

2004

SAILMAKING NOTES

SAILSetc
TECHNICAL INFORMATION

T120



These notes introduce the basic sailmaking process and give guidance concerning the materials, tools and methods used and practical hints and tips which will be valuable to anyone having a go for the first time.

These notes are not intended to be a complete guide to model sailmaking. Such a guide would fill many more pages than these notes and take much more time to prepare than is available.

The book 'Making Model Yacht Sails' by Larry Robinson is recommended reading for anyone wanting to learn how to make competitive rc yacht sails – it describes the mould method of shaping sails used by the top sailmakers and is a contemporary masterclass in its own right. It is stocked by SAILSetc.

Sailmaking materials are listed in the **SAILSetc** catalogue and in our list of additional and surplus sailmaking materials (Supplementary Price List SP03 - GOODBUYS Cloth) which is updated from time to time. *Please ask for a free copy.*

SAILSetc

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CHOICE OF CLOTH

Fore and aft sails are made from Polyester based cloth in almost all cases. Dacron, Tetoran, Tergal are all analogous with Polyester.

Sailcloth is generally available in soft, medium and hard finishes. It is easier to use medium and hard finish cloth because of the greater diagonal (bias) stability and stretch resistance which is imparted by the finishing process. This may entail heat setting the fibres (partially melting them), or bonding them together with resins, or a combination of the two.

Mylar cloths (cloths made by laminating a film of non woven plastic to a woven cloth) have higher stability and stretch resistance for a given weight but will be more difficult to work with due to their high inherent stiffness. There may also be a lack of symmetry caused by the laminating process itself. It may be wise to use ordinary woven cloths for an easy introduction to model sailmaking.

CLOTH WEIGHT

The weight of sailcloth is given in several different units. The best unit and easiest to understand is weight in grams per square metre. This figure is closely related to thickness which can easily be checked with the aid of a micrometer or good quality vernier gauge.

The weight of cloth in grams/m² is 900 times the thickness in millimetres (+ or - 10%).

<u>Grams/metre*2</u>	<u>Suggested Application</u>
<100	Lightweight sails for all classes
100 - 120	Lightweight sails for the heavier and more stable classes
120 - 140	No 2 suit for One Metres, B suit for Marbleheads, No 1 suit for 6M
140 - 160	No 3 suit One Metres, B & C suit for Marbleheads, No 2 suit for 10R, No 1 suit for A Class
160 - 180	No 2 suit for A Class, other small suits
200	Smaller suits for A Class

NB The Optimist class rules have been changed to introduce a minimum cloth weight. As most sailcloth below 140 g/m² was for this class there is now little incentive for manufacturers to produce cloths in that range. Thus it may be impossible to obtain lightweight woven cloths.

CUTTING CLOTH

Medium and hard finish cloths can be cut with sharp scissors and without heat sealing the edges. Fraying will occur eventually but not immediately.

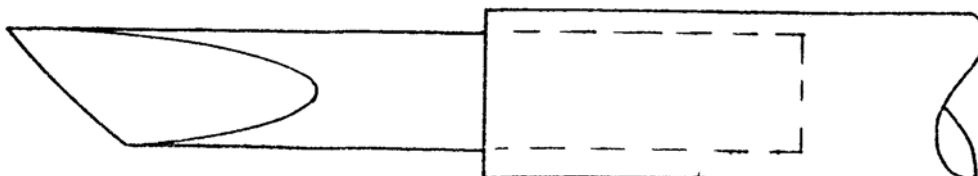
To make a good job of cutting and heat sealing cloth in one action it is worthwhile modifying a soldering iron. We use a Weller 75, or 120, watt soldering iron and modify the tip by straightening it out, cutting it off to 30-40 mm long and filing on a knife edge.

Cut along a steel or aluminium straight edge on a heat proof surface. Kitchen work top material is excellent e.g. Formica or Beaumel, although the kitchen may not be the best place to carry out the work! If you are using a less powerful soldering iron you may find that too much heat is lost to a metal straight edge. In this case try using a straight edge made from a piece of 3 mm plywood.

