

## Inspection of the gearbox components

By Volodjushka

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It's necessary to wash thoroughly all removed parts with gasoline, diesel fuel, kerosene, etc. Otherwise some defects can simply not be seen. For example, cracks in bearing cages sometimes are found out only after careful washing. Very frequently the destroyed parts, like broken gear teeth, broken and/or loose springs and lockrings rest in the gearbox case bottom under a layer of old oil and metal powder. They come to light only after a good, thorough cleaning. In general, don't be too lazy to wash everything out, as any debris or fragments can spoil all the work like the spoon of tar in the honey flask.

So, in order:

Wash away **the bottom cover and its magnetic plug** from all brass dust of synchronizers and metal fragments:



Airblast all parts after washing.

Wash out and examine **the shifting mechanism** for presence of cracks in the lever extension. The mechanism gets out of operation very seldom, but the extension sometimes breaks:



The **bearings** must be washed thoroughly. In the case of ball bearings examine the internal and external races and the ball cages as well:



Check the radial play by shaking the races in opposite directions, respective to each other:



Search the ball cages for cracks:



In roller bearings check the rollers for pitting and pale-dark blue coloration:



Stretch the plastic needle bearing cage to check its integrity and examine the rollers for pitting or scoring:



Replace the bearings if there's any sign of play, cracks or pitting. The countershaft's front double-row ball bearing almost always breaks up during the disassembly procedures, so it's replaced by a new one:



S&#t happens:



Wash and check all the **gear straight and slanted teeth** are present and bear no signs of cracks in them. The tooth end faces should be sharp, without any deterioration and/or chopped off (as shown on the left picture). Sides should not have traces of deterioration, as shown in the right picture:



The persistent ring of the synchronizer spring (between the slanting and straight gear teeth) should be ideally equal, and should not be semicircular, warped, oval or dented. This applies particularly to the 5<sup>th</sup> gear (if the gearbox rear nut is loosened, the 5<sup>th</sup> gear sprocket takes the entire load and bends against the 5<sup>th</sup>/reverse gear cluster) the picture shows a 5<sup>th</sup> gear sprocket with a dented persistent ring:



The **synchronizer baulk rings** are cleaned out and examined for deterioration of the tooth tips from both sides:





There should not be wear or rub marks on the top part. The left picture shows marks made by contact against the lockring. The marks also tell how strong the baulk ring interacts with the sleeve, in this case the baulk ring sinks deeply and its top face bears against the sleeve teeth (right picture):



The integrity of the **synchronizer springs** is checked visually:



Wash the **synchronizer sleeves** with a hard brush, especially the groove over the teeth where a lot of metallic debris always builds up (shown with an arrow in the picture):



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Examine the tooth end faces. They should be sharp without deterioration or chopped off:



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Tooth sides should not have any signs of deterioration:



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The fork groove facet should be precise, without any burrs.

The baulk ring should not sink deeply into the sleeve and touch its teeth as on the right picture:

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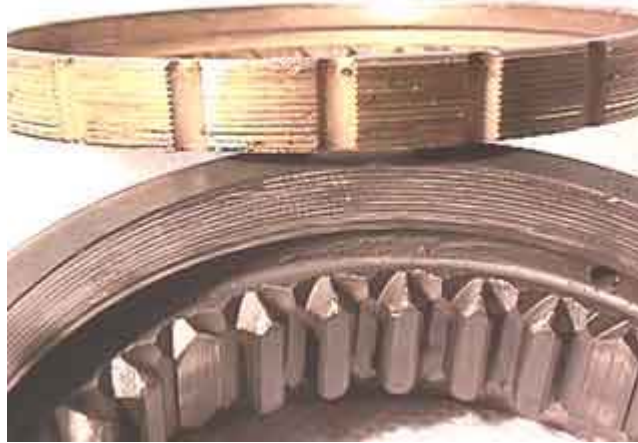


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Also the working surface of the sleeve should not have any scores made by the baulk rings:

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Worn out sleeves are replaced by new ones.

Wash from oil and wipe the **shift forks**. They should not have signs of wear or damage on the working surface:



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Worn out forks are replaced by new ones.

Wash out the **gear hubs** with gasoline and check their splines for damage:





Faulty hubs are replaced by new ones.

