CARBON SPARS

SELDÉN
for sailing

Seldén carbon spars

Seldén was founded in 1960 and has grown to become the world leading spar producer with manufacturing facilities in Europe, USA and Asia. Our products and processes combine reliable and tested methods with the latest technology that enable us to produce spars for Olympic and World Champions, offshore racers, blue water cruisers and family sailors alike. It is this experience and knowledge that we have applied to our latest generation of carbon spars.

Our carbon spars are designed using the latest finite element analysis backed by many years of solid engineering experience.

Our unique production method gives a unique look. We call it Mandrel Filament Moulding (MFM). The process is fully automated and computer controlled for ultimate accuracy, repeatability, efficiency and that stunning ‘Viper’ pattern.

Seldén produce over 400 carbon masts per year as well as booms, poles and bow sprits for boats including high performance skiffs, racing keelboats, IRC race boats and some of the world’s most prestigious cruising yachts. With more sailors choosing Seldén carbon spars, the pattern is obvious.

Why go carbon?

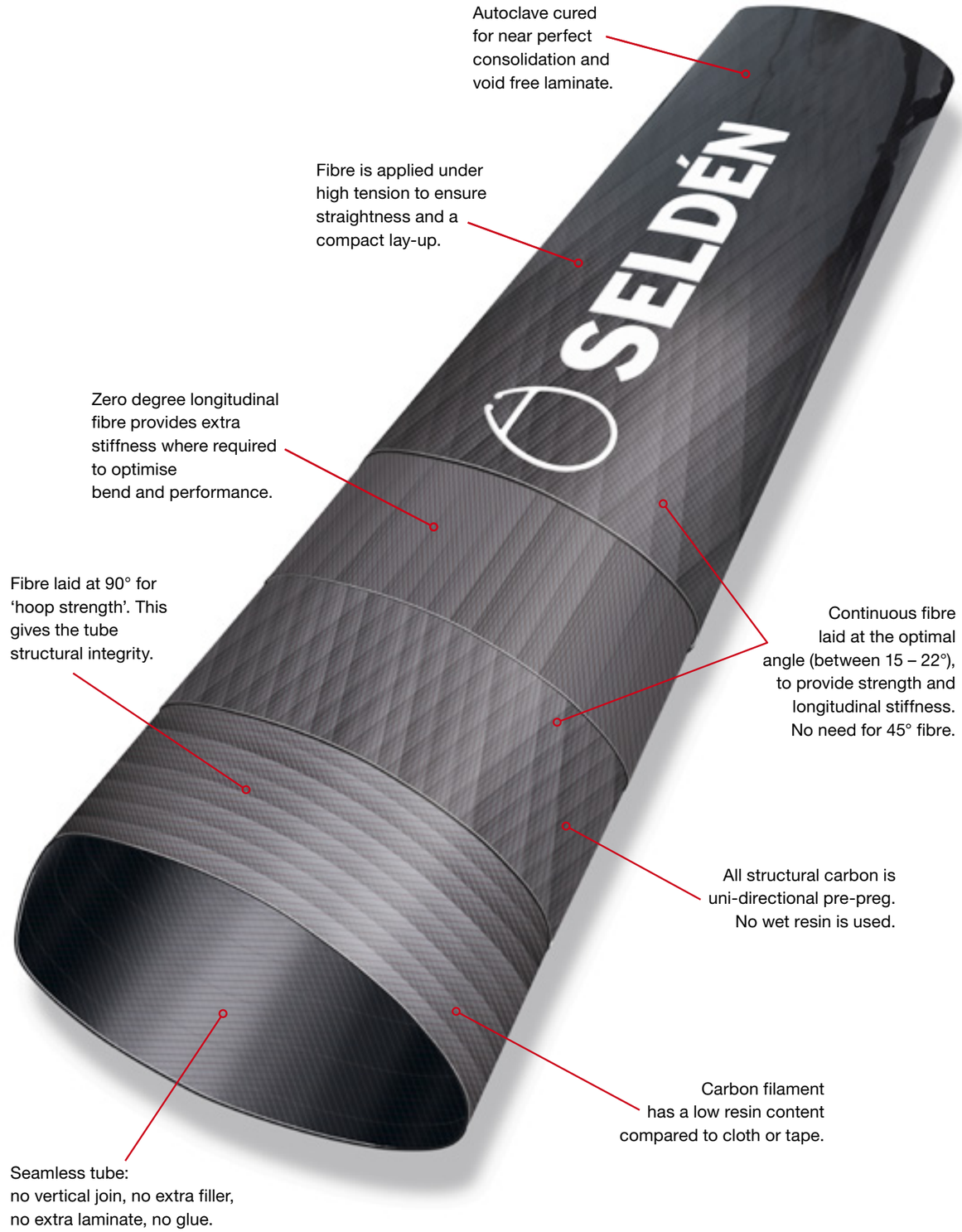
All over the world Dinghy, Keelboat and Yacht sailors are enjoying the benefits of Seldén carbon spars for both racing and cruising.

