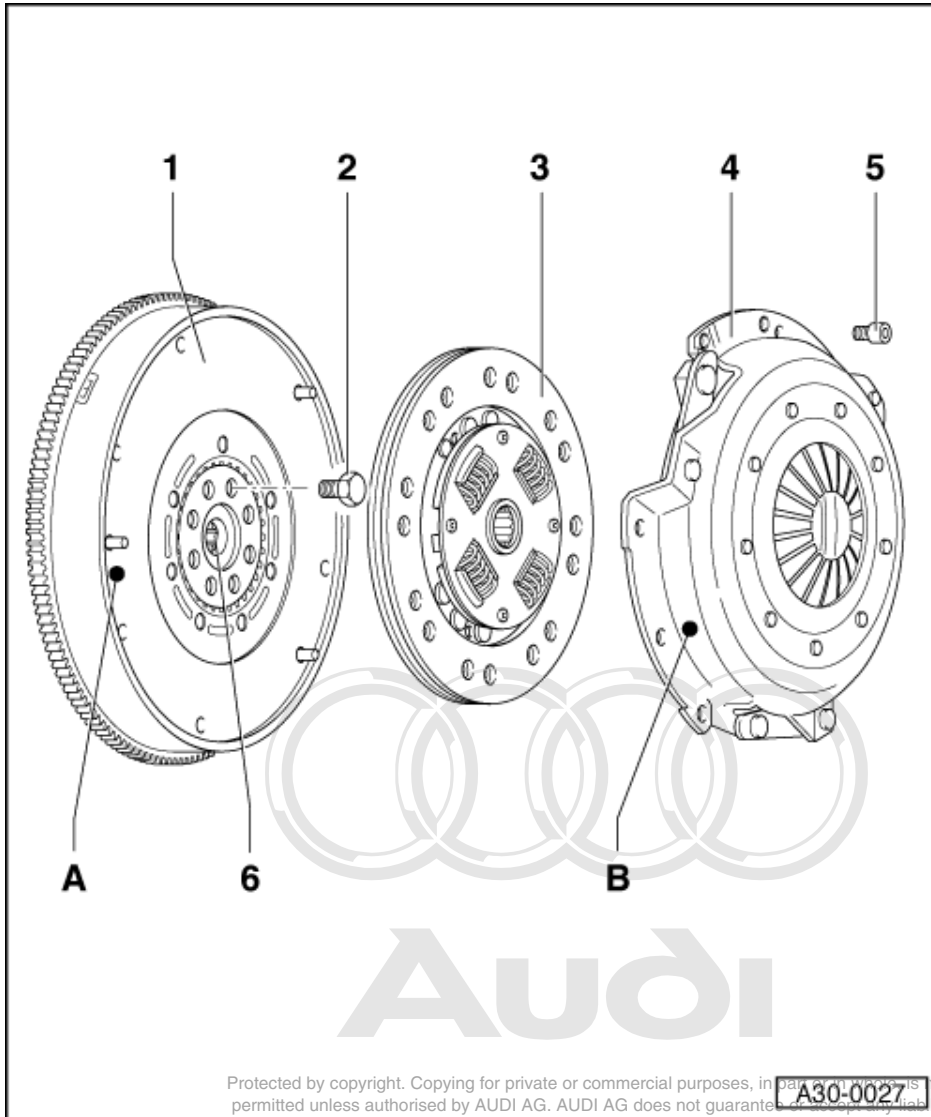
- Gearbox must be removed to work on the clutch
=>Page 54 .

A - Coloured marking on dual-mass flywheel

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

B - Coloured marking on pressure plate

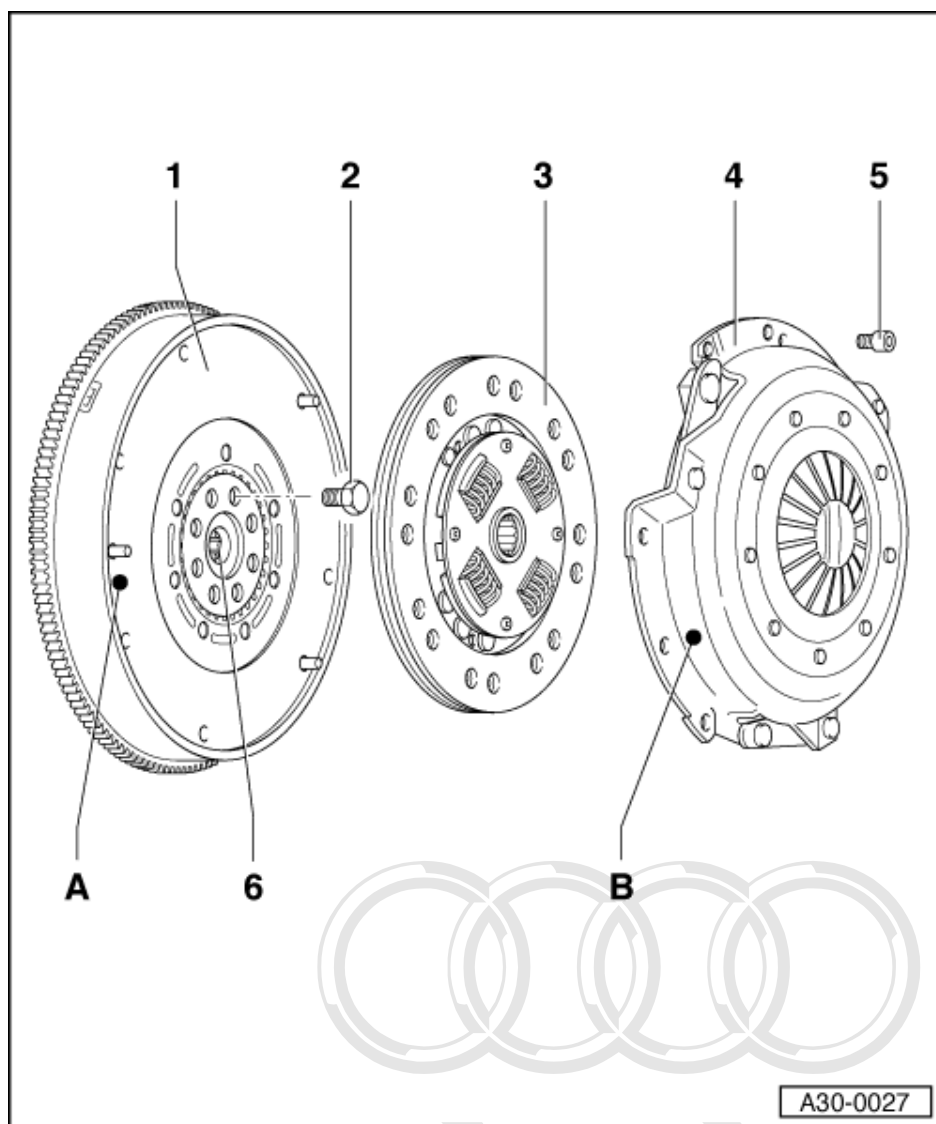
- ♦ On all 2.8 ltr 5V 142 kW engines
- ♦ On some 2.8 ltr 128 kW engines
- ♦ White marking -A- on dual-mass flywheel must coincide with white marking -B- on pressure plate.



1 Dual mass flywheel

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

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

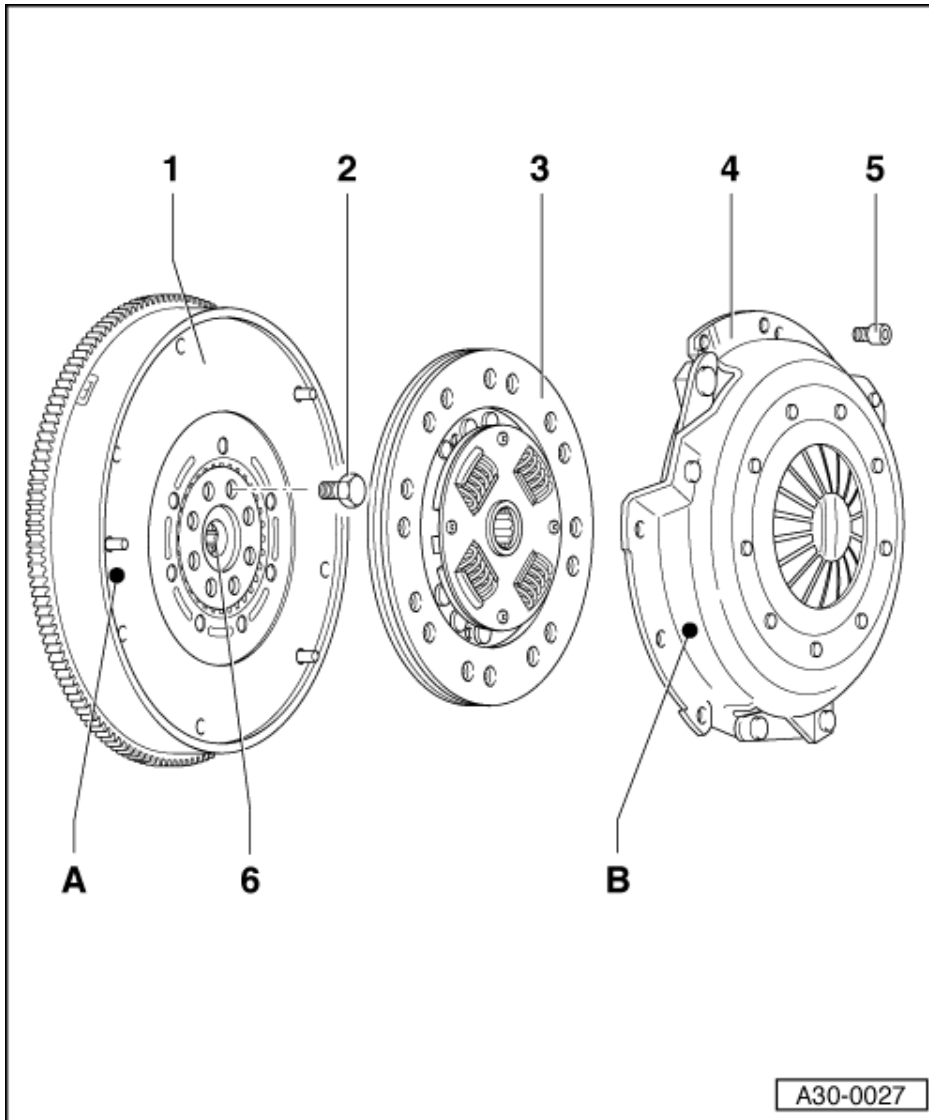


2 Bolt for dual-mass flywheel - 60 Nm + turn 180° further

- ◆ Renew

3 Clutch plate

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



4 Pressure plate

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

5 Bolt - 22 Nm

- ♦ Loosen and tighten gradually in several stages and in diagonal sequence

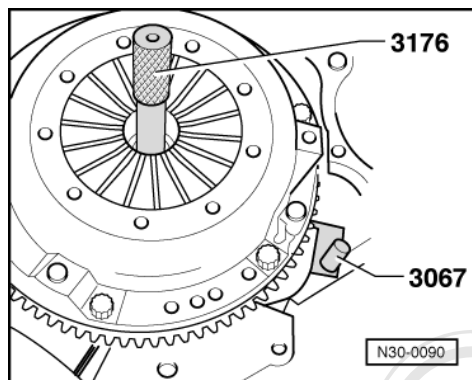
6 Needle roller bearing

- ♦ Removing and installing

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



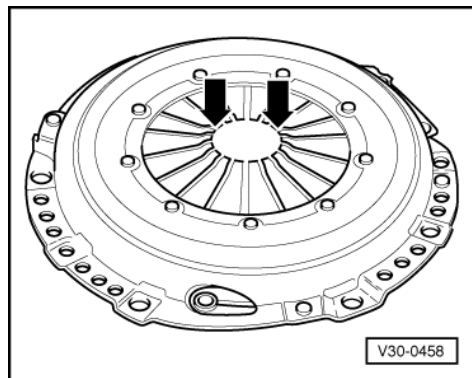
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-> Fig.1 Centring clutch plate and removing and installing pressure plate

Special tools, testers and auxiliary items

- ♦ Retainer 3067
- ♦ Mandrel 3176
- Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" towards pressure plate and gearbox
- On vehicles with 2.8 ltr 5V 142 kW engine (and on 2.8 ltr 128 kW engine, if marking provided), ensure that white marking on dual-mass flywheel coincides with white marking on pressure plate when assembling.
- Clutch lining and contact surface of pressure plate must make full contact with flywheel before securing bolts are inserted.
- Loosen and tighten bolts in several stages and in diagonal sequence - 22 Nm.
- Reverse position of retainer 3067 when removing.
- Use mandrel 3176 to centre clutch plate.

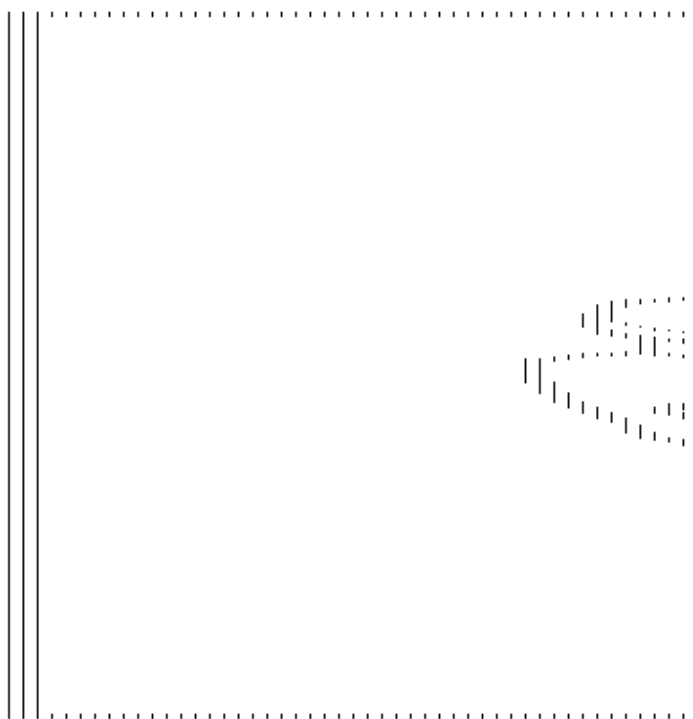


-> Fig.2 Checking ends of the diaphragm spring

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

Note:

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



-> Fig.3 Checking spring connection and riveted fastenings

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



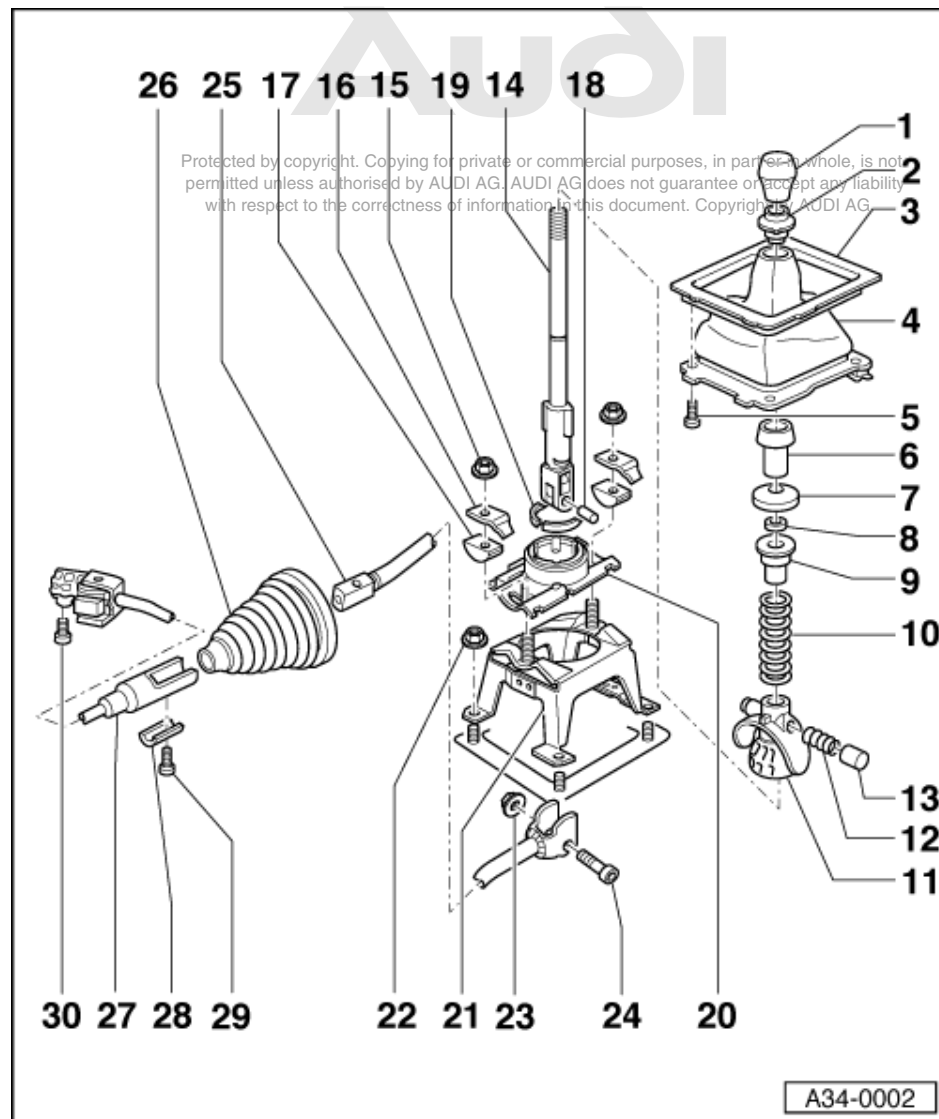
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34 - Controls, Housing

1 - Servicing selector mechanism

1.1 - Servicing selector mechanism



1.2 - Standard-travel selector mechanism

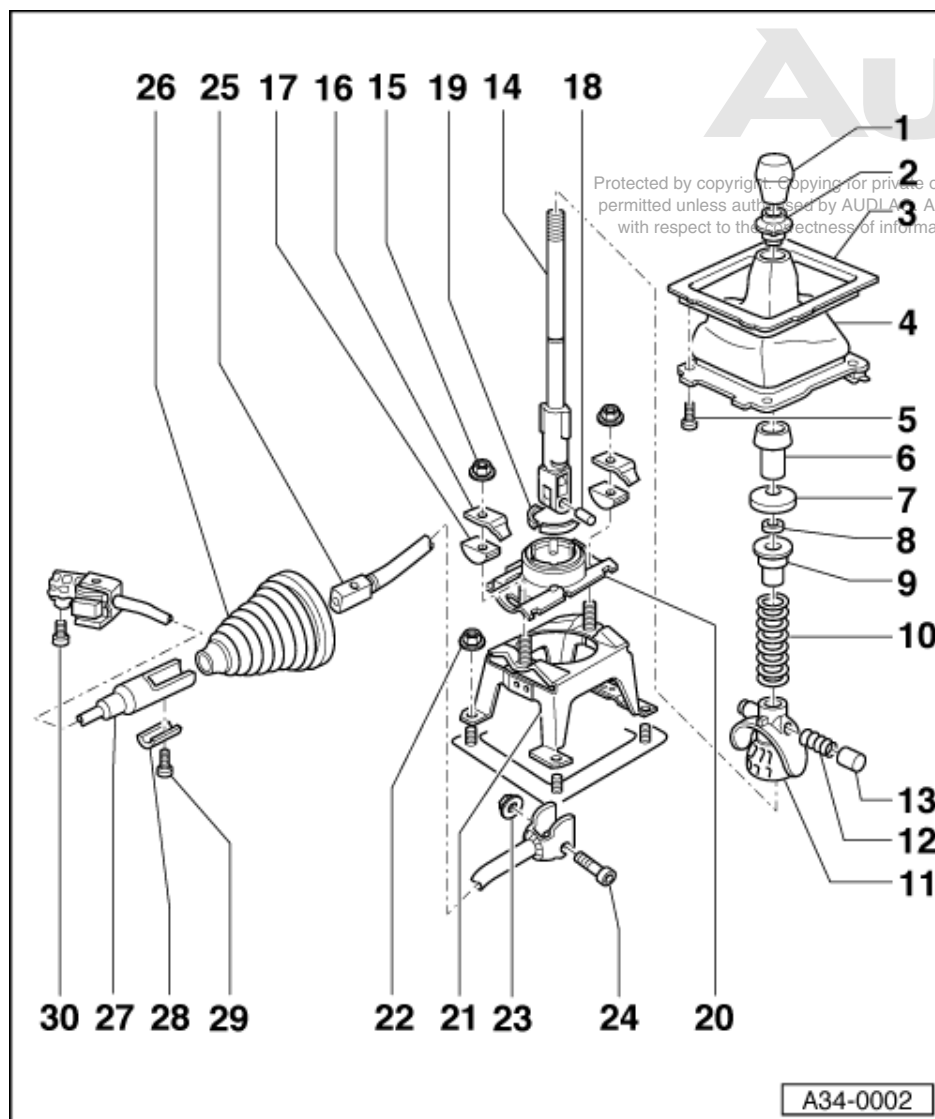
Contact corrosion.
Notes =>

Notes:

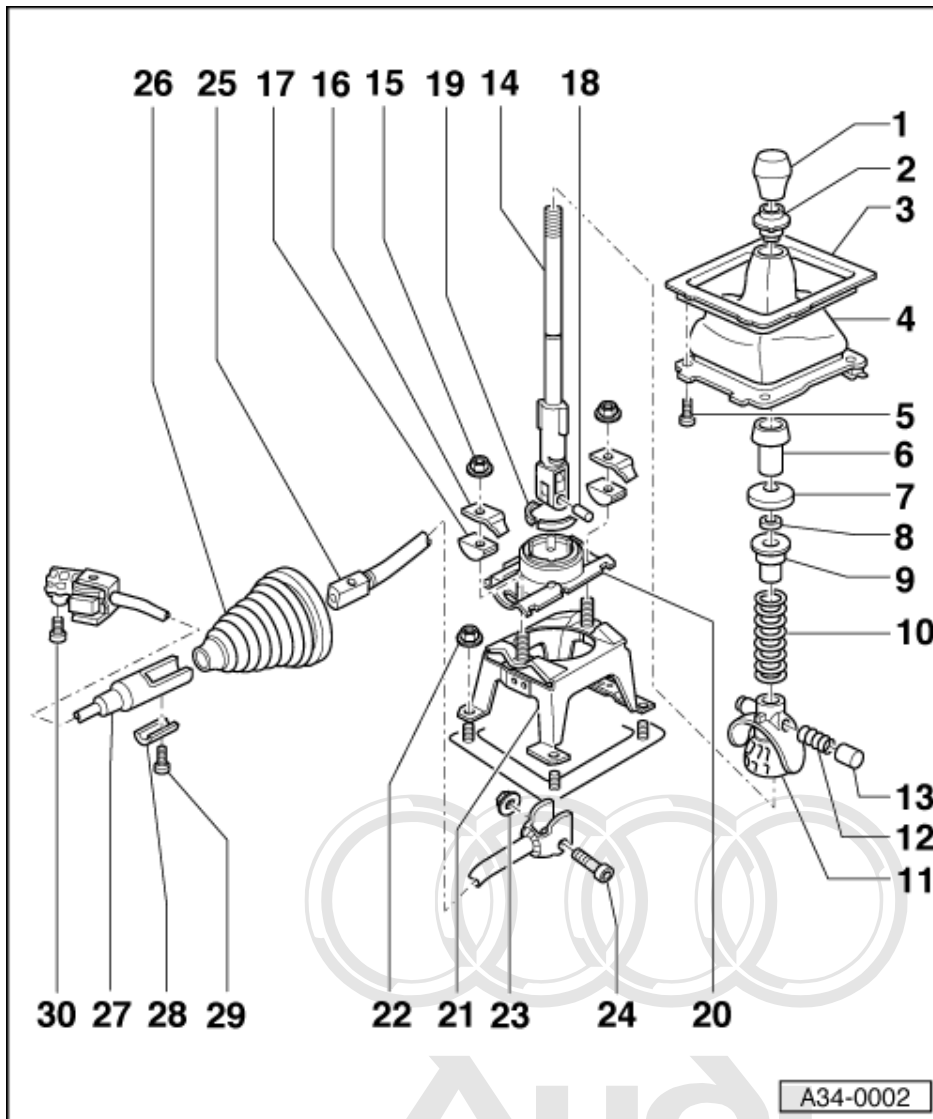
- ♦ Lubricate bearings and moving surfaces with polycarbamide grease, part No. G 052 142 A2.
- ♦ Adjusting gear selector mechanism

=>Page 39 .

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



- 4 Cover (gaiter)
 - ♦ Retainer on rear of cover; prise out carefully from centre console.
- 5 Bolt
- 6 Bush
- 7 Sealing collar
- 8 Circlip
 - ♦ Do not open out too far when fitting
- 9 Spacer bush
- 10 Spring
- 11 Ball stop
 - ♦ Insert spring and bush in the ball stop and assemble on the gear stick so that the spring and bush are on the right when looking forwards.
 - ♦ Install ball stop before fitting circlip (item 19).



12 Spring

13 Bush

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

14 Gear stick

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

15 Nut - 25 Nm

16 Leaf spring

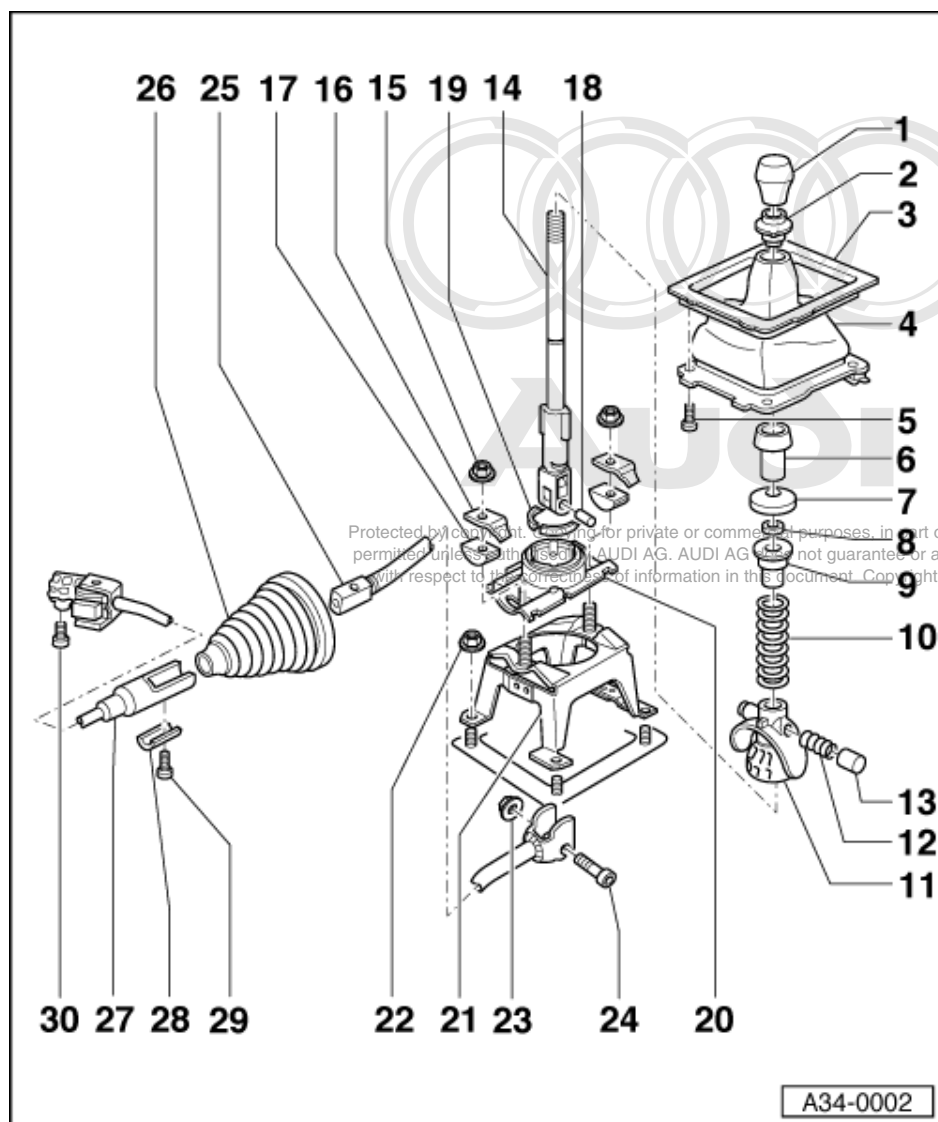
- ♦ Not fitted on all versions

17 Connector

18 Spacer

19 Circlip

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

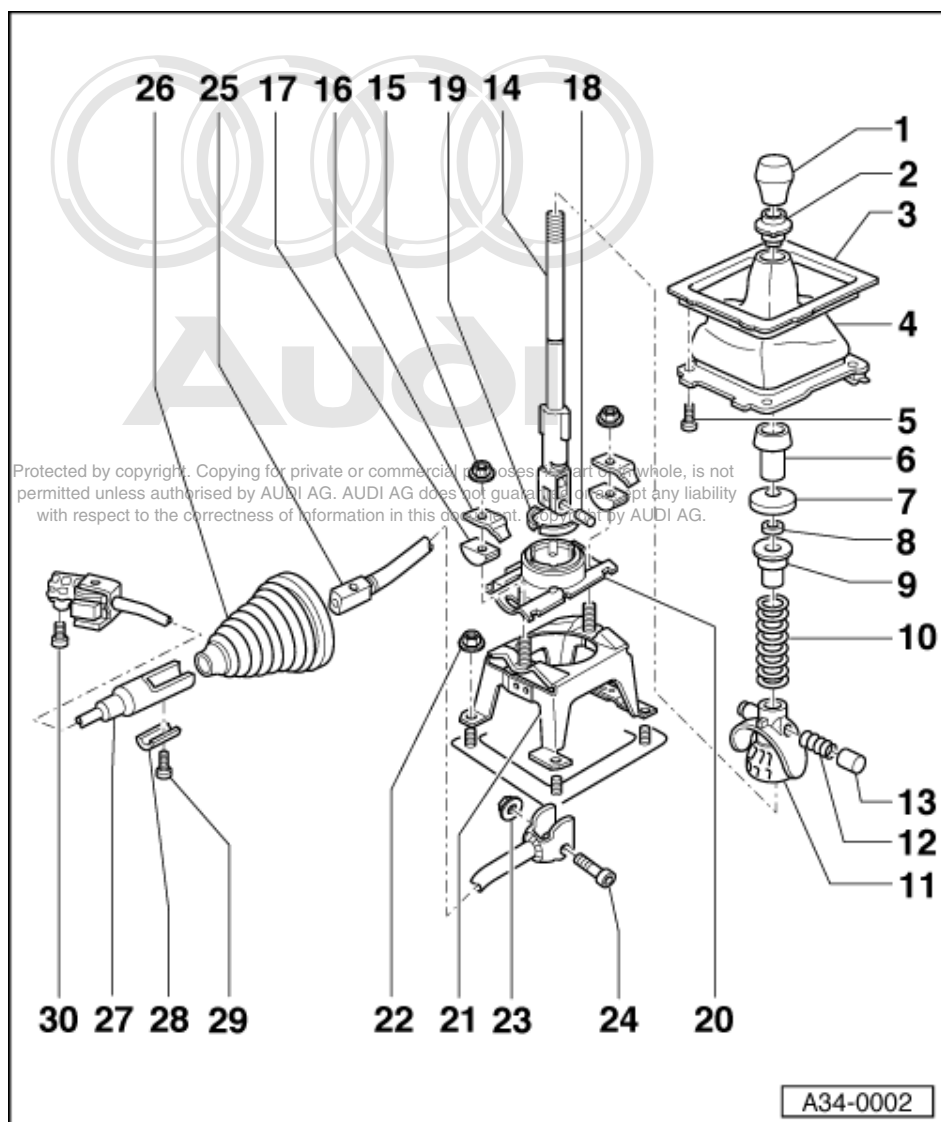
**20 Ball housing**

- ◆ Limit pieces for ball stop on left and right sides must be engaged
- ◆ Installation position: reverse detent faces left
- ◆ With buffer for ball stop -Item **11** -

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

- ◆ Self-locking
- ◆ Renew

24 Bolt**25 Rear selector rod**



26 Bellows

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

27 Front selector rod

- ♦ With selector joint

28 Clamp

29 Bolt - 23 Nm

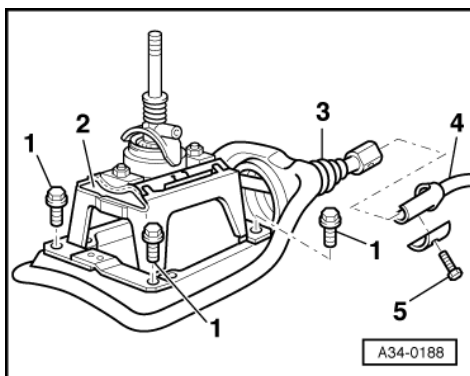
- ♦ Before slackening bolt, take off and push back heat shield

30 Bolt - 20 Nm

- ♦ Self-locking
- ♦ Renew

1.3 - Removing and installing standard-travel selector mechanism

Removing



- -> Unscrew bolts -5- on front selector rod -4-.
- Pull off bellows -3- from underside of body.
- Remove centre console:

=> General body repairs, Interior; Repair group 68; Storage compartments and covers; Removing and installing centre console and handbrake lever trim Storage compartments and covers Removing and installing centre console and handbrake lever trim

- Unscrew bolts -1- securing console to body.
- Remove selector mechanism together with console -2-, bellows -3- and rear selector rod out of centre tunnel from the inside.

Installing

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

- Push selector rod on so that the securing bolt fits in the recess in the selector shaft.
- Make sure lips of bellows are securely fitted around opening in body.

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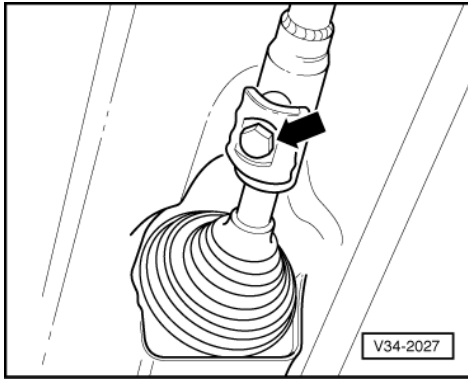
Tightening torques

Component	Nm
Console to centre tunnel	10
Front selector rod to rear selector rod	23

1.4 - Adjusting standard-travel selector mechanism

Requirements:

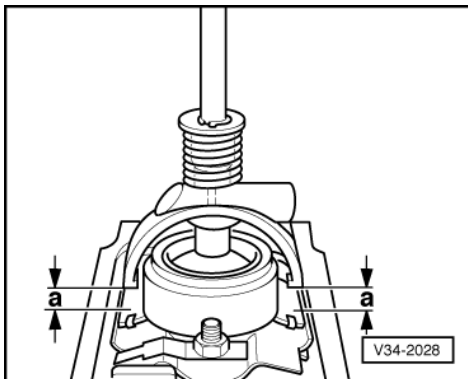
- ♦ Moving parts of selector mechanism and transmission elements must be in proper condition.
- ♦ Selector mechanism must move freely.
- ♦ Gearbox, clutch and clutch mechanism must be in proper condition.
- ♦ Gearbox in neutral.
- Unbolt heat shield and push it towards the rear, so that bolt securing selector rod is accessible.



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

Note:

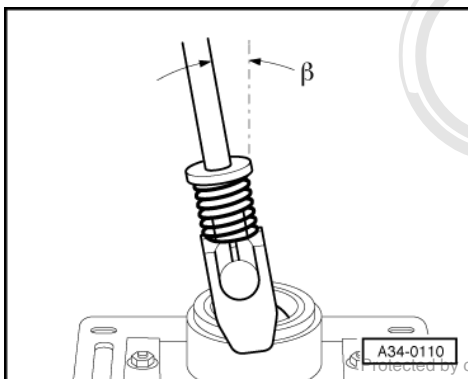
Shown in illustration with catalytic converter and heat shield removed.



- Remove gear stick knob and cover (gaiter).
- Adjust gear stick as follows:
 - Gear stick in vertical position
 - -> Distance -a- between ball stop buffers and ball housing should be equal on both sides.

Note:

The illustration shows the gear stick from behind (looking towards the front of the vehicle).



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

Note:

The illustration shows the gear stick from the right.

- Hold gear stick in this position (second mechanic required).

- Tighten selector rod bolt below vehicle to 23 Nm.

Note:

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

- Fit heat shield.

1.5 - Checking gear stick adjustment

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- The gear stick lever must rest in the 3rd/4th gear gate when gearbox is in neutral.
 - Operate clutch.
 - Check that all gears can be engaged.
 - Check operation of reverse gear lock.
 - Put gear stick into the 5th/reverse gear gate and move gear stick towards reverse gear (without applying excessive pressure on the gear stick).
 - The amount of travel until contact is made with reverse gear stop should be 5 ... 10 mm (measured at gear stick knob).
 - Reduce pressure on gear stick to let it move back.
 - The gear stick should return by itself from the 5th/reverse gate into the 3rd/4th gate.
 - Check fine adjustment if necessary.

Fine adjustment

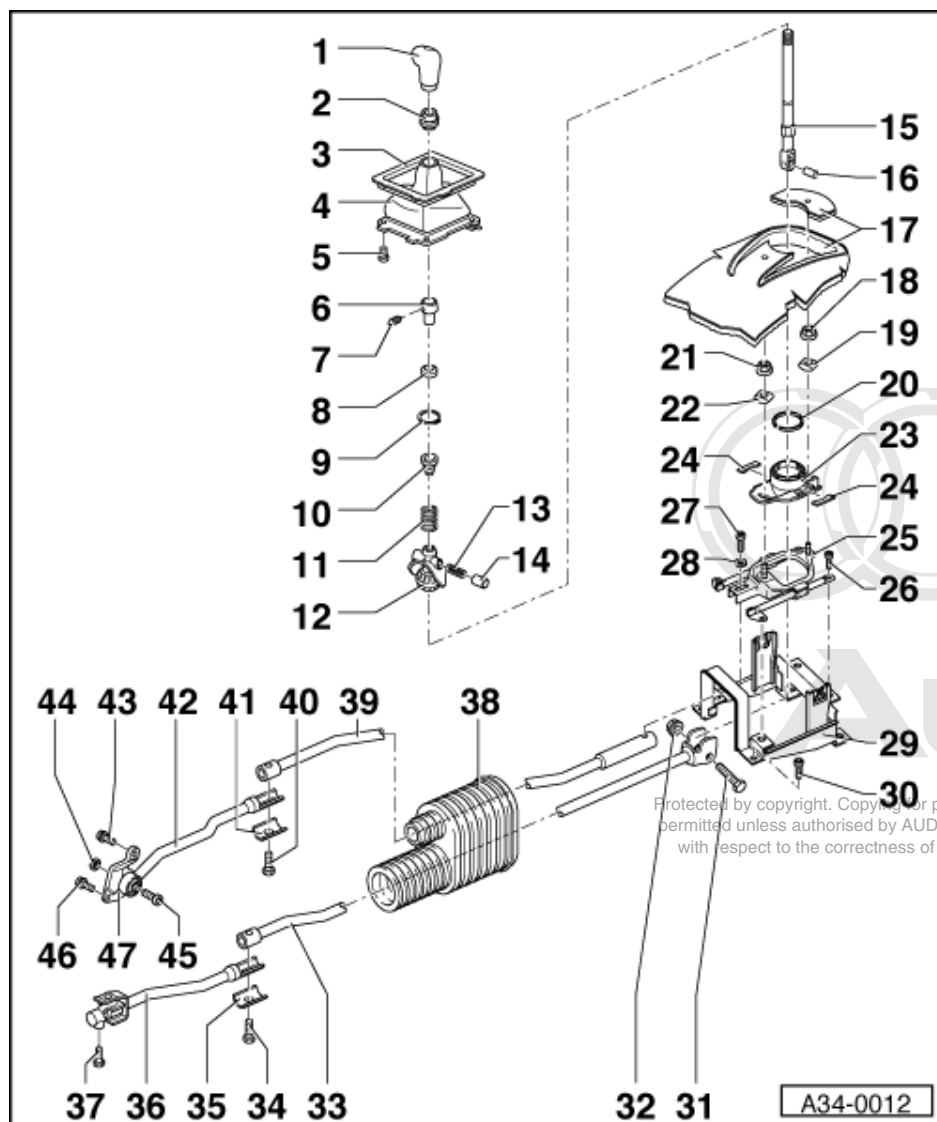
- If the gear stick setting is incorrect it can be adjusted as follows:
 - Slacken nuts for ball housing.
 - Move gear stick with ball housing to the right towards 5th/reverse gate as far as the stop in the gearbox, and hold in this position.
 - When doing this push the ball housing to left against the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

Note:

If only 5th gear and reverse gear cannot be engaged, the 5th and reverse gear locking unit must be checked and replaced if necessary =>Page 89.



1.6 - Servicing short-travel selector mechanism

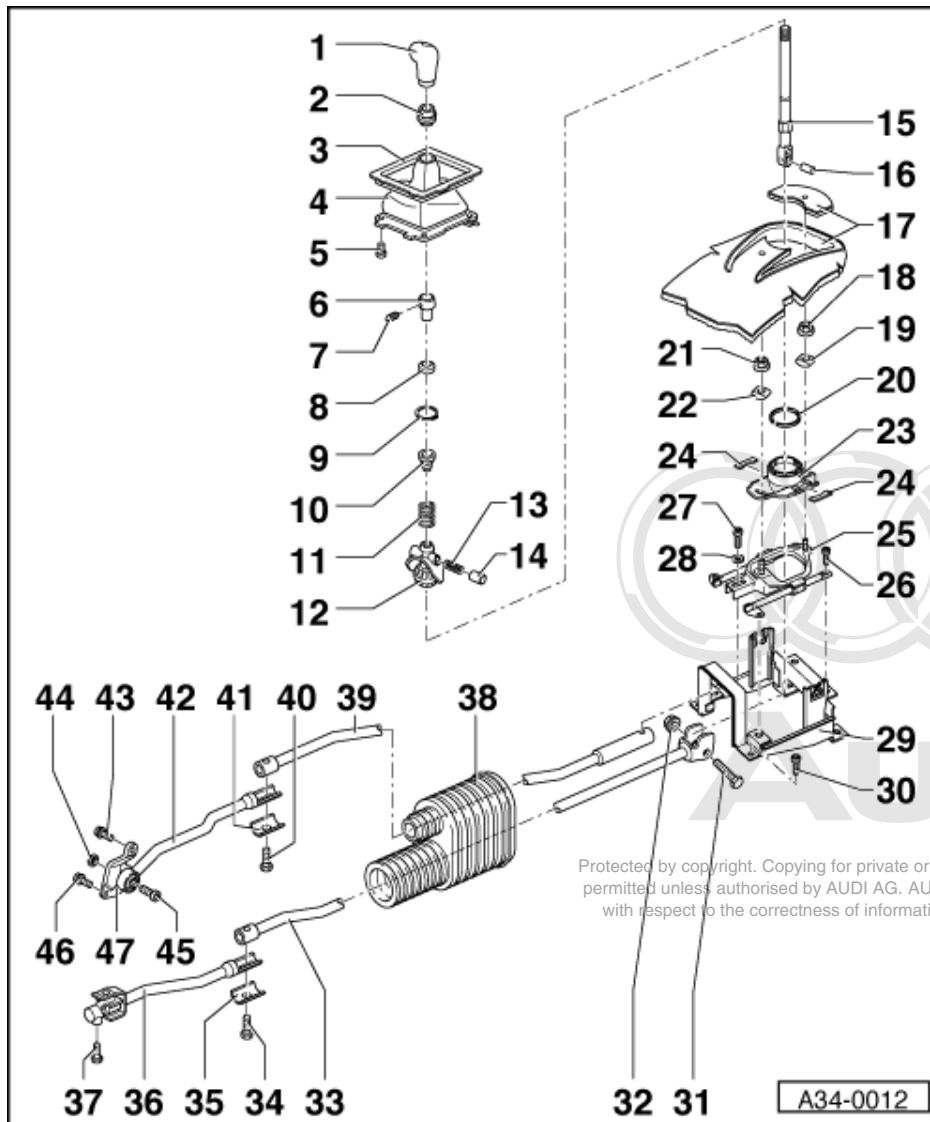


Caution
Contact corrosion.
Notes => Page

Notes:

- ♦ Lubricate bearings and moving surfaces with polycarbamide grease, part No. G 052 142 A2.
- ♦ Adjusting gear selector mechanism
=>Page 50 .

