



Rig pimp

Selden's **Richard Gibson** explains how our Fireball's new rig was put together.

With a hull that was now sailable, and able to take the stresses of a new rig, mast manufacturers Selden set to work on putting together a new rig for our Fireball.

Selden has been making masts since 1960, and while the company makes more and more carbon masts these days, they also produce a huge number of aluminium rigs for a variety of classes, including the Fireball. The company has invested in some of the most advanced manufacturing methods for tapering aluminium spars, and our mast started life with the highest

grade 6082 aluminium alloy extrusion, before going through an automated 'four step' process which is designed to produce not only the best performing mast, but also a high level of consistency in every tube.

Four-step production

'Firstly the taper is cut using a plasma cutter,' explains Selden's Richard Gibson. 'Our investment in automated CNC controlled technology has allowed the production of the most consistent tapered masts available. The plasma cutting process ensures a smooth edged perpendicular cut that is 100 per cent accurate time after time, reducing the inconsistencies that are common to a manually prepared taper.'

'This process also provides the ultimate product development tool as simply by modifying the CNC programme the dimensions of the mast taper can be adjusted to suit high-end performance requirements.'

'The second step sees the automated welding of the spar. This process joins either side of the taper together in one continuous and controlled pass. This helps eliminate weld variation and localised hotspots, keeping excess heat out of the



Above and right Step one: the CNC plasma cutter is used to cut the mast taper.

Carbon spars

By using the latest technology, carbon spars are becoming more affordable, although our boat has an aluminum spar, we took a closer look...

With a sophisticated carbon filament winding machine and autoclave, Seldén is producing a new generation of carbon spars. During the design process the position and alignment of each fibre is precisely calculated to meet the required bend characteristics for the mast. This detailed design is then used to programme the company's filament winding facility, the aim: optimum performance for minimum weight.

Firstly, carbon filaments are wound around a mandrel (male mould) under controlled tension, via a designated winding program supplied by the design team.

Richard Gibson explains, 'This filament winding process, a computer controlled process (CNC), guarantees consistent accurate filament fibre orientation from spar to spar. Carbon filaments can be laid from 0 degrees (uni-directional) to 89 degrees (hoops) and at all angles between to produce a wide range of bend characteristics. This accurate alignment of composite filaments is vital to the performance characteristics of a carbon spar.

'The highest grade pre-preg tows of T700 or TZ carbon fibre are used to give sailors the best stiffness-to weight spar. This enables the highest fibre to resin content pre-preg to be used. The aerospace grade pre-preg has a UV stabiliser in the resin system to give the spars a guaranteed long life, even in the sunniest of climes.

'The masts are externally reinforced using pre-preg woven carbon cloth to ensure localised reinforcement at high-load areas and secure attachment of fittings.'

The material is consolidated in Seldén's in-house 20m-long autoclave. The combination of heat and pressure cures the resin and consolidates the pre-preg material, forming a ready-to-assemble carbon tube.



Above and far left The CNC-controlled filament winding machine.



Left Carbon filaments are wound round a mandrel.



Left The masts are externally reinforced.



Below Seldén's autoclave in the company's UK factory.



Below and left The automated welding process.





Above Our mast undergoes heat treatment and beadpeening.

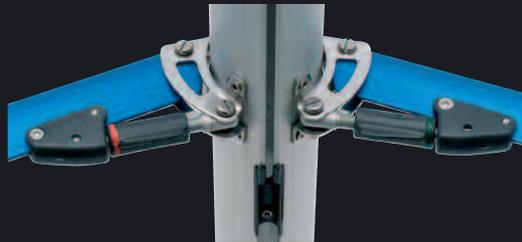
taper, providing greater consistency and performance from the mast taper.

'The weld produced is so perfect there is no need to mechanically grind the weld, again reducing the opportunity for inducing inconsistencies into the mast section.

'Step three involves heat treatment and beadpeening of the spar. All Seldén's masts are heat treated in the company's purpose-designed oven. This artificial hardening ensures that you get maximum performance from the tapered section.

'Seldén's purpose-designed beadpeening machine provides a uniform cleaning process and means no hand cleaning or grinding, again guaranteeing consistency from mast to mast. This process also improves the fatigue properties of

Right The spreader brackets are made from stainless steel.



Below The masts are assembled at Seldén's factory in Gosport, near Portsmouth.



the mast for improved longevity and creates the distinctive Seldén satin finish to the spar.'

Rig assembly

Finally the anodised, tapered mast is ready to be assembled using unique custom-designed fittings. 'Seldén's dinghy spars have benefited from a complete redesign of fittings over the last six years. With developments such as our fully adjustable spreader system, unique gnaw solution and simple single line reefing systems for dinghies, constant development and innovation ensures a Seldén mast carries the best fittings in the market place.'

To reduce weight, increase strength and reduce the corroding properties of aluminium fittings, Seldén's fittings are made from injection moulded glass filled nylon. This material is stronger than the equivalent cast aluminium material, is inert with aluminium and does not corrode in saltwater. The glass fibres that fill the nylon material ensure excellent strength and durability.

'Our spreader brackets are made from stainless steel, formed on a precision jig as a one piece fitting, ensuring 100 per cent symmetry and providing a consistent base on which to attach spreaders,' adds Richard. In the assembly process, the mast section is firstly measured out on an electronically calibrated measurement bench, marking positions of fittings and also its overall length. The slots for sheave boxes, T-terminals and halyard exit slots are then routed out of the mast section using a copy router, which utilises a template and Laserguide to ensure a high level of accuracy.

The masts then move into the assembly area, where the spars are put together. The production team assemble the masts using a variation of jigs. Individual jigs are used for T-terminal backing plates, sheave boxes, and spreader brackets, and complete lower end jigs are used for each individual mast specification, ensuring accurate placement of the fittings from heel to boom bracket on every mast. All stainless steel fittings are lacquered before assembly, ensuring a good barrier between the two materials. Die lines extruded on the mast section signify the front of the mast, and the sail track on the aft face, aiding placement of fittings accurately.

The masts are then quality checked, cleaned, labelled and bagged; then delivered on to the customer... in our case that meant a road trip from Seldén's factory near Portsmouth, to dinghy specialists Pinnell & Bax in Northampton...

And next...

We visit the sail loft at Pinnell & Bax to see how the sails were made, the rig goes in the boat, Marlow adds some string, and Fireball guru Dave Wade from P&B gives the boat a quick tune-up before we scramble to get our boat sailing for the nationals... some of the finishing touches will have to wait until the winter. ■

 **SELDÉN**
for sailing