

## GROOVY MAST SECTION

drawings and notes describing the use of aluminium and carbon fibre GROOVY mast section

### carbon fibre & your safety

Whenever working with carbon fibre you should take precautions to avoid inhaling the dust caused by abrading or sawing. Use of a dust mask is preferred. Alternatively always work the material wet i.e. with wet abrasive paper, and with wetted saw blades. Clean all lubricating water away before it can dry out. Splinters are also particularly dangerous because they are sharp and stiff. Take care to abrade all sharp edges smooth and rubber wear gloves when doing so.

### history

The first alloy GROOVY mast section was the 14.5 mm diameter size designed in 1978. This was quickly followed by the 16.7 mm diameter section designed to match it and for Oliver Lee to use for the rig of his 1.5 Metre One Design yacht. The range has grown to provide a near optimum section for almost every common application. 12.7, 11.1 and 9.7 mm diameters were created in the years following.

The 16.7 and 9.7 mm sizes of alloy GROOVY are no longer available.

The first carbon fibre GROOVY section was designed in 1984 – diameters were 15.4, 12.7 and 10.5 mm. Initially these were made using high strength (standard stiffness carbon). Since then the stiffness has increased by a factor of two thanks to the use of high modulus fibres.

Sadly the manufacturers of this material were bought out by a British owned firm that was unable to maintain the same quality of product. Unable to replace existing stocks of these sections, we sold the remaining stock (almost all 12.7 mm size) to Bill Green in 2020. Bill will be able to supply the material until his stocks run out.

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## **SAILSetc**

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## rigging the mast

### BASIC METHOD FOR ALLOY GROOVY

1 The mast step is fabricated from 1/2" by 1/2" T section aluminium alloy. Cut slots to approximately half depth using a flat needle file. Alternatively use **SAILSetc** item V565. Fix to the internal structure with a screw or bond in place using epoxy resin and some glass or carbon cloth.

2 Gap between centres of slots:

mast diameter	11.1	12.7	14.5	item V565
AL GROOVY	5.5	7.5	9.0	fixed at 7.5

3 6 mm deep x 2 mm wide slot cut fore & aft in base of mast. Round off sharp edges.

4 Fit a gooseneck/kicking strap suitable for the class of yacht. **SAILSetc** items 1, 2, 3 or 8. Each is supplied with an explanatory sketch.

5 Spreader of 3 mm stainless steel rod provides sufficient stiffness and strength for the largest models. Use 2.5-3 mm aluminium (knitting needles) on One Metres. Make spreader length 55-75% of the distance between shroud attachment points at deck level. Place at 50-55% of the distance between the deck and the hounds above the deck. Cut vertical slots in the ends of the spreaders with a hacksaw to take the shrouds.

Alternatively use spreader kit, **SAILSetc** item 21-050 or 21-075

6 Use epoxy resin and talcum powder mix to bond spreaders in place. Tape spreaders in place while glue sets. The spreader kit has an explanatory sketch provided with it.

7 Both shrouds terminate at a single 1.5 mm Ø wire hook which fits into one of the series of holes drilled in the fore side of the mast. Rows should be 3-5 mm apart with holes staggered at 4 mm intervals giving adjustment in 2 mm steps. When rigging the mast, place the hook in the middle hole and make shrouds up as accurately as possible without using the spreaders. Pull shrouds over spreaders to tighten the rigging. If the shrouds are too slack or too tight, re-locate the upper hook in another hole. Adjust the length of one hook at the lower end to achieve an upright mast. When correctly adjusted, tape the upper hook to the mast. Re-rigging the boat in the same state is simplified and rigging screws are dispensed with for shrouds.

Alternatively use rigging screws, **SAILSetc** items 30-030SL or 30-035SL.

8 Forestay terminates in a 1.2 or 1.5 mm diameter hook 50 mm above the shroud hook.

9 Not permitted on One Metres. The pop rivet is clenched in place but NOT TIGHT enough to pull out the clenching pin. The pin is then cut to leave 10 mm protruding from the mast. Use a 50 mm length of brass tube over the pin to form the jumper strut.

