Transmission, disassembling and assembling

ATF cooler and ATF filler tube, removing and installing ⇒ page 37-54

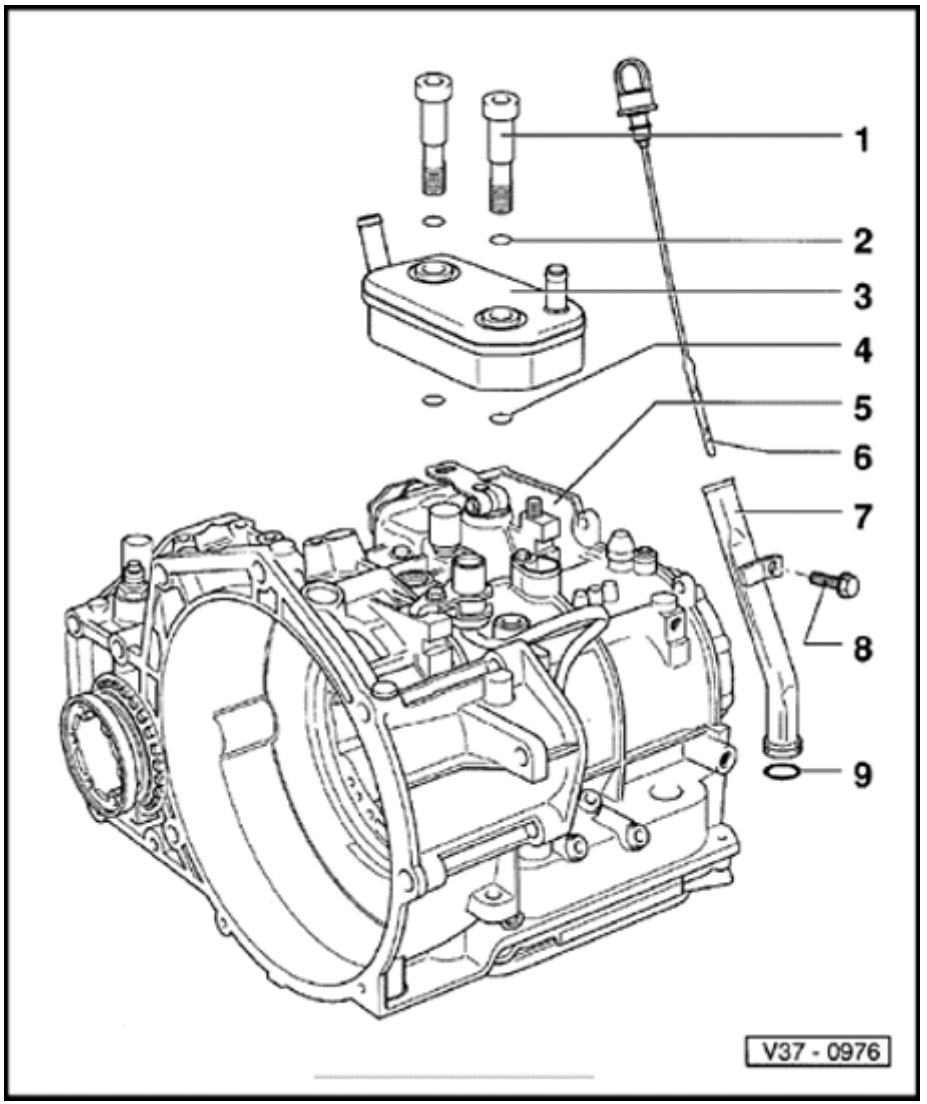
Planetary gearbox disassembly and assembly, overview ⇒ page 37-55

Planetary gearbox, disassembling ⇒ page 37-70

Planetary gearbox, assembling ⇒ page 37-76

Planetary gearbox adjustments, overview ⇒ page 37-89

Valve body, removing and installing ⇒ page 38-36



ATF cooler and ATF filler tube, removing and installing

1 - Banjo bolt

- Tightening torque: 35 Nm (26 ft lb)

2 - O-ring

- Always replace

3 - ATF cooler

4 - O-ring

- Always replace

5 - Transmission housing

6 - ATF dipstick

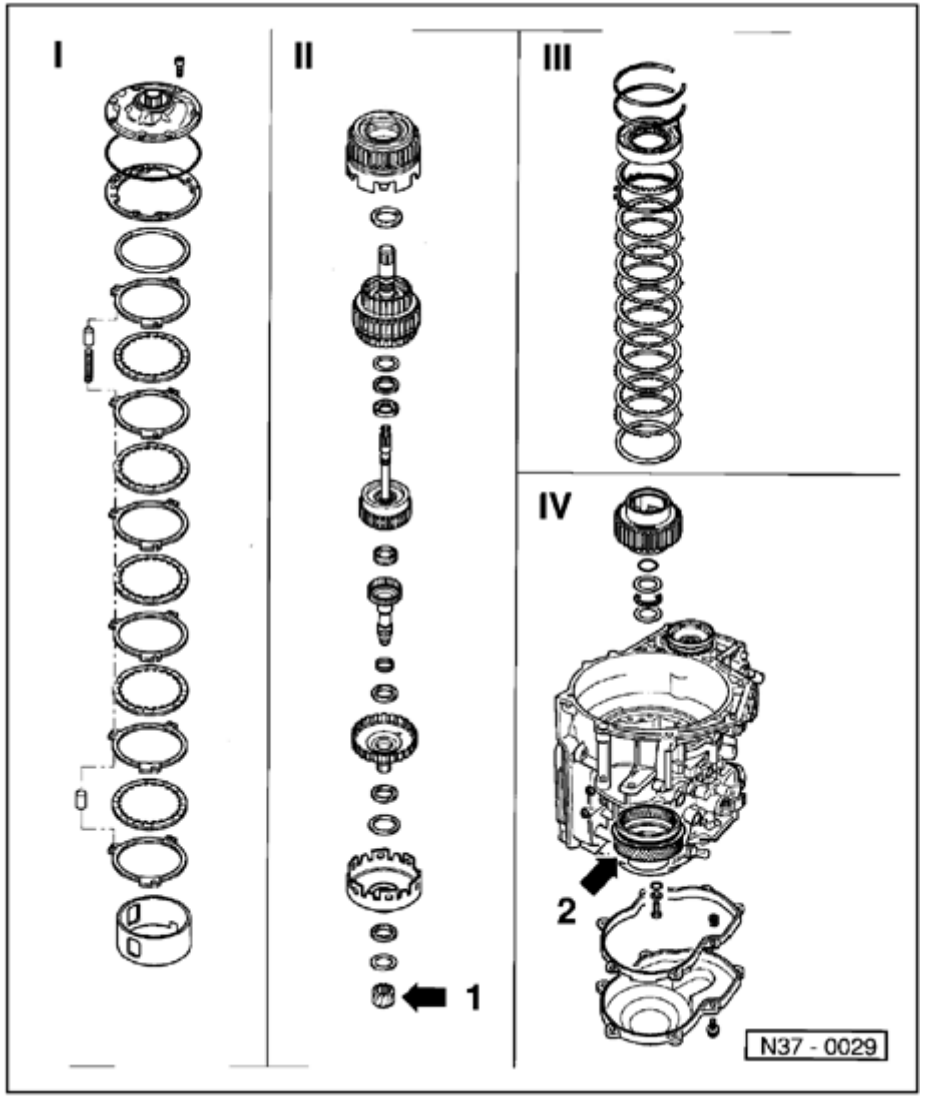
- Checking ATF level ⇒ page 37-47

7 - ATF filler tube

8 - Bolt

9 - O-ring

- Always replace



Planetary gearbox disassembly and assembly, overview

Note:

Disassembling planetary gearbox ⇒ *page 37-70* .

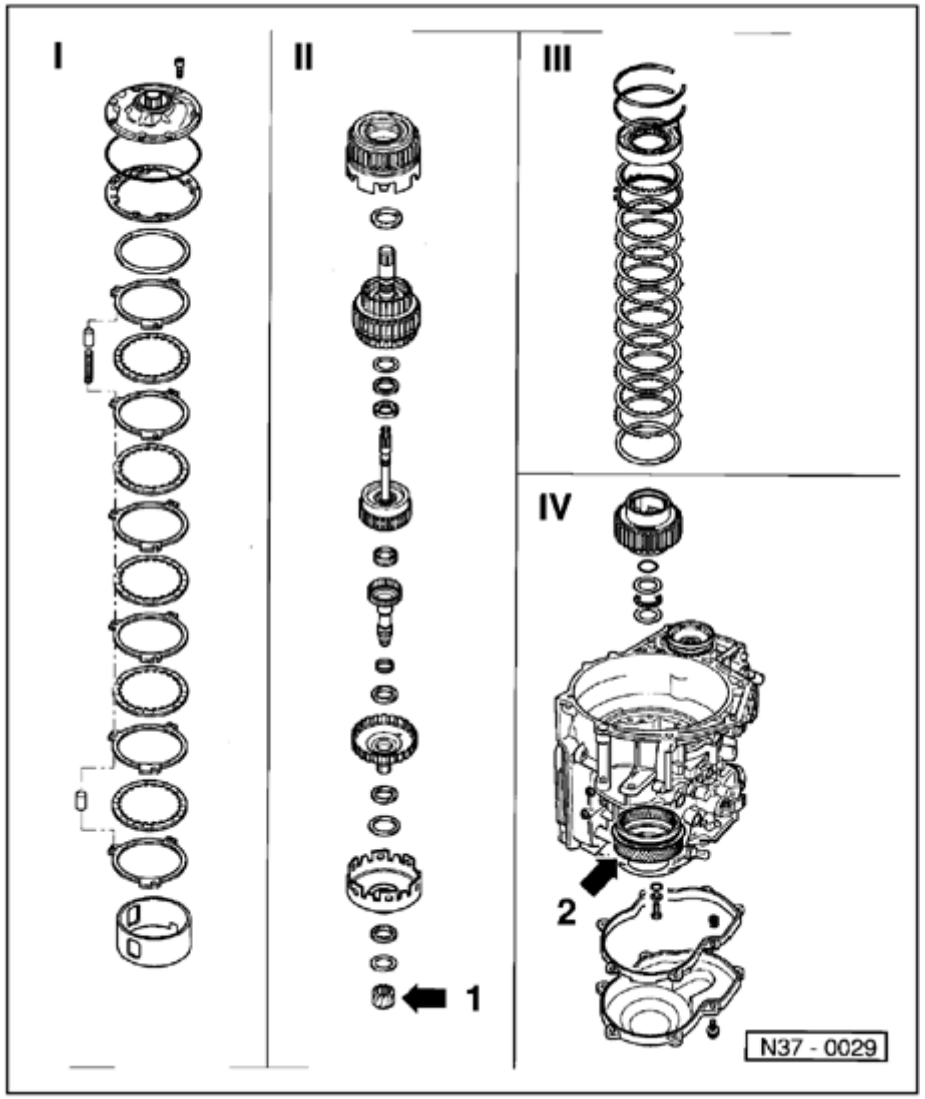
Assembling ⇒ *page 37-76* .

I - ATF pump to support tube, removing and installing ⇒ page 37-57

II - Reverse gear clutch -K2- to large sun gear, removing and installing ⇒ page 37-61

Note:

The small sun wheel (arrow 1) cannot be removed from the planet carrier in transmissions from 01.93 ⇒ page 00-5 .



III - Free wheel and reverse gear brake -B1-, removing and installing ⇒ page 37-64

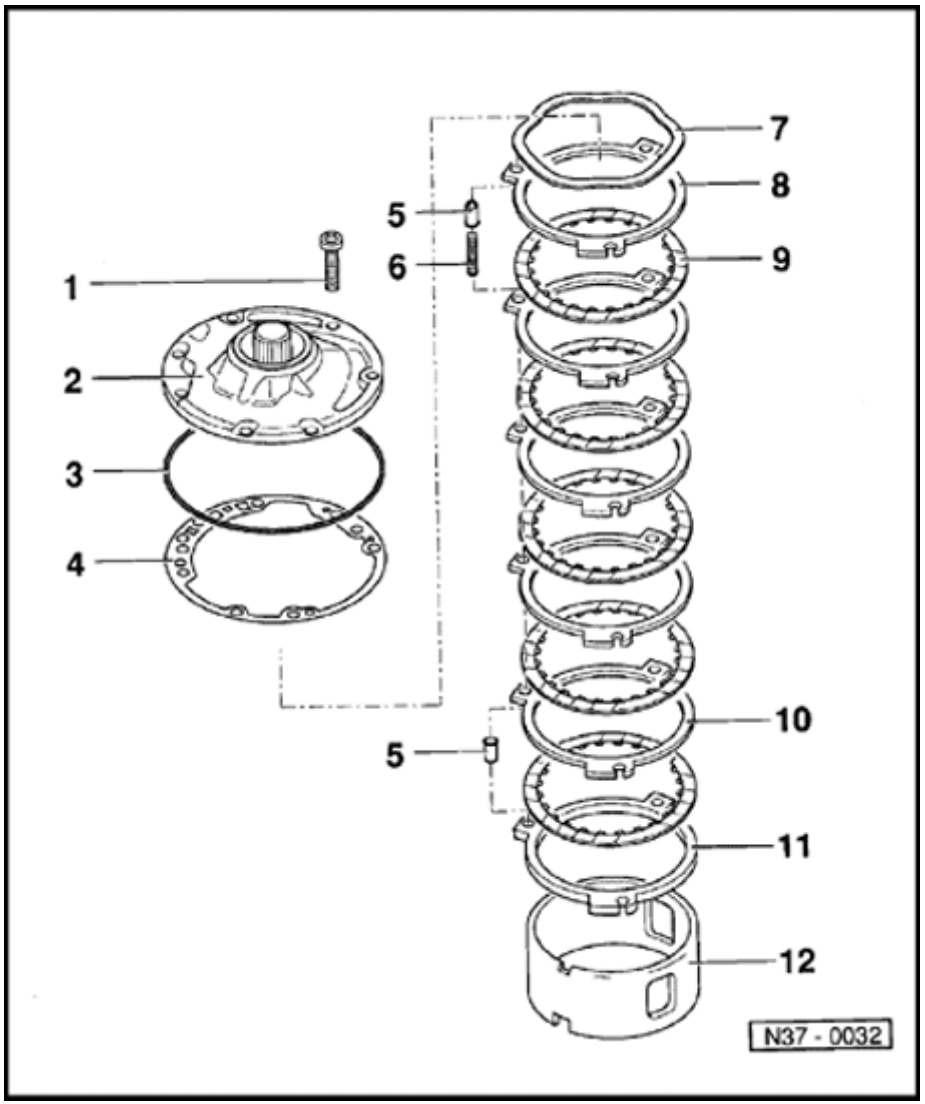
Note:

To remove and install free wheel first remove valve body together with plugs ⇒ page 38-36 .

IV - Planet carrier and input gear, removing and installing ⇒ page 37-67

Note:

- *It is not necessary to remove the input gear (arrow).*
- *Removing and installing input gear ⇒ page 39-8 .*



I - ATF pump to support tube, removing and installing

⇒ Overview, page 37-55

Note:

Disassembling planetary gearbox ⇒ *page 37-70* .

Assembling ⇒ *page 37-76* .

1 - Bolt

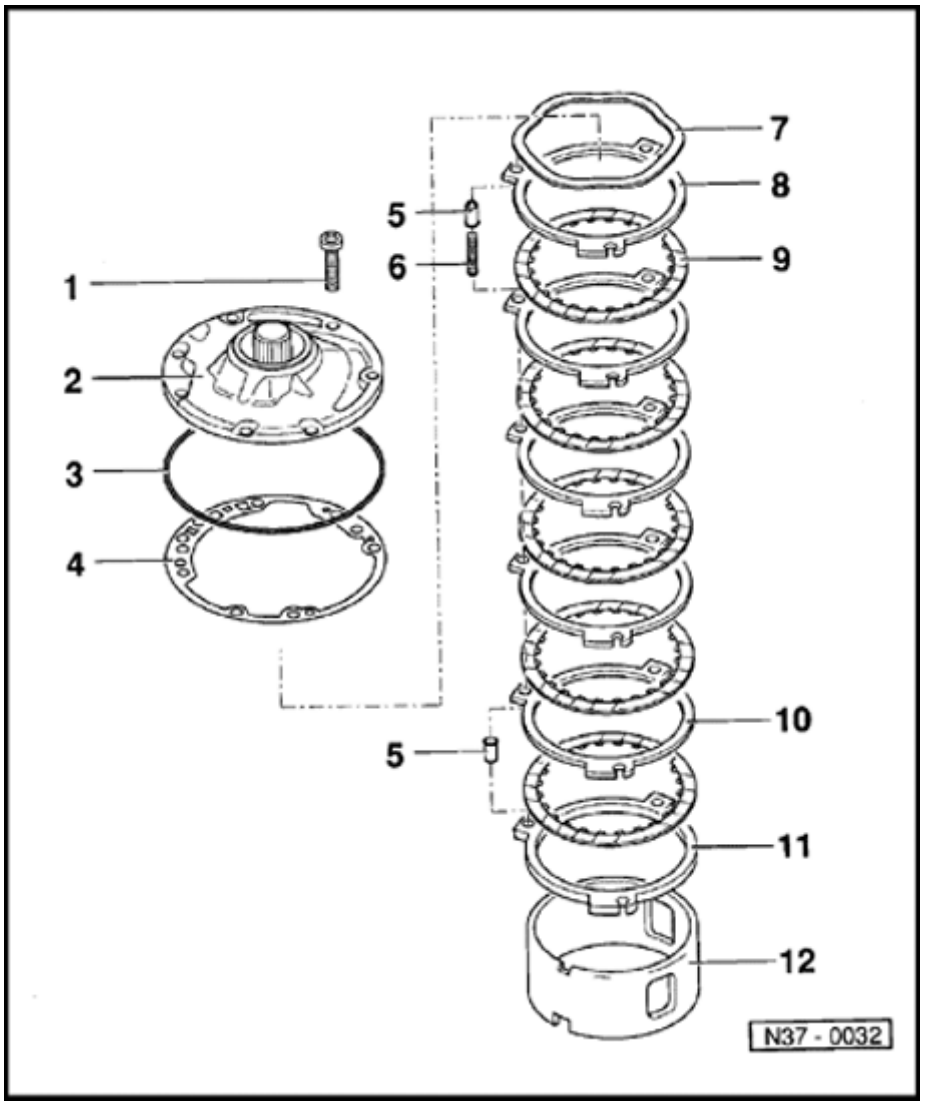
- Qty. 7
- Tightening torque: 8 Nm (71 in lb) plus an additional $^{1}/_{4}$ -turn (90 °)
- The additional $^{1}/_{4}$ -turn (90 °) may be done in several stages

2 - ATF pump with -B2- piston

- Disassembling and assembling ⇒ page 38-1

3 - O-ring

- Always replace
- Place on ATF pump



4 - Gasket

- Always replace

5 - Spring cap

- Qty. 6
- Install 3 spring caps after installing first outer plate
- Install 3 spring caps before installing last outer plate

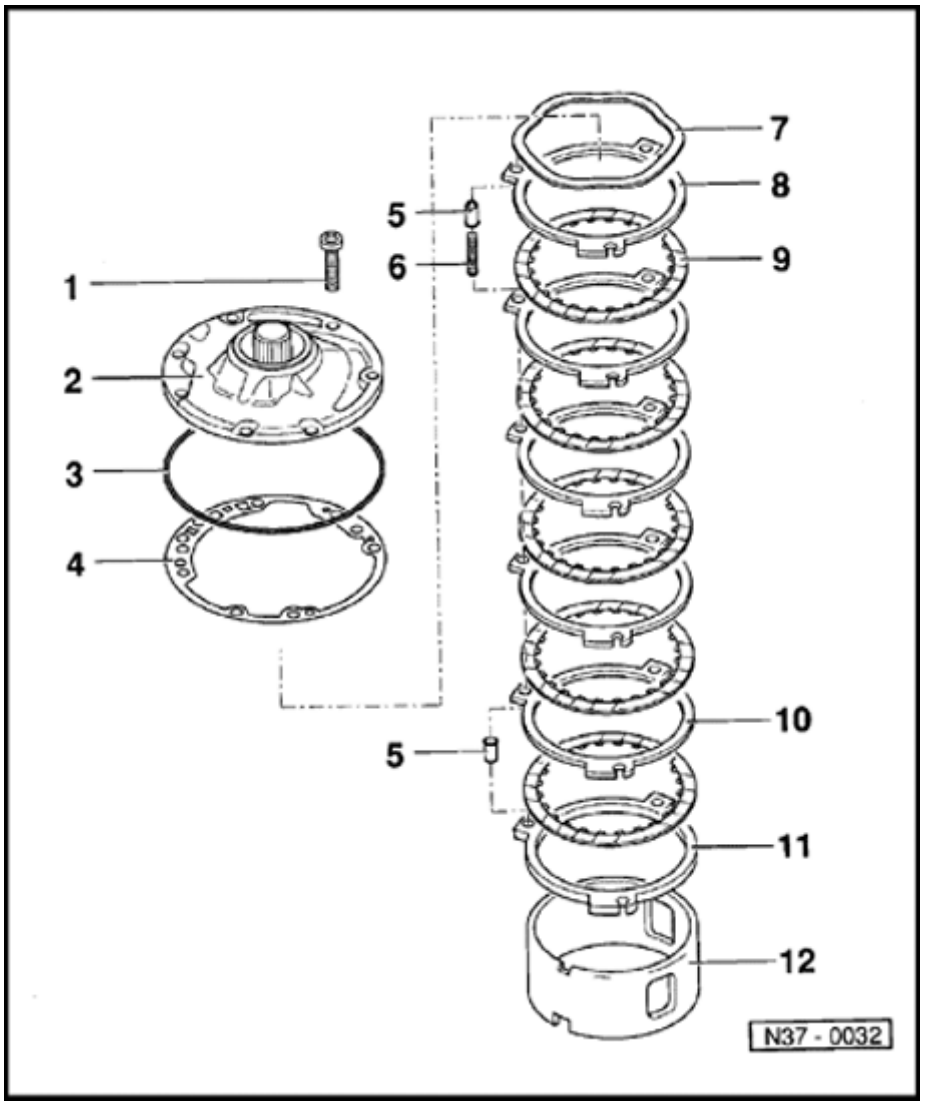
6 - Spring

- Qty. 3

7 - Corrugated spring washer

8 - Outer plate -B2-

- Quantity ⇒ from page 00-3
- Determining thickness of outer plate ⇒ page 37-113 , 2nd and 4th gear brake -B2-, adjusting



9 - Inner plate -B2-

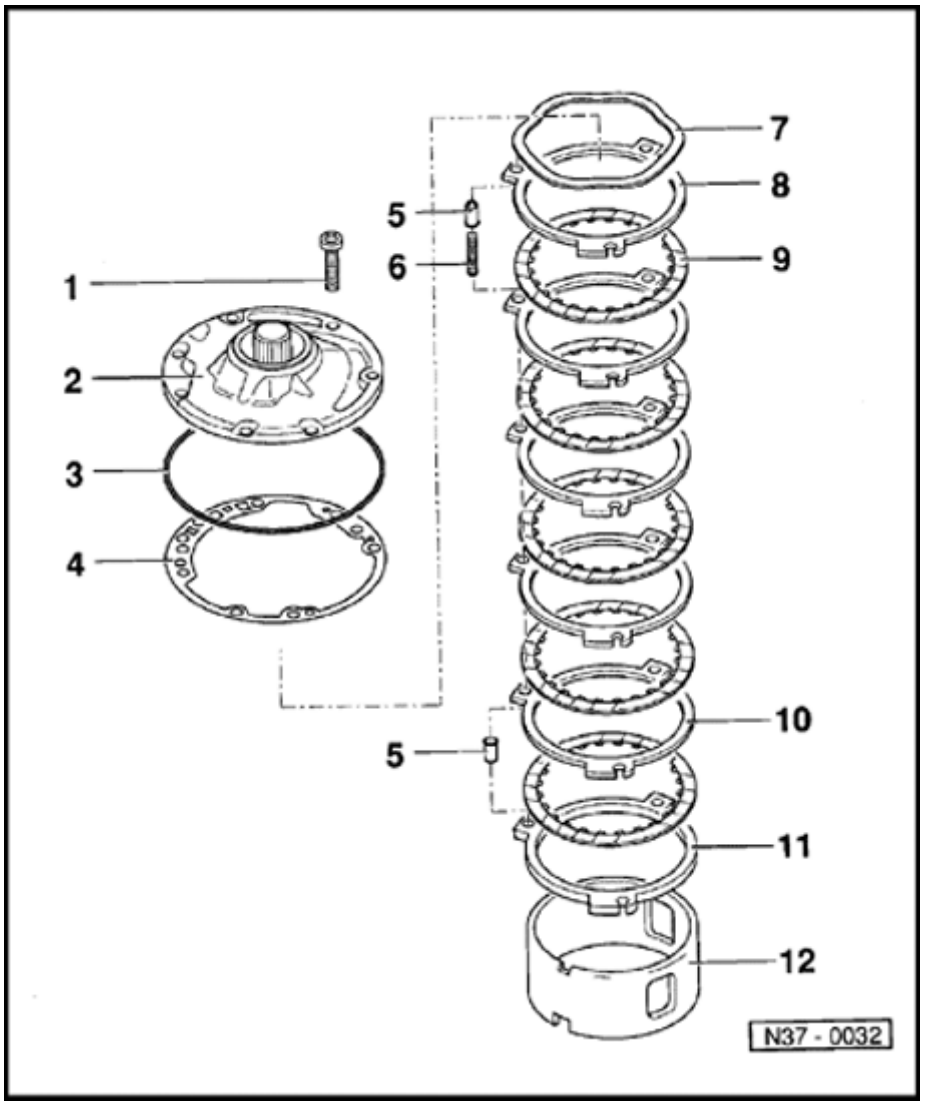
- Quantity ⇒ from page 00-3
- Before installing, place in in ATF for 15 minutes

10 - Outer plate -B2-

- Always install outer plates that are 2 mm (0.079 in.) thick
- Quantity ⇒ from page 00-3

11 - Outer plate -B2-

- Fit 3 mm (0.118 in.) thick outer plate to supporting tube

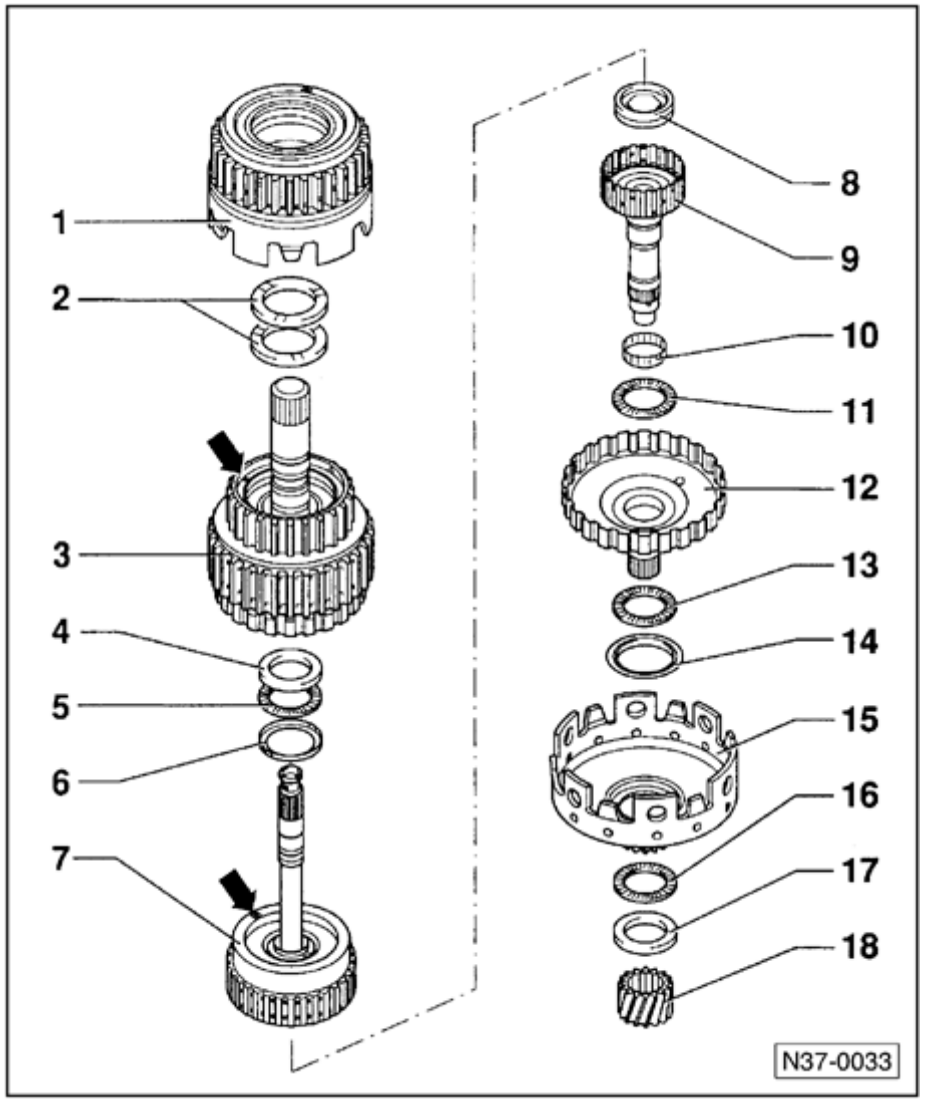


12 - Supporting tube -B2-

- For -B2- plate package
- Length of -B2-:

with 4 inner plates	72.3 mm (2.846 in.)
with 5 inner plates	68.6 mm (2.701 in.)
with 6 inner plates	64.9 mm (2.555 in.)

- Quantity of -B2- inner plates ⇒ from page 00-3
- Insert so that groove engages in wedge of free wheel



II - Reverse gear clutch -K2- to large sun gear, removing and installing

⇒ Overview, page 37-55

Note:

Disassembling planetary gearbox ⇒ *page 37-70* .

Assembling ⇒ *page 37-76* .

1 - Reverse gear clutch -K2-

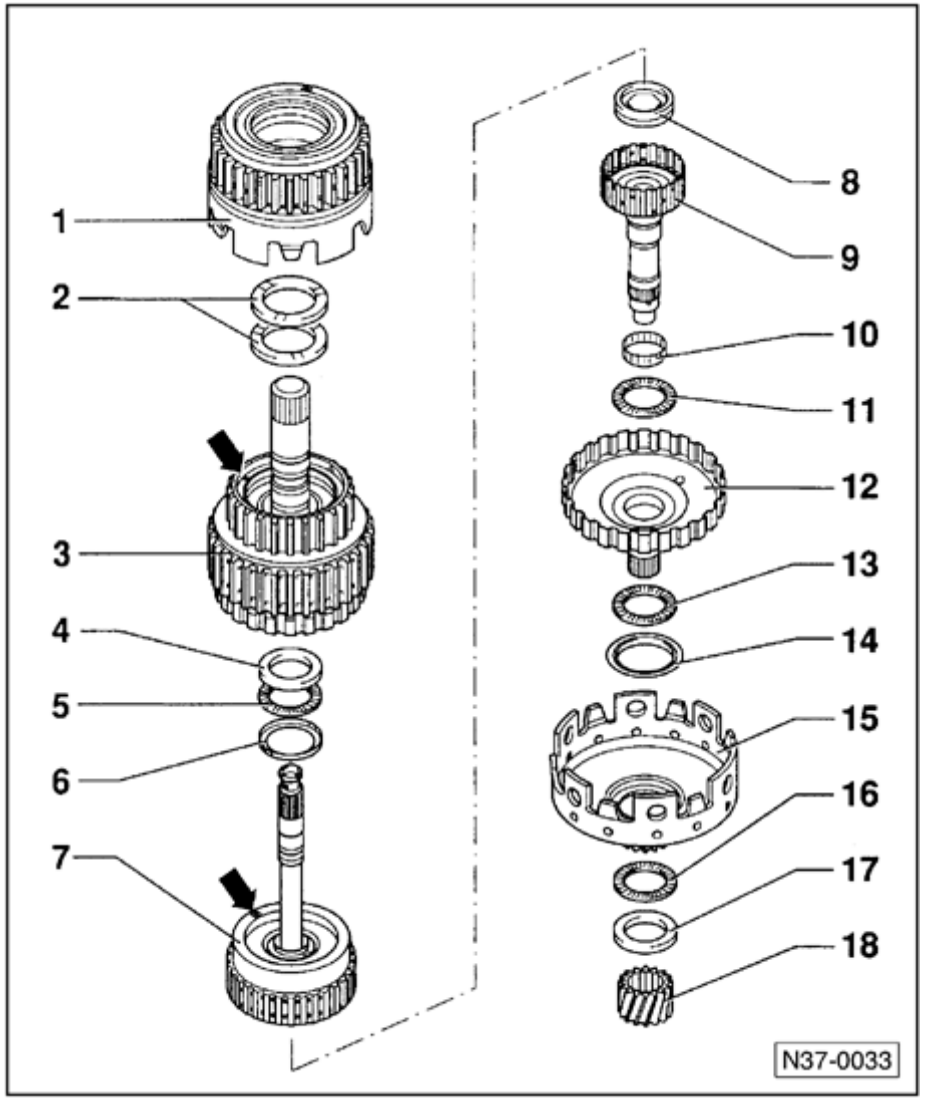
- Disassembling and assembling ⇒ page 38-23

2 - Shim

- Determining thickness ⇒ page 37-106 , Clutch play between -K1- and -K2-, adjusting
- 1 or 2 shims can be installed

3 - 1st to 3rd gear clutch -K1- with turbine shaft

- With ball valve (arrow), disassembling and assembling ⇒ page 38-16
- Without ball valve (for transmissions from 01.93 ⇒ page 00-5). Disassembling and assembling ⇒ page 38-16



4 - Axial needle bearing washer

5 - Axial needle bearing

6 - Axial needle bearing washer

- Lugs face toward axial needle bearing

7 - 4th gear clutch -K3- with pump shaft

- With ball valve (arrow), disassembling and assembling ⇒ page 38-26
- 4th gear clutch -K3- without ball valve (for transmissions from 01.93 ⇒ page 00-5), disassembling and assembling ⇒ page 38-26 .

