After cleaning, all parts should always be checked to see whether they are still serviceable.

1. Annular Grooved Bearing and Roller Cage

As a rule, annular grooved bearings and roller cages can be considered serviceable if the bearing grooves or contact surfaces as well as the balls or rollers show no visible damage or wear. This inspection can only be made successfully if the bearing has previously been washed in gasoline or trichloroethylene until all dirt has been removed. The bearing can be considered free of dirt when it moves without any suggestion of binding when rotated by hand.
Before it can be checked for quiet running, the carefully cleaned bearing must be lubricated with a few drops of engine oil or transmission oil. In judging the serciceableness of bearings, it should be taken into account that even bearings that have been in use for only a short period are considerably noisier than new bearings, without actually being unserviceable.
In order to avoid the discarding of bearings that are still serviceable, the assessment of their condition should be entrusted only to trained personnel experienced in this work. Under normal operating conditions the radial play of a bearing should not increase to any considerable extent.
After approx. 100 000 km the bearings are near the end of their service life and when repairs are carried out they should be replaced even if on inspection they should still prove serviceable. However, an additional consideration should always be whether the bearings can be replaced easily, i. e., without considerable installing or preparatory work.

Dimensions and Tolerances of Annular Grooved Bearing and Roller Cage in mm

Designation	Location	Radial play	End play of annular grooved bearing and speed gears	Internal diameter	External diameter	Width
Annular grooved bearing 6305 C 3 DIN 625	Countershaft	0.017 — 0.032	0.17 — 0.32	25	62	17.00
Annular grooved bearing 6306 N DIN 625 and Annular grooved bearing 6306 ZN DIN 625 (ZN with cover plate)	Main shaft 6306 N (X) Drive shaft 6306 ZN	0.008 — 0.022	0.10 — 0.20	30	72	19.00
Roller cage 3.5 x 8 DIN 5402 120 981 02 12	1st speed gear	0.030 — 0.045	minimum 0.10	35	42	21.40
Split roller cage 3.5 x 8 DIN 5204 120 981 03 12	2nd speed gear	0.030 — 0.045	minimum 0.10	35	42	21.40
2 Roller cages 2.5 x 11.8 DIN 617 000 981 28 12	3rd speed gear*	0.030 — 0.058	minimum 0.10	35	40	15.50

* In the 1st version the gear is supported on a plain bearing.

The front annular grooved bearing 6306 ZN DIN 625 of the drive shaft is marked either 1 or 2 and is closed on one side by a cover plate.
The rear annular grooved bearing 6306 N DIN 625 of the main shaft may be marked either 1 X or 2 X.

The designations 1 and 2 indicate the width of the groove in the outer race of the bearing. According to the width of the groove the snap ring should be selected to fit tightly in the groove.
The snap rings are available in the following thicknesses: 1.90, 2.00, and 2.05 mm.
Bearings marked X have a maximum rounding radius at the inner race of r = 2 mm.

On the rear transmission side of the main shaft, only bearings marked X should be installed. On the front transmission side of the drive shaft this limitation of radius is not necessary.

2. Countershaft

Check countershaft for true running, max. eccentricity 0.02 mm.

Shaft diameter for annular grooved bearing seating = $\frac{25.000}{24.996}$ mm

Shaft diameter for countergear seating = $\frac{35.033}{35.017}$ mm

Bore of 3rd speed countergear = $\frac{35.000}{35.025}$ mm

Countergear bore (Drive constant) = $\frac{34.994}{35.010}$ mm

3. Mainshaft

Check mainshaft for true running, max. eccentricity 0.02 mm.

