

Star 45 Short Kit Build

by
Bob Szczepanski

An old used Star 45 showed up at our pond one day last Fall. Nostalgia struck and I was hooked! A flood of memories sailing an International Star boat on Lake Ontario and the Finger Lakes, in upstate New York back in the mid to late '60's, came in a massive wave. Not being a prolific or avid boat builder (frames and fiber glassing are not an option), the excitement almost immediately vanished until I found out that a Star 45 short kit was available. I immediately ordered one. It arrived 7 weeks later. See Figure #1.

The kit was just that, a bunch of parts, no instructions, photos or diagrams were included. The Star 45 is a builders boat. The short kit is too, but does provide a huge head start on the major assemblies. Upon conducting an extensive inspection of all the parts, it was clear that the quality was quite good. The hull measured in at the absolute minimum length: 44 ½ inches. Unfortunately, it also had a 5+ degree twist starting from the beam max point aft to the transom. I knew the length and certainly the twist would prove to be problematic. A number of small contaminant flaws were observed in the gel coat on the hull, rudder and keel fin. These were wet sanded off, then polished back to the original high gloss. The keel bulb was completely unfinished and clearly straight from the mold. The bottom of the hull also had a full width permanent slight oil can depression just aft of the molded in keel reinforcement hard point. Minor stuff, certainly better than I could likely to expect to achieve on my own. The deck, however, seemed flawless. In my haste to start work and get the feel of the kit parts, I cut out the molded-in deck hatch and installed a temporary balsa cross beam in the hull to establish the max. beam dimension (I chose 11 1/8"), prior to taking the Figure #1 photo. I discovered that polyester resin, as opposed to epoxy, was used for all the lay ups and that the gel coat on all the molded parts was fairly soft and could be scratched very easily. I would need to be careful handling these parts. Everything in the kit was weighed prior to any construction and recorded as follows:

Bare Hull – 16.6 oz. (an impressive achievement!)

Deck – 9.7 oz.

Keel Fin – 9.0 oz

Keel Bulb – 137.0 oz.

Rudder – 3.0 oz.

Misc. Kit Hardware – 1.7 oz.

Total – 177 oz. (11# 1 oz.)

Clearly achieving the Class required minimum weight (12#) would not be a problem. In fact, I decided a strict weight management effort was in order.

The start of the building process was to locate and draw center lines on both sides of the deck and hull. I discovered several things. First, the molded in scribe marks and three sets of dimples on the outside of the hull for the keel bolts were dead on center as was the scribe mark for the rudder post. Second, the molded in dimple for the rudder post was a bit off center and was not used to drill out the hole. I drilled out the aft most pair of keel bolt

dimples. Third, the hard point in the hull for the compression post was about 1/2" off center, but was sized large enough not to be a problem. Finally, the underside of the deck was layed up with all reinforcements an 1/8" off center. Since the edge overhang of the deck was large enough to accommodate such a small offset, this only had to be noted. The lesson learned, however, even with a good quality kit, is to assume nothing, check and measure everything.

The twist in the hull made installing the rudder a bit of a challenge. Also, the kit supplied rudder block angled sides didn't allow the post to be aligned to minimize the distance from the top of the rudder to the bottom of the hull. After re-cutting the block to correct the angle, the deck was taped on and used to eliminate the hull twist while gluing in the rudder block and aligning the rudder. Lots of blue tape, two levels and a plumb bob did the trick! See Figure #2. The same process was repeated to install the keel fin and keel bolt tubes, since I wanted a removable keel for ease of travel and storage. See Figure #3. Next, a small bulkhead was installed in the bow for the winch/sheet line turning block. Also, all deck hardware was installed and a forward hatch cutout made. It was sized to fit my hand and also saved a whopping .75 oz. That amount was just enough to offset the weight of the hatch covers. See Figures #4 & #5. Thinking ahead to mounting the electronics board, I fabricated two slotted support posts for the keel tubes. One of them had another slot cut in that would accept the electronics board and make it easily removable with one screw. See Figure #6. You can see the final electronics board installation in Figures #6A & #6B.

Prior to gluing the deck on, I took a side trip. In Figure #6 you can see two HS-785 winch servos with custom made drums. Why do this? The the price of a HS-785 is quite inexpensive, but the down side of a single HS-785 sail winch is speed and limited torque. So, it was time to get creative. To solve the speed limit, I added an additional block which was located in the winch/sheet line. See Figure #7. This effectively doubles the speed of line movement at the expense of doubling the load on the winches. So, two winches are needed to double the total available torque and match the load. While the extra block doubles the speed of the line movement, the distance that the line must be moved by the winches is halved. This fortunate fact provides the opportunity to use custom drums to optimize the movement and increase the force. The standard HS-785 drum is 1 1/2" in diameter. After doing some geometry and simple math, I opted to make 3/4" diameter drums. The drum size reduction further doubles the available force from each winch, at the expense of some speed. To mitigate the loss of speed from the smaller drums, the size of each was designed to yield slightly less than 3 total turns on each winch. End result: about two seconds from full in to full out and more than double the force output of a standard HS-785. The penalty? - about 2 ounces of more weight than the single winch most would typically use. Hmm, at about \$100 an ounce price differential on a 12 pound boat = "good trade." Plus, it was kind of fun doing something different and saving a few dollars. Actually, to help rationalize the extra weight, I opted for a two cell 2300 MA Li Poly battery pack and a voltage regulator. This combination is about 3 ounces lighter than using a standard 5 cell AA pack. Ah, these days it is all about spin control, so as the government would say, I actually saved an ounce!