- Carbon masts are lighter: less weight in the rig increases righting moment and reduces pitching for more performance and more comfortable sailing.
- Carbon masts are stiffer: improved control of mast bend improves sail shape and reduces forestay sag, more performance and higher pointing.
- Carbon booms are up to 40% lighter: less weight in the boat and on the mainsail leech increases performance. Lighter booms have less momentum making for easier and safer gybes.
- Carbon poles are lighter: easier to lift and easier to handle for faster and safer hoists, gybes and drops.

The Seldén system

- Pre-preg construction: all tubes are made using 100% pre-preg materials. No wet lay-up is used.
- Seamless tubes: using a male mandrel makes a single piece tube. The need for vertical joins and joints using screws and filler is eliminated.
- MFM: straight, thin filaments of carbon fibre are laid on a male mould.
- CNC: carbon is laid by a computer controlled head. Consistent, accurate, repeatable, no human error.
- Autoclave cured: superior consolidation and controlled curing.
- Choice of fibre modulus and finish quality.
- Composite boom brackets and removable carbon headboxes.
- Optimised fibre angle: fibre laid from 0 – 90°.
- FE Designed: Finite element software used for 3D modelling spar designs.

Cross section



Give us the facts

At Seldén every rig is specifically designed and engineered for each boat. We base our mathematical dimensioning on data supplied by the yacht designer using our ‘rig facts form’.

This is used by our ‘Rigcalc’ team to calculate the righting moment of the boat which determines section size and rig loads. Every boat is added to a database which gives our designers an experience bank of over 10,000 rig designs.

Heeling test in 1965. The righting moment of the boat is measured ay 30° heel.

Heeling test today. Materials change, good methods don't.

In addition to this we have stringent policy of checking our calculations with heel tests. We started this practise in 1965 and continue it today. Materials and technologies change, good methods don’t.

Finite Element Analysis
In addition to the usual Rigcalc process our team of structural engineers can model carbon spars using the latest finite element analysis software. This software allows them to create a visual representation of a rig and then simulate the behaviour of different rig designs. They can even model the effect of different wind and wave conditions and the effect these will have on the structural integrity of the rig.

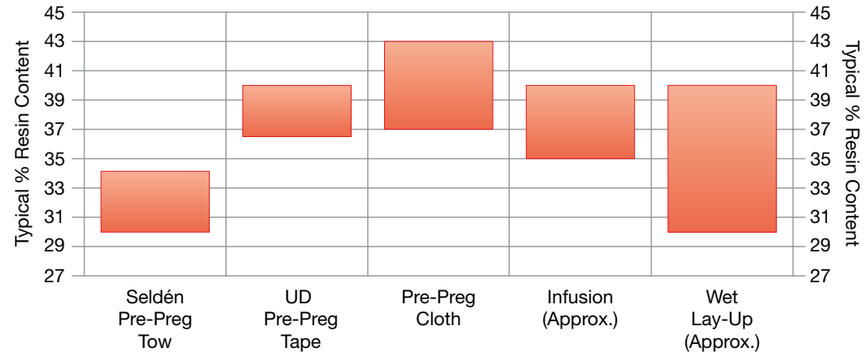
The use of this technology allows our Rigcalc team to further optimise the design and construction of our carbon spars. Together with our composite engineers they optimise the stiffness of each panel of the mast and strengthen the tube for every fitting.