10 Backstay crane of 4.8 mm Ø alloy rod or 5 mm Ø aluminium knitting needle.

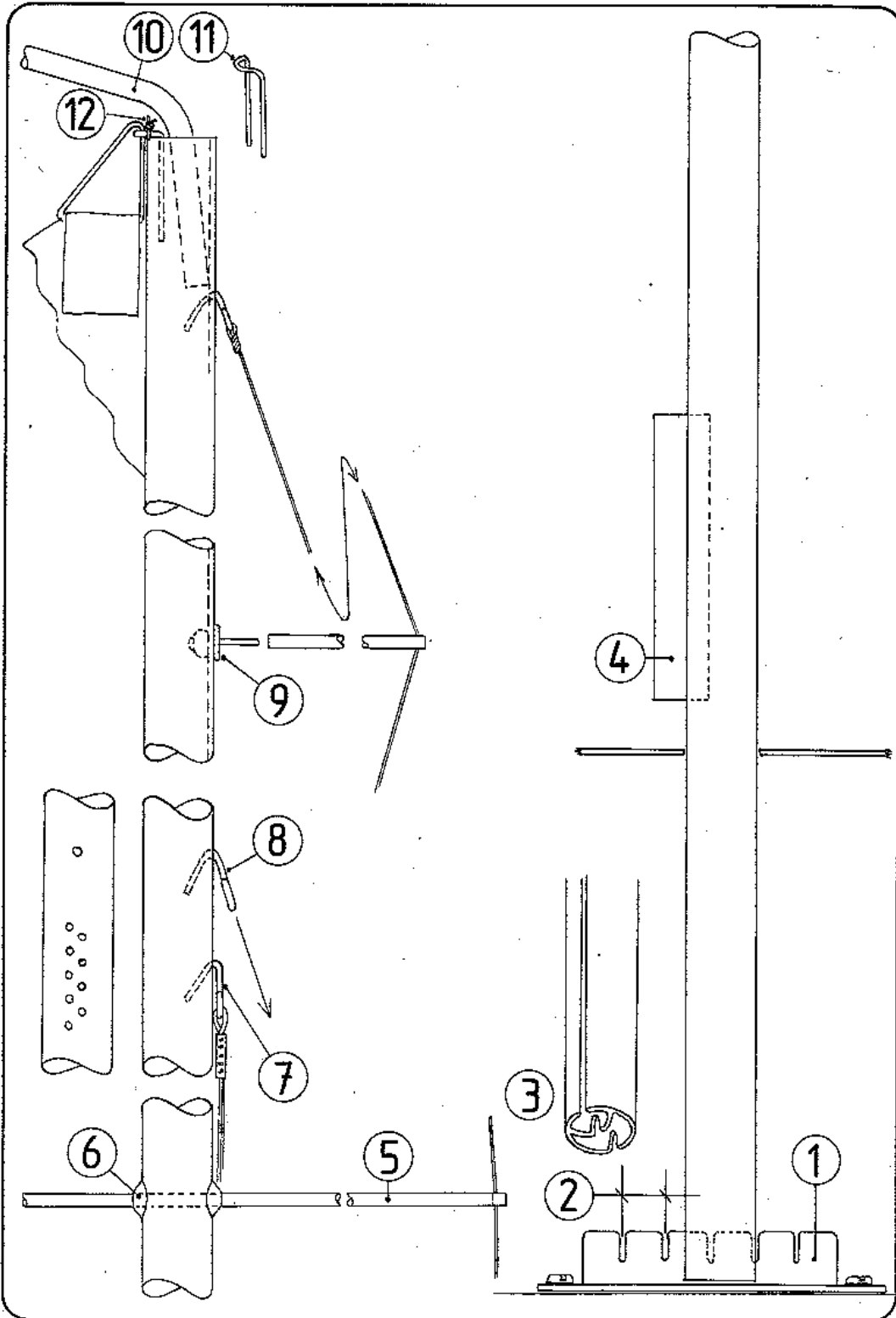
Alternatively use **SAILSetc** items 23-110, 23-127 and 22-040.

