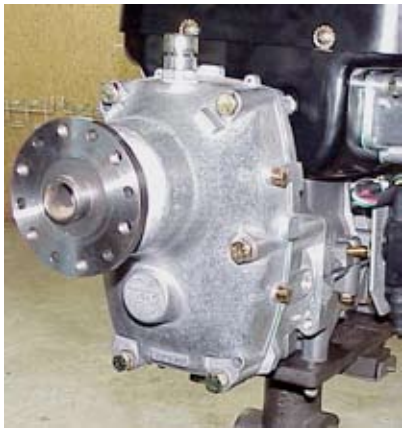
Part #54

Gear Box Maintenance

By Mike Stratman



Found on the vast majority of Rotax Powerplants below 66 hp, the B gearbox is the workhorse of the Ultralight industry. The design is extremely simple allowing most anyone to perform regular maintenance with a limited number of specialty tools. This month we'll do a complete teardown and inspection of this popular unit, discuss some of the design features, and take a look at what happens when regular maintenance checks are overlooked.

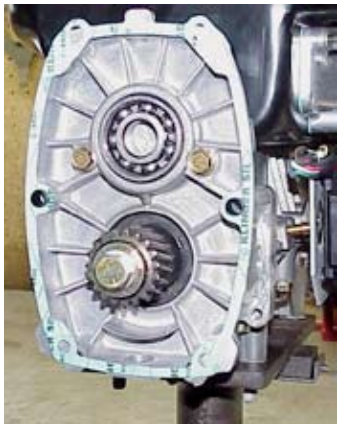


Figure #1 – After draining and splitting the case halves two additional bolts need to be removed from the inside.

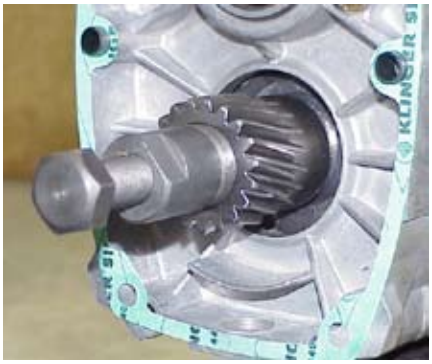


Figure #2 – The drive gear can be removed easily with the #276-808 puller shown here.

Inspection and Teardown: *Remove the bottom drain plug and drain all oil from box. Inspect the plug carefully for debris. The magnetic in the center of the plug is designed to collect any metal chips of filings. A properly functioning box should have little or no filings collected on the magnet. Remove the six 8mm bolts on the outside of the box. This will allow you to split the cases and remove the prop half of the gearbox. Saving the gasket to use again will probably not happen so make sure you have an extra gasket handy if you venture inside. Two more bolts next to the shaft bearing need to be removed to remove the remainder of the box from the crankcase. Note the large o-ring that seals the box to the machined flat surface on the crankcase. This keeps the gear oil from leaking past this point. Rarely does the o-ring need to be changed, so set it a side for reuse.*

Drive Gear Removal: *Removing the drive gear is generally not necessary unless you need to change ratio or replace the crank. Removal is easy with the #276-808 Puller available from Rotax for around $75. Just thread into the gear (real old boxes don't have threads, so the tool doesn't work) and tighten drive bolt. Apply heat carefully if gear refuses to budge making sure not to fry crank seal. If you don't have the puller or have an old box without threads a calm type puller can be used but puller alignment is difficult to maintain.*

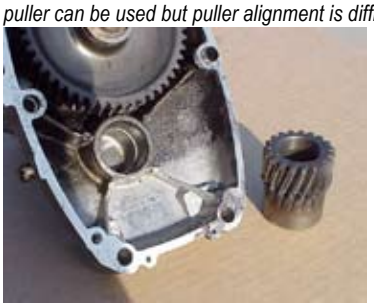


Figure #3 – This gearbox terminated in a grinding failure due to lack of lubrication. Note the blackened gears and metal-to-metal contact. Also note the debris line ¾" below fill port. While oil was present but the level was too low to transfer properly.