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



4 Cover (gaiter)

- ♦ Detach trim on left and right of centre console in order to remove securing bolts

5 Bolt

6 Bush

7 Securing bolt

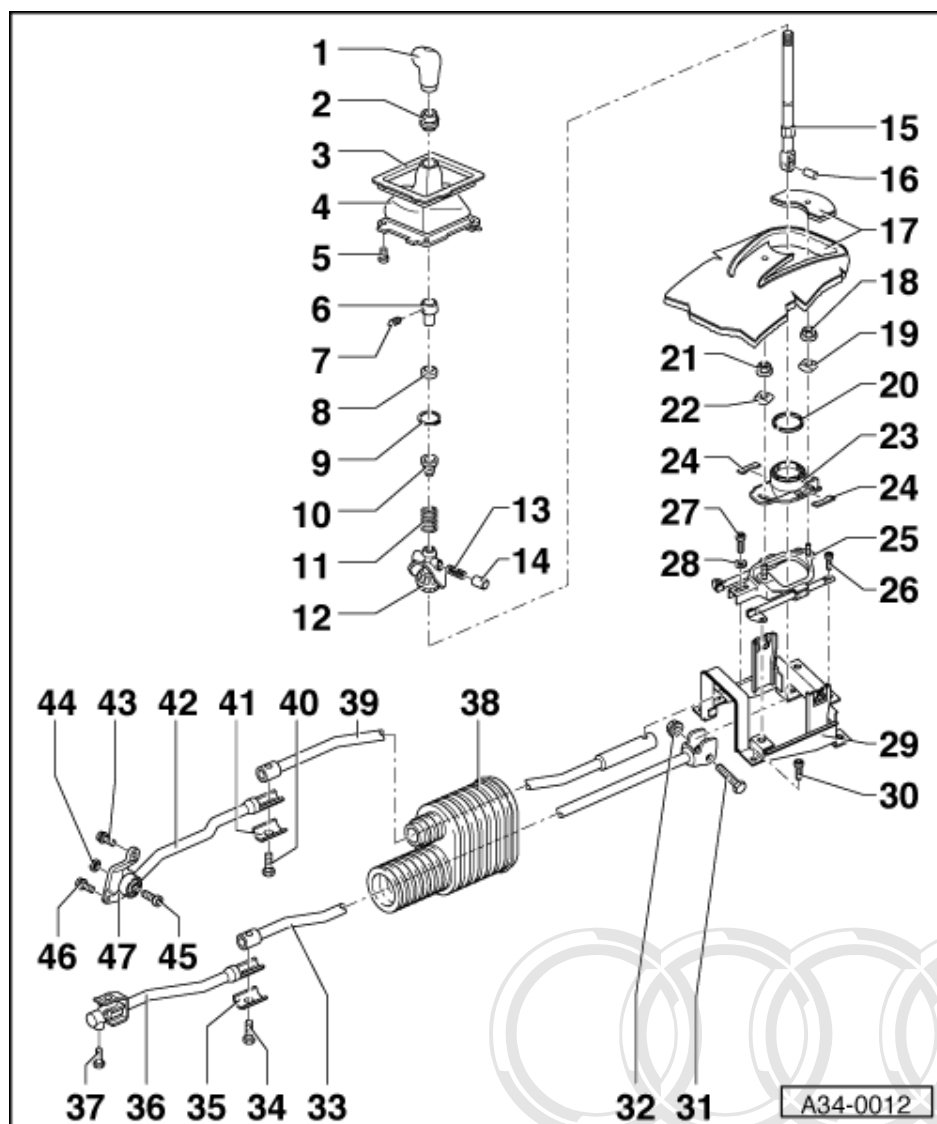
8 Sealing collar

9 Circlip

- ♦ Do not open out too far when fitting

10 Spacer bush

11 Spring

**12 Ball stop**

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

13 Spring**14 Bush**

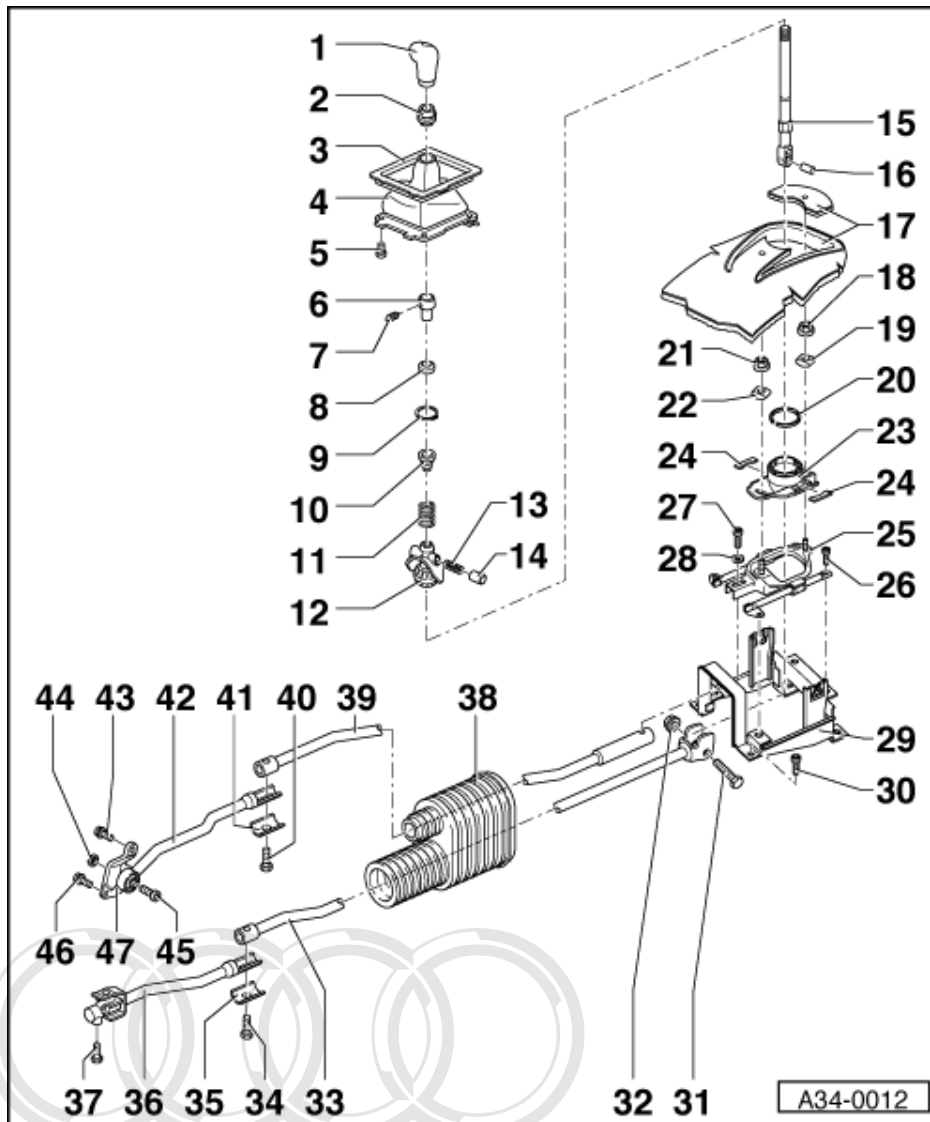
- ◆ Fitting position: The rounded end faces the gear stick

15 Gear stick

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

16 Spacer**17 Noise insulation**

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18 Nut - 10 Nm

19 Connector

20 Circlip

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

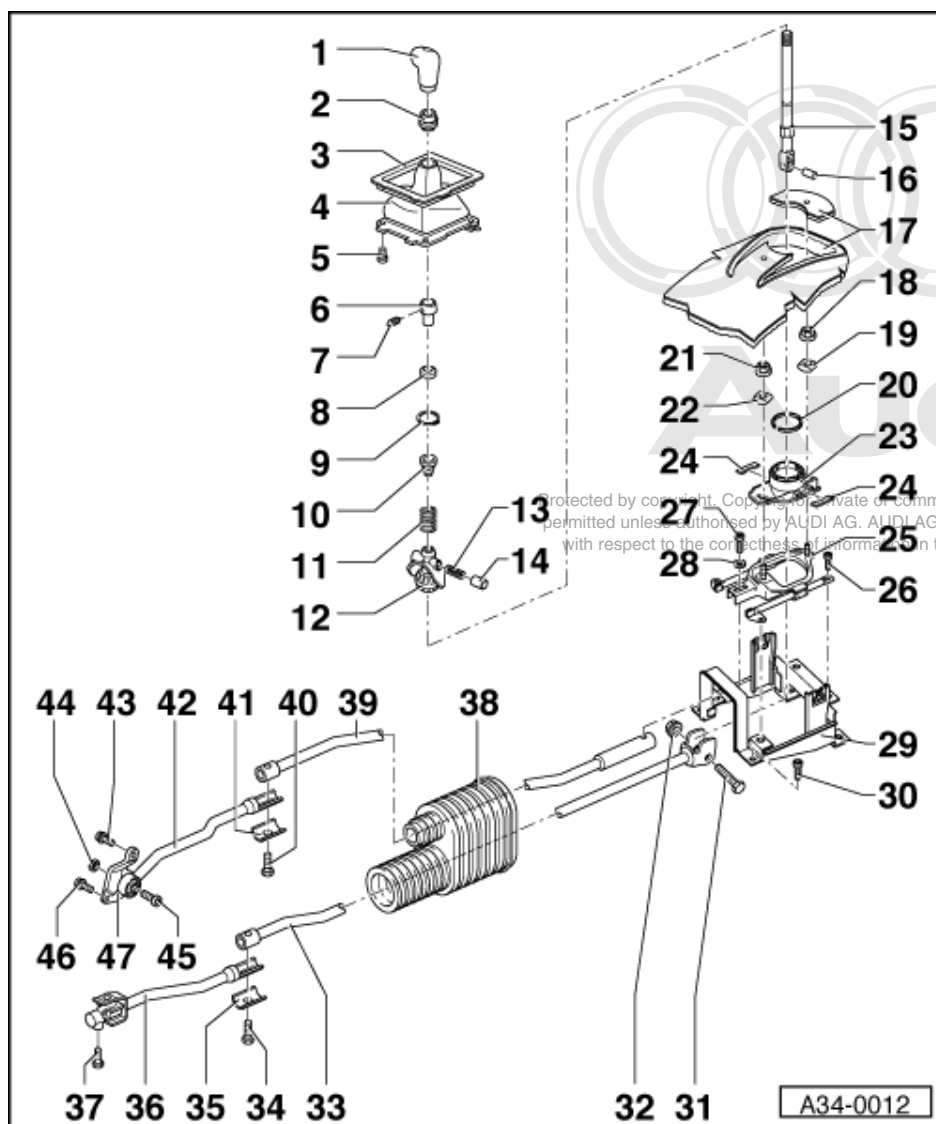
21 Nut - 25 Nm

22 Connector

23 Ball housing

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

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24 Buffer

25 Slide

- ♦ Mounting for ball housing (Item 23)

26 Bolt - 10 Nm

27 Bolt - 25 Nm

28 Washer

29 Console

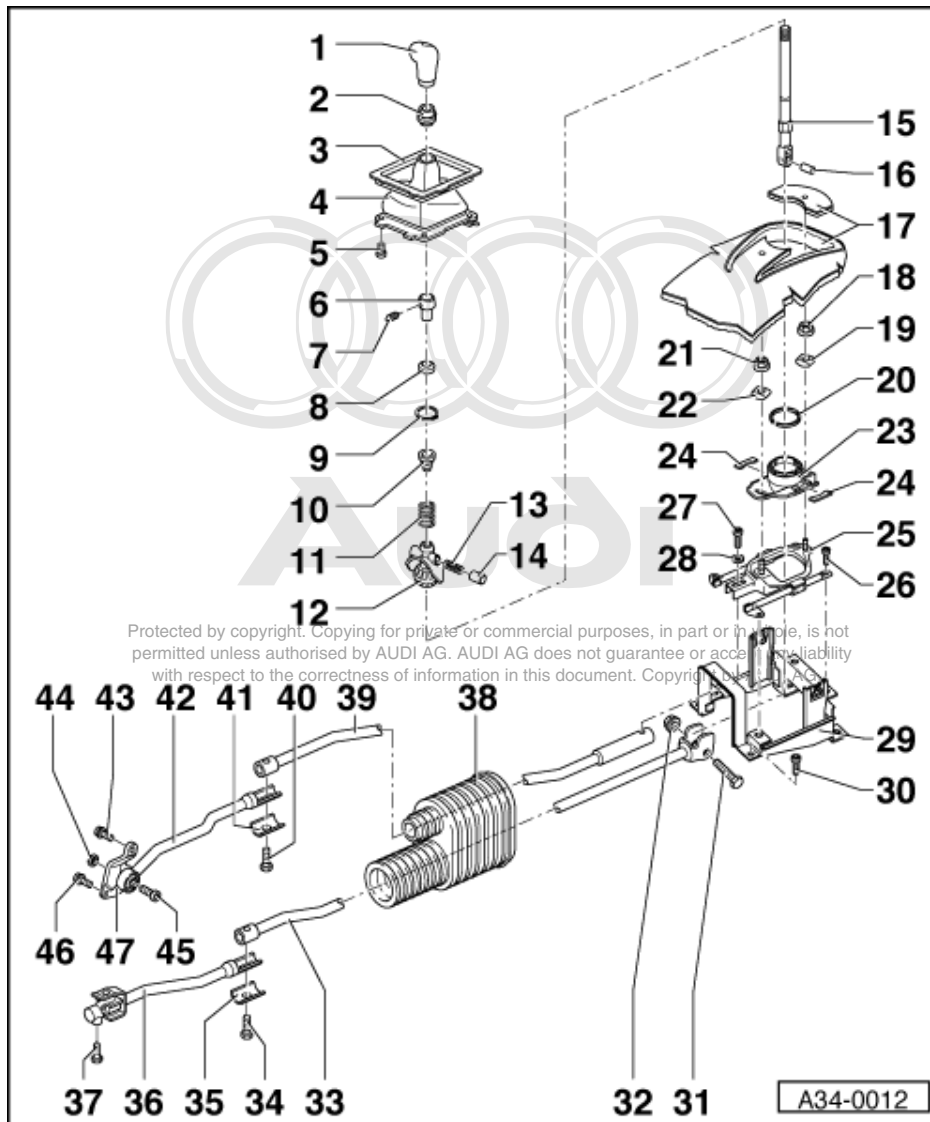
30 Bolt - 10 Nm

31 Bolt

32 Nut - 10 Nm

- ♦ Self-locking
- ♦ Renew

33 Rear selector rod

**34 Bolt - 23 Nm**

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

35 Clamp**36 Front selector rod**

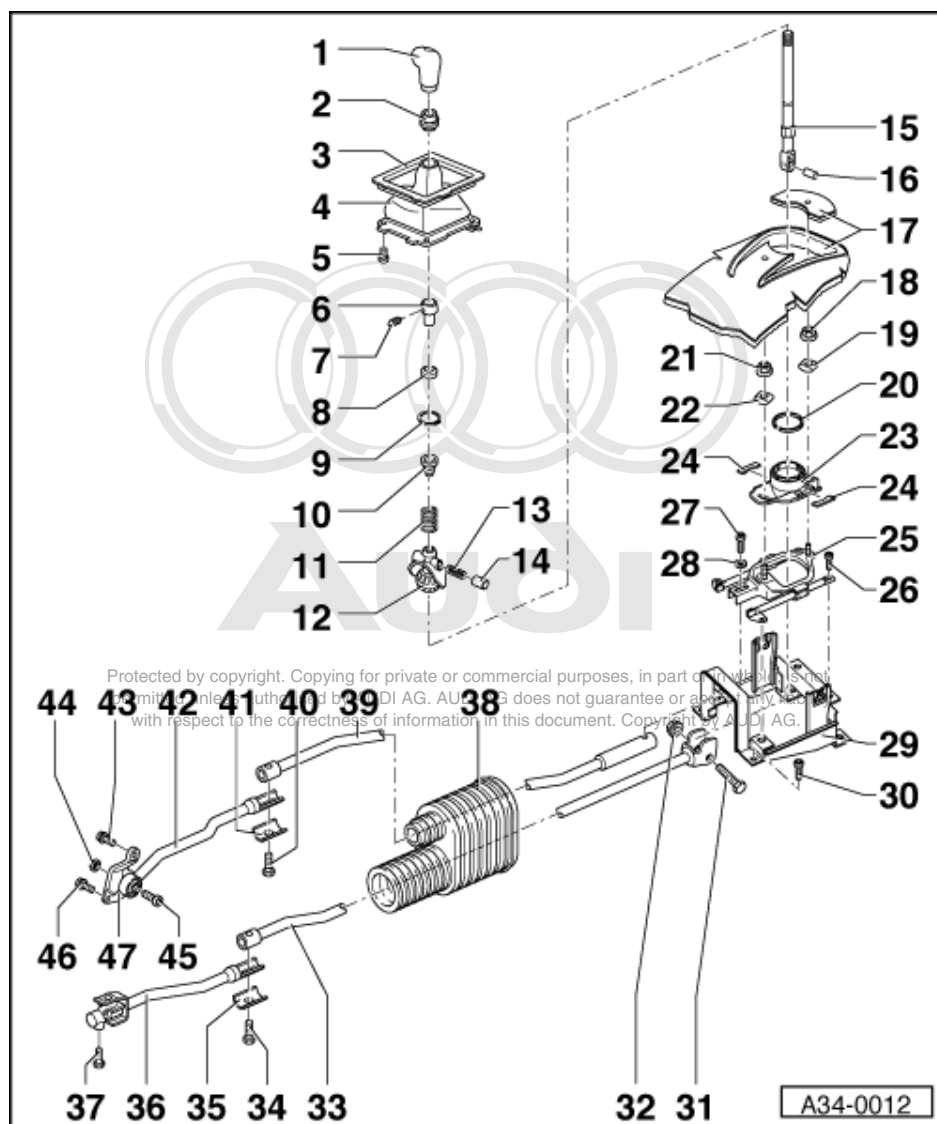
- ♦ With selector joint

37 Bolt - 20 Nm

- ♦ Self-locking
- ♦ Renew

38 Bellows

- ♦ Remove catalytic converter and heat shield before removing and installing
- ♦ Carefully pull over selector rod and push rod
- ♦ Align with markings on selector rod and push rod when installing.



39 Rear push rod

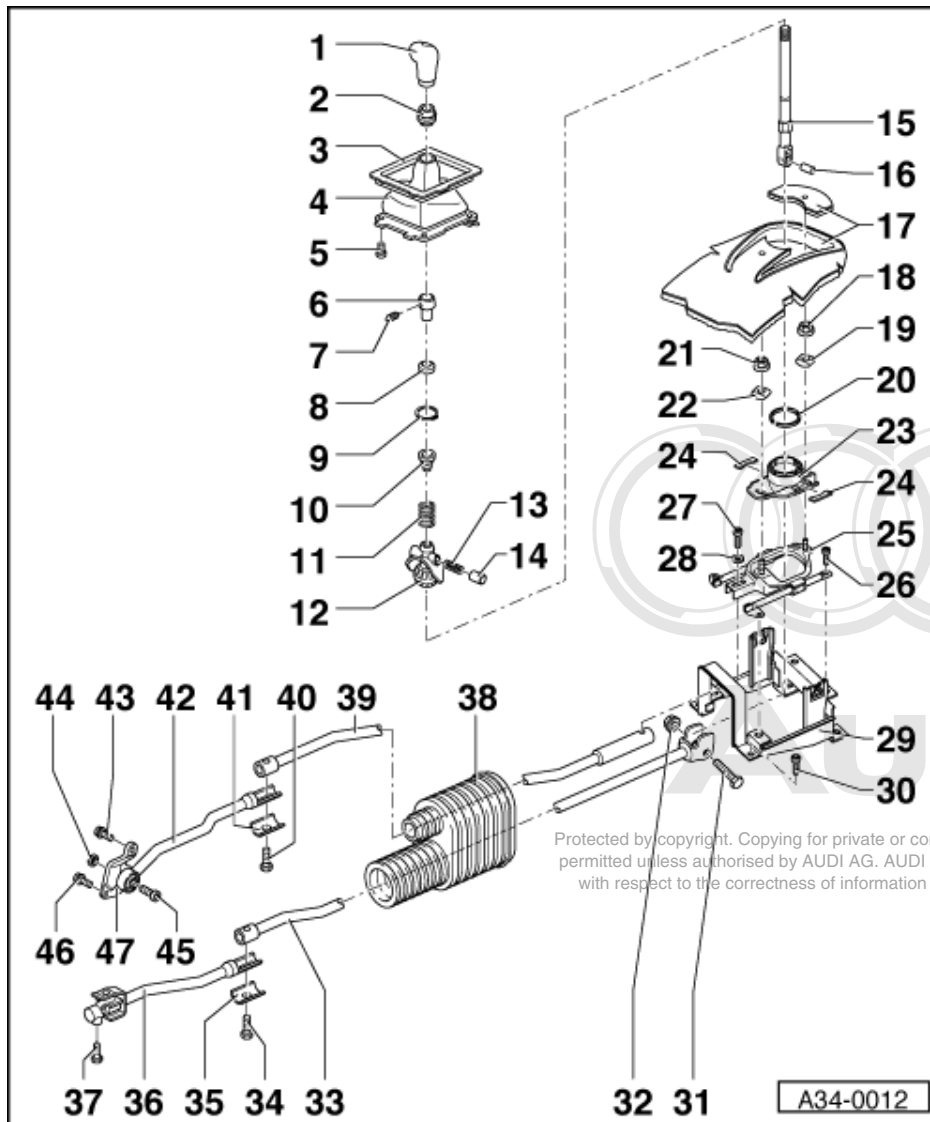
40 Bolt - 23 Nm

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

41 Clamp

42 Front push rod

- ♦ To avoid tension in linkage, secure front push rod to housing for selector mechanism and rear push rod first
- ♦ Hold bolt -Item 45 - to prevent it from turning when tightening nut -Item 44 -

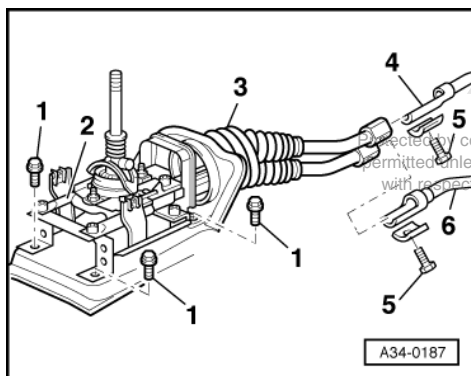


- 43 Bolt - 40 Nm
- 44 Nut - 40 Nm
- 45 Bolt
- 46 Bolt - 40 Nm
- 47 Bracket for push rod



1.7 - Removing and installing short-travel selector mechanism

Removing



- -> Unscrew bolts -5- for front selector rod -4-.
- Pull off bellows -3- from underside of body.
- Remove centre console:

=> General body repairs, Interior; Repair group 68; Storage compartments and covers; Removing and installing centre console and handbrake lever trim Storage compartments and covers Removing and installing centre console and handbrake lever trim

- Unscrew bolts -1- securing console to body.
- Remove selector mechanism together with console -2-, bellows -3-, rear selector rod and rear push rod out of centre tunnel from the inside

Installing

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

- Push selector rod and push rod on so that the securing bolt fits in the recess in the selector shaft.
- Make sure lips of bellows are securely fitted around opening in body

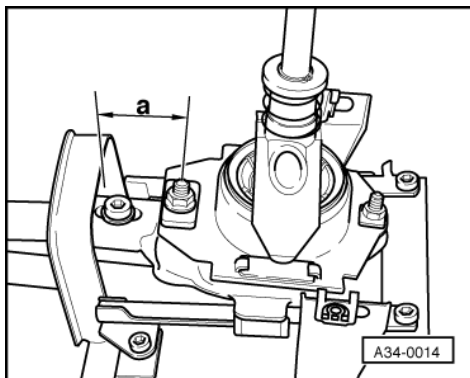
Tightening torques

Component	Nm
Console to centre tunnel	10
Front selector rod to rear selector rod	23
Front push rod to rear push rod	23

1.8 - Adjusting short-travel selector mechanism

Requirements:

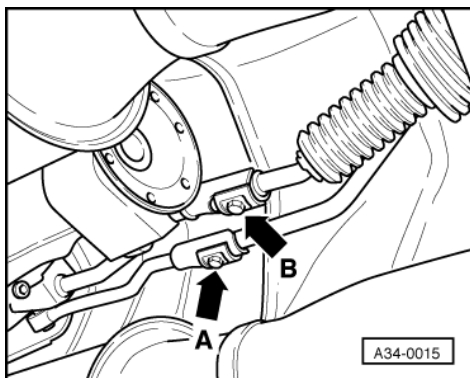
- ♦ Moving parts of selector mechanism and transmission elements must be in proper condition.
 - ♦ Selector mechanism must move freely.
 - ♦ Gearbox, clutch and clutch mechanism must be in proper condition.
 - ♦ Gearbox in neutral.
- Remove gear stick knob and cover (gaiter).
 - Remove noise insulation.



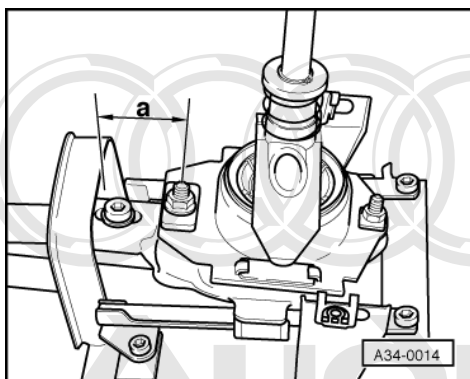
- -> Check distance -a-.
- Distance $a = 28 \pm 1$ mm

Adjusting distance -a-:

- Unbolt heat shield and push it towards rear, so that bolt securing front push rod is accessible.



- -> Slacken bolt -arrow A- slightly.

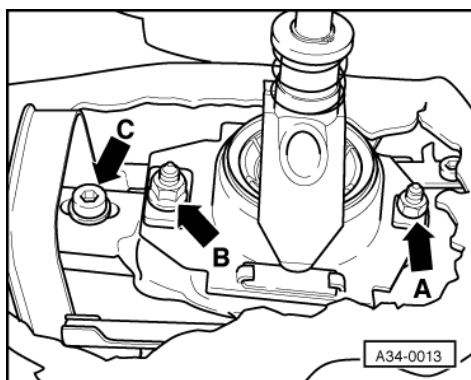


- -> Adjust slide to distance -a-.
- Distance $a = 28 \pm 1$ mm
- Tighten the bolt (-arrow A- in Fig. A34-0015) to 23 Nm.

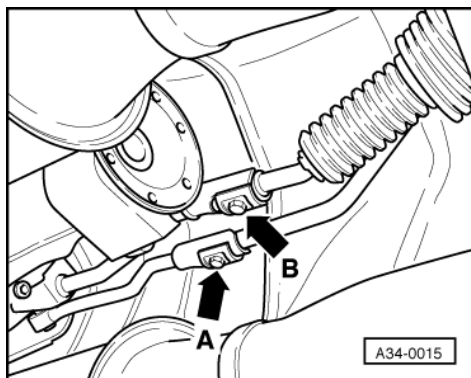
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Adjusting(cntd.):



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

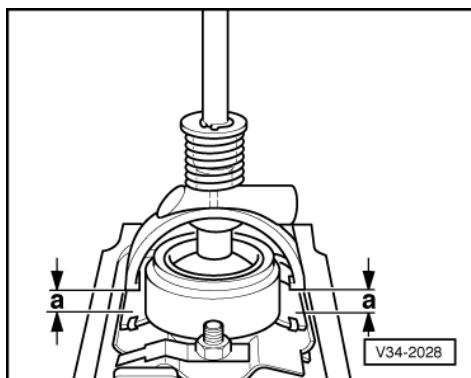


- -> Slacken bolt -arrow B-.

Note:

Illustration shows manual gearbox 01A.

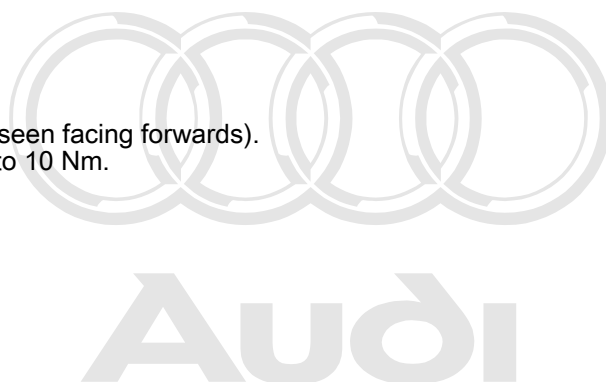
- Adjust gear stick as follows:



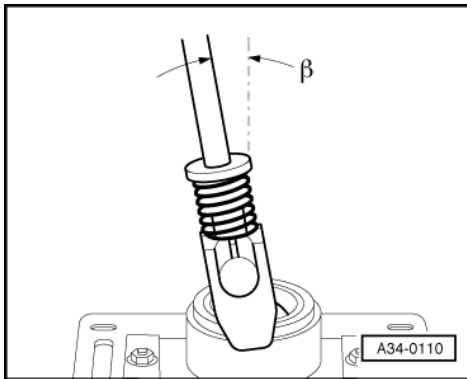
- -> Distance -a- between ball stop buffers and ball housing should be equal on both sides.

Note:

The illustration shows the gear stick from behind (looking towards the front of the vehicle).



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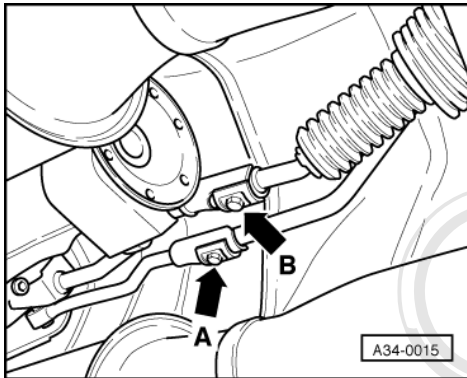


- -> Set gear stick at an angle of approx. 5° to the rear (angle β)

Note:

The illustration shows the gear stick from the right.

- Hold gear stick in this position (second mechanic required).



- -> Tighten selector rod bolt -arrow B- below vehicle to 23 Nm.

Notes:

- ◆ Gear stick must not be moved when bolt is being tightened.
- ◆ The illustration shows manual gearbox 01A.

- Fit heat shield.

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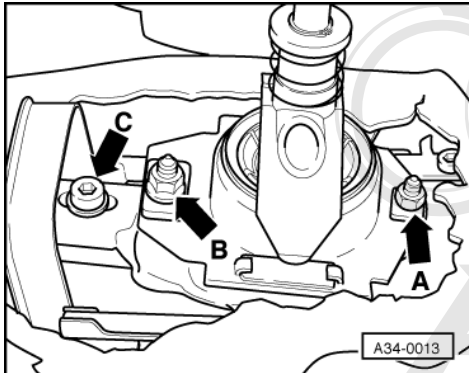
1.9 - Checking gear stick adjustment

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



Fine adjustment

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



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

2 - Removing and installing gearbox

2.1 - Removing and installing gearbox

Special tools, testers and auxiliary items

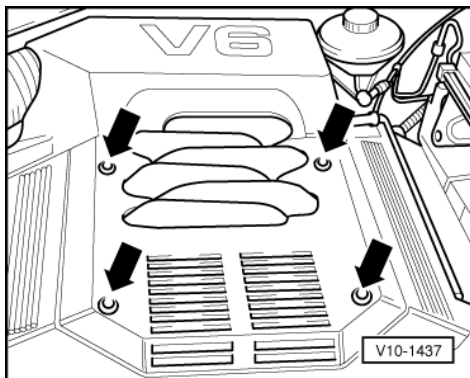
- ♦ Gearbox support 3282
- ♦ Adjustment plate 3282/10
- ♦ Engine/gearbox jack V.A.G 1383 A
- ♦ Torque wrench V.A.G 1331 (5...50 Nm)
- ♦ Torque wrench V.A.G 1332 (40...200 Nm)
- ♦ Universal support V.A.G 1359/2

2.2 - Removing

Caution
Contact corrosion. Notes => Page 6 .

Notes:

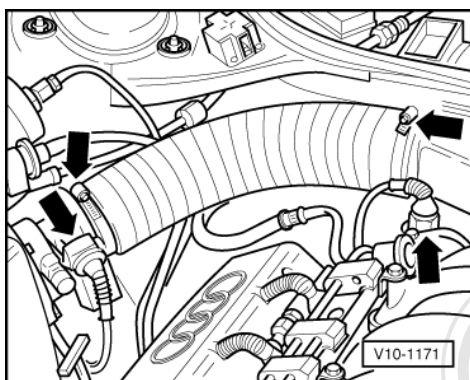
- ♦ It is not necessary to support the engine with the engine support bracket when lowering the gearbox out of the vehicle (removing and installing gearbox).
- ♦ The torque reaction support on the engine does not have to be detached.
- Obtain radio code on vehicles with coded radio.
- Disconnect earth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



- -> Remove engine cover panel -arrows-.

Note:

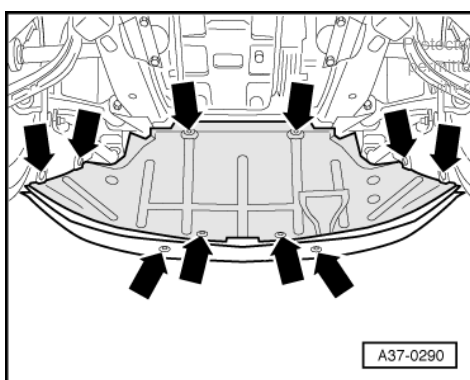
The illustrations below show the 2-valve engine.



- -> Remove air duct between air mass meter and intake manifold -top arrows-.
- Unclip both Lambda probe cables at connections, (Lambda probes remain installed).
- Unscrew securing nuts on front exhaust pipes (left and right) accessible from above.
- Unscrew engine/gearbox securing bolts accessible from above.

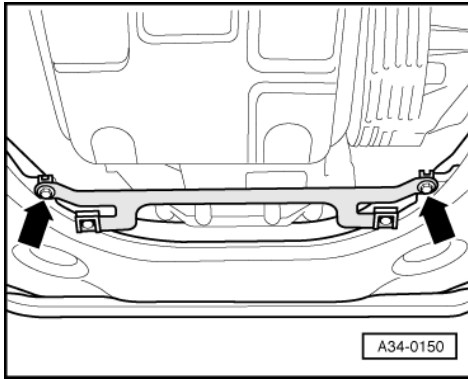
Note:

When removing the bolts, note their lengths and positions so that they can be re-fitted correctly.

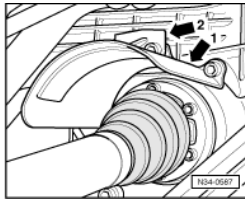


- -> Remove noise insulation -arrows-.

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- -> Unbolt bracket for noise insulation -arrows-.



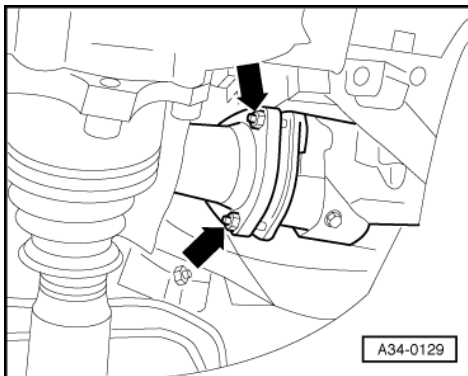
- -> Detach heat shields above left and right drive shafts
- Unbolt drive shaft from flange on gearbox.

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

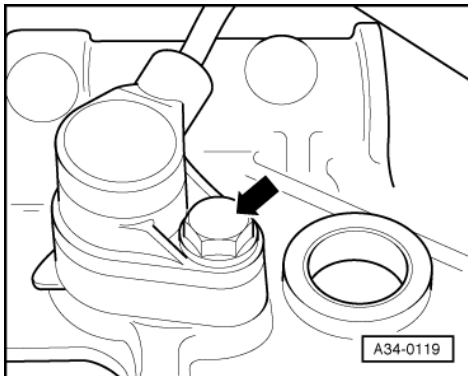
Note:

Take care not to damage protective coating on drive shafts.

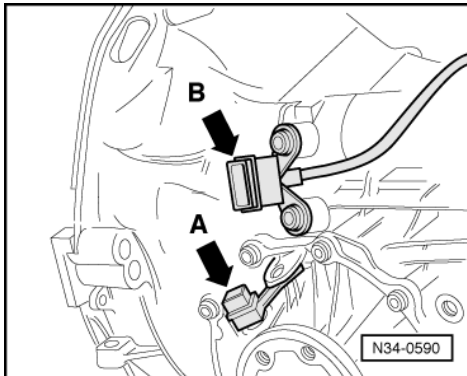
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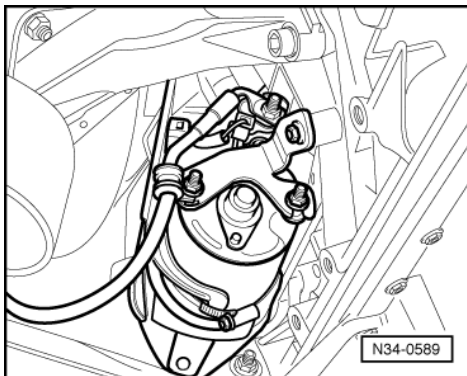
- -> Unbolt front exhaust pipes with catalytic converters from left and right exhaust manifolds (3 nuts on each side) -arrows-:
- Release clamps on exhaust pipes.
- Remove exhaust pipe together with front exhaust pipe and catalytic convertor.



- -> Unbolt engine speed sender -G28 (arrow) from front left side of gearbox.



- -> Pull connector off sender for speedometer -arrow A-.
- Pull off connector on reversing light switch (multi-function sender) -arrow B-.
- Disconnect all other electrical connections and earth wires from gearbox and from the engine/gearbox securing bolts.



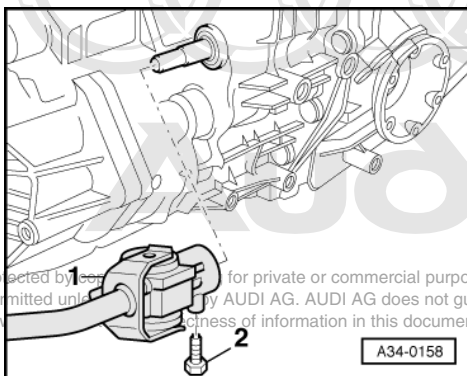
- -> Unbolt starter from engine/gearbox and secure as necessary.

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

Note:

Starter cables do not have to be disconnected.

Vehicles with standard-travel selector mechanism:

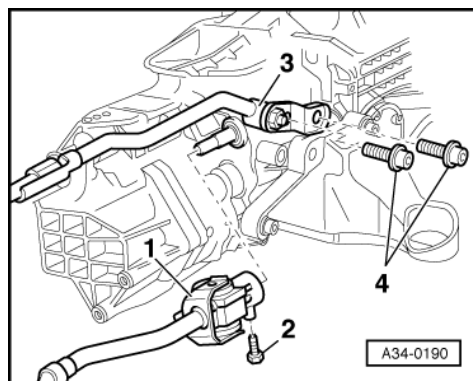


- -> Unscrew bolt -2- at selector joint -1- on selector rod.

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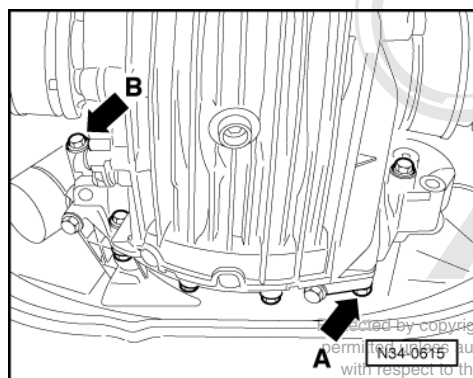


Vehicles with short-travel selector mechanism:



- -> Unscrew bolt -2- at selector joint -1- on selector rod.
- Unscrew hexagon socket head bolts -4- out of push rod -3-.

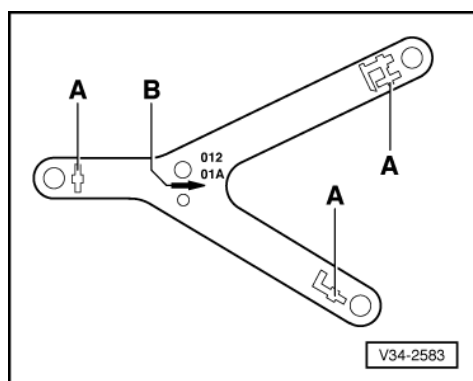
All models



- -> Unscrew bottom engine/gearbox securing bolts, except for bolts indicated by arrows -A- and -B-.

Note:

When removing the bolts, note their lengths and positions so that they can be re-fitted correctly.



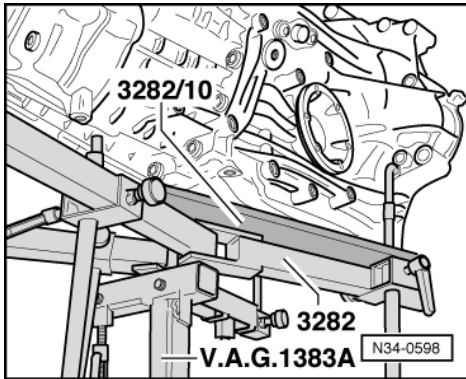
- -> Set up gearbox support 3282 for removing manual gearbox 012/01W with adjustment plate 3282/10 and attach to gearbox jack V.A.G 1383 A.

A - Attachments

Notes:

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

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

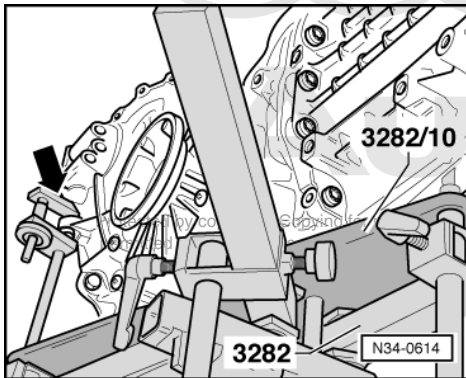


- -> Run gearbox jack V.A.G 1383 A with gearbox support 3282 in under the gearbox and take up the weight of the gearbox.

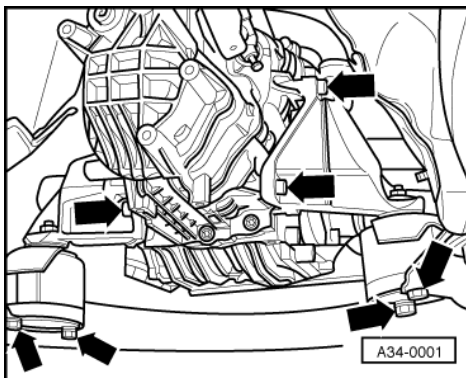
Note:

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

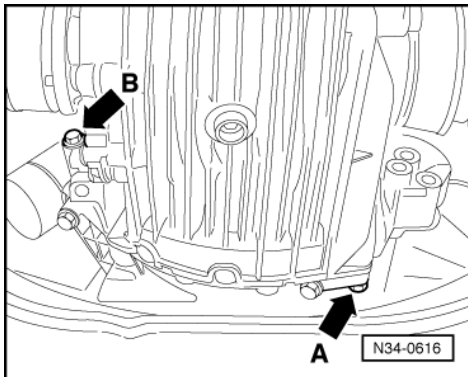
- Support gearbox with gearbox jack V.A.G 1383 A.



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



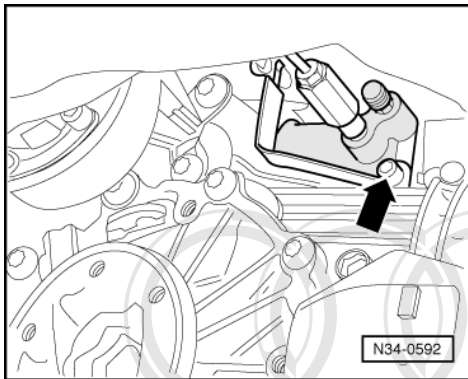
- -> Unbolt right and left gearbox supports complete with bonded rubber mountings -arrows- from gearbox and subframe.



- -> Remove remaining engine/gearbox securing bolts (arrows -A- and -B-).
- Press gearbox off dowel sleeves and lower carefully with gearbox jack V.A.G 1383 A just far enough for access to the slave cylinder.

Note:

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



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

Note:

Do not depress clutch pedal after removing slave cylinder.

- Lower gearbox completely.

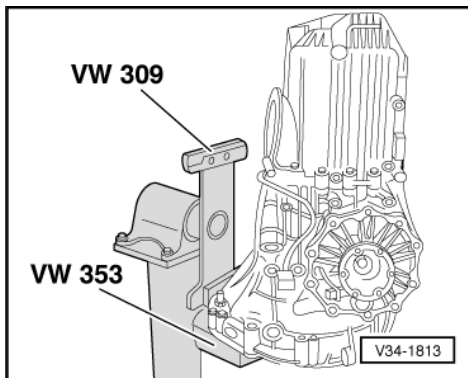
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When lowering gearbox ensure there is sufficient clearance to drive shafts.

2.3 - Securing gearbox to repair stand

Special tools, testers and auxiliary items

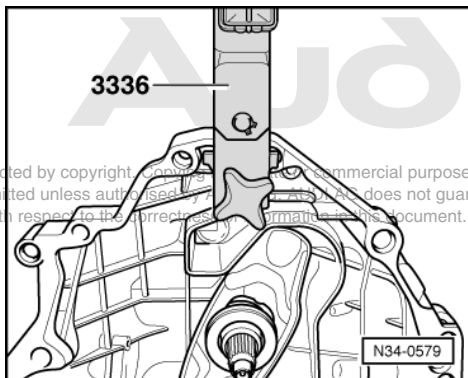
- ♦ Retaining plate VW 309
- ♦ Gearbox support VW 353



- -> Secure gearbox to repair stand with gearbox support VW 353 and holding plate VW 309 to carry out repairs.

2.4 - Transporting the gearbox

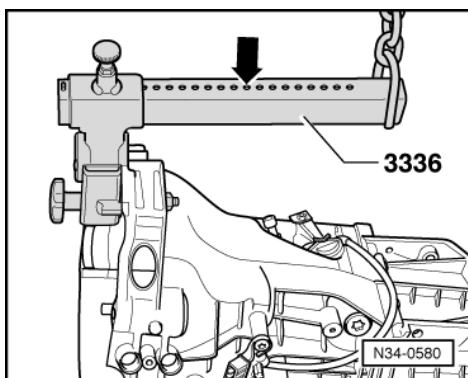
Special tools, testers and auxiliary items



- ◆ Gearbox support 3282
- ◆ Gearbox attachment appliance 3336

The gearbox attachment appliance can be used when transporting the gearbox and when setting up gearbox support 3282.

- -> Bolt gearbox lifting beam 3336 to clutch housing.



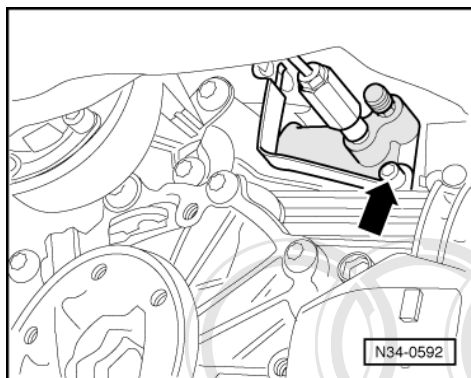
- -> Set support beam on sliding piece with locking pin (arrow).
- Number of holes visible = 17
- Lift gearbox with workshop crane and gearbox attachment appliance 3336.



2.5 - Installing

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

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



- -> Lift gearbox until clutch slave cylinder with bracket for pipe/hose can be installed (arrow).
- Install lower engine/gearbox securing bolts and bolts for starter when doing this install starter.

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

- Check adjustment of selector mechanism; adjust if necessary => Page 50 .
- Align exhaust system free of stress

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

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

- Check oil level in gearbox
=>Page 64 .
- After connecting battery, enter anti-theft code for radio

=> Radio operating instructions

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

Tightening torques

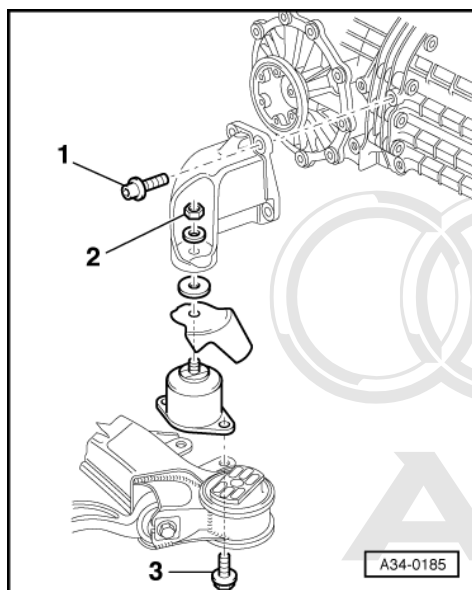
Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		

Component		Nm
Drive shaft to flange shaft	M8	40
	M10	77
Engine speed sender -G28		10
Clutch slave cylinder to gearbox		
Hexagon socket head bolt 1)		20
Hexagon bolt 2)		25

- 1) Replace bolt
- 2) Apply locking fluid D 185 400 A2 before installing

Component	Nm
Heat shields over drive shafts to gearbox	23
Selector joint to gearbox 1)	20
Front push rod to gearbox and gearbox support	40
Front exhaust pipe to exhaust manifold	30
Clamp for exhaust pipe	40
Bracket for noise insulation to subframe	10

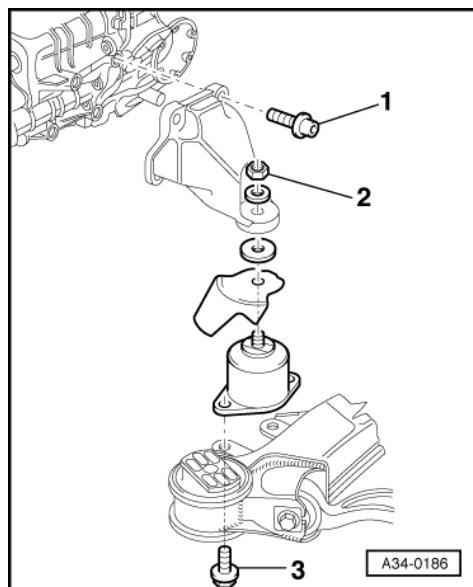
- 1) Replace bolt



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-> Gearbox/engine mounting (left)

Item	Bolt	Qty.	Nm
1	M 10 x 35	4	40
2	M10	1	40
3	M10 x 22	2	40



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-> Gearbox/engine mounting (right)

Item	Bolt	Qty.	Nm
1	M 10 x 35	4	40
2	M10	1	40
3	M10 x 22	2	40

3 - Checking oil level in gearbox

3.1 - Checking oil level in gearbox

Special tools, testers and auxiliary items

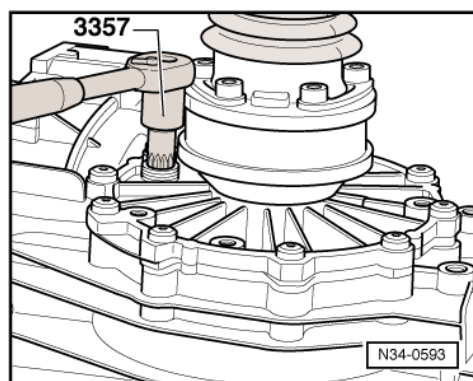
- ♦ Hexagon key socket attachment, 17 mm A/F

or

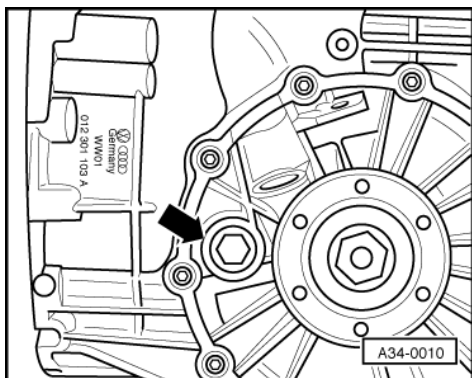
- ♦ Socket attachment 3357

Notes:

- ♦ The vehicle must be absolutely horizontal when checking gearbox oil level. This work is best performed over an inspection pit or using a 4-column lifting platform.
- ♦ The oil filler plug is on the left of the gearbox below the speedometer sender; it may be concealed by the heat shield for the drive shaft.



- ♦ -> Depending on the version fitted, use either special tool 3357 or a 17 mm hexagon key to loosen the oil filler plug and oil drain plug.



- -> To check oil level, unscrew oil filler plug (arrow).
- Check oil level with locally manufactured tool e.g. a piece of angled wire.
 - Specified value: oil level 7 mm below bottom edge of oil filler hole.

Note:

The oil can be filled up to the bottom lip of the oil filler hole when servicing.

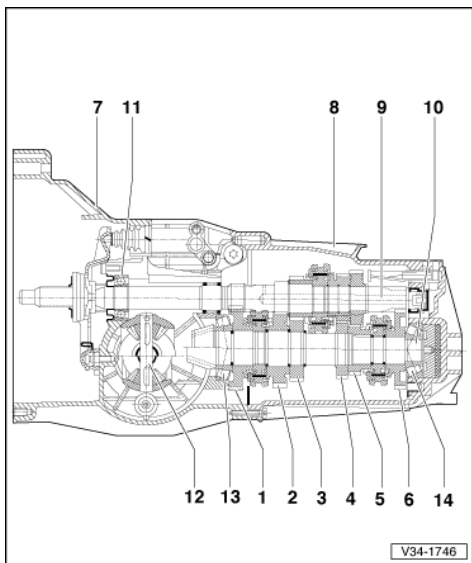
- Top up gearbox oil if necessary. Specification =>from Page 2 .
- Fit oil filler plug.

Tightening torque

Component	Nm
Oil filler plug	25

4 - Dismantling and assembling gearbox

4.1 - Dismantling and assembling gearbox



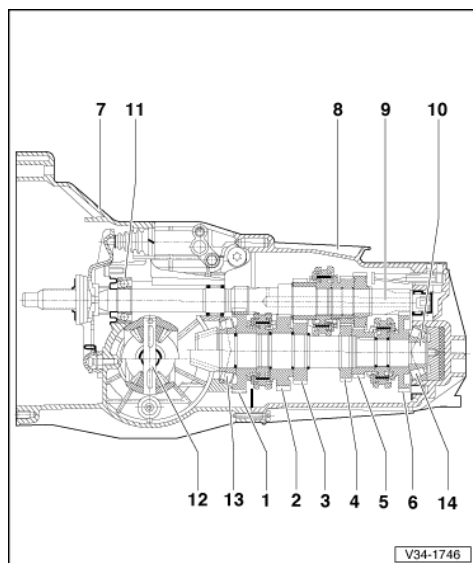
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Sequence =>Page 75 .