11 Loop of 1.2 mm Ø wire. Shape and adjust to size so that the wire headboard fitted to **SAILSetc** sails can rotate freely when the sail sheeting angle changes. Ends of loop pass into the mast track.

Alternatively use mast head fittings, **SAILSetc** items 23-110 & 23-127.

- 12 Wire loop is kept in place using thin cord tied a shown. This prevents loop from being lost when sail is removed from mast. Arrangement shown allows mast height to be minimised thus reducing windage.

### rigging details for alloy GROOVY



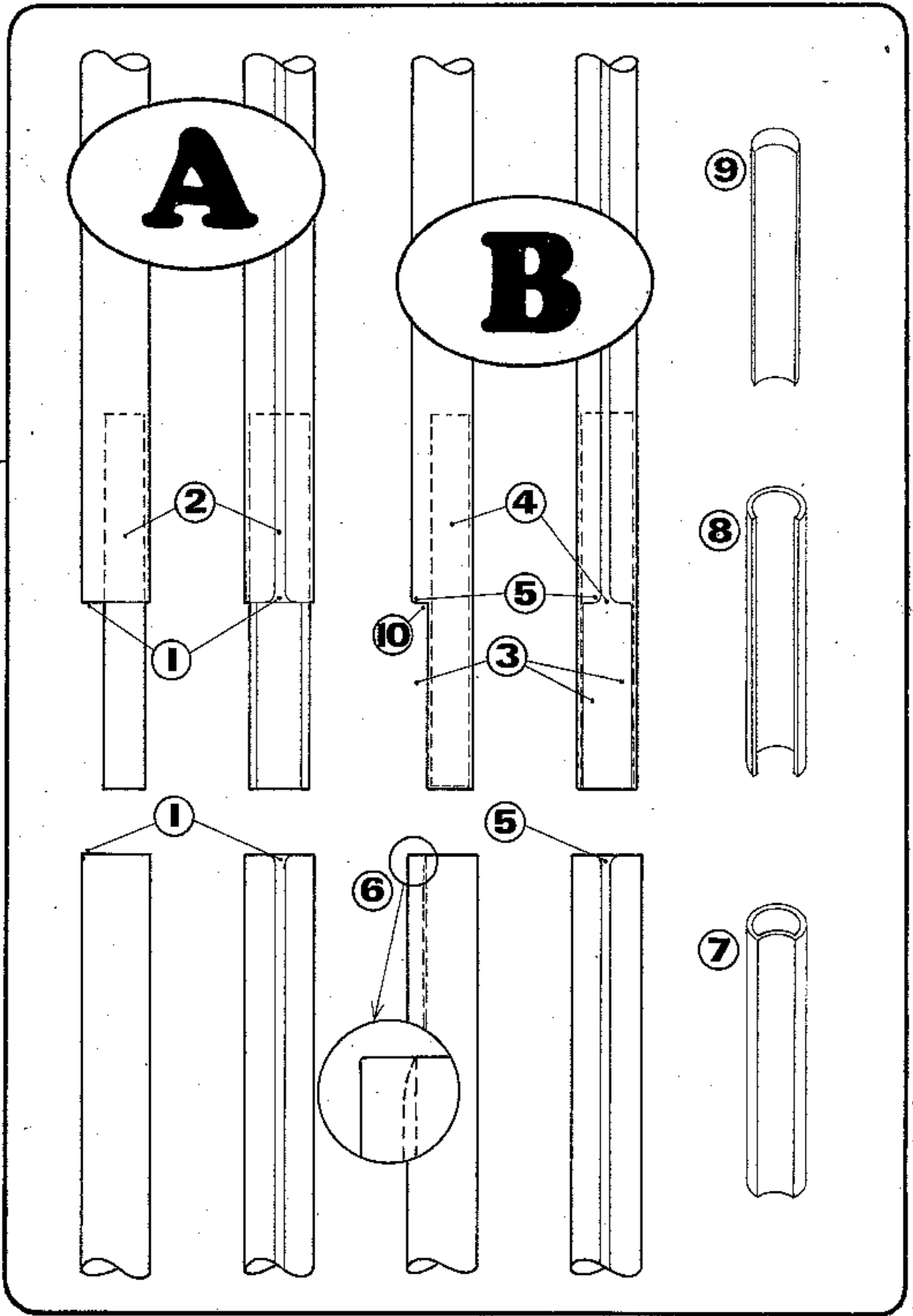
## joining techniques

### method A - for two pieces of same diameter alloy GROOVY

- 1 After cutting the mast, use a half round needle file and fine abrasive paper to round of all sharp edges at the track ends to prevent the bolt rope becoming snagged or torn.
- 2 The mast joiner is glued into either piece of mast using epoxy resin. For a permanent join, glue to both pieces of mast. Thick cyano glue is an alternative to epoxy resin.

