

REPAIR MANUAL

4 HP-20



ZF GETRIEBE GMBH SAARBRÜCKEN

Version 99/04/01
CD

subject to alterations

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Preliminary information

This manual covers the procedure for repairing the complete transmission.

The repairing of this transmission is only allowed to persons with specific training from ZF Getriebe GmbH.

The entire disassembly and assembly procedure is described in chronological order.

The photographs were kept general in nature so that they can be used with various applications; they are not binding in every case.

We use *Service Bulletins* and training to announce important information and application-specific changes that must be taken into consideration in maintenance work. If this repair manual is given to a third party, there will be no modification service.

The *Service Bulletins* regulations and specifications must be followed when making repairs.

Depending on the type of damage that has occurred, the repair work can be limited to that which is necessary to repair the damage.

In this case you must observe the following:

- Seals (such as O-rings, shaft seals, gaskets, and filters) must always be renewed.
- All O-rings, rectangular-section rings, and other sealing rings must always be lubricated with petroleum jelly before installation.
- All bearings must always be oiled lightly when installed.
- For transmissions that have covered a large number of kilometers (> 80,000 km), all lined clutch discs and steel clutch discs must be replaced.
- After clutches/brakes have been damaged, the converter, oil tubes, and oil cooler, must be cleaned thoroughly with a suitable cleaning agent.
- If brakes C or D has been damaged, or if a considerable distance has been covered (> 80,000 km), pistons C and D must be replaced.

The following requirements should be met before the repair work is started:

- The required special tools should be available.
(The complete set of special tools is listed in Chapter 1.7)
- A suitable transmission testing rig should be available.
The required testing values can be found in the *Service Bulletins*.

Note:

This manual treats the automatic control unit as a complete unit, which should not be disassembled without special knowledge; it should be exchanged as a complete unit.

A separate repair manual is planned for the automatic control unit.

Important:

The transmission is filled with long-life oil.

The oil does not have to be changed until it has been in use for ten years.

The transmission must only be delivered with the oil type and oil amount specified in the corresponding parts list documentation (see Part List).

Technical After Sales Service

Technical Documentation

After Sales Service School

Bach

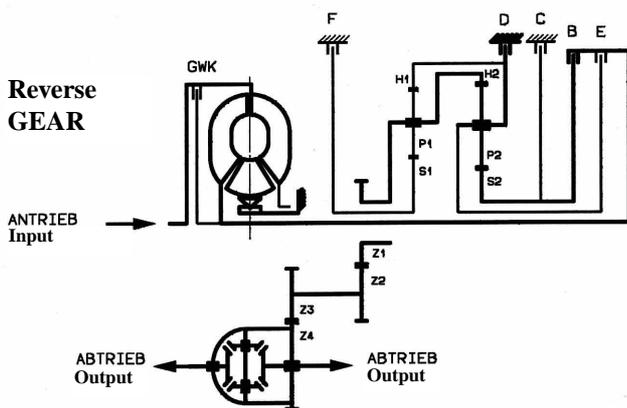
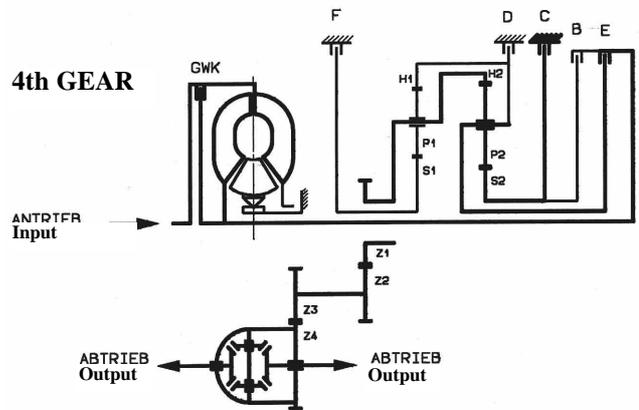
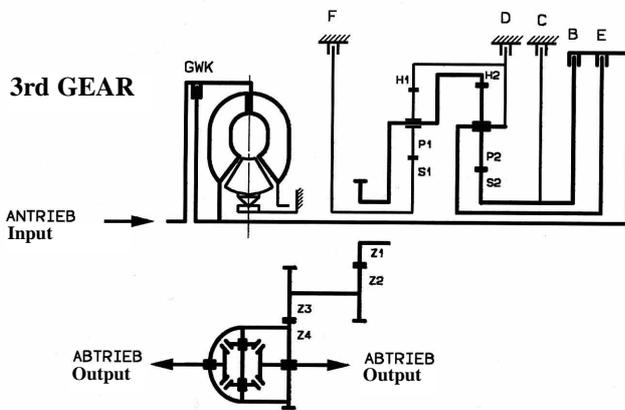
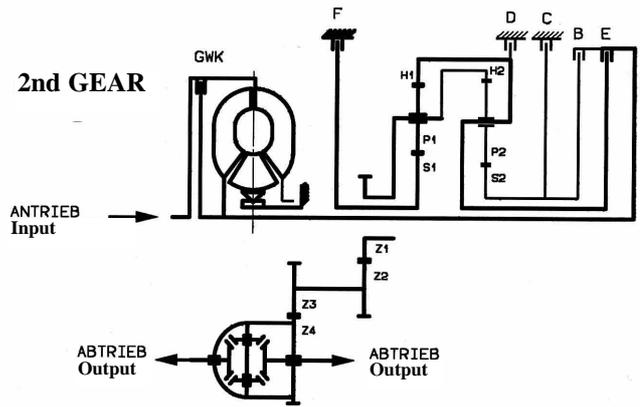
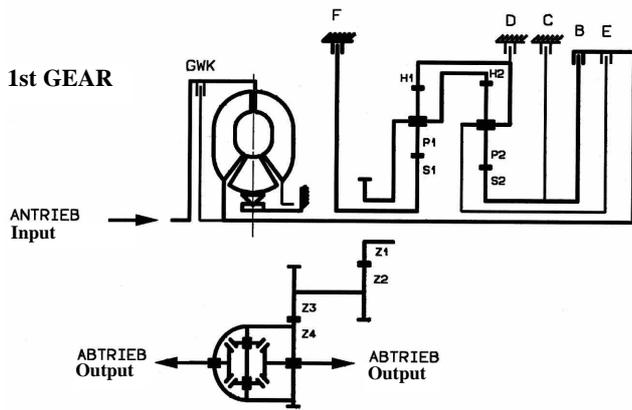
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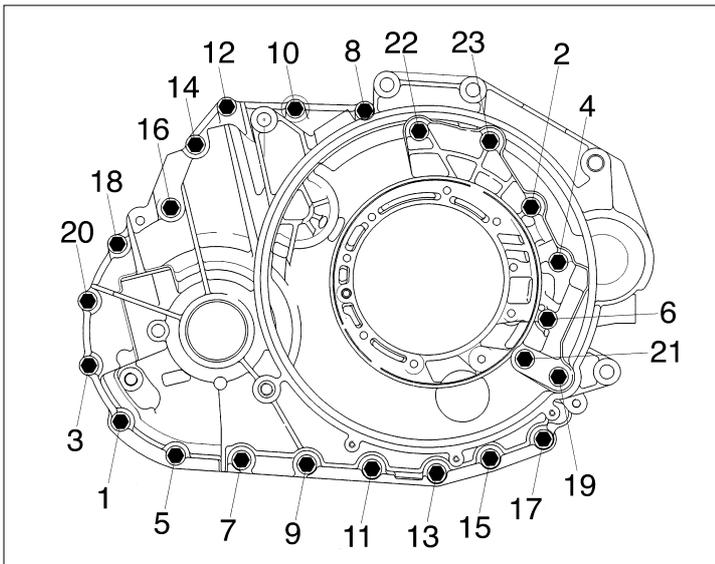
Schultz

1. General information
1.1 Picture of the transmission



1.2 Power flow diagram





1.3 Specifications

1.3.1 Screw torque specifications

1.3.1.1 Converter bell housing (PSA)

First pre-tighten the screws in the following order:

19 ⇨ 14 ⇨ 9 ⇨ 8 ⇨ 3 ⇨ 4

Then, in numerical order, tighten the screws all the way (see diagram).

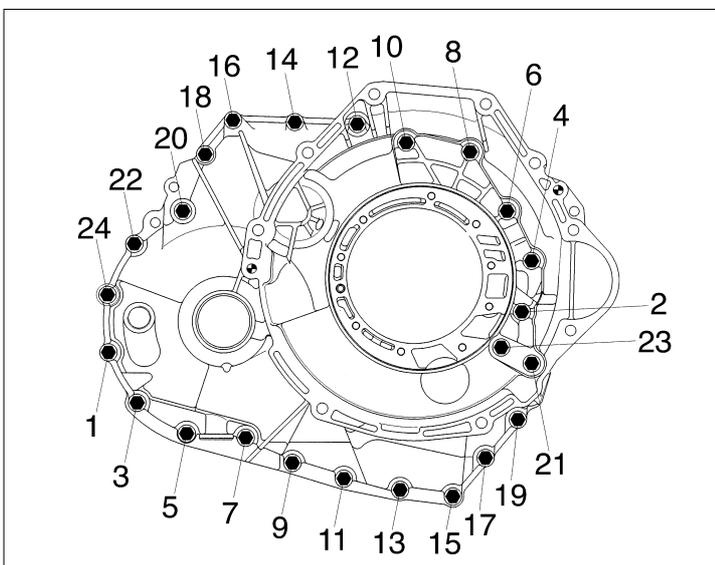
1 ⇨ 2 ⇨ 3 ⇨ ... ⇨ 23

Important!

The numbers correspond to the *actual* sequence for final tightening.

(Assessment, Specification 1019 700 137)

(See Chapter 1.5 for tightening torque)



1.3.1.2 Converter bell housing (MB)

First pre-tighten the screws in the following order:

21 ⇨ 20 ⇨ 11 ⇨ 8 ⇨ 3 ⇨ 4

Then, in numerical order, tighten the screws all the way (see diagram).

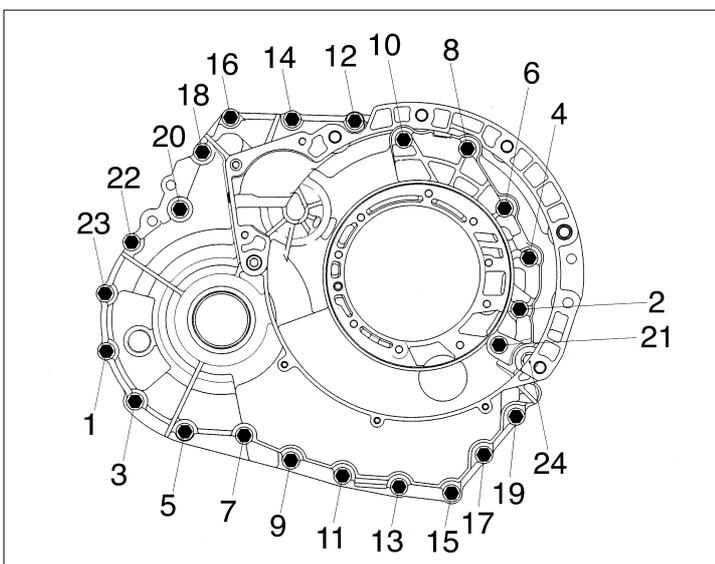
1 ⇨ 2 ⇨ 3 ⇨ ... ⇨ 24

Important!

The numbers correspond to the *actual* sequence for final tightening

(Assessment, Specification 1019 700 138)

(See Chapter 1.5 for tightening torque)



1.3.1.3 Converter bell housing (FIAT)

First pre-tighten the screws in the following order.

19 ⇨ 20 ⇨ 11 ⇨ 8 ⇨ 3 ⇨ 6

Then, in numerical order, tighten the screws all the way (see diagram).

1 ⇨ 2 ⇨ 3 ⇨ ... ⇨ 24

Important!

The numbers correspond to the *actual* sequence for final tightening

(Assessment, Specification 1019 700 088)

(See Chapter 1.5 for tightening torque)

1.3.1.4 Transmission cover (PSA/RSA)

First pre-tighten the screws in the following order.

4 ⇨ 5

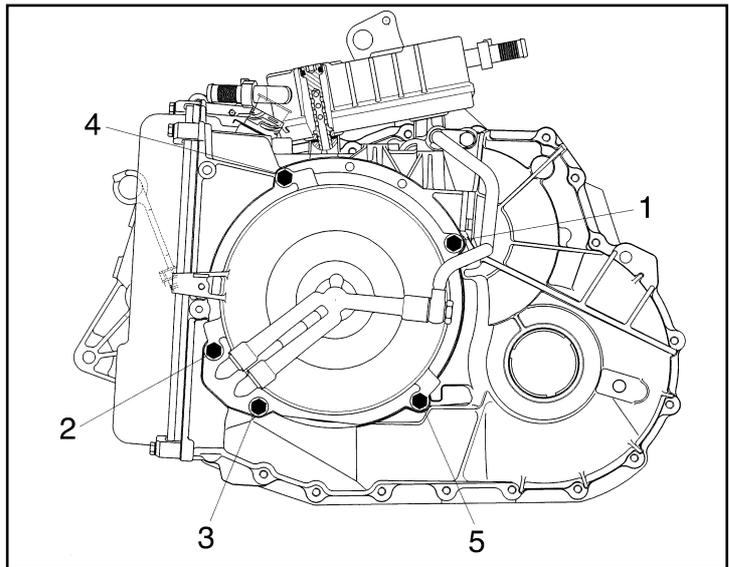
Then, in numerical order, tighten the screws all the way (see diagram).

1 ⇨ 2 ⇨ 3 ⇨ ... ⇨ 5

Important!

The numbers correspond to the *actual* sequence for final tightening (Assessment, **Specification 1019 700 218**)

(See Chapter 1.5 for tightening torque)



1.4 Making adjustments

1.4.0 Measuring the clutch packs (procedure)

Place the two intermediate pieces 5p01 050 329/5p01 060 329 on the marked position on measuring fixture 5p01 000 330.



Using the knurled screw, turn adjusting device 5p01 001 458 to the upper limit.

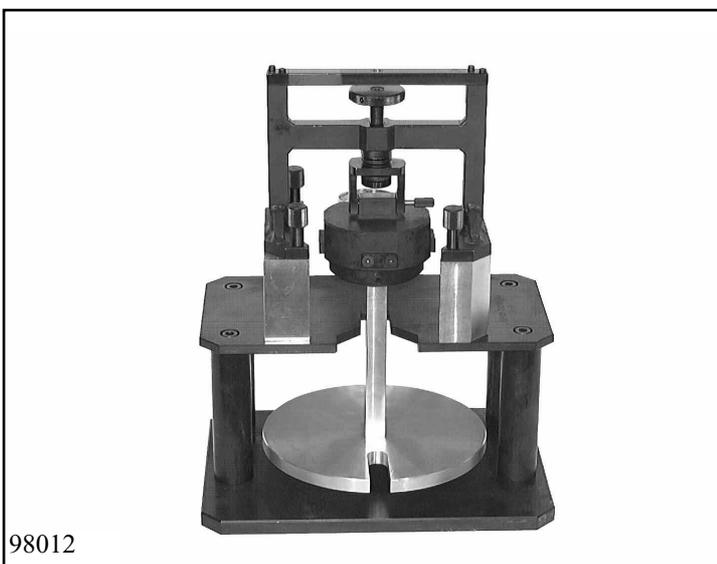
Attach force measuring unit 5p01 000 329 to adjusting device.



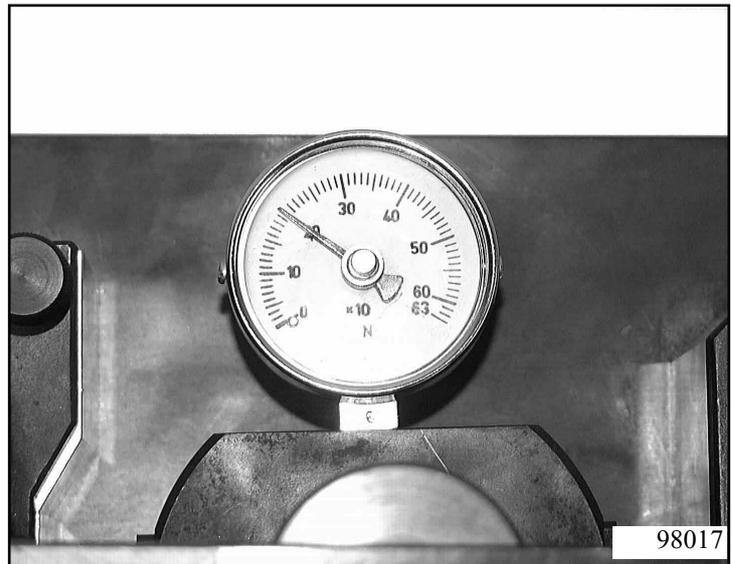
Fasten it with 4 knurled screws to the measuring fixture using the intermediate pieces.

Using a fixing pin, connect measuring plate 5p01 040 330 with the force measuring unit.

Using the knurled screw, clamp the clutch pack to be measured (with steel disc on the top and corrugated disc – if there is one – on the bottom) in the device at 200N.



Check the value on the force measuring unit's display.

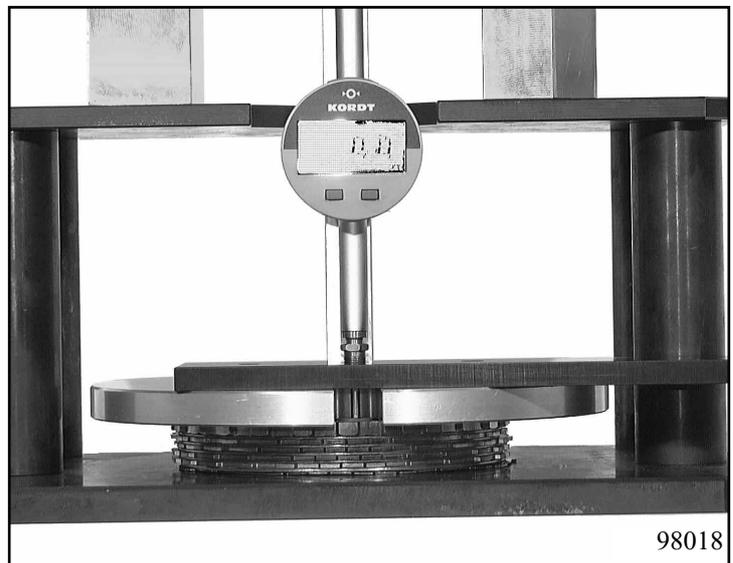


Then place measuring bar 5p01 060 330 on the measuring plate, put the dial gauge's measuring base in the measuring plate's groove on the top disc of the set, and set the dial gauge to 0. Now use the measuring bar to measure down to the base plate.

Read the measurement value $\Rightarrow M_X$

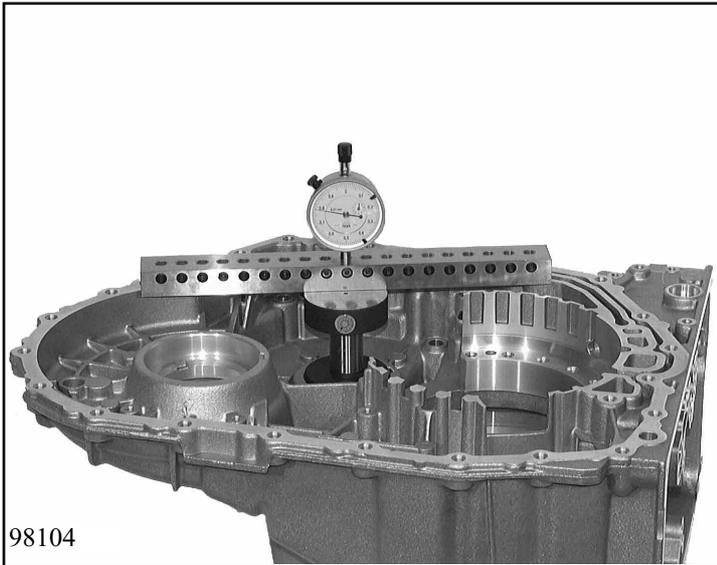
Note!

In each case, the **X** index in M_X stands for the brake/ clutch packs that are put in (B, C, D, E, F).



1.4.1 Adjusting the preload for the side shaft and differential

1.4.1.1 Determining side shaft installation space

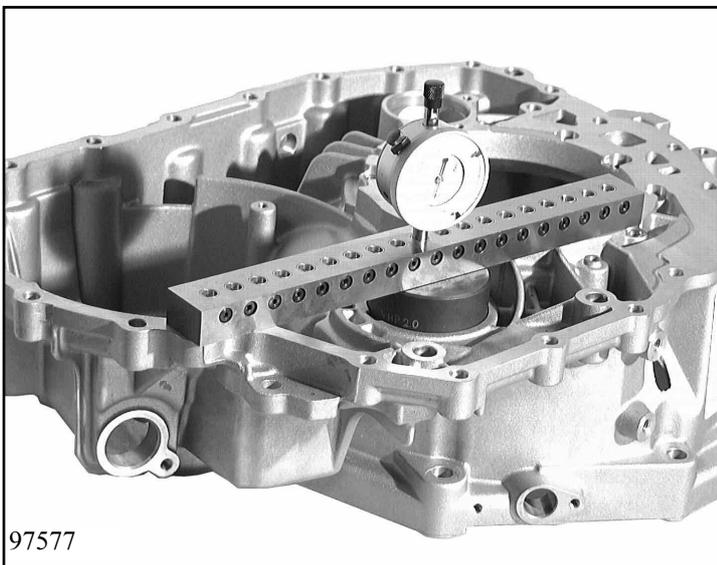


Insert plug gauge 5p89 004 178 into the side shaft bearing seat on the transmission housing and use the measuring bar to measure down to the plug gauge from the transmission housing support surface.

Installation space B_{SG} is equal to the G_{SG} value plus plug gauge height H_{SG} .

Calculation:

$$B_{SG} = G_{SG} + H_{SG}$$



Insert plug gauge 5p89 004 177 into the side shaft bearing seat on the converter bell housing and use the measuring bar to measure down to the plug gauge from the converter bell support surface.

Installation space B_{SW} is equal to the G_{SW} value plus plug gauge height H_{SW} .

Calculation:

$$B_{SW} = G_{SW} + H_{SW}$$

Installation space for the side shaft B_S is now determined from installation space B_{SG} plus installation space B_{SW} plus constant K_P for the paper gasket.

Calculation:

$$B_S = B_{SG} + B_{SW} + K_P$$

Example (for 1.4.1.1):

$$H_{SG} = 82.492 \text{ mm}$$

$$H_{SW} = 34.497 \text{ mm}$$

$$K_P = 0.26 \text{ mm}$$

$$G_{SG} = 0.215 \text{ mm}$$

$$G_{SW} = 0.55 \text{ mm}$$

$$B_{SG} = 0.215 + 82.492$$

$$= 82.707 \text{ mm}$$

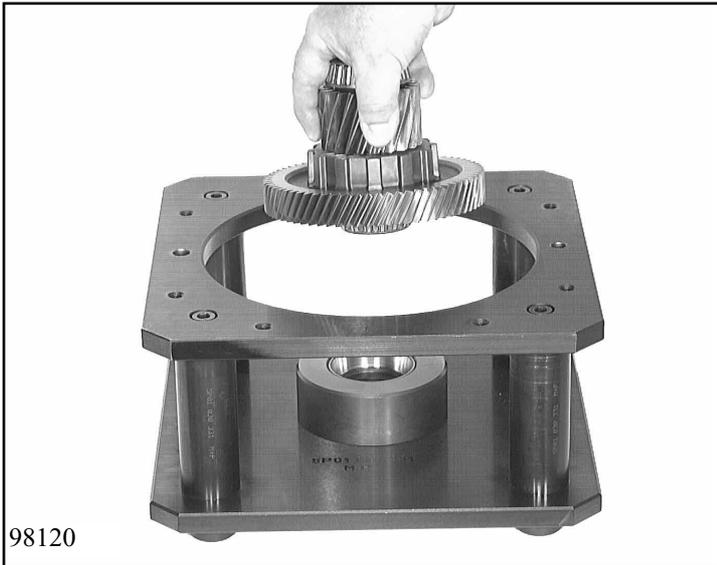
$$B_{SW} = 0.55 + 34.497$$

$$= 35.047 \text{ mm}$$

$$\Rightarrow B_S = 82.707 + 35.047 + 0.26$$

$$= 118.014 \text{ mm}$$

1.4.1.2 Determining side shaft installation height



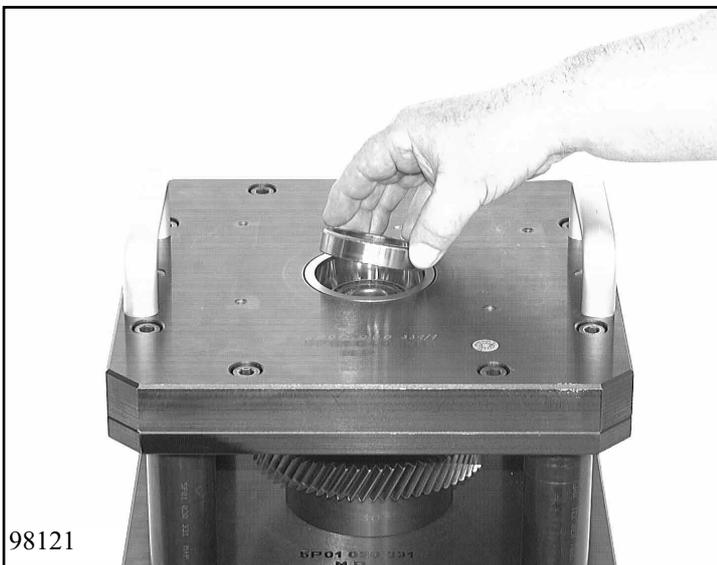
98120

Fix bush 5p01 120 331 in basic tool for height measuring device 5p01 000 331 with 3 screws (M6x16) and in measuring plate 5p01 040 331 bush 5p01 110 331 with 4 screws (M6x12). Insert outer bearing shell in bush 5p01 120 331. Insert the side shaft into the basic tool of height-measuring fixture 5p01 000 331. Fasten measuring plate 5p01 040 331 onto the basic tool with eight screws (M10x30).

Important!

Strictly cleanliness !

(See Chapter 1.5 for tightening torques)

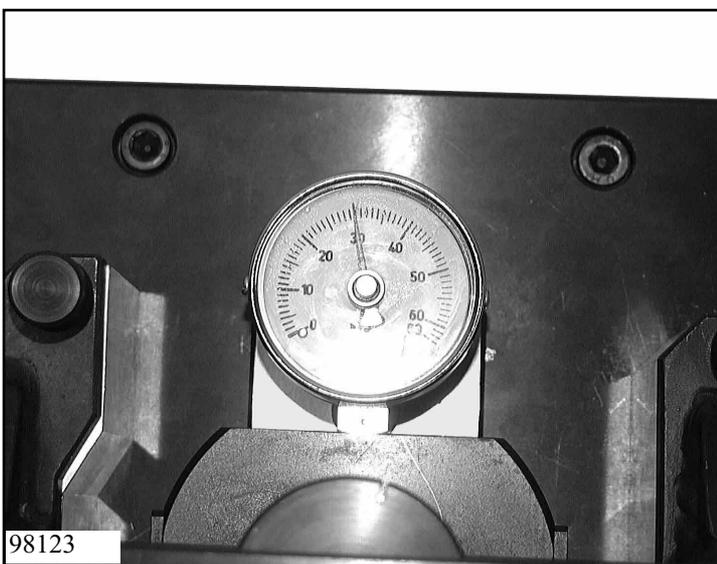


98121

Put outer bearing shell on side shaft and measuring bell 5p01 130 331 on the bearing outer ring.

Set intermediate pieces 5p01 000 329 on the positions marked on the measuring plate.

Use the knurled screw to turn adjusting device 5p01 001 458 to the upper limit. Hang force measuring unit 5p01 000 329 in adjusting device 5p01 001 458 and screw it together with the height-measuring fixture using the intermediate pieces. Connect the measuring bell to the force measuring unit using a fixing pin.



98123

Use the knurled screw to clamp the side shaft into the device at 300 N.

Check the value on the force measuring unit's display.

Turn the side shaft for several complete turns.

Using the measuring bar, measure the excess height from the measuring bell tongues to the measuring plate.

To do this, place the measuring bar on the measuring bell's tongue, set to **0**, and then measure down to the measuring plate. Do the measurement procedure on both tongues.

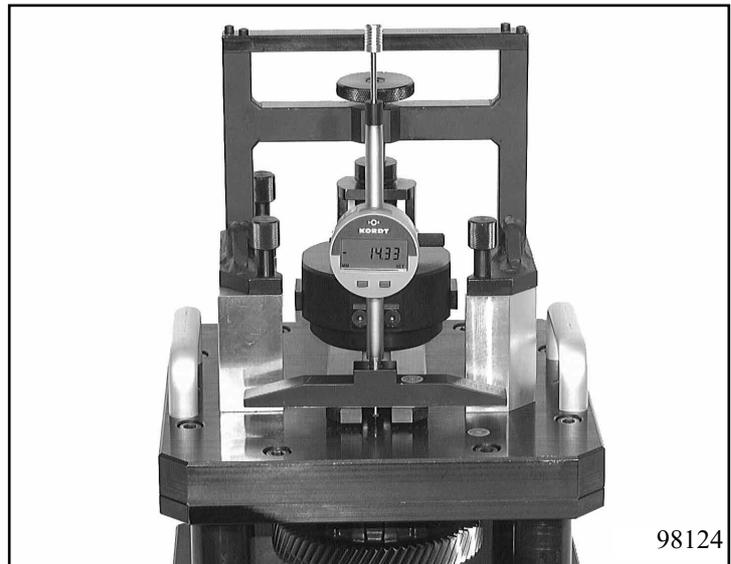
Average the M_1 , M_2 measurement values

⇨ M_S

The height of the side shaft H_S is equal to the averaged measurement value M_S plus the constant dimension for the height measurement device K_S minus the constant dimension for the thrust bell K_G .

Calculation:

$$H_S = K_S + M_S - K_G$$



Example: (for 1.4.1.2)

$$K_S = 132.287 \text{ mm}$$

$$K_G = 30.013 \text{ mm}$$

$$M_1 = 14.33 \text{ mm}$$

$$M_2 = 14.27 \text{ mm}$$

$$M_S = (14.33 + 14.27)/2$$

$$= 14.3 \text{ mm}$$

$$H_S = 132.287 + 14.3 - 30.013$$

$$= 116.574$$

1.4.1.3 Determining the side shaft shim

Zero dimension N_S is equal to installation space B_S minus side shaft height H_S . Disc thickness S_S is equal to zero dimension N_S plus preload dimension V_S – in accordance with **specification 0000 700 907**. The parts list shows preload dimension V_S as 0.07 to 0.12 mm. The test value is permissible when it is between 0.055 and 0.135 mm.

Calculation:

$$N_S = B_S - H_S$$

$$S_S = V_S + N_S$$

Example: (for 1.4.1.3)

$$B_S = 118.014 \text{ mm}$$

$$H_S = 116.574 \text{ mm}$$

$$V_S = 0.07 \text{ to } 0.12 \text{ mm}$$

$$N_S = 118.014 - 116.574$$

$$= 1.44 \text{ mm}$$

$$S_S = 1.44 + (0.07 \text{ bis } 0.12)$$

$$= 1.51 \text{ to } 1.56 \text{ mm}$$

Chosen:

$$\Rightarrow S_S = 1.54 \text{ mm}$$

1.4.1.4 Determining differential installation space

Insert plug gauge 5p89 004 681 into bearing seat for differential transmission housing and use measuring bar to measure down from transmission housing support surface to the plug gauge.

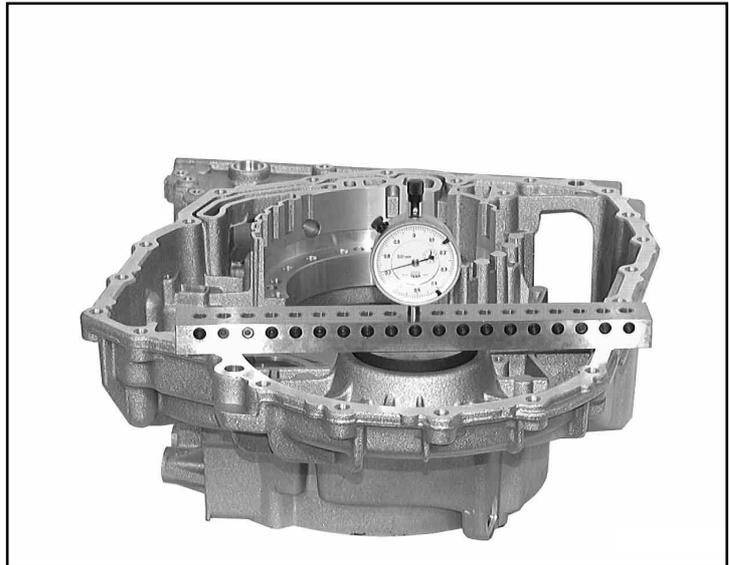
Installation space B_{DG} is equal to measured G_{DG} dimension plus plug-gauge height H_{DG} .

Calculation:

$$B_{DG} = G_{DG} + H_{DG}$$

Important!

Use plug gauge 5p89 004 768 for MB application.

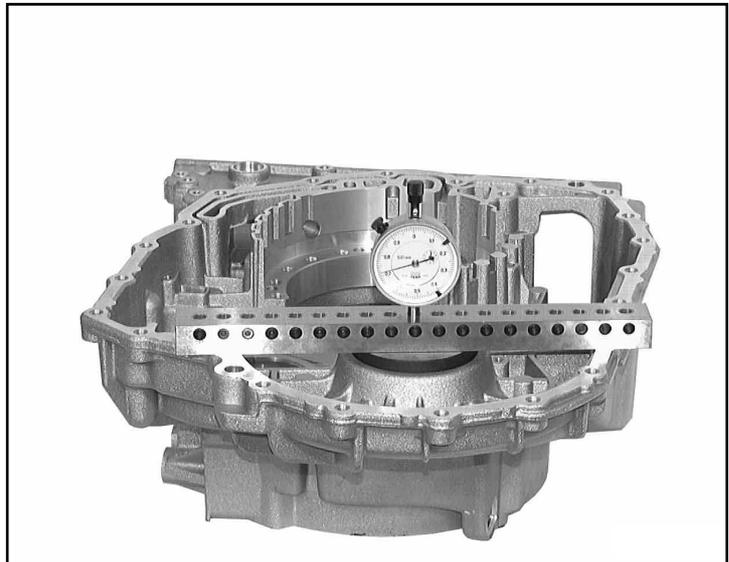


Insert plug gauge 5p89 004 682 into the bearing seat for the differential converter bell housing and, using the measuring bar, measure down to the plug gauge bell from the converter bell housing support surface.

Installation space B_{DW} is equal to the measured G_{DW} dimension plus the plug gauge height H_{DW} .

Calculation:

$$B_{DW} = G_{DW} + H_{DW}$$



Installation space for the differential B_D is now determined from installation space B_{DG} plus installation space B_{DW} plus the constant K_P for the paper gasket.

Calculation:

$$B_D = B_{DG} + B_{DW} + K_P$$

Example (for 1.4.1.4):

$$H_{DG} = 24.996 \text{ mm}$$

$$H_{DW} = 119.998 \text{ mm}$$

$$K_P = 0.26 \text{ mm}$$

$$G_{DG} = 0.285 \text{ mm}$$

$$G_{DW} = 0.67 \text{ mm}$$

$$B_{DG} = 0.285 + 24.996 \\ = 25.281 \text{ mm}$$

$$B_{DW} = 0.67 + 119.998 \\ = 120.668 \text{ mm}$$

$$\Rightarrow B_D = 25.281 + 120.668 + 0.26 \\ = 146.209 \text{ mm}$$

1.4.1.5 Determining the differential installation height

Fix bush 5p01 060 331 into basic tool for height measuring device 5p01 000 331 with 3 screws (M6x16). Insert outer bearing shell in bush 5p01 060 331
Insert the differential into the basic tool of height-measuring fixture
Fasten measuring plate 5p01 040 331 onto the basic tool with eight screws (M10x30).

Important!

