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★ **NEW INFORMATION** since last filming

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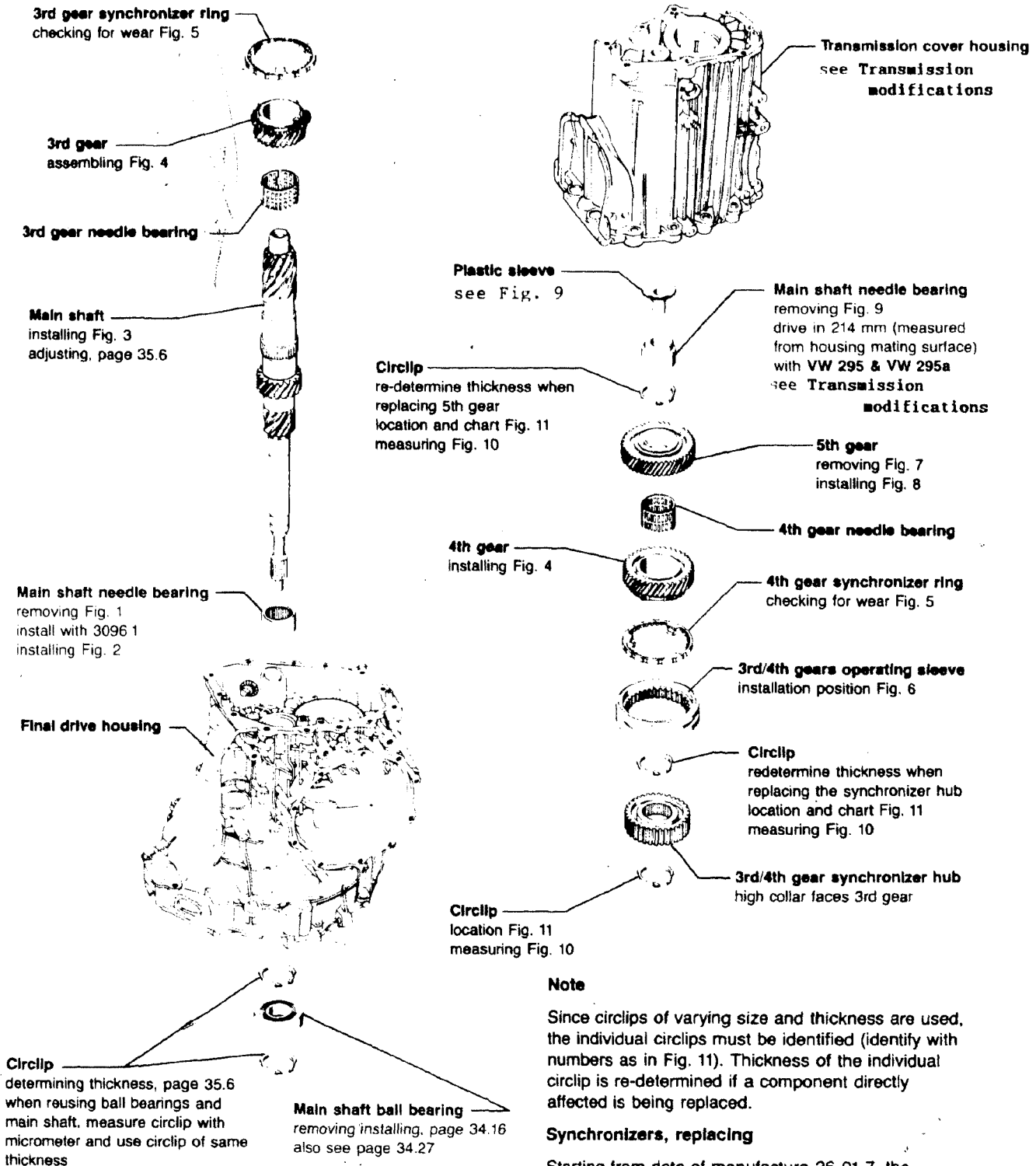
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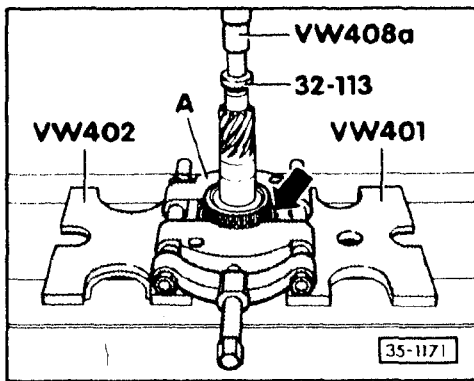
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Note

When installing new gears or main shaft, note technical data, see Repair Group 00 - code letters, application, ratios, filling capacities.

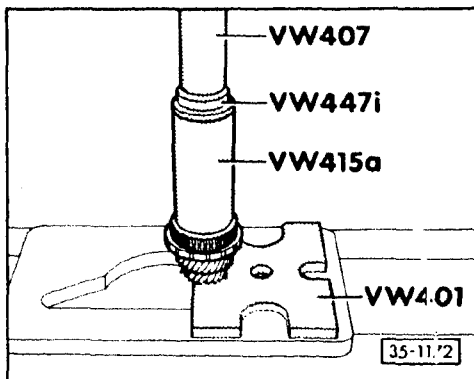


3rd/4th gear synchronizer hub, pressing off

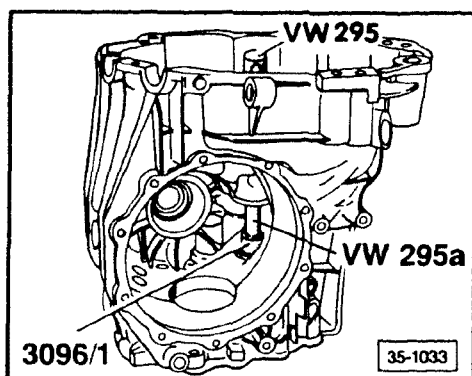
- support hub with separator A, 22-115 mm,
e.g. Kukko 17/2

Note

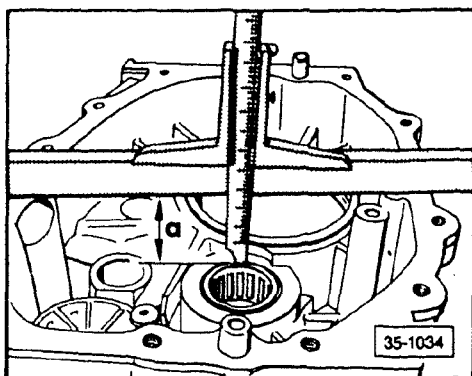
Press 3rd gear synchronizer ring (arrow)
towards 3rd gear before positioning separator.



