



Workshop Manual

Audi A4 2001 ➤

Audi A4 Cabriolet 2003 ➤

Audi A6 2005 ➤

Servicing 6-speed manual gearbox 0A2, front-wheel drive

Edition 08.2005

List of Workshop Manual Repair Groups

Repair Group

00 - Technical data

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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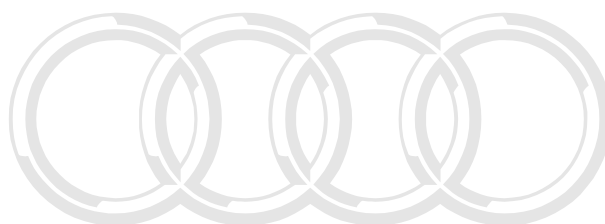
Contents

00 - Technical data	1
1 Gearbox identification	1
2 General repair instructions	2
2.1 Special tools	2
2.2 Components	2
34 - Controls, housing	7
1 Dismantling and assembling gearbox	7
1.1 Overview of gearbox	7
1.2 Exploded view	8
1.3 Removing and installing gearbox cover and selector shaft - exploded view	9
1.4 Removing and installing 1st, 2nd and reverse gear - exploded view	11
1.5 Removing and installing input shaft, 3rd - 6th gear wheels, pinion shaft and selector rods - exploded view	14
1.6 Dismantling and assembling sequence	17
1.7 Renewing grooved ball bearing for input shaft with gearbox removed (gearbox remains assembled)	42
2 Servicing gearbox cover	46
3 Servicing gearbox housing	51
4 Servicing selector shaft	59
4.1 Renewing oil seal for selector shaft with gearbox removed (gearbox remains assembled)	59
35 - Gears, shafts	61
1 Input shaft	61
1.1 Input shaft - exploded view	61
1.2 Dismantling and assembling input shaft - assembly sequence	65
2 Pinion shaft	74
2.1 Pinion shaft - exploded view of components	74
2.2 Dismantling and assembling pinion shaft	78
2.3 Re-determining shim "S5" for positioning 4th gear wheel	79
2.4 Re-determining shim "S6" for positioning 2nd speed selector gear	80
39 - Final drive - differential	84
1 Renewing flange shaft oil seals	84
2 Removing and installing differential	85
3 Dismantling and assembling differential	89
4 Adjusting pinion shaft and crown wheel	96
4.1 Adjustment and marking of final drive gear set	96
4.2 Adjusting pinion shaft	99
4.3 Adjusting crown wheel	105



Audi A4 2001 ➤ , Audi A4 Cabriolet 2003 ➤ , Audi A6 2005 ➤

Servicing 6-speed manual gearbox 0A2, front-wheel drive - Edition 08.2005



Audi

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00 – Technical data

1 Gearbox identification

Note

For detailed information on code letters, gearbox allocation, ratios and capacities please refer to the Workshop Manual ⇒ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 00.

Location on gearbox

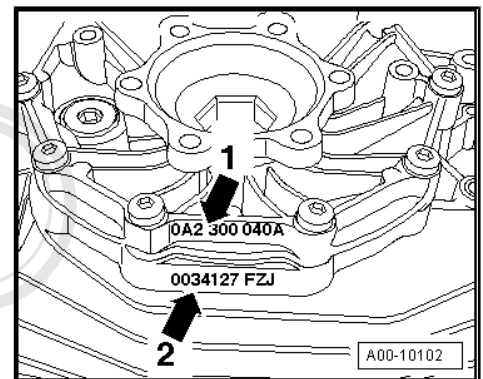
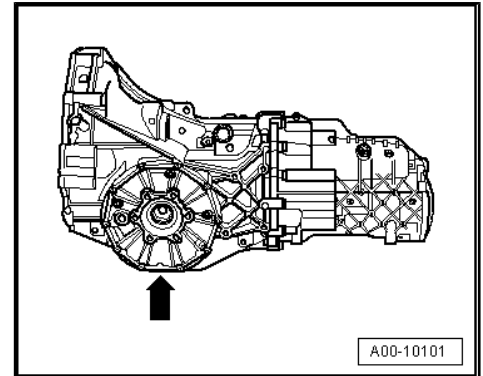
- ◆ Gearbox Part No., code and serial number -arrow-

Manual gearbox 0A2 -arrow 1- with gearbox Part No. (e.g. 0A2 300 040 A)

Gearbox serial number and code letters -arrow 2-

Example:	0034127	FZJ
	Gearbox serial number	Code letters

Additional data are production-related.



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2 General repair instructions

Proper tools and the maximum possible care and cleanliness are essential for satisfactory gearbox repairs. The usual basic safety precautions also naturally apply when carrying out repair work.

A number of generally applicable instructions for the various repair procedures (previously repeated at numerous places in the Workshop Manual) are summarised here under the designation "Components" ➔ [page 2](#) . They apply to the work described in this Manual.

2.1 Special tools

For a complete list of special tools used in this Workshop Manual ➔ "Special tools, Workshop equipment" .

2.2 Components

2.2.1 Gearbox

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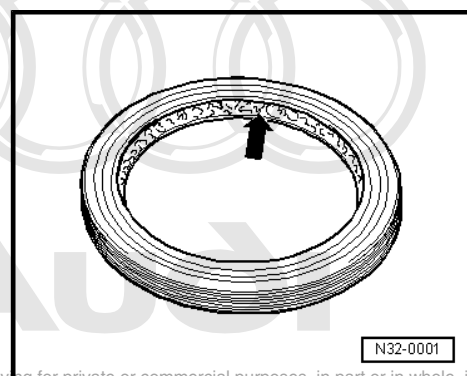
- ◆ Allocate bolts and other components according to gearbox code letters, refer to ➔ Electronic parts catalogue "(ETKA)" .
- ◆ Thoroughly clean all joints and surrounding areas before dismantling.
- ◆ When exchanging or repairing the manual gearbox, check the oil level and fill with oil if necessary ➔ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 34 .
- ◆ Determine capacities and specifications via corresponding code letters ➔ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 00 .

2.2.2 Sealants

- ◆ Thoroughly clean joint surfaces on gearbox housing etc. before applying sealing paste.
- ◆ Apply sealing paste -AMV 188 001 02- evenly and not too thickly.
- ◆ Breather holes must remain free of sealing paste.

2.2.3 O-rings, oil seals, gaskets

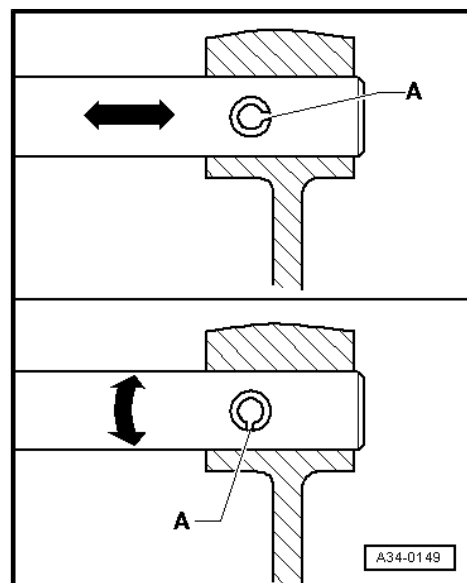
- ◆ Always install new O-rings, oil seals and gaskets.
- ◆ After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.
- ◆ Thoroughly clean housing joint surfaces before assembling.
- ◆ Before installing oil seals, lightly oil the outer circumference of the seal and fill the space between the sealing lips -arrow- about half full with grease -G 052 128 A1- .
- ◆ The open side of the oil seals faces toward the side with fluid filling.
- ◆ When installing a new oil seal, position the seal in the housing so that sealing lip does not contact the shaft in the same place as the old seal (make use of insertion depth tolerances).
- ◆ Lightly lubricate O-rings before installation to prevent them from being trapped and damaged during assembly.
- ◆ After renewing seals and gaskets, check and, if necessary, top up oil level in gearbox ➔ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 34 .



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2.2.4 Locking elements

- ◆ Do not over-stretch circlips.
- ◆ Always renew circlips which have been damaged or over-stretched.
- ◆ Circlips must be properly seated in the base of the groove.
- ◆ Renew spring pins. Position: the slit -A- should be in line with the line of force -arrow-.



2.2.5 Nuts, bolts

- ◆ Loosen the nuts and bolts in reverse sequence to the specified tightening sequence.
- ◆ Nuts and bolts which secure covers and housings should be loosened and tightened in diagonal sequence and in stages if no tightening sequence is specified.
- ◆ Loosen and tighten particularly sensitive parts in diagonal sequence and in stages, taking care to keep them straight.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.
- ◆ Always renew self-locking bolts and nuts.

- ◆ Use a wire brush to clean the threads of bolts which are secured with locking fluid. Then apply locking fluid - AMV 185 101 A1- to bolt threads before installing.
- ◆ Threaded holes which take self-locking bolts or bolts coated with locking fluid must be cleaned (using a tap or similar). Otherwise there is a danger of the bolts shearing off the next time they are removed.

2.2.6 Shims

- ◆ Use a micrometer to measure the shims at several points. Tolerance variations make it possible to obtain the exact shim thickness required.
- ◆ Check for burrs and damage.
- ◆ Do not install shims which are damaged or not in perfect condition.

2.2.7 Bearings

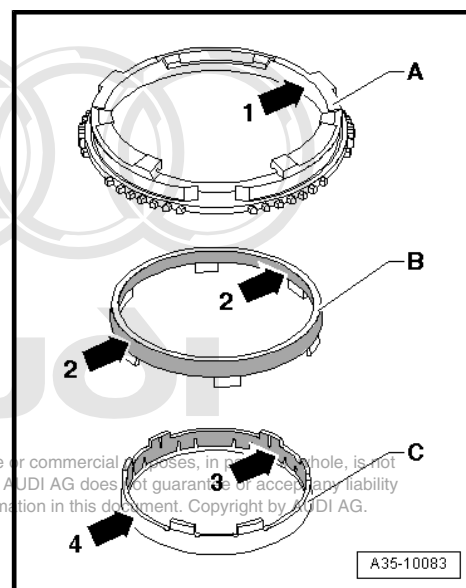
- ◆ Install needle bearings, ball sleeves and roller bearings so the lettering (side with thicker metal) faces towards the installing tool.
- ◆ Install new tapered roller bearings as supplied; do not lubricate additionally with oil.
- ◆ Lubricate all bearings (except tapered roller bearings) with gear oil before installing in gearbox.
- ◆ Heat inner races of tapered roller bearings to approx. 100°C before installing. Press in onto stop when installing so there is no axial clearance.
- ◆ Heat inner races of needle bearings and roller bearings to max. 130 °C.
- ◆ Do not interchange the outer or inner races of bearings of the same size (the bearings are paired).
- ◆ If required, renew the tapered roller bearings on one shaft together and use new bearings from a single manufacturer.
- ◆ Check the double angular contact ball bearing
⇒ [Item 8 \(page 7\)](#) for wear (running noises); pinion shaft remains installed and differential is removed. "The bearing should not catch and should run smoothly when rotating the pinion shaft".
- ◆ Always renew the double angular contact ball bearing on the pinion shaft when renewing the final drive gear set or if gear oil is contaminated with metal particles.

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2.2.8 Synchroniser rings

- ◆ Do not interchange. When reusing synchroniser rings, always fit to the same selector gear.
- ◆ Check for wear; renew if necessary.
- ◆ Check the coated contact surfaces -arrows 2- on intermediate ring -B- for damage (flattened sections, missing particles in carbon coating).
- ◆ Check inner contact surface -arrow 1- on synchro-ring -A- and outer contact surface -arrow 4- on inner ring -C- for "ridges" and "scores".
- ◆ Check coating on inner rings -C- with coated contact surface -arrow 3- for damage (missing particles in carbon coating).
- ◆ Lubricate with gear oil before installing.

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2.2.9 Gear wheels and synchronising hubs

- ◆ Before installing, clean and heat on a hotplate to 100°C (maximum).
- ◆ Press in onto stop when installing so there is no axial clearance.
- ◆ The temperature can be measured with temperature tester - V.A.G 1558- , ignition tester -V.A.G 1767- or diesel tester - V.A.G 1743- .
- ◆ Note correct installation position.

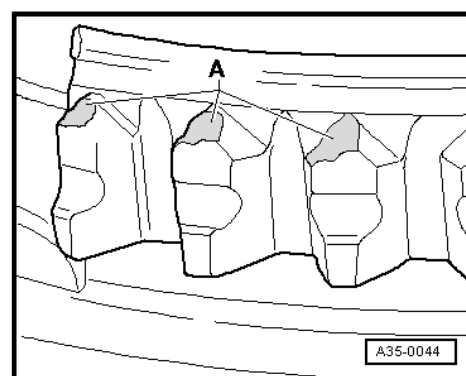
2.2.10 Selector gears

- ◆ After installing, check 1st to 6th speed selector gears for minimal axial play (min. 0.10 mm) and freedom of movement.

2.2.11 Wear pattern on selector gears and locking collars

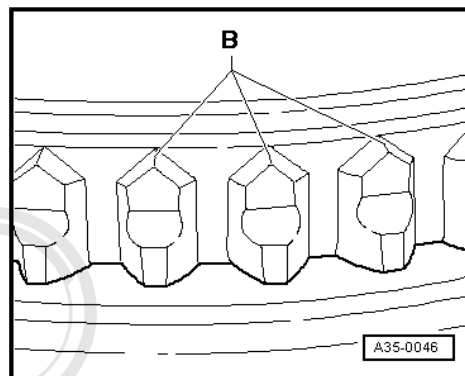
- ◆ Traces of wear on synchro-ring or selector gear:

A - Worn ends of splines on synchro-ring or selector gear.



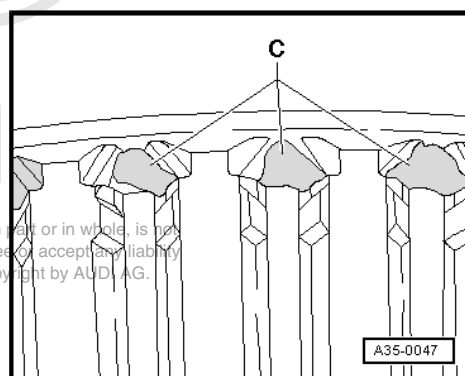
◆ In comparison: intact synchro-ring or selector gear:

B - Intact ends of splines on synchro-ring or selector gear.



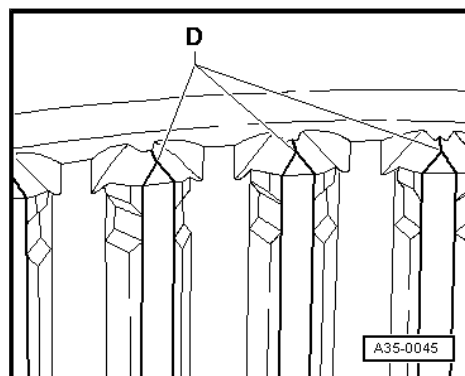
◆ Traces of wear on locking collar:

C - Worn ends of internal splines on locking collar.



◆ In comparison: intact locking collar:

D - Intact ends of internal splines on locking collar.



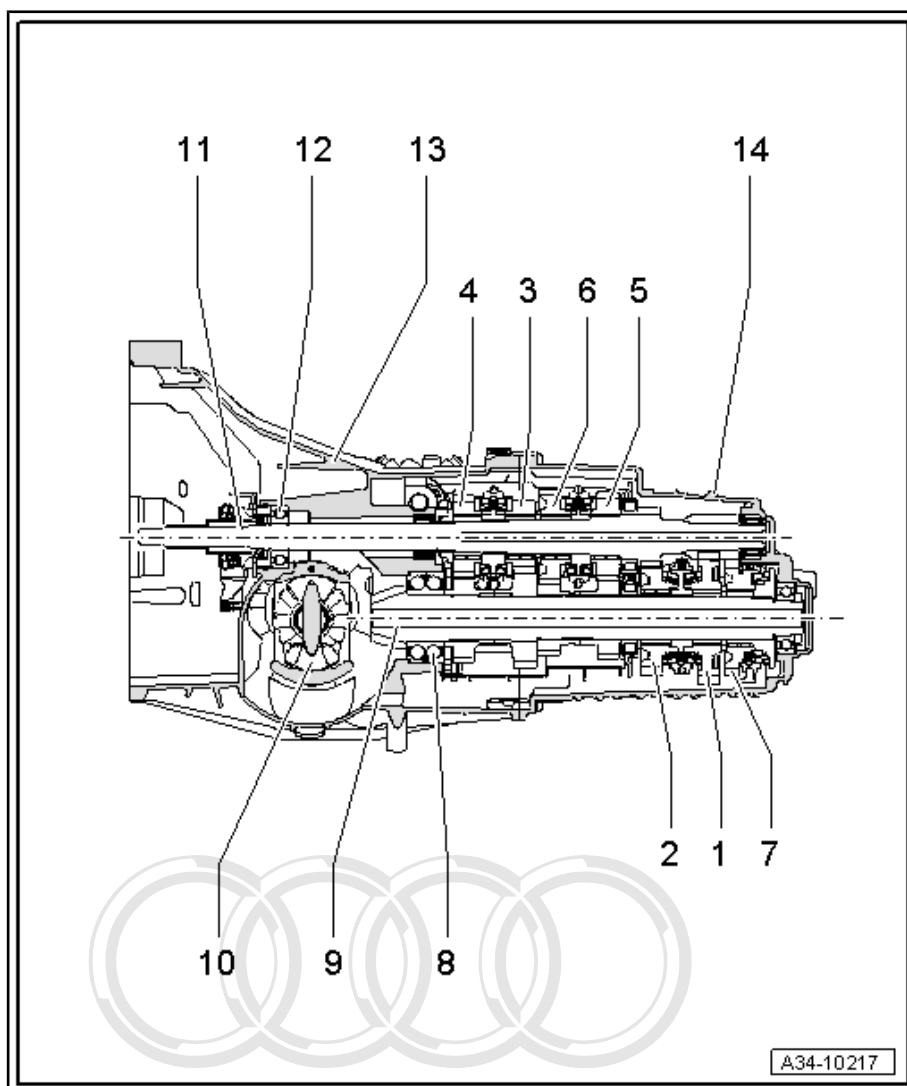
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34 – Controls, housing

1 Dismantling and assembling gearbox

1.1 Overview of gearbox

- 1 - 1st gear
- 2 - 2nd gear
- 3 - 3rd gear
- 4 - 4th gear
- 5 - 5th gear
- 6 - 6th gear
- 7 - Reverse gear
- 8 - Double angular contact ball bearing
- 9 - Pinion shaft (output shaft)
- 10 - Differential
- 11 - Input shaft
- 12 - Grooved ball bearing
 - For input shaft
- 13 - Gearbox housing
- 14 - Gearbox cover



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1.2 Exploded view

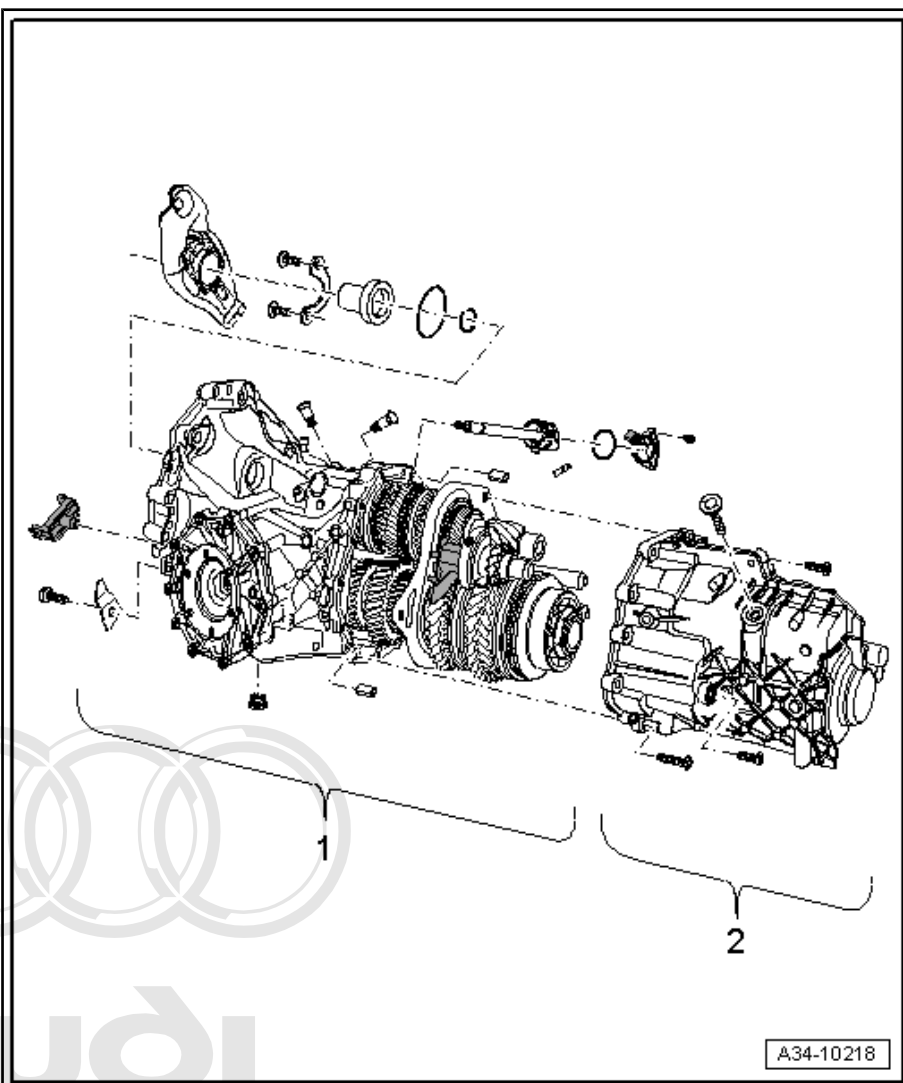
Sequence for dismantling and assembling ⇒ [page 17](#)

1 - Gearbox housing with input shaft, pinion shaft, differential, selector rods and selector shaft

- ☐ Removing and installing gearbox cover and selector shaft
⇒ [page 9](#)
- ☐ Removing and installing 1st, 2nd and reverse gear with selector rods
⇒ [page 11](#)
- ☐ Removing and installing input shaft, 3rd - 6th gear wheels, pinion shaft and selector rods
⇒ [page 14](#)
- ☐ Removing and installing differential ⇒ [page 85](#)
- ☐ Servicing gearbox housing ⇒ [page 51](#)

2 - Gearbox cover

- ☐ Servicing ⇒ [page 46](#)



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1.3 Removing and installing gearbox cover and selector shaft - exploded view



Note

Do not interchange locking bushes for selector shaft and selector rods. Apply marking prior to removal.

1 - Gearbox housing

- ☐ With input shaft, pinion shaft, differential and selector rods
- ☐ Use pin without lug
⇒ [Item 7 \(page 9\)](#)
when renewing gearbox housing

2 - Locking bush

- ☐ For selector shaft
- ☐ 2 x
- ☐ Do not interchange locking bushes for selector shaft and selector rods
- ☐ Modification: with flanged edge on ball sleeve ⇒ [page 10](#)

Renewing the two locking bushes is also possible with gearbox installed in vehicle ⇒ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 34

3 - Selector shaft with selector cylinder

- ☐ Removing and installing
⇒ [page 17](#)

4 - O-ring

- ☐ For selector shaft cover
- ☐ Always renew
- ☐ Lubricate with gear oil
- ☐ Insert in circumferential groove in selector shaft cover

5 - Cover for selector shaft

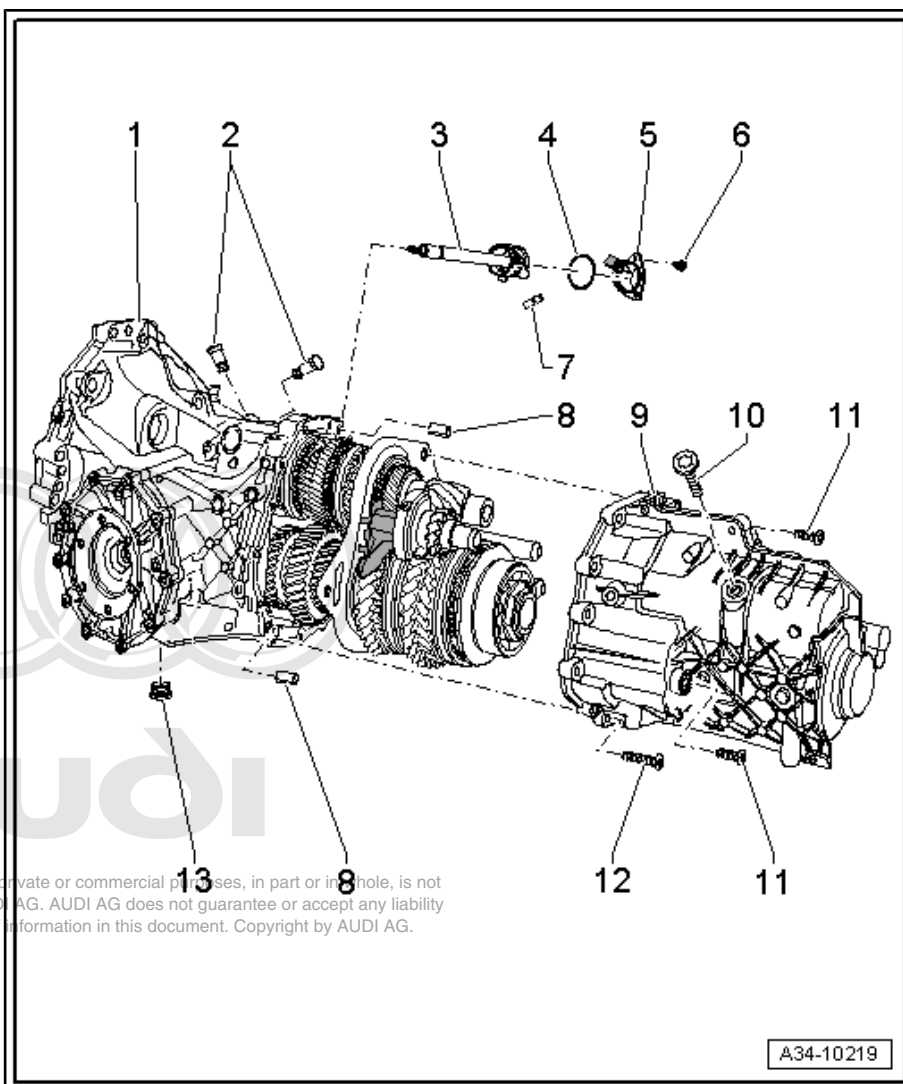
- ☐ With reversing light switch -F4-
- ☐ Removing and installing reversing light switch -F4- ⇒ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 34
- ☐ Tightening torque for reversing light switch -F4- , 20 Nm

6 - Bolt, 24 Nm

- ☐ 3 x
- ☐ Apply locking fluid -AMV 185 101 A1- when fitting

7 - Pin

- ☐ For selector shaft stop
- ☐ Insert in drilling in gearbox housing.





Note

- ◆ *There are two versions of pins: with or without a lug. Please refer to ⇒ Electronic parts catalogue "ETKA" for correct version.*
- ◆ *Installation position of pin with lug: insert end with lug into gearbox housing.*
- ◆ *Installation position of pin without lug: pin is fitted in gearbox housing without radial clearance.*

8 - Dowel pin

- ☐ 2 x
- ☐ Insert in gearbox cover

9 - Gearbox cover

- ☐ Servicing ⇒ [page 46](#)

10 - Bolt, 24 Nm

11 - Bolt, 27 Nm

- ☐ 2 x
- ☐ Self-locking
- ☐ Renew

12 - Bolt, 24 Nm

- ☐ 13 x

13 - Oil drain plug, 40 Nm

Locking bushes for selector shaft modified

A - The previous type of selector shaft locking bushes had no flanged edge on the ball sleeve -arrow 1-. This type of locking bush must always be replaced, unless version -B- is fitted already.

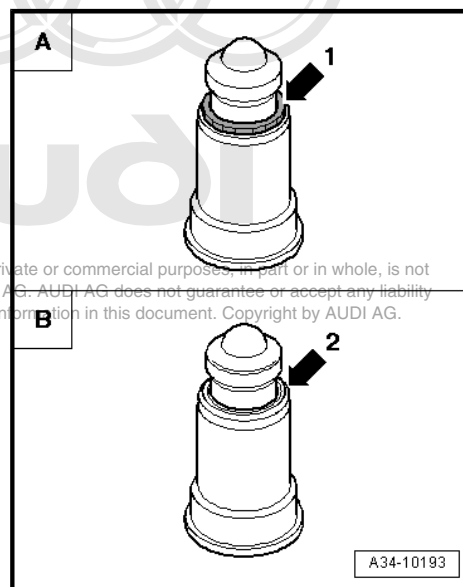
B - The new type of selector shaft locking bushes with flanged edge on ball sleeve -arrow 2- can be re-installed.



Note

- ◆ *If the gearbox is fitted with selector shaft locking bushes of type -A-, these must always be replaced with locking bushes of type -B-. Parts No. ⇒ Electronic parts catalogue "ETKA".*
- ◆ *Version -B- can be re-used if already installed.*
- ◆ *Locking bushes for selector shaft can also be renewed with gearbox installed in vehicle ⇒ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 34 .*

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1.4 Removing and installing 1st, 2nd and reverse gear - exploded view



Note

- ◆ Items 12 and 15 to 22 were modified on 1st and 2nd gear selector rod version with spring-loaded selector fork ➔ [page 13](#). Refer to ➔ Electronic parts catalogue "ETKA" to allocate components.
- ◆ Selector gears should have an axial play of min. 0.10 mm after installing.

1 - Nut, 300 Nm

- ☐ Apply locking fluid - AMV 185 101 A1- when fitting
- ☐ Slackening ➔ [page 24](#)
- ☐ Tightening ➔ [page 38](#)

2 - Grooved ball bearing

- ☐ Pull off with clutch unit ➔ [page 25](#)
- ☐ Driving on ➔ [page 37](#)

3 - Washer

4 - Clutch unit

- ☐ Removing and installing ➔ [page 17](#)

5 - Inner ring for reverse gear

- ☐ Installation position ➔ [page 35](#)
- ☐ Renew if scored or if there are visible traces of wear

6 - Intermediate ring for reverse gear

- ☐ Installation position ➔ [page 35](#)
- ☐ Checking for wear ➔ [page 34](#)

7 - Synchro-ring for reverse gear

- ☐ Installation position ➔ [page 35](#)
- ☐ Checking for wear ➔ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

8 - Reverse selector gear

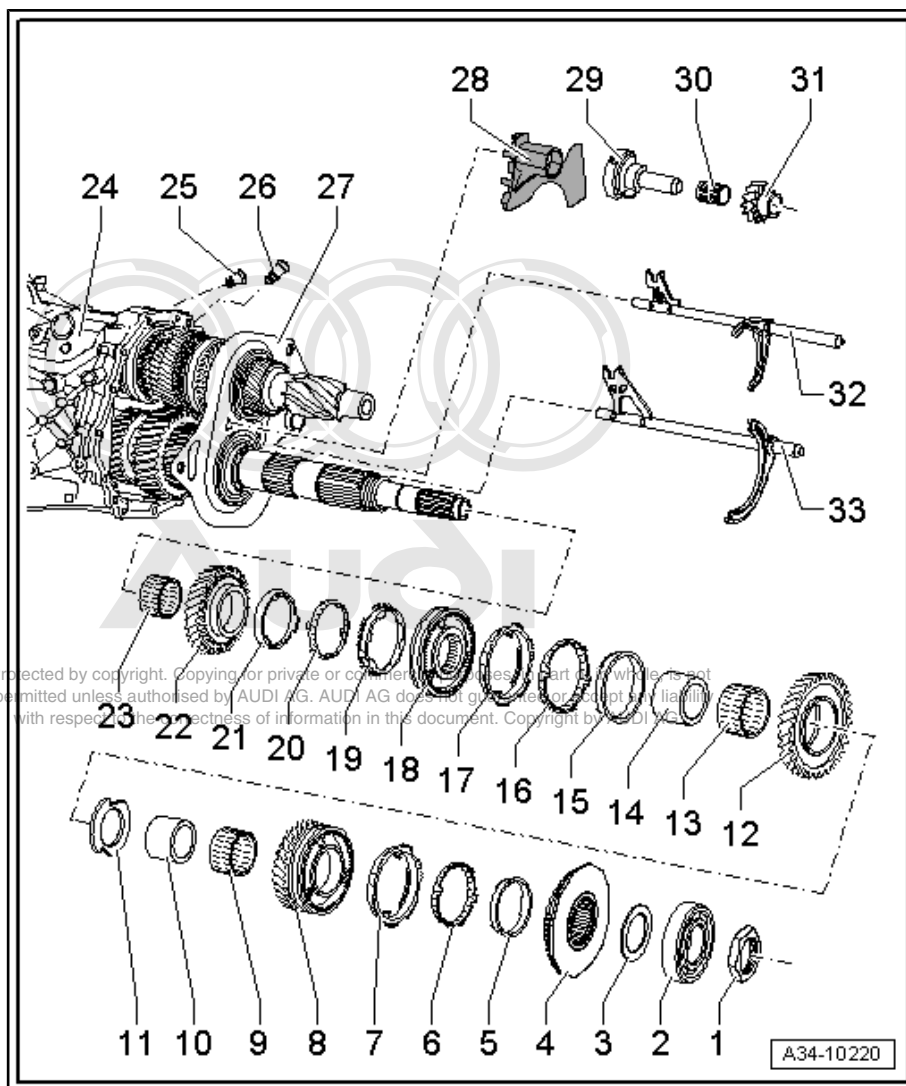
- ☐ With locking collar for reverse gear
- ☐ Assembling locking collar and reverse selector gear ➔ [page 36](#)

9 - Needle bearing

- ☐ For reverse gear

10 - Needle bearing inner race

- ☐ For reverse selector gear
- ☐ Pull off together with 1st speed selector gear ➔ [page 26](#)
- ☐ Driving on ➔ [page 36](#)





11 - Thrust washer

- ☐ For 1st speed selector gear and reverse gear

12 - 1st speed selector gear

13 - Needle bearing

- ☐ For 1st gear

14 - Needle bearing inner race

- ☐ For 1st speed selector gear
- ☐ Pull off together with 2nd speed selector gear ⇒ [page 26](#)
- ☐ Driving on ⇒ [page 36](#)

15 - Inner ring for 1st gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

16 - Intermediate ring for 1st gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)

17 - Synchro-ring for 1st gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear
- ☐ Do not interchange with synchro-ring for 2nd gear

18 - Locking collar/synchronising hub for 1st and 2nd gear

- ☐ Assembling locking collar/synchronising hub ⇒ [page 35](#)

19 - Synchro-ring for 2nd gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear
- ☐ Do not interchange with synchro-ring for 1st gear

20 - Intermediate ring for 2nd gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)

21 - Inner ring for 2nd gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

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22 - 2nd speed selector gear

23 - Needle bearing

- ☐ For 2nd gear

24 - Gearbox housing

- ☐ With input shaft, pinion shaft, differential and selector rods
- ☐ Use pin without lug ⇒ [Item 7 \(page 9\)](#) when renewing gearbox housing

25 - Locking bush

- ☐ For 1st and 2nd gear selector rod

26 - Locking bush

- ☐ For reverse gear selector rod

27 - Bearing mounting

- ☐ Supports bearings for input shaft and pinion shaft in gearbox cover

28 - Mounting for reverse shaft

- ☐ Clip into bearing mounting ➔ [Item 27 \(page 13\)](#)

29 - Reverse shaft

- ☐ With support for reverse shaft
- ☐ Assembling reverse shaft and support for reverse shaft ➔ [page 13](#)

30 - Needle bearing

- ☐ For reverse gear wheel

31 - Reverse gear wheel

- ☐ Installation position: teeth face mounting for reverse shaft

32 - Selector rod for 1st and 2nd gear

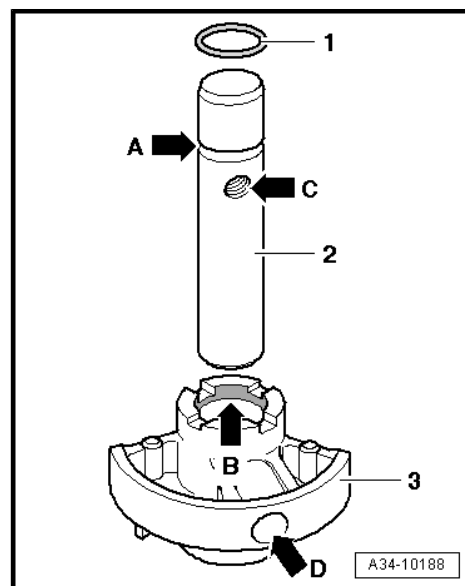
- ☐ Installation position ➔ [page 17](#)
- ☐ Only to be renewed complete with pinned selector fork for 1st and 2nd gear
- ☐ Modification: with spring-loaded selector fork ➔ [page 13](#), allocate via ➔ [Electronic parts catalogue "ETKA"](#).

33 - Reverse gear selector rod

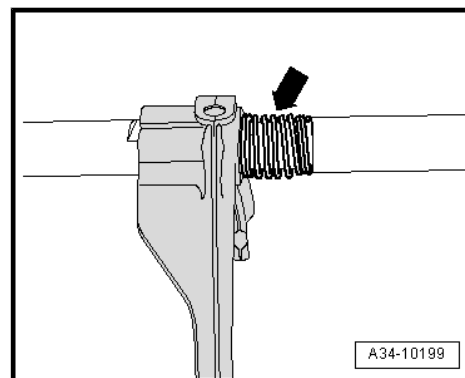
- ☐ Installation position ➔ [page 17](#)
- ☐ Only to be renewed complete with pinned selector fork for reverse gear

Assembling reverse shaft and support for reverse shaft

- Insert O-ring -1- in circumferential groove -arrow A- on reverse shaft -2-.
 - Lubricate O-ring with gear oil and push reverse shaft into support for reverse shaft -3- (from side with chamfer -arrow B-).
- Tapped hole -arrow C- must align with hole -arrow D-.



Selector rod for 1st and 2nd gear with spring-loaded selector fork -arrow-



1.5 Removing and installing input shaft, 3rd - 6th gear wheels, pinion shaft and selector rods - exploded view

1 - Bolt, 24 Nm

- ☐ Apply locking fluid -AMV 185 101 A1- when fitting

2 - Leaf spring

3 - Intermediate piece

- ☐ Insert in hole in gearbox housing.

4 - Clutch release lever

- ☐ With release bearing

5 - Bolt, 24 Nm

- ☐ 2 x
- ☐ Apply locking fluid -AMV 185 101 A1- when fitting

6 - Retaining piece

- ☐ For guide sleeve

7 - Guide sleeve

- ☐ With oil seal
- ☐ Removing input shaft oil seal ➔ [page 16](#)
- ☐ Installing input shaft oil seal ➔ [page 16](#)

8 - O-ring

- ☐ Always renew
- ☐ Lubricate with gear oil
- ☐ Insert in circumferential groove in gearbox cover

9 - Circlip

- ☐ Insert in circumferential groove in input shaft

10 - Selector rod for 5th and 6th gear

- ☐ Installation position ➔ [page 17](#)
- ☐ Only to be renewed complete with pinned selector fork for 5th and 6th gear

11 - Selector rod for 3rd and 4th gear

- ☐ Installation position ➔ [page 17](#)
- ☐ Only to be renewed complete with pinned selector fork for 3rd and 4th gear
- ☐ Modification: with spring-loaded selector fork ➔ [page 16](#) , allocate via ➔ Electronic parts catalogue "ETKA" .

