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## **STEP-BY-STEP REFIT**

BY BOB KENNEL

### **Twelve Inches off the Keel, Please**

**When a frustrated lake sailor gets a chain saw in his hands, you'd better watch your toes**

When it came time to anchor on our CS 30, we always looked with envy at the boats that were able to snuggle up to the shore with their shoal-draft keels. We were always the farthest out of the anchorage on Lac des Deux-Montagnes, a natural basin in the Outaouais River just west of Montreal where we moor and cruise our boat. Last year, below-average snowfalls and insignificant spring rains gave us keel-scraping water levels as early as May. This prompted us to seriously consider an unconventional procedure: cutting off a portion of the keel and redistributing that weight into two bulbs fitted onto the remaining keel stub.



**1. A chain saw may seem a little barbaric, but it gets the job done. Be sure to wear a dust mask.**

When I contacted Mars Metal in Burlington, Ontario, custom manufacturers of cast-lead torpedo bulbs, I told them that I wanted to do as much of the work myself as possible. The technicians were more than helpful, never tiring of the many phone calls I made seeking additional information and advice.

We agreed that 1 foot was the most I could cut from the solid-lead keel without dramatically impairing the boat's performance. This would give my boat 4 feet 6 inches of draft. Based on preliminary measurements, Kevin Milan, president of Mars Metal, estimated that I would be removing about 500 pounds of lead.

Although he described the process as "a little barbaric," he assured me a chain saw would do the job.

## Making the Cut

After making sure that the bottom of the keel was parallel to the waterline, I drew a line 1 foot above the keel's base. When deciding if my own chain saw was up to the task, a good friend's favorite expression, "Rent it," came to mind. Nevertheless, my 15-year-old 2-horsepower chain saw, with a slightly used chain, proved to be more than adequate. While I cut, the Travelift held the boat in slings about 1 inch above the keel's cradle. My wife, Elizabeth, kept an eye on the cut, making sure I kept the saw as level as possible. With the chain saw warmed up and well lubricated, it took about 15 minutes to cut the 43-inch-long keel.



This included a couple of stops to let the blade cool, inspect progress, and clear the shavings from the saw.

We had to be careful because the cutoff portion, deceptively small for its tremendous weight, began to drop before I'd severed the last few inches. The resulting cut was clean and level. There was no turning back now.

### **2. Five 1/2-inch stainless-steel rods securely fasten the two bulbs to the keel.**

Before lowering the boat onto the 12-inch-square wooden blocks that rested on the cradle, I traced the outline of the keel stub onto five sheets of graph paper taped end to end and faxed them to Mars Metal. I weighed the cutoff piece on an industrial scale hung from a tractor bucket. It weighed 536 pounds, only 36 more pounds than Milne's estimate. With my sketch and the weight of the surplus keel, Mars Metal was able to design torpedo bulbs to fit the contour of the keel stub.

## Preparing the Keel

With still a week to go before the bulbs' delivery, we had more than enough time to prepare the keel. The bulbs would be fastened along the sides of the stub, so I ground the bottom 6 inches of the keel stub to expose bare lead. This was to ensure better adhesion of the West System epoxy, which we would use for fairing and bonding. I also built two supports using 4-by-4 lumber to hold the bulbs in place during installation.

The bulbs arrived as scheduled, and after enlisting the help of a strong friend, we planned for an early start. We used a forklift to gingerly place the bulbs on the platforms on each side of the keel. We muscled the bulbs into place about 11/2 inches back from the leading edge of the keel, where they matched the contour.

Each of the bulbs weighed about 350 pounds. Measuring approximately 6 inches high, 6 inches wide, and 53 inches long, they tapered gradually to the aft end, 10 inches past the trailing edge of the keel. They were 200 pounds heavier than the cutoff portion, but this additional weight was absolutely critical to maintain the boat's same stability and righting moment as before.

