

## **HOW TO: Care for your carbon Fibre**

Carbon fibre composites are amazing materials - light, very stiff, strong, and highly resistant to corrosion and fatigue.

An understanding of the composite structure allows us to predict the performance expected and care required in order to get the best out of your product.

In a composite the fibre is only one of the major components - the other is the resin or adhesive, which acts to hold the soft fibres rigid in relation to each other. For structural applications, epoxy is still the resin of choice possessing good fibre adhesion, strength, toughness and economics.

In order to get the maximum life from your carbon fibre composite tubing we recommend the following care and precautions:

- Do not allow the tubing to become excessively hot. High performance epoxy resins, together with oven post curing are employed in our tubes, however at temperatures above approximately 75°C the epoxy can soften, which dramatically reduces strength or otherwise can cause the tube to bow or warp. Note that black objects are the best absorbers of IR radiation (heat) and we have recorded a surface temperature of 65°C from a tube lying flat on the ground in the summer sun on a windless day.
- Epoxy resins are UV light degraded. Excessive UV light has the effect of turning the exposed epoxy resin into a chalky layer, which can then easily fall off resulting in exposure of the fibres to the weather. Moisture can then enter the exposed fibres and cause wicking to the inside of the laminate, which further reduces the laminate's strength and integrity.
- Whilst these two effects can be either avoided or are relatively long term (many dinghy sailors have chosen to leave their masts naturally black) we recommend painting the composite tubing with a UV resistant polyurethane based paint or clear coating. Correct application of paint will effectively eliminate degradation due to these effects and allow the other long life properties (i.e. excellent corrosion and fatigue resistance) of composite tubing to be realised.
- Carbon fibres are good conductors of electricity. In a similar way that aluminum masts need lightning strike protection so do carbon fibre composite masts.
- The fact that carbon fibres are good conductors also leads to corrosion potential with dissimilar metals. The major metal to avoid here is aluminum, which is anodic to carbon and hence corrodes away in time. The use of plastic fittings, SS fittings or aluminum fittings with isolation barriers is good practice. Some SS metals may still corrode but generally higher grades of SS possess sufficient surface passivity protection to avoid corrosion. All said and done, many people still use aluminum fittings in direct contact with carbon fibre composites (i.e. spinnaker pole end fittings) and the corrosion effect is no greater than the general aging that occurs to the fitting due to wear and tear.

- Carbon fibre composites are very directional in regard to mechanical properties. This is generally seen as an advantage because fibre direction can be optimised by aligning in the same direction as load paths. Most composite tubing used for masts, booms, poles, etc. are optimised for axial strength and stiffness. The strength and stiffness in the other ‘hoop’ direction is correspondingly much less. As a result, carbon fibre composite spars are produced with thicker walls than aluminum spars however they can still be weaker in this hoop direction. Care should be taken to avoid excessive hoop loads for tubes designed for axial loads. An example of this kind of load is dropping a spinnaker pole onto the forestay whilst under spinnaker load. Localised sleeving of the pole (i.e. SS inner tube, Carbon inner tube) is good practice to strengthen the pole at this point.
- Carbon fibre composites do not yield (plastically deform) prior to failure. Often little warning is given that the tube is likely to fail. Care should be taken in regard to heavily loaded tubes to avoid personal and product injury.
- As mentioned above, tough epoxy resins are employed in our composite tubing and this improves the tube’s wear and tear properties. However, dropping of composite tubing is to be avoided as high instantaneous loading can occur which can cause damage to the tubing.

### **CST Composites**

PO Box 651, Caringbah, NSW 1495 AUSTRALIA

Phone: (+612) 9668 8488, Fax: (+612) 9668 8499

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