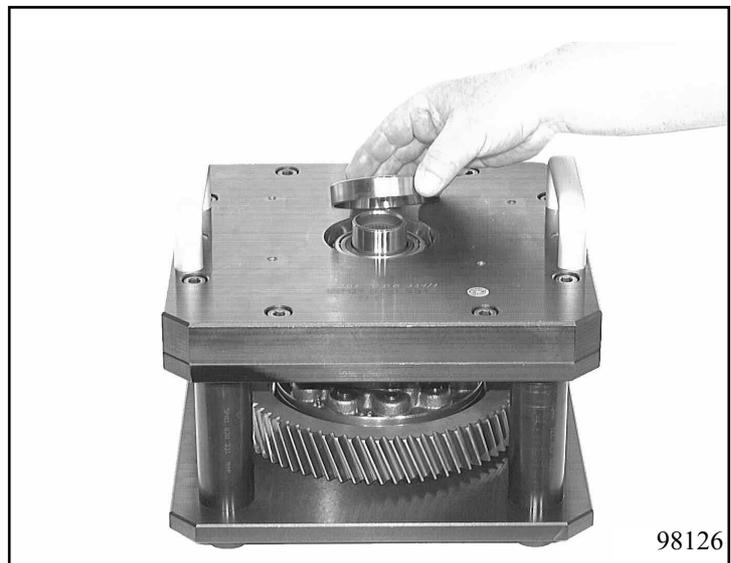
Strictly cleanliness !

Bush 5p01 050 331 is to be fixed with 4 screws (M6x12) into measuring plate 5p01 040 331 for MB application.
(See Chapter 1.5 for tightening torques)



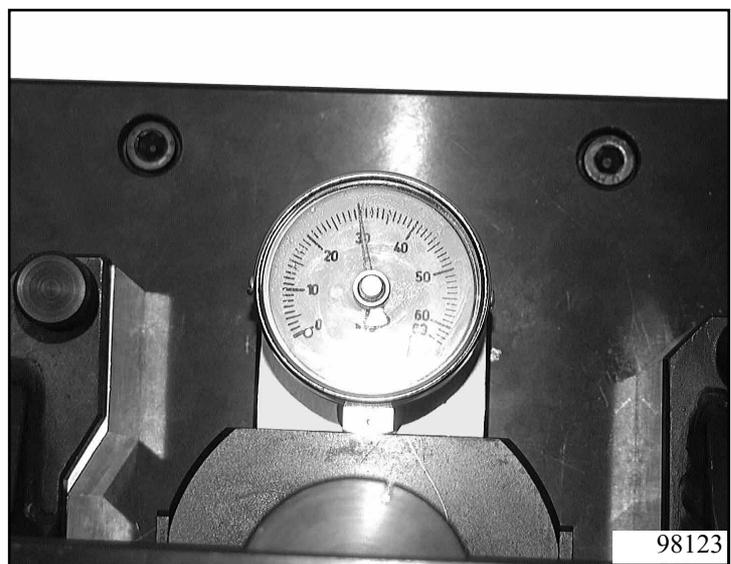
Set outer bearing shell on differential and measuring bell 5p01 070 331 onto bearing outer ring.
Put the intermediate pieces 5p01 000 329 on the positions marked on the measuring plate.

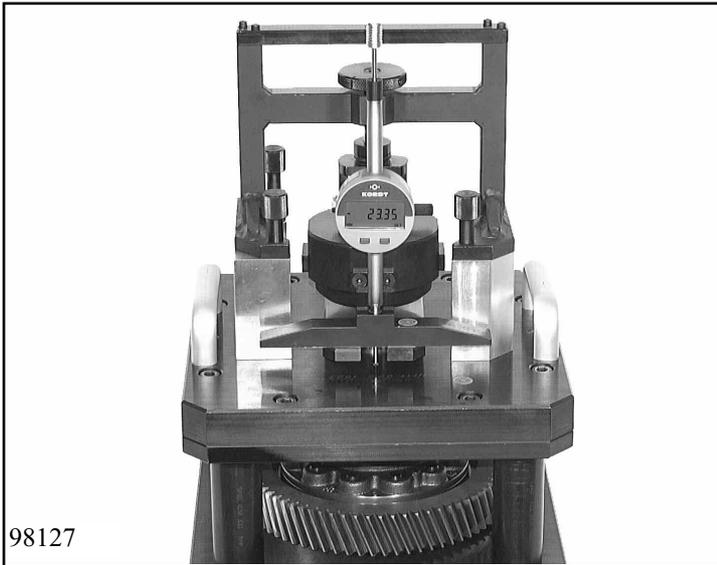
Using the knurled screw, turn the adjusting device to the upper limit.
Hang force measuring unit 5p01 000 329 in adjusting device 5p01 001 458 and screw it together with the height-measuring fixture using the intermediate pieces.
Connect the measuring bell with the force measuring unit using a fixing pin.



Using the knurled screw, clamp the differential into fixture at 300 N.
Check the value on the force measuring unit.
Give the differential several complete turns.

Using the measuring bar, measure the excess height from the measuring bell tongues to the measuring plate.





98127

To do this, place the measuring bar on the measuring bell's tongue, set to **0**, and then measure down to the measuring plate. Do the measurement procedure on both tongues.

Average the M_3 , M_4 measurement values
 $\Rightarrow M_D$

The height of the differential H_D is equal to the averaged measurement value M_D plus the constant dimension for the height measurement device K_D minus the constant dimension for the trust bell K_G

Calculation:

$$H_D = K_S + M_D - K_G$$

Example: (for 1.4.1.5)

$$K_D = 151.242 \text{ mm}$$

$$K_G = 30.013 \text{ mm}$$

$$M_3 = 23.35 \text{ mm}$$

$$M_4 = 23.51 \text{ mm}$$

$$M_D = (23.35 + 23.51)/2$$

$$= 23.43 \text{ mm}$$

$$H_S = 151.242 + 23.43 - 30.013$$

$$= 144.659 \text{ mm}$$

1.4.1.6 Determining the differential shim

Zero dimension N_D is equal to installation space B_D minus differential height H_D .

Disc thickness S_D is equal to zero dimension N_D plus preload dimension V_D – acc. to **specification 0000 700 907**.

The preload dimension V_D from the parts list is 0.21 to 0.26 mm. Permissible test value is 0.195 to 0.275 mm.

Calculation:

$$N_D = B_D - H_D$$

$$S_D = V_D + N_D$$

Example: (for 1.4.1.3)

$$B_D = 146.209 \text{ mm}$$

$$H_D = 144.659 \text{ mm}$$

$$V_D = 0.21 \text{ bis } 0.26 \text{ mm}$$

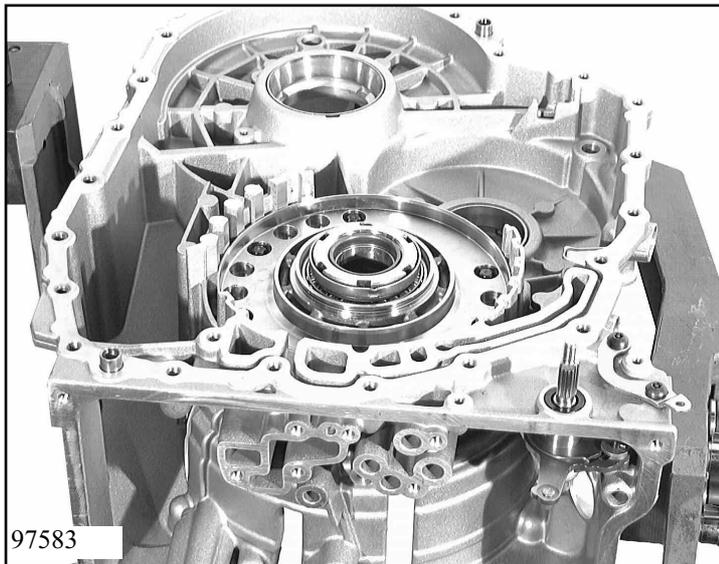
$$N_D = 146.209 - 144.659$$
$$= 1.55 \text{ mm}$$

$$S_D = 1.55 + (0.21 \text{ bis } 0.26)$$
$$= 1.76 \text{ bis } 1.81 \text{ mm}$$

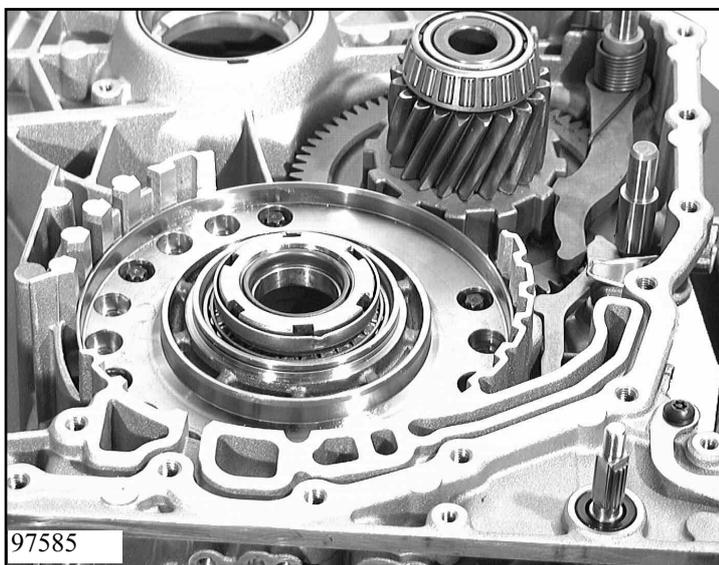
Selected:

$$\Rightarrow S_D = 1.78 \text{ mm}$$

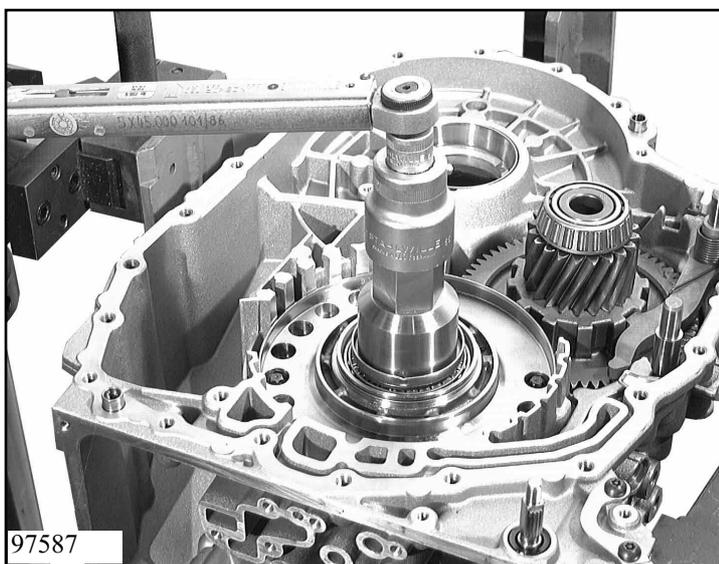
1.4.2 Adjusting the preload for the bearing plate



In order to ensure play, measuring ring 5x46 041 752 is used for *Completing the bearing plate* (Chapter 3.3) during adjustment instead of an adjusting ring. The bearing plate is put into the housing and fastened with six screws.



Insert the side shaft. Install the bolt, support bolt, and parking lock pawl with leg spring. Attach the spring. Engage the parking lock. Remove the slotted nut with securing ring.



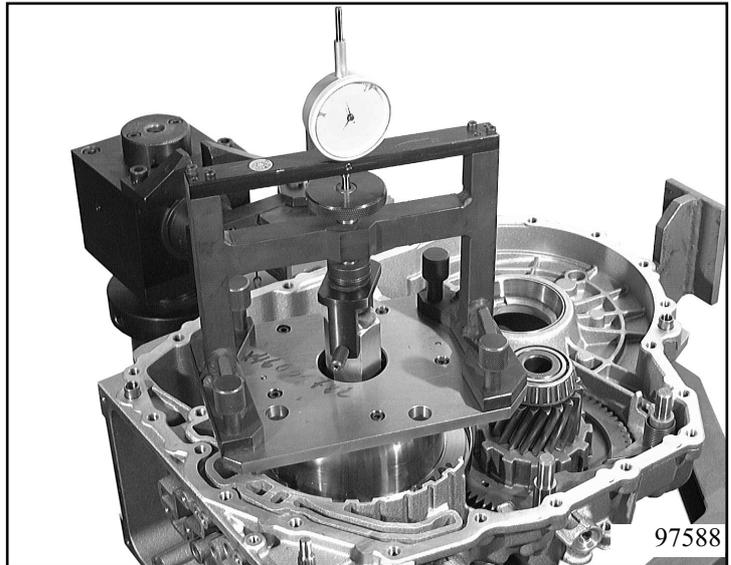
Screw measuring nut 5x46 032 123 on and tighten it.

Release the parking lock.

(See Chapter 1.5 for tightening torques)

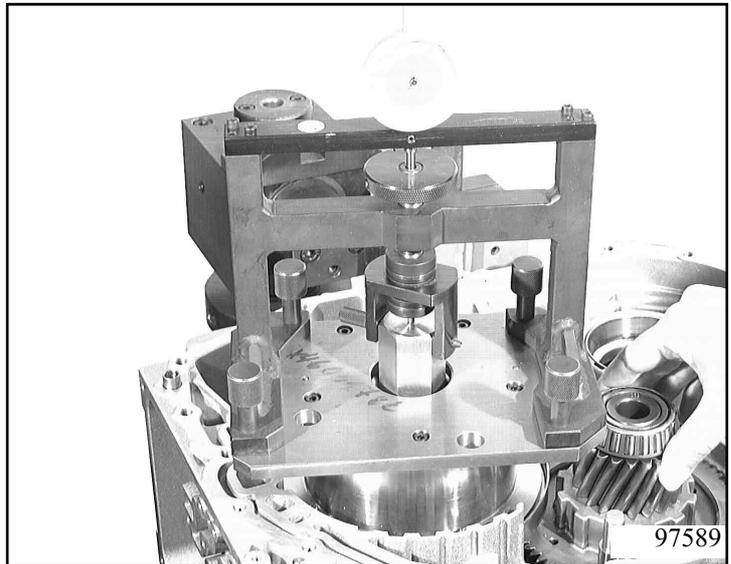
Fasten spacer sleeve 5x46 022 123 onto the bearing plate with three screws.
 Mount measuring plate 5x46 012 123 on spacer sleeve with five machine screws.
 On top of this, fasten adjusting device 5p01 001 458 with four knurled screws so that the bores of .screw measuring nut and adjusting device fit.

(See Chapter 1.5 for tightening torques)



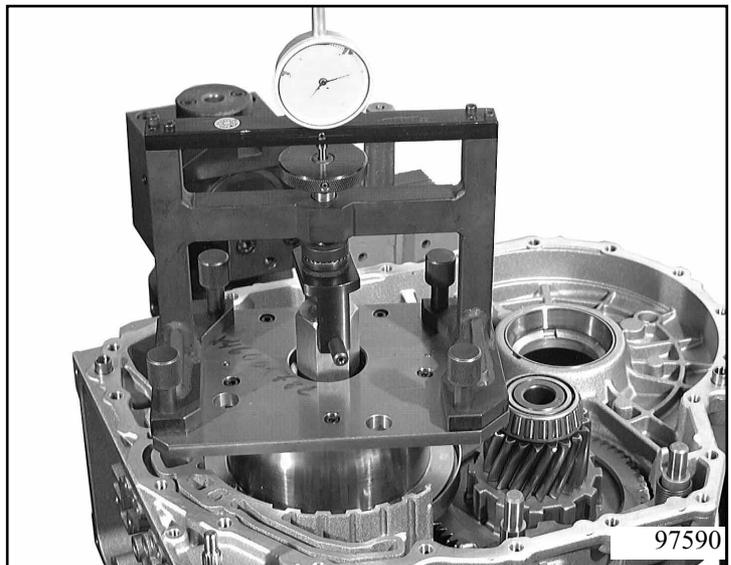
Attach measuring nut with bolt to adjusting device.
 Tighten knurled screw until resistance is felt, then turn a half further rotation.

Turn the output gear further with the side shaft until the indicator on the dial settles down, and set the dial gauge to **0**.



Now turn the knurled screw in the opposite direction until resistance can be detected, and give it a half further rotation.
 Turn the output gear further by turning the side shaft until the indicator on the dial gauge settles down and then read the dial gauge ⇨ dimension **M**

Note !
 Turn until the indicator movements no longer become smaller.



Zero dimension **N** is equal to the thickness of disc **D** minus dimension **M**.

Calculation:

$$\mathbf{N = D - M}$$

Shim thickness **S** is equal to zero dimension **N** minus adjusting dimension **V**, preload dimension **V** acc. to **specification 0000 700 907**, from the parts list is 0.03 to 0.085 mm.

The test value is permissible if it is between 0.03 and 0.1 mm

Remove measuring fixture.

Calculation:

$$\mathbf{S = N - V}$$

Example: (for 1.4.2)

$$\mathbf{M = 0.22 \text{ mm}}$$

$$\mathbf{D = 6.3 \text{ mm}}$$

$$\mathbf{V = 0.03 \text{ to } 0.085 \text{ mm}}$$

$$\begin{aligned}\mathbf{N} &= \mathbf{6.3 - 0.22 \text{ mm}} \\ &= \mathbf{6.08 \text{ mm}}\end{aligned}$$

$$\mathbf{S = 6.08 - (0.03 \text{ to } 0.085)}$$

$$\mathbf{S = 5.995 \text{ to } 6.05 \text{ mm}}$$

Selected:

$$\square \mathbf{S = 6.025 \text{ mm}}$$

Remove adjusting device, bearing plate and spacer saver, engage the parking lock and loosen the measuring nut.

Release the parking lock and remove the bolt, supporting bolt, parking lock pawl, leg spring, and side shaft.

Take the bearing plate back off and replace the installed shim with the one determined.

Note !

See

Dismantling the bearing plate (Chapter 2.8.2)/

Completing the bearing plate (Chapter 3.3)

1.4.3 Adjusting brakes C and D

1.4.3.1 Adjusting clearance of brake D (adjustment disc)

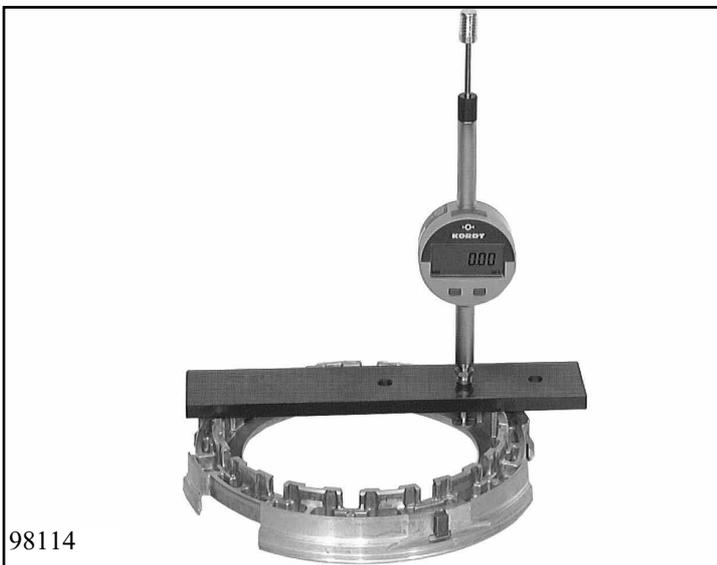


Determine brake D installation space E_D with measuring bar 5p01 060 330.

To do this set measuring bar on the edge of the brake D disc carrier. Put measuring base on highest point of disc supporting surface on ridge and set the dial gauge to 0.

Pull the measuring sensor upwards, insert it into the snap ring groove and press it against the groove's upper edge.

Read off measured value on dial gauge $\Rightarrow W_D$



Determine thickness M_D of clutch pack for brake D (without adjustment disc) according to **Chapter 1.4.0: Measuring the clutch packs.**

$\Rightarrow M_D$

Installation space E_D is equal to measured value W_D plus base thickness $F \Rightarrow E_D$.

Test value P_D is then derived from installation space E_D minus M_D .

Value P_D must lie between 4.46 and 5.73 mm. **Test specification 1019 700 108**

Use test dimension P_D to select adjustment disc L_D .

Calculation:

$$E_D = W_D + F + S_D$$

$$P_D = E_D - M_D$$

Example (for 1.4.3.1):

$$F = 1.48 \text{ mm (base thickness)}$$

$$W_D = 17.02 \text{ mm}$$

$$M_D = 13.43 \text{ mm}$$

$$E_D = 17.02 + 1.48$$

$$= 18.5 \text{ mm}$$

$$P_D = 18.5 - 13.43$$

$$= 5.07 \text{ mm}$$

From the table:

$$\square L_D = 2.1 \text{ mm}$$



98113

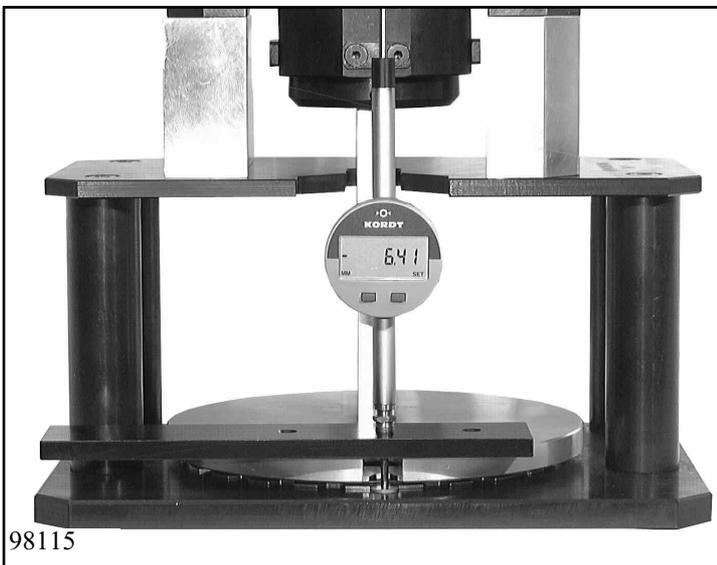
1.4.3.2 Adjusting clearance of clutch C (snap ring)

Determine installation space E_C for brake C with measuring bar 5p01 060 330.

For this, set measuring bar on the edge of the brake C disc carrier. Place the measuring base on the highest point on the disc support surface on the ridge and set the dial gauge to **0**.

Pull the measuring sensor upwards, insert it into the snap ring groove and press it against the groove's upper edge.

Read off measured value on the dial $\Rightarrow W_C$



98115

Determine thickness M_C of the clutch pack for brake C (without cup spring) according to **Chapter 1.4.0: Measuring the clutch packs**.

$\Rightarrow M_C$

Installation space E_C is equal to measured value W_C plus base thickness $F \Rightarrow E_C$

Test value P_C is then equal to installation space E_C minus M_C .

According to **test specification 1019 700 085**, value P_C must lie between 1.86 and 2.4 mm. According to **test specification 1019 700 216**, it must lie between 1.77 and 2.28 mm (brake disc release).

Select snap ring S_C using test dimension P_C .

Calculation:

$$E_C = W_C + F$$

$$P_C = E_C - M_C$$

Example (for 1.4.3.2):

$$F = 1.48 \text{ mm (base thickness)}$$

$$W_C = 6.95 \text{ mm}$$

$$M_C = 6.41 \text{ mm}$$

$$E_C = 6.95 + 1.48$$

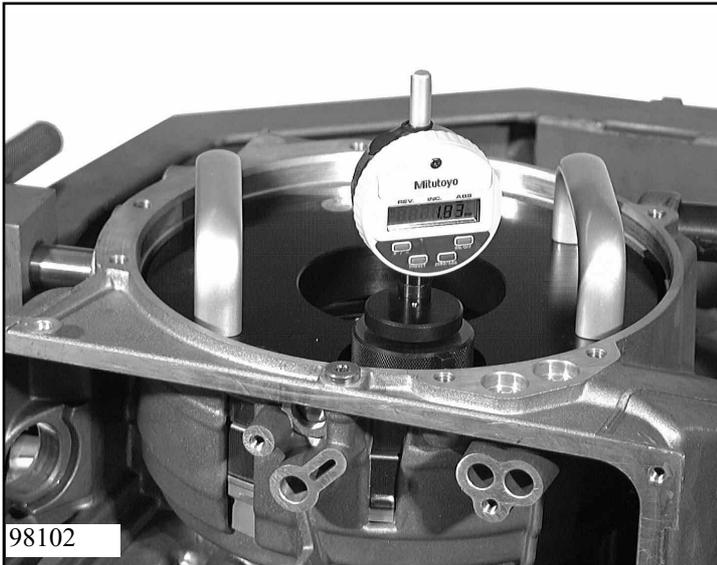
$$= 8.43 \text{ mm}$$

$$P_C = 8.43 - 6.41$$

$$= 2.02 \text{ mm}$$

From the table:

$$\Rightarrow S_C = 1.5 \text{ mm}$$



1.4.4 Adjusting clearance of cylinder C (snap ring)

Put measuring fixture 5p01 002 925 on cylinder C.

Press the measuring base down on the top edge of the cylinder and set the dial gauge to 0.

Release the measuring base and swivel it into the snap ring groove so that it touches the upper edge of the groove. Repeat measurement twice, turning by 120°.

Average measurement values M_1 , M_2 , $M_3 \Rightarrow M$. Adding D to M then gives you test dimension P .

Test dimension P should lie between 3.10 and 3.90 mm. **Specification 1019 700 201**

Use test dimension P to select snap ring S .

Release play should be between 0.05 and 0.25 mm. (200 N)

Calculation:

$$P = M + D$$

Example (for 1.4.4):

$$D = 1.48 \text{ mm}$$

$$M_1 = 1.93 \text{ mm}$$

$$M_2 = 1.88 \text{ mm}$$

$$M_3 = 1.83 \text{ mm}$$

$$M = (1.93 + 1.88 + 1.83) / 3 = 1.88 \text{ mm}$$

$$P = 1.88 + 1.48 = 3.36 \text{ mm}$$

$$\Rightarrow S = 3.2 \text{ mm}$$

1.4.5 Adjusting clutches B and E.

Insert the *clutch E* adjusting ring on piston E and secure with snap ring 02.010/230.

(Here variant B)

Note !

Adjusting ring E

for **variant A** 5p89 004 182

for **variant B** 5p89 004 374

Specification 1019 700 126



97615

Put the *clutch B* adjusting ring on the snap ring.
Insert cup 02.090 and secure it with snap ring 02.100.

(Here variant B)

Note !

Adjusting ring B

for **variant A** 5p89 004 181

for **variant B** 5p89 005 403

Specification 1019 700 127

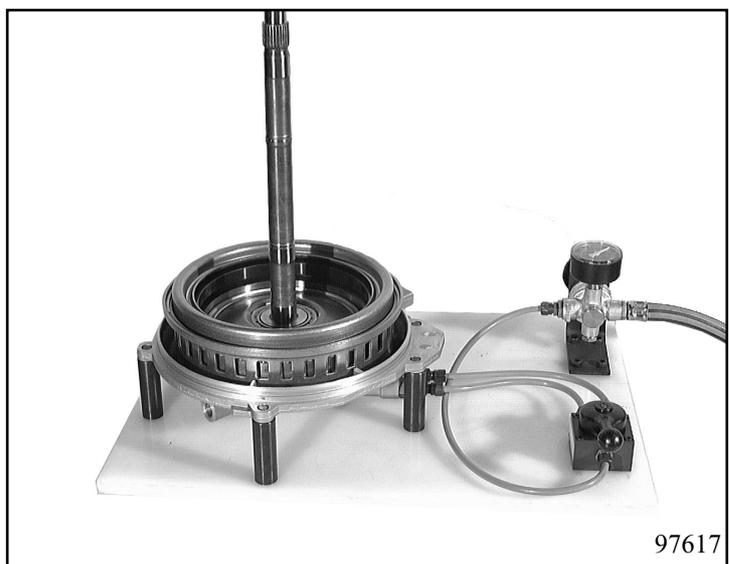


97616

Put the complete set on measuring fixture 5p01 002 984 and connect the fixture to the compressed-air system.

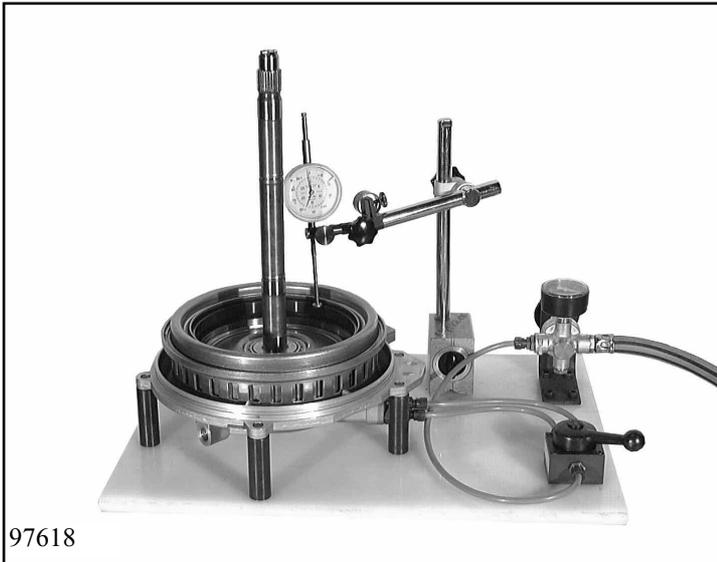
Note !

Maximum air pressure: 5 bar.



97617

1.4.5.1 Determining snap ring play



Put the dial gauge sensor on the clutch B adjusting ring.
Feed compressed air to clutch B via control valve.
Set dial gauge to 0.



After this, pressurize clutch E via the control valve and read measurement value.
Repeat measurement twice with the set turned by 120°.
Average measurement values M_1 , M_2 , M_3 ⇨ snap ring play S

$$S = (M_1 + M_2 + M_3) / 3$$

Example (for 1.4.5.1):

$$M_1 = 0.27 \text{ mm}$$

$$M_2 = 0.23 \text{ mm}$$

$$M_3 = 0.25 \text{ mm}$$

$$\begin{aligned} \text{⇨ } S &= (0.27 + 0.23 + 0.25) / 3 \\ &= 0.25 \text{ mm} \end{aligned}$$

1.4.5.2 Measuring installation space, clutch B

Put the dial gauge's sensor on the clutch B adjusting ring.

Feed compressed air to clutch E via control valve. Set dial gauge to 0.

Lift measurement ring B by hand until it touches the cup and read the measurement value.

Repeat measurement twice with the set turned by 120°. ⇨ M_4 , M_5 , M_6

Average measurement values M_4 , M_5 , M_6 ⇨ M_B



The minimum installation space E_B is equal to the height of the ring R_B plus measurement value M_B

Calculation:

$$M_B = (M_4 + M_5 + M_6) / 3$$

$$E_B = R_B + M_B$$

Example (for 1.4.5.2):

$$M_4 = 2.36 \text{ mm}$$

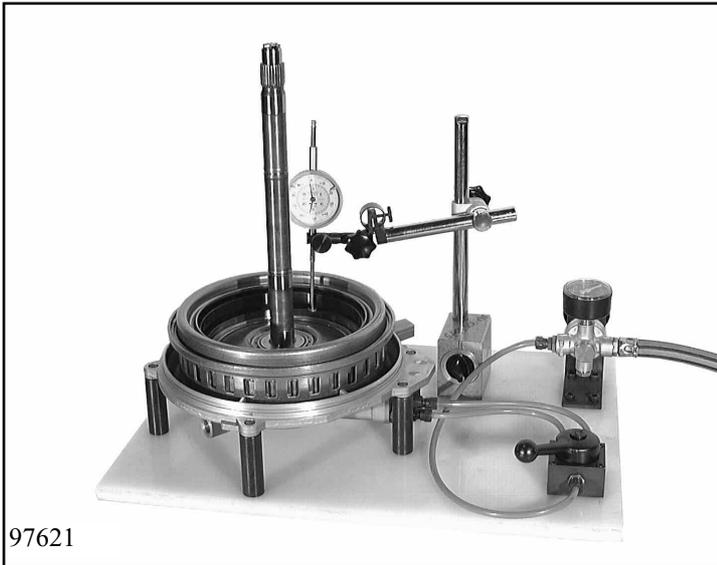
$$M_5 = 2.40 \text{ mm}$$

$$M_6 = 2.38 \text{ mm}$$

$$R_B = 11.99 \text{ mm}$$

$$M_B = (2.36 + 2.40 + 2.38) / 3 \\ = 2.38 \text{ mm}$$

$$\text{⇨ } E_B = 11.99 + 2.38 \\ = 14.37 \text{ mm}$$



1.4.5.3 Measuring installation space, clutch E

Put the dial gauge's sensor on the clutch E adjusting ring.

Set dial gauge to 0.

Feed compressed air to clutch E via control valve, and read off the measured value.

Repeat procedure twice with the set turned by 120°. ⇨ M_7, M_8, M_9

Average measurement values M_7, M_8, M_9 . ⇨ M_E

Now take the adjusting rings off again.

The minimum installation space E_E equals ring height R_E plus M_E minus snap ring play S .

Calculation:

$$M_E = (M_7 + M_8 + M_9) / 3$$

$$E_E = R_E + M_E - S$$

Example (for 1.4.5.3):

$$M_7 = 2.6 \text{ mm}$$

$$M_8 = 2.55 \text{ mm}$$

$$M_9 = 2.54 \text{ mm}$$

$$R_E = 20.98 \text{ mm}$$

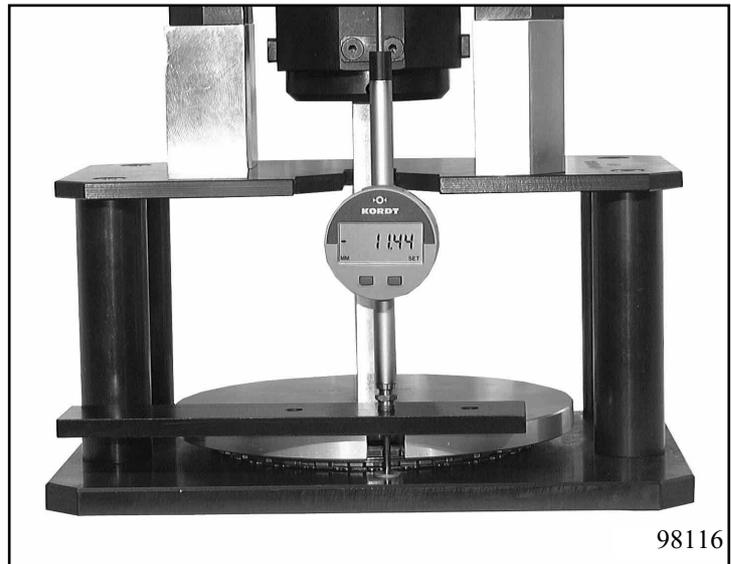
$$M_E = (2.6 + 2.55 + 2.54) / 3 = 2.56 \text{ mm}$$

$$\text{⇨ } E_E = 20.98 + 2.56 - 0.25 = 23.29 \text{ mm}$$

1.4.5.4 Measuring clutch pack B

Determine thickness M_B for the clutch pack for clutch B (without adjustment disc) according to **Chapter 1.4.0: Measuring the clutch packs.**

⇒ M_B



1.4.5.5 Determining adjustment disc B.

Test dimension P_B is equal to the installation space E_B minus set thickness M_B . Determine adjustment disc E_B from **specification 1019 700 127**. For variant B, test dimension P_B should lie between 2.56 and 3.86 mm.

Calculation:

$$P_B = E_B - M_B \Rightarrow L_B$$

Using test dimension P_B , select adjustment disc L_B .