12 - Locking bush

- ☐ For 5th and 6th gear selector rod

13 - Locking bush

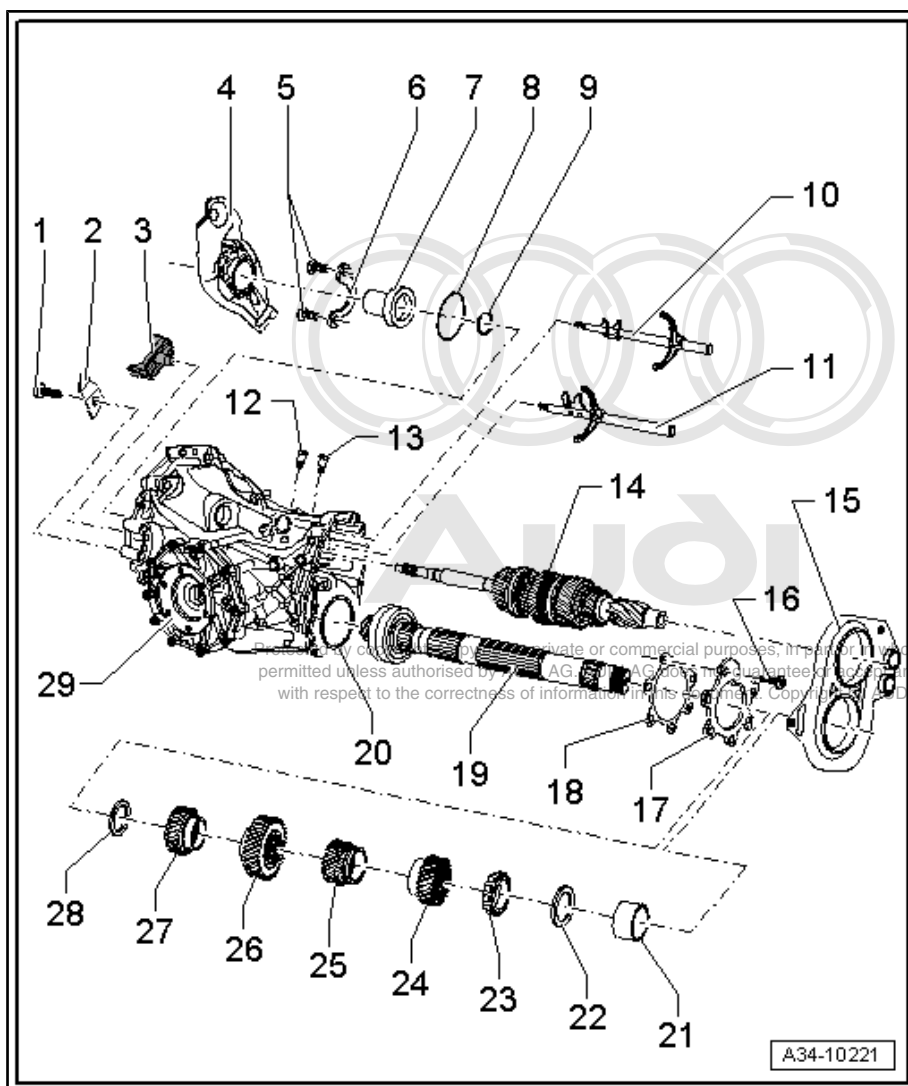
- ☐ For 3rd and 4th gear selector rod

14 - Input shaft

- ☐ Dismantling and assembling ➔ [page 61](#)

15 - Bearing mounting

- ☐ Clean locking fluid out of tapped holes (using thread tap or similar)



- ☐ Pressing out and pressing in ball sleeves for selector rods ⇒ [page 17](#)



Note

- ◆ *The roller bearing outer races on the input shaft and pinion shaft cannot be renewed individually.*
- ◆ *The roller bearing outer races must not have any radial clearance in the bearing mounting.*

16 - Bolt, 30 Nm

- ☐ 6 x
- ☐ Clean thread and apply locking fluid -AMV 185 101 A1- when fitting

17 - Retaining plate

- ☐ Installation position: machined side faces towards gearbox housing (can only be installed in one position).

18 - Shim "S4"

- ☐ Table of adjustments ⇒ [page 98](#)

19 - Pinion shaft

- ☐ With double angular contact ball bearing
- ☐ Dismantling and assembling ⇒ [page 74](#)

20 - Shim "S3"

- ☐ Table of adjustments ⇒ [page 98](#)

21 - Needle bearing inner race

- ☐ For 2nd speed selector gear
- ☐ Pulling off with 5th gear wheel ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 33](#)

22 - Shim "S6"

- ☐ To position 2nd speed selector gear
- ☐ Re-determining thickness ⇒ [page 80](#)

23 - Roller bearing

- ☐ For pinion shaft
- ☐ Do not interchange with roller bearing for input shaft
- ☐ Pulling off with 5th gear wheel ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 32](#)

24 - 5th gear wheel

- ☐ Pulling off ⇒ [page 27](#)
- ☐ Installation position: high inside collar faces towards 6th gear wheel
- ☐ Driving on ⇒ [page 32](#)

25 - 6th gear wheel

- ☐ Pulling off ⇒ [page 27](#)
- ☐ Installation position: high inside collar faces 5th gear wheel
- ☐ Driving on ⇒ [page 32](#)

26 - 3rd gear wheel

- ☐ Pulling off ⇒ [page 27](#)
- ☐ Installation position: high inside collar faces 4th gear wheel
- ☐ Driving on ⇒ [page 31](#)

27 - 4th gear wheel

- ☐ Pulling off ⇒ [page 28](#)

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- ❑ Installation position: high inside collar faces 3rd gear wheel
- ❑ Driving on ➤ [page 31](#)

28 - Shim "S5"

- ❑ To position 4th speed gear
- ❑ Re-determining thickness ➤ [page 79](#)

29 - Gearbox housing

- ❑ With differential and flange shafts
- ❑ Use pin without lug ➤ [Item 7 \(page 9\)](#) when renewing gearbox housing

Removing input shaft oil seal

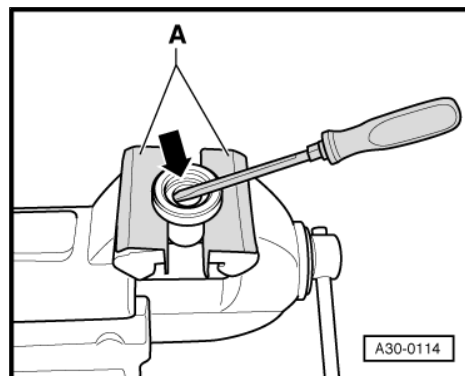
- Carefully lever out oil seal -arrow- with a screwdriver.

A - Jaw protectors



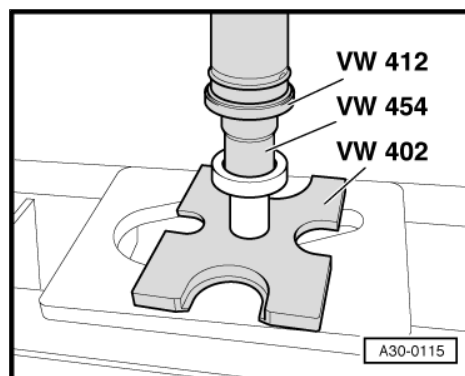
Note

The oil seal can also be removed using extractor tool -T20143- .

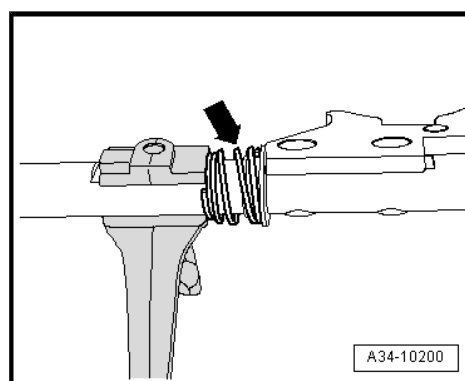


Installing input shaft oil seal

- Lightly oil outer circumference of oil seal.
- Pack space between sealing lip and dust lip half-full with sealing grease -G 052 128 A1- .
- Carefully press in oil seal for input shaft as far as it will go.



Selector rod for 3rd and 4th gear with spring-loaded selector fork -arrow-



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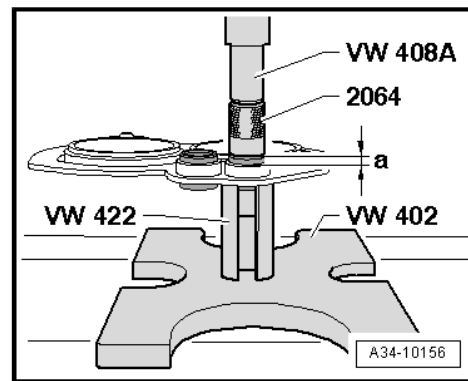
Pressing out and pressing in ball sleeves for selector rods

- Support bearing mounting with tube -VW 422- .
- Fit the small $\varnothing$ of locking pin -2064- in the ball sleeve.
- Press out old ball sleeve.
 - Press in new ball sleeve to dimension -a- (approx. 4 mm).



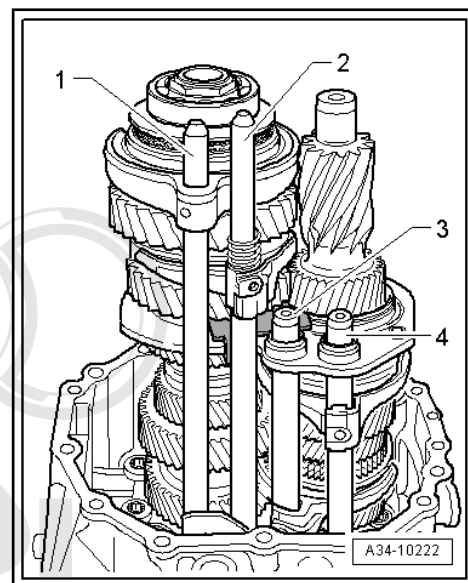
Note

Fit ball sleeve so that side with lettering (thicker metal) faces locking pin -2064- .



Installation position of selector rods in gearbox

- 1 - Selector rod with reverse gear selector fork
- 2 - Selector rod with selector fork for 1st and 2nd gear
- 3 - Selector rod with selector fork for 3rd and 4th gear
- 4 - Selector rod with selector fork for 5th and 6th gear



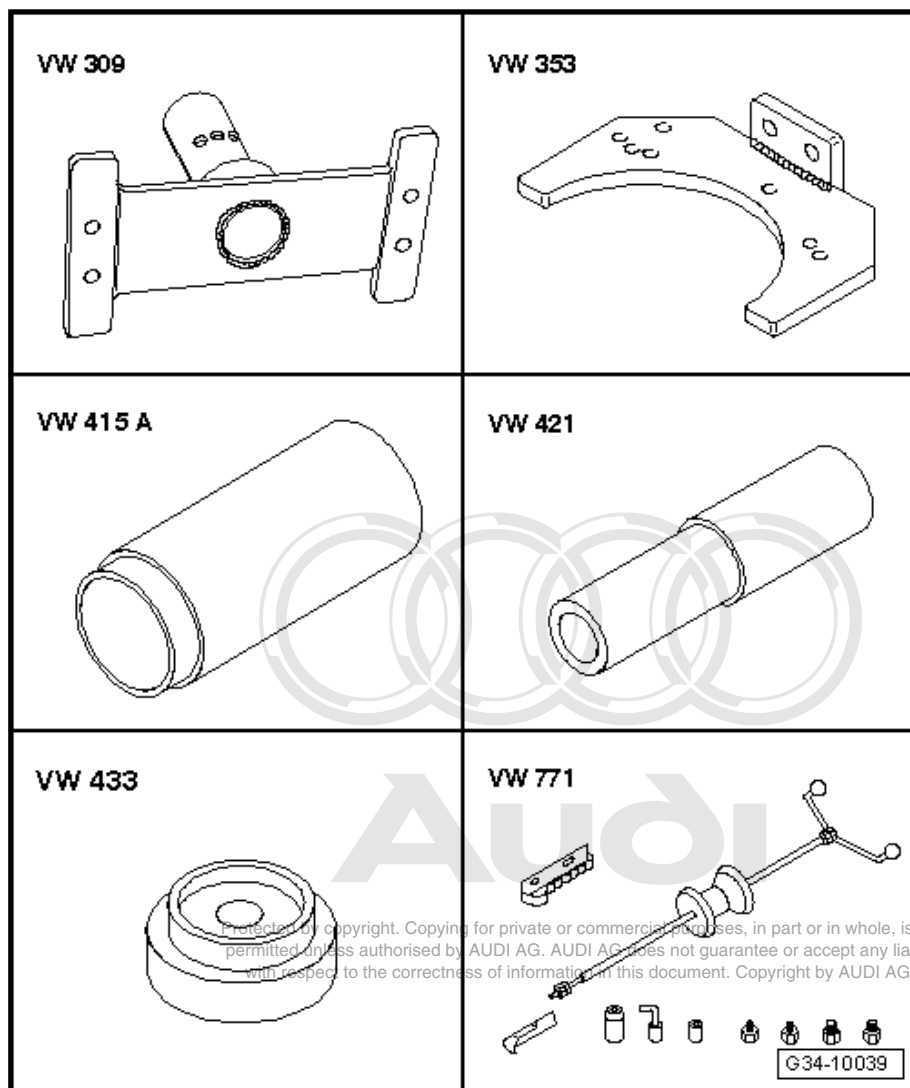
1.6 Dismantling and assembling sequence

Removing and installing gearbox cover, internal selector mechanism, input shaft and pinion shaft.

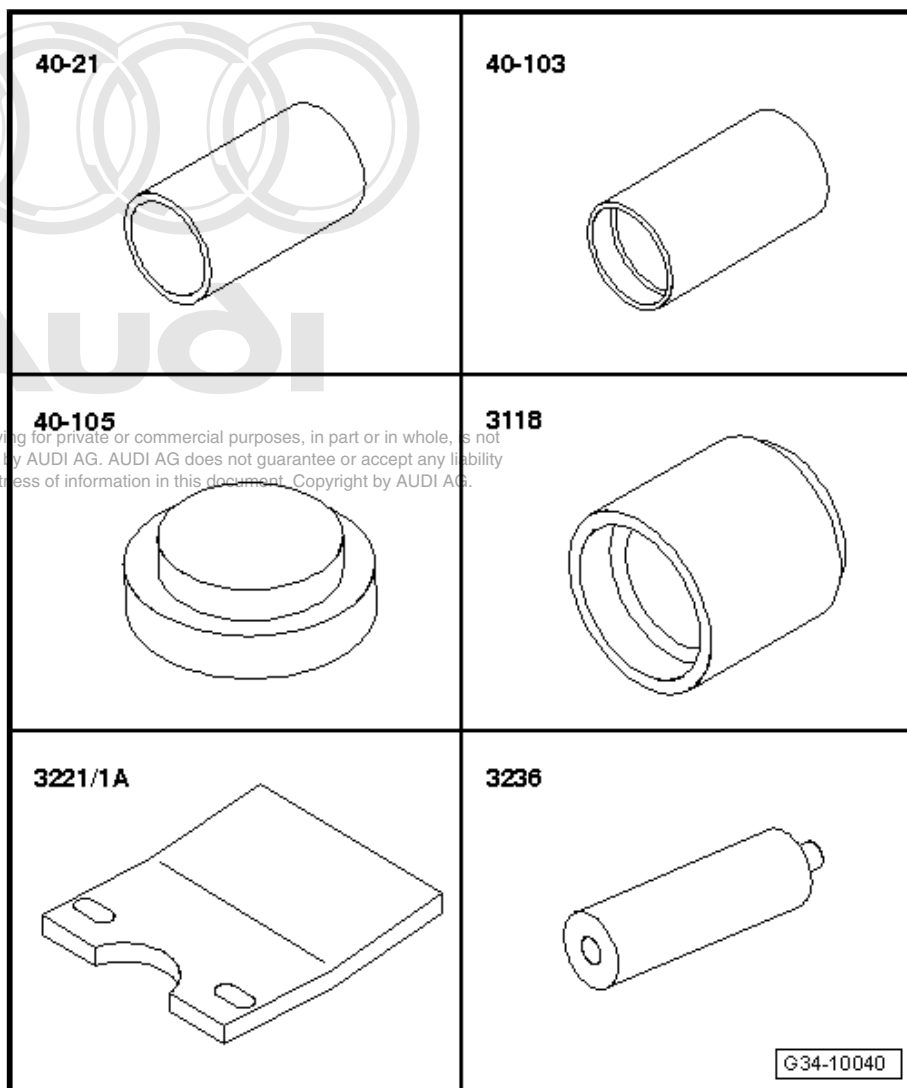
Remove differential from gearbox housing before removing pinion shaft. Then rotate pinion shaft by hand and check double angular contact ball bearing for wear (running noises). The bearing should not "catch" and should run smoothly when the installed pinion shaft is rotated.

Special tools and workshop equipment required

- ◆ Support plate -VW 309-
- ◆ Gearbox support -VW 353-
- ◆ Tube -VW 415 A-
- ◆ Tube -VW 421-
- ◆ Press tool -VW 433-
- ◆ Multi-purpose tool -VW 771-

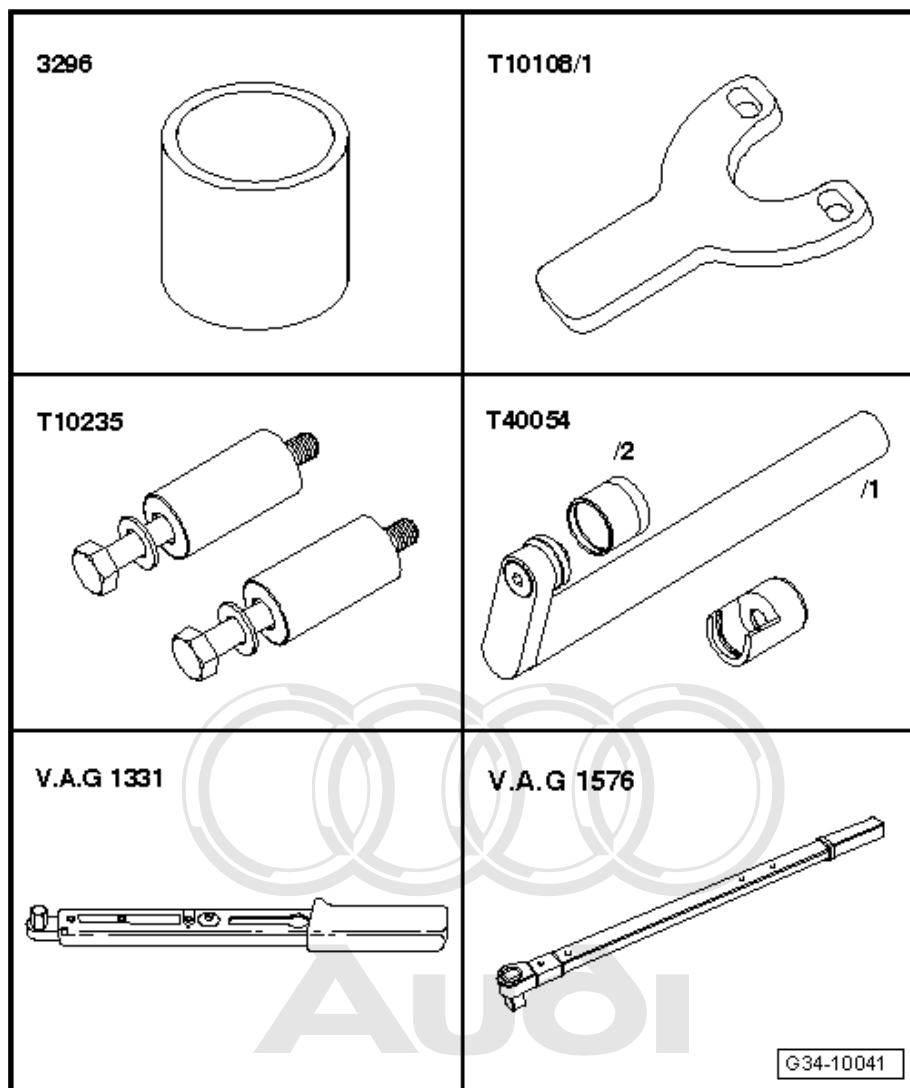


- ◆ Press tool -40 - 21-
- ◆ Support -40 - 103-
- ◆ Thrust plate -40 - 105-
- ◆ Press tool -3118-
- ◆ Support plate -3221/1A-
- ◆ Thrust piece -3236-



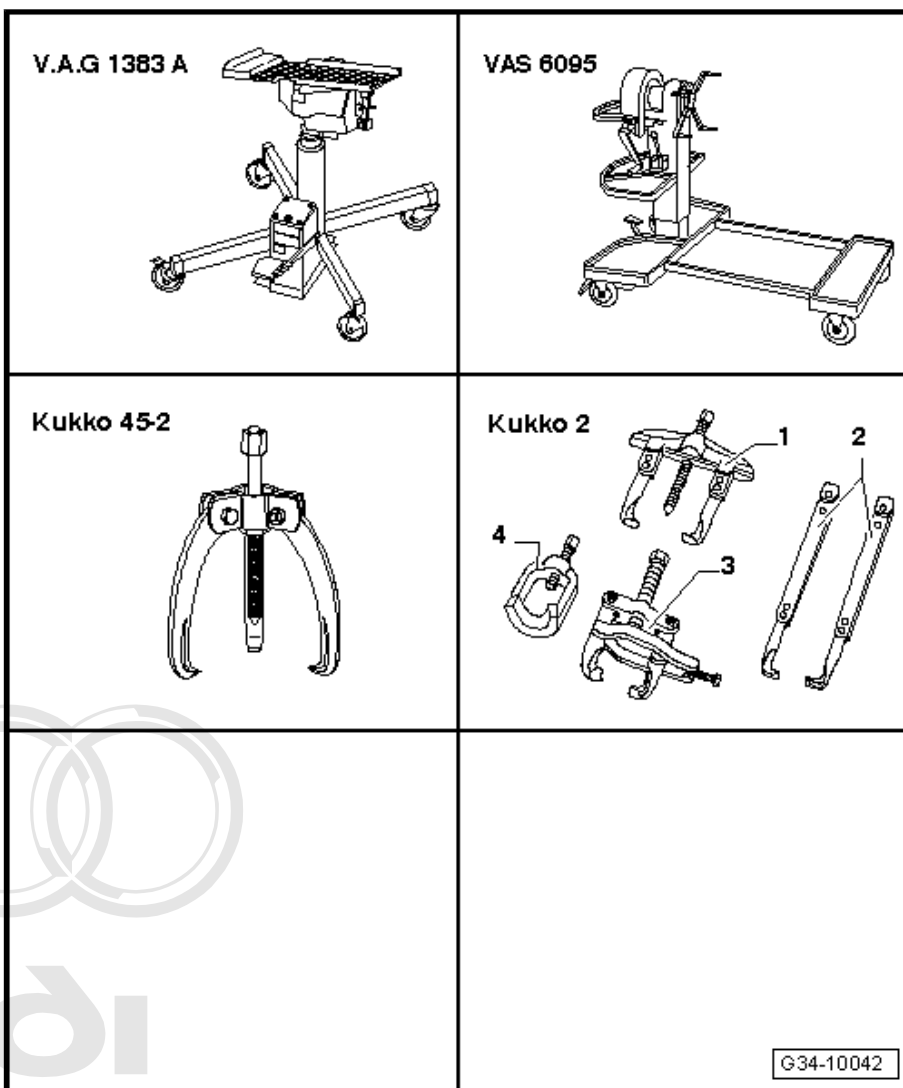
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- ◆ Tube -3296-
- ◆ Support plate -T10108/1-
- ◆ Adapter -T10235-
- ◆ Puller -T40054-
- ◆ Torque wrench -V.A.G 1331-
- ◆ Torque wrench -V.A.G 1576-



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- ◆ Engine and gearbox jack - V.A.G 1383 A- with universal gearbox support - V.A.G 1359/2-
- ◆ Engine/gearbox support - VAS 6095-
- ◆ Three-arm puller -Kukko 45-2-
- ◆ -1- Two-arm puller -Kukko 20/10-
- ◆ -2- Puller hook, length 200 mm
- ◆ -2- Puller hook, length 250 mm
- ◆ Puller -T10335-
- ◆ -Fühlerblattlehre-
- ◆ Sealing paste -AMV 188 001 02-
- ◆ Assembly sleeve -01E 311 120-
- ◆ Locking fluid - AMV 185 101 A1-
- ◆ Sealing grease - G 052 128 A1-
- ◆ Socket attachment (46 mm) with $\frac{3}{4}$ " drive
- ◆ 2 bolts M10 (length 70 mm)
- ◆ 4 bolts M10 (length 35 mm)
- ◆ 4 nuts M12



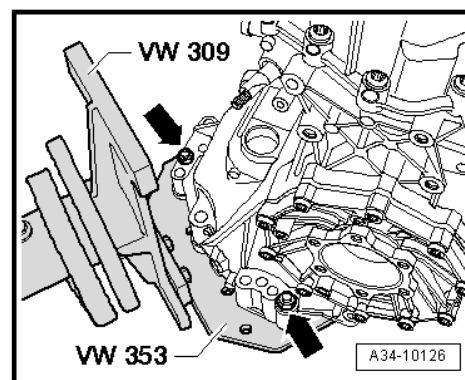
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- ◆ 2 washers Ø 12 mm

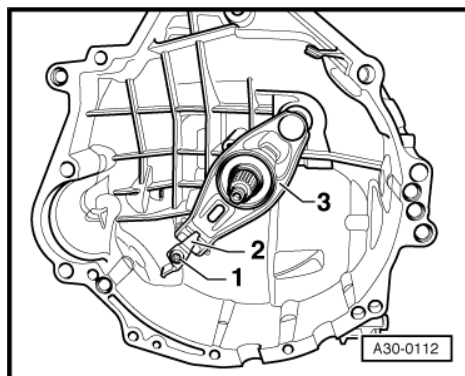
- ◆ Drip tray

1.6.1 Dismantling gearbox

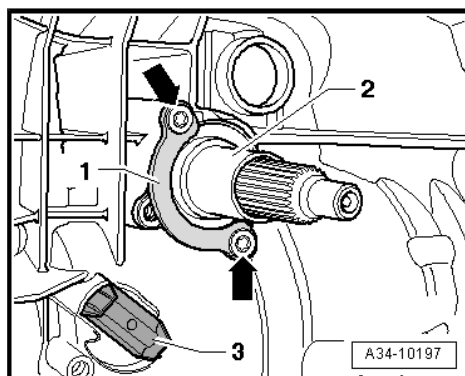
- Place container under gearbox.
- Drain gear oil.
- Secure gearbox to assembly stand with bolts -arrows-.
- Turn gearbox in assembly stand so that it is in horizontal position.



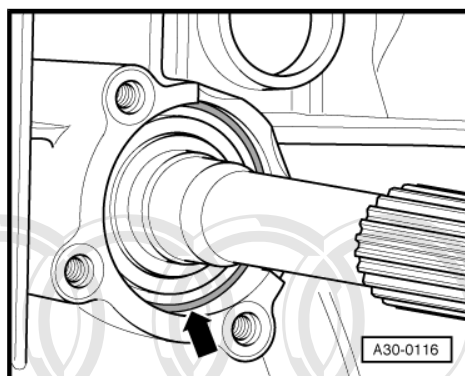
- Slacken off bolt -1- and remove leaf spring -2-.
- Remove clutch release lever -3- with release bearing.



- Unscrew bolts -arrows- and remove retaining piece -1-.
- Pull guide sleeve -2- out of gearbox housing.
- Remove intermediate piece -3- from gearbox housing.



- Lever off O-ring -arrow- using a small screwdriver.



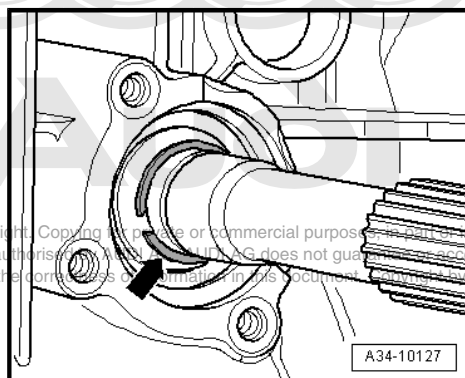
- Then remove circlip -arrow- in front of grooved ball bearing for input shaft.



Note

- ◆ *It is not necessary to remove the grooved ball bearing for input shaft to dismantle the gearbox.*
- ◆ *A defective input shaft bearing can be renewed with gearbox removed (gearbox remains assembled); the required procedure is described on ➔ [page 42](#) .*

- Put selector shaft in neutral position.



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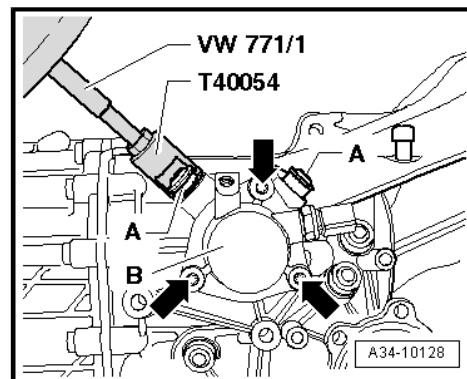
- Pull out the two locking bushes -A- for selector shaft.



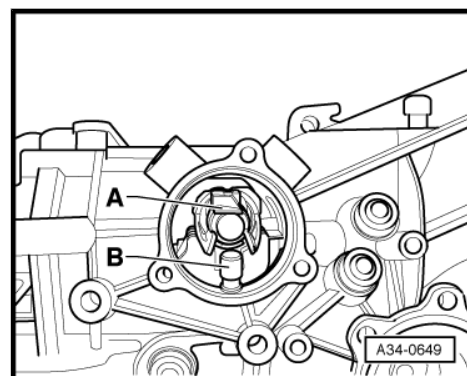
Note

- ◆ *Mark the locking bushes to make sure that they are not interchanged with the locking bushes for the selector rods.*
- ◆ *The locking bushes were modified shortly after start of production ➔ [page 10](#).*

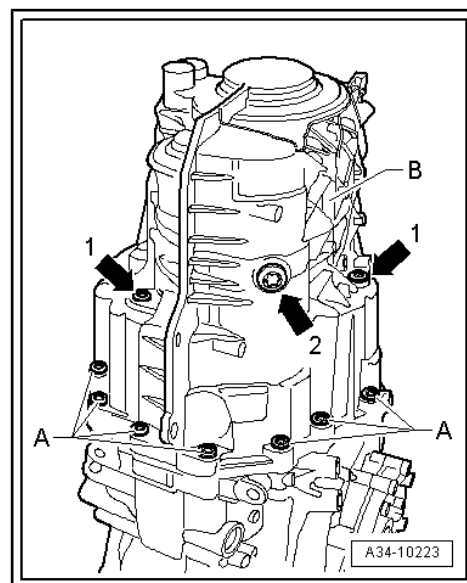
- Remove bolts -arrows- and take off selector shaft cover -B-.



- Push selector shaft -A- into gearbox as far as it will go, simultaneously removing pin -B-.
- Pull out selector shaft.
- Selector rods remain in neutral position.
- Then turn the gearbox in the assembly stand so that the gearbox cover faces upwards.

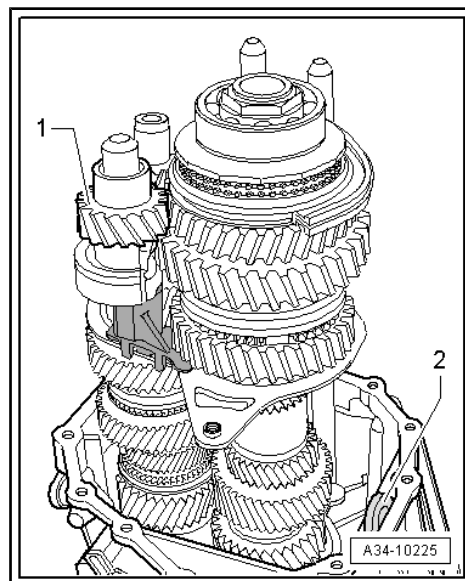


- Unscrew bolts -arrows 1- (securing bearing mounting), bolt -arrow 2- (securing reverse shaft) and bolts -A- securing gearbox cover to gearbox housing.
- Remove gearbox cover -B- from gearbox housing.

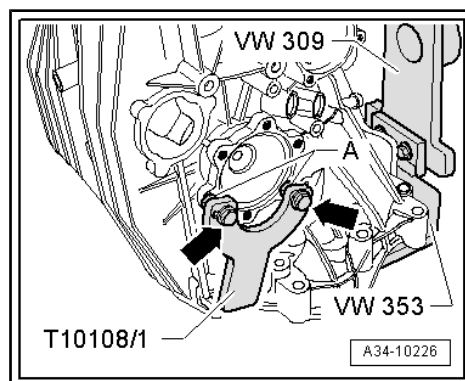


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- Remove reverse gear wheel -1- and reverse shaft.
- Remove magnet -2- from gearbox housing.



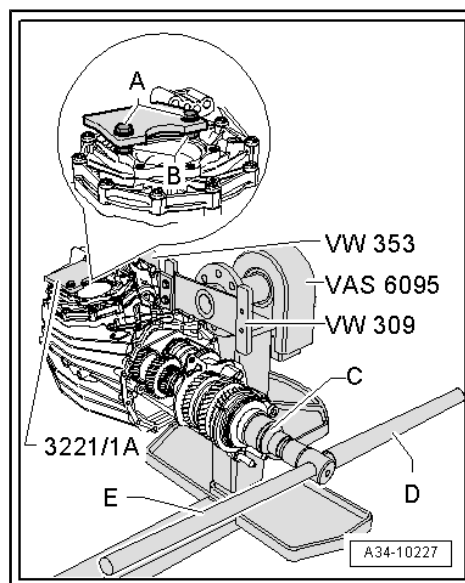
- Secure support plate -T10108/1- to flange shaft (right-side) with 2 bolts M10 x 35 -arrows-. When doing this, insert 2 nuts M12 -A- between flange shaft and support plate .
- Turn gearbox in assembly stand so that it is in horizontal position.



- Secure support plate -3221/1A- to flange shaft (left-side) with 2 bolts M10 x 35 -A-. When doing this, place a nut M12 and washer -B- on each bolt between flange shaft and support plate .
- The gearbox must be in neutral.
- Now unscrew nut from pinion shaft using handle -E-. A second mechanic should help to slacken the nut using a tube -D-.

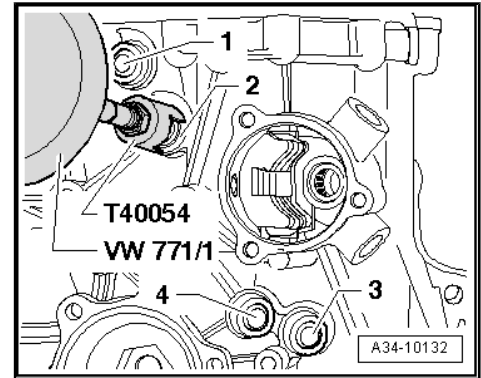
C - Socket attachment (46 mm) with $\frac{3}{4}$ " drive.

- Position gearbox vertically in assembly stand.



– Remove locking bushes -1- to -4- for selector rods.

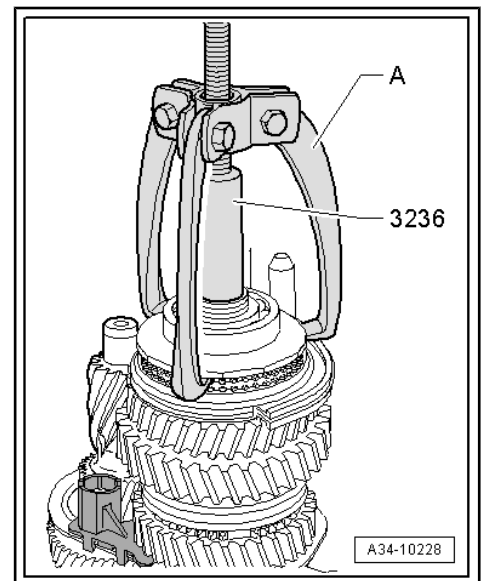
- 1 - Locking bush for reverse gear selector rod
- 2 - Locking bush for 1st and 2nd gear selector rod
- 3 - Locking bush for 5th and 6th gear selector rod
- 4 - Locking bush for 3rd and 4th gear selector rod



Pulling off clutch unit with grooved ball bearing from pinion shaft

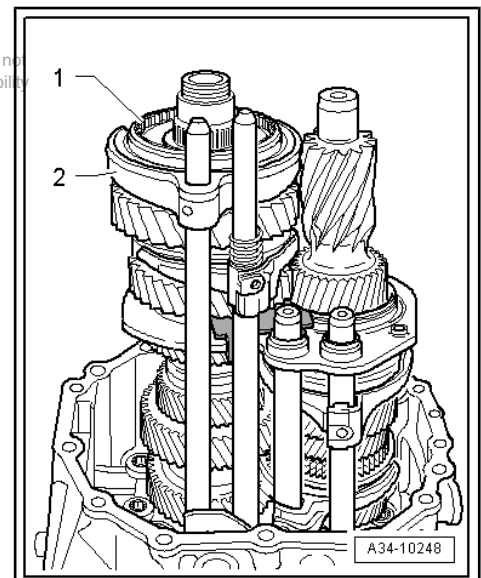
A - Three-arm puller, e.g. Kukko 45-2

– Take off synchro-rings for reverse gear.



– Remove locking collar -1- with selector fork -2- and reverse selector gear.

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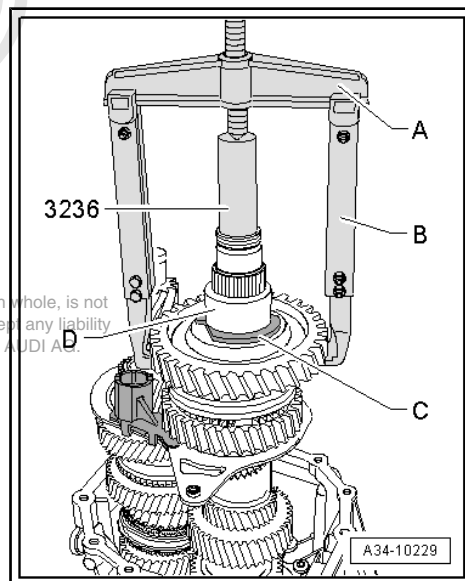
Pulling off 1st speed selector gear with thrust washer -C- and needle bearing inner race -D- for reverse selector gear

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

B - Puller hook, 200 mm

- Take out needle bearing and synchro-rings for 1st gear.

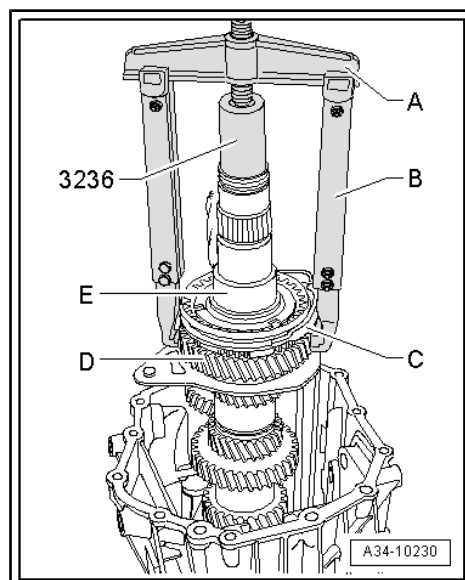
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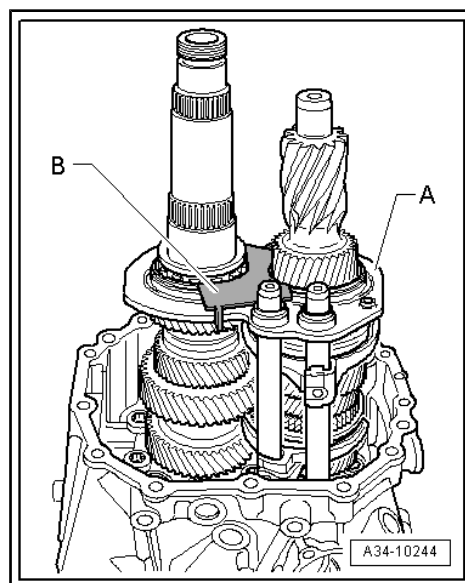
Pulling of 2nd speed selector gear -D- together with needle bearing inner race -E- for 1st speed selector gear and selector fork -C- for 1st and 2nd gear

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

B - Puller hook, 250 mm



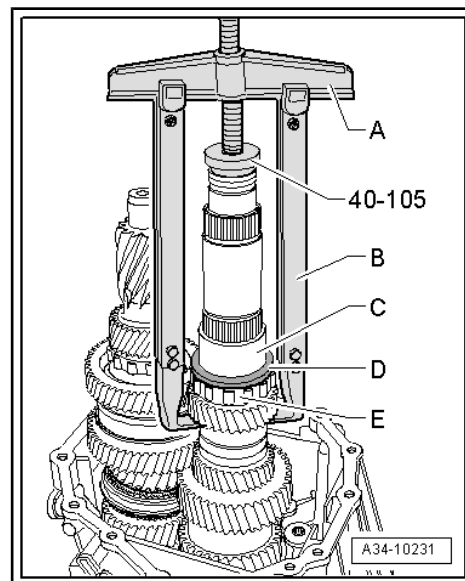
- Remove bearing mounting -A- with mounting for reverse shaft -B-.



