Part #55
C & E Gearbox Maintenance – Basic Teardown & Inspection

By Mike Stratman

Last time we covered the teardown and maintenance of the popular model "B" gearbox. As we found, with a minimum of specialty tools and fixtures the average Joe can perform much of his own work. When it comes to the model "C" and "E" gearboxes things are a lot more complex and specialty tools are absolutely a necessity to accomplish a number of important tasks. In the event of a severe prop strike it is highly recommended to teardown and inspect both crank and propshaft for run out. This month we'll perform a step-by-step teardown and inspection of both models. We'll discuss a couple of important production changes you need to know about and well as cover the tools and fixtures that you will have to have on hand before performing surgery. Also we'll introduce an aftermarket product that has really caught on with model "C" gearbox owners.

What is the reasons for going to a model "C" or "E" gearbox instead of a model "B" ??: *This question is really quite simple. Your selection of propeller determines which gearbox you will need. The general rule to follow is that a model "B" gearbox can handle anything up to a 68" two blade or a 64" 3 blade prop. Anything larger than this and the "B" box will not handle the load properly. Smooth idle will begin to be in excess of 2000 rpm and starting will be come more difficult. At lower rpm's the engine will shake excessively due to the gearbox's design limitations. If you wish to run larger diameter props at slower speeds you must go to the "C" or "E" boxes. Remember the general rule that a big prop turning slow is quieter and more efficient than a small prop turning fast. These boxes use a rubber hardy disk to absorb the extra stresses caused by prop inertia. See Part #31 "Measuring Prop Inertia" for more info on gearbox limitations.*

Internal these boxes are much the same with the exception of an internal electric start in the model "E". This allows for a lighter and more compact system when compared to magneto end electric starters. It also allows you to retain the stock recoil starter for back-up purposes.

Determining the Ratio of Rotation: *There are several ways to determine which ratio your particular box is. The factory stamps this info on a flat area on the outer case housing. It would be best to confirm is info with another check because the vendor selling the box may change the gear set. Mark the hardy disk inside the large opening on the inner case with a piece of white caulk. Record the rotations of the prop needed to complete one revolution of the hardy disk. This should give you one of the following ratios. 2.62, 3.0, 3.47, or 4.0 to 1 revolution of the crankshaft. Another way the determine the ratio is to count the number of teeth on both gears and divide the number of teeth on the large gear by the number of teeth on the small gear on a calculator. Example: 55/21 = 2.619 or 2.62 ratio. The following is the tooth count of the four ratios available:*

Ratio	Small Gear	Large Gear
2.62	21 teeth	55 teeth
3.00	19 teeth	57 teeth
3.47	17 teeth	59 teeth
4.00	15 teeth	60 teeth

Figure #1 – This centrifugal clutch takes the place of the flywheel and rubber doughnut in the model "C" gearbox. Unit disengages below 2500 rpm. For easy starts and smooth idles. Not a Rotax factory product.

***Model "C" Gearbox Clutch**: The aftermarket has come up with a very slick centrifugal clutch option for the model "C" box. This unit is an easy bolt on conversion that takes the place of the stock flywheel, hardy disk, and three-arm spider assembly. At 2500-rpm centrifugal force causes internal brake shoes to contact an outside drum that in turn starts the prop rotating. This does wonders for the operation of the entire aircraft. Start-up is no load and real easy, pulling thru the compression of the pistons only. Idle is extremely smooth and low, really low, like down to less than 500 rpm. This is ideal for easier descents. The prop now acts as a brake as it free wheels at low rpms instead of extending the glide when you throttle back. Ground handling for floatplanes is much easier as you can let the engine idle without the craft being pushed around on the water. The addition of the clutch generally makes the plane a lot quieter and easier to handle on the ground. Much larger props with more blades no longer produce the low rpm problems because the engine is no longer hard linked to the prop. See figure #1 for illustration. Sorry, it doesn't work on the "E", as the starter motor would be turning the prop only.*

Figure #2 – Get started by draining the oil by removing the magnetic drain plug.