Materials

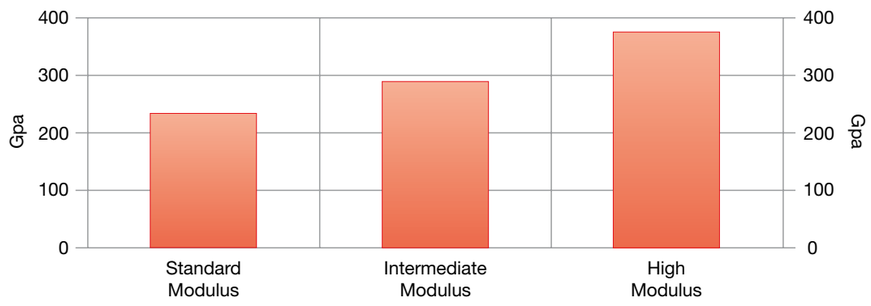
100% Pre-Preg Carbon
All our spars are made from pre-preg meaning that the fibre is coated in the precise amount of epoxy resin for optimum lamination. This allows us to build a lighter, stronger spar because for a given weight we have a higher ratio of carbon to resin. No wet lay-up is used anywhere on our spars.

The MFM process uses carbon tow, a ribbon of carbon fibres held together by the uncured resin. The resin content of carbon tow is lower than carbon cloth or the uni-directional tape used in other production systems such as female moulding. This is not always the case with some manufacturers

Resin Content



Modulus of Different Fibre Grades



At Seldén we only use the best quality carbon fibre.
We use three different modulus of carbon that we call standard, intermediate and high. The higher the modulus the stronger the carbon so the lighter and stiffer the mast. Which modulus we use depends on the performance requirement of the customer. If you specify a high modulus Seldén mast it means all the fibre is high modulus.

	Typical Fibre Type	Modulus Gpa
Standard Modulus	T700	230
Intermediate Modulus	T800	294
High Modulus	M40J	377

Mandrel Filament Moulding (MFM)

MFM is a process unique to Seldén. Our custom made CNC fibre laying machines are fast, efficient and equipped with a delivery system designed and fitted by Seldén to provide the finished spar with unrivalled accuracy and precision. The key stages of the process are:

Winding

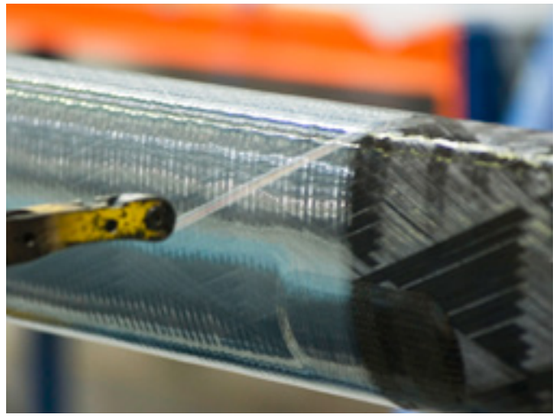
An aluminium male mould is rotated on the MFM machine. A carriage travels next to the mandrel that carries spools of carbon fibre and the delivery system. This has a series of feeding wheels, a tensioning system and a delivery wheel that lays the carbon fibre on to the mandrel.

Computer controlled

The number of layers and the angle at which the fibres are laid is controlled by the same design software that our composite designers and the Rigcalc team used to design the spar.

Shrink wrapping

When the lay-up is complete the delivery head sheathes the mandrel/carbon combination in heat shrink tape. It is then removed from the MFM machine, enclosed in a vacuumed bag and prepared for the curing process.



Autoclave cured

All Seldén carbon spars are autoclave cured. An autoclave is a pressurised curing oven. The secret to making a strong laminate is to use precisely the correct balance of heat and pressure to squeeze and cure the spar. Our system is computer controlled and runs a complex cure cycle to ensure optimum consolidation of the laminate.

Only the use of autoclave curing will guarantee a well consolidated and virtually void free laminate.

Extraction

Once cured the mandrel is extracted from the carbon tube which is ready for finishing.

The perfect finish

Seldén carbon spars are available with a choice of 5 quality levels of surface finish. Which quality you choose depends on the type of boat and the requirement of the spar.

Spars can be supplied with a clear finish or painted the colour of choice.

Natural: Dinghy spars and spinnaker poles are supplied with no additional painted finish. The resin system used in the manufacture of all our carbon spars includes a UV inhibitor to protect the epoxy resin. A black pigment is also added to the resin to further improve UV resistance. A natural finish and the limited UV resistance it provides is ideal for spars where weight and cost are critical.