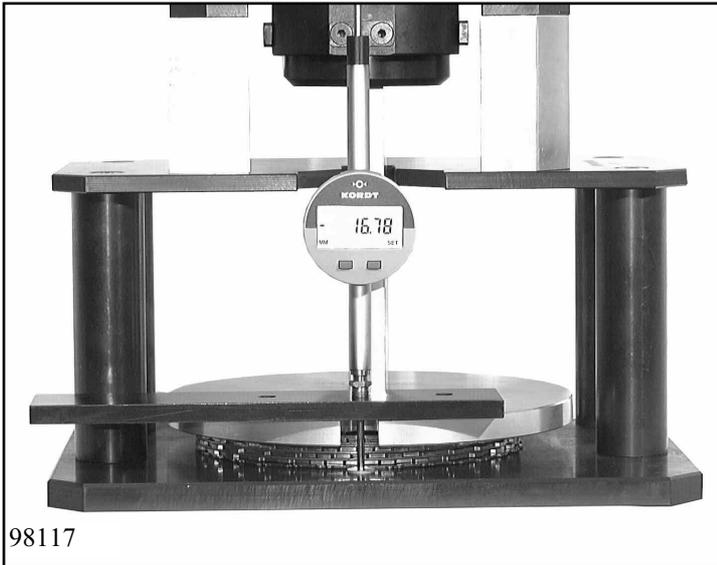
Example (for 1.4.5.4/1.4.5.5):

$$M_B = 11.44 \text{ mm}$$

$$E_B = 14.38 \text{ mm}$$

$$P_B = 14.38 - 11.44 \\ = 2.94 \text{ mm}$$

$$\Rightarrow L_B = 2.1 \text{ mm}$$



1.4.5.6 Measuring clutch pack E

Determine thickness M_E for the clutch pack for clutch E (without adjustment disc) according to **Chapter 1.4.0: Measuring the clutch packs.**

⇒ M_E

1.4.5.7 Determining adjustment disc E

Test dimension P_E is equal to installation space E_E minus set thickness M_E .
 For variant B, test dimension P_E should lie between 5.33 and 6.66 mm.
 Determine adjustment disc E_E from **specification 1019 700 126**

Calculation:

$$P_E = E_E - M_E \Rightarrow L_E$$

Use test dimension P_E to select adjustment disc L_E

Example (for 1.4.5.7):

$$M_E = 16.78 \text{ mm}$$

$$E_E = 23.29 \text{ mm}$$

$$P_E = 23.29 - 16.78 \\ = 6.51 \text{ mm}$$

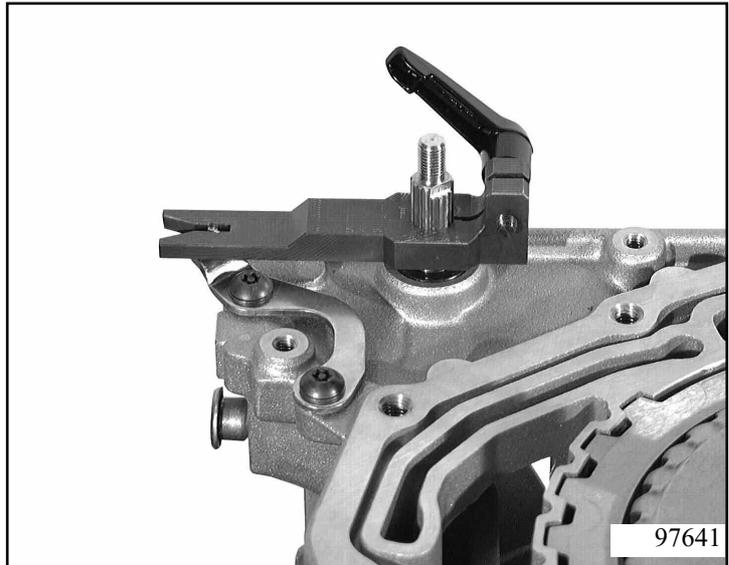
$$\Rightarrow L_E = 4.8 \text{ mm}$$

1.4.6 Installing position switch

Loosen screws 01.180 for adjusting plate 01.150 so that the adjusting plate slides easily.

Slide adjustment tool 5x46 001 454 into transmission position **N** on the selector shaft so that the dowel pin of the adjustment tool fits into the bore in the adjusting plate.

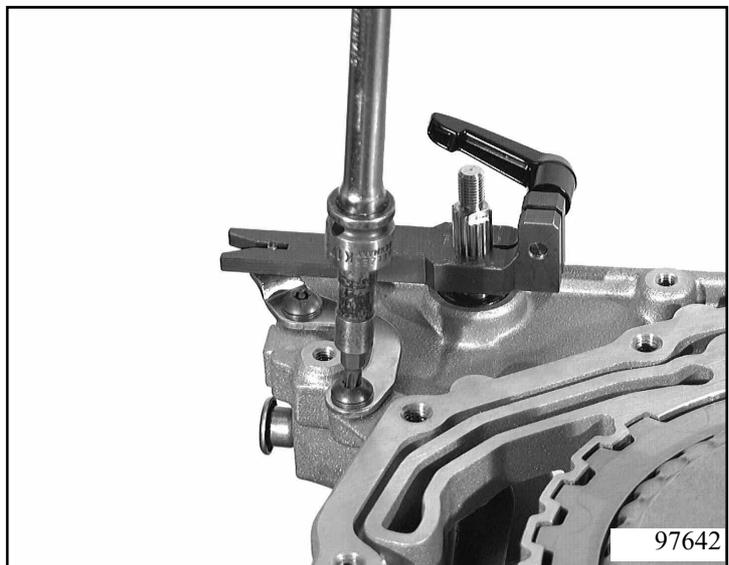
Clamp the adjustment tool tightly



Tighten the screws.

(Torx TX-27H)

(See Chapter 1.5 for tightening torque)



Check the adjustment by removing the adjustment tool, switching through all positions twice, and then putting the adjustment tool in the **N** position back on.

If the dowel does not fit into the adjusting plate, repeat the adjustment.

After this affix the screw heads with safety coating.

1.4.7 Adjusting clearance of brake F

1.4.7.1 Measuring installation space F



Using a depth gauge, measure from the transmission housing sealing surfaces to the piston's disc support surface at two opposing points $\Rightarrow M_1, M_2$

Average the measurement values M_1, M_2
 $\Rightarrow B_F$

Calculation:

$$B_F = (M_1 + M_2) / 2$$

Example (for 1.4.7.1):

$$M_1 = 18.6 \text{ mm}$$

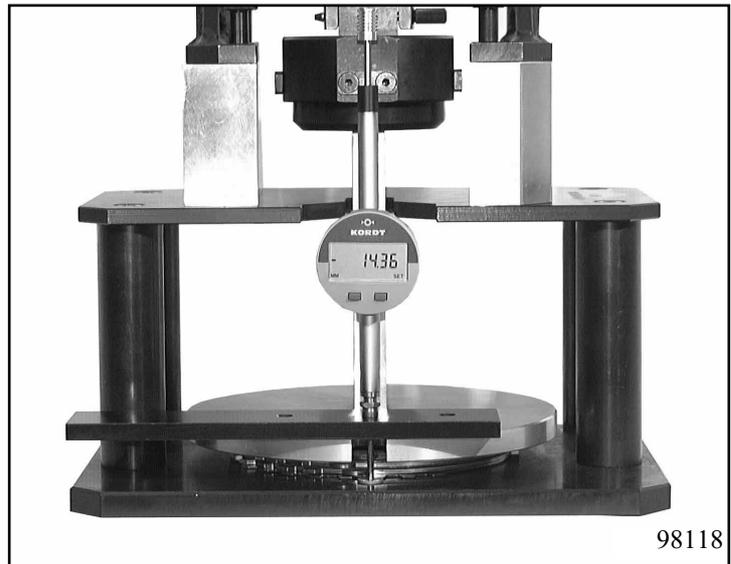
$$M_2 = 18.8 \text{ mm}$$

$$B_F = (18.6 + 18.8) / 2$$
$$= 18.7 \text{ mm}$$

1.4.7.2 Measuring clutch pack F

Determine thickness M_F of the clutch F clutch pack (without adjustment disc) according to **Chapter 1.4.0: Measuring the clutch packs.**

⇒ M_F



1.4.7.3 Determining adjustment disc F

Test dimension P_F is equal to installation space B_F minus set thickness D_F . Determine adjustment disc E_F from **specification 1019 700 084**

Test dimension P_F should lie between 3.79 and 4.93 mm.

Calculation:

$$P_F = B_F - M_F \Rightarrow E_F$$

Use test dimension P_F to select adjustment disc E_F .

Example (for 1.4.7.2/1.4.7.3):

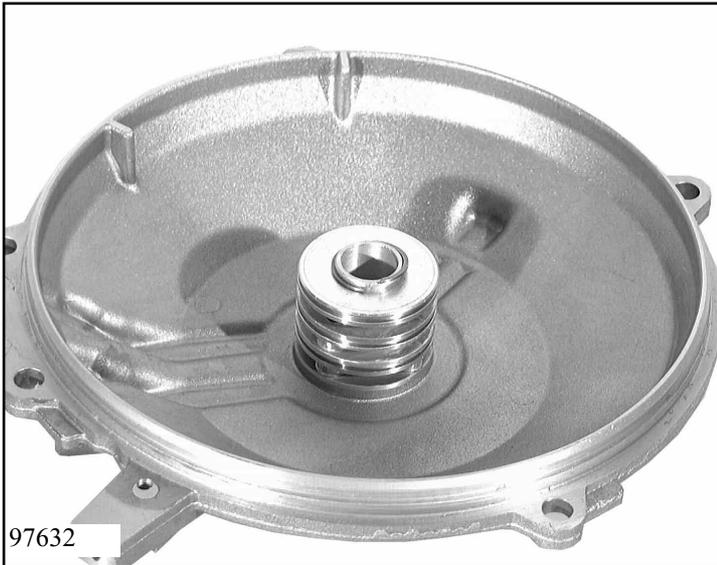
$$M_F = 14.2 \text{ mm}$$

$$B_F = 18.7 \text{ mm}$$

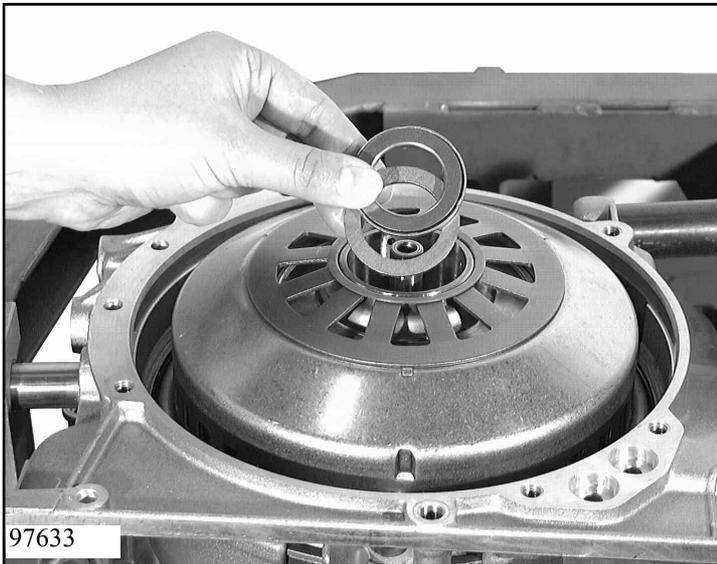
$$P_F = 18.7 - 14.2 \\ = 4.5 \text{ mm}$$

$$\Rightarrow E_F = 3.3 \text{ mm}$$

1.4.8 Assembly cover for adjusting axial play (preparation)



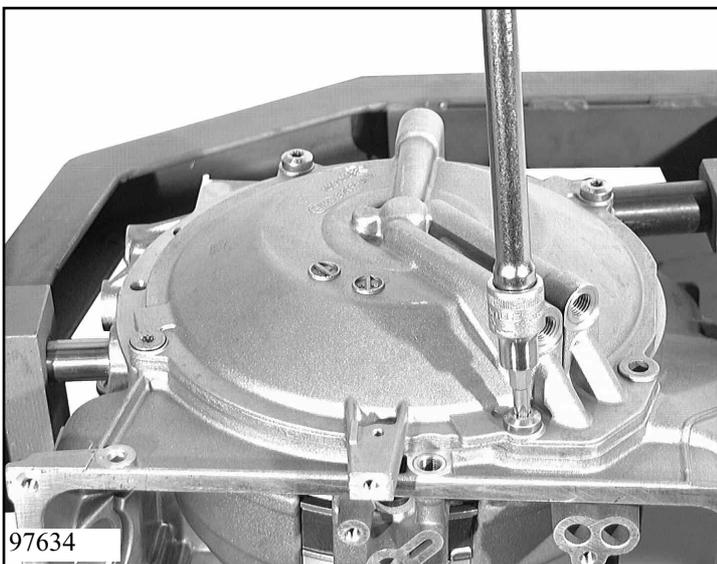
Put oil feeding bush 01.020/120 without sealing sleeves 01.020/140 on transmission cover 01.020/110 and secure with snap ring 01.020/160.



Place shim 01.100 and bearing 01.090 on cylinder B/E.

Note!

The selected shim should allow axial play.



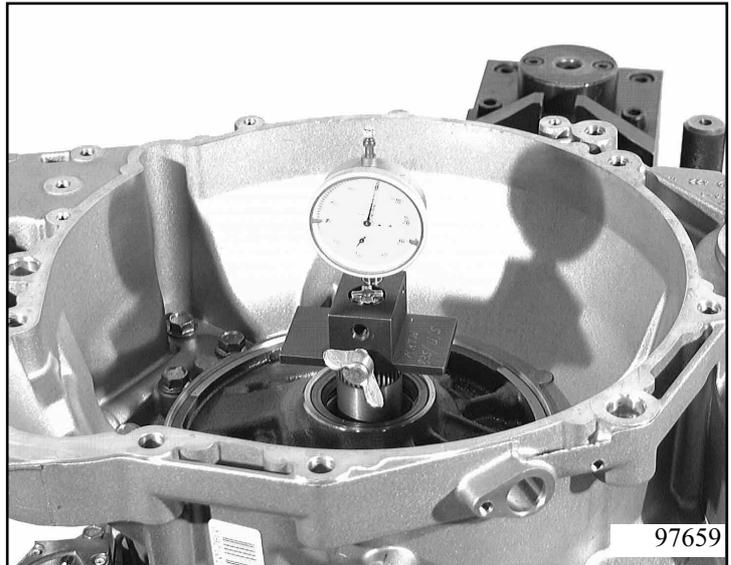
Put the transmission cover on the housing and screw the cover on tight with four Torx screws 01.064 and 1 Torx screw 01.060.

Important!

See tightening torque specifications in Chapter 1.3

1.4.9 Adjusting axial play, input shaft

Clamp fixture 5p01 002 379 on the input shaft so that the measuring base rests on the stator shaft.



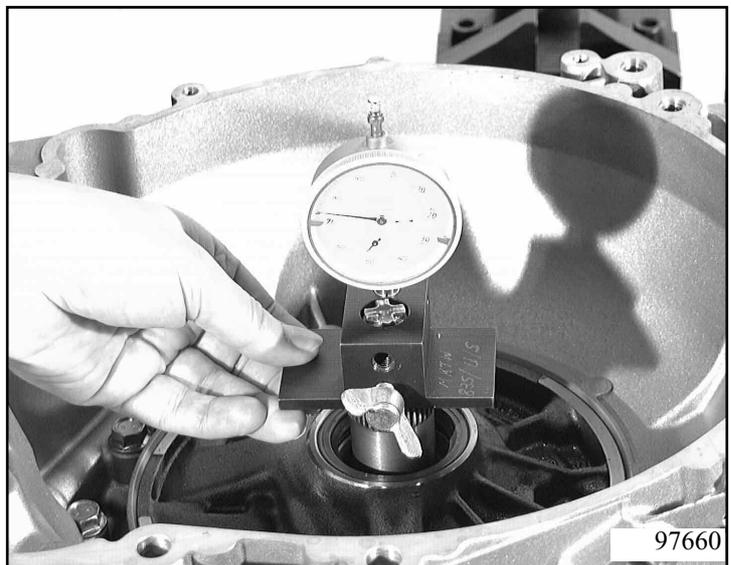
Set dial gauge to **0**.

Determine axial play by pulling and pressing on the handle (repeat measurement).

Average the measurement values $M_1, M_2 \Rightarrow M$

Remove the measuring fixture.

Play **S** should be (according to **specification 1019 700 222**) between 0.18 and 0.42 mm.



Example (for 1.4.9):

$$M_1 = 0.51 \text{ mm}$$

$$M_2 = 0.49 \text{ mm}$$

$$M = (0.51 + 0.49)/2 \\ = 0.5 \text{ mm}$$

$$S = 0.18 \text{ to } 0.42 \text{ mm}$$

$$D = 0.5 - (0.18 \text{ to } 0.42) \\ = 0.08 \text{ to } 0.32 \text{ mm}$$

$$\Rightarrow D = 0.2 \text{ mm (selected)}$$

Disc thickness must be between 0.08 and 0.32 mm thicker. It is sensible to select one with a disc that averages 0.2 mm thicker than the one that was installed.



If the play lies outside the adjustment range, the shim must be replaced accordingly.

To do this, turn the transmission by 180° and remove the transmission cover. Remove the bearing.

Replace the shim with one of appropriate size and put the bearing back in.

Note!

See *Completing and installing transmission cover* (Chapter 3.5)

1.5 Tightening torques

No.	Designation	Part List-Item-No.	Wrench size No.	Page	Tightening torque [Nm]
1	Machine screw (pretightening, conv. bell housing) (final tightening, “)	22.120 22.130 22.120 22.130 22.132	Hexagonal SAF = 13 mm	1.3/1 3.8/5	15 ± 2 26 ± 2.6
2	Machine screw (final tightening, conv. bell housing)	22.134	TORX - TX 40 or Hexagonal SAF = 13 mm	1.3/1 3.8/5	26 ± 2.6
3	Machine screw (pretightening, trans. cover) (final tightening, “)	01.060 01.164	TORX - TX 40	1.3/2 1.4/31 3.5/2	15 ± 2 23 ± 2.3
4	Machine screw (differential)	09.120	Hexagonal SAF = 19 mm	3.1/1	145 ± 14.5
5	Machine screw (guide plate)	06.160	TORX - TX 27	3.2/2	10 ± 1
6	Machine screw (bearing plate)	14.020	TORX - E10	1.4/14 3.3/2	35 ± 3.5
7	Slotted nut (bearing plate)	14.010/170	Socket wrench 5X46 001 089	1.4/13 3.3/2	250 ± 25
8	Machine screw (transmission cover)	01.064	TORX - TX 40	3.5/2	23 ± 2.3
9	Countersunk screw (transmission cover)	01.060	TORX - TX 40	3.5/2	23 ± 2.3
10	Machine screw (adjusting plate, switch)	01.180	TORX - TX 27 H	1.4/28	10 ± 1
11	Machine screw (oil baffle plate)	01.016	TORX - TX 27	3.7/1	8 ± 0.8
12	Hexagon screw (switch)	01.210	Hexagonal SAF = 10 mm	3.7/2	10 ± 1
13	Machine screw (oil baffle plate)	22.230	TORX - TX 27	3.8/2	8 ± 0.8

No.	Designation	Part List- Item-No.	Wrench size No.	Page	Tightening torque [Nm]
14	Machine screw (converter bell housing/pump)	10.020	TORX - TX 27	3.8/3	10 ± 1
15	Machine screw (converter bell housing/pump)	10.010/150	TORX - TX 27	3.8/3	10 ± 1
16	Hexagon screw (oil tank)	22.270	Hexagonal SAF = 10 mm	3.8/4	10 ± 1
17	Hexagon screw (oil filter)	22.180	Hexagonal SAF = 10 mm	3.8/4	10 ± 1
18	Hexagon screw (converter bell housing/retaining strap)	22.130	Hexagonal SAF = 13 mm	3.8/5	26 ± 2.6
19	Machine screw (converter bell housing)	22.132	TORX - TX 40	3.8/5	26 ± 2.6
20	Hexagon screw (converter bell housing)	22.134 22.120	SAF = 13 mm	3.8/5	26 ± 2.6
21	Union screw (oil tube)	01.290	Hexagonal SAF = 13 mm	3.8/5	25 ± 2.5
22	Machine screw (oil tube)	01.286	Hexagonal SAF = 13 mm	3.8/6	23 ± 2.3
23	Screw plug, M10x1 (transmission housing/cover)	01.260	Internal hexagon SAF = 5 mm	3.8/6	20 ± 2
24	Machine screw (inductive transmitter)	01.130	TORX - TX 27	3.8/7	8 ± 0.8
25	Machine screw (control unit)	27.300	TORX - TX 27	3.8/8	8 ± 0.8
26	Machine screw (inductive transmitter)	27.230	TORX - TX 27	3.8/8	8 ± 0.8
27	Hexagon screw (oil pan)	03.050	SAF = 10 mm	3.8/8	6 ± 0.6
28	Screw plug, M12x1,5 (transmission housing/cover)	01.020/150	Internal hexagon SAF = 6 mm	3.8/8	20 ± 2

No.	Designation	Part List- Item-No.	Wrench size No.	Page	Tightening torque [Nm]
29	Screw plug, M10x1 (converter bell housing)	22.150	Internal hexagon SAF = 5 mm	3.8/8	12 ± 1.2
30	Union screw (heat exchanger)	01.340	Internal hexagon SAF = 8 mm	3.9/2	35 ± 3.5
31	Screw plug, M16x1.5 (converter bell housing)	22.100	Internal hexagon SAF = 8 mm	3.9/2	20 ± 2
32	Screw plug, M12x1.5 (converter bell housing)	22.200	Internal hexagon SAF = 6 mm	3.9/2	30 ± 3
33	Hexagon screw (speedometer connection)	09.392	SAF = 11 mm	3.9/3	7 ± 0.7
34	Hexagon screw (M8x55) (converter retaining bracket)		SAF = 13 mm	3.9/3	20 ± 2
35	Hexagon screw (M10x15) (converter retaining bracket)		SAF = 17 mm	3.9/3	20 ± 2
36	Screw (M6x12) (height measuring device)		Internal hexagon SAF = 5 mm	1.4/5 1.4/10	10 ± 1
37	Screw (M6x16) (height measuring device)		Internal hexagon SAF = 5 mm	1.4/5 1.4/10	10 ± 1
38	Screw (M10x30) (height measuring device)		Internal hexagon SAF = 8 mm	1.4/5 1.4/10	35 ± 3,5

1.6 Transmission test (test bench)

The following points must be checked:

Correct oil level

Proper oil level; observe the vehicle manufacturer's specifications and Part List.

Oil level too low

This can result in:

- Engine over-revving or no power flow in curves or when starting from a stop
- Valve chatter due to air pockets in the oil
- General malfunctions

Among other things, burned clutches can be the result.

Oil level too high

Danger of loss due to splashing, formation of foam, strong increases in temperature at high road speeds. Loss of oil via breather; among other things, burned clutches and shifting problems can result.

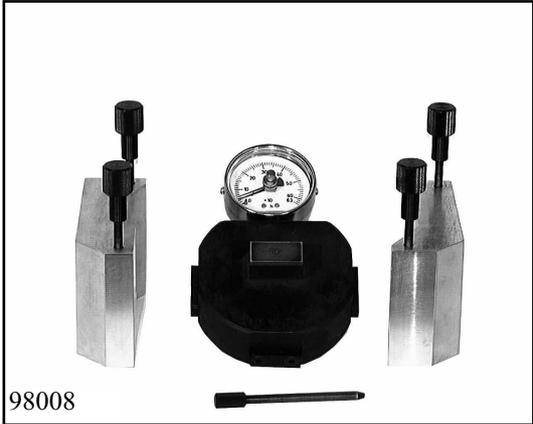
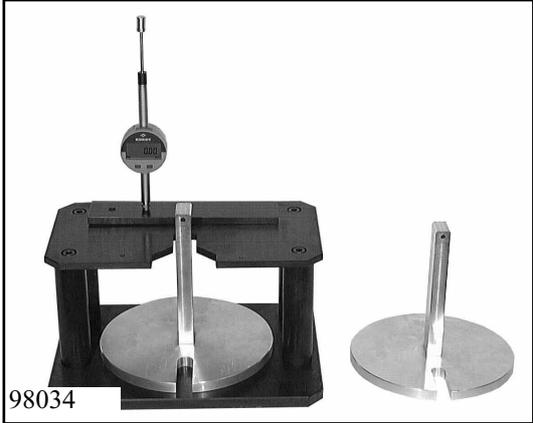
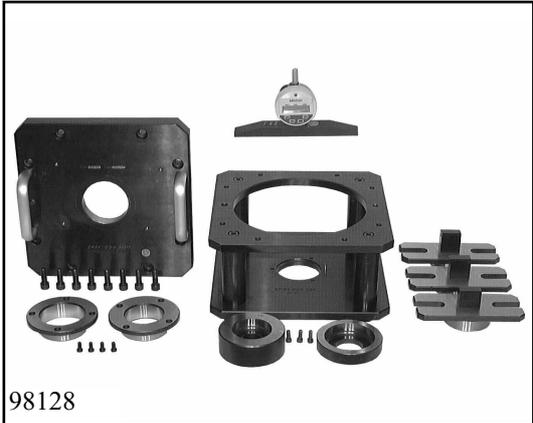
Proper engine settings

Correct idle speed; follow specifications from vehicle manufacturer.

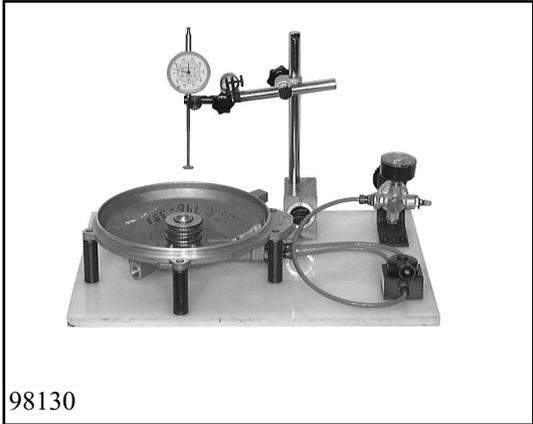
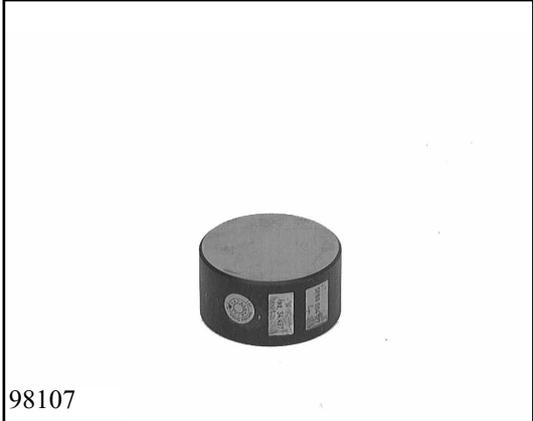
Power flow, forward and reverse

Correct adjustment of selector linkage or control cable; observe the vehicle manufacturer's specifications.

1.7 Special tools

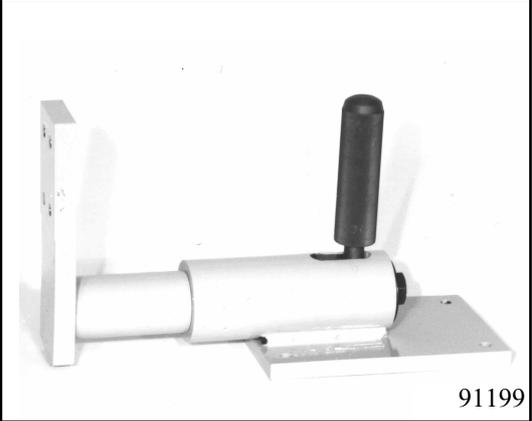
OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">1</p>  <p>98008</p>	<p>5p01 000 329 -Force measuring unit</p>	<p>Identical 5 HP 24</p>
<p style="text-align: center;">2</p>  <p>98034</p>	<p>5p01 000 330 -Measuring fixture, clutch play</p> <p>(Measuring plate: - short neck >20 mm - long neck <20 mm clutch pack thickness)</p>	<p>Identical 5 HP 24</p>
<p style="text-align: center;">3</p>  <p>98128</p>	<p>5p01 000 331 -Height-measuring fixture, differential and side shaft</p>	

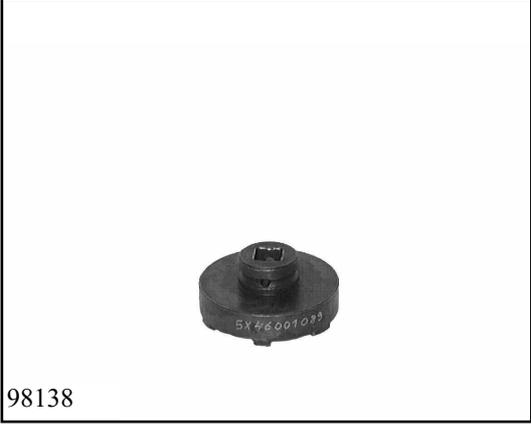
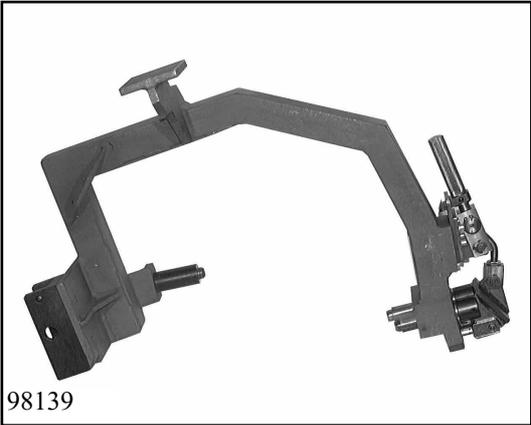
Remarks	Order-No. / Application	OBJECT
<p>Identical</p> <p>4 HP 18 Q 5 HP 24</p>	<p>5p01 001 458 -Adjusting device, preload</p>	<p style="text-align: center;">4</p>  <p style="text-align: right;">97301</p>
	<p>5p01 002 379 -Fixture, axial play, input shaft</p>	<p style="text-align: center;">5</p>  <p style="text-align: right;">98129</p>
	<p>5p01 002 925 -Measuring fixture, snap ring play, cylinder C</p>	<p style="text-align: center;">6</p>  <p style="text-align: right;">98103</p>

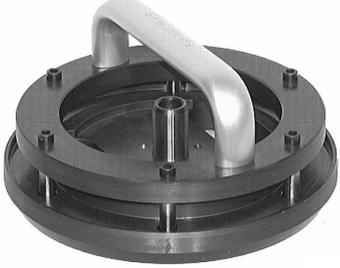
OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">7</p>  <p>98130</p>	<p>5p01 002 984 -Measuring fixture, installation space and snap ring play, clutches B/E</p>	
<p style="text-align: center;">8</p>  <p>98107</p>	<p>5p89 004 177 -Plug gauge installation space, converter bell housing, side shaft</p>	
<p style="text-align: center;">9</p>  <p>98106</p>	<p>5p89 004 178 -Plug gauge, installation space, transmission housing, side shaft</p>	

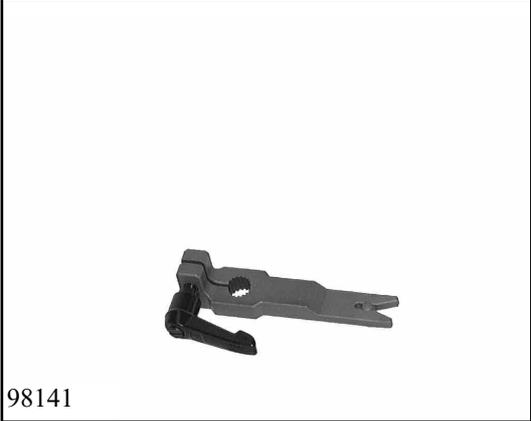
Remarks	Order-No. / Application	OBJECT
	<p>5p89 004 181 -Adjusting ring, clutch B, variant A (~ 17 mm)</p> <p>5p89 004 182 -Adjusting ring, clutch E, variant A (~ 24 mm)</p> <p>5p89 004 372 -Adjusting ring, clutch E, variant B (~ 21 mm)</p>	<p style="text-align: center;">10</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98131</p> </div> <p style="text-align: center;">11</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98132</p> </div> <p style="text-align: center;">12</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98133</p> </div>

OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">13</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98134</p> </div>	<p>5p89 005 403 -Adjusting ring, clutch B, variant B (~ 12 mm)</p>	
<p style="text-align: center;">14</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98305</p> </div>	<p>5x46 030 167 -Assembly bracket for pressing down cup spring B (equivalent to part 3 of device 5x46 000 167)</p>	<p>Identical 4 HP 14 Q 4 HP 18 Q 4 HP 22 5 HP 18 5 HP 24</p>
<p style="text-align: center;">15</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98135</p> </div>	<p>5x46 000 306 -Plug gauge, pump (moves easily)</p>	<p>Identical 4 HP 18 Q</p>

Remarks	Order-No. / Application	OBJECT
<p>Identical</p> <p>5 HP 18 5 HP 24 5 HP 30</p>	<p>5x46 000 763 -Work bench fixing device</p> <p>5x46 001 036 -Assembly bracket for pressing down the cup spring E</p> <p>5x46 001 046 -Assembly bracket for pressing down cup spring, brake C/D</p>	<p style="text-align: center;">16</p> <div style="text-align: right; margin-right: 20px;">91199</div>  <p style="text-align: center;">17</p> <div style="text-align: right; margin-right: 20px;">98137</div>  <p style="text-align: center;">18</p> <div style="text-align: right; margin-right: 20px;">98163</div> 

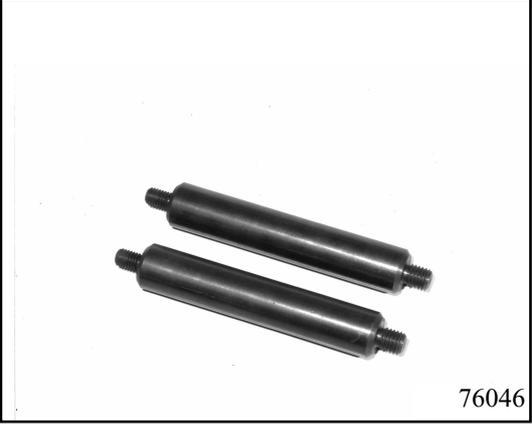
OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">19</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98138</p> </div>	<p>5x46 001 089 -Slotted nut insert, bearing plate</p>	
<p style="text-align: center;">20</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98142</p> </div>	<p>5x46 001 134 -Assembly drift, shaft seal, selector shaft</p>	
<p style="text-align: center;">21</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98139</p> </div>	<p>5x46 001 396 -Assembly bracket, transmission, complete</p>	

Remarks	Order-No. / Application	OBJECT
	<p>5x46 001 418 -Assembly sleeve, retaining ring, input shaft</p> <p>5x46 001 443 -Assembly fixture, piston D</p> <p>5x46 001 453 -Assembly drift, shaft seal, pump</p>	<p style="text-align: center;">22</p> <div data-bbox="890 477 1422 898" style="border: 1px solid black; padding: 10px;">  <p style="text-align: right;">98143</p> </div> <p style="text-align: center;">23</p> <div data-bbox="890 1037 1422 1458" style="border: 1px solid black; padding: 10px;">  <p style="text-align: right;">98144</p> </div> <p style="text-align: center;">24</p> <div data-bbox="890 1597 1422 2018" style="border: 1px solid black; padding: 10px;">  <p style="text-align: right;">98140</p> </div>

OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">25</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98141</p> </div>	<p>5x46 001 454 -Adjusting tool, position switch</p>	
<p style="text-align: center;">26</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98145</p> </div>	<p>5x46 001 775 -Assembly fixture (lifting) for input shaft with clutches B and E</p>	
<p style="text-align: center;">27</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98146</p> </div>	<p>5x46 002 123 -Adjusting device, preload, bearing plate</p> <p>Consisting of:</p> <ul style="list-style-type: none"> 5x46 012 123 measuring plate 5x46 022 123 spacer sleeve 5x46 032 123 measuring nut 5x46 042 123 measuring ring 	

Remarks	Order-No. / Application	OBJECT
	<p>5x46 001 937 -Dismantling tool for pistons B and E (compressed air)</p> <p>(tool corresponds to oil feeding bush 1019 201 069/072 + 3 three sealing sleeves 0734 401 130)</p> <p>5x46 001 955 -Core insert for ROLLEX extractor (side shaft)</p> <p>5x46 001 956 -Core insert for ROLLEX extractor (differential)</p>	<p style="text-align: center;">28</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98147</p> </div> <p style="text-align: center;">29</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98171</p> </div> <p style="text-align: center;">30</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98168</p> </div>

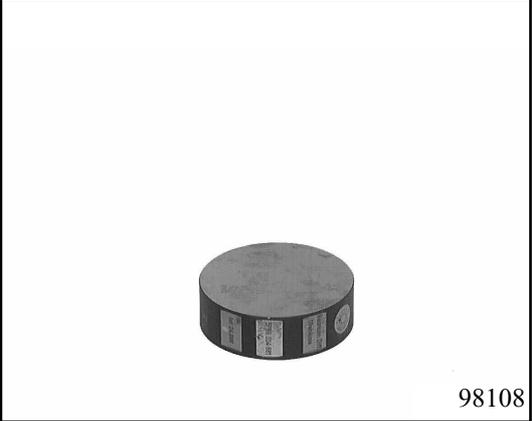
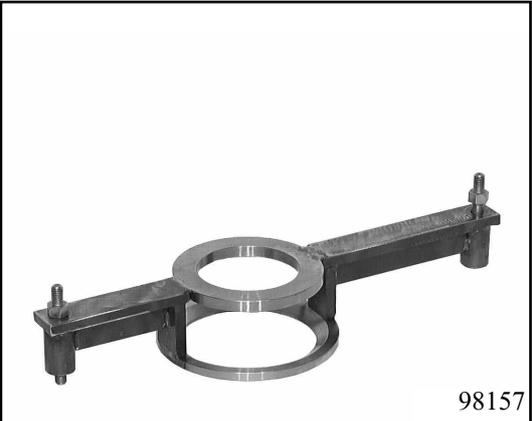
OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">31</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98170</p> </div>	<p>5x46 001 957 -Core insert for ROLLEX extractor (output spur gear)</p>	
<p style="text-align: center;">32</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98172</p> </div>	<p>5x46 001 999 -Core insert for ROLLEX extractor (side shaft)</p>	
<p style="text-align: center;">33</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98148</p> </div>	<p>5x46 002 033 -Drift dowl pin (selector shaft)</p>	