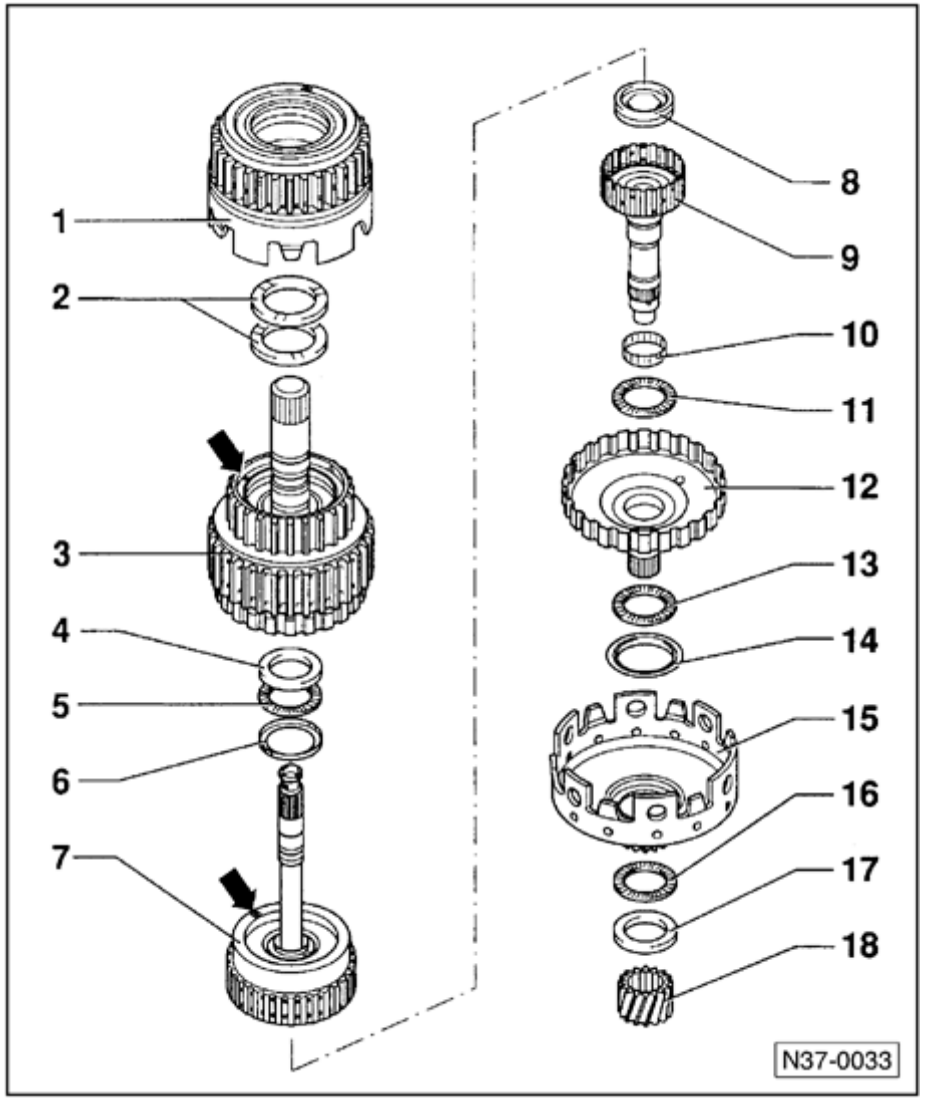
8 - Axial needle bearing with washer

- Axial needle bearing faces toward small drive shaft

9 - Small drive shaft

10 - Needle bearing

11 - Axial needle bearing



12 - Large drive shaft

- Modified -K1- clutch from 01.93

13 - Axial needle bearing

14 - Axial needle bearing washer

- With shoulder

15 - Large sun gear

- Transmissions up to 12.92: 27 teeth ⇒ page 00-3
- Transmissions from 01.93: 24 teeth ⇒ page 00-5

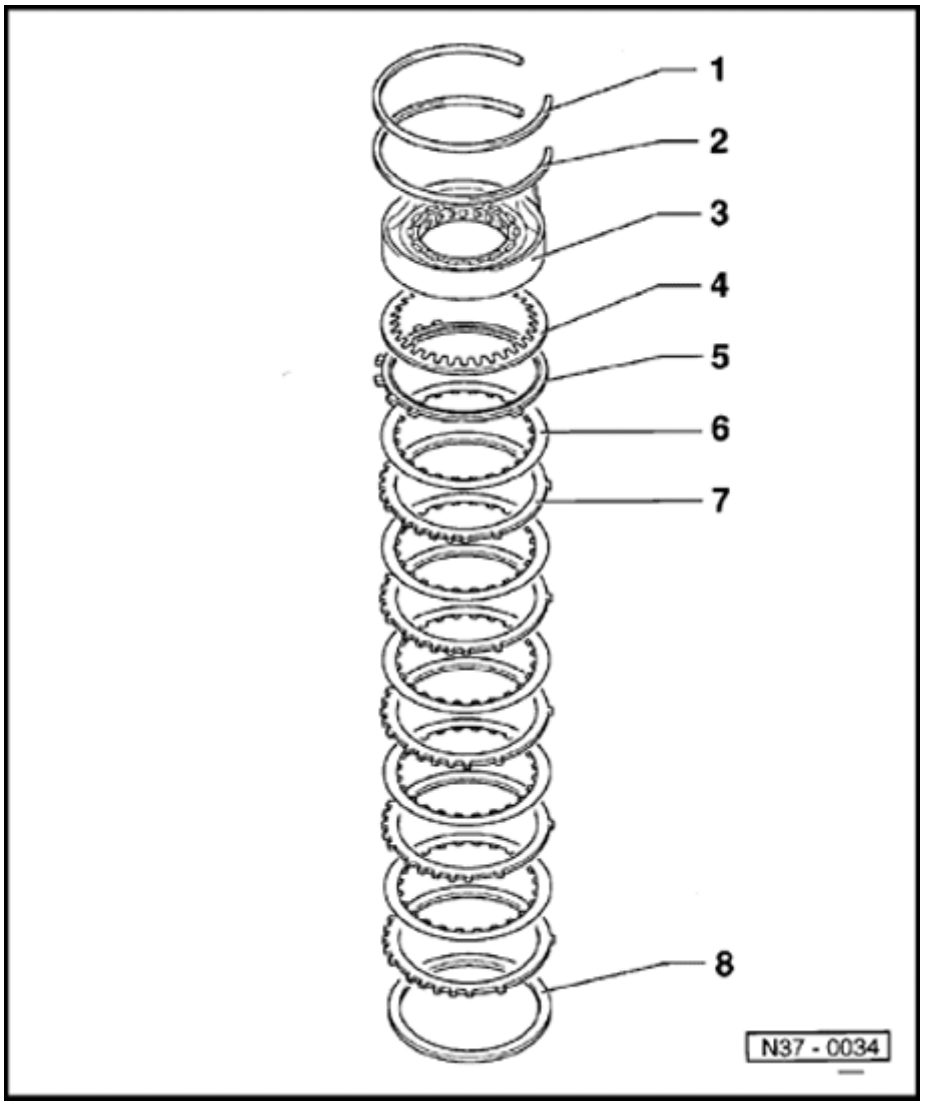
16 - Axial needle bearing

- Transmissions up to 12.92: outer diameter 41 mm (1.61 in.) ⇒ page 00-3
- Transmissions from 01.93: outer diameter 39.1 mm (1.54 in.) ⇒ page 00-5

17 - Axial needle bearing washer

18 - Small sun gear

- Cannot be removed from planet carrier in transmissions from 01.93 ⇒ page 00-5



III - Free wheel and reverse gear brake -B1- , removing and installing

⇒ Overview, page 37-55

Note:

Disassembling planetary gearbox ⇒ *page 37-70* .

Assembling ⇒ *page 37-76* .

1 - Circlip

- For supporting tube -B2-

2 - Circlip

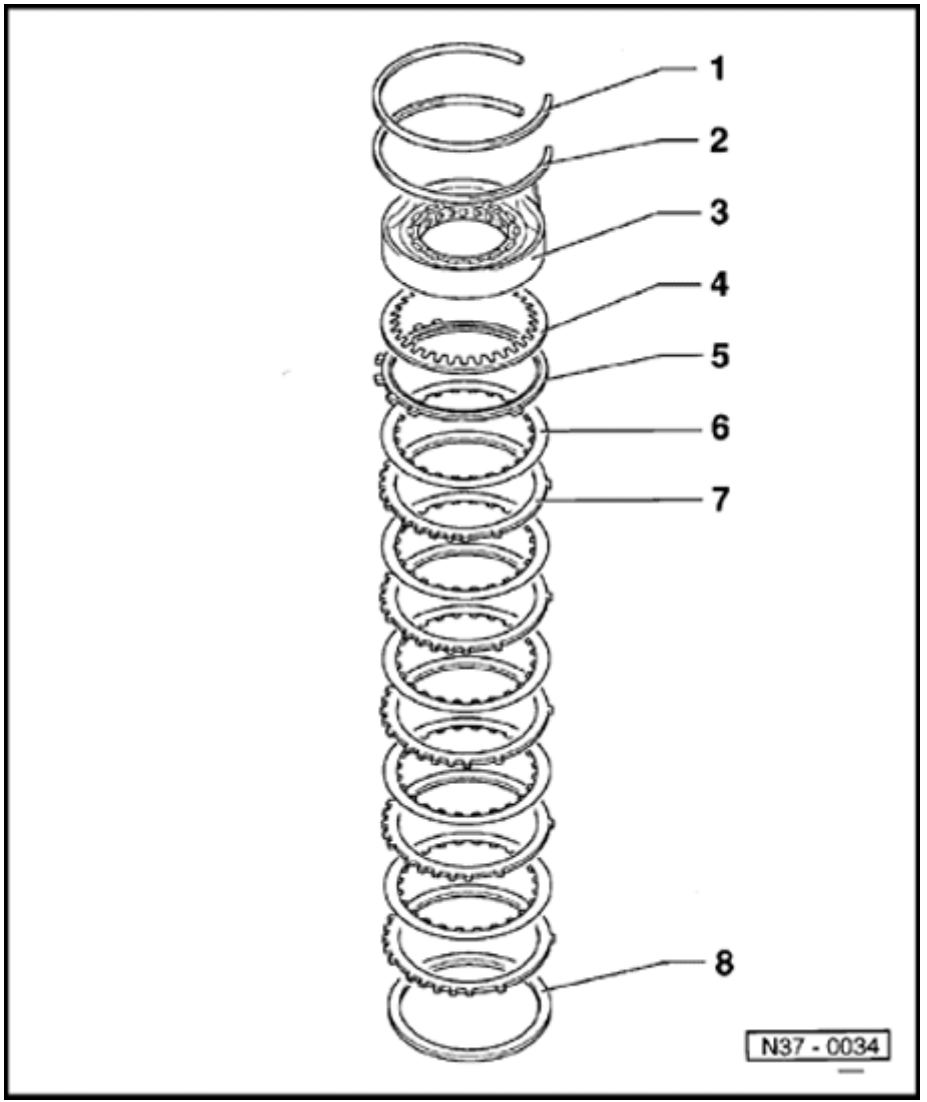
- For free wheel

3 - Free wheel with -B1- piston

- Before removing free wheel, remove valve body and sealing plugs ⇒ page 38-36
- Disassembling and assembling ⇒ page 38-4

4 - Dished spring

- Install with convex part facing free wheel



5 - Pressure plate

- Install with flat side facing plates
- Differing plate thickness depending on number of inner plates installed:

Up to transmission build date 16 08 2:

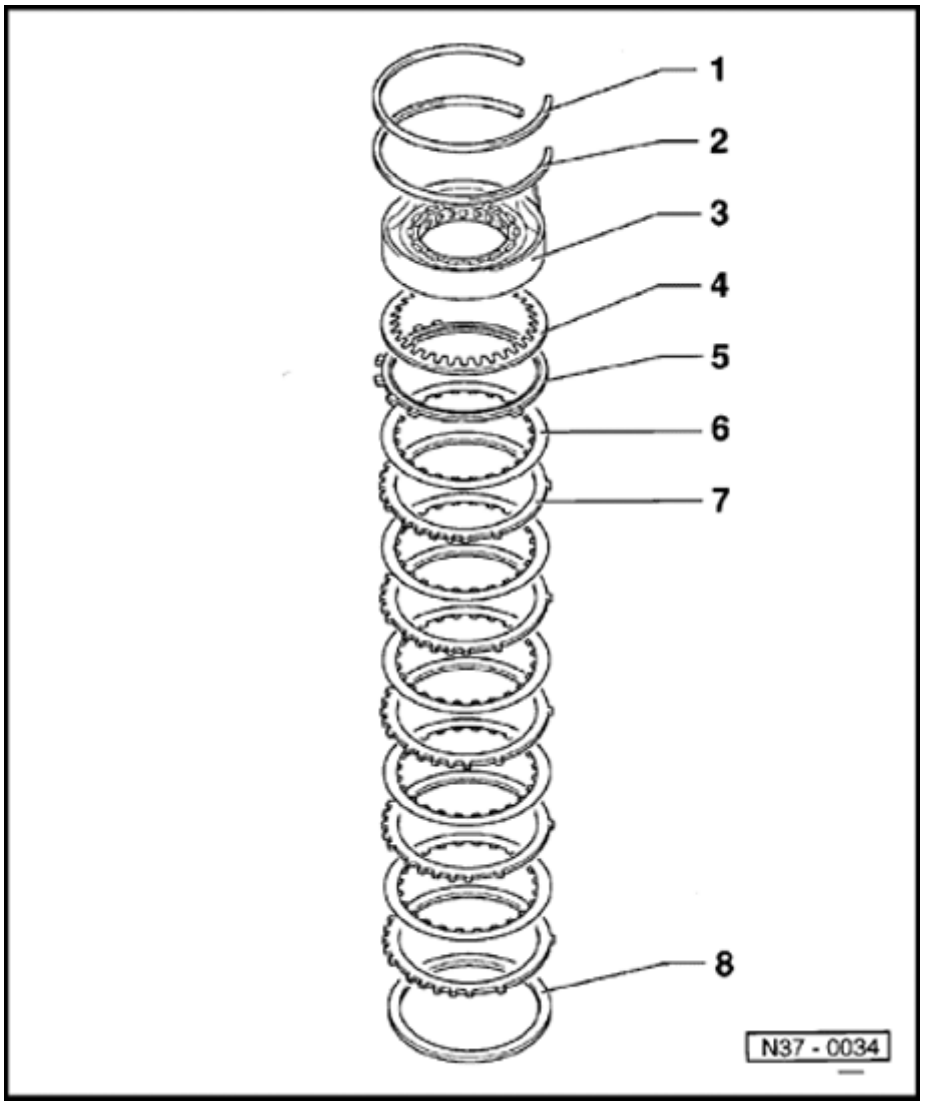
- With 4 inner plates 7.5 mm (0.295 in.) (an additional 3.7 mm (0.146 in.) shim - 8- is installed)
- With 5 inner plates 7.5 mm (0.295 in.)

From transmission build date 17 08 2:

- With 4 inner plates 11.1 mm (0.437 in.)
- With 5 inner plates 7.5 mm (0.295 in.)

Transmissions from 01.93:

- With 4 inner plates 13.5 mm (0.531 in.)
- With 5 inner plates 10.5 mm (0.413 in.)
- Quantity of -B1- inner plates ⇒ from page 00-3



6 - Inner plate, -B1-

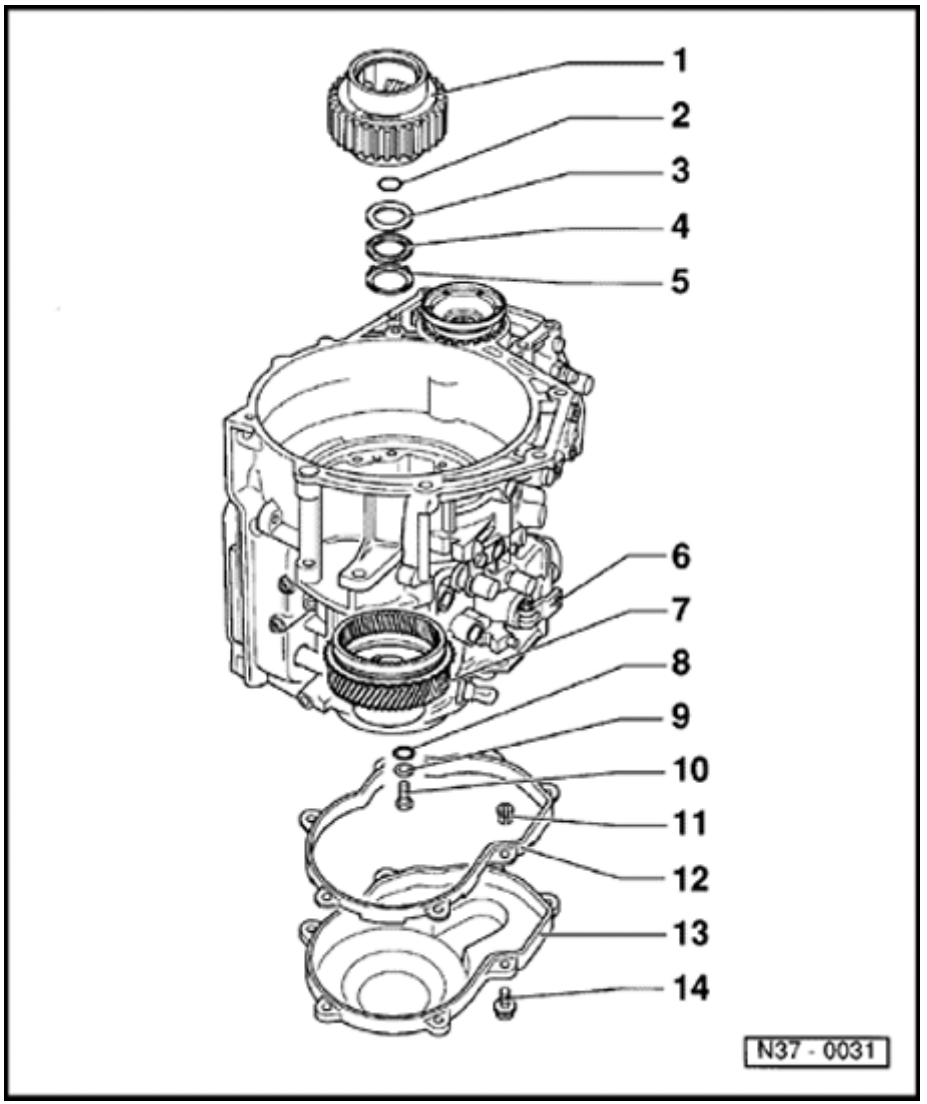
- Quantity ⇒ from page 00-3
- Before installing place in ATF for 15 minutes

7 - Outer plate, -B1-

- Quantity ⇒ from page 00-3

8 - Shim

- Determining thickness ⇒ page 37-98 , Reverse gear brake -B1-, adjusting
- Additional 3.7 mm (0.146 in.) shim for -B1- with 4 inner plates, up to transmission build date 16 08 2 item - 5 -



IV - Planet carrier and input gear, removing and installing

⇒ Overview, page 37-55

Note:

Disassembling planetary gearbox ⇒ *page 37-70*

Assembling ⇒ *page 37-76* .

1 - Planet carrier

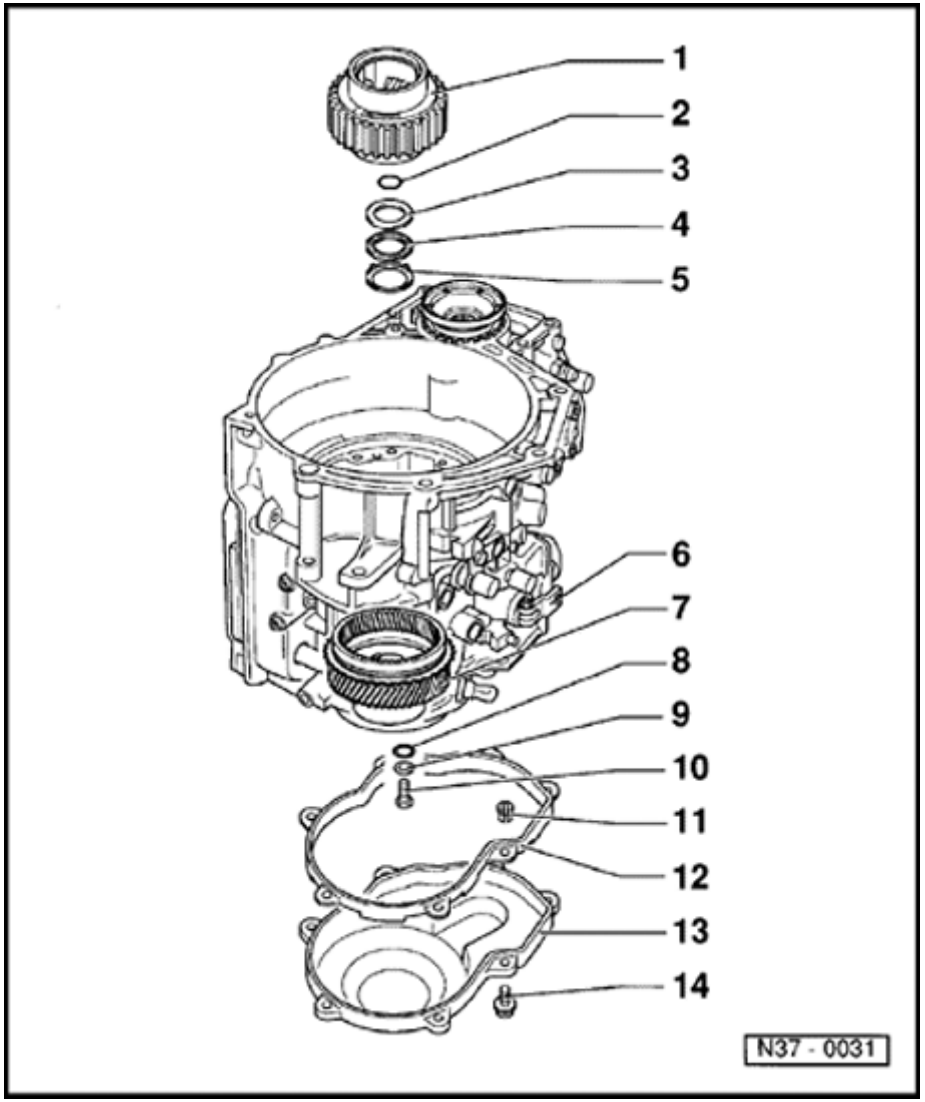
- Modified ratios for transmissions from 01.93 ⇒ page 00-5
- Small sun gear cannot be removed in transmissions from 01.93
- Adjusting ⇒ page 37-90

2 - O-ring

- Always replace
- Insert in planet carrier

3 - Axial needle bearing washer

4 - Axial needle bearing



5 - Axial needle bearing washer

- Install smooth side in input gear

6 - Transmission housing

7 - Input gear

- Do not remove to disassemble planetary gearbox
- Removing and installing input gear or axial needle bearing for planet carrier ⇒ page 39-8

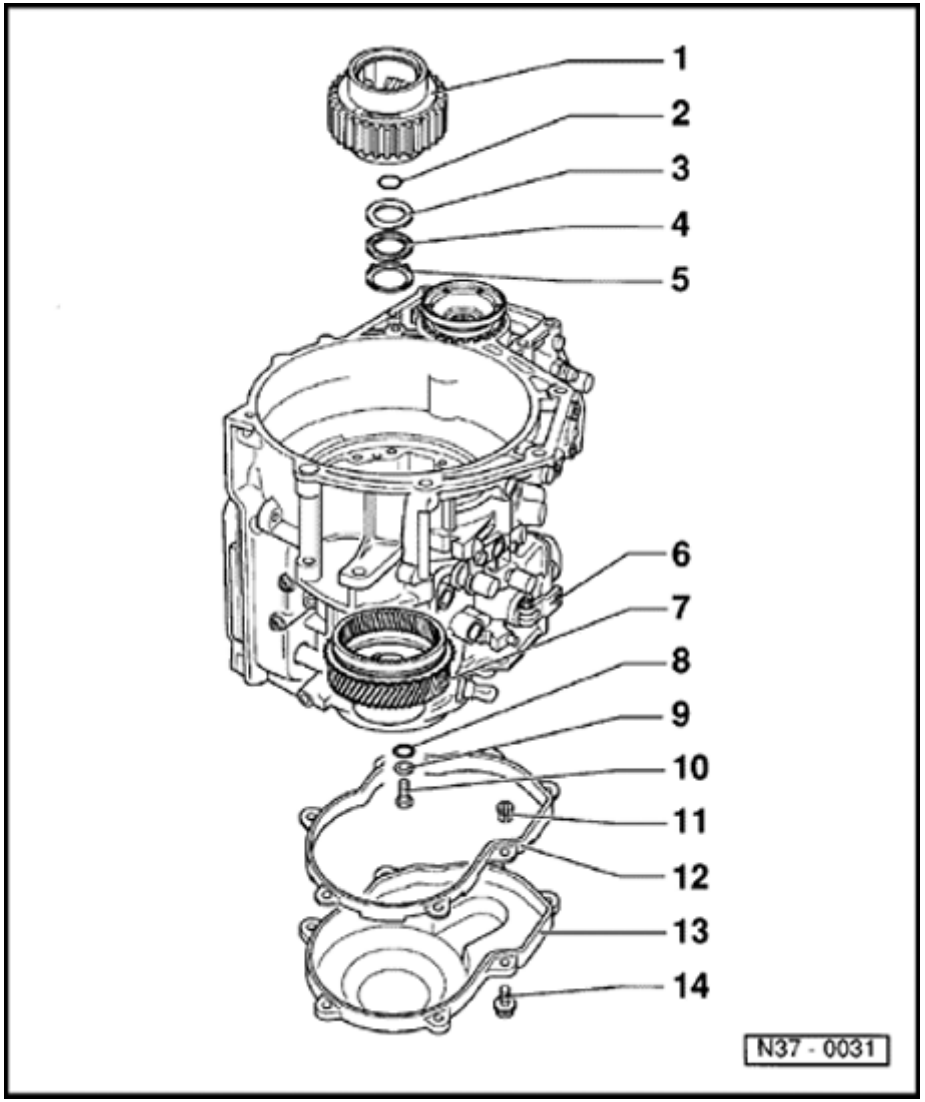
8 - Planet carrier shim

- Determining thickness ⇒ page 37-90 , Planet carrier, adjusting

9 - Washer

10 - Bolt

- Tightening torque: 30 Nm (22 ft lb)
- For small input shaft



11 - Spacer bush

- Qty. 7
- Clip into gasket

12 - Gasket

- Always replace

13 - Cover

14 - Bolt

- Tightening torque: 8 Nm (71 in lb)

Planetary gearbox, disassembling and assembling

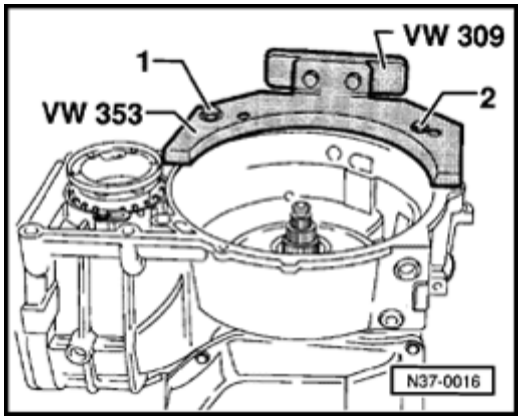
Disassembling

- Seal ATF cooler connections.

- Drain ATF.

  ATF can be removed using VAG 1358A extraction system with VAG 1358A/1 probe, or EZ1 fluid evacuator.

- Remove torque converter.

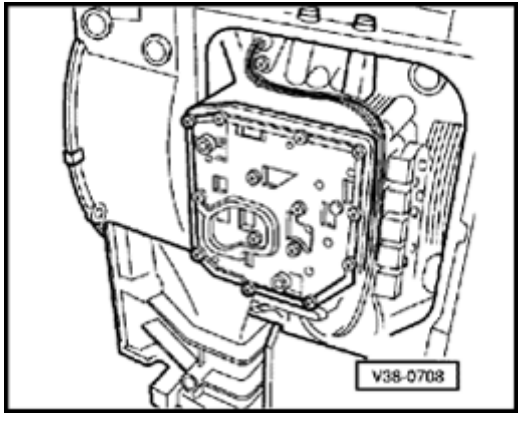


- Secure transmission to assembly support with bolts -1- and -2-.

- Remove transmission housing cover with gasket (arrow).

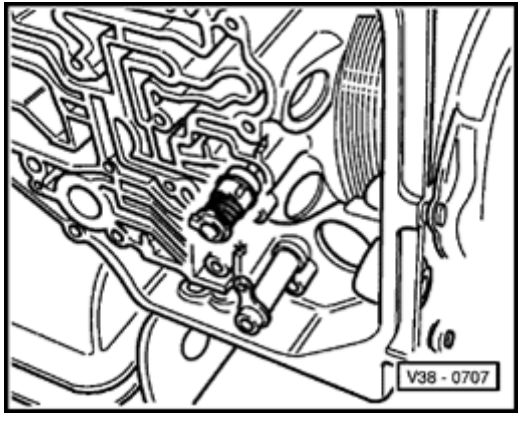
- Remove sump.

- Remove ATF screen.



- Remove valve body.

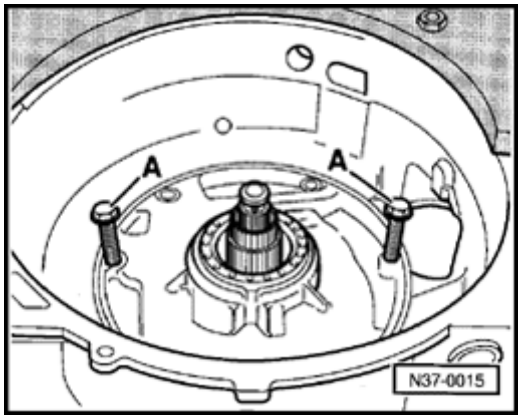
⇒ page 38-36



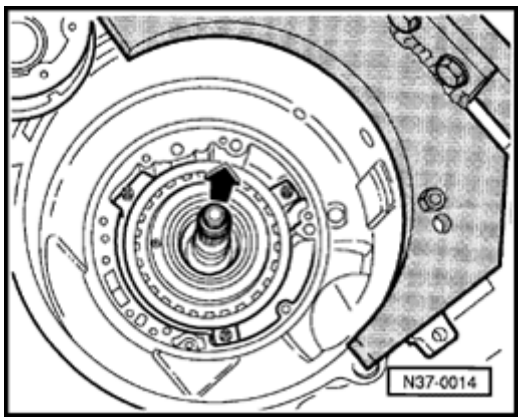
- Remove sealing plugs for -B1-.

To remove ATF pump:

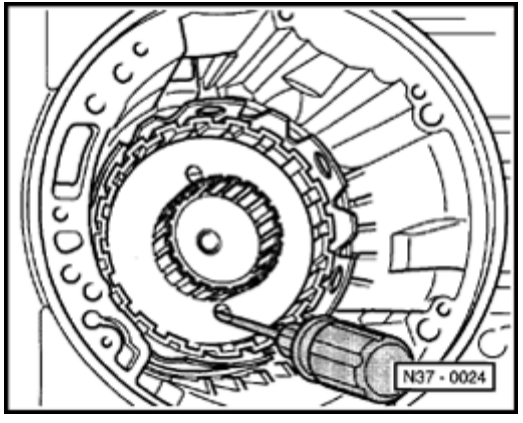
- Remove ATF pump bolts.



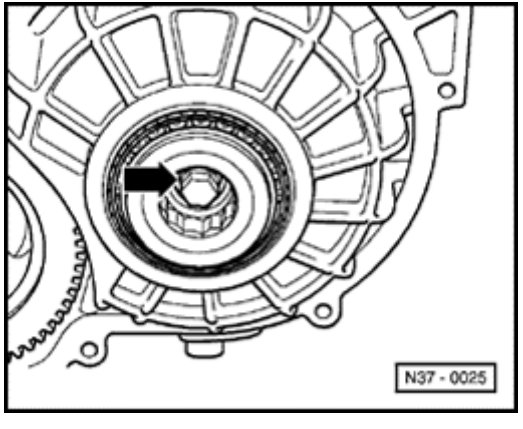
- Screw bolts -A- (M8) into tapped holes in ATF pump.
- Press ATF pump off transmission by turning bolts -A- evenly.



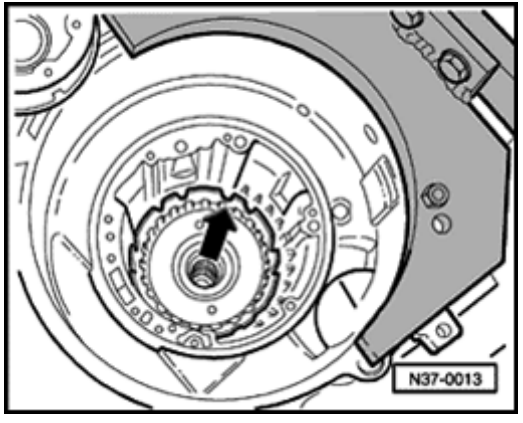
- Take out all clutches with supporting tube, -B2- plates, springs and spring caps together.