3rd/4th gear synchronizer hub, pressing on

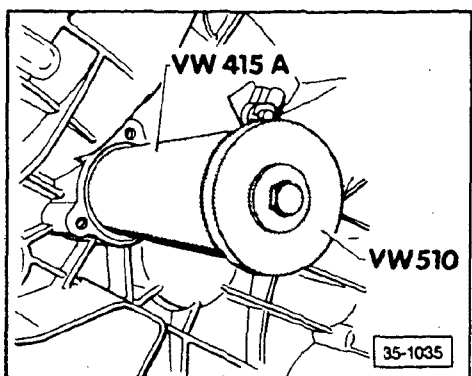


► Fig. 1 Main shaft needle bearing, removing



► Fig. 2 Needle bearing, installing

- dimension **a** from lower edge of straightedge to upper edge of needle bearing 39.5 mm

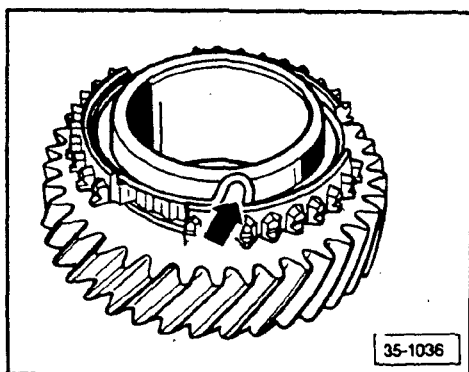


► Fig. 3 Main shaft, installing

- install main shaft, output shaft, and shift mechanism complete
- install circlip (item 3) and pull main shaft with a bolt into housing and ball bearing

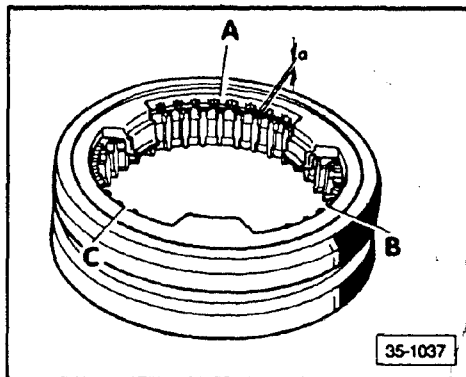
Note

Preferred method of installation is with **3235**.
See page 34.13



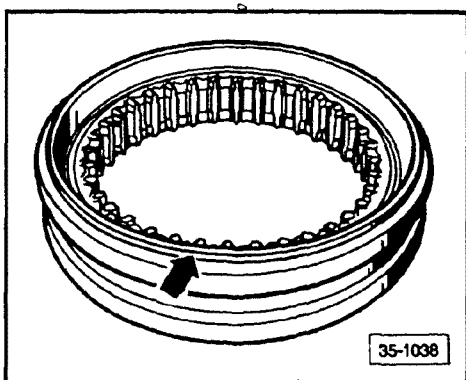
► Fig. 4 Spring, installing

- install spring (**arrow**) in gear by installing angled end in bore



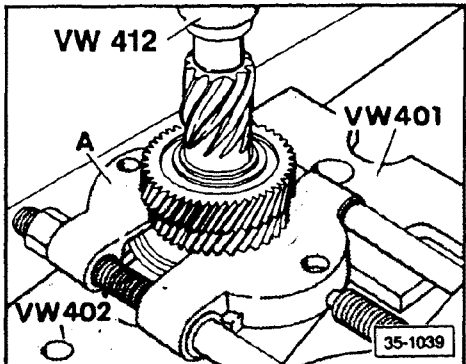
► Fig. 5 Synchronizer ring, checking for wear

- press synchronizer ring into operating sleeve and measure gap *a* with a feeler gage in positions A, B, and C
- add measured values and divide by 3
 - value obtained must not be less than 0.5 mm



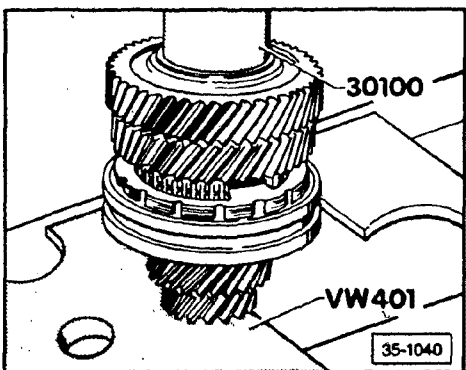
► Fig. 6 3rd/4th gear operating sleeve, installing

- recessed side (arrow) faces 3rd gear



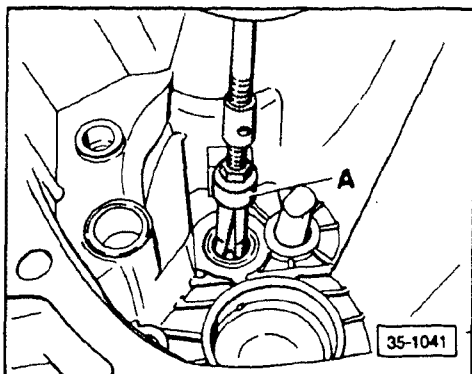
► Fig. 7 5th gear, removing

- A — separating device 12 - 75 mm, e.g. Kukko 17/2



► Fig. 8 5th gear, installing

- the higher collar faces reverse gear
- the oil traps face 4th gear



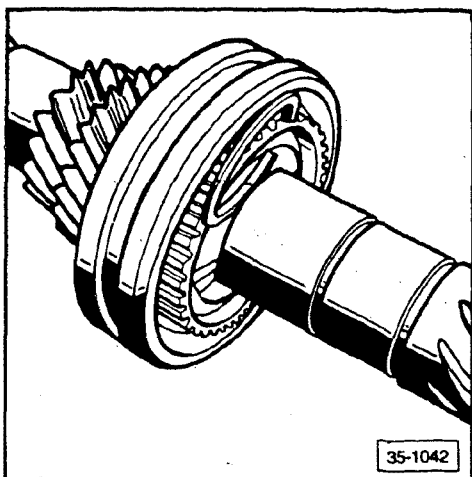
► Fig. 9 Main shaft needle bearing, removing

- use puller A e.g. Kukko 21/4 (23.5 mm - 30 mm) with VW 771/1 and VW 771/15

beginning with transmission 21 07 9, the oil drilling for 3rd/4th gear is no longer present in **some** transmissions.

The needle bearing to support the main shaft in the transmission housing is then installed without the plastic sleeve.

If, during repairs, the main shaft is replaced with a shaft that has the oil drilling, the plastic sleeve must be installed. (see page 35.2)

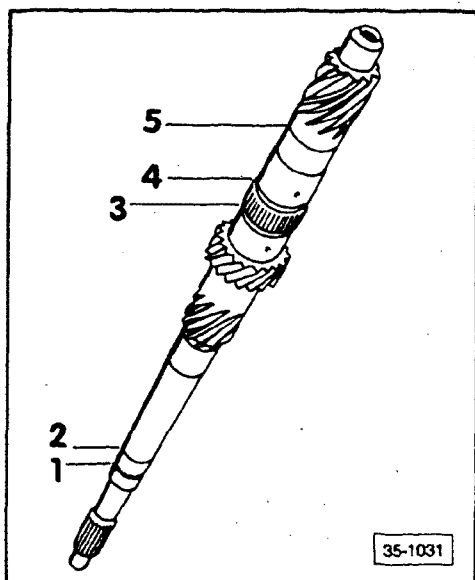


► Fig. 10 4th gear circlip, determining

- determine the thickest circlip that can be used and install
- determine circlip for 5th gear in same manner

Note

The following circlips are available – see Fig. 11.