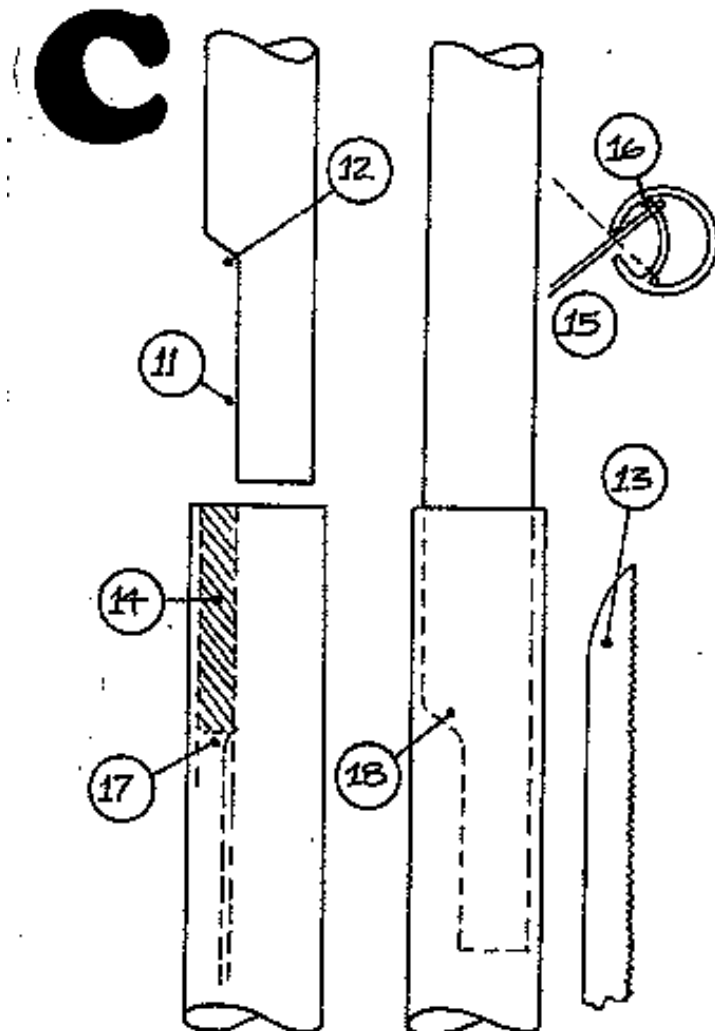
### method B - for two pieces of different diameter carbon GROOVY

- 3 Remove the track cheeks from the end 40 mm of the smaller of the two pieces. Avoid making any notches or deep cuts at **10**.
- 4 Glue a mast joiner into the mast to act as reinforcement at this weak point.
- 5 Round off all sharp edges inside and outside of track ends.
- 6 Where there will be a small step in the track, the back of the track should be filed away to provide a smooth step as indicated. Glue sections together using epoxy glue. Alloy sections can be left unglued if desired.
- 7 spare.
- 8 Pattern of joiner supplied for 14.5 & 12.7 AL GROOVY. The former is machined from 12.7 mm by 1.6 mm wall thickness alloy tubes. The latter is actually a purpose designed extrusion.
- 9 Pattern of joiner supplied for 10.5 CF & 11.1 AL GROOVY. Machined from 9.5 mm & 7.9 mm diameter alloy rod.