To match the cool winch set up, programming the pair was the next step. The first winch was easy, just plug it into the throttle channel. The trick lies in the second winch. I plugged it into the elevator channel, then set up a programmable mix to slave it to the throttle. It quickly became evident that any inadvertent up or down movement of the rudder stick would move

the second winch and would change sail trim. Not good! Then, a light bulb went on and I decided to change the elevator max. throws to 0%. Returning to the programmable mix, I programmed the throws to match the percentages on the throttle channel, but in the opposite direction. Now, you could move the right stick (rudder control) up and down and no winch movement would happen, yet both winches were perfectly in sync. when the sail control stick was moved. Yeehaw! Another major benefit to this was that one winch would rotate clockwise and the other in the opposite direction, so that the winch line would come off the top of one drum and the bottom of the other and provide some separation of the winch lines. Way Cool!

Back to building. The deck was glued on by aligning all the center lines and correcting for the twist in the hull. Again, lots of blue tape, levels and plumb bobs. I used epoxy thickened with micro balloons to keep the glue from running. Once dry, the deck overhang was sanded off, then the assembled parts were declared a boat. Mounting the keel bulb on the fin was the next objective. Getting the fin to fit in the slot molded into the keel bulb was a project in itself. Removing lead from the inside of a slot requires determination and patience. I am good on determination, but sadly lacking in patience. I heavily rounded off the bottom leading and trailing edge of the fin and attacked the slot in the bulb with a rotary tool and a coarse file. Two hours and a bunch of cussing later it fit. OK, now what? Time to float the boat and determine the load waterline. First, of course, the total all up weight must be targeted. The completed boat less fin and keel bulb weighed in at 49.5 oz. The complete rig and sails weigh approximately 10 oz. The raw keel bulb and fin weighed in at 146.5 oz. yielding a total all up projected weight of 206 oz. (12# 14 oz. - nearly 7% over minimum) I decided this was too much over the minimum and knew that drilling out the keel bulb was the only viable way to reduce weight. It sounded good to me, but doing a little math before the drilling built courage. The unmodified ballast to weight ratio of the existing assembly worked out to be just a bit over 66% while the intended weight reduction (about 5%) yielded a ballast to weight ratio of just under 65%. I put on my cowboy hat and fired up the drill. Being careful not to change the keel bulb's CG, equal amounts of lead were drilled out on either side. I removed 10+ oz. total to yield a keel fin/bulb weight of 136.5 oz. (See Figure #8) This would yield a target sailing weight of 12# 4 oz. At this weight, the boat would be safely legal and barely 2% over minimum, while suffering only a very small reduction in the righting moment. After temporarily attaching the fin and now weight reduced keel bulb to the completed hull, along with a simulated rig weight located on the mast step, a trip to the pond was in order. People say "whatever floats your boat", but the goal here was to determine the load waterline in order to align the keel bulb axis parallel to it. That done, it was time to check the rudder alignment. Interestingly and happily enough, the axis of the rudder shaft ended up perpendicular to the waterline. Life can be good!

All my keel handling and bulb fitting apparently caused the keel bolts in the fin to become slightly loose. A clear wobble could be seen (and heard) in each rod. This was totally unacceptable and left unattended would cause hull flex and deterioration over time. The fix was to drill out the fin, align and then stabilize the rods with CA, then fill the holes and embed the fin top with epoxy. See Figure #9. The bulb itself was finished by plugging the drilled holes with cotton balls and coating the bare lead with a filler made of epoxy and micro balloons. Sanding, priming and painting the fin and bulb completed the assembly. See Figures #10 thru #13.

In summary, the Star 45 short kit is not a project for the casual builder, but certainly is less demanding than a scratch build and I think a very reasonable value. The minimum length hull required some modification to the rig layout to get everything to fit on deck and not hang up on the backstay. The boat, ready to sail, ended up weighing 12# 3.5 oz.. I did spend well over 100 hours from start to finish, not counting building the rig and mounting sails. My guess is that a more prolific and avid builder (and now me) could go from short kit to boat in 60 to 80 hours. The problem for me is that I am only good for one boat build every two or three years, so I'll have to wait a bit for the next one. My thanks and appreciation go out to my new sailing friend, Phil Runquist, a very accomplished Star 45 builder, for his encouragement and guidance.









