

Inspection and Repair of Transmission

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|---------|
| Job No. |
| 26-5 |

For Models 180 to 220 SE the inspection and repair procedures for the transmission are essentially the same as described for Model 190. Deviations from these procedures are described in the following pages and the measurements required for checking and repair work are listed in tables.

Dimensions and Tolerances of Bearings in mm

| Model | Bearing designation | External diameter | Internal diameter | Width | Radial play |
|---|---|--|-------------------|----------|-----------------------|
| Front and rear mounting of countershaft in transmission case | | | | | |
| 180, 180 D, 190 SL, 220 a 1 st version | Annular grooved bearing 6305 DIN 625 | 62 | 25 | 17 | $\frac{0.008}{0.022}$ |
| All models 2 nd version | Annular grooved bearing 6305 C 3 DIN 625 | 62 | 25 | 17 | $\frac{0.017}{0.032}$ |
| Rear mounting of main shaft in transmission case | | | | | |
| All models | 136 981 02 25 (previously 6306 N DIN 625) | 72 | 30 | 19 | $\frac{0.008}{0.022}$ |
| Front mounting of drive shaft in crankshaft | | | | | |
| All models | Annular grooved bearing 6202 DIN 625 | 35 | 15 | 11 | $\frac{0.007}{0.019}$ |
| Rear mounting of drive shaft in transmission case | | | | | |
| All models | Annular grooved bearing 6306 ZN DIN 625 | 72 | 30 | 19 | $\frac{0.008}{0.022}$ |
| Front mounting of main shaft in drive shaft | | | | | |
| 180, 180 D, (1 st version), 220 a | Roller cage 16×24×20 | Part No. 000 981 03 12 | | | |
| 180 a, 180 b, 180 Db, 190 D, 190 Db, 190 SL, 219, 220 S, 220 SE, and 180 D (2 nd version) | Roller cage 16×24×20 | Part No. 000 981 08 12 Part No. 000 981 09 12 | | optional | |
| 1 st speed gear mounting on main shaft | | | | | |
| All models | Roller cage 3.5×8 DIN 5402 Part No. 120 981 02 12 | 42 | 35 | 21.40 | $\frac{0.030}{0.045}$ |
| 2 nd speed gear mounting on main shaft | | | | | |
| All models | Split roller cage 3.5×8 DIN 5204 Part No. 120 981 03 12 | 42 | 35 | 21.40 | $\frac{0.030}{0.045}$ |
| 3 rd speed gear mounting on main shaft | | | | | |
| 180, 180 D, 190 SL, 220 a, 219, 220 S, 1 st version | plain bearing | | | | |
| 180 a, 180 D, 190 SL, 219, 220 S, 2 nd version | 2 Needle cages 2.5×11.8 DIN 617 Part No. 000 981 28 12 | 40 | 35 | 15.50 | $\frac{0.030}{0.058}$ |
| 180 a, 180 b, 180 D, 180 Db, 190 D, 190 Db, 190 SL, 219, 220 S, 220 SE, 3 rd version | 1 Needle cage Part No. 000 981 29 12 | 40 | 35 | 31.00 | $\frac{0.010}{0.038}$ |

All bearings with a ten-digit Part number deviate in one way or another from the standardized bearings and should therefore always be ordered with their particular part number.

1. Countershaft

| | |
|---|------------------------------|
| Check countershaft for true running, max. eccentricity | 0.02 mm |
| Shaft diameter for annular grooved bearing seating | $= \frac{25.000}{24.987}$ mm |
| Shaft diameter for countergear seating | $= \frac{35.033}{35.017}$ mm |
| Bore of 3 rd speed countergear | $= \frac{35.000}{35.025}$ mm |
| Countergear bore (Drive constant) | $= \frac{34.994}{35.010}$ mm |
| Note: The shaft diameter for the annular grooved bearing seating was | $\frac{25.009}{24.996}$ mm |

2. Main Shaft

The main shafts differ in the bearing surfaces for the 3rd speed gear. On the 1st and 2nd versions the 3rd speed gear is carried in a plain bearing, whereas on the 3rd version it is carried in a needle bearing. As a result, there is a difference in the bearing surface diameter of the main shaft for the 3rd speed gear as shown in the table below.