Check the **shift rails** for ease of movement in the gearbox case:



Also check the condition of the detent mechanism surfaces and the shift gates (where the shifting mechanism works). Faulty rails are replaced by new ones.

The **countershaft** gears are examined for integrity of the teeth and absence of cracks on them:





Check the condition of the front and rear end threads. Note (on the left picture) that the 4-speed gearbox countershaft rear end isn't threaded:



(Picture taken by [Leo](#)).

The **reverse idler and drive gear** should have sharp tooth end faces. Any gears with worn out teeth are replaced by new ones:



The **5<sup>th</sup>/reverse gear cluster** is checked on presence of all teeth (sometimes the slanting teeth break up) and absence of cracks on them. Also check the small sprocket for damage on the end faces. The bearing inner race should not be removed by the hand's force:



A faulty gear cluster is replaced by a new one.

The **gear cluster bolt** breaks up rather frequently:



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One time I broke this bolt during tightening with the torque wrench. The broken bit remains in the countershaft; but it can be removed easily with a small screwdriver and a little patience:



Check the **input shaft** bearing, the 4<sup>th</sup> gear sprocket, the synchronizer baulk ring and its spring. If there are any remarks about its condition replace the input shaft by a new one.

The **main shaft** fails extremely seldom. Nevertheless, check if there's any play between the shaft and the output flange splines:



In my practice I found a case where the main shaft splines were damaged. On the left picture it is well visible how the splines were narrowed down. This was the result of a quite negligent attitude (operating the gearbox with a loose rear nut):



Examine the Woodruff key and the main shaft keyway:



Sometimes is possible to find surprises just by lifting with your fingernail:





If there's any play between the key and the keyway replace the key or the main shaft as needed.

The **gearbox rear cover** must be cleaned of any oil and metal fragments. Check the bores of the bearings of the main shaft and countershaft. The outer bearing races must not turn in their bores:



A lot of fragments and debris accumulates in the **gearbox case** front and rear and between the casting reinforcement ribs. Wash all the case thoroughly:





Check the bores of all bearings for scoring or cracks. The bearing outer races should not be turned in their bores. A damaged case is replaced by a new one.

A lot of junk accumulates also in the **bellhousing**, like fragments of the spring washer and/or the input shaft bearing. Therefore I must be washed thoroughly to check its condition. If the front countershaft bearing has been completely destroyed pay attention to the condition of the bearing clamping tabs (shown by arrows in the picture):



If these tabs are damaged the complete bellhousing must be replaced.

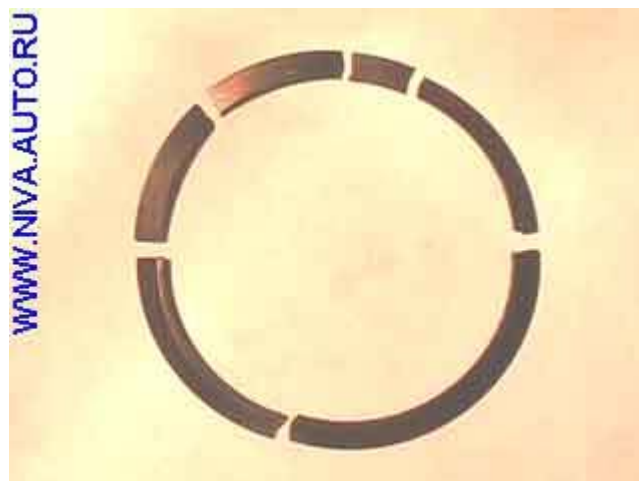
Inspect the **clutch release bearing guide tube**. If it shows a deep groove made by contact with the spring (thrust) washer or can be removed easily from its place by hand force replace the guide tube:



The **spring (thrust) washer** is checked by stretching and twisting:



A warped, damaged or broken washer is replaced by a new one:



Check the **oil seals** for damage and cuts on the rubber lip:





The seal working edges should be not more than 1 mm in width.

The **clutch release bearing fork** must be checked for cracks and damage on the places shown by the arrows:



A cracked or worn out fork is replaced by a new one.

The **reverse light indicator switch** should not be left aside, if its contacts are heavily corroded or if pressing the ball doesn't close the circuit (use a tester or control lamp for checking this up), replace the switch by a new one.

Clean all mating surfaces from any old gasket material.

Volodjushka, 14.03.03.