Dimensions and Tolerances of Bearing Surfaces of Mainshaft and Gears in mm

	Diameter main shaft		Bore of gear		Radial play of gears	
1st gear	$\frac{35.000}{34.987}$		$\frac{42.018}{42.033}$		0.030 — 0.045	
2nd gear	$\frac{35.000}{34.987}$		$\frac{42.018}{42.033}$		0.030 — 0.045	
	Plain bearing	Roller bearing	Plain bearing	Roller bearing	Plain bearing	Roller bearing
3rd gear	$\frac{37.955}{37.946}$	$\frac{35.000}{34.987}$	$\frac{38.000}{38.016}$	$\frac{40.030}{40.045}$	0.045 — 0.070	0.030 — 0.058

4. Speed gears

Gear ratios	
1st gear	1:4.05
2nd gear	1:2.38
3rd gear	1:1.53
4th gear	1:1
Reverse gear	1:3.92
Constant (Drive shaft:countershaft)	1:1.88

Number of teeth	
1st gear	13/28
2nd gear	19/24
3rd gear	27/22
Constant	17/32
Reverse gear	12/17/25

The serviceability of used gears depends on their quiet running and on the degree of wear of the tooth flanks and the small gear section. The backlash of new gears is 0.10—0.16 mm for the 1st and 2nd speed gears, 0.06—0.12 mm for the 3rd and 4th speed gears, and 0.10—0.20 mm for the reverse gear. The end play between gear and thrust washer is 0.10—0.18 mm.
The fit between keys and grooves on the shafts and on the gears should also be checked. The speed gears should all turn easily.

1st Speed gear

The 1st speed gear is carried in a roller bearing which consists of 2×18 rollers and cage. If individual rollers are damaged, the complete roller cage assembly must be replaced.

2nd Speed gear

The 2nd speed gear is also carried in a roller bearing; the bearing is split and consists of 2×18 rollers and cage. If individual rollers are damaged, the split roller cage assembly must be replaced.

3rd Speed gear

Check the bronze bushing which is fitted into the 3rd speed gear by a special process.
If the radial play exceeds 0.1 mm or if the 3rd gear slips out although the pressure spring in the shift fork is satisfactory and the engine mounting is not defective (see Job No. 22—0), the gear must be replaced.
On recent models, also the 3rd speed gear is carried in roller bearings consisting of two roller cages. Each roller bearing consists of 28 rollers and cage. If individual rollers are damaged, the complete roller bearing must be replaced.

Reverse Idling Gear

If the bushing in the reverse idling gear is replaced, it should be pressed in with a force-fit allowance of 0.01—0.03 mm and should be expanded at the free ends at an angle of 45° (Fig. 26—5/1).

After expanding, the bushing must be able to withstand an axial pressure of 15000 kg.
The inside diameter "D" of the bushing is 20.065—20.098 mm and the diameter of the reverse idling shaft is 19.987—20.000 mm. The resulting radial play is 0.065—0.111 mm.

Note: Bushings should only be replaced as an emergency measure. Wherever possible, the reverse idling gear should be replaced if the bushing is loose.

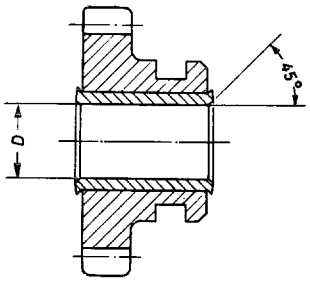

Fig. 26 — 5/1

5. Synchronizing Rings

The synchronizing rings are checked for serviceability by putting the synchronizing ring on the cone of the appropriate speed gear and by turning it to the right. After turning, the synchronizing ring should be firmly seated on the cone of the speed gear but it must be possible to remove it without forcing. **When the ring is fitted, there should still be a sufficient distance (minimum 0.5 mm) between the short gear section of the synchronizing ring and that of the speed gear; if this is not the case, the synchronizing ring or the appropriate speed gear should be replaced!**

If new synchronizing rings are used, they should be tested in the same way.

The 1st speed gear synchronizing ring has a nose width of 10 mm, and the synchronizing rings for the 2nd, 3rd, and 4th speed gears have a nose width of 8.4 mm (see Fig. 26 — 5/3).

The grooves of the synchronizing rings are subdivided by 12 splines (see Fig. 26 — 5/2).