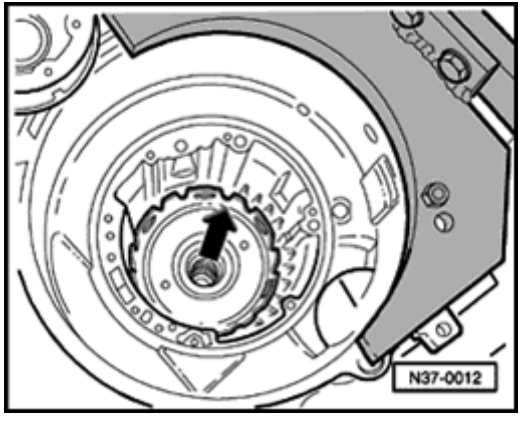
- Insert screwdriver through hole of large drive shaft and large sun gear to loosen and tighten bolt for small drive shaft.



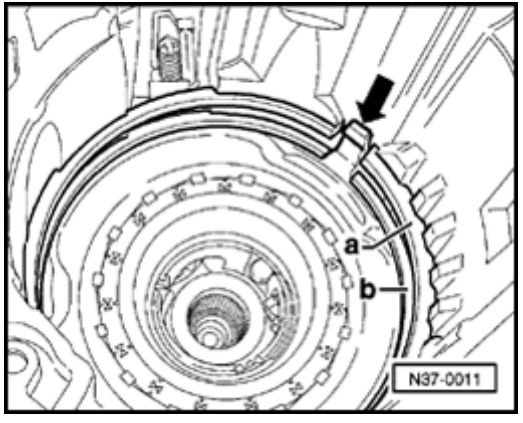
- Loosen small drive shaft bolt (arrow).
- Remove small drive shaft bolt, washer and shim.
  - ♦ Planet carrier axial needle bearing remains in transmission/input gear
- Pull out small drive shaft.



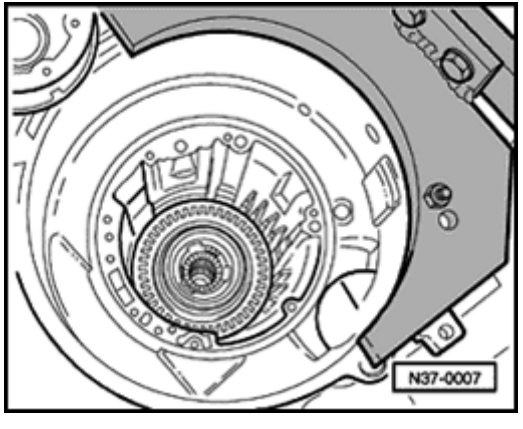
- Pull out large drive shaft (arrow).



- Pull out large sun gear (arrow).



- Remove supporting tube circlip -a- and free wheel circlip -b-.
- Remove free wheel from transmission housing by pulling on free wheel retaining wedge (arrow) with pliers.

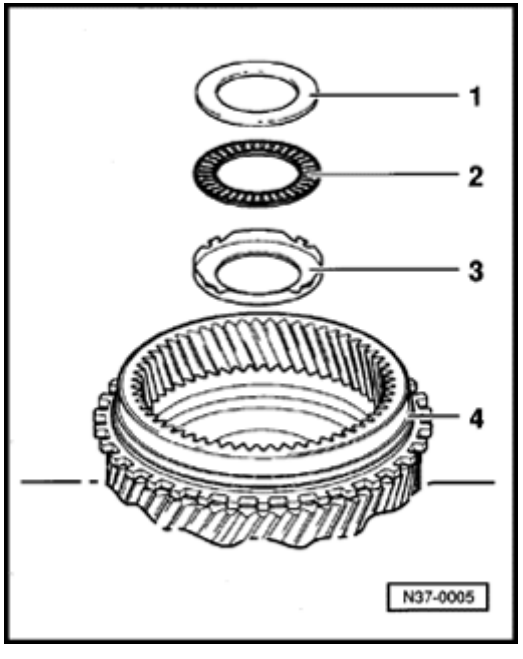


- Pull out planet carrier with dished spring.
- Remove reverse gear brake -B1- plates.

Note:

- *It is not necessary to remove input gear to disassemble the planetary gearbox. Removing and installing input gear* ⇒ *page 39-8* .
- *Assembling planetary gearbox* ⇒ *page 37-76* .

Planetary gearbox, assembling



- Install axial needle bearing with washer onto input gear.

1 - Axial needle bearing washer

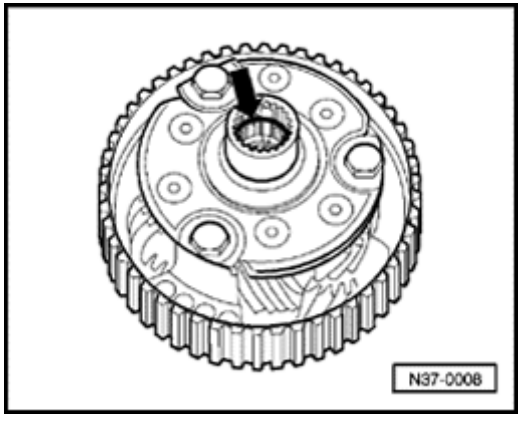
2 - Axial needle bearing

3 - Axial needle bearing washer

- Install smooth side into input

4 - Input gear

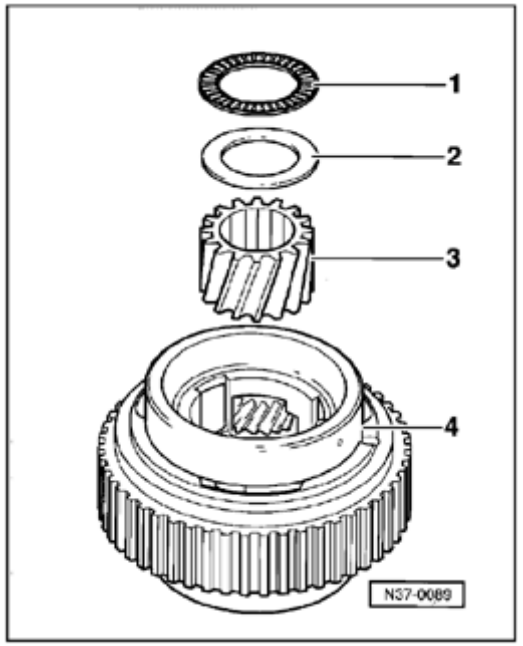
(Installed in transmission housing ⇒ page 37-55)



- Install O-ring in planet carrier.

Note:

After replacing planet carrier, adjust ⇒ page 37-90 .



- Install washer and axial needle bearing into planet carrier.

1 - Axial needle bearing

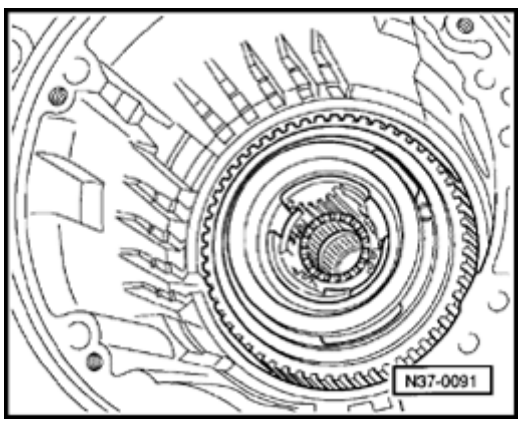
- Transmissions up to 12.92: outer diameter 41.0 mm (1.61 in.) ⇒ page 00-3
- Transmissions from 01.93: outer diameter 39.1 mm (1.54 in.) ⇒ page 00-5

2 - Axial needle bearing washer

3 - Small sun gear

- Cannot be removed for transmissions from 01.93 ⇒ page 00-5

4 - Planet carrier

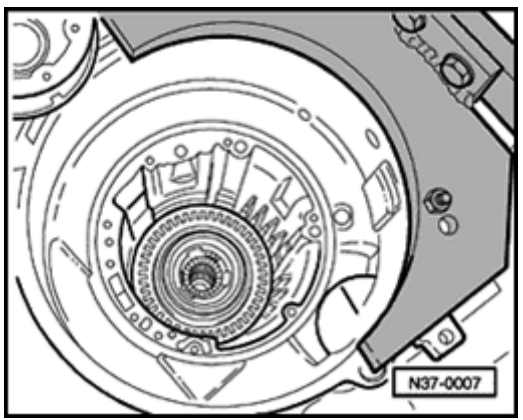


- Install planet carrier into input gear.
- Center washer and axial needle bearing in small sun gear.

- Install inner and outer -B1- plates.

- Install pressure plate with flat side facing plates.

Thickness of pressure plate varies according to number of plates ⇒ page 37-65 .



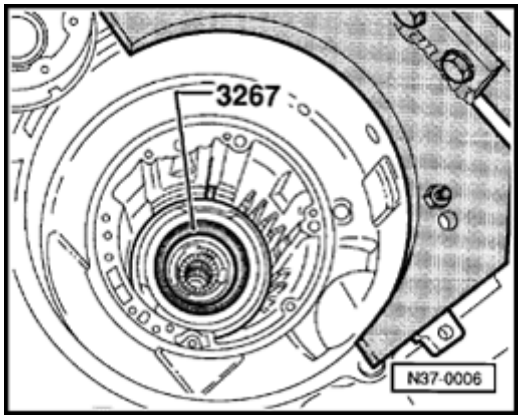
- Install dished washer with convex side facing toward free wheel.

Note:

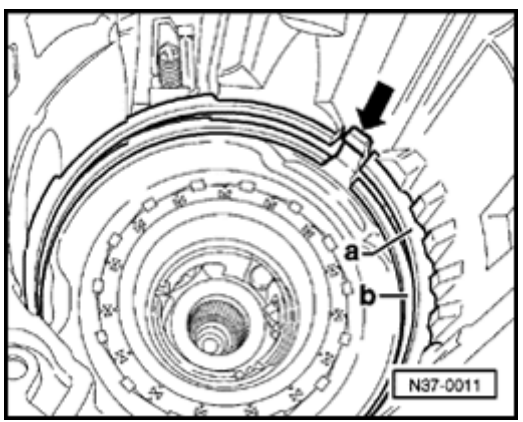
When replacing:

- *Transmission housing*
- *Free wheel*
- *Piston for reverse gear brake -B1-*
- *or plates*

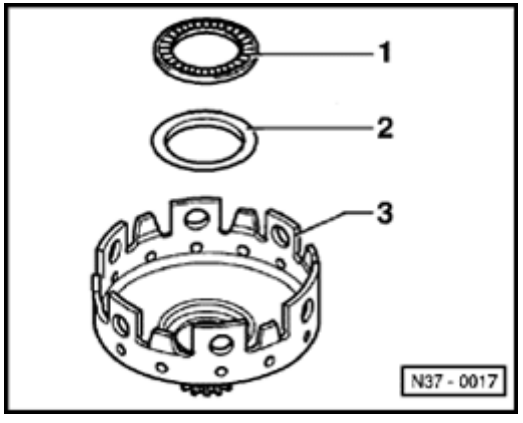
Then adjust -B1-, ⇒ page 37-98 .



- Preload free wheel rollers with 3267 assembly ring and install free wheel.



- Install circlip -b- for free wheel and circlip -a- for supporting tube.
  - Install so that circlip gaps are over free wheel retaining wedge (arrow).
- Carry out check measurement of -B1- ⇒ page 37-105 .



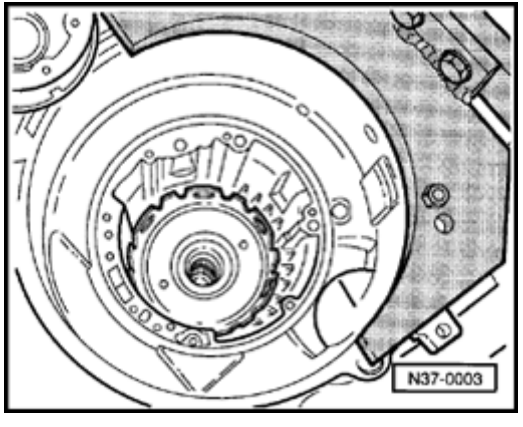
- Install washer with axial needle bearing in large sun gear.

1 - Axial needle bearing

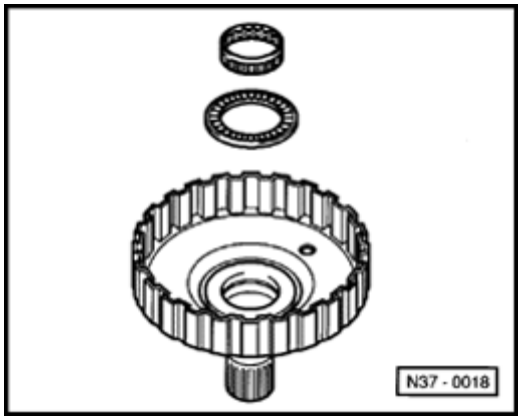
2 - Washer with shoulder

- Install with smooth side facing axial needle bearing

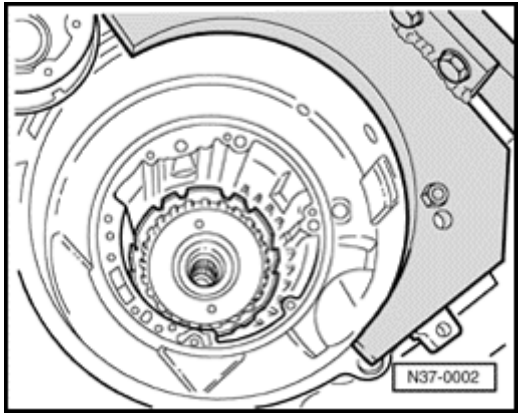
3 - Large sun gear



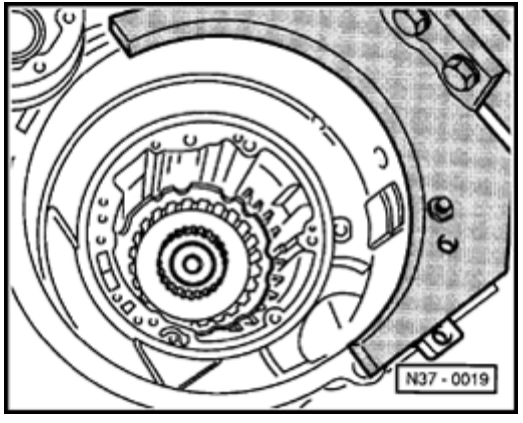
- Install large sun gear with bearing.
  - Center both washers with axial needle bearing between sun gears.



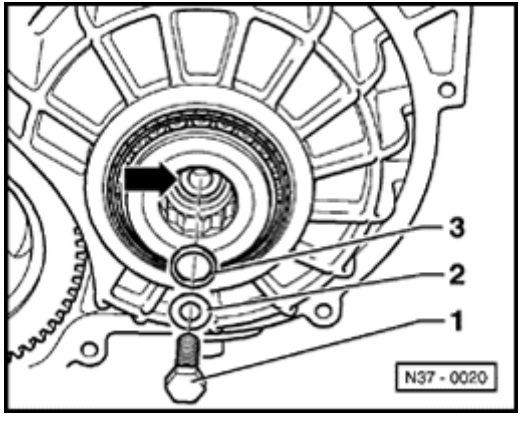
- Install axial needle bearing and needle bearing in large drive shaft.



- Install large drive shaft with bearing.



- Install small drive shaft.



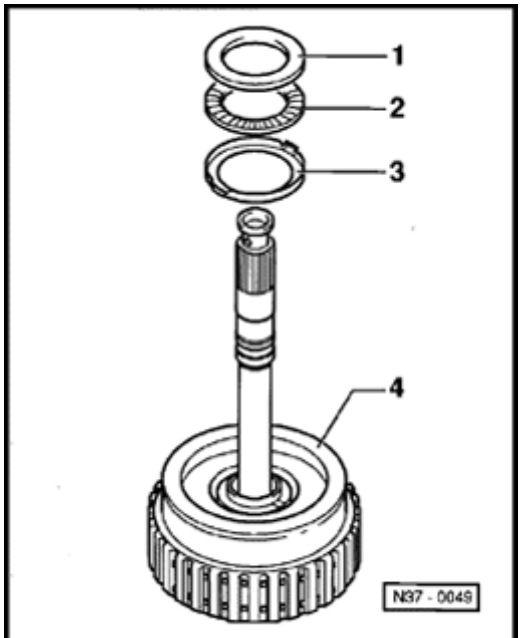
- Install small drive shaft bolt -1- with washer -2- and shim -3-.
  - Tightening torque: 30 Nm (22 ft lb)

Note:

- *Install shim -3- onto small drive shaft shoulder (arrow).*
- *Determining shim thickness* ⇒ *page 37-90 , Planet carrier, adjusting.*

- Carry out planet carrier check measurement.

⇒ page 37-97 .



- Install axial needle bearing with washers in 4th gear clutch -K3-.

1 - Axial needle bearing washer

2 - Axial needle bearing

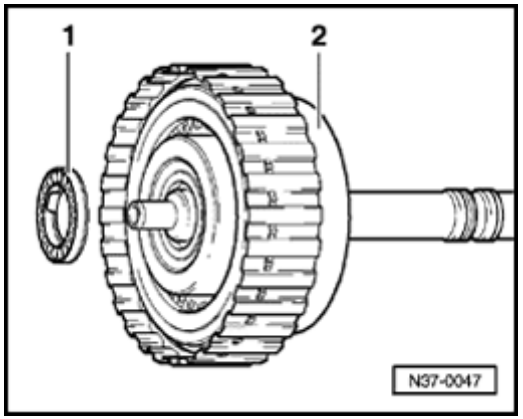
3 - Axial needle bearing washer

- Install with smooth side facing -K3-.

4 - 3rd and 4th gear clutch -K3-

Note:

Make sure that piston rings seat correctly.



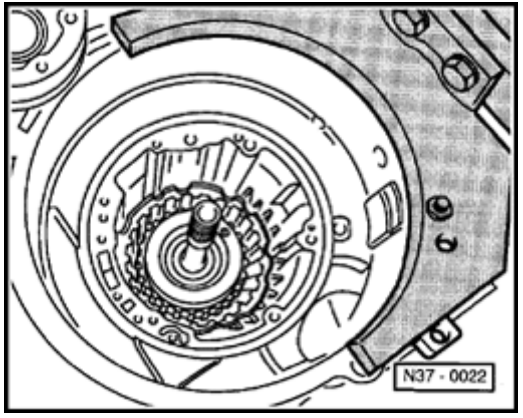
- Install axial needle bearing with washer on 4th gear clutch -K3-.

1 - Axial needle bearing with washer

- Moisten axial needle bearing washer with ATF so that bearing -1-, while installing, sticks to -K3-.

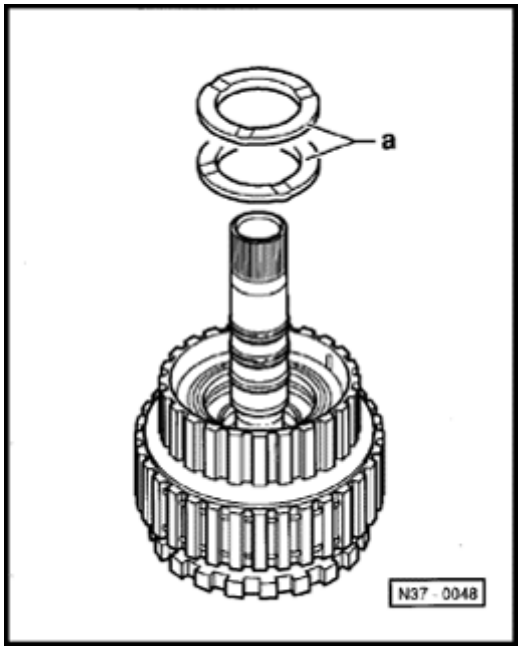
- Install bearing washer on -K3-.

2 - 3rd and 4th gear clutch -K3-



- Install 3rd and 4th gear clutch -K3-.

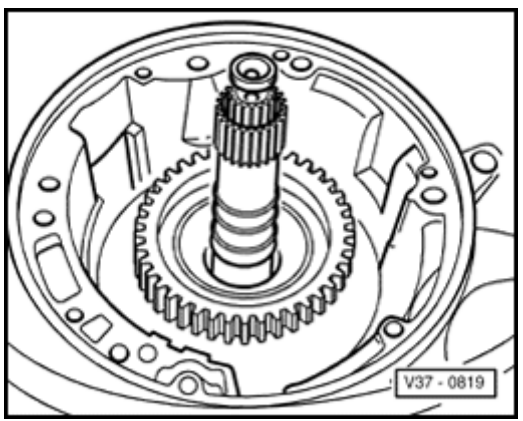
  - Transmissions from 01.93: -K3- clutch operates only 4th gear ⇒ page 00-5



- Install shims -a- in -K1-.

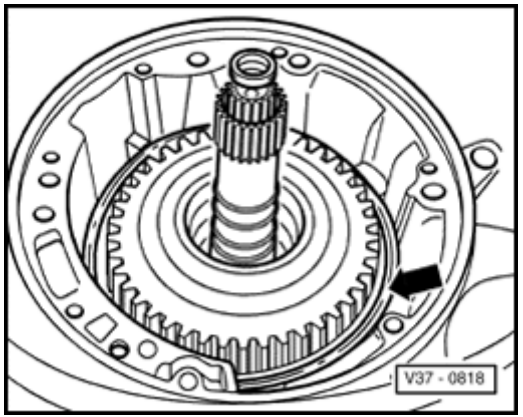
Notes:

- *Re-measure shim when replacing -K1-, -K2- or ATF pump ⇒ page 37-106 , Clutch play between -K1- and -K2-, adjusting.*
- *1 or 2 shims can be installed.*

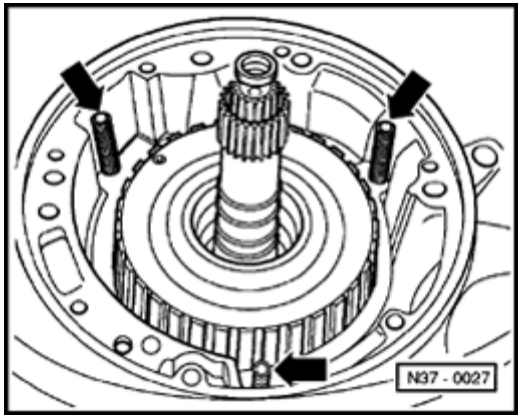


- Install 1st to 3rd gear clutch -K1-.

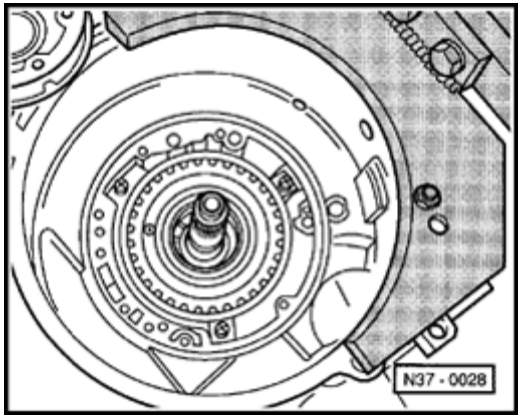
- Install reverse gear clutch -K2-.



- Install supporting tube for plate set -B2- (arrow) so that supporting tube groove engages in free wheel wedge.



- Install -B2- plates as follows:
- First install a 3 mm (0.118 in.) thick outer plate.
- Install three spring caps in outer plate.
- Install compression springs (arrows).
- Install all but the last outer plate.



- Before installing the last outer plate, install three spring caps onto compression springs.

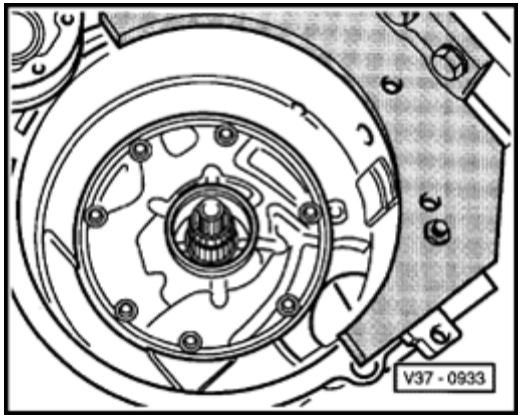
Note:

When replacing:

- *Supporting tube*
- *the ATF pump*
- *or the plates*

... the 2nd and 4th gear brakes -B2- are to be adjusted, ⇒ *page 37-113* .

- Replace corrugated washer.
- Replace ATF pump seal.
- Install O-ring on ATF pump.

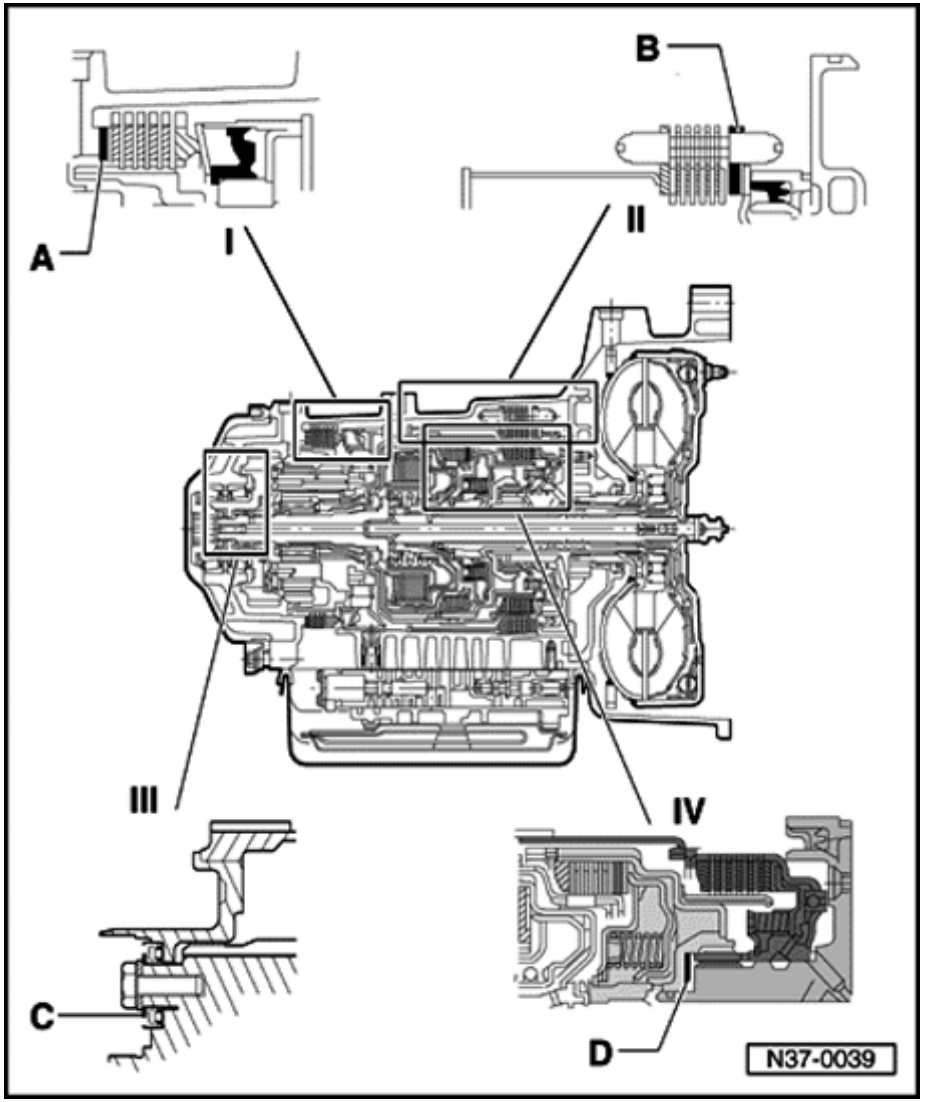


- Install ATF pump.
- Tighten bolts evenly, alternating cross-wise.
  - Tightening torque: 8 Nm (71 in lb) plus an additional $^{1}/_{4}$ -turn (90°)
  - Additional $^{1}/_{4}$ -turn can be done in several stages.

Note:

- *Make sure that the O-ring is not damaged.*

- Carry out check measurement of clutch play ⇒ page 37-112 .
- Install sealing plugs, valve body and oil pan ⇒ page 38-36 .
- Install cover with gasket and spacer bushings.



Planetary gearbox adjustments, overview

I - Reverse gear brake -B1-

- A = Shim
- Determining thickness ⇒ Reverse gear brake -B1-, adjusting, page 37-98

II - 2nd and 4th gear brake -B2-

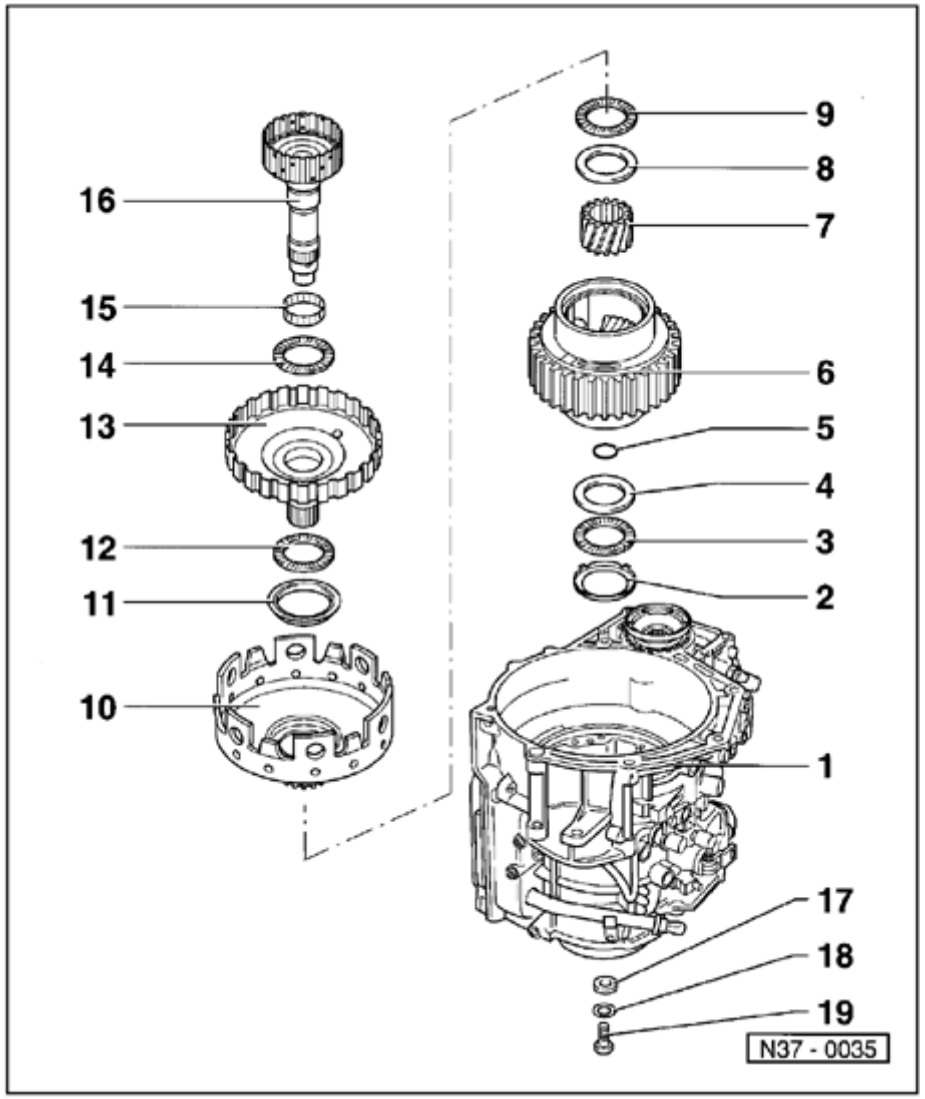
- B = Outer plate
- Determining thickness ⇒ page 37-113 , 2nd and 4th gear brake -B2-, adjusting

III - Planet carrier

- C = Shim
- Determining thickness ⇒ page 37-90 , Planet carrier, adjusting

IV - Clutch play

- D = Shim
- Determining thickness ⇒ page 37-106 , Clutch play between -K1- and -K2-, adjusting



Planet carrier, adjusting

Overview of components to adjust planet carrier

- When adjusting planet carrier, install components in transmission housing without shim - 17 -.

