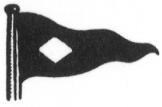


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# GLENDOWIE BOATING CLUB (INC)

Clubhouse: Glendowie Road

27 April 2008

## STARLING MASTS

During the last race of the 2007 North Island Starling Championships approximately 20 masts were reported bent, some damaged beyond repair. While the 25 – 32 knot winds in this race exceeded the upper end of the design range for this rig, the number of failures was greater than has been the recent norm. This was of concern to the Glendowie Boating Club and Foster Masts. A request for feedback from affected skippers and stress analysis of failed masts was commenced. In addition, new unused sections from the existing Fosters stocks, as well as samples from a newly arrived batch were tested.

### Failures during sailing

The two principal reasons for failures are the current practice of using rotating rigs and high ratio boom vang systems. The result is rig tensions far in excess of that envisaged when the mast section was designed in 1969. It would appear the majority of masts failed during downwind sailing with severe sideways bending between the hounds and the gooseneck. All of the survey respondents reported the absence of a lower support forestay, a stay added to assist securing rotating rigs during downwind sailing. Most of the failed masts did not have internal stiffeners. An observer also reported lack of mainsheet stopper knots on some boats, which in turn enabled the boom to load up on the side stay. The resulting lever action from the outer end of the boom transferred aft loading on the gooseneck, exacerbating the bending loads on the mid sections of the mast.

### Test Results

Both Fosters and the GBC had hoped the tensile testing would reveal a bad batch or at least some soft individual extrusions. Starling masts are made of 6261 aluminium and tempered to T6 standard, the highest temper available in New Zealand. The specification calls for a minimum Webster Test Value of 15.5 hardness. All masts tested (both unused and damaged) were within the 17 - 18 range of hardness, well in excess of the specification. (A UK Proctor mast was also tested and was well below the 15.5 hardness of the Starling spec.)

### Recommendations

The Starling rig is a fragile rig that needs care in both rigging and race use. With racing conducted in over 20 knots care must be exercised to avoid failures and with experience failures can be minimised. The following are precautions to assist the survival of a Starling rig.

- ❑ Fit a lower fore stay and ensure it is tight when the rig is rotated. Class rules allow attachment 880 +/- 50mm from the base of the mast to the same fitting at the bow as the main forestay. If the main stays are rigged very loose, it is almost impossible to achieve tension on the lower fore stay and downwind failure is more likely.
- ❑ For skippers over 65 kgs or skippers who physically drive their boats hard, it is recommended an internal tubular stiffener be fitted. One example is to use an Ullrich Aluminium Co. tube 22mm o/d, 1.2 mm wall thickness. Cut off 1.3 metre length with

- 0.3 metre taper cut in the top and a vertical cut through the short side to enable compression for sliding up the mast.
- ❑ When sailing downwind in over 20 knots, do not allow the boom and side stay to come in contact. Ensure a stopper knot restricts boom travel.
  - ❑ Prior to rounding the top mark, ensure the boom vang has any excess tension released. Full vang tension downwind in strong winds will eventually result in a bent mast.
  - ❑ Use a gooseneck that does not require removal of the sail track. A Laser fitting works well. If a cutout is required, ensure a small internal tubular stiffener is fitted. Masts tend to bend upwind at the cutout when too much boom vang tension is applied.
  - ❑ Consider converting to a fixed/non-rotating mast. This would ensure the stronger fore/aft section was carrying the load when sailing down wind. Far fewer masts were damaged when fixed masts were the fleet norm.

### **Conclusions**

There is no question that the Starling rig is fragile. It has been suggested the current Fosters F4 section should be either beefed up or replaced by a carbon section.

If the class changed to a thicker alloy section some of the rig adjustment flexibility available under the current regime would be lost, as would the learning benefits of sailing with an adjustable rig setup. The one-design nature of the mast would also be lost with the addition of a second rig option, since all existing masts would require grandfather rights. The resulting addition would add a layer of complication to the boats that would arguably create more difficulties and uncertainties than it solved.

Carbon masts are being investigated and one has been made for testing. It is likely carbon masts will be available for the export version of the MacKay GRP Starling. Cost and bend consistency are two very big issues that are yet to be resolved and there is no intention of an owner rule change ballot for carbon masts in the short-term future. At \$120 per section, the existing alloy mast remains an attractive option.

The Starling Class Administration Committee strongly urges all sailors and parents to review the above recommendations and apply them as applicable to reduce the chance of mast failures.

Brian Peet,  
Chairman,  
Starling Class Administration.