Remarks	Order-No. / Application	OBJECT
<p>Identical</p> <p>3 HP 22 4 HP 14 Q 4 HP 18 Q 4 HP 22 5 HP 18 5 HP 24 5 HP 30</p>	<p>5x56 000 090 -Extracting handles for converter (2 items)</p>	<p style="text-align: center;">34</p>  <p style="text-align: right;">76046</p>
<p>Identical</p> <p>4 HP 14 Q 4 HP 18 Q</p>	<p>5x46 021 007 Kukko extractor 21/7</p> <p>or</p> <p>5x46 021 007 Kukko extractor 21/8</p>	<p style="text-align: center;">35</p>  <p style="text-align: right;">98149</p>
<p>Identical</p> <p>4 HP 14 Q 4 HP 18 Q</p>	<p>5x46 022 002 Kukko extractor 22-2 (basic tool)</p>	<p style="text-align: center;">36</p>  <p style="text-align: right;">98150</p>

OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">37</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98151</p> </div>	<p>5x46 503 491 Rollex extractor Size IA (basic tool)</p>	<p>Identical 4 HP 18 Q</p>
<p style="text-align: center;">38</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98152</p> </div>	<p>5x46 010 011 Rollex extractor 1000/1 (basic tool)</p>	<p>Identical 3 HP 22 4 HP 14 Q 4 HP 18 Q</p>
<p style="text-align: center;">39</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98153</p> </div>	<p>5x46 013 011 Rollex extractor 13000/1 (spur gear, bearing plate)</p>	

Remarks	Order-No. / Application	OBJECT
<p>Identical</p> <p>4 HP 14 Q</p> <p>4 HP 18 Q</p>	<p>5x46 485 001</p> <p>Rollex extractor 48500</p> <p>(side shaft)</p>	<p style="text-align: center;">40</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98154</p> </div>
	<p>5x46 302 206</p> <p>Rollex extractor 30-32206/1</p> <p>(side shaft)</p>	<p style="text-align: center;">41</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98164</p> </div>
	<p>5x46 032 010</p> <p>Rollex extractor 32010X/1</p> <p>(differential)</p>	<p style="text-align: center;">42</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p style="text-align: right;">98155</p> </div>

OBJECT	Order-No. / Application	Remarks
<p data-bbox="427 409 464 443" style="text-align: center;">43</p> <div data-bbox="178 474 711 898" style="border: 1px solid black; padding: 10px;">  <p data-bbox="183 862 256 891">98156</p> </div>	<p data-bbox="767 427 1198 499">5x95 000 415 -Extractor handles, sealing sleeve</p>	

Remarks	Order-No. / Application	OBJECT
PSA only	5p89 004 681 -Plug gauge, installation space, transmission housing, differential	<p style="text-align: center;">44</p>  <p style="text-align: right;">98108</p>
PSA only	5p89 004 682 -Plug gauge, installation space, converter bell housing, differen- tial	<p style="text-align: center;">45</p>  <p style="text-align: right;">98109</p>
PSA only	5x46 001 051 -Fixture for dismantling/ assembly, cup spring, brake F	<p style="text-align: center;">46</p>  <p style="text-align: right;">98157</p>

OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">47</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98158</p> </div>	<p>5x46 001 450 -Drift, shaft seal, transmission housing, differential</p>	<p>PSA only</p>
<p style="text-align: center;">48</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98159</p> </div>	<p>5x46 001 451 -Drift, shaft seal, converter bell housing, differential</p>	<p>PSA only</p>

Remarks	Order-No. / Application	OBJECT
MB only	5p89 004 767 -Plug gauge, installation space, converter bell housing differential	<p style="text-align: center;">49</p>  <p style="text-align: right;">98110</p>
MB only	5p89 004 768 -Plug gauge, installation space, transmission housing, differential	<p style="text-align: center;">50</p>  <p style="text-align: right;">98111</p>
MB only	5x46 001 308 -Fixture for disassembly/ assembly, cup spring, brake F	<p style="text-align: center;">51</p>  <p style="text-align: right;">98160</p>

OBJECT	Order-No. / Application	Remarks
<p style="text-align: center;">52</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98161</p> </div>	<p>5x46 001 625 -Drift, shaft seal, transmission housing, differential</p>	<p>MB only</p>
<p style="text-align: center;">53</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98162</p> </div>	<p>5x46 001 627 -Drift, shaft seal, converter bell housing, differential</p>	<p>MB only</p>
<p style="text-align: center;">54</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>98169</p> </div>	<p>5x46 002 000 -Core insert for ROLLEX extractor (differential)</p>	<p>MB only</p>

1.8 Function tests

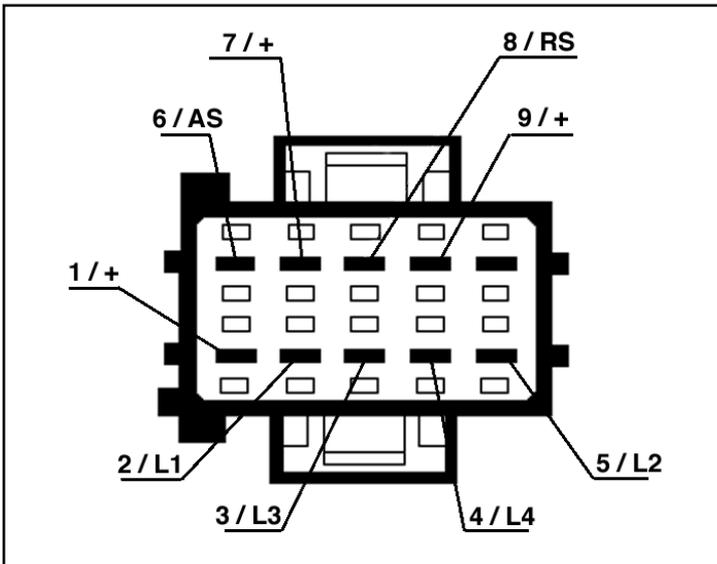
1.8.1 Position switch

1.8.1.1 PSA/RSA

Using a multimeter, make a resistance test on the switch according to the function table.

Code table

	P	Z1	R	Z2	N	Z3	D	Z4	3	Z4	2	Z4	1
L1	0	0	0	0	0	1	1	1	1	1	1	1	0
L2	0	0	0	1	1	1	1	1	1	1	0	1	1
L3	1	1	0	0	0	0	1	0	1	1	1	1	1
L4	0	1	1	1	0	0	0	1	1	1	1	1	1
AS	1		0		1		0		0		0		0
RS	0		1		0		0		0		0		0

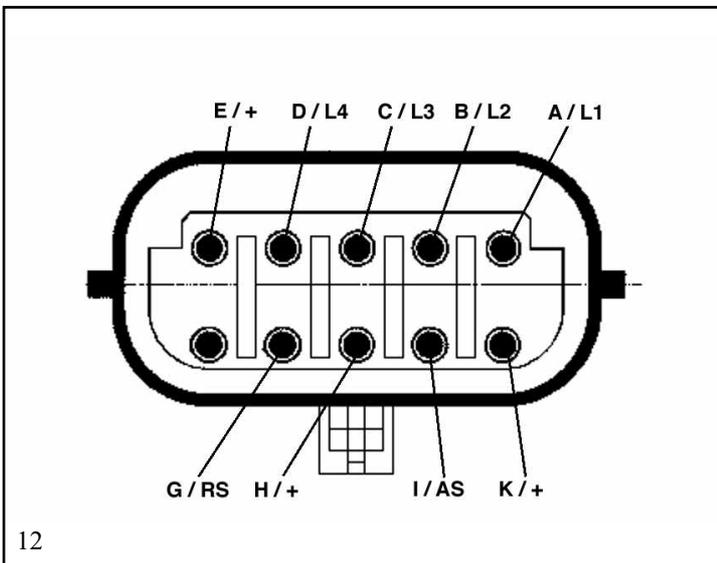


1.8.1.2 MB/FIAT

Using a multimeter, make a resistance test on the switch according to the function table.

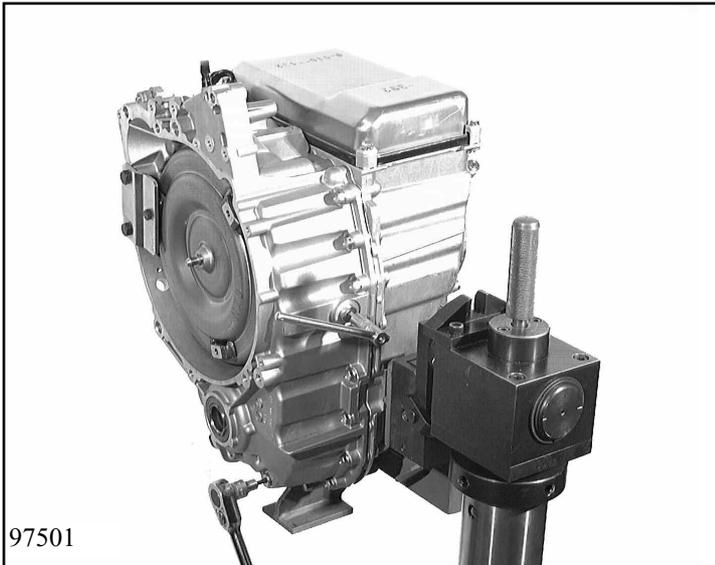
Code table

	P	Z1	R	Z2	N	Z3	D	Z4	3	Z4	2	Z4	1
L1	0	0	0	0	0	1	1	1	1	1	1	1	0
L2	0	0	0	1	1	1	1	1	1	1	0	1	1
L3	1	1	0	0	0	0	1	1	0	1	1	1	1
L4	0	1	1	1	0	0	0	1	1	1	1	1	1
AS	1		0		1		0		0		0		0
RS	0		1		0		0		0		0		0



2. Disassembly

2.1 Removing converter, control unit

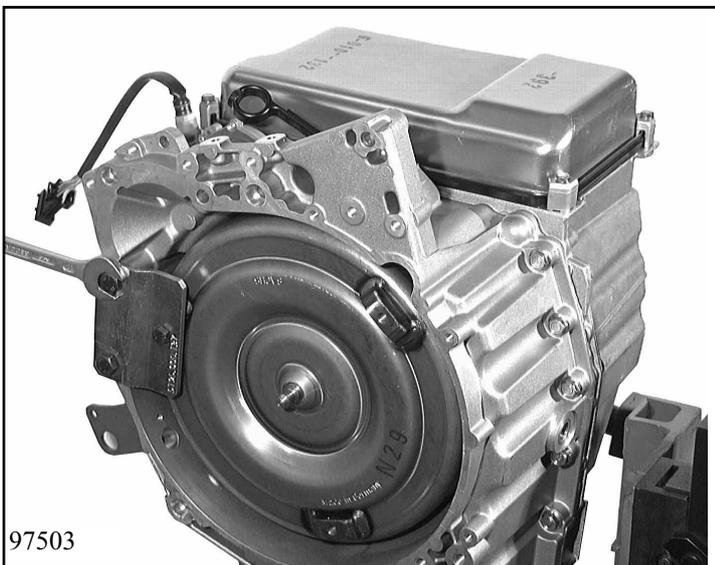


Clamp the transmission into retaining bracket 5x46 001 396 and fasten onto the assembly trolley, possibly in work bench fixing device 5x46 000 763.

Turn the transmission with oil pan upwards.

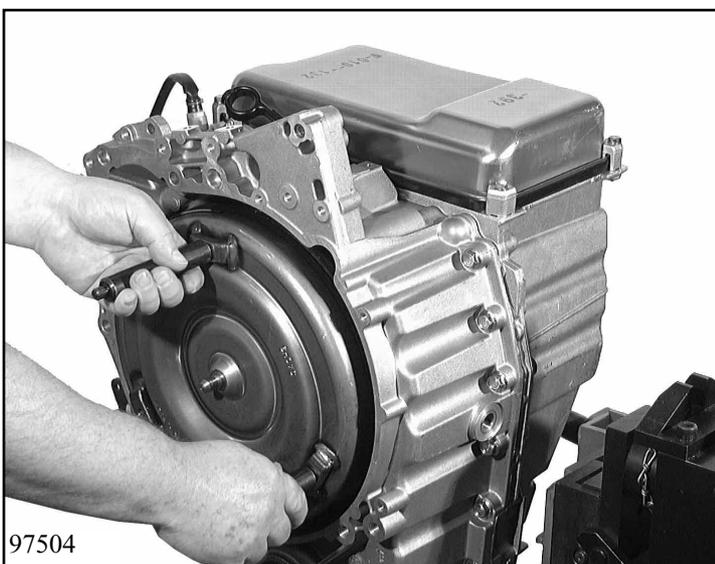
Unscrew two oil drain plugs and let the oil drain.

(Wrench size = Internal hexagon, 8 mm
Wrench size = Internal hexagon, 6 mm)



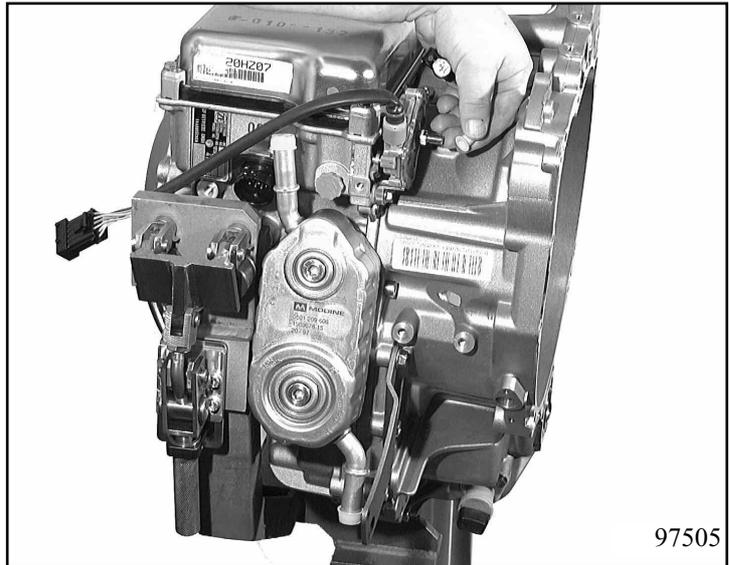
Remove converter retaining bracket with fastening screws.

(Wrench size = 17 mm
Wrench size = 13 mm)



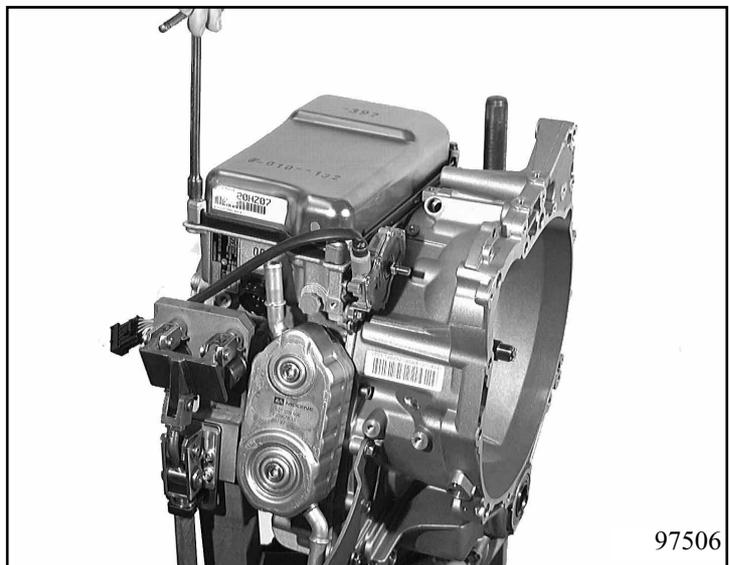
Using the converter extracting handles 5x56 000 090, lift the converter out.

Remove the transport plugs from the oil cooler and selector shaft.
Take out the oil dipstick., if there is one.



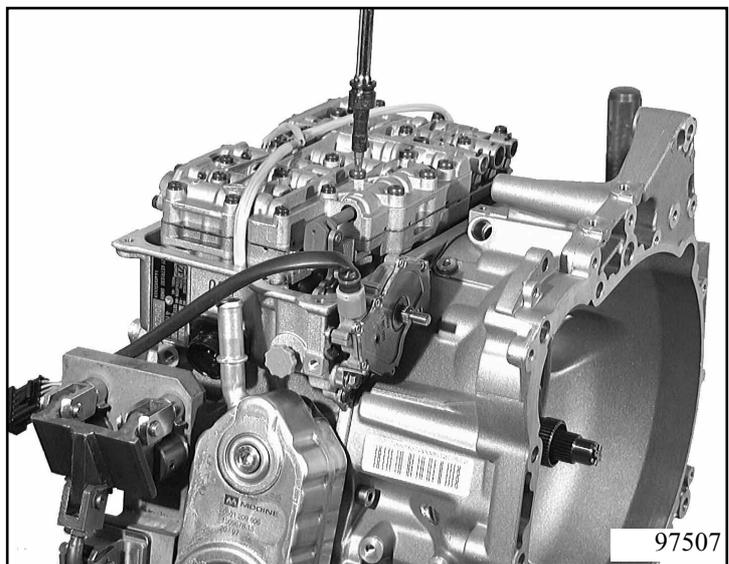
Loosen the screws and take off the oil pan. Remove the seal from the oil pan.

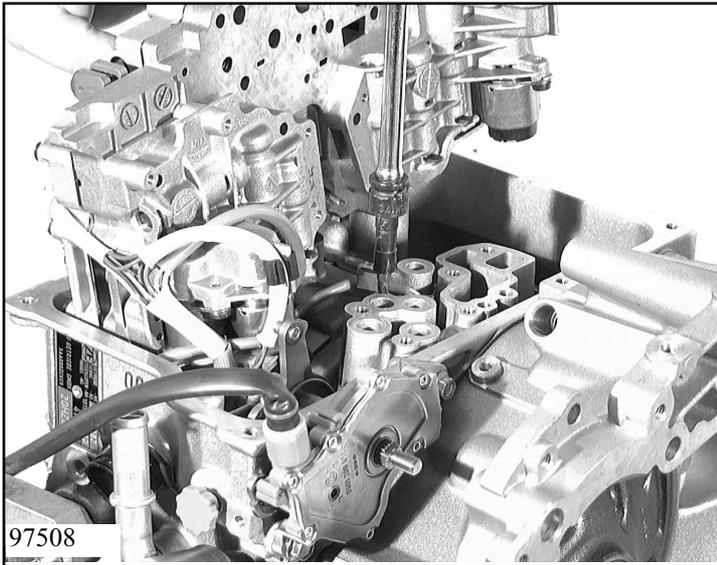
(Wrench size = 10 mm)



Unscrew the screws (large head) on the control unit, screw off the holder for the inductive transmitter, and tilt the control unit.

(Torx TX-27)



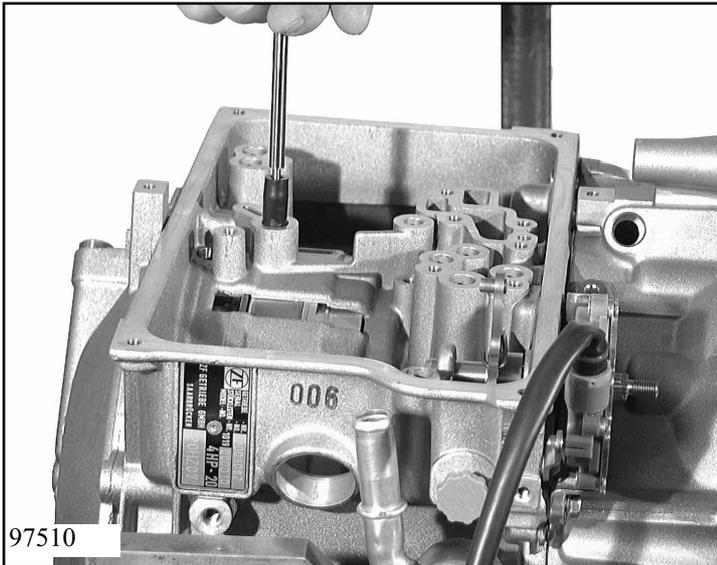


Loosen the fastening screw for the inductive transmitter under the control unit. Then lever the cable out of the retaining clip and pull out the inductive transmitter.

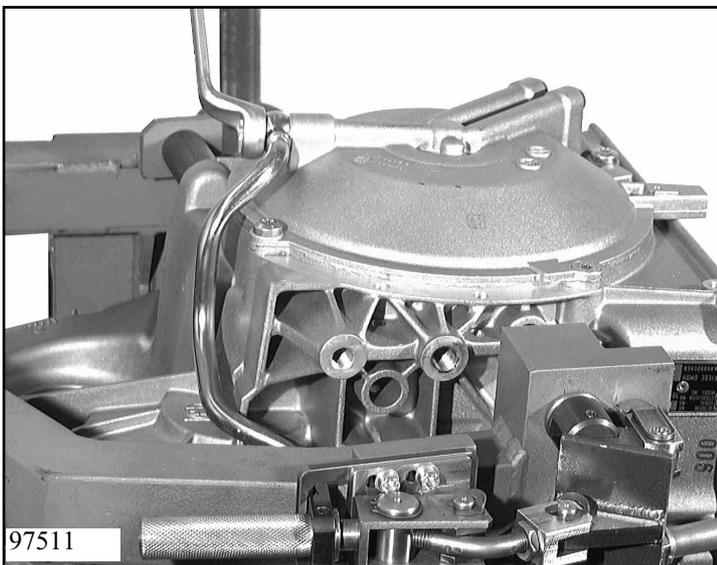


Separate the retaining clip from the plug, press the plug into the transmission housing, and remove the complete control unit. Then remove the cable clips.

2.2 Removing clutch B/E

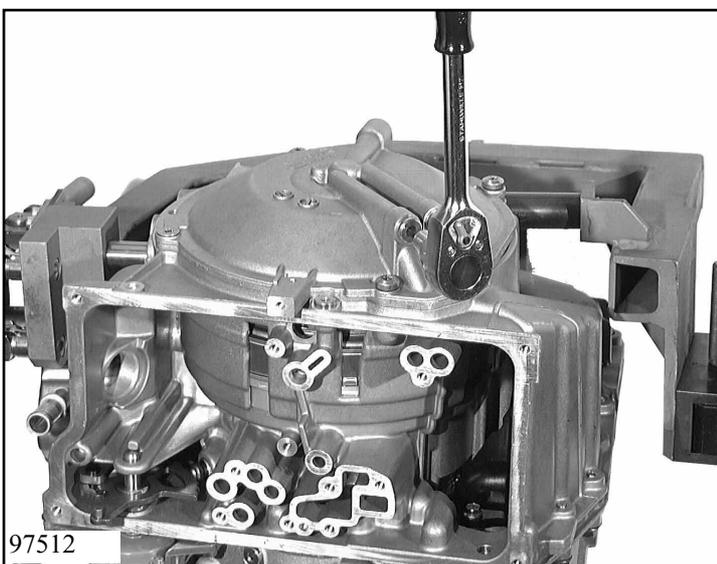


Pull out sealing sleeves (brake C) with extracting tool 5x95 000 415.
Turn transmission by 90°.



Unscrew the oil tube and remove the retaining plate, screws and oil tube.
Take the O-ring and sealing rings off the oil tube.

(Wrench size = 19 mm
Wrench size = 13 mm)

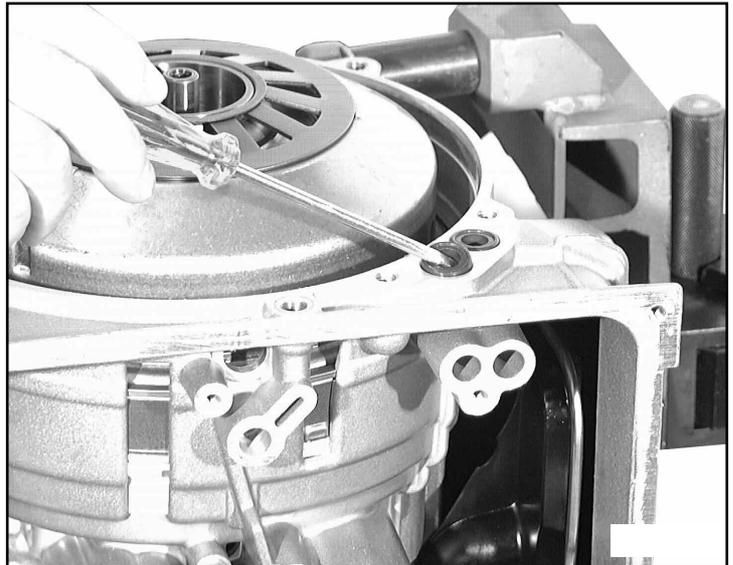


Unscrew the two plugs from the cover and remove the screw plug from the transmission housing.
Loosen the five Torx screws on the cover and remove the cover.

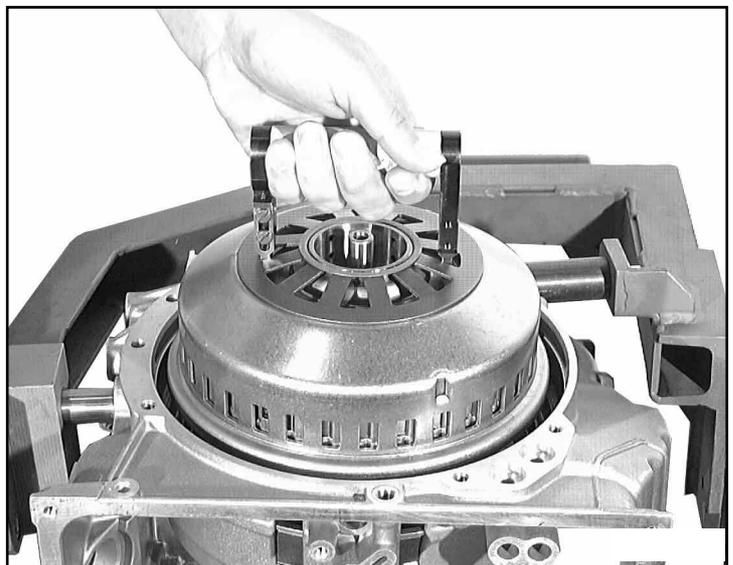
(Wrench size = Internal hexagon, 6 mm
Wrench size = Internal hexagon, 5 mm)

(Wrench size = Torx TX-40)

Remove the two sealing rings (clutch B/E).

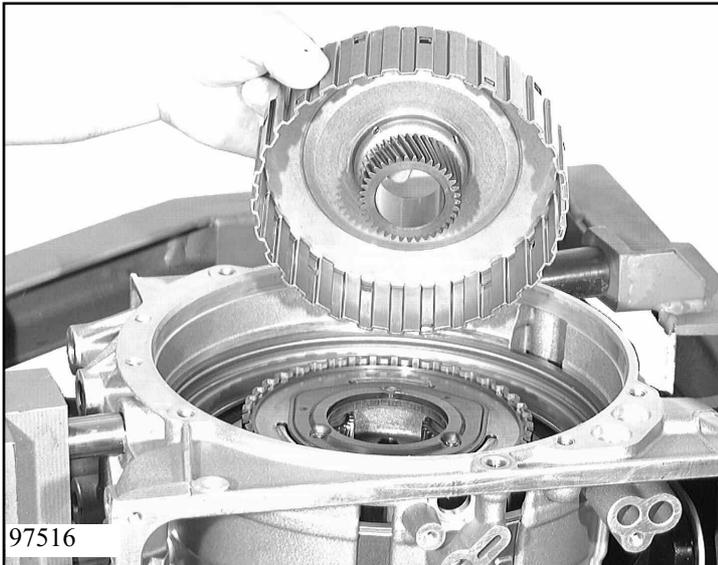


Take out input shaft with clutch B/E using device 5x46 001 775.
Take needle roller bearing and shim out of clutch B/E.



Remove needle roller bearing and thrust washer.

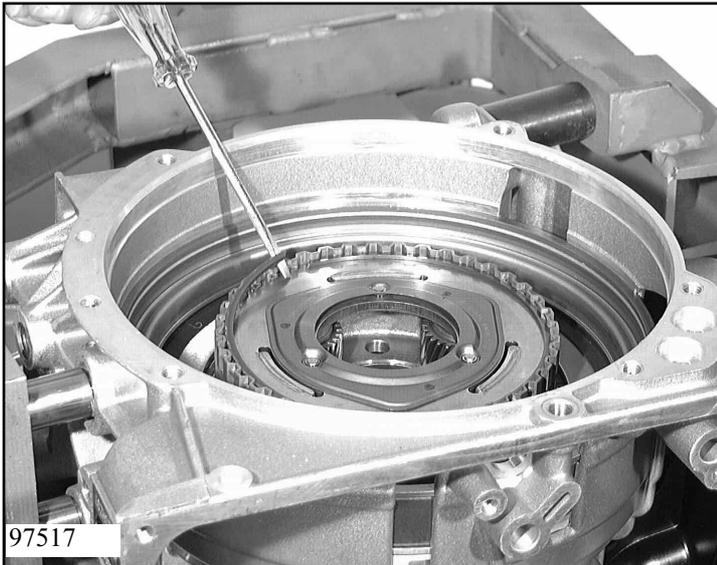




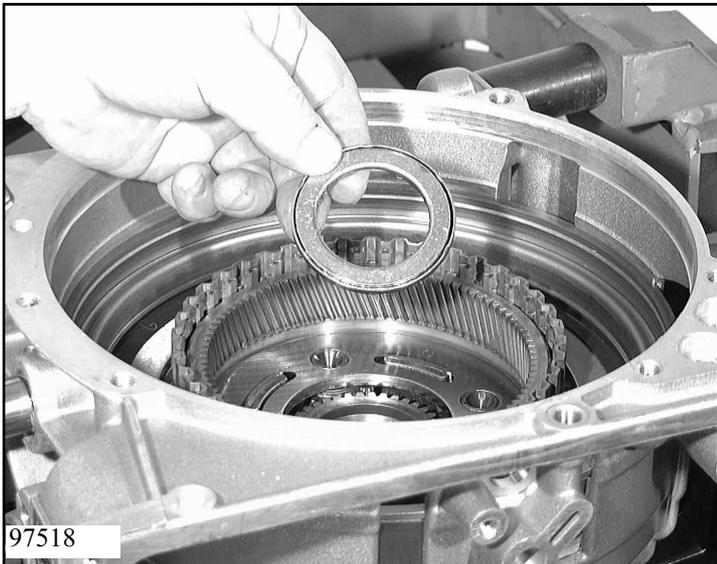
Remove sun wheel with inner disc carrier
B/C.

2.3 Removing and dismantling planetary gear set I + II

Remove snap ring from ring gear I, and take out planetary gear set II.



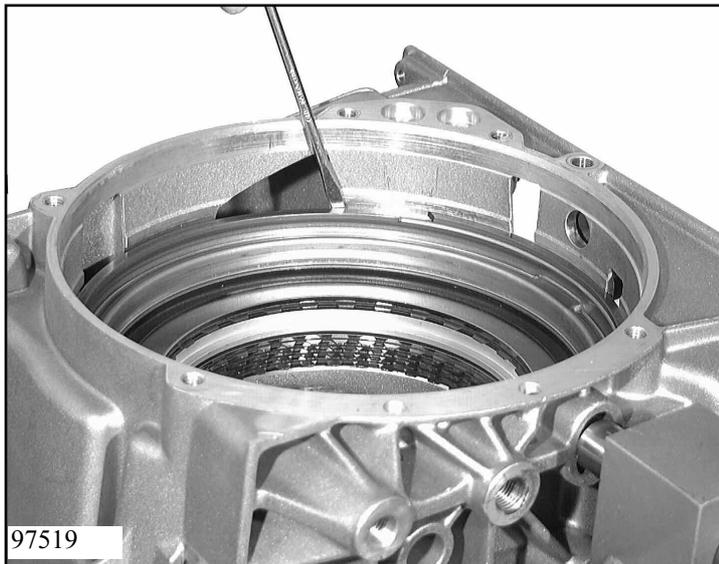
Remove the axial needle roller bearing. Take out planetary gear set I with ring gear II, sun wheel I and oil trays. Take oil trays and sun wheel I off the planetary gear set.



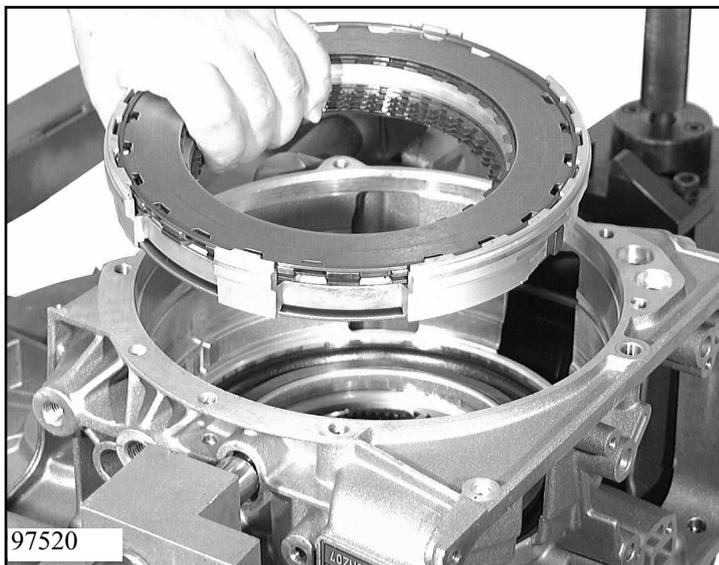
Take out ring gear I.
Remove snap ring from sun wheel I.



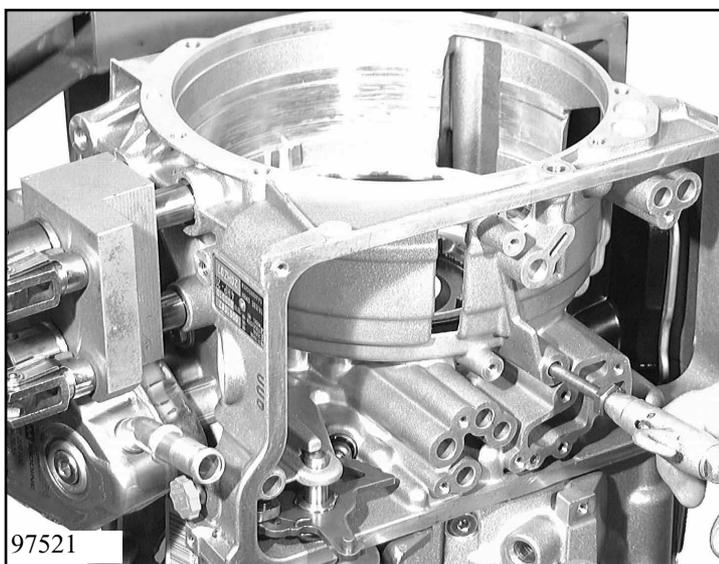
2.4 Taking out brake C and D



Take snap ring out of transmission housing and remove cylinder with piston C.



Take disc carrier C/D with clutch packs and spring clutch disc off piston D.



Release piston D (by applying compressed air to the feed bore) and remove it.

Turn transmission by 180°.

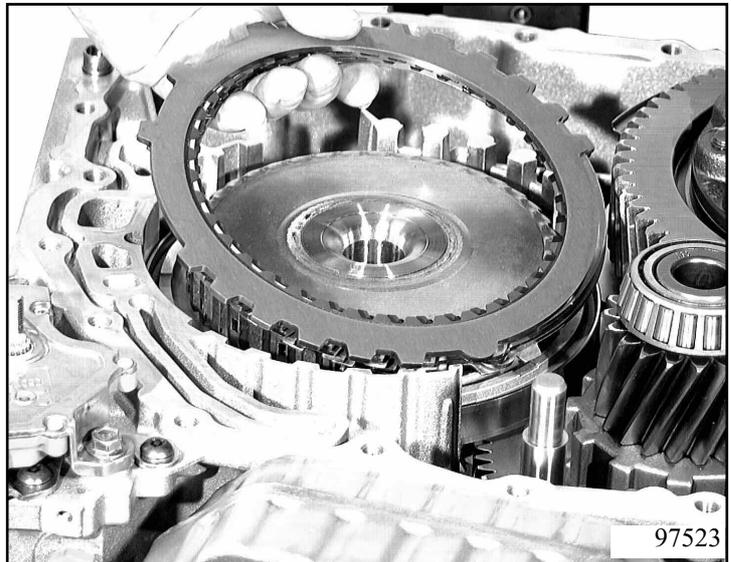
Loosen the converter bell housing screws, and remove the retaining strap and converter bell housing.
Lift off paper and metal gaskets.