## method C - better method for two pieces of different diameter carbon GROOVY

- 11 Remove 25 mm of track cheeks from the smaller of the pieces. Avoid making any deep cuts at 12.
- 12 Round off sharp edges inside & outside of track.
- 13 Snap off the end of a 'junior' hacksaw blade (preferably grind to the profile shown).
- 14 Use the blade to cut away 25 mm of the inside of the track of the larger mast section – as follows.
- 15 Angle the blade when cutting as shown. Use a 1.6 mm bit in a hand drill to cut across the uncut piece of the track. Use pliers to break off the waste material.
- 16 Remove any ridges with a suitable file or abrasive paper held on to a tube.
- 17 Take particular care to remove splinters from end of track. See 6, page 5.
- 18 Abrade all gluing surfaces and when the fit is good, bond using epoxy resin or thick cyano glue. Bind tightly whilst setting and push a piece of cord along the track to seep out any surplus glue. Ensure the mast is straight before allowing to cure.



## techniques for carbon GROOVY

CF GROOVY is made of unidirectional fibres which provide the highest possible stiffness/weight ratio. Due to the absence of transverse material in these sections, high local loading from hooks, screws, pop rivets etc is liable to cause splitting unless local reinforcement is provided. This is best achieved by wrapping the section with unidirectional carbon fibre tow. (Glass tape may be used instead).

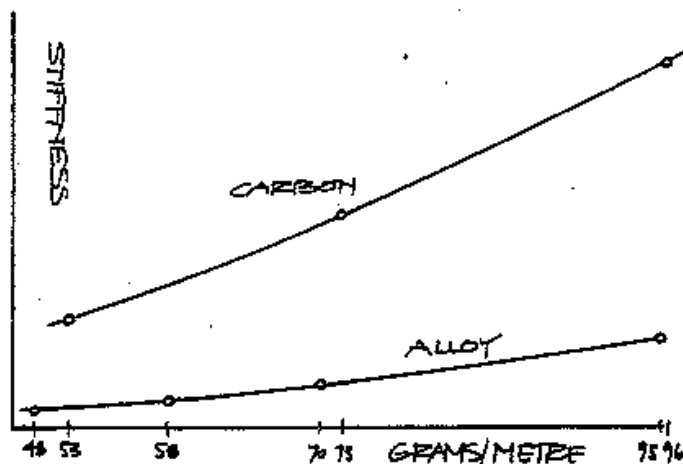
- 1 Using masking tape mask off the mast 15 mm each side of the point to be reinforced.
- 2 Abrade the area to be treated to remove surface grease. Place a length of 3 or 4 mm Ø nylon or polyester cord in the mast track for protection. Tape one end of the carbon tow to the mast next to the area to be reinforced. Paint the abraded area with epoxy resin and wrap the tow in a neat spiral around the mast until it covers the 30 mm section. Brush in more epoxy resin until the tow is wetted out and continue to wrap the tow in a spiral to the other end of the section to be reinforced. Tape the end of the tow to the mast. Brush in more resin until the tow is properly wetted out.

When the resin is half cured, use a sharp knife to cut the tape away from the track slot. When fully cured you can smooth the surface of the reinforced area with 240/400/600 grade abrasive paper. Smooth any sharp edges near the track and bring back the gloss by polishing with metal polish (Brasso) or by rubbing in some fresh epoxy resin.