***Drain Oil and Inspect Plug**: Get started by draining the oil by removing the drain plug. The periodic maintenance chart schedules replacement of the oil after the first 10 hours and then again every 100 hours. Because the plug also has a built-in magnet which collects any metal filings that may be present. Small particles are OK. Big chunks obviously require you to inspect farther looking for the source. Next remove the rack of 6mm bolts that hold the two case halves together. Tap the case halves gently apart with a rubber hammer. On the model E box the gears, sprag clutch, and shims need to be set-aside in the order they are removed so they can be returned in the proper order.*

Figure #3 – A long reach Allen wrench is need to remove the bolt hidden down inside the small drive gear.

Removing The Engine Side Case Half: *Once the cases are split you need to remove the small drive gear with a long reach Allen wrench as shown in figure #3. Install your fixation pin in the pulse port as shown in figure #5 to prevent the crank from turning. This pin can be found in the tool kit that comes with every new engine. Order #876-640 if you can't find yours. Use anything else and you take a huge risk that the pin will bend and subsequently can't be removed without damage to the crankcase or brass pulse port. At this point you are ready to remove the 8 case bolts located both inside the box as well as outside the case. See figure #4.*

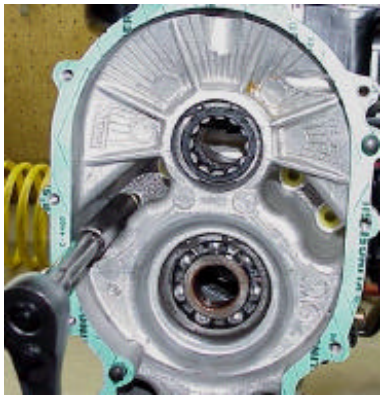

Figure #4 – Remove the 8 case bolts, four inside and four outside the box to remove the entire case half from the block.

Removing the 3-Arm Spider Assembly: *Once the housing is removed you need to inspect the rubber doughnut or hardy disk closely for cracks or fatigue. Also check the disk for the hardness number. All new units are a #75 hardness. Older units maybe a #65 or #55. The steel band shown in figure #4 is on all new disks to help compress the disk for better bolt alignment during installation. Use a 5" hose clamp to compress the disk if necessary. Always remove band after installation. Leaving it on during operation is not an option as this will prevent the disk from functioning properly and will eventually destroy the disk.*

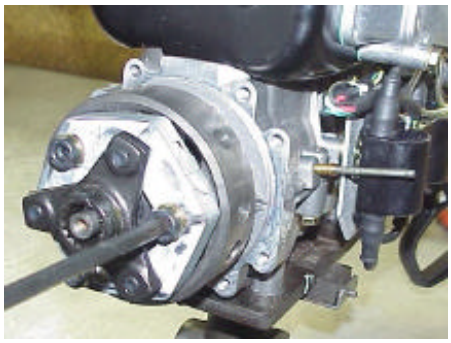

Figure #5 – In order to change the crankshaft, the spider, hardy disk, and flywheel need to be removed. Note fixation bolt in pulse port to prevent crank from turning.

Remove the Flywheel: *The puller shown in Figure #6 is ideal for removing the flywheel. If you have a magneto end flywheel puller it will work here as well. The bolt pattern is the same.*

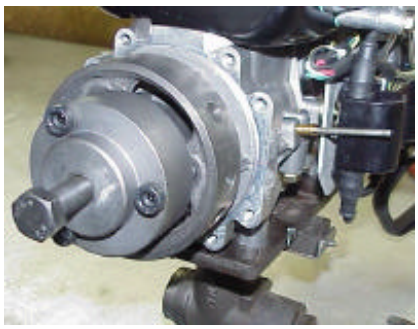

Figure #6 – Pulling the flywheel requires the right puller. Your magneto puller works here as well. A large 3-jaw puller is also an option.

At this point you are as deep into the box you are going to go without a number of specialty tooling. Next month we'll show you how to change gears sets, remove the propshaft, do a complete inspection, and update your box following the latest Rotax Service Bulletins. We will also illustrate several special jigs that need to be fashioned to perform certain tasks.