Figure #4 – To Remove the case bearing, heat the outside of the case aggressively to expand the surrounding boss

Inspect Gears for Wear: *A properly lubricated box should shown minimal wear at where gears contact. Improperly lubricated gears will show burned black debris coating the inside of the box as shown in the above photo. On this box the operator claimed the box has plenty of oil. Checkout the noticeable debris line ¾" below the side oil port. While the box had oil, the level was too low for the drive gear to circulate the oil properly, hence the lose of the gear set. When run in the up position oil level is crucial because even with the box filled to the port only half of the drive gear is submerged. In the down position the large gear does a better job of circulating the oil even with the level down a bit.*

Bearing Wear: *Inspect for bearing wear by checking for excessive play. Rarely do the two roller bearings in the B box need to be replaced. To remove the engine side bearing, heat the outside of the case aggressively with a hot hand torch (preferably MAPP Gas). This will expand the case surrounding the bearing. Slap housing flat onto a piece of wood to extract the gear.*

Figure #5 – Compressing the large gear requires a hydraulic press and a special yoke as shown. Steel yoke cost is around $22 from Rotax

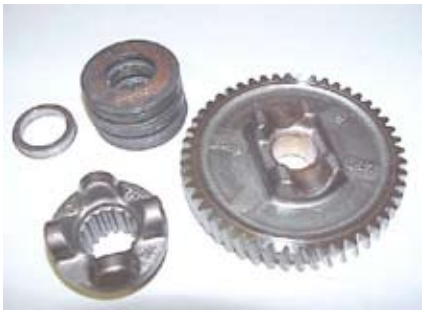


Figure #6 – Large gear includes knuckle joint that acts as shock absorber between engine and prop.

Removing the Large Gear: *You will need a hydraulic press and a #876-880 Yoke. Place the box in the press with the prop flange down. Place the yoke on top of the gear as shown and press to compress the spring washers. When fully compressed the split rings can be removed from the top of the prop shaft releasing the large gear from the shaft. Note the shims on top of the gear. These shims are used to remove slack when the gear is fully compressed. If the gear gets hung up on the prop shaft you may need to remove burs off the shaft caused by the pressure of the split rings. Use a long piece of emery cloth to polish off metal burs.*

Inspect the Knuckle Joint: *Remove the large gear, dog gear, disk springs, and remaining shims. Inspect the contact point between the dog gear and the flange on the back of the large gear. This knuckle joint is loaded by 12 the disk springs below the dog gear. This joint is the "shock absorber" between the engine and the prop. It has always been difficult to get a large diameter prop and a crankshaft to rotate smoothly especially at low rpms. You will notice that your engine will not idle lower than a certain rpm without the entire powerplant shaking violently. Depending on your prop inertia (see Part # 31 " Measuring Prop Inertia") below a certain rpm this joint will allow the prop to lag behind and when snap to catch up, thus the rough idle. The harder this joint works the more wear will be present between these two parts. Be sure to reassemble the box using the other set of "ears" on the dog gear to renew the knuckle joint.*

Figure #7 – In order to remove the prop shaft without damage to the housing a simple jig needs to be fashioned.

Removing the Shaft: *If you need to remove the shaft to service the front seal or bearing you will need a jig or fixture to hold the gearbox housing while the shaft is pressed out. A simple wooden fixture shown here uses the bolt flats at four different spots to support the housing. An improperly supported housing can easily break so take a few minutes to fashion a jig to avoid costly mistakes.*

Figure #8 – Removing this snap ring allows access to bearing and outer seal.

Figure # 9 - Be sure to safety wire the drain plug and side ports as shown. The thread boss shown by the arrow is for mounting a Rotax twin radiator system. Leave it blank if you don't use it. The cavity behind it is dry.

Remove the Bearing and Seal: *With the shaft exposed the last thing you need to do is remove the snap ring shown in the photo. Turn the housing over and press the seal and bearing out from the outside using a large diameter socket.*

Inspection and Reassembly: *Inspect all parts for wear or bearing play. Replace all seals and gaskets. While reassemble is fairly straightforward pay particular attention to reloading the disk springs. You should be able to feel the disks bottom out during compress. Stop here and install all the shims you can and yet still be able to insert the split ring halves. This will assure the knuckle joint is fully loaded. When finished be sure refill the gear oil to the lower of the two side ports. Be sure to safety wire the ports as shown as well as the magnetic drain plug to the adjacent tab provided on the housing. Check fluid level every 25 hours and replace gear oil after the first 10 hours and then at 100-hour intervals.*

END

Source: Part 54.doc