4.2 - Overview

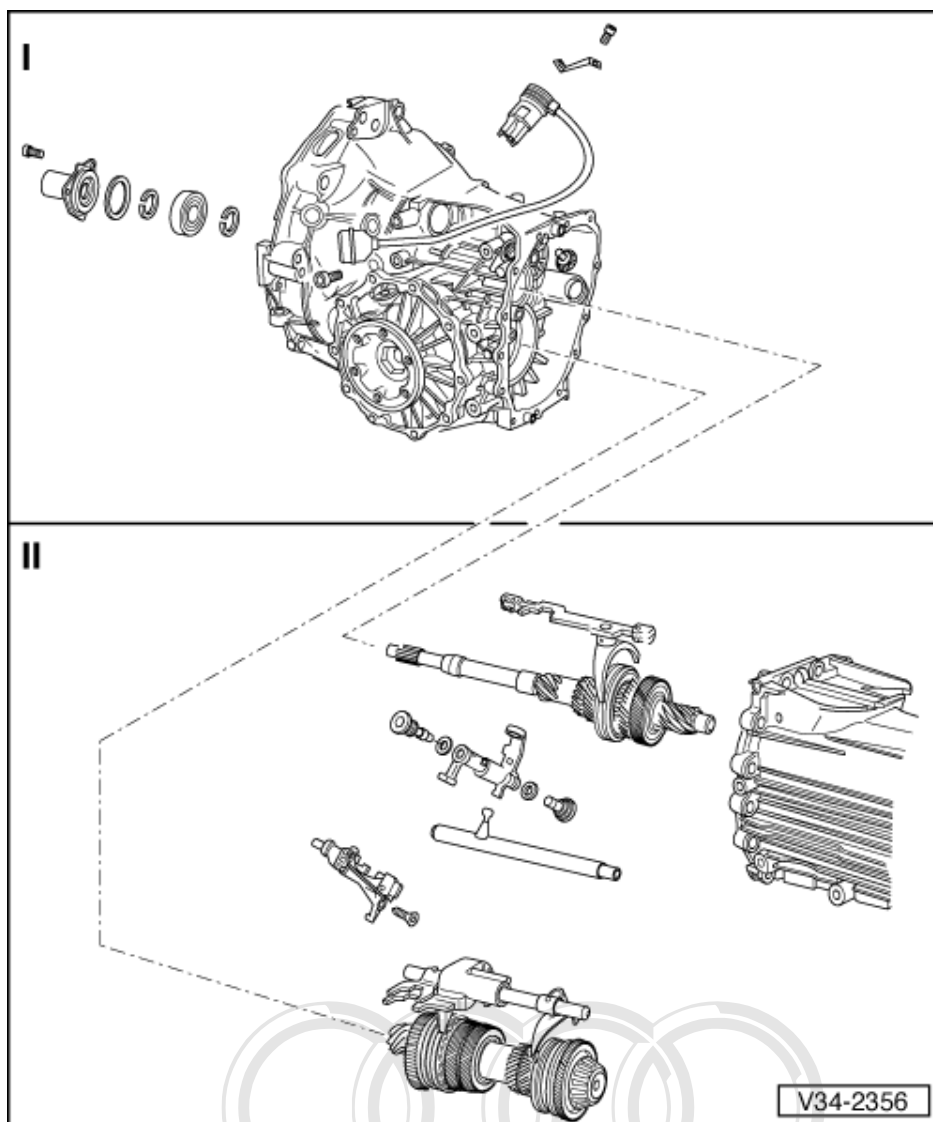
- 1 1st gear
- 2 2nd gear
- 3 3rd gear
- 4 4th gear
- 5 5th gear
- 6 Reverse gear
 - ♦ Removing and installing reverse idler gear=>Page 131
- 7 Gearbox housing
- 8 Gearbox cover



- 9 Input shaft
 - ♦ Dismantling and assembling
=> Page 92
- 10 Pinion shaft
 - ♦ Dismantling and assembling
=> Page 109
- 11 Ball bearing
 - ♦ Adjusting => adjusting input shaft, Page 107
- 12 Differential
 - ♦ Removing and installing
=> Page 138
 - ♦ Dismantling and assembling
=> Page 143
- 13 Taper roller bearing
 - ♦ Adjusting => Page 157
- 14 Taper roller bearing
 - ♦ Adjusting => Page 157

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4.3 - Assembly overview

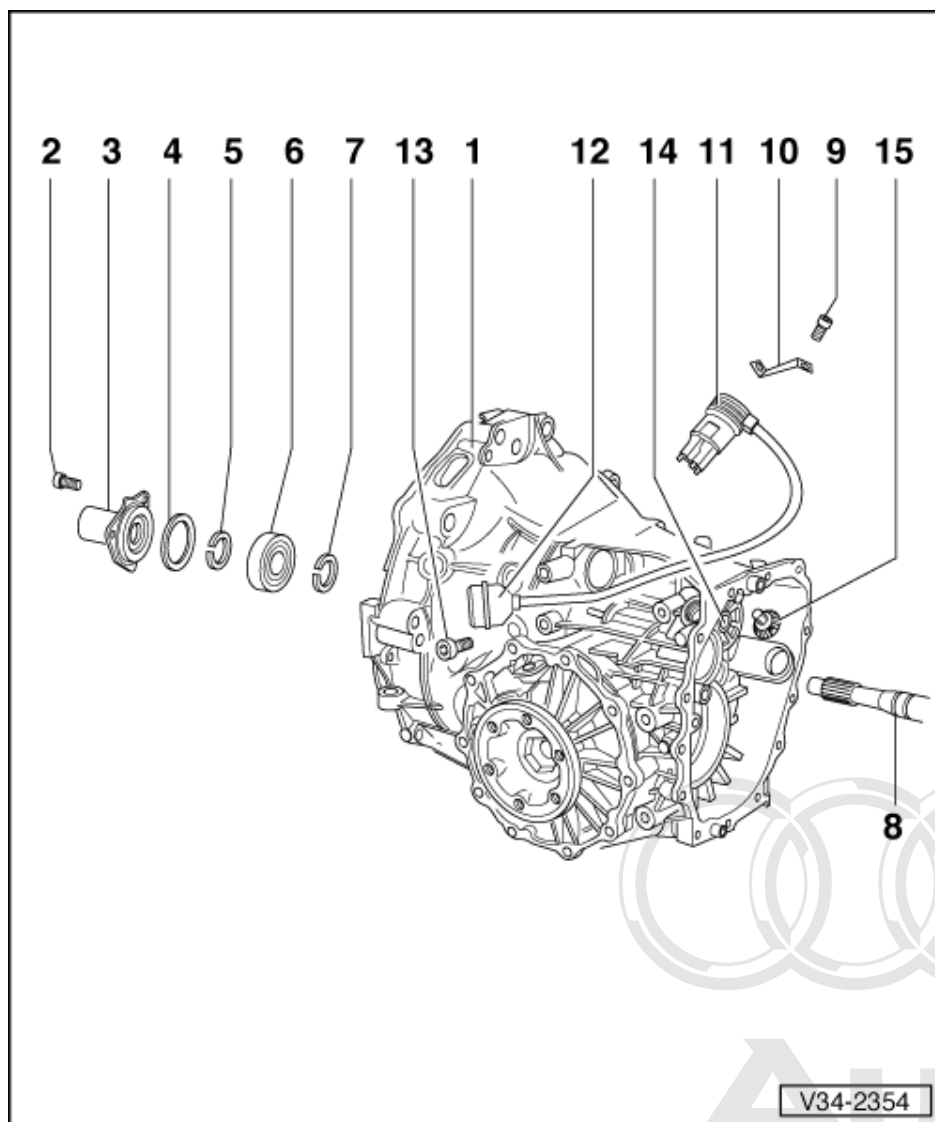


- I - Removing and installing input shaft ball bearing and multi-function sender => Page 68
II - Removing and installing input shaft, pinion shaft, selector rods, gearbox cover
=>Page 72

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4.4 - Removing and installing input shaft ball bearing and multi-function sender

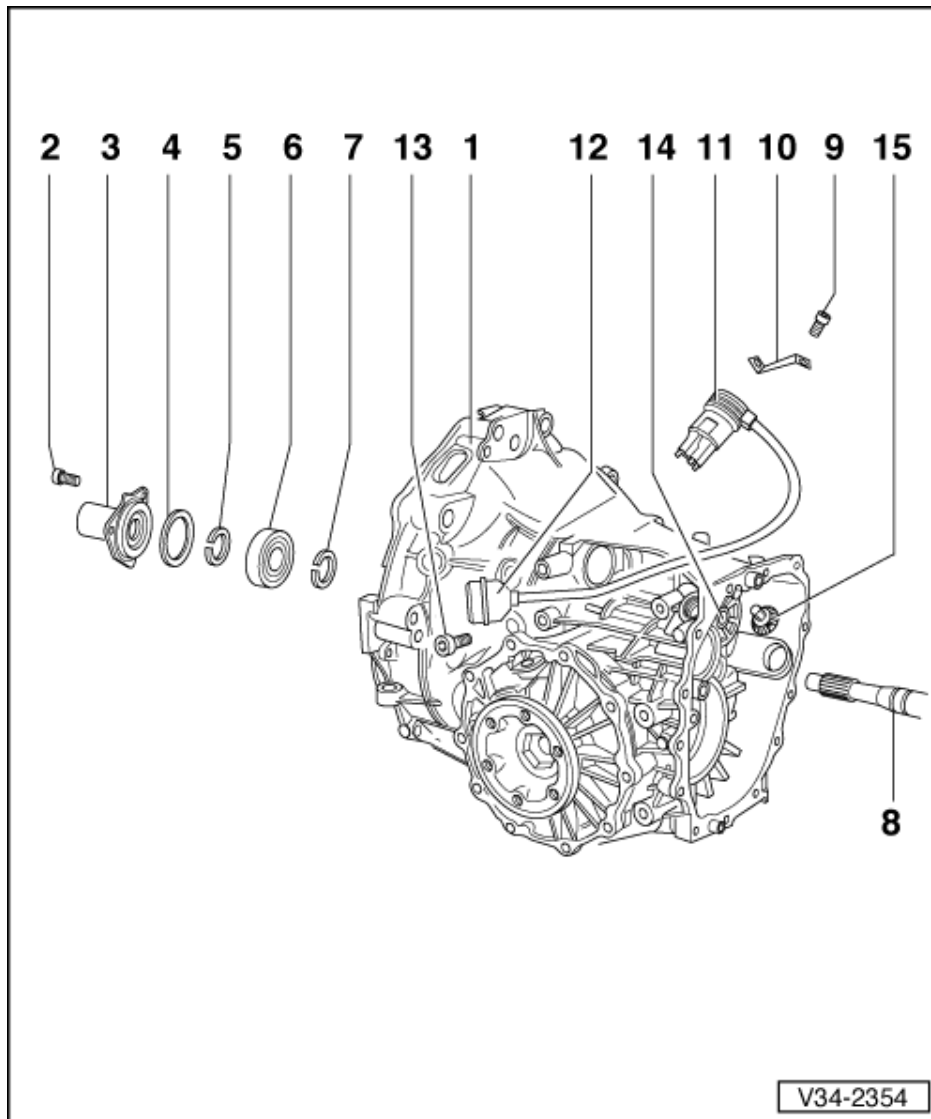


1 Gearbox housing

- ◆ With differential and flanged shafts
- ◆ Removing and installing flange shafts => Page 133
- ◆ Removing and installing differential => Page 138
- ◆ Removing and installing speedometer sender and drive wheel
=> Page 136
- ◆ Breather installation position
=> Fig. 72

2 Torx socket head bolt, -35 Nm

- ◆ Self-locking
- ◆ Renew



3 Guide sleeve

- ♦ With O-ring and oil seal for input shaft => Page 23

4 Dished washer

- ♦ Smaller diameter (convex side) faces guide sleeve

5 Circlip

- ♦ Determining thickness => adjusting input shaft, Page 107

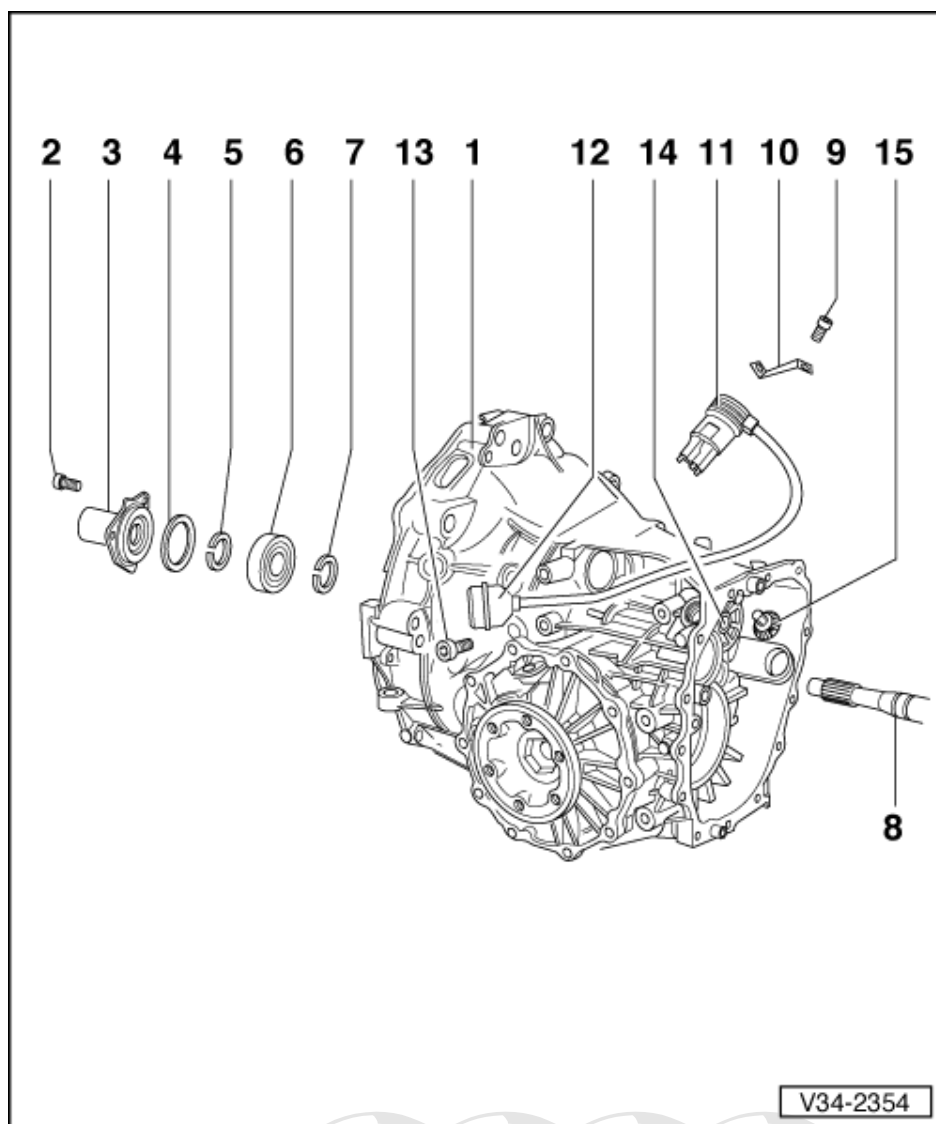
6 Bearing

- ♦ Removing and installing
=> Page 75

7 Circlip

- ♦ Determining thickness => adjusting input shaft, Page 107

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8 Input shaft

- ♦ Removing and installing
=> Page 72
- ♦ Dismantling and assembling
=> Page 92
- ♦ Adjusting =>Page 107
- ♦ Servicing input shaft bearings
=> Page 92

9 Bolt - 25 Nm

10 Locking plate

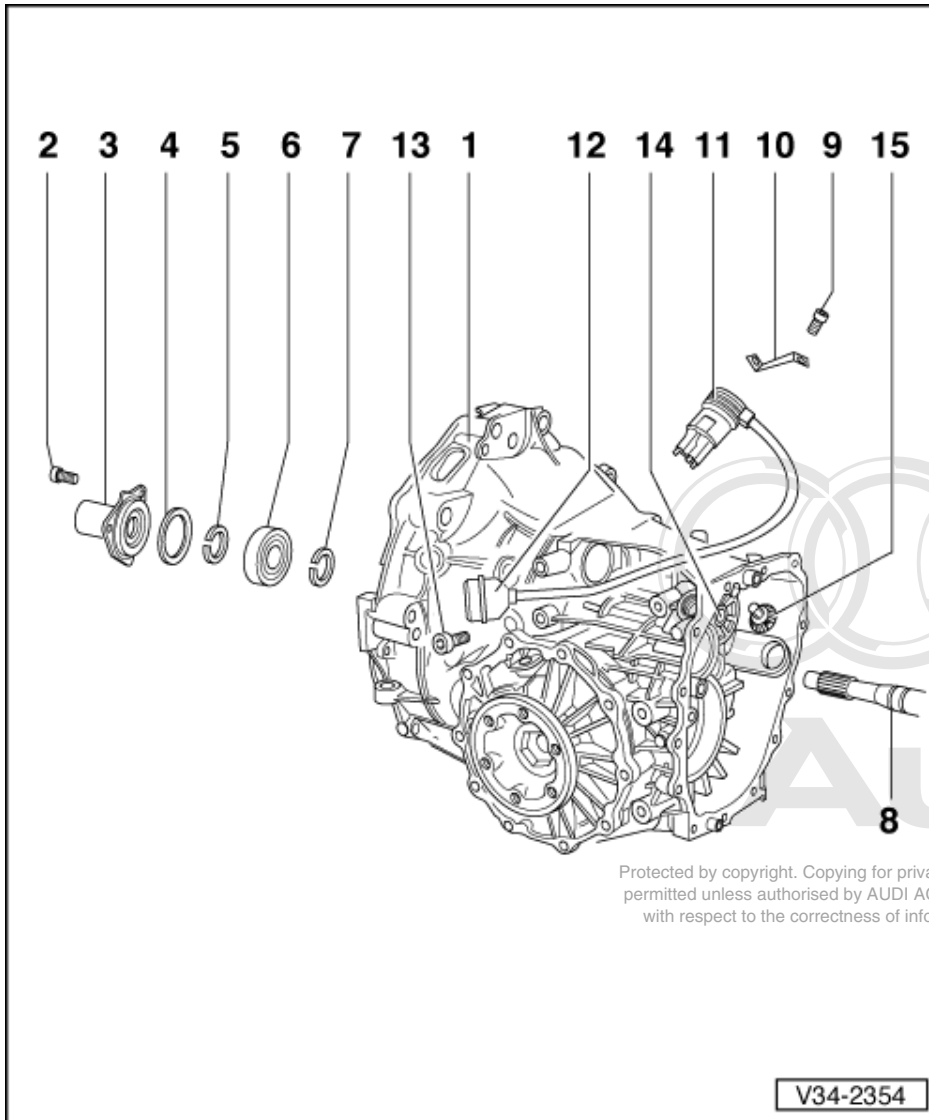
- ♦ For multi-function sender

11 Multi-function sender

12 Connector

- ♦ For multi-function sender

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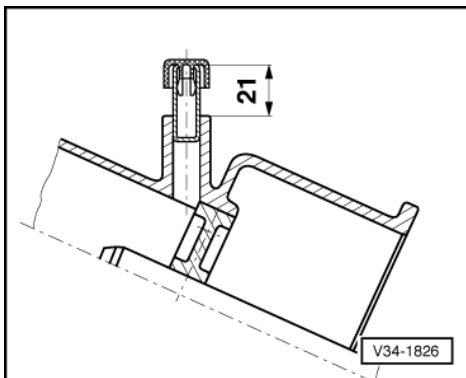
13 Bolt - 10 Nm

14 Cover for selector shaft

- ♦ Removing and installing
=> Page **84**

15 Locking unit for 5th gear and reverse gear

- ♦ Removing and installing
=> Page **89**

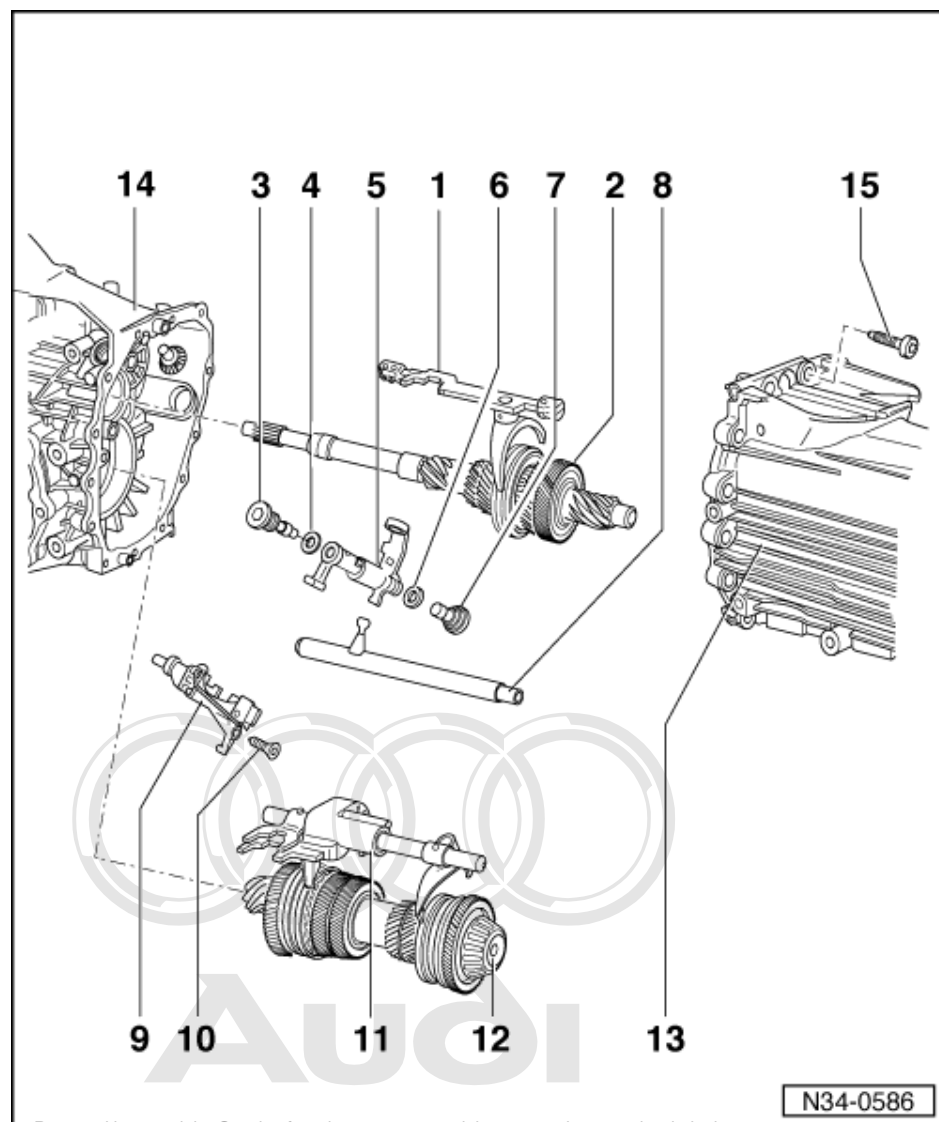




-> Fig.1 Breather installation position

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

4.5 - Removing and installing input shaft, pinion shaft, selector rods and gearbox cover



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

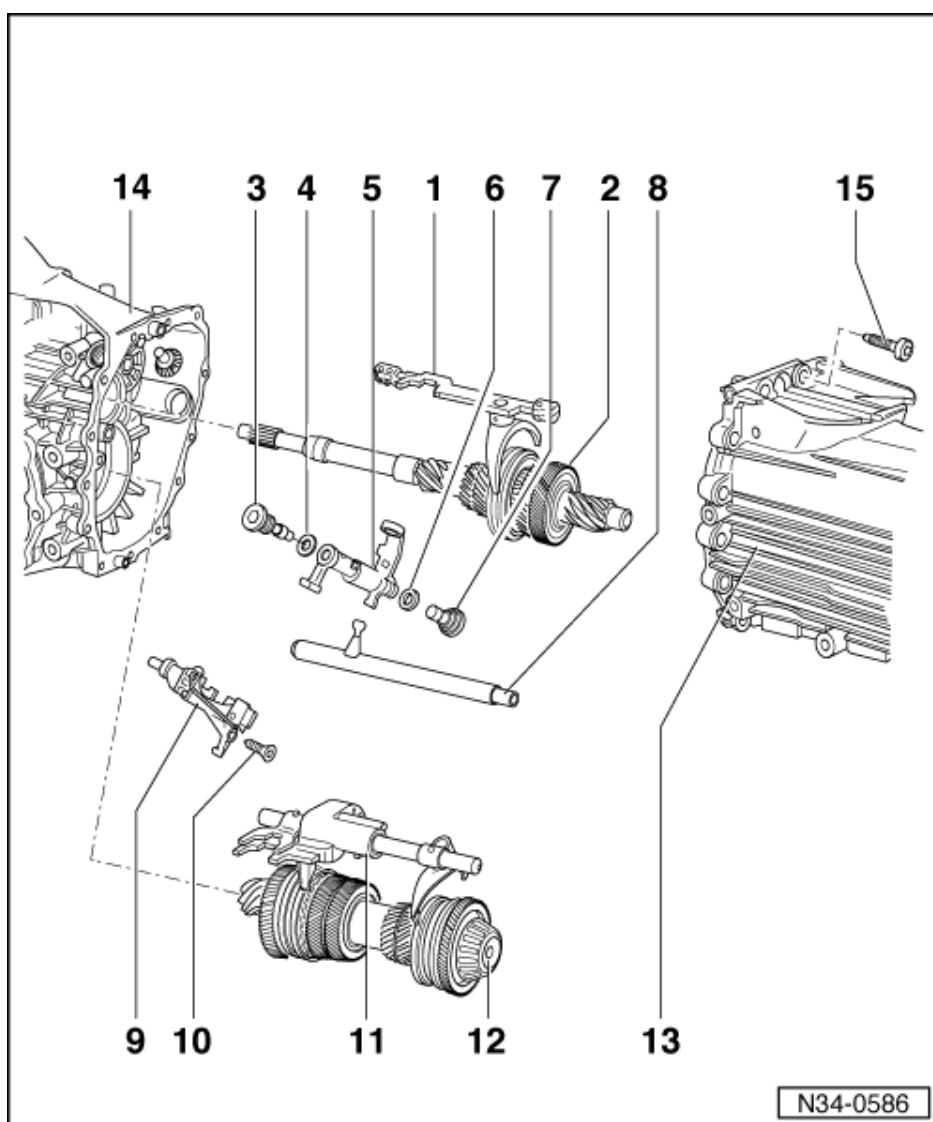
- ♦ Dismantling and assembling
=> Page 84
- ♦ Replacing mounting bushes
=> Page 84

2 Input shaft

- ♦ Dismantling and assembling
=> Page 92
- ♦ Adjusting =>Page 107
- ♦ Servicing input shaft bearings
=> Page 107

**3 Left stop bolt,
40 Nm**

4 Washer

**5 Relay shaft**

- ♦ Installation position => Page 84

6 Washer**7 Right stop bolt,
40 Nm****8 Selector shaft**

- ♦ Installation position => Page 84
- ♦ Replacing selector shaft oil seal
=> Page 84

9 Detent segment

- ♦ Installation position => Page 84

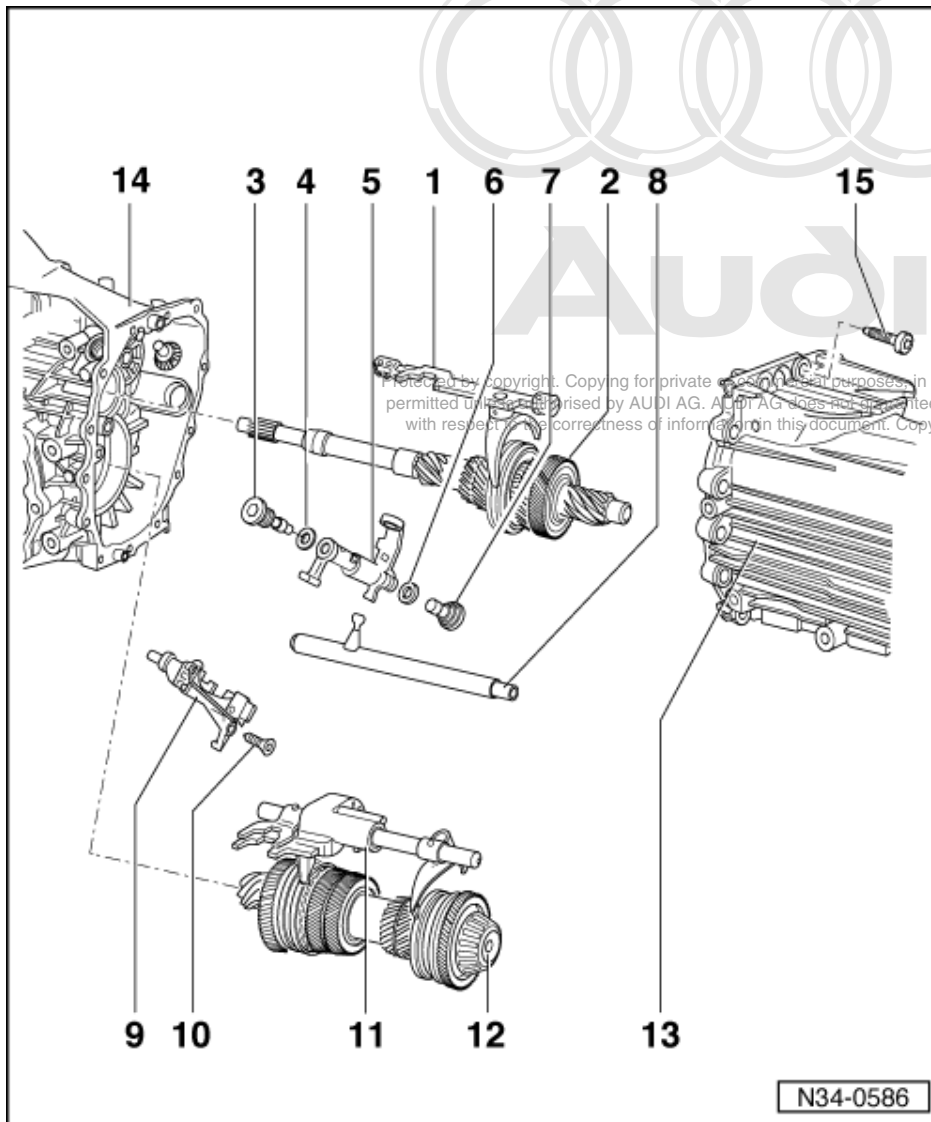
10 Torx bolt -25 Nm

- ♦ With shoulder to secure the detent element spring

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

- ♦ Dismantling and assembling
=> Page 84
- ♦ Removing and installing ball sleeves => Fig. 88

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12 Pinion shaft

- ◆ Dismantling and assembling
=> Page **109**
- ◆ Adjusting =>Page **157**
- ◆ Servicing pinion shaft bearings
=> Page **109**

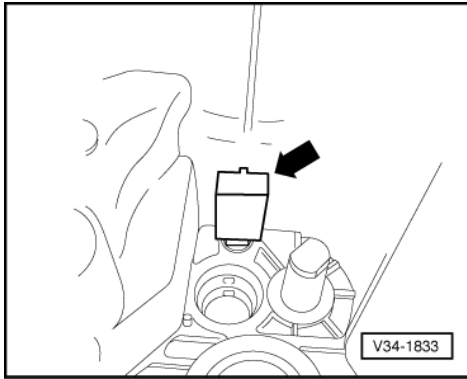
13 Gearbox cover

- ◆ Apply thin coat of sealing paste AMV 188 001 02 to sealing surfaces
- ◆ Removing and installing oil collector tray=>Fig. **75**

14 Gearbox housing

- ◆ Allocate components according to gearbox code letters using Parts catalogue => Page **2**

15 Torx bolt - 22 Nm



-> Fig.1 Removing and installing oil collector tray

Removing

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

Installing

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

4.6 - Removing and installing input shaft ball bearing, multi-function sender, input shaft, pinion shaft, selector rods and gearbox cover

Notes:

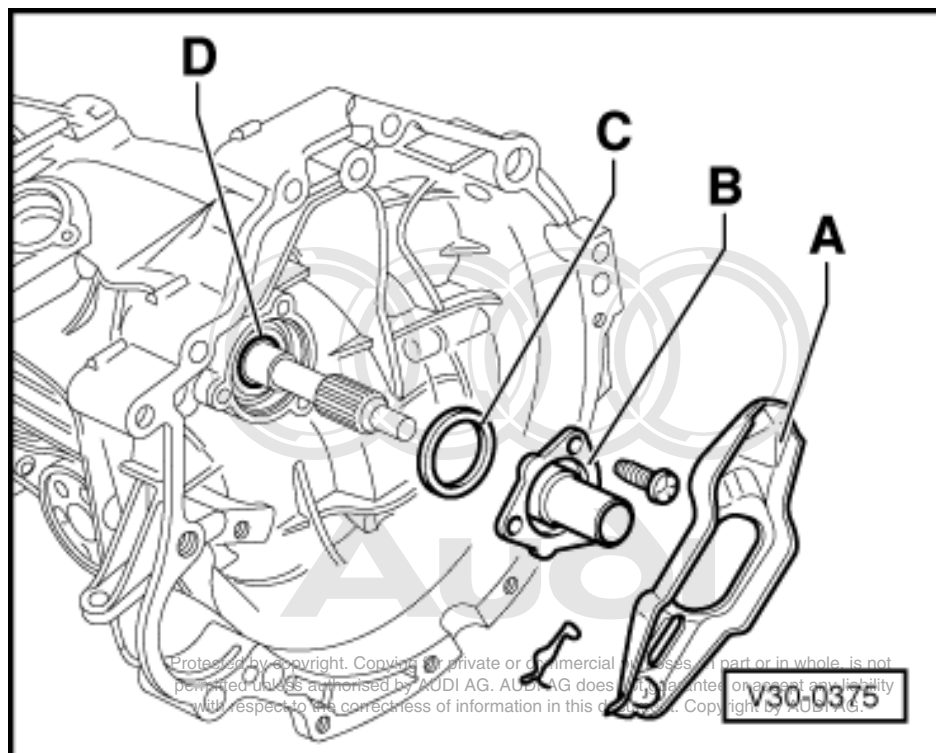
- ◆ To remove the above-mentioned components it is not necessary to remove the differential.
- ◆ Removal is only necessary when adjustments have to be carried out => adjustment overview, Page 156 .

Special tools, testers and auxiliary items

- ◆ Retaining plate VW 309
- ◆ Gearbox support VW 353
- ◆ Pressing-in tool 3235
- ◆ Drip tray V.A.G 1306
- ◆ Taper roller bearing extractor V.A.G 1582
- ◆ Clamping piece V. A. G. 1582/2
- ◆ Sealant AMV 188 001 02

Removing

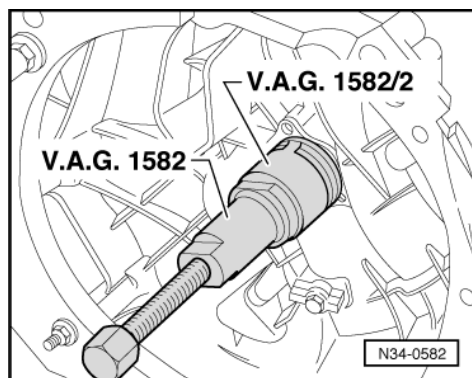
- Place drip tray VW 1306 below gearbox.
- Drain gear oil.
- Secure gearbox to repair stand=>Page 60 .



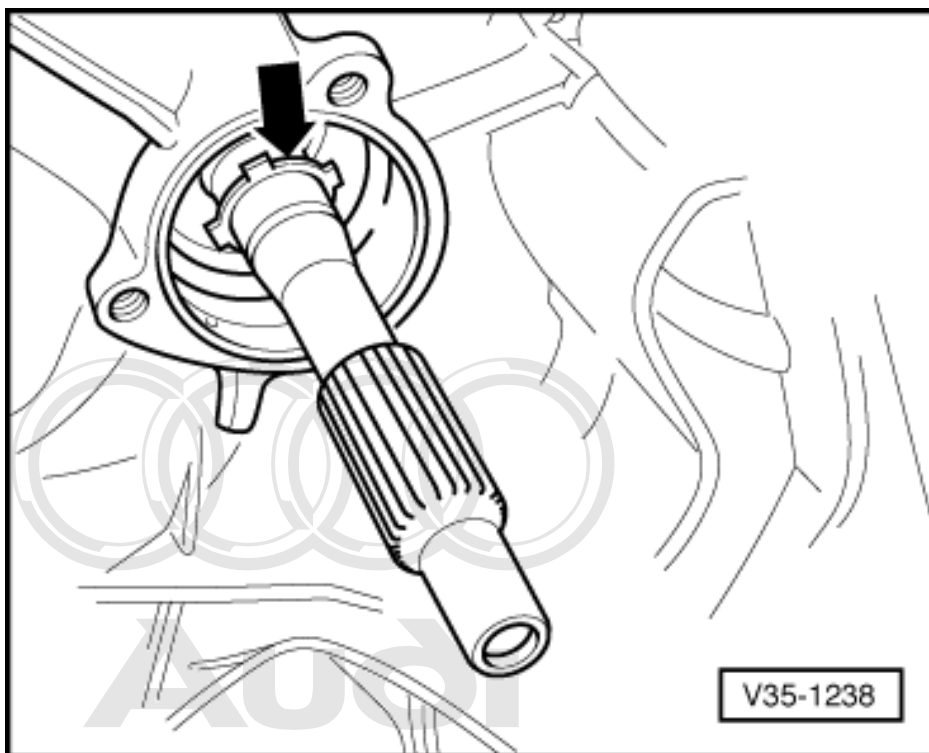
- -> Remove clutch release lever -A- with release bearing.

Notes:

- ♦ Before pulling off guide sleeve, cover splines on input shaft with a shrink-fit hose to protect oil seal.
- ♦ Removing oil seal in guide sleeve=>Page 24 .
- Remove guide sleeve -B-
- Remove dished washer -C-
- Remove circlip -D- in front of input shaft ball bearing.
- If the ball bearing, input shaft or gearbox housing is not to be replaced, note the thickness of the circlip.

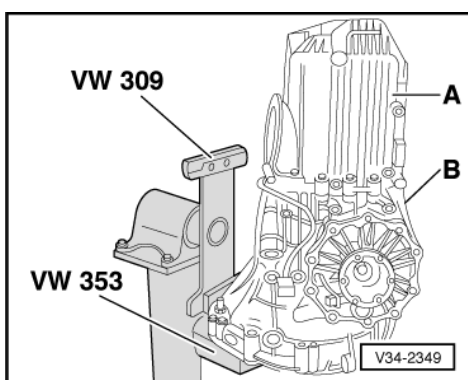


- -> Pull the input shaft ball bearing out of gearbox housing.

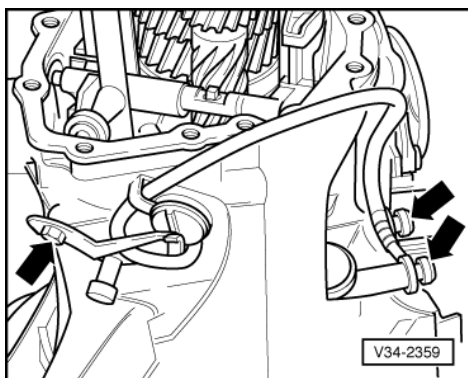


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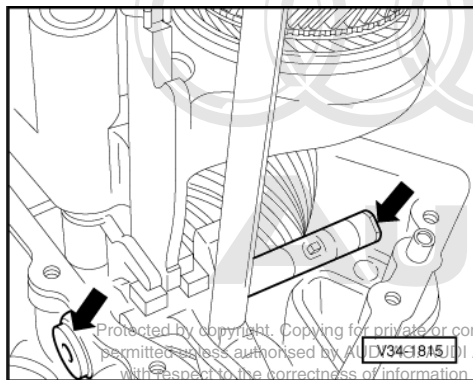
-> Remove the circlip (arrow) behind the input shaft ball bearing.
If the ball bearing, input shaft or gearbox housing is not to be replaced, note the thickness of the circlip.



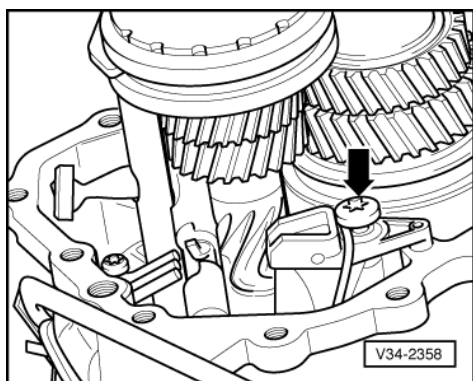
- -> Unbolt gearbox cover -A- from gearbox housing -B-.



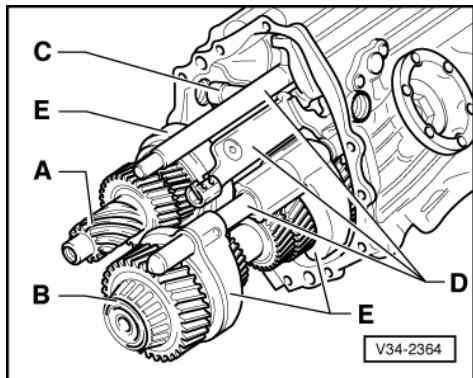
- -> Remove bolts (arrows) and pull out the multi-function sender.



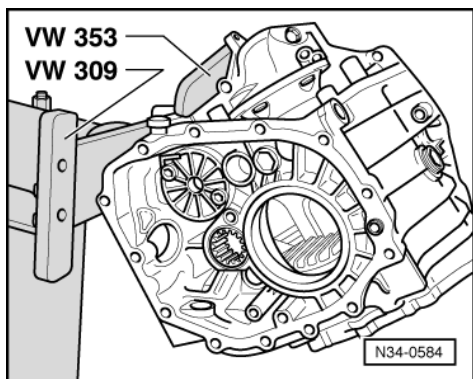
- -> Remove relay shaft bolts (arrows).



- -> Screw off detent segment (arrow) and swing it out.



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

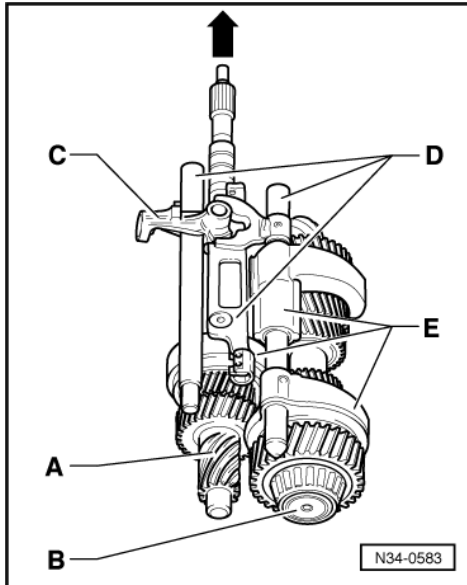


Installing

Note:

If the input shaft ball bearing, the input shaft or the gearbox housing have been replaced, it is necessary to re-determine the thickness of the circlips for the input shaft before installing the components=>Page 107, Adjusting input shaft.

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

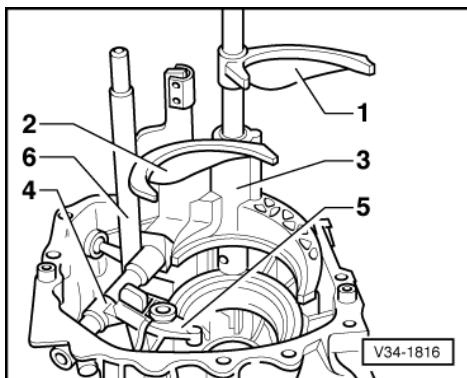


- -> Assemble the input shaft -A-, the pinion shaft -B-, the relay shaft -C-, the selector rods -D- with selector shaft and selector forks -E- together.
- Install these components together into the gearbox housing.

Note:

Relay shaft -C- and the selector shaft can also be fitted later if necessary =>Fig. V34-1816, Page 80.

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-> Location of gear selector mechanism in gearbox

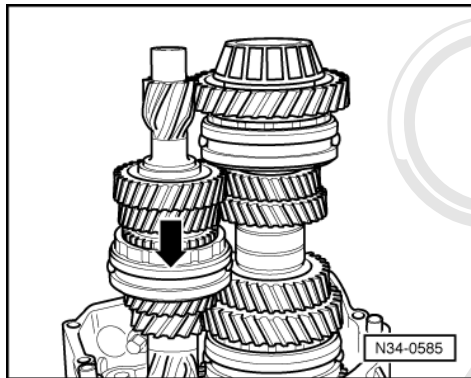
- 1 - Selector fork for 5th gear and reverse gear
- 2 - Selector fork for 3rd gear and 4th gear
- 3 - Selector fork for 1st gear and 2nd gear
- 4 - Relay shaft
- 5 - Detent mechanism



6 - Selector shaft

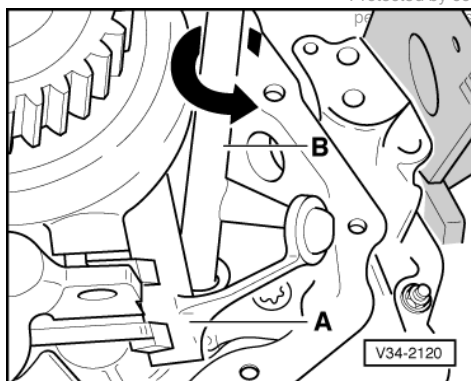
Note:

Shown in illustration with input shaft and pinion shaft removed.

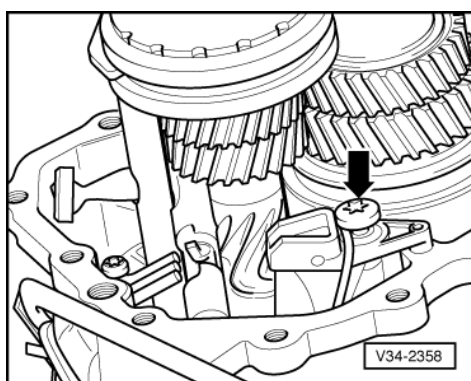


- -> Turn gearbox housing and engage 3rd gear (direction of arrow).

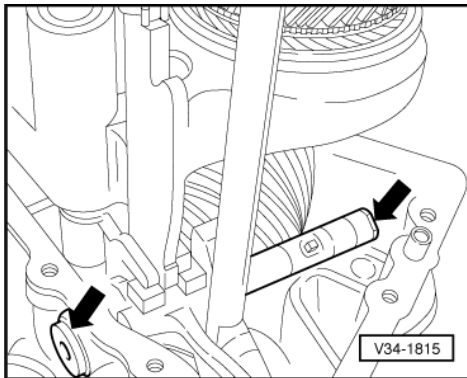
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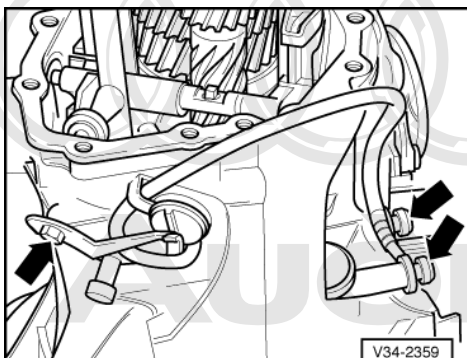
- -> Now install relay shaft -A-.
- Insert selector shaft -B- sideways onto the drilling in gearbox housing and assemble into mounting eye.
- Then turn the selector shaft carefully in direction of arrow.



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

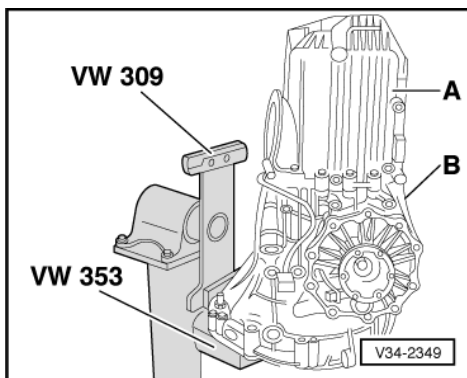


- -> Insert the relay shaft bolts (arrows).



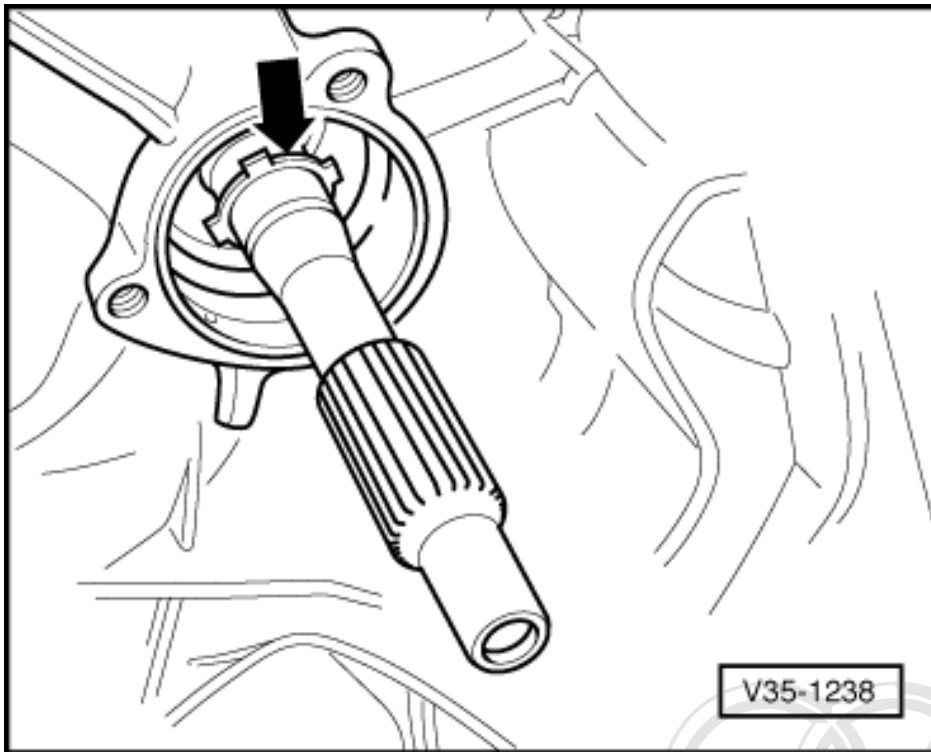
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- **Replace O-ring for multi-function sender.**
- -> Carefully insert multi-function sender and tighten (arrows).