1 - Transmission housing

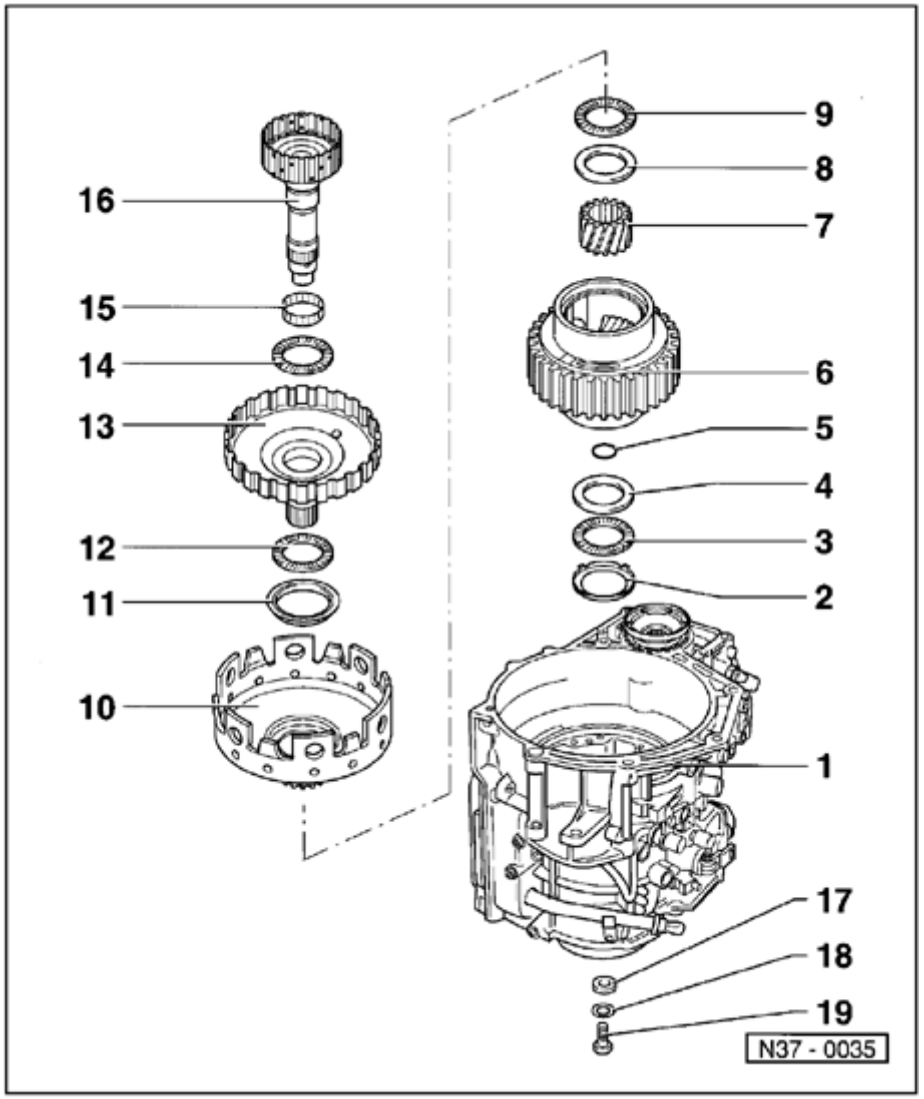
- ♦ With input gear and axial needle bearing
- ♦ Axial needle bearing remains in input gear
- ♦ Damaged axial needle bearing ⇒ page39-8 , Input gear, removing and installing

2 - Axial needle bearing washer

- ♦ Insert smooth side in input gear

3 - Axial needle bearing

4 - Axial needle bearing washer



5 - O-ring

- Insert into planet carrier ⇒ page 37-76 , Planetary gearbox, assembling

6 - Planet carrier

7 - Small sun gear

- Cannot be removed from planet carrier in transmissions from 01.93 ⇒ page 00-5

8 - Washer

9 - Axial needle bearing

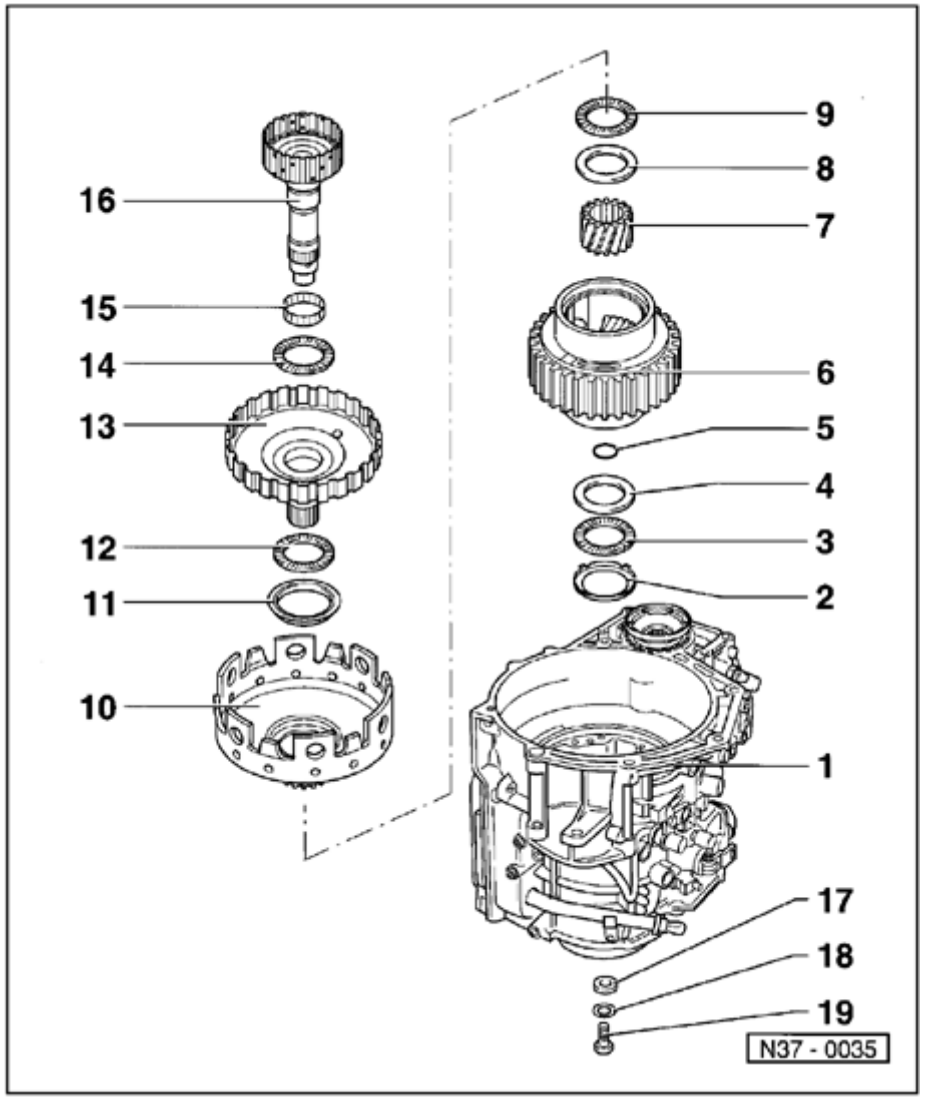
10 - Large sun gear

11 - Washer

- Insert into large sun gear ⇒ page 37-76 , Planetary gearbox, assembling

12 - Axial needle bearing

13 - Large drive shaft



14 - Axial needle bearing

15 - Needle bearing

16 - Small drive shaft

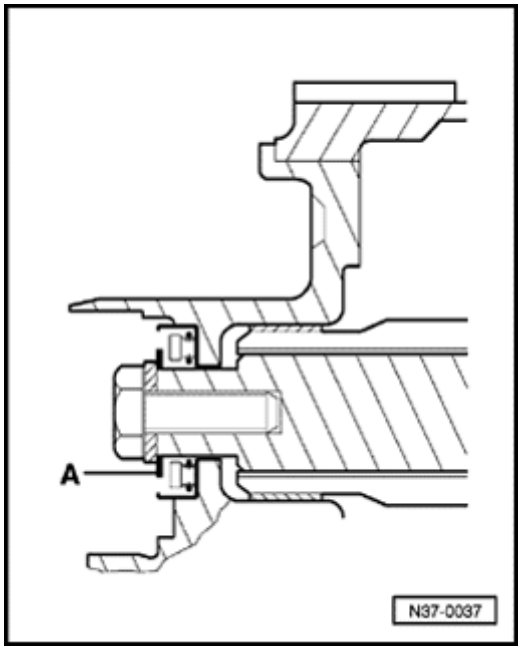
17 - Shim

- Do not install in planet carrier when adjusting

18 - Washer

19 - Small drive shaft bolt

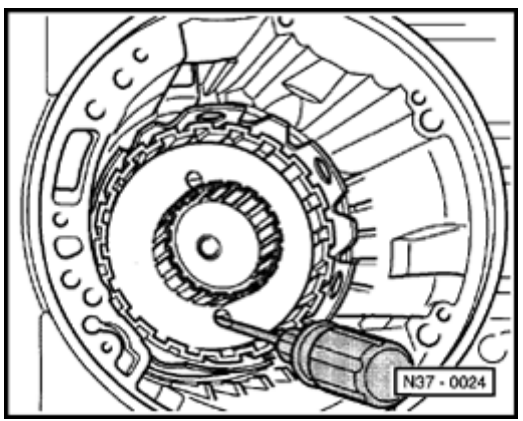
- Tightening torque: 30 Nm (22 ft lb)



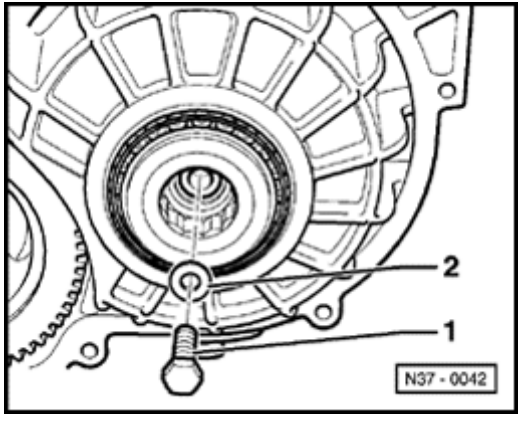
Determining shim -A- thickness

- Install all components to adjust planet carrier in transmission housing.

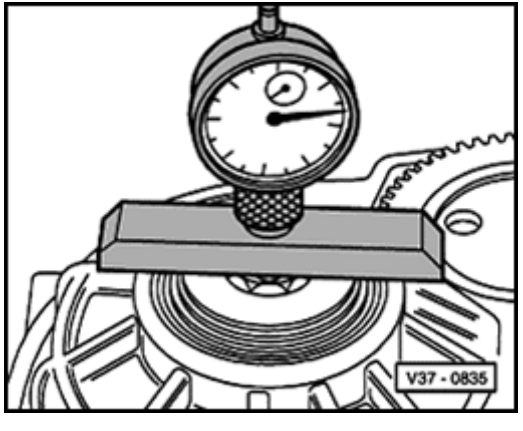
⇒ page 37-90 , items - 2 - through - 16 -.



- Insert screwdriver through hole of large drive shaft and large sun gear to loosen and tighten bolt for small drive shaft.



- Install small input shaft bolt -1- with washer -2-, but without shim.
  - Tightening torque: 30 Nm (22 ft lb)



- Set up dial indicator so that top of gauge is positioned on center of bolt head with 1 mm preload.
- Zero dial gauge.
- Move small input shaft up and take measurement.
  - Example: measurement = 2.00 mm
- Specify thickness of shim according to table and determine Part No. from parts catalog microfiche.

Table of shims

Dial indicator measurement - mm	Shim thickness - mm
1.26 - 1.35	1.0
1.36 - 1.45	1.1
1.46 - 1.55	1.2
1.56 - 1.65	1.3
1.66 - 1.75	1.4
1.76 - 1.85	1.5
1.86 - 1.95	1.6
1.96 - 2.05	1.7
2.06 - 2.15	1.8
2.16 - 2.25	1.9
2.26 - 2.35	2.0
2.36 - 2.45	2.1
2.46 - 2.55	2.2
2.56 - 2.65	2.3
2.66 - 2.75	2.4

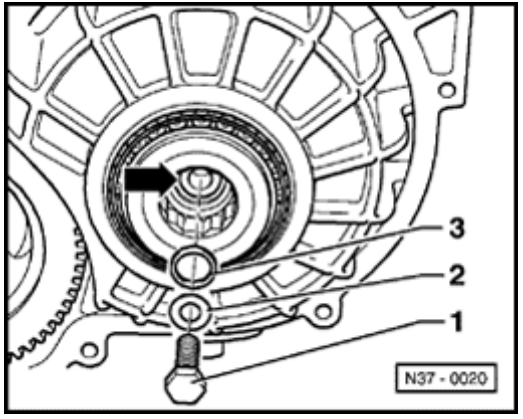
2.76 - 2.85	2.5
2.86 - 2.95	2.6
2.96 - 3.05	2.7
3.06 - 3.15	2.8
3.16 - 3.25	2.9

Example:

Measurement = 2.00 mm:

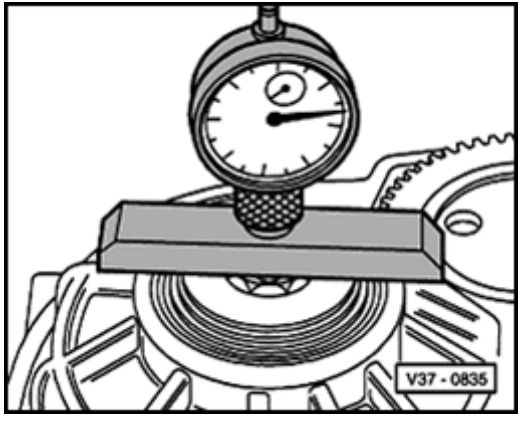
- Insert 1.7 mm shim.

- Remove small input shaft bolt.



- Install correct shim -3- on small input shaft (arrow).
- Tighten small input shaft bolt -1- with washer -2-.
  - Tightening torque: 30 Nm (22 ft lb)
- Carry out planet carrier check measurement.

⇒ page 37-97 .



Planet carrier check measurement

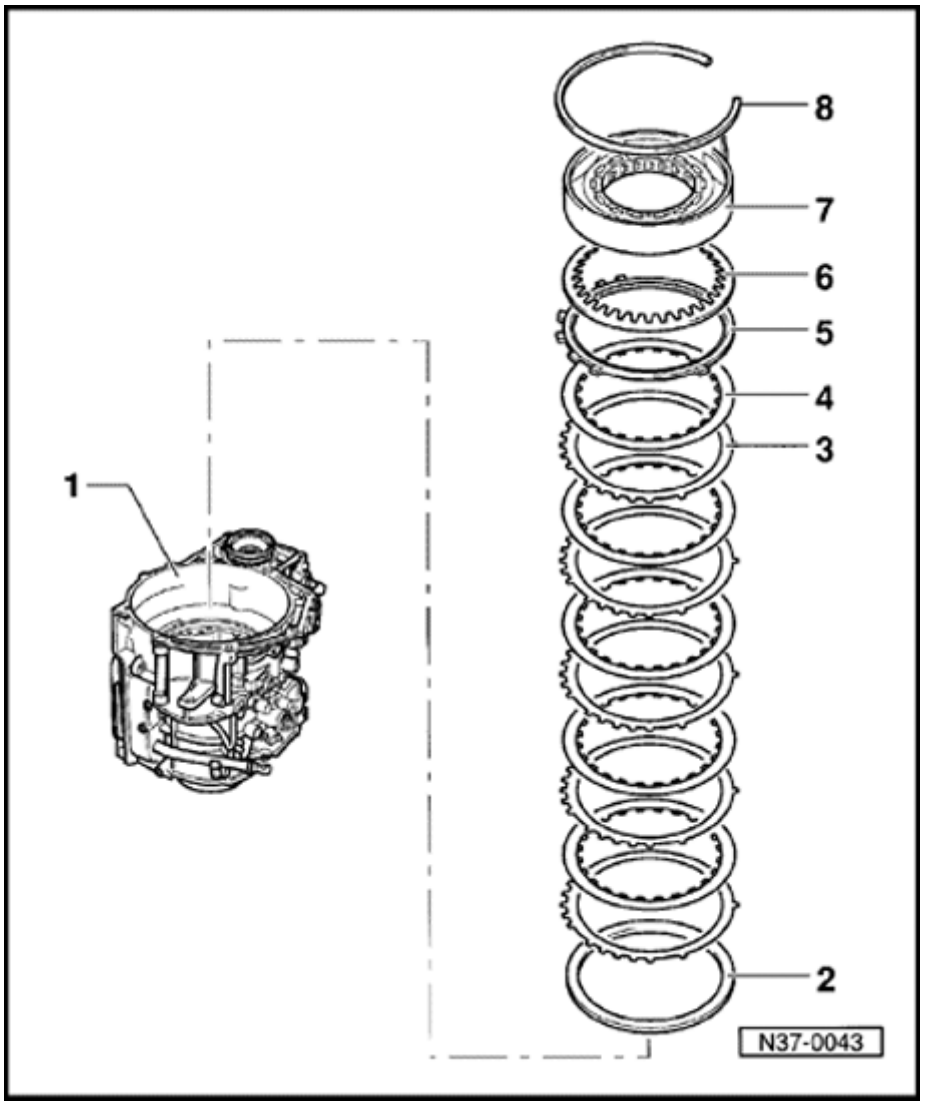
- Insert dial indicator in VW 382/7 measuring bar and place the tip on the small input shaft bolt.
- Move small input shaft up and down and measure axial play on dial indicator.

Specifications:

- min. = 0.23 mm (0.0091 in.)
- max. = 0.37 mm (0.0146 in.)

Note:

If the planet carrier has been adjusted with reverse gear brake -B1- and free wheel removed, then install reverse gear brake -B1- before installing planet carrier ⇒ *Planetary gearbox, assembling, page 37-76* .



Reverse gear brake -B1-, adjusting

Overview of components to adjust reverse gear brake -B1-

1 - Transmission housing

2 - Shim

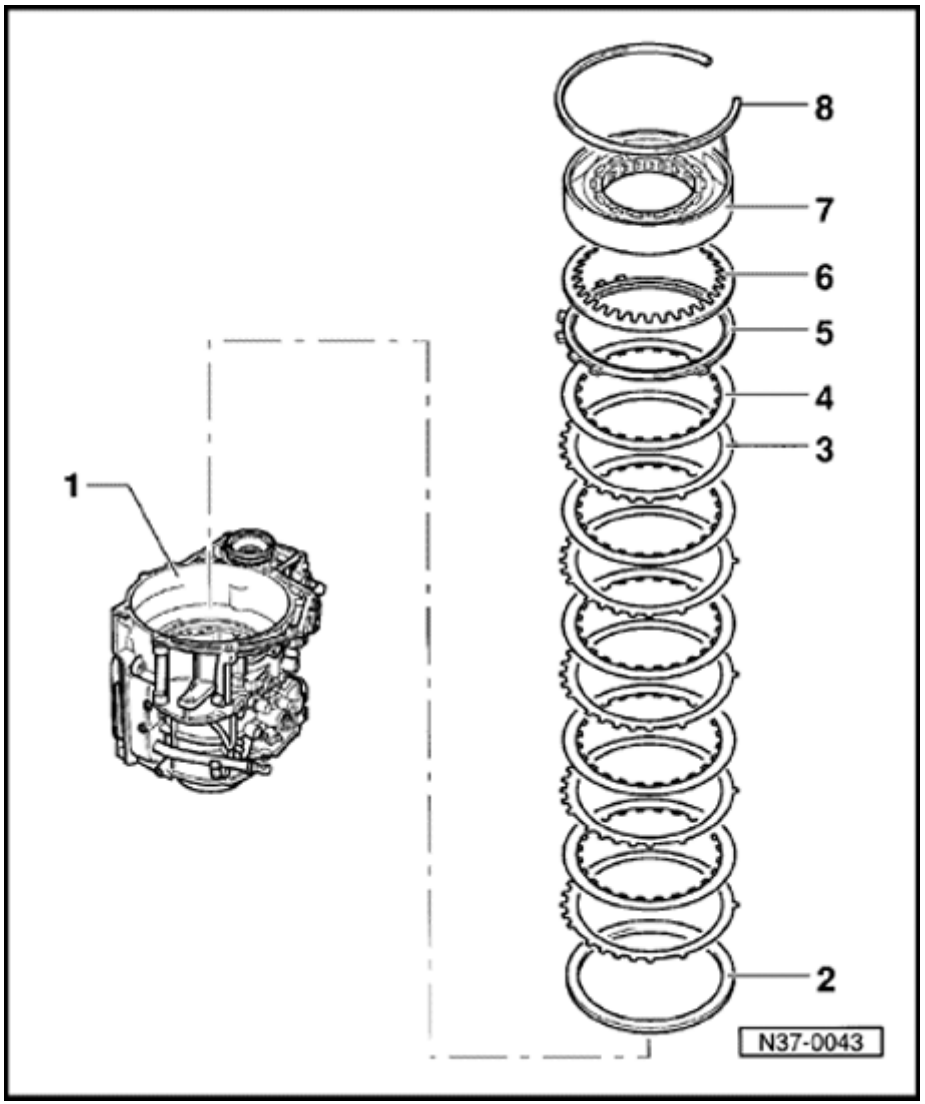
- Up to transmission build date 16 08 2: additional 3.7 mm (0.146 in.) shim for -B1- with 4 inner plates item -5-

3 - Outer plate -B1-

- Quantity ⇒ from page 00-3

4 - Inner plate -B1-

- Quantity ⇒ from page 00-3



5 - Pressure plate -B1-

- Install with flat side facing plates
- Differing thicknesses depending on number of inner plates installed:

Up to transmission build date 16 08 2:

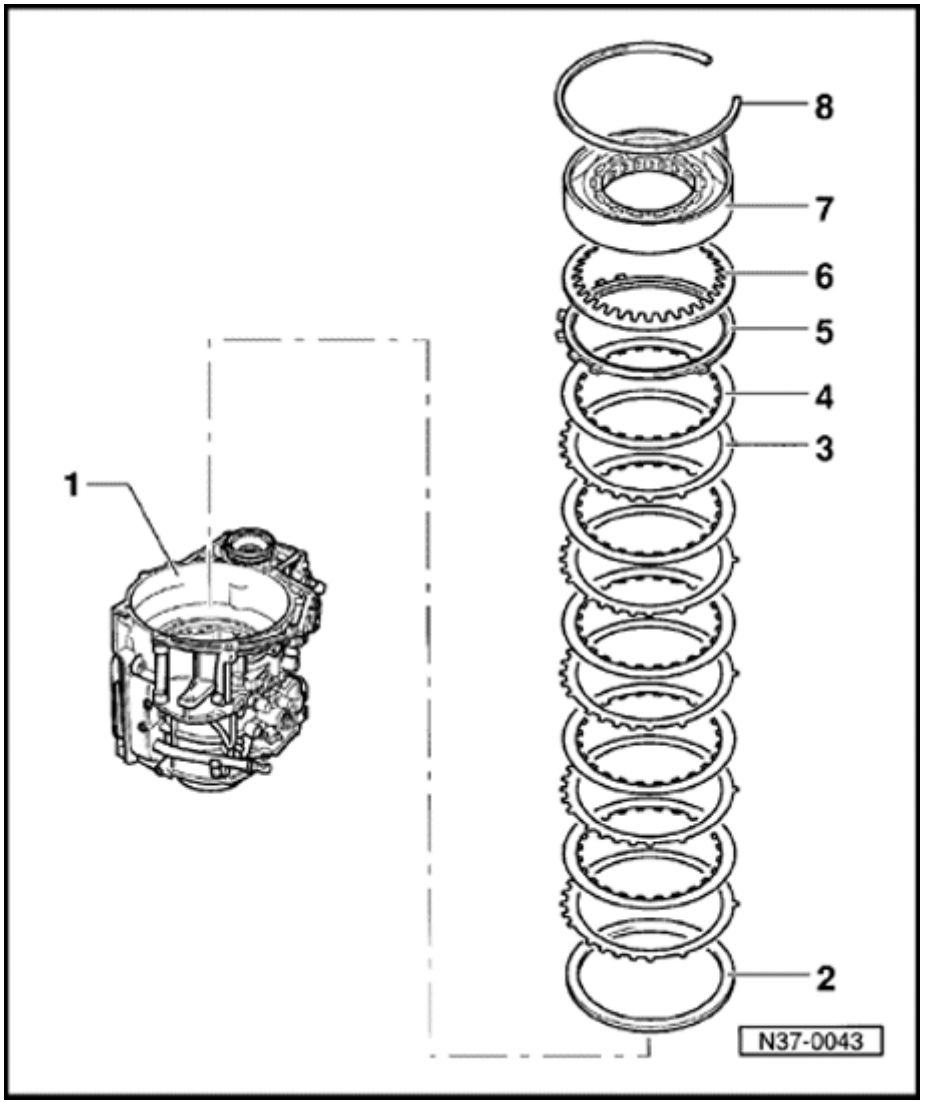
- With 4 inner plates 7.5 mm (0.295 in.) (an additional 3.7 mm (0.146 in.) shim - 8- is installed)
- With 5 inner plates 7.5 mm (0.295 in.)

From transmission build date 17 08 2:

- With 4 inner plates 11.1 mm (0.437 in.)
- With 5 inner plates 7.5 mm (0.295 in.)

Transmissions from 01.93:

- With 4 inner plates 13.5 mm (0.531 in.)
- With 5 inner plates 10.5 mm (0.413 in.)
- Quantity of -B1- inner plates ⇒ from page 00-3



6 - Dished washer

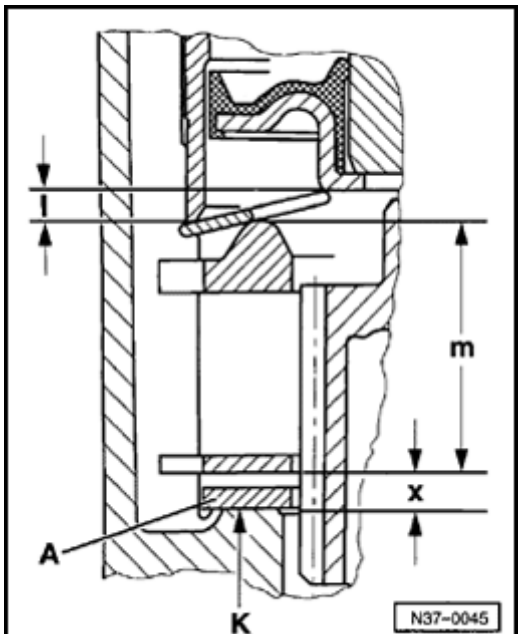
- Convex side faces towards free wheel

7 - Free wheel with -B1- piston

Note:

Before removing or installing free wheel remove valve body and take out sealing plugs ⇒ *page 38-36* .

8 - Circlip



Determining shim -A- thickness

Shim thickness is determined by gap -x- and shim is selected from table
⇒ page 37-104 .

$$\text{Gap } x = k + \frac{l}{2} - m$$

A - Shim

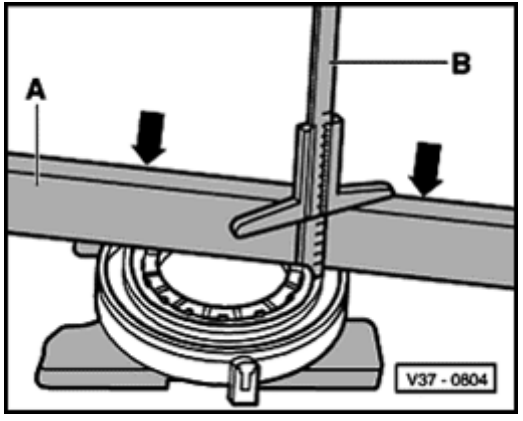
x - Gap

l - Position of piston in free wheel

m - Height of plate set including thrust plate

K - Constant = 26.8 mm

- Constant is determined by installation height in transmission housing and is not adjustable.

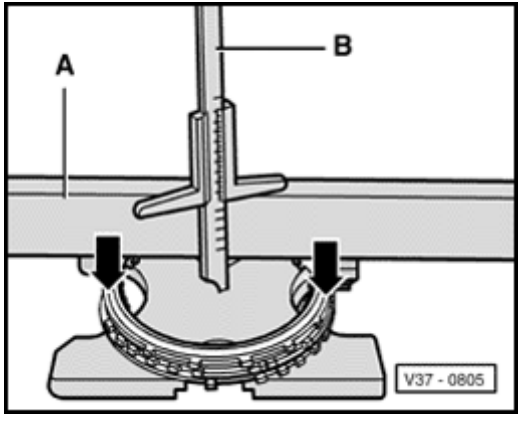


Calculating "l":

- Press piston in direction of arrows as far as stop.
- Place straightedge -A- onto outer race of free wheel.
- Measure to inner edge of piston with depth gauge -B-.

Example:

Measurement	=	51.8 mm
- Straightedge height	=	- 48.2 mm
Calculated dimension "l"	=	3.6 mm



Calculating "m":

- Place straightedge "A" on thrust plate.
- Compress set of plates including pressure plate in direction of arrows and measure the thickness of plate set with depth gauge "B".

Example:

Measurement	=	73.5 mm
- Straightedge height	=	- 48.2 mm
Calculated dimension "m"	=	25.3 mm

$$= 26.8 + \frac{3.6}{2} - 25.3 = 3.3\,\text{mm}$$

$$= 26.8 + \frac{3.6}{2} - 25.3 = 3.3\,\text{mm}$$

- Determine size of shims according to table.

Table of shims

Gap "x" - mm	Shim thickness - mm
2.36 - 2.45	1.0
2.46 - 2.55	1.1
2.56 - 2.65	1.2
2.66 - 2.75	1.3
2.76 - 2.85	1.4
2.86 - 2.95	1.5
2.96 - 3.05	1.6
3.06 - 3.15	1.7
3.16 - 3.25	1.8
3.26 - 3.35	1.9
3.36 - 3.45	1.0 + 1.0
3.46 - 3.55	1.0 + 1.1
3.56 - 3.65	1.1 + 1.1
3.66 - 3.75	1.1 + 1.2
3.76 - 3.85	1.2 + 1.2
3.86 - 3.95	1.2 + 1.3

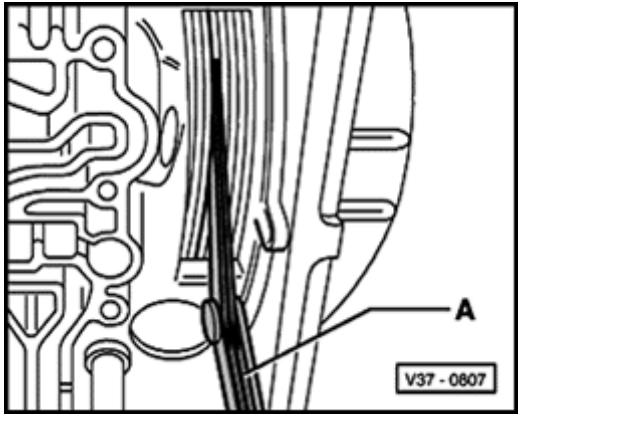
3.96 - 4.05	1.3 + 1.3
4.06 - 4.15	1.3 + 1.4
4.16 - 4.25	1.4 + 1.4

- Determine thickness of shims according to table and determine Part No. from parts catalog microfiche.

- After determining shim for -B1- carry out check measurement ⇒ page 37-105 .

Reverse gear brake -B1- check measurement

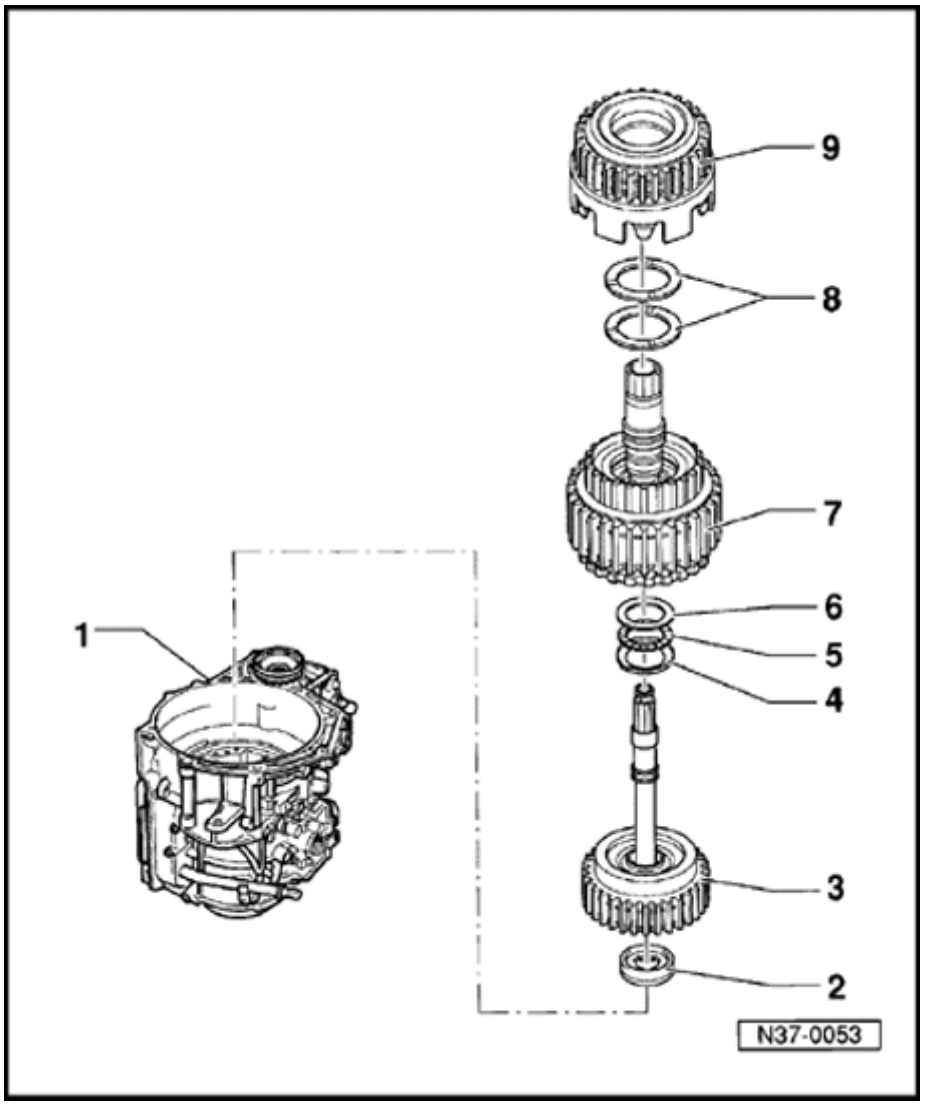
- Install parts up to free wheel and secure with circlip ⇒ Planetary gearbox, assembling, page 37-76 .



- Measure clearance between plates with feeler gauge -A-.

Specifications:

- minimum = 1.20 mm
- maximum = 1.80 mm



Clutch play between -K1- and -K2-, adjusting

- To adjust clutch play install components without shim - 8 - ⇒ Planetary gearbox, assembling, page 37-76 .