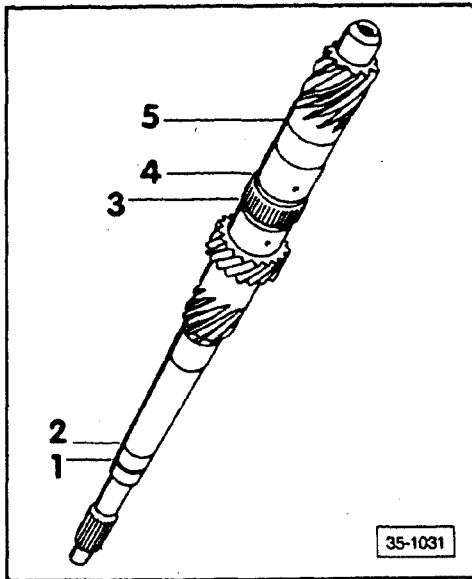


► Fig. 11 Location of circlips

- thicknesses of circlips 1, 2, 4, and 5 must be determined
- thickness of circlip 3 is always the same
- determine thickness of circlips 1 and 2
 - see Main shaft, adjusting
- circlip 3, annealing color brown, Part No. N 902 045.01 2.00 mm thick

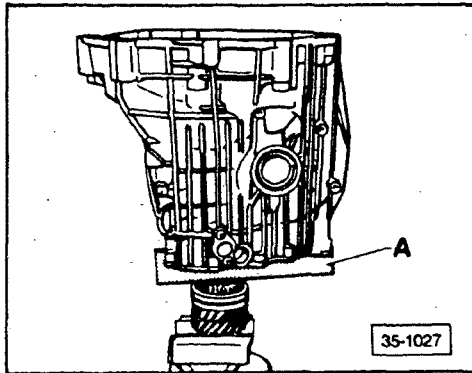
circlip 4, annealing color blue

Thickness of circlip (mm)	Part number
1.90	N 902 944.01
1.93	N 902 944.02
1.96	N 902 944.03
1.99	N 902 944.04
2.02	N 902 944.05
2.05	N 902 944.06



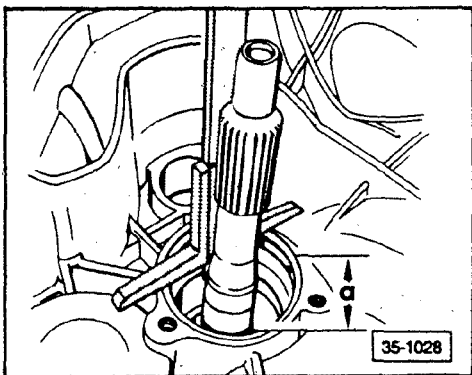
circlip 5

Thickness of circlip (mm)	Part number
1.90	N 902 942.02
1.93	N 902 942.03
1.96	N 902 942.04
1.99	N 902 942.05
2.02	N 902 942.06

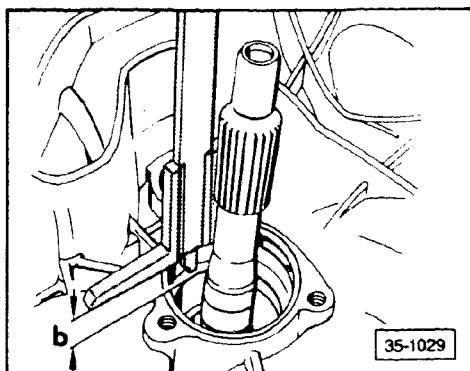


Main shaft, adjusting

- tighten main shaft with jaw covers in vise
- place special tool (A) 3167 on 3rd gear and install housing on special tool via main shaft



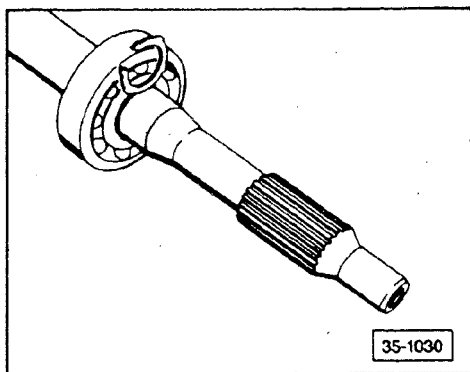
- place depth gage on housing and measure to the lower recess of the main shaft
a = 28.5 mm



- place depth gage on housing and measure to contact surface of ball bearing
 - dimension **b** = 26.8 mm
- determine thickness of lower circlip
 - dimension **x**:
 $x = a - b$
 $x = 28.5 \text{ mm} - 26.8 \text{ mm} = 1.70 \text{ mm}$
- determine thickness of circlip according to table

Measurement result (mm)	Thickness (mm)	Part number
1.48-1.56	1.54	N 902 941.14
1.57-1.65	1.63	N 902 941.15
1.64-1.71	1.69	N 902 941.05*
1.66-1.74	1.72	N 902 941.16
1.72-1.79	1.77	N 902 941.06*
1.75-1.83	1.81	N 902 941.17
1.80-1.87	1.85	N 902 941.07*
1.84-1.92	1.90	N 902 941.18
1.88-1.95	1.93	N 902 941.08*
1.93-2.01	1.99	N 902 941.19
1.96-2.03	2.01	N 902 941.09*
2.02-2.10	2.08	N 902 941.20
2.04-2.11	2.09	N 902 941.10
2.11-2.20	2.17	N 902 941.11
2.20-2.27	2.25	N 902 941.12
2.28-2.35	2.33	N 902 941.13

