

Upgrade for T37 rudder shaft seal

Derek Storm, June 2013

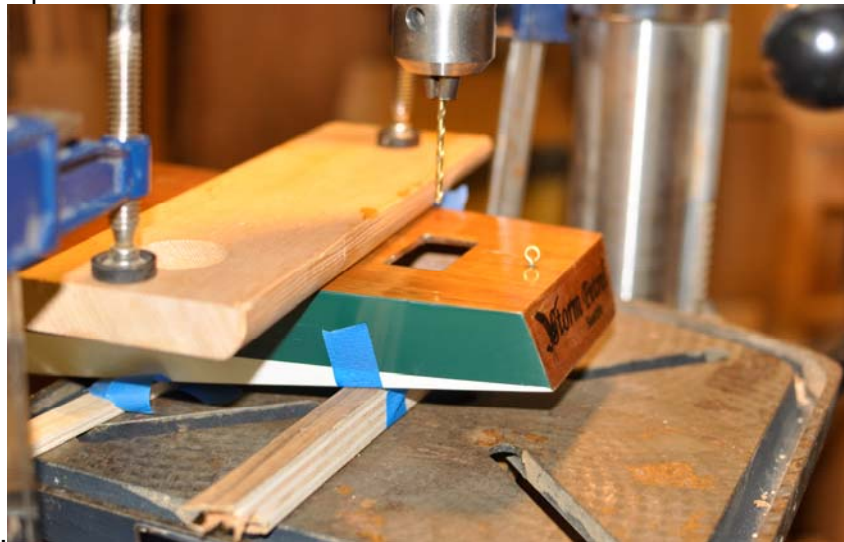
The new (June 2013) rudders provided with the kits have a bearing made from two carbon fiber tubes glued concentrically, with a space at the top for a soft yellow plastic tube, which squeezes into the larger tube and squeezes around the 3/32 rudder shaft to make a positive seal. There is no 5/8 diam wooden dowel anymore.

The older rudder shaft bushings have a 1/8 ID carbon tube glued into a 5/8 diam dowel, and the 3/32 rudder shaft goes in a nylon bushing that is 3/32 ID and 1/8 OD. Grease on this bushing helps keep water out but is not a positive seal, as most of us have experienced.

Rather than drill out the whole length of the wooden dowel in order to insert the full length of the large diameter tube (and risk drilling through the bottom of the boat, and also worry about mis-alignment), I decided to use the existing 1/8 ID tube and the nylon bushing to support most of the rudder shaft, but to put in a short piece of the larger diameter tube at the top of the wooden dowel. Then the seal can be made with the yellow tube pushed into the larger diameter carbon tube, just like on the new version, but the alignment of the shaft is left to the existing tubes.

To accomplish this, I only had to drill a 1/4 inch deep hole in the top of the wooden dowel, cut off a 1/4 inch length of the new larger diameter tube, and epoxy it in. To provide alignment, I used a 3/32 diam drill bit instead of the rudder shaft, since it is probably stiffer and I wouldn't risk getting epoxy on my nicely painted rudder.

Originally the hole for the rudder shaft was drilled from the bottom of the boat with it resting on the deck to make the hole perpendicular to the deck (and the water line). Now I will drill from the top, but it is easy enough to rest the boat on shims set so the drill press table is parallel to the deck.



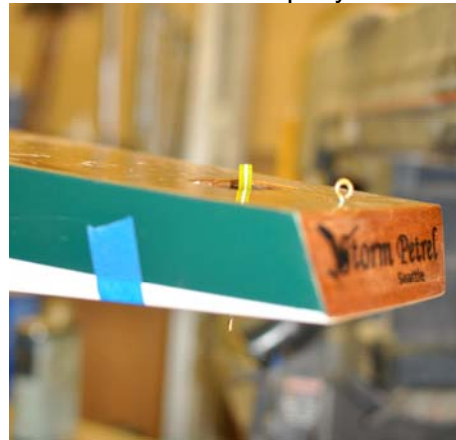
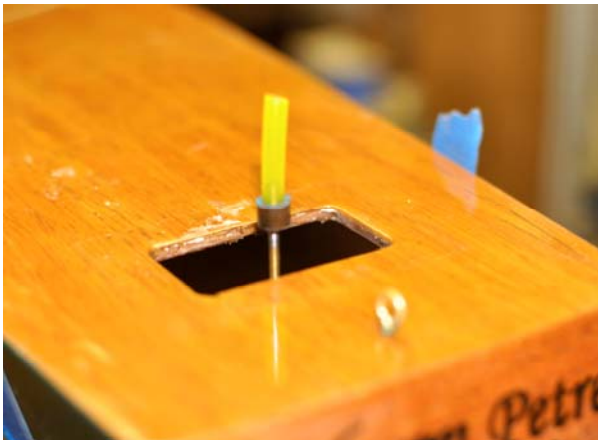
The 1/8 inch drill in the chuck enables accurate location of the drill press centered on the existing hole. The shims are different thickness and were located fore-and-aft to make

the deck level. This was accomplished by measuring the distance from the deck to the bottom of the shim. The tape under the shims protects the paint.