1 - Transmission housing

2 - Axial needle bearing with washer

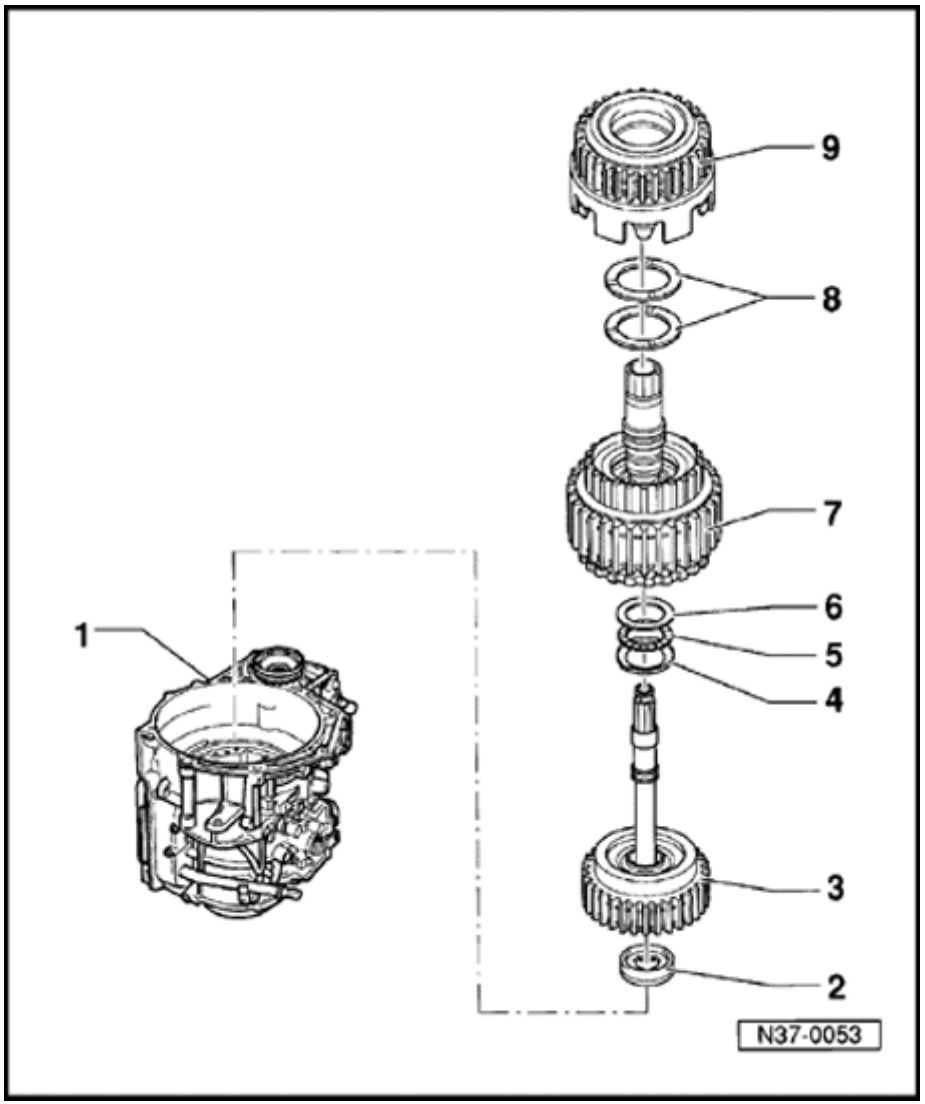
- Axial needle bearing faces towards small input shaft
- Washer faces toward -K3-

3 - 3rd and 4th gear clutch -K3- with pump shaft

- On transmissions from 01.93 the -K3- clutch operates only 4th gear ⇒ page 00-5

4 - Axial needle bearing washer

- Lugs face toward axial needle bearing



5 - Axial needle bearing

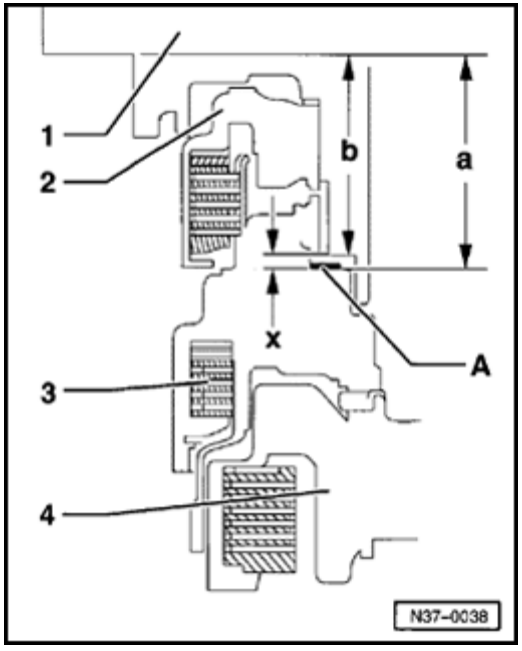
6 - Axial needle bearing washer

7 - 1st to 3rd gear clutch -K1- with turbine shaft

8 - Shim

- Do not install when adjusting clutch play
- 1 or 2 shims may be installed to achieve correct thickness

9 - Reverse gear clutch -K2-



Determining shim -A- thickness

A - Shim

1 - ATF pump

2 - Reverse gear clutch -K2-

3 - 1st to 3rd gear clutch -K1-

4 - 4th gear clutch -K3-

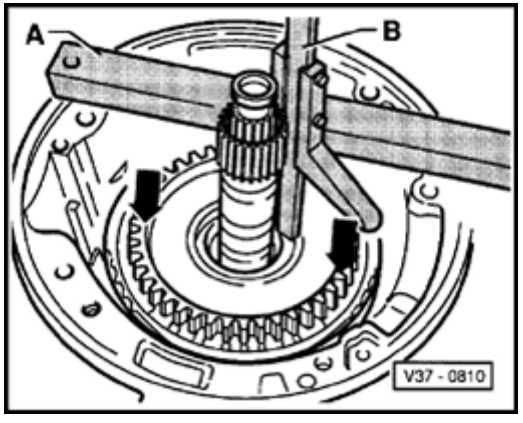
Note:

On transmissions from 01.93, clutch -K3- operates only 4th gear ⇒ page 00-5 .

- Calculating thickness of shim. Determine gap "x" and calculate shim thickness.

Gap x = a – b

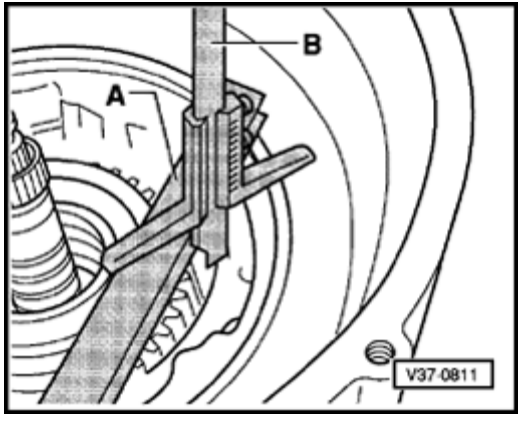
Calculating "a":



- Place straightedge -A- onto transmission housing.
- Press -K1- down in direction of arrow and measure distance into -K1- with depth gauge -B-.

Example:

Measurement 1 = 88.5 mm



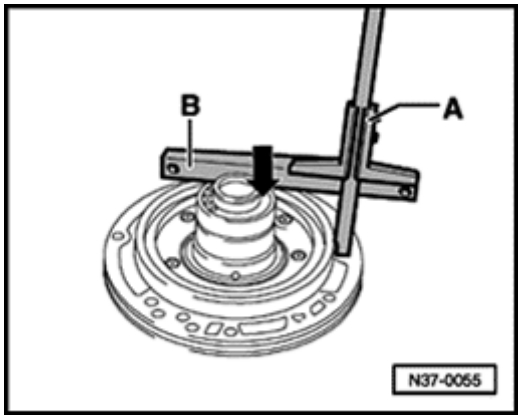
- Measure with depth gauge -B- to pump flange on transmission housing.

Example:

Measurement 2 = 34.3 mm

Measurement 1	=	88.5 mm
- Measurement 2	=	- 34.3 mm
Calculated dimension "a"	=	54.2 mm

= Dimension measured from pump flange/transmission housing into -K1-.



Calculating "b":

- Place straightedge -B- onto stator support (arrow) and measure with depth gauge -A- to gasket of pump flange.

Example:

Measurement	=	70.5 mm
- Straightedge height	=	- 19.5 mm
Calculated dimension "b"	=	51.0 mm

Gap x = a – b

= 54.2 – 51.0 = 3.2 mm

- Determine shim size according to table.

Table of shims

Gap "x" - mm	Shim thickness - mm
- 2.54	1.4
2.55 - 3.09	1 + 1
3.10 - 3.49	1.2 + 1.2
3.50 - 3.89	1.4 + 1.4
3.90 - 4.29	1.6 + 1.6
4.30 - 4.69	1.8 + 1.8
4.70 - 5.04	1.2 + 1.2 + 1.6
5.05 - 5.25	1.2 + 1.2 + 1.8

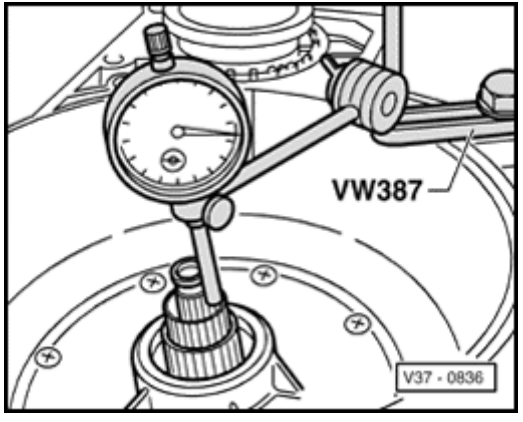
- Determine thickness of shims according to table and determine Part No. from parts catalog microfiche.

- Carry out clutch play check measurement after installing ATF pump.

Check measurement (clutch play)

- The clutch play cannot be measured until the ATF pump has been installed.

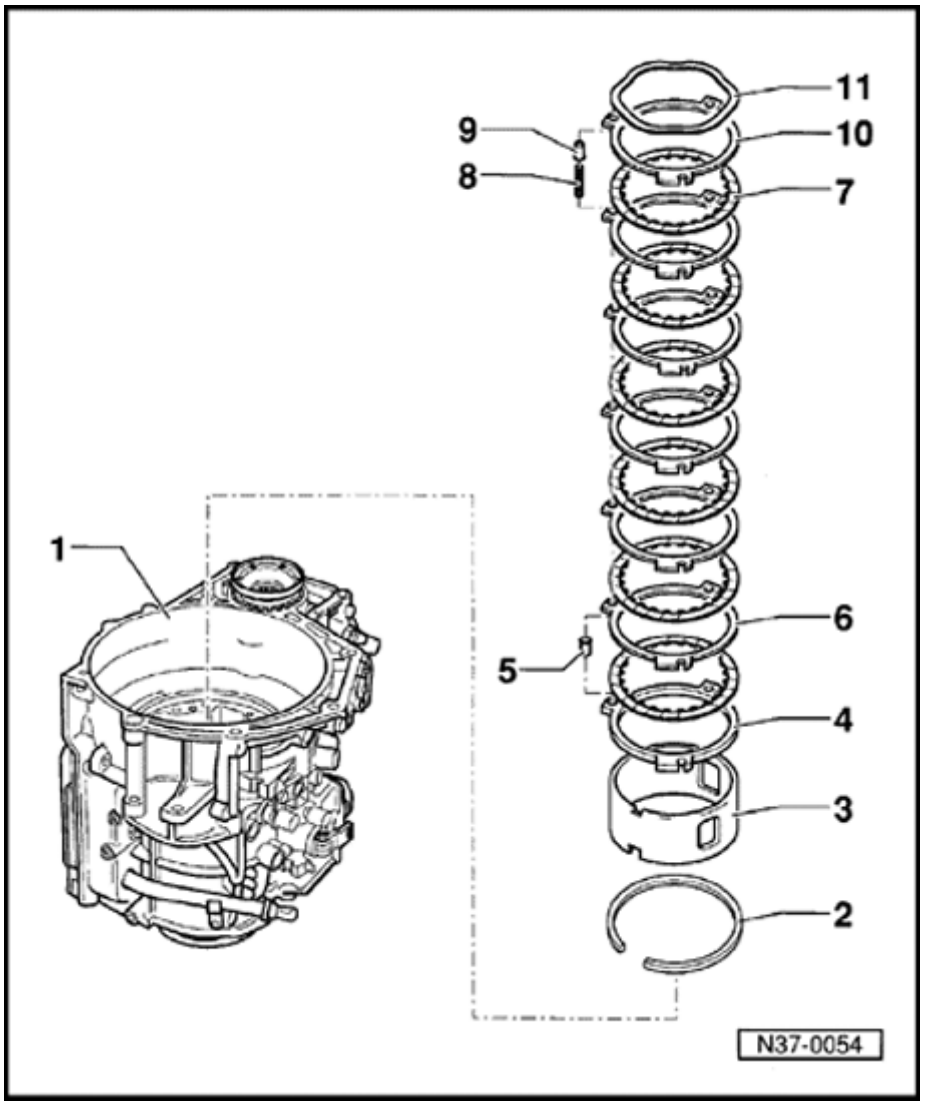
- Attach dial indicator holder to transmission housing and place on turbine shaft with a 1 mm preload.



- Move turbine shaft up and down and read axial play on dial indicator gauge.

Specifications:

- minimum = 0.5 mm (0.020 in.)
- maximum = 1.2 mm (0.047 in.)



2nd and 4th gear brake -B2-, adjusting

- Install components to adjust 2nd and 4th gear brake -B2- but without corrugated washer - 11 - and last outer plate - 10 - ⇒ Planetary gearbox, assembling, page 37-76 .

1 - Transmission housing

2 - Circlip

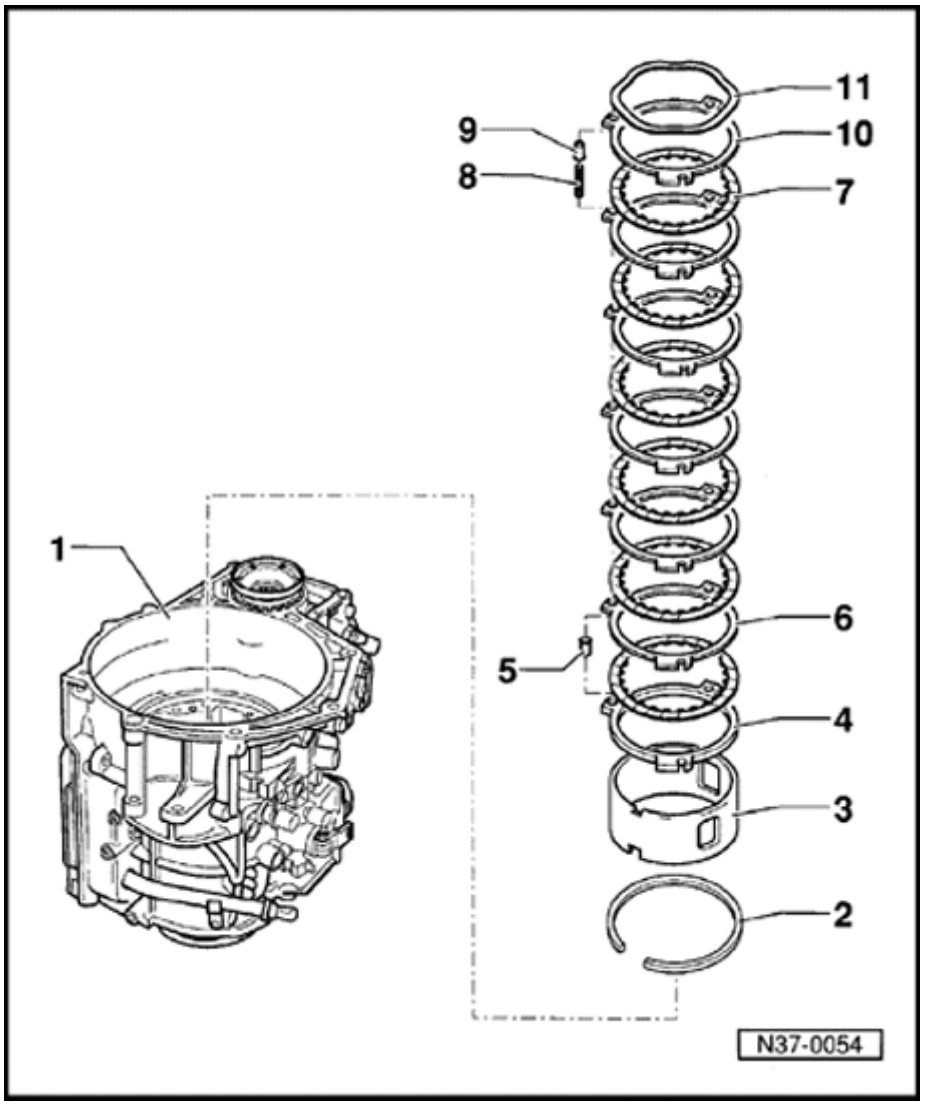
- For supporting tube

3 - Supporting tube -B2-

- Length of -B2-:

4 inner plates	72.3 mm (2.847 in.)
5 inner plates	68.6 mm (2.701 in.)
6 inner plates	64.9 mm (2.555 in.)

- Quantity inner plates -B2- ⇒ from page 00-3
- Insert so that notch locates on free wheel wedge



4 - Outer plate -B2-

- 3 mm thick

5 - Spring cap

- Install after installing first outer plate

6 - Outer plate -B2-

- Always install 2 mm thick outer plates
- Quantity ⇒ from page 00-3

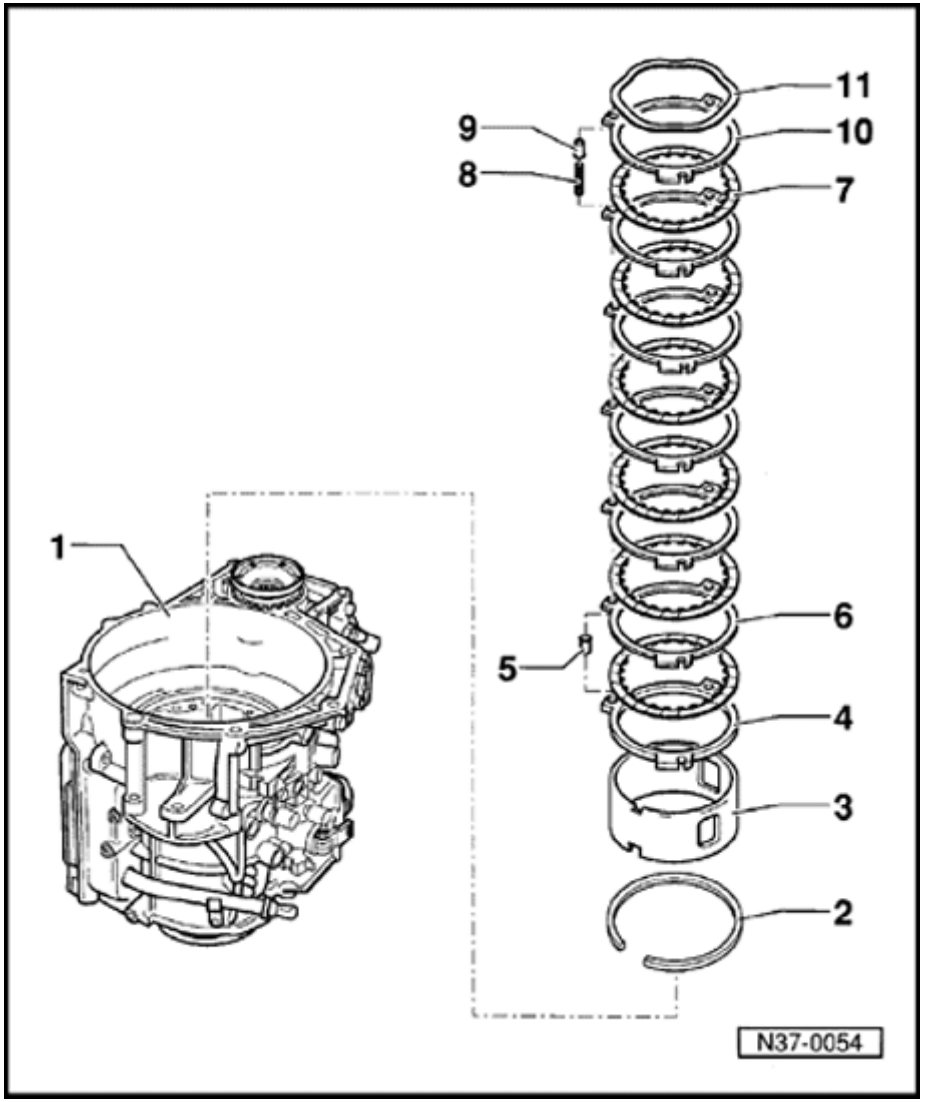
7 - Inner plate -B2-

- Quantity ⇒ from page 00-3

8 - Spring

9 - Spring cap

- Install before installing last outer plate

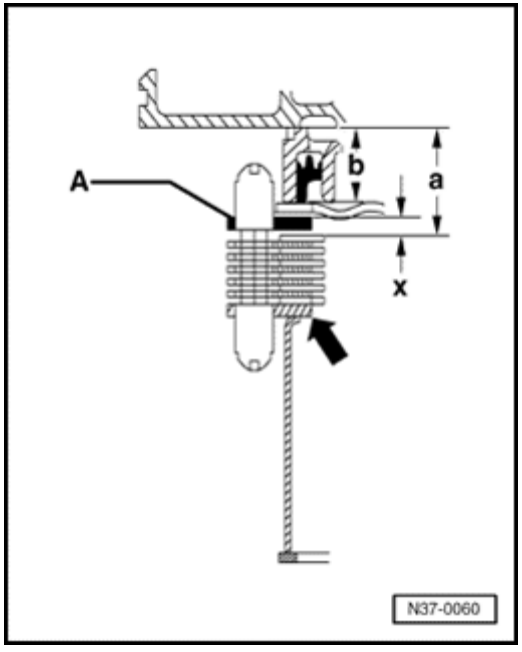


10 - Outer plate -B2-

- Do not install when adjusting -B2-
- 2 outer plates can be installed.

11 - Corrugated washer

- Do not install when adjusting -B2-



Calculating thickness of last outer plate -A-

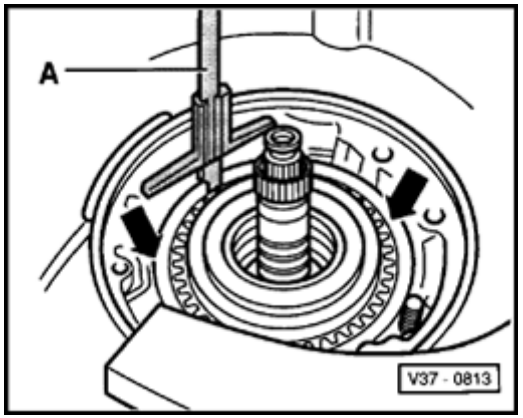
The thickness of the outer plate is determined by gap "x" and is selected from table ⇒ page 37-118 .

Gap x = a – b – 3.6 mm

A - Outer plate

Note:

First outer plate (arrow) is always 3 mm thick.



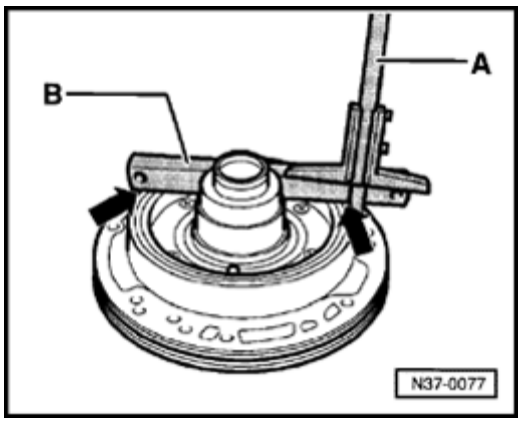
Calculating "a":

- Measure from pump flange/transmission housing to the last inner plate with depth gauge "A". Press inner plate down (in direction of arrow) for this step.

Example:

Measurement "a"	=	30.2 mm

Calculating "b":



- Place straightedge "B" onto stator support (-arrow-) and measure with depth gauge "A" to gasket of pump flange.

Example:

Measurement	=	40.1 mm
- Straightedge height	=	- 19.5 mm
Calculated size "b"	=	20.6 mm

Gap x = a – b – 3.6 mm

= 30.2 – 20.6 = 6.00 mm

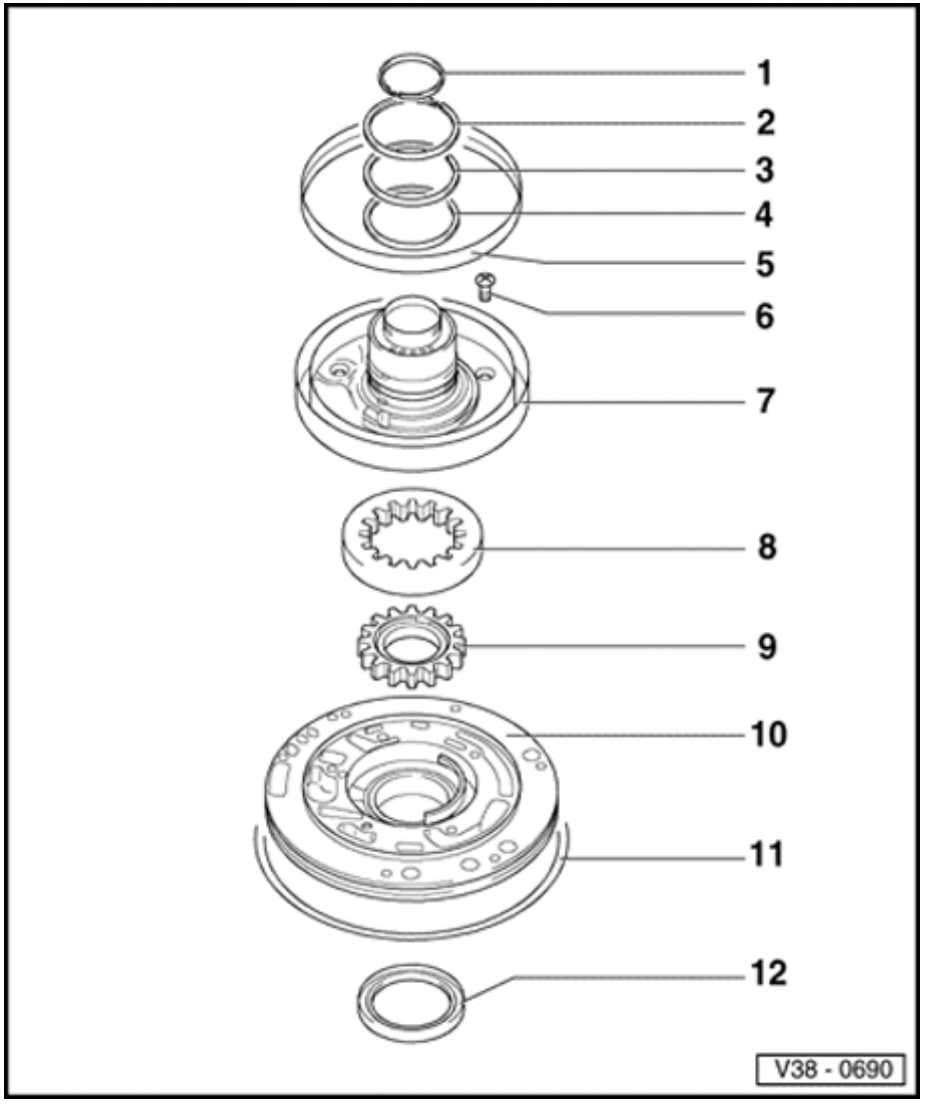
- Determine thickness of outer plate according to table:

Table of plates

Gap "x" - mm	Plate thickness - mm
4.25 - 4.49	2.75
4.50 - 4.74	3.00
4.75 - 4.99	3.25
5.00 - 5.24	3.50
5.25 - 5.49	3.75
5.50 - 5.74	2.00 + 2.00
5.75 - 5.99	2.00 + 2.25
6.00 - 6.24	2.25 + 2.25
6.25 - 6.49	2.25 + 2.50
6.50 - 6.74	2.50 + 2.50
6.75 - 7.00	2.50 + 2.75

- Determine thickness of outer plate according to table and determine Part No. from parts catalog microfiche.

- Two outer plates can be installed if necessary to achieve the specified thickness.



ATF pump, disassembling and assembling

1 - Piston ring

- Check that ring is correctly located ⇒ Fig. 1
- Installing ⇒ Fig. 2

2 - Piston ring

- Check that ring is correctly located ⇒ Fig. 1
- Installing ⇒ Fig. 2

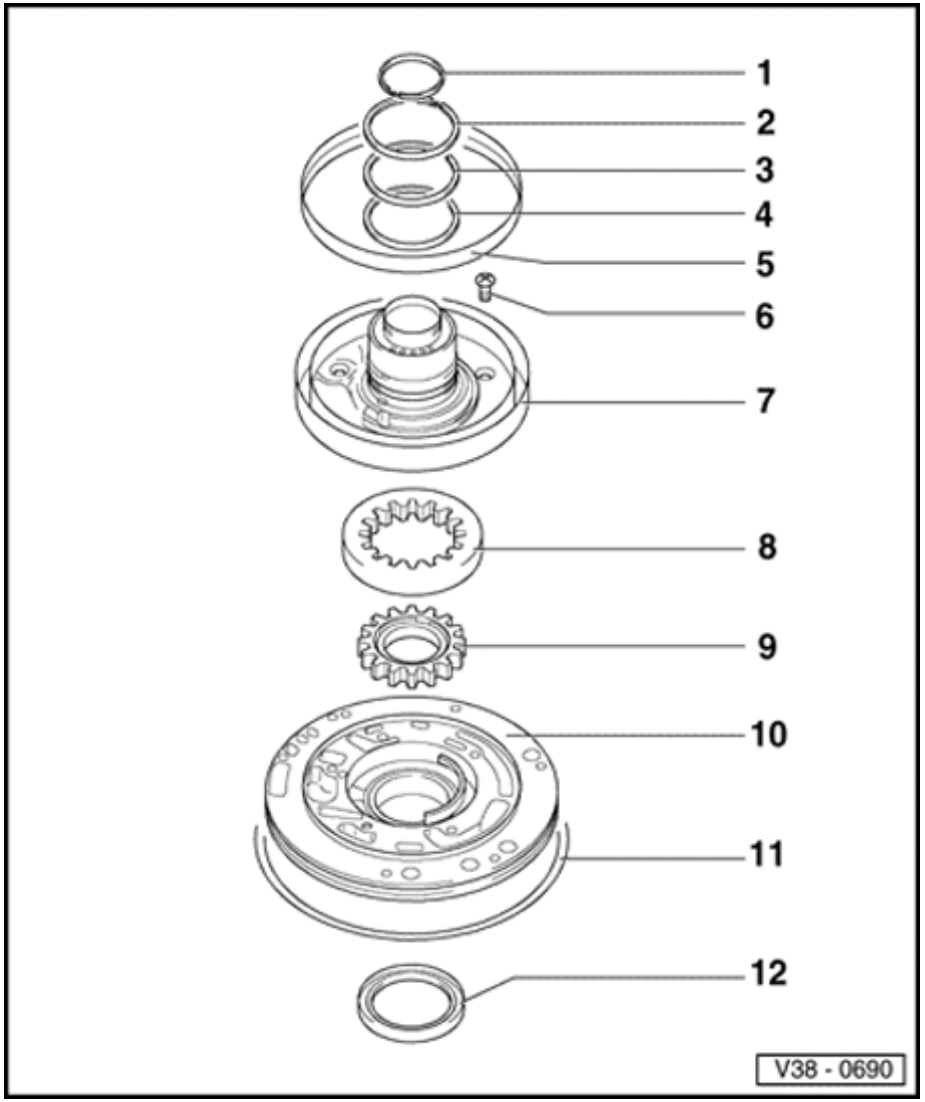
3 - Piston ring

- Check that ring is correctly located ⇒ Fig. 1
- Installing ⇒ Fig. 2

4 - Thrust washer

5 - Piston

- Sealing lips are vulcanized to piston
- Moisten sealing lips with ATF before installing
- Turn piston slightly while installing



6 - Bolt

- Tightening torque: 10 Nm (7 ft lb) plusadditional $^{1}/_{8}$ -turn (45 °)

7 - Stator support

8 - Outer gear

- Manufacturer's marking faces stator support
- If outer gear is incorrectly installed, ATF pump may not operate freely in the installed position

9 - Inner gear

- Larger groove faces stator support

10 - Housing for ATF pump

11 - O-ring

- Always replace

12 - Torque converter oil seal

- Removing and installing ⇒ page 32-3

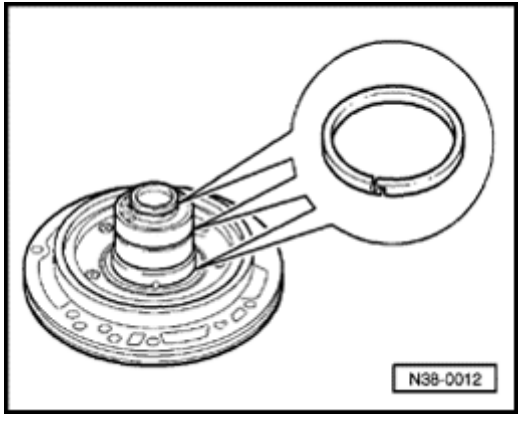


Fig. 1 Checking that piston rings are correctly located

- Make sure that ends of piston rings are hooked together.

