

### **Procedure for Removal and Replacement of Keel Bolts and Short Bolts.**

1. Firstly the cradle had to be adjusted so that the lead ballast could pass between the front and back cradle cross beams. In the case of Rosemary the gap had to be 76 inches. Two new bolt holes were drilled in the right and left cradle base so that the rear beam could be moved back. The boat was jacked up so that wooden blocks could be placed under the back of the lead keel and the boat was clear of the rear cradle beam. The boat was then propped, the cradle cross beam was disconnected and moved back by about 3 inches, and bolted back in place. The boat was then lowered back down so that the aft dead wood was sitting on the rear cradle beam.
2. To drop the lead ballast the front dead wood had to be removed first. The boat was jacked up so that the front dead wood was clear of the cradle. Wooden blocks were placed under the lead keel.



The front dead wood was attached to the wooden keel by two bolts, one of which was near the mast step (in some 17's it is actually in the mast slot). The nuts were treated with WD40 and heated using a heat gun before they were opened. Once the bolts were removed the dead wood was disconnected.



3. A number of wooden blocks were placed on the front cross beam of the cradle. This acted like a false dead wood. The boat was lowered back down as shown in the photo below.



4. For stability the boat was then strapped down to the cradle using cargo straps, before the cradle was jacked up on to beer kegs. This was done in order to get enough clearance to remove the keel bolts.



5. Inside the boat the old paint was removed from the keel bolts, the nuts were then dosed with WD40 and heat treated using a heat gun. The nuts were opened using the tool shown in the photo below (owned by Paddy Cronin). It had a hollow handle into which a bar could be inserted for leverage and had a universal joint so that the bar could be manipulated in tight spaces. It came with a set of imperial sockets. In Rosemary the nuts and bolts were bronze and the nuts opened without much hassle.



6. In Rosemary there were 6 keel bolts. They were removed one at a time. To do this a lump hammer was found to be the best tool (I tried a small sledge but it was inclined to bend the bolts rather than knock them through). The bolts were quite tight in the lead. To free the bolts each was knocked down so that they were flush with the wooden keel. The part of the bolt protruding from the lead was lubricated with oil and then knocked back up flush with the lead again. This was repeated until the bolt was loose. The threaded end of the bolt (where the nut had been attached) was inclined to “bell”, so before the bolt was finally driven through the lead, the threaded top of the bolt with the “bell” was cut off with angle grinder. (Otherwise the “bell” caught on the top of the lead and could not be driven through). The bolt was then knocked out using a solid piece of stainless steel bar as a drift.
  
7. As each keel bolt was released, it was replaced with a length of steel treaded bar with a nut and washer on each end. When all the bolts were knocked out the lead could then be dropped. Its descent was controlled by loosening the nuts on each treaded bar. A tube spanner was the handiest tool for this job. The threaded bar also ensured that the alignment of the bolt holes in the lead ballast with the corresponding bolt holes in the wooden keel was retained. **Once the ballast was lowered it was supported from the ground up, with wooden blocks under the lead. It was important to have no strain on the wooden keel as the short bolts were removed.**



8. As the average length of the short bolts was approximately 18 cm, the ballast was only lowered to about 25cm from the wooden keel.



9. In order to retain structural integrity each short bolt was removed and replaced with a new bolt, before the next old short bolt was removed. Because the floors in Rosemary were bronze, the new bolts were made from smooth bronze bar (imperial) purchased in the UK. The bar came with UNC nuts and we threaded it with a UNC die. A twist of caulking cotton was



placed at the end of each bolt. Sikaflex was gunned into the bolt hole and then the bolt was driven home. A twist of caulking was placed under the nut before it was tightened down.



10. Similarly the keel bolts were also made from bronze bar (imperial).



- 11 The bottom of the wooden keel was cleaned off and sealed with International Universal Clear primer (UCP). The top of the ballast was cleaned with a wire brush. The ballast was pulled back up on the threaded rod so that there was about a 3cm gap between the top of the ballast and the wooden keel. The new keel bolts were fitted. A twist of caulking cotton was placed at the end of the bolt before the bolt was driven into place. Rubber caulking was gunned onto the top face of the ballast. Using two jacks the ballast was pushed back into position and the new keel bolts were tightened down. Again a twist of caulking cotton was placed under each nut.
- 12 The short bolts under the forward dead wood were replaced before the latter was reattached.