(Wrench size = 13 mm)

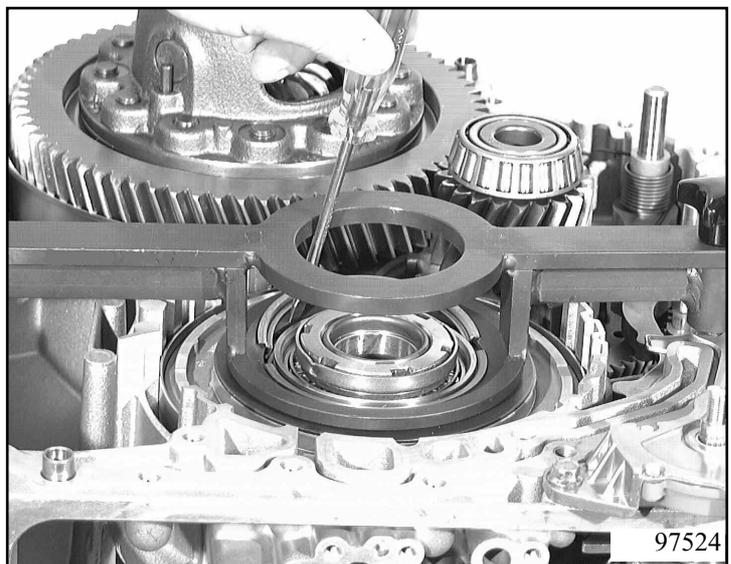
(Wrench size = Torx TX-40)



Take off the clutch pack and the brake F inner disc carrier.

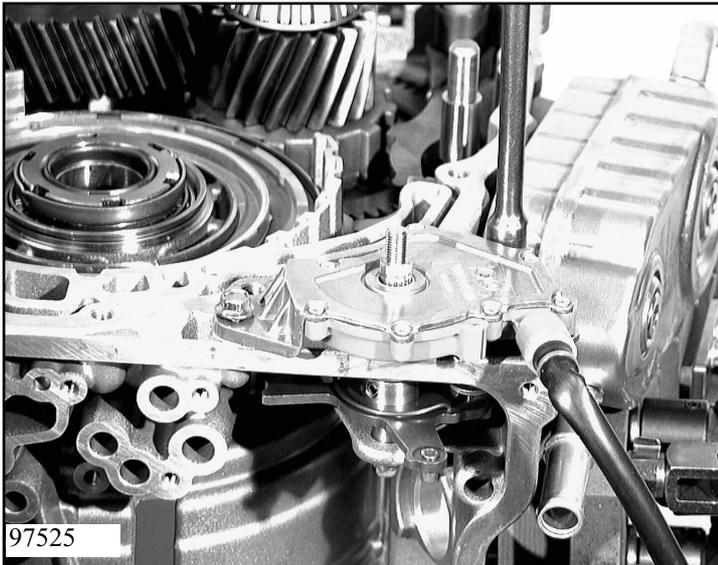


Release the slotted nut lock, mount fixture 5x46 001 051 and remove the brake F split stop ring.
Remove the fixture and take off the cup spring.



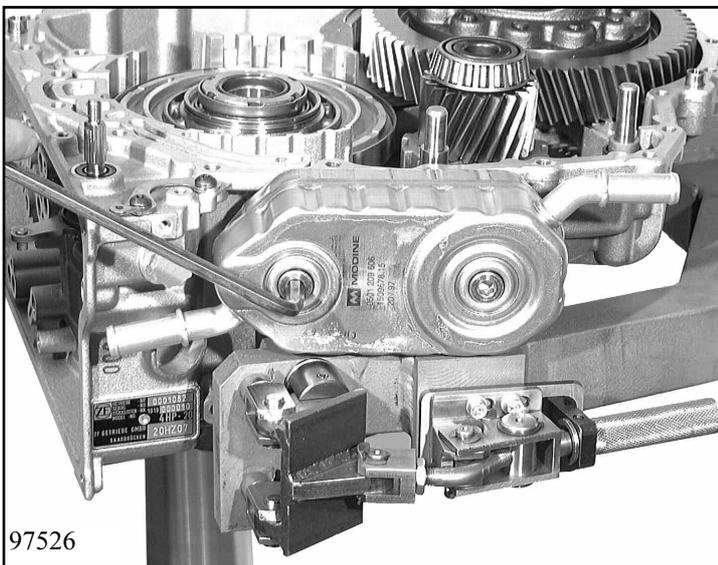
Important!

Other applications may require a different assembly fixture.



Move selector lever to the “N” position. Remove the position switch screws and take off the position switch.

(Wrench size = 10 mm)

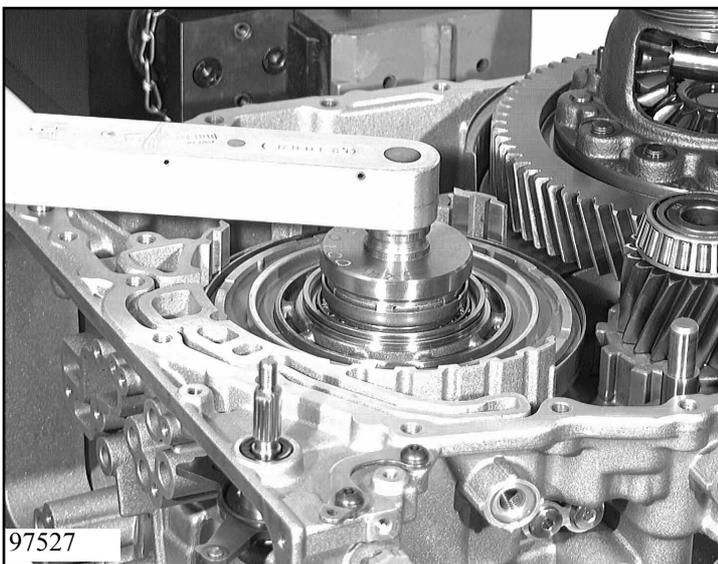


Loosen the two union screws on the oil cooler and take off the oil cooler.

(Wrench size = Internal hexagon, 8 mm)

Important!

Take note of the oil cooler seals.



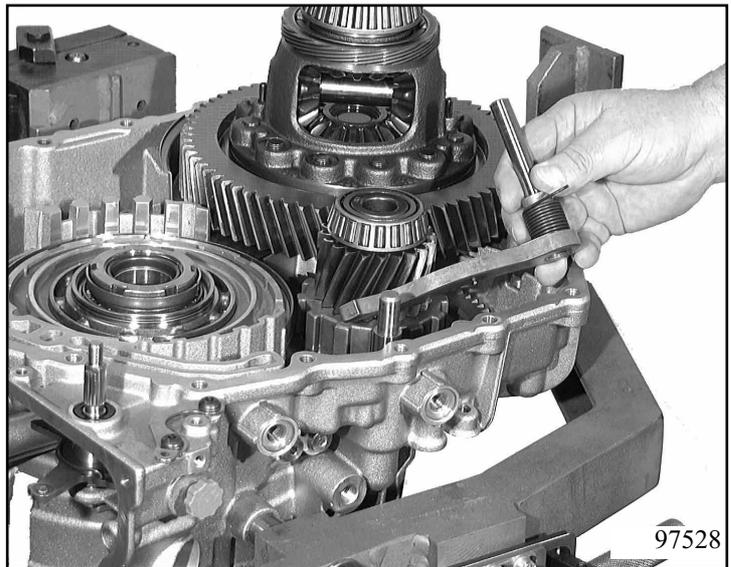
Set the parking lock so that the slotted nut is held steady and can be removed. To do this, use the selector shaft to move to position P.

Loosen the slotted nut with slotted nut wrench 5x46 001 089.

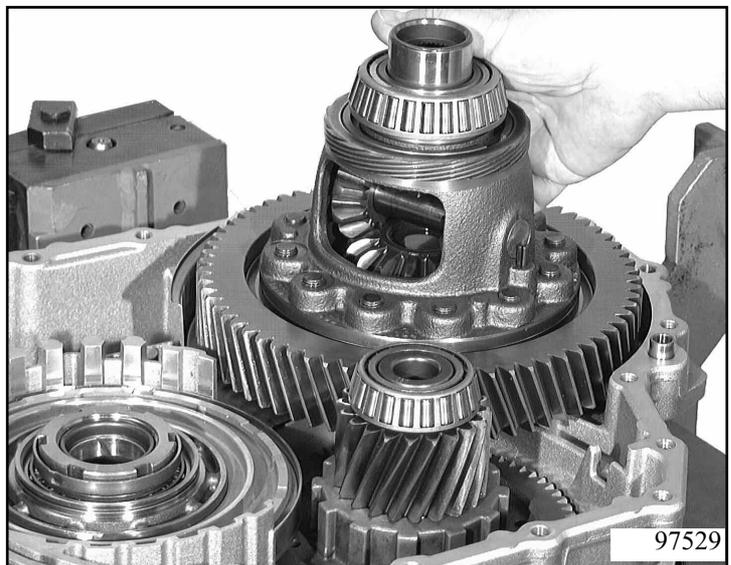
Release the parking lock.

Take off the parking lock mechanism's bolt, pawl, leg spring and support bolt. Unscrew and remove the guide plate.

(Wrench size = Torx TX-27)

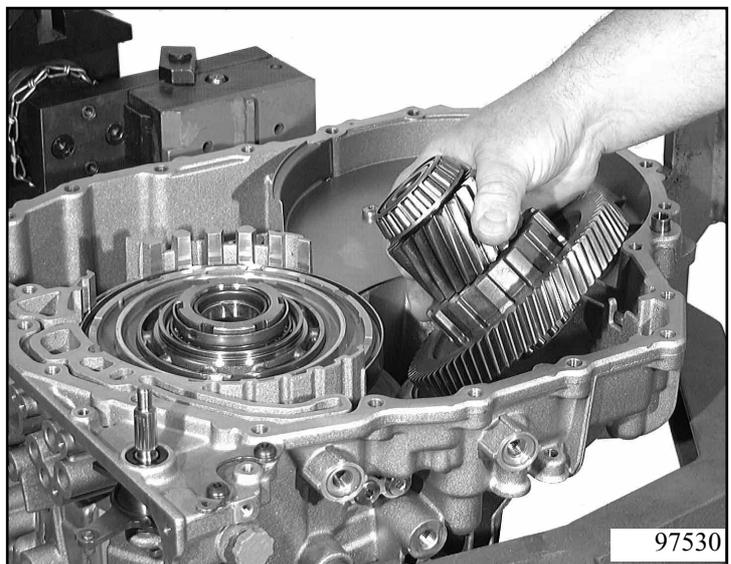


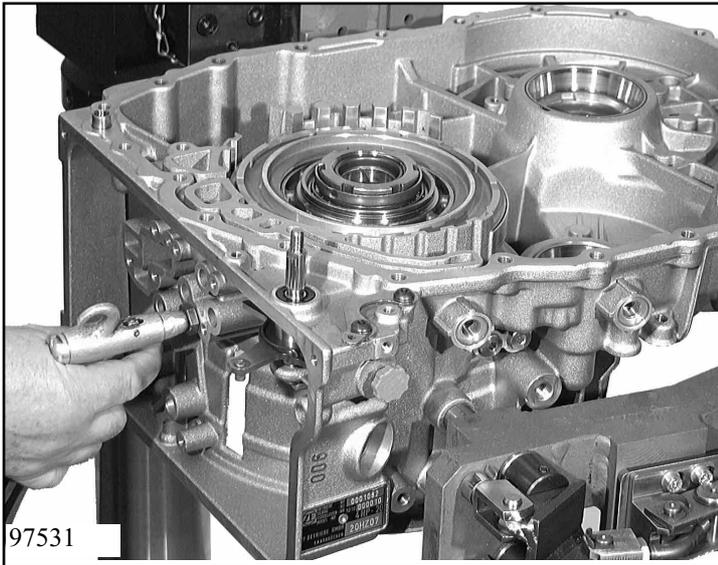
Lift out the differential.



Tilt and remove the side shaft. Unscrew and remove the oil tray.

(Wrench size = Torx TX-27)





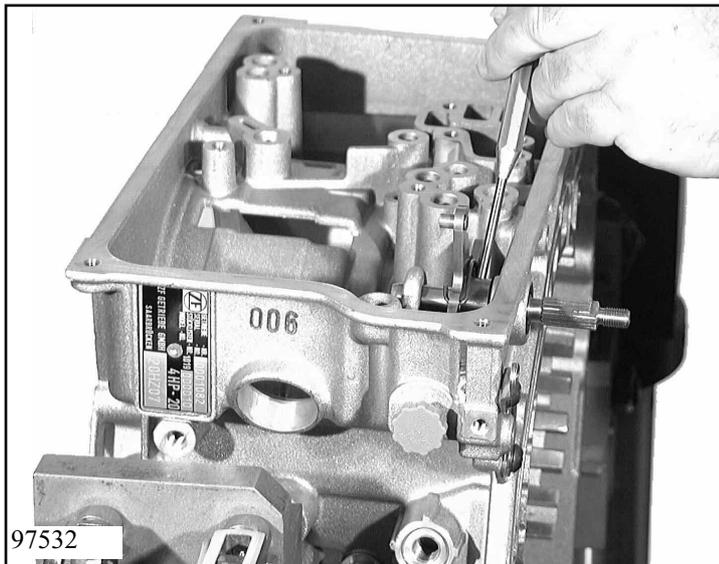
Release and remove piston F by applying compressed air to the bore.
Take the two O-rings off piston F.
Remove bearing plate with spur gear.

(Wrench size = Torx - E10)

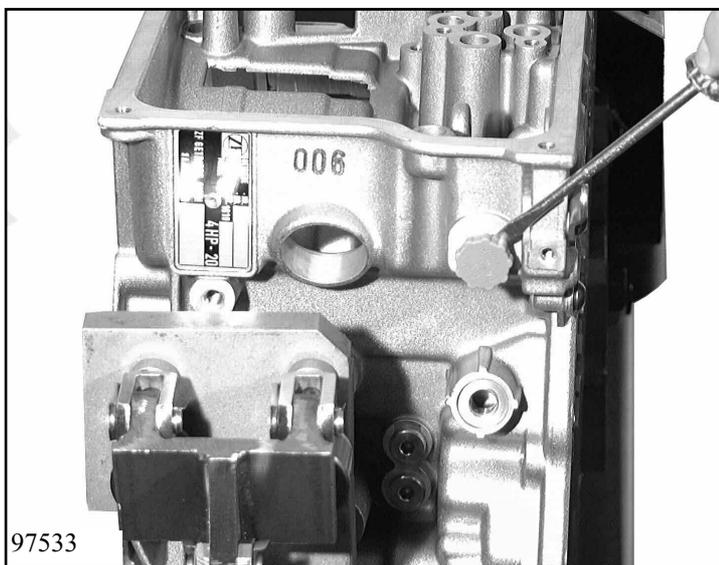
Important!

Since the bearing seat is tight, press the bearing plate upwards from underneath to remove it.

2.5 Removing shifting mechanism and ancillaries

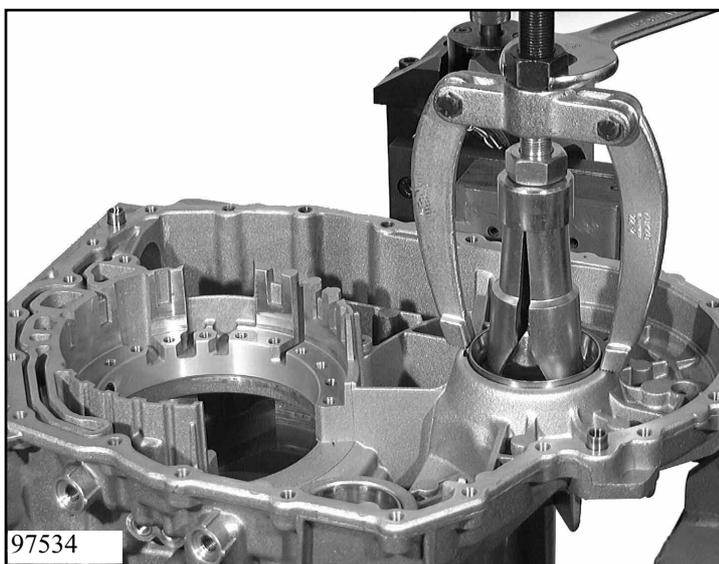


Turn the transmission by 90°.
Drive out slotted pin.
Take out selector shaft and detent disc with locking cams and disassemble into the individual parts.
Then remove the stop bush and sealing ring.



Use a screwdriver to remove the breather cover and unscrew the rest of the plugs.
Drive out the differential shaft seal.

(Wrench size = Internal hexagon, 5 mm)



Turn the by transmission 90° and remove the two bearing shells with the Kukko extractor. Remove the bearing shim.

(Kukko extractor 5x46 021 007 or 5x46 021 008 combined with basic tool 5x46 022 002).

Note!

The two centering bushes, the position switch adjusting plate and the breather normally remain installed.

2.6 Dismantling the converter bell housing

Take off the oil filter by loosening the retaining screw.

Pull off the O-ring.

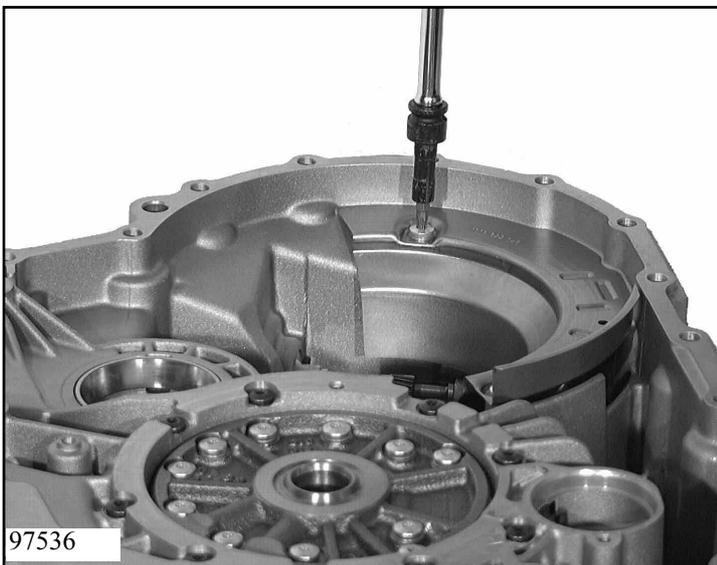
Unscrew the oil tank.

(Wrench size = 10 mm)



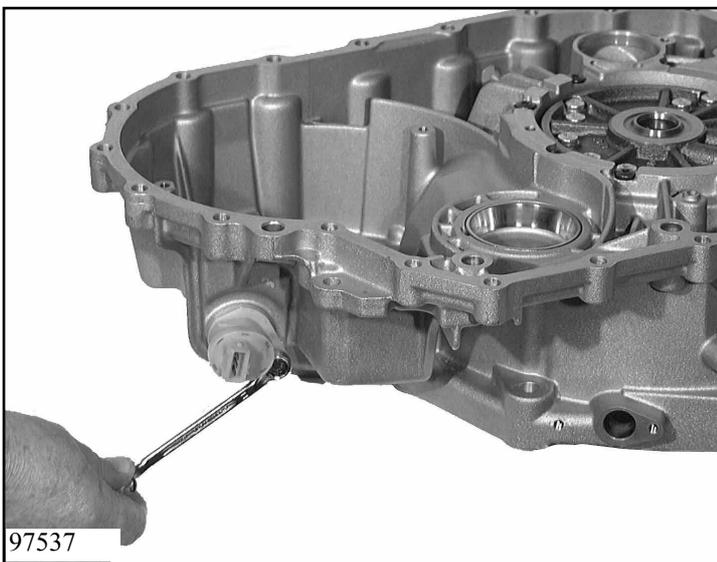
Unscrew and remove the oil tray. Pull off the magnets.

(Wrench size = Torx TX-27)



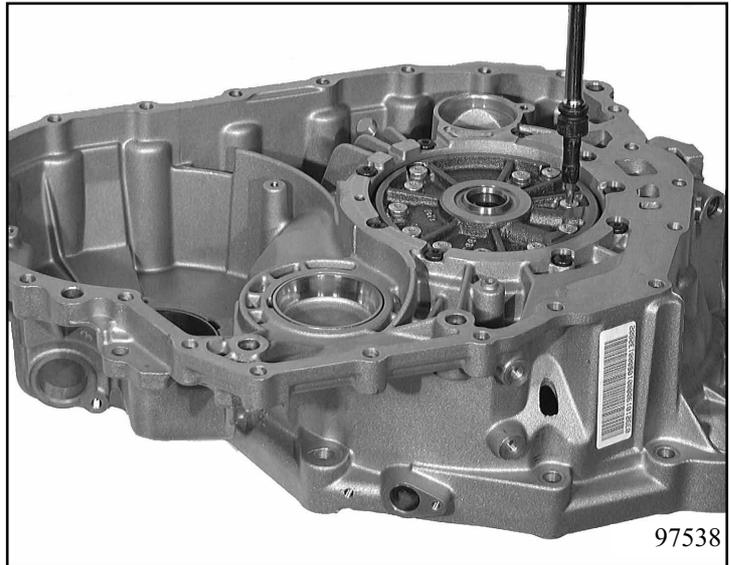
Take off the protective cap and hexagon screw for the speedometer connection. Then remove the speedometer pinion shaft and connection.

(Wrench size = 11 mm)

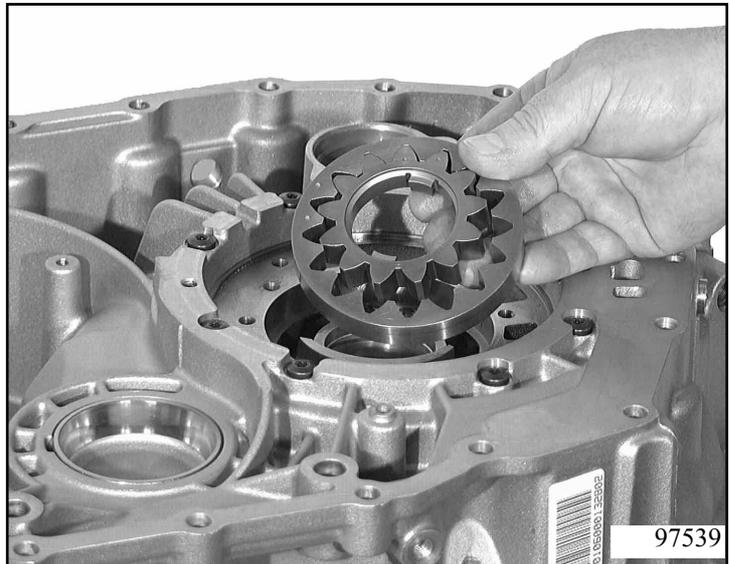


Loosen the stator shaft screws and take out the stator shaft by tapping it slightly with a plastic hammer.

(Wrench size = Torx TX-27)



Take out the pump wheel and ring gear. Then unscrew and press out the pump housing. Pull off the O-ring, and remove the centering sleeve. Lever out the shaft seal pump and remove the guide ring.

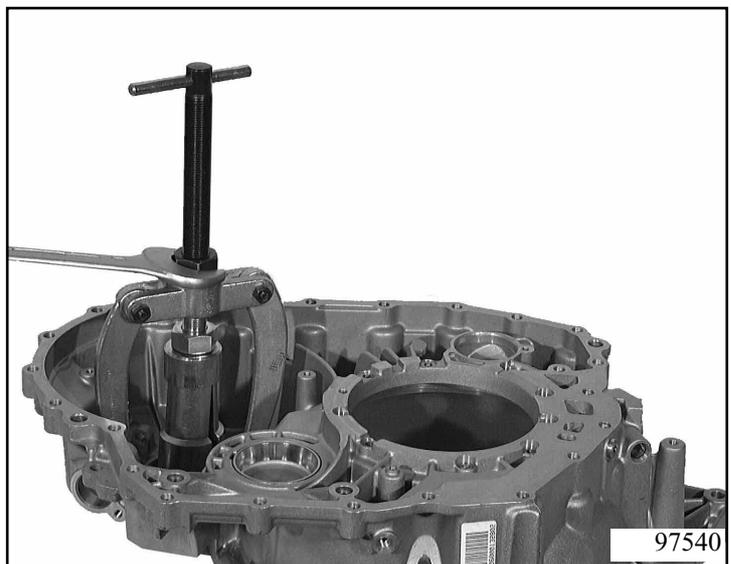


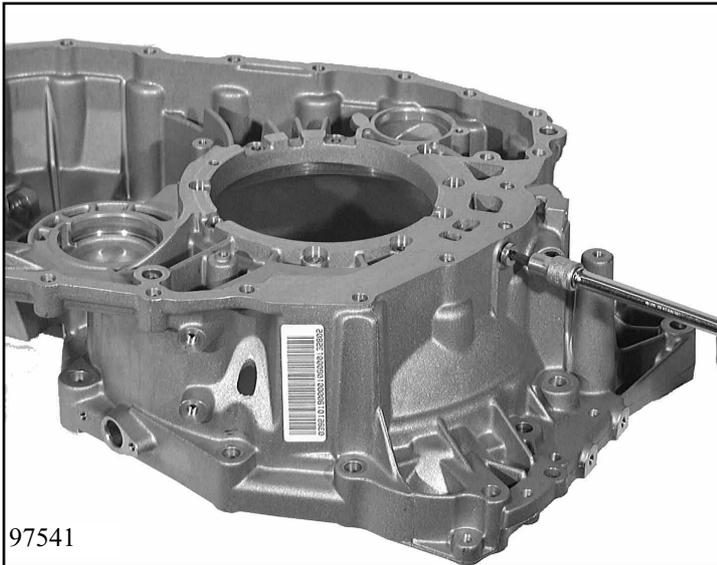
Drive out the differential shaft seal. Remove the bearing shells with Kukko extractor.

(Kukko extractor 5x46 021 007 or 5x46 021 008 combined with basic tool 5x46 022 002)

Important!

To prevent possible running noises later, keep the bearing shells together with the correct taper roller bearing.





Unscrew the screw plug from the converter bell housing.

(Wrench size = Internal hexagon, 5 mm)

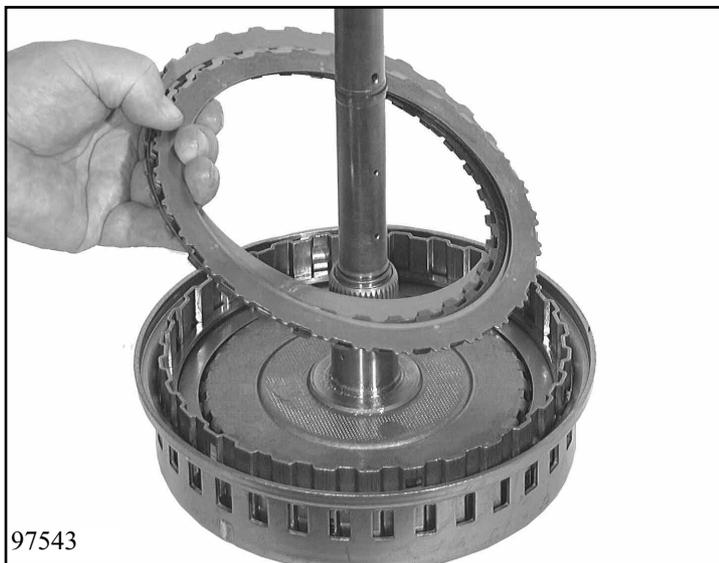
2.7 Dismantling clutch B/E, and brake C/D

2.7.1 Dismantling clutch B/E

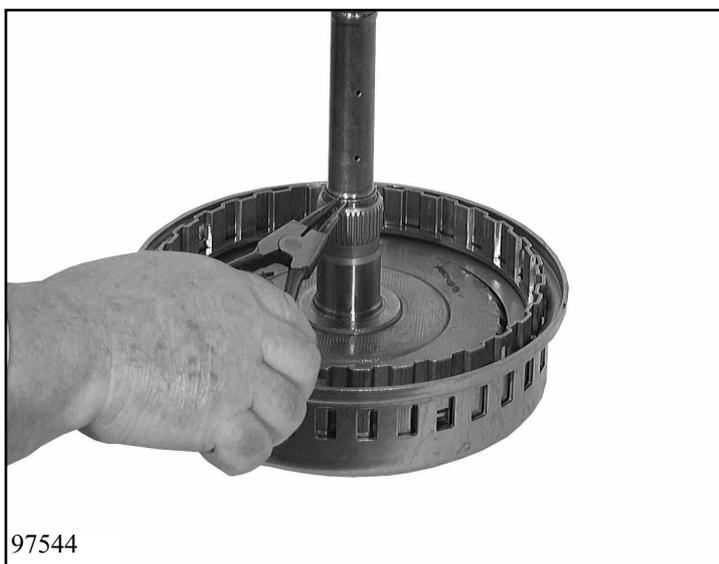
Take out the retaining ring and remove the cup.



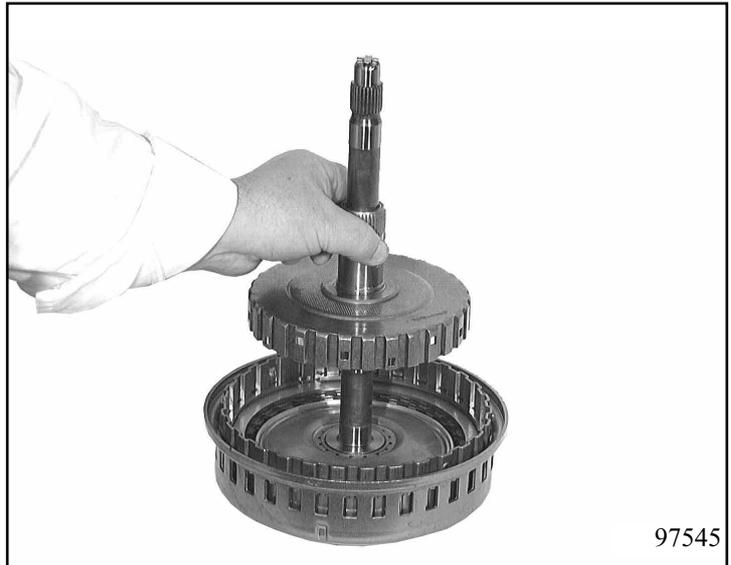
Remove clutch pack B.



Remove the rectangular-section ring for the input shaft and the retaining ring.



Remove inner disc carrier E and axial needle roller bearing.



Take out the snap ring.
Remove clutch pack E.



Press down cup spring (clutch E) with assembly fixture 5x46 001 036 and remove split stop ring.
Remove the oil dam and cup spring.
Pull the O-ring off the oil dam.

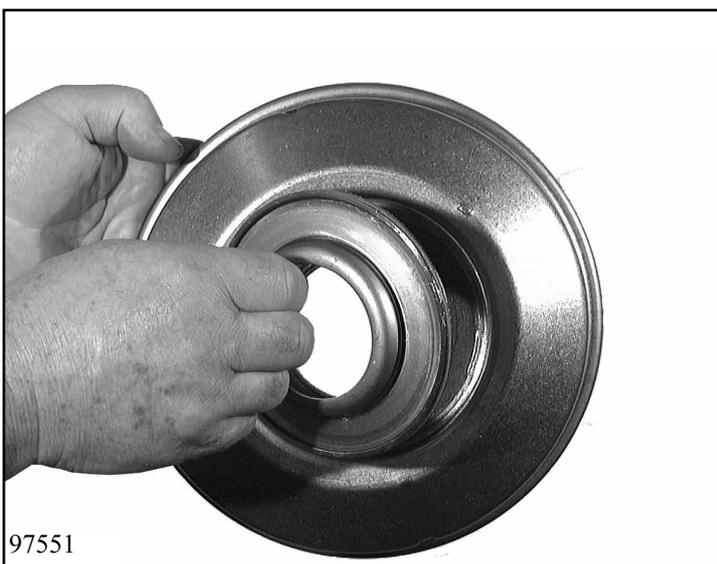




Press down cup spring (clutch B) with assembly fixture 5x46 030 167 and remove the split stop ring. Take out the cup spring.



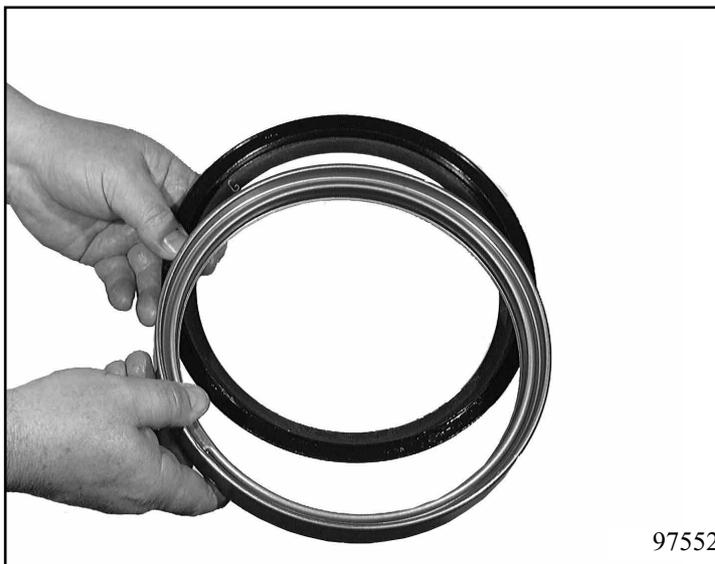
Put disassembly tool 5x46 001 937 in cylinder B/E. Blow out pistons B and E with compressed air. Pull out disassembly tool.



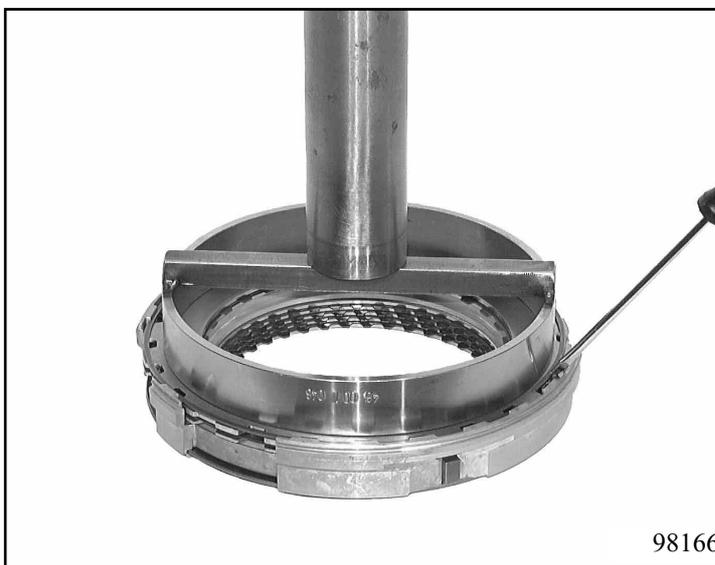
Take oil dam off piston B and remove O-ring. Remove the two O-rings from cylinder B. Take one O-ring off piston E and one off cylinder E.

2.7.2 Dismantling brake C/D

Press piston C out of cylinder C.



Hold down cup spring (brake C) with assembly fixture 5x46 001 046 and remove snap ring. Then take out the final disc, cup spring, and clutch pack.



Turn over disc carrier C/D and remove snap ring (brake D) with assembly fixture 5x46 001 046 by pressing down the cup spring. Then remove the clutch pack and cup spring.



Note !

If the fitting keys are not loose, leave them on the disc carrier.

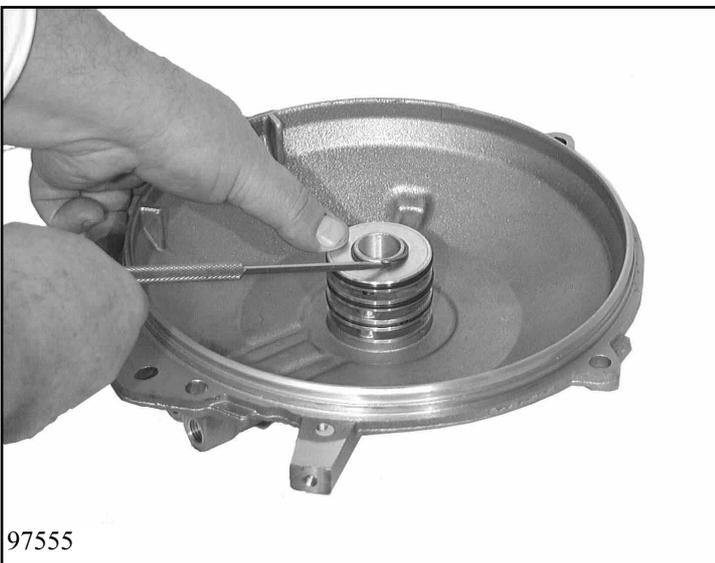
2.8 Dismantling the cover, bearing plate, side shaft and differential

2.8.1 Dismantling the cover

Important!

There may be a ball installed in the dowel pin bore under the oil feeding bush.

Danger of loss!



Remove the O-ring from the cover.
Press downward on the oil-feeding bush and take it off after removing the snap rings.
Remove the three rectangular-section rings from the oil-feeding bush. Leave the dowel pin in the bush.
Take the three sealing sleeves out of the cover.

2.8.2 Dismantling the bearing plate.



Remove the slotted nut and the retaining ring.
Press the output spur gear out of the bearing plate with a suitable pressure piece in the mandrel press.
Take off the bearing inner ring's adjusting ring.