**Pulling off 5th gear wheel together with needle bearing inner race
 -C- for 2nd gear, thrust washer "S₆" -D- and roller bearing -E-**

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

B - Puller hook, 250 mm



Pulling off 6th gear wheel

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

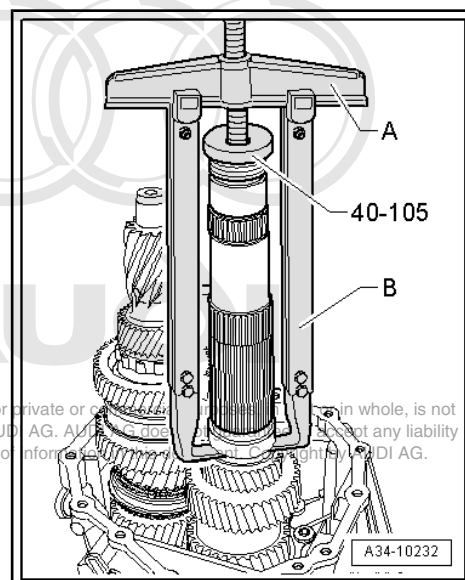
B - Puller hook, 250 mm



Note

- ◆ Apply puller hook at annular slot on gear wheel.
- ◆ On some gearboxes, the 3rd to 6th gear wheels are fitted onto the pinion shaft with push fit (not press fit). On these gearboxes, the gear wheels can be removed by hand.

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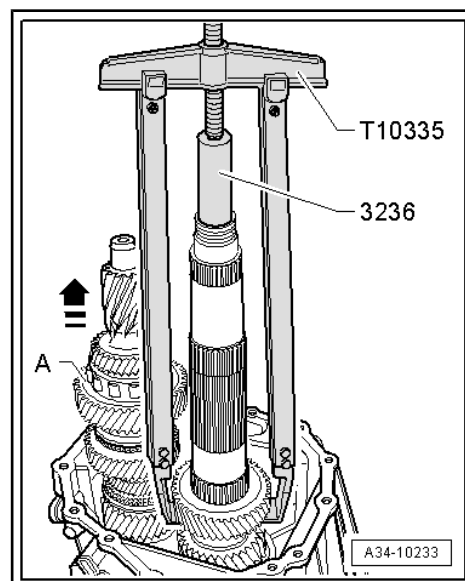


Pulling off 3rd gear wheel

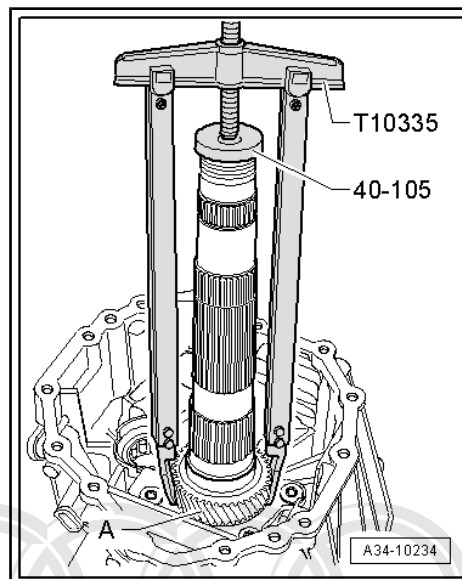


Note

Guide input shaft -A- with selector forks for 3rd/4th and 5th/6th gear out of gearbox housing in direction of -arrow- when pulling off gear wheel.



Pulling off 4th gear wheel -A-

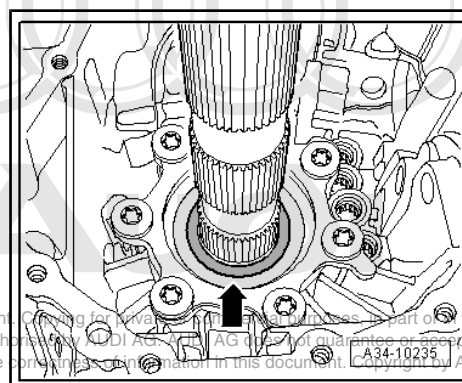


- Remove shim(s) “S5” -arrow- from pinion shaft and note thickness of shim(s).



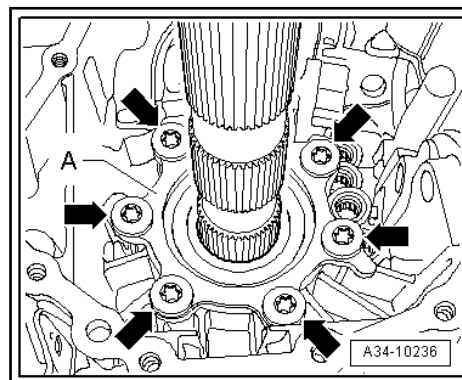
Note

Remove differential from gearbox housing before removing pinion shaft. Then rotate pinion shaft by hand and check double angular contact ball bearing for wear (running noises). The bearing should not “catch” and should run smoothly when the installed pinion shaft is rotated.



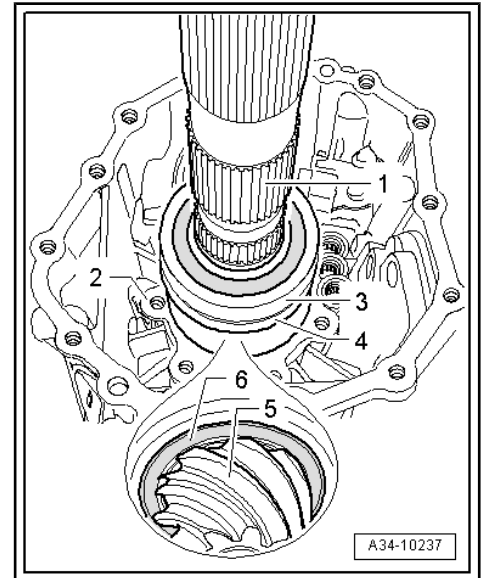
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- Remove bolts -arrows- and detach retaining plate -A- and shim “S4” located below retaining plate.



- Carefully pull pinion shaft -1- out of opening in gearbox housing -2-.

Take care not to pull apart the outer races -3- and -4- of the double angular contact ball bearing, otherwise the seal -6- of the double angular contact ball bearing can be damaged by the pinion gear -5-. If this should happen, the double angular contact ball bearing must be renewed.



1.6.2 Assembling gearbox

If the gearbox housing or the final drive gear set have been renewed, you must first re-determine the thickness of the shim "S6" ➔ [page 80](#) . The shim is located on the pinion shaft and is responsible for the proper positioning of the 2nd speed selector gear.

Re-determine thickness of shim(s) "S5" if final drive gear set is being renewed ➔ [page 79](#) . The shim is located on the pinion shaft and is responsible for the proper positioning of the 4th gear wheel.

Always renew the double angular contact ball bearing on the pinion shaft when renewing the final drive gear set or if gear oil is contaminated with metal particles.



Note

- ◆ Carefully use thread tap to remove any remaining locking fluid from all threaded holes which will accommodate self-locking bolts.
- ◆ Clean the thread for the nut on the pinion shaft.
- ◆ Lubricate all needle bearings and synchro-rings with gear oil before fitting.
- ◆ Thoroughly clean housing joint surfaces.
- ◆ Check synchro-rings for wear ➔ [page 34](#) .
- ◆ Heat needle bearing inner races, gear wheels and roller bearings to 100 °C (max.) before pressing on.



WARNING

Wear protective gloves when positioning heated components.

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- Fit shim "S3" in gearbox housing.

- Lubricate outer races -3- and -4- with gear oil.
- Carefully push pinion shaft -1- with double angular contact ball bearing into gearbox housing -2- by hand (press down top outer race -3-).

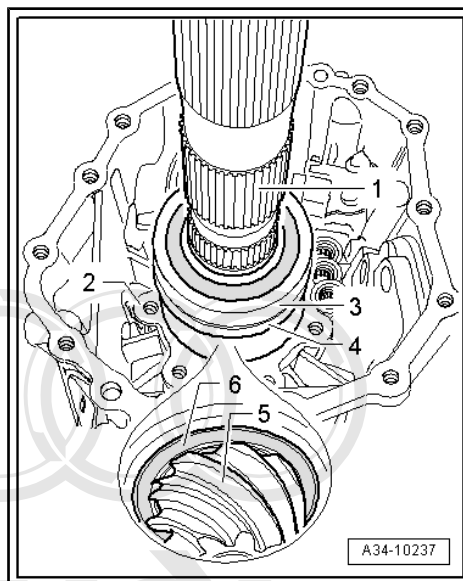


Note

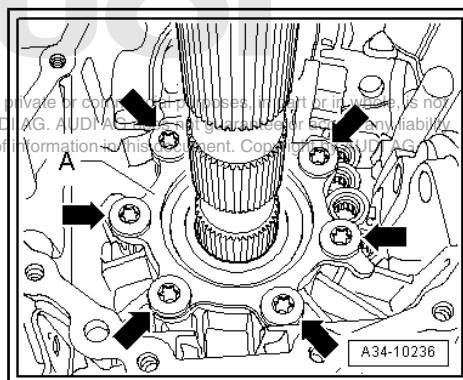
Using hot air blower, heat area around seat of bearing in gearbox housing if necessary.

Make sure that outer races -3- and -4- are kept straight when inserting and that they remain attached to each other. Otherwise the seal -6- can be damaged by the pinion gear -5-.

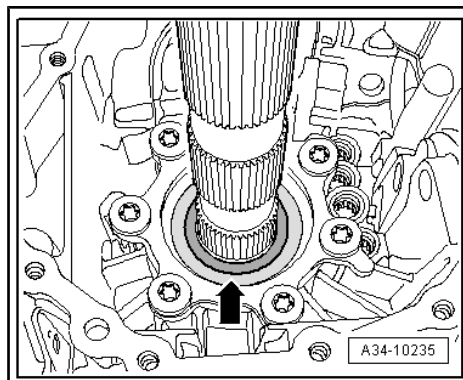
The bearing must be renewed if the seal of the double angular contact ball bearing is damaged.



- Fit shim "S4" and retaining plate -A- (can only be fitted in one position).
- Clean threads of old bolts -arrows- with a wire brush. Then insert bolts with locking fluid -AMV 185 101 A1- and tighten to 30 Nm in diagonal sequence.
- Install differential ⇒ [page 85](#) .
- Now re-determine thickness of shim "S5" ⇒ [page 79](#) if pinion shaft (final drive gear set) is being renewed.



- Fit shim(s) "S5" -arrow- onto pinion shaft.

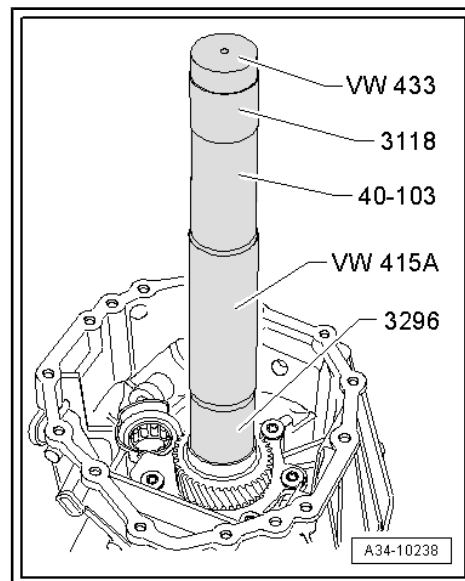


Driving on 4th gear wheel as far as stop.

◆ Installation position:

High inside collar faces 3rd gear.

- Shoulder of press tool -3118- and tube -VW 415 A- faces towards 4th gear wheel.

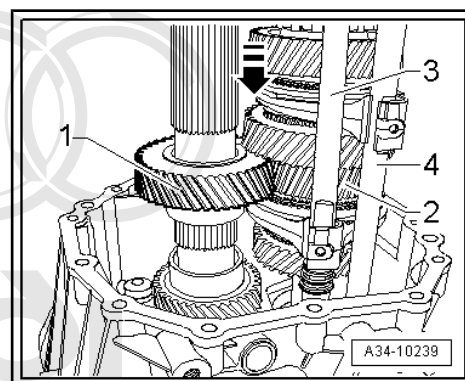


- Make sure that 3rd gear wheel -1- meshes with 3rd speed selector gear -2- on input shaft.

◆ Installation position of 3rd gear wheel:

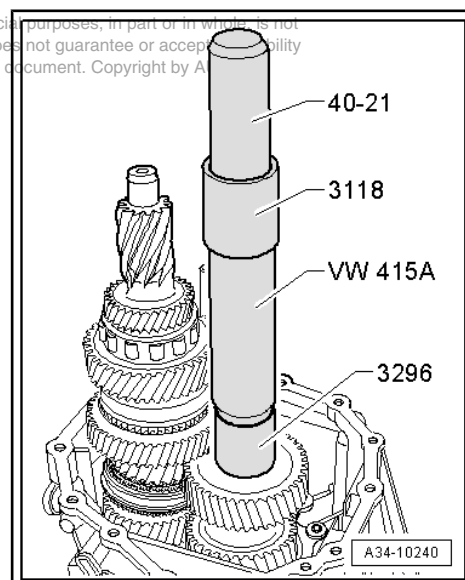
High inside collar faces 4th gear.

- Now insert input shaft together with selector forks -3- and -4- into gearbox housing in direction of -arrow-; fit 3rd gear wheel onto pinion shaft when doing so.



Driving on 3rd gear wheel as far as stop.

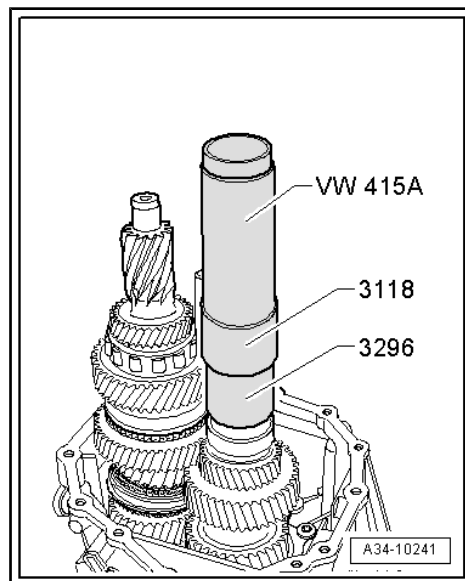
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Driving on 6th gear wheel as far as stop.

◆ Installation position:

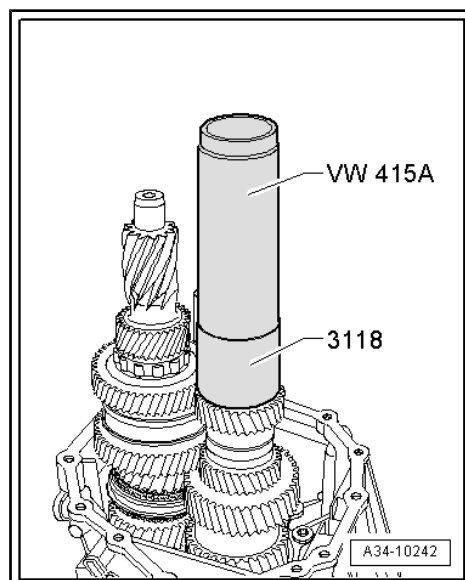
High inside collar faces 5th gear.



Driving on 5th gear wheel as far as stop.

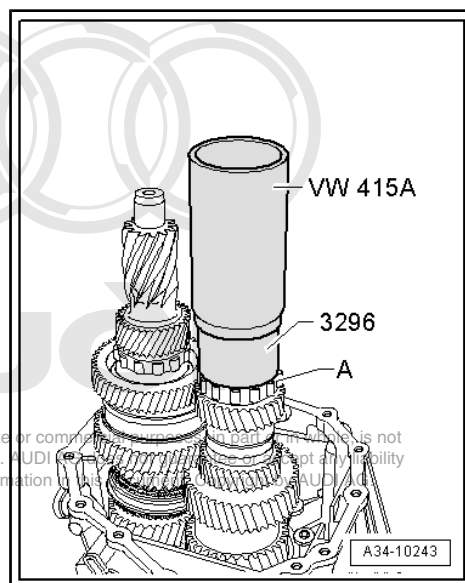
◆ Installation position:

High inside collar faces 6th gear.



Driving on roller bearing -A- for pinion shaft.

If gearbox housing, final drive gear set or gear wheels on pinion shaft are being renewed, you must now re-determine shim "S6" for positioning 2nd speed selector gear ➔ [page 80](#) .



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- Fit bearing mounting -A-.

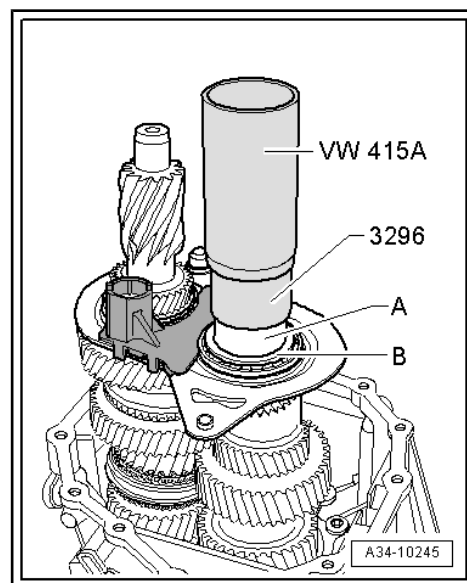
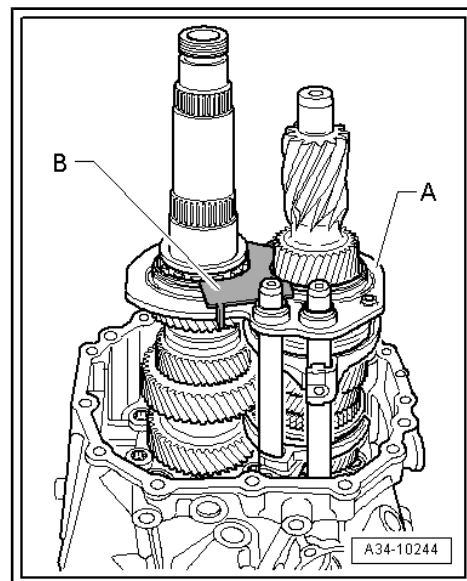
The mounting -B- for reverse shaft must be fitted on the bearing mounting.



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Driving on needle bearing inner race -A- for 2nd speed selector gear

- First fit shim "S₆" -B-.



Checking synchro-rings for 1st, 2nd and reverse gear for wear

- Check outer friction surface on inner ring for scoring or visible traces of wear and renew if necessary.
- Check inner friction surface of synchro-ring for scoring or visible traces of wear and renew if necessary.
- Fit inner ring, intermediate ring and synchro-ring onto cone of selector gear/clutch unit and rotate rings to achieve proper seating.



Note

To achieve proper seating, rotate synchro-rings approx. one turn while pressing down rings simultaneously.

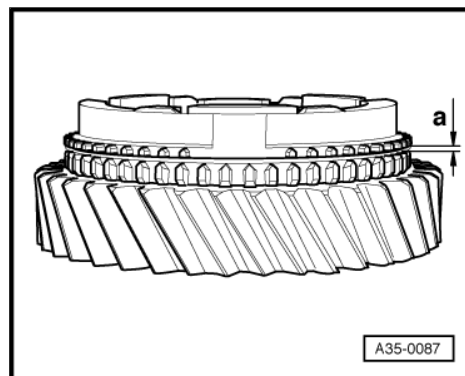
- Then measure gap -a- using a feeler gauge .

Gap -a-	Wear limit
1st and 2nd gear	0.7 mm
Reverse gear	0.7 mm



Note

Renew inner ring, intermediate ring and synchro-ring for the corresponding gear together.



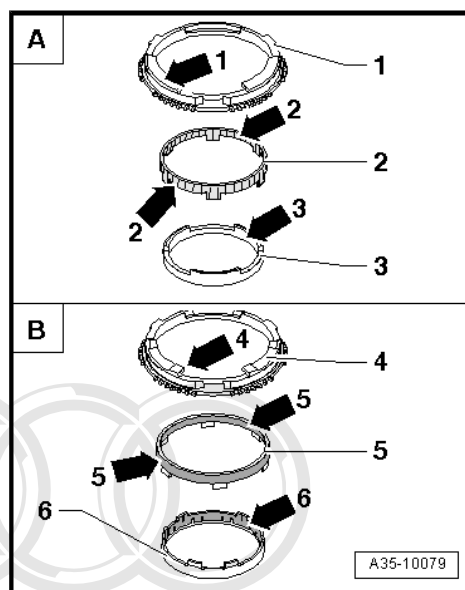
Identification of reverse gear synchro-rings -A- and 1st/2nd gear synchro-rings -B-

- 1 - Reverse gear synchro ring: the lugs -arrow 1- have a smooth surface.
- 2 - Reverse gear intermediate ring: the friction surfaces -arrows 2- are coated with sintered particles (brass colour).
- 3 - Reverse gear inner ring: has no inner friction surface -arrow 3-.
- 4 - Synchro-ring for 1st and 2nd gear: the lugs are fitted with 2 projections each -arrow 4-.
- 5 - Intermediate ring for 1st and 2nd gear: the friction surfaces -arrows 5- are carbon-coated (black coating).
- 6 - Inner ring for 1st and 2nd gear: the inner friction surface -arrow 6- is carbon-coated (black coating).



Note

Do not interchange synchro-ring for 1st gear (item 4) with synchro-ring for 2nd gear. The synchro-ring for 2nd gear has asymmetric splines, which are matched to the locking collar
⇒ [page 35](#) .

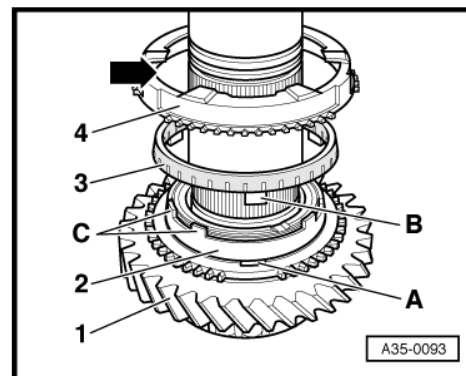


Installation position of synchro-rings for 1st, 2nd and reverse gear



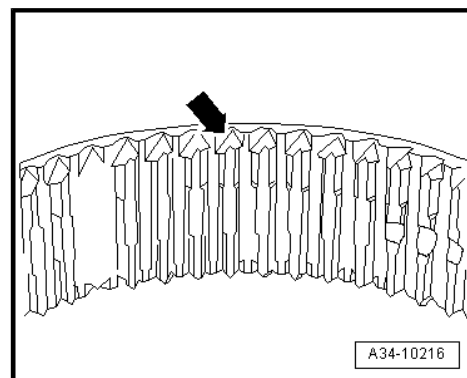
Note

- ◆ If components are not being renewed, make sure they are re-installed on the same gear.
- ◆ Do not interchange synchro-rings for reverse gear with synchro-rings for 1st and 2nd gear ⇒ [page 34](#).
- Fit inner ring -2- onto selector gear -1-/clutch unit.
- Fit intermediate ring -3-. Lug -B- must be inserted into recess -A-.
- Fit synchro-ring -4-. Guide lugs -C- through recess -arrow-.
- Place 2nd speed selector gear with needle bearing and synchro-rings onto pinion shaft.
- Then fit synchronising hub for 1st and 2nd gear.



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Note correct position of locking collar for 1st and 2nd gears. The side with asymmetric splines -arrow- must point towards 2nd gear.



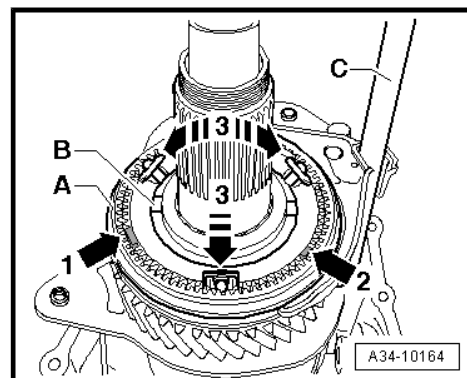
- Fit locking collar -A- (in installation position) together with selector fork for 1st and 2nd gear -C- over synchronising hub -B-.



Note

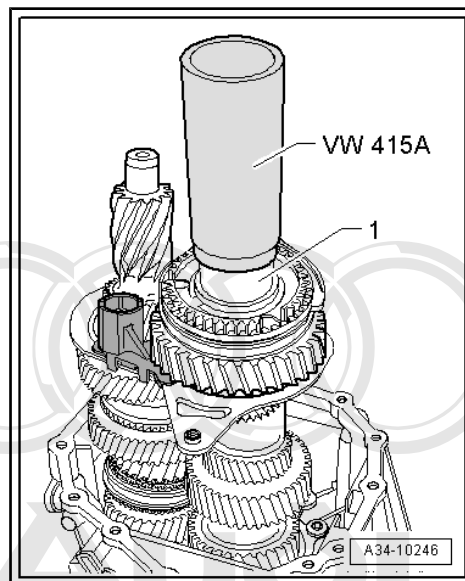
The locking collar can only be fitted over the synchronising hub in one position; the gaps in the splines -arrow 1- and -arrow 2- have different widths. Detach synchronising hub -B- from pinion shaft and turn upside down if necessary.

- Then position thrust blocks in recesses in synchronising hub and press thrust blocks in direction of -arrow 3- into recesses in locking collar. The locking collar must be held in the centre position.



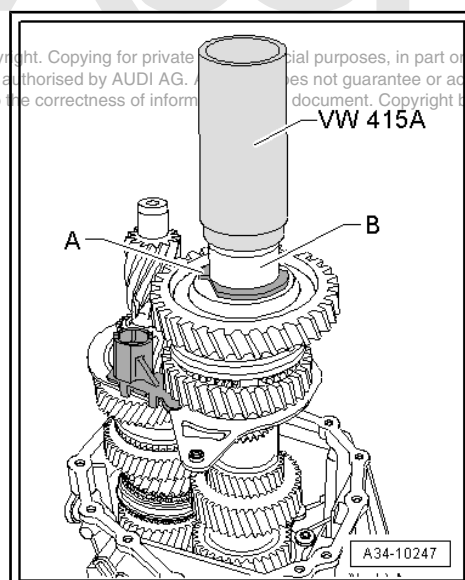
Driving on needle bearing inner race -1- for 1st speed selector gear.

- Place 1st speed selector gear with needle bearing and synchro-rings onto needle bearing inner race.



Driving on thrust washer -A- for 1st gear and reverse gear and needle bearing inner race -B- for reverse selector gear

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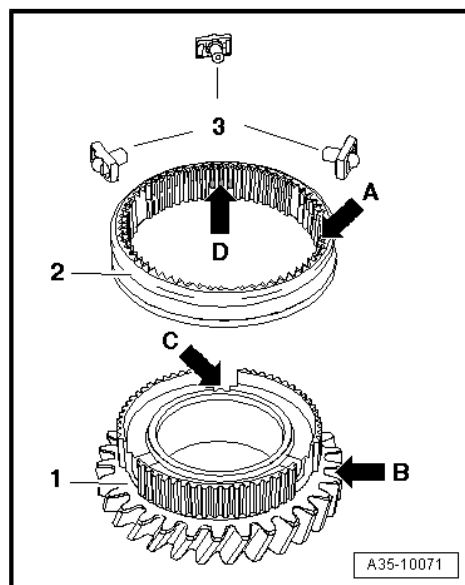
Assembling locking collar and reverse selector gear

- 1 - Reverse selector gear
- 2 - Locking collar
- 3 - Thrust blocks

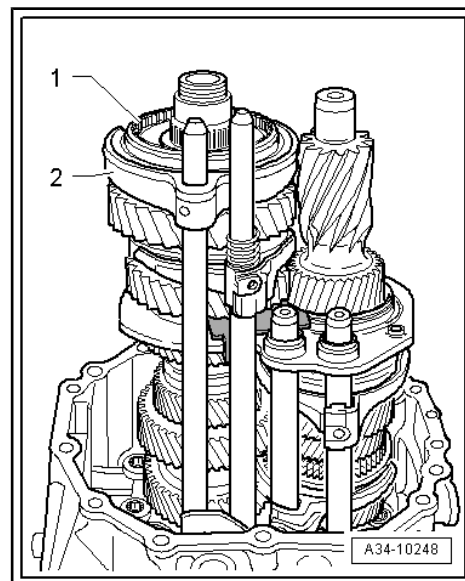
- Push locking collar over reverse selector gear.

Installation position:

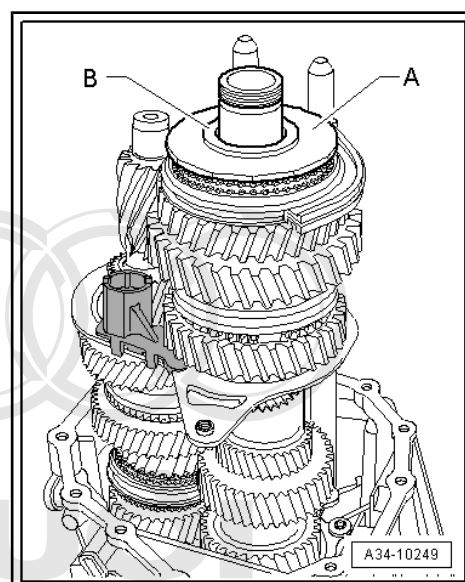
- After assembling, the pointed splines -arrow A- on the locking collar point away from the driving teeth -arrow B- of the reverse selector gear.
- Recesses for thrust blocks -3- in reverse selector gear -arrow C- and locking collar -arrow D- must align.
- Then position thrust blocks in recesses on reverse selector gear and press thrust blocks into recesses in locking collar.



- Fit reverse selector gear -1- (with locking collar fitted) together with needle bearing and reverse gear selector rod -2-.

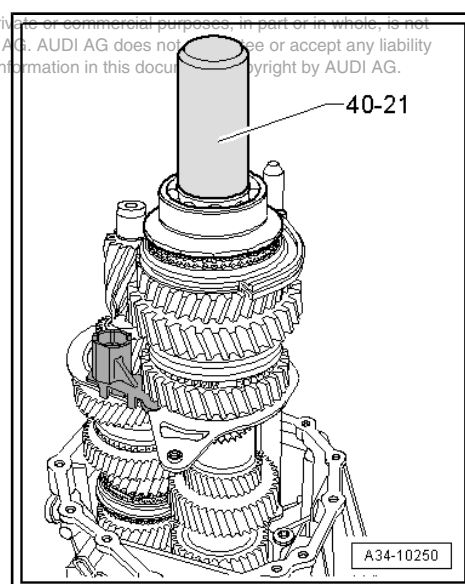


- Fit clutch unit -A- with reverse gear synchro-rings.
- Fit washer -B- onto clutch unit.
- Heat grooved ball bearing for pinion shaft to max. 130 °C.



Driving on grooved ball bearing

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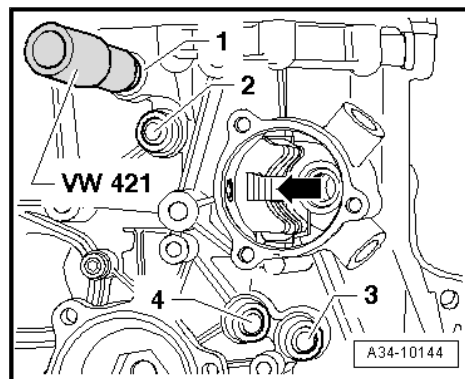
- Move selector rods to neutral -arrow-.
- Drive in locking bushes -1- to -4- for selector rods as far as stop using tube -VW 421- .

- 1 - Locking bush for reverse gear selector rod
- 2 - Locking bush for 1st and 2nd gear selector rod
- 3 - Locking bush for 5th and 6th gear selector rod
- 4 - Locking bush for 3rd and 4th gear selector rod

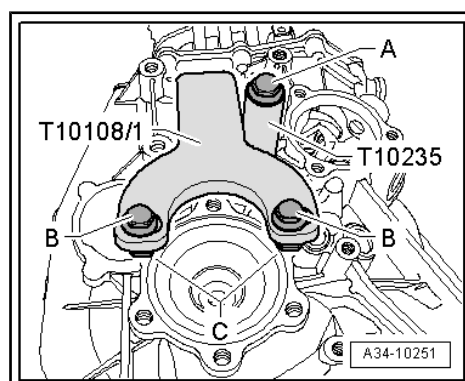


Note

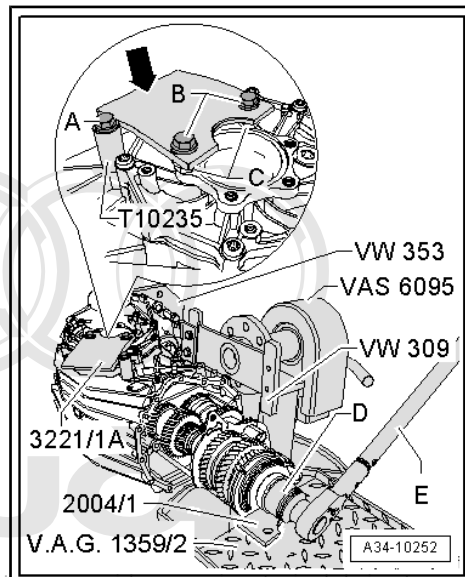
Do not interchange locking bushes for selector rods and selector shaft.



- Secure adapter -T10235- in tapped hole on right side of gearbox housing using a bolt M10 x 70 -A- as shown on illustration.
- Secure support plate -T10108/1- to flange shaft (right-side) with 2 bolts M10 x 35 -B-. When doing this, insert 2 nuts nut M12 -C- between flange shaft and support plate .
- Turn gearbox in assembly stand so that it is in horizontal position.



- Secure adapter -T10235- in tapped hole on left side of gearbox housing using a bolt M10 x 70 -A- as shown on illustration.
- Secure support plate -3221/1A- to flange shaft (left-side) with 2 bolts M10 x 35 -B-. When doing this, place a nut M12 and washer -C- on each bolt between flange shaft and gearbox support .
- The support plates must rest against the adapters -T10235- .
- The shoulder -arrow- of support plate -3221/1A- should face gearbox housing.
- The gearbox must be in neutral.
- Support pinion shaft with engine and gearbox jack - V.A.G 1383 A- and universal gearbox support -V.A.G 1359/2- . When doing so, position plate -2004/1- below grooved ball bearing on pinion shaft.
- Clean thread of pinion nut. Then apply locking fluid - AMV 185 101 A1- to nut and tighten to 300 Nm.

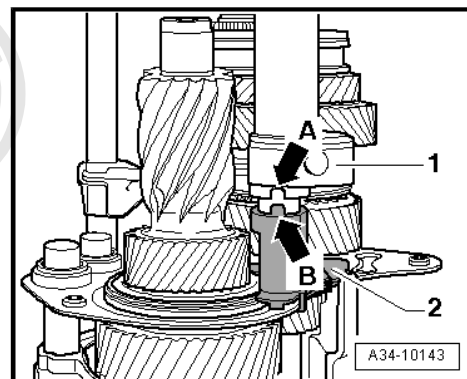


D - Socket attachment (46 mm) with $\frac{3}{4}$ " drive.

E - Torque wrench

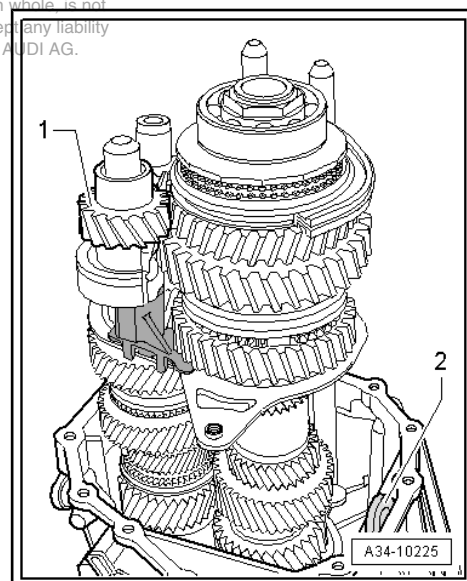
- Then check selector gears for freedom of movement and axial play.
- The axial play of the selector gears must be at least 0.10 mm.
- Position gearbox vertically in assembly stand.

- Fit reverse shaft -1- with recess -arrow A- onto lug -arrow B- of reverse shaft mounting -2-.

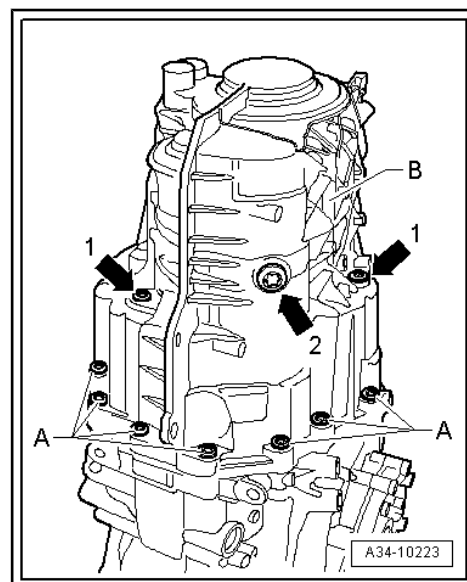


- Fit reverse gear wheel -1- with needle bearing onto reverse shaft; teeth of reverse gear wheel must point towards reverse selector gear.
- Fit magnet -2- into rib in gearbox housing.
- Check whether the two dowel sleeves for centring gearbox cover to gearbox housing are fitted in gearbox cover.
- Apply sealing paste -AMV 188 001 02- evenly and not too thickly onto contact surfaces between gearbox housing and gearbox cover.

Assembly sequence for gearbox cover:



- Fit gearbox cover -B- onto gearbox housing. Do not screw in bolts -A- at this stage.
- Screw in bolt -arrow 2- into reverse shaft hand-tight.
- Screw new bolts -arrows 1- into bearing mounting and tighten hand-tight.
- Then tighten the 13 bolts -A- to 24 Nm.
- Then tighten bolts -arrows 1- to 27 Nm and bolt -arrow 2- to 24 Nm.
- Then turn gearbox in assembly stand in horizontal position.

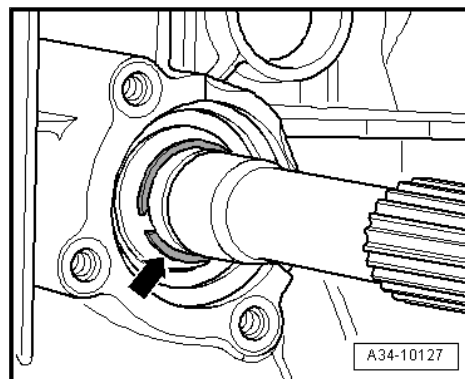


- Then install circlip -arrow- in front of grooved ball bearing for input shaft.

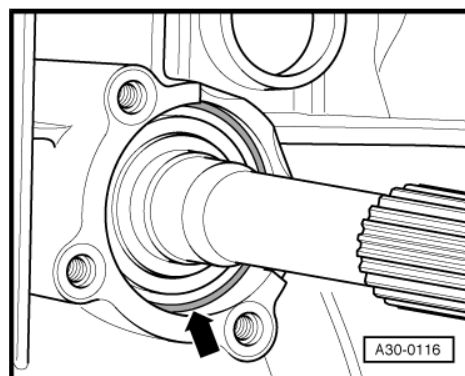


Note

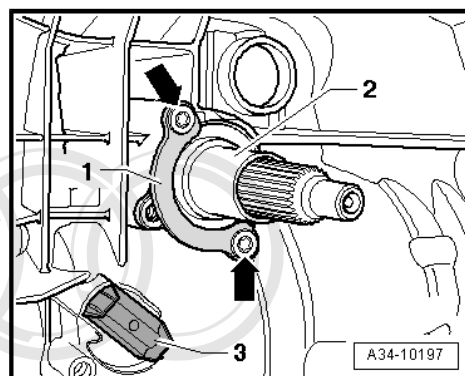
If necessary, pull input shaft out of gearbox housing as far as stop by hand so that the circlip can be fitted properly.



- Lubricate new O-ring -arrow- with gear oil before fitting into circumferential groove on gearbox housing.
- Fit a thin insulating hose or shrink hose onto input shaft splines.
- Pack space between sealing lip and dust lip of oil seal in guide sleeve half-full with sealing grease -G 052 128 A1- .
- Lightly oil outer circumference of guide sleeve.



- Push guide sleeve -2- over input shaft and into gearbox housing.
 - Remove insulating hose/shrink hose.
 - Fit retaining piece -1-.
1. Clean threads of bolts -arrows- with a wire brush. Then insert bolts with locking fluid -AMV 185 101 A1- and tighten to 24 Nm.
- Insert intermediate piece -3- in gearbox housing.

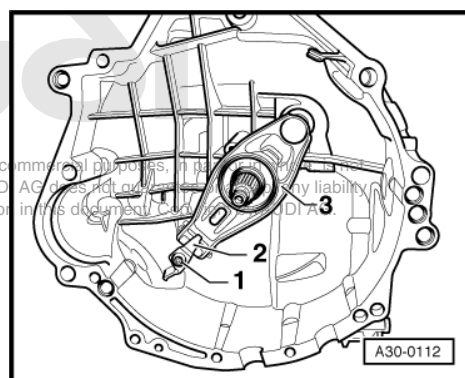


Only on Audi A4 and Audi Cabriolet:

- Before installing clutch release lever -3-, apply a thin coat of copper grease to contact surface for operating rod of clutch slave cylinder.