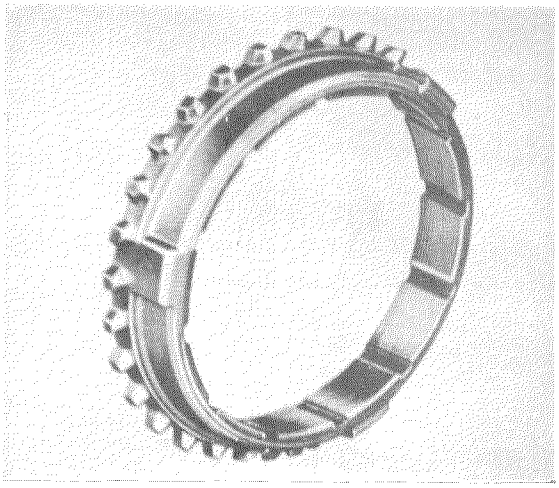

Fig. 26 — 5/2

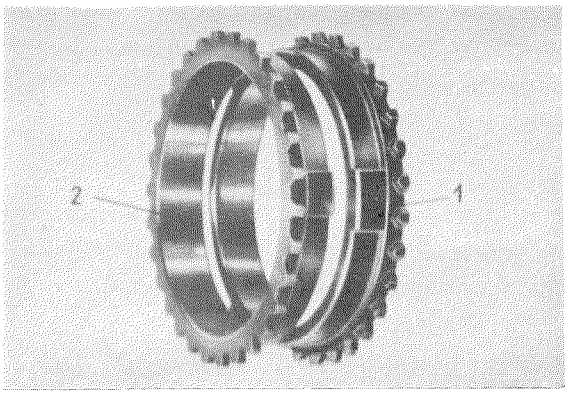

Fig. 26 — 5/3

1 Synchronizing ring for 1st speed gear, nose width = 10 mm
2 Synchronizing ring for 2nd to 4th speed gear, nose width = 8.4 mm

6. Drive Shaft

At the contact surface of the sealing ring, the drive shaft is provided with a left-hand thread pattern (Fig. 26 — 5/4). If the contact surface is worn, the drive shaft can be re-machined down to a diameter of 29.700 mm. New drive shafts have a contact surface diameter of 29.848—29.000 mm. After refinishing, the contact surface should again be provided with a left-hand thread pattern (see Job. No. 25 — 5, Paragraph 5). The helical gear is not pressed on the drive shaft; drive shaft and helical gear are

made in one piece. Only the synchronizing cone with the short gear section is pressed on the drive shaft with a considerable force-fit allowance. Check drive shaft for out-of-roundness. Maximum permissible out-of-roundness = 0.03 mm. The drive shaft must not be re-straightened!

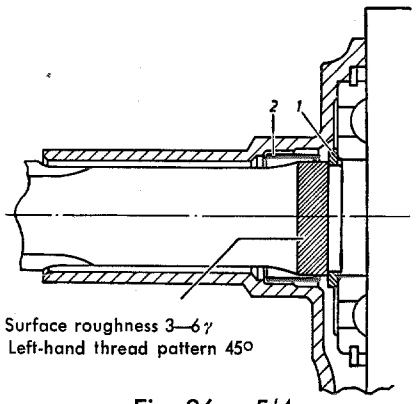

Fig. 26 — 5/4

1 Snap ring
2 Sealing ring

7. Three-way Flange

Check the contact surface of the sealing ring at the three-way flange. At the contact surface, the three-way flange can be refinished; maximum stock removal 0.5 mm in diameter. Dimension when new: 37.840 — 38.000 mm. After refinishing, the contact surface should be given a right-hand thread pattern (see Job. No. 35 — 5, Paragraph 5). Check three-way flange for run-out (see Reassembly of Transmission, Job No. 26 — 4, Paragraph 55).

8. Transmission Case Top Cover

Check separating surface for evenness and, if necessary, refinish by hand.
Replace worn shift forks, shift rails, guide and stop plates, if the degree of wear makes this necessary.

Check the springs in the shift forks in accordance with the table below.

Spring Testing Table

Designation	External diameter mm	Free length mm	Length under load mm	Length under load kg	Wire gage mm	Load tolerance %
Pressure springs 120 993 14 01	6	12.4	a) 8.2 b) 7.3	1.65 2.00	0.75	±5
Pressure springs for shift forks, 1st and 2nd gear, 3rd and 4th gear 186 993 13 01	7.6	20.2	a) 15.5 b) 13.0	3.2 5.0	1.1	±8
Pressure springs for reverse gear shift shoe 136 993 31 01	7.8	20.25	a) 15.5 b) 13.0	9.8 15.0	1.4	±8

a) installed b) under final load