MYLAR FILMS

Film is sold in various thickness usually measured in microns (1 micron = 1/1000 mm). We do not supply mylar film but you should be able to obtain it from a good drawing office supplier. Try to buy it in sheet form rather than rolled as it will be flat. Pads are a good source.

36 micron	light airs suits for all classes
50 micron	No 1 suits for all conditions for One Metres, Marbleheads and 10 Raters.
75 micron	sails for heavier winds



MARBLEHEAD & ONE METRE SAILS

STANDARD (NON-PANELLED) SAILS

PLANNING

Rather than work directly onto sailcloth it is usually more economical to do the initial design work full size on paper. Parcel wrapping paper in roll form (Kraft paper) or wall paper (lining paper) are both ideal.

MAINSAILS

Mark out the main triangle formed by the luff, leech and foot dimensions. Then add on the estimated roach profile as shown on the second drawing. Accuracy is not essential at this stage.

Next, mark on the luff curve which allows the sail to match the curve formed by the mast when the rigging is tensioned. Use a long wooden or plastic batten held down with tins of food or other heavy objects.

Allow a curvature of 5 mm per metre of luff length. Allow an extra 50 to 100% if the mast is deck stepped to cope with the extra mast bend, and 30% less if the mast is to be very stiff and supported by a lot of rigging (or for light airs suits of sails).

The point of maximum curvature should be positioned 60% up the luff from the foot of the sail if the mast is un-tapered. Heavily tapered masts may require the position of maximum curvature to be as much as 75% up the luff.

Ensure that the luff curve is a fair even curve from the bottom to the top by sighting along the batten before marking.

Divide the leech to obtain the cross width measurement points (see class rules for details) and check the cross widths. Adjust these up or down to get the maximum permitted area. If a bolt rope (for GROOVY mast) is to be added to the sail, the cross widths should be 2 mm below the maximum permitted figures.

Mark the foot roach with a straight edge (One Metre) or a fair even curve.

HEADSAILS

Proceed as for mainsails but mark the luff straight or with a slight hollow of 1 to 3 mm per metre of luff length. Stiffer masts will permit a straighter luff to be used. Deck stepped masts will require most hollow. Place the position of maximum hollow at mid luff.

TRANSFER TO THE CLOTH

Accurately cut the sail profiles from the paper and place onto the cloth. The leech of the cloth should always run along the warp (length) direction, Do not be tempted to economise on cloth by tilting the sail from the optimum angle.

Carefully transfer the profile of the sail patterns onto the cloth and re-draw the profile. When you are sure that the dimensions are correct, go ahead and cut out the sails using the hot knife soldering iron and straight edge. Curved edges can be cut free-hand or may be managed as a series of short straight edges. Alternatively make a pattern of 3 mm plywood to the required curvature.

OTHER CLASSES

STANDARD SAILS

The profile shape of Ten Rater and 36R Class sails is not restricted in any way, so you have complete freedom with regard to roach shape. Otherwise proceed as for M and One Metre sails.

ALL CLASSES

PANELLED SAILS

GENERAL

Proceed as for Standard Sails but make the patterns longer on the luff and leech by an amount equal to the number of seams you intend to make multiplied by the width of the seams (normally 8 mm with 6 mm double sided tape). Then allow an extra 15 mm extra all round the marked out sail before dividing up into panel sized pieces. Keep the seams approximately at right angles to the local leech and, to begin with, keep the number of seams to a minimum.

When placing the panel patterns onto the cloth, ensure that the local panel leech is aligned along the warp.

SELF ADHESIVE DOUBLE SIDED TAPE

Several different types are available for sailmaking. All have their good points, but we prefer to use a less tacky type as this permits more taking apart and re-working of seams before sewing. Generally the tape serves only to hold the panels together until the sewing is finished. Hence it should be as narrow as practicable so that it adds least to the stiffness and weight of the sail.

Unfortunately the narrowest normally available in office and artists' supply shops is usually 12 mm which would have to be cut in two. We can supply rolls of 6 mm and 10 mm width.

Recently we have found that using a 6 mm tape with the very thin films common now causes small wrinkles at the seams. Using a 10 mm wide tape avoids this.