Continued for all models:

- Install clutch release lever together with release bearing.
- Clean thread of bolt -1- with a wire brush.
- Position leaf spring -2- onto bolt -1-.
- Then insert bolt -1- with locking fluid -AMV 185 101 A1- and tighten to 24 Nm.



- Push assembly sleeve -01E 311 120- -A- onto selector shaft -B-.

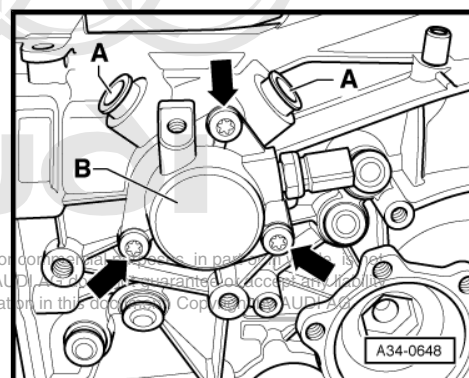
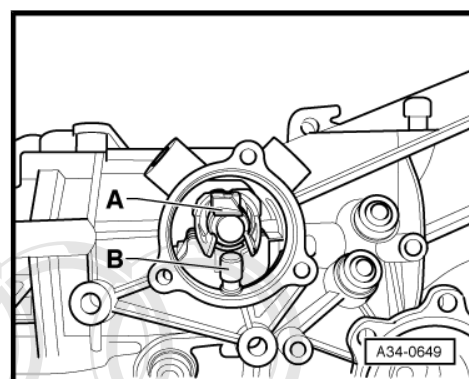
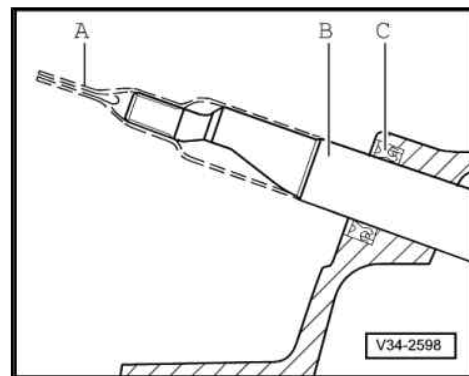


Note

To avoid damaging oil seal -C-, oil seal and selector shaft must only be fitted using assembly sleeve -01E 311 120- -A-.

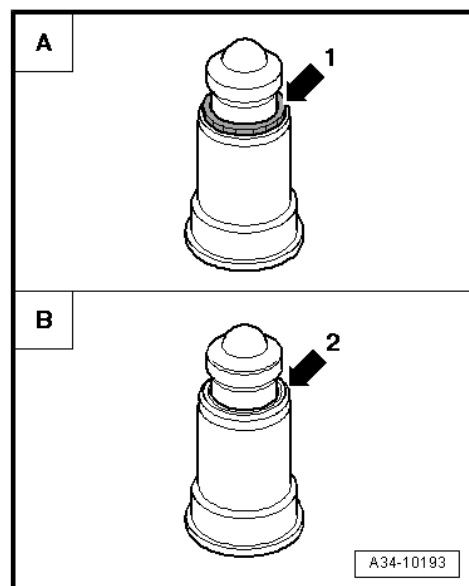
- Selector rods must be in neutral position.
- Install complete selector shaft.
- Installation position: Chamfer of selector shaft points downwards.
- Push selector shaft -A- into gearbox as far as it will go, simultaneously inserting pin -B-.
- Use pin without lug ➔ [Item 7 \(page 9\)](#) when renewing gearbox housing.
- Installation position of pin -B- with lug: insert end with lug into gearbox housing.
- Installation position of pin -B- without lug: pin is fitted in gearbox housing without radial clearance.
- Fit cover -B- with new O-ring.
- Clean threads of bolts -arrows- with a wire brush. Then insert bolts with locking fluid -AMV 185 101 A1- and tighten to 24 Nm.

A -
 Locking bushes for selector shaft

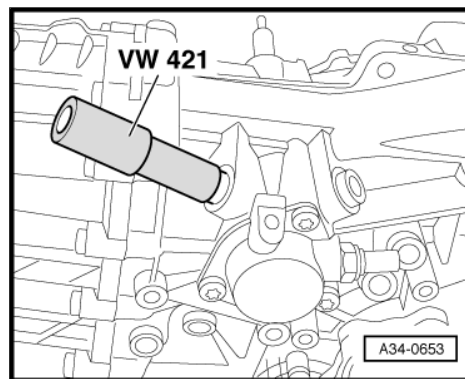


Note

- ◆ *Install only version -B- of locking bushes for selector shaft with flanged edge -arrow 2-.*
- ◆ *If the gearbox is fitted with selector shaft locking bushes of type -A-, these must always be replaced with locking bushes of type -B-. Parts No. ➔ Electronic parts catalogue "ETKA".*
- ◆ *Version -B- can be re-used if already installed.*



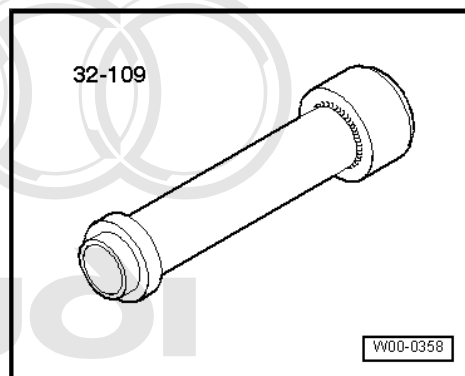
- Drive in selector shaft locking bushes ➔ [page 41](#) using tube - VW 421- .
- Select all gears.



1.7 Renewing grooved ball bearing for input shaft with gearbox removed (gearbox remains assembled)

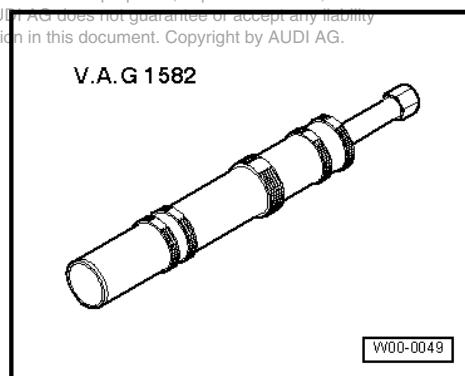
Special tools and workshop equipment required

- ◆ Tube -32 - 109-



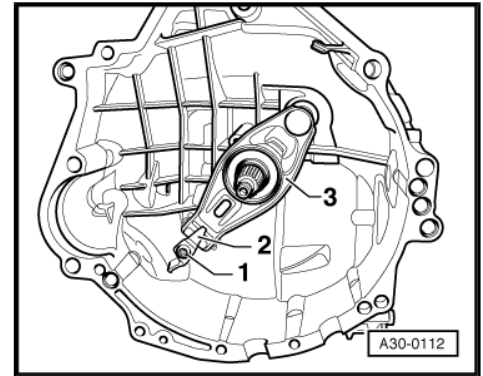
- ◆ Tapered roller bearing puller -V.A.G 1582-

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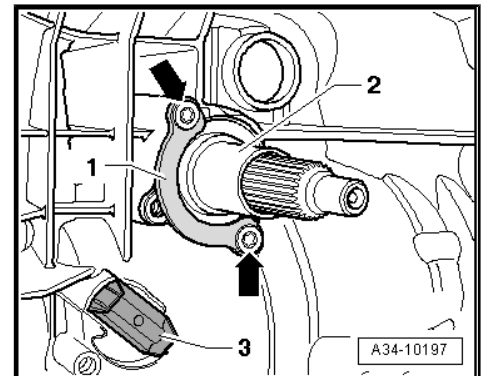


- ◆ Adapter -V.A.G 1582/12-
- ◆ Sealing grease -G 052 128 A1-
- ◆ Locking fluid -AMV 185 101 A1-

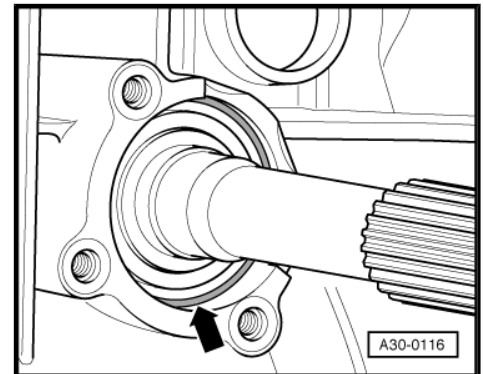
- Slacken off bolt -1- and remove leaf spring -2-.
- Remove clutch release lever -3- with release bearing.



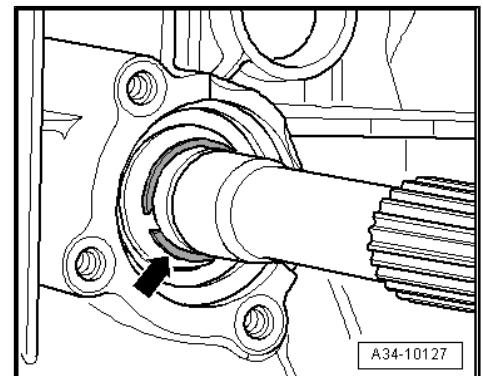
- Unscrew bolts -arrows- and remove retaining piece -1-.
- Fit a thin insulating hose or shrink hose onto input shaft splines.
- Pull guide sleeve -2- out of gearbox housing.
- Remove intermediate piece -3- from gearbox housing.



- Lever off O-ring -arrow- using a small screwdriver.



- Then remove circlip -arrow- in front of grooved ball bearing for input shaft.

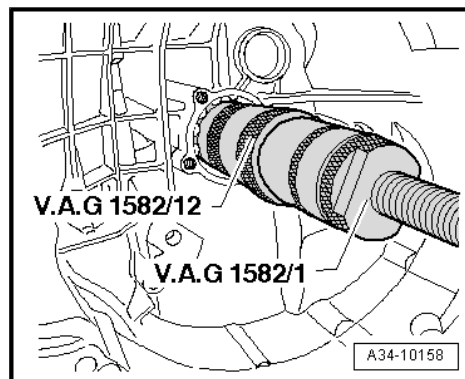


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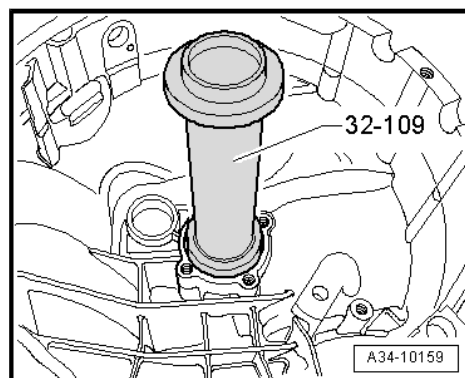
- Pull grooved ball bearing for input shaft out of gearbox housing.
- Then push new grooved ball bearing onto input shaft.

Installation position:

The sealed side of the ball cage faces the gearbox housing.



- Drive grooved ball bearing onto stop in gearbox housing.

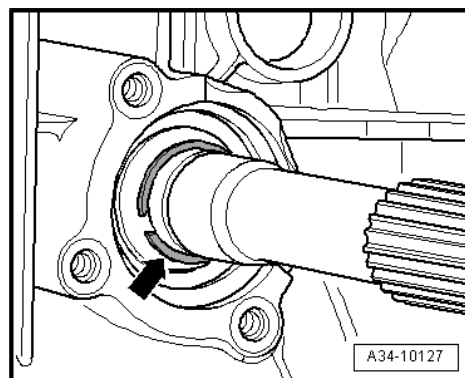


- Then install circlip -arrow- in front of grooved ball bearing for input shaft.

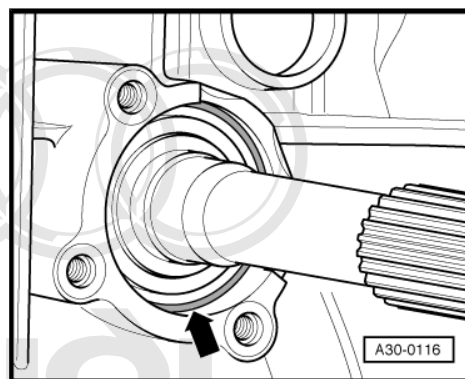


Note

If necessary, pull input shaft out of gearbox housing as far as stop by hand so that the circlip can be fitted properly.

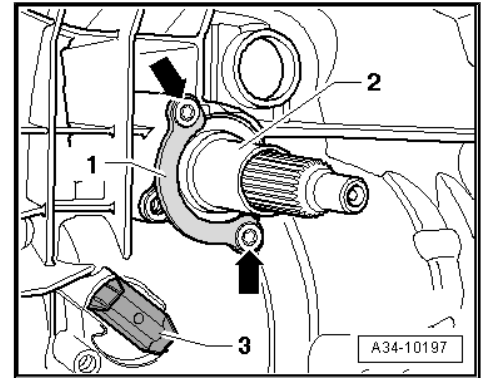


- Lubricate new O-ring -arrow- with gear oil before fitting into circumferential groove on gearbox housing.
- Pack space between sealing lip and dust lip of oil seal in guide sleeve half-full with sealing grease -G 052 128 A1- .
- Lightly oil outer circumference of guide sleeve.



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- Push guide sleeve -2- over input shaft and into gearbox housing.
- Remove insulating hose/shrink hose.
- Fit retaining piece -1-.
- Clean threads of bolts -arrows- with a wire brush. Then insert bolts with locking fluid -AMV 185 101 A1- and tighten to 24 Nm.
- Insert intermediate piece -3- in gearbox housing.

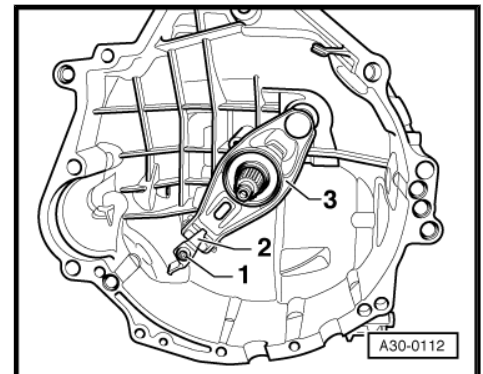


Only on Audi A4 and Audi Cabriolet:

- Before installing clutch release lever -3-, apply a thin coat of copper grease to contact surface for operating rod of clutch slave cylinder.

Continued for all models:

- Install clutch release lever together with release bearing.
- Clean thread of bolt -1- with a wire brush.
- Position leaf spring -2- onto bolt -1-.
- Then insert bolt -1- with locking fluid -AMV 185 101 A1- and tighten to 24 Nm.



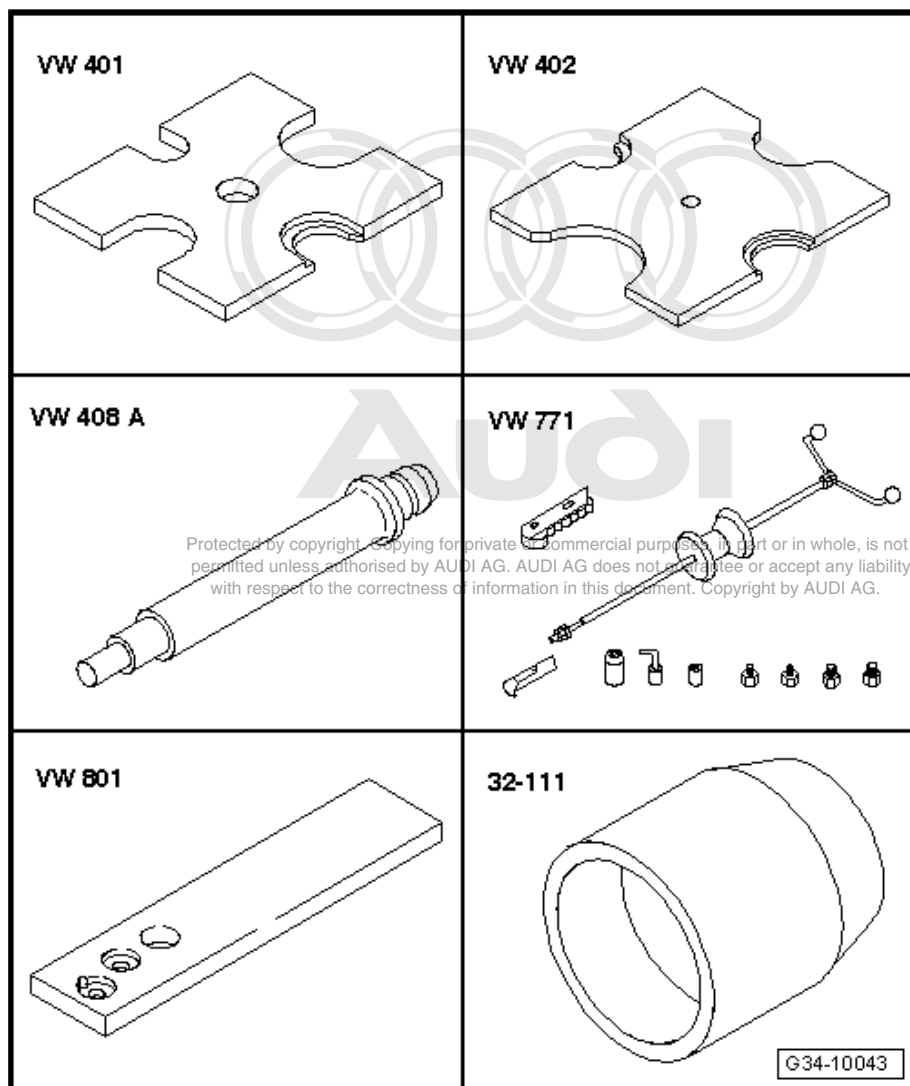
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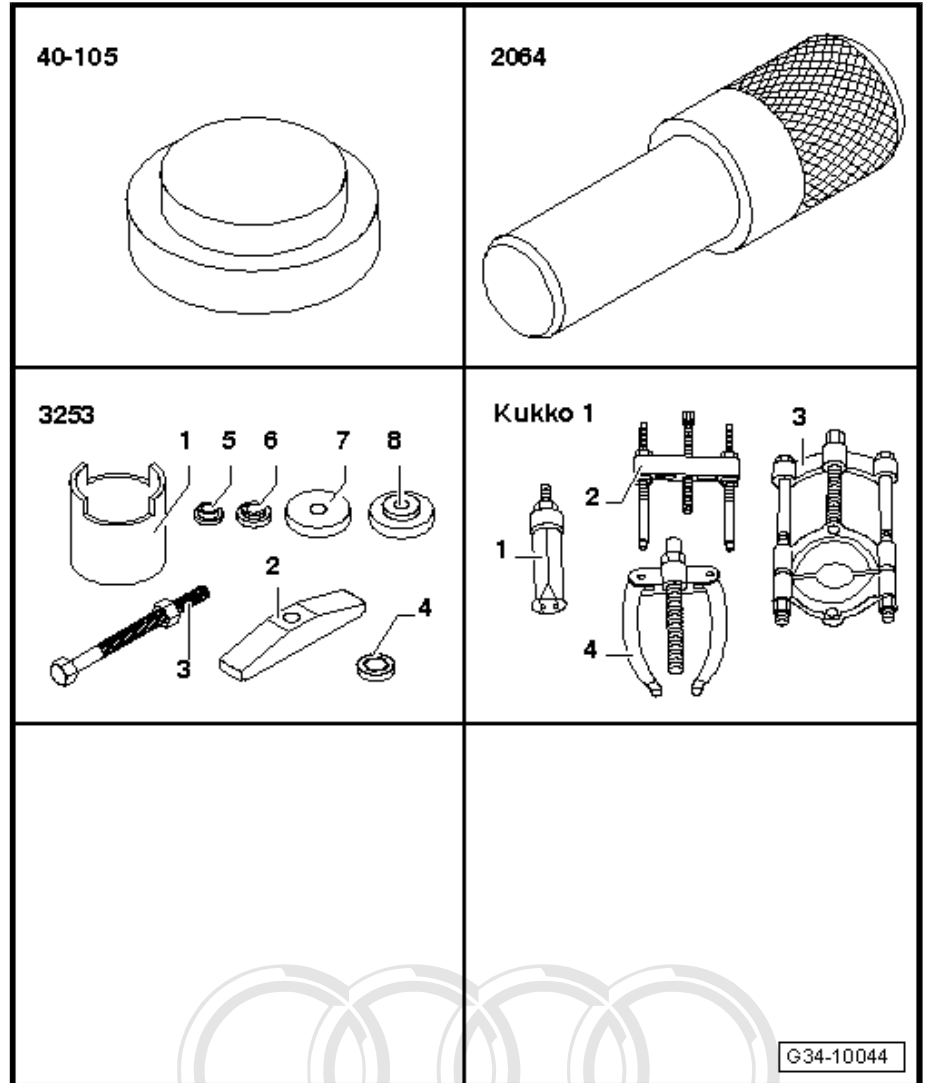
2 Servicing gearbox cover

Special tools and workshop equipment required

- ◆ Thrust plate -VW 401-
- ◆ Thrust plate -VW 402-
- ◆ Press tool -VW 408 A-
- ◆ Multi-purpose tool -VW 771-
- ◆ Adapter -VW 771/44-
- ◆ Support plate -VW 801-
- ◆ Thrust piece -32 - 111-



- ◆ Thrust plate -40 - 105-
- ◆ Locking pin -2064-
- ◆ Assembly tool -3253-
- ◆ -1- Internal puller -Kukko 21/2-
- ◆ -1- Internal puller -Kukko 21/4-
- ◆ -4- Counter-support -Kukko 22/2-
- ◆ Depth gauge



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1 - Gearbox cover

2 - Dowel pin

- ☐ 2 x
- ☐ Insert in gearbox cover
- ☐ Drive in until flush with rear surface of housing flange

3 - Ball sleeve

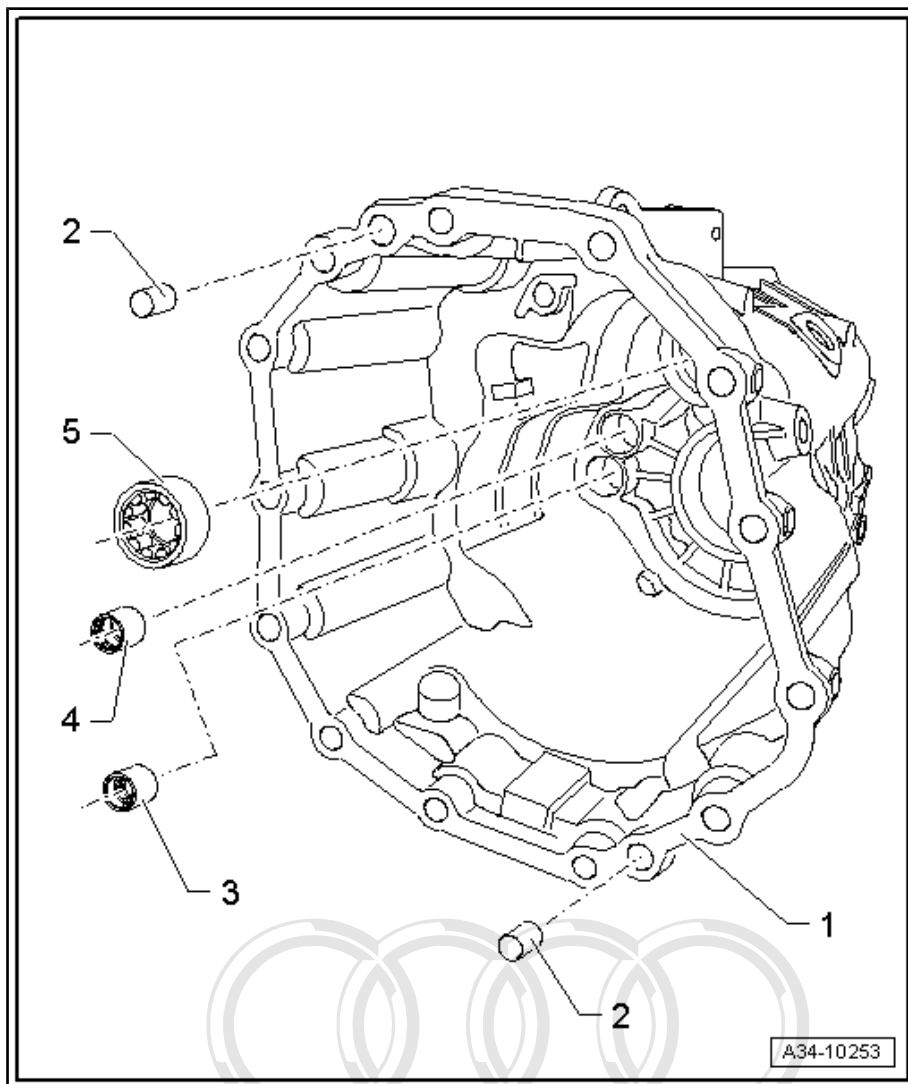
- ☐ For reverse gear selector rod
- ☐ Pulling out ⇒ [page 48](#)
- ☐ Pressing in ⇒ [page 49](#)
- ☐ Measuring installation depth ⇒ [page 49](#)

4 - Ball sleeve

- ☐ For selector rod for 1st and 2nd gear
- ☐ Pulling out ⇒ [page 48](#)
- ☐ Pressing in ⇒ [page 49](#)
- ☐ Measuring installation depth ⇒ [page 49](#)

5 - Roller bearing

- ☐ Bearing for input shaft in gearbox cover
- ☐ Always renew
- ☐ Pulling out ⇒ [page 49](#)
- ☐ Pressing in ⇒ [page 50](#)
- ☐ Peen to secure after installing ⇒ [page 50](#)



Pulling out ball sleeve from gearbox cover

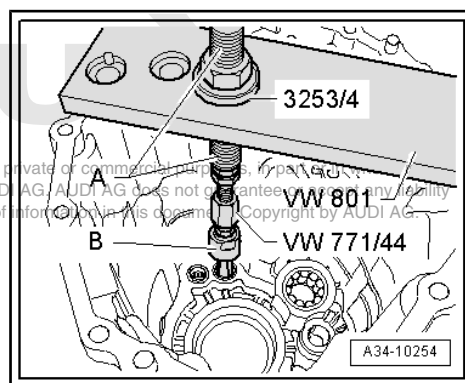
A - Counter-support , e.g. -Kukko 22/2-

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



Note

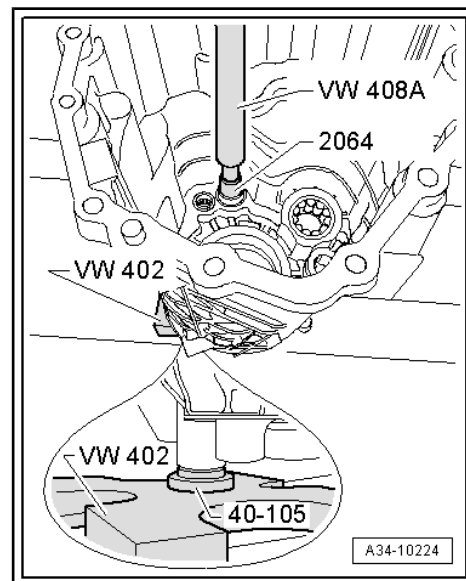
A stud (M10) and adapter -VW 771/15- can also be used instead of adapter -VW 771/44- .



Pressing ball sleeve into gearbox cover

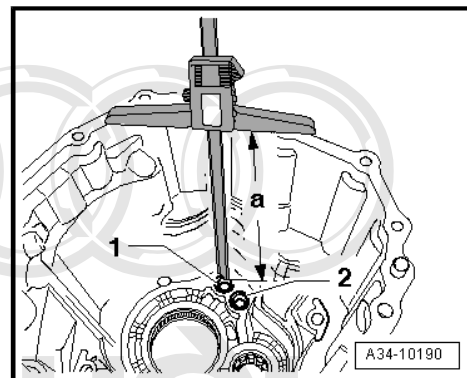
- Fit ball sleeve so that side with lettering (thicker metal) faces locking pin -2064-. Fit the small Ø of locking pin -2064- in the ball sleeve.
- Support gearbox cover below bearing seat using thrust plate -40 - 105- .

Installation depth of ball sleeve ➔ [page 49](#) .



Installation depth of ball sleeve in gearbox cover

- Press in ball sleeve for reverse gear selector rod -1- and for 1st/2nd gear selector rod -2- to dimension -a- = 250.5 ± 0.5 mm.



Pulling out roller bearing from gearbox cover

A - Counter-support , e.g. -Kukko 22/2-

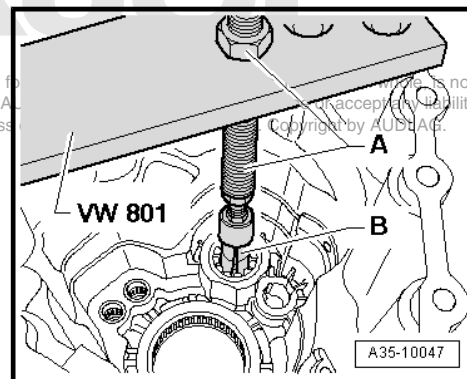
B - Internal puller 30...37 mm , e.g. -Kukko 21/4-

- Eliminate peening depressions if necessary.



Note

Always renew roller bearing after pulling out.



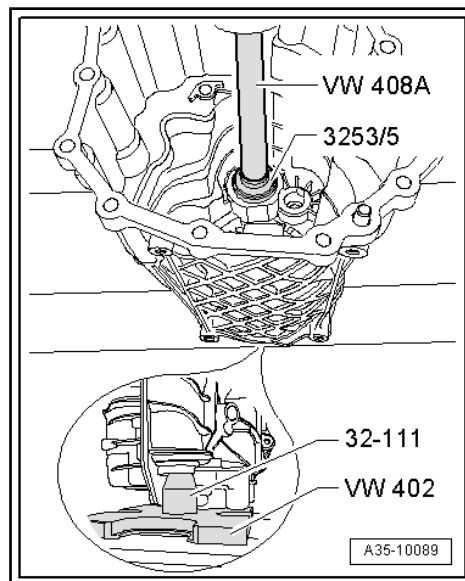
Carefully press in new roller bearing into gearbox cover until limit stop.

Support gearbox cover below bearing seat using thrust piece -32-111-.

- Secure roller bearing after pressing in by peening into gearbox cover ⇒ [page 50](#) .



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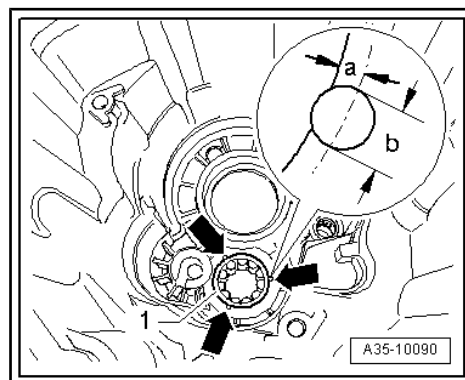


Securing roller bearing in gearbox cover by peening.

- Use a blunt punch with a ball shaped end (ball Ø approx. 5 mm) to peen in position.
- The roller bearing -1- is secured with 3 peening positions offset by 120° -arrows-.

Observe position and Ø of peening positions:

- ◆ Dimension -a- = 2 mm
- ◆ Dimension -b- = 3 mm

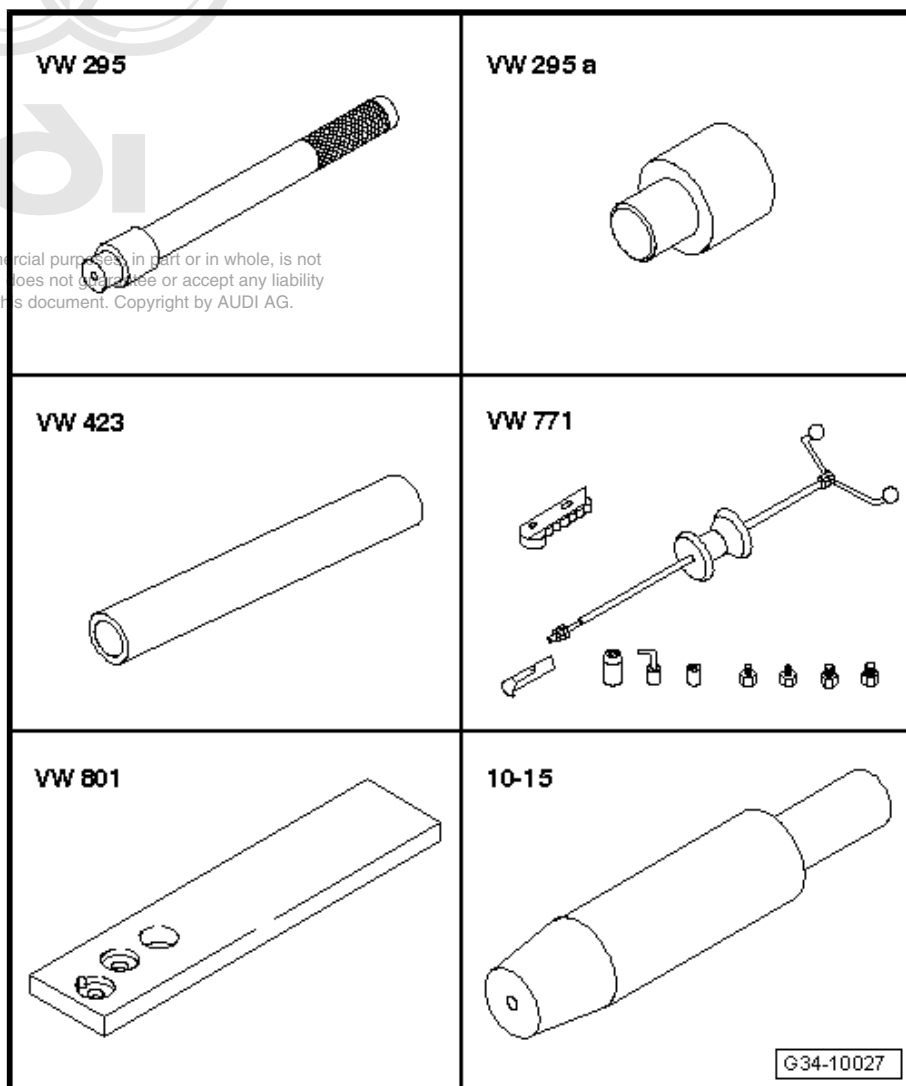


3 Servicing gearbox housing

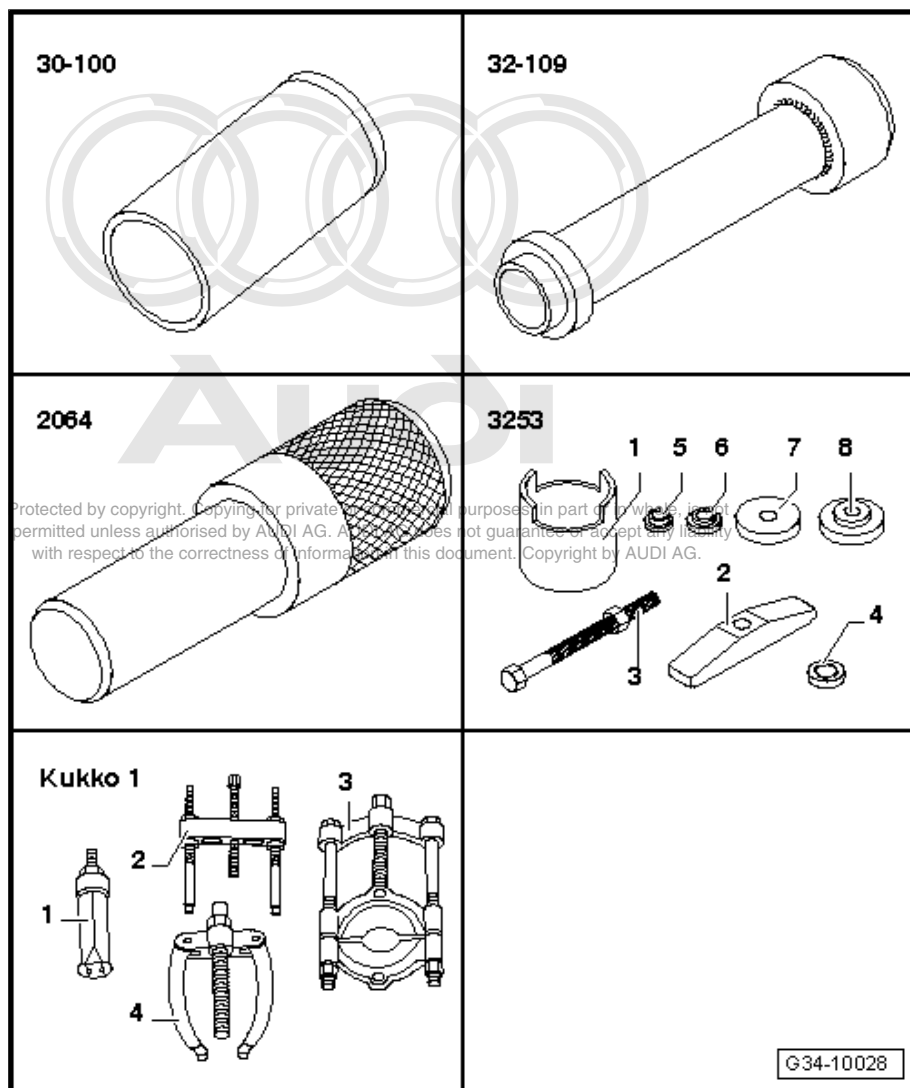
Special tools and workshop equipment required

- ◆ Drift -VW 295-
- ◆ Adapter -VW 295 A-
- ◆ Tube -VW 423-
- ◆ Multi-purpose tool -VW 771-
- ◆ Support plate -VW 801-
- ◆ Guide pin -10 - 15-

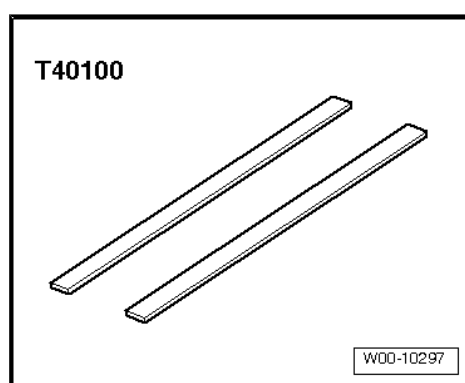
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- ◆ Drift sleeve -30 - 100-
- ◆ Tube -32 - 109-
- ◆ Locking pin -2064-
- ◆ Assembly tool -3253-
- ◆ Internal puller -3275-
- ◆ -1- Internal puller -Kukko 21/2-
- ◆ -4- Counter-support -Kukko 22/1-
- ◆ -4- Counter-support -Kukko 22/2-
- ◆ Depth gauge



- ◆ Straightedge -T 40100-



1 - Needle bearing

- ☐ For input shaft
- ☐ Always renew
- ☐ Pulling out ⇒ [page 54](#)
- ☐ Driving in ⇒ [page 55](#)
- ☐ Measuring insertion depth ⇒ [page 55](#)
- ☐ Peen to secure after installing ⇒ [page 55](#)

2 - Ball sleeve

- ☐ For selector shaft
- ☐ Pulling out ⇒ [page 55](#)
- ☐ Driving in and securing ⇒ [page 55](#)

3 - Cap

- ☐ For gearbox breather

4 - Breather pipe

- ☐ Installation depth ⇒ [page 56](#)
- ☐ Clip in cap ⇒ [Item 3 \(page 53\)](#) for gearbox breather

5 - Gearbox housing

- ☐ When renewing: re-determine positioning of 2nd speed selector gear ⇒ [page 80](#) , adjust pinion shaft and differential (final drive gear set) ⇒ [page 98](#)

6 - Ball sleeve

- ☐ For selector shaft
- ☐ Pulling out ⇒ [page 56](#)
- ☐ Driving in ⇒ [page 56](#)

7 - Oil seal for selector shaft

- ☐ Can be renewed with gearbox removed (gearbox remains assembled) ⇒ [page 59](#)
- ☐ Always renew
- ☐ Pulling out ⇒ [page 56](#)
- ☐ Driving in ⇒ [page 57](#)
- ☐ Always use assembly sleeve to fit oil seal (if selector shaft remains installed in gearbox) ⇒ [page 59](#)

8 - Tapered roller bearing outer race (right-side)

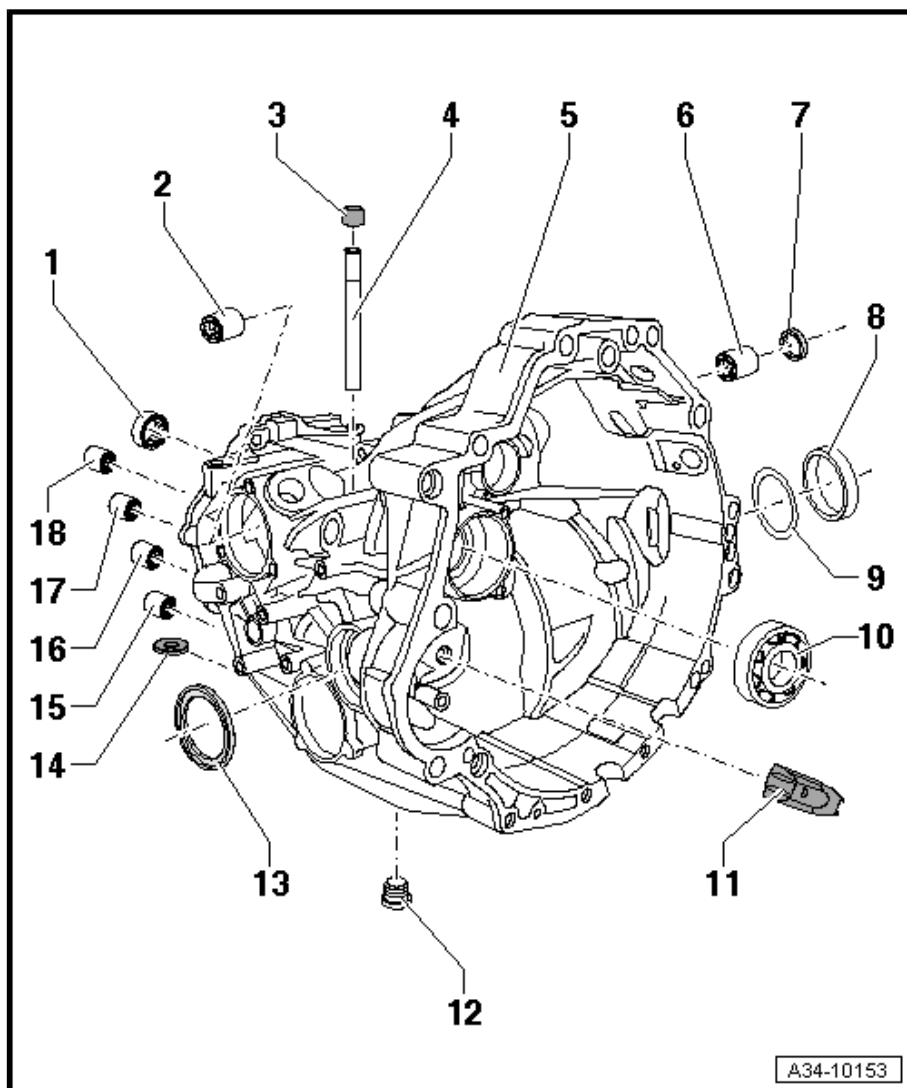
- ☐ For differential
- ☐ If renewed: adjust differential (crown wheel) ⇒ [page 105](#)
- ☐ Removing and installing ⇒ [Item 3 \(page 92\)](#)

9 - Shim "S2"

- ☐ Note thickness
- ☐ Table of adjustments ⇒ [page 98](#)

10 - Grooved ball bearing

- ☐ For input shaft
- ☐ Removing (gearbox dismantled) ⇒ [page 57](#)
- ☐ Removing (gearbox removed but not dismantled) ⇒ [page 42](#)



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- ☐ Installing ⇒ [page 57](#)

11 - Intermediate piece

- ☐ Renew if damaged

12 - Oil drain plug, 40 Nm

13 - Oil seal

- ☐ For flange shaft (right-side)
- ☐ Renewing ⇒ [page 84](#)

14 - Magnet

- ☐ Clean
- ☐ Insert in gearbox housing rib

15 - Ball sleeve

- ☐ For reverse gear selector rod
- ☐ Pulling out ⇒ [page 57](#)
- ☐ Driving in ⇒ [page 58](#)
- ☐ Measuring insertion depth ⇒ [page 58](#)

16 - Ball sleeve

- ☐ For selector rod for 1st and 2nd gear
- ☐ Pulling out ⇒ [page 57](#)
- ☐ Driving in ⇒ [page 58](#)
- ☐ Measuring insertion depth ⇒ [page 58](#)

17 - Ball sleeve

- ☐ For selector rod for 3rd and 4th gear
- ☐ Pulling out ⇒ [page 57](#)
- ☐ Driving in ⇒ [page 58](#)
- ☐ Measuring insertion depth ⇒ [page 58](#)

18 - Ball sleeve

- ☐ For selector rod for 5th and 6th gear
- ☐ Pulling out ⇒ [page 57](#)
- ☐ Driving in ⇒ [page 58](#)
- ☐ Measuring insertion depth ⇒ [page 58](#)

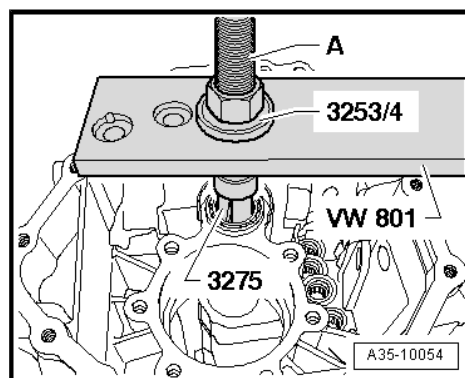
Pulling out input shaft needle bearing from gearbox housing

A - Counter-support , e.g. -Kukko 22/2-

- Eliminate peening depressions if necessary.