Take the bearing inner ring out of the bearing plate.



Use the Kukko internal extractor to take the bearing outer rings out of the bearing plate.

(Kukko extractor 5x46 021 008 combined with basic tool 5x46 022 002)



Take the bearing inner ring off the output spur gear using the Rollex extractor disassembly tool 5x46 013 001, core piece 5x46 001 957 and Rollex basic tool 5x46 503 491.



2.8.3 Dismantling the side shaft



Take the bearing inner ring off the side shaft using Rollex extractor 5x46 485 001, core piece 5x46 001 955 and Rollex basic tool 5x46 010 011.

Remove the second bearing inner ring from the side shaft using the Rollex extractor 5x46 302 206, core piece 5x46 001 999 and basic tool 5x46 001 011.

2.8.4 Dismantling the differential



Remove both bearing inner rings with Rollex extractor 5x46 032 010, core piece 5x46 001 956 and Rollex basic tool 5x46 503 491.

Then unscrew and remove the spur gear from the differential body.

(Depending on the version:

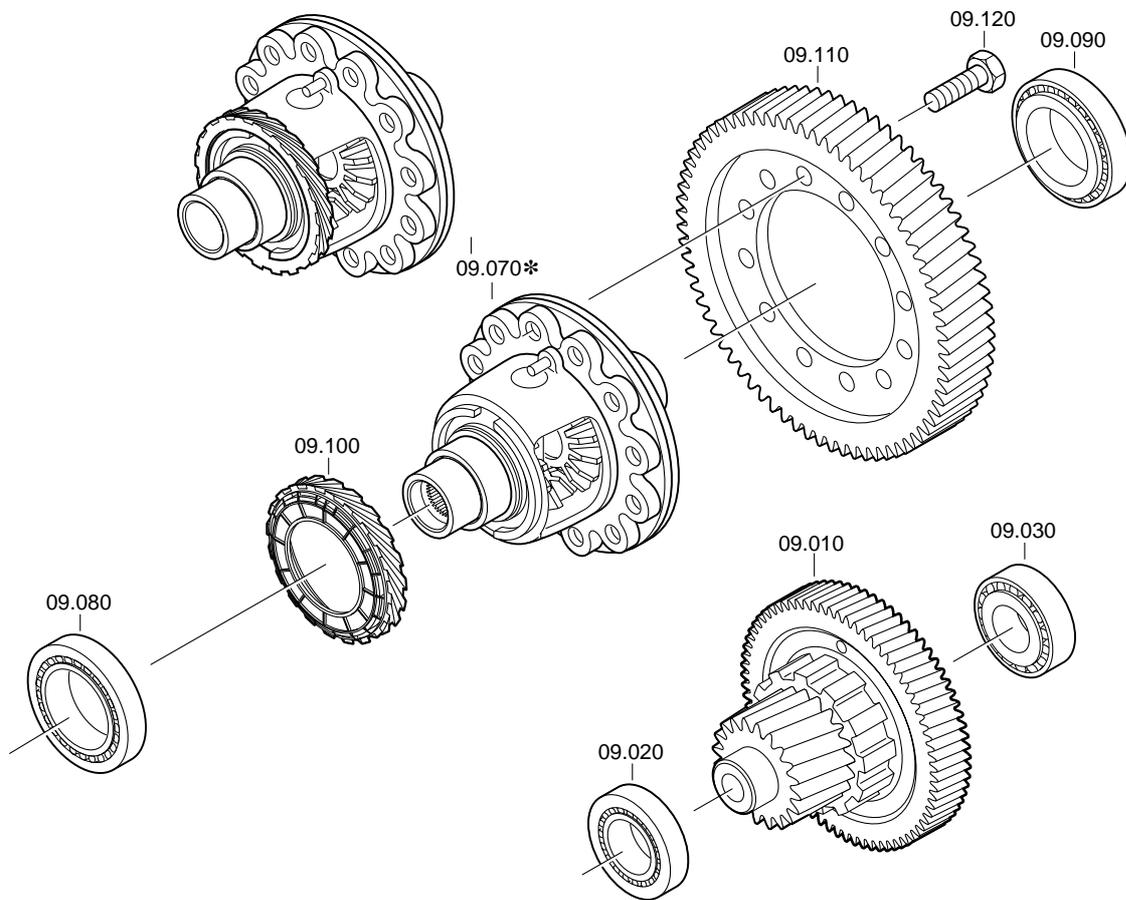
Wrench size = 19 mm or Torx E14)

Important!

Core piece 5x46 002 000 is additionally used for other applications.

3. Assembly

3.1 Completing the differential and side shaft



3.1.1 Completing the differential



Tightly fasten spur gear 09.110 crosswise with 12 screws 09.120 onto the differential body 09.070.

Mount bearing inner rings 09.080, 09.090 on the differential using a suitable tool in the mandrel press.

(See Chapter 1.5 for tightening torques)

Important!

If the speedometer worm is made of plastic, it must be put on the differential body before the bearing inner ring.

97562

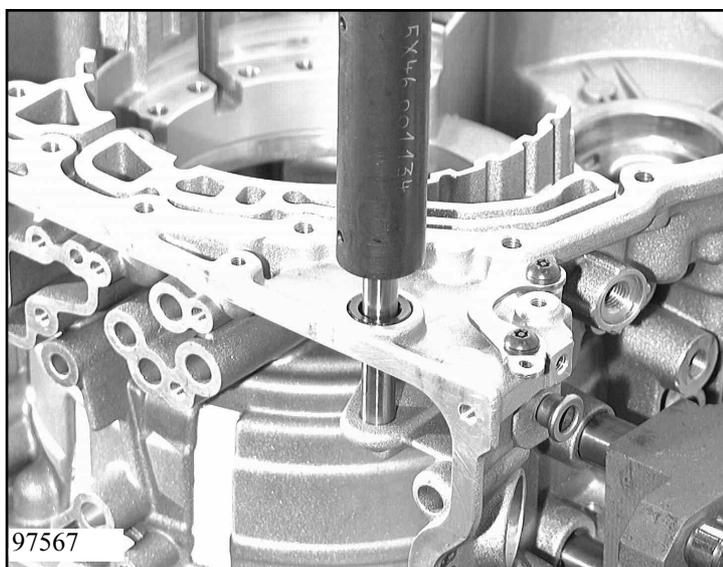
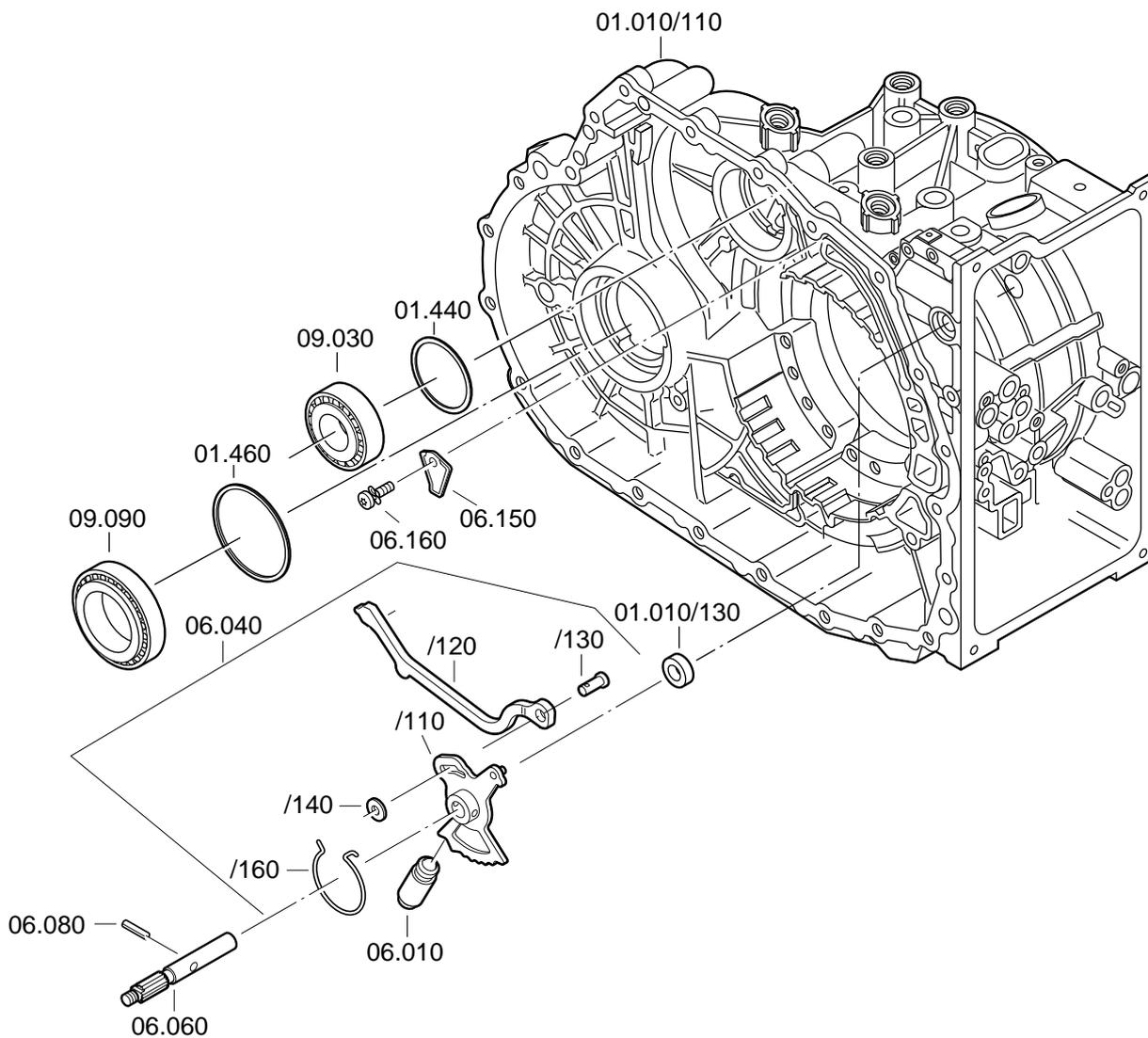
3.1.2 Completing the side shaft

Mount both bearing inner rings
09.020/09.030 on side shaft 09.010 using
a suitable tool in the mandrel press.



3.2 Installing the parking lock mechanism and bearing shells in the housing

3.2.1 Installing the parking lock mechanism in the housing

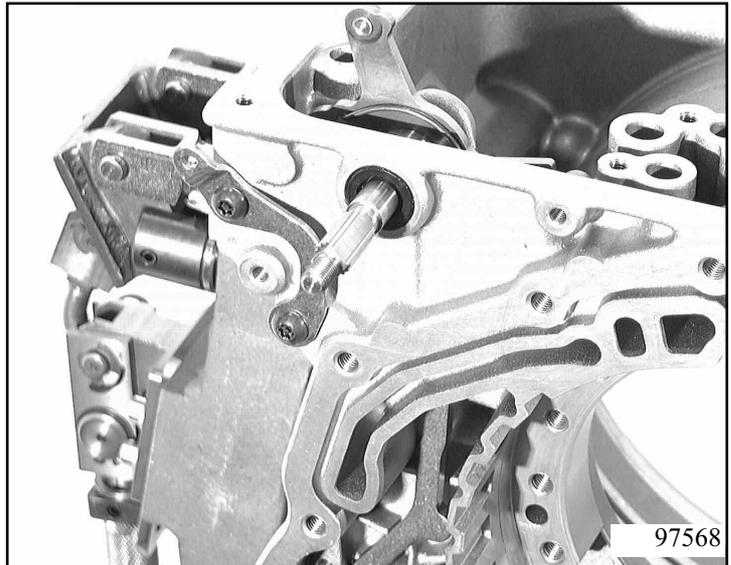


Using drift 5x46 001 134, drive shaft seal 01.010/130 into transmission housing 01.010.
Turn the transmission by 90°.

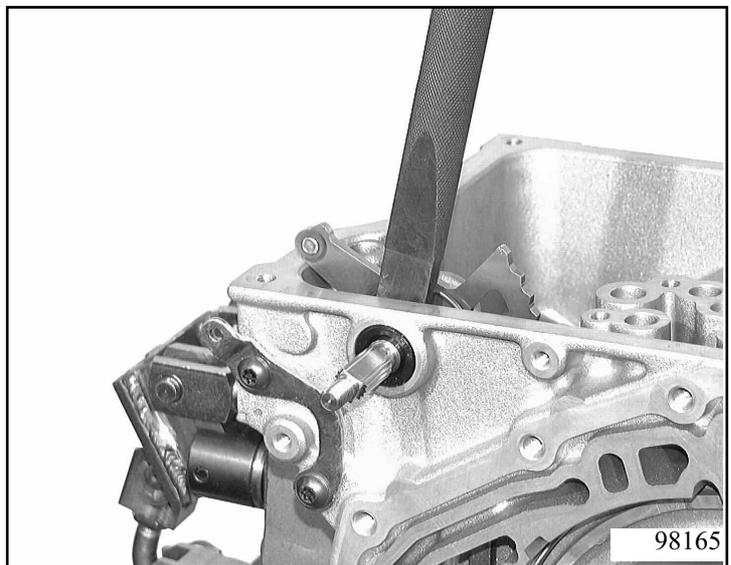
Fasten locking cams 06.040/120 to detent disc /110 using bolt /130, disc /140 and spring clamp /160.

Put stop bush 06.010 into the transmission housing.

Place detent disc 06.040 with locking cams in the transmission housing and fasten with selector shaft 06.080.

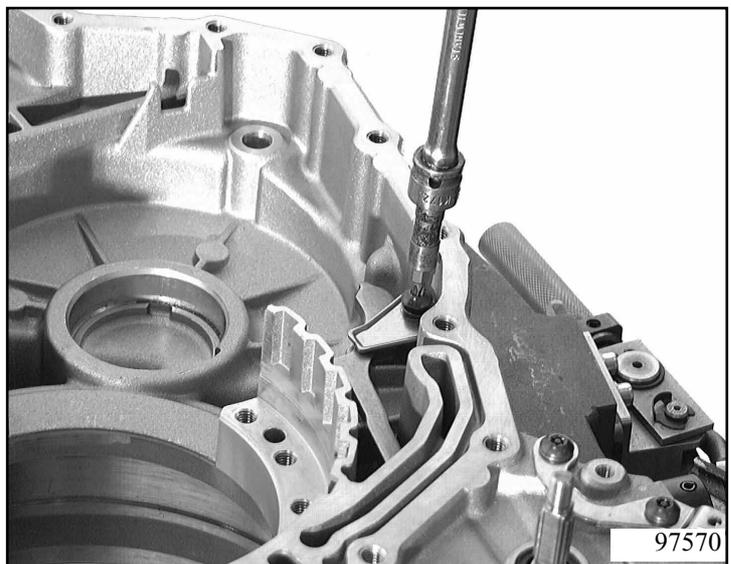


Move to position P and turn the flattened side of the gear teeth slanted upwards. With drift 5x46 002 033 connect the selector shaft to the detent spring using dowel pin 06.080.

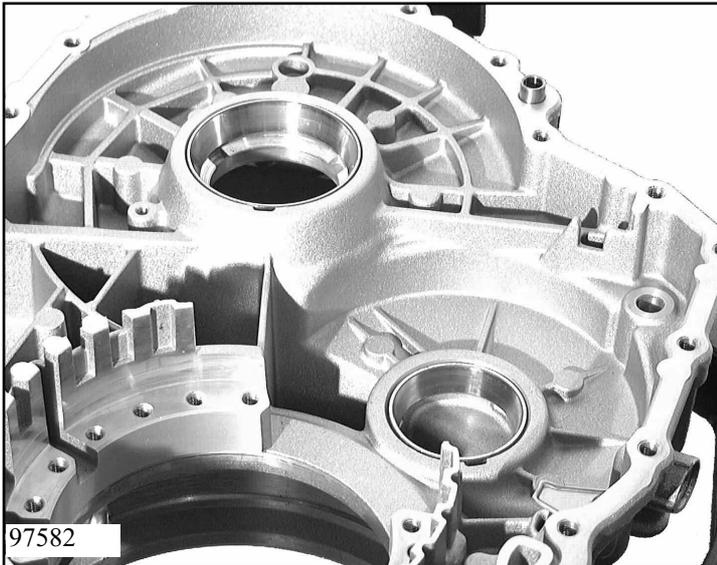


Turn the transmission back by 90°. Fasten guide plate 06.150 (parking lock) with screw 06.160.

(See Chapter 1.5 for tightening torque)



3.2.2 Installing the bearing shells in the housing



Heat the bearing seats well and insert bearing outer rings 09.030,09.090 with shims for differential 01.460 and side shaft 01.440 into the transmission housing.

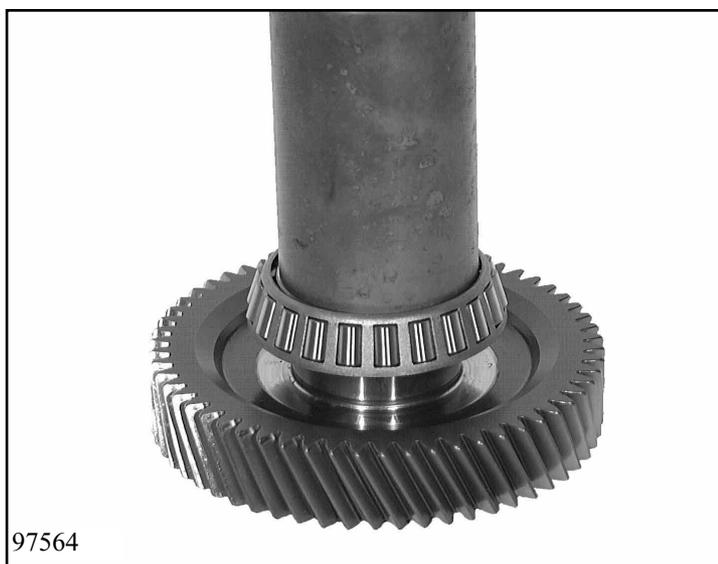
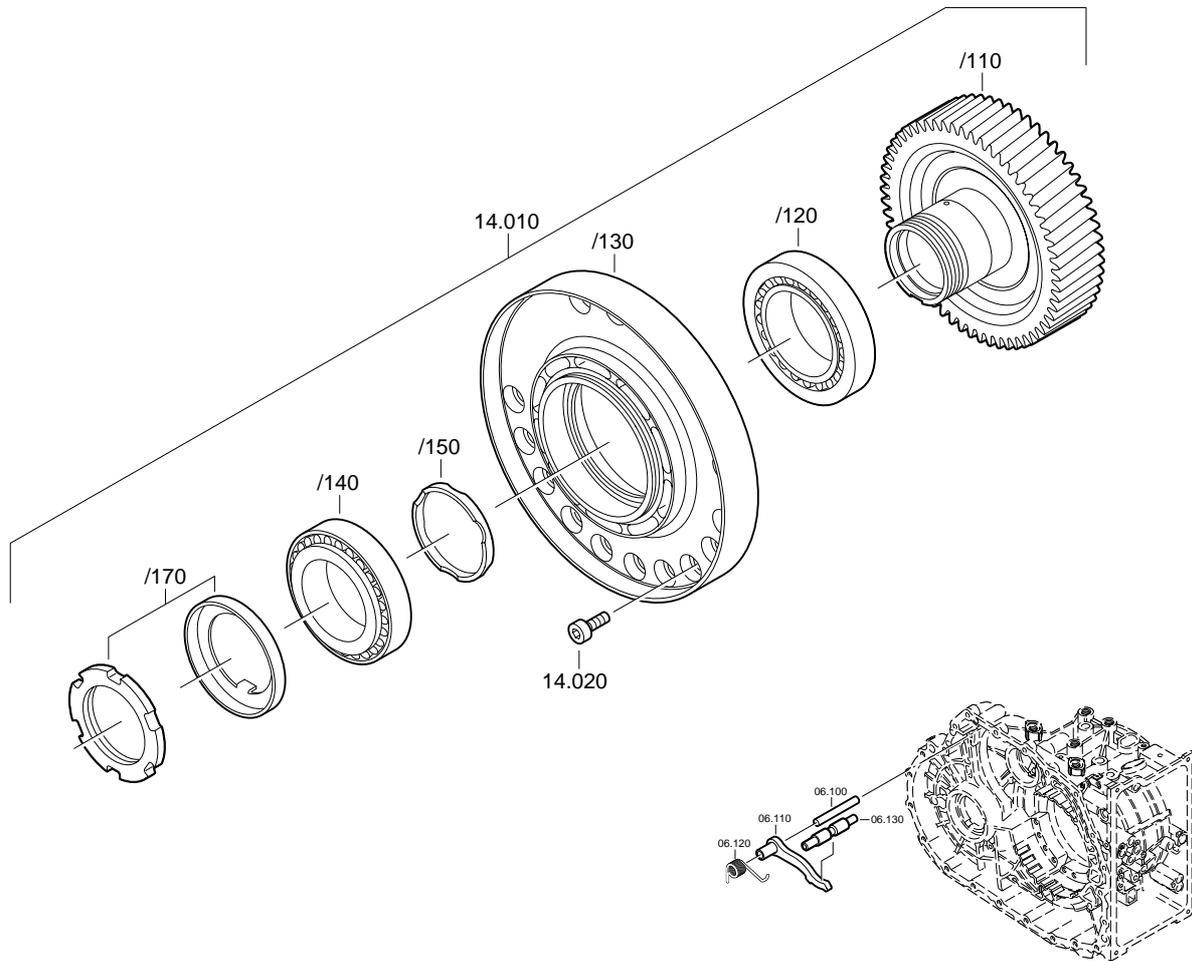
Important!

Avoid build-up of filings !!!

Making adjustments, **Chapter 1.4.1**

3.3 Completing and installing the bearing plate

3.3.1 Completing the bearing plate



97564

Using a suitable mandrel, press bearing inner ring 14.010/120 on to spur gear 14.010/110 in the mandrel press. Then press both bearing outer rings 14.010/120, 14.010/140 into the bearing plate with a suitable mandrel.

Slip adjusting ring 14.010/150 over the shaft.



Important !

Making adjustments, **Chapter 1.4.2** when bearing components are replaced

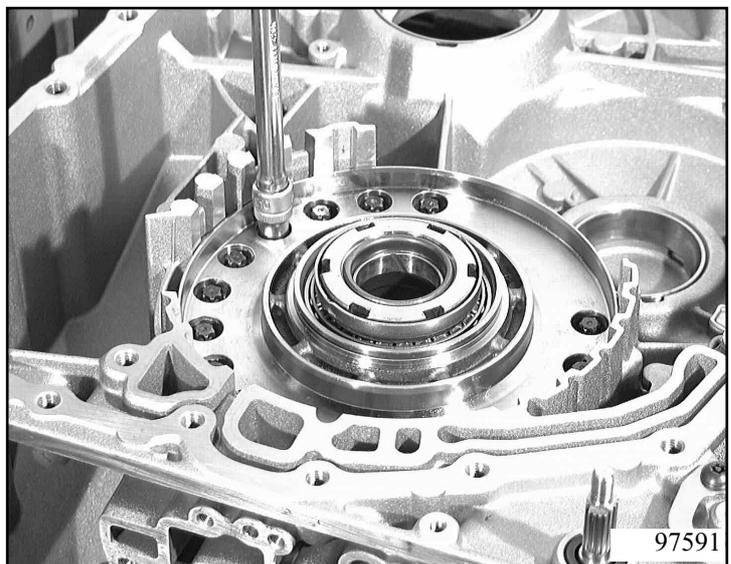
Place the bearing plate on the spur gear. Using a suitable mandrel, press in the bearing inner ring in the mandrel press. Put tab washer 14.010/170 and slotted nut on by hand.



3.3.2 Installing the bearing plate

Place the bearing plate in the housing and fasten it crosswise with 16 screws 14.020. Tighten slotted nut 14.010/170 and secure with punch mark.

(See Chapter 1.5 for tightening torque)

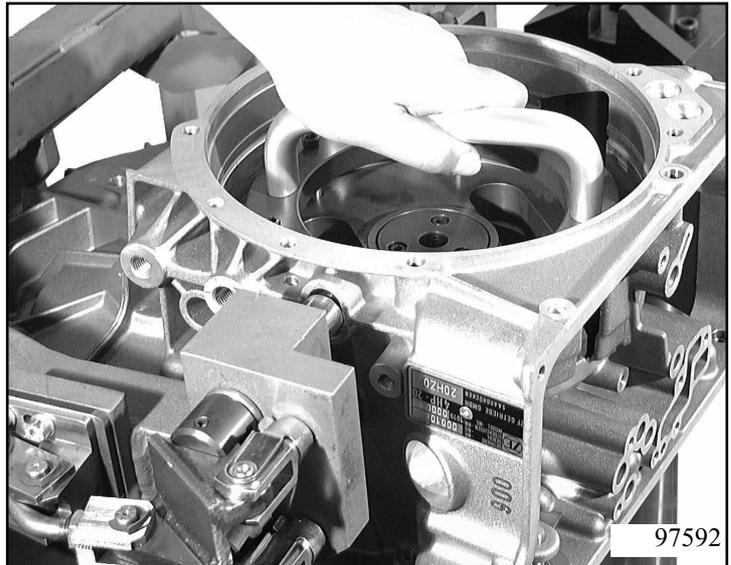


Note!

To do this, install side shaft, bolt 06.100, support bolt 06.130, parking lock pawl 06.110, and leg spring 06.120. Install spring, set parking lock and tighten the slotted nut with slotted nut wrench 5x46 001 089. Afterwards, take these parts back off.

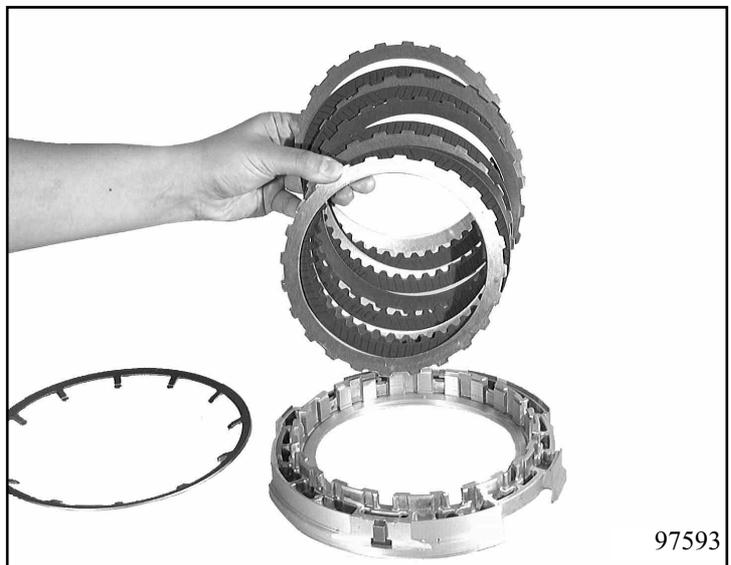
3.4.1 Installation of brake D/C

Turn the transmission by 180°.
Insert piston D 73.010 into assembly tool 5x46 001 440 and install in the transmission housing.
Insert spring clutch disc 73.020.



3.4.1.1 Completing brake D

Insert the brake D clutch pack into disc carrier 73.040/110, alternating a steel clutch disc 73.040/120 with a lined clutch disc 73.040/130, beginning with a steel clutch disc.
Install cup spring 73.040/140 and adjustment disc 73.040/150.



Important !

Making adjustments, Chapter 1.4.3.1

Be sure to leave the adjustment disc off when making adjustments!

Using assembly bracket 5x46 001 046 press down cup spring and secure with round snap ring 73.040/160.



3.4.1.2 Completing brake C



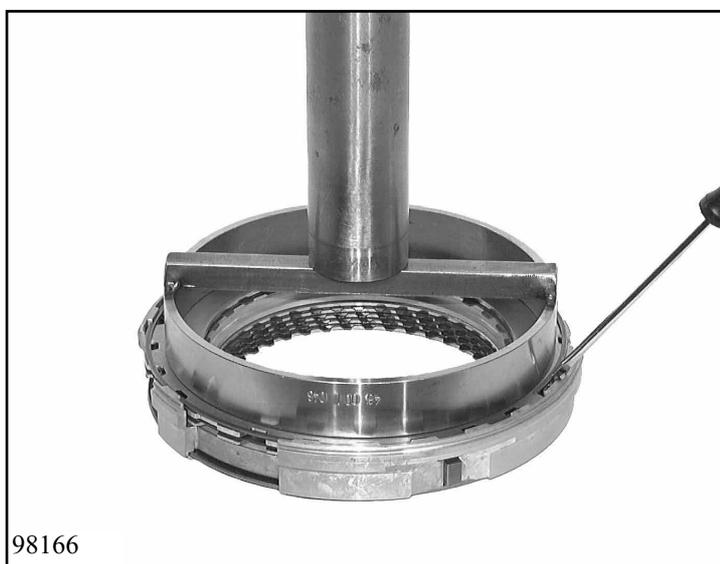
Insert steel clutch disc 73.040/170, followed by cup spring 73.040/190, lined clutch disc 73.040/180 and final disc 73.040/200.

Important !

Newer transmissions have two lined clutch discs and one steel clutch disc here instead.

The lined discs must be installed in such a way that the lining faces the steel disc. This is called the brake disc version.

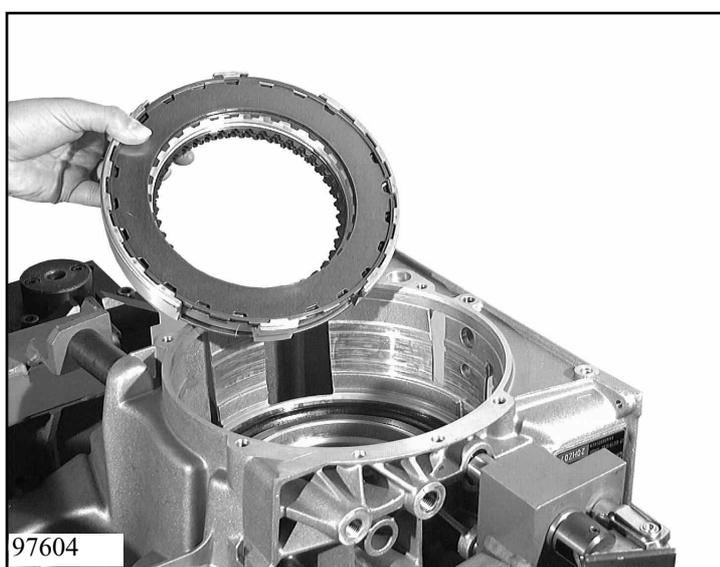
Making adjustments, Chapter 1.4.3.2



Using assembly bracket 5x46 001 046, press down the cup spring and secure it with the snap ring.

Important !

If the fitting keys 73.040/120 did not remain on the disc carrier, drive them into the center of the disc carrier.

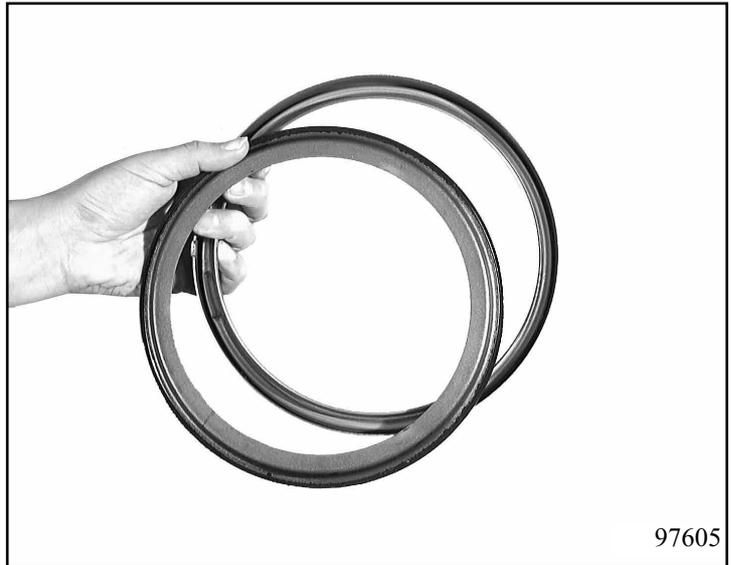


Install the disc carrier in the transmission housing.

Important !

Insert the fitting keys into the appropriate grooves.

Carefully press piston C 73.060/120 into cylinder C 73.060/110.



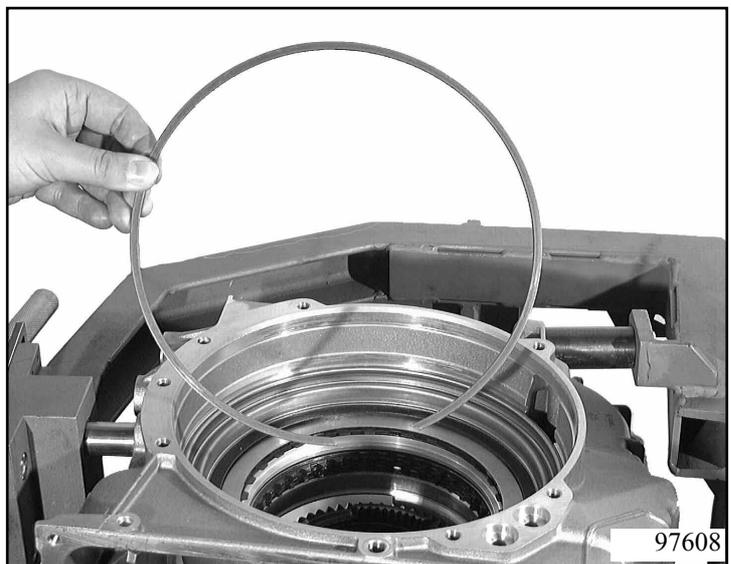
Important !
Do not damage the sealing lips.

Insert the piston and cylinder into the transmission housing.



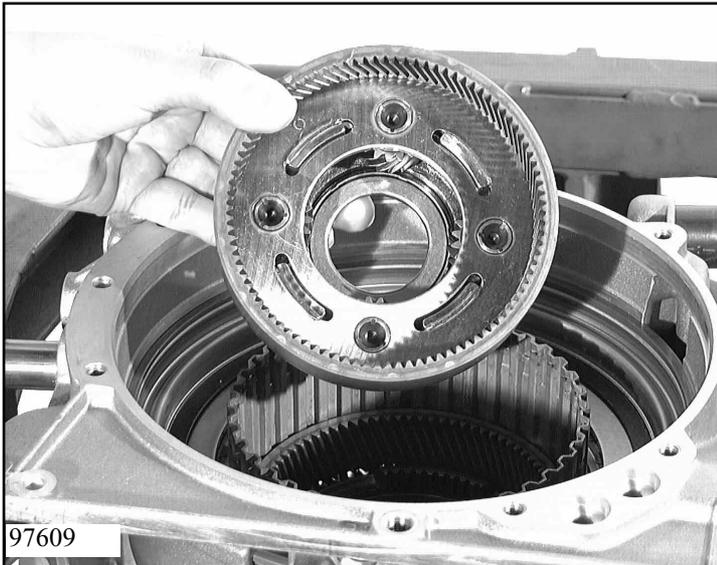
Important !
The brake C feed must be aligned with the feed bore in the transmission housing.

Secure cylinder C in the housing using snap ring 73.070.



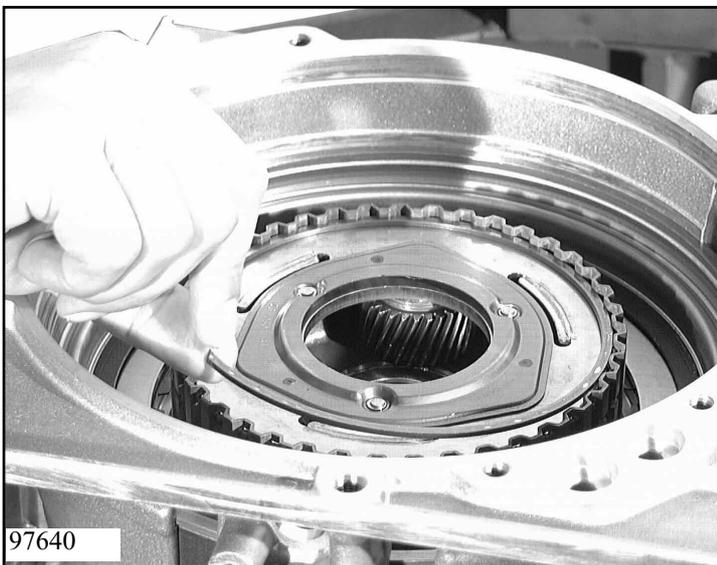
Important !
Making adjustments, Chapter 1.4.4

3.4.2 Installation of planetary drive



Align the brake D lined clutch discs and insert ring gear I 32.010/110, turning it as you do so.

Stick oil tray 32.010/180 on disc carrier I/ring gear II 32.010/120 with petroleum jelly, and then insert it into ring gear I, turning it until the gear teeth mesh in the output gear.



