CHANGE IN BEARINGS?

The ball bearings that support the spinning crankshaft in a model glow plug engine will, at some time, need to be replaced. Crankshaft bearings usually wear out after a few hundred flights or perhaps may succumb to early rust damage from post combustion moisture. Bearing rust is common, especially if the engine is not “run dry” after every flying session.

The signs of a bad bearing are symptoms such as metallic noise, (a metal humming sound loud enough to hear from the ground), when the engine is running or a roughness that can be felt when the engine is turned over by hand. Another indication is that the propeller can be rocked at the tips. In severe cases, you may see black residue coming from your muffler. If this happens, the bearing is not only worn-out, but may be coming apart inside the engine. Such extremely worn out bearings can damage the crankcase, piston and cylinder lining. At this point the engine may be beyond economical repair.

You could send the engine to the manufacturer and wait until they get the job done. But it is a lot quicker, and less expensive, to change bearings yourself. It is much easier than you might think. An added bonus is that you learn more about your engine and how it works. This article assumes that you can find a bearing in your local hobby shop or local bearing supplier but that is usually not a problem. There are several model engine bearing suppliers as well the parts department of your engine’s manufacturer who can supply these parts.

This article will only cover changing the bearings in a two-cycle model engine. Changing bearings in a four-cycle is similar, but requires much more involved disassembly and assembly.

A two-cycle engine has few parts to remove and put back in the right place. Most trainer-type planes come with a two-cycle engine that can be serviced by a newcomer to RC flying. The engine chosen for this report was actually an OS 1.40 RX because it is larger, which makes it a bit easier to photograph on the inside. (*Plus, this OS 140 is* my *2004 Pattern Competition engine and this was a good opportunity to get stainless steel bearings installed in it by an engine expert. Ed.)*

However, the principles of bearing replacement apply to *all* two-cycle engines. The basic tools (photo 1) needed to take an engine apart are the correct size Allen wrenches (usually metric and usually were supplied with your engine), a block of wood, a heat gun or oven, and a torque-wrench. (Most modern electric screwdriver/drills have torque clutch settings that can be dialed to different degrees of relative torque.) A torque wrench is not an absolute necessity however.

Photo 1

To change the crankshaft bearings you need to take the engine apart. To put it back together you will need all of the parts. It is a therefore a *very good idea* to use a series of plastic containers to “capture” the parts as you disassemble the engine. You can label these containers with names such as carburetor parts, head parts, backplate, piston liner, etc. A flat oven tray, lined with a paper towel, provides a good catchall when working on an engine. The paper towel prevents parts bouncing and makes them easy to see.

Begin by removing the carburetor. You will be heating the engine to loosen the bearing so the “soft-bits” found in the carburetor need to be protected. Carburetors are usually held on by one

pinch bolt (photo 2) or by two screws on either side of the crankcase (photo 2A). Loosen the nut on the pinch bolt to remove the carburetor or remove the two screws. Lift the carburetor up and put it aside (photo 2B)

Photo 2

Photo 2A

Photo 2B

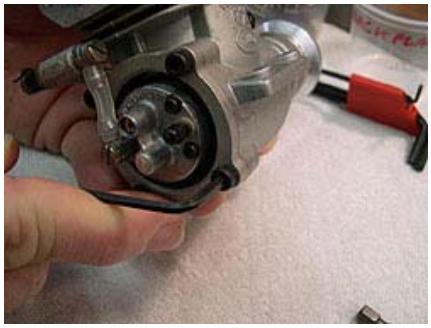

Photo 3

Next, mark the top of the backplate, to insure it is reinstalled with the same side up, and then remove it (photo 3). Keep the screws and the backplate together. The screws are often a specific length and should not be mixed with the rest of the screws. In most cases, you will find a gasket on the backplate cover. Take care to keep this gasket in one piece.