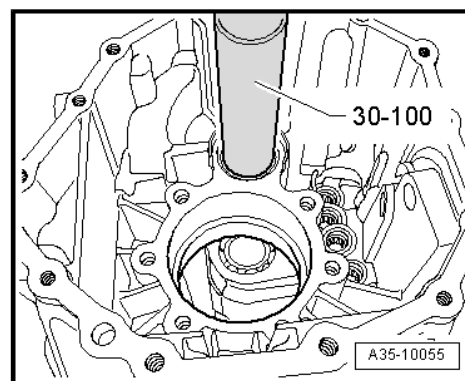
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Driving input shaft needle bearing into gearbox housing

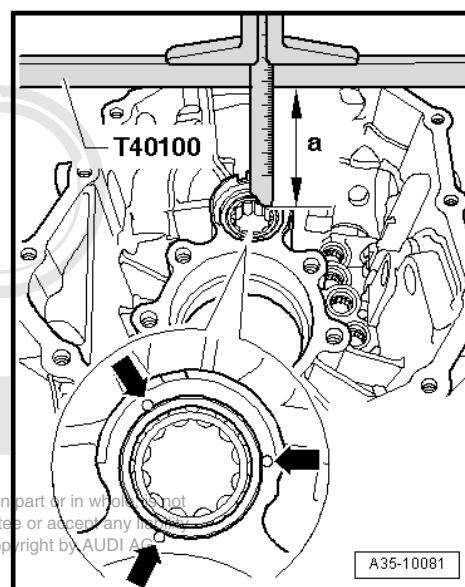
Install needle bearing so the lettering (side with thicker metal) faces towards the drift sleeve -30 - 100- .

Insertion depth of needle bearing ⇒ [page 55](#) .



Measuring insertion depth of needle bearing and peening needle bearing

- Dimension for pressing in -a- = 88.0 ± 0.5 mm
- Use a blunt punch with a ball shaped end (ball $\varnothing$ approx. 5 mm) to peen in position.
- The needle bearing is secured with 3 peening positions offset by 120° -arrows-.

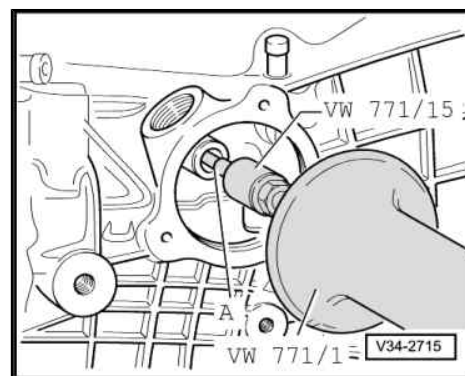


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Removing selector shaft ball sleeve

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

- Eliminate peening depressions if necessary.



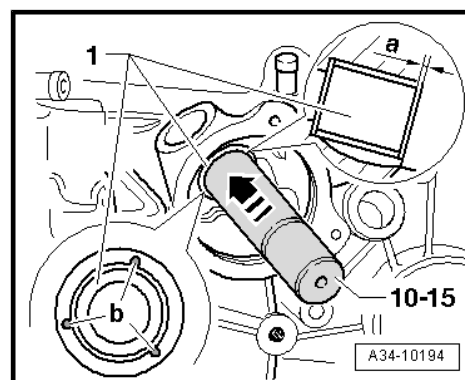
Driving in ball sleeve for selector shaft and securing by peening

Fit ball sleeve so that side with lettering (thicker metal) faces guide pin -10 - 15- .

- Drive in ball sleeve -1- to depth -a- = 1.5 ± 0.5 mm below surface of housing.

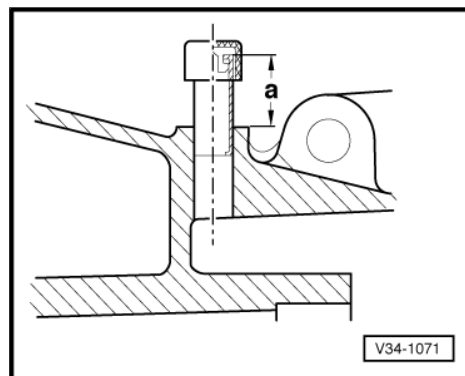
Perform the following procedure to secure by peening after driving in:

- Use a blunt punch with a ball shaped end to peen ball sleeve in position.
- The ball sleeve is secured with 3 peening positions -b- offset by 120° .



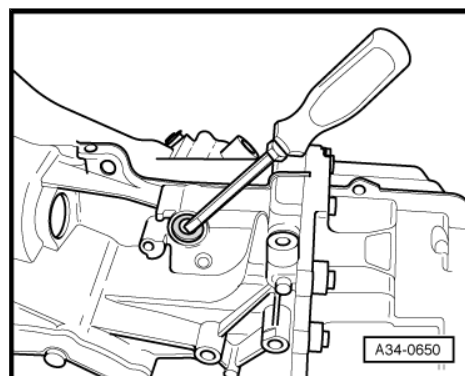
Installation dimension of breather pipe

Dimension -a- = 16.8 mm



Pulling out oil seal for selector shaft with gearbox dismantled

- Lever out oil seal carefully with a screwdriver.

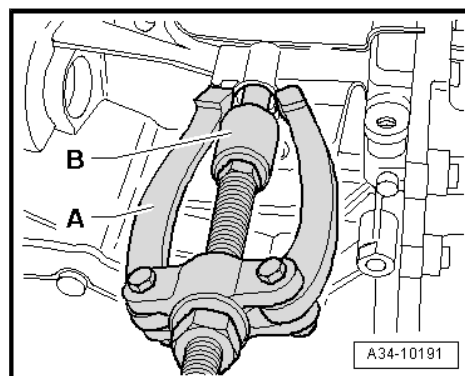


Removing selector shaft ball sleeve

First remove selector shaft oil seal ➤ [page 56](#) .

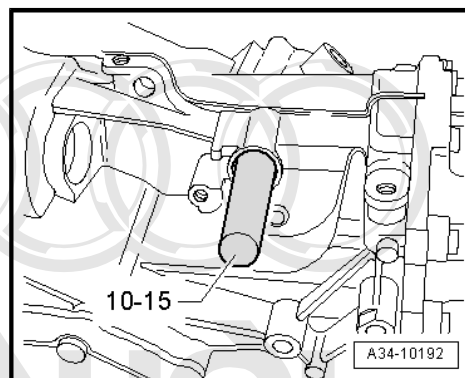
A - Counter-support , e.g. -Kukko 22/1-

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



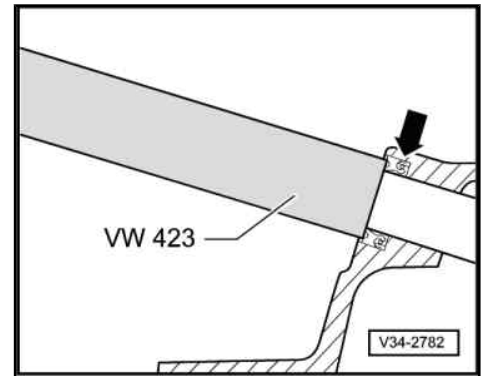
Driving in ball sleeve for selector shaft

- Insertion depth: 8.5 ± 0.5 mm below surface of housing.



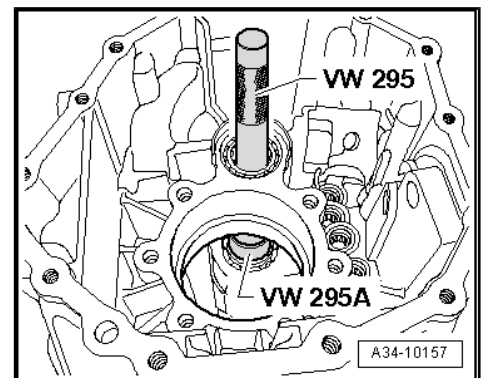
Driving in oil seal for selector shaft

- Pack space between sealing lip and dust lip half-full with sealing grease -G 052 128 A1- .
- Lightly oil outer circumference of oil seal.
- Knock in new oil seal -arrow- to a depth of 1.0 ± 0.2 mm below surface of housing; keep seal straight when installing.



Removing grooved ball bearing for input shaft when gearbox is dismantled

- Fit smaller diameter of adapter -VW 295 A- into grooved ball bearing.
- Drive out grooved ball bearing.

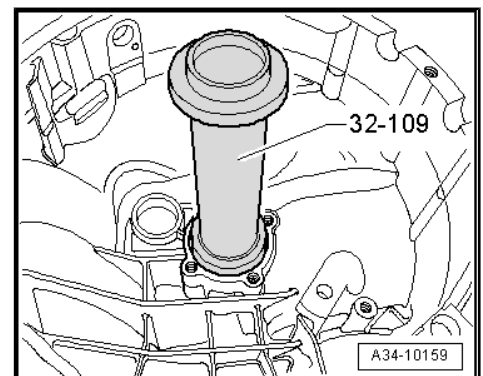


Driving in grooved ball bearing for input shaft as far as stop

Installation position:

The sealed side of the ball cage faces the gearbox housing.

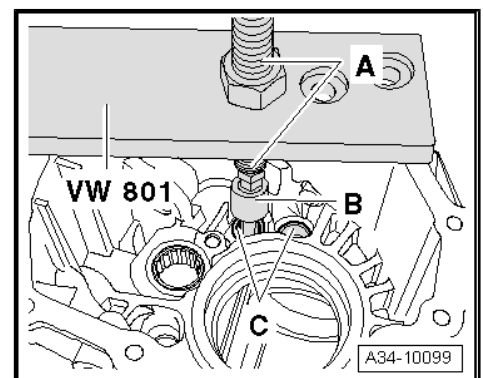
- Drive grooved ball bearing onto stop in gearbox housing.



Pulling out ball sleeve -C- for selector rod

A - Counter-support , e.g. -Kukko 22/2-

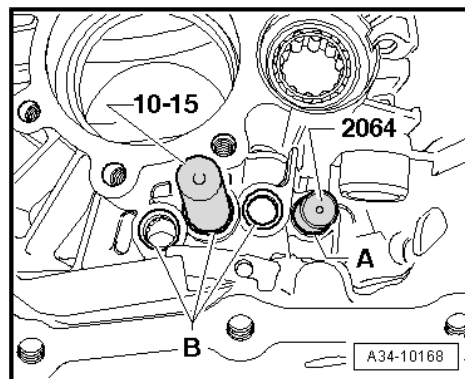
B - Internal puller 14.5...18.5 mm , e.g. -Kukko 21/2-



Driving in ball sleeve for selector rod

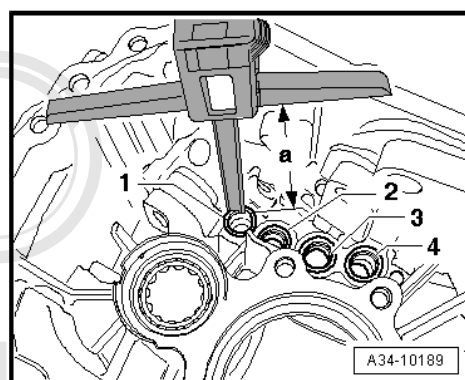
- Drive in ball sleeve -A- for 5th and 6th speed selector rod to installation depth ➔ [page 58](#) using locking pin -2064- .
- Drive in remaining three ball sleeves -B- to installation depth ➔ [page 58](#) using guide pin -10 - 15- .

Fit ball sleeve so that side with lettering (thicker metal) faces guide pin -10 - 15- or locking pin -2064- .



Insertion depth of ball sleeves in gearbox housing

- Press in ball sleeve for 5th/6th gear selector rod -1- to dimension -a- = 143.5 ± 0.5 mm.
- Press in ball sleeve for 3rd/4th gear selector rod -2- to dimension -a- = 133.5 ± 0.5 mm.
- Press in ball sleeve for 1st/2nd gear selector rod -3- to dimension -a- = 116.5 ± 0.5 mm.
- Press in ball sleeve for reverse gear selector rod -4- to dimension -a- = 116.5 ± 0.5 mm.



Note

Measure distance between surface of housing to respective ball sleeve using depth gauge.

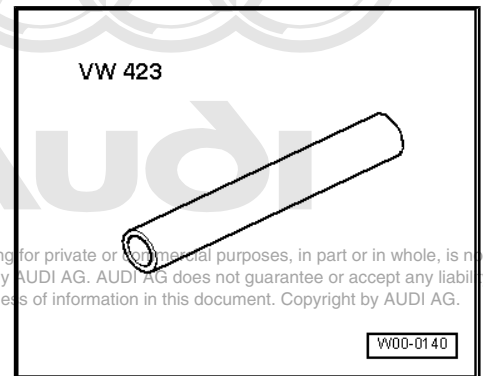
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4 Servicing selector shaft

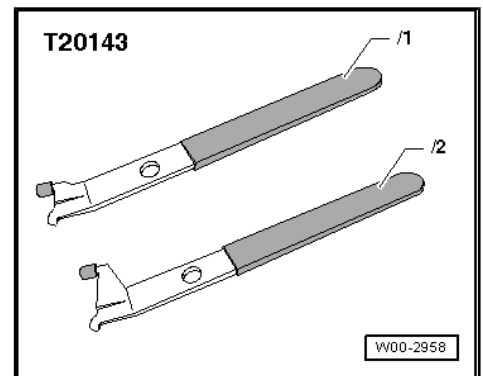
4.1 Renewing oil seal for selector shaft with gearbox removed (gearbox remains assembled)

Special tools and workshop equipment required

- ◆ Tube -VW 423-



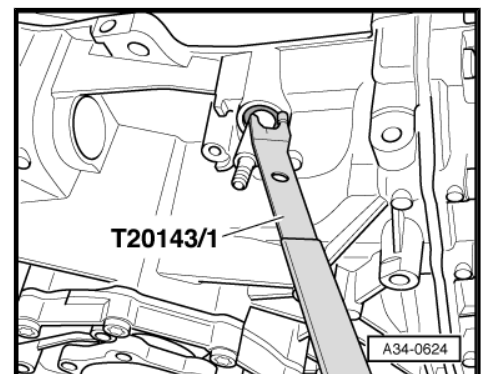
- ◆ Extractor lever -T20143/1-



- ◆ Assembly sleeve -01E 311 120-
- ◆ Sealing grease -G 052 128 A1-

Removing

- With selector shaft installed
- Carefully lever out oil seal, making sure shaft is not damaged.



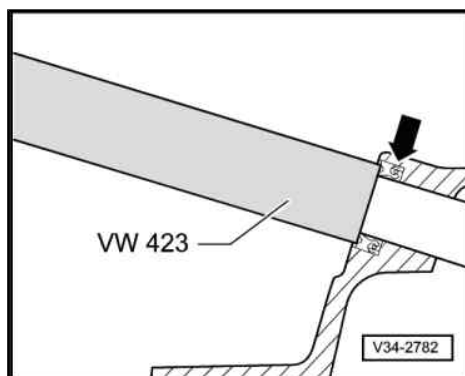
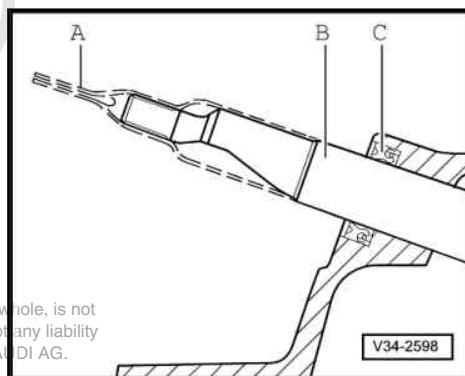
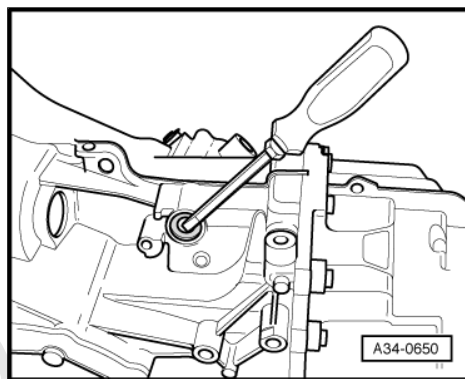
- With selector shaft removed
- Carefully lever out oil seal using a screwdriver or extractor tool -T20143- .

Installing

- To avoid damaging oil seal -C-, oil seal and selector shaft must only be fitted using assembly sleeve -01E 311 120- -A-.
- Pack space between sealing lip and dust lip half-full with sealing grease -G 052 128 A1- .
- Lightly oil outer circumference of oil seal.

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- Knock in new oil seal -arrow- to a depth of 1.0 ± 0.2 mm below surface of housing; keep seal straight when installing.



35 – Gears, shafts

1 Input shaft

1.1 Input shaft - exploded view

Dismantling and assembling input shaft - assembly sequence

⇒ [page 65](#)



Note

- ◆ Refer to technical data when installing new gears ⇒ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 00.
- ◆ When renewing synchro-rings, renew inner ring, intermediate ring and synchro-ring for the corresponding gear together.
- ◆ Lubricate all bearings and synchro-rings on input shaft with gear oil before installing.
- ◆ The 12-point nut ⇒ [Item 7 \(page 62\)](#) has a left-hand thread; turn nut clockwise to unfasten.
- ◆ Items 8, 11 to 14, 18 to 21, 25, 28 to 31 and 34 to 37 were modified on gearboxes with spring-loaded selector forks ⇒ [page 16](#). Refer to ⇒ Electronic parts catalogue "ETKA" to allocate components.



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1 - Circlip

2 - Grooved ball bearing

- ☐ Renewing (gearbox removed but not dismantled) ➤ [page 42](#)
- ☐ Renewing (gearbox dismantled) ➤ [Item 10 \(page 53\)](#)

3 - Gearbox housing

4 - Needle bearing

- ☐ Removing and installing ➤ [Item 1 \(page 53\)](#)

5 - Circlip

- ☐ Re-determining thickness ➤ [page 73](#)

6 - Washer

- ☐ Re-determining thickness ➤ [page 73](#)

7 - 12-point nut, 75 Nm

- ☐ On some gearboxes the tightening torque can be above specification ➤ [page 73](#)
- ☐ With left-hand thread

8 - 4th speed selector gear

9 - Needle bearing

- ☐ For 4th gear

10 - Needle bearing inner race

- ☐ For 4th speed selector gear

11 - Inner ring for 4th gear

- ☐ Installation position ➤ [page 69](#)
- ☐ Renew if scored or if there are visible traces of wear

12 - Intermediate ring for 4th gear

- ☐ Installation position ➤ [page 69](#)
- ☐ Checking for wear ➤ [page 68](#)

13 - Synchro-ring for 4th gear

- ☐ Installation position ➤ [page 69](#)
- ☐ Checking for wear ➤ [page 68](#)
- ☐ Renew if scored or if there are visible traces of wear

14 - Locking collar for 3rd and 4th gear

- ☐ Assembling locking collar/synchronising hub ➤ [page 72](#)

15 - Locking piece

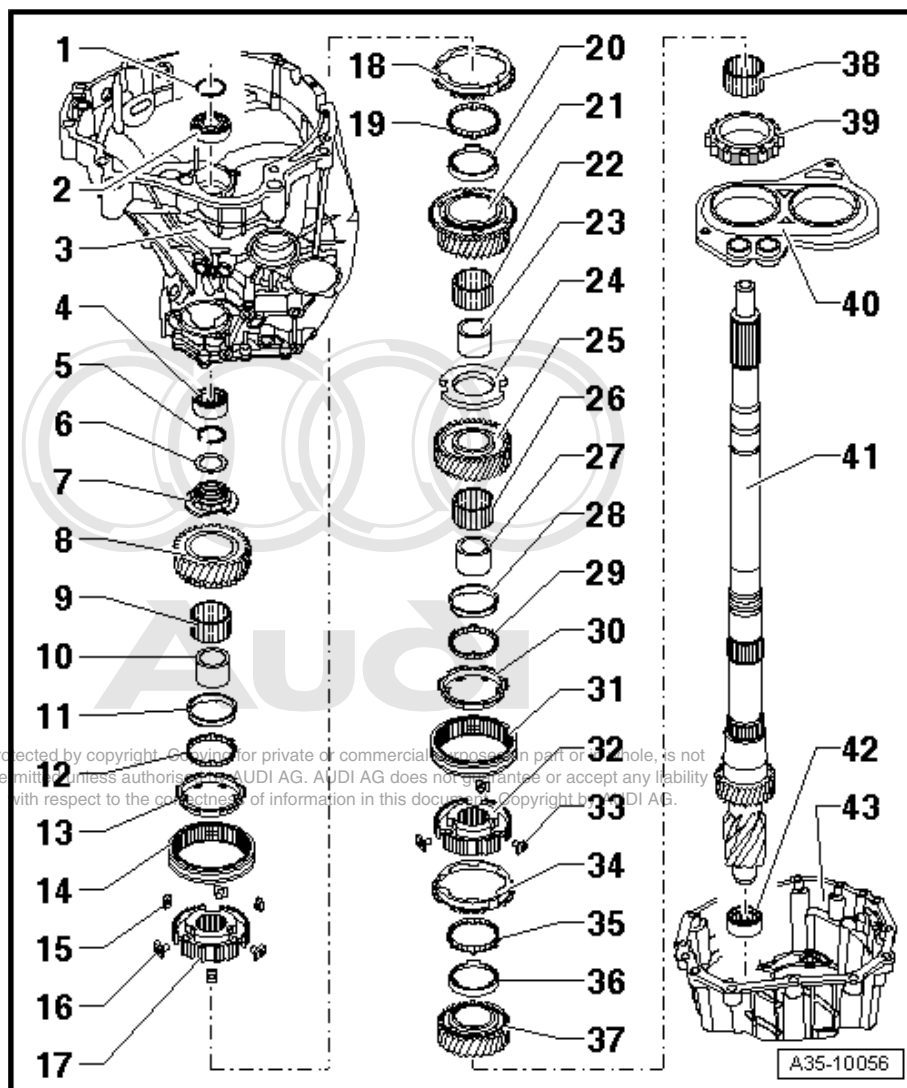
- ☐ Installation position: insert locking piece into locking collar with convex side first ➤ [page 72](#)
- ☐ Installing locking pieces (3x) ➤ [page 72](#)

16 - Thrust block

- ☐ Installing thrust blocks (3x) ➤ [page 72](#)

17 - Synchronising hub for 3rd and 4th gear

- ☐ Pressing off ➤ [page 67](#)



- ☐ Pressing on ⇒ [page 71](#)
- ☐ Assembling locking collar/synchronising hub ⇒ [page 72](#)

18 - Synchro-ring for 3rd gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Checking for wear ⇒ [page 68](#)
- ☐ Renew if scored or if there are visible traces of wear

19 - Intermediate ring for 3rd gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Checking for wear ⇒ [page 68](#)

20 - Inner ring for 3rd gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Renew if scored or if there are visible traces of wear

21 - 3rd speed selector gear

22 - Needle bearing

- ☐ For 3rd gear

23 - Needle bearing inner race

- ☐ For 3rd speed selector gear

24 - Thrust washer

- ☐ For 3rd speed and 6th speed selector gears

25 - 6th speed selector gear

26 - Needle bearing

- ☐ For 6th gear

27 - Needle bearing inner race

- ☐ For 6th speed selector gear

28 - Inner ring for 6th gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Renew if scored or if there are visible traces of wear

29 - Intermediate ring for 6th gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Checking for wear ⇒ [page 68](#)

30 - Synchro-ring for 6th gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Checking for wear ⇒ [page 68](#)
- ☐ Renew if scored or if there are visible traces of wear

31 - Locking collar for 5th and 6th gear

- ☐ Assembling locking collar/synchronising hub ⇒ [page 69](#)

32 - Synchronising hub for 5th and 6th gear

- ☐ Installation position: high inside collar faces 5th speed selector gear
- ☐ Pressing off ⇒ [page 67](#)
- ☐ Pressing on ⇒ [page 70](#)
- ☐ Assembling locking collar/synchronising hub ⇒ [page 69](#)

33 - Thrust block

- ☐ Installing thrust blocks (3x) ⇒ [page 69](#)

34 - Synchro-ring for 5th gear

- ☐ Installation position ⇒ [page 69](#)
- ☐ Checking for wear ⇒ [page 68](#)

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- ☐ Renew if scored or if there are visible traces of wear

35 - Intermediate ring for 5th gear

- ☐ Installation position ➤ [page 69](#)
- ☐ Checking for wear ➤ [page 68](#)

36 - Inner ring for 5th gear

- ☐ Installation position ➤ [page 69](#)
- ☐ Renew if scored or if there are visible traces of wear

37 - 5th speed selector gear

38 - Needle bearing

- ☐ For 5th gear

39 - Roller bearing

- ☐ For input shaft
- ☐ Do not interchange with roller bearing for pinion shaft
- ☐ Pressing off ➤ [page 68](#)
- ☐ Pressing on ➤ [page 69](#)

40 - Bearing mounting

- ☐ The roller bearing outer race ➤ [Item 39 \(page 64\)](#) cannot be renewed individually, renew bearing mounting if signs of wear are found.
- ☐ The roller bearing outer race must not have any radial clearance in the bearing mounting

41 - Input shaft

- ☐ Identification of input shafts ➤ [page 64](#)
- ☐ Modification: with additional "PTFE element" for positioning needle bearing for 5th gear ➤ [page 64](#) ; select components from ➤ Electronic parts catalogue "ETKA"

42 - Roller bearing

- ☐ Bearing for input shaft in gearbox cover
- ☐ Always renew
- ☐ Removing and installing ➤ [Item 5 \(page 48\)](#)

43 - Gearbox cover

Identification of input shafts

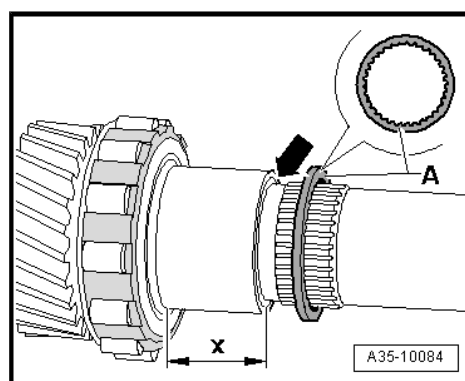
Dimension x = 31 mm for input shafts without "PTFE element"

Dimension x = 29 mm for input shafts with "PTFE element" -A-



Note

Push "PTFE element" -A- onto input shaft -arrow- as far as stop after fitting needle bearing for 5th gear.

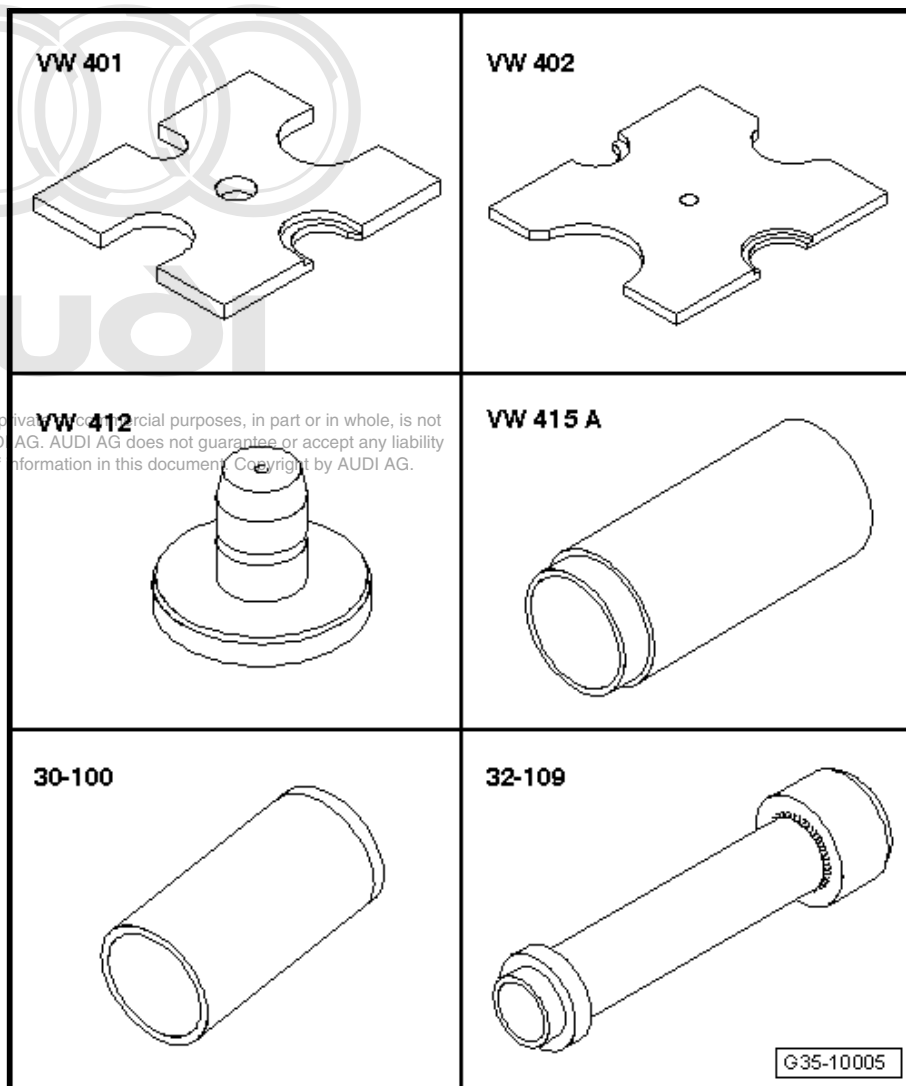


1.2 Dismantling and assembling input shaft - assembly sequence

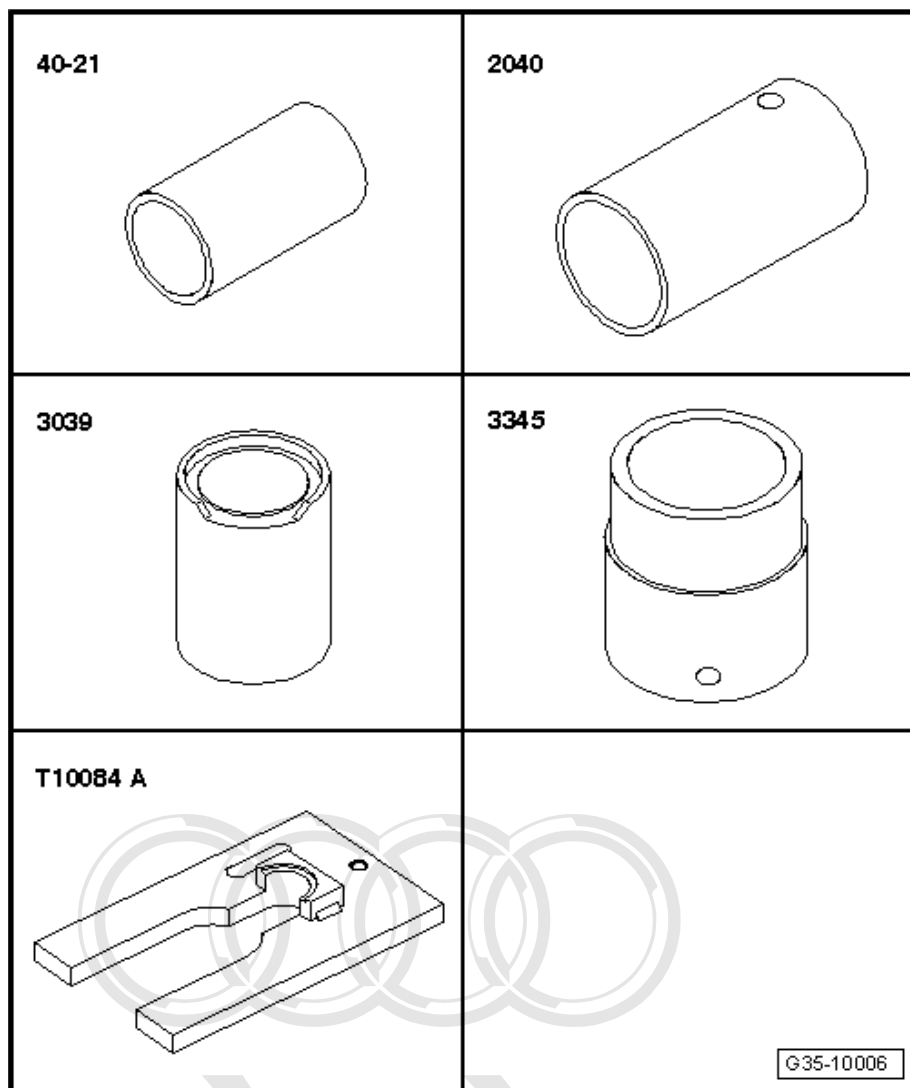
Special tools and workshop equipment required

- ◆ Thrust plate -VW 401-
- ◆ Thrust plate -VW 402-
- ◆ Press tool -VW 412-
- ◆ Tube -VW 415 A-
- ◆ Drift sleeve -30 - 100-
- ◆ Tube -32 - 109-

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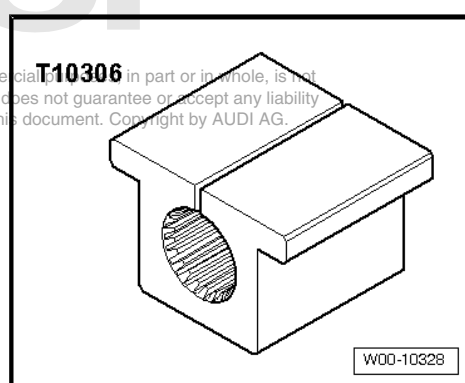


- ◆ Press tool -40 - 21-
- ◆ Tube -2040-
- ◆ Guide sleeve -3039-
- ◆ Tube for wheel bearing -3345-
- ◆ Thrust plate -T10084 A-
- ◆ Feeler gauge

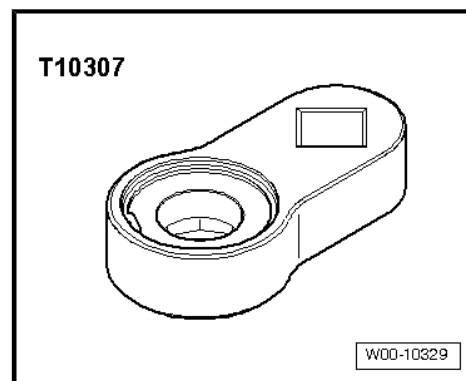


- ◆ Clamping device -T10306-

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◆ Angled ring spanner -T10307-



Dismantling input shaft

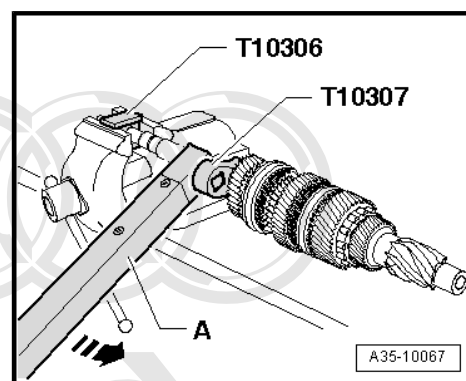
- First remove circlip ⇒ [Item 5 \(page 62\)](#) and washer ⇒ [Item 6 \(page 62\)](#) in front of 12-point nut on removed input shaft.
- Apply angled ring spanner -T10307- to 12-point nut.
- For the next step, the end of the input shaft with the clutch plate splines must be placed in clamping device -T10306- and clamped in a vice.