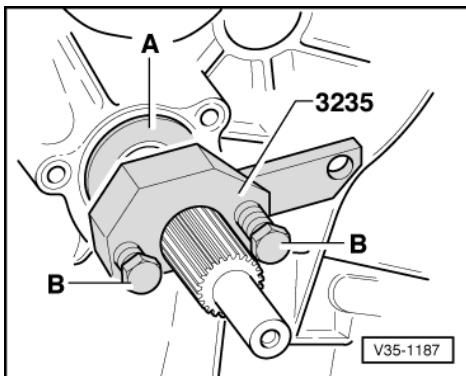


Check whether the dowel sleeves for the gearbox cover -A- are fitted in gearbox housing -B-.

- Apply thin coat of sealant AMV 188 001 02 to sealing surfaces.
- Fit gearbox cover onto gearbox housing.

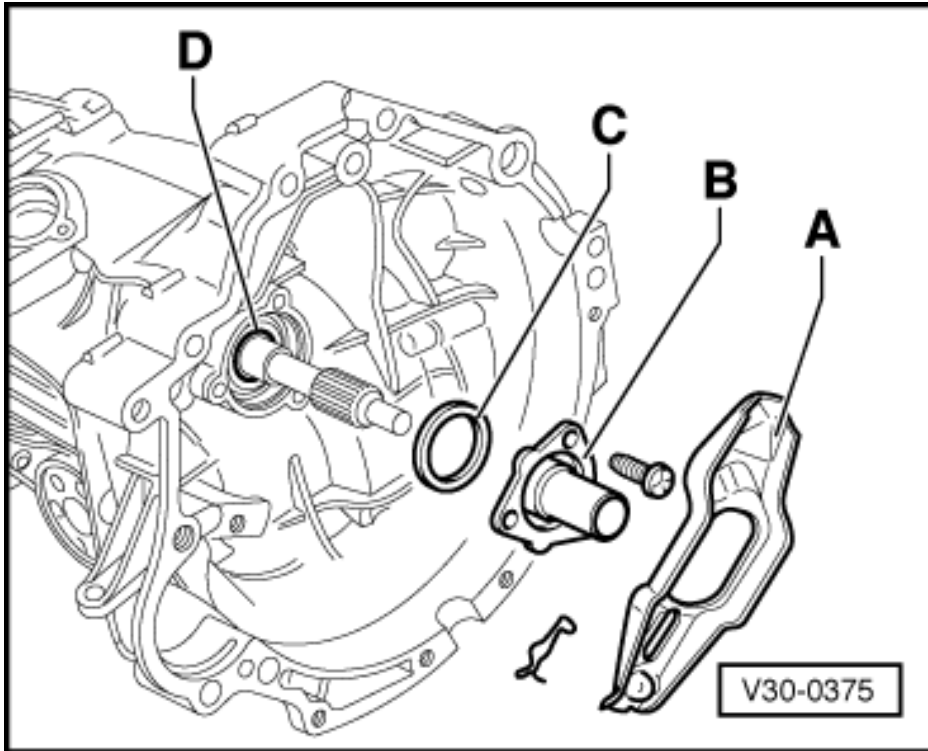


- -> Fit rear input shaft ball bearing circlip (arrow).
- Slide the ball bearing onto the input shaft.
- Position: closed side of ball cage faces towards gearbox housing.



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

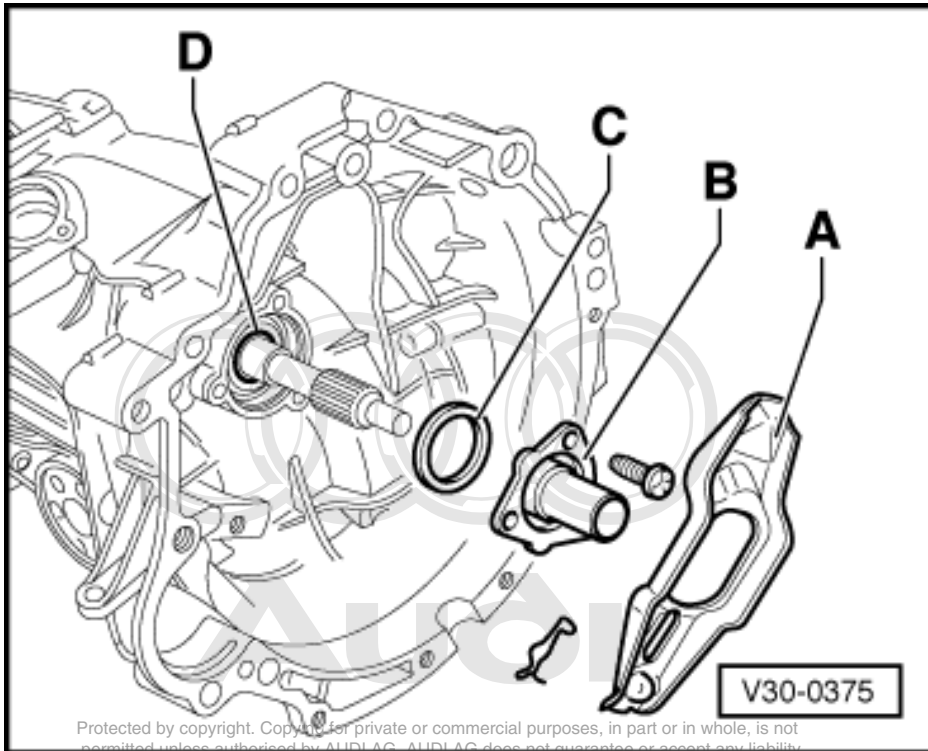
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- -> Now fit the input shaft ball race front circlip -D-.
- Then fit dished washer -C-.
- Position: convex side towards guide sleeve -B-

Notes:

- ◆ Before fitting guide sleeve, cover splines on input shaft with a shrink-fit hose to protect oil seal.
- ◆ Installing oil seal in guide sleeve
=>Page 24 .



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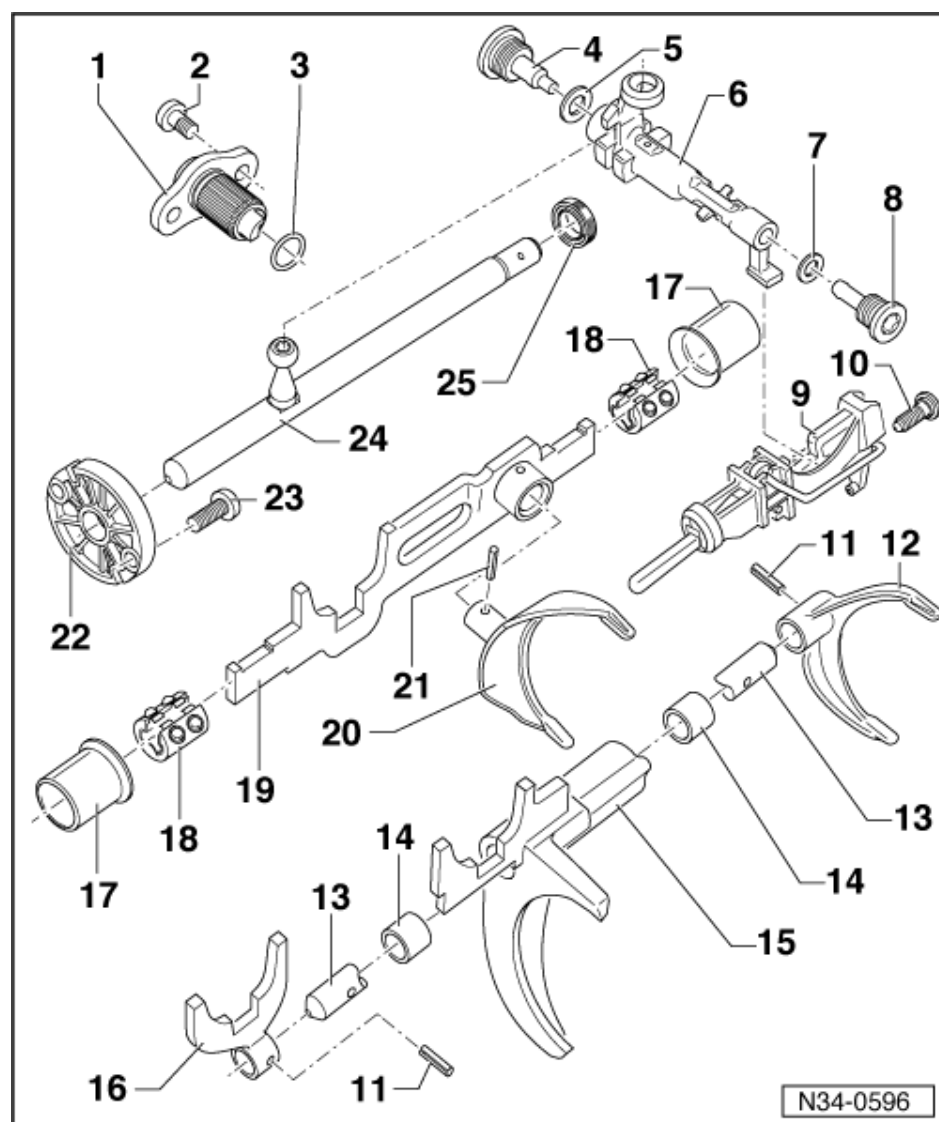
- -> Fit guide sleeve -B- for release bearing.
- Fit clutch release lever -A- and release bearing.

5 - Dismantling and assembling selector mechanism in gearbox

5.1 - Dismantling and assembling selector mechanism in gearbox

Special tools, testers and auxiliary items

- ♦ Drift VW 295
- ♦ Adapter VW 295 A
- ♦ Press plate VW 401
- ♦ Tube VW 423
- ♦ Spacer sleeve VW 472/2
- ♦ Multi-purpose tool VW 771
- ♦ Internal puller Kukko 21/4



Note:

Installation position of the complete selector mechanism in gearbox => Fig. 89

1 Locking unit for 5th gear and reverse gear

- ♦ Removing and installing
=> Page 89

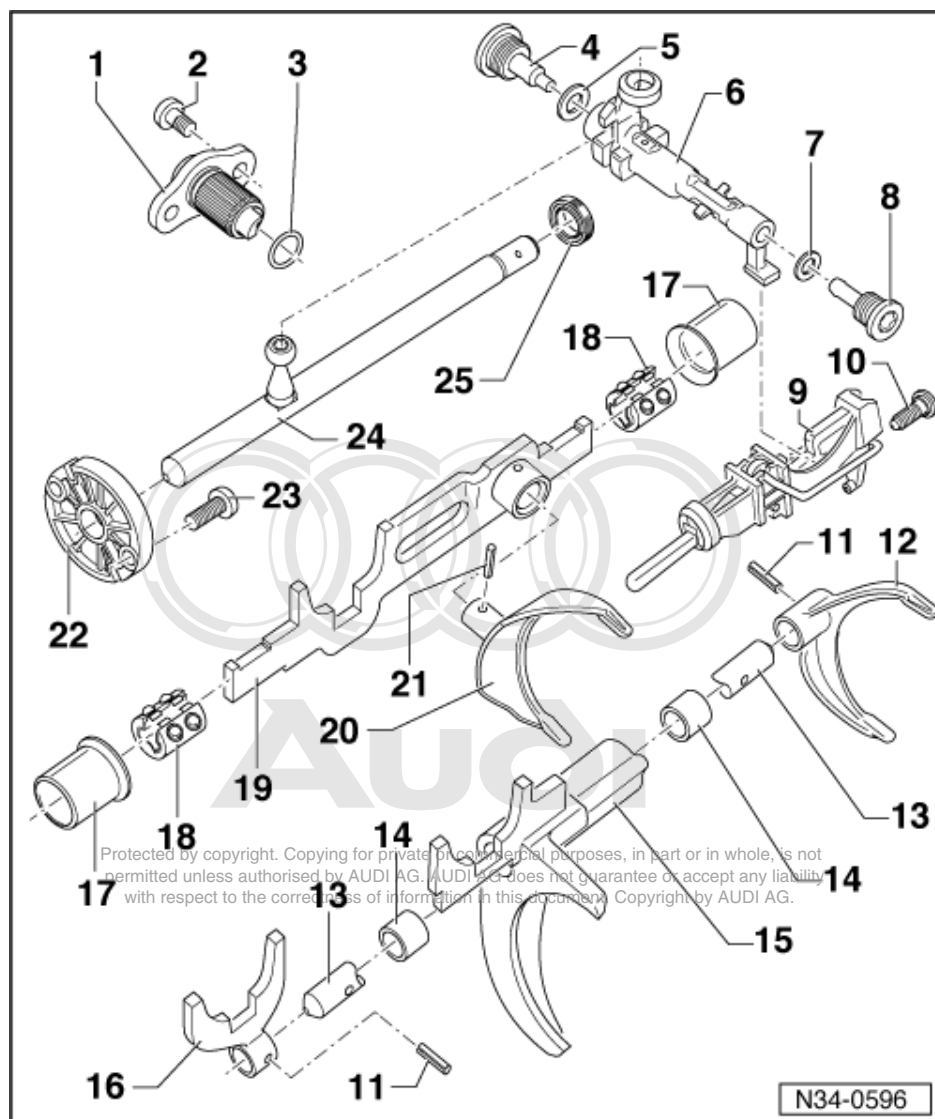
2 Torx bolt - 10 Nm

3 O-ring

- ♦ Renew

4 Right stop bolt, 40 Nm

5 Washer



6 Relay shaft

7 Washer

8 Left stop bolt, 40 Nm

9 Detent segment

10 Torx bolt - 25 Nm

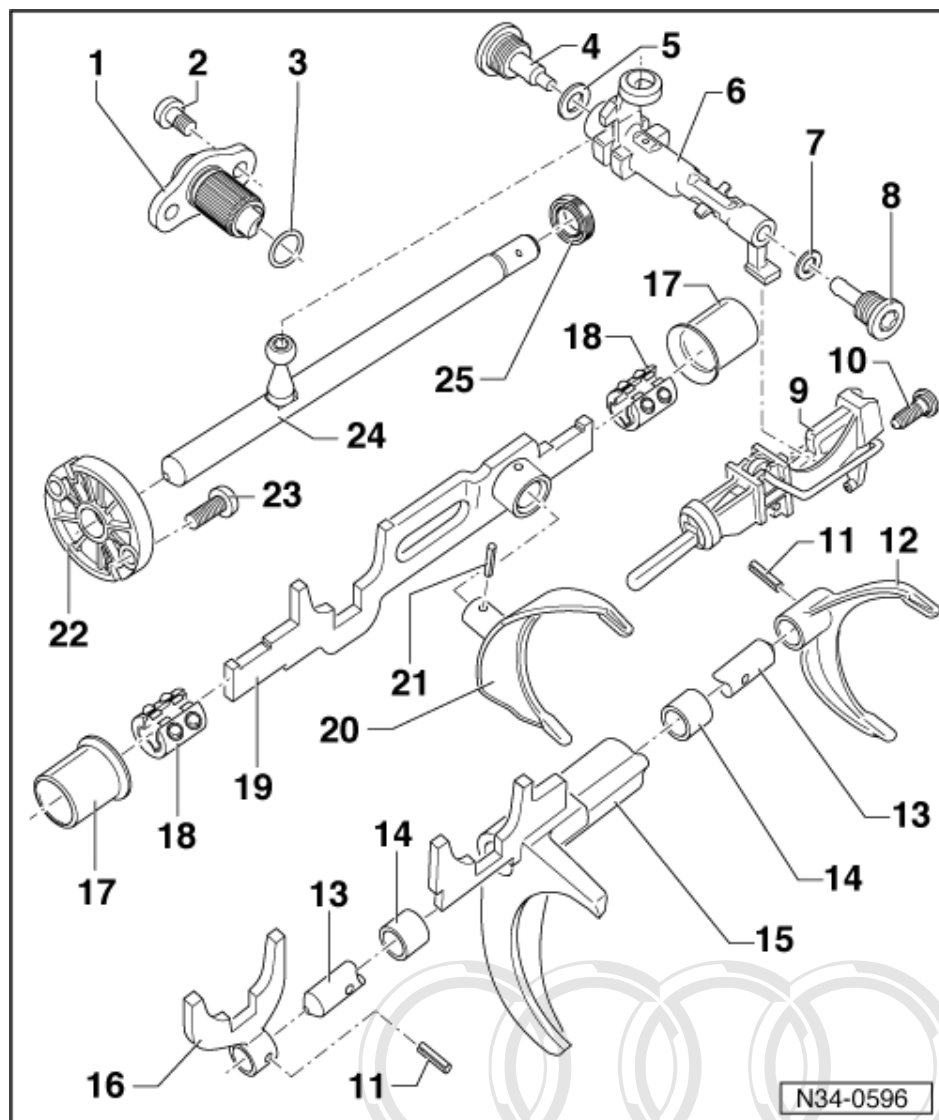
11 Spring pin

12 5th and reverse gear selector fork

- ♦ Installation position
=> Fig. 88



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



14 Ball sleeve

- ♦ Removing and installing
=> Fig. 88

15 Selector fork, 1st and 2nd gear

16 Coupling plate

- ♦ Installation position
=> Fig. 88

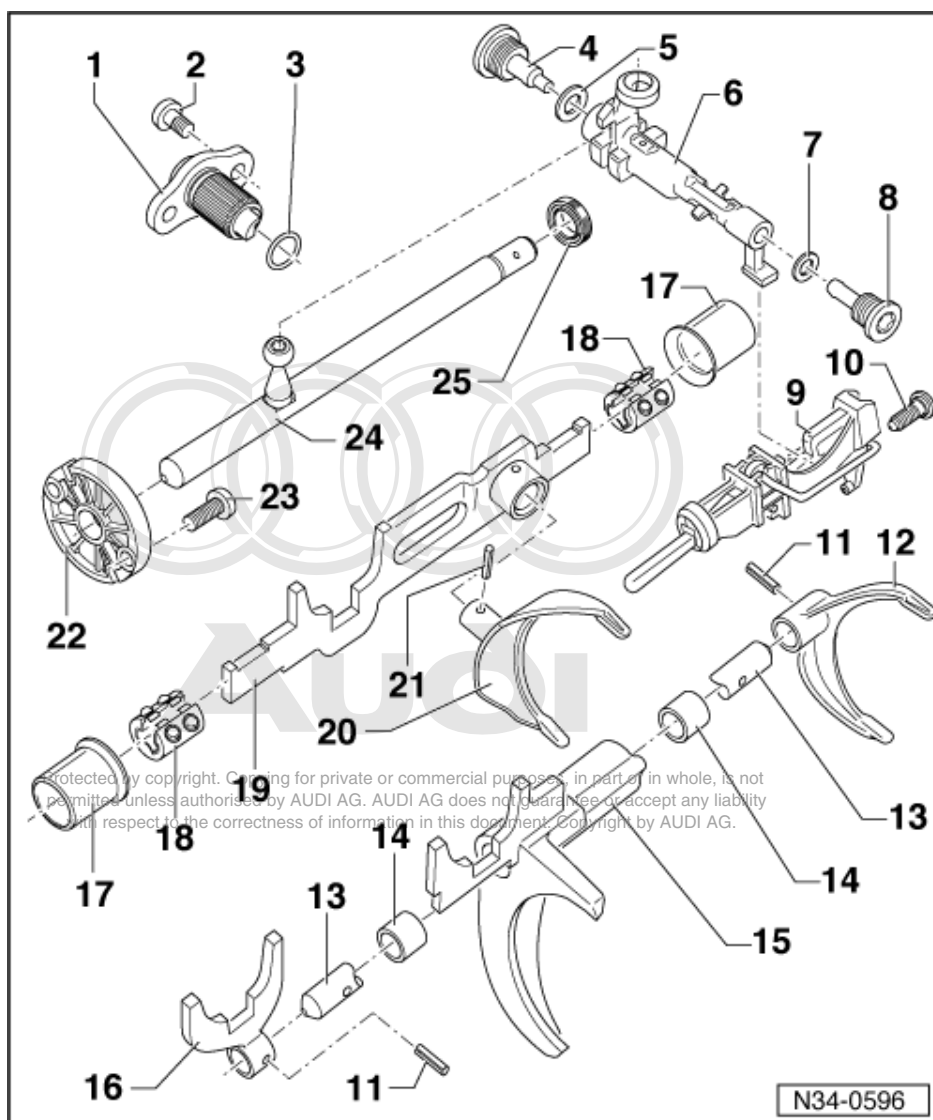
17 Mounting bush for 3rd and 4th gears

- ♦ Removing
=> Fig. 88
- ♦ Installing
=> Fig. 89

18 Ball sleeve

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

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19 Selector rod for 3rd and 4th gear

20 3rd and 4th gear selector fork

21 Spring pin

22 Cover

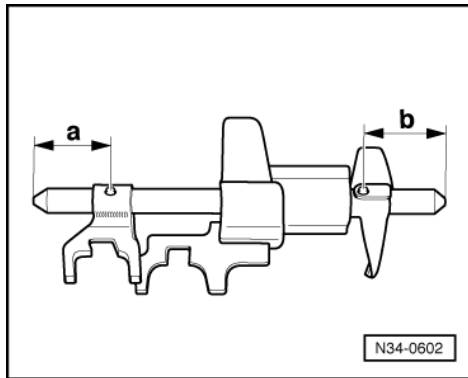
- ♦ For selector shaft

23 Torx bolt - 20 Nm

24 Selector shaft

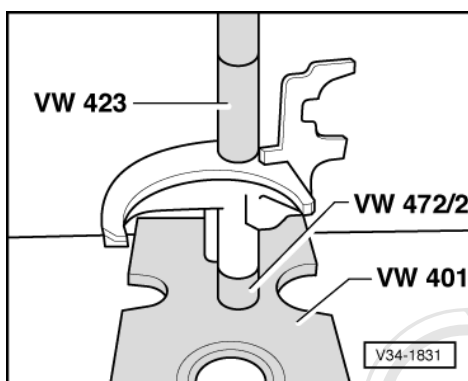
25 Oil seal

- ♦ Lever out with screwdriver
- ♦ Installation position
=> Fig. 89

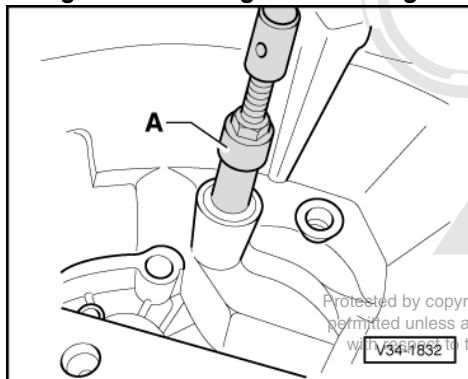


-> Fig.1 Installation position of 5th and reverse gear selector fork and coupling plate for selector rod.

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

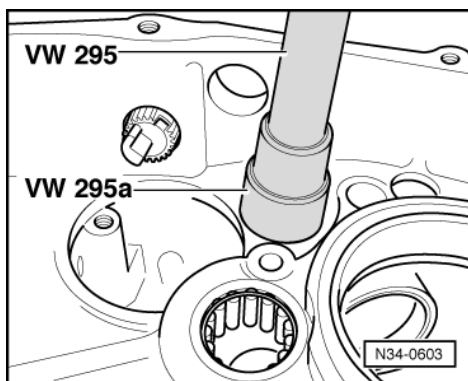


-> Fig.2 Removing and installing ball sleeve

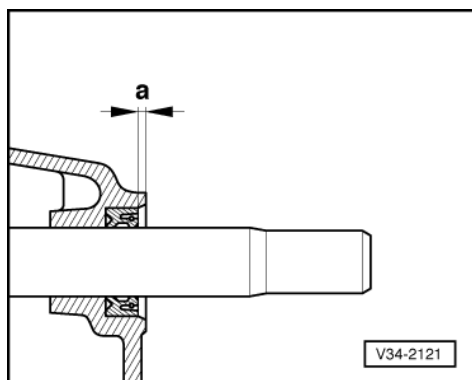


-> Fig.3 Pulling out mounting bush for 3rd and 4th gear selector rod

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

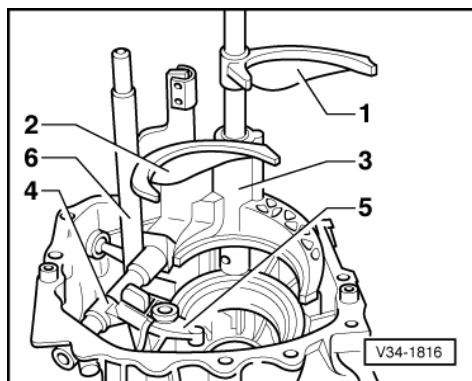


-> Fig.4 Driving in 3rd and 4th gear selector rod mounting bush onto stop



-> Fig.5 Oil seal installation position

- Pack space between sealing lip and dust lip with a small amount of multi-purpose grease.
- Lightly oil outer circumference of seal.
 - Distance a = 1 mm

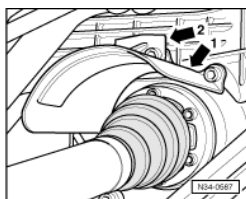


-> Fig.6 Installation position of complete selector mechanism in gearbox:

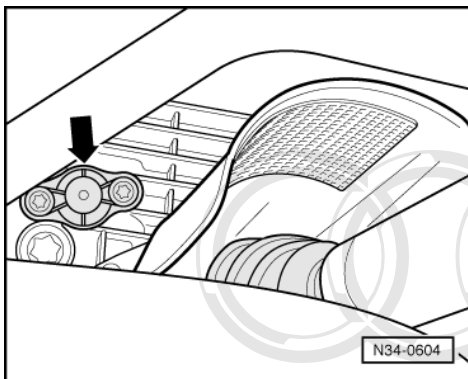
- 1 - Selector fork for 5th gear and reverse gear
- 2 - Selector fork for 3rd gear and 4th gear
- 3 - Selector fork for 1st gear and 2nd gear
- 4 - Relay shaft
- 5 - Detent mechanism
- 6 - Selector shaft

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

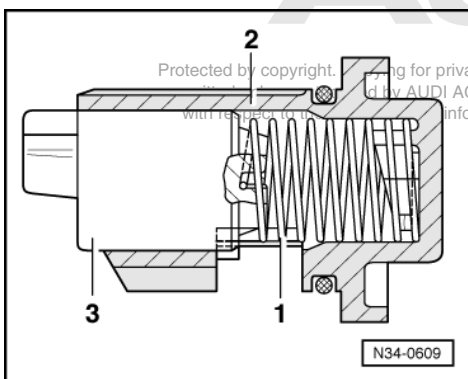


- -> Remove heat shield -arrow -2- above right-hand drive shaft.
- Detach heat shield -arrow -1- above right-hand drive shaft and pivot downwards.

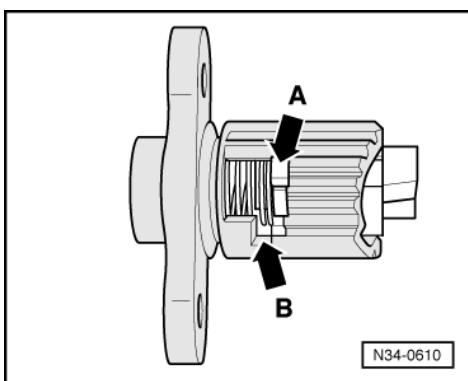


- -> Remove locking unit -arrow-.

Assembling locking unit:



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



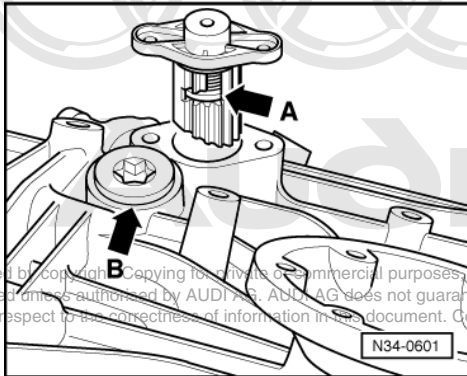
-> Installation position of bush:

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

Checking installation position:

- Turn bush to left and release.

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



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-> Installation position of complete locking unit in gearbox:

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



35 - Gears, Shafts

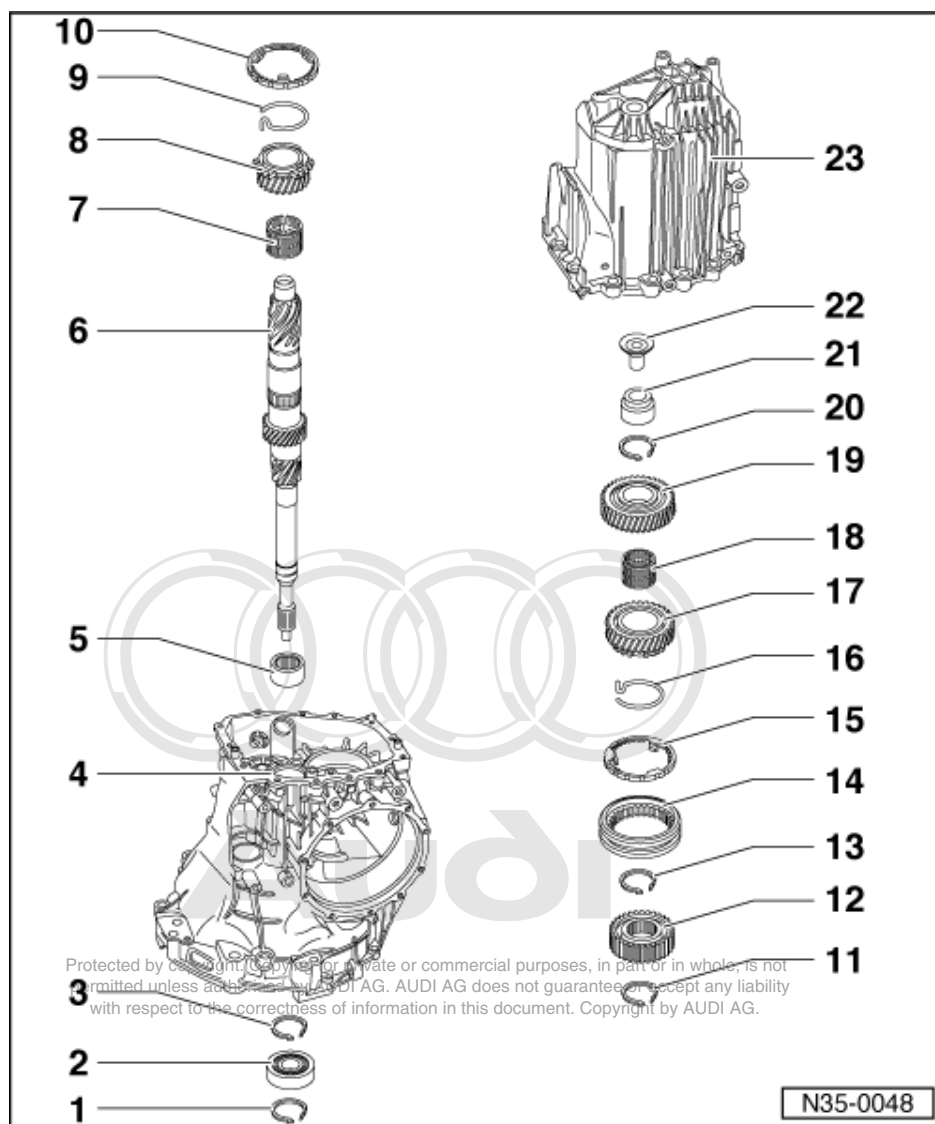
1 - Dismantling and assembling input shaft

1.1 - Dismantling and assembling input shaft

Special tools, testers and auxiliary items

- ◆ Drift VW 222a
- ◆ Drift VW 295
- ◆ Adapter VW 295 A
- ◆ Thrust plates VW 401 and VW 402
- ◆ Press tools VW 407 and VW 408 A
- ◆ Tube VW 415 A and 416 B
- ◆ Thrust plate VW 447 i
- ◆ Multi-purpose tool VW 771
- ◆ Drift 30-24
- ◆ Drift sleeve 30-100
- ◆ Thrust plate 40-105
- ◆ Press tool 40-202
- ◆ Separating tool Kukko 17/2
- ◆ Internal puller Kukko 21/4

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**Notes:**

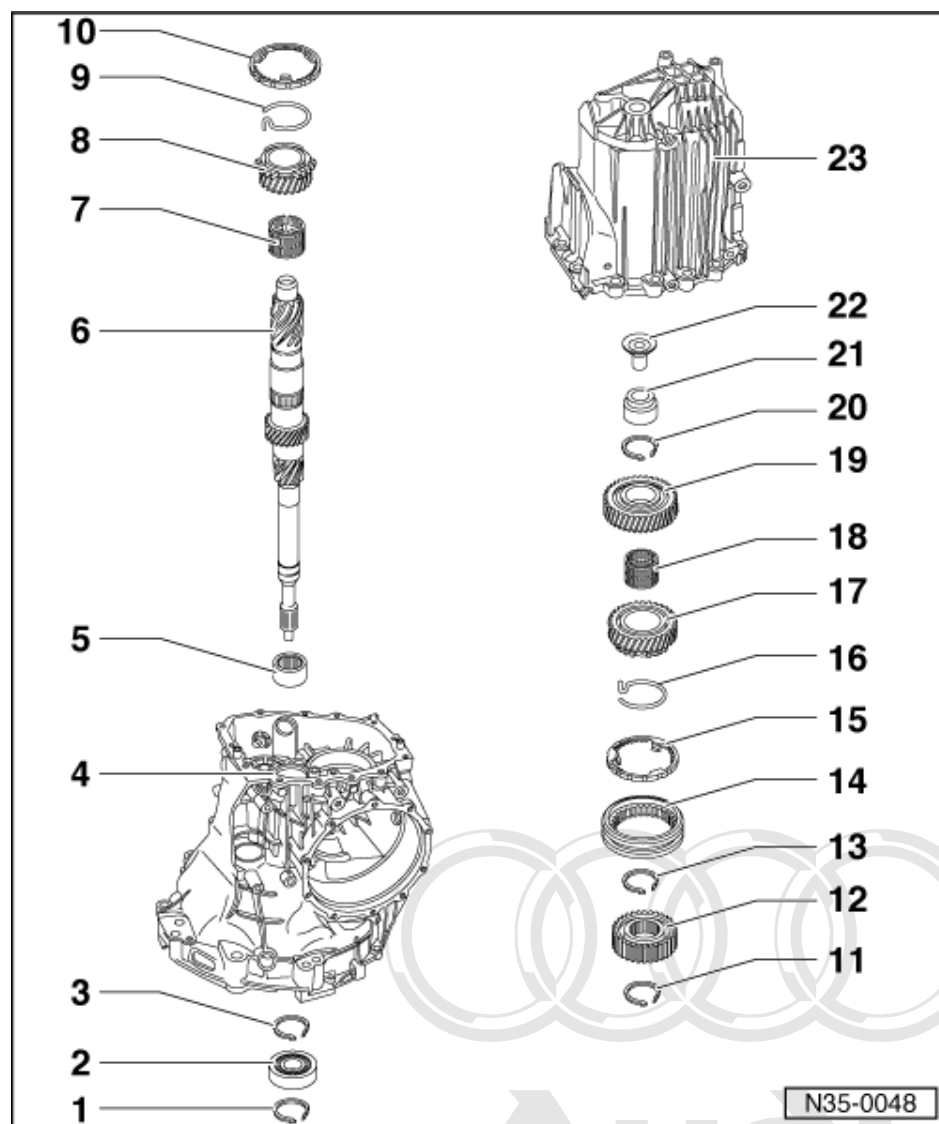
- ♦ When installing the input shaft or new gears, consult technical data => from Page 2.
- ♦ The position of the ball bearing will be affected if Items 107

1 Circlip

- ♦ Identification
- ♦ Installation position => Fig. 15 item 1
- ♦ Determining thickness => adjusting input shaft, Page 107

2 Ball bearing

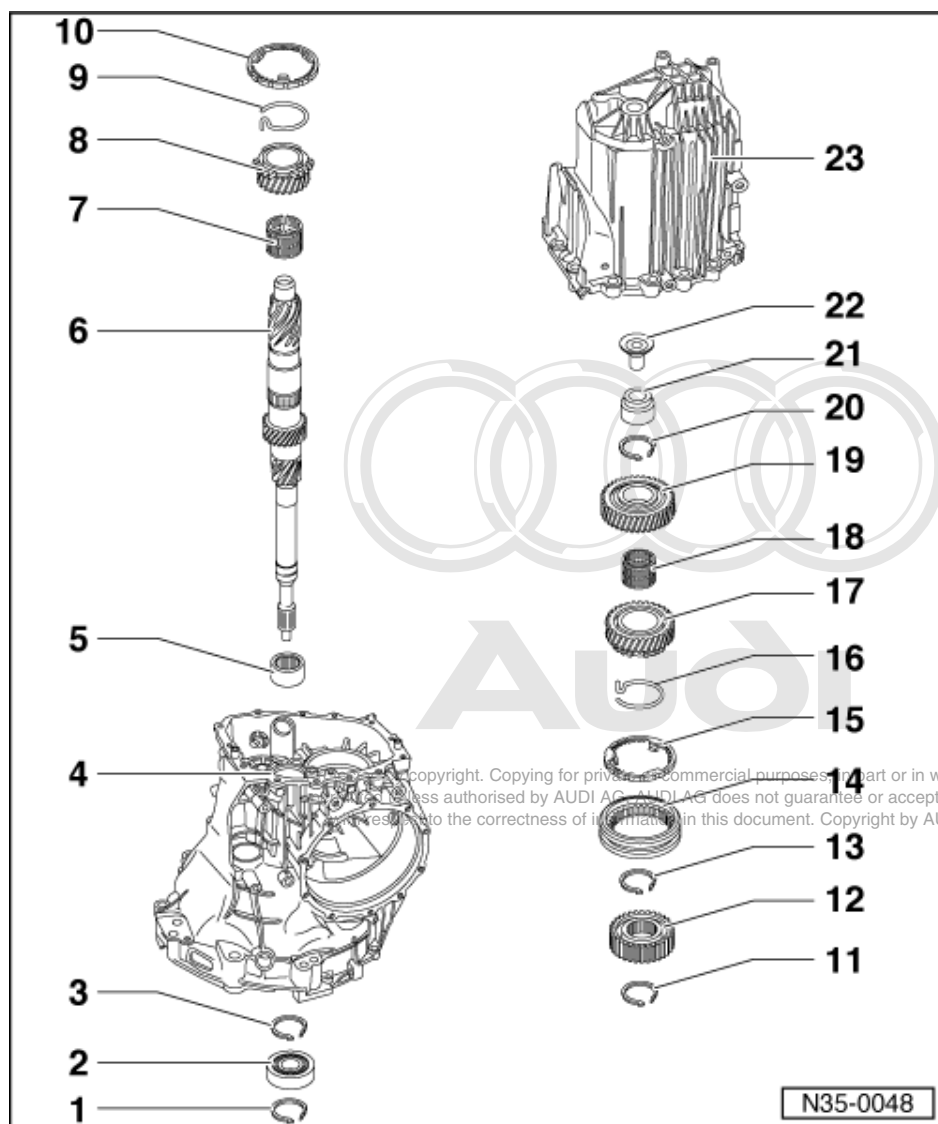
- ♦ Removing and installing
=> Page 75

**3 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15 item 2
- ◆ Determining thickness => adjusting input shaft, Page 107

4 Gearbox housing**5 Needle roller bearing**

- ◆ Secured with bolt
=> Fig. 99
- ◆ Removing => Fig. 99
- ◆ Selecting correct needle bearing for input shaft => Fig. 99
- ◆ Installation position
=> Fig. 100
- ◆ Pressing in => Fig. 100
- ◆ Securing => Fig. 101

**6 Input shaft**

- ◆ With oil feed sleeve
- ◆ Knocking in oil feed sleeve=> Fig. 101
- ◆ Adjusting => Page 107
- ◆ Selecting correct needle bearing for input shaft => Fig. 99

7 Needle bearing for 3rd gear

- ◆ Identification

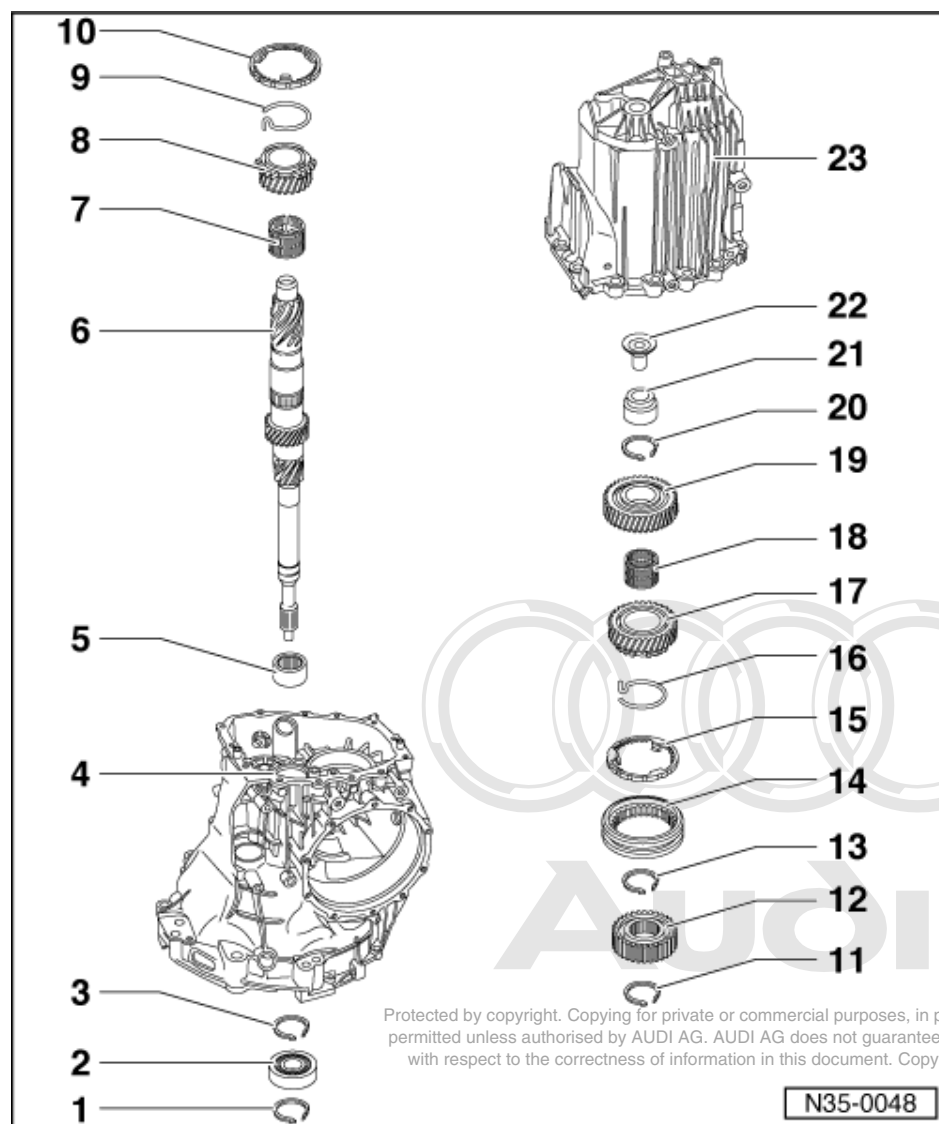
8 3rd speed sliding gear**9 Spring**

- ◆ Insert in 3rd speed sliding gear
=> Fig. 103
- ◆ Allocation of spring to sliding gear

=> Parts catalogue

10 Synchro-ring for 3rd gear

- ◆ Checking for wear
=> Fig. 104

**11 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15 item 3

12 Synchro-hub for 3rd and 4th gear

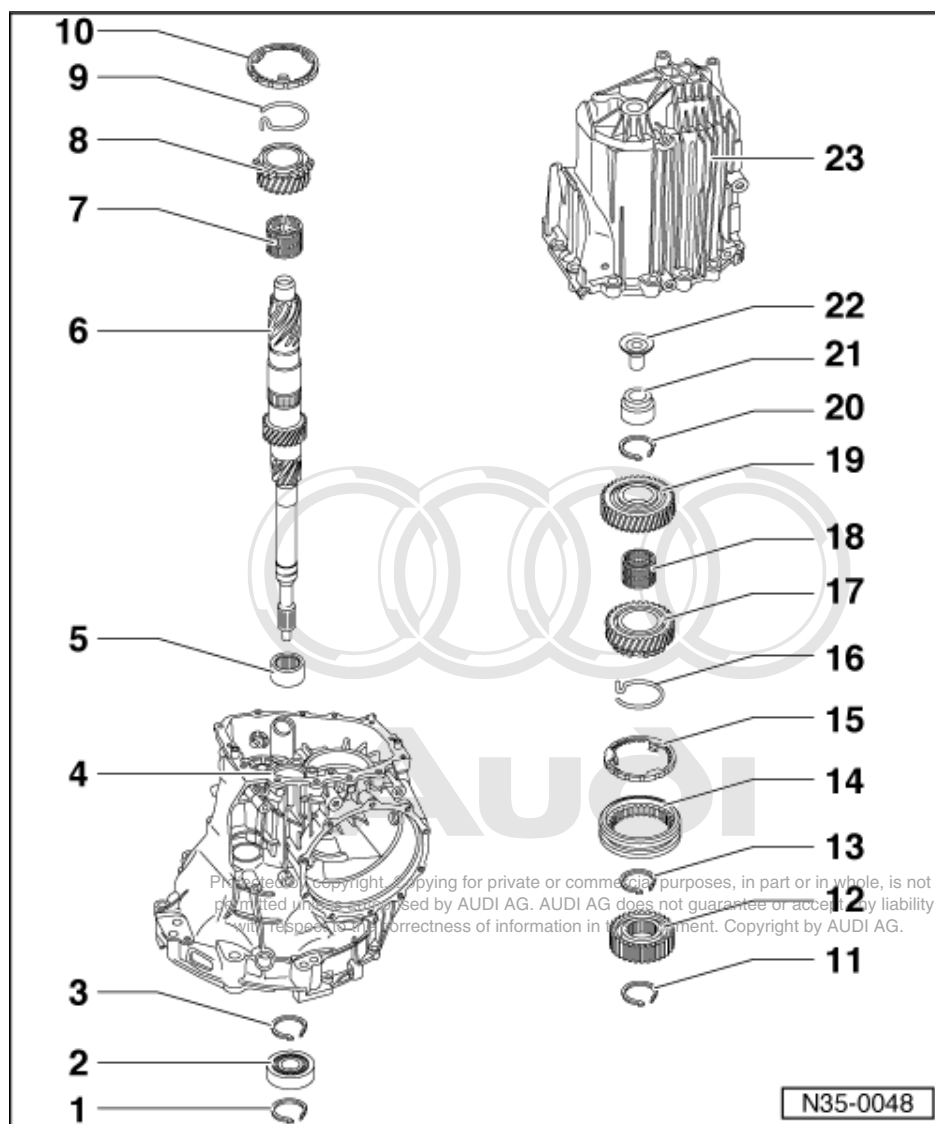
- ◆ Shoulder faces to 3rd gear
- ◆ Pressing off=> Fig. 103
- ◆ Pressing on => Fig. 106

13 Circlip

- ◆ Identification
- ◆ Installation position => Fig. 15 item 4
- ◆ If synchro hub is replaced, redetermine thickness =>Fig. 105

14 3rd and 4th gear locking collar

- ◆ Installation position
=> Fig. 106

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

- ♦ Checking for wear
=> Fig. 104

16 Spring

- ♦ Insert in 4th speed sliding gear
=> Fig. 103
- ♦ Allocation of spring to sliding gear

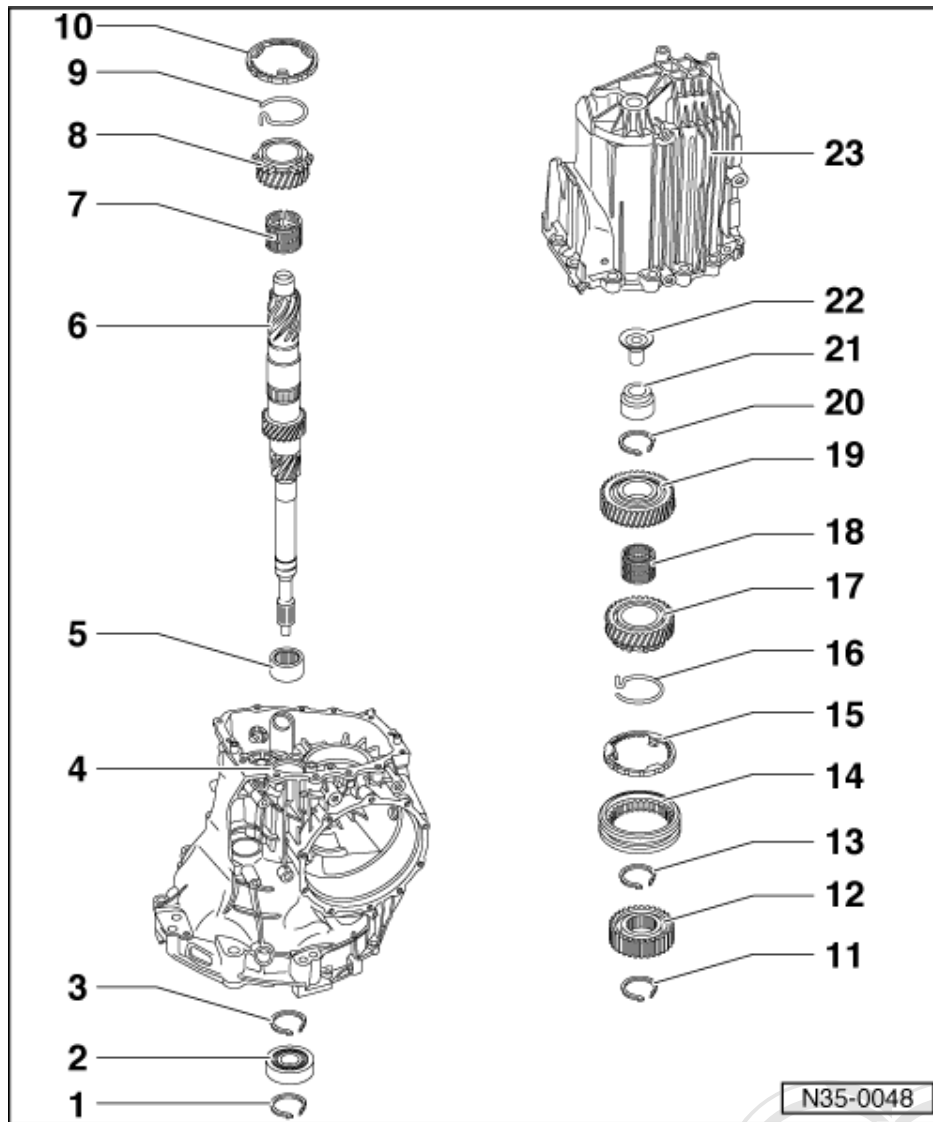
=> Parts catalogue

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

- ♦ Identification

19 5th gear wheel

- ♦ Pressing off => Fig. 102
- ♦ Pressing on => Fig. 106

**20 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15, item 5
- ◆ If 5th gear wheel is replaced redetermine thickness
=>Fig. 105

21 Roller sleeve

- ◆ Renew
- ◆ Will be damaged when removing
- ◆ Pulling out => Fig. 101
- ◆ Installation position
=> Fig. 102
- ◆ Driving in => Fig. 102

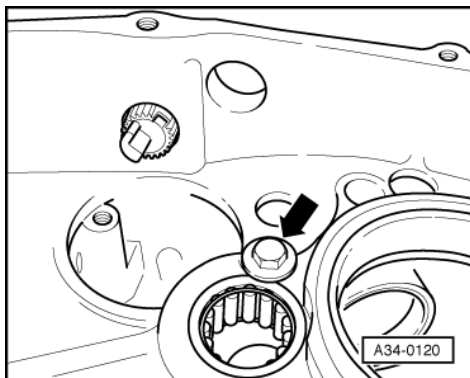
22 Sleeve

- ◆ Made of plastic

23 Gearbox cover

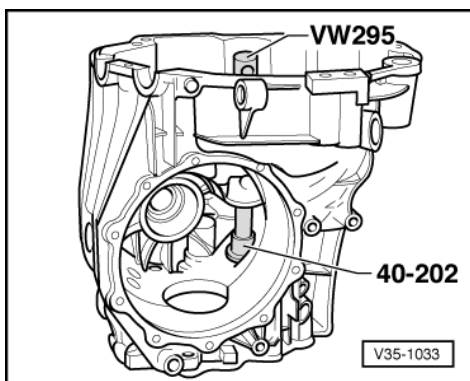
- ◆ Apply thin coat of sealing paste AMV 188 001 02 to sealing surfaces

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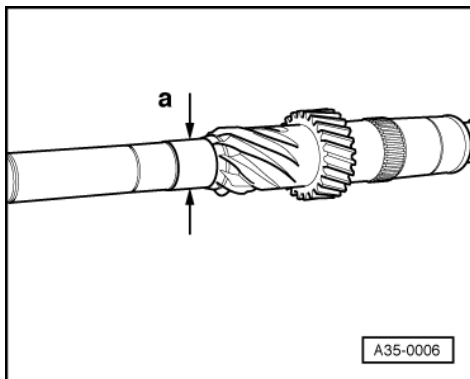


-> Fig.1 Removing securing bolt -arrow- for needle bearing

- Unscrew securing bolt -arrow-.