Insert snap ring 32.010/140 into sun wheel I 32.010/130 and install sun wheel I in planet carrier I.

Stick bearing 32.010/150 on to planet carrier II with some petroleum jelly, place planet carrier II into ring gear II, and secure it with with snap ring 32.010/170.

To do this, lift ring gear I up slightly.



Put in sun wheel II 32.050, thrust washer 32.060 and needle bearing 32.070.

3.4.3 Complete clutch B and E

Put O-ring 02.010/140 on piston E 02.010/130.

Insert O-ring 02.010/120 in cylinder E 02.010/110.

Press piston E into cylinder E by hand.



Put O-ring 02.010/170 on oil dam 02.010/160.

Insert cup spring 02.010/150 and oil dam on piston E; press it down with assembly bracket 5x46 001 036 in the mandrel press, and secure it with split stop ring 02.010/180.



Put two O-rings 02.010/300, 02.010/310 on to cylinder B 02.010/110 and press piston B 02.010/320 into the cylinder.

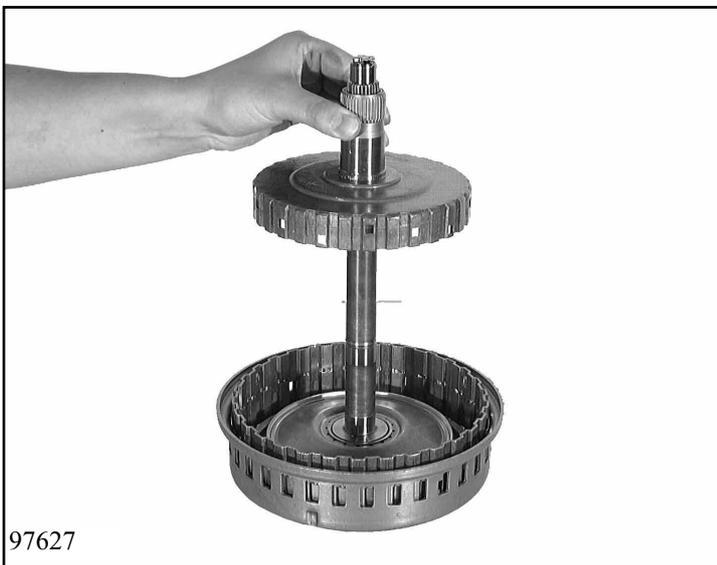




97614

Put O-ring 02.010/340 onto oil dam 02.010/330 and press the oil dam into the cylinder.
Place cup spring 02.010/350 onto the cylinder; using assembly bracket 5x46 030 167, press the cup spring down in the mandrel press and secure with split stop ring 02.010/360.

Important !
Making adjustments, Chapter 1.4.5



97627

Stick axial bearing 02.010/240 onto 02.010/250 with some petroleum jelly and insert the spider shaft over the input shaft in clutch E.

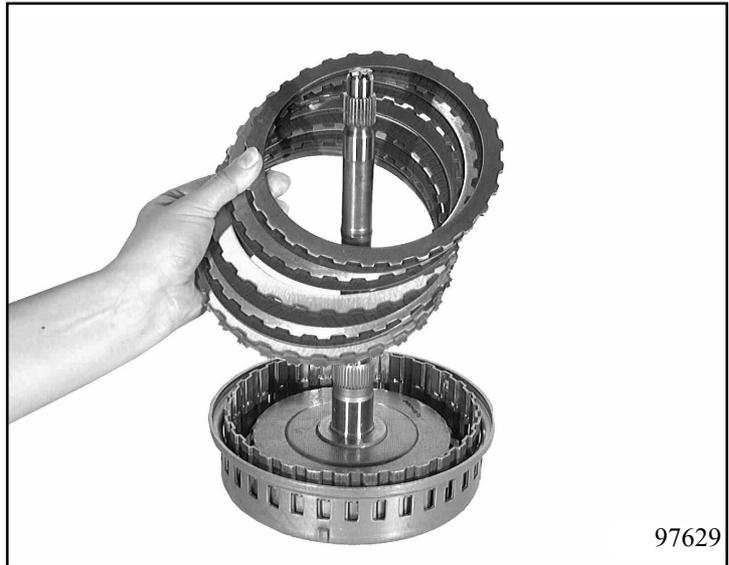


97628

Using fixture 5x46 001 418 and rectangular-section ring 02.010/270, mount retaining ring 02.010/260 on the input shaft.

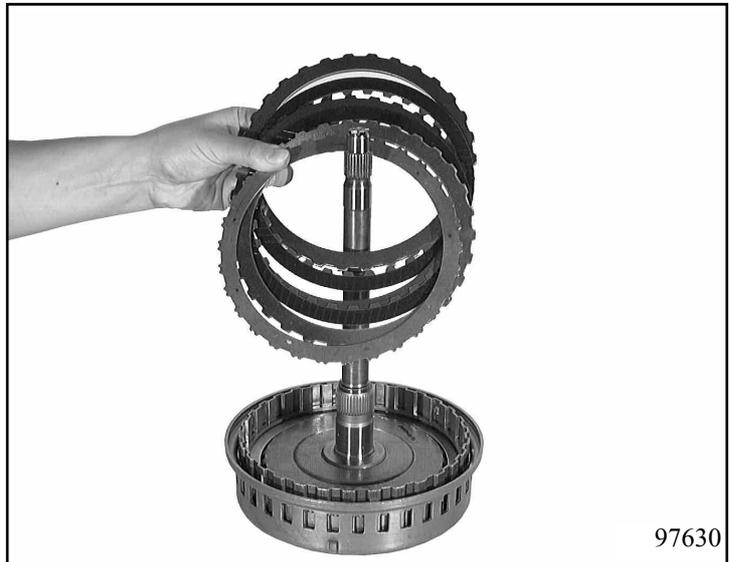
3.4.3.1 Inserting clutch pack E

Insert spring clutch disc 02.010/190, and then insert steel clutch discs 02.010/200 and lined clutch discs 02.010/210 in alternating order. Insert adjustment disc and secure it with snap ring.

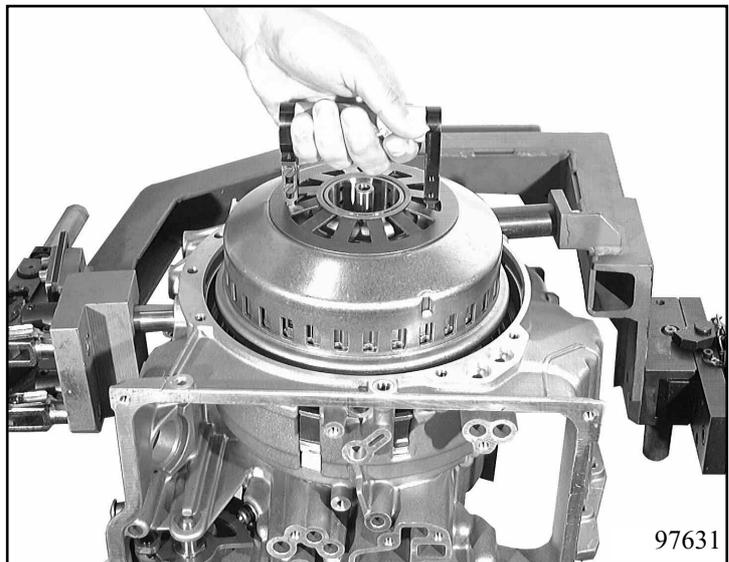


3.4.3.2 Inserting clutch pack B

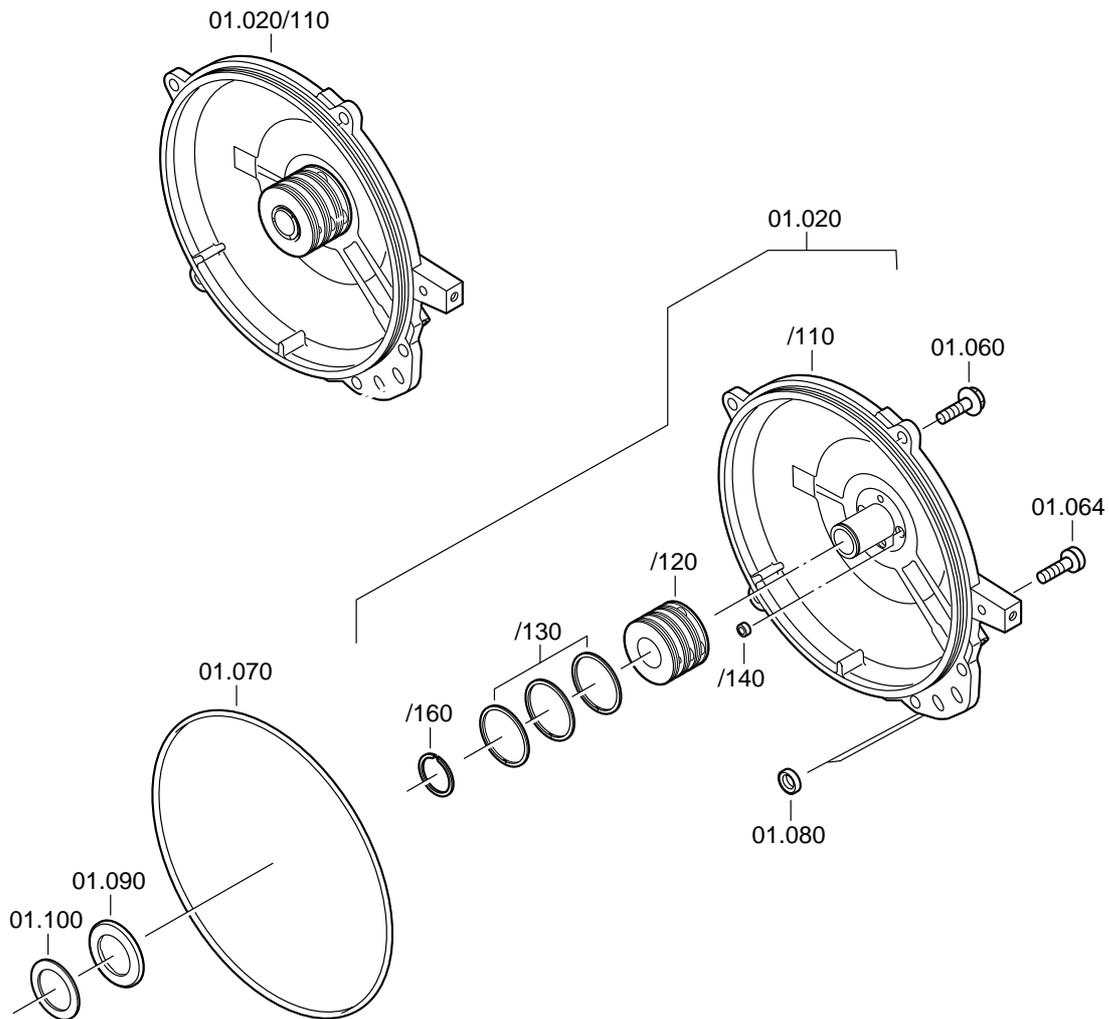
Insert final disc 02.030, and then insert lined clutch disc 02.040 and steel clutch disc 02.060 in alternating order. The last steel disc is adjustment disc 02.070. Then insert spring clutch disc 02.080 and cup 02.090 and secure them with snap ring 02.100.



Set in input shaft with clutch B/E using assembly fixture 5x46 001 775, place it into the transmission housing, turning it as you do so.



3.5 Completing and installing the transmission cover.



Important !

For transmissions with a removable oil-feed bush, the cover must be installed– as described in Chap. 1.4.8 – in order to be able to perform the *Adjustment of axial play for the input shaft*.

Note !

When the bore for the dowel pin in the cover is too deep (> 10 mm) a ball with a diameter of 3.5 mm must also be put in, otherwise the dowel pin might fall out.

Important! (when the oil feed bush is removable)

Insert sealing sleeves 01.020/140 into the bores in the cover. Then put oil feed bush 01.020/120 on cover 01.020/110, press it down, and secure it with retaining ring 01.020/160.

Put O-ring 01.070 on transmission cover 01.020/110.

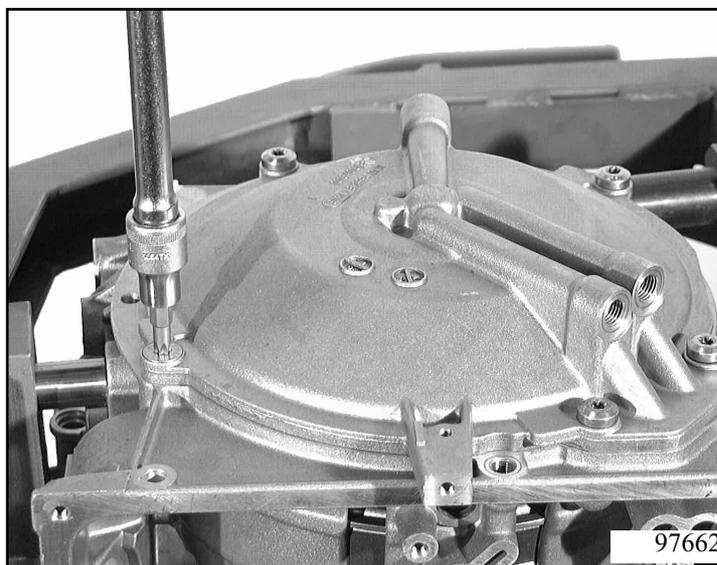
Put three rectangular-section rings 01.020/130 on the oil feed bush.



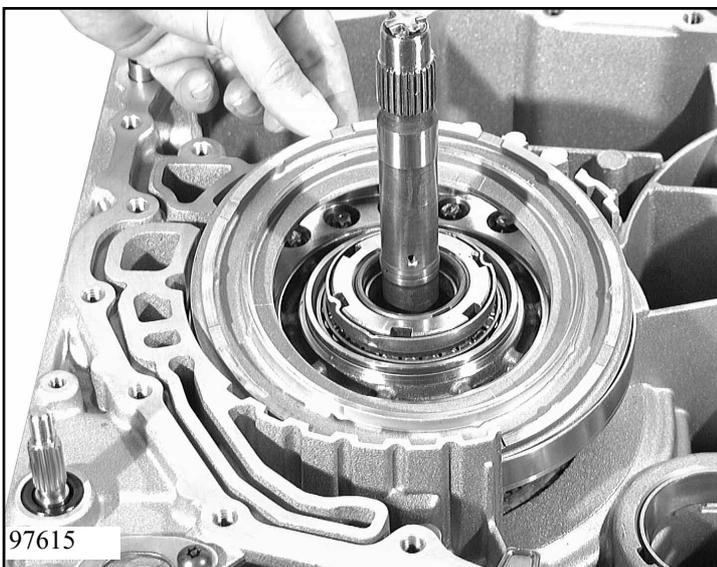
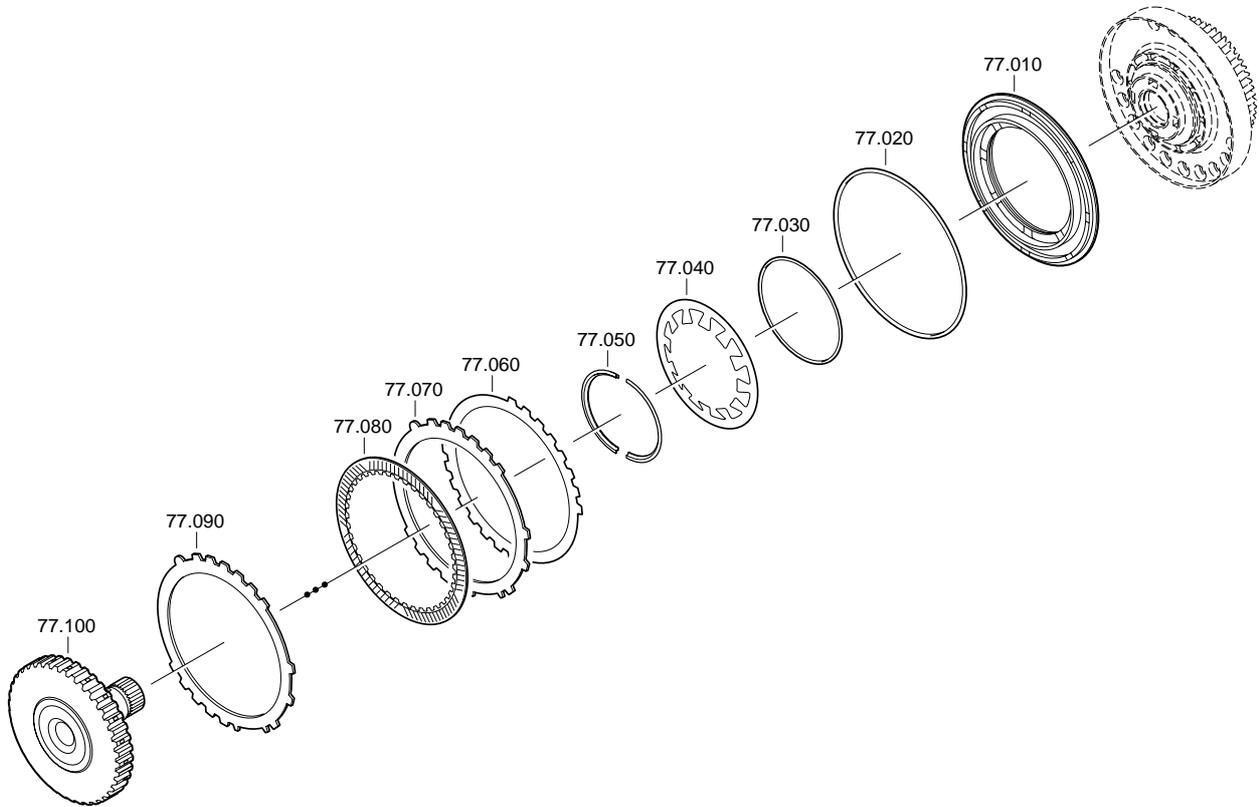
Insert two sealing sleeves 01.080 into the transmission housing; lay shim 01.100 and axial needle roller bearing 01.090 on the hub of clutch B/E.

Press the transmission cover into the housing. Then fasten the cover with four Torx screws 01.064 and one Torx screw 01.060.

(See Chapter 1.3 for tightening torque specification)



3.6 Installing brake F



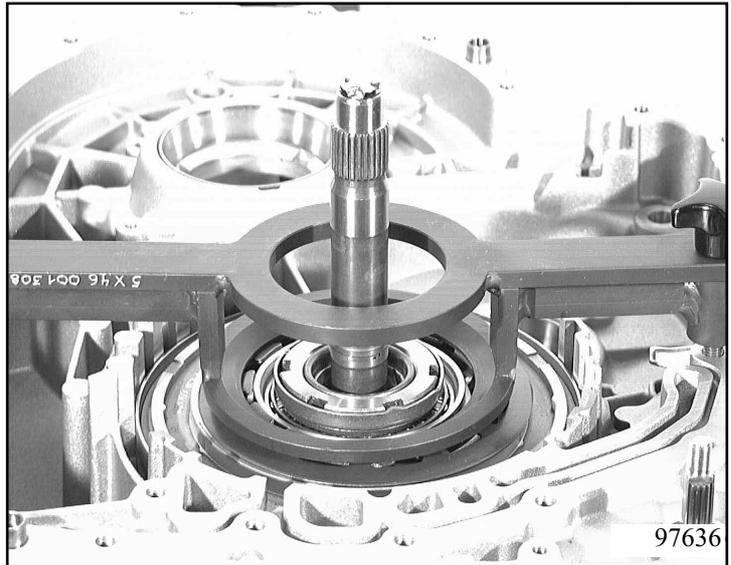
Important !

Making adjustments, Chapter 1.4.7

Turn the transmission by 180°.

Put O-rings 77.020 and 77.030 on piston 77.010 and carefully press the piston into the bearing plate.

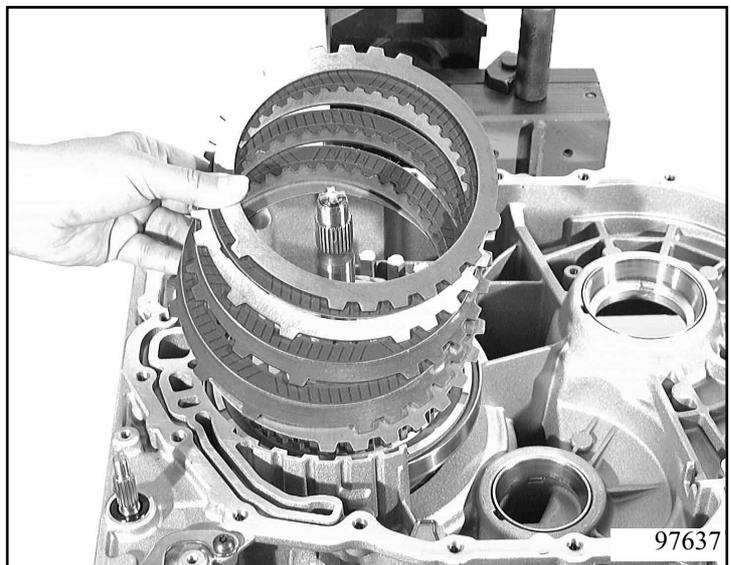
Insert cup spring 77.040; using fixture 5x46 001 051, press cup spring down and secure it with split stop ring 77.050.



Important!

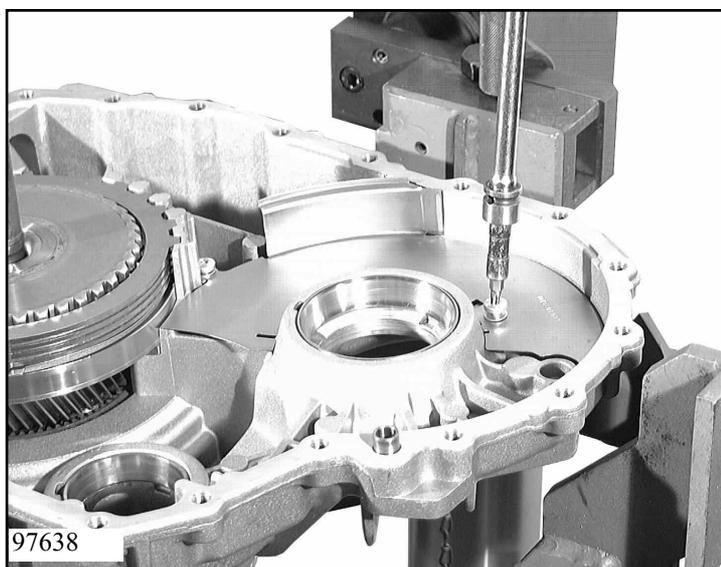
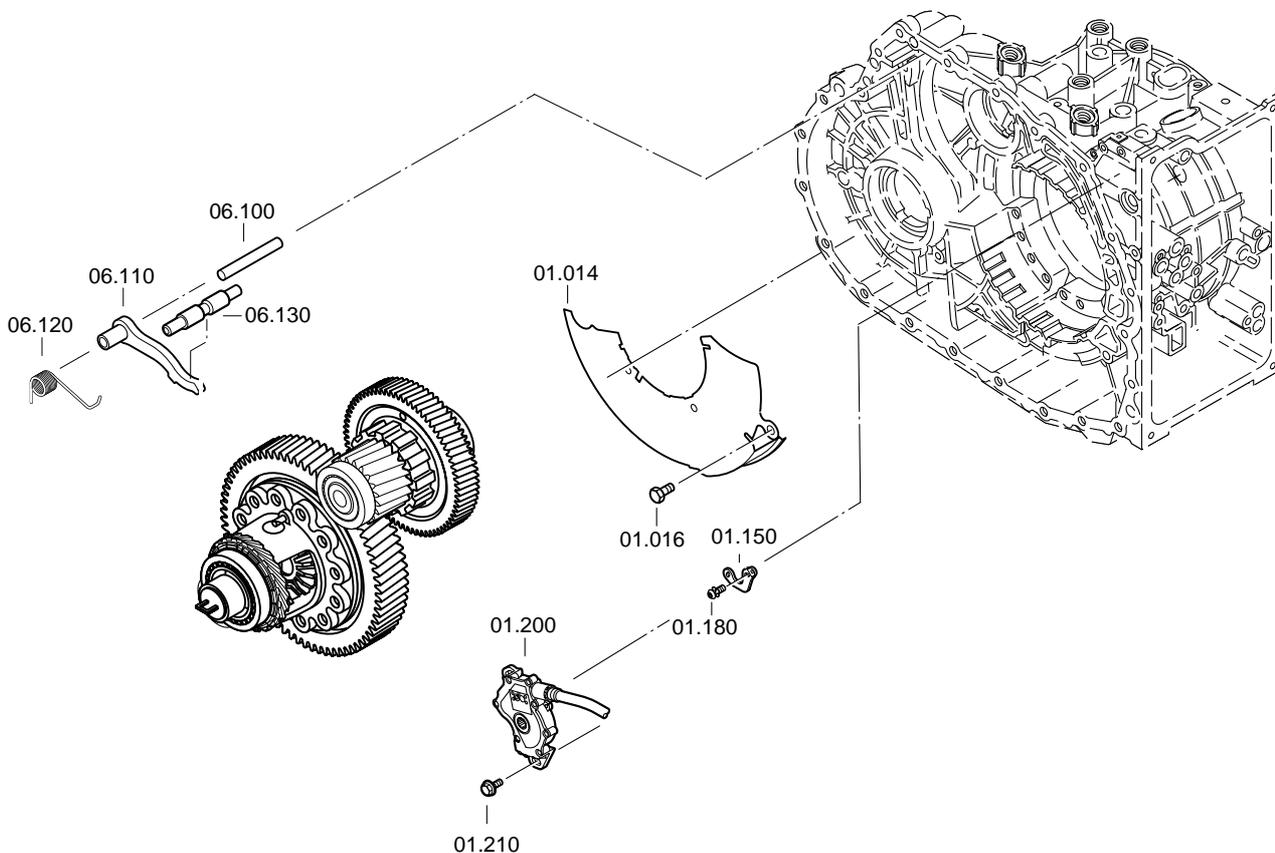
A different assembly fixture might be required for other applications.

Install inner disc carrier F 77.100.
Insert the clutch pack beginning with spring clutch disc 77.060. Then insert steel clutch disc 77.070 and lined clutch disc 77.080 in alternating order.
Put adjusting clutch disc 77.090 on as the last disc.



3.7 Installing the side shaft, differential, parking lock and position switch

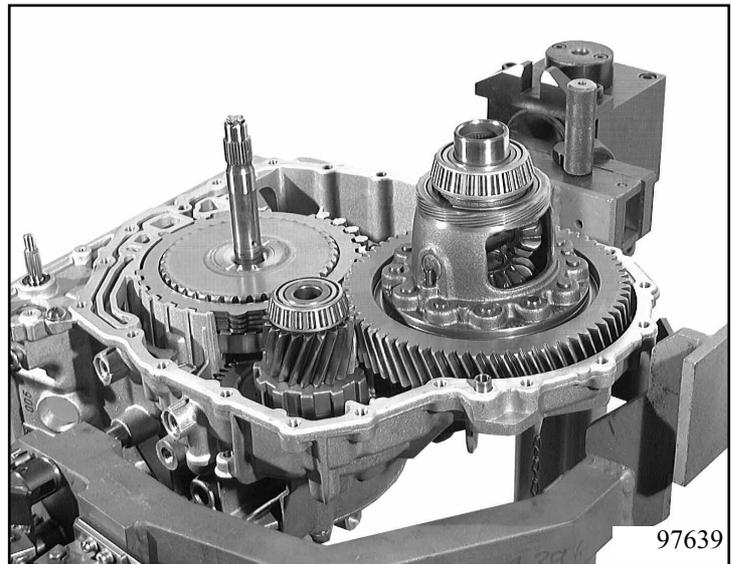
3.7.1 Installing the side shaft and differential



Screw oil baffle plate 01.014 into the transmission housing with three screws 01.016.

(See Chapter 1.5 for tightening torque)

Insert the complete side shaft and complete differential into the transmission housing.



3.7.2 Installing the parking lock and position switch

Install bolt 06.100 and supporting bolt 06.130 into transmission housing. Slide in pawl 06.110 with leg spring 06.120 over bolt and attach the leg spring.

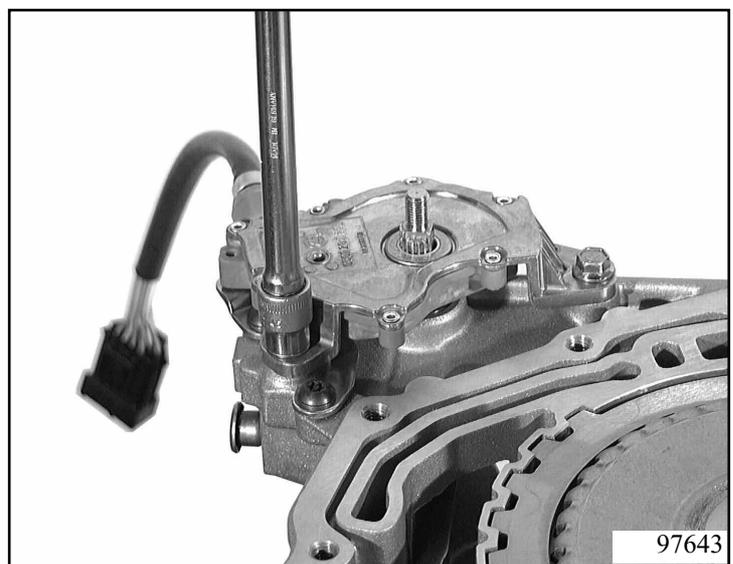


Put position switch 01.200 on selector shaft in the “N” position and screw it tight with two screws 01.210.

The position switch spigot must fit into the adjusting plate’s guide.

(See Chapter 1.5 for tightening torque)

Important !
Making adjustments, Chapter 1.4.6

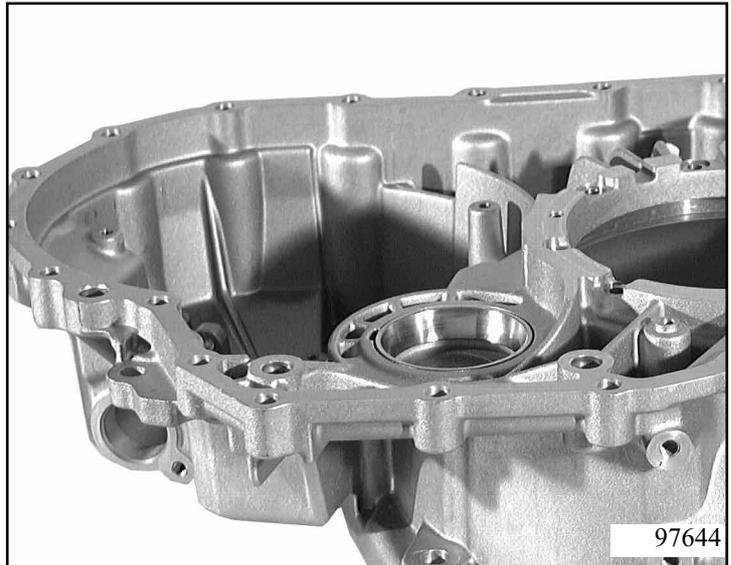


3.8.1 Completing and installing the converter bell housing

Install both outer bearing shells into the converter bell housing by warming the bearing seats thoroughly.

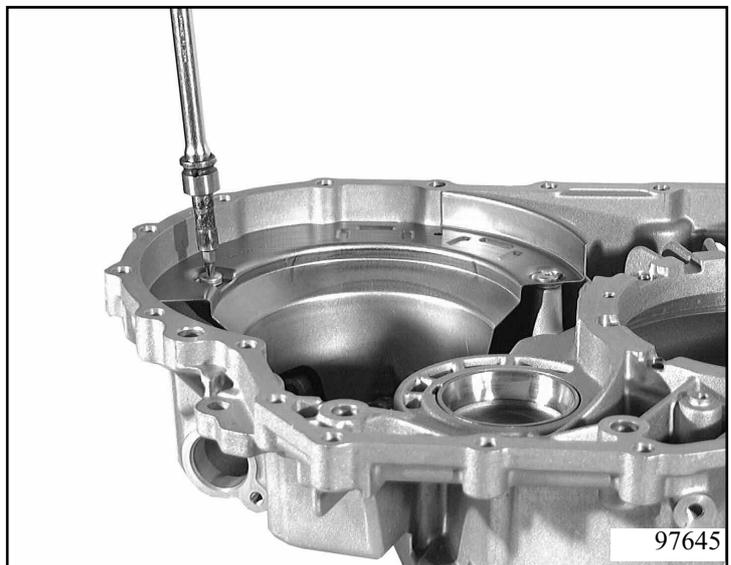
Important!

Avoid build-up of cuttings !!!



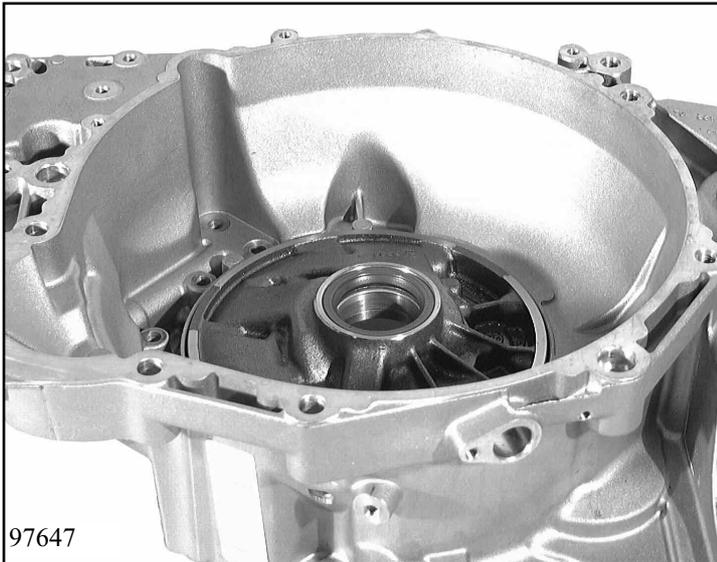
Fasten two magnets 22.240 at the markings on oil baffle plate 22.220. Screw oil baffle plate tightly onto the converter bell housing with three screws 22.230.

(See Chapter 1.5, tightening torque)



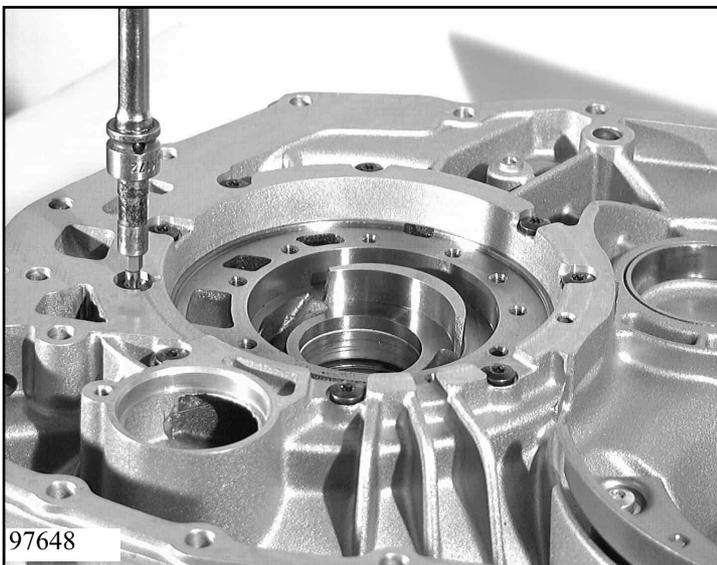
Place O-ring 10.050 on pump housing 10.010.
Insert disc 10.010/154 into pump housing and press in shaft seal 10.010/160 in the mandrel press with mandrel 5x46 001 453.





Insert dowel pin into pump housing 01.010/114.
Press pump housing into converter bell housing.

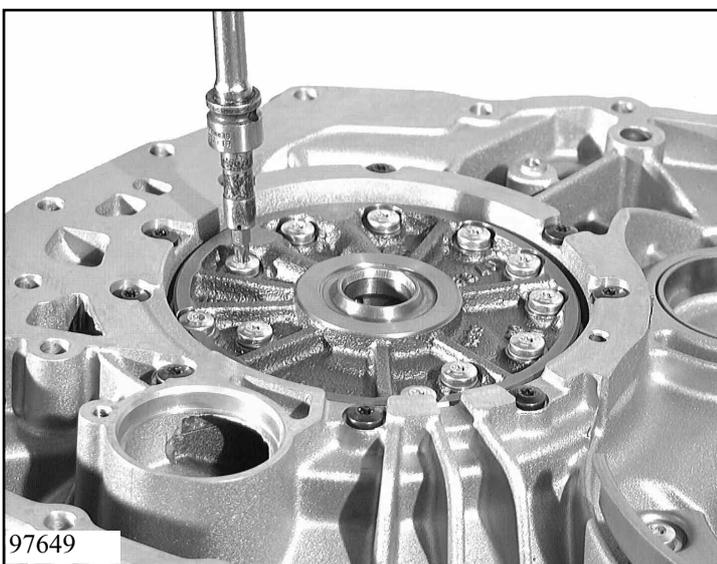
Note !
The dowel pin must fit into the bore that was drilled for this purpose.