A 1st or 2nd version main shaft can be replaced by a 3rd version shaft when repairs are carried out, provided that the 3rd speed gear is also replaced and that a needle cage is installed.

Dimensions and Tolerances of Bearing Surfaces of Main Shaft and Gears in mm

| Model | Gear | Diameter main shaft | Bore of speed gear | Radial play of speed gears | End play of speed gears |
|--|----------------------|-------------------------|-------------------------|----------------------------|-------------------------|
| All models | 1 st gear | $\frac{35.000}{34.987}$ | $\frac{42.018}{42.033}$ | 0.03—0.045 | 0.10—0.18 |
| All models | 2 nd gear | | | | |
| 1 st version plain bearing 180, 180 D, 190 SL, 220 a | 3 rd gear | $\frac{37.970}{37.961}$ | $\frac{38.000}{38.016}$ | 0.030—0.055 | |
| 2 nd version plain bearing 180, 180 D, 190 SL, 220 a, 219, 220 S | | $\frac{37.955}{37.946}$ | | 0.045—0.070 | |
| 3 rd version needle bearing 180 a, 180 D, 190 SL, 219, 220 S | | $\frac{35.000}{34.987}$ | $\frac{40.030}{40.045}$ | 0.030—0.058 | |
| 4 th version needle bearing 180 a, 180 b, 180 D, 180 Db, 190 D, 190 Db, 190 SL, 219, 220 S, 220 SE | | | $\frac{40.009}{40.025}$ | 0.010—0.038 | |

3. Speed gears

The back lash is

1st and 2nd gear = 0.10–0.16 mm
 3rd and 4th gear = 0.06–0.12 mm
 Reverse gear = 0.10–0.20 mm

Gear Ratios and Number of Teeth

| Model | Gear ratio | | | | | | Number of teeth | | | | |
|--|-----------------|-----------------|-----------------|-----------------|----------|----------|-----------------|-----------------|-----------------|-------|-------|
| | 1 st | 2 nd | 3 rd | 4 th | rev. | C. | 1 st | 2 nd | 3 rd | rev. | C. |
| 180, 180 a, 180 b, 180 D, 180 Db, 190 D, 190 Db | 1 : 4.05 | 1 : 2.38 | 1 : 1.53 | 1 : 1 | 1 : 3.92 | 1 : 1.88 | 13/28 | 19/24 | 27/22 | 12/25 | 17/32 |
| 190 SL 1 st version | 1 : 3.40 | 1 : 2.0 | 1 : 1.29 | 1 : 1 | 1 : 3.29 | 1 : 1.58 | 13/28 | 19/24 | 27/22 | 12/25 | 19/30 |
| 220 a 1 st version | 1 : 3.40 | 1 : 2.32 | 1 : 1.52 | 1 : 1 | 1 : 3.29 | 1 : 1.58 | 13/28 | 17/25 | 25/24 | 12/25 | 19/30 |
| 190 SL, 220 a 2 nd version 219, 220 S, 220 SE | 1 : 3.52 | 1 : 2.32 | 1 : 1.52 | 1 : 1 | 1 : 3.29 | 1 : 1.58 | 13/28 | 17/25 | 25/24 | 12/25 | 19/30 |

C = Drive constant, i. e. gear ratio between drive shaft and countershaft

4. Synchronizing Rings

See instructions given for Model 190.

5. Drive Shaft

The contact surface for the sealing ring is no longer provided on the whole circumference, but only over a length of 15 mm.