-> Fig.2 Driving-out needle bearing.



-> Fig.3 Selecting correct needle bearing for input shaft

Input shaft dia.	Part No. needle bearing
a = 27 mm	012 311 123 D
a = 29 mm	012 311 123

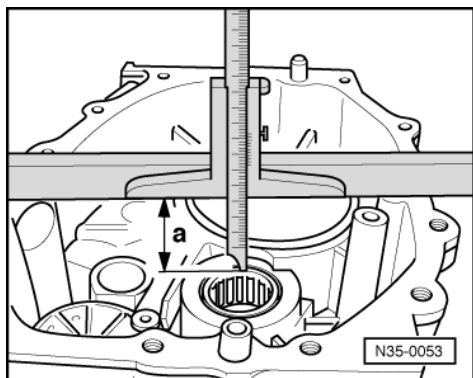
Note:

To avoid damage resulting from incorrect installation, check the following after replacing the input shaft:

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- ♦ It must be possible to guide input shaft into place.
- ♦ The input shaft must fit closely with no free play.

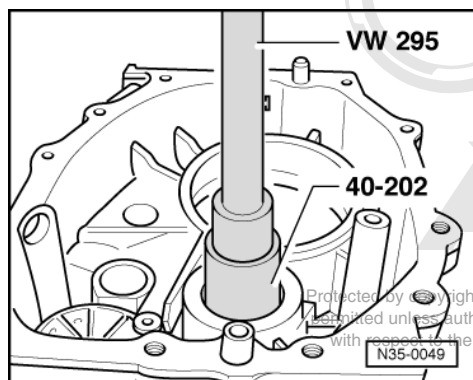


-> Fig.4 Installation position of needle bearing

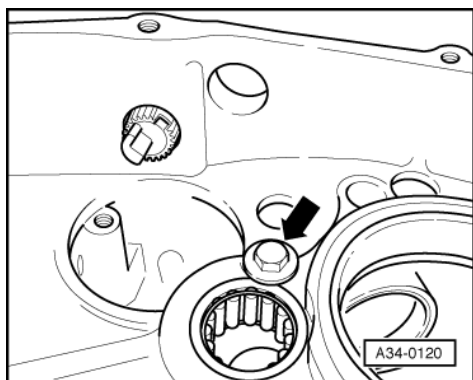
Distance -a- from lower edge of straight edge to upper edge of needle bearing = 39.5 mm

Note:

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

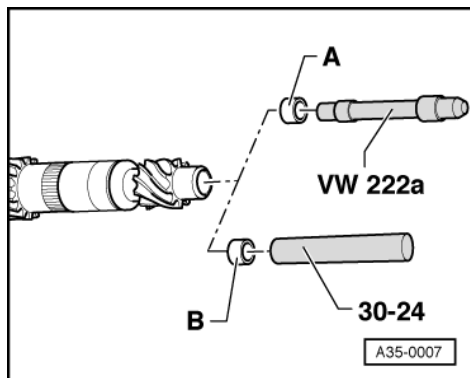


-> Fig.5 Pressing in needle bearing



➔ Fig.6 Screwing in securing bolt -arrow-

- ♦ Tightening torque: 25 Nm



➔ Fig.7 Knocking oil feed sleeve into input shaft

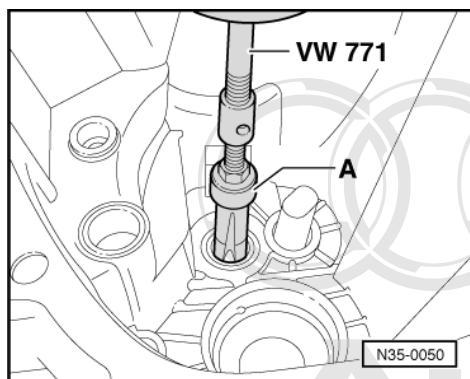
Item	Oil feed sleeve dia.	Fitting tool
A	14 mm	VW 222 A
B	16 mm	30-24

- ♦ Installation position:

Flanged edge on oil feed sleeve faces towards fitting tool.

- ♦ Installation depth:

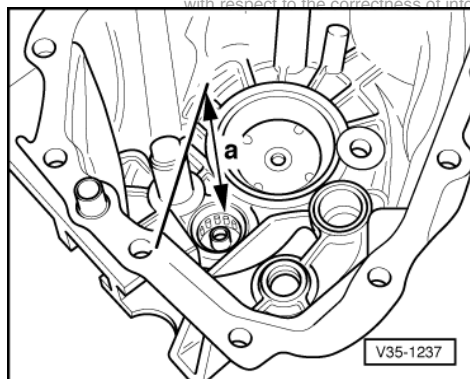
3.5 mm below end of shaft



➔ Fig.8 Pulling out roller sleeve

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

- Before fitting internal extractor the plastic sleeve inside the roller sleeve must be destroyed.



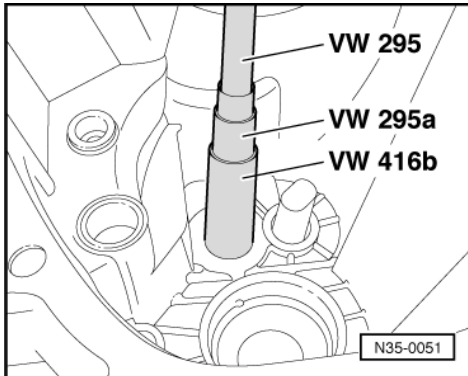


-> Fig.9 Installation position of roller sleeve

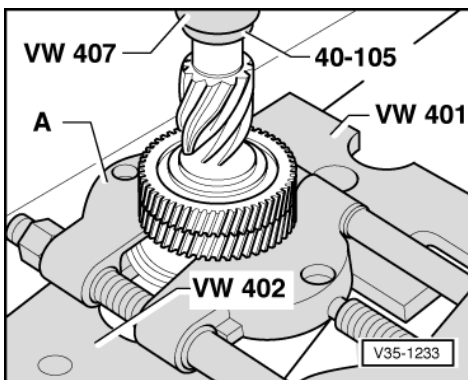
- ◆ Distance a = 216 mm

Note:

Distance is measured from top surface of cover to top surface of bearing.



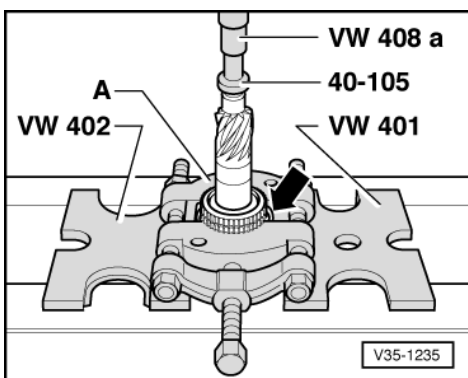
-> Fig.10 Driving in roller sleeve



-> Fig.11 Pressing off 5th gear wheel

- Remove circlip before pressing off.

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

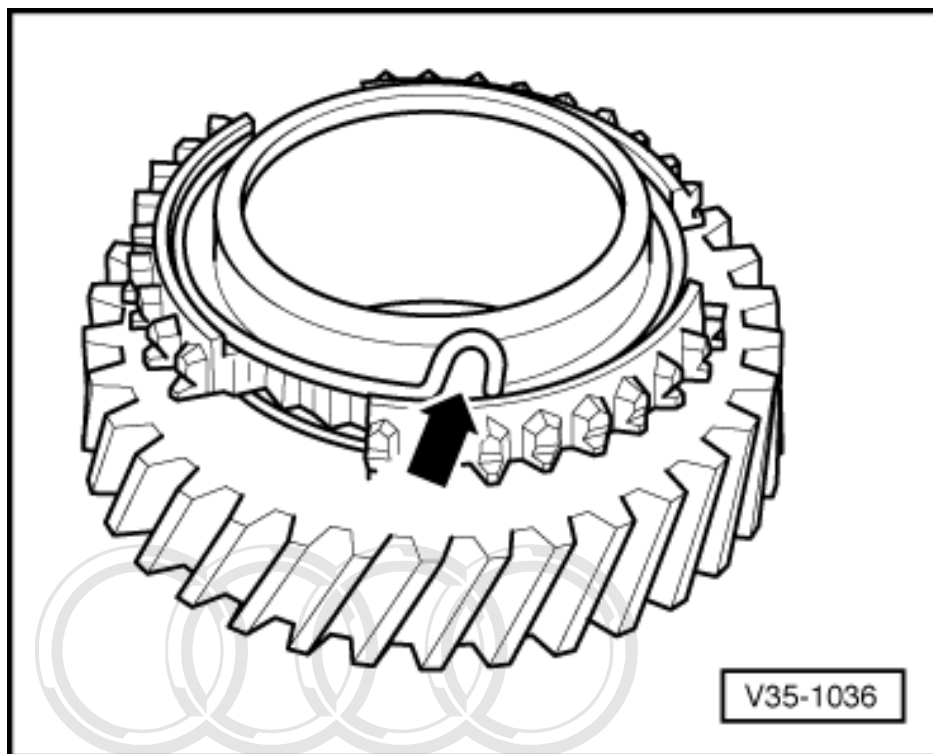


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-> Fig.12 Pressing off 3rd and 4th gear synchro hub

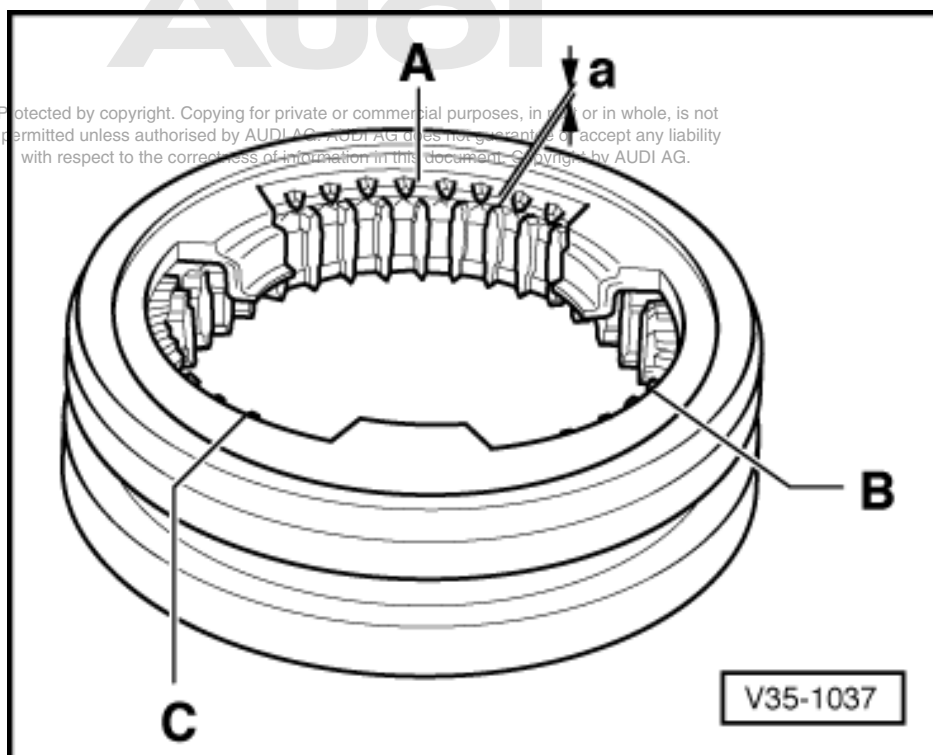
- Remove circlip before pressing off.
- Press 3rd gear synchro ring (arrow) towards 3rd gear wheel, then fit separating device -A-.

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



-> Fig.13 Inserting spring in gear wheel

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



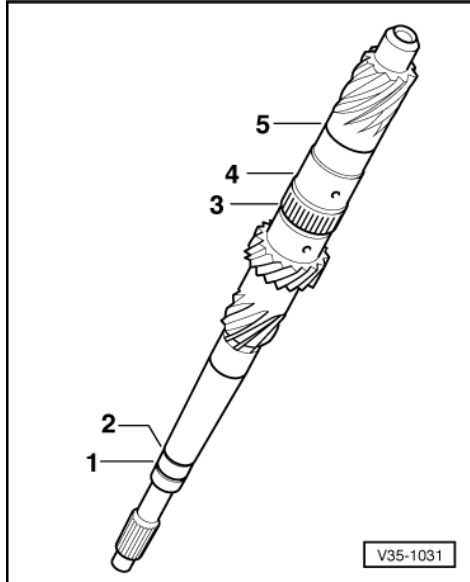
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-> Fig.14 Checking synchro-ring for wear

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

The average gap must not be less than 0.5 mm.



-> Fig.15 Position of circlips

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

Determine thickness => adjusting input shaft, Page 107 .

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

Thickness: 2.00 mm. Identification: brown colour

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

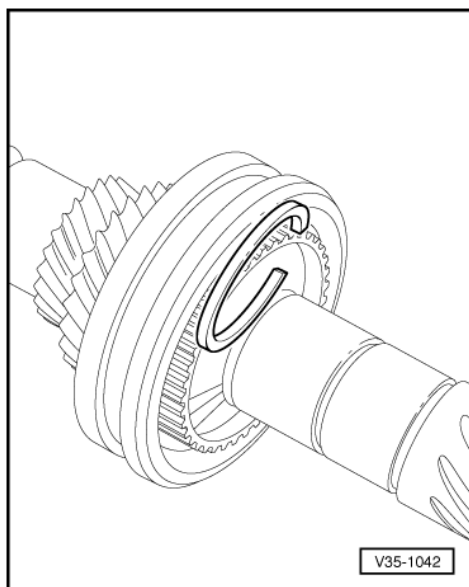
Determine thickness => table on Page 105 .
Identification: blue colour

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

Determine thickness => table on Page 105 .



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-> Fig.16 Determining thickness of circlip

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

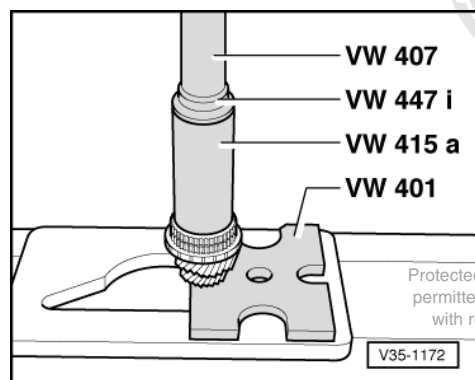
=> Parts catalogue

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

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

The following circlips are available for 5th gear wheel

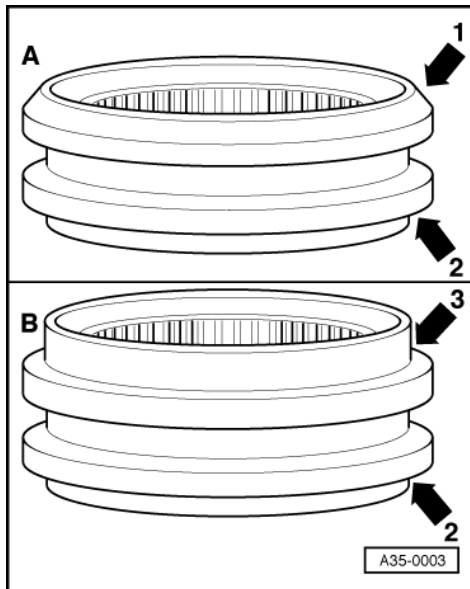
Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	



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-> Fig.17 Pressing on 3rd and 4th gear synchro-hub

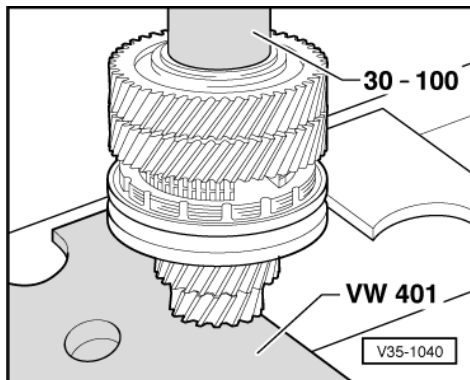


-> Fig.18 Installation position of locking collar

Different types of locking collar are installed: version -A- with chamfered surface -arrow 1- or version -B- with large shoulder -arrow 3-.

♦ Installation position:

Chamfered surface -arrow 1- faces towards 4th gear.
Small shoulder -arrow 2- faces towards 3rd gear.
Large shoulder -arrow 3- faces towards 4th gear.



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-> Fig.19 Pressing on 5th gear wheel

Caution
Wear protective gloves.

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

♦ Installation position:

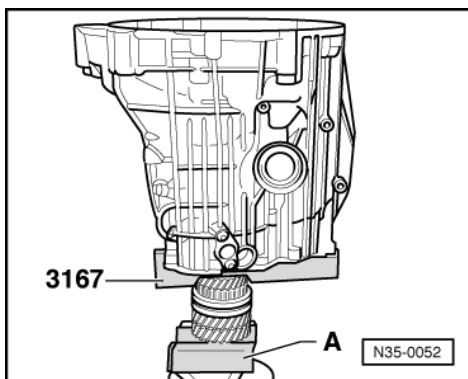
High collar faces towards reverse gear.

2 - Adjusting input shaft

2.1 - Adjusting input shaft

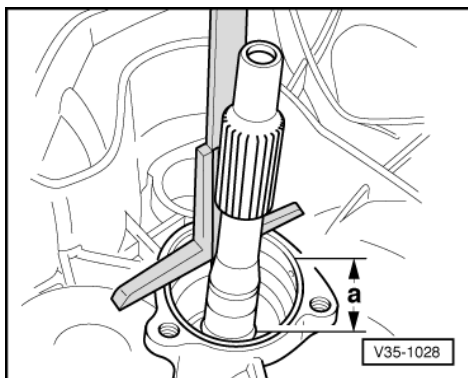
Note:

The input shaft must be readjusted if the gearbox housing, the input shaft or the ball bearing has been replaced.



Special tools, testers and auxiliary items

- ◆ Drift sleeve 30-100
- ◆ Distance gauge 3167
- ◆ Depth gauge
- -> Clamp input shaft in vice using vice clamps -A-.
- Place distance gauge 3167 onto 3rd gear wheel.

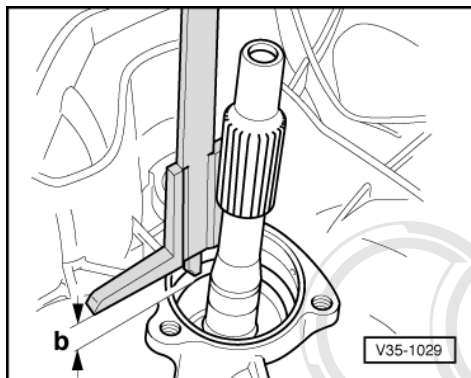


- Place gearbox housing over input shaft onto the distance gauge.

Calculating dimension "x"

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

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

Determining circlip behind the input shaft ball bearing

Formula:

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

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Example:

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

- Determine circlip from table. Part No.

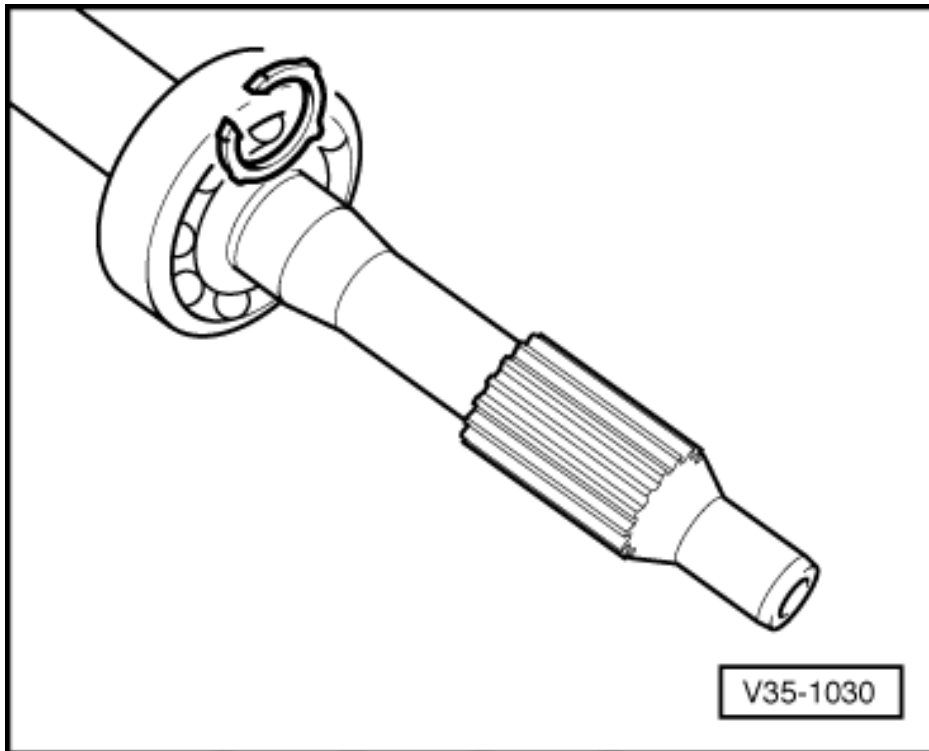
=> Parts catalogue

Circlips available

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

Determining the circlip in front of input shaft ball bearing

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



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

=> Parts catalogue

Circlips available

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

3 - Dismantling and assembling pinion shaft

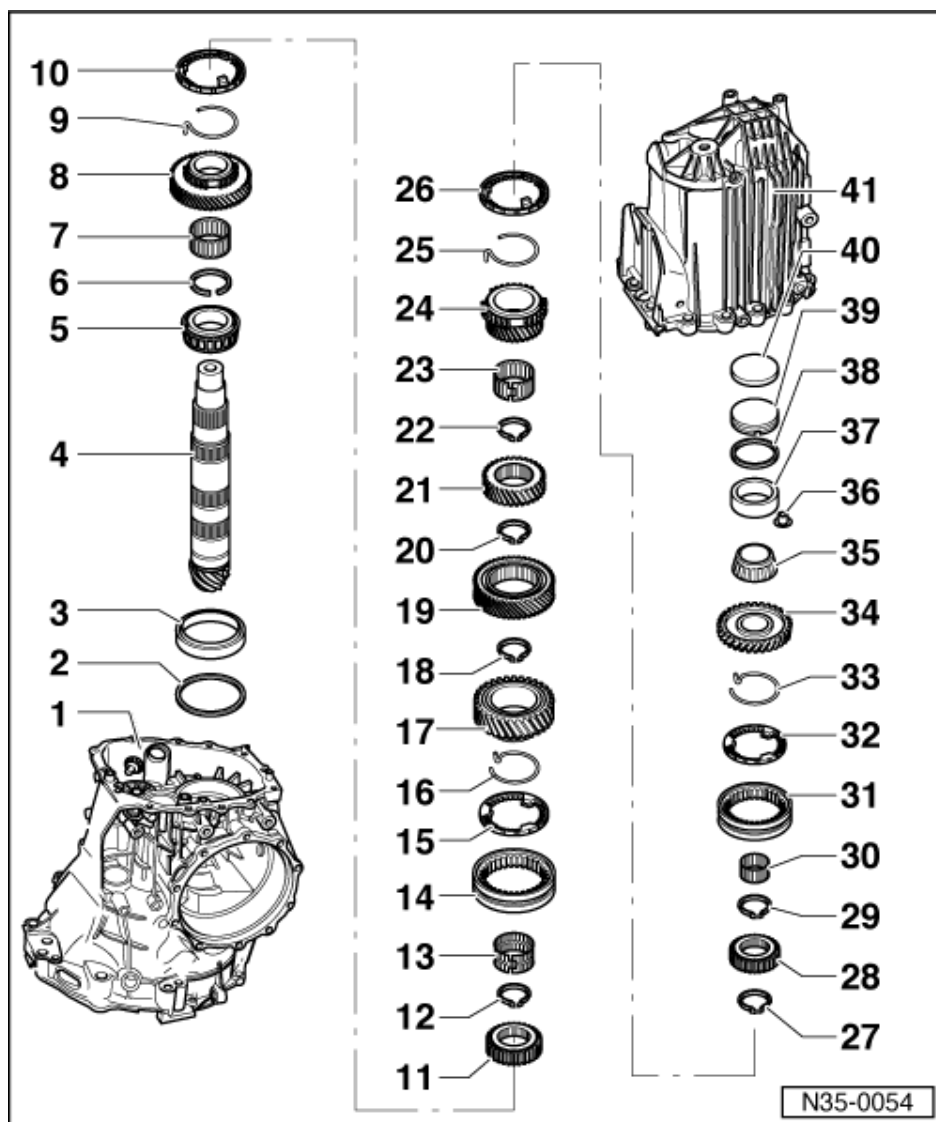
3.1 - Dismantling and assembling pinion shaft

Special tools, testers and auxiliary items

- ◆ Crankshaft seal installing tool VW 204 B
- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 408 A
- ◆ Press tool VW 412
- ◆ Tube VW 415 A
- ◆ Tube VW 421
- ◆ Installing sleeve VW 455
- ◆ Tube VW 519
- ◆ Multi-purpose tool VW 771
- ◆ Tube 2010
- ◆ Thrust pad 3062
- ◆ Thrust piece 3118
- ◆ Fitting tool 3128



- ♦ Separating tool Kukko 17/2
- ♦ Internal puller Kukko 21/1

**Notes:**

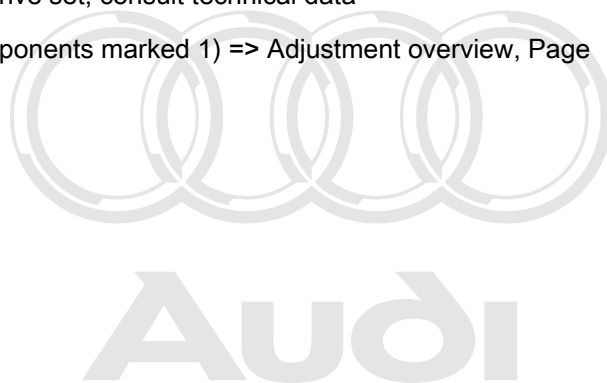
- ♦ When installing new gear wheels or the final drive set, consult technical data
=> from Page 2.
- ♦ Adjustments are required when replacing components marked 1) => Adjustment overview, Page 156.

1 Gearbox housing**2 Shim "S3"**

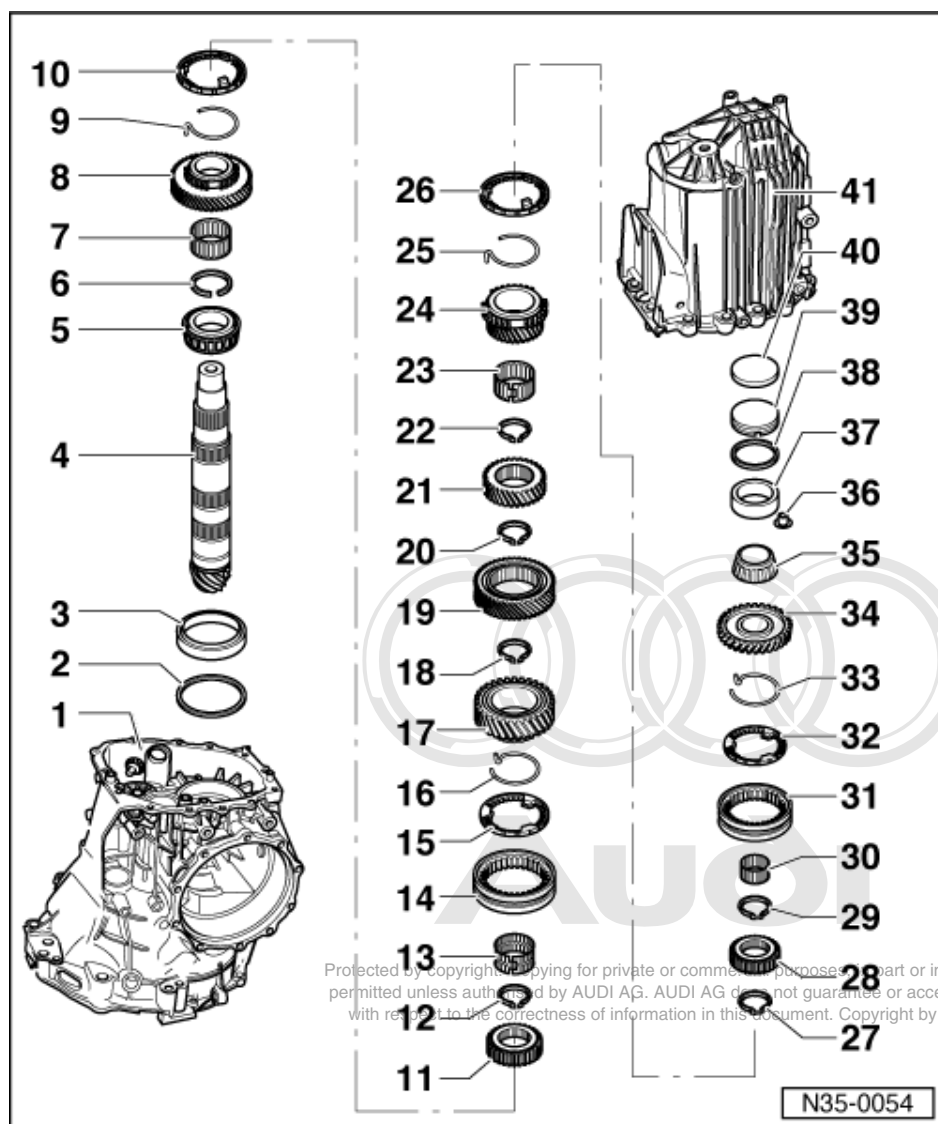
- ♦ Adjustment overview
=> Page 156

3 Outer race for large taper roller bearing 1)

- ♦ Pulling out => Fig. 119
- ♦ Pressing in => Fig. 120



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**4 Pinionshaft1)**

- ♦ Is mated with crown wheel, always replace together as a set
- ♦ Adjusting crown wheel and pinion shaft => Page 153

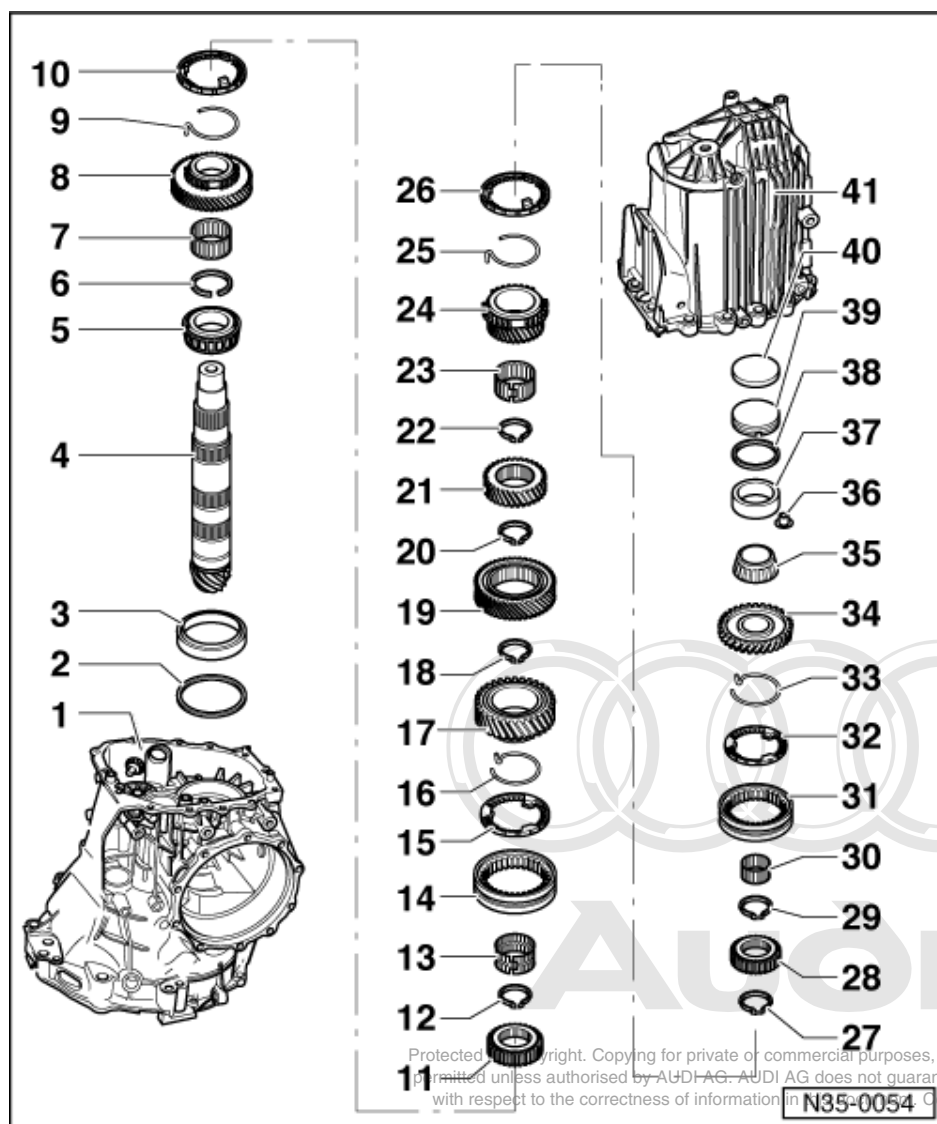
5 Inner race for large taper roller bearing 1)

- ♦ Replace
- ♦ Will be damaged when removing
- ♦ Pressing off => Fig. 119
- ♦ Pressing on => Fig. 120

6 Circlip

- ♦ Identification
- ♦ Installation position => Fig. 15, item 1
- ♦ Redetermine thickness if taper roller bearing is replaced
=> Fig. 120

7 Needle bearing for 1st gear

**8 1st speed sliding gear****9 Spring**

- ◆ Insert in 1st speed sliding gear
=> Fig. 126
- ◆ Allocation of spring to gear

=> Parts catalogue

10 Synchro-ring for 1st gear

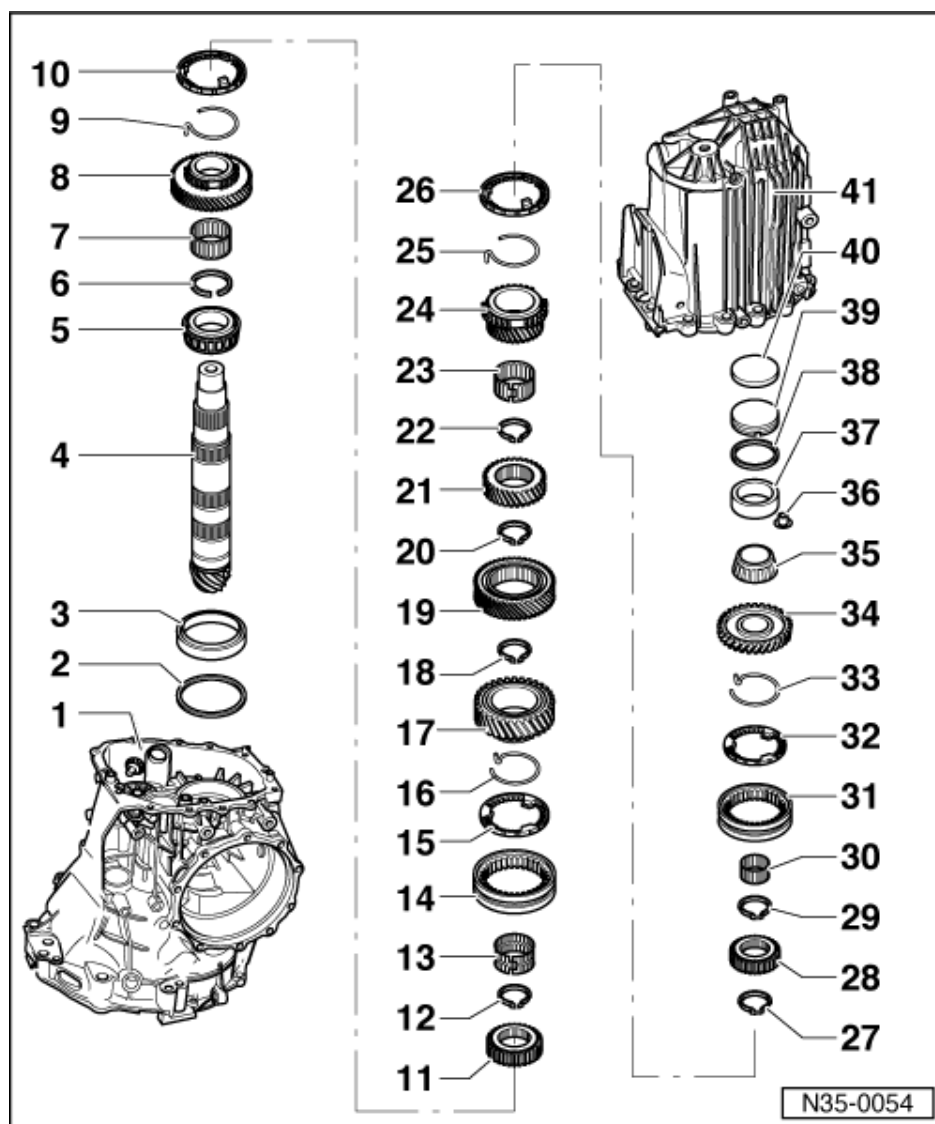
- ◆ Checking for wear
=> Fig. 127

11 Synchro-hub for 1st and 2nd gear

- ◆ Pressing off=> Fig. 124
- ◆ Pressing on => Fig. 127

12 Circlip

- ◆ Identification
- ◆ Installation position => Fig. 15 item 2
- ◆ Redetermine thickness if synchro hub is replaced => Fig. 120

**13 Needle bearing for 2nd gear****14 1st and 2nd gear locking collar with synchro-hub**

- ♦ Installation position
=> Fig. 128

15 Synchro-ring for 2nd gear

- ♦ Checking for wear
=> Fig. 127

16 Spring

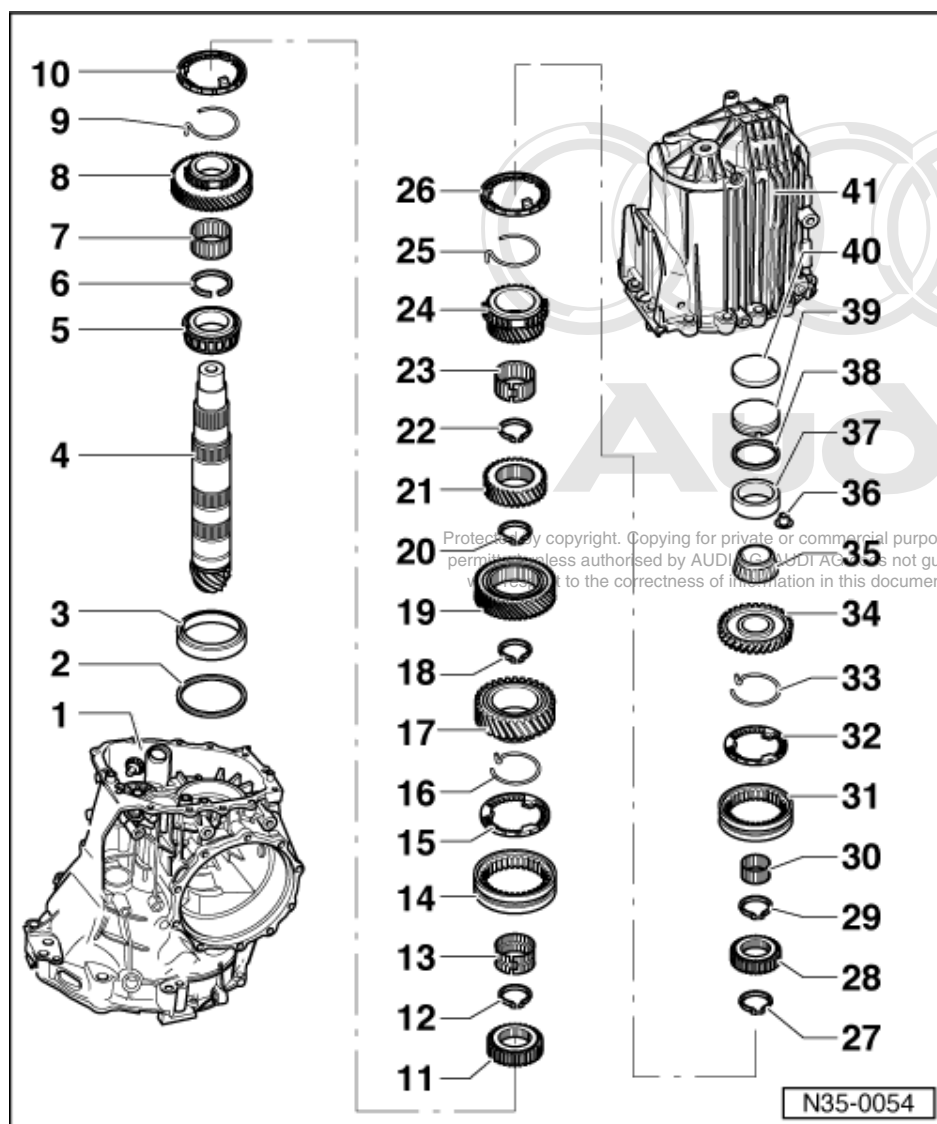
- ♦ Insert in 2nd speed sliding gear
=> Fig. 126
- ♦ Allocation of spring to gear

=> Parts catalogue

17 2nd speed sliding gear**18 Circlip**

- ♦ Identification
- ♦ Installation position => Fig. 15, item 3

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**19 3rd gear wheel**

- ◆ Pressing off => Fig. 123
- ◆ Pressing on => Fig. 128

20 Circlip

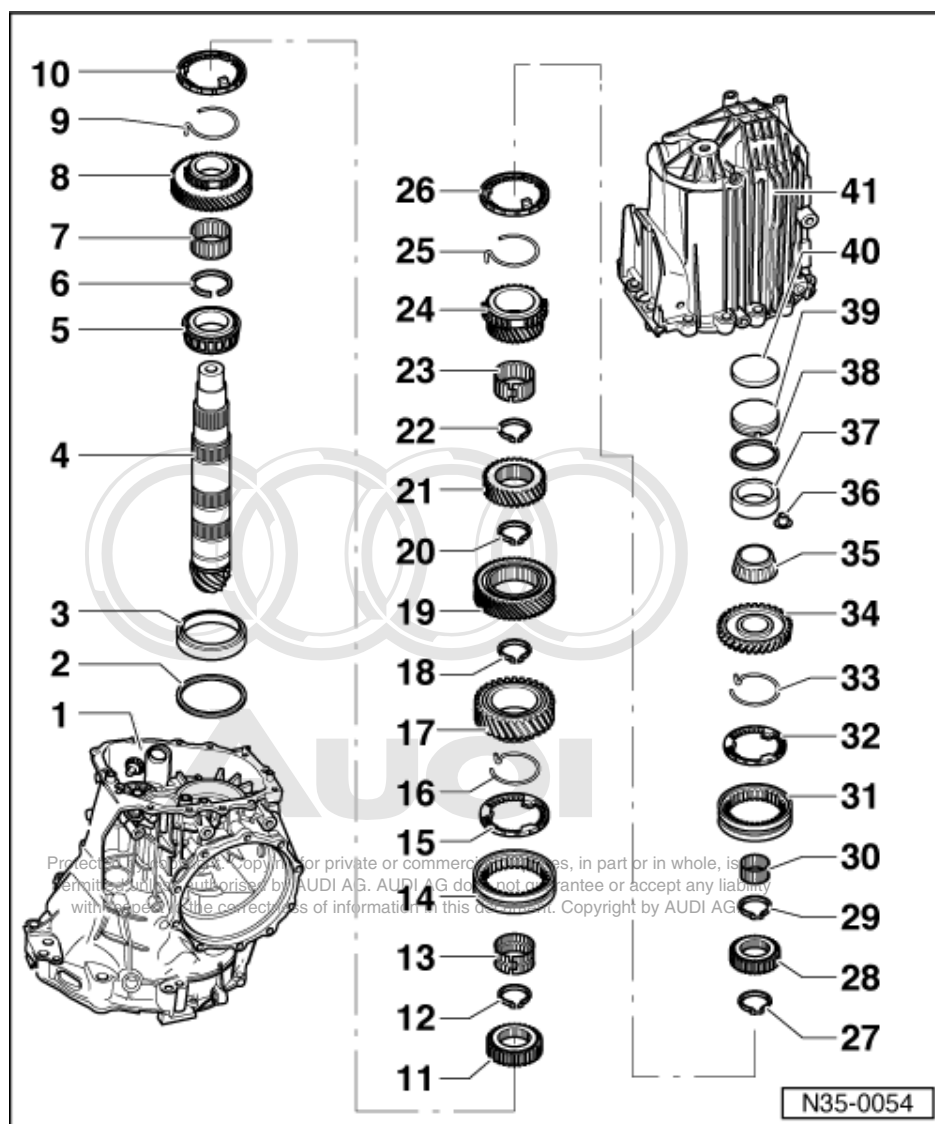
- ◆ Identification
- ◆ Installation position => Fig. 15, item 4
- ◆ Redetermine thickness if 3rd gear wheel is replaced
=>Fig. 120

