Choice and purchase of spare parts

By Volodjushka

The normal operation and service life of the gearbox depends greatly from both a skillful selection and correct choice of high quality spare parts.

Gear selection mechanism: It's better to buy the complete set of three. Second-hand shift rails which are sold separately are frequently bent or warped.

Ball bearings: Check up for absence of play between the bearing races:

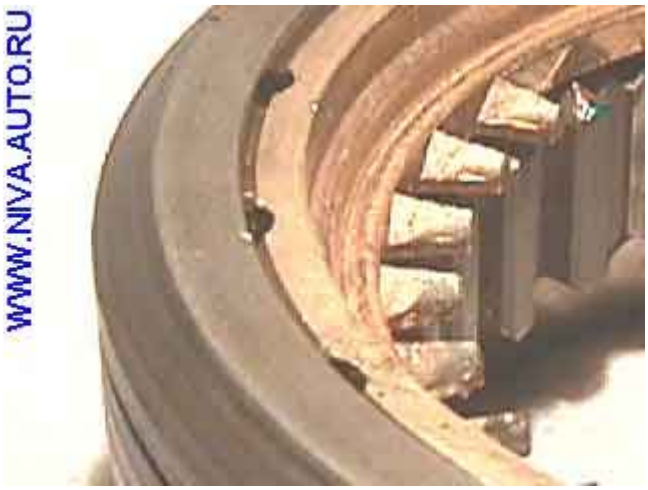
All bearings must be checked to ensure both races rotate relative to each other easily. The needle bearing plastic separator must be free of cracks.

As malfunction of the input shaft bearing seems to happen rather frequently, during repairs I recommend replacing for good the original unit with a SKF 615722 of Swedish or Italian manufacture:

Synchronizer baulk rings: All tooth edges must be precise. Check up for ease of movement and absence of jamming on the gear straight tooth rim:

Place the synchronizer baulk ring in its respective sleeve. It should not have any significant ovality:

A normal synchronizer baulk ring shouldn't act strongly (below on the right an obviously bad synchronizer) and to be sunk in the sleeve more than 0.5 mm (at the upper right). The left picture shows a normal synchronizer baulk ring:



All of the gear straight teeth faces must look precisely equal**.** The tooth faces must all be symmetrical (see left picture). Shifting to any gear with asymmetrically sharpened teeth (right photo) will prove troublesome:

Insert all gears in their respective sleeves. They should go in and out easily without jamming.

The lubrication channels on the faces of the synchronizer sleeves and gears must not be clogged:

If it's necessary to buy **assembled gear / baulk ring sets**, check for absence of jamming between the baulk ring and the gear's straight teeth. Also check that the synchronizer spring sits squarely against the persistent ring. The synchronizer baulk ring must travel parallel all along the way, if it doesn't either the persistent ring is warped or the synchronizer's spring is incorrectly installed:

Grab the gear and synchronizer assembly and enclose it in the sleeve. Turn it a few times (left picture) and then push the gear into the sleeve, compressing the synchronizer spring (right picture):

The gear should go on tight, but must enter and exit the sleeve easily without jamming. On the left picture it can be seen that the gear has jammed on the sleeve and can't return to the original position (right picture):

The 4th-speed gear is machined on the input shaft, but it's checked the same way as all others. The picture shows a 4th-speed gear with damaged straight teeth. This condition can't be seen in the picture, but note how the sleeve has jammed on the gear straight teeth and can't come back to its original position under the synchronizer spring action:

The splines of the input shaft must also be checked out. For this purpose insert the input shaft in the clutch disc and move the disc all the way up and down 2 – 3 times. The picture shows the disc has jammed on the input shaft end, which has gouged splines:

All sleeves must have precisely equal teeth, without any rough edges which would interfere with gear shifting. The tooth faces should all be symmetric (left picture). The right picture shows clearly that the sleeve teeth edges have been displaced to the right:

Each sleeve should have 8 lubrication channels. Some channels may appear to have a small displacement relative to each other but this should not be taken as a sign of defects:

Some defective sleeves are shown below. On the left upper picture one channel is missing, on the right upper picture the channel is obviously displaced to the middle, and the bottom pictures show a badly chamfered sleeve:


Check up that the gear hub splines don't jam on the sleeves, they should move freely in both directions:

This picture shows evident jamming:

Check up that the sleeves are inserted easily on their gears (as is described above).

Insert the shift forks on the sleeves and rotate them in both directions, they should move freely without any jamming. The right picture shows a non-factory standard sleeve, note the fork can't get completely into the sleeve groove. At the left, the same fork with another sleeve, now factory standard:

Forks should look equal and homogeneous – A brassy powdered color, without any black specks:

The shift rails should get into the fork holes with a little tightness. Check them by inserting each rail in its respective fork.

The fork fastening bolts should enter freely into their bores:

Insert the forks on the sleeves. They should move easily in circles:

We've already described how to check the **hub splines.** The hubs of 1st-2nd and 3rd-4th speeds get damaged very seldom. The 5th-speed hub needs special attention, as it frequently jams on the sleeve:

Shift rails should all be equal and move easily in the gearbox case bores. Check out for presence and look at the quality of the fork fastening bolt holes (the left photo shows burrs in the hole edge), detent ball notches (three of them) and interlock retainer notches (one notch for the 1st-2nd and 5th-reverse rail, the 3rd-4th shift rail has two opposite notches):

The countershaft should not have any chipped or broken teeth. The ends should have precisely cut threads. Note that the 4-speed gearbox countershaft has an unthreaded rear end (left picture):

The reverse gears should have equal, symmetrical and chip-free teeth. Check the condition of the reverse idler gear brass insert:

The gear cluster teeth and splines should be symmetrical and free of any damage:

Check the condition of the gear cluster splines. For this purpose the cluster is installed in the rear end of the countershaft (left picture). Also check the landing of the front countershaft bearing inner race (right picture), it shouldn't go in by the hand's force, only with the aid of a hammer:

The main shaft: To check the shaft's diameter all gears, bushings, hubs, sleeves, bushes and bearings must be installed on it, on a new shaft all parts should go in with a small tightness. To check the splined end we must insert the rear flange and turn the shaft and flange in opposite directions and look for absence of play between both parts:

Here's a damaged main shaft. Note the bearing has jammed and can't land into place:

The bellhousing gets out of operation extremely seldom, only in the event of complete breakage of the front countershaft bearing holding tabs. There's no choice criteria for buying a bellhousing, it's possible to buy the first got. But either if the new bellhousing has been sold together with a clutch release

bearing guide tube or not, this guide tube must be checked by installing the release bearing hub and ensuring it slides easily in both directions:

Check the bearing bores in the gearbox **rear cover.** The bearings should go in squarely with effort. The picture shows how the bearing is installed using a hammer wooden handle:

Check the **spring (thrust) washer** by stretching and twisting it:

The spring washer must not be oval or distorted in any way:

Oil seals should have sharp working edges:

When checking the **release bearing yoke** pay attention to the color and manufacturing quality. The original yoke it's a dark grey color, its spring is kept in place by two small copper rivets. The factory-installed rivets have semi-circular heads. See that the release bearing spring clip holds the yoke snugly:

It is noticed that those spare parts which are marked with paint are almost always of a high quality:

But I recommend not counting much on it and choosing spare parts more carefully.