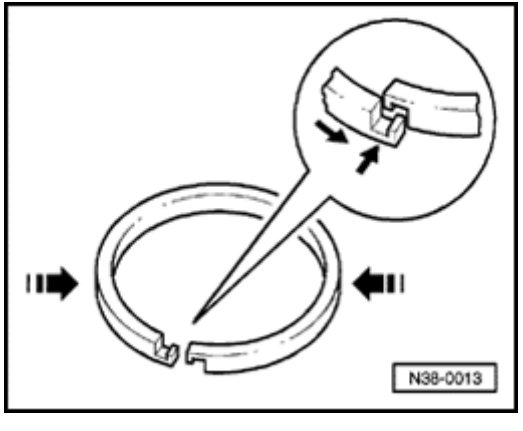
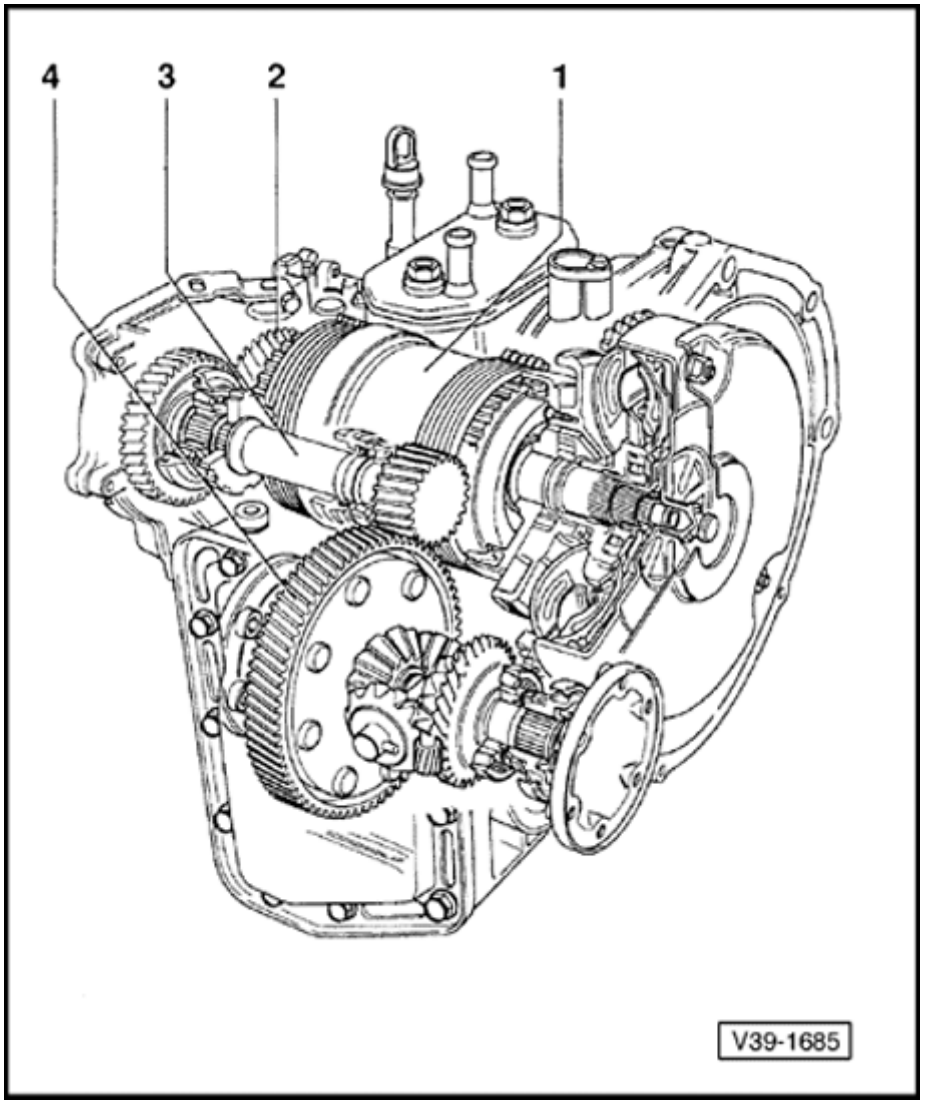


Fig. 2 Fitting and hooking ends of piston ring together

- Place piston ring in groove.
- To hook ends together press sides of ring in and guide ends over one another.
- Do not twist piston ring out of groove on one side.



Final drive, disassembling and assembling

Repair overview

1 - Planetary gear

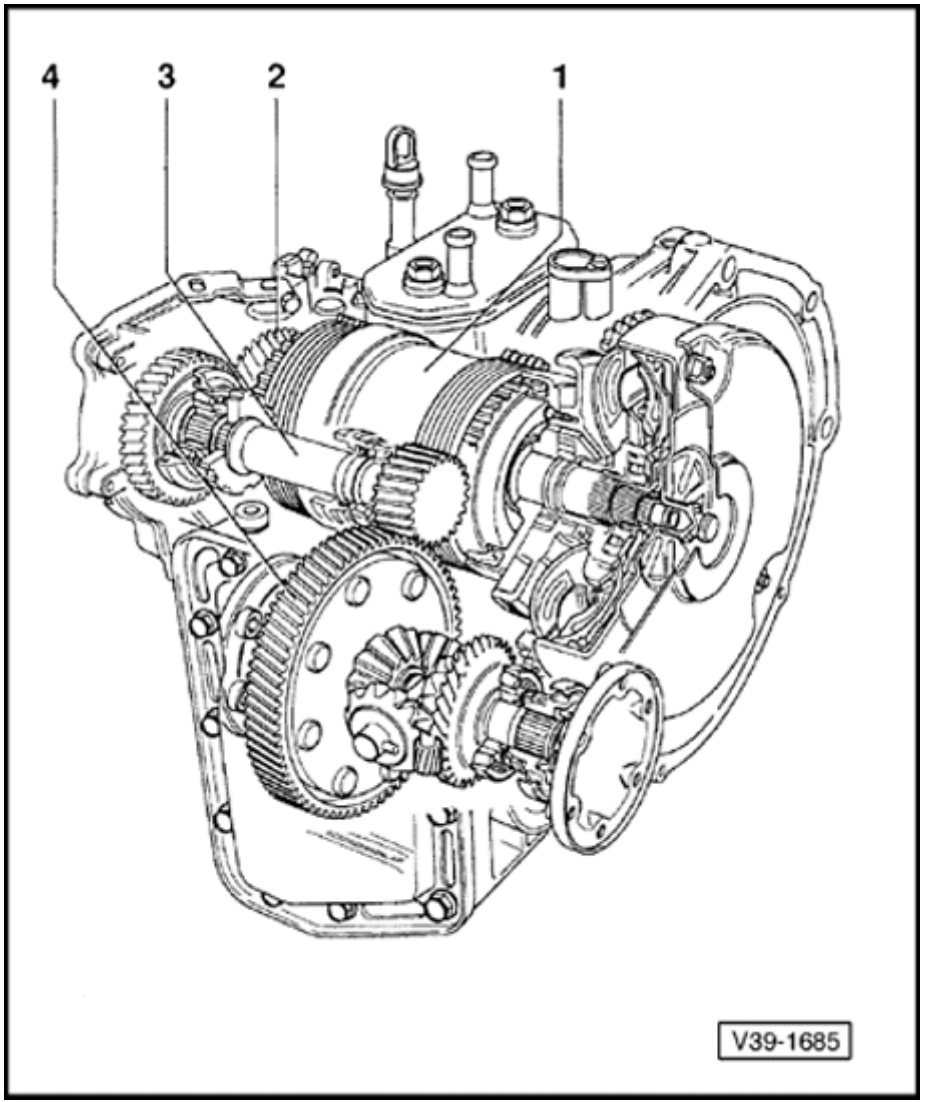
- Disassembling and assembling ⇒ page 37-55

2 - Input gear

- Removing and installing ⇒ page 39-8
- Adjusting ⇒ page 39-49
- Adjusting final drive (overview) ⇒ page 39-42

Note:

Repairs on the input gear can be carried out only after the component parts of the planetary gear have been removed.

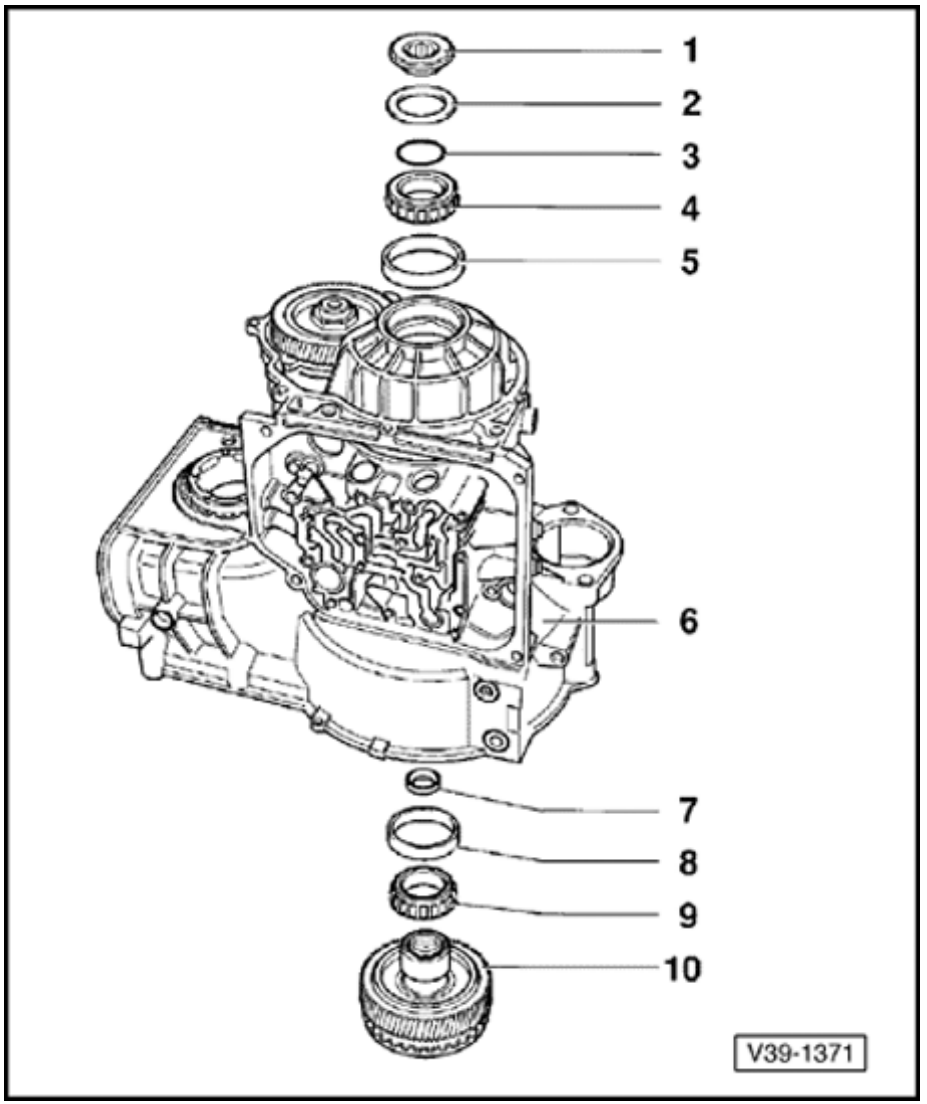


3 - Drive pinion

- Removing and installing ⇒ page 39-14
- Adjusting ⇒ page 39-45
- Adjusting final drive (overview) ⇒ page 39-42

4 - Differential

- Removing and installing ⇒ page 39-23
- Disassembling and assembling ⇒ page 39-34
- Adjusting ⇒ page 39-52
- Adjusting final drive (overview) ⇒ page 39-42



Input gear, removing and installing

Note:

Drive pinion and differential do not need to be removed.

1 - Socket-head fastener

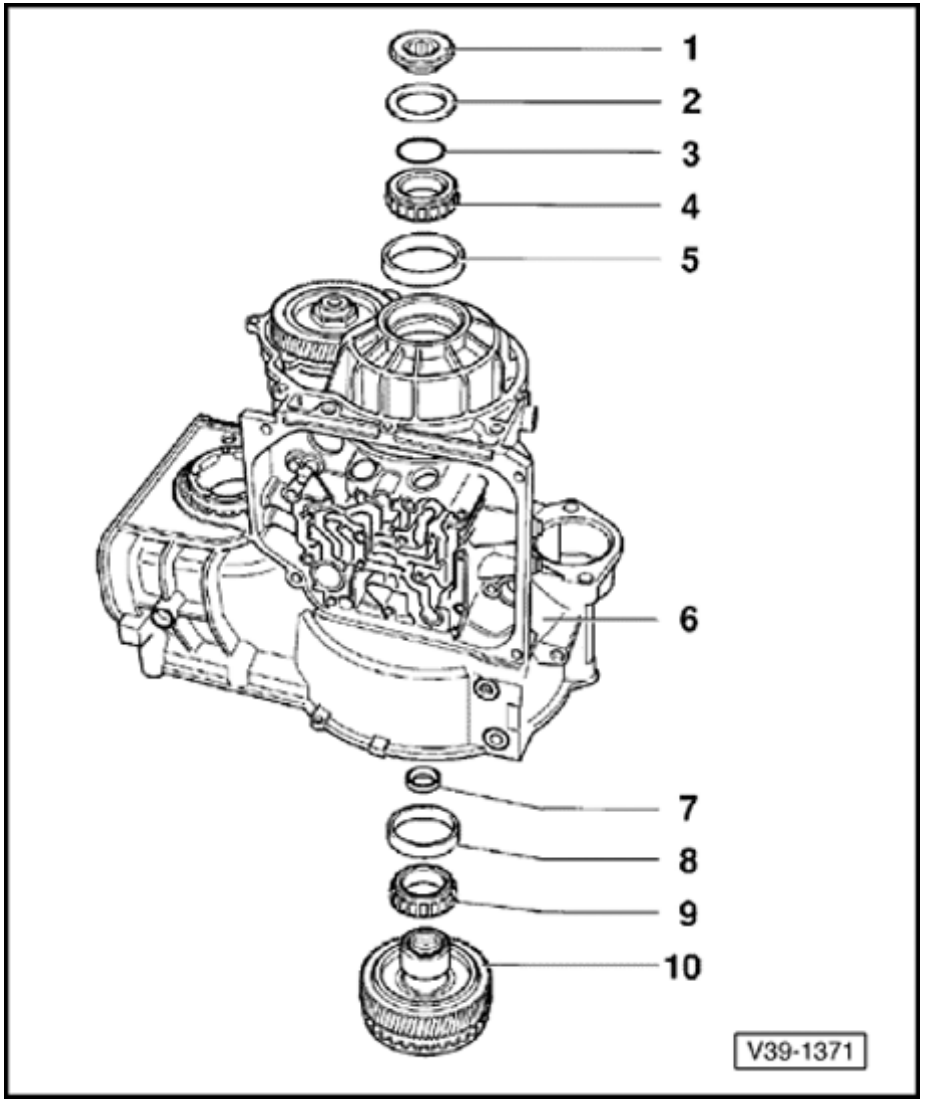
- Tightening torque: 250 Nm (184 ft lb)
- Engage parking lock to remove and install
- Use 22 mm hex wrench
- Before installing socket head fastener insert axial needle bearing - 7 -

2 - Dished washer

- Curved side faces socket head fastener

3 - Shim

- Determining thickness ⇒ page 39-49 , Input gear, adjusting



4 - Tapered roller bearing inner race

- Install so that lugs engage in groove of tapered roller bearing inner race - 9 - ⇒ Fig. 3
- Installation position ⇒ Fig. 4
- After measuring thickness of shim, fit onto input gear with AMV 185 101 A1 thread locking fluid

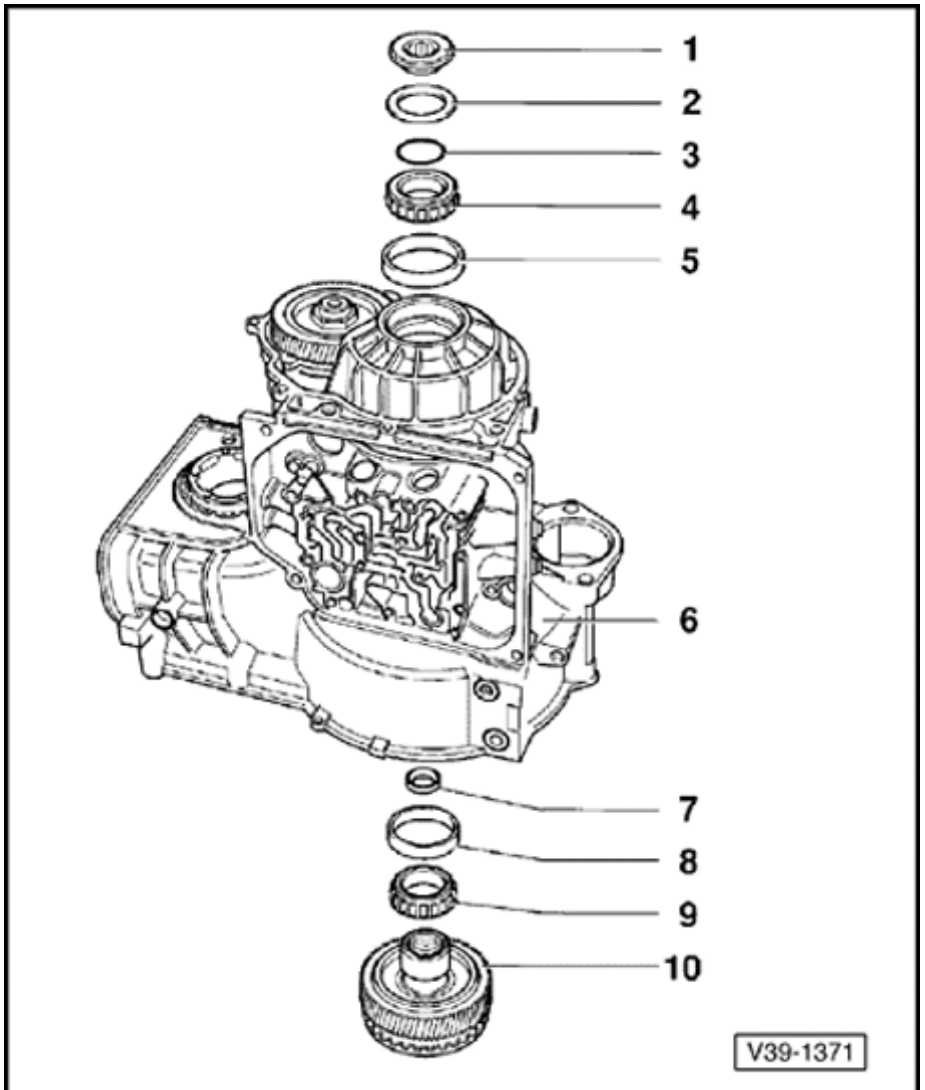
5 - Tapered roller bearing outer race

- Drive out with drift
- Drive in with tool 30-205
- Install with AMV 185 101 A1 locking fluid

6 - Transmission housing

7 - Axial needle bearing

- Install with flat side facing input gear
- Insert into input gear before installing socket-head fastener - 1 -



8 - Tapered roller bearing outer race

- Drive out with drift
- Drive in with 30-205 and appropriately long drift
- Install with thread locking fluid AMV 185 101 A1

9 - Tapered roller bearing inner race

- Pulling off ⇒ Fig. 1
- Pressing on ⇒ Fig. 2
- Installation position ⇒ Fig. 4
- Install with AMV 185 101 A1 locking fluid

10 - Input gear

- With impulse wheel for Vehicle Speed Sensor (VSS) -G68-
- Number of teeth ⇒ page 00-3 , Technical data
- Adjusting ⇒ page 39-49
- If signs of damage exist, always replace input gear and output gear together
- Removing ⇒ Fig. 5

Note:

If input gear is replaced, adjust planet carrier ⇒ page 37-8. .

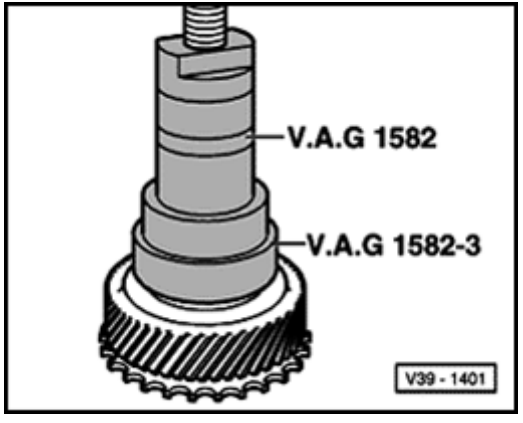


Fig. 1 Pulling off tapered roller bearing inner race

- Place press piece on input gear.

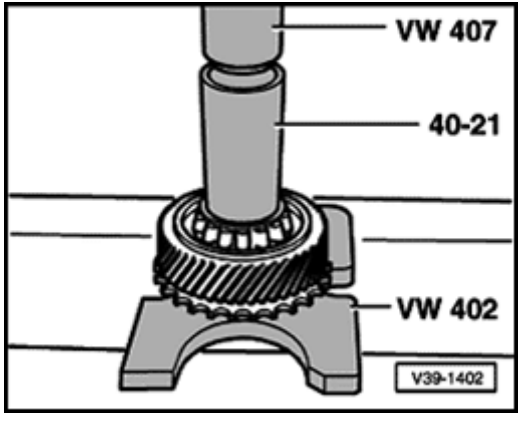


Fig. 2 Pressing on tapered roller bearing inner race

Note:

A press piece must be placed below the hub of the input gear to avoid damaging the input gear.

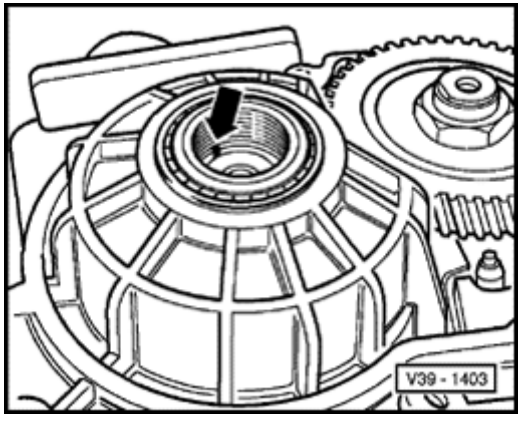


Fig. 3 Installing tapered roller bearing inner race

- Install tapered roller bearing inner race so that the lugs of the inner race engage in the grooves of the opposite inner race (arrow) ⇒ Fig. 4 .

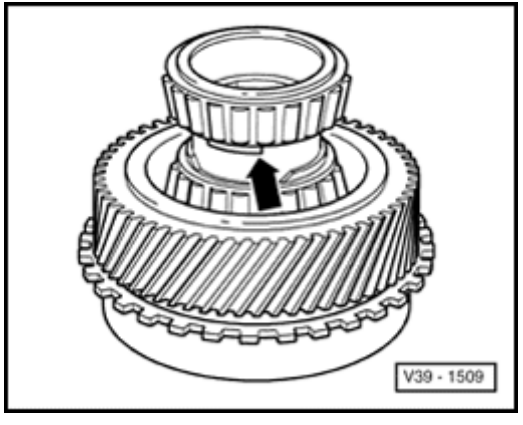


Fig. 4 Installation position of tapered roller bearing inner race

- Lug (arrow) must engage in groove of the opposite inner race.

Note:

Tapered roller bearings without lugs can also be installed.

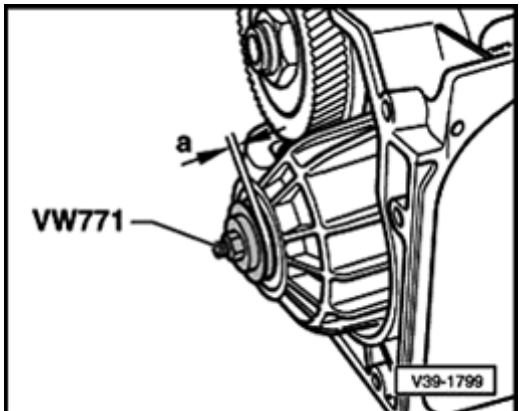
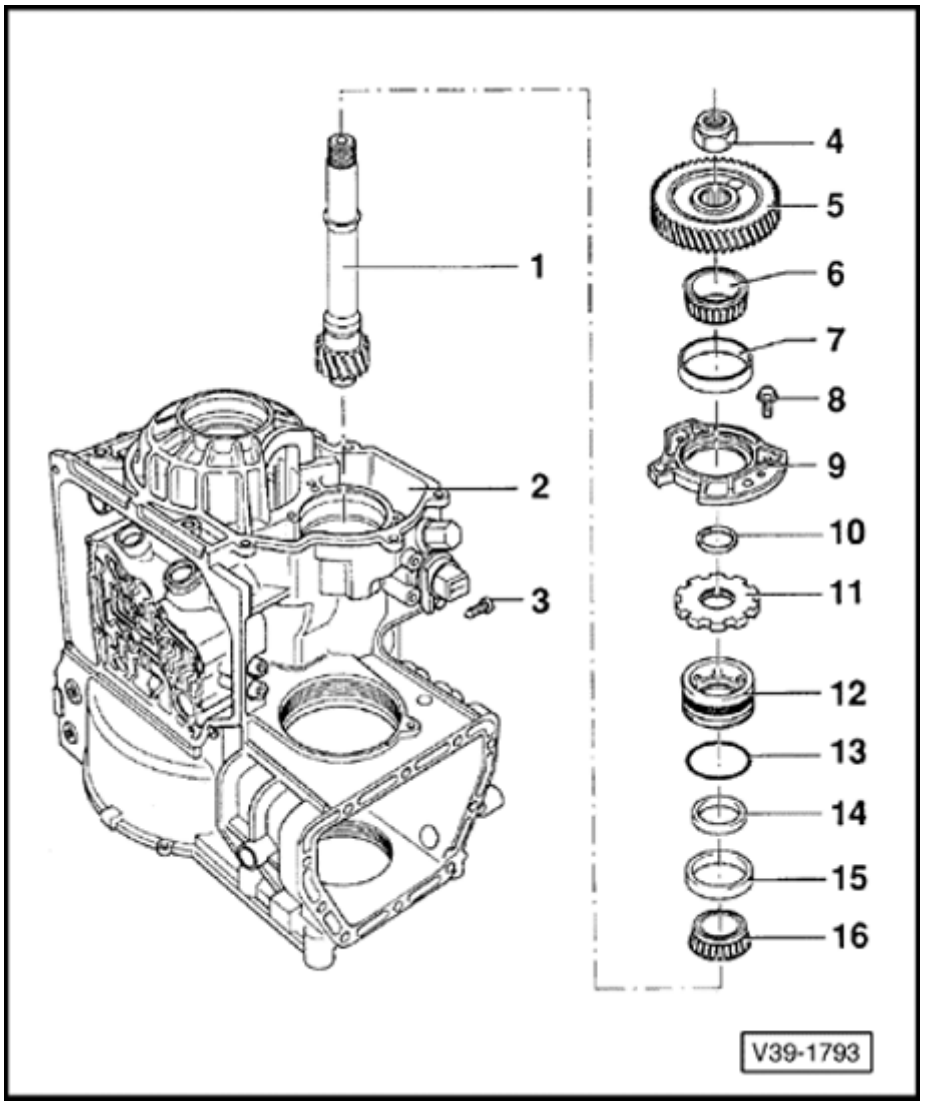


Fig. 5 Removing input gear

- Install socket-head fastener without dished washer, shim and axial needle bearing, just far enough so that gap -a- remains between socket-head fastener and tapered roller bearing inner race.
  - ♦ Gap -a- = approx. 3 mm (0.118 in.)
- Drive out input gear with VW 771 as far as the stop of the tapered roller bearing inner race.
- Remove VW 771 and remove input gear.



Drive pinion, removing and installing

Note:

To remove the drive pinion, the selector shaft must be removed after taking out the parking lock ⇒ page 38-45 , Parking lock, disassembling and assembling.

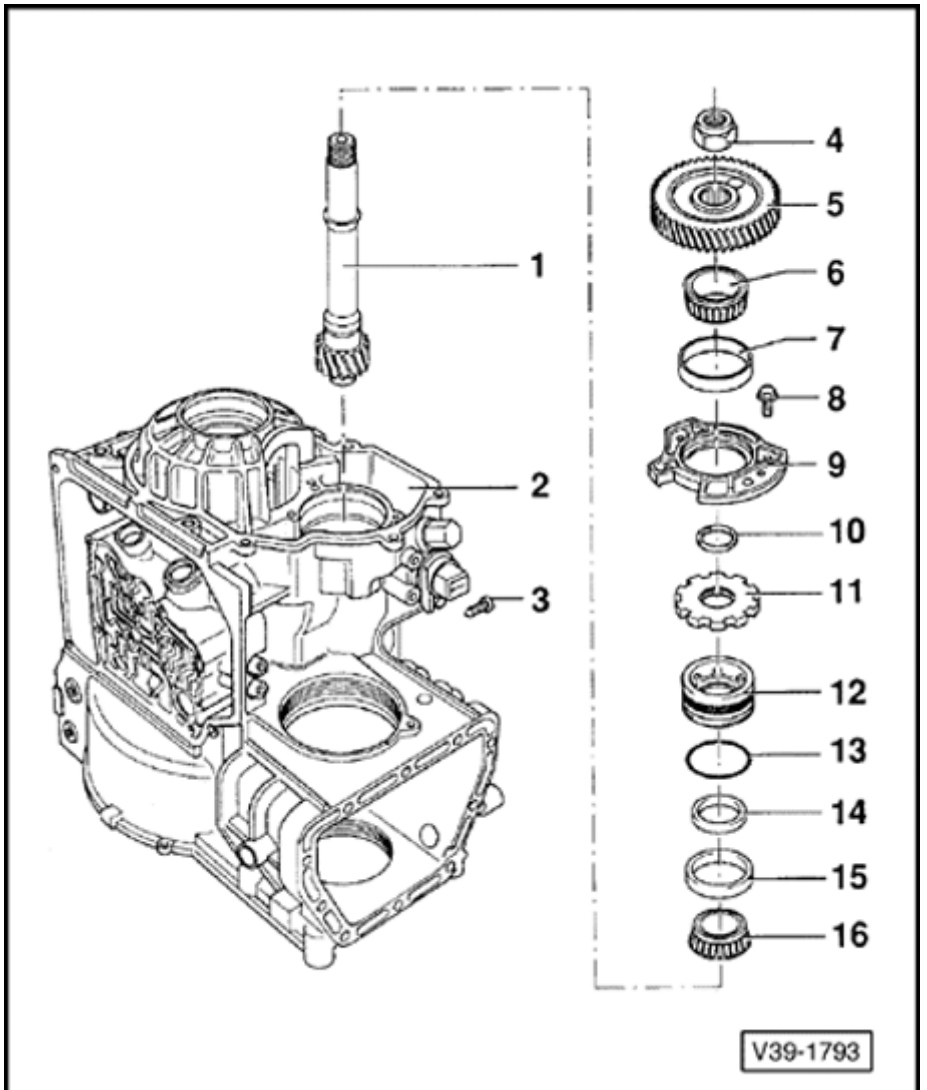
1 - Drive pinion

- Number of teeth ⇒ from page 00-3 , Technical data
- Adjusting ⇒ page 39-45
- Removing ⇒ Fig. 8

2 - Transmission housing

3 - Screw

- Tightening torque: 12 Nm (9 ft lb)
- Remove screw before removing or installing bearing supporting ring - 12 -
- Install with AKD45600001 sealing compound



4 - Hex nut

- Tightening torque: 250 Nm (184 ft lb)
- Engage parking lock to remove or install
- Secure with drift

5 - Output gear

- Number of teeth ⇒ from page 00-3 , Technical data
- Pulling off ⇒ Fig. 1
- If signs of damage exist, always replace input gear and output gear together

6 - Tapered roller bearing inner race

- Pulling off ⇒ Fig. 2
- Pressing on ⇒ Fig. 3

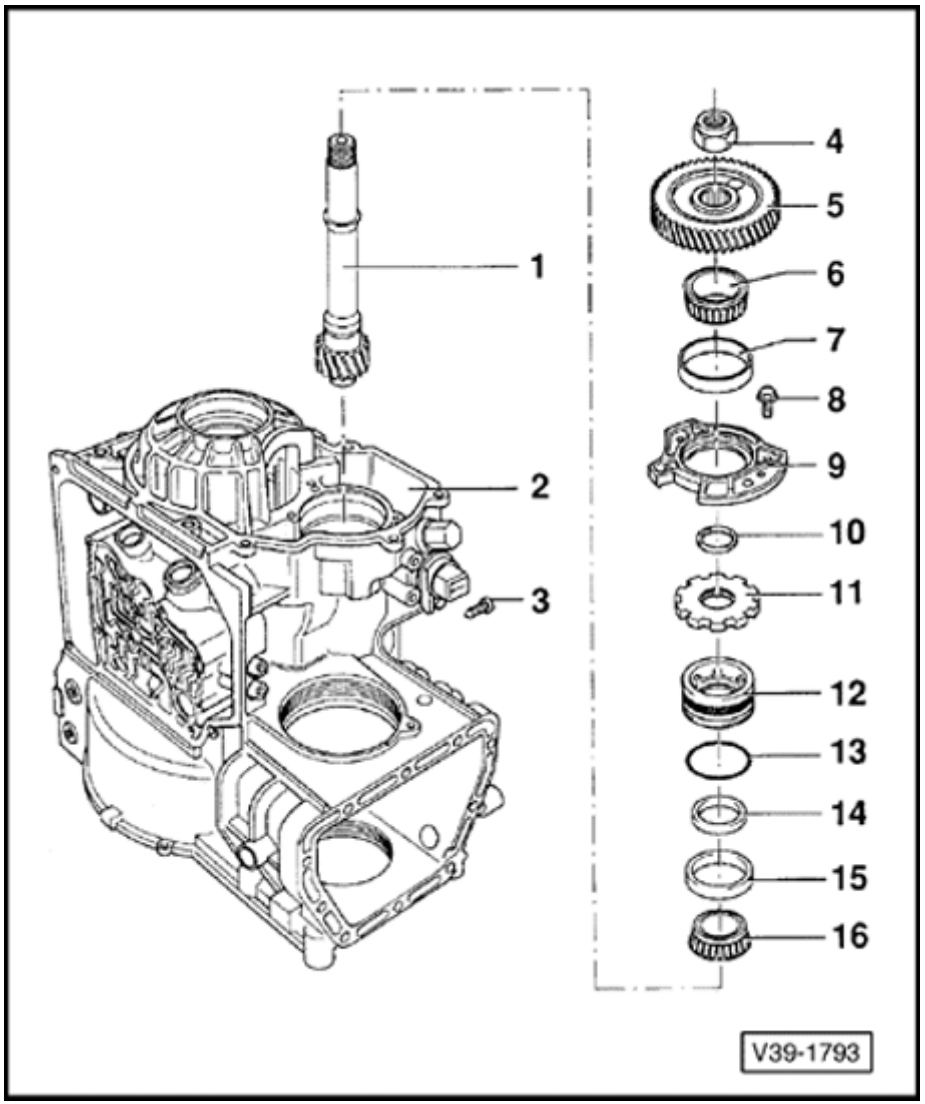
7 - Tapered roller bearing outer race

- Drive out with drift
- Pressing in ⇒ Fig. 4

8 - Bolt

- M6: 14 Nm (10 ft lb)
- M8: 25 Nm (18 ft lb)