ASSEMBLY OF PANELS

A good sail shape is produced by assembling the panels so that the camber is 'built in' to the body of the sail. Basically this means fixing one straight panel edge to an adjacent curved panel edge.

It is totally unnecessary to make the panel edges themselves curved and it is normal practice to mark on a curved line approximately parallel to the panel edge to which the adjacent straight panel edge is aligned.

The curved edge is drawn a little further from the panel edge than the width of the double sided tape which will be used to fix the panels together with. We use about 8 mm of seam width and 6 mm wide tape. The amount of curvature in the line will be between 1 and 6 mm per metre of seam length. Use more curvature for the upper seams and err on the generous side initially, reducing as you become more proficient. The position of the maximum curvature should be between 40 and 55% back from the luff.

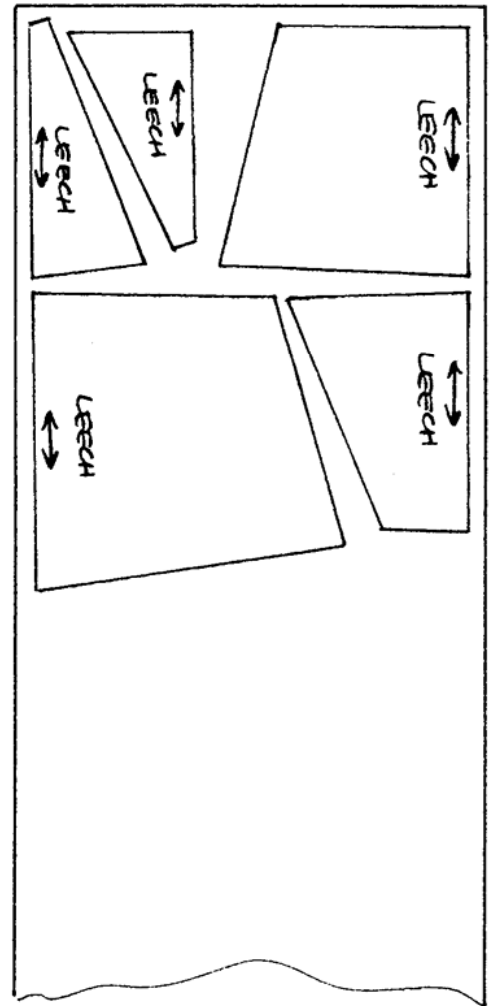
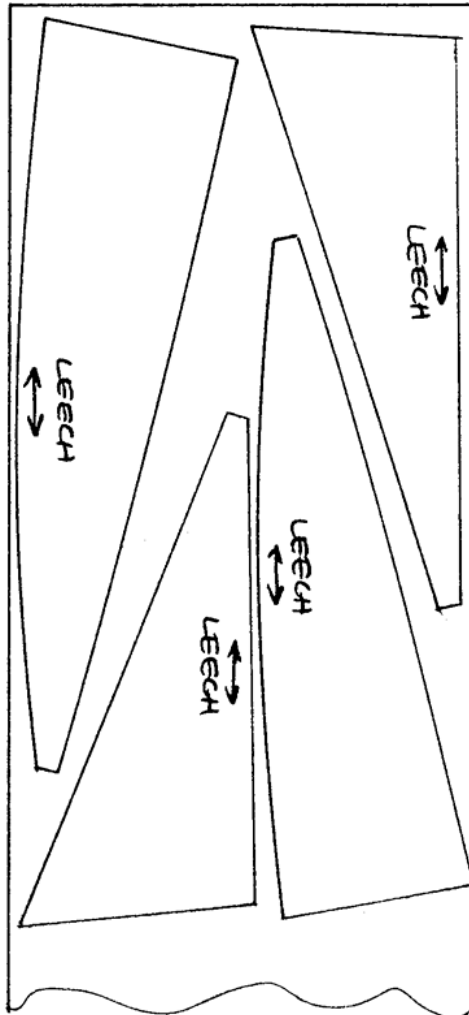
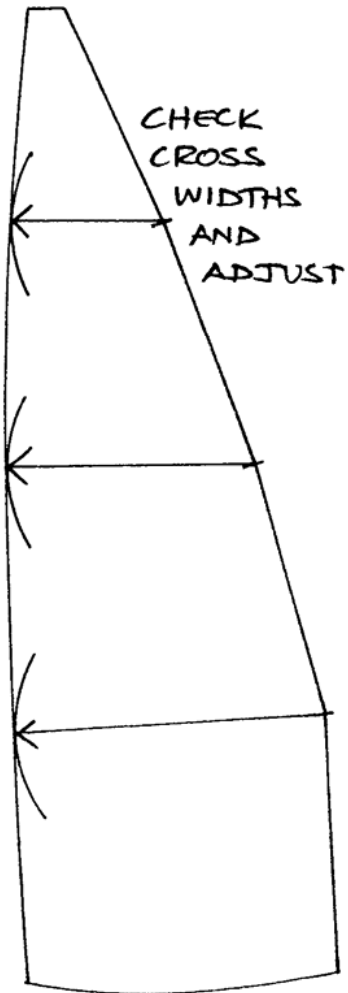
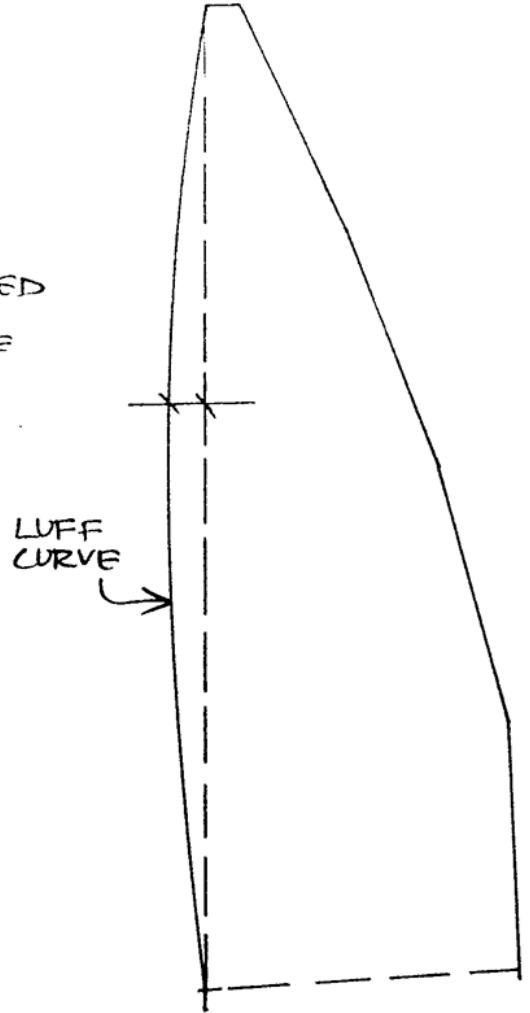
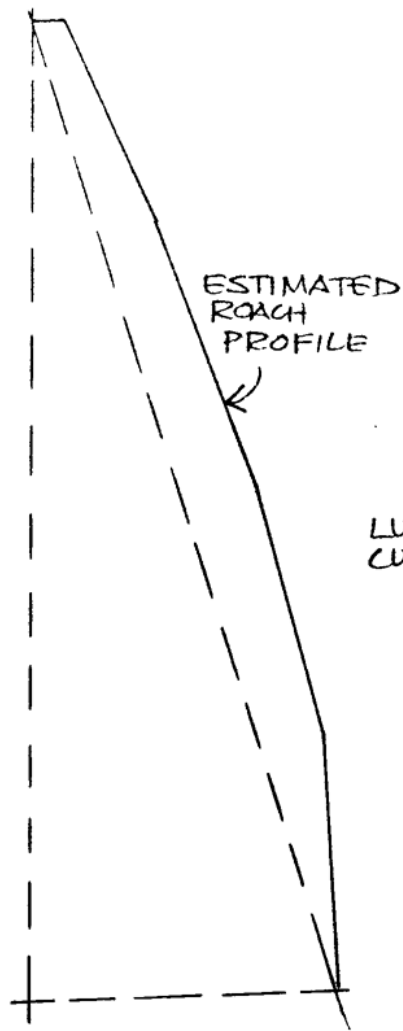
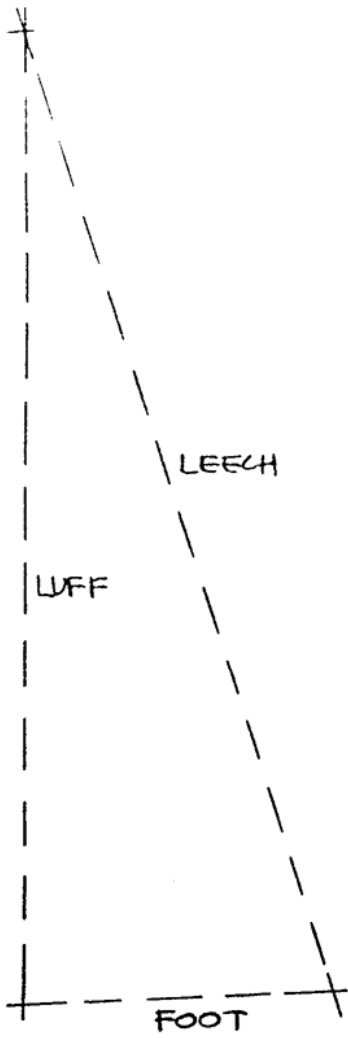
The construction of several templates from 3 mm plywood makes marking out these curves considerably easier than using battens. You will find that the character of the sail section is largely dictated by the character of the curve used to draw the curved seam line.