I drilled a 5/16 diameter hole (giving room to align the approx 9/32 OD carbon tube) ¼ inch deep at the edges (the point goes down a bit more). The picture shows the hole with the 1/8 inch drill again, used to clean out the inside of the existing tube.



Putting the 3/32 drill with the 1/8 OD nylon tube into the 1/8 tube provided alignment for the new seal and outer seal tube. The yellow tube is pushed all the way to the end of the carbon tube. The tube will be cut off later, but keeping the long tube makes it easy to remove it after the glue sets. A bit of grease rubbed on the drill should prevent it from being glued in permanently. The picture on the left shows the drill holding the tubes before gluing. In the second picture the carbon fiber tube is glued into place, and the end of the 3/32 drill bit is sticking out the bottom of the boat. The extra length of the nylon tube also sticks out the bottom. This will be trimmed off after the epoxy sets.



Some of the epoxy flows around the bottom of the yellow tube and adheres to the tube and drill bit, as well as to the nylon tube. When the epoxy set, I removed the yellow tube by pulling and twisting on it, and I easily removed the drill bit by holding it with pliers, turning, and then pushing it down. The nylon tube was sticking out the bottom, and grabbing the end of this with the pliers enabled its removal with a twist and pull. The squashed end gets cut off. I cleaned out the 1/8 hole with a drill bit, and using a counter sink (a ¼ inch drill bit would work) I cleaned off the epoxy that had flowed up the outside

of the yellow tube. To complete the new assembly, I cut a piece off the end of the yellow tube that was a bit longer than the hole it will go into, pushed it in all the way, pushed in the nylon tube from the bottom, marked it and cut it flush with the boat bottom. Then I inserted the rudder shaft while holding the yellow tube down. It went right in and the brass piece that turns it (crank?) is set right down to the end of the new bushing assembly. It works fine on the bench. We will see if it is really completely water tight.

In summary:

You need

1. ¼ inch length of the larger diameter carbon tube used for the current rudder installation. (It is 0.281 in OD and about 11/64 ID.)
 2. ¼ inch length of the yellow soft plastic tube used for the current rudder installation. However, starting with about 1 inch length gives you a way to pull the tube out after gluing
 3. 1/8 and 5/16 inch drill bits. A drill press is good, but you could do it with a hand drill.
 4. Epoxy with some thickener
 5. A 3/32 inch diam twist drill bit is useful, but you could use the 3/32 inch diam rudder shaft
1. Remove the rudder with the nylon bushing. (If you lost the allen wrench for the rudder crank, get a new 3/32 inch one and cut the end short as in the original assembly.)
 2. Drill a 5/16 diam hole ¼ inch deep in the top of the dowel. This hole should be concentric to the 1/8 ID tube for the rudder.
 3. Push the yellow tube into the ¼ long piece of the 0.281 inch OD carbon tube so it is flush at the end.
 4. Put a light film of grease (Vaseline) on the 3/32 drill bit (or the rudder shaft).
 5. Put the nylon bushing on the 3/32 drill bit (or the rudder shaft), push the bit (shaft) with the bushing up through the existing tube.
 6. Push the yellow tube/carbon tube assembly down the bit (shaft) until it seats at the bottom of the new hole. See that you have some room around it for epoxy. This will push some of the nylon tube out the bottom of the boat.
 7. Push the bit (shaft) up with the yellow tube/carbon tube in preparation for gluing, leaving the nylon tube flush with the bottom of the new hole.
 8. Put a thin coat of un-thickened epoxy on the sides of the new hole in the dowel, and put some modestly thickened epoxy on the sides of the carbon tube.
 9. Push the tube all the way down into the hole. There should be no gaps in the epoxy between the OD of the tube and the hole in the dowel
 10. After the epoxy sets, pull and twist the yellow tube to remove it. Then twist and push down on the drill bit to remove it. Grab the extending nylon tube at the bottom of the boat with pliers and twist and pull to remove it.
 11. Clean up the 1/8 inch diameter hole for the rudder shaft, and remove excess epoxy above the new carbon tube.
 12. Trim the nylon and yellow plastic tubes to fit. Push the yellow plastic into the carbon tube, and install the rudder shaft (with nylon bushing) pushing it through the yellow tube while holding the tube in place inside the carbon tube. Save the remaining yellow tube in case you need a replacement.
 13. Reattach the crank to the rudder shaft and align the rudder angle.
 14. Sail dry !!