*these circlips will no longer be available when current supplies are depleted

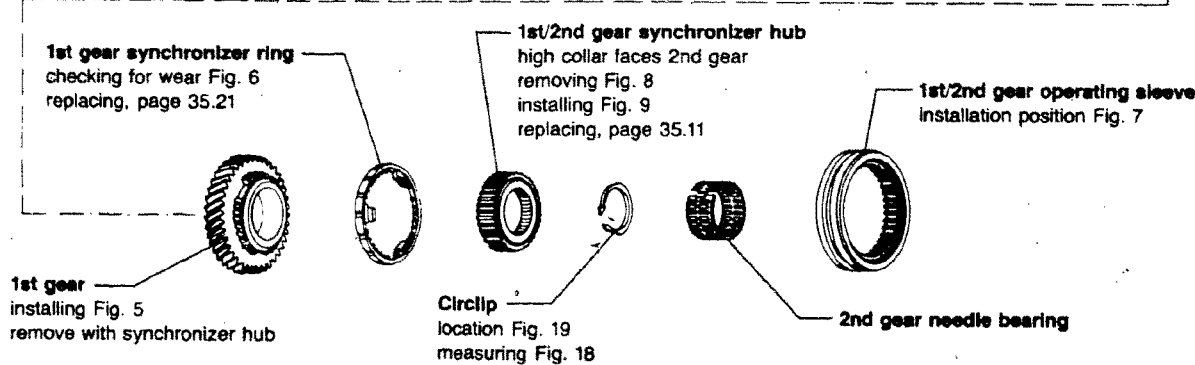
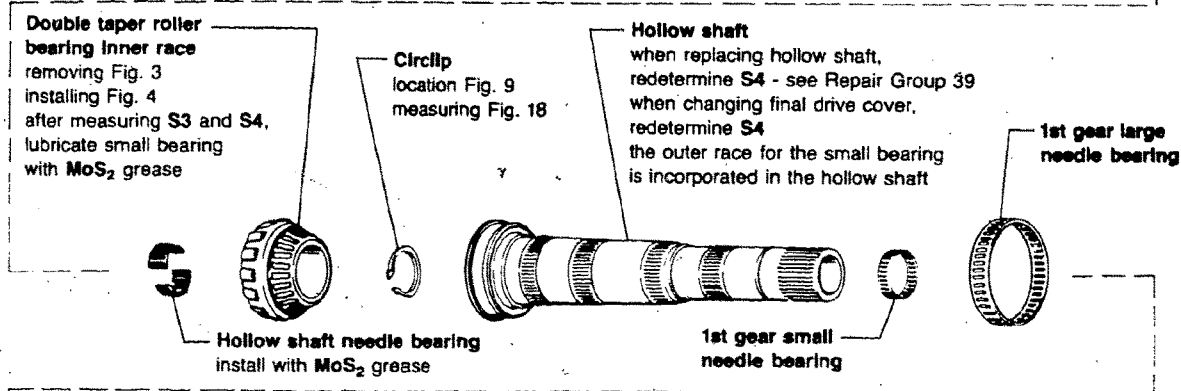
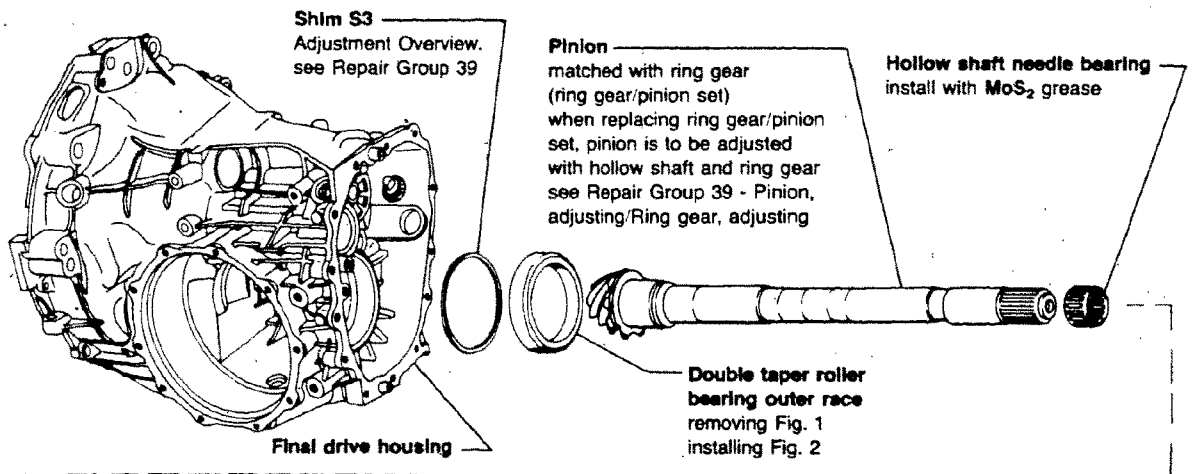


- install circlip and ball bearing on main shaft with **30-100**
- determine the thickest circlip that can be installed in upper circlip groove

The circlips available are the same as shown in the above chart

THIS FRAME INTENTIONALLY LEFT

BLANK



CAUTION

When replacing taper roller bearings, determine the installation position before removing the pinion with the hollow shaft (actual measurement). See Repair Group 39 - Determining installation position of the pinion.

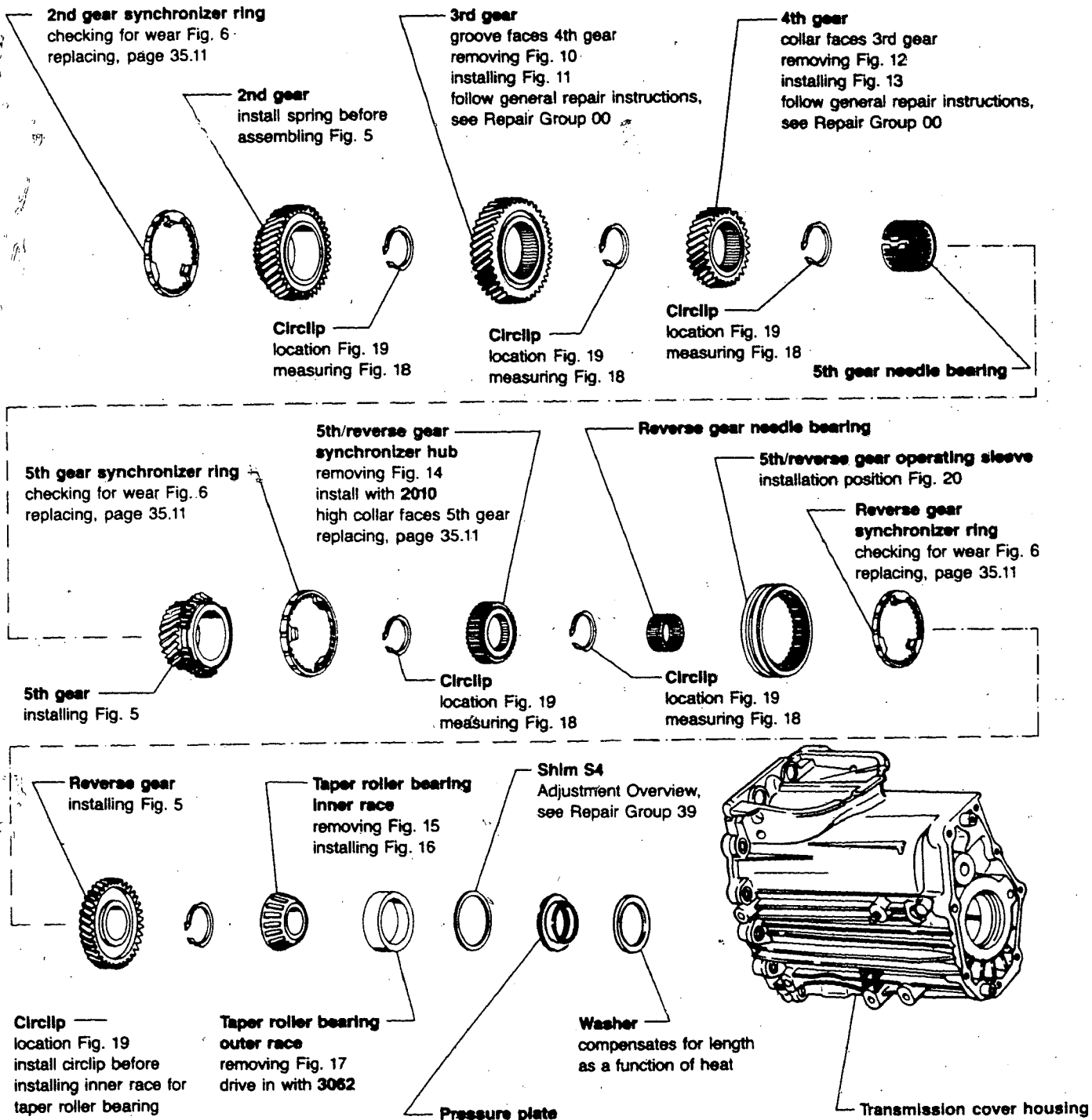
CAUTION

Do not damage seal lips between taper roller bearings.