With the marked panel on a flat surface, apply the tape along the edge between the line and the panel edge. Take care not to stretch the tape and overlap the ends by 25 mm or so to keep the panel in place on the work top. Pull off the backing strip from the tape and, starting at the leech, carefully place the adjacent panel straight edge along the marked line. Trim off the excess double sided tape at each end of the seam.

Alternatively see the book 'Making Model Yacht Sails' by Larry Robinson for a better method.

When all the sail panels have been assembled, hook the head of the sail up and stretch out the sail by holding it out at the tack and clew to check the shape. Take apart and adjust any seams which are not smooth and do check that the sail sets equally well on each tack. When satisfied with the shape each seam can be sewn. Use zigzag stitch if possible for all horizontal seams as this resists the applied load better. However, it is not essential. See the sewing notes later. Start sewing at the luff and sew to the leech. When you have reached the leech sew back for 25 mm and finish by sewing to the leech again. No knot is necessary as hot cutting the leech will seal the stitching.

Once sewn, the profile of the sail should be marked out as for Standard Sails. There is one major difference caused by the built in camber in the sails. Because of this fullness the mainsail luff curves will have to be made larger by around 50 to 100%, depending on the degree of camber. More time should be allowed for getting the luff curve fair when the sail is stretched out off the marking board. Panelled jibs luffs will normally have a straight or slightly convex luff curve when laid flat. Adjust the luff curve until there is a slightly hollow or straight luff when the sail is stretched out off the marking board. Thereafter the finishing process for Panelled Sails is the same as for Standard Sails.



ALL CLASSES

FINISHING

REINFORCEMENTS

The sail corners take large point loads and have to be reinforced to prevent distortion. Use two or three extra layers of cloth stuck down with a contact adhesive (clear Bostik or Evostick are good). Sewing may not be necessary if the gluing is good. Alternatively use some of the self adhesive sailcloth listed in the **Sails etc** catalogue. Trim the patches to shape with sharp scissors or a hot knife soldering iron once they have been finally positioned.

TAPES

The luffs of sails have to be reinforced to prevent stretching. Use 25 mm tape folded in half placed over the luff and sewn to hold in place. Alternatively use 12 mm self adhesive tape placed along one edge of the luff - this may not need to be sewn. Take care not to tension the tapes when applying as this will tend to introduce puckers into the luff of the sail.

EYELETS FOR ROUND MAST SECTION

Burn appropriate sized holes for the eyelets using the point of the soldering iron knife tip.

Clench home the eyelets using a metal block as a base on which to hammer the punch. Wrapping the block with carpet material or cork cuts down the amount of noise emitted in the process. Leave a small area on the top uncovered by insulation material. If no metal block is available, another hammer or even a heavy pair of pliers may make a good substitute.