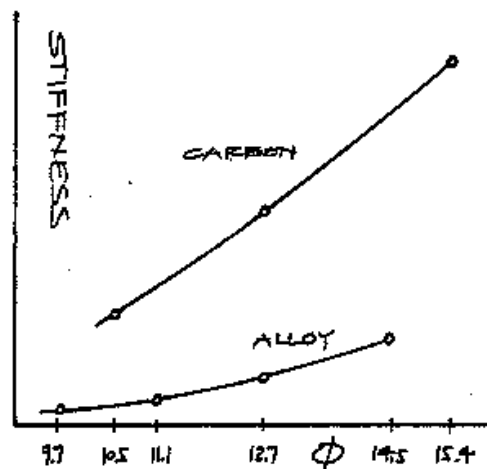
- 3 After reinforcement this section of the mast can be treated much like alloy GROOVY and can be drilled to take hooks, pop rivets (with care), screws etc.
- 4 Use a backstay crane, **SAILSetc** items 22-090. On 12.7 mm diameter CF GROOVY the crane fits into the centre after a cut is made in the mast section. The load from the backstay will tend to split the inner part of the track which cannot easily be reinforced. Consequently the backstay crane should be glued in place using plenty of thickened epoxy resin. Wrap externally with tow as usual to a distance at least 10 mm below the crane.
- 5 Here internal reinforcement is provided by a length of mast joiner, or short piece of next smaller CF GROOVY, where the spreaders pass through the mast. This makes external wrapping unnecessary.
- 6 Where a temporary or permanent join of two pieces is made, the ends of the tube should be wrapped to prevent splitting.
- 7 spare.