Note

Before installing new gear or ring gear/pinion set - note technical data - see Repair Group 00.

Manual Transmission – Case, Gears, Shafts



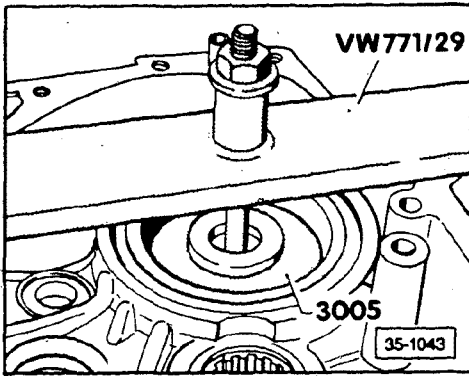
Note

Since circlips of varying size and thickness are being used, the individual circlips must be identified (identify with numbers as in Fig. 19). Thickness of the individual circlip is re-determined if a component directly affected is being replaced.

Synchronizers, replacing

Starting from date of manufacture 26 01 7, the outside diameter of the three synchronizer ring stops and the groove in the synchronizer hub were reduced by 0.6 mm. Do not install synchronizer hubs and rings of different sizes together.

35-1105

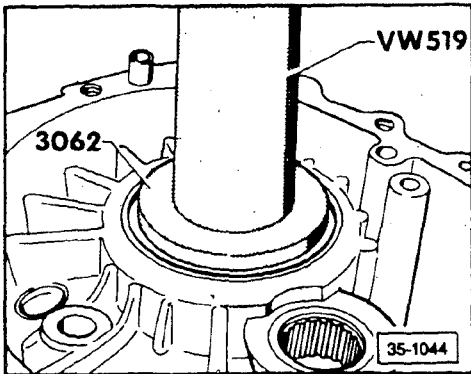


► Fig. 1 Double taper roller bearing outer race, removing

- place special tool 3005 under outer race, install VW 771/29 and a bolt on housing
- when tightening bolt, outer race is pulled out of housing

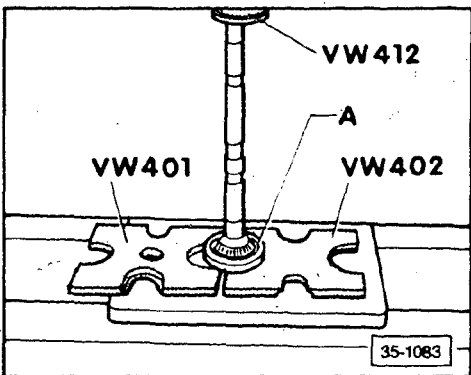
Note

VW 771/1 and VW 771/15 can also be used for this operation.



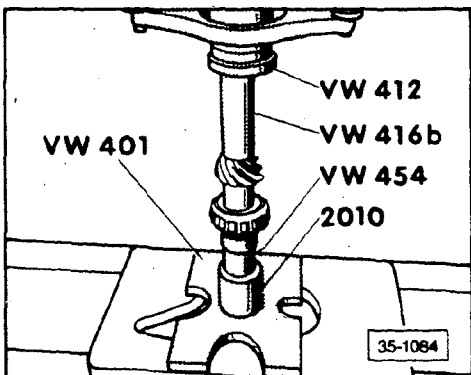
► Fig. 2 Double taper roller bearing outer race, installing

- outer race for small bearing is incorporated in hollow shaft



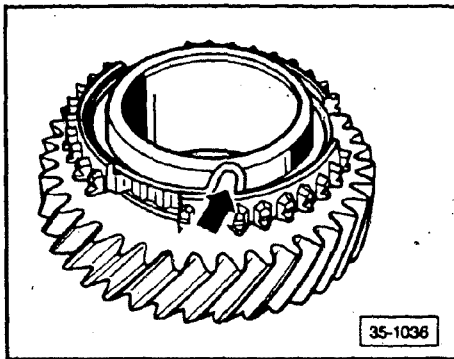
► Fig. 3 Double taper roller bearing inner race, removing

- outer race A must be installed to remove inner race



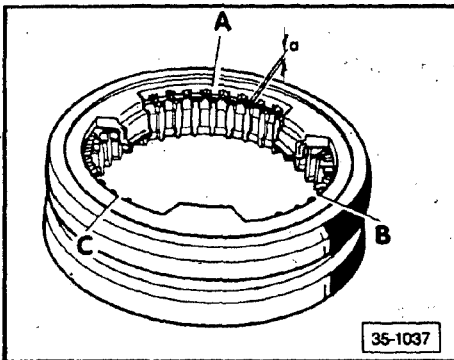
► Fig. 4 Double taper roller bearing inner race, installing

- secure double taper roller bearing as described in Fig. 18



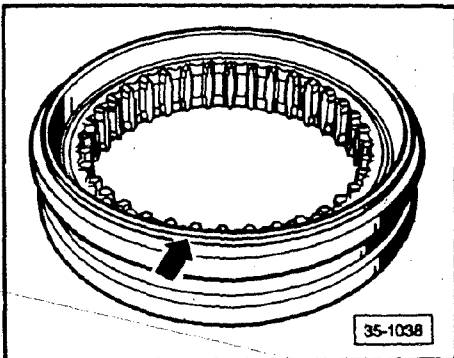
► Fig. 5 Spring, installing in gear

- assemble spring (arrow) in gear by installing angled end of spring in bore



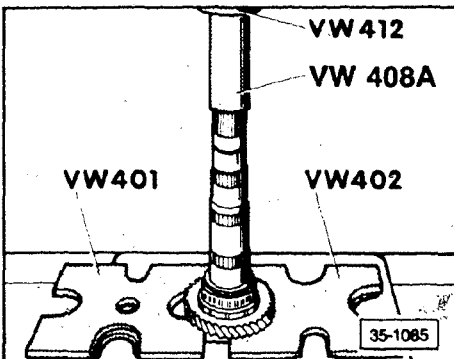
► Fig. 6 Synchronizer ring, checking for wear

- press synchronizer ring into operating sleeve and measure gap **A** with a feeler gage in positions **A**, **B**, and **C**
- add values obtained and divide by 3
 - the measured value must not be less than 0.5 mm



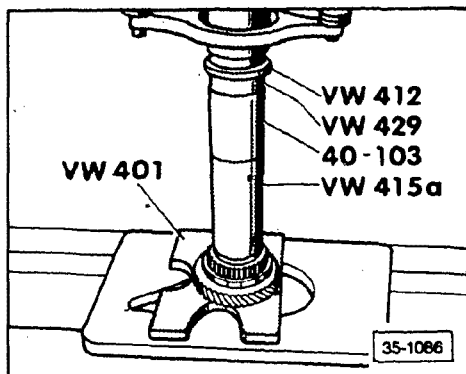
► Fig. 7 1st/2nd gear operating sleeve, installing

