

# The Birth of a Keel

*One of the great kicks of having a custom boat built is the seeing the parts honed and then watching them fit into a smooth sailing machine. The keel is poured; Boston Light has legs*

By Knowles L. Pittman

Boston Light, our brand-new 53-foot cutter, is primarily a cruising boat, but one on the higher end of the performance spectrum. With her bulb keel she draws about 7 feet - a bit much for, say, the Bahamas, but a draft that should yield good windward performance. Years ago the nearly sacred keel-laying ceremony signified the first step in boat construction, but nowadays most boats are nearly complete before they first meet what is to become their dependable, supporting, shock-absorbing great hunk of heavy metal. This was the case with our boat.

A well-designed keel is an efficient lifting surface, analogous to a sail going to windward or to an air plane wing. The designer's aim is to create maximum lift with minimum drag, which slows the boat. Another function is to serve as a pivot against which the rudder can work.

The ballast keel's primary job is, of course, to lend stability, much in the way the weight in the bottom of a child's toy always returns it to an upright position no matter how hard or often it's knocked over. The ballast may be a slab of iron or lead encapsulated in fibreglass, but more often it is a discrete casting affixed to the upper portion of the fin, which is usually a continuation of the hull; this is how Boston Light's keel was designed.



In early June Boston Light's ballast keel was poured at [Mars Metal](#) in Burlington, Ontario, where raw metals - lead, bronze, and others, are melted down and cast into useful products. It's a typical light-industry building in a parklike setting among others of its kind. The only hint of



what goes on inside the building is an enormous ventilation system on the roof that filters and collects the byproducts of the casting process.

### **Making the mold**

The pattern for the keel mold was fabricated by Scorpio Yachts, the boat's builder, by first lofting the designer's lines, just as they did with the hull. The pattern was made of wood and fibreglass in two parts, as though it had been run through a bread slicer fore and aft.

**Mars Metal** constructed a casting box of 3/4 - inch plywood, open at the top. The pattern parts were precisely positioned inside the box; then a fine white silica molding sand, almost as fine as talcum powder, was poured around the pattern. As the sand was poured in, it was mixed with carefully measured binder and a catalyst. The box was clamped shut for 12 hours as the mixture hardened into a mold that was an exact impression of the pattern, half in each side of the box. Finally, the box was opened and the pattern, having served its purpose, was removed and discarded.



### **Setting up the mold**

When the mold had been filled and polished, the internal structure of the keel was suspended from the top of the mold. Nine keelbolts, interconnected by welding with a stainless-steel "spider" at the upper surface, were also welded into a stainless cage near the bottom of each bolt. Each threaded bolt had been heated and bent into a J hook at the lower end to increase its gripping surface. There is a single bolt forward, three pairs behind it, and two more in single file aft. One- -inch #304 stainless bolts, each about 18 inches long, were used in the forward and aft positions. The three pairs in the middle are 1 1/4 inches in diameter and 24 inches long.

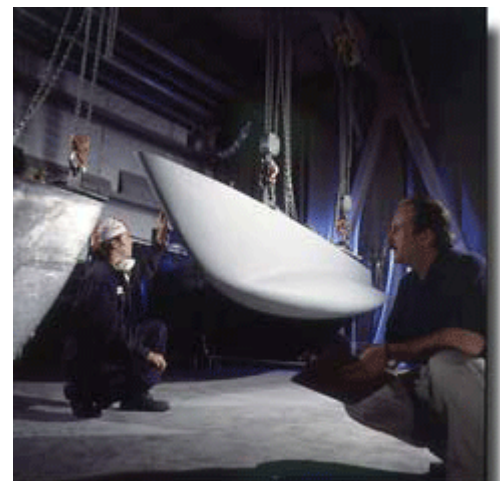
### **Pouring the keel**

On the morning of the pour, foundry man Richard Patten began charging the melting pot with about 5,000 pounds of lead (98 percent)/ antimony (2 percent, for resistance to bending or breaking) alloy. The liquid metal itself ran noiselessly without ripples or waves. Shortly after 1300 the metal in the pot had edged above 800 F, and the mold was positioned below the pouring spout. Pattern took over, watching the pot level and temperature all through the operation, calling for more metal 100-pound pigs, 2,000-pound sows, or 4,000-pound buttons. It took nearly 4 hours to set up the pour of Boston Light's keel and 4 more hours for the keel to solidify; since the metal shrinks as it solidifies, additional metal was added to top up the mold.

After several days, the keel was removed from the mold and - still hot to the touch - received its final grinding, polishing, and finishing with an epoxy sealer. The keel's shipping weight was 15,200 pounds.

### **Finishing off**

The final, tricky operation of drilling holes to accept the keelbolts took place at Maitland Valley Marina in



Goderich, Ontario, on the Canadian side of lake Huron. Boston Light and the keel were both trucked to the marina. A template was made of the final bolt pattern, and holes were drilled vertically up through the bottom of the fin, which had been reinforced by the builder with epoxy, carbon fibre, and a 1/2 - inch stainless plate. The keel was attached, and Boston Light was launched smoothly in fresh water - her first voyage on the way to the sea.

**Photography by Tom Bochsler**