A - Torque wrench



Note

- ◆ Due to the offset centre of gravity of the input shaft, the input shaft must be supported (e.g. by a second mechanic).
- ◆ The 12-point nut has a "left-hand thread" (turn tool in direction of arrow to slacken nut).



- Unfasten twelve-point nut by turning in direction of -arrow-.

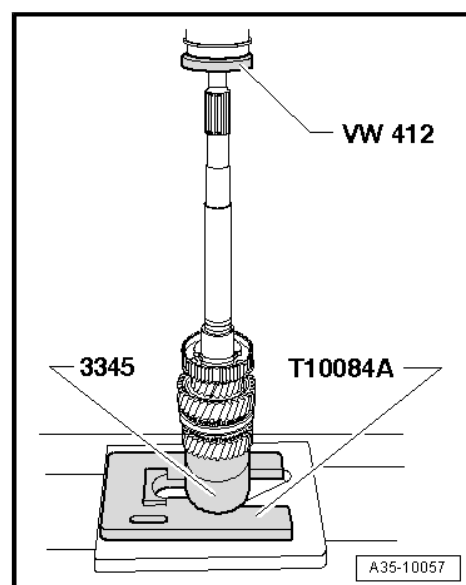
- Remove 4th speed selector gear with needle bearing and synchro-rings.

- Press off 3rd speed, 5th speed and 6th speed selector gears together with synchronising hub and needle bearing inner races.



Note

It may be necessary to exert a pressure of up to 200 kN (20 t).



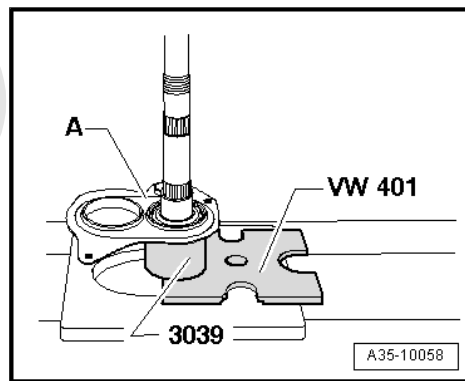
- Position bearing mounting -A- over input shaft roller bearing to prevent the rollers from being pressed out of the bearing cage.
- Press roller bearing off input shaft.
- Clean thread for 12-point nut on input shaft to remove any residue of locking fluid.

Assembling input shaft



Note

- ♦ **Clean the input shaft thread.**
- ♦ **Lubricate all needle bearings and synchro-rings with gear oil before fitting.**
- ♦ **Heat needle bearing inner races and roller bearing to 130 °C (max.) before pressing on (wear protective gloves).**
- ♦ **Heat synchronising hubs to 100 °C (max.) before pressing on (wear protective gloves).**
- ♦ **Always press on roller bearing, needle bearing inner races and synchronising hubs as far as stop to make sure the axial clearance of the selector gears meets the specification.**



Checking 3rd to 6th gear synchro-rings for wear

- Check outer friction surface on inner ring for scoring or visible traces of wear and renew if necessary.
- Check inner friction surface of synchro-ring for scoring or visible traces of wear and renew if necessary.
- Fit inner ring, intermediate ring and synchro-ring onto cone of selector gear and rotate to achieve proper seating.

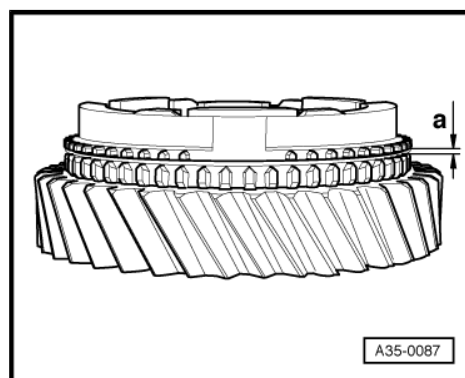


Note

To achieve proper seating, rotate synchro-rings approx. one turn while pressing down rings simultaneously.

- Then measure gap -a- using a feeler gauge .

Gap -a-	Wear limit
3rd to 6th gear	0.7 mm



Note

Renew inner ring, intermediate ring and synchro-ring for the corresponding gear together.

Installation position of synchro-rings for 3rd to 6th gear

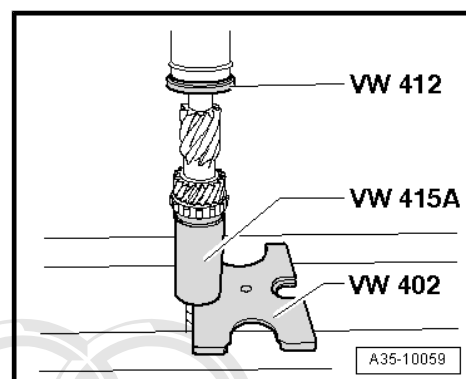
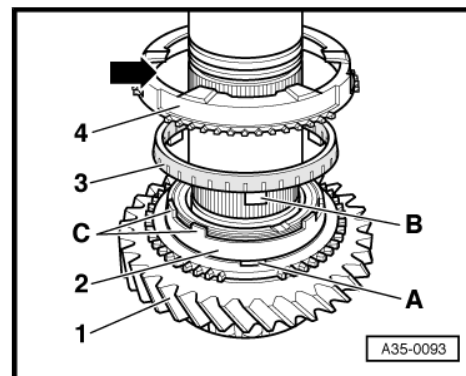


Note

If components are not being renewed, make sure they are re-installed on the same gear.

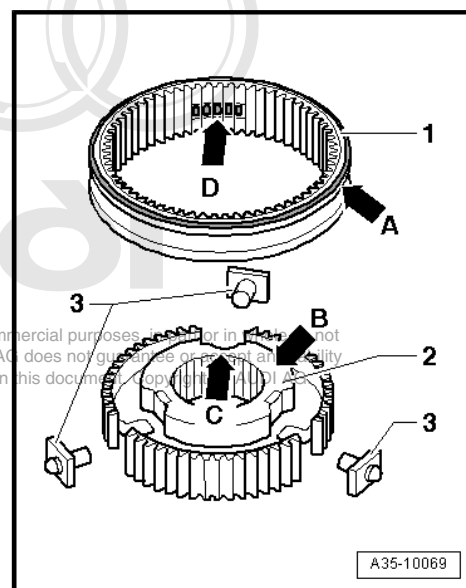
- Fit inner ring -2- onto selector gear -1-.
- Fit intermediate ring -3-. Lug -B- must be inserted into recess -A-.
- Fit synchro-ring -4-. Guide lugs -C- through recess -arrow-.
- Press roller bearing onto input shaft as far as stop (shoulder on tube -VW 415 A- faces roller bearing).
- Install 5th speed selector gear with needle bearing and synchro-rings.

Now fit PTFE element if the input shaft is supplied with additional "PTFE element" ➔ [page 64](#) .



Assembling 5th and 6th gear locking collar/synchronising hub

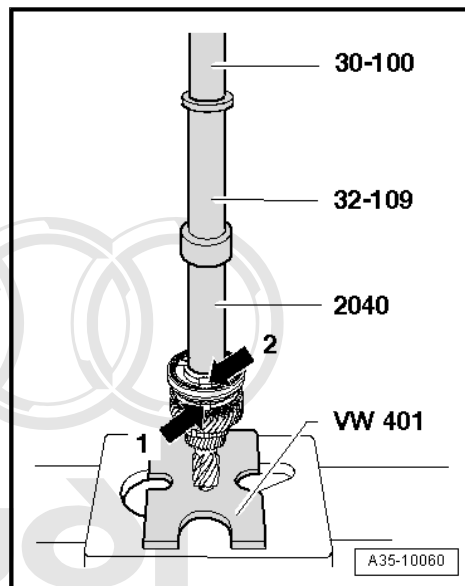
- Slide locking collar -1- over synchronising hub -2-.
- The groove -arrow A- on the locking collar and the high inside collar -arrow B- on the synchronising hub must face 5th speed selector gear.
- The recesses -arrow C- for the thrust blocks -3- in the synchronising hub must align with the recesses -arrow D- in the locking collar.
- Then position thrust blocks -3- in synchronising hub and press thrust blocks into recesses in locking collar.



Pressing on 5th and 6th gear synchronising hub with locking collar

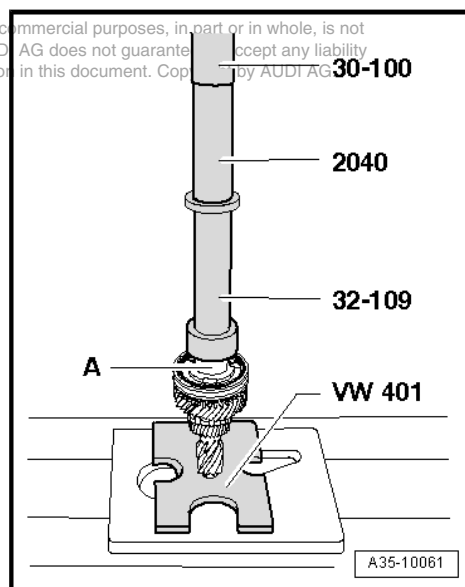
Note the following when performing the following steps:

- Fit input shaft in drilling of thrust plate -VW 401- .
- Position drift sleeves on centre of heated components (synchronising hub and needle bearing inner races).
- First press on components just briefly, then stop exerting pressure and check whether drift sleeves are still positioned properly and press on as far as stop.
- On an input shaft with "PTFE element", the "PTFE element" must be fitted before pressing on the synchronising hub for 5th and 6th gear.
- When pressing on, lugs on synchro-ring -arrow 1- must line up with recesses in synchronising hub -arrow 2-.

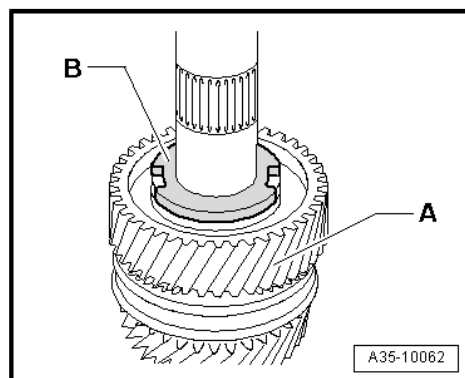


Pressing on needle bearing inner race -A- for 6th speed selector gear

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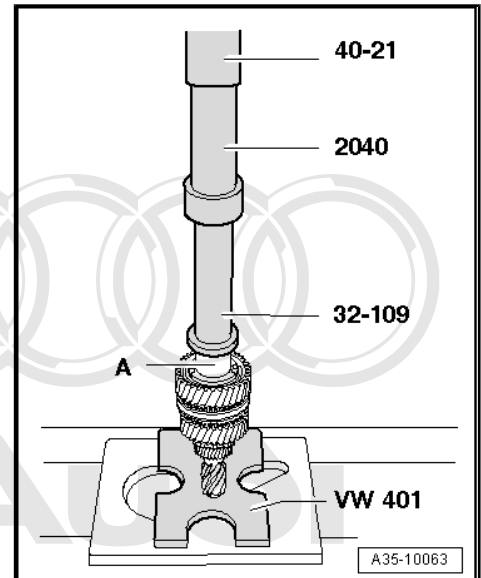


- Install 6th speed selector gear -A- with needle bearing and synchro-rings.
- Position thrust washer -B- for 3rd speed and 6th speed selector gears on 6th speed selector gear.



Pressing on needle bearing inner race -A- for 3rd speed selector gear

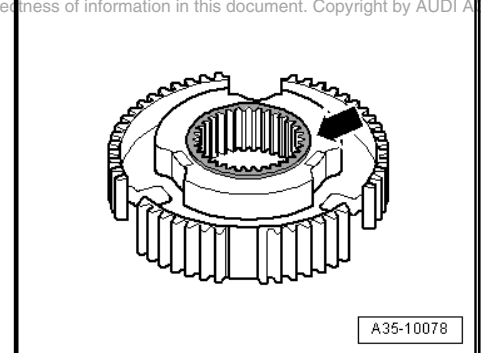
- Fit 3rd speed selector gear with needle bearing and synchro-rings.



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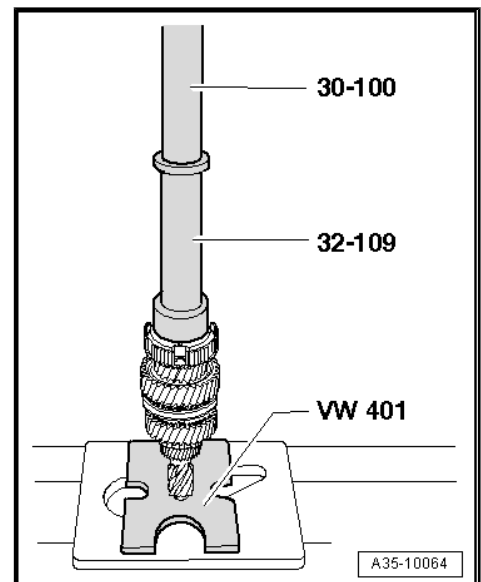
Installation position of 3rd and 4th gear synchronising hub

- The shoulder -arrow- on the synchronising hub faces towards 3rd speed selector gear.



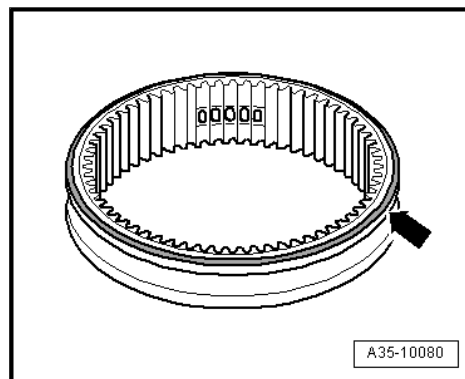
Pressing on synchronising hub for 3rd and 4th gear

- When pressing on, lugs on synchro-rings must line up with recesses in synchronising hub.



Installation position of 3rd and 4th gear locking collar

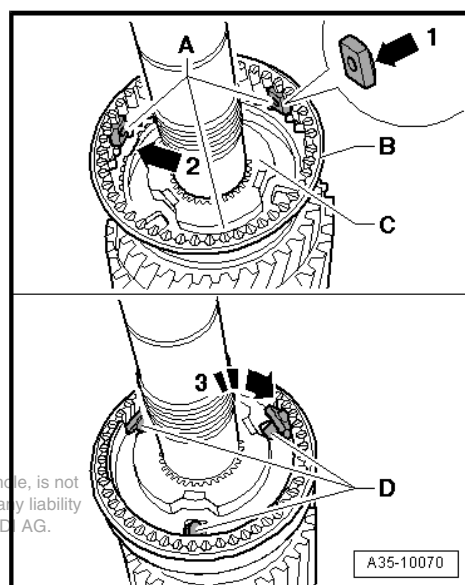
- The groove -arrow- on the locking collar faces towards 3rd speed selector gear.



Assembling 3rd and 4th gear locking collar/synchronising hub

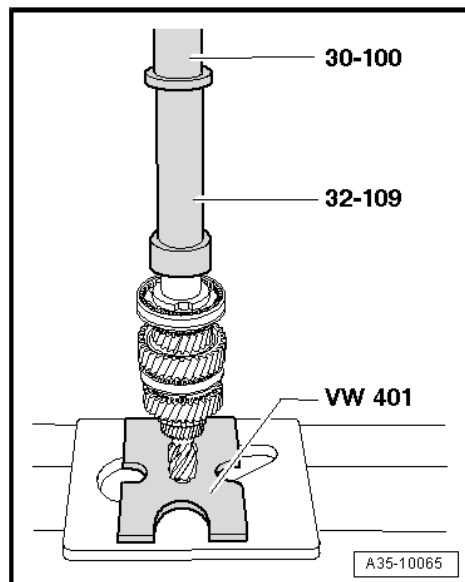
- 3rd and 4th gear synchronising hub is pressed on.
- Apply a small amount of grease to convex side -arrow 1- of each of the three locking pieces -A-.
- Fit the three locking pieces with convex side first into recesses in locking collar -B-.
- Note installation position of locking collar ➤ [page 72](#) .
- Then position locking collar over synchronising hub -C- so that recesses on synchronising hub -arrow 2- align with locking pieces.
- Then position thrust blocks -D- in synchronising hub and press thrust blocks in direction of -arrow 3- into recesses in locking collar. The locking collar must be held in the centre position.

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Pressing on needle bearing inner race for 4th speed selector gear

- Fit 4th speed selector gear with needle bearing and synchronising rings.
- Clean thread of used 12-point nut.
- Screw 12-point nut hand-tight onto input shaft.

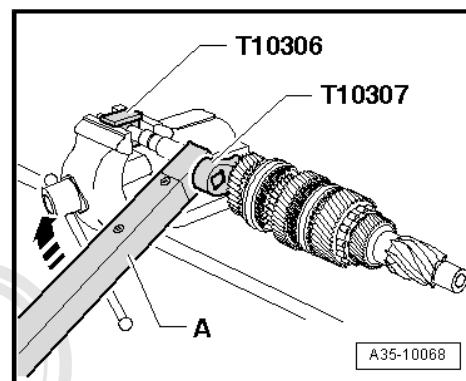


- Apply angled ring spanner -T10307- to 12-point nut.
- For the next step, the end of the input shaft with the clutch plate splines must be placed in clamping device -T10306- and clamped in a vice.



Note

- ◆ Due to the offset centre of gravity of the input shaft, the input shaft must be supported (e.g. by a second mechanic).
- ◆ The 12-point nut has a "left-hand thread" (turn tool in direction of arrow to tighten nut).



A - Torque wrench

- Turn 12-point nut in direction of -arrow- and tighten to 75 Nm.



Note

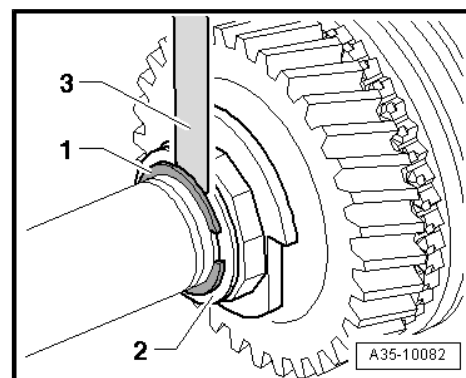
If input shaft, selector gears or synchronising hubs are not being renewed, screw in 12-point nut until it is possible to re-fit the existing shim and circlip.

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- Then check selector gears for freedom of movement and axial play.
- The axial play of the selector gears must be at least 0.10 mm.

The thickness of the circlip -1- and the shim -2- is determined according to the following procedure:

- The gap after fitting shim and circlip available as spare parts must be max. 0.10 mm (measured between circlip and shim).
- Check the gap with a feeler gauge -3-.



Note

The circlip -1- must be properly seated in the base of the groove when checking the gap.

- Determine shim and circlip from table. Part numbers ⇒ Electronic parts catalogue "ETKA".

The following circlips are available:

Circlip thickness (mm)		
1.70	1.80	1.90
1.75	1.85	

The following shims are available:

Shim thickness (mm)		
0.9	1.1	1.3
1.0	1.2	

- Install shim and circlip of the correct thickness as determined above.

2 Pinion shaft

2.1 Pinion shaft - exploded view of components

Dismantling and assembling pinion shaft ➔ [page 78](#)



Note

- ◆ *Refer to technical data when installing new gears or final drive gear set ➔ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 00.*
- ◆ *Always renew the double angular contact ball bearing on the pinion shaft when renewing the final drive gear set or if gear oil is contaminated with metal particles.*
- ◆ *Lubricate all needle bearings and synchro-rings with gear oil before installing.*
- ◆ *When renewing synchro-rings, renew inner ring, intermediate ring and synchro-ring for the corresponding gear together.*
- ◆ *If synchro-rings are not being renewed, make sure they are re-installed on the same gear. Do not interchange synchro-rings for reverse gear with synchro-rings for 1st and 2nd gear ➔ [page 34](#).*
- ◆ *Items 18 to 25 and 28 were modified on 1st and 2nd gear selector rod version with spring-loaded selector fork ➔ [page 13](#). Refer to ➔ Electronic parts catalogue "ETKA" to allocate components.*
- ◆ *Adjustment work is required when renewing the parts marked with ¹⁾. Table of adjustments ➔ [page 98](#).*



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1 - Gearbox housing 1)

2 - Shim "S3"

- ☐ Table of adjustments
 ⇒ [page 98](#)

3 - Pinion shaft 1)

- ☐ Is mated with crown wheel, always renew together as a set
- ☐ Dismantling and assembling ⇒ [page 78](#)
- ☐ Adjusting crown wheel and pinion shaft
 ⇒ [page 96](#)

4 - Double angular contact ball bearing

- ☐ If only this bearing is renewed, re-adjustment is not necessary
- ☐ Pressing off
 ⇒ [page 79](#)
- ☐ Pressing on
 ⇒ [page 79](#)
- ☐ Installation position:
 shoulder on outer race
 faces towards pinion
 gear

5 - Shim "S4"

- ☐ Table of adjustments
 ⇒ [page 98](#)

6 - Retaining plate

- ☐ Installation position:
 machined side faces to-
 wards gearbox housing
 (can only be installed in one position).

7 - Bolt, 30 Nm

- ☐ 6 x
- ☐ Apply locking fluid -AMV 185 101 A1- when fitting

8 - Shim "S5"

- ☐ To position 4th speed gear
- ☐ Re-determining thickness ⇒ [page 79](#)

9 - 4th gear wheel

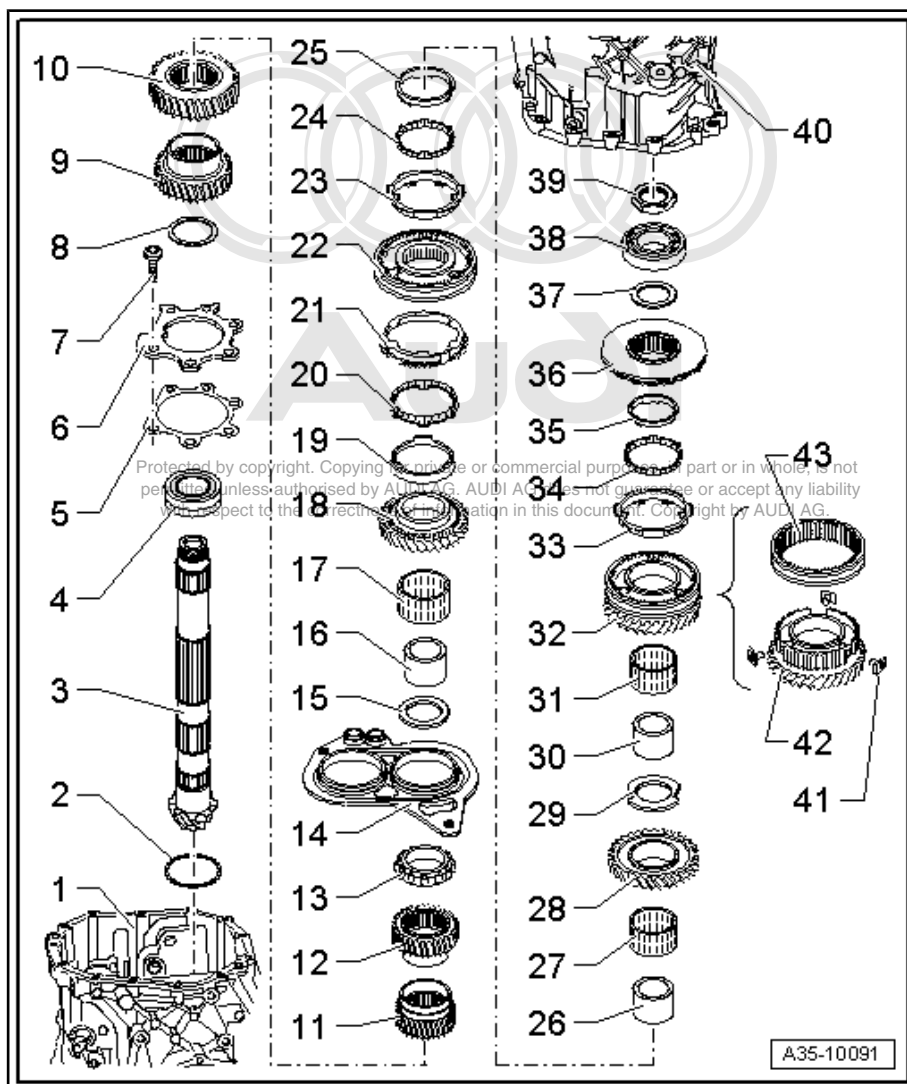
- ☐ Pulling off ⇒ [page 28](#)
- ☐ Driving on ⇒ [page 31](#)
- ☐ Installation position: high inside collar faces 3rd gear wheel

10 - 3rd gear wheel

- ☐ Pulling off ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 31](#)
- ☐ Installation position: high inside collar faces 4th gear wheel

11 - 6th gear wheel

- ☐ Pulling off ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 32](#)
- ☐ Installation position: high inside collar faces 5th gear wheel



12 - 5th gear wheel

- ☐ Pulling off ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 32](#)
- ☐ Installation position: high inside collar faces towards 6th gear wheel

13 - Roller bearing

- ☐ For pinion shaft
- ☐ Do not interchange with roller bearing for input shaft
- ☐ Pulling off with 5th gear wheel ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 32](#)

14 - Bearing mounting

- ☐ The roller bearing outer race ⇒ [Item 23 \(page 15\)](#) cannot be renewed individually; renew bearing mounting if signs of wear are found.
- ☐ The roller bearing outer race must not have any radial clearance in the bearing mounting.

15 - Shim "S6"

- ☐ To position 2nd speed selector gear
- ☐ Re-determining thickness ⇒ [page 80](#)

16 - Needle bearing inner race

- ☐ For 2nd speed selector gear
- ☐ Pulling off with 5th gear wheel ⇒ [page 27](#)
- ☐ Driving on ⇒ [page 33](#)

17 - Needle bearing

- ☐ For 2nd gear

18 - 2nd speed selector gear

19 - Inner ring for 2nd gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

20 - Intermediate ring for 2nd gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)

21 - Synchro-ring for 2nd gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

22 - Locking collar with synchronising hub for 1st and 2nd gear

- ☐ Removing and installing ⇒ [page 17](#)
- ☐ Installation position of locking collar: the side with asymmetric splines must point towards 2nd gear ⇒ [page 35](#)
- ☐ Assembling locking collar/synchronising hub ⇒ [page 35](#)

23 - Synchro-ring for 1st gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

24 - Intermediate ring for 1st gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)



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25 - Inner ring for 1st gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

26 - Needle bearing inner race

- ☐ For 1st speed selector gear
- ☐ Pull off together with 2nd speed selector gear ⇒ [page 26](#)
- ☐ Driving on ⇒ [page 36](#)

27 - Needle bearing

- ☐ For 1st gear

28 - 1st speed selector gear

29 - Thrust washer

- ☐ For 1st speed selector gear and reverse gear

30 - Needle bearing inner race

- ☐ For reverse selector gear
- ☐ Pull off together with 1st speed selector gear ⇒ [page 26](#)
- ☐ Driving on ⇒ [page 36](#)

31 - Needle bearing

- ☐ For reverse gear

32 - Reverse selector gear

- ☐ With locking collar for reverse gear
- ☐ Removing and installing ⇒ [page 17](#)
- ☐ Dismantling and assembling locking collar and reverse selector gear ⇒ [page 36](#)

33 - Synchro-ring for reverse gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)
- ☐ Renew if scored or if there are visible traces of wear

34 - Intermediate ring for reverse gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Checking for wear ⇒ [page 34](#)

35 - Inner ring for reverse gear

- ☐ Installation position ⇒ [page 35](#)
- ☐ Renew if scored or if there are visible traces of wear

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36 - Clutch unit

- ☐ Removing and installing ⇒ [page 17](#)

37 - Washer

38 - Grooved ball bearing

- ☐ Pull off with clutch unit ⇒ [page 25](#)
- ☐ Driving on ⇒ [page 37](#)

39 - Nut, 300 Nm

- ☐ Apply locking fluid -AMV 185 101 A1- when fitting
- ☐ Slackening ⇒ [page 24](#)
- ☐ Tightening ⇒ [page 38](#)

40 - Gearbox cover

41 - Thrust block

- ☐ Installing thrust blocks (3x) ⇒ [page 36](#)

42 - Reverse selector gear

43 - Locking collar for reverse selector gear

2.2 Dismantling and assembling pinion shaft

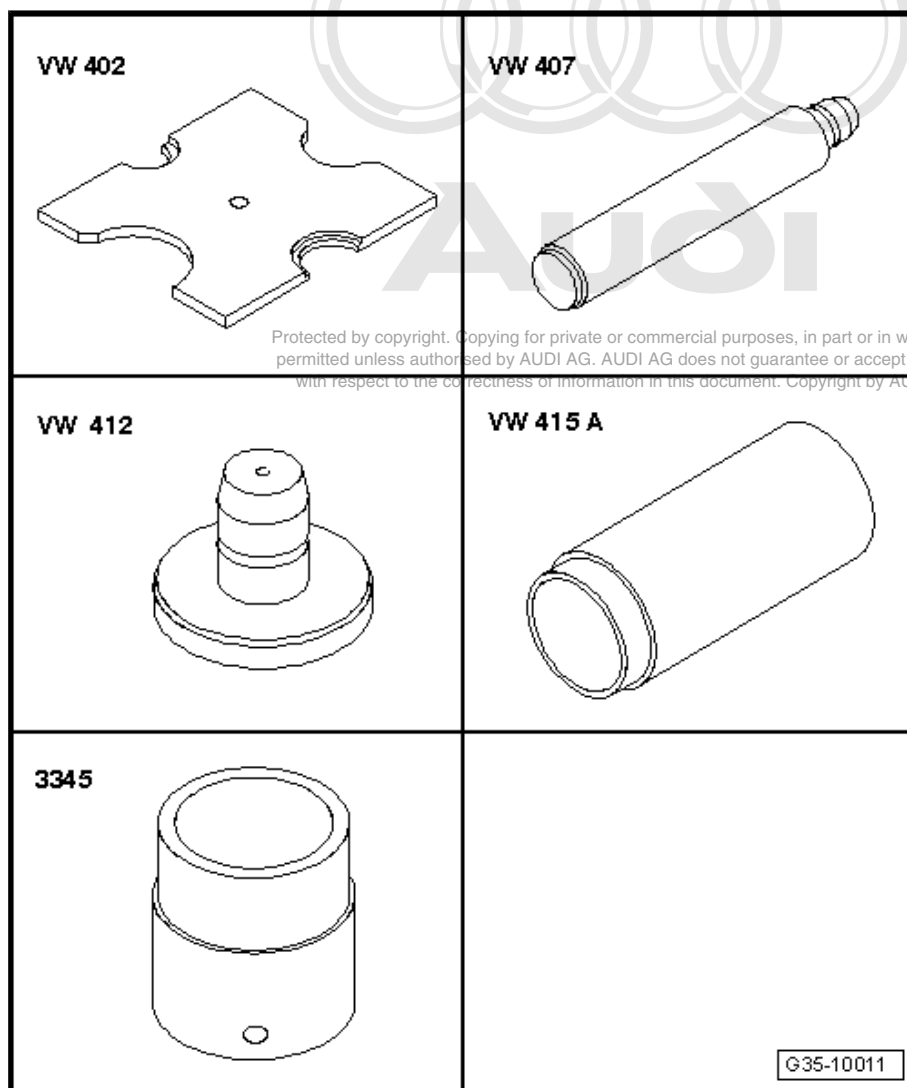


Note

Removing and installing selector gears for 1st and 2nd gear, the reverse selector gear, 3rd to 6th gear wheels and the pinion shaft is described in chapter on dismantling and assembling gearbox
⇒ [page 17](#).

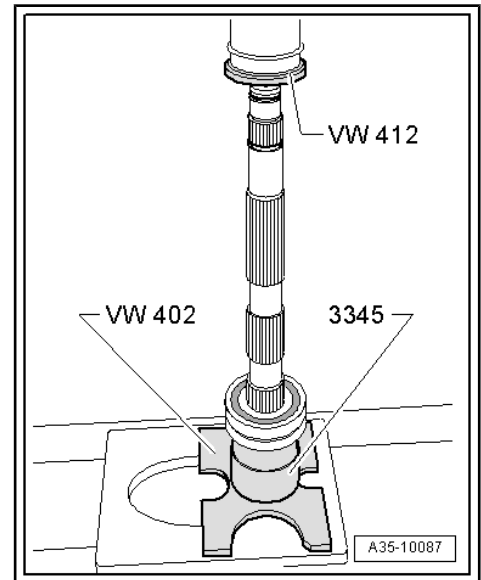
Special tools and workshop equipment required

- ◆ Thrust plate -VW 402-
- ◆ Press tool -VW 407-
- ◆ Press tool -VW 412-
- ◆ Tube -VW 415 A-
- ◆ Tube for wheel bearing -3345-



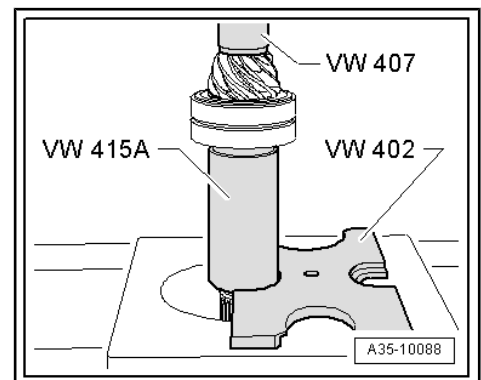
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Pressing off double angular contact ball bearing



Pressing on double angular contact ball bearing

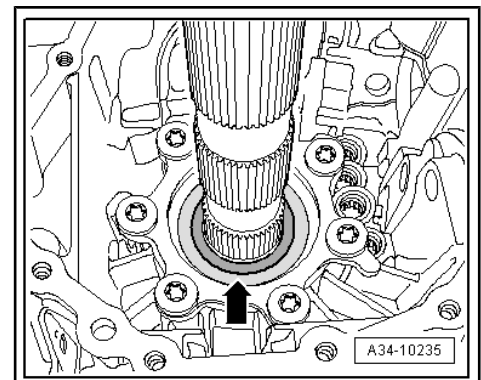
- Installation position: shoulder on bearing outer race faces towards pinion gear.
- Place smaller diameter of tube -VW 415 A- on bearing inner race.
- Press on double angular contact ball bearing as far as it will go.



2.3 Re-determining shim "S₅" for positioning 4th gear wheel

This adjustment is necessary when renewing the final drive gear set.

This shim -arrow- positions the 4th gear wheel (on the pinion shaft).



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The nominal dimension "A1" -arrow- indicating the actual required shim thickness for "S₅" is marked on the crown wheel of the final drive gear set. In this example: dimension "A1" = 98.86 mm.

Determine required shim from table.

The following shims are available:

Nominal dimension "A1"	Shim "S ₅ " ¹⁾
Marked dimension (mm)	Thickness (mm)
99.27...99.30	0.80
99.22...99.26	0.85
99.17...99.21	0.90
99.12...99.16	0.95
99.07...99.11	1.00
99.02...99.06	1.05
98.97...99.01	1.10
98.92...98.96	1.15
98.87...98.91	1.20
98.82...98.86	1.25
98.77...98.81	1.30
98.72...98.76	1.35
98.70...98.71	1.40

1) The exact shim thickness required can be obtained by using the shim tolerance variations. Install two shims if necessary.



Note

Select correct shims from ⇒ *Electronic parts catalogue "ETKA"*.

- The determined shim thickness "S₅" in this example is 1.25 mm.

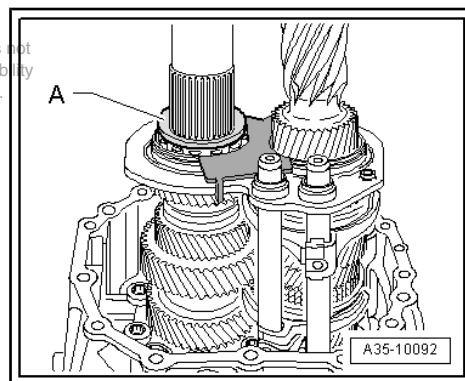
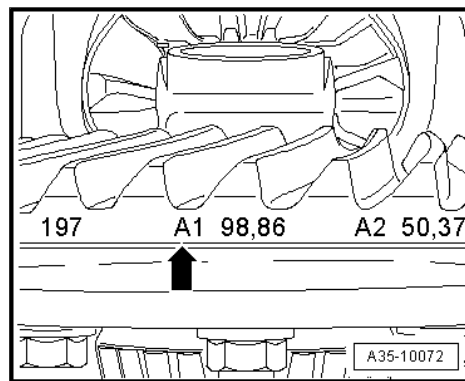
2.4 Re-determining shim "S₆" for positioning 2nd speed selector gear

Shim -A- is responsible for the correct positioning of 2nd speed selector gear and thus the positioning of the gear assembly in the gearbox.

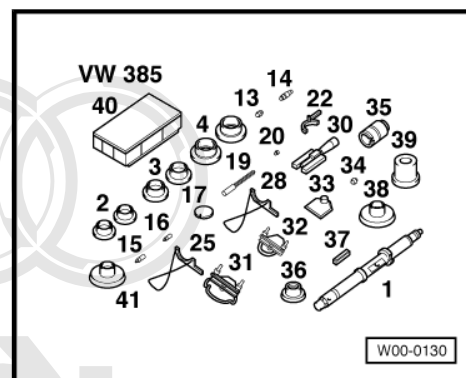
This adjustment is necessary when the following components are renewed:

- ◆ Gearbox housing
 - ◆ Final drive gear set
- or the
- ◆ Gear wheels on pinion shaft

Special tools and workshop equipment required

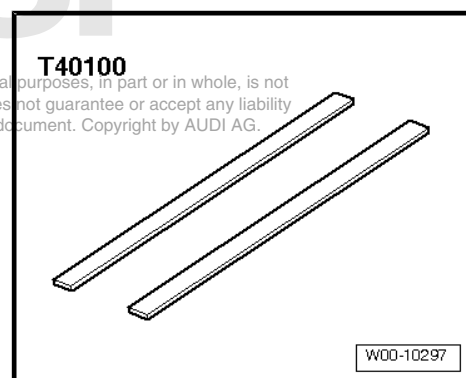


◆ Universal measuring tool -VW 385-



◆ Straightedge -T 40100-

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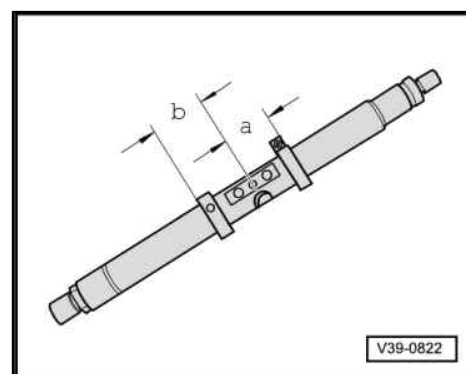


◆ Digital depth gauge (e.g. -VAS 6320-)

- Set adjustment rings of universal measuring tool -VW 385/1- to the following values:

◆ Dimension -a- = 45 mm

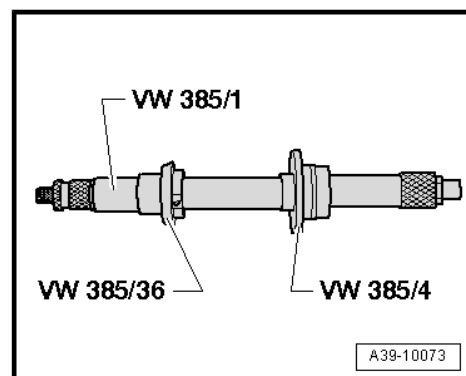
◆ Dimension -b- = 60 mm



- Assemble universal measuring tool -VW 385/1- as illustrated:

Determining dimension -A-

- Tapered roller bearing outer races for differential bearings are installed in gearbox housing and cover for final drive.
- Insert universal measuring tool -VW 385/1- with centring disc -VW 385/4- facing towards gearbox housing.
- Fit cover for final drive with O-ring installed and and tighten four bolts to 24 Nm.
- Using the adjustable ring, move the centring disc outwards until it is no longer possible to turn the universal measuring tool by hand.
- The round side of universal measuring tool must point up towards depth gauge during this procedure.



- Position straightedge -T 40100- onto cleaned joint surface of gearbox housing.
- Measure depth between straightedge and highest point on universal measuring tool -VW 385/1- using depth gauge -1- (e.g. digital depth gauge -VAS 6320-).