- recessed side (arrow) faces 1st gear



► Fig. 8 1st/2nd gear synchronizer hub, removing

- remove synchronizer hub with 1st gear

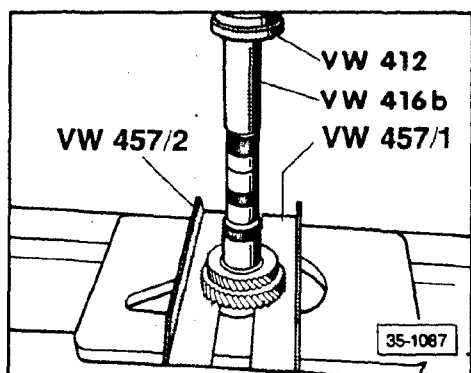


► Fig. 9 1st/2nd gear synchronizer hub, installing

- install synchronizer hub with 1st gear so that chamfer on internal splines faces 2nd gear

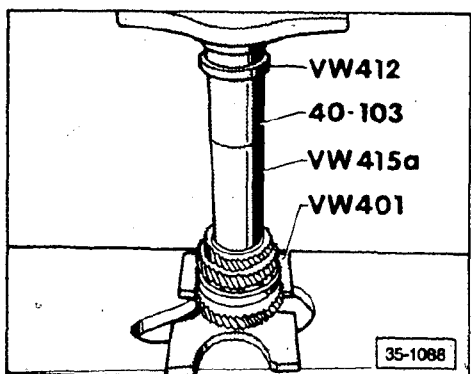
Note

Alternately, the shaft can be pressed onto the gear using VW 408A, 2050 and VW 40/40



► Fig. 10 3rd gear (toothed gear), removing

- remove toothed gear and 2nd gear together

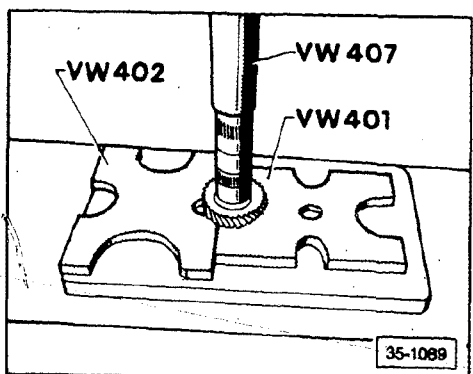


► Fig. 11 3rd gear, installing

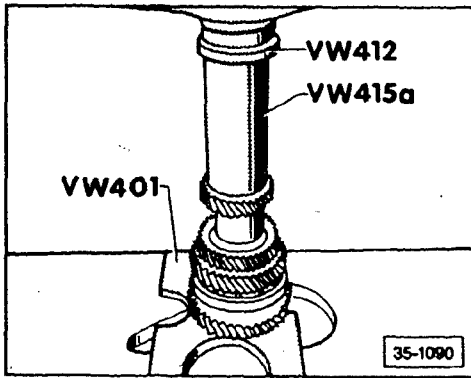
- installation position: groove faces 4th gear

Note

See Fig. 9.



► Fig. 12 4th gear, removing

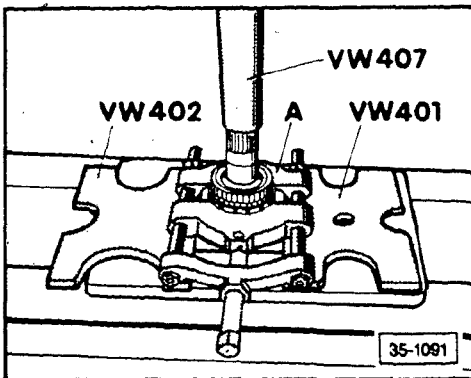


► Fig. 13 4th gear, installing

- collar faces 3rd gear

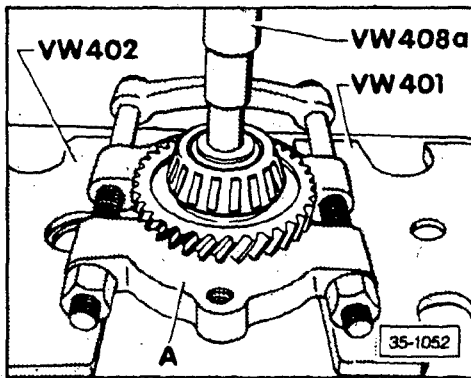
Note

Also see Fig. 9.



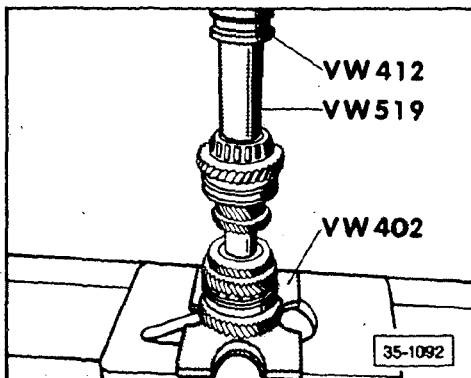
► Fig. 14 Synchronizer hub, removing

- remove synchronizer hub with 5th gear
- A - separating device 12 - 75 mm, e.g. Kukko 17/1



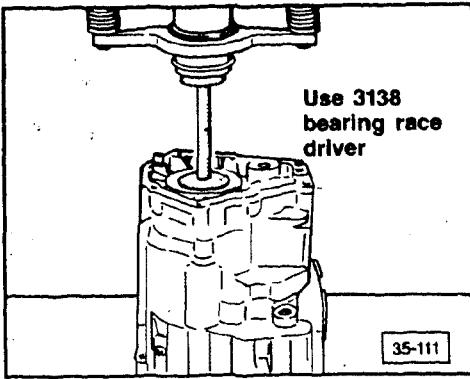
► Fig. 15 Taper roller bearing inner race, removing

- remove inner race with reverse gear
- A = separating device 12 - 75 mm, e.g. Kukko 17/1 or use VW 402/VW 401 without separating device



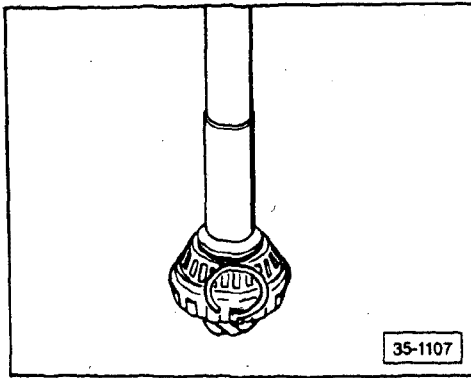
► Fig. 16 Taper roller bearing inner race, installing

- install circlip before installing inner race
- thickness of circlip Fig. 19



► Fig. 17 Taper roller bearing outer race, removing

- refer to Fig. 21
- remove outer race together with pressure plate, adjustment shim, and length-adjusting washer



► Fig. 18 Taper roller bearing circlip, determining

- determine the thickest circlip that can be used and install

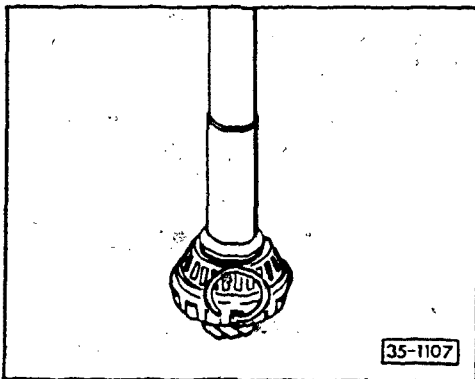
Thickness of circlip (mm)	Spare part number
2.00	N 902 942 10
2.02	N 902 942 06
2.04	N 902 942 11
2.06	N 902 942 12
2.08	N 902 942 08
2.10	N 902 942 13