Turn the converter bell by 180° and fasten pump housing crosswise with nine screws 10.020.

(See Chapter 1.5 for tightening torques)

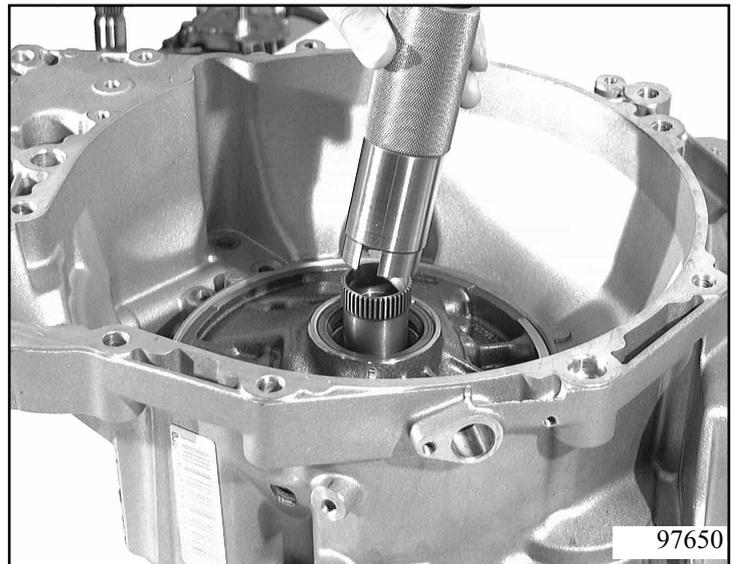
Important !
To prevent the pump housing from falling out, insert two screws before turning it over.



Insert the ring gear and pump wheel with points visible on the top into the pump housing.
Insert stator shaft 10.010/140 and tighten with 11 screws 10.010/150.

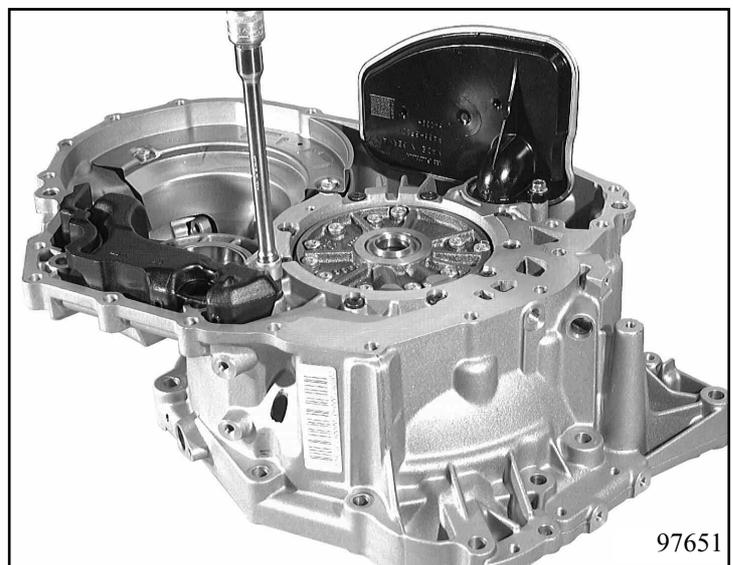
(See Chapter 1.5 for tightening torque)

Using pump plug gauge 5x46 000 306, check that the pump turns easily.



Install oil tank 22.260 with screw 22.270. Put O-ring 22.170/120 on oil filter. Turning the oil filter slightly, insert it into the converter bell and tighten it with screw 22.180.

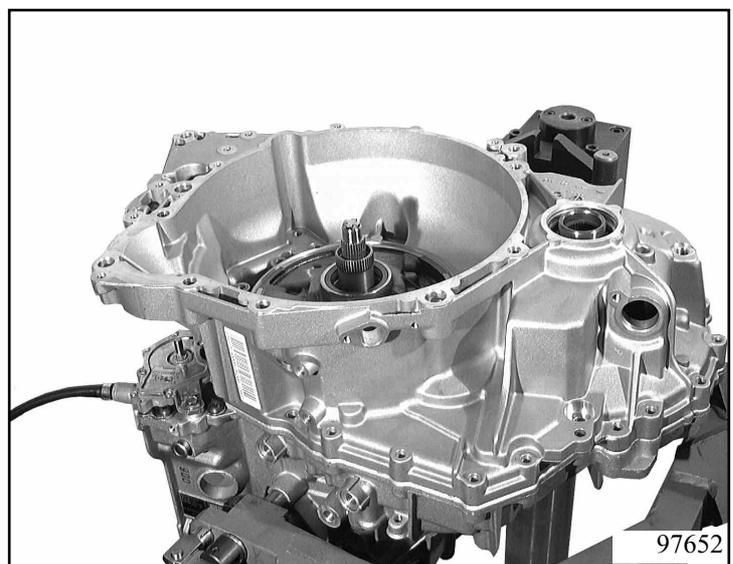
(See Chapter 1.5 for tightening torque)

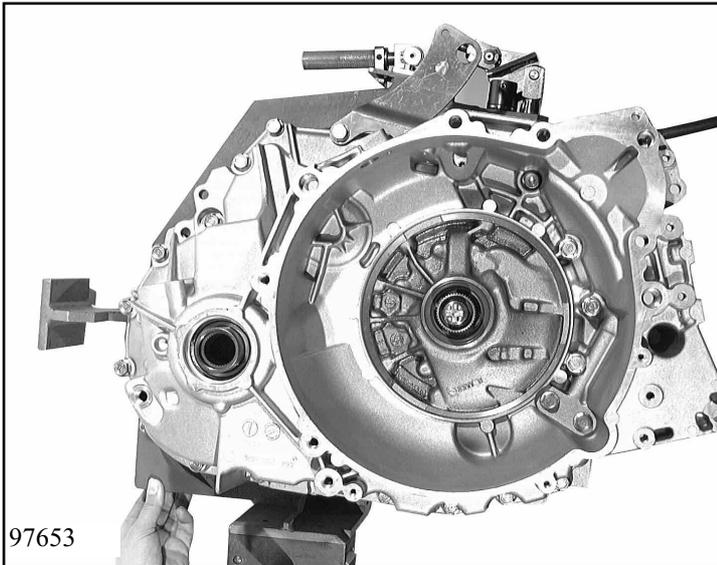


Put paper gasket 22.140 and metal gasket 22.144 on the transmission housing. Press the converter bell on to the transmission housing.

Important !

Two dowel pins 01.010.120 must be inserted in the transmission housing.

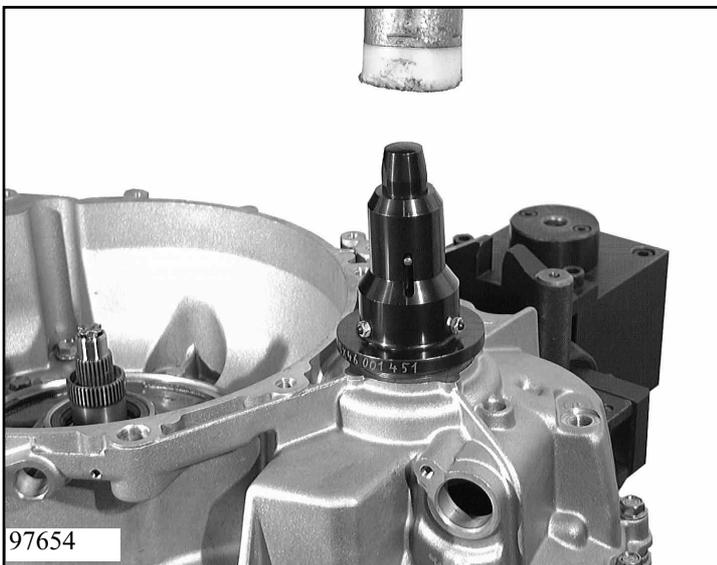




Fasten retaining strap 22.110 onto the converter bell with two screws 22.130. Insert one screw with new Usit ring 22.132 in the converter bell at the bore with screw contact face that has been milled smooth. Insert and tighten two screws 22.134 and four screws 22.130 inside and 14 screws 22.120 in the converter bell.

Important !

For tightening specification, see **Chapter 1.3**

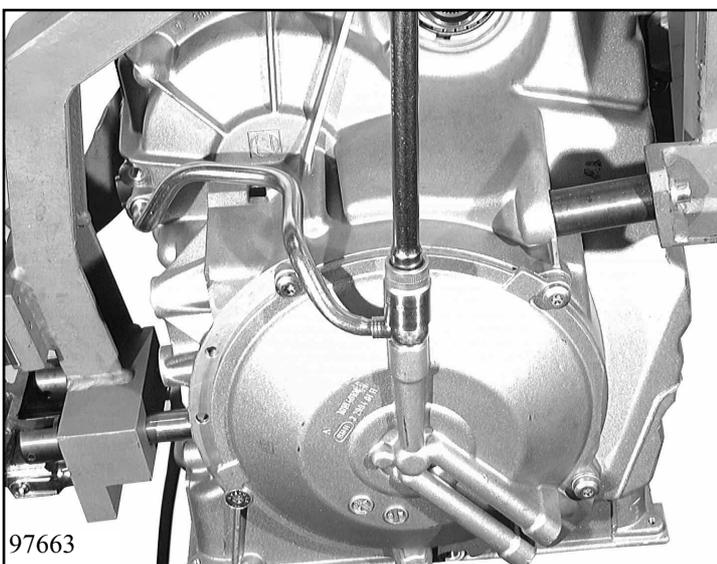


Drive shaft seal 09.370 into converter bell with drift 5x46 001 451.

Important !

Check axial play.

Making Adjustments, **Chapter 1.4.9**

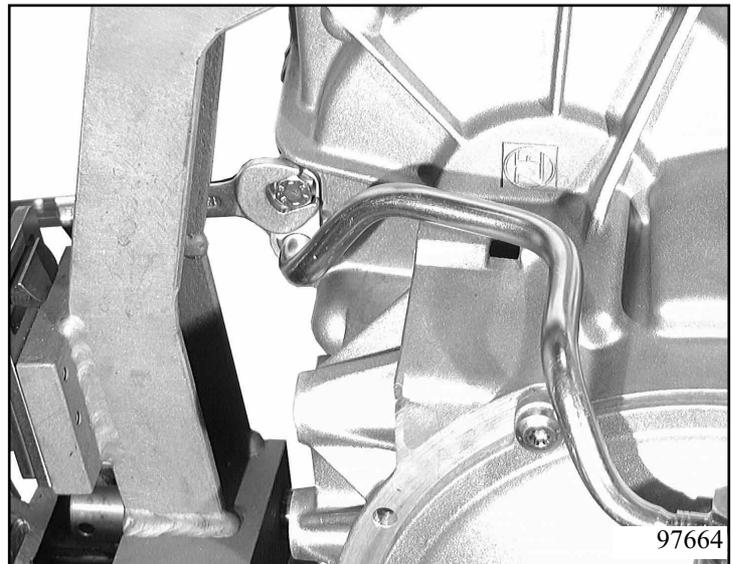


Turn the transmission by 90°. Place O-ring 01.270 on oil tube 01.280. Place seal on union screw 01.290 in front of and behind the oil tube. Insert the oil tube into the transmission housing, and tighten the union screw in the transmission cover.

(See Chapter 1.5 for tightening torque)

Place fixing plate 01.284 over the pipe on the transmission housing and secure it to the transmission housing with screw 01.286.

(See Chapter 1.5 for tightening torque)



Turn the transmission by 90°. Drive shaft seal 09.350 into the transmission housing with drift 5x46 001 450.

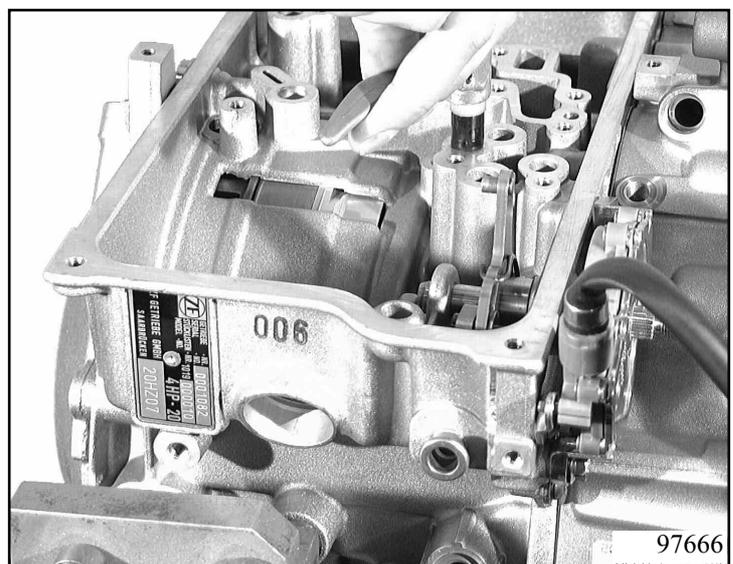
Screw one plug 01.260 into the transmission housing.

Note!

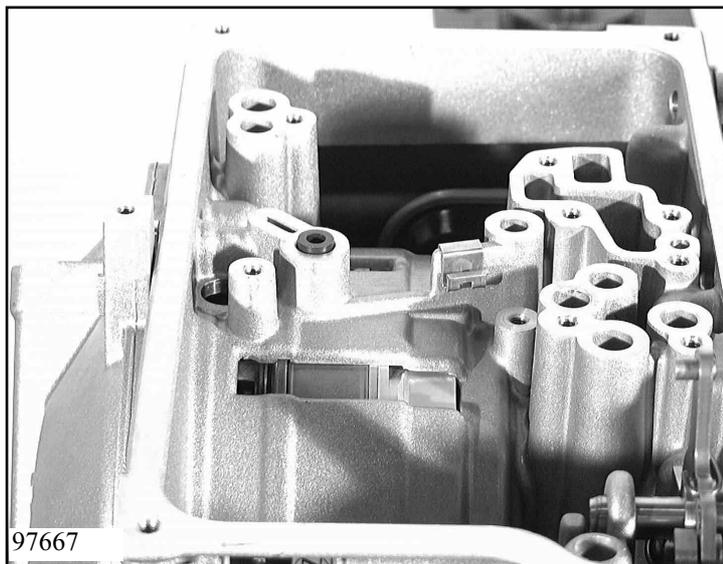
On older transmissions, the testing connections are closed with two plugs 01.260. Newer transmission do not have any testing connections at all.
(See Chapter 1.5 for tightening torque)



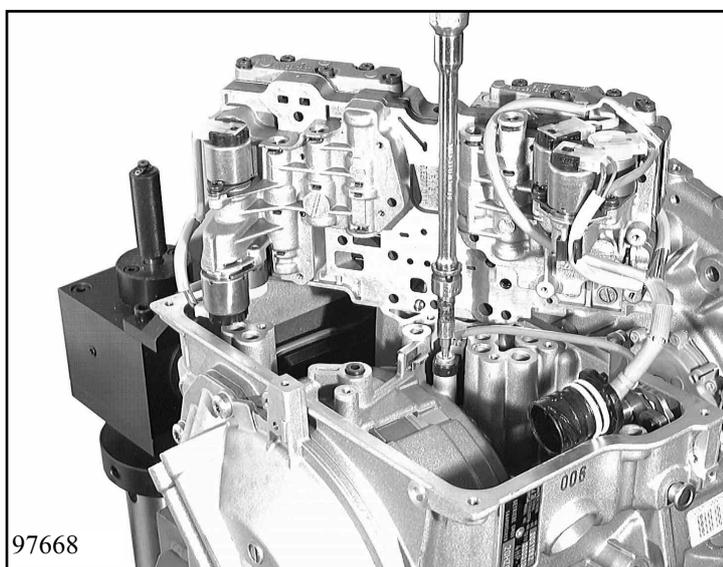
Turn the transmission by 90°. Check the rest of the brakes (C, D and F) with compressed air.



3.8.2 Installing the control unit, inductive transmitter and oil pan



Put a new O-ring 27.200/116 in the wiring harness plug.
Press sealing sleeve 01.230 into the brake C feed.
Insert cable clamp 01.140 on the transmission housing web.

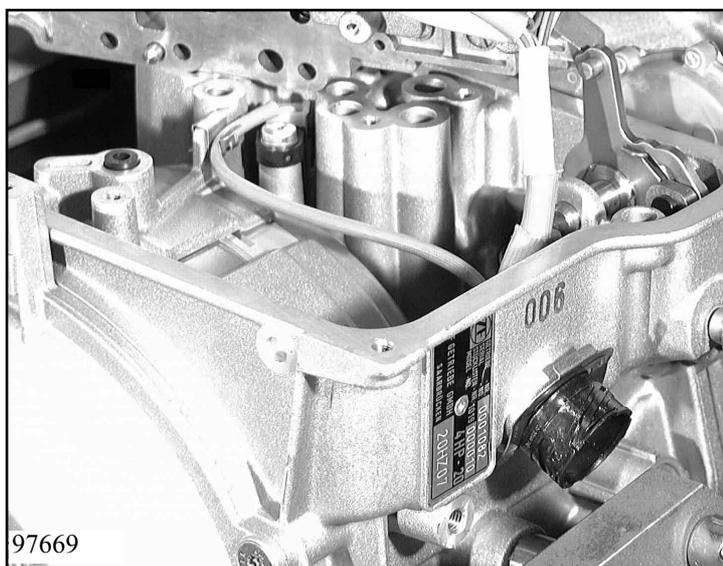


Put the complete control unit with inductive transmitter 01.110 and wiring harness 27.200 on the transmission housing, tilting it slightly.
Insert inductive transmitter 01.110 into the transmission housing, and screw it tight with screw 01.130.

(See Chapter 1.5 for tightening torque)

Important !

With some transmission parts specifications, spacing washer 01.120 is installed underneath the inductive transmitter retaining strap.

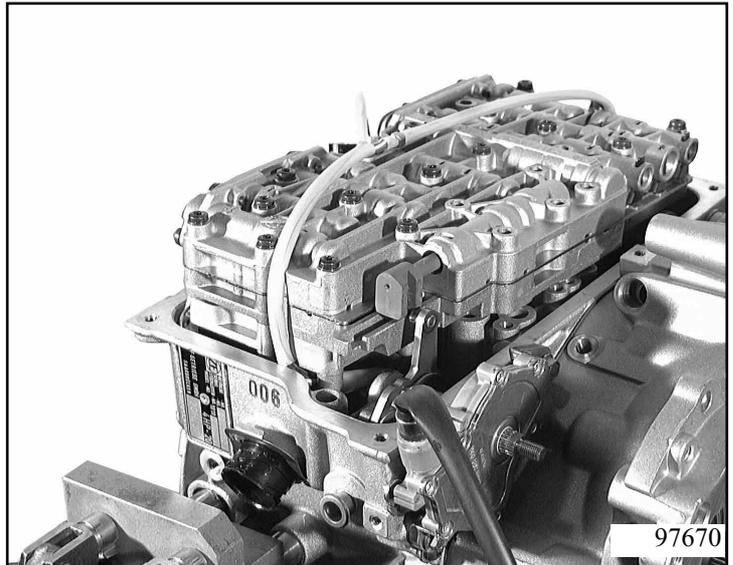


Press the wiring harness plug into its hole in the transmission housing and fasten it with locking plate 27.210.
Press the inductive transmitter cable into the mounted clip.

Insert the control unit.

Important !

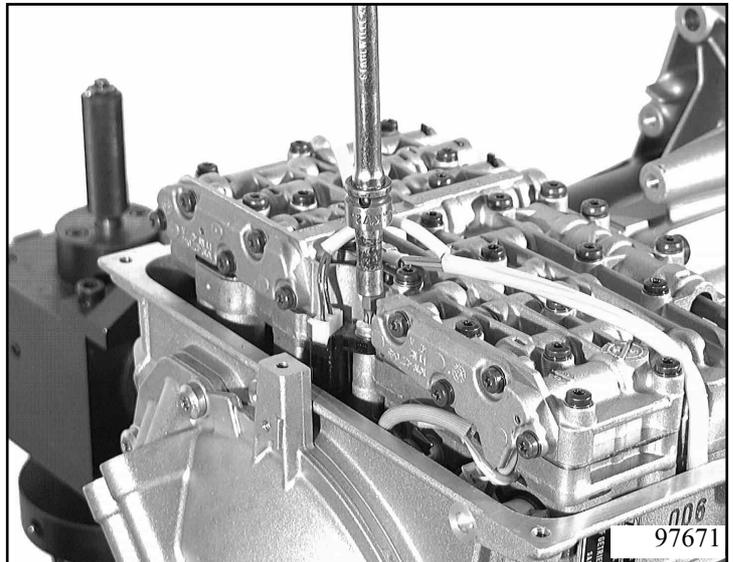
The groove for the selector shift valve must be put properly into the detent disc lug and the dowel pin must be inserted correctly into the transmission housing.



Fasten the control unit with seven screws 27.300.

Insert inductive transmitter 27.220 into the transmission housing and tighten with screw 27.230.

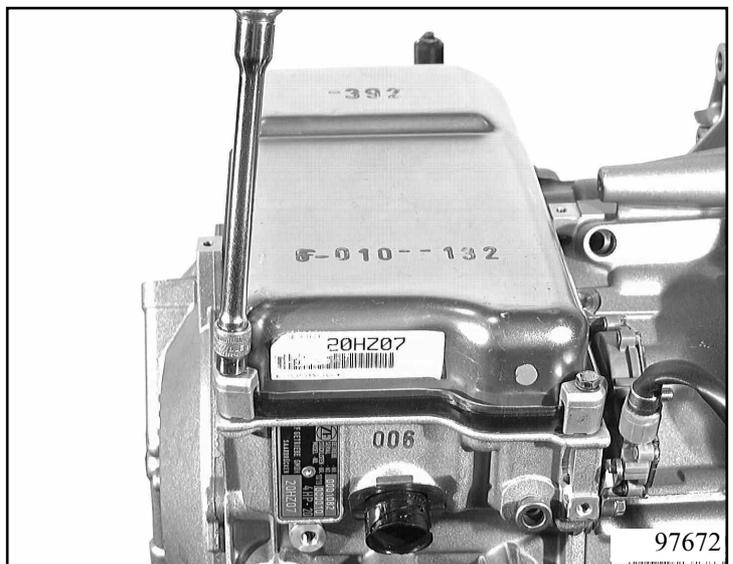
(See Chapter 1.5 for tightening torque)



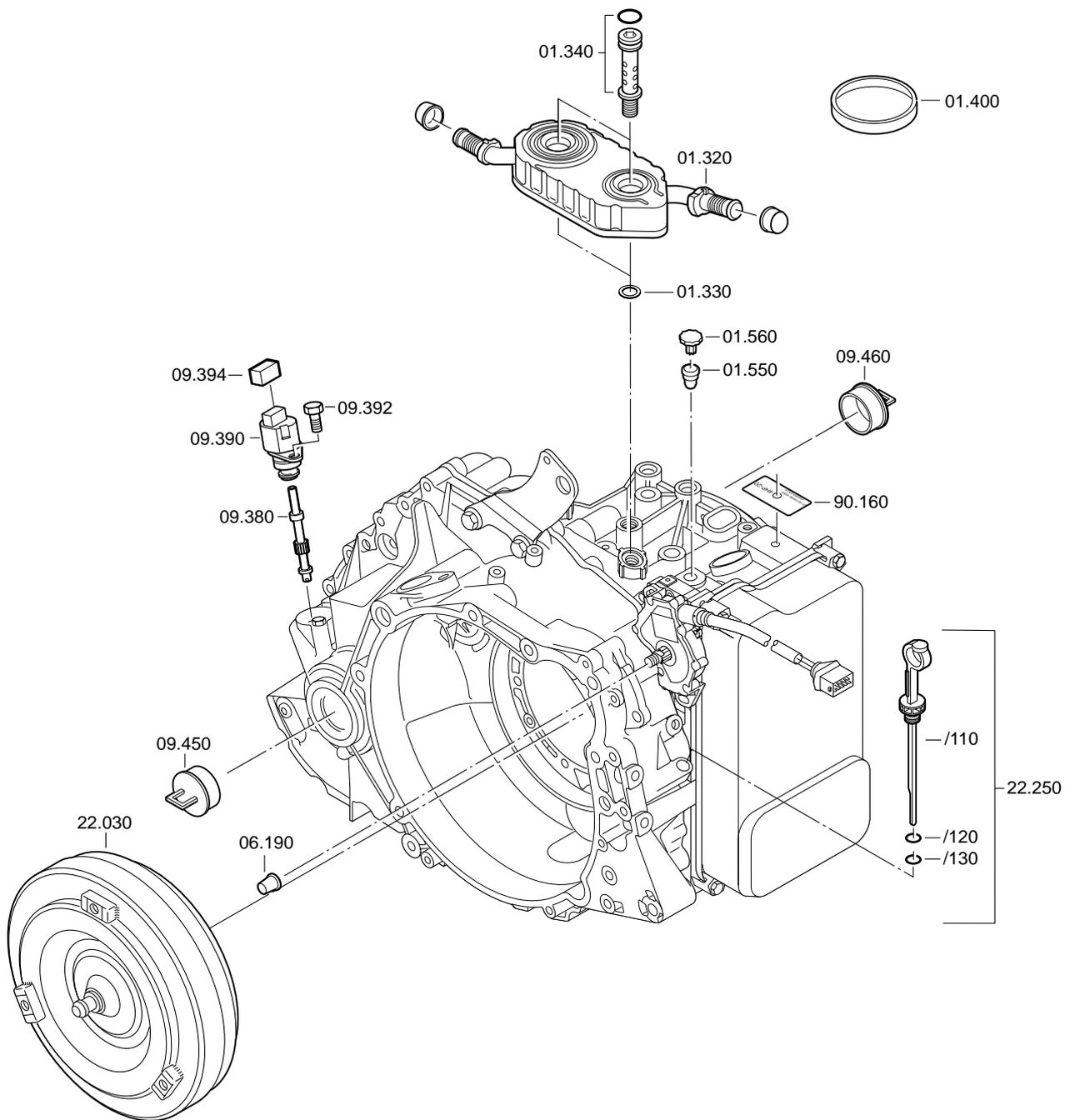
Insert two 03.090 magnets into the recess in oil pan 03.010, put on rubber seal 03.060 and fasten the oil pan with four angle brackets 03.040 and screws 03.050.

Screw in new plugs (two plugs 01.020/150 in the cover and one plug 22.150 in the converter bell).

(See Chapter 1.5 for tightening torque)



3.9 Installing ancillaries (oil cooler, converter, speedometer shaft connection, protective transport caps)



(Only for application with oil cooler !!!)

3.9.1 Installing the oil cooler

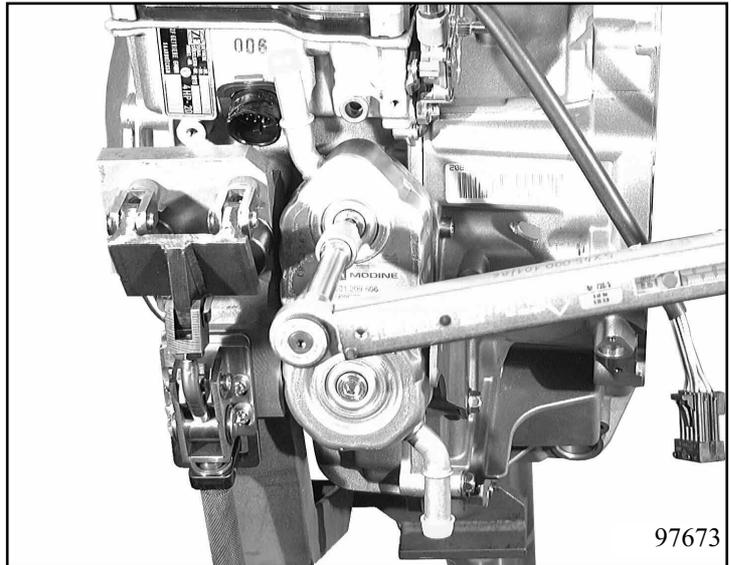
Stick one seal ring 01.330 with some petroleum jelly into each of the oil cooler connection bores in the housing.

Put one O-ring 01.340/020 on each union screw 01.340.

Put plug 01.320/010 on heat exchanger.

Using the union screws, fasten heat exchanger 01.320 to the transmission housing with the pointed end towards the oil pan.

(See Chapter 1.5 for tightening torque)

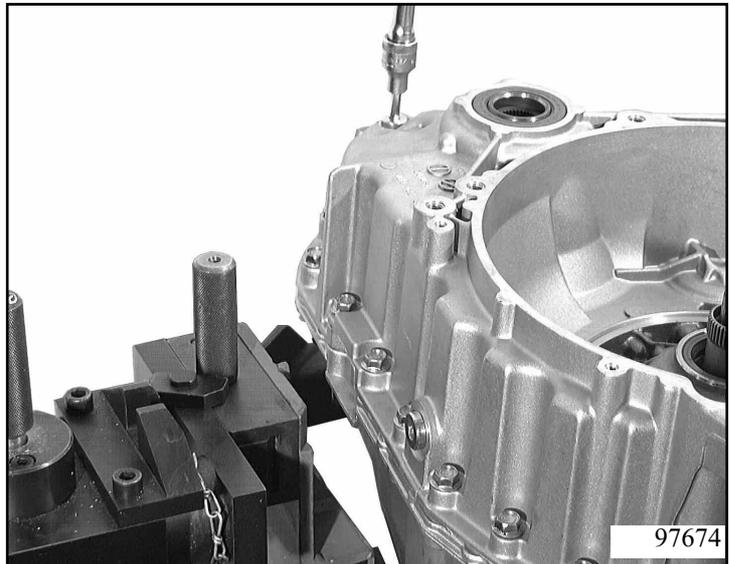


3.9.2 Installing the breather cover, oil dipstick and oil drain plug

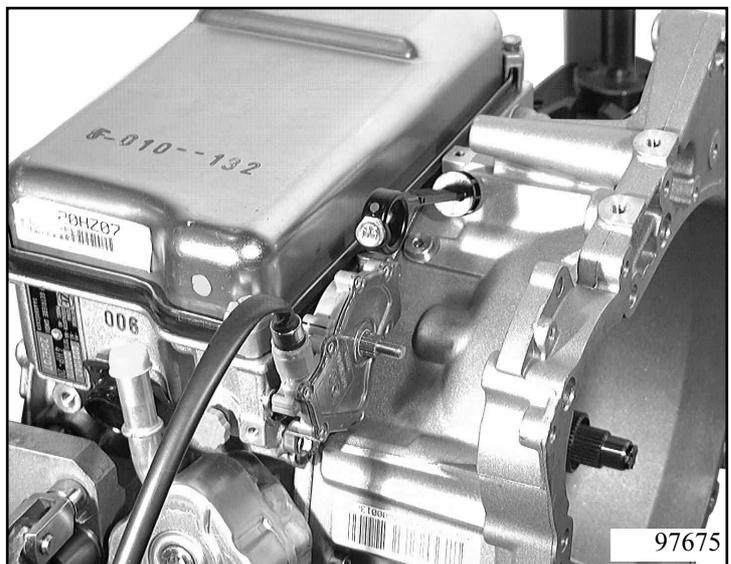
Lock breather cover 01.560 into breather 01.550.

Screw two oil drain plugs 22.100 and 22.200 into the converter bell housing.

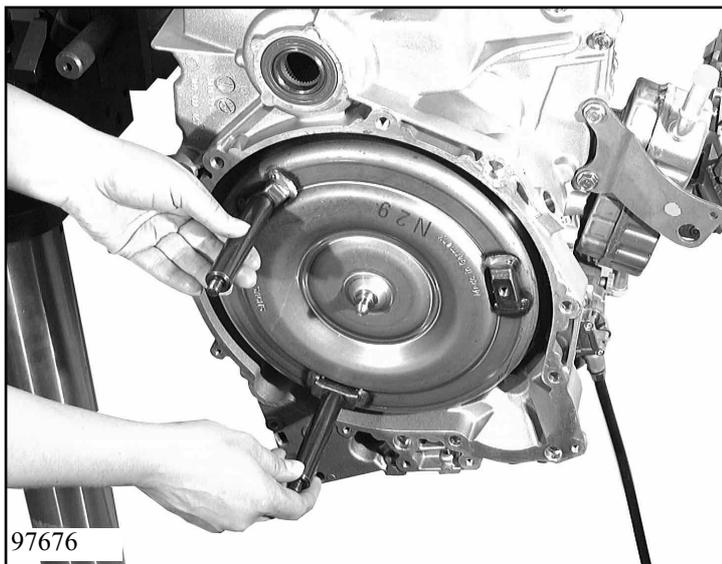
(See Chapter 1.5 for tightening torque)



Insert two new O-rings 22.250/120 and 22.250/130 at oil dipstick 22.250/110. Insert the oil dipstick into the transmission.



3.9.3 Installing the converter



Using extracting handles 5x56 000 090, insert converter 22.030, turning it as you do. Turn the transmission by 90°. (Converter towards the top).

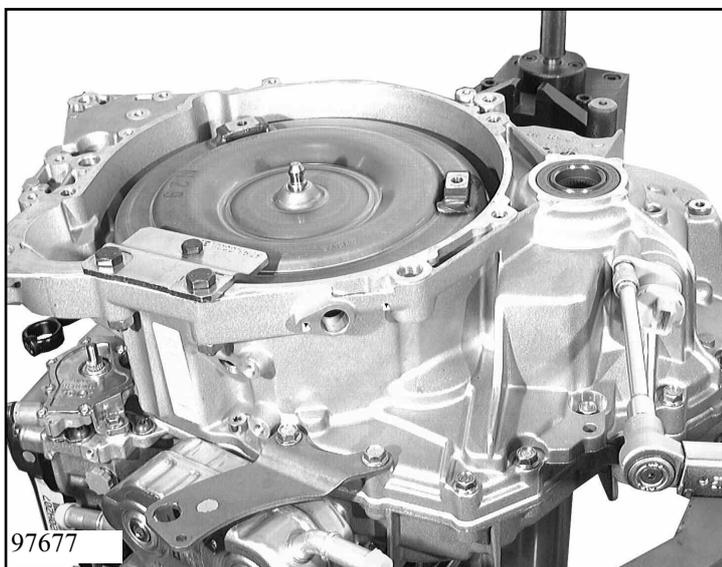
Fasten converter retaining bracket 5p95 000 137 with three screws and two nuts.

(See Chapter 1.5 for tightening torque)

Important!

Ensure that the converter fastening screw is not too long, or the converter will be damaged and the converter clutch will not function properly.

3.9.4 Installing speedometer shaft with connection

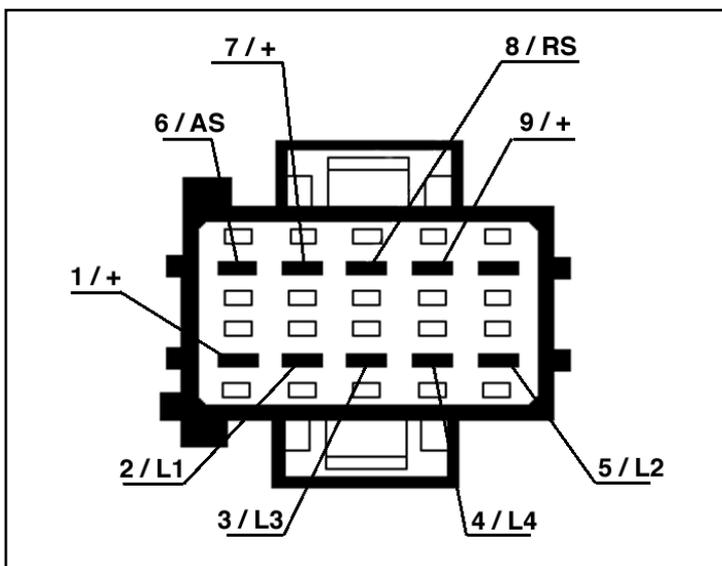


Put one new O-ring (for 09.390) on the speedometer connection.

Insert pinion shaft 09.380 into the speedometer connection, and slide both into the converter bell housing. Fasten with screw 09.392.

(See Chapter 1.5 for tightening torque)

3.9.5 Function test for the position switch



Using a multimeter, make a resistance test on the switch according to the function table.

(See Chapter 1.8 for function test)

3.9.6 Installing the protective transport caps

Put a new protective transport cap 09.394 on the speedometer connection.

Insert protective transport caps 09.450 and 09.460 in the differential openings.

Put protective transport cap 06.190 on the selector shaft.

Fasten the position switch cable with ring 01.400.