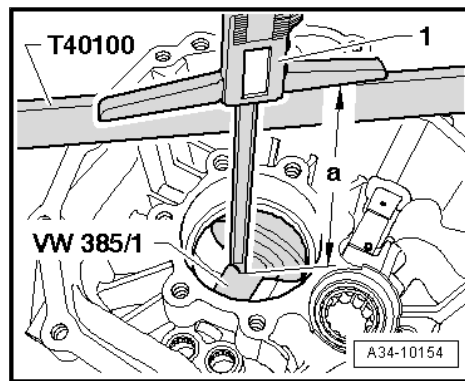
In example: measurement -a- = 143.80 mm.

- Subtract height of straightedge -T 40100- from this measurement and add half the $\varnothing$ of universal measuring tool -VW 385/1- to this calculation. This value is 16 mm.

Example:

Depth as measured with digital depth gauge	143.80 mm
- Height of straightedge -T 40100-	40.00 mm
+ half the $\varnothing$ of universal measuring tool -VW 385/1-	16.00 mm
= Dimension -A-	119.80 mm

Determining dimension -B-



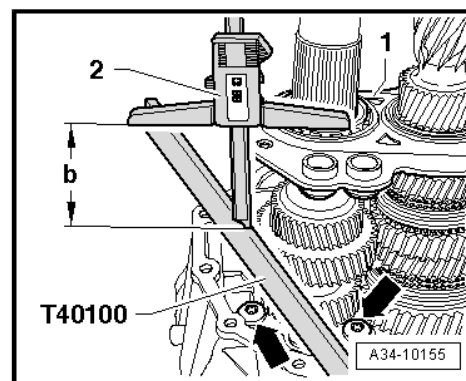
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- Pinion shaft is fitted with shims “S3” and “S4”.
- The securing bolts -arrows- for the retaining plate are tightened to 30 Nm.
- Install input shaft, shim “S5”, 3rd to 6th gears with roller bearing and bearing mounting -1- ➔ [page 29](#) .



Note

To make it easier to apply the digital depth gauge , the bearing mounting is not in its normal installation position in the illustration.



- Position straightedge -T 40100- onto cleaned joint surface of gearbox housing.
- Measure depth between roller bearing inner race and straightedge using digital depth gauge -2- (e.g. digital depth gauge -VAS 6320-).

In example: measurement -b- = 172.00 mm.

- Add the height of straightedge -T 40100- to this measurement.

Example:

Depth as measured with digital depth gauge	172.00 mm
+ Height of straightedge -T 40100-	40.00 mm
= Dimension -B-	212.00 mm

Determining thickness of shim “S6”

Formula: measuring range (overall dimension) = dimension -A- + dimension -B-

Example:

Dimension -A-	119.80 mm
+ Dimension -B-	212.00 mm
= Measuring range (overall dimension)	331.80 mm

Select required shim from table ➔ [page 83](#) .

Measuring range (overall dimension)	Shim “S6”
Measured value (mm)	Thickness (mm)
331.38 ... 331.43	4.70
331.44 ... 331.53	4.60
331.54 ... 331.63	4.50
331.64 ... 331.73	4.40
331.74 ... 331.83	4.30
331.84 ... 331.93	4.20
331.94 ... 332.03	4.10
332.04 ... 332.08	4.00



Note

Select correct shims from ➔ Electronic parts catalogue “ETKA”.

- The shim thickness “S6” in this example is 4.30 mm.



39 – Final drive - differential

1 Renewing flange shaft oil seals

Renewing flange shaft oil seals (left and right) with gearbox installed in vehicle ➔ 6-speed manual gearbox 0A2, front-wheel drive; Rep. Gr. 39 .

Renewing flange shaft oil seals (left and right) with gearbox removed ➔ [page 85](#) .

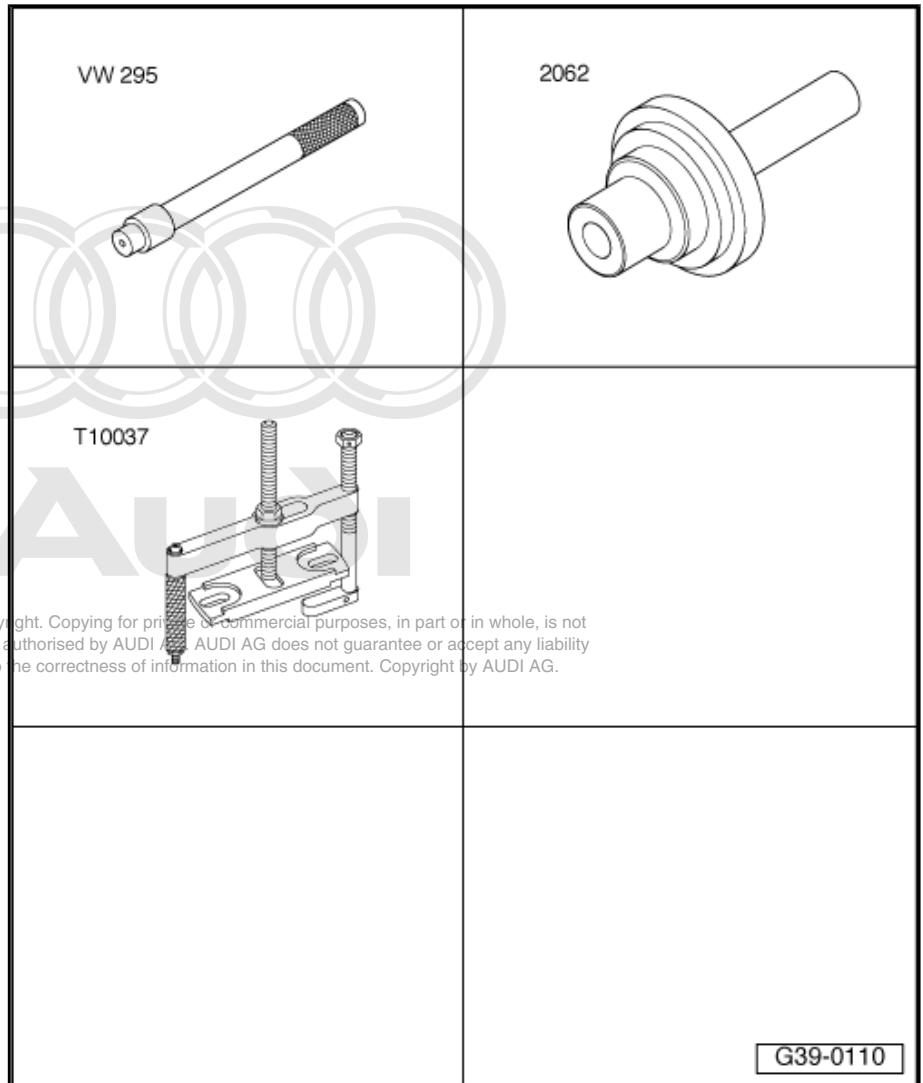


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2 Removing and installing differential

Special tools and workshop equipment required

- ◆ Drift -VW 295-
- ◆ Punch -2062-
- ◆ Puller -T10037-
- ◆ Sealing grease -G 052 128 A1-



Note

- ◆ Removing and installing is possible with the 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 needs to be adjusted.
- ◆ Adjustment work is required when renewing the parts marked with ¹⁾. Table of adjustments ⇒ [page 98](#).

1 - Gearbox housing ¹⁾

2 - Oil seal

- ☐ Removing ➔ [page 87](#)
- ☐ Installing (left-side)
➔ [page 87](#)
- ☐ Installing (right-side)
➔ [page 88](#)

3 - Circlip

- ☐ Renew
- ☐ Removing and installing
➔ [page 87](#)

4 - Flange shaft

- ☐ Removing (left-side)
➔ [page 86](#)
- ☐ Removing (right-side)
➔ [page 87](#)
- ☐ Drive in with drift -VW 295-

5 - Differential with crown wheel¹⁾

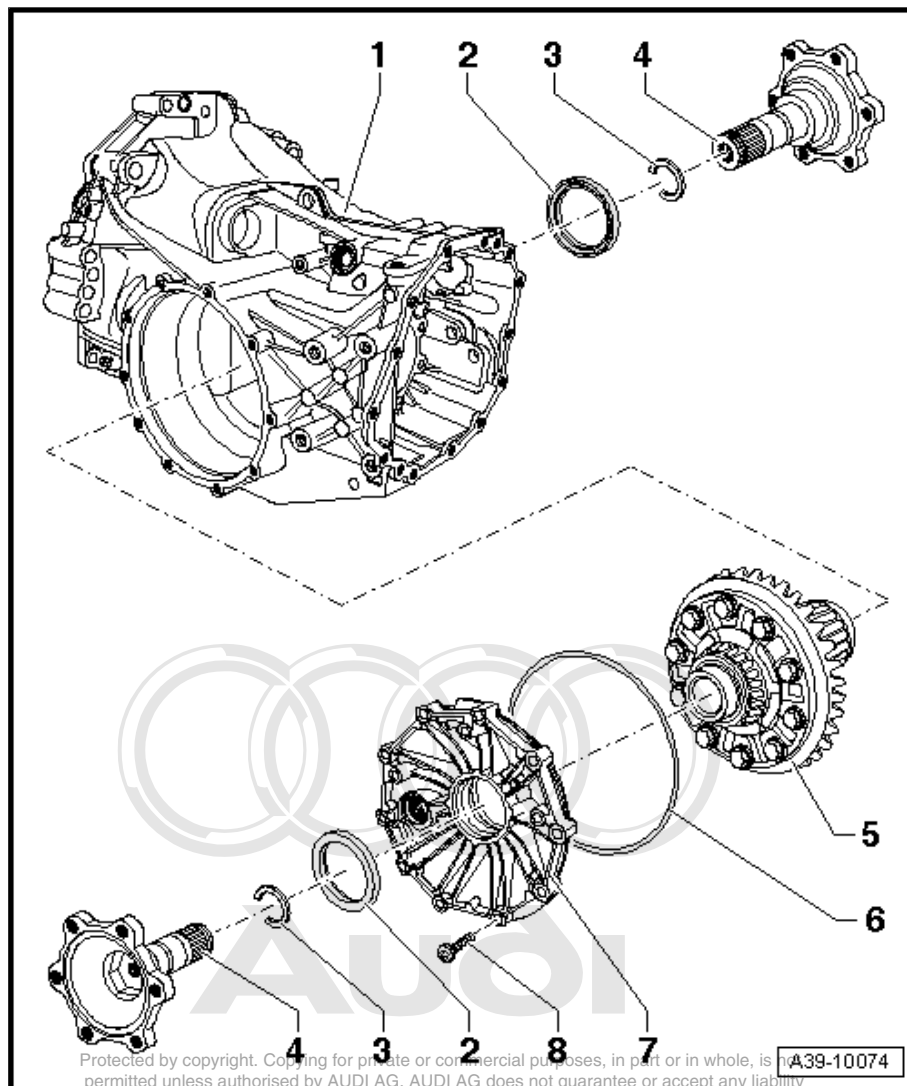
- ☐ Dismantling and assembling ➔ [page 89](#)

6 - O-ring

- ☐ Always renew
- ☐ Lubricate with gear oil

7 - Cover for final drive¹⁾

8 - Torx bolt, 24 Nm



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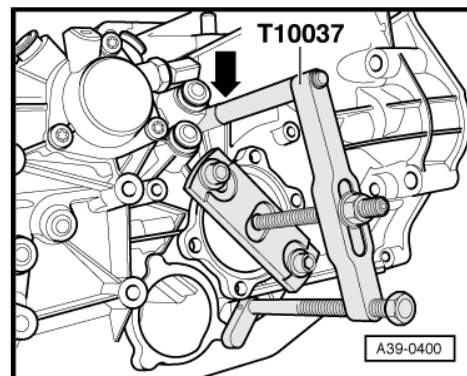
Removing flange shaft (left-side)

- Remove flange shaft (left-side); to do so, secure puller - T10037- to cover for final drive -arrow-.



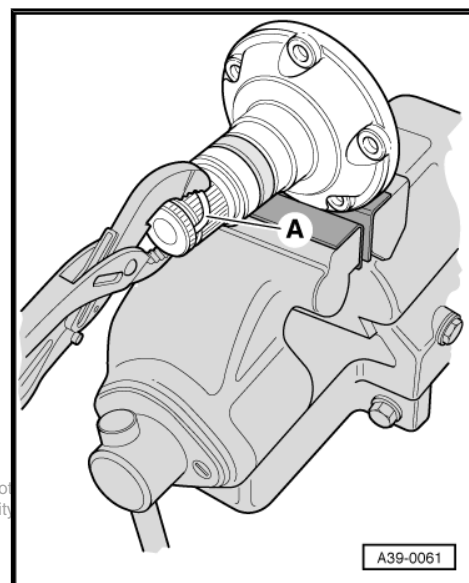
Removing flange shaft (right side)

- Remove flange shaft (right-side); to do so, secure puller - T10037- to gearbox housing -arrow-.



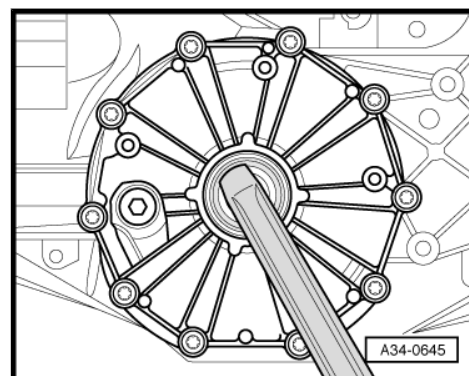
Removing and installing circlip

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



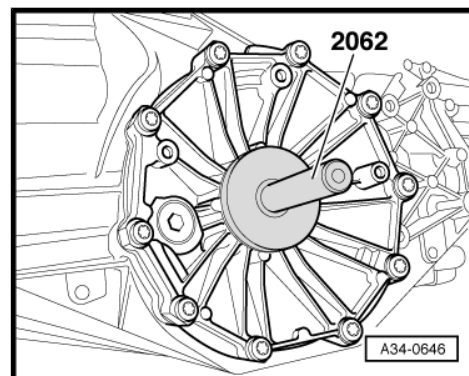
Removing flange shaft oil seal

- Lever out flange shaft oil seal using an assembly lever.



Installing flange shaft oil seal (left-side)

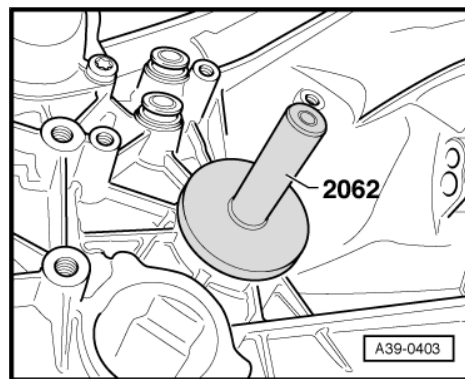
- Lightly oil outer circumference of new oil seal.
- Knock in new flange shaft oil seal using punch -2062- ; keep seal straight when installing.
- Insertion depth: 5.65 ± 0.15 mm below top of cover.
- Pack space between sealing lip and dust lip half-full with sealing grease -G 052 128 A1- .





Installing flange shaft oil seal (right-side)

- Lightly oil outer circumference of new oil seal.
- Knock in new flange shaft oil seal using punch -2062- ; keep seal straight when installing.
- Insertion depth: 5.65 ± 0.15 mm below surface of housing.
- Pack space between sealing lip and dust lip half-full with sealing grease -G 052 128 A1- .

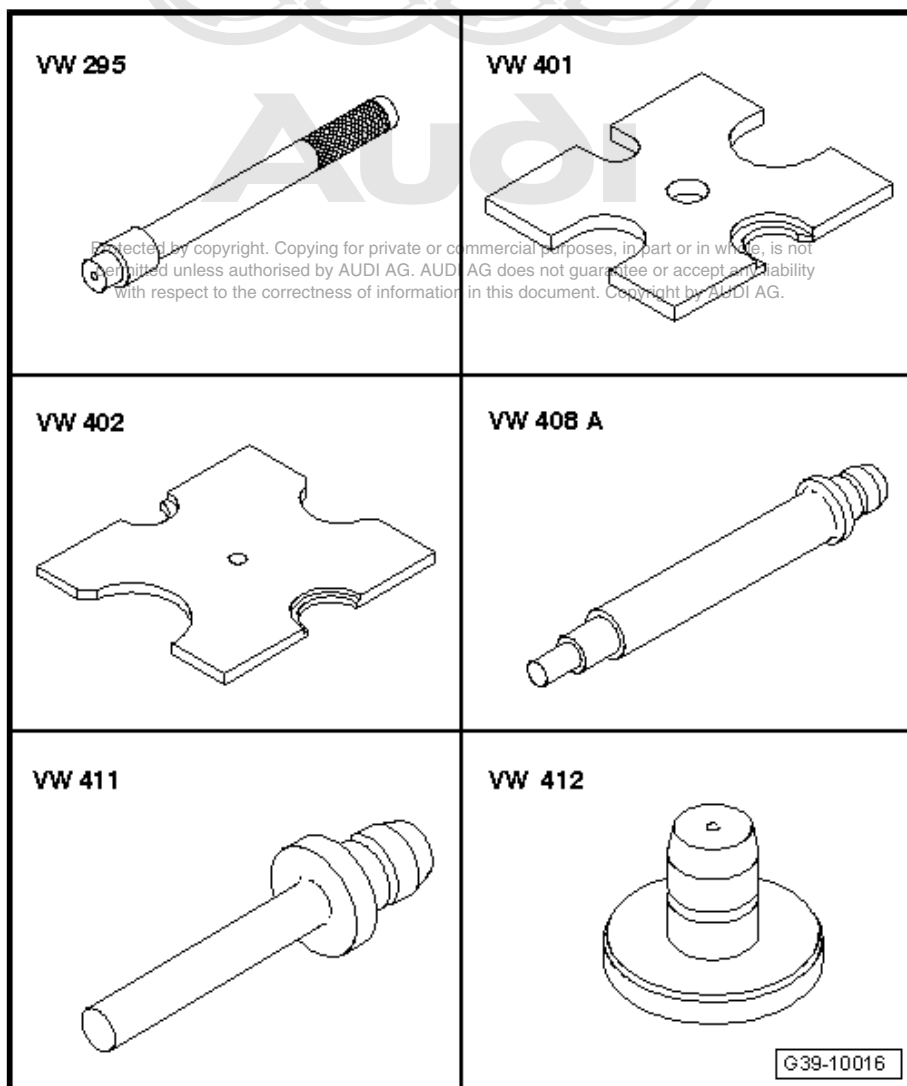


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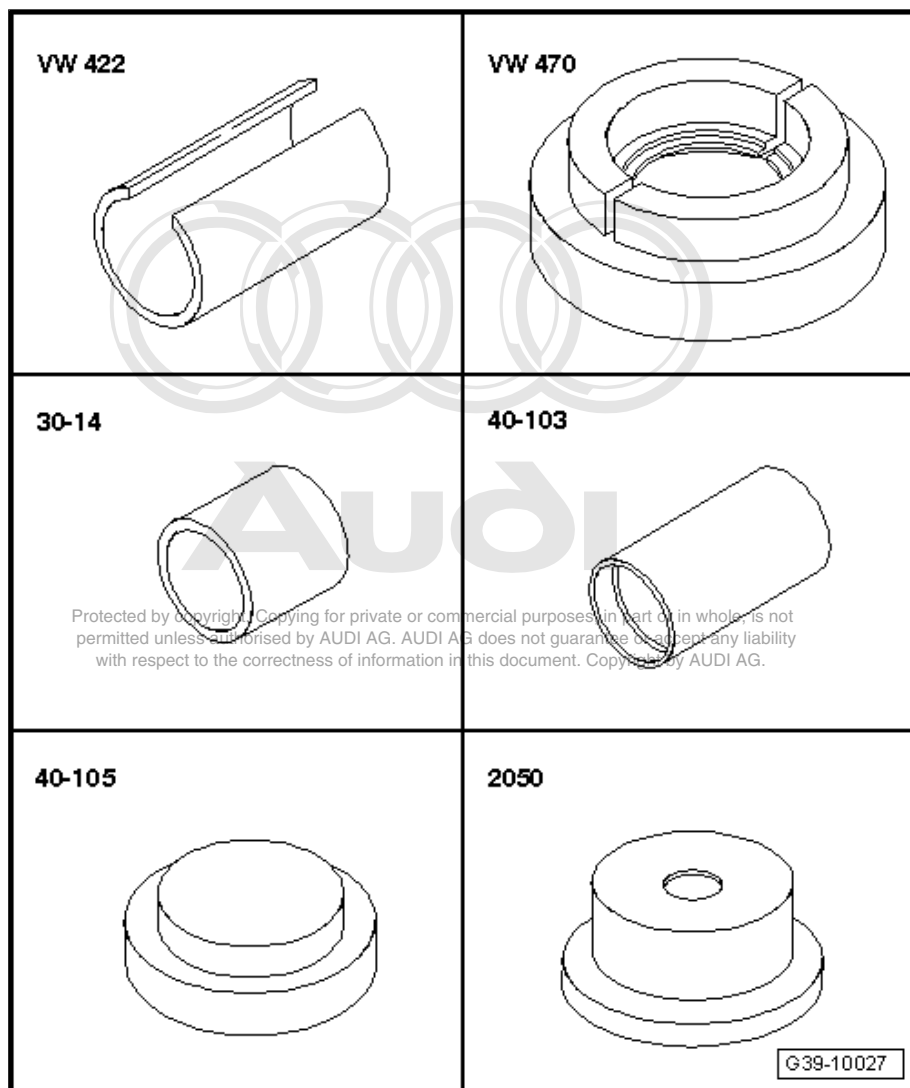
3 Dismantling and assembling differential

Special tools and workshop equipment required

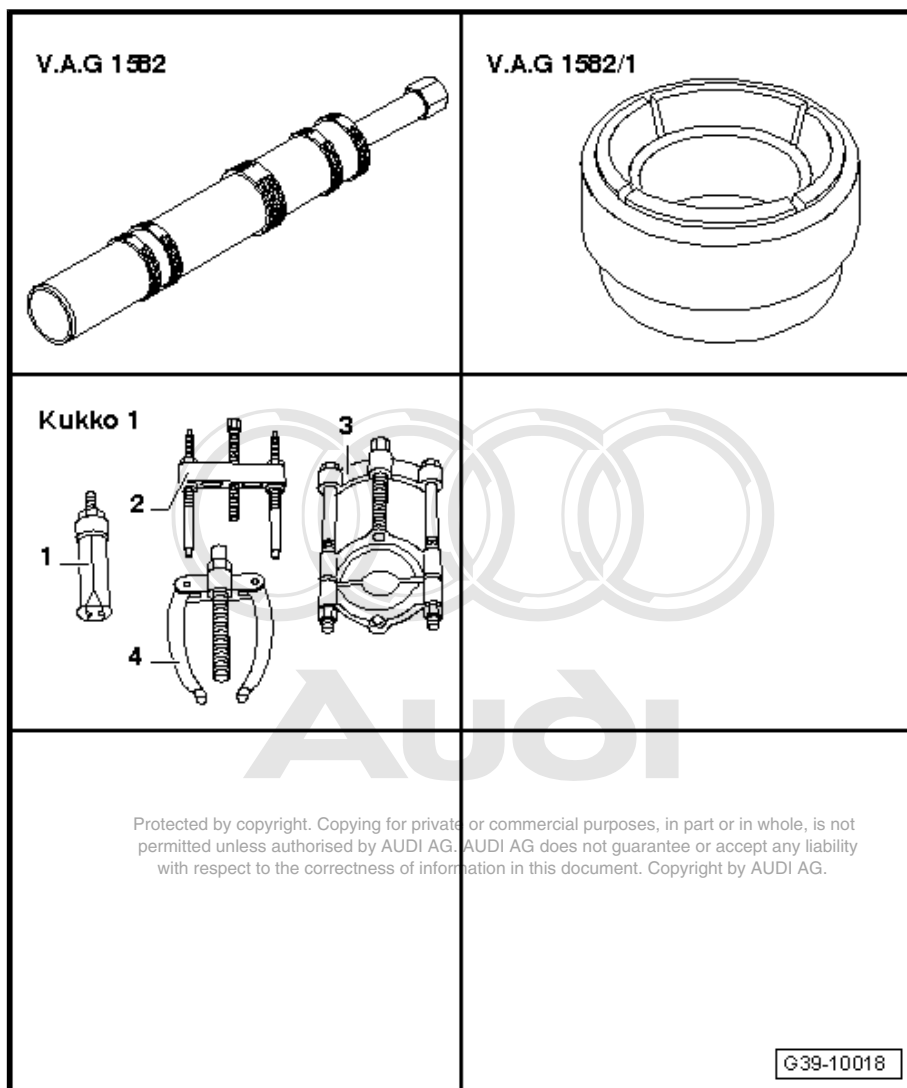
- ◆ Drift -VW 295-
- ◆ Thrust plate -VW 401-
- ◆ Thrust plate -VW 402-
- ◆ Press tool -VW 408 A-
- ◆ Press tool -VW 411-
- ◆ Press tool -VW 412-



- ◆ Tube -VW 422-
- ◆ Thrust pieces for pinion shaft bearing -VW 470-
- ◆ Tube -30 - 14-
- ◆ Support -40 - 103-
- ◆ Thrust plate -40 - 105-
- ◆ Thrust piece -2050-



- ◆ Tapered roller bearing puller -V.A.G 1582-
- ◆ Adapter -V.A.G 1582/1-
- ◆ -1- Internal puller -Kukko 21/8-
- ◆ -4- Counter-support -Kukko 22/2-



Removing and installing differential ➔ [page 85](#) .



Note

- ◆ *Always renew both tapered roller bearings together.*
- ◆ *Adjustment work is required when renewing the parts marked with ¹⁾. Table of adjustments ➔ [page 98](#) .*

1 - Gearbox housing ¹⁾

2 - Shim "S₂"

- ☐ Note thickness
- ☐ Table of adjustments
⇒ [page 98](#)

3 - Outer race for tapered roller bearing (right-side) ¹⁾

- ☐ Pulling out ⇒ [page 93](#)
- ☐ Driving in ⇒ [page 93](#)

4 - Inner race for tapered roller bearing (right-side) ¹⁾

- ☐ Pulling off ⇒ [page 93](#)
- ☐ Pressing on
⇒ [page 94](#)

5 - Crown wheel ¹⁾

- ☐ Is paired with pinion shaft (final drive set)
- ☐ Allocate according to gearbox code letters via
⇒ Electronic parts catalogue "ETKA".
- ☐ Drive crown wheel off differential cage using a punch ⇒ [page 94](#)
- ☐ Fitting onto differential cage ⇒ [page 95](#)

6 - Differential cage ¹⁾

7 - Bolt, 160 Nm

- ☐ Always renew
- ☐ Lightly tighten bolts then tighten in diagonal sequence to correct torque

8 - Inner race for tapered roller bearing (left-side) ¹⁾

- ☐ Pulling off ⇒ [page 93](#)
- ☐ Pressing on ⇒ [page 94](#)

9 - Outer race for tapered roller bearing (left-side) ¹⁾

- ☐ Pulling out ⇒ [page 94](#)
- ☐ Pressing in ⇒ [page 94](#)

10 - Shim "S₁"

- ☐ Note thickness
- ☐ Table of adjustments ⇒ [page 98](#)

11 - Cover for final drive ¹⁾

- ☐ With O-ring

12 - One-piece thrust washer

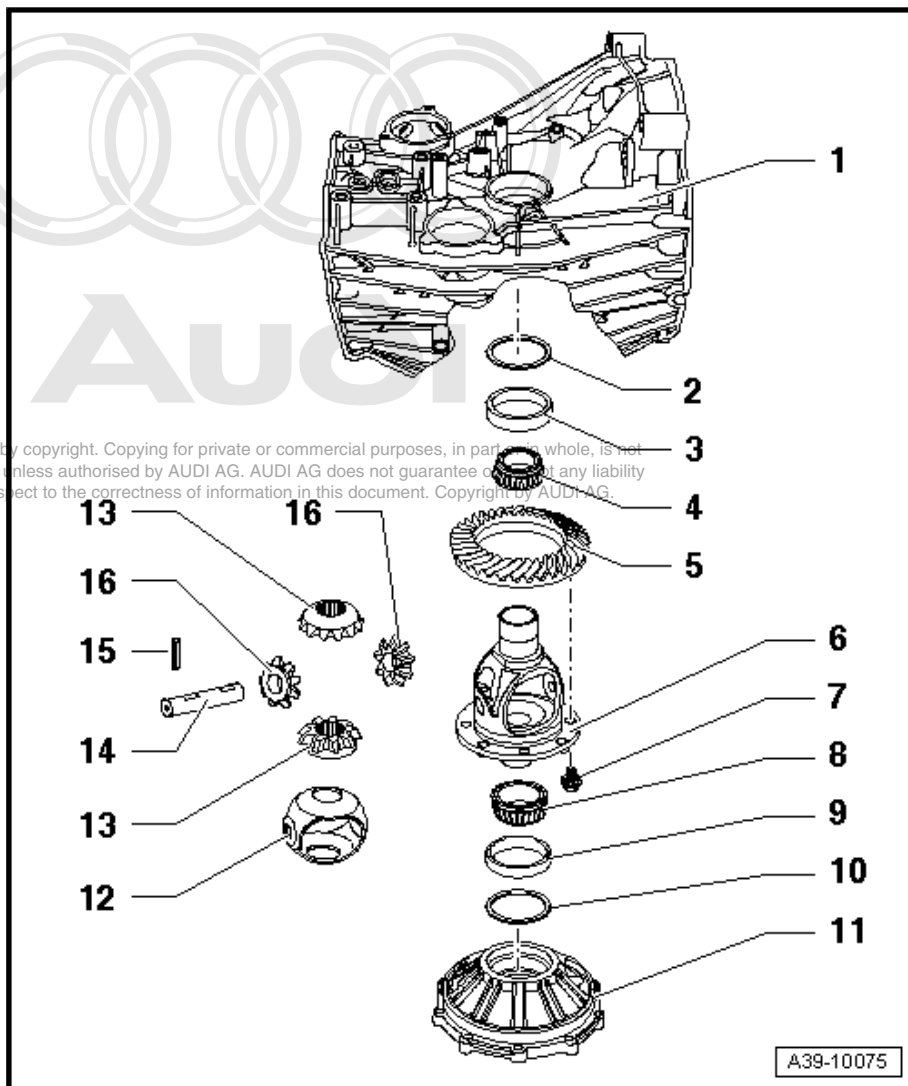
- ☐ Lubricate with gear oil before installing

13 - Sun wheel

- ☐ Installing ⇒ [page 95](#)

14 - Differential pinion pin

- ☐ Drive out with drift after removing spring pin



15 - Spring pin

- ☐ For securing differential pinion
- ☐ Is sheared off on removal ⇒ [page 95](#)
- ☐ Drive in flush

16 - Planet pinion

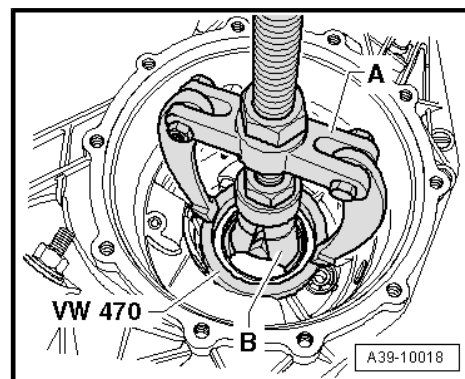
- ☐ Installing ⇒ [page 95](#)

Pulling tapered roller bearing outer race (right-side) out of gear-box housing

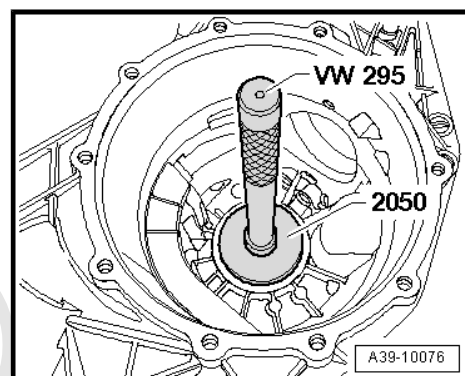
A - Counter-support , e.g. -Kukko 22/2-

B - Internal puller 56...70 mm , e.g. -Kukko 21/8-

- After removing, check shims for damage.



Driving outer race for tapered roller bearing (right-side) into gear-box housing



Pulling off tapered roller bearing inner races

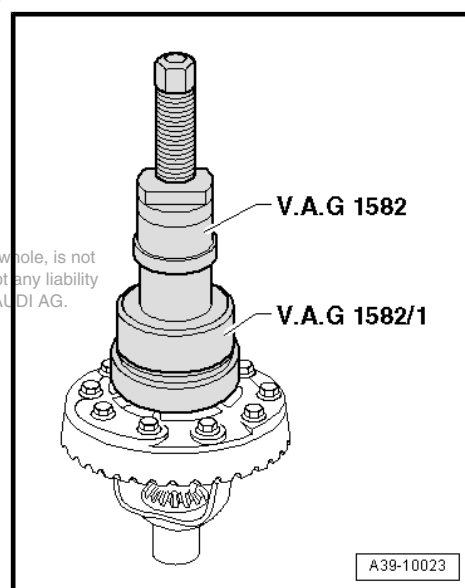
- Before setting up the puller, place thrust plate -40 - 105- on differential cage.



Note

The procedure for pulling tapered roller bearing inner races (left and right) off differential is the same for both sides.

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Pressing on tapered roller bearing inner race (left and right)



Note

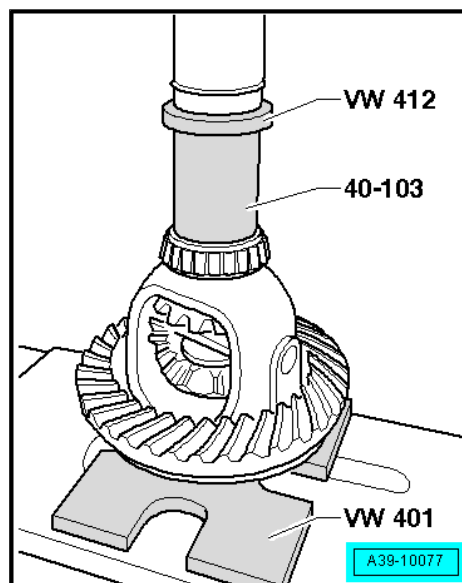
Use the same tools for pressing on tapered roller bearing inner race on left side and right side.



WARNING

Wear protective gloves.

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

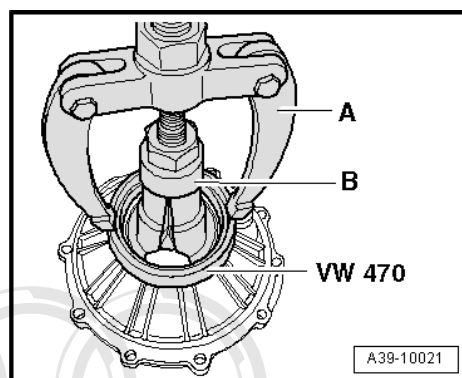


Pulling tapered roller bearing outer race (left-side) out of cover for final drive

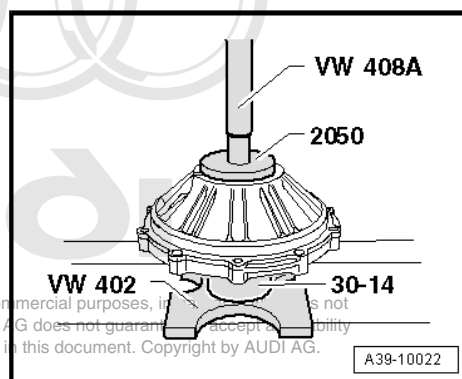
A - Counter-support , e.g. -Kukko 22/2-

B - Internal puller 56...70 mm , e.g. -Kukko 21/8-

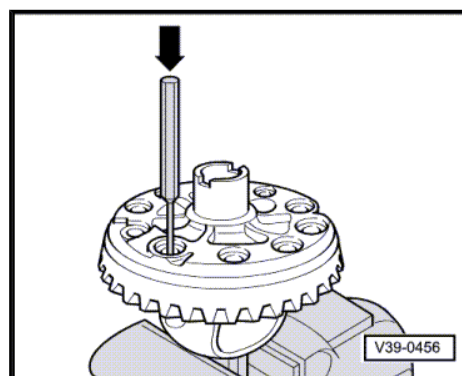
- After removing, check shims for damage.



Pressing tapered roller bearing outer race (left-side) into cover for final drive.



Driving crown wheel off cage



Heating crown wheel to approx. 100 °C and installing

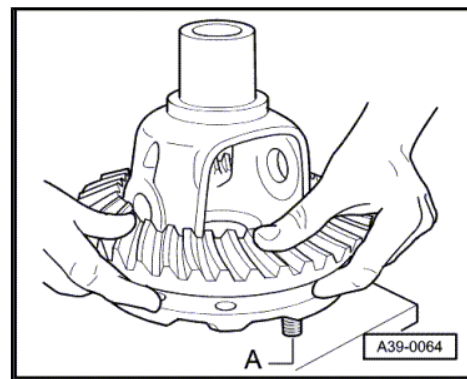
- When fitting crown wheel, use centralising pins -A- (shop-made tool) to locate.



WARNING

Wear protective gloves.

- Allow to cool slightly before screwing in new securing bolts. Then tighten to specified torque.

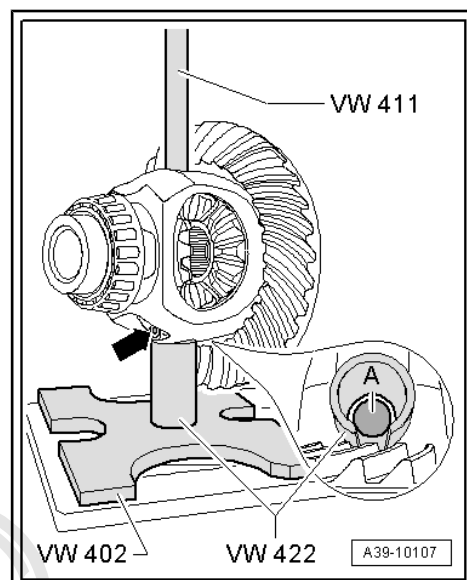


Removing differential pinion pin

- Position tube -VW 422- under differential cage (slot facing crown wheel).

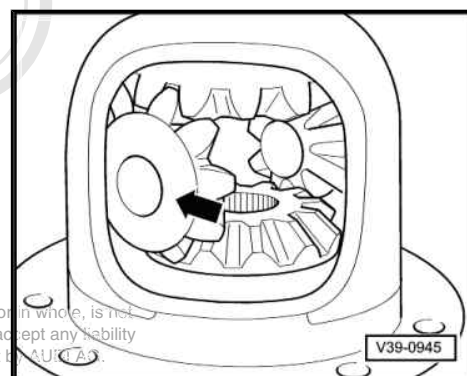
The spring pin -arrow- is sheared off when pressing out the differential pinion pin -A-.

- Drive out parts of spring pin remaining in differential cage and differential pinion pin.



Installing differential bevel gears

- Lubricate one-piece thrust washer with gear oil and install.
- Insert sun wheels.
- Insert planet pinions offset 180° and rotate into position -arrow-.
- Align drillings of one-piece thrust washer, planet pinions and differential cage.
- Drive differential pinion pin into final position and secure.



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4 Adjusting pinion shaft and crown wheel



Note

- ◆ *Careful adjustment of the crown wheel and pinion shaft is essential to ensure that the final drive gives long service and runs silently. 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 final drive set (pinion shaft and crown wheel) may only be renewed together as a matched pair.*
- ◆ *Observe the general repair instructions for bearings and shims.*
- ◆ *Always renew the double angular contact ball bearing on the pinion shaft when renewing the final drive gear set or if gear oil is contaminated with metal particles.*

4.1 Adjustment and marking of final drive gear set



Note

First determine distance -E- for the final drive gear set that you are adjusting. This distance is then set on master gauge -VW 385/30-.



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1 - "4386" number of matched pair of gears

2 - Distance "A1" is the distance measured between the centre axis of the crown wheel and the reverse side of the pinion gear. This distance is required for determining shim "S5" for positioning 4th gear wheel ➔ [page 79](#).