BOLT ROPE OR SLIDES FOR GROOVY MAST SECTION

You can purchase bolt rope ready to sew onto the mainsail luff. Alternatively cut 30 mm wide tapes of spinnaker cloth and sew in the 3 mm diameter bolt rope before adding to the sail luff.

A simple alternative is to add slides to the mainsail luff at 150 mm intervals instead. The slides we use are the medium size crimps, item 70a in the catalogue. Tape these to the luff with small 30 mm x 10 mm pieces of the 145 g/m² self adhesive Dacron.

BATTENS/POCKETS

Batten pockets can be formed by sewing or gluing narrow tapes of sailcloth. Check the class rules first for the maximum permitted pocket size. Alternatively use double sided tape to attach battens cut from plastic sheet. 0.25 to 0.75 mm thick Plasticard (available in most model shops) makes reasonably good battens. Score it with a sharp knife and snap off the battens after applying the tape rather than trying to cut right through. We can supply uni-directional carbon/epoxy sheet which will not adopt a permanent bend like the non-reinforced plastics do.

SEWING

It is possible, thanks to the advent of good glues, self adhesive materials and eyelets, to make perfectly good sails without having to sew. However it is useful to sew sometimes. It does make seams more resistant to stretching and gives complete security from failure in strong winds.

MACHINE

Hand machines are probably easiest to master as there are less controls and they are more controllable. Even so, be prepared for a slow and patience testing initiation into the art of extracting good performance from a domestic machine with sailcloth.

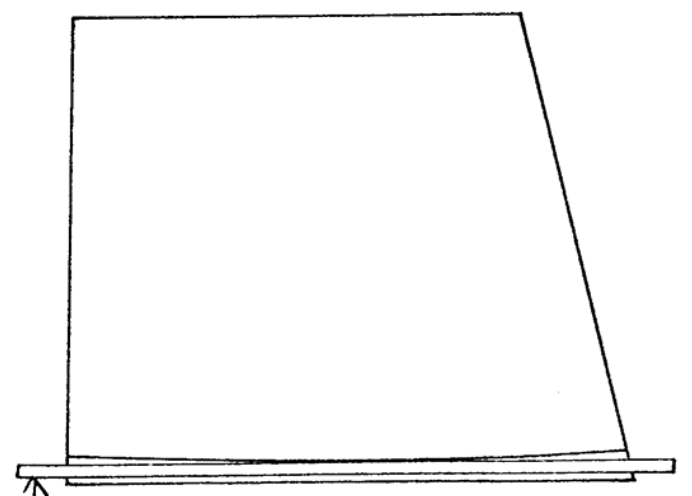
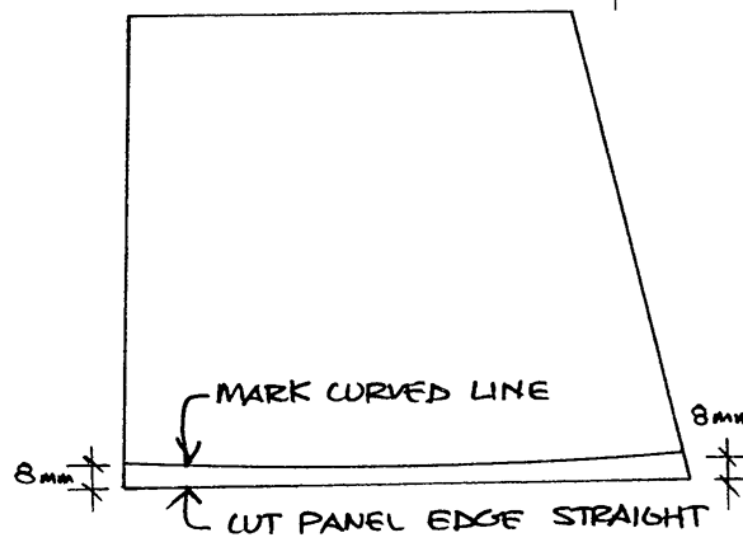
