

### Repairing worn rudder bearings

Common wear points on sailboats with spade-type rudders are the bearings which support the rudder shaft. Worn bearings can result in sloppy steering and an irritating thump as the rudder shaft flops from side to side in the enlarged bearing. Worn bearings can also detract from the precise sense of feel, especially important to a helmsman if the boat is raced.

Most stock rudders simply bear on the inside of the fiberglass housing in which the metal rudder shaft turns (Figure 8-8)<D>. Some builders use Delrin plastic or a similar material as an insert for lower friction and better wearing performance. But the high loads exerted by the rudder eventually wear out the bearings. This section describes how to restore tight steering control by injecting a new, long-wearing epoxy/graphite bearing surface around the rudder shaft.

The amount of slop in the rudder bearings is most easily detected when the boat is out of the water. Grab the bottom of the rudder blade and wiggle it side to side. Look for excess lateral motion of the rudder blade, and listen for the thump of the shaft hitting the opposite side of the bearing as the rudder is wiggled. Careful observation will show if the movement is coming from the lower, upper or both bearing points.

Lower the rudder from the boat and wipe the shaft with solvent to remove grease and oil. Inspect the shaft for roundness and straightness. IMPORTANT! If the shaft is out of round or bent, you may need to take it to a machine shop to make it true. Look for burrs, rough spots or grooves. Sand smooth any burrs or other rough spots on the shaft with emery cloth or very fine sandpaper. The smoother the surface of the shaft, the less it will abrade the bearing surface. If scores or similar flaws are too deep to sand out, fill them with an epoxy/406 Colloidal Silica mixture, following the procedures for bonding to metal as discussed in Section 7.

Wipe the upper and lower bearing surfaces with solvent to remove all traces of grease or oil. Sand the bearing surfaces with coarse sandpaper. Drill three 3/16" (5 mm)- diameter holes through the shaft housing at the level of the bearing surfaces. These ports will permit injection of the thickened epoxy to form the new bearing surfaces. Cut the end of an 807 Syringe to wedge tightly into the 3/16" holes. This will allow you to inject the thickened mixture under pressure into the gap between the shaft and the bearing surface.

Wax the shaft surface with three coats of automotive paste wax to act as a release agent and prevent the shaft from bonding to the new bearing surface.

Replace the rudder in the boat and sight the rudder to make sure that it is vertical. The keel will serve as a good reference point. Brace the rudder to prevent movement.

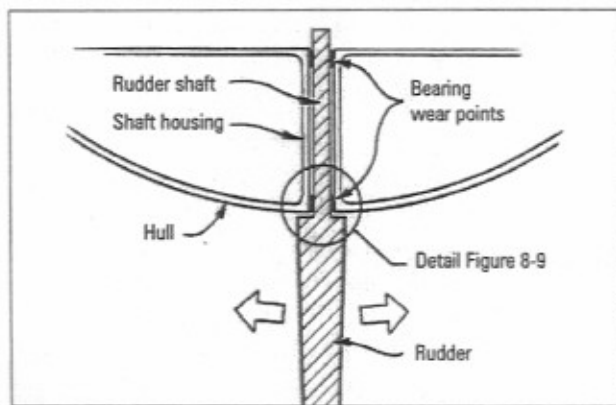
Prepare a bearing mixture of epoxy and a blend of 50% 406 Colloidal Silica and 50% 423 Graphite Powder. The epoxy/406/423 mixture should have the consistency of mayonnaise to prevent running or sagging. Load the mixture into a syringe.

Inject enough of the material through the drilled ports to create "pads" at each port. If the mixture begins to run out of the lower bearing, tape around the opening to retain the mixture while it cures. Allow the mixture to cure thoroughly.

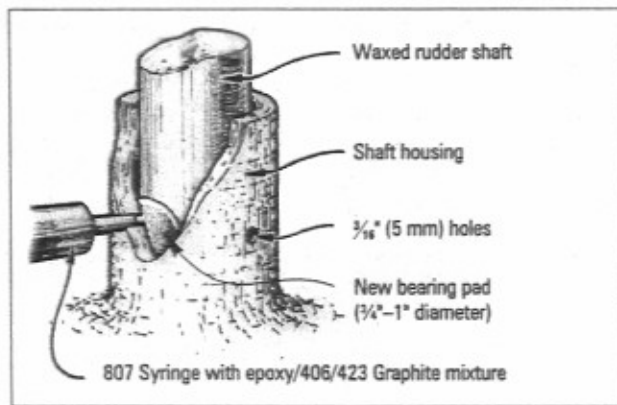
Break the shaft free by grasping the rudder blade and twisting it. If the cured bearings are too tight after rotating the rudder briefly (which is not typical), remove the rudder and apply a buffing compound to the rudder shaft. Reinstall the rudder and work it back and forth until it turns freely in the new bearings.

Lower the rudder once more and thoroughly clean any remaining mold release or buffing compound from the shaft and bearing surfaces. Spread a thin layer of waterproof grease on the shaft and reinstall the rudder.

This technique is useful for restoring a variety of bearing surfaces. The epoxy/406/423 Graphite mixture provides a hard, low-friction bearing surface. The durability of the bearing depends a great deal on the smoothness of the surface sliding against it.



**Figure 8-8** Most stock rudders simply bear on the inside of a fiberglass housing and the high loads exerted by the rudder eventually wear out the bearing surfaces.



**Figure 8-9** Inject enough of epoxy/406/423 mixture through the drilled  $\frac{3}{16}$ " (5 mm)-diameter ports to form a  $\frac{3}{4}$ "-1" diameter pad between the shaft and housing at each port.