Note

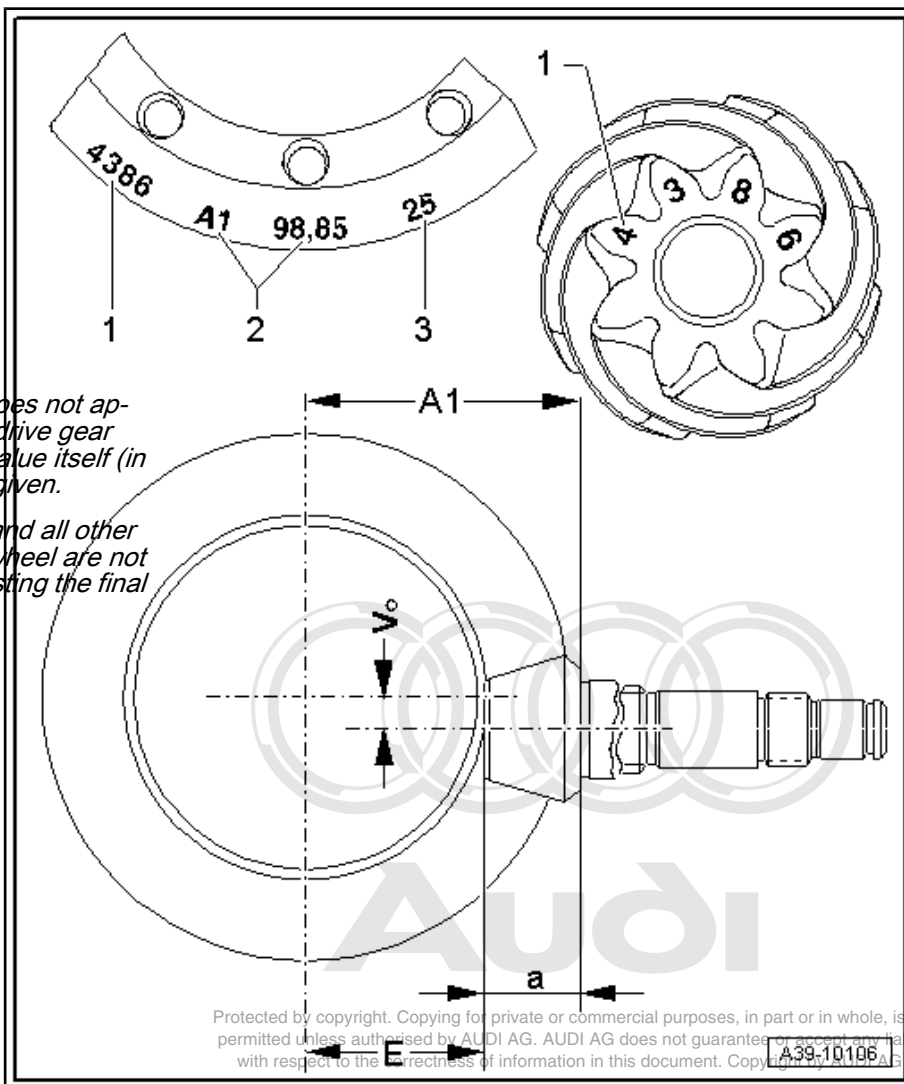
- ◆ The marking "A1" does not appear on some final drive gear sets, however the value itself (in example: 98.85) is given.
- ◆ The value (item 3) and all other data on the crown wheel are not required when adjusting the final drive gear set.

3 - This value is not always given and is not required when adjusting the final drive gear set.

a - Is the distance between the end face and the reverse side of the pinion gear. It can be 39.0 or 39.5 mm. Measure this distance first in order to set distance "E".

E - Actual distance between centre axis of crown wheel and face of pinion shaft at point with quietest running for this gear set.

Vo - Hypoid offset



4.1.1 Position of shims



Note

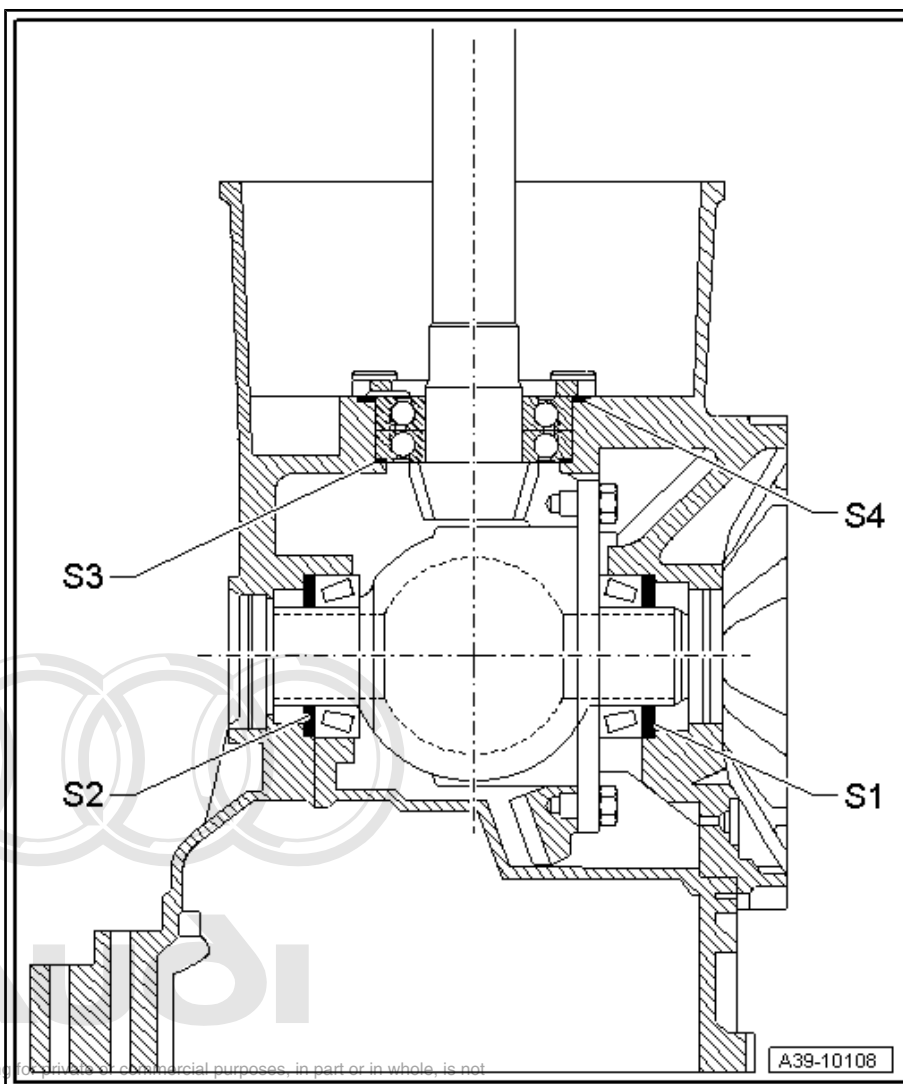
Table of adjustments when renewing individual components of gearbox ➔ [page 98](#) .

S1 - Shim for crown wheel in cover for final drive

S2 - Shim for crown wheel in gearbox housing

S3 - Shim for correct positioning of pinion shaft in gearbox housing

S4 - Shim for preload of double angular contact ball bearing on pinion shaft



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4.1.2 Table of adjustments



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.
- ◆ No adjustments are required when renewing the double angular contact ball bearing on the pinion shaft.
- ◆ Refer to the following table to avoid unnecessary adjustment work:

Components requiring adjustment:	Pinion shaft	Crown wheel	Backlash
----------------------------------	--------------	-------------	----------

	("S ₃ " + "S ₄ ") ⇒ page 99	("S ₁ " + "S ₂ ") ⇒ page 105	0.12 - 0.22 ⇒ page 109
Component renewed			
Gearbox housing	X	X	X
Differential cage		X	X
Tapered roller bearings for differential		X	X
Final drive gear set ²⁾	X	X	X
Cover for final drive		X	X

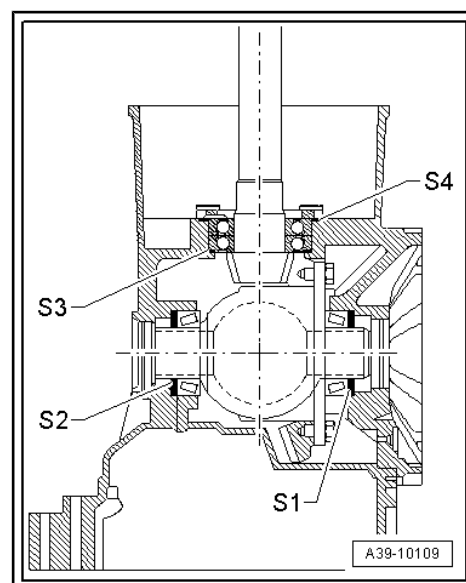
2) Pinion shaft and crown wheel may only be replaced together.

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4.1.3 Recommended sequence for adjusting gear set

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

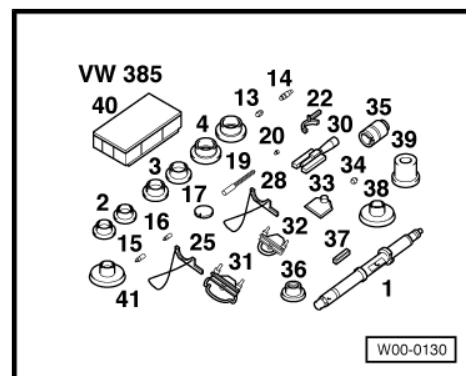
- ◆ Determine shim thickness "S₃" so that the dimension from the centre of the crown wheel to the face of the pinion shaft corresponds to the dimension determined during production.
- ◆ Determine shim "S₄" for preloading of double angular contact ball bearing.
- ◆ Determine total shim thickness "S_{total}" (S₁ plus S₂) for the specified preload on differential tapered roller bearings.
- ◆ Distribute total shim thickness "S_{total}" (S₁ plus S₂) so that the specified backlash between crown wheel and pinion shaft is obtained.



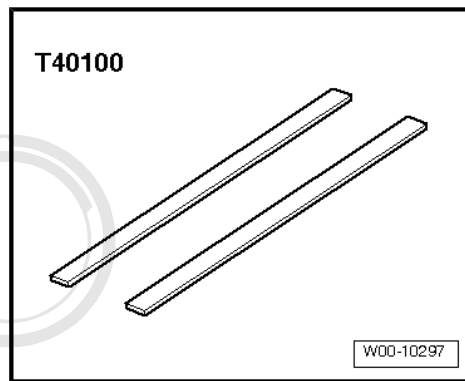
4.2 Adjusting pinion shaft

Special tools and workshop equipment required

- ◆ Universal measuring tool -VW 385-



◆ Straightedge -T 40100-



◆ Depth gauge (e.g. digital depth gauge -VAS 6320-)

◆ Dial gauge

Determining distance “a” (length of pinion gear)

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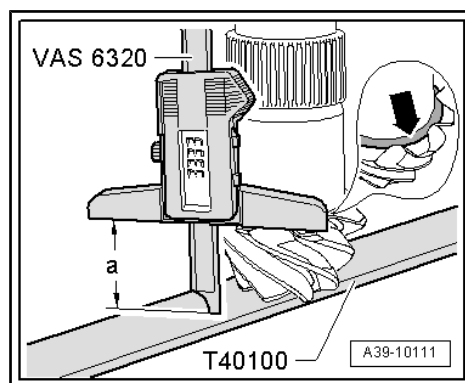
- Double angular contact ball bearing is removed from the pinion shaft.
- Place pinion shaft on straightedge -T 40100- .
- Measure distance between reverse side of pinion gear -arrow- and straightedge -T 40100- .
- This distance should be either 39.0 or 39.5 mm. (39.50 mm in this example.)

Determining distance “E”

$$E = A1 - a$$

Example:

Distance “A1” is marked on the crown wheel	98.85 mm
- Distance “a” (length of pinion gear)	39.50 mm
= Distance “E” = length of master gauge - VW 385/30-	59.35 mm



Determining thickness of provisional shims “S3” and “S4.”

- Differential removed.
- Double angular contact ball bearing pressed onto the pinion shaft.



Note

For measurement purposes the old (removed) shim “S3” (in example 1.00 mm) is inserted provisionally. This is referred to in the following as “S3.” “S3*” is exchanged with the final shim “S3” after determining distance “E”.*

- Secure gearbox housing onto gearbox support -VW 353- (gearbox housing must be in vertical position).
- Fit previous shim “S3*” (in example 1.00 mm) in the gearbox housing.

- Lubricate outer races -3- and -4- of double angular contact ball bearing with gear oil.
- Carefully push pinion shaft -1- with double angular contact ball bearing into gearbox housing -2- by hand (press down top outer race -3-).

 Note

Using hot air blower, heat area around seat of bearing in gearbox housing if necessary.

Make sure that outer races -3- and -4- are kept straight when inserting and that they remain attached to each other. Otherwise the seal -6- can be damaged by the pinion gear -5-.

The bearing must be renewed if the seal of the double angular contact ball bearing is damaged.

Determine the provisional shim "S₄" as follows:

- Measure depth between double angular contact ball bearing outer race -1- and joint flange -2- for the retaining plate using digital depth gauge (e.g. digital depth gauge -VAS 6320-).

In example: measurement -a- = 1.14 mm. Determine the provisional shim "S₄" from table ➤ [page 104](#) .

 Note

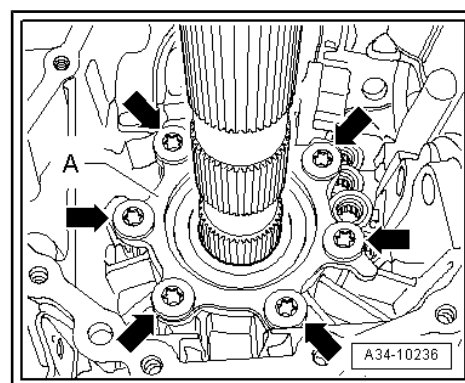
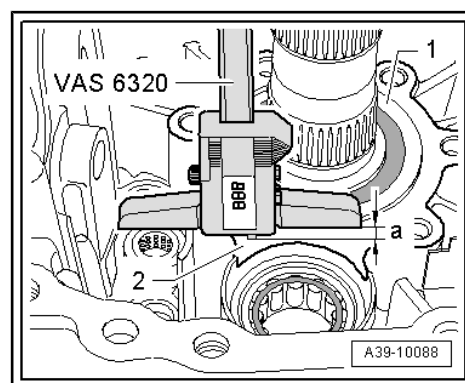
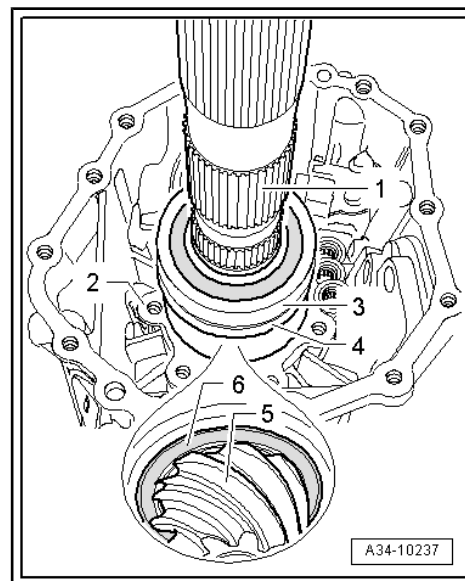
For measurement purposes a shim "S₄" with a thickness of 0.95 mm is inserted provisionally. This is referred to in the following as "S₄". "S₄*" is exchanged with the final shim "S₄" after determining distance "E".*

- Position provisional shim "S₄*" (0.95 mm in example) and the retaining plate -A- (only fits in one position) on joint flange in gearbox housing.
- Clean threads of old bolts -arrows- with a wire brush. Then tighten bolts in diagonal sequence to 30 Nm.

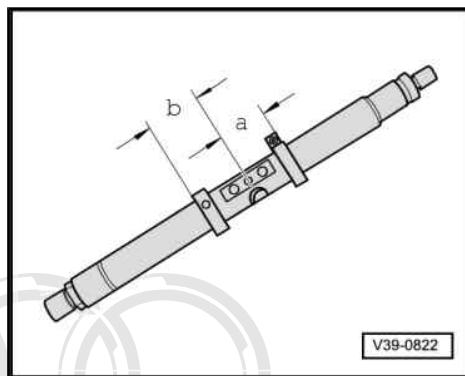
Setting dimension "E"

 Note

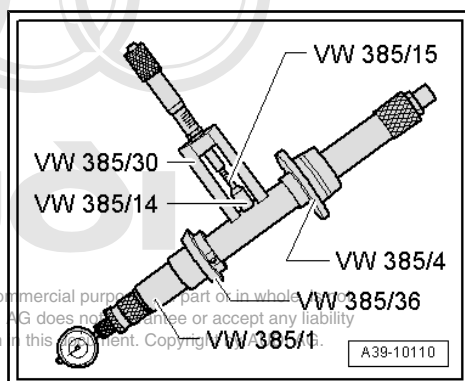
Dimension "E" must be set on the master gauge -VW 385/30- to determine the final shim thickness of "S₃" and "S₄" for this particular final drive gear set.



- Set adjustment rings of universal measuring tool -VW 385/1- to the following values:
 - ◆ Dimension -a- = 45 mm
 - ◆ Dimension -b- = 60 mm



- Assemble universal measuring tool -VW 385/1- as illustrated:
 - ◆ Dial gauge extension -VW 385/15-, 9.3 mm long
- Set master gauge -VW 385/30- to dimension "E" (59.35 mm in example) and place onto universal measuring tool -VW 385/1-.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm pre-load.

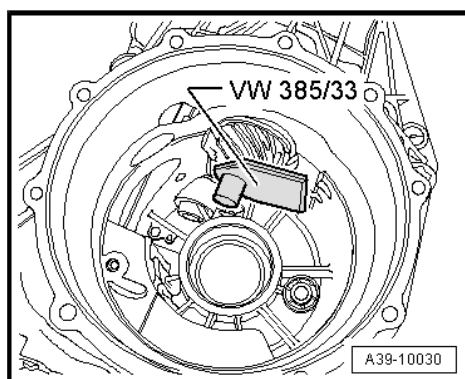


- Place end measuring plate -VW 385/33- on face of pinion gear.

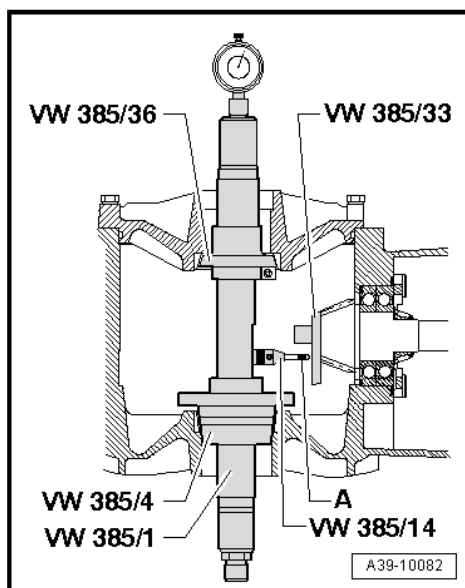


Note

Ensure contact surface of end measuring plate -VW 385/33- fits exactly and is free of oil.



- Detach master gauge -VW 385/30- and insert universal measuring tool in gearbox housing.
 - ◆ Fit gauge extension -A- (length = 9.3 mm).
 - ◆ The dial gauge faces towards the final drive cover
 - The O-ring is fitted into cover for final drive.
- Fit cover for final drive and tighten 4 bolts to 24 Nm.
- Using the adjustable ring, pull 2nd centring disc -VW 385/36- out as far as possible so that the universal measuring tool can still just be turned by hand.



- Turn universal measuring tool until the dial gauge pointer touches the end measuring plate on pinion gear, then measure maximum deflection (return point).
- ◆ Measurement in following example: = 0.10 mm (in red scale)



Note

Then (after removing universal measuring tool), check once again that the dial gauge indicates "0" with 2 mm preload when master gauge -VW 385/30- is in place.

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Determining thickness of shim "S₃"

- ◆ Subtract value if measurement is obtained on red scale.
- ◆ Add value if measurement is obtained on black scale.

Formula:

"S₃" = "S₃^{*}" + "measured value" ("measured value" on black scale)

"S₃" = "S₃^{*}" - "measured value" ("measured value" on red scale)

Example:

Inserted shim "S ₃ [*] "	1.00 mm
- Measured value (in red scale)	0.10 mm
= Thickness of shim "S ₃ "	0.90 mm

- Determine shim(s) according to table. Part numbers ⇒ Electronic parts catalogue "ETKA".

Available shims for "S₃"

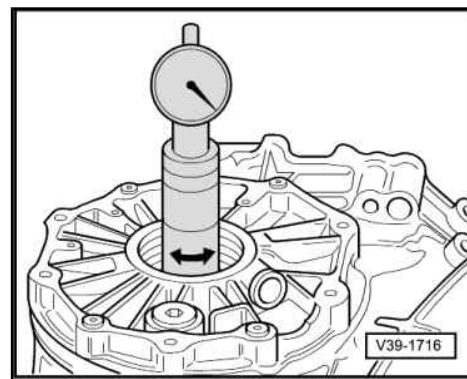
Shim thickness (mm) ³⁾		
0.55	0.75	0.95
0.60	0.80	1.00
0.65	0.85	1.05
0.70	0.90	

3) The exact shim thickness required can be obtained by using the shim tolerance variations. Install two shims if necessary.

- Remove provisional shims "S₃^{*}" and "S₄^{*}".
- Fit determined shim "S₃" (0.90 mm in example) in gearbox housing.

Determining thickness of shim "S₄"

- Determined shim "S₃" is fitted in gearbox housing.



- Lubricate outer races -3- and -4- of double angular contact ball bearing with gear oil.
- Carefully push pinion shaft -1- with double angular contact ball bearing into gearbox housing -2- by hand (press down top outer race -3-).



Note

Using hot air blower, heat area around seat of bearing in gearbox housing if necessary.

Make sure that outer races -3- and -4- are kept straight when inserting and that they remain attached to each other. Otherwise the seal -6- can be damaged by the pinion gear -5-.

The bearing must be renewed if the seal of the double angular contact ball bearing is damaged.

Determine the shim "S₄" as follows:

- Measure depth between double angular contact ball bearing outer race -1- and joint flange -2- for the retaining plate using digital depth gauge (e.g. digital depth gauge -VAS 6320-).

In example: measurement -a- = 1.04 mm. Determine the shim "S₄" from table ➔ [page 104](#) .

Shims available for "S₄"

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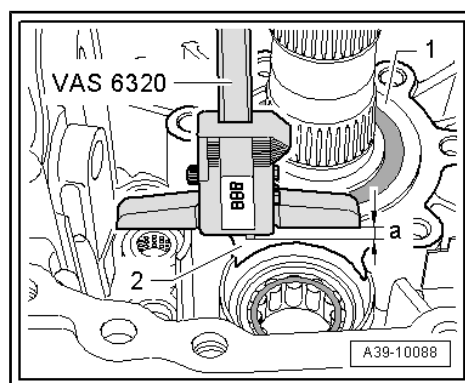
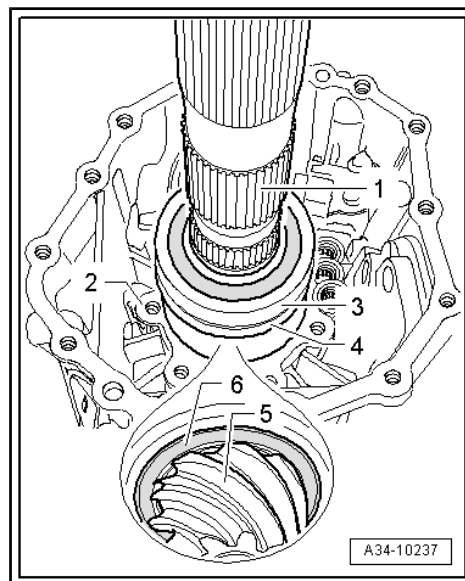
Size of gap	Shim "S ₄ "
Measured value (mm)	Thickness (mm)
0.67 ... 0.71	0.50
0.72 ... 0.76	0.55
0.77 ... 0.81	0.60
0.82 ... 0.86	0.65
0.87 ... 0.91	0.70
0.92 ... 0.96	0.75
0.97 ... 1.01	0.80
1.02 ... 1.06	0.85
1.07 ... 1.11	0.90
1.12 ... 1.16	0.95
1.17 ... 1.21	1.00
1.22 ... 1.26	1.05
1.27 ... 1.31	1.10
1.32 ... 1.36	1.15
1.37 ... 1.41	1.20
1.42 ... 1.46	1.25
1.47 ... 1.51	1.30
1.52 ... 1.56	1.35
1.57 ... 1.61	1.40

4) The exact shim thickness required can be obtained by using the shim tolerance variations. Install two shims if necessary.



Note

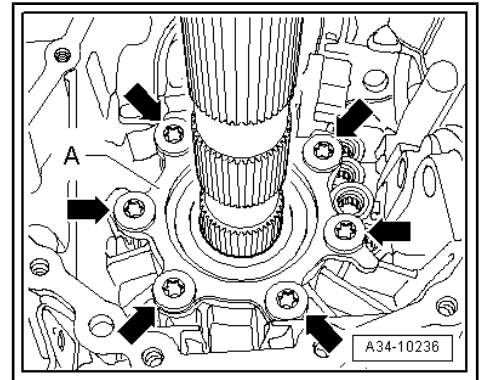
Select correct shims from ➔ *Electronic parts catalogue "ETKA"* .



- Position determined shim “S₄” (0.85 mm in example) and the retaining plate -A- (only fits in one position) on joint flange in gearbox housing.
- Then tighten bolts -arrows- in diagonal sequence to 30 Nm.

Checking dimension “E”

- Install pinion shaft with appropriate measured shims “S₃” and “S₄”.

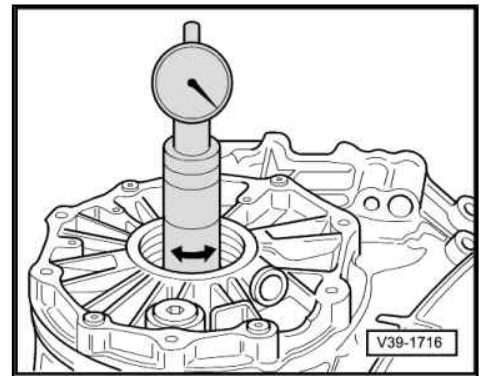


- Insert universal measuring tool and check adjustment.
- Read off dial gauge anti-clockwise (red scale).
- ◆ If the shims have been correctly selected, the dimension “a” should be indicated within a tolerance of ± 0.04 mm.



Note

Then (after removing universal measuring tool), check once again that the dial gauge indicates “0” with 2 mm preload when master gauge -VW 385/30- is in place.



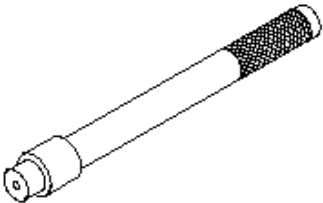
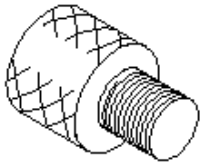
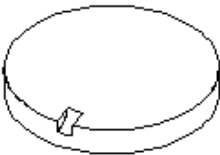
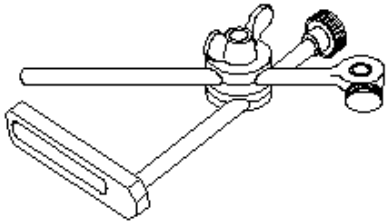
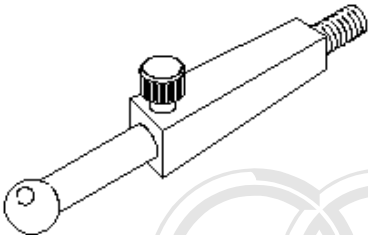
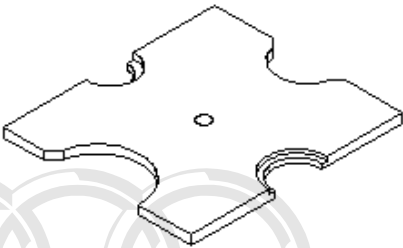
4.3 Adjusting crown wheel

(Adjusting differential)

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Special tools and workshop equipment required

- ◆ Drift -VW 295-
- ◆ Dial gauge extension - VW 382/10-
- ◆ End measuring plate - VW 385/17-
- ◆ Universal dial gauge bracket -VW 387-
- ◆ Adjustable measuring lever -VW 388-
- ◆ Thrust plate -VW 402-

VW 295 	VW 382/10 
VW 385/17 	VW 387 
VW 388 	VW 402  ©39-10009

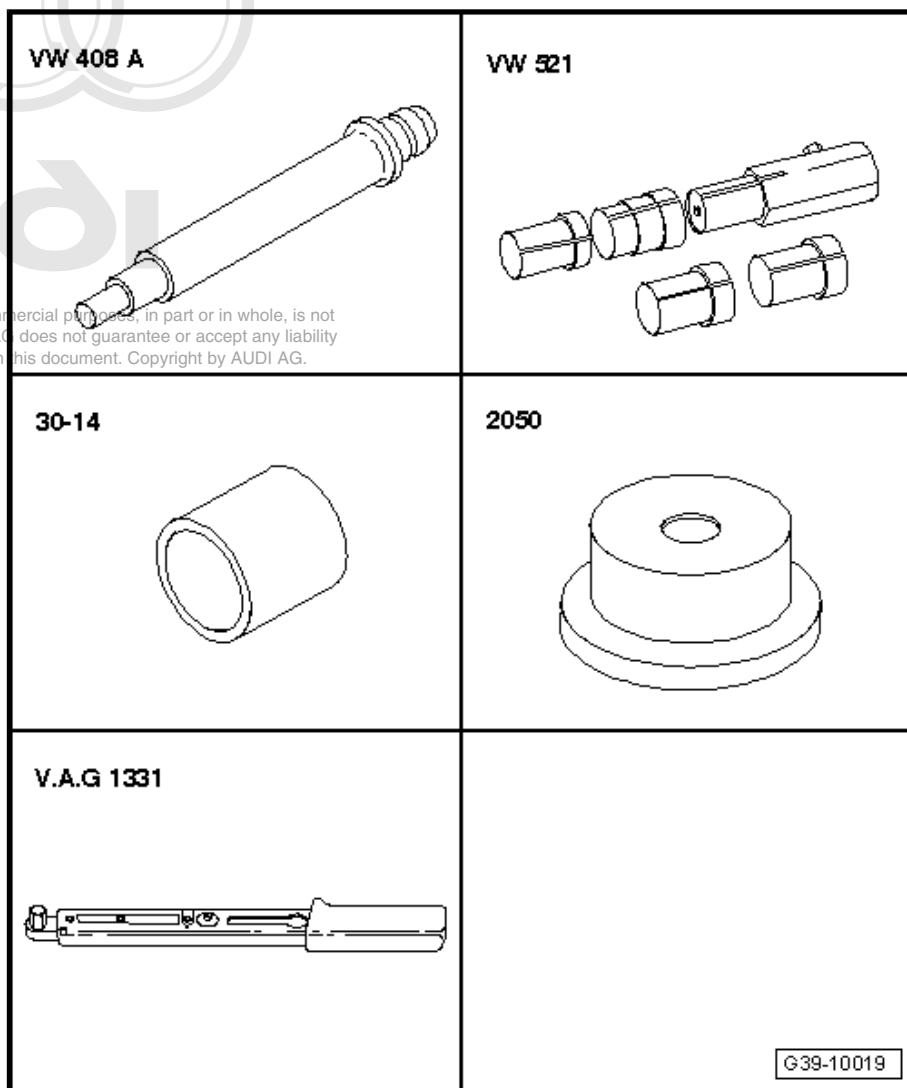


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- ◆ Press tool -VW 408 A-
- ◆ Crown wheel adjusting tool -VW 521-
- ◆ Tube -30 - 14-
- ◆ Thrust piece -2050-
- ◆ Torque wrench - V.A.G 1331-

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- ◆ Dial gauge
- ◆ Dial gauge extension, 30 mm



It is necessary to readjust the crown wheel when the following components have been renewed:

Gearbox housing, cover for final drive, tapered roller bearings for differential, differential cage or final drive gear set.

Table of adjustments ⇒ [page 98](#)

Determining total shim thickness "S_{total}" for shims "S₁" plus "S₂"

(Adjustment of pre-load of tapered roller bearings for differential)

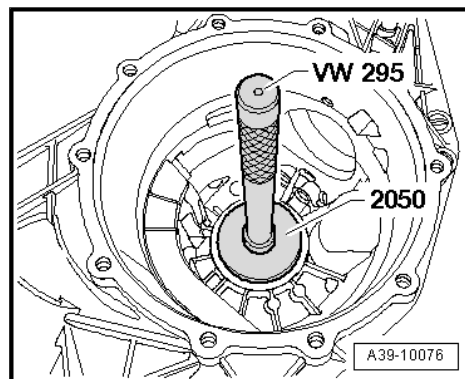
- Pinion shaft removed.
- If only the tapered roller bearings for the differential are being renewed, the crown wheel can be removed from the differential cage. The pinion shaft then does not have to be removed.
- Remove flange shaft oil seals
- Remove tapered roller bearing outer races for differential and take out shims ⇒ [page 89](#) .

- Drive outer race for tapered roller bearing (right-side) with shim "S₂" into gearbox housing. For measurement purposes use a 1.30 mm thick "S₂" shim (or 2 shims of 0.65 mm).

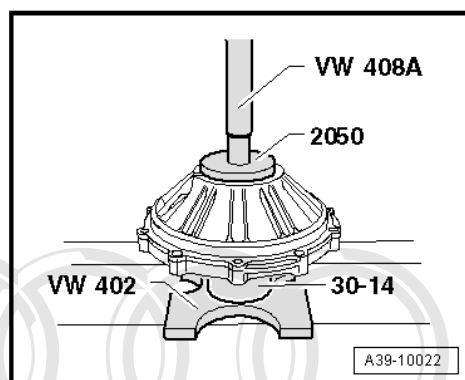


Note

For measurement purposes a 1.30 mm thick shim "S₂" is inserted provisionally. This is referred to in the following as "S₂*". "S₂*" is exchanged with the final shim "S₂" after determining backlash.



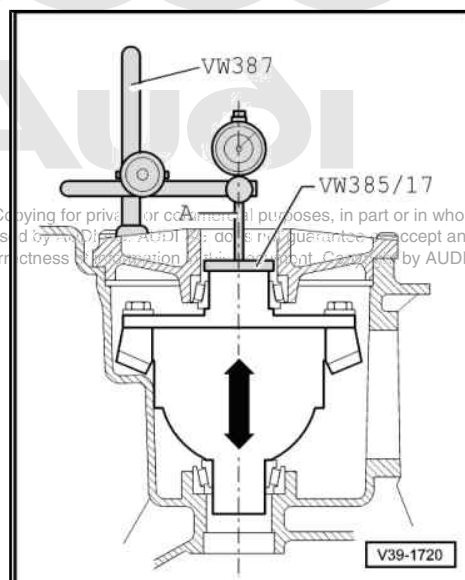
- Press tapered roller bearing outer race (left-side) without shim "S₁" into cover for final drive.
- Install differential in gearbox housing. The crown wheel is positioned on the left-hand side (same side as cover for final drive).
- The O-ring is fitted into cover for final drive.
- Fit cover for final drive with 4 bolts (24 Nm).
- Turn gearbox so that cover for final drive points upwards.
- Turn differential 5 turns in both directions so that the tapered roller bearings settle.
- Place measuring plate -VW 385/17- on differential.
- Set up measuring tool using 30 mm extension.
- Set dial gauge (3 mm measuring range) -A- to "0" with 2 mm preload.



Note

Tip of dial gauge must be located at centre of differential.

- Raise differential without turning, read clearance off dial gauge and note down.
- Measurement in following example: 0.62 mm



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 Note

- ◆ *Secure special tools -VW 521/4- and -VW 521/8- on right of differential (gearbox side) to lift differential.*
- ◆ *If the measurement has to be repeated, the differential must again first be turned 5 turns in each direction to settle the tapered roller bearings.*

Formula: $S_{total} = S_2^{**} + \text{measured value} + \text{bearing preload}$

Example:

Inserted shim(s) " S_2^{**} "	1.30 mm
+ measured value	0.62 mm
+ Bearing preload (constant value)	0.30 mm
= Total shim thickness " S_{total} " for " S_1 " plus " S_2 "	2.22 mm

Determining thickness of shim " S_1^{**} "

 Note

- ◆ *Provisional shim " S_1^{**} " is replaced with final shim " S_1 " after determining backlash.*
- ◆ *Total shim thickness " S_{total} " remains unchanged.*

Formula: $S_1^{**} = S_{total} - S_2^{**}$

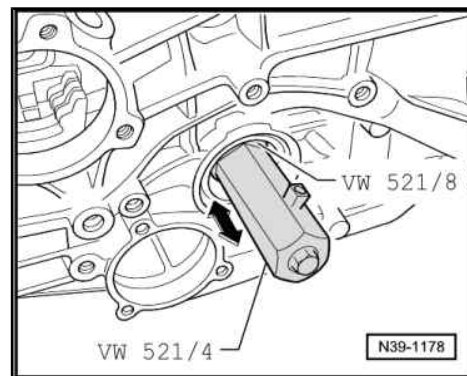
Example:

Total shim thickness " S_{total} " for " S_1 " plus " S_2 "	2.22 mm
- Inserted shim(s) " S_2^{**} "	1.30 mm
= Thickness of shim " S_1^{**} "	0.92 mm

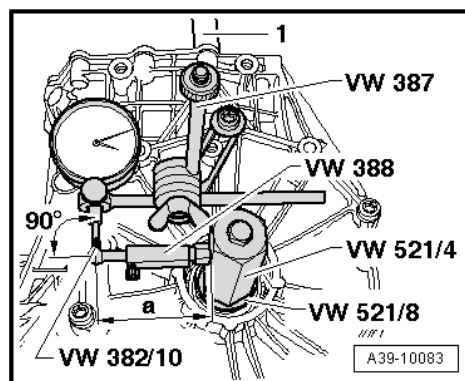
Select correct shims from ⇒ Electronic parts catalogue "ETKA".

Measuring backlash

- Pinion shaft fitted with shims " S_3 " and " S_4 ".
- The O-ring is fitted into cover for final drive.
- Install differential with crown wheel: " S_1 " is fitted on cover side, " S_2 " in gearbox housing.
- Fit cover for final drive and tighten bolts to 24 Nm.
- Insert crown wheel adjusting tool -VW 521/4- and -VW 521/8-.
- Turn differential 5 turns in both directions so that the tapered roller bearings seat properly.



- Secure universal dial gauge bracket -VW 387- to gearbox housing.
- Fit dial gauge with dial gauge extension -VW 382/10- (6 mm flat).
- Adjust measuring lever -VW 388- to distance “a” = 75 mm (for Ø 186 mm crown wheel).
- Measure play between teeth faces (backlash) as follows:
- Turn crown wheel until it makes contact with the face of one tooth (end of backlash travel).
- Preload dial gauge to 2 mm and set to “0”.
- Turn back crown wheel until it makes contact with opposite tooth face (backlash).
- Take backlash reading and note down measured value.
- Turn crown wheel through 90° and repeat measurements a further 3 times.



Note

If the pinion shaft -1- rotates during the measurements, counter-hold pinion shaft to make sure that the measured value of the backlash is correct.

Determining average backlash

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

Example:

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

- Result: the average backlash is $1.16 \text{ mm} : 4 = 0.29 \text{ mm}$



Note

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

Determining thickness of shim “S₂”

Formula: “S₂” = “S₂” - measured backlash + specified backlash

Example:

Inserted shim “S ₂ ”	1.30 mm
- Measured backlash	0.29 mm
+ Specified backlash	0.15 mm
= Thickness of shim “S ₂ ”	1.16 mm

- Determine shim(s) according to table. Part numbers ⇒ Electronic parts catalogue “ETKA” .

Available shims for "S₂"

Shim thickness (mm) ⁵⁾		
0.45	0.61	0.77
0.49	0.65	0.81
0.53	0.69	0.85
0.57	0.73	

5) The exact shim thickness required can be obtained by using the shim tolerance variations. Install two shims if necessary.

Determining thickness of shim "S₁"

Formula: "S₁" = "S_{total}" - "S₂"

Example:

Total shim thickness "S _{total} " for "S ₁ " plus "S ₂ "	2.22 mm
- Thickness of shim "S ₂ "	1.16 mm
= Thickness of shim "S ₁ "	1.06 mm

- Determine shim(s) according to table. Part numbers ⇒ Electronic parts catalogue "ETKA" .

Available shims for "S₁"

Shim thickness (mm) ⁶⁾		
0.45	0.61	0.77
0.49	0.65	0.81
0.53	0.69	0.85
0.57	0.73	

6) The exact shim thickness required can be obtained by using the shim tolerance variations. Install two shims if necessary.

Checking adjustment

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



Note

- ◆ *If the pinion shaft -1- rotates during the measurements, counter-hold pinion shaft to make sure that the measured value of the backlash is correct.*
- ◆ *Adjustment must be repeated if backlash is outside tolerance. The total shim thickness "S_{total}" must remain unchanged.*
- ◆ *The discrepancy between individual measured values must not exceed 0.06 mm.*

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