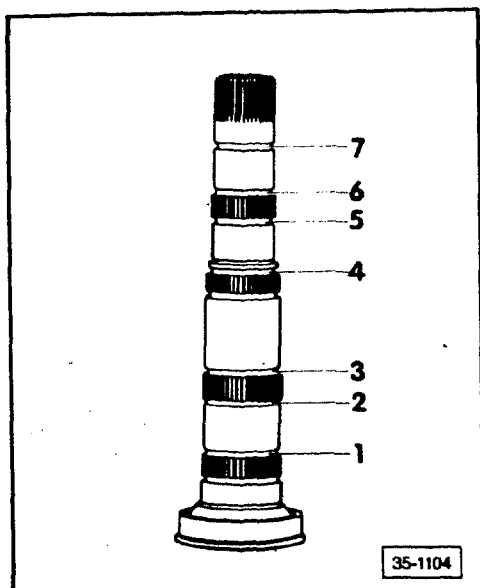
- synchronizer hub circlips and 3rd/4th gear circlip are determined in same manner as taper roller bearing circlip
- the following circlips are available for the hollow shaft, see Fig. 19

Tapered roller bearing circlip, revised

Beginning with transmission date 03 04 0, the circlip sizes are revised as follows:

Thickness of circlip (mm)	Part number
2.00	N 902 942.10
2.03	N 902 942.15
2.06	N 902 942.12
2.09	N 902 942.16
2.12	N 902 942.17
2.15	N 902 942.18





► Fig. 19 Circlips, location

- see Transmission modifications
- determine thickness of circlips 1, 3, 4, and 6
 - thickness of circlips 2, 5, and 7 is always equal (see table)

circlip 1, annealing color blue

Thickness of circlip (mm)	Part number
1.90	N 902 947.01
1.93	N 902 947.02
1.96	N 902 947.03
1.99	N 902 947.04
2.02	N 902 947.05

circlip 2, annealing color blue

Thickness of circlip (mm)	Part number
2.50	N 902 947.06

circlip 3

Thickness of circlip (mm)	Part number
1.90	N 902 946.02
1.93	N 902 946.03
1.96	N 902 946.04
1.99	N 902 946.05
2.02	N 902 946.06

circlip 4

Thickness of circlip (mm)	Part number
1.87	N 902 952.01
1.90	N 902 952.02
1.93	N 902 952.03
1.96	N 902 952.04

circlip 5, annealing color brown

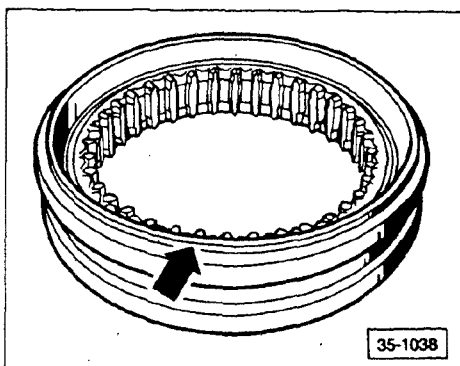
Thickness of circlip (mm)	Part number
2.00	N 902 945.01

circlip 6, annealing color blue

Thickness of circlip (mm)	Part number
1.90	N 902 944.01
1.93	N 902 944.02
1.96	N 902 944.03
1.99	N 902 944.04
2.02	N 902 944.05
2.05	N 902 944.06

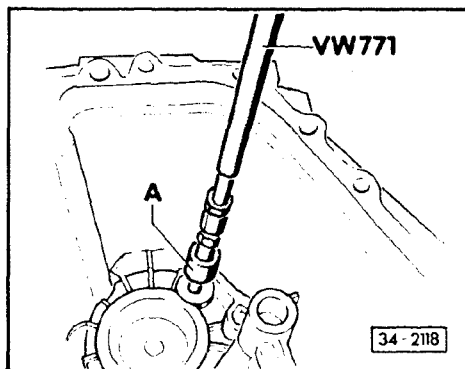
circlip 7

Thickness of circlip (mm)	Part number
2.50	N 902 944.07



► Fig. 20 5th/reverse gear operating sleeve, installing

- recessed side (arrow) faces 5th gear



► Fig. 21 Securing bushing for taper roller bearing outer race, remove

- remove production-installed bushing
 - A = extractor, 12 - 16 mm, e.g. Kukko 21/1

Note

It is not necessary to install the bushing if the outer race is replaced.

Transmission modifications

Reverse gear

Beginning with transmission date 20 08 0, the reverse gear teeth on the main shaft and those of the reverse gear have been lengthened as follows:

- dimension **a** = current: 54.50 mm
New: 56.50 mm

- dimension **a** = current: 18.3 mm
New: 19.7 mm

Note

The new mainshaft can be installed in earlier transmissions (before 20 08 0) but the needle bearing must be installed 2.0 mm deeper (see Mainshaft needle bearing installation on this page).

Main shaft needle bearing installation

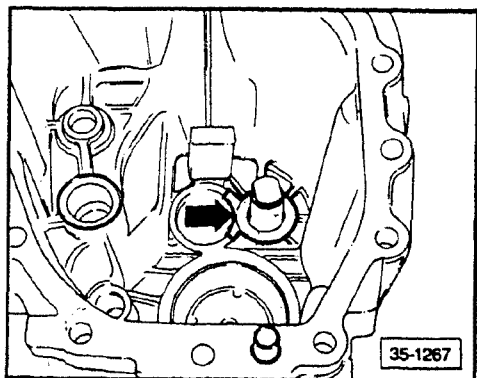
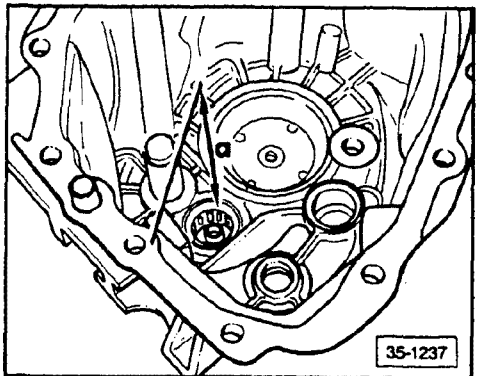
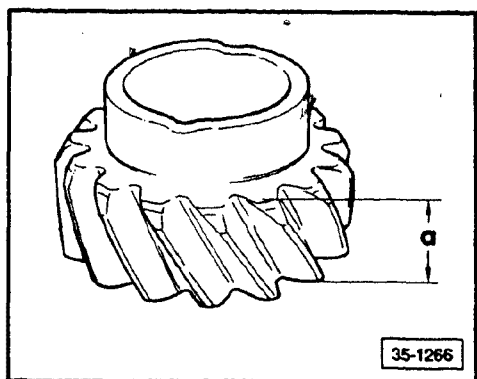
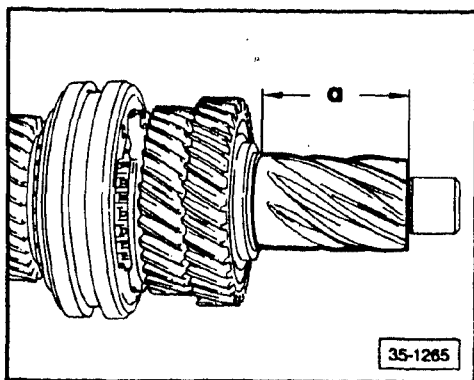
Beginning with transmission date 20 08 0, the main shaft needle bearing in the final drive housing is installed 2.0 mm deeper.

