Centreboard case distortion in Cornish Shrimper No. 124

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No 124: Bumble Chugger (BC) was built in 1983.

Towards the end of the summer of 2003 the centreboard started to stick when it was let down. At first we assumed that mud, sand and/or stones had jammed the centreboard. After jerking and releasing the up-haul a few times it eventually went down the full way.

At the end of the season BC was taken out on a cradle at the Felixstowe Ferry Boatyard and the centre board was lowered. No stones or mud could be found.

After some thought during the winter months when BC was laid up I considered the possibility that the centreboard case was being squeezed by the ballast. I removed the floorboards to examine the ballast for any signs of movement. A crack had opened up along the starboard side of the centreboard case. It varied from 2 to 4 mm wide and had caused the strip of wood which supports the floorboard to separate from the centreboard case over a length of about 500 mm.

I discovered from discussion with Cornish Crabbers Ltd (now Select Yachts) that the ballast is made up of steel pressings set in a compound of slate dust and polyester resin. In BC each pressing is about 3 mm diameter and 1 mm thick. Several million of these pressings are used to make up the volume of ballast

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In order to understand my train of thought it is necessary to note that when sailing to windward the centreboard exerts large forces on the centreboard case (especially in strong winds). These forces may be sufficient to cause a crack to form between the fibre glass wall of the centreboard case and the ballast. Once such a crack has formed it provides access to sea water and oxygen. This allows the steel pressings to start to rust.

Once this process starts it causes the pressings to expand creating enormous forces. These forces in turn cause the crack size to increase and allow more water and air to get in and the rusting increases and extends the crack further along the length of the centreboard case. As a consequence of this pressure the centreboard case distorts reducing the size of the slot in which the centreboard slides.

At the beginning of the sailing season of 2004 I decided to investigate this possibility more seriously. Cornish Crabbers had informed me that two tuffnel blocks were bolted each side of the centreboard. If these were removed it would provide enough room to allow the centreboard to slide up and down. It should be noted that such blocks are not fitted to later models of Shrimpers.

BC was placed on the cradle at the Felixstowe Ferry Boatyard again at Easter, 2004 (9/10 April) and the centre board was lowered to remove the tuffnel blocks. At the same time I tried to remove the centreboard altogether. This was not possible. At the hinge point a collar passes through the centreboard and projects out each side by 2 mm (approx.). It was this collar that jammed on the centreboard case and prevented it from being removed. I replaced the centreboard to its inboard position and confirmed that it was free to be raised and lowered without jamming.

During this operation the centreboard was moved sufficiently to allow a visual check inside the centreboard case. A bulge could be seen on the starboard side.

After further discussion it was decided that no more action would be taken during the summer of 2004. A liquid filler was poured into the crack and then a mastic sealant placed along the top of the crack. In retrospect I do not believe this helped to prevent further rusting. In the autumn I would attempt to replace the ballast close to the centreboard.

During the summer the centre board remained free to move up and down until mid-August, when it started to stick again. This suggested that the bulge had increased during this time. I decided to replace a strip of ballast 4 inches wide adjacent to the starboard side of the case (see Figure 1). Before I started work I checked the position of the centreboard case by taking measurements from the top of the bunk lath to a series of eight points at two levels ‘A’ and ‘B’.

At the beginning of October, 2004, I began the work. The tools included an ‘angle grinder’ with a 200mm metal cutting blade, a sledge hammer and cold chisels. Paper overalls, goggles and breathing mask were essential as the angle grinder created a great deal of dust and flying pellets. It was a horrid job.