9 - Bearing cap



10 - Shim

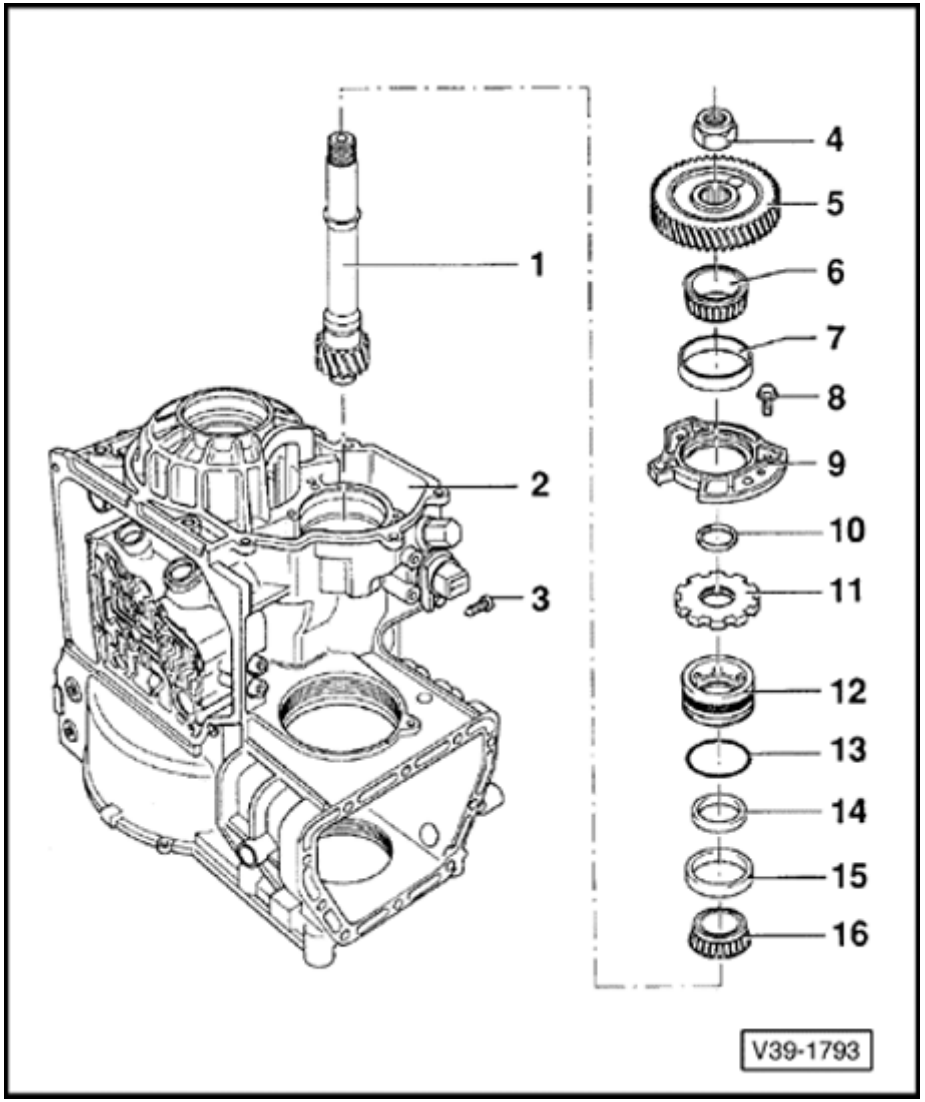
- Determining thickness ⇒ page 39-45 , Drive pinion, adjusting

11 - Parking lock gear

- Rounded side faces teeth of drive

12 - Bearing support ring

- Tightening torque: 200 Nm (148 ft lb)
- Remove screw - 3 - before removing or installing bearing support ring
- Removing or installing ⇒ Fig. 5
- Bearing support ring cannot be unscrewed until the selector shaft has been removed ⇒ page 38-45 , Parking lock, disassembling and assembling
- Install bearing supporting ring carefully. Sealing lip and spring must not be damaged.
- Supporting ring with seal ⇒ Fig. 6



13 - O-ring

- Always replace
- Place onto bearing support ring - 12 -

14 - Oil seal for drive pinion

- Remove with screwdriver
- Installation position ⇒ Fig. 6
- Driving in ⇒ Fig. 7

15 - Tapered roller bearing outer race

- Driving in ⇒ Fig. 9

16 - Tapered roller bearing inner race

- Drive off with drift
- Pressing on ⇒ Fig. 10

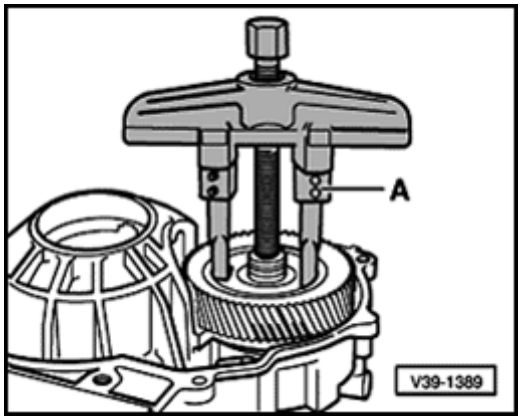


Fig. 1 Pulling off output gear

A - Kukko 20-10 and Matra V 172 pulling hooks

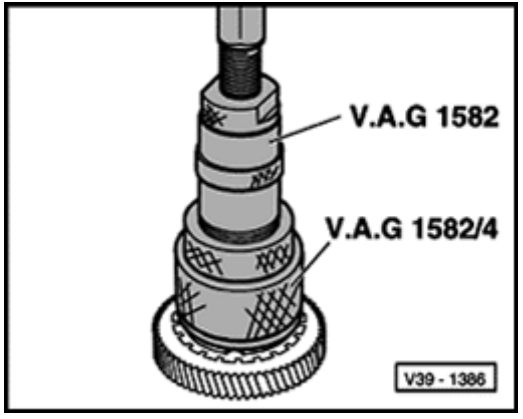


Fig. 2 Pulling off tapered roller bearing inner race

- Place press piece onto collar of output gear.

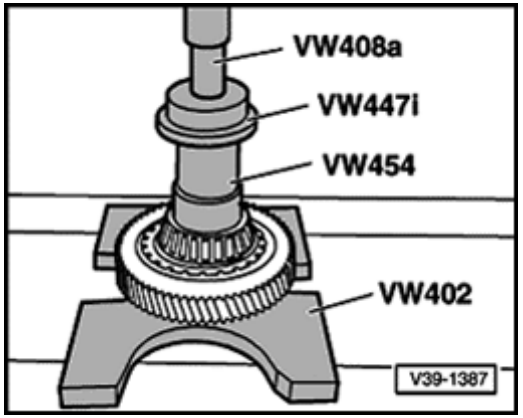


Fig. 3 Pressing on tapered roller bearing inner race

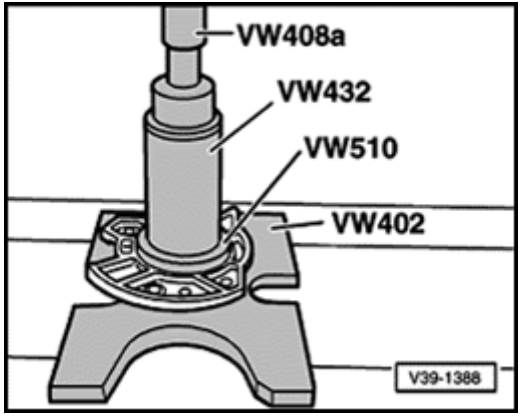


Fig. 4 Pressing in tapered roller bearing outer race

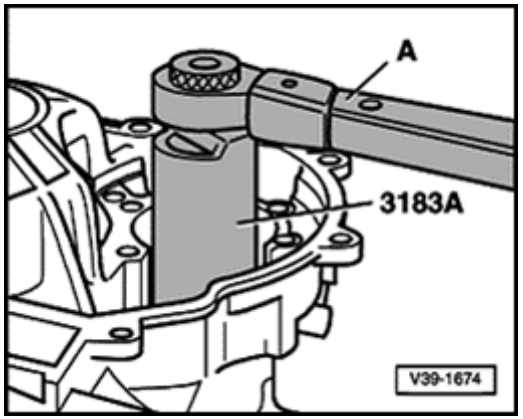


Fig. 5 Removing and installing bearing supporting ring

A - Torque wrench

- Tighten bearing supporting ring.
  - ♦ Tightening torque: 200 Nm (148 ft lb)
- Secure with locking screw. Install screw with thread sealing compound AKD45600001.

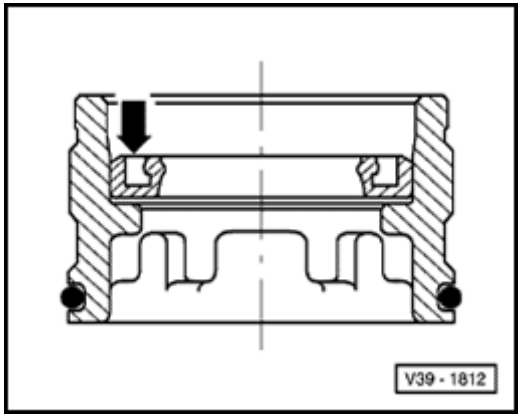


Fig. 6 Bearing supporting ring with seal for drive pinion

Installation position of seal:

- ♦ Open side (arrow) faces toward tapered roller bearing outer race

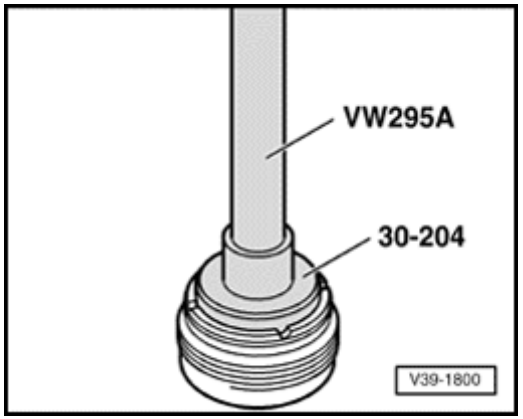


Fig. 7 Driving in drive pinion oil seal

- Install oil seal so that sealing lip faces special tool 30-204.

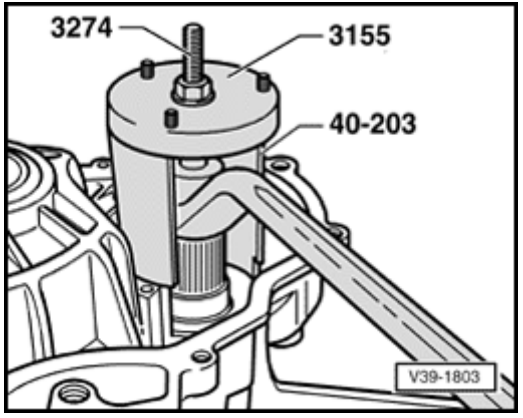


Fig. 8 Removing drive pinion

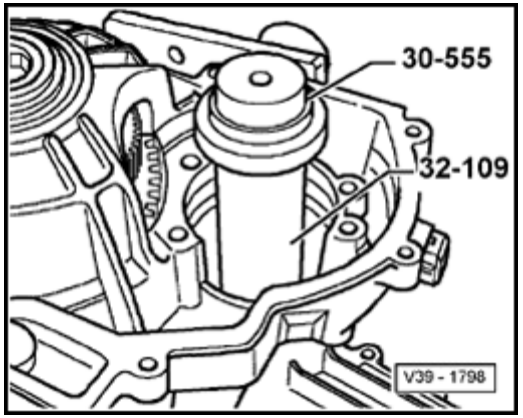


Fig. 9 Driving in tapered roller bearing outer race

- Install drive pinion with tapered roller bearing inner race, then drive in outer race.

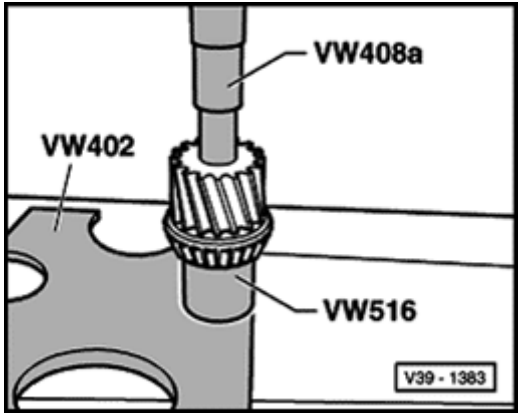
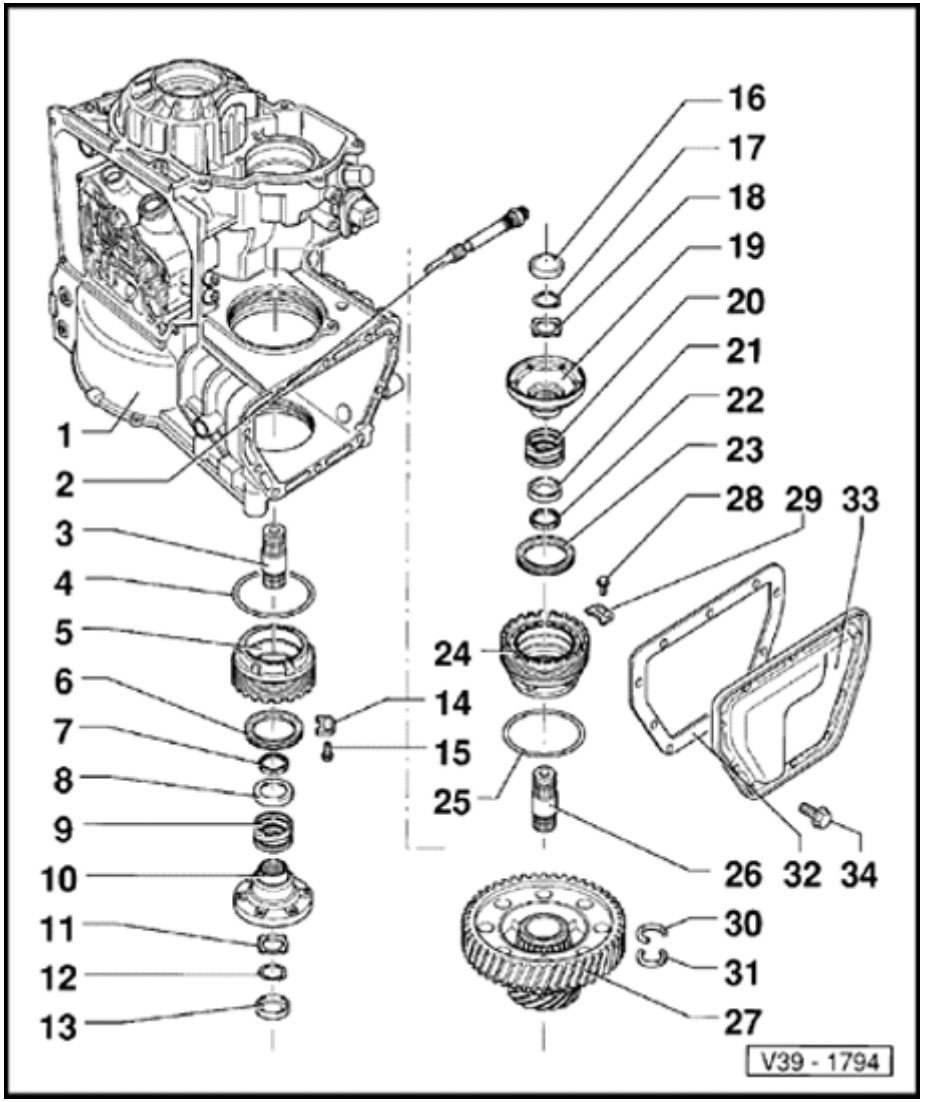


Fig. 10 Pressing on tapered roller bearing inner race



Differential, removing and installing

Note:

- *If tapered roller bearings are to be re-used, mark the adjusting ring ⇒ Fig. 2*
- *The drive pinion does not need to be removed for removing and installing the differential.*

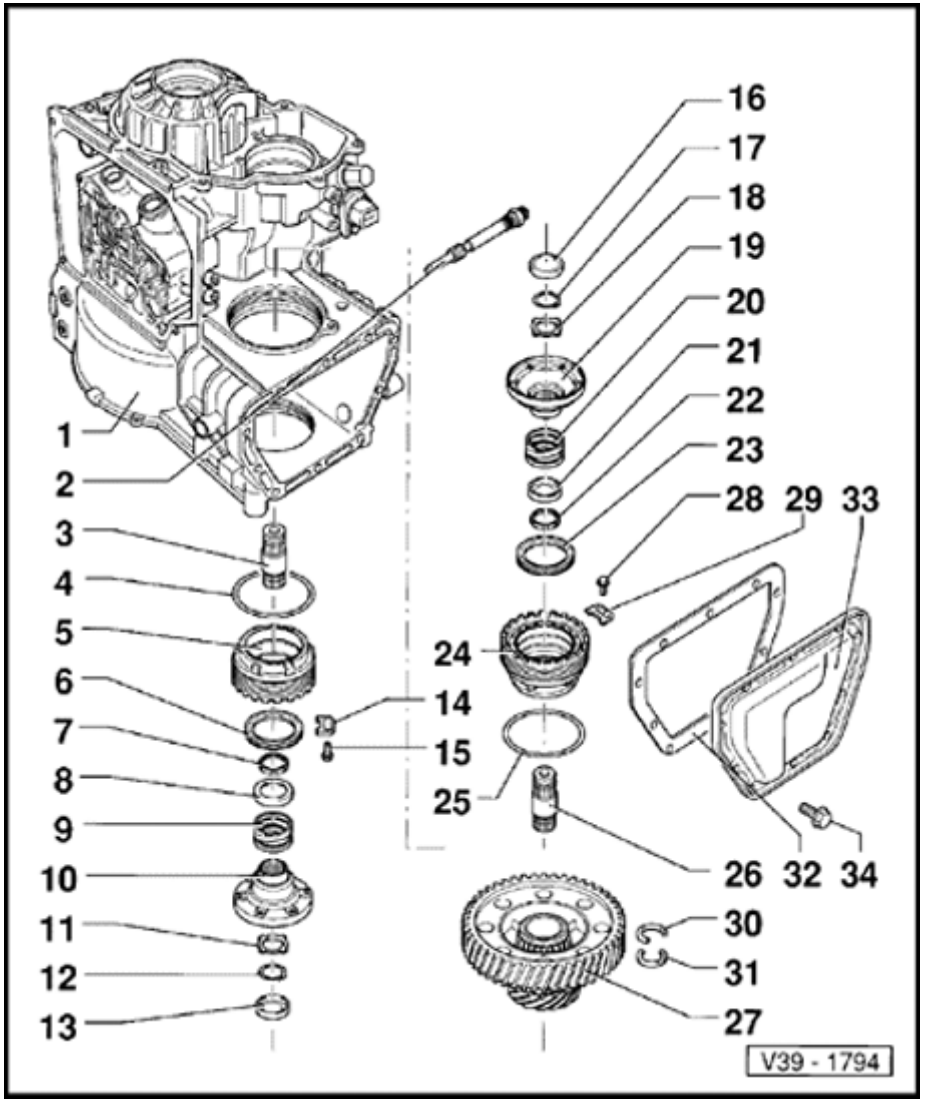
1 - Transmission housing

2 - Speedometer drive

- With marking for oil level indication ⇒ Fig. 7

3 - Output shaft/drive flange

- Install thread facing drive flange
- Remove before taking out differential
- First adjust differential before installing



4 - O-ring

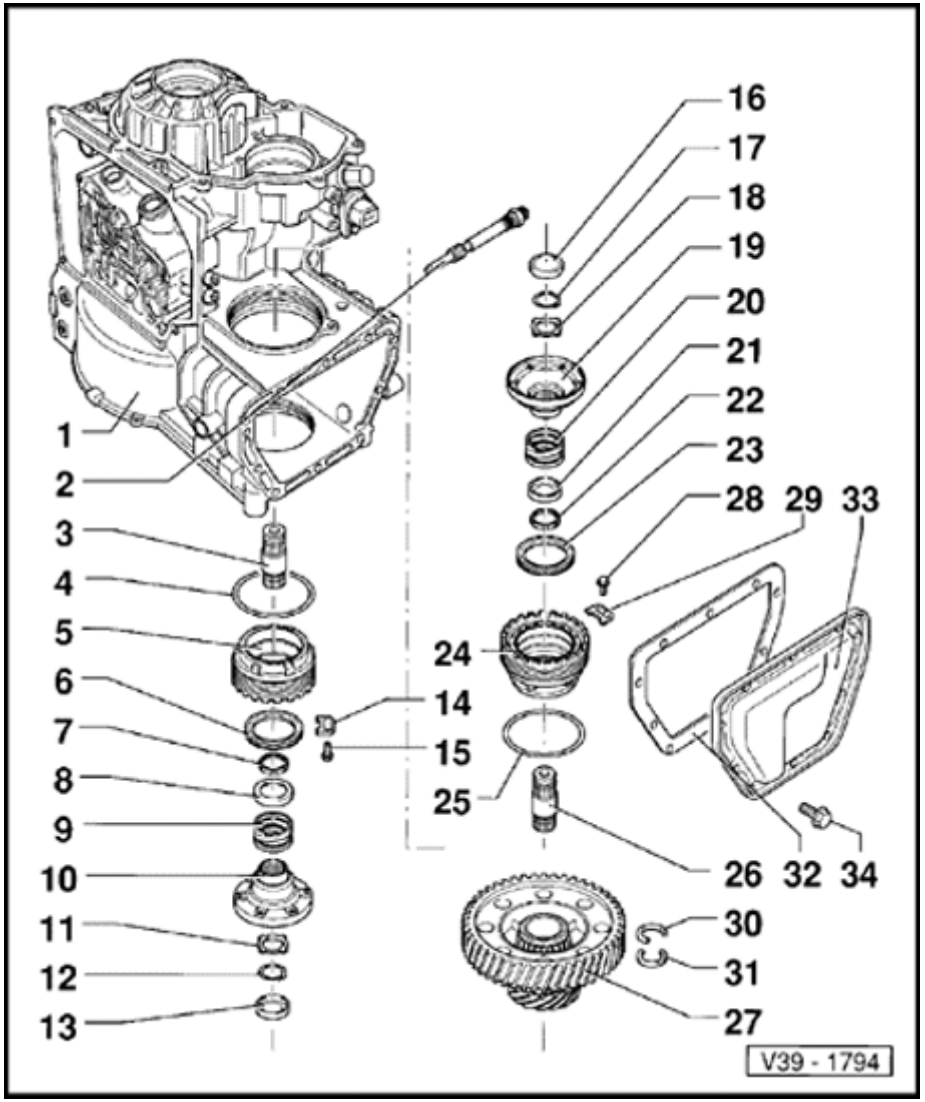
- Always replace

5 - Adjusting ring

- Removing ⇒ Fig. 3
- If used bearings are re-installed, mark installation position and line up on marking again when installing ⇒ Fig. 2
- If new bearings are installed, pay attention to setting instructions ⇒ page 39-52 , Differential, adjusting

6 - Oil seal for drive flange

- Before installing, pack space between sealing lips with multi-purpose grease
- Can be replaced with transmission installed ⇒ page 39-2
- Remove with VW 681
- Driving in ⇒ Fig. 1



7 - Tapered ring

- Shoulder faces thrust washer

8 - Thrust washer

- Place over compression spring

9 - Compression spring

10 - Drive flange

- Install with tapered ring, thrust washer and compression spring
- Remove before taking out inner circlip on bevel gear
- Removing and installing ⇒ Fig. 4

11 - Dished washer

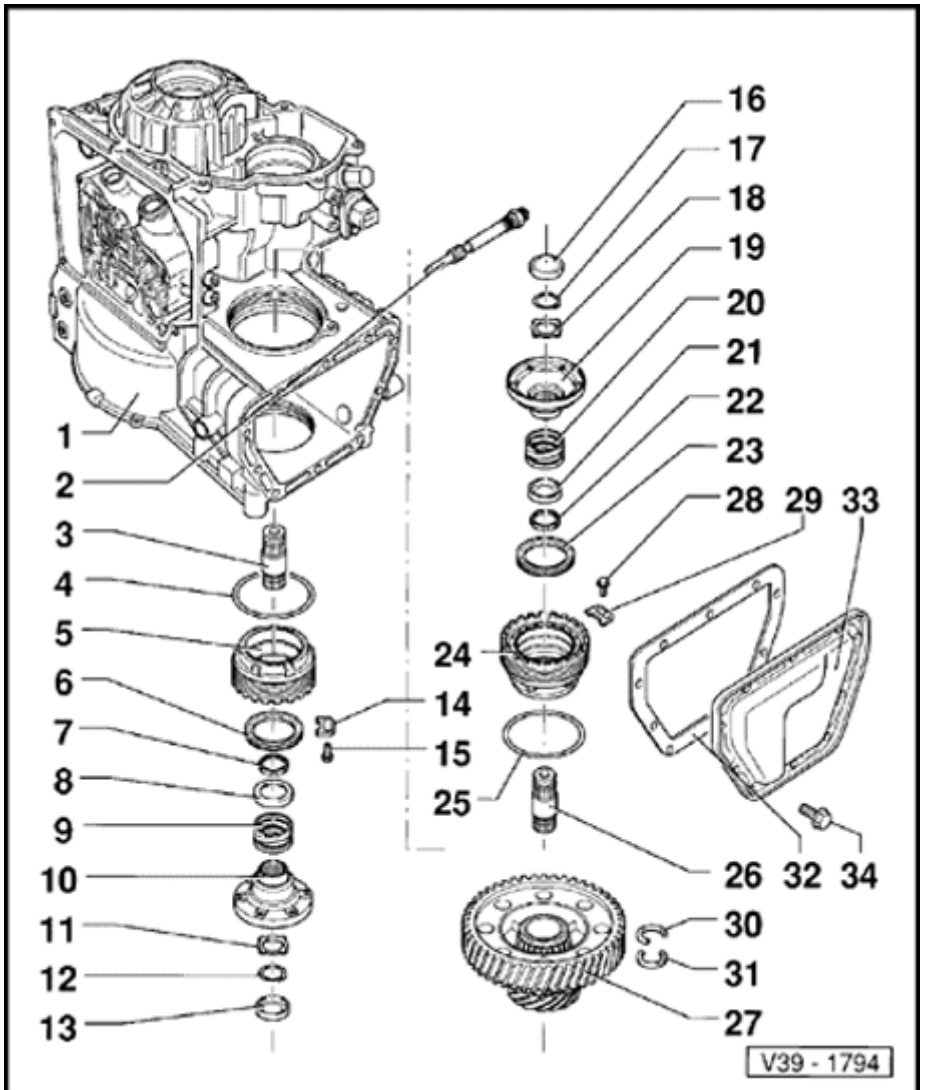
12 - Circlip

13 - Cover

14 - Locking element

15 - Screw

- Tightening torque: 12 Nm (9 ft lb)



16 - Cover

17 - Circlip

18 - Dished washer

19 - Drive flange

- Install with tapered ring, thrust washer and compression spring
- Remove before taking out inner circlip on bevel gear
- Removing and installing ⇒ Fig. 4

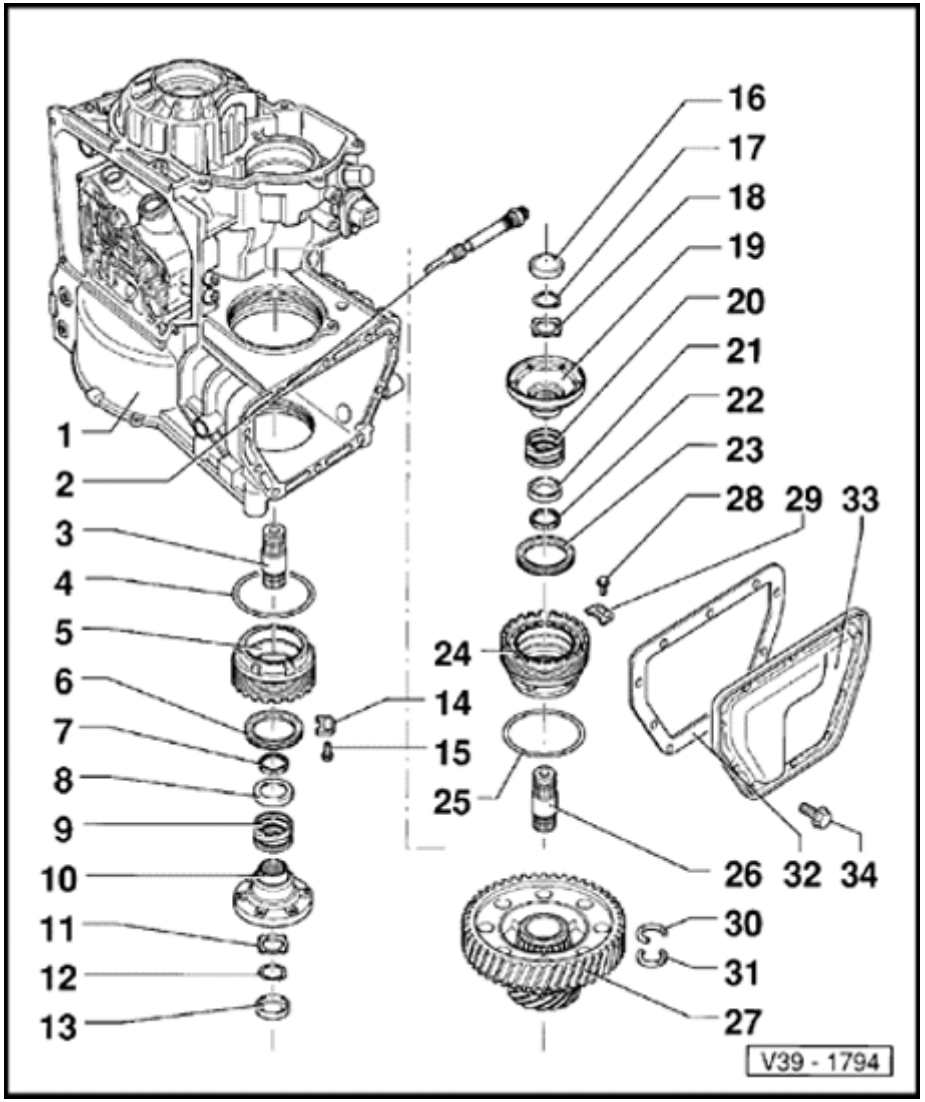
20 - Compression spring

21 - Thrust washer

- Place over compression spring

22 - Tapered ring

- Shoulder faces thrust washer



23 - Oil seal for drive flange

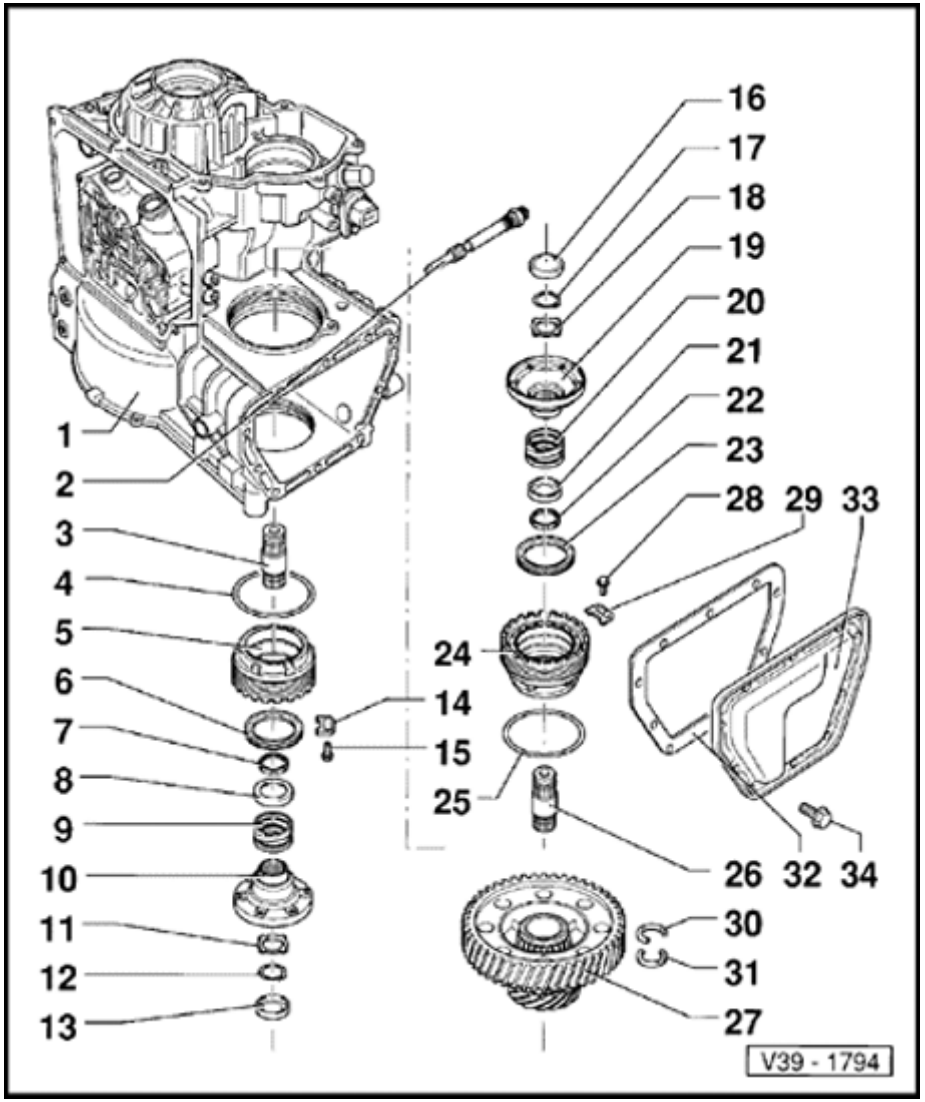
- Before installing, pack space between sealing lips with multi-purpose grease
- Can be replaced with transmission installed ⇒ page 39-2
- Remove with VW 681
- Driving in ⇒ Fig. 1