21 4th gear wheel

- ◆ Pressing off => Fig. 123
- ◆ Pressing on => Fig. 129

22 Circlip

- ◆ Identification
- ◆ Installation position => Fig. 15, item 5
- ◆ Redetermine thickness if 4th gear wheel is replaced
=>Fig. 120

**23 Needle roller bearing****24 5th speed sliding gear****25 Spring**

- ♦ Insert in 5th speed sliding gear
=> Fig. 126
- ♦ Allocation of spring to gear

=> Parts catalogue

26 Synchro-ring for 5th gear

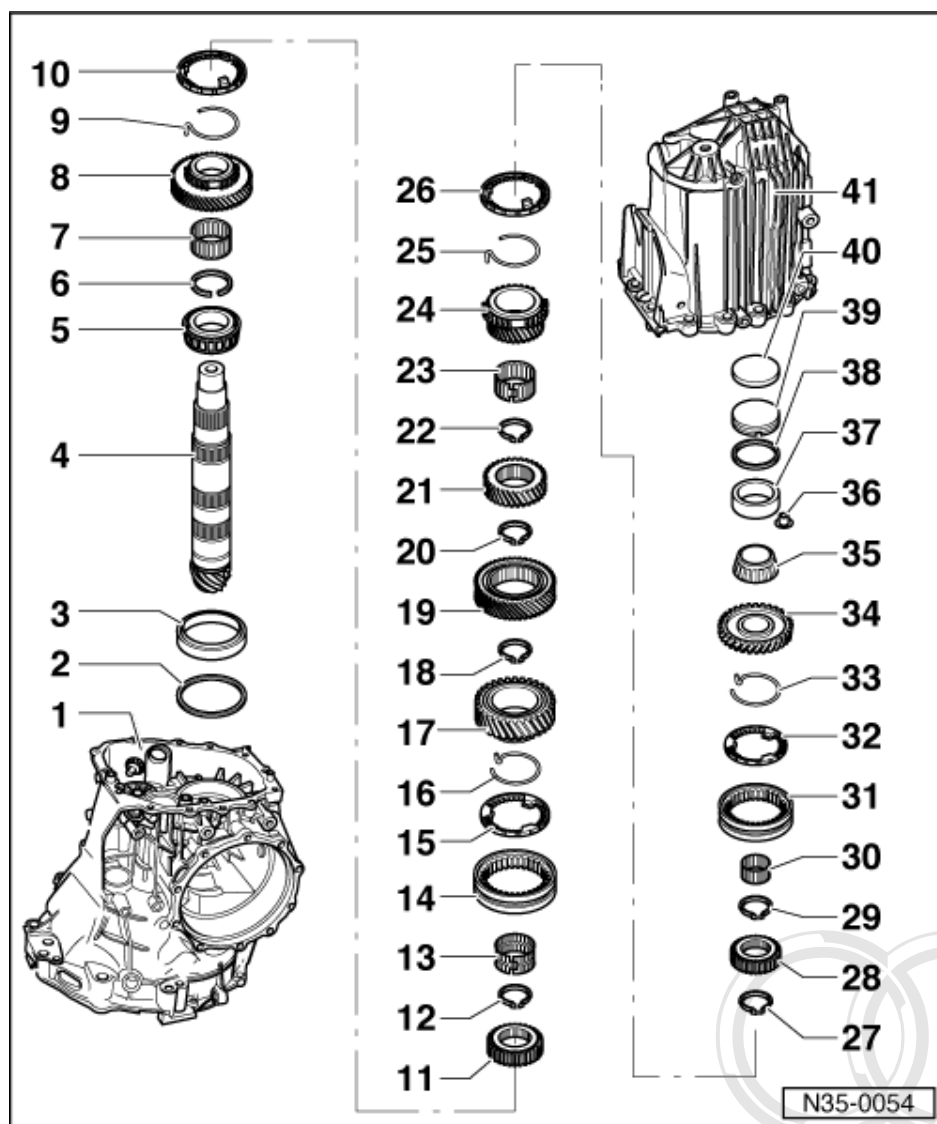
- ♦ Checking for wear
=> Fig. 127

27 Circlip

- ♦ Identification
- ♦ Installation position => Fig. 15, item 6

28 5th gear and reverse gear synchro-hub

- ♦ Pressing off => Fig. 123
- ♦ Pressing on => Fig. 129

**29 Circlip**

- ◆ Identification
- ◆ Installation position => Fig. 15, item 5
- ◆ Redetermine thickness if synchro hub is replaced => Fig. 120

30 Needle roller bearing

- ◆ For reverse gear

31 5th and reverse gear locking collar

- ◆ Installation position
=> Fig. 130

32 Reverse gear synchro-ring

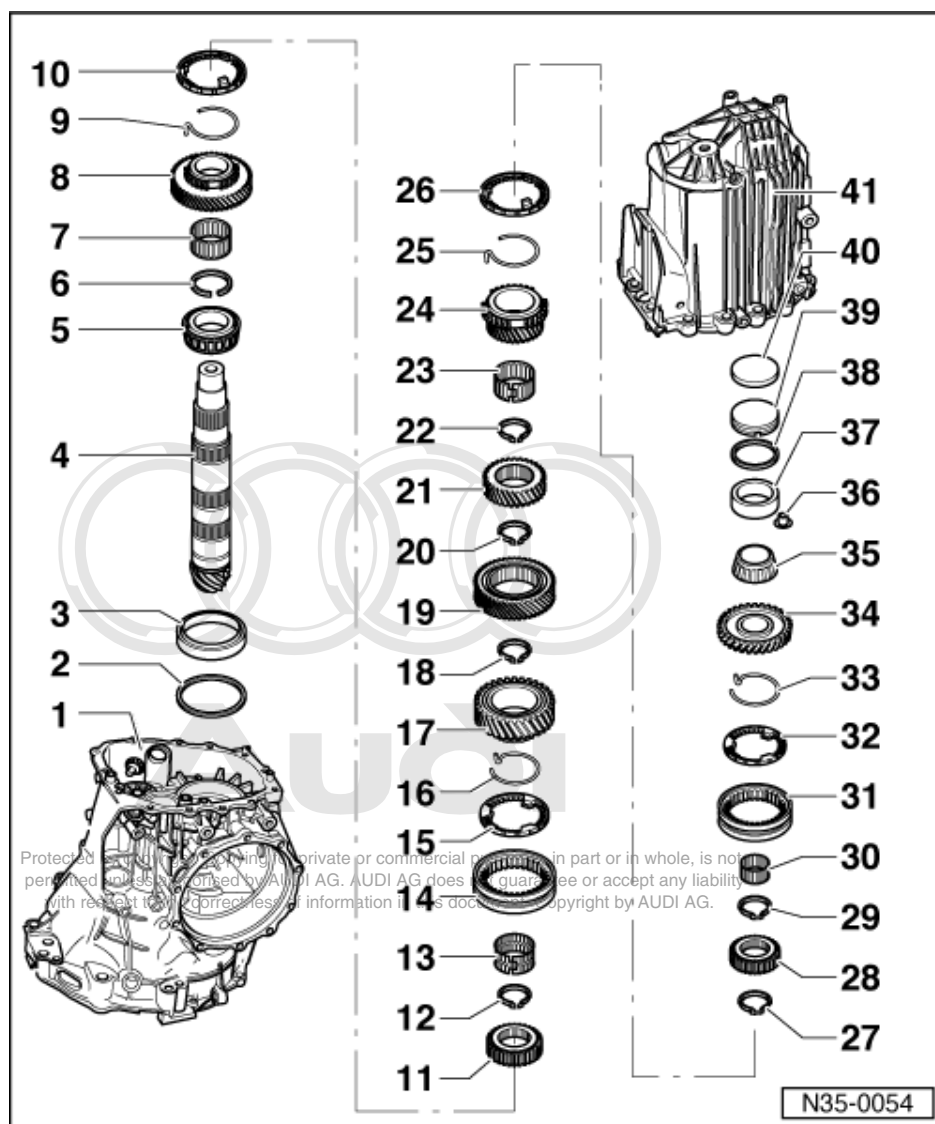
- ◆ Checking for wear
=> Fig. 127

33 Spring

- ◆ Insert in reverse sliding gear
=> Fig. 126
- ◆ Allocation of spring to gear

=> Parts catalogue

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**34 Reverse sliding gear wheel****35 Inner race for small taper roller bearing 1)**

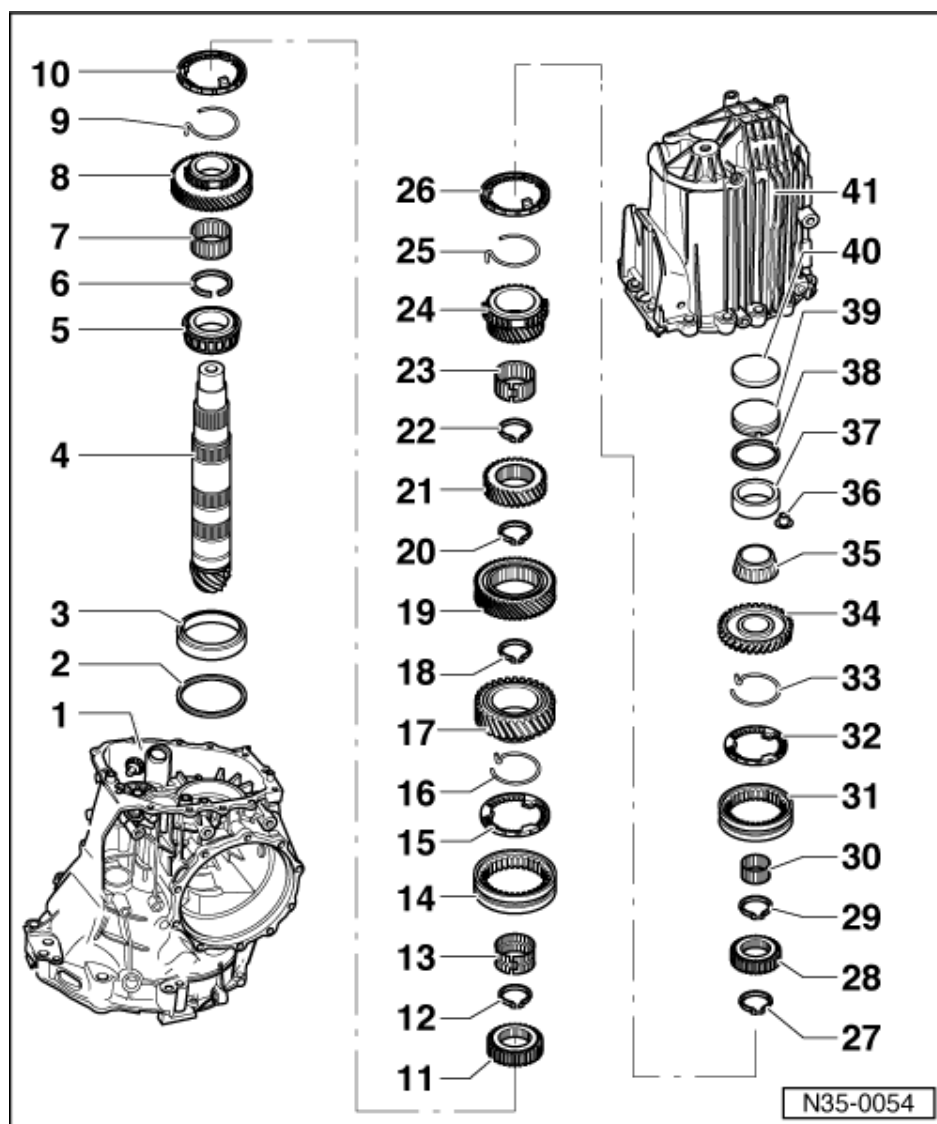
- ♦ Pressing off => Fig. 122
- ♦ Pressing on => Fig. 122

36 Bush

- ♦ To secure small taper roller bearing outer race
- ♦ Pulling out => Fig. 121
- ♦ Need not be fitted after the small taper roller bearing has been replaced

37 Outer race for small taper roller bearing 1)

- ♦ Pulling out => Fig. 121
- ♦ Pressing in => Fig. 122

**38 Shim "S4"**

- ♦ Adjustment overview
=> Page 156

39 Pressure plate**40 Disc**

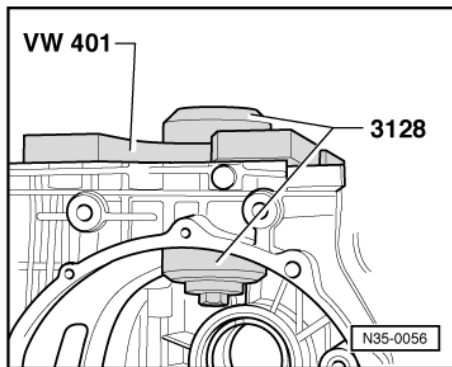
- ♦ To remove, screw self-tapping screw into centre of disc and use screw to pull out disc
- ♦ Select components according to gearbox code letters using Parts catalogue
=>from Page 2.

41 Gearbox cover

- ♦ Apply thin coat of sealing paste AMV 188 001 02 to sealing surfaces



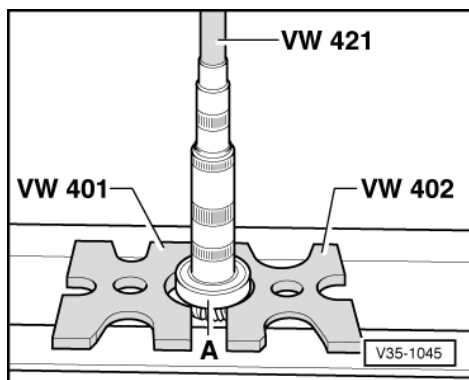
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-> Fig.1 Pulling out large taper roller bearing outer race

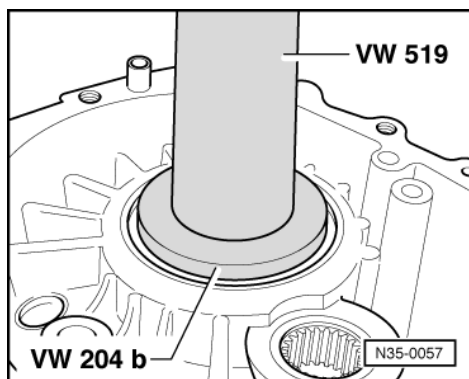
- Remove differential => Page 138 .
- Place pressure piece of puller 3128 below the outer race.
- Fit threaded part of puller 3128 with pressure plate VW 401 onto gearbox housing

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



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

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

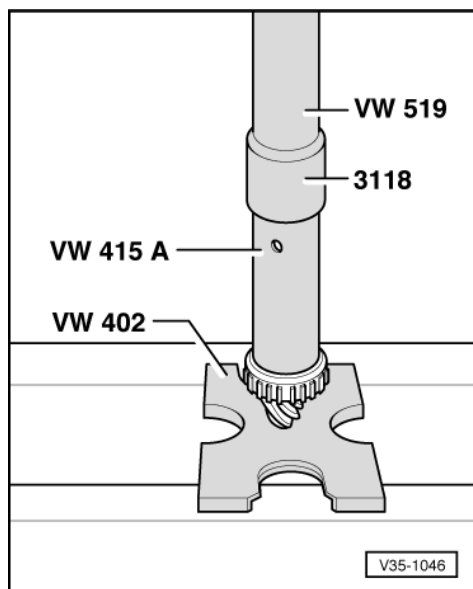


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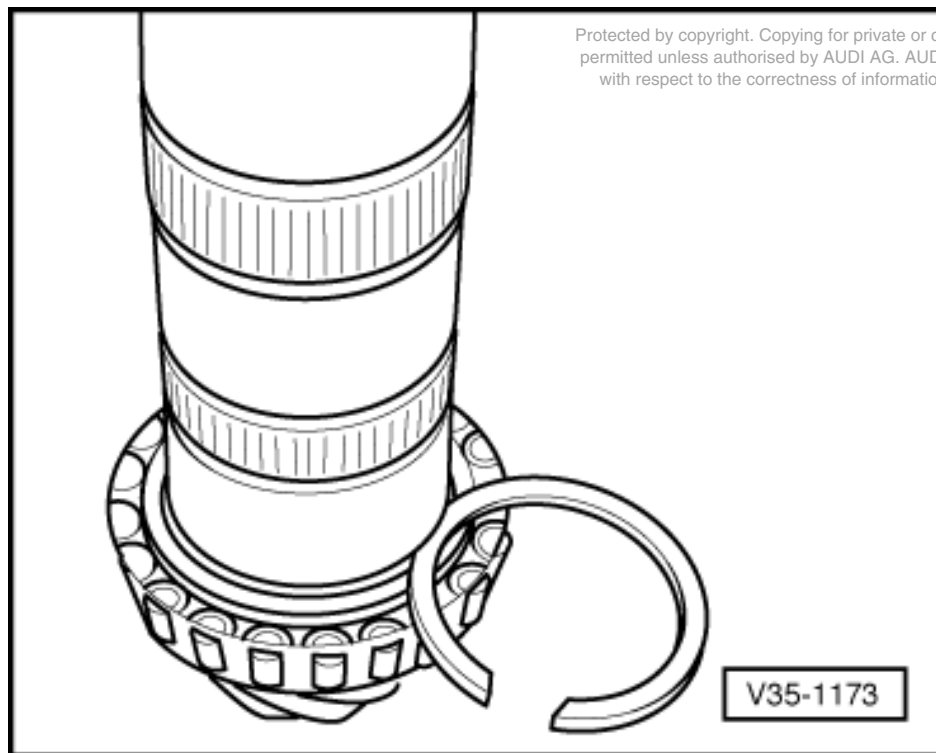


-> Fig.3 Pressing in large taper roller bearing outer race

The smaller diameter of the special tool VW 204 b faces to outer race.



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



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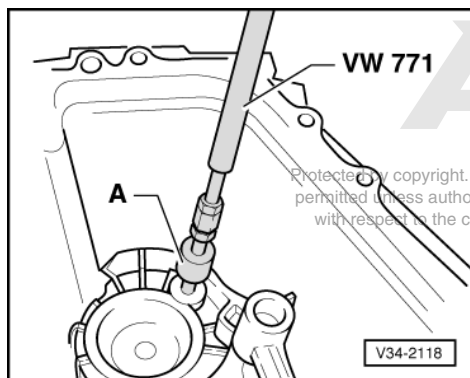
-> Fig.5 Determining thickness of circlip

- Determine the thickest circlip which will still fit and install it.

- The circlips for the synchro hubs and individual gear wheels should also be determined as for the taper roller bearing shown.

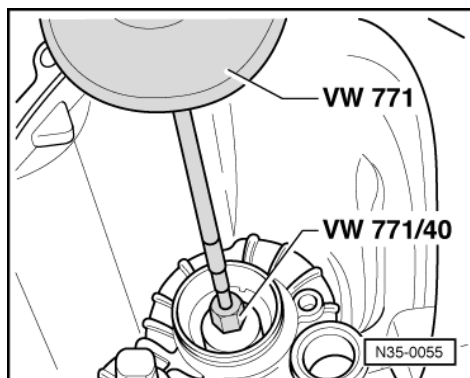
Circlips available and part numbers:

=> Parts catalogue



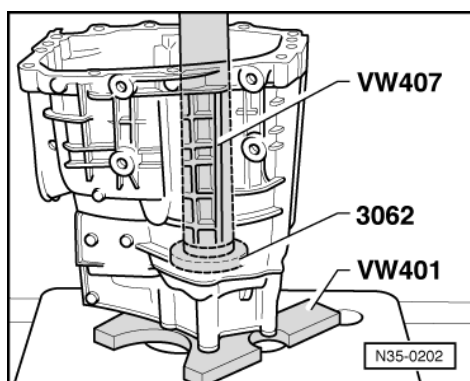
-> Fig.6 Pulling out securing bush for small taper roller bearing outer race

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



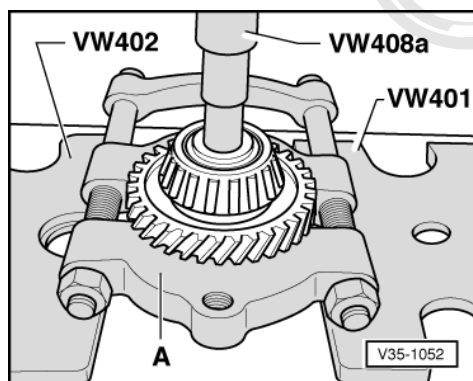
-> Fig.7 Pulling out small taper roller bearing outer race

- Screw special tool VW 771/40 into the pressure plate.
- Attach multi-purpose tool VW 771 and pull outer race out over the pressure plate.





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

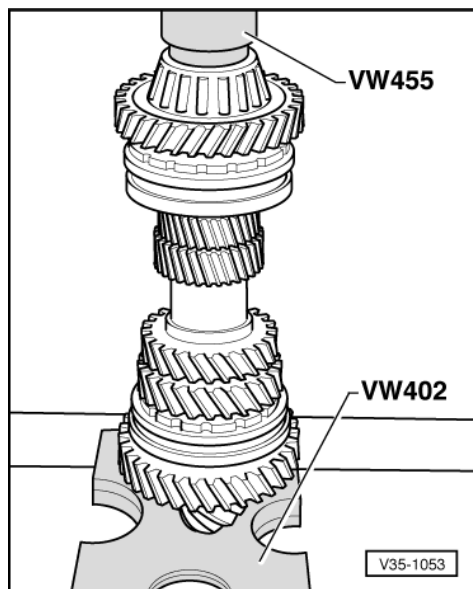


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-> Fig.9 Pressing off small taper roller bearing inner race

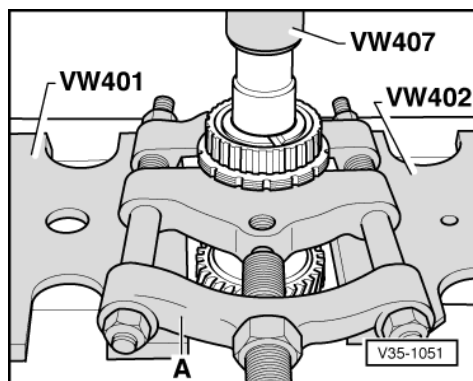
- Press off inner race with reverse gear sliding gear

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



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

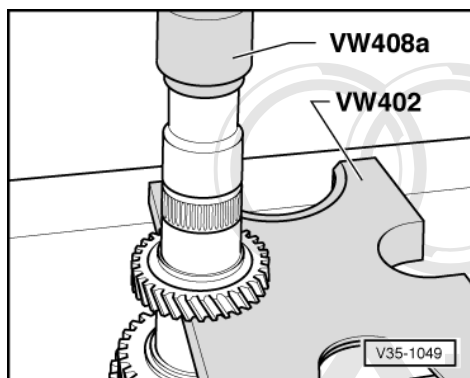
- Fit circlip before pressing on inner race.



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

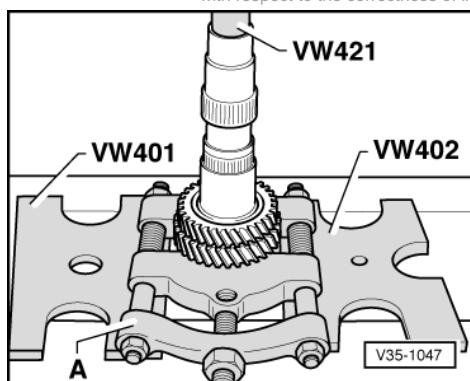
- Remove circlip before pressing off.
- Press off synchro-hub with 5th speed sliding gear

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



-> Fig.12 Pressing off 4th gear wheel

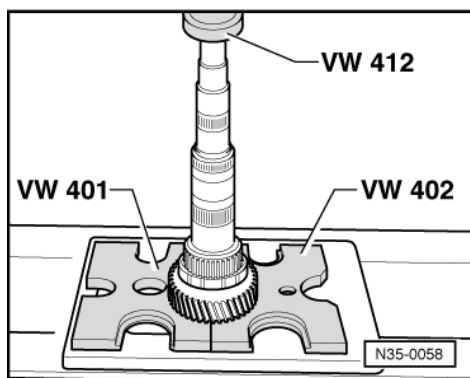
- Remove circlip before pressing off.
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-> Fig.13 Pressing off 3rd gear wheel

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

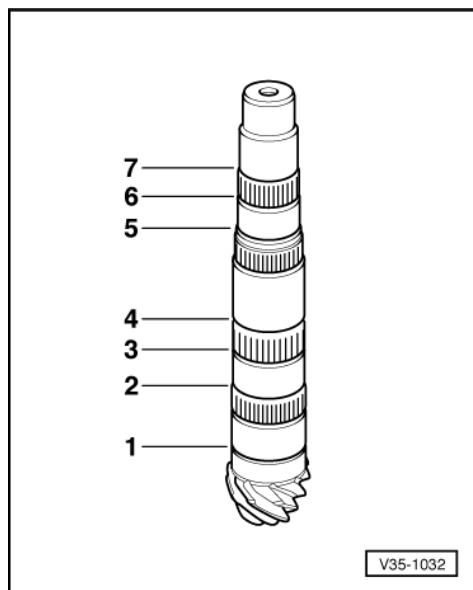
A - Separating device 22 ... 115 mm, e.g. Kukko 17/2





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

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



-> Fig.15 Position of circlips

- The circlips for the synchro-hubs, needle bearings and individual gear wheels should be determined as shown in Fig. 5 .
- ♦ Circlip -1- secures the taper roller bearing inner race.

Circlip thickness (mm)		
2.00	2.06	2.12
2.03	2.09	2.15

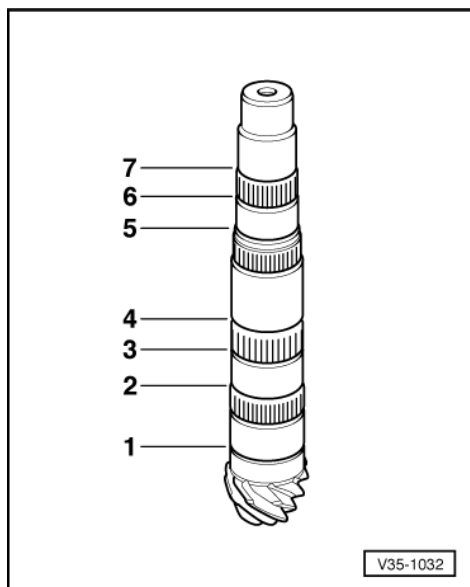
- ♦ Circlip -2- secures the 1st and 2nd gear synchro-hub.

Identification: colour blue

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

- ♦ Circlip -3- secures the needle bearing for 2nd speed sliding gear.

Thickness: 2.50 mm. Identification: colour blue



- ◆ -> Circlip -4- secures the 3rd gear wheel.

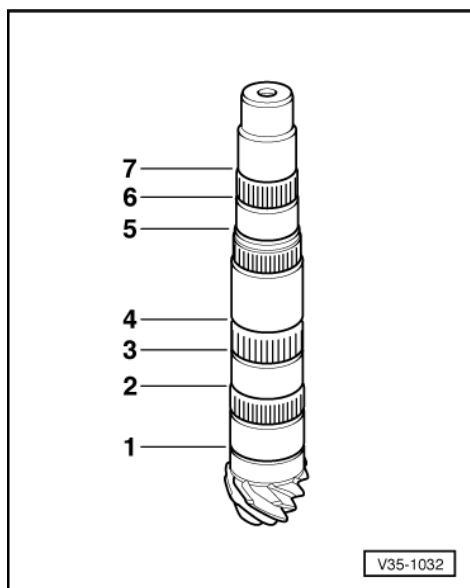
Circlip thickness (mm)		
1.90	1.98	2.06
1.94	2.02	

- ◆ Circlip -5- secures the 4th gear wheel.

Circlip thickness (mm)		
1.86	1.94	
1.90	1.98	

- ◆ -> Circlip -6- secures the needle bearing for 5th speed sliding gear.

Thickness 2.00 mm. Identification: colour brown



- ◆ -> Circlip -7- secures the synchro-hub for 5th and reverse gear.

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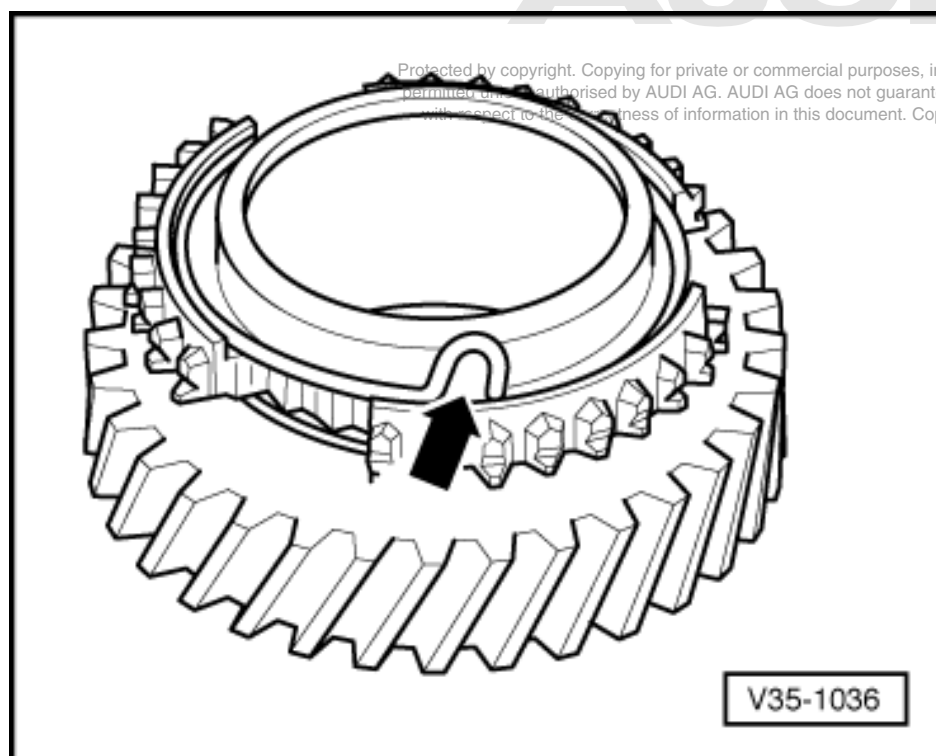


Identification: colour blue

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

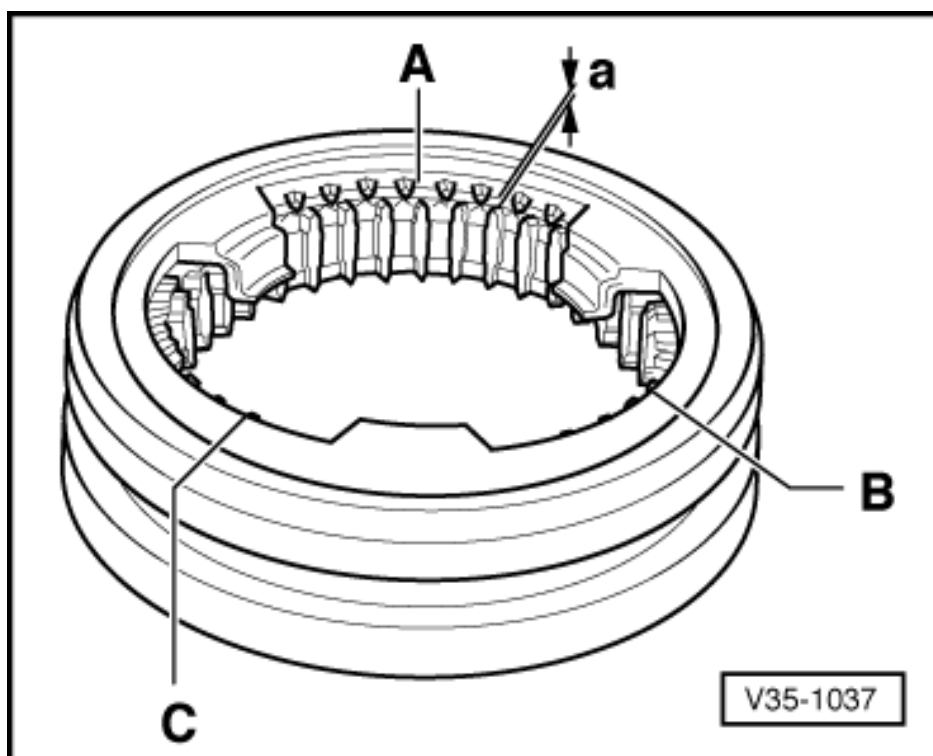
- Determine circlips according to table. Part numbers

=> Parts catalogue



-> Fig.16 Inserting spring in gear wheel

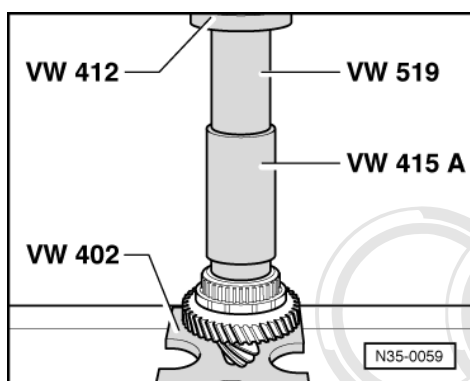
The bent end of the spring (arrow) must be hooked into the hole in the gear wheel.



-> Fig.17 Checking synchro-ring for wear

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

The average gap must not be less than 0.5 mm.

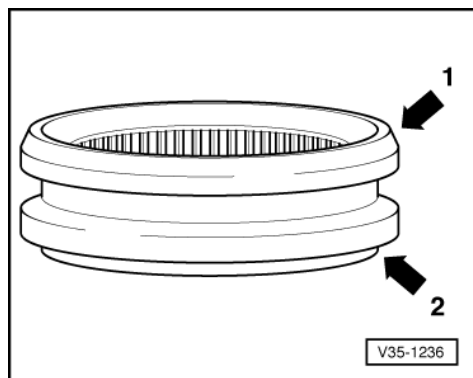


-> Fig.18 Pressing on 1st and 2nd gear synchro-hub

- ♦ Installation position:

High inside collar faces towards 2nd gear.

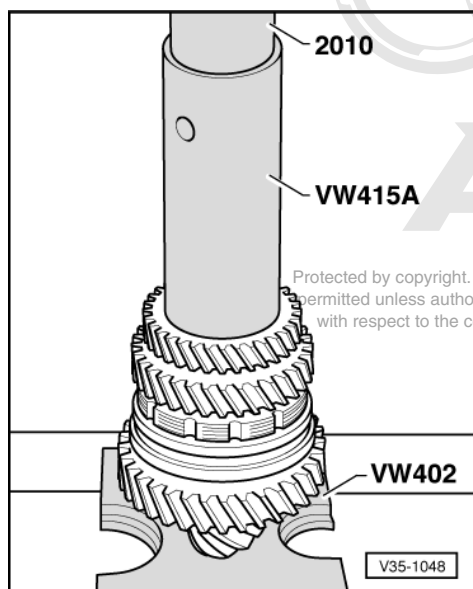
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-> Fig.19 Installation position of locking collar for 1st and 2nd gear

- ♦ Installation position:

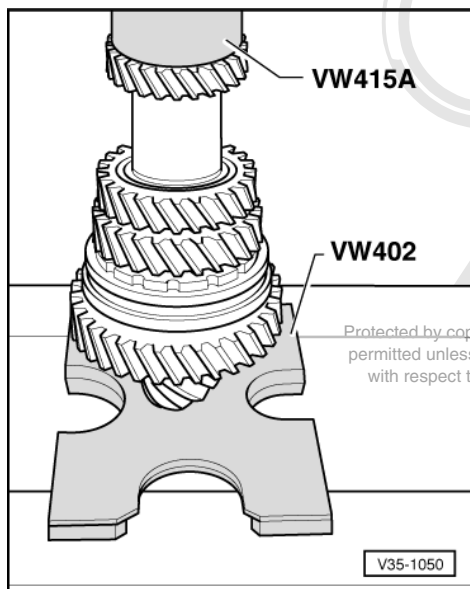
Chamfered surface -arrow 1- faces towards 2nd gear.
Shoulder -arrow 2- faces towards 1st gear.



-> Fig.20 Pressing on 3rd gear wheel

- ♦ Installation position:

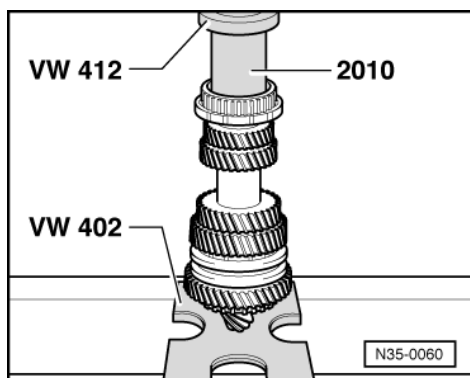
Groove on gear wheel faces towards 4th gear.



-> Fig.21 Pressing on 4th gear wheel

- ◆ Installation position:

High inside collar or groove on gear wheel faces towards 3rd gear.



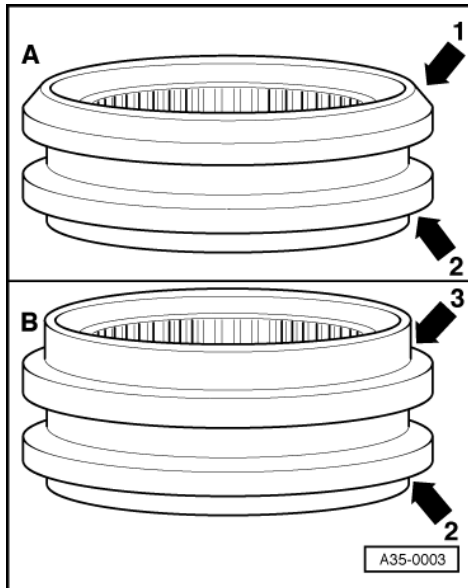
-> Fig.22 Pressing on 5th gear and reverse gear synchro-hub

- ◆ Installation position:

High inside collar faces towards 5th gear.

Note:

The large internal diameter in special tool 2010 faces to synchro hub.

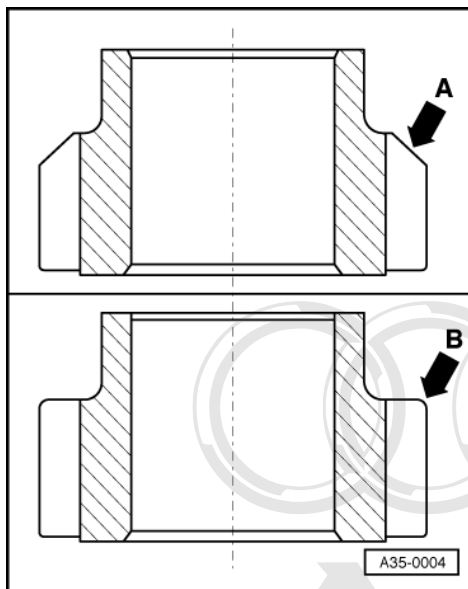


-> Fig.23 Installation position of locking collar for 5th and reverse gear

Different types of locking collar are installed: version -A- with chamfered surface -arrow 1- or version -B- with large shoulder -arrow 3-.

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

Chamfered surface -arrow 1- faces towards 4th gear.
Small shoulder -arrow 2- faces towards 5th gear.
Large shoulder -arrow 3- faces towards reverse gear.



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

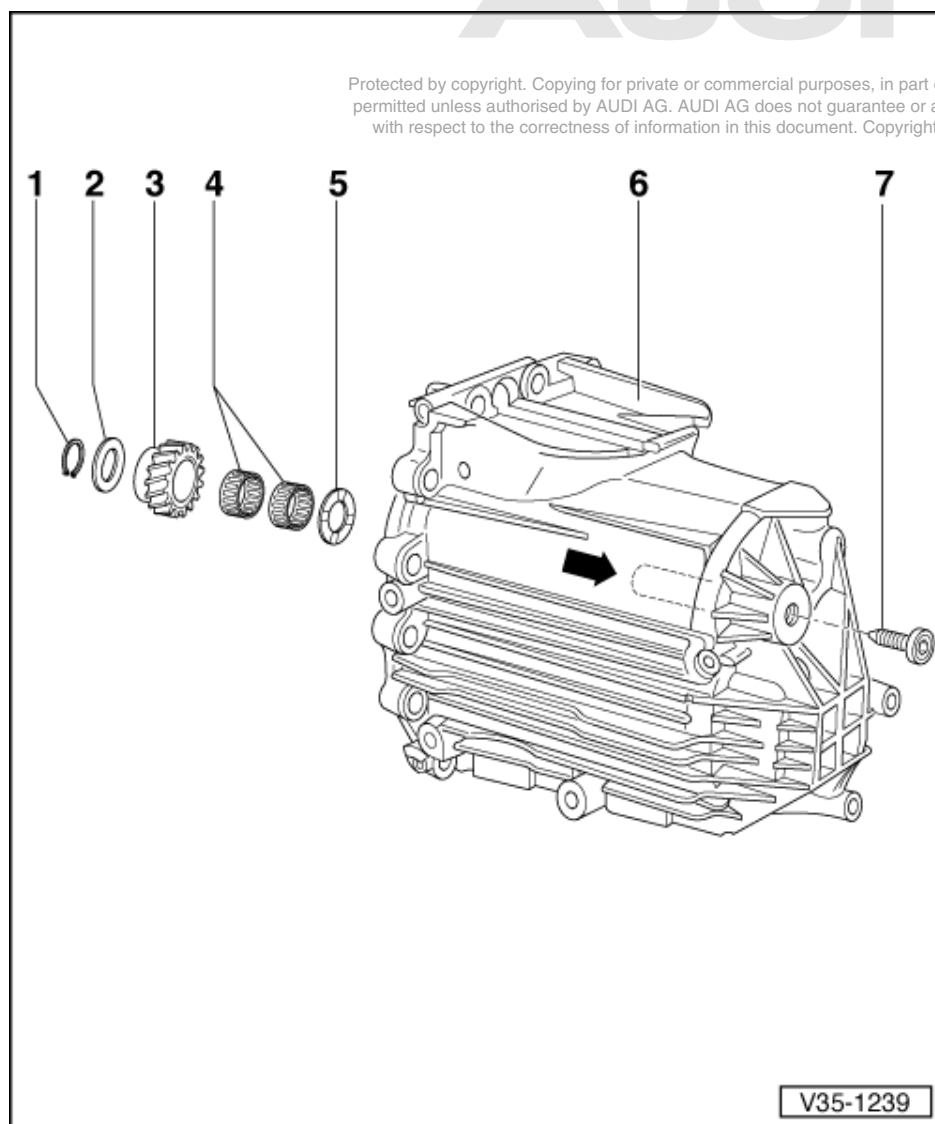
A Reverse gear wheel with chamfered surface	Both types of locking collar can be installed (with chamfered surface or with large shoulder)
---	---

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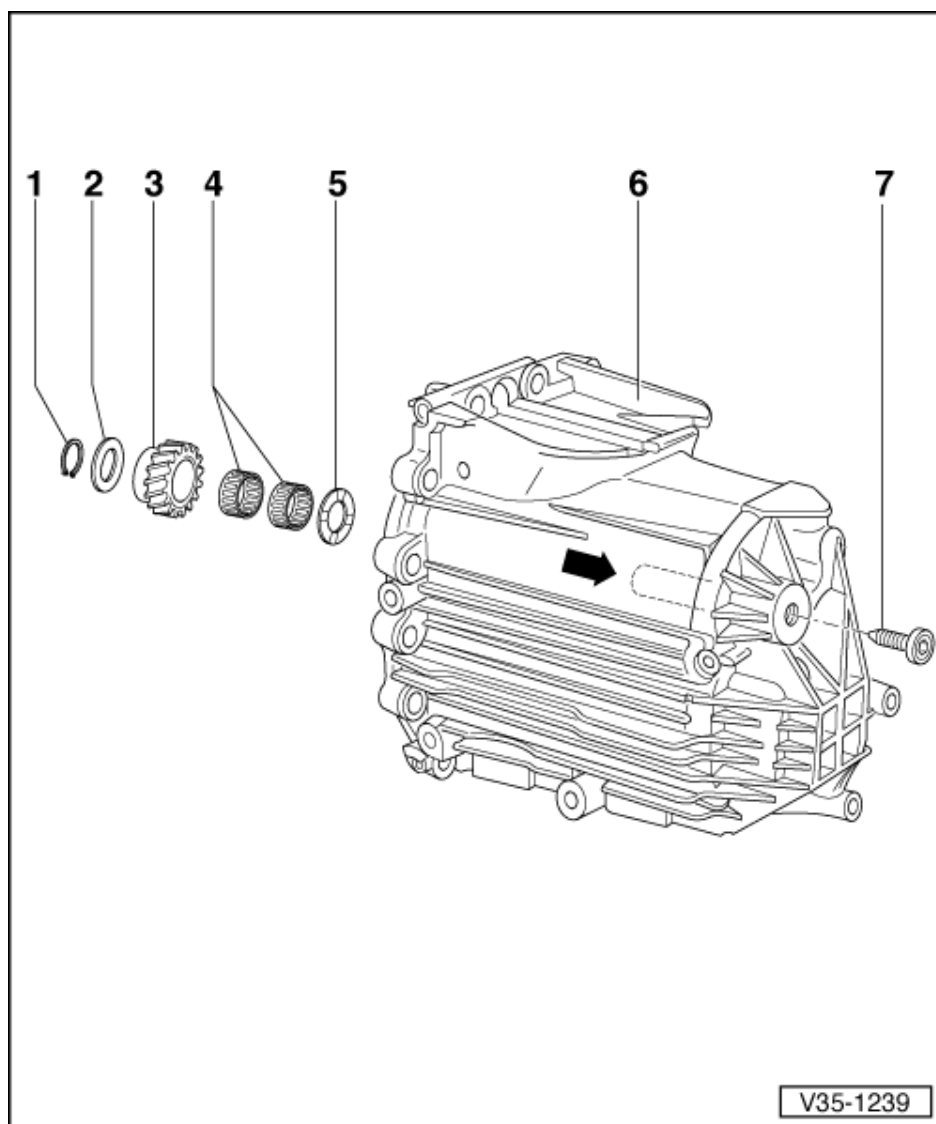
B Reverse gear wheel without chamfered surface	Install only locking collar with large shoulder; not locking collar with chamfered surface
--	--

4 - Removing and installing reverse gear wheel

4.1 - Removing and installing reverse gear wheel



- 1 Circlip
- 2 Support plate
- 3 Reverse gear wheel
 - ♦ Different versions; allocation
=> Fig. 130
- 4 Needle roller bearing
- 5 Thrust washer



6 Gearbox cover

- ◆ With reverse gear shaft (arrow)
- ◆ To remove the reverse gear it is not necessary to remove the reverse gear shaft.
- ◆ The reverse gear shaft is not available as a replacement part.
- ◆ Apply thin coat of sealing paste AMV 188 001 02 to sealing surfaces

7 Torx bolt - 35 Nm

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

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39 - Final drive, Differential

1 - Renewing seal for flange shaft

1.1 - Renewing seal for flange shaft

- Gearbox installed
- Observe general repair instructions
=>Page 7.

Special tools, testers and auxiliary items

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

Notes:

- ◆ Removing and installing oil seal on left-hand side is illustrated below.
- ◆ Procedure for removing oil seals on left and right-hand sides is identical.
- ◆ Exhaust system does not have to be removed.
- ◆ Flange shaft may be with or without polygon bearing. Allocation => Page 2.

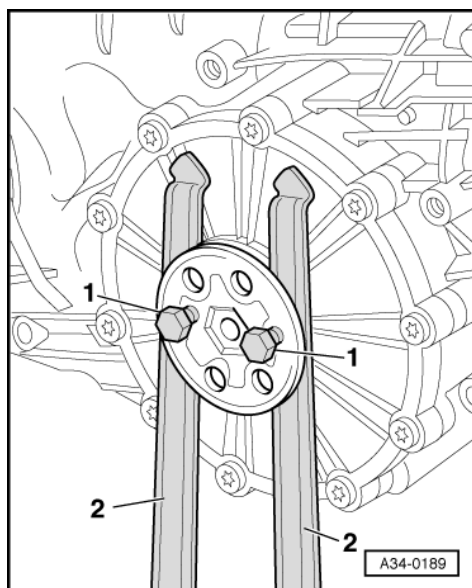
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Removing

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

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

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



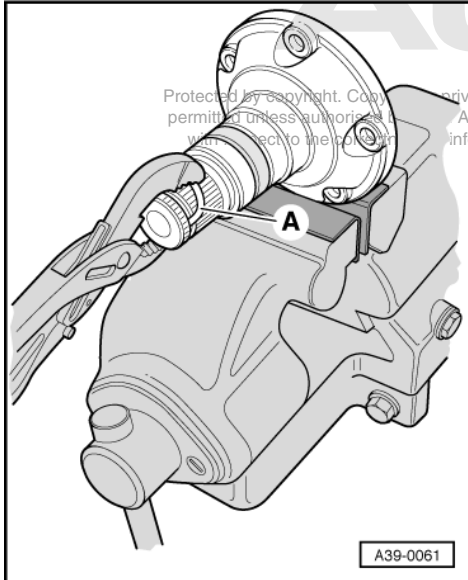
- Place drip tray VW 1306 below gearbox.
- -> Insert two levers -2- behind flange shaft (second mechanic required).



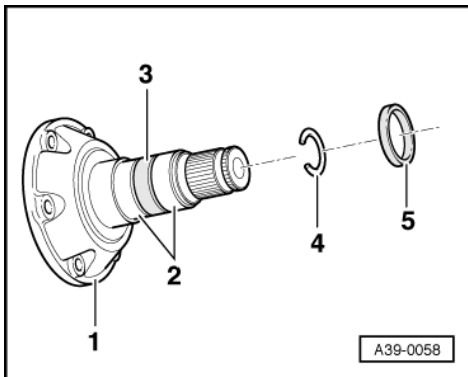
- To press off flange shaft, screw in two bolts -1- evenly in opposite threads in flange shaft.

