

# Inspection and Repair of Transmission

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 <sup>st</sup> version	Annular grooved bearing 6305 DIN 625	62	25	17	$\frac{0.008}{0.022}$
All models 2 <sup>nd</sup> 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 <sup>st</sup> 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 <sup>nd</sup> version)	Roller cage 16×24×20	Part No. 000 981 08 12 Part No. 000 981 09 12 optional			
1 <sup>st</sup> 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 <sup>nd</sup> 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 <sup>rd</sup> speed gear mounting on main shaft					
180, 180 D, 190 SL, 220 a, 219, 220 S, 1 <sup>st</sup> version	plain bearing				
180 a, 180 D, 190 SL, 219, 220 S, 2 <sup>nd</sup> 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 <sup>rd</sup> 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	$= \frac{25.000}{24.987} \text{ mm}$
Shaft diameter for countergear seating	$= \frac{35.033}{35.017} \text{ mm}$
Bore of 3 <sup>rd</sup> speed countergear	$= \frac{35.000}{35.025} \text{ mm}$
Countergear bore (Drive constant)	$= \frac{34.994}{35.010} \text{ mm}$
<b>Note:</b> The shaft diameter for the annular grooved bearing seating was	$\frac{25.009}{24.996} \text{ mm}$

## 2. Main Shaft

The main shafts differ in the bearing surfaces for the 3<sup>rd</sup> speed gear. On the 1<sup>st</sup> and 2<sup>nd</sup> versions the 3<sup>rd</sup> speed gear is carried in a plain bearing, whereas on the 3<sup>rd</sup> 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 3<sup>rd</sup> speed gear as shown in the table below.

A 1<sup>st</sup> or 2<sup>nd</sup> version main shaft can be replaced by a 3<sup>rd</sup> version shaft when repairs are carried out, provided that the 3<sup>rd</sup> 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 <sup>st</sup> gear	$\frac{35.000}{34.987}$	$\frac{42.018}{42.033}$	0.03—0.045	0.10—0.18
All models	2 <sup>nd</sup> gear				
1 <sup>st</sup> version plain bearing 180, 180 D, 190 SL, 220 a	3 <sup>rd</sup> gear	$\frac{37.970}{37.961}$	$\frac{38.000}{38.016}$	0.030—0.055	
2 <sup>nd</sup> version plain bearing 180, 180 D, 190 SL, 220 a, 219, 220 S		$\frac{37.955}{37.946}$		0.045—0.070	
3 <sup>rd</sup> 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 <sup>th</sup> 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

1<sup>st</sup> and 2<sup>nd</sup> gear = 0.10–0.16 mm

3<sup>rd</sup> and 4<sup>th</sup> 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 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	rev.	C.	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	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 <sup>st</sup> 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 <sup>st</sup> 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 <sup>nd</sup> 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 1<sup>st</sup> version the helical gear is secured on the drive shaft by means of a Woodruff key. In the case of the 2<sup>nd</sup> version and all other models drive shaft and helical gear are made in one piece.

#### a) Drive Shaft for Transmissions with Mechanical Clutch

Shaft diameter (1<sup>st</sup> version)  
for annular grooved bearing seating 6306 ZN  $= \frac{30.009}{29.996}$  mm

Shaft diameter (2<sup>nd</sup> version)  
for annular grooved bearing seating 6306 ZN  $= \frac{29.996}{29.991}$  mm

Shaft diameter  
for annular grooved bearing seating 6202  $= \frac{14.994}{14.983}$  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 <sup>st</sup> version			up to 65 01919
190 SL 1 <sup>st</sup> version			up to 65 00172
219 1 <sup>st</sup> version			up to 65 00740
180 D 2 <sup>nd</sup> version	186 262 08 45	90	as from 65 01920
190 SL 2 <sup>nd</sup> version			as from 65 00173
219 2 <sup>nd</sup> 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 refinishing, 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