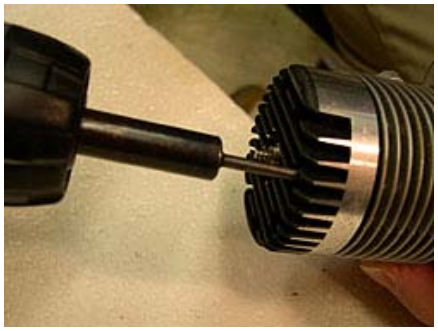

Photo 4

Loosen the cylinder head bolts about half a turn all the way around (photo 4) If you are not using a torque wrench, you should remember just how much force was used to loosen the head bolts. Use this same amount of force when retightening these bolts. Slightly loosening all the bolts, before removing any, prevents warping of the head due to uneven bolt removal. Remove all bolts and gently lift the head away from the crankcase (photo 4A). Look out for the head-gasket--it may well look like part of the cylinder head. The head gasket is the brass ring in photo 4B. Keep the head-gasket in place in the head, or in a safe place where it cannot be bent if it came loose when you lifted the head from the engine. Remove the head and put it aside.


Photo 4A Photo 4B

Many engines have a drive-washer with a key-way that is easy to remove (photo 5). If it does not pull off by hand, then you need to use a “puller” tool (photo 5A). These are commonly found in automotive stores. An inexpensive type is one used to pull battery terminals free.


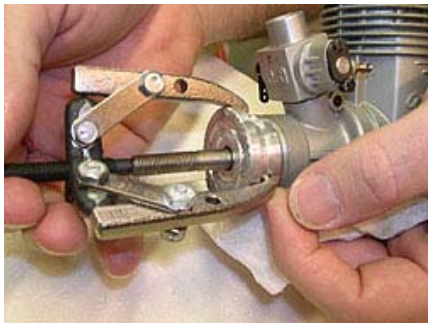

Photo 5 Photo 5A

The cylinder liner is removed next (photo 6). If it is stuck in position, apply some warmth from a heat gun to expand the aluminum engine casing. Aluminum expands a lot more than the steel liner and this usually works. Be very careful with the heat gun. Just a small amount of heat is required. Do not focus the heat gun onto the aluminum cylinder casing for extended periods to avoid unwanted warping.


Photo 6 Photo 7

First, mark the rear of the connecting rod with a felt tip pen. Photo 7 shows a view inside the case before the piston is removed. The brass/aluminum part is the connecting rod and its bronze bushing. Rotate the crankshaft until the connecting rod end is at the bottom of the crankcase. Then remove the piston and connecting rod by sliding the rod to the rear of the engine and all the way to the back of the piston. If the rod will not slide in the piston, you can use dental floss to clean the wrist pin inside the piston.

There is usually no need to disassemble the piston and connecting rod. The piston may have a ring. There is no need to remove the ring. It is a good idea to mark the position of the ring with a

felt-tip pen. Here will be an anti-rotation pin in the piston ring groove. The opening in the ring should be next to that pin.

The crankshaft will either push out or tap out with a wooden block (photo 8). Do not use a hammer on the bare end of the shaft. It will damage the threads.

Photo 8

Now you can heat up the crankcase to make it easy to remove the bearings. Heat the engine for about ten minutes in an oven at 350° F -USE HEAT PROTECTIVE GLOVES. Heating the assembly causes the aluminum crankcase to expand more than the steel bearings, making them easy to remove. A heat gun may also be used on the bottom of the crankcase, but take care not to heat up one area too much and distort the casing.

Photo 9 Photo 10

Photo 9 shows the front bearing still in the engine and its replacement. The front bearing should tap out with the gentle use of a wooden dowel, wooden or metal drift (photo 10). If it is hard to remove, heat the engine again. Replace the old bearing with the new bearing while the casing is still hot. The shield on the front bearing faces out. Use a wooden block or metal bearing drift to install the bearing. It usually just drops into the heated crankcase with just a slight tap to be sure the bearing is firmly seated.