- dimension **a** = current: 214 mm
New: 216 mm

The final drive housing is slightly milled-out in the reverse gear area (arrow).

Note

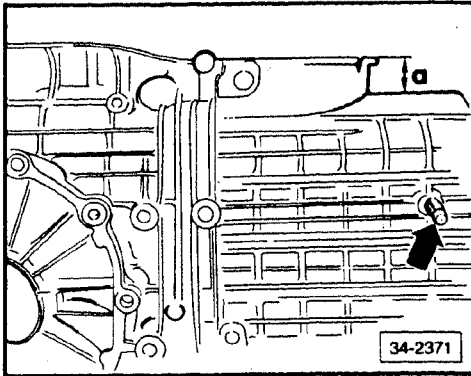
The new reverse gear can only be installed in transmissions that have the revised housing and main shaft.



Tensioning cable mounting

Beginning with transmission date 20 08 0, the tensioning cable mount on the transmission was changed.

- dimension **a** = current: 23.5 mm
New: 31.5 mm



Beginning in 9/90 a mounting hole in the housing replaces the previously used mounting stud (**arrow**). The tensioning cable bracket is then provided with a mounting stud.

Note

Change the cable bracket when installing a new transmission.

Rear pinion needle bearing deleted

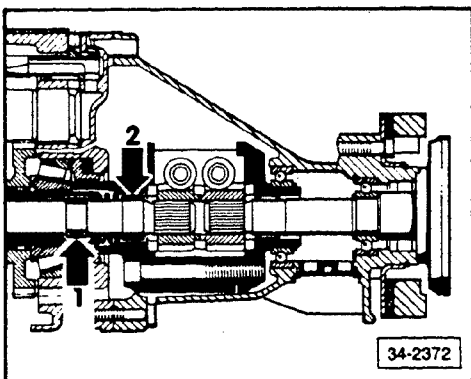
Beginning with transmission date 24 08 0, the rear needle bearing (**arrow 1**) is deleted.

The pinion is now supplied with a needle bearing in the Torsen differential (**arrow 2**).

Note

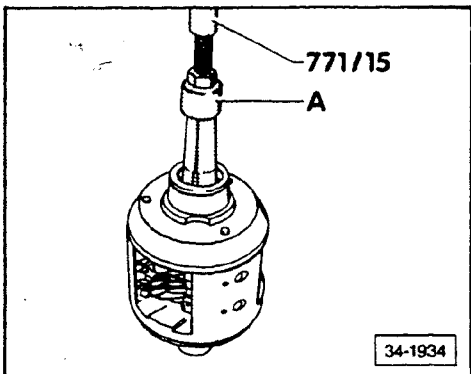
The pinion and Torsen differential with the revised bearing can only be installed together in a current transmission.

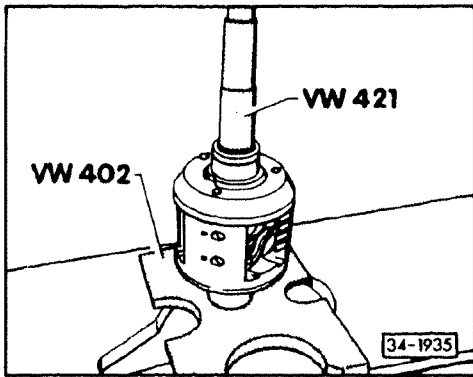
The shaft is not machined in the area of the current bearing seat (**arrow 1**). It can only be installed together with the revised pinion and Torsen differential in current transmissions.



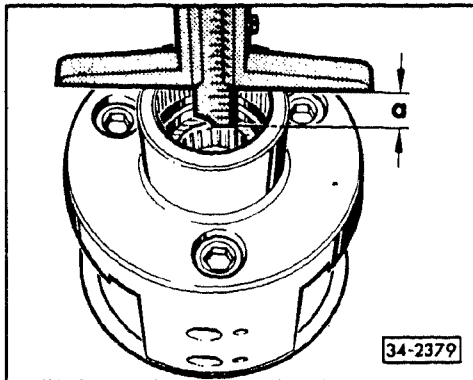
Needle bearing, removing

A = puller (Kukko 21/4, 23.5-30 mm)



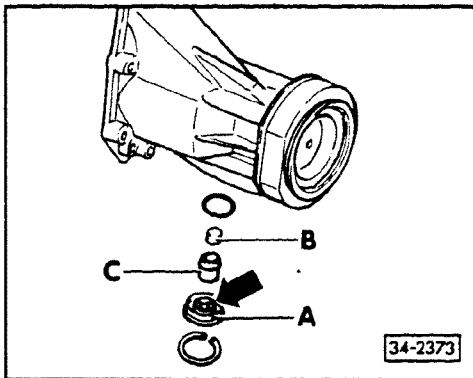


Needle bearing, pressing in



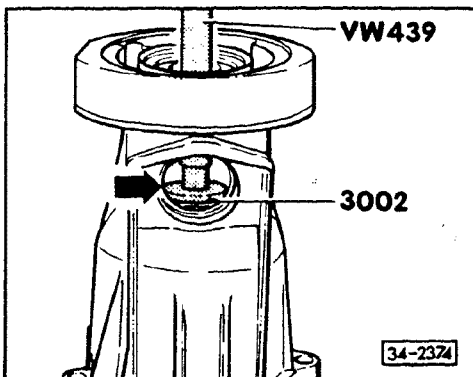
Needle bearing, press in depth

- $a = 32.5 \text{ mm}$



Additional magnet in Torsen differential cover

Beginning with transmission date 24 08 0, cap A is provided with magnet B, which is in sleeve C



Torsen differential, removing

- drive out with VW 439 and 3002
- insert 3002 through hole in housing (arrow)

Tapered roller bearing circlip, revised

Beginning with transmission date 03 04 0, the circlip sizes are revised as follows

Thickness of circlip (mm)	Part number
2.00	N 902 942.10
2.03	N 902 942.15
2.06	N 902 942.12
2.09	N 902 942.16
2.12	N 902 942.17
2.15	N 902 942.18

Hollow shaft circlips, revised

Beginning with transmission date 03 04 0, the circlip sizes are revised as follows:

Circlip 3

Thickness of circlip (mm)	Part number
1.90	N 902 946.02
1.94	N 902 946.09
1.98	N 902 946.10
2.02	N 902 946.06
2.06	N 902 946.11

Circlip 4

Thickness of circlip (mm)	Part number
1.86	N 902 952.07
1.90	N 902 952.02
1.94	N 902 952.08
1.98	N 902 952.09

Note

The circlips 1, 2, 5, 6, and 7 remain unchanged.

New circlips can be installed in all current transmissions.

Current circlips will be deleted when supplies are used up.