The bulbs came predrilled with five holes to accept 1/2-inch stainless-steel rods. We would have to drill four matching holes through the keel; the fifth hole lay beyond the trailing edge. With the bulbs temporarily in place, we marked the centers of the four holes using a long, thin screwdriver to tap a center mark into the soft lead keel. We then removed the bulbs so we could drill the keel. I made the holes slightly bigger, using a 3/4-inch bit in a commercial, slow-rotating drill. This would make it easier to align the torpedoes on each side when the time came to bolt them on with the stainless-steel rods.

Drilling the holes was easier than anticipated. To keep the drill bit from binding, I applied a liberal amount of machine oil to the bit and frequently backed the drill out to clear the shavings. At the trailing edge, the bulbs were spaced a little farther apart than anticipated, so I cut a small slice of lead from the surplus keel and wedged it into the gap between the two. With the bulbs in place and the nuts on the rods slacked off as much as possible, it was time to mix the epoxy.



**4. The epoxy squeezed out as we tightened the bolts. We also sealed and faired the countersunk bolt holes with epoxy.**



**3. The tapered ends of the bulb run 10 inches past the trailing edge of the keel. The additional 200 pounds of weight was essential to maintain the boat's same stability and righting moment.**

**Epoxy Magic** The instructions for the West System epoxy were easy to follow. I mixed the epoxy and filler to a peanut-butter consistency and pushed the mixture between the bulbs and the keel with a kitchen spatula. The \$1.59 spatula proved to be a great investment. I used it not only for mixing and spreading epoxy but also for smoothing the joint between the keel and torpedoes once they were later bolted in place.

When I felt all surfaces were sufficiently covered, I began to tighten the bolts. Mars Metal had countersunk the bolt holes and supplied stainless-steel washers. The counter-sunk holes were tapered, so the washers bent slightly as the bolts were tightened. (Mars Metal has since modified the design.) We cut off the excess stainless-steel rod, pushed more epoxy into the bolt holes, and allowed it to set. The epoxy was easy to work with, and applying it to horizontal surfaces was simple. We'd started at 8:30 a.m., stopped for lunch, and had cleaned the tools by 4 p.m.

### **A Smooth Finish**

In all, we applied four coats of West System epoxy. The last coat was of a syrupy consistency that allowed it to flow into every crevice and provide an even coat. Wet sanding with progressively finer grits gave the bulbs a smooth, factorylike finish. We gave all bare metal and faired surfaces another four coats of Interprotect 2000, a two-part epoxy primer. We then applied two coats of antifouling before the boat was lifted again so we could complete the epoxy, primer, and antifouling sequence to the areas that were under the blocks.

I'd investigated several options before undertaking this project. Upgrading to a new, larger boat with shoal draft was too expensive, and besides, we feel our boat is extremely well equipped and maintained.



**6. We faired the surface and applied Interprotect 2000 two-part epoxy primer before applying the final coats of antifouling paint.**

I contemplated swapping keels with a shoal-draft CS 30, but that also proved to be uneconomical. The two torpedo bulbs, hardware, and freight came to \$2,706.03. Shop materials were an additional \$300. I estimate the project took about 21 hours from start to finish.

Consult experts on your boat before beginning such a project. Righting moment is only one function of the foil-shaped keel. Its lift and lateral plane also affect how the boat will sail. Before cutting and drilling, be sure to find out how far down the keel bolts extend. Also, don't cut off so much keel that your rudder becomes the deepest foil on your boat.

One of the experts I called for advice on this project said your rudder becomes the deepest foil on your boat.

One of the experts I called for advice on this project said the boat's windward ability might suffer. "You may notice that you can't point as high," he said, "but when you're cruising, who wants to spend all day heading to windward?" I really haven't noticed any



**5. An inexpensive kitchen spatula was ideal for fairing the radius where the bulb met the keel. The last syrupy coat of epoxy filled every crevice.**

marked difference in her performance. Throughout the project, I had many fellow sailors follow my progress with interest. After discussing the merits of the reduced draft, a friend paid me the ultimate compliment when he asked if I'd like to do the same to his boat this year. I guess I should sharpen that chain saw.

***Over the last 10 years, Bob Kennell and his family have cruised their CS 30 on Lake Ontario, Lac des Deux-Montagnes, and Lake Champlain.***

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