Photo 11

The secret to removing the rear bearing is to firmly tap the whole casing onto a wooden block (photo 12, taken in action hence the slightly blurred look). If the case is hot enough, the bearing will drop out (photo 13). If it is hard to remove, heat the case again. The rear bearing is usually

the easiest to remove and sometimes drops out of the engine while you are preparing to install the front bearing.


Photo 12 Photo 13

With the engine still hot, slide the rear bearing onto the crankshaft, push the cold crankshaft into and through the new front bearing and use the crankshaft as a guide to seat the new rear bearing. Do not use force. Once again, apply more heat if required. Refit the drive washer using a spacer or propeller and tighten to ensure the assembly is snug. Then let everything cool down.

After everything is cooled, remove the propeller and test by rotating the crankshaft so that the connecting rod pin is at the 4 or 8 o'clock position with the engine held vertically. Let go of the crankshaft. The pin should rise to the top as the counter weight falls to the bottom. If not, reheat, install the propeller and retighten to align the crankshaft better in the new bearings.

Now it is time to reinstall the rod and piston. Look for the mark you made on the rod and make sure the mark faces rearward. Slide the piston in through the top of the cylinder casing; position the crankshaft rod's pin at the bottom and slide the rod onto the crankshaft pin. There is often a cutaway to clear the crankshaft.

Position the ring, if there is a ring, against the ring pin in the piston's groove and then refit the cylinder liner. It is important to position the liner with the exhaust port facing the exhaust port in the aluminum crankcase. There is often a pin on the crankcase that lines up with an indention in the liner (photo 14). If there is no pin, look for the dark carbon "burn" that indicates which is the exhaust port. Getting this right prevents the ring gap ends from catching on an open port.


Photo 14 Photo 15

In a ringed engine, the liner will have a chamfer that allows you to place the liner over the piston and ring when it is held at top dead center (photo 15). Apply some air tool or Mobil1 oil to the chamfer to make installation easier. Position the cylinder over the piston and slide down as shown in photos 16-18. Then add a few drops of oil to lubricate the engine on its first run (photo 19). Test rotate the engine to insure everything is fine and no binding is felt.


Photo 16 Photo 17


Photo 18 Photo 19

Replace the backplate and set your torque driver to approx. 15 in/lb. Make sure that the backplate has the mark you made at the top. There may be a recess on the top that allows the piston to come all the way down. Tighten all backplate bolts alternating sides.

Replace the cylinder head (photo 20), and the head gasket. Tighten all of the head bolts evenly by hand. There is a specific tightening sequence for all cylinder heads (photo 21).


Photo 20 Photo 21

The example shown above is an eight-bolt head. The formula is to tighten diagonally opposite bolts. With an odd-numbered bolt pattern, move one bolt to the left as you go diagonally. Do not attempt to tighten the bolts completely the first time. Gradually tighten in sequence until they are almost fully tight (photo 22). Then tighten completely with the torque wrench or by hand, using the same force that you used to loosen the bolts originally.

Photo 22 Photo 23

Use a torque wrench screwdriver if available and set to about 17 - 19 in./lb. Use 17 on smaller, .25-sized engines. Many of the electric screwdrivers that are available today have torque settings. The numbers that they use sometimes equate to in./lb. settings.

Finally, replace the carburetor by holding it down firmly to get a good seal between the engine and the carburetor. Check to see if there are parts left. Put the plug back, replace the needle and the spring ratchet, etc.

Turn over slowly to be sure everything is in the right place. When running the engine for the first time, use a slightly rich setting to lubricate all of the parts. After that, the normal settings can be resumed.

Our model two-stroke engines are a marvel of practical simplicity, though very difficult to design. Changing crankshaft bearings in one of these engines is about the easiest mechanical task we have performed. Proceed slowly, watch carefully during disassembly and mark the position of any part you feel uncertain about before disassembly. Replacing bearings yourself just saved you some money and about 4-6 weeks down time waiting for it to come back from the manufacturer.