### STIFFNESS COMPARISON

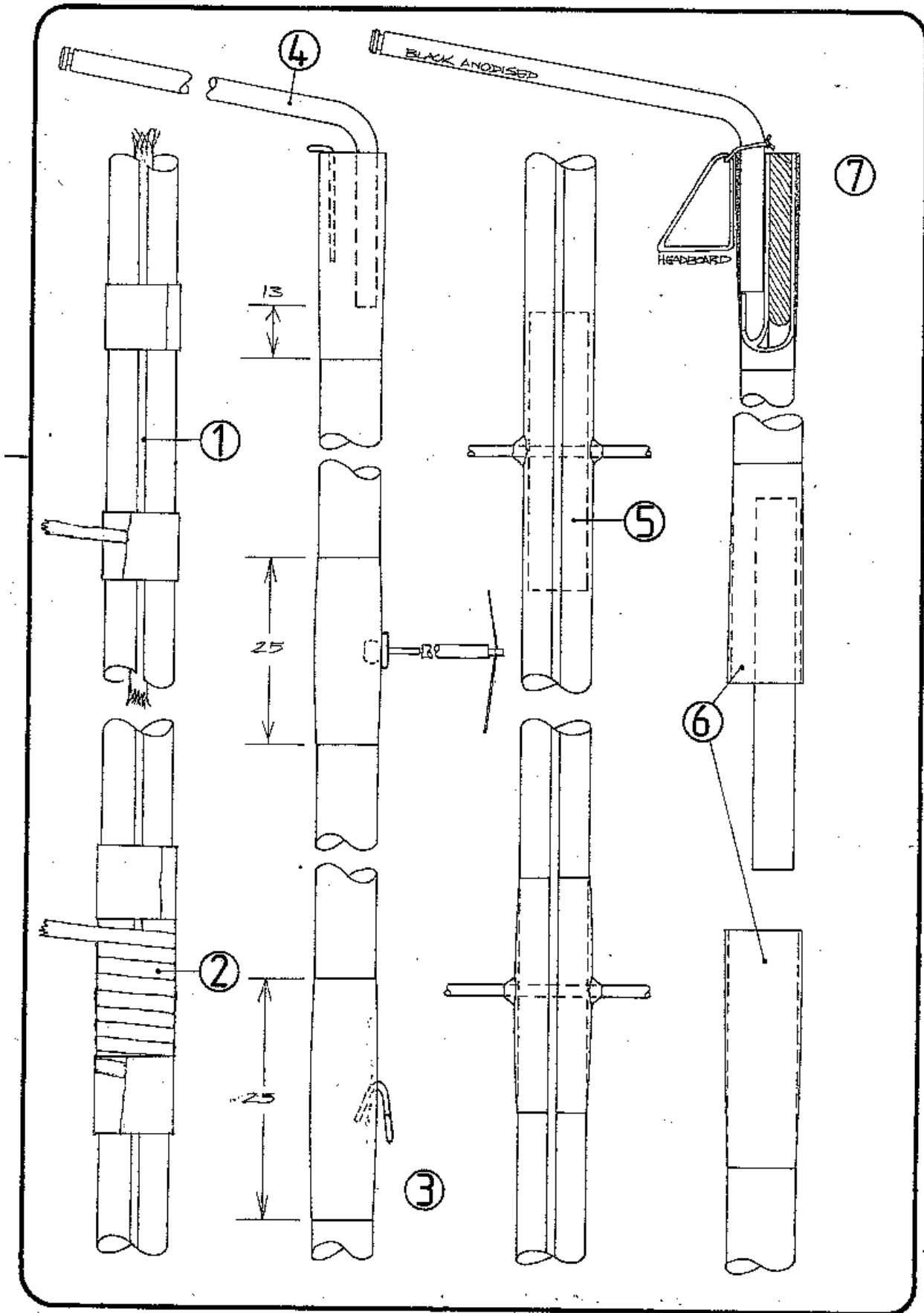
*stiffness versus weight*



*stiffness versus diameter*



# rigging details for carbon GROOVY





## choose the right section

The tables below indicate a suitable choice of mast section thus *OK*. If the section is suitable for only some rigs then the range of mainsail luff length is indicated.

For example, suitable sections for a Marblehead rig with shrouds with a mainsail length of 1600 mm are either 12.7 CF GROOVY or 14.5 AL GROOVY.

The sections indicated will be averagely stiff (neither over stiff nor too flexible) provided the yacht is of contemporary competitive dimensions and the sails are cut appropriately.

### *STAYED RIG (one set of shrouds & spreaders)*

	A Class	10 Rater	6 Metre	M	36/600	1M	36
15.4 CF GROOVY	<i>OK</i>					NA	NA
12.7 CF GROOVY	<i>OK</i>	<i>OK</i>	<i>OK</i>	<i>OK</i>		NA	NA
10.5 CF GROOVY		< 1200	<i>OK</i>	< 1500	<i>OK</i>	NA	NA
14.5 AL GROOVY		< 1500	<i>OK</i>	< 1800			
12.7 AL GROOVY		< 800		< 1000		No 1	< 2000
11.1 AL GROOVY						No 2 & 3	< 1100
9.7 AL GROOVY							< 800

### *UN-STAYED RIG (swing or shroudless rigs)*

		10 Rater		M	36/600		36
15.4 CF GROOVY		<i>OK</i>					NA
12.7 CF GROOVY		< 1500		< 1700			NA
10.5 CF GROOVY					<i>OK</i>		NA
14.5 AL GROOVY				< 800			
12.7 AL GROOVY							< 900
11.1 AL GROOVY							

## tapered masts

### i.e. smaller diameter section used at top

Generally you will obtain better performance from your yacht if the upper sections of the mast are of reduced diameter. Windage will be reduced and the transverse stability will be increased. The drawback is more time spent making up the rigs.

Where the yacht has a mast which will always be used e.g. A Class and 6 Metre, there is limited value in fitting a smaller section because of the problems associated with keeping the

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forestay tight when using the lower suits of sails. The One Metre class does not permit tapered masts.

Use two piece tapered masts for Marblehead swing rigs, Marblehead and 10 Rater shroudless rigs.

See the various SAILSetc Rig Drawings for more information.

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