On Model 220 a 1st version the helical gear is secured on the drive shaft by means of a Woodruff key. In the case of the 2nd version and all other models drive shaft and helical gear are made in one piece.

a) Drive Shaft for Transmissions with Mechanical Clutch

$$\begin{aligned} \text{Shaft diameter (1st version)} \\ \text{for annular grooved bearing seating 6306 ZN} \end{aligned} = \frac{30.009}{29.996} \text{ mm}$$

$$\begin{aligned} \text{Shaft diameter (2nd version)} \\ \text{for annular grooved bearing seating 6306 ZN} \end{aligned} = \frac{29.996}{29.991} \text{ mm}$$

$$\begin{aligned} \text{Shaft diameter} \\ \text{for annular grooved bearing seating 6202} \end{aligned} = \frac{14.994}{14.983} \text{ mm}$$

b) Drive Shaft for Transmissions with Hydraulic Automatic Clutch

In the case of transmissions with hydraulic automatic clutch the drive shaft is no longer carried in the crankshaft, but in two needle bearings in the flange shaft of the hydraulic automatic clutch.

$$\text{Shaft diameter for annular grooved bearing seating 6306 ZN} = \frac{29.996}{29.991} \text{ mm}$$

$$\text{Shaft diameter for front needle bearing} = \frac{12.000}{11.989} \text{ mm}$$

$$\text{Shaft diameter for rear needle bearing} = \frac{18.000}{17.989} \text{ mm}$$

6. Three-Way Flange

Pay attention to the bolt hole circle when replacing the three-way flange.

Three-Way Flange Table

| Model | Part No. | Bolt hole circle diameter mm | Applicable up to Chassis End No. |
|--|---------------|------------------------------|----------------------------------|
| 180, 220 a | 180 262 06 45 | 80 | all |
| 180 D 1 st version | | | up to 65 01919 |
| 190 SL 1 st version | | | up to 65 00172 |
| 219 1 st version | | | up to 65 00740 |
| 180 D 2 nd version | 186 262 08 45 | 90 | as from 65 01920 |
| 190 SL 2 nd version | | | as from 65 00173 |
| 219 2 nd version | | | as from 65 00741 |
| 180 a, 180 b, 180 Db, 190 D, 190 Db, 220 S, 220 SE | | | all |

Models 190 SL, 220 a, 219, and Model 180 D with single-jointed rear axle can subsequently be provided with a three-way flange with a bolt hole circle of 90 mm, provided that also the ~~front~~ propeller shaft is replaced at the same time (see also Job No. 41-4).

Check the contact surface of the sealing ring on the three-way flange. When repairs are carried out, the contact surface of the three-way flange can be refinished to a diameter of 37.34 mm. On new flanges the dimension is 37.840—38.000 mm. After refishing, the contact surface should be given a right-hand thread pattern on approx. 20 mm of its circumference. On previous flanges the right-hand thread pattern extended over the whole circumference of the flange. Check the three-way flange for run-out.

7. Transmission Case Top Cover

Check the separating surface for unevenness and refinish if necessary. Replace worn shift forks, shift rails, and guide plates if necessary. Check the springs in the shift forks and the pressure springs for the synchronizing units (see table below.).

Spring Testing Table

| | | External diameter | Free Length | Length under Load installed under final load | | | | Wire gage | Load tolerance % |
|--|--|-------------------|-------------|--|-----|------|------|-----------|------------------|
| | | | | mm | kg | mm | kg | | |
| All models | Pressure springs Part No. 180 993 41 01 | 6.0 | 11.6 | 8.3 | 1.8 | 7.1 | 2.5 | 0.8 | ± 5 |
| 180, 180 a, 180 b, 180 D, 180 Db, 190 D, 190 Db, 219, 220 a, 220 S, 220 SE | Shift fork pressure spring for forward gears Part No. 186 993 13 01 | 7.6 | 20.2 | 15.5 | 3.2 | 13.0 | 5.0 | 1.1 | ± 8 |
| 180, 180 a, 180 b, 180 D, 180 Db, 190 D, 190 Db, 219, 220 a, 220 S, 220 SE, and 190 SL | Shift fork pressure spring for reverse gears Part No. 136 993 31 01 | 7.8 | 20.25 | 15.5 | 9.8 | 13.0 | 15.0 | 1.4 | ± 8 |
| 190 SL | Shift fork pressure spring for forward gears Part No. 198 993 07 01 | 7.75 | 20.6 | 15.5 | 6.7 | 13.0 | 10.0 | 1.25 | ± 8 |