Standard Clear: In this process spars are fully sanded and painted with 3 coats of Clear UVR. The result is the deep shine viper pattern that make our spars stand out. This is the standard finish for all keelboat and yacht spars.

Standard Clear Plus: With the plus finish 3 coats of epoxy primer are applied before re-sanding and 3 coats of clear UVR. This provides a deeper gloss and improved UV resistance that prolongs the life of the finish.

Ultimate Clear: For the ultimate finish 6 coats of epoxy primer are applied. The spar is then faired and coated with 3 layers of Clear UVR. The fairing makes a smoother mast surface between external patches.

Standard Solid: A solid finish provides far greater UV resistance that any clear finish. The standard solid finish uses 2 coats of epoxy primer that are then sanded and followed by a further coat of primer and 3 top coats.

Standard Plus Solid: Similar to the Standard Solid except a 4 coats of epoxy primer are used to allow fairing before top coats are applied. The fairing makes a smoother mast finish between external patches.

Ultimate Solid: 2 coats of high build are applied before the primer and top coat. This allows deeper fairing and an even smoother finish to the mast panels between the external patching.

		Type of Spar			
		Dinghy Spars	Keelboat Spars	Yacht Spars	Keelboat & Yacht Spinnaker Poles
	Natural Finish				Standard
	Standard Clear	Optional	Standard	Standard	Optional
	Standard Plus Clear		Optional	Optional	Optional
	Ultimate Clear		Optional	Optional	
	Standard Solid		Optional	Optional	Optional
	Standard Pus Solid		Optional	Optional	
	Ultimate Solid		Optional	Optional	
Process	UV Inhibited Clear Epoxy	YES	YES	YES	YES	YES	YES	YES
Process	Full sand & 3 coats Clear UVR.		YES					
Process	Full sand & 3 coats clear primer. Full sand & 3 coats Clear UVR.			YES	YES			
Process	Full sand & 2 coats primer. Full sand & 1 coat primer, 3 top coats.					YES	YES	
Process	Full sand & 2 coats high build. Full sand & 3 coats primer. Full sand & 3 top coats.							YES
Process	Primer coat fairing				YES		YES	YES
Benefits		Light Weight	Gloss Finish	Super Gloss Finish	Super Gloss Finish	Gloss Finish	Super Gloss Finish	Super Gloss Finish
Benefits		Limited UV Protection	Good UV Protection	Excellent UV Protection	Excellent UV Protection	Best UV protection	Best UV protection	Best UV protection
Benefits		Clear Finish	Clear Finish	Clear Finish	Clear Finish	Choice of Colour	Choice of Colour	Choice of Colour
Benefits					Smooth Panels, raised patching		Semi-Smooth Panels, raised patching	Smooth Panels, raised patching

Note: Matt finishes and other custom options are available at customer request.

Specialist fittings – masts

All Seldén yacht carbon spars are fitted with carbon head boxes, boom brackets and vang brackets as standard. Seldén is world renowned for the quality of the fittings on our aluminium spars. Where appropriate the same fittings are used on carbon spars, in other applications dedicated fittings have been designed.

Headbox

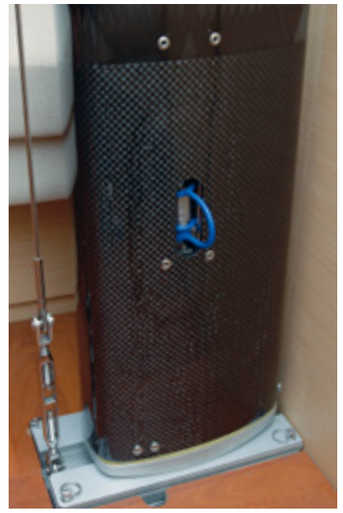
All Seldén carbon yachts spars are fitted with carbon headboxes. These incorporate sheaves for main halyards and masthead spinnakers if required. They are removable for maintenance.

Cap Tangs

Seldén carbon yacht masts come with stainless steel bushing and composite compression tube bonded into the mast to connect cap shrouds. These suit all leading cap tang systems and are suitable for composite, rod and wire rigging.