Note:

It is important to remove the flange shaft evenly and with equal pressure applied, otherwise the differential housing may break.



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



-> Assembling flange shaft with polygon bearing

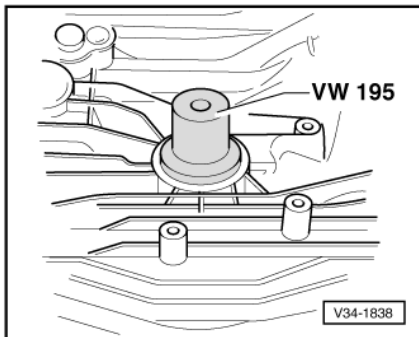
- 1 - Flange shaft
- 2 - Needle bearing (polygon bearing)
- 3 - Spacer ring
- 4 - Circlip
- 5 - Spacer ring - additionally fitted on shafts with 30 mm spline diameter

Notes:

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

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

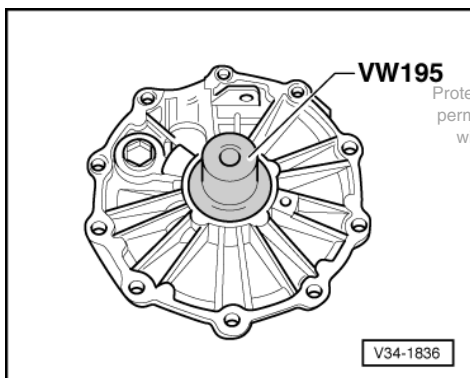
Installing



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

Note:

If the old flange shaft is reinstalled after the repair, the oil seal must be knocked in to a depth of approx 6.5 mm so that the new seal does not run on the same contact surface as the old one.



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- -> Knock in new oil seal for left-hand flange shaft to a depth of 5.5 mm below outer surface of cover using VW 195; keep seal straight when installing.

Note:

If the old flange shaft is reinstalled after the repair, the oil seal must be knocked in to a depth of approx 6.5 mm so that the new seal does not run on the same contact surface as the old one.

- Knock flange shaft in with drift VW 295.
- Bolt drive shaft to flange shaft.
- Fit drive shaft heat shields.
- Check oil level in gearbox
=>Page 64 .

Tightening torques

Component		Nm
Drive shaft to flange shaft	M8	40
	M10	77



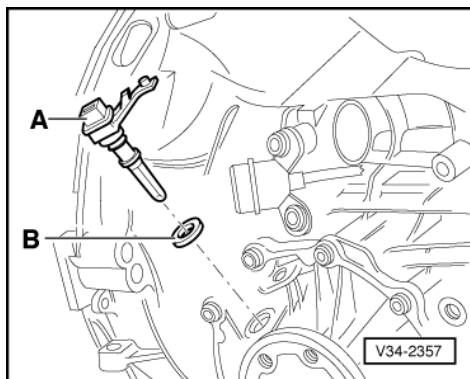
2 - Removing and installing speedometer sender and drive wheel

2.1 - Removing and installing speedometer sender and drive wheel

- Gearbox installed
- Observe general repair instructions
=>Page 7 .

2.2 - Removing and installing speedometer sender -G22

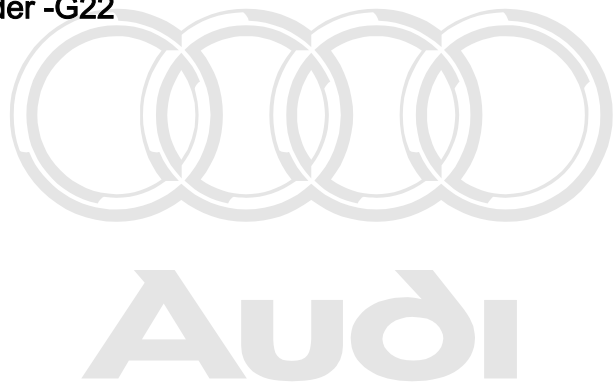
Removing



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

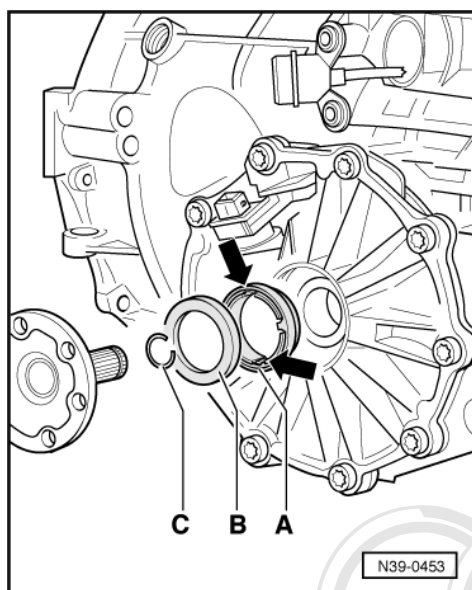
Installing

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



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2.3 - Removing and installing speedometer drive wheel

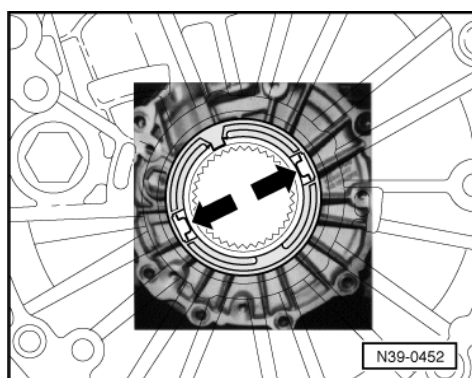


Special tools, testers and auxiliary items

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

Removing

- -> Remove flange shaft on left side and oil seal -B-
=> Replacing flange shaft seal, Page 133
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- Remove speedometer sender
=> Page 136.
- -> Press retaining clips in direction of arrows with a screwdriver.
- Remove drive wheel by levering out, alternating between sides.

Installing

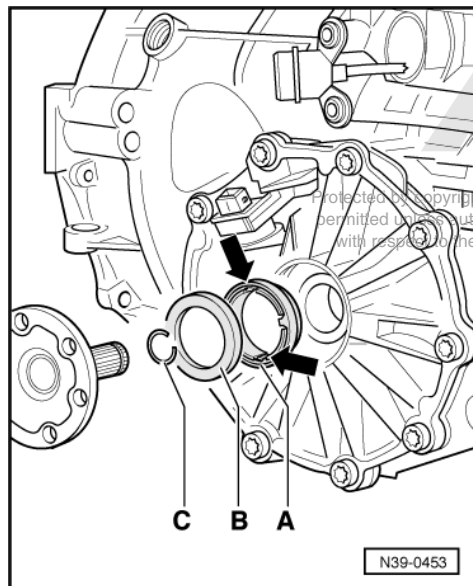
Installation is carried out in the reverse order, when doing this note the following:



Note:

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

Installation position:



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

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

- Always replace seal -B- and circlip -C- =>Page 134 .
- Knock flange shaft in with drift VW 295.
- Top up oil in gearbox and check oil level => Page 64 .

Tightening torques

Component		Nm
Drive shaft to flange shaft	M8	40
	M10	77
Heat shields above drive shafts to gearbox		23

3 - Removing and installing differential

3.1 - Removing and installing differential

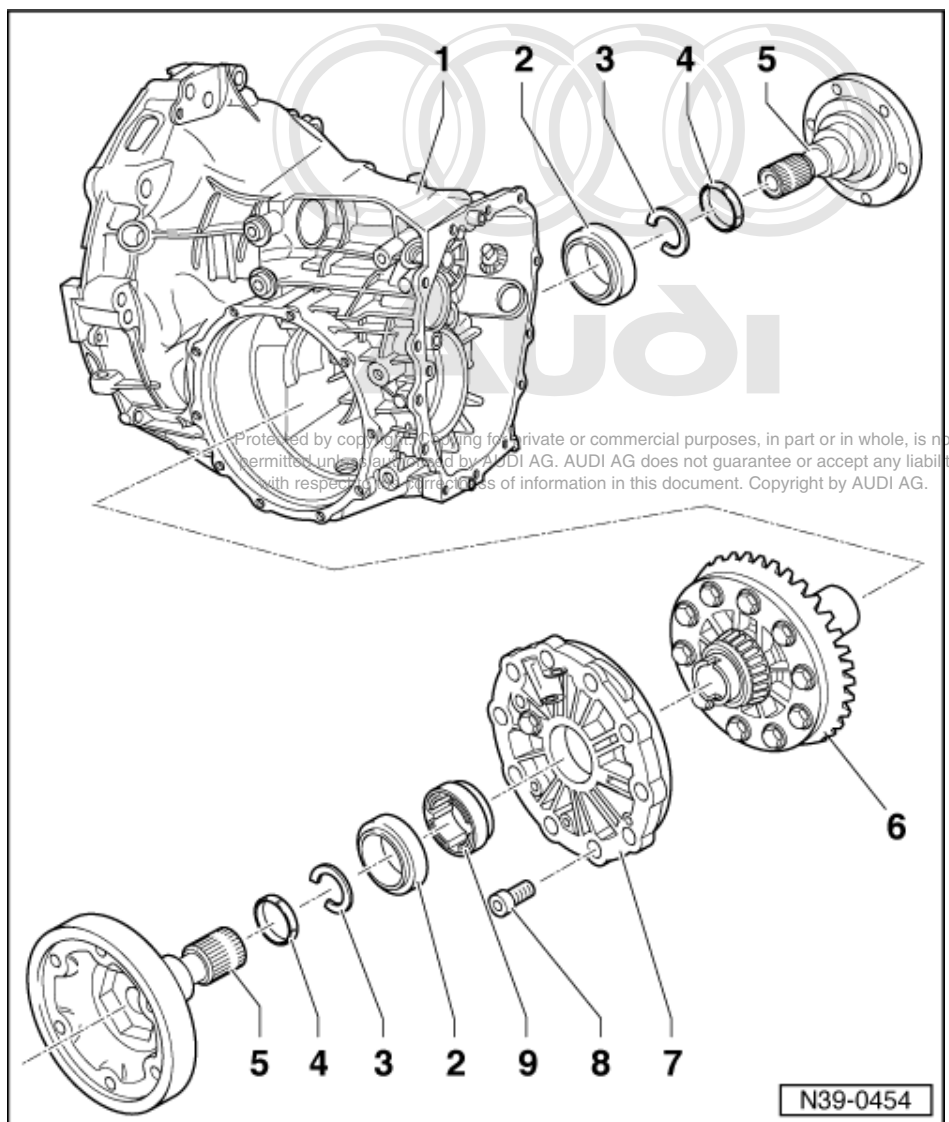
Special tools, testers and auxiliary items

- ♦ Multi-purpose tool VW 771
- ♦ Socket 3257
- ♦ Internal puller Kukko 21/3

Notes:

- ♦ Removing and installing is possible with gearbox installed.
- ♦ The differential can be removed and installed without removing the selector mechanism, input shaft, pinion shaft or gearbox cover. These components must be removed if the differential has to be adjusted.
- ♦ Flange shaft may be with or without polygon bearing. Allocation => Page 2 .

- ◆ The polygon bearings can only be replaced together with the flange shaft.
- ◆ Inspect polygon bearings for visible damage.
- ◆ If the polygon bearings do not run smoothly with the flange shaft removed, this does indicate that the bearings are defective. A test for noisy bearings can only be performed with bearings installed.
- ◆ A spacer ring=>Fig. 4, -Item 5- is fitted between the polygon bearing and the differential sun wheel on flange shafts with 30 mm spline diameter.
- ◆ Adjustments are required when replacing components marked 1)
=>Adjustment overview Page 156.



1 Gearbox housing 1)

2 Oil seal

- ◆ Replace => Page 133
- ◆ Note correct insertion depth for oil seal=>Page 135

3 Circlip

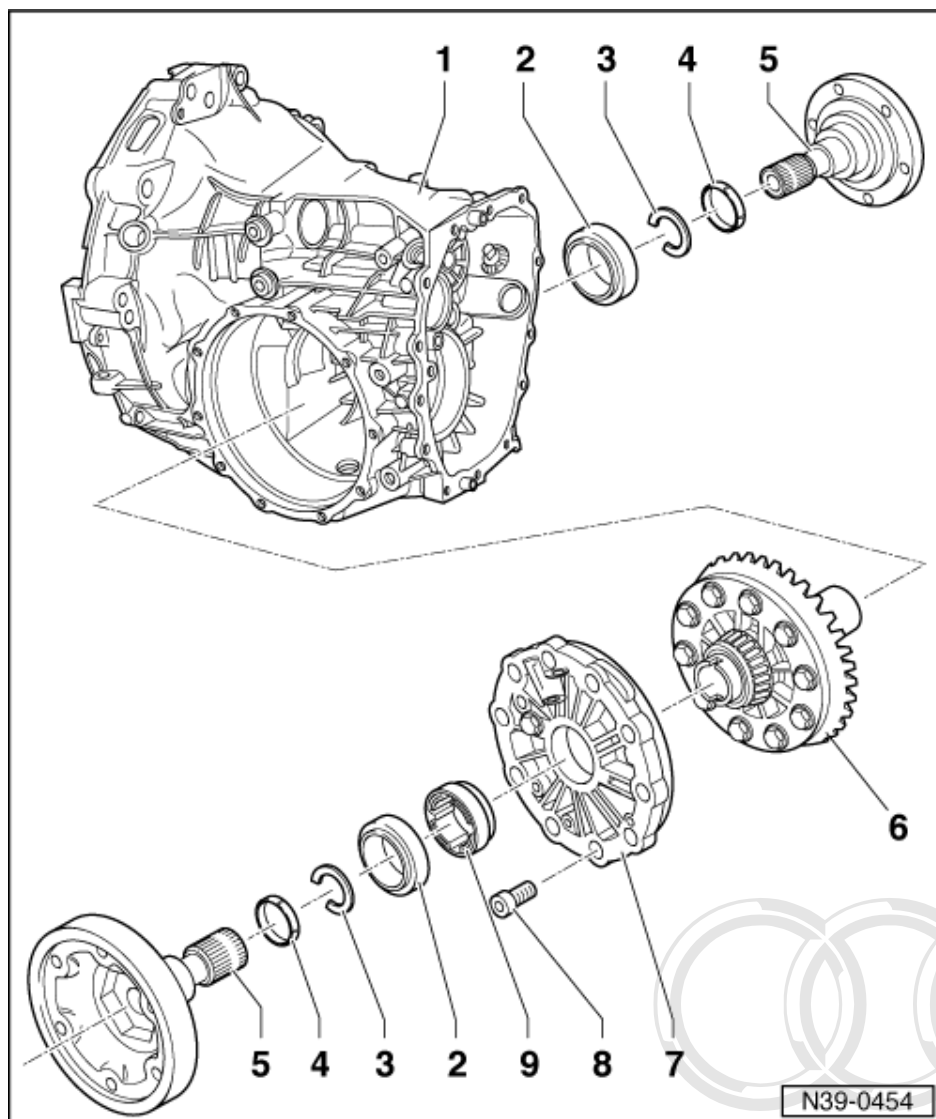
- ◆ Replace
- ◆ Removing and installing
=>Fig. 142

4 Spacer ring

- ◆ Is only fitted on flange shafts with polygon bearing which have a spline diameter of 30 mm => Page 2
- ◆ Removing => Fig. 142



- ♦ Installing => Fig. 143



5 Flange shaft

- ♦ Removing and installing
=> Page 133
- ♦ Assembling flange shaft with poly bearing => Fig. 143

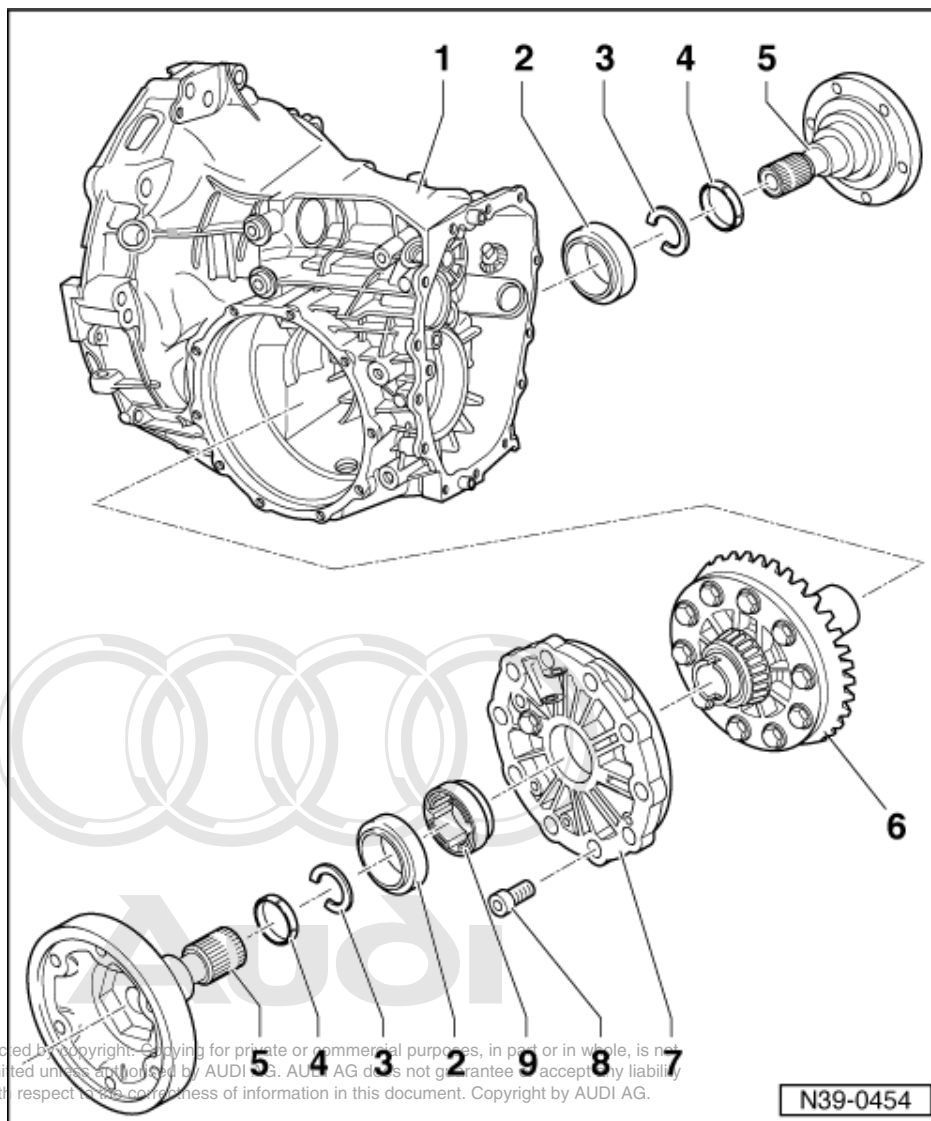
6 Differential with crown wheel 1)

- ♦ Can be removed without removing gear cluster.
- ♦ Dismantling and assembling
=> Page 143

7 Cover for final drive 1)

- ♦ Apply thin coat of sealing paste AMV 188 001 02 to sealing surfaces

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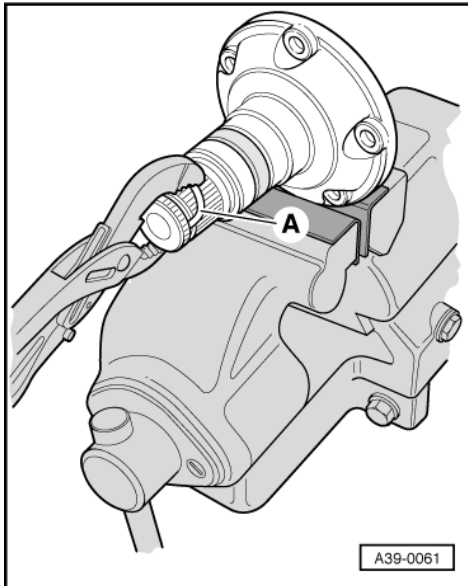
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N39-0454

8 Torx bolt - 25 Nm

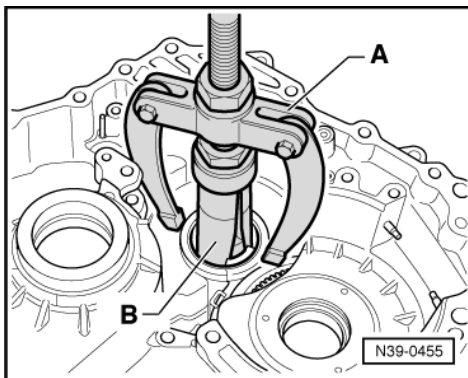
9 Speedometer drive wheel

- ◆ Removing and installing
=>Page **137**
- ◆ Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily



-> Fig.1 Removing and installing circlip

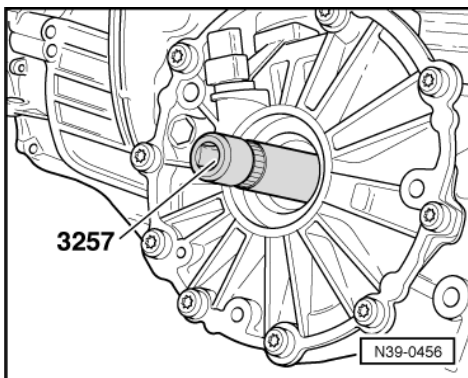
- Clamp flange shaft in vice, using vice clamps. Use new circlip -A- to press old circlip out of groove in flange shaft.



-> Fig.2 Removing spacer ring

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

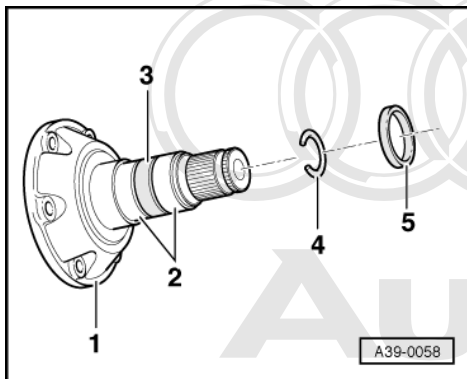
- If the spacer ring is tight pull out using the multi-purpose tool VW 771.



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-> Fig.3 Installing spacer ring

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



-> Fig.4 Assembling flange shaft and polygon bearing

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

Note:

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

4 - Dismantling and assembling differential

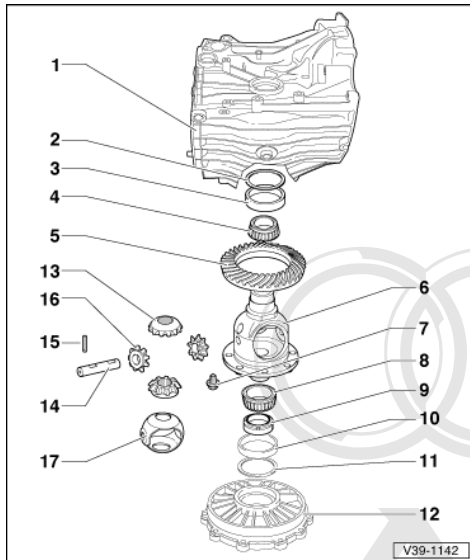
4.1 - Dismantling and assembling differential

Special tools, testers and auxiliary items

- ◆ Drift VW 295
- ◆ Press plate VW 401
- ◆ Press plate VW 402
- ◆ Press tool VW 407
- ◆ Press tool VW 408 A
- ◆ Thrust plate VW 447 H
- ◆ Thrust plate VW 447 i
- ◆ Thrust piece VW 472/1
- ◆ Thrust pad VW 511
- ◆ Thrust plate 30-11
- ◆ Thrust plate 30-205
- ◆ Press tool 40-21
- ◆ Thrust plate 40-105
- ◆ Drift 3138
- ◆ Sleeve 3144
- ◆ Tube 3296
- ◆ Sealant AMV 188 001 02
- ◆ Two-arm puller Kukko 20/10 or Kukko 44/2
- ◆ Two-arm puller Kukko 204/2

**Notes:**

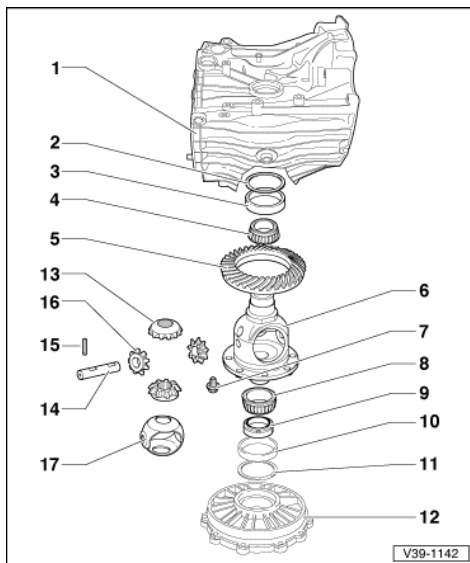
- ♦ Removing and installing differential
=>Page **138** .
- ♦ Renew both taper roller bearings together.
- ♦ Adjustments are required when replacing components marked 1)
=> Adjustment overview Page **156** .

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

- ♦ Note thickness
 - ♦ Adjustment overview
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- => Page **156**

3 Outer race for taper roller bearing (right) 1)

- ♦ Taper roller bearings same on left and right (does not apply to gearboxes without polygon bearings => from Page **2**)
- ♦ Driving out (gearbox with polygon bearings) => Fig. **147**
- ♦ Driving out (gearbox without polygon bearings) => Fig. **148**
- ♦ Driving in (gearbox with polygon bearings) => Fig. **148**
- ♦ On gearboxes without polygon bearings, drive in using VW 295 and 30-205

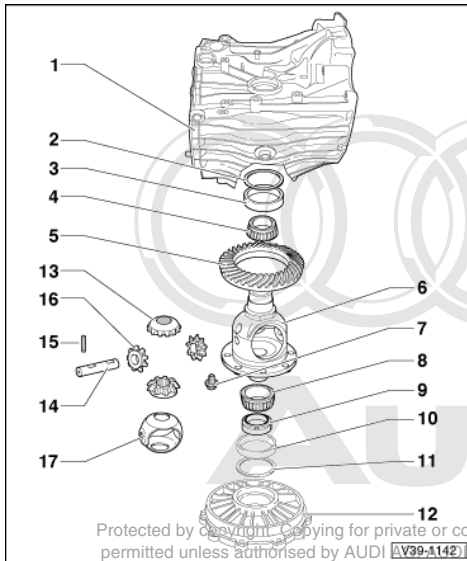
**4 Inner race for taper roller bearing (right)1)**

- ♦ Taper roller bearings same on left and right (does not apply to gearboxes without polygon bearings => from Page **2**)

- ♦ Pull off with 3296
=> Fig. 149
- ♦ Pressing on (gearbox with polygon bearings) => Fig. 149
- ♦ On gearboxes without polygon bearings, drive on using press tool 40-21

5 Crown wheel 1)

- ♦ Is mated to pinion shaft (pinion set)
- ♦ Select according to gearbox code using Parts Catalogue
=> from Page 2
- ♦ Drive off housing with a drift
=> Fig. 151
- ♦ Fit to differential cage
=> Fig. 151



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6 Differential housing 1)

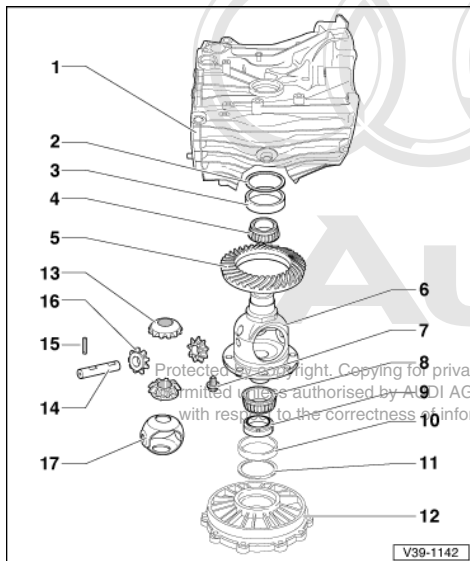
- ♦ Select according to gearbox code using Parts Catalogue
=> from Page 2

7 Bolt - 60 Nm + turn 45°further

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

8 Inner race for taper roller bearing (left) 1)

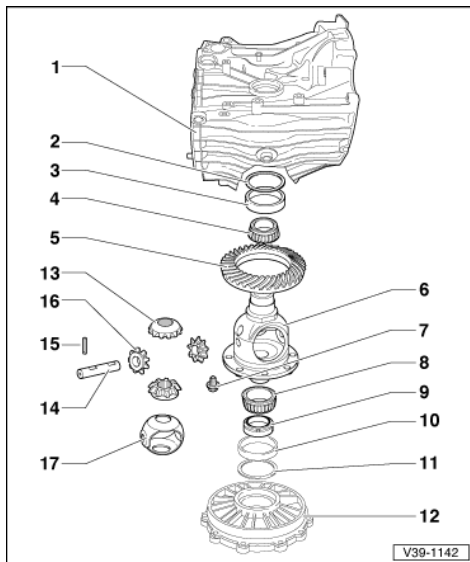
- ♦ Taper roller bearings same on left and right (does not apply to gearboxes without polygon bearings
=> from Page 2)
- ♦ Pulling off => Fig. 149
- ♦ Pressing on (gearbox with polygon bearings) => Fig. 150
- ♦ On gearboxes without polygon bearings, press on using press tool 40-21

**9 Speedometer drive wheel**

- ◆ Removing and installing
=>Page **137**
- ◆ Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily.

10 Outer race for taper roller bearing (left) 1)

- ◆ Taper roller bearings same on left and right (does not apply to gearboxes without polygon bearings => from Page **2**)
- ◆ Knocking out => Fig. **150**
- ◆ Driving in (gearbox with polygon bearings) => Fig. **151**
- ◆ On gearboxes without polygon bearings, drive in using VW 511 and VW 295

**11 Shim "S1"**

- ◆ Note thickness
- ◆ Adjustment overview
=> Page **156**

12 Cover for final drive 1)

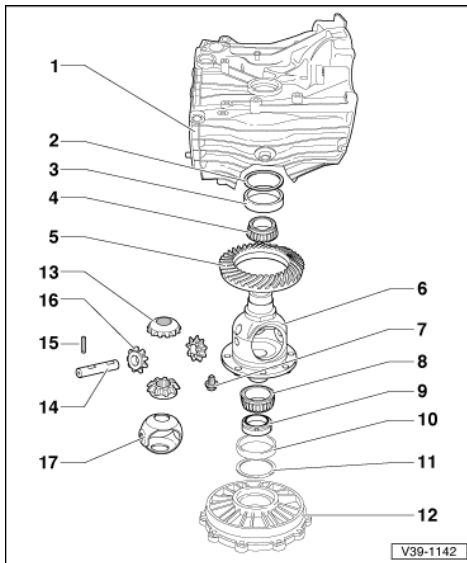
- ◆ Apply thin coat of sealing paste AMV 188 001 02 to sealing surfaces

13 Sun wheel

- ◆ Installing => Fig. **152**

14 Shaft for planet wheels

- ◆ Knock out with drift after removing spring pin



15 Spring pin

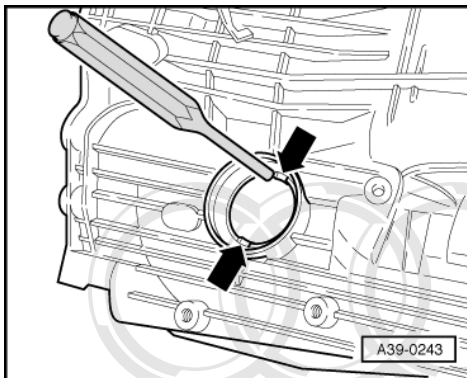
- ◆ For securing planet pinion axis shaft
- ◆ Version with annular groove: removing and installing => Fig. 152
- ◆ Version without annular groove: knock out with drift

16 Planet pinion

- ◆ Installing => Fig. 152

17 One-piece thrust washer

- ◆ Coat with gearbox oil when installing

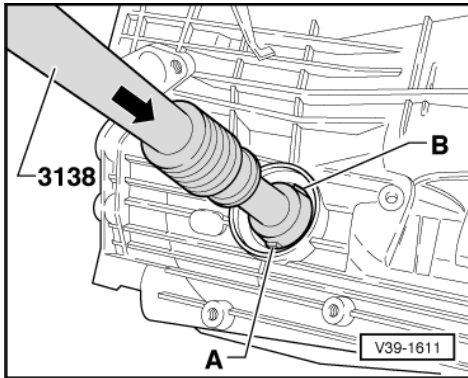


-> Fig.1 Driving outer race for taper roller bearing (right) out of gearbox housing (gearbox with polygon bearings)

- To drive out bearing race, apply drift alternately at slots -arrows- in bearing seat.

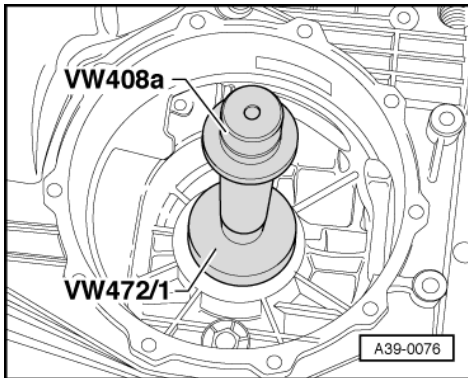
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The shims will be damaged when the bearing race is removed. Fit new shims.



-> Fig.2 Driving outer race for taper roller bearing (right) out of gearbox housing (gearbox without polygon bearings)

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

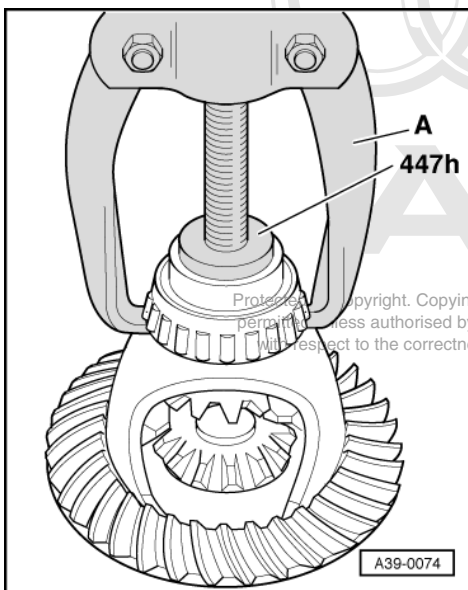


-> Fig.3 Driving right taper roller bearing outer race into gearbox housing

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

Note:

Use thrust plate 30-205 and drift VW 295 on gearboxes which have flange shafts without polygon bearings (=> from Page 2).



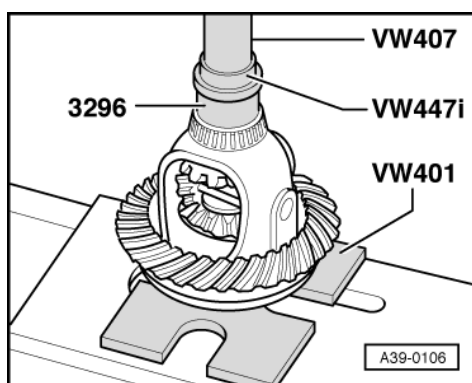
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-> Fig.4 Pulling off right taper roller bearing inner race

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

Notes:

- ◆ If using a puller with small-diameter spindle, also fit thrust plate 30-11 between thrust plate 447 H and puller.
- ◆ Use thrust plate 40-105 on gearboxes which have flange shafts without polygon bearings (=> from Page 2).
- ◆ There is a slot under the bearing seat in the differential housing for applying puller -A-.



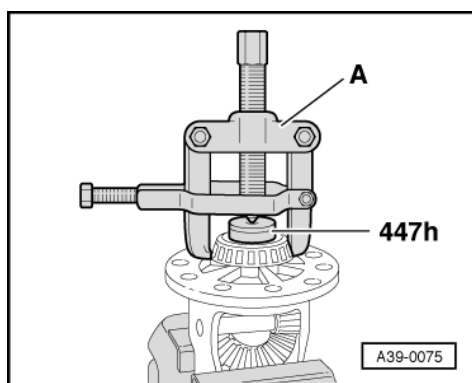
-> Fig.5 Pressing on right taper roller bearing inner race

Caution
Wear protective gloves.

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

Note:

Use press tool 40-21 for gearboxes which have flange shafts without polygon bearings (=> from Page 2).

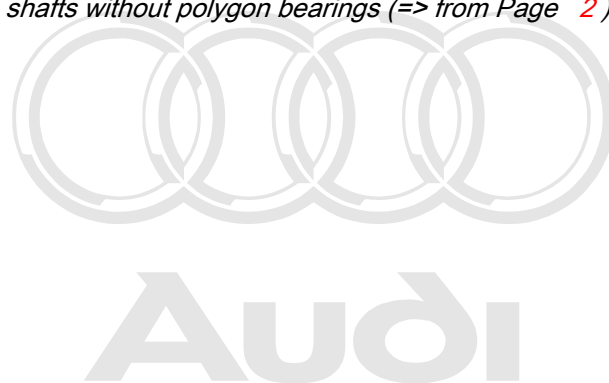


-> Fig.6 Pulling off left taper roller bearing inner race

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

Notes:

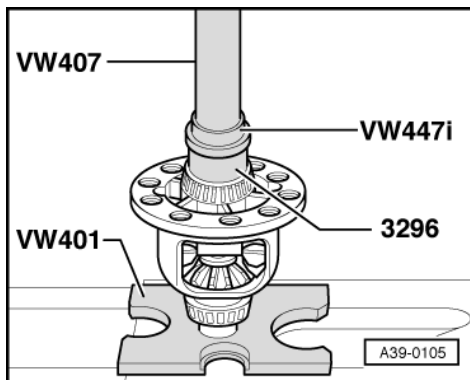
- ◆ If using a puller with small-diameter spindle, also fit thrust plate 30-11 between thrust plate 447 H and puller.
- ◆ Use thrust plate 40-105 for gearboxes which have flange shafts without polygon bearings (=>from Page 2).



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- ♦ There is a slot under the bearing seat in the differential housing for applying puller -A-.



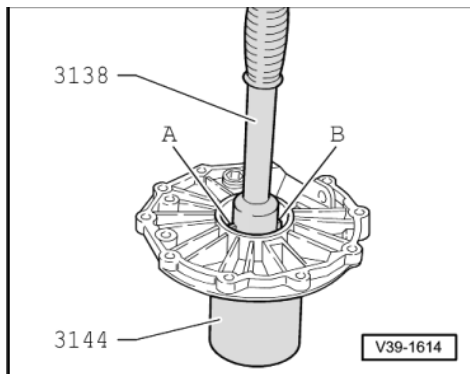
-> Fig.7 Fitting left taper roller bearing inner race

Caution
Wear protective gloves.

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

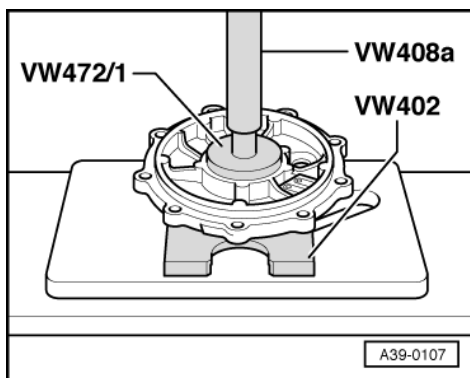
Note:

Use press tool 40-21 for gearboxes which have flange shafts without polygon bearings (=> from Page 2).



-> Fig.8 Knocking left taper roller bearing outer race out of cover

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

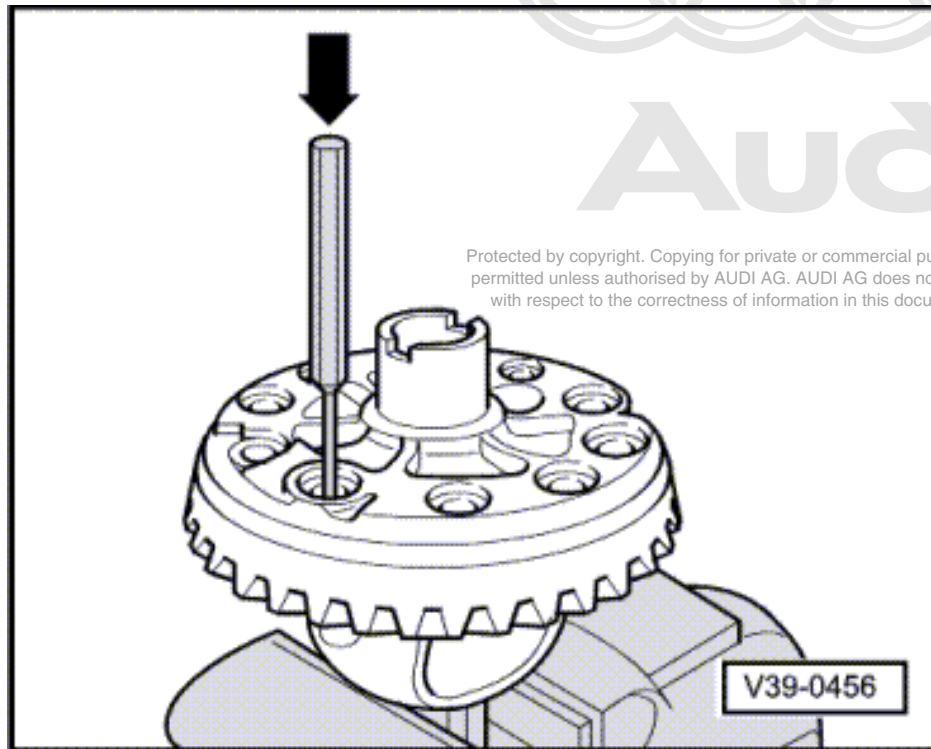


-> Fig.9 Driving left taper roller bearing outer race into cover

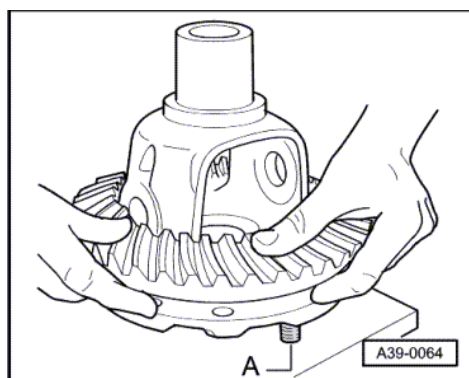
- Press piece VW 472/1 is fitted with the cone in the outer race.

Note:

Use thrust pad VW 511 and drift VW 295 for gearboxes which have flange shafts without polygon bearings (=>from Page 2).



-> Fig.10 Driving crown wheel off housing



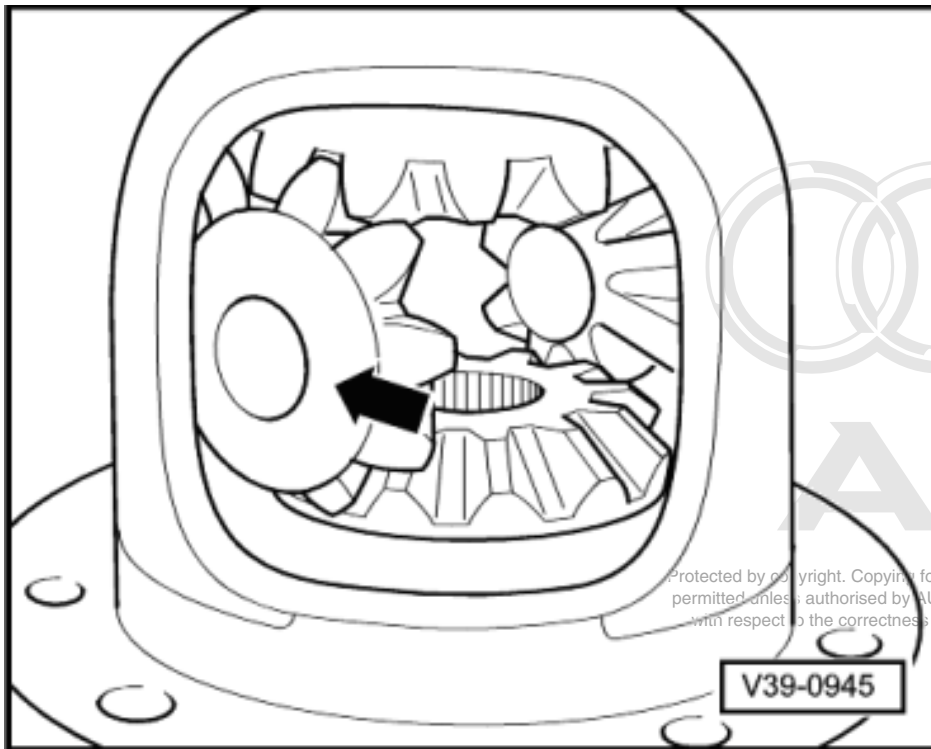
-> Fig.11 Fitting crown wheel

Caution
Wear protective gloves.

- When fitting crown wheel guide with centralizing pins -A- (local manufacture).
- Heat crown wheel to approx. 100 °C and install.

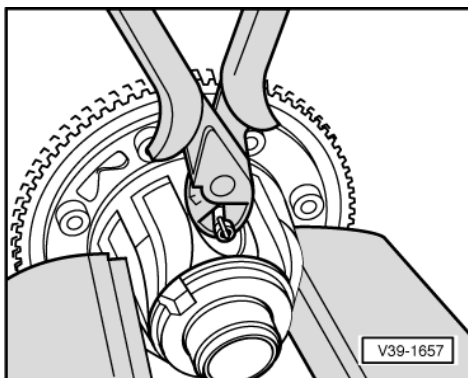


- Allow the crown wheel to cool off slightly before inserting the bolts. Then tighten to specified torque.



-> Fig.12 Installing sun wheels and planet pinions

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



-> Fig.13 Removing and installing spring pin

Removing

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

Installing

- Drive in spring pin as far as the stop.

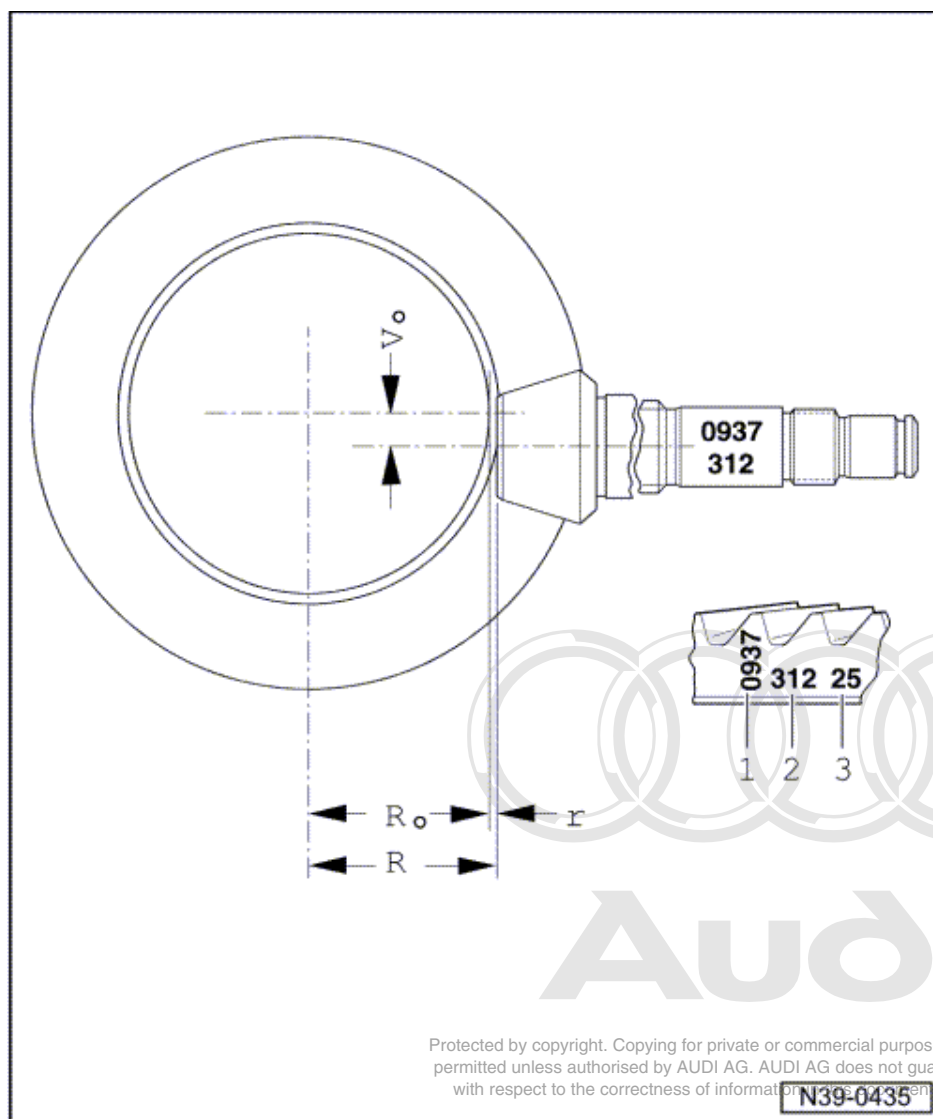
5 - Adjusting pinion shaft and crown wheel

5.1 - Adjusting pinion shaft and crown wheel

General notes:

- ♦ Careful adjustment of the pinion shaft and crown wheel is important for the service life and smooth running of the final drive. For this reason, the pinion shaft 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 pinion shaft 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 (pinion shaft and crown wheel) may only be replaced together as a matched pair.
- ♦ Observe the general repair instructions for taper roller bearings and shims.
- ♦ The friction torque measurement is only used as a final check to make sure that the adjustment is correct.

