

Assembling and ballasting the keel – Soling 1M
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Assembling the keel and pouring the ballast seems to worry some builders of the Soling 1M. Fear not... the following steps should make the project easy.

The keel is assembled and ballasted in three stages.

- A) Basic Assembly - keel is un-ballasted, used to align the keel trunk.
- B) Initial Ballasting - brings the weight of the boat close to minimum
- C) Final Ballasting - completed boat is weighed. Final ballast is added to bring boat up to 10 pounds.

Materials needed:

Masking tape
Pencil
Ruler
C clamps
Hobby Knife
120 grit sand paper
Flat sanding surface (Plate glass, mirror, MDF)
Thick CA glue
Five minute epoxy
Denatured alcohol
MEK
16 ounces of resin with slow hardener
Small artist paint brush
Two small funnels with exit openings approximately ¼ to 3/8 inch
Heat gun or candle
6 ½ pounds # 8 or #9 lead shot
2 – Zip-lock plastic bags
Pint size paper paint bucket
Paper cup
Vibrating tool (electric engraver, electric clippers, shaver)

A) BASIC ASSEMBLY

1. Waterproof the keel spar using five minute epoxy thinned with denatured alcohol. Paint it on letting it soak into the wood. Set aside to cure for at least one hour. (Alcohol slows the cure process.)
2. Sand the top 1 ½ inches of the keel spar sides smooth. (The portion that will slip into the keel trunk.) Rough sand the rest of the spar.
3. Bond the keel bolt into the keel spar with epoxy. Set aside.

4. Temporarily tape together the two plastic keel halves. Look around the joint for any gaps. Mark any gap areas with a pencil. Do not use felt tip pens or ball point as they will eventually bleed through the styrene.
5. Sand the top of the keel so that both left and right sides are the same height with a small 1/16 inch dish in the middle. (The front and rear of the keel should be taller than the area of the spar.)

Note: The dish in the top of the keel will make it easier to fair the keel to the hull when you do the final fitting.

6. Disassemble the keel halves. Use a piece of MDF, plate glass, or a mirror as a flat surface. Place a piece of 120 grit sandpaper on the flat surface, grit up, and sand the mating surfaces of the keel halves a small amount to flatten the joint area.
7. Lay one keel half on the work table and mark the spar location. Use pencil. The leading edge of the spar is 1 ¾ inches from, and parallel to, the leading edge of the keel. The spar extends 1 ½ inches above the top of the keel.

Note: The angle corner on the front of the spar may not line up perfectly with the top of the keel. The 1 ½ inch extension dimension is more important.

8. Bond the spar in place with thick CA glue.
9. Place some thick CA on the remaining exposed side of the spar and assemble the two halves of the keel. Use two “C” clamps with some scrap wood to add pressure to the spar area.
10. With masking tape, completely seal the outside edge of the keel halves, closing the joint firmly. Using a small paint brush, dribble a small amount of MEK into the keel allowing it to run around the inside and seal the joint. Pour out any excess immediately. Leave the tape in place and set the assembly aside overnight. Do NOT sand the edges of the keel at this time. The edges are sanded after the final ballast resin pour.

B) INITIAL BALASTING

Note: The keel assembly is used to locate and install the keel trunk BEFORE the lead is added. Do not continue with the ballasting until the keel trunk is constructed aligned and installed. It is much easier to handle the keel without the lead.

Also, the keel ballast is added in two stages. The first stage gets the weight of the boat close to 9 pounds. The finish stage brings the boat weight up to the Class minimum. Ideally, the keel ballasting should be one of the last things you do constructing the boat.

11. With masking tape, cover the top 2 inches of the keel to protect it from any spilled resin.
12. Obtain a small bucket or cut the top off a one gallon plastic milk jug or other similar container.
13. Place the keel assembly into the bucket with the open end of the keel up. Prop the keel up in the bucket using smooth stones or bricks. The keel does not need to be perfectly level. Just open end up.
14. Obtain two small plastic funnels with small exits of $\frac{1}{4}$ to $\frac{3}{8}$ inch. Most grocery stores have a good selection.
15. Heat the small end of the funnels with a heat gun or candle until the plastic is soft. Flatten the exits of the funnels into an oval shape so they will fit inside the top of the keel leaving enough room for the shot to flow through. After they have cooled, insert the funnels into the keel, one in front of the spar and one behind. Tape the funnels in place.
16. Weigh out about 5 $\frac{1}{2}$ pounds of #8 or #9 lead shot. Reserve another 1 pound to be added during the final pour.
17. Mix about 10 to 12 ounces of resin with slow hardener in a medium size paper paint bucket. The disposable kind is best. Do not use plastic buckets.

Note: We recommend using West System #105 epoxy resin and #206 Slow hardener for the ballasting. It will not get as hot as some polyester resins. If you do use polyester resin, be sure to use "Casting" resin, not laminating or finishing resin.

18. Start by pouring a small amount of resin into the rear funnel. Using a paper cup as a scoop, add some shot to the forward funnel. Alternate resin and shot. By pouring only resin in the rear funnel and shot in the forward funnel you will keep shot from getting stuck in the funnels.
19. After you have added approximately 5 $\frac{1}{2}$ pounds of shot, vibrate the keel with any buzzing type tool such as an electric engraver, clippers, or shaver. Buzz the keel for a few minutes to vibrate any air bubbles to the top of the resin-shot mixture and shake the shot to the bottom. Use only enough resin to just cover the shot. (Pour out any excess resin and vibrate the keel again to level the shot.)
20. Now fill the bucket with cold water up to the level of the resin in the keel to keep the assembly from getting too hot. The greatest amount of heat is generated during the first hour. You may need to add ice if the water temperature starts to feel hot. Keep the water under body temperature but not below room temp. (98 to 60 degrees F) The temperature should be pretty stable after the first hour. Let the resin cure overnight.

C) FINAL BALLASTING

21. When the boat is nearly complete, take the model to a parcel shipping store and have them weigh it with all the parts: boat, keel, rudder, rigging, sails, radio, batteries, hatches and paint. Take with you two plastic zip lock baggies, one with the reserve pound of shot marked "boat", the other empty marked "excess".
22. Place all the items on the scale. Adjust the quantity of loose shot in the "boat" baggie to bring the boat and all the parts up to 9 pounds 12 ounces. (The missing four ounces will be resin used in the final pour.)
23. Back at home, prop up the keel with blocks or bags. The final pour does not require cooling in a bucket.
24. Place masking tape around the top of the keel so that the tape extends about ¼ inch above the keel.
25. Mix up four or five ounces of resin with hardener.
26. Using the funnels pour the shot from the baggie labeled "boat" into the keel. Try to divide the shot evenly between fore and aft of the spar. You want the shot as low in the keel as possible, not all piled in front or aft of the spar.
27. Add resin to top off the keel. The keel should be slightly over filled.
28. Vibrate the air bubbles out of the shot.
29. When the resin sets to a firm gel, (30 to 60 minutes), remove the masking tape and trim excess resin above the keel with a sharp hobby knife. Be sure to clean out the areas on the sides of the keel spar. Set keel aside and let the resin fully cure.
30. With the resin fully cured, sand the edges of the keel and fit the top of the keel to the hull.
31. When the boat is completed, take it back to the package store for a second weighing. Adjust the final weight as necessary with hull ballast or an extra battery.

Enjoy your project!