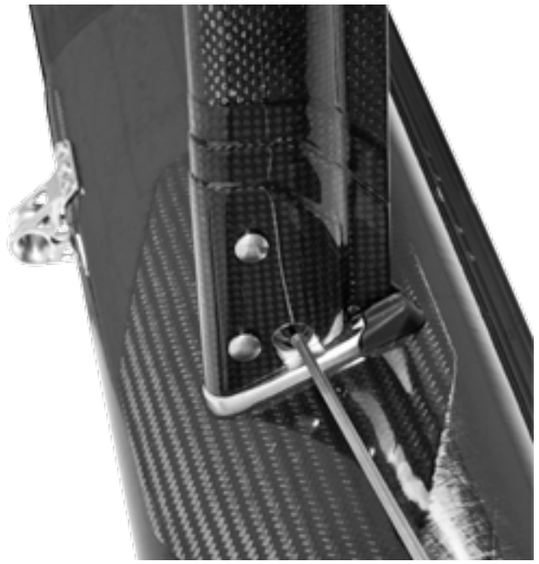
Mainsail Track

Carbon yacht masts are supplied with custom mainsail track which can accommodate both RCB cars for cruising and luff rope for racing. The track is bonded and riveted for extra security. Keelboat spars are fitted with an aluminium luff track for bolt rope as standard but can be fitted with RCB track as an option.



Forestay Fitting

Our nose tangs are cast from high strength stainless steel and can accommodate wire, rod and composite rigging. On smaller masts T Terminals are available.



Spreaders and Spreader Brackets

Spreader brackets are stainless steel cast through bars. These are strong, light and have integral stemball seats for diagonal rigging attachment. On section CC105 and smaller wrap round stainless steel brackets are used.

As standard aluminium spreaders are supplied. Our optional carbon fibre spreaders offer significant weight savings and are custom designed to suit each application. Note that there is no additional penalty under IRC for carbon spreaders.

Boom and Vang Brackets

All Seldén carbon yacht masts come with composite boom and kicker brackets. These are manufactured from pre-preg carbon and are bonded to the mast. Keelboat masts are supplied with light weight aluminium brackets.

Carbon Booms

A Seldén carbon boom offers up to a 40% weight saving compared to aluminium. Our booms are made using the same MFM process as our mast and are available with the same choices of fibre and finish.

Note that under IRC there is no additional penalty for a carbon boom if your boat already has a carbon mast.

Mast Heels and Bases

Masts heels are lightweight aluminium alloy with composite insulation to prevent corrosion. On most yacht sections an internal hydraulic mast jacking system is an option. This allows easier tuning while dispensing with the need for external jacks, jacking bars and modifications to the floor of the boat.

Mast bases are light weight aluminium and can be adjusted to suit mast rake and bend.

Specialist fittings – booms

End Fittings
Inboard end fittings are machined aluminium. They have integrated slots to house a variety of sheave combinations all of which are recessed in to the boom tube.

The outboard end features an alloy sheave housing which is again integrated in the main tube and in concealed from view by a carbon coverplate across the boom end.

Vang Attachment
High strength is provided by fitting a cast stainless steel tang to hand laid local carbon reinforcement.

Mainsheet Attachment
A simple but strong Dyneema loop passes through a composite tube in the boom. Stainless bushes are fitted to prevent wear.

Reefing Options
Booms can be supplied with conventional slab and single line reefing. Clutches can be integrated into the tube at the inboard end if required.

Outhaul
As standard a Dyneema outhaul line is supplied to be lead to the cockpit. On smaller booms and for racing applications an internal cascade system with a cam cleat and lead block at the inboard end is available.

Boom Lights
Can be fitted as an optional extra.

Seldén ‘Y’ boom

The Seldén ‘Y’ boom is a Park Avenue type carbon boom designed to allow easier reefing and sail stowage for the larger cruising yacht. Lazy jacks guide the sail on to the top of the boom while the beautifully shaped wings of the ‘Y’ boom help to catch and retain the mainsail when lowered. A sail cover is then zip closed over the top of the sail. Single line reefing and boom lights can be specified as options. ‘Y’ booms can only be supplied with a painted finish.

Beautifully shaped tapered profile. Picture shows integral inboard end fitting with concealed sheaves for the single line reefing luff lines, integral track for the sail cover and pad eyes for lazy jacks.

Outboard end showing outhaul track and car, concealed sheaves and pad eye for preventer.

Close detailing of the concealed inboard end sheaves.