5.2 - Adjusting and marking of gear sets



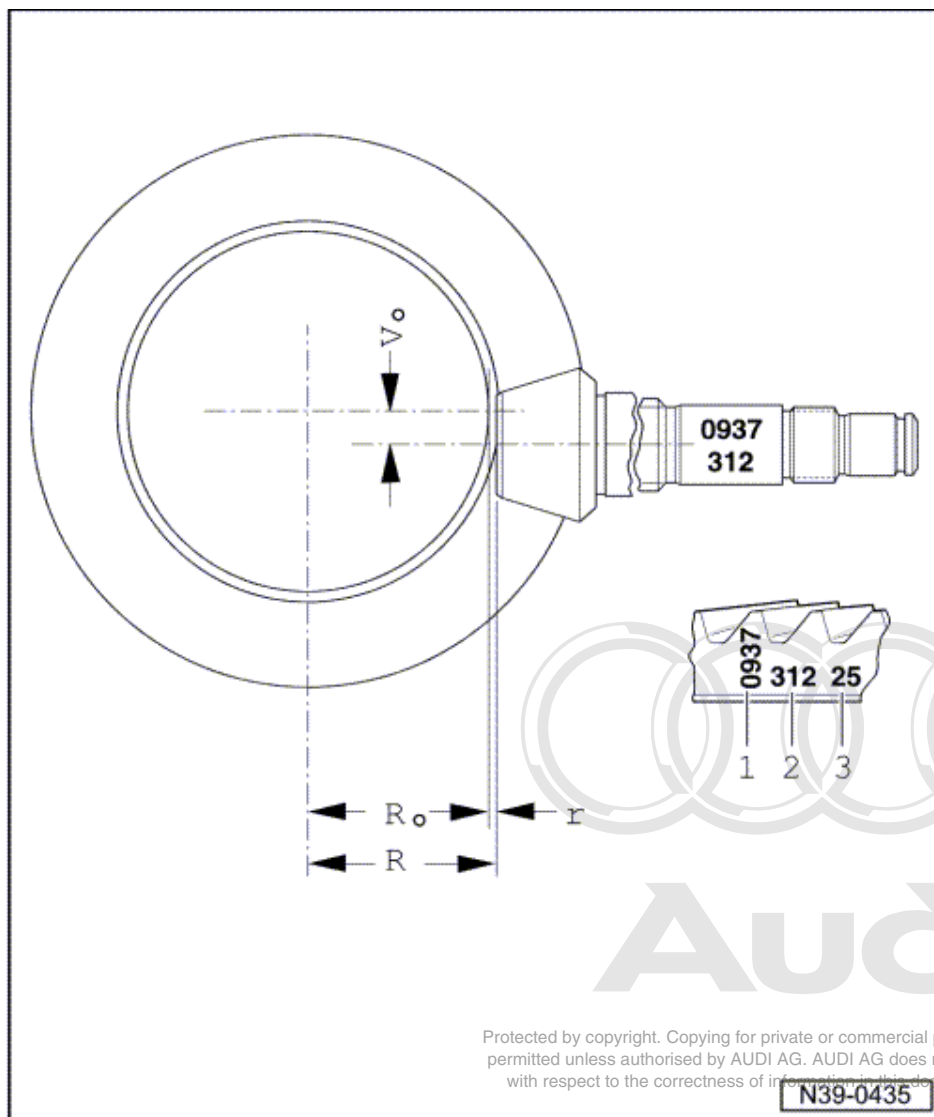


- 1 Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.
- 2 Pairing number (312) of final drive set.
- 3 Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies $r = 0.25$ mm

Ro - Length of test machine master gauge used.

Ro -Crown wheel $\varnothing 170$ mm = 54.95 mm

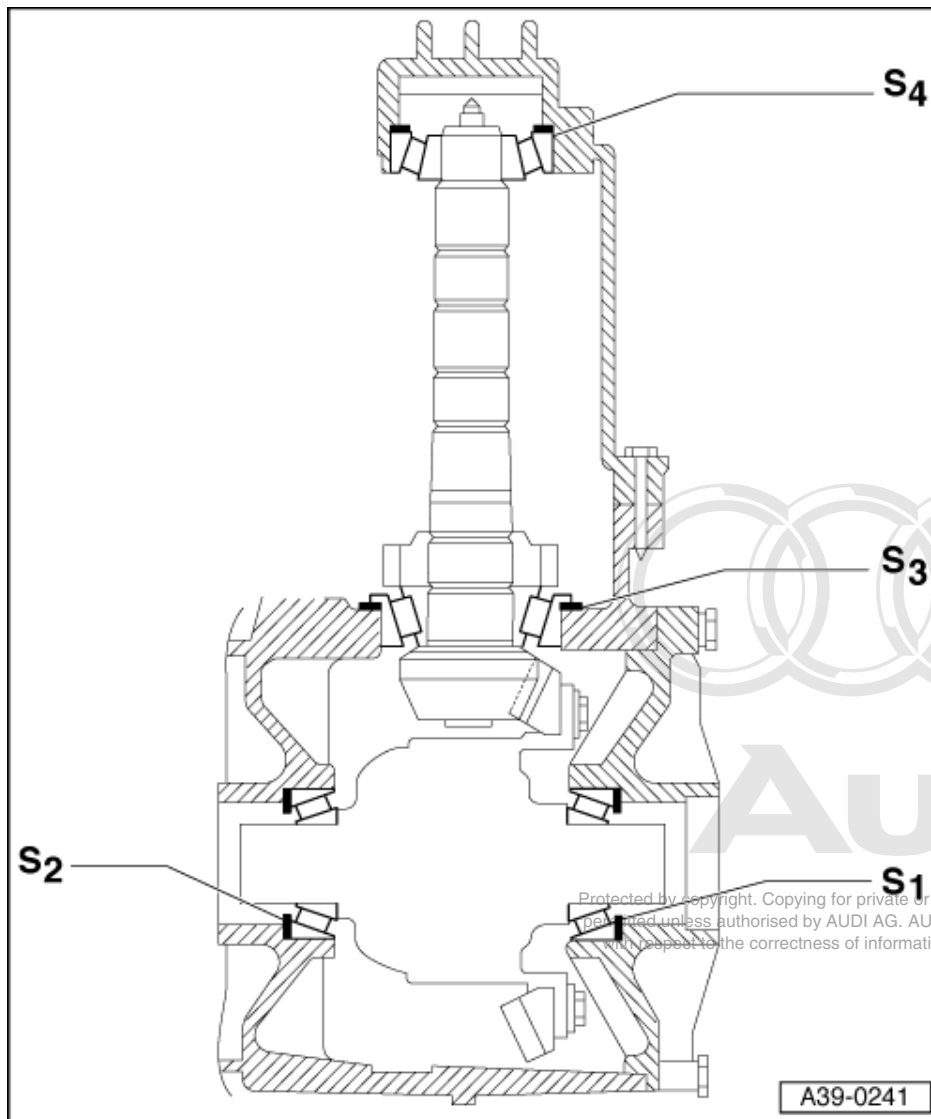
Ro -Crown wheel $\varnothing 180$ mm = 59.65 mm



R - Actual distance between crown wheel axis and face of pinion shaft in position of quietest running for this gear set.

Vo - Hypoid offset

5.3 - Position of shims



Note:

Adjustment overview when replacing individual components of gearbox

=>Page 156.

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



5.4 - Adjustment overview

Note:

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

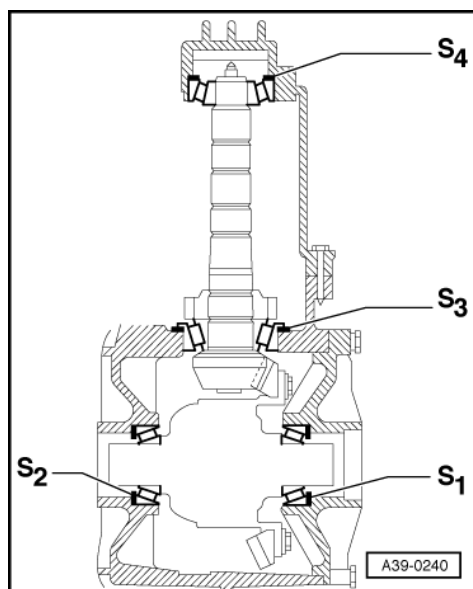
Part renewed: ▼	to be adjusted:			
	Crown wheel "S1"+"S2" 1) => Page 168	Pinion shaft "S3"+"S4" 1) using deviation "r" => Page 157	Pinion shaft "S4" 1) => Page 166	Backlash => Page 171
Gearbox housing 3)	X	X		X
Gearbox cover			X	
Differential housing	X			X
Taper roller bearing for pinion shaft		X		X
Taper roller bearing for differential	X			X
Final drive set 2)	X	X		X
Cover for differential	X			X

1) Shims; installation position => Page 155 .

2) Pinion shaft and crown wheel; only renew together.

3) If the gearbox housing is renewed the input shaft must also be adjusted => Page 107 , adjusting input shaft.

5.5 - Sequence for readjusting final drive set



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

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- 1.) Determine total shim thickness "Stotal" for "S1" + "S2" (sets preload for taper roller bearings of differential) => from Page 168 .
- 2.) Determine total shim thickness "Stotal" for "S3" + "S4" (sets preload for taper roller bearings for pinion shaft) => from Page 157 .
- 3.) Distribute total shim thickness "Stotal" for "S3" + "S4" so that the distance from centre of crown wheel to face of pinion shaft is the same as distance "R" which was determined during production => from Page 164 .
- 4.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash between crown wheel and pinion shaft is maintained => from Page 172 .

Note:

Overview of components and shims

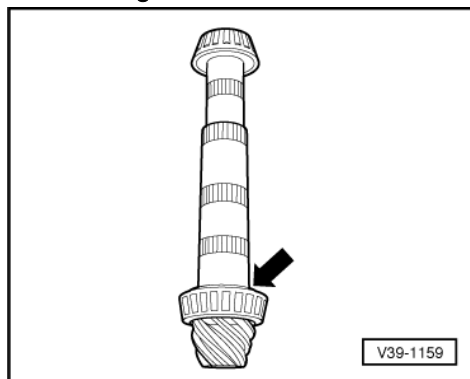
=>Page 155 .

5.6 - Adjusting pinion shaft

Repairs after which the pinion shaft must be adjusted => table on Page 156 .

Special tools, testers and auxiliary items

- ◆ Crankshaft seal installing tool VW 204 B
- ◆ Lever VW 296
- ◆ Universal mandrel VW 385
- ◆ Universal mandrel VW 385/1
- ◆ Centring disc VW 385/2 (for gearbox without polygon bearings)
- ◆ 2 x centring disc VW 385/3
- ◆ Measuring plunger VW 385/14
- ◆ Dial gauge extension VW 385/15
- ◆ Master gauge VW 385/30
- ◆ End dimension plate VW 385/33
- ◆ Universal dial gauge bracket VW 387
- ◆ Press plate VW 401
- ◆ Press tool VW 407
- ◆ Tube VW 519
- ◆ Fitting tool VW 792
- ◆ Thrust plate 3005
- ◆ Torque gauge 0 ... 600 Ncm
- ◆ Dial gauge
- ◆ Dial gauge extension 9.3 mm
- ◆ Dial gauge extension 6.5 mm
- ◆ Dial gauge extension 30 mm

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

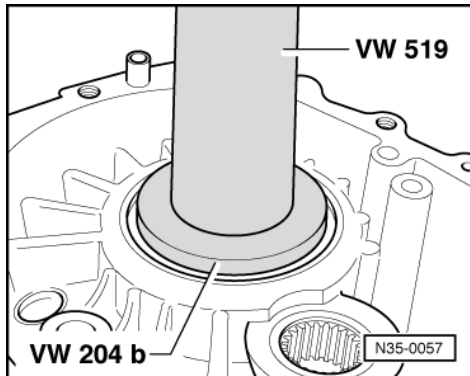


(Setting preload of taper roller bearings for pinion shaft)

- Differential removed
- Press on large taper roller bearing inner race
=>from Page **109**.
- -> Secure lower taper roller bearing (arrow).

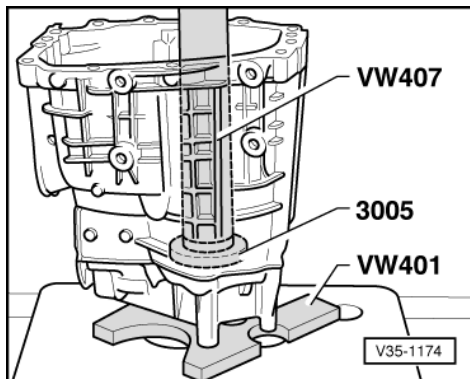
Note:

Pinion shaft is shown in illustration with gears removed.



- -> Fit taper roller bearing outer race for pinion shaft in gearbox housing without shims
=>Fig. **120**.
- Fit disc -Item **118** in gearbox cover.

Pressure plates with thickness 14.8 or 15.3 mm can be installed:



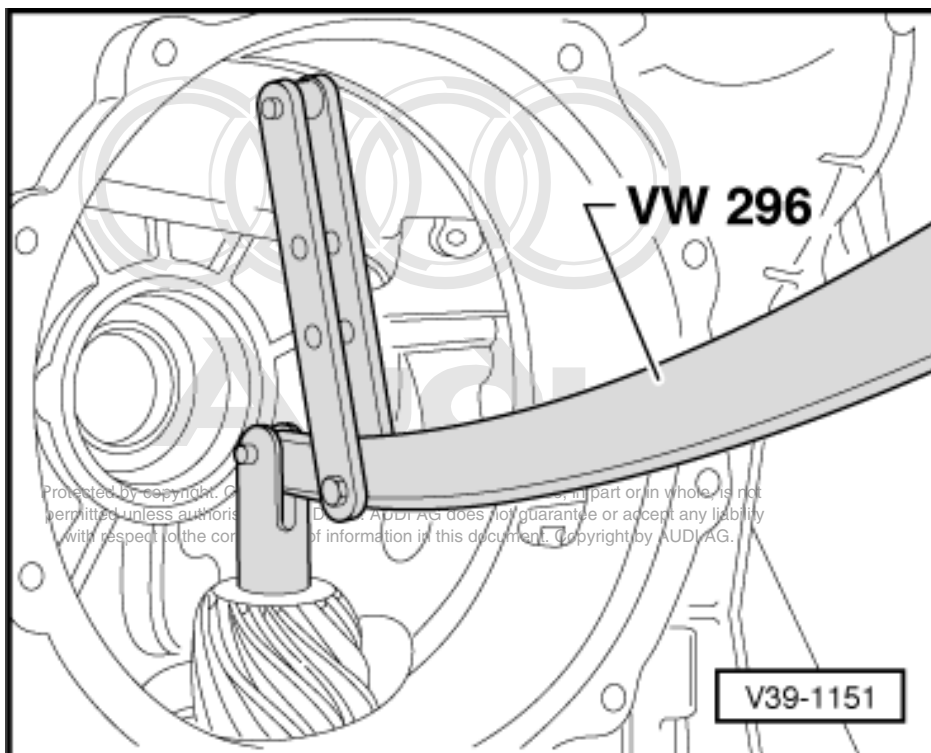
- -> Fit taper roller bearing outer race for pinion shaft in gearbox cover with shim "S4*" (1.0 mm thick) => Fig. **122**.

Note:

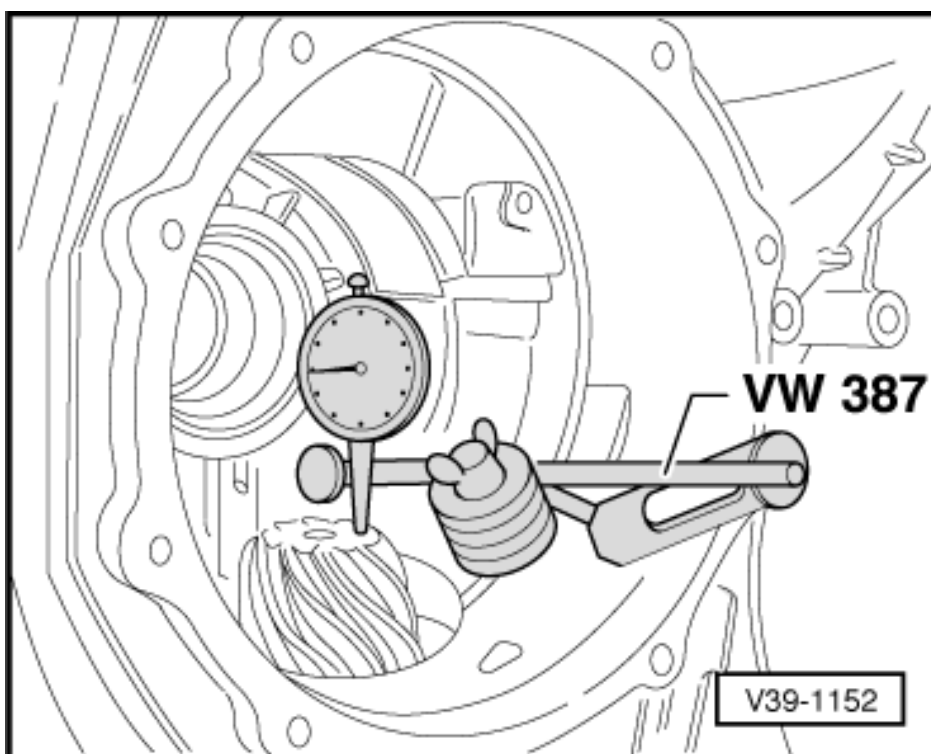
For measurement purposes a shim "S4" of 1.0 mm is initially inserted which is designated "S4" After determining measurement "e" "S4*" will be replaced by the correct shim "S4".*

- Insert completely assembled pinion shaft in gearbox housing.
- Fit gearbox cover and tighten bolts to 22 Nm.
- Turn gearbox so that the gearbox cover is downwards.

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- -> Press down on face of pinion shaft with lever VW 296 until the taper roller bearing outer race contacts gearbox cover.
- Maintaining pressure, turn pinion shaft by hand so that the taper roller bearing settles.

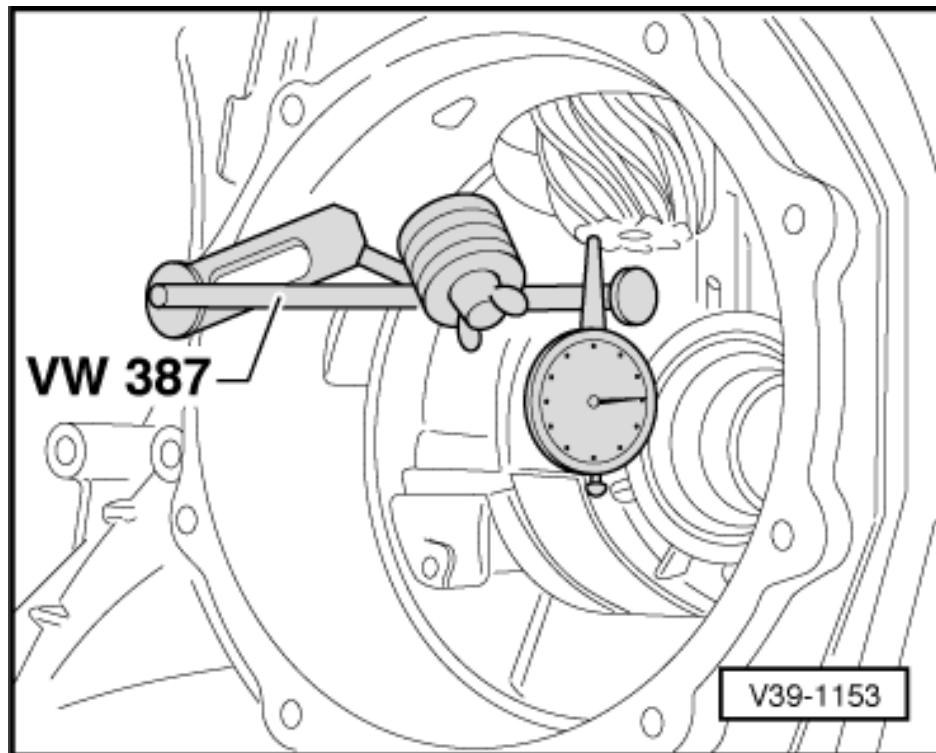


- -> Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) to "0" with 1 mm preload.

**Note:**

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

- Turn gearbox 180° so that the gearbox cover is upwards.
- Rotate pinion shaft 5 turns in each direction so that the bearing settles.



- -> Read off and note the play indicated on the dial gauge.
- Measurement in example: 0.45 mm

Note:

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

Formula:

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

Example:

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

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

"S3" = "Stotal" - "S4"

Example:

Total shim thickness "Stotal" for "S3" + "S4"	1.60 mm
- Inserted shim "S4"	1.00 mm

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= Thickness of shim "S3**"	0.60 mm
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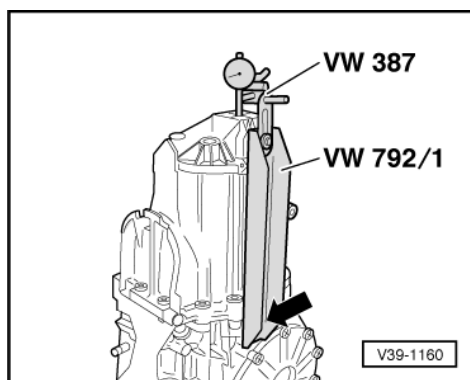
- Remove taper roller bearing outer race, fit shim "S3**" in gearbox housing and install outer race again => Fig. 120 .
- Insert completely assembled pinion shaft into gearbox housing again.
- Fit gearbox cover and tighten bolts to 22 Nm.

Checking preload of pinion shaft taper roller bearing

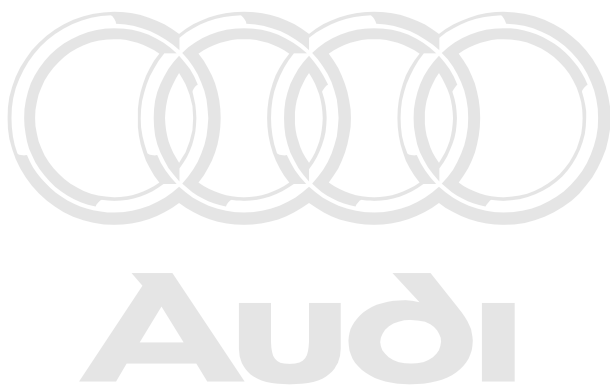
- Rotate pinion shaft 5 turns in each direction so that the bearing settles.

Notes:

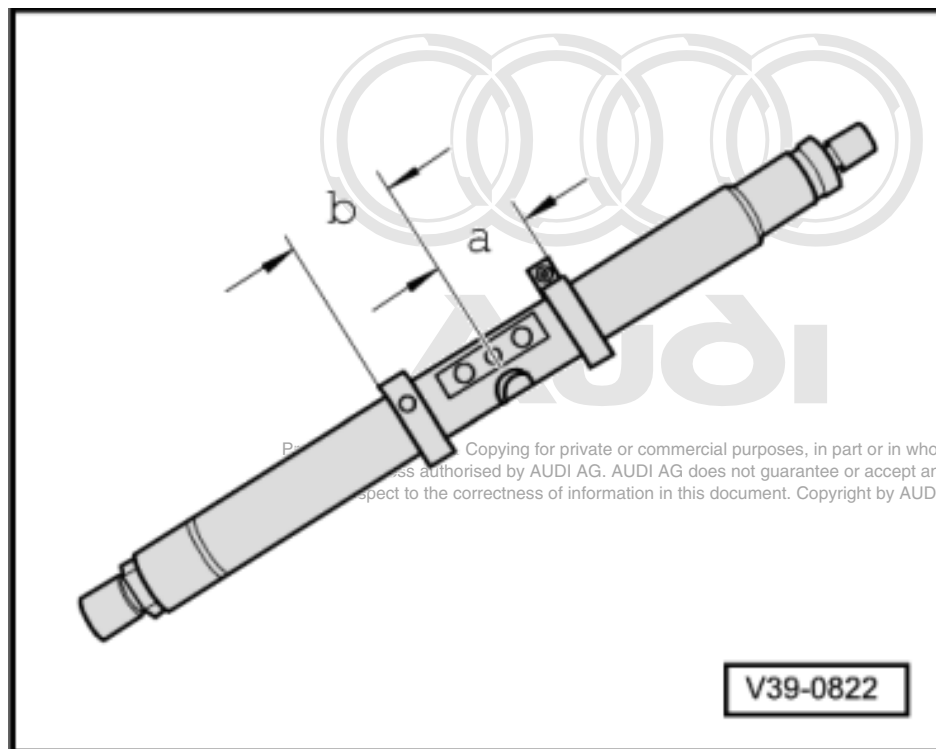
- ◆ If the pinion shaft cannot be turned by hand, screw an M10 x 20 bolt into the pinion head and turn the shaft by applying a suitable tool to this bolt.
- ◆ Remove bolt after turning shaft.



- -> Fit measuring tools and secure with bolt (arrow) to gearbox housing.
- Fit dial gauge (3 mm measuring range) onto centre of gearbox cover and set to "0" with 2 mm preload.
- Loosen gearbox cover bolts and turn pinion shaft several times.
- If the correct shims have been selected the dial gauge will now indicate the following value:
 - 0.05 ... 0.15 mm
- Tighten gearbox cover bolts again to 22 Nm.
- Remove measuring tools.
- Rotate pinion shaft 5 turns in each direction so that the bearing settles.



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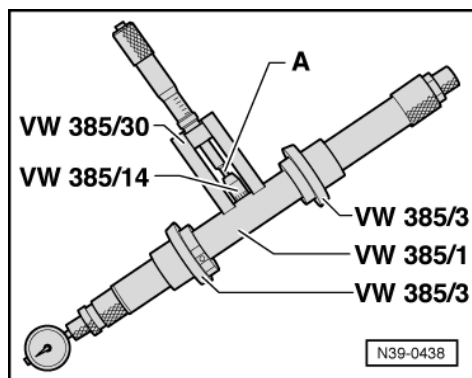


Determining measurement "e"

Note:

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

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



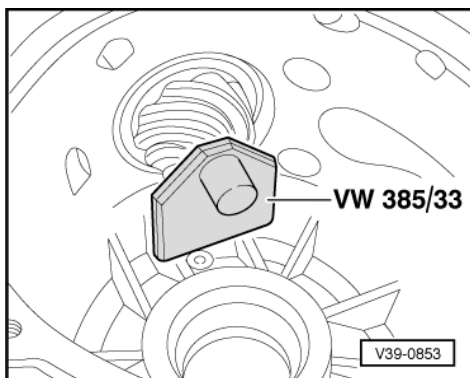
- -> Assemble universal mandrel VW 385/1 as illustrated:

Dial gauge extension A	Ro	Crown wheel dia.
6.5 mm for VW 385/30	54.95	170 mm
9.3 mm for VW 385/15	59.65	180 mm

- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

Note:

For a gearbox which has flange shafts without polygon bearings (=> Page 2 onwards) use centring disc VW 385/2 opposite the dial gauge instead of centring disc VW 385/3.

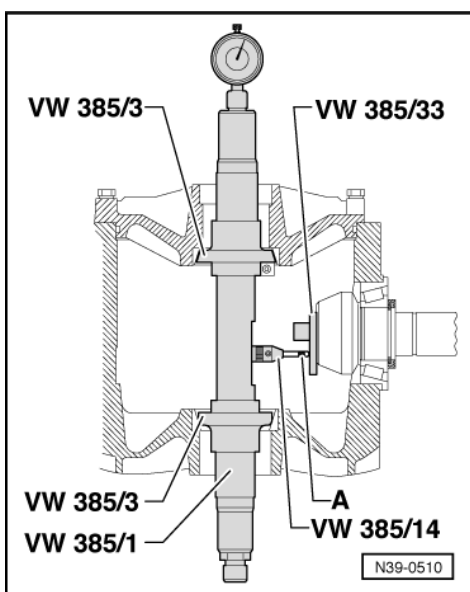


- -> Place end measuring plate on face of pinion shaft.

Note:

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

- Remove master gauge and insert measuring mandrel in the housing.



- -> Dial gauge extension -A- must be fitted => table on Page 162 .

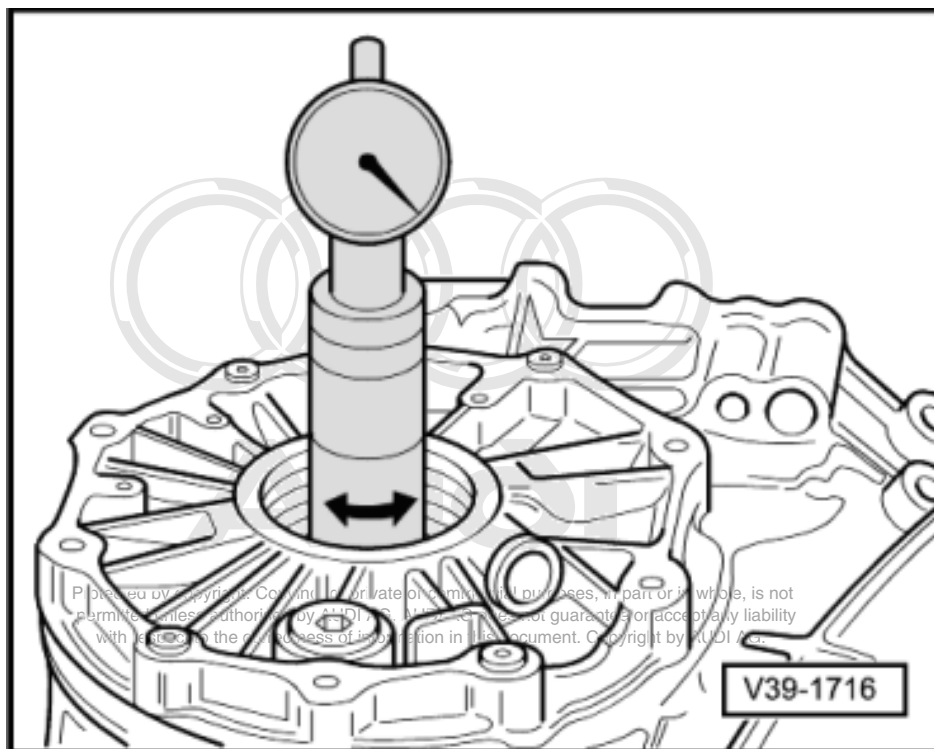
Fit cover for final drive and tighten 4 bolts to 22 Nm.

Using the adjustable ring, pull 2nd centring disc VW 385/3 out as far as possible so that the mandrel can still just be turned by hand.

Note:

For a gearbox which has flange shafts without polygon bearings (=> Page 2 onwards) use centring disc VW 385/2 opposite the dial gauge instead of centring disc VW 385/3.

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

Note:

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

Determining thickness of shim "S3"

Formula:

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

("e" in black scale)

or

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

("e" in red scale)

Notes:

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

Example:

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

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

=> Parts catalogue

The following shims are available for "S3"

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

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

Determining thickness of shim "S4"

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

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

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

=> Parts catalogue

Available shims for "S4"

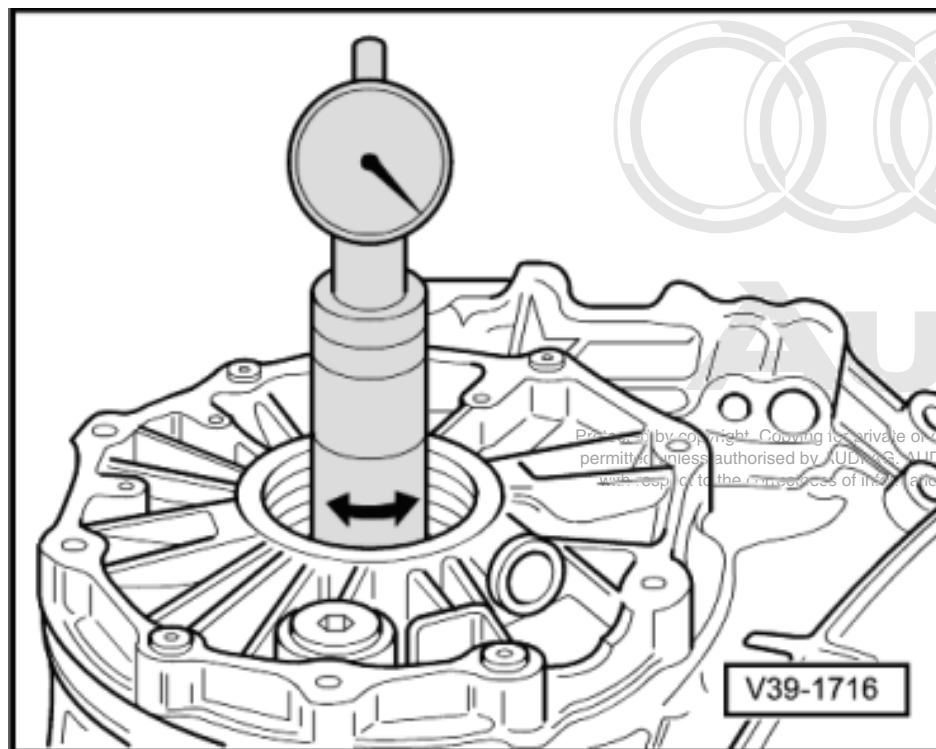
Shim thickness (mm) 1)		
0.49	0.65	0.81
0.53	0.69	0.85
0.57	0.73	0.89
0.61	0.77	

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 pinion shaft with determined shims "S3" and "S4" and turn 5 turns in both directions.



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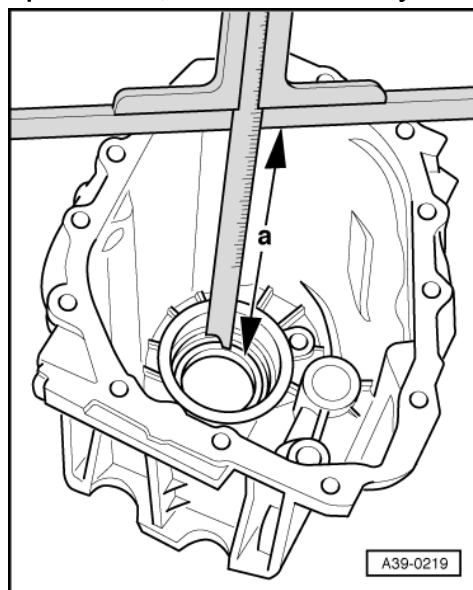
- -> Insert universal mandrel, => "determining measurement 'e'" on Page 162 and perform check measurement.
- Read off dial gauge anti-clockwise (red scale).
 - If the shims have been correctly selected, the deviation "r" (marked on outer circumference of crown wheel) must be shown - within a tolerance of ± 0.04 mm

Note:

Then (after removing universal mandrel), check once again that the dial gauge indicates "0" with 2 mm preload when master gauge VW 385/30 or VW 385/15 is in place. If this is not the case, correct the adjustments.

5.7 - Re-determining "S4" shim when fitting new gearbox cover

Special tools, testers and auxiliary items



- ◆ Universal dial gauge bracket VW 387
 - ◆ Fitting tool VW 792/1
 - ◆ Dial gauge
 - ◆ Dial gauge extension
 - ◆ Depth gauge (accurate to within 5/100 mm or less)
- Clean housing flange.
 - -> Measure difference in depth "a" on old and new gearbox cover.

Example:

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

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

Example:

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

Available shims => Table Page **165**.

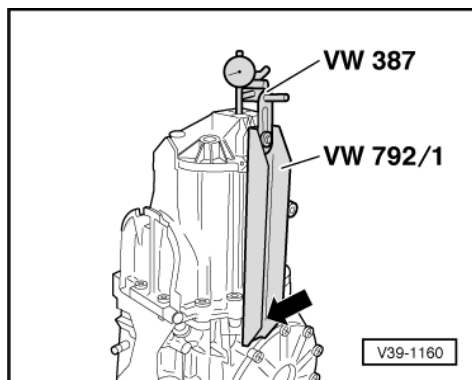
- Install taper roller bearing outer race with "S4" shim in gearbox cover.
- => Fig. **122**.
- Insert completely assembled pinion shaft into gearbox housing again.
- Fit gearbox cover and tighten bolts to 22 Nm.

Checking preload of pinion shaft taper roller bearings

- Rotate pinion shaft 5 turns in each direction so that the bearing settles.

Note:

The pinion shaft can be rotated by turning both flange shafts together.



- -> Fit measuring tools and secure with bolt (arrow) to gearbox housing.
- Fit dial gauge (3 mm measuring range) onto centre of gearbox cover and set to "0" with 2 mm preload.
- Loosen gearbox cover bolts and turn pinion shaft several times.
- If the correct shims have been selected the dial gauge will now indicate the following value:
 - 0.05 ... 0.15 mm
- Remove measuring tools.
- Apply thin coat of sealant AMV 188 001 02 to sealing surfaces.
- Tighten gearbox cover bolts again to 22 Nm.



5.8 - Adjusting crown wheel

(Adjusting differential)

The table on Page 156 lists the repairs after which the crown wheel has to be adjusted.

Special tools, testers and auxiliary items

- ♦ Dial gauge extension VW 382/10
- ♦ Measuring plate VW 385/17
- ♦ Universal dial gauge bracket VW 387
- ♦ Measuring lever VW 388
- ♦ Press plate VW 402
- ♦ Press tool VW 408 A
- ♦ Thrust piece VW 472/1
- ♦ Crown wheel adjusting device VW 521
- ♦ Retainer 3177
- ♦ Torque gauge 0 ... 600 Ncm
- ♦ Dial gauge
- ♦ Dial gauge extension 30 mm

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

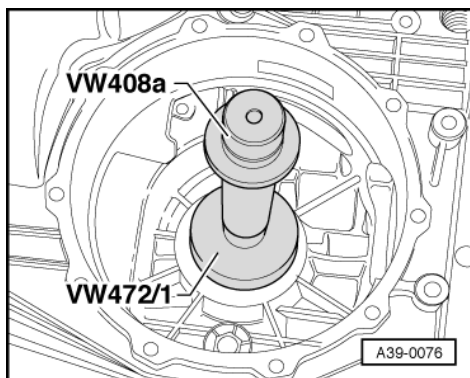
(Setting preload of taper roller bearing for differential)

- Pinion shaft removed

Note:

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

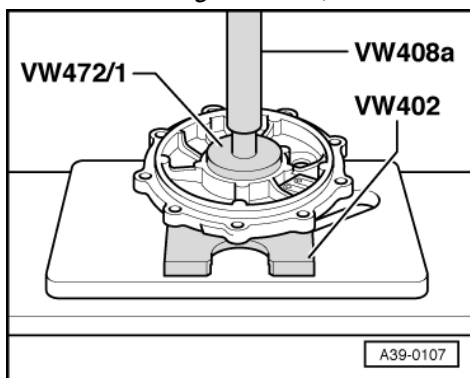
- Remove seal and outer races of both taper roller bearings for differential.
- Remove shims => Page 143 .



- -> Drive right taper roller bearing outer race with shim "S2" into gearbox housing=>Fig. 148 . A shim "S2*" with a thickness of 1.20 mm (two 0.60 mm shims) is used for the initial measurement.

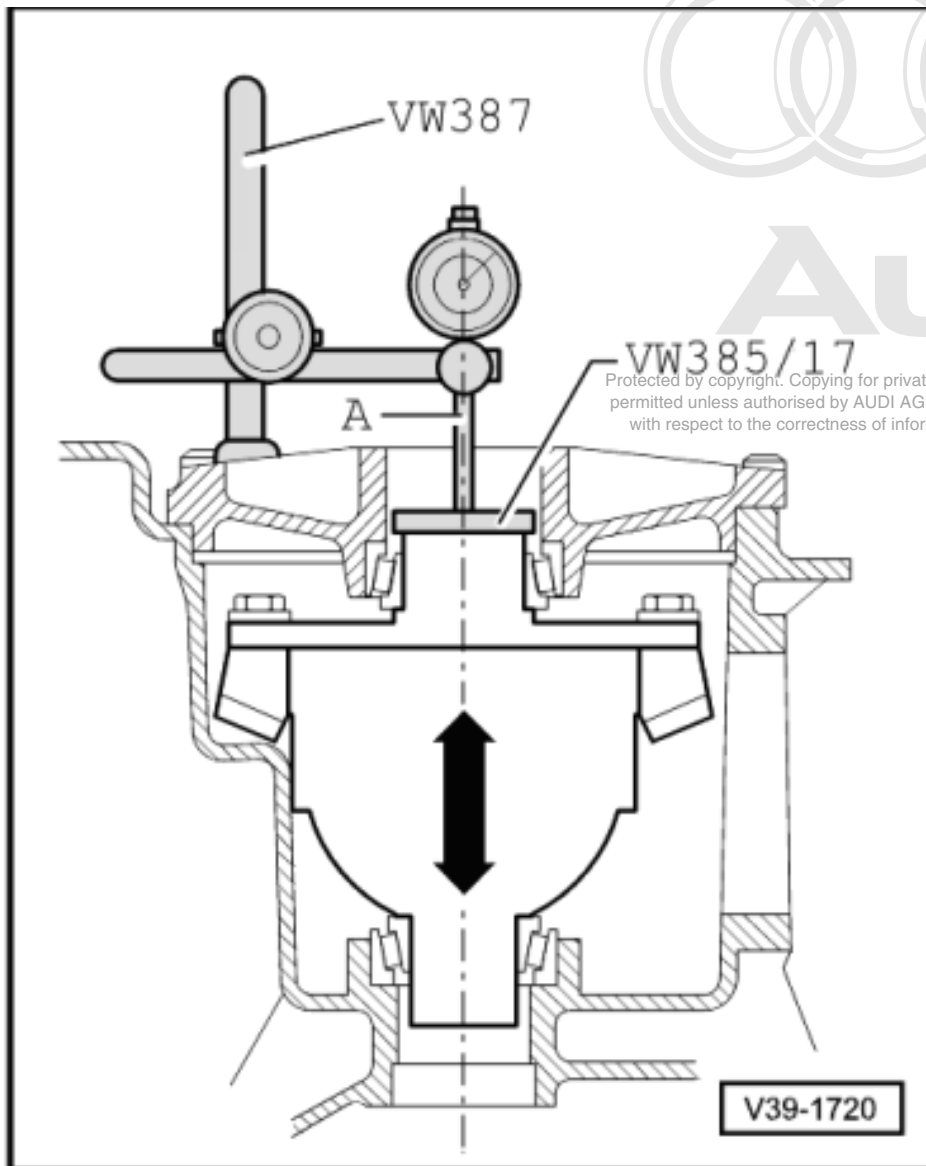
Note:

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



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- -> Press right taper roller bearing outer race into cover for differential without shim "S1" =>Fig. 151 .
- 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.

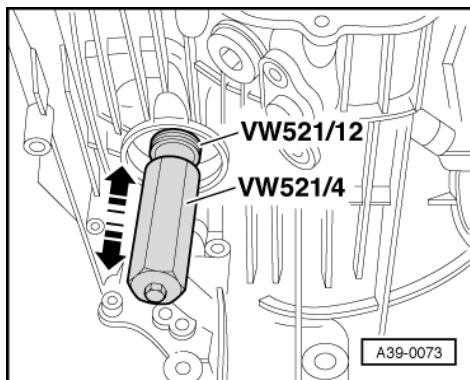


- Turn differential 5 turns in both directions so that the taper roller bearings settle.
- -> Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) -A- to "0" with 2 mm preload.

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:**

- ♦ -> To lift the differential, attach special tools VW 521/4 and VW 521/8 (for gearbox without polygon bearings) or VW 521/12 (for gearbox with polygon bearings) on the right of the differential (housing side).
- ♦ If the measurement has to be repeated, the differential must be turned 5 turns in each direction first to settle the taper roller bearings.

Formula:

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

Example:

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

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Determining thickness of shim "S1"**Notes:**

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

Formula:

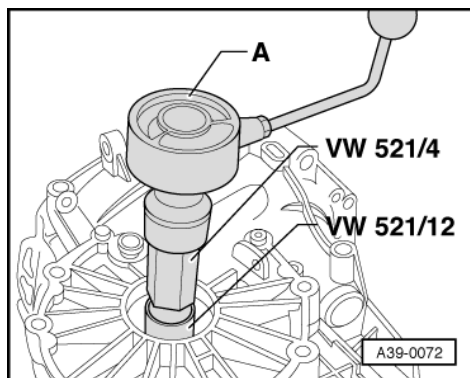
$$\text{"S1*"} = \text{"Stotal"} - \text{"S2*"}$$

Example:

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

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

- ♦ Differential tapered roller bearings are low friction bearings. Therefore the friction 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 friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- Pinion shaft removed



- -> Fit torque gauge -A- (0 ... 600 Ncm) onto differential. (Use VW 521/8 for gearbox without polygon bearings, and VW 521/12 for gearbox with polygon bearings.)
- Read off friction torque.

Friction torque specifications:

New bearings	Used bearings
200 ... 350 Ncm	30 ... 60 Ncm

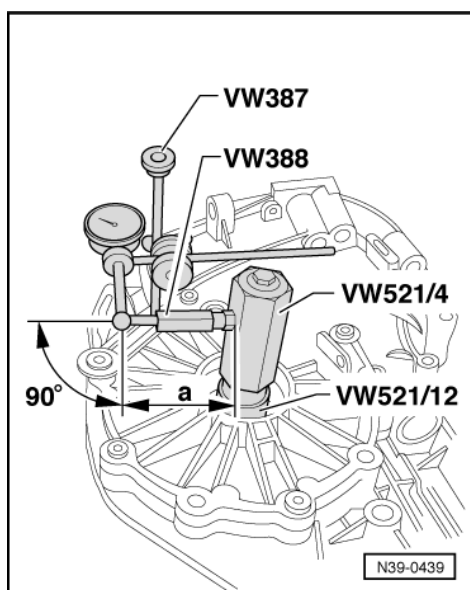
Note:

If the final drive set (pinion shaft and crown wheel) is being re-adjusted, the adjustment of the pinion shaft should be performed now, and the adjustment checked=>Page 157.

Measuring backlash

(Position of crown wheel in gearbox housing)

- Pinion shaft with shims "S3" and "S4" fitted
- Install differential.
- Turn the differential 5 turns in each direction to settle the taper roller bearings.



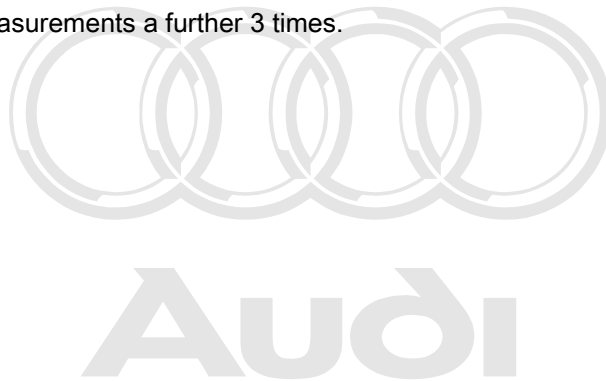
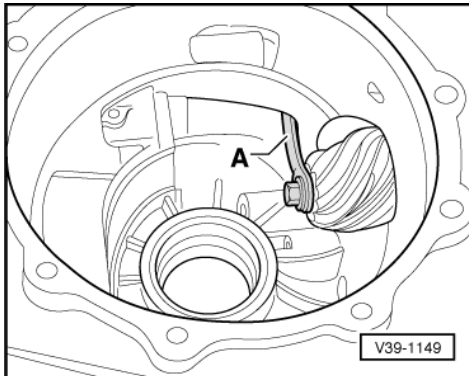
- -> Secure dial gauge retainer VW 387 onto housing.
- Attach crown wheel adjusting device VW 521/4 and VW 521/8 (on gearbox without polygon bearings), or VW 521/12 (on gearbox with polygon bearings).
- Fit dial gauge with dial gauge extension VW 382/10 (6 mm flat).



- Adjust measuring lever VW 388 to distance "a":

Distance "a"	Crown wheel dia.
67 mm	170 mm
72 mm	180 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.



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Notes:

- ♦ -> If the pinion shaft rotates when the differential is turned, fit clamp 3177 -A- so that the backlash can be measured accurately.
- ♦ Loosen the clamp in order to turn the crown wheel.
- ♦ When inserting the differential, the opening for the differential bevel gears must then face the pinion shaft.
- If the retainer 3177 has been fitted, install differential turned through 180° and repeat measuring procedure.

Determining average backlash

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

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

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

Note:

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

Determining thickness of shim "S2"

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

Example:	
Inserted shim "S2"	1.20 mm

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

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

=> Parts catalogue

The following shims are available for "S2"

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

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

Determining thickness of shim "S1"

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

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

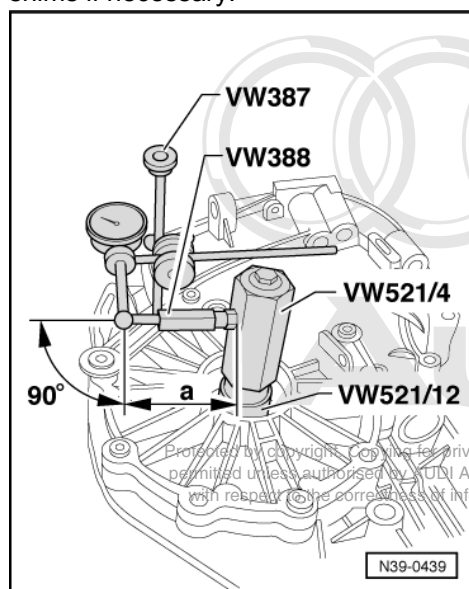
- Determine shim(s) as accurately as possible from table. Part numbers

=> Parts catalogue

The following shims are available for "S1"

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

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





-> Performing check measurement

- After installing shims "S1" and "S2", turn differential 5 turns in both directions so that the taper roller bearings settle.

Note:

For gearbox without polygon bearings, use special tool VW 521/8 instead of VW 521/12 as illustrated.

- 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.



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