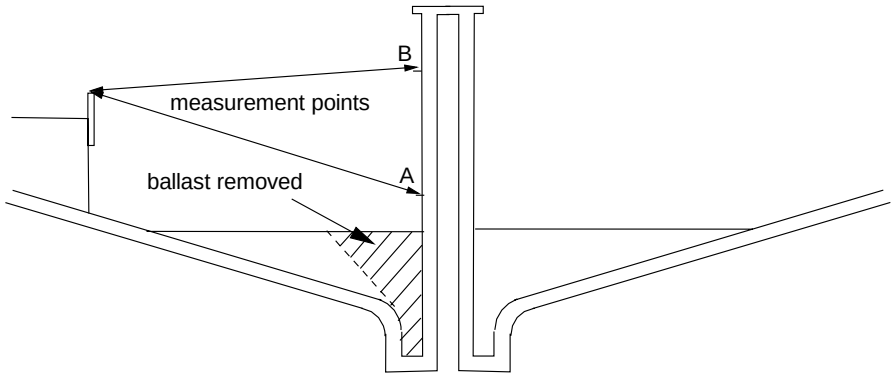

Figure 1: Section through hull showing the ballast removed

The pressed steel cuttings separated from the ballast compound and flew out in a yellow/red hot state, burning holes in my paper overalls. Once the saw cuts had reached about 50 mm deep I used the hammer and cold chisels to remove the bulk of the ballast.

Close to the centreboard case there were patches where the steel pressings had rusted and formed a clinker.

This clinker had formed expanding struts which had caused the centreboard case to be squeezed. In one place there was a void in the ballast about 50 mm long, 20 mm wide and high but the steel pressings around its surface had surprisingly not rusted.

Contrary to my first expectations the rusting had not spread from the rear end of the centreboard case. Although the plywood bulkhead at that end had been distorted by the expansion of the ballast, the steel pressings close to the centreboard case were not rusty. Rusty areas close to the centreboard case appeared to be randomly placed, possibly related to how dense the ballast mix had been.

I took five sets of measurements at the position described above (see Figure 1):

- before work started,
- after cutting away 25mm,
- after cutting away 50mm,
- after cutting away 100mm,
- after the ballast had been replaced (see Table 1).

Table 1: Measurements of centreboard case distortion (Starboard side).

Position No.	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
	Distance from forward bulkhead (mm)							
	254	***406***	***559***	***711***	***864***	***1,016***	***1,168***	***1,321***
Before repair								
Level B (mm)	353	355	354	356	358	360	359	358
Level A (mm)	367	369	368	370	374	374	371	371
After cutting 25mm								
Level B (mm)	353	353	352	355	358	360	358	357
Level A (mm)	365	366	366	367	372	373	370	369
After cutting 50mm								
Level B (mm)	353	353	352	353	356	358	358	357
Level A (mm)	363	364	365	367	369	370	369	369
After cutting 100mm								
Level B (mm)	352	353	352	353	355	357	357	356
Level A (mm)	363	364	364	365	368	369	367	368
After repair								
Level B (mm)	352	353	352	353	355	356	356	355
Level A (mm)	364	365	365	365	368	368	368	367

Table 1 shows that removing the ballast has allowed the centreboard to move back an average of 4mm at the lower level (A) and 2mm at the upper level (B).

In total I removed 6 stone (38 kg) of ballast. The volume of this filled a plastic bucket.

I replaced the ballast with 4½ stone (29 kg) of lead. This was melted down and poured over a paving stone to produce thin flat sheets. I have to admit an appalling accident during this operation. I had been using a specially bought saucepan for melting the lead which was done by heating it up on our gas cooker! A particularly large piece of lead was precariously balanced in the saucepan and slowly melting from the bottom up. I took my attention off it, for just a moment, and of course disaster occurred. The lead had slowly tipped over as it melted and the saucepan lost its balance!! The whole lot, including a considerable amount of molten lead then fell over towards me. I was just quick enough to jump out of the way to avoid being burnt - but the vinyl floor wasn't so nimble!!! Gillie was not best pleased. The outcome was that I had to lay a new kitchen floor.

The next stage in the process was to cut the thin sheets of lead into ½ inch strips which were in turn cut into half inch squares. Gillie (very long suffering!) helped with this task.

The remaining 1½ stone (9.5 kg) was made up with resin and slate dust. Cornish Crabbers supplied a large pack of slate dust and Wessex Resins & Adhesives Ltd provided me with the epoxy resin with a slow reacting hardener (209). The main reason for this was to keep the heat generated by the reaction to a minimum.

I mixed the resin in 800ml batches. The slate dust was then added and mixed in until the paste was quite thick. The lead pellets were added in-situ. The filling process was carried out in two sessions. Gillie mixed the resin and paste while I filled the groove and tamped the lead pellets into place. The first session filled the lower two inches of the groove. After the epoxy mixture had hardened and cooled the second session filled up the ballast to the original level.

I am writing this a year later and, touch wood, so far everything has been OK. There has been no further problem with getting the centreboard up and down.