Mainsheet pad eye faired in to underside of the boom.

LED boom light option.

Spinnaker poles

A carbon spinnaker pole is a popular upgrade for both cruising and racing sailors. Carbon poles are up to 40% lighter than an aluminium equivalent. This makes them much easier to handle during hoists, gybes and drops, as well as reducing line loads on the topping lift. Seldén carbon poles are available for boats up to 70ft.

As standard they are supplied with a natural finish, clearcoat and painted finishes are available as an option. Protective Twaron wrap can be specified to reduce damage where the pole contacts the forestay.

Seldén carbon poles are available for boats up to 70ft. Larger poles are tapered at both ends.
A range of fittings and rigging options are available.

Gennaker bowsprits

Seldén gennaker bowsprits are available as an easy to fit kit. A range of bow fittings are available to fit most boats which allow the pole to be easily extended and retracted. Complete pole and launch systems can also be supplied for fitting through the bow of the boat. These comprise a complete carbon pole, fibreglass launch tube for fitting through the topsides and all associated bearings.

Carbon section list

Seldén carbon Spars are produced in a wide range of sections spanning applications from racing dinghies and skiffs through to yachts up to 75ft. In addition to the profiled mast sections shown below Seldén can produce 20 different sizes of round tube used for spinnaker poles, gennaker bowsprits and launch tubes, as well as 10 different sizes of tapered round tube used for tapered spinnaker poles.

Seldén has a programme of continual investment in tooling and new tooling can be made to specific order. Please enquire for details.

Note that all dimensions are typical. The actual finished size of the section and wall thickness depends on the design of the individual spar.

Section	Section dim. mm	Typical Wall Thickness mm	Typical Application
CC050	54/54	2.0	Dinghy Mast
CC064	64/52	2.0	Dinghy Mast
CC077	77/62	2.4	Keelboat Mast
CC086	87/62	2.4	Keelboat Mast/Boom
CC095	96/68	2.4	Keelboat Mast/Boom
CC105	106/71	2.4	Keelboat Mast/Boom
CC115	116/74	3.0	Keelboat Mast/Boom
CC138	139/86	3.0	Keelboat Mast/Boom
CC154	157/87	3.6	Yacht Mast/Boom
CC174	177/93	3.6	Yacht Mast/Boom
CC192	195/102	4.2	Yacht Mast/Boom
CC210	213/110	4.2	Yacht Mast/Boom
CC226	228/118	4.2	Yacht Mast/Boom
CC244	247/127	4.8	Yacht Mast/Boom
CC263	265/135	5.4	Yacht Mast/Boom
CC284	286/146	5.4	Yacht Mast/Boom
CC303	306/156	6.0	Yacht Mast/Boom
CC364	376/192	6.6	Yacht Mast/Boom

DINGHIESKEELBOATSYACHTS

Seldén Mast AB, Sweden
Tel +46 (0)31 69 69 00
Fax +46 (0)31 29 71 37
e-mail info@seldenmast.com

Seldén Mast Limited, UK
Tel +44 (0)1329 50 40 00
Fax +44 (0)1329 50 40 49
e-mail info@seldenmast.co.uk

Seldén Mast Inc., USA
Tel +1 843 760 6278
Fax +1 843 760 1220
e-mail info@seldenus.com

Seldén Mast A/S, Denmark
Tel +45 39 18 44 00
Fax +45 39 27 17 00
e-mail info@seldenmast.dk

Seldén Mid Europe B.V., Netherlands
Tel +31 (0)111 698 120
Fax +31 (0)111 698 130
e-mail info@seldenmast.nl

Seldén Mast SAS, France
Tel +33 (0)251 362 110
Fax +33 (0)251 362 185
e-mail info@seldenmast.fr

Seldén Mast Asia Ltd, Hong Kong
Tel +852 3572 0613
Fax +852 3572 0623
e-mail info@seldenmast.com.hk

www.seldenmast.com

The Seldén Group is the world's leading manufacturer of mast and rigging systems in carbon and aluminium for dinghies, keelboats and yachts. .

Our well known brands are Seldén and Furlex. The world-wide success of Furlex has enabled us to build a network of over 750 authorised dealers covering the world's marine markets. So wherever you sail, you can be sure of fast access to our service, spare parts and know-how.

SELDÉN
for sailing

595-823-E 2016-10-24