24 - Bearing body

- Tightening torque: 150 Nm (111 ft lb)
- When installing new bearing, pay attention to setting instructions ⇒ page 39-52 , Differential, adjusting
- Remove with tool 3155
- Installing ⇒ Fig. 5

25 - O-ring

- Always replace



26 - Output shaft/drive flange

- Install thread facing drive flange
- Before removing, take out differential
- First adjust differential before installing

27 - Differential

- Disassembling and assembling ⇒ page 39-34
- Before removing differential, take out bearing body, adjusting ring and output shafts

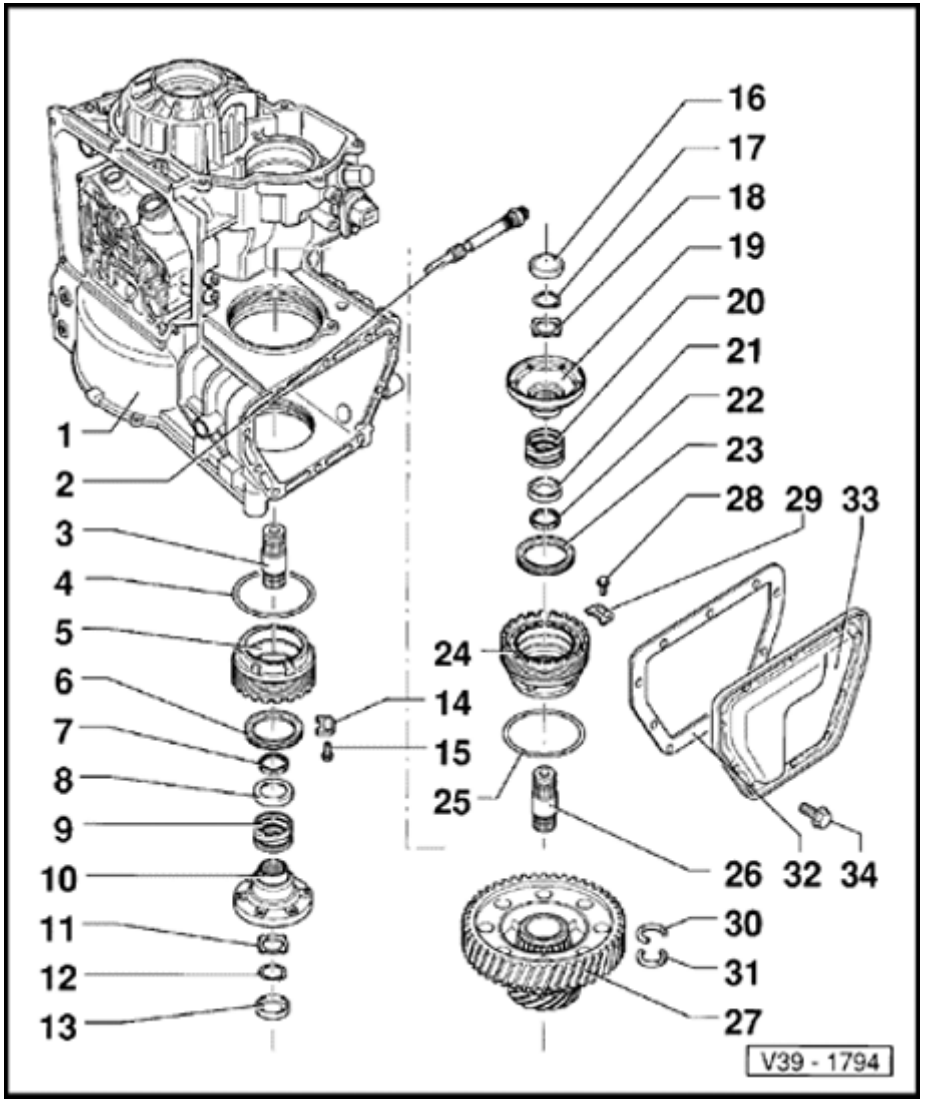
28 - Screw

- Tightening torque: 12 Nm (9 ft lb)

29 - Locking element

30 - Circlip

- First remove drive flange before removing circlip
- Removing and installing ⇒ Fig. 6



31 - Circlip

- First remove drive flange before removing circlip
- Removing and installing ⇒ Fig. 6

32 - Seal

- Always replace

33 - Cover

- For differential

34 - Screw

- Tightening torque: 28 Nm (21 ft lb)
- Install with thread locking fluid AMV 185 101 A1

Note:

After adjusting tapered roller bearings, secure bearing body and adjusting ring.

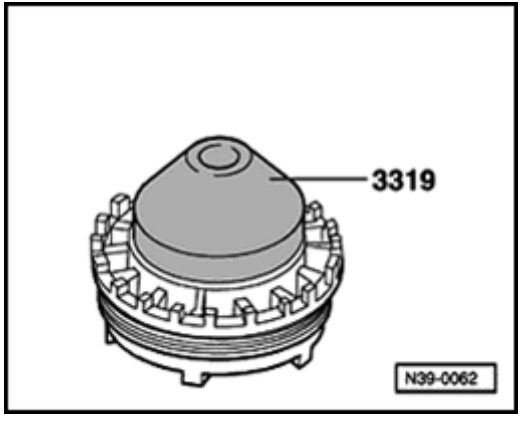


Fig. 1 Driving in drive flange oil seal up to stop

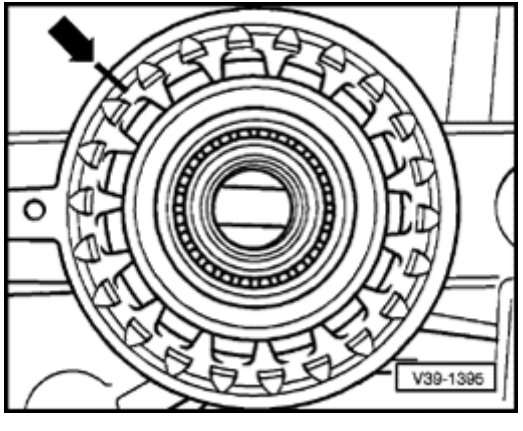


Fig. 2 Marking adjusting ring

- If used bearings are re-installed, mark installation position (arrow) and use marking to position adjusting ring when installing.

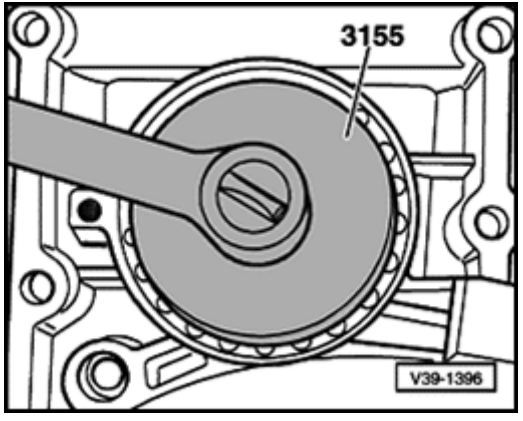


Fig. 3 Removing adjusting ring

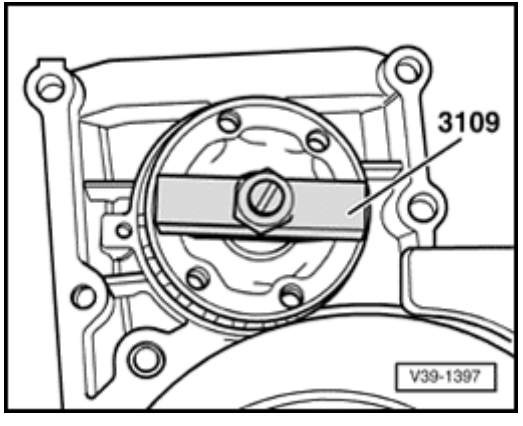


Fig. 4 Removing and installing drive flange

Note:

Drive flange can also be removed with VW 391.

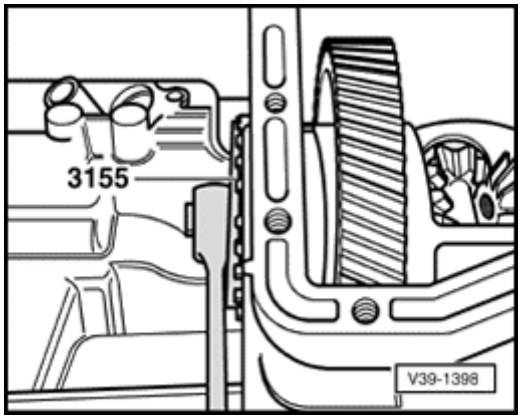


Fig. 5 Installing differential

- Screw in bearing body as far as stop, then tighten.
  - ♦ Tightening torque: 150 Nm (111 ft lb)

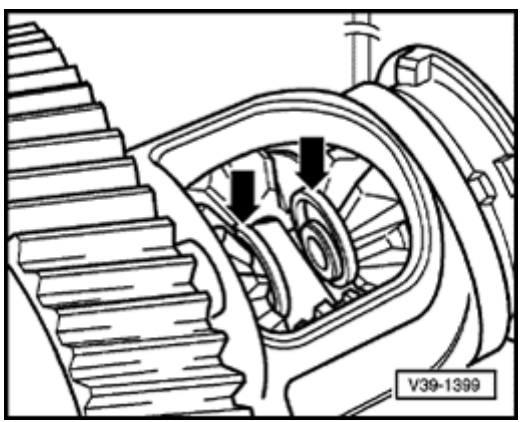


Fig. 6 Installing circlip

- Remove circlip (arrow) with two screwdrivers.

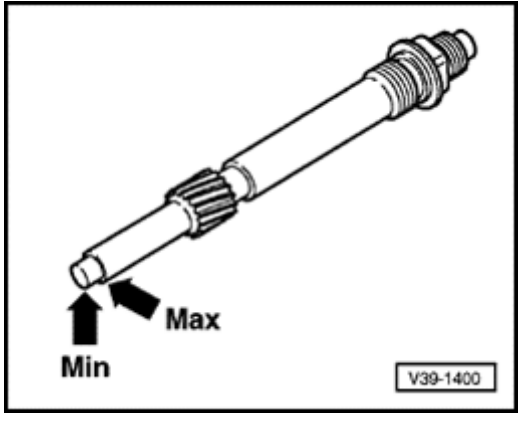
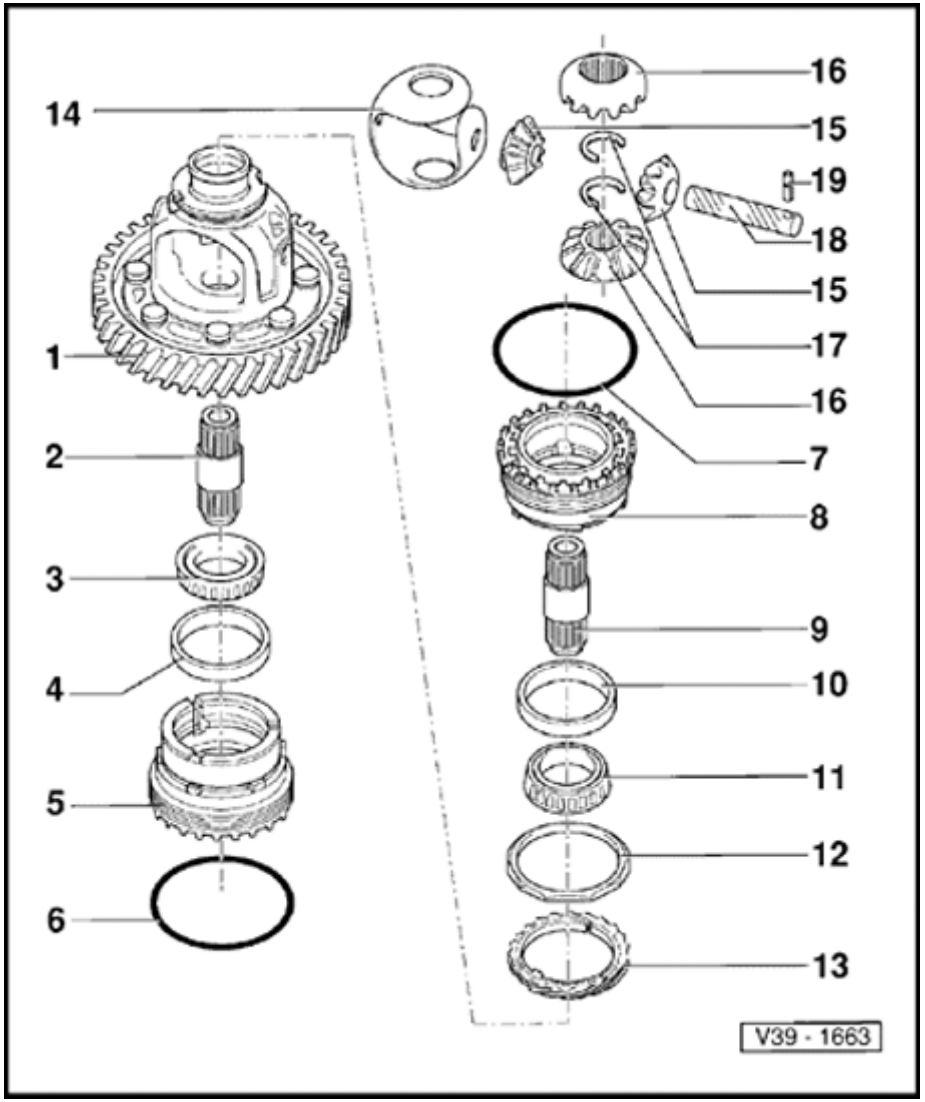


Fig. 7 Speedometer drive

- With transmission installed, check gear oil in final drive ⇒ page 39-1 .



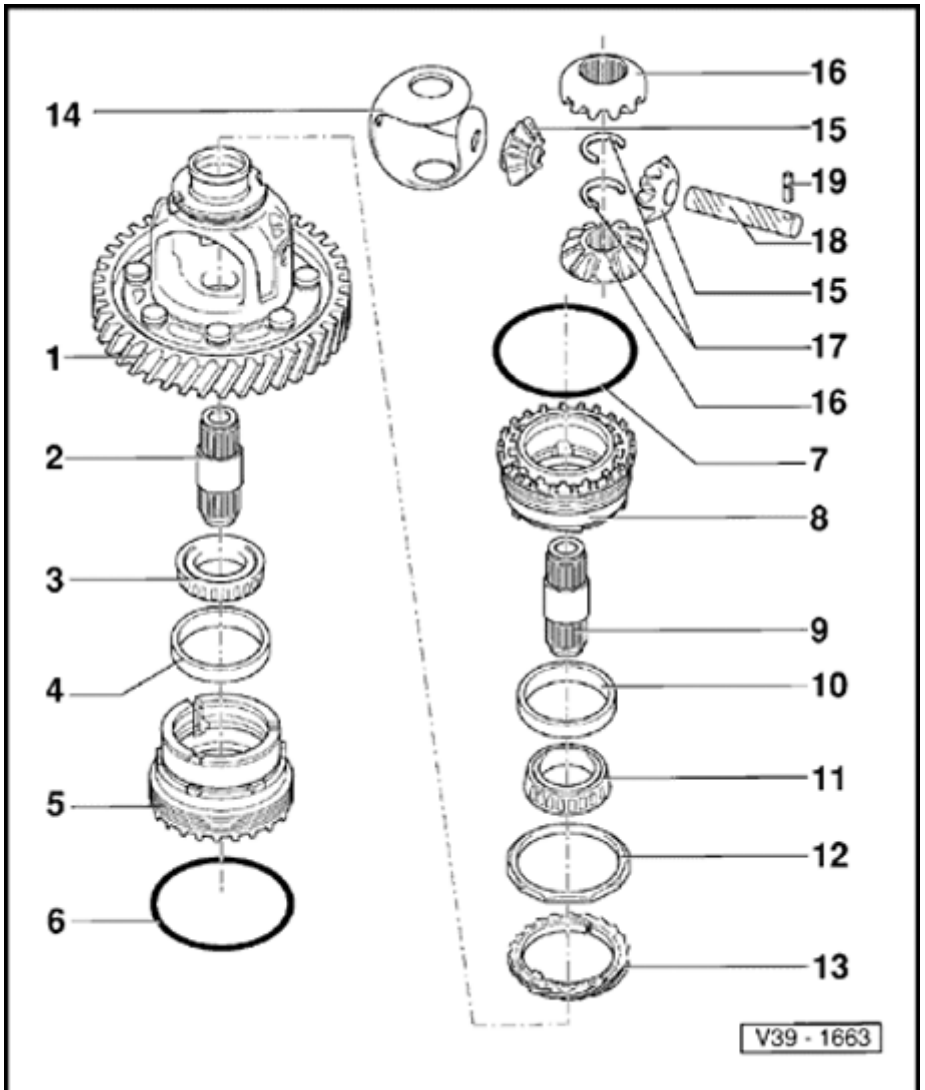
Differential, disassembling and assembling

Note:

- *Heat tapered roller bearing inner race to 100° C (212° F) before pressing on.*
- *Heat adjusting ring for tapered roller bearing to 100° C (212° F) before pressing in tapered roller bearing outer race.*

1 - Differential housing with riveted gear for final drive

- Final drive gear is riveted onto differential housing and then machined
- If differential or final drive gear is damaged, replace differential housing along with riveted final drive gear
- Number of teeth on final drive gear ⇒ from page 00-3 , Technical data



2 - Output shaft/drive flange

- Removing and installing ⇒ page 39-23

3 - Tapered roller bearing inner race

- Pulling off ⇒ Fig. 1
- Pressing on ⇒ Fig. 2

4 - Tapered roller bearing outer race

- Remove and install only when adjusting ring heated
- Drive out with drift
- Pressing in ⇒ Fig. 4

5 - Bearing body for tapered roller bearing

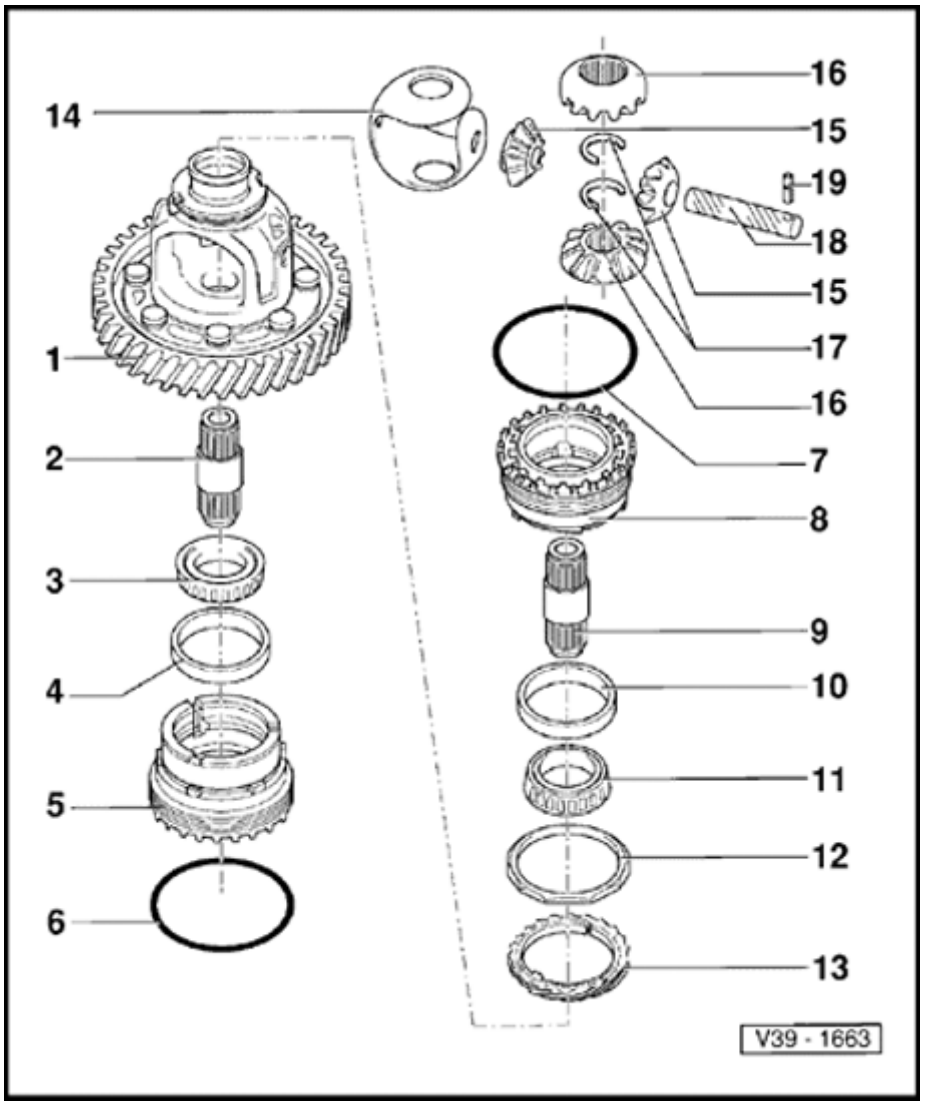
- Removing and installing ⇒ page 39-23 , Differential, removing and installing

6 - O-ring

- Always replace

7 - O-ring

- Always replace



8 - Adjusting ring for tapered roller bearing

- Removing and installing ⇒ page 39-23 , Differential, removing and installing

9 - Output shaft/drive flange

- Removing and installing ⇒ page 39-23 , Differential, removing and installing

10 - Tapered roller bearing outer race

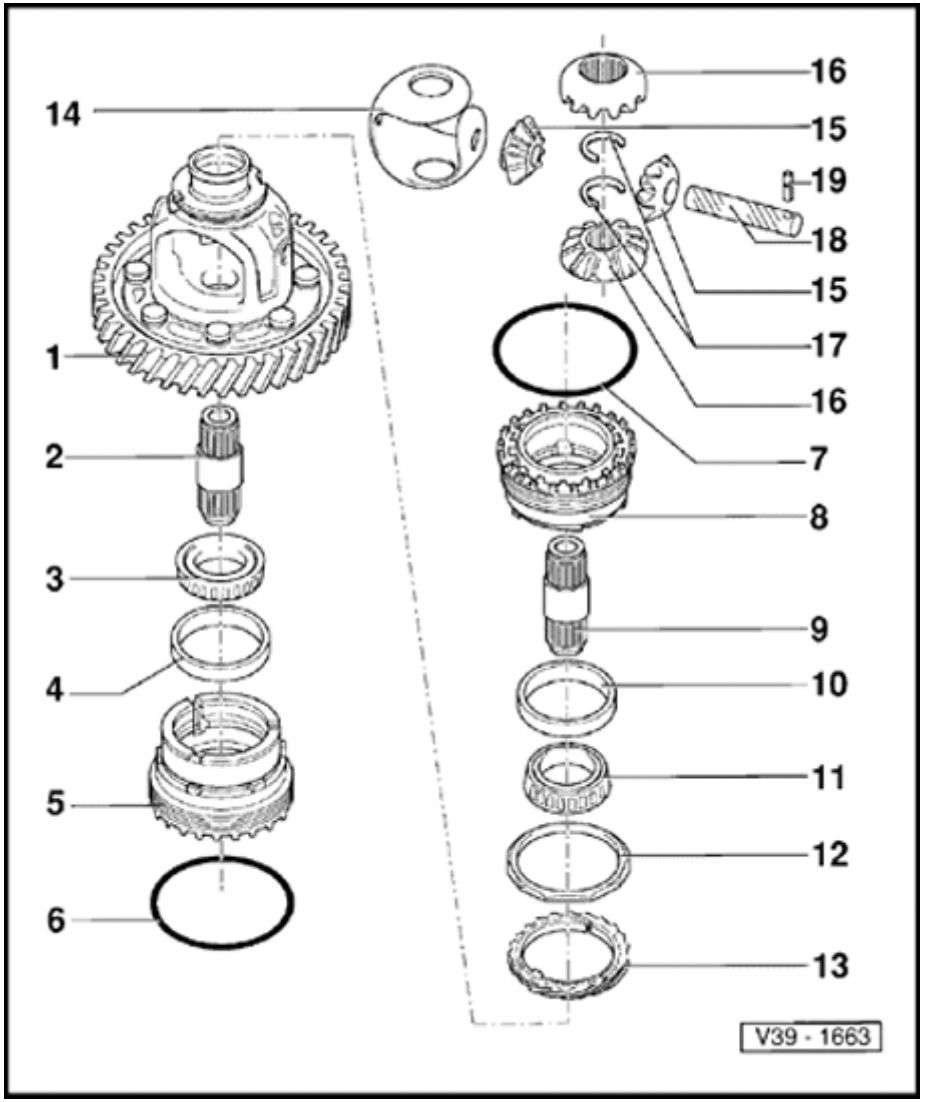
- Remove and install only when adjusting ring heated
- Drive out with drift
- Pressing in ⇒ Fig. 4

11 - Tapered roller bearing inner race

- Pulling off ⇒ Fig. 1
- Pressing on ⇒ Fig. 2

12 - Speedometer drive bushing

- Drive off together with speedometer drive gear - 13 -
- Drive on with drift



13 - Speedometer drive gear

- Drive out with drift
- Fit on together with driver bushing -item 12 -

14 - One-piece thrust washer

- Place into differential housing before installing bevel gears

15 - Small bevel gears

- Installing ⇒ Fig. 3

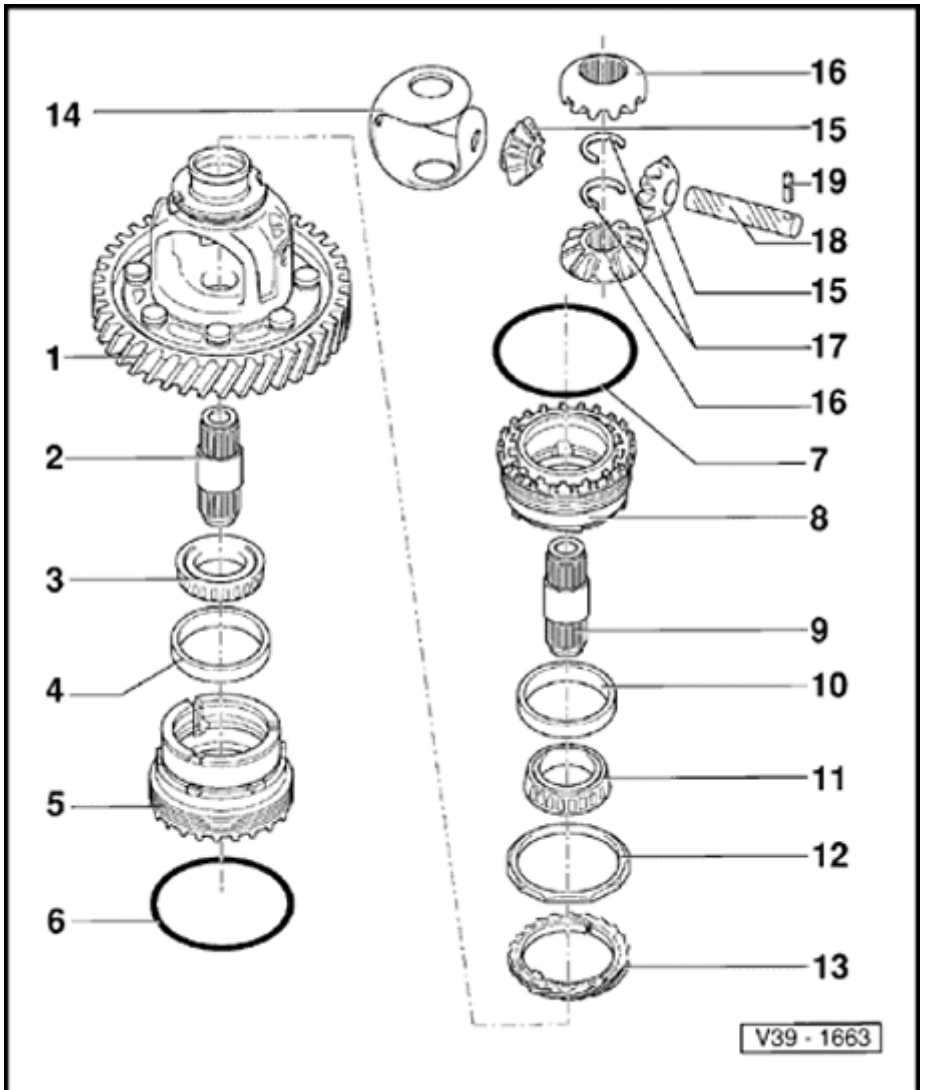
16 - Large bevel gears

- Installing ⇒ Fig. 3

17 - Circlip

CAUTION!

Do not remove the circlip until after removing the drive flange as the compression spring is pre-tensioned.



18 - Shaft for bevel gears

- Drive out with drift
- When driving in, do not damage one-piece thrust washer

19 - Spring pin

- For securing shaft for bevel gears
- Removing and installing spring pin with circumferential groove ⇒ Fig. 5

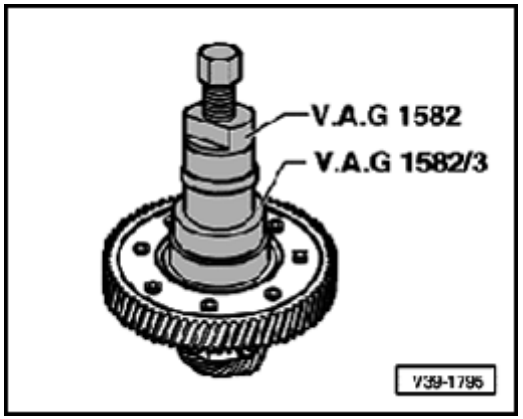


Fig. 1 Pulling off tapered roller bearing inner race

- Place press tool 30-555 on differential housing.

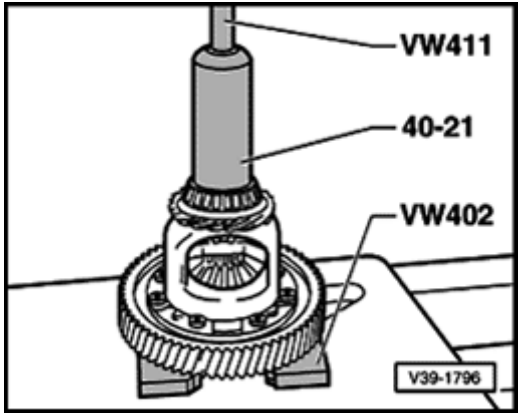


Fig. 2 Pressing on tapered roller bearing inner race

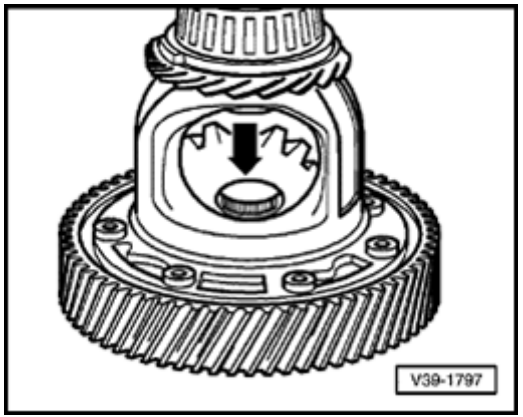


Fig. 3 Installing differential bevel gears

- Install one-piece thrust washer with gear oil.
- Install small bevel gears, drive in shaft and secure with spring pin.
- Install large bevel gears offset 180° and swivel in (in direction of arrow).

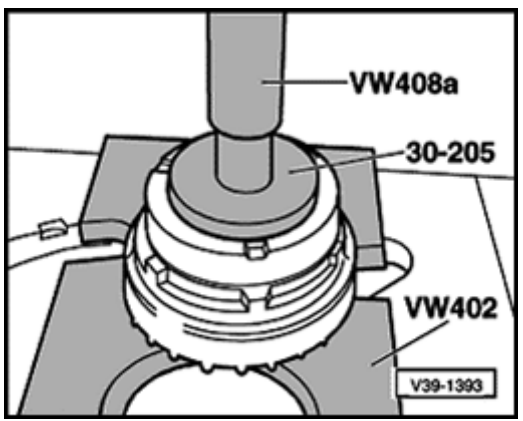


Fig. 4 Pressing in tapered roller bearing outer race

- With adjusting ring or bearing body heated, install outer race and press home as far as stop.

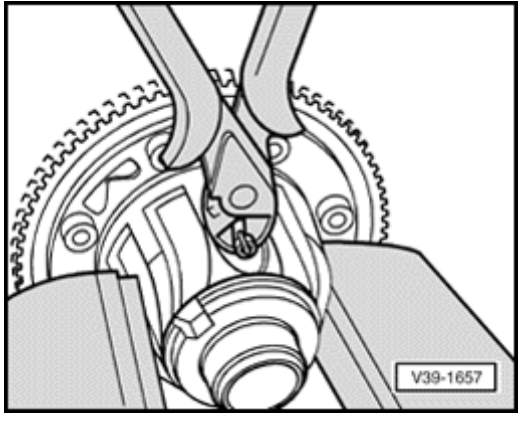


Fig. 5 Removing and installing spring pin with circumferential groove

- Length of spring pin: 28.5 mm (1.122 in.)

Removing

- Pull out spring pin with side-cutting pliers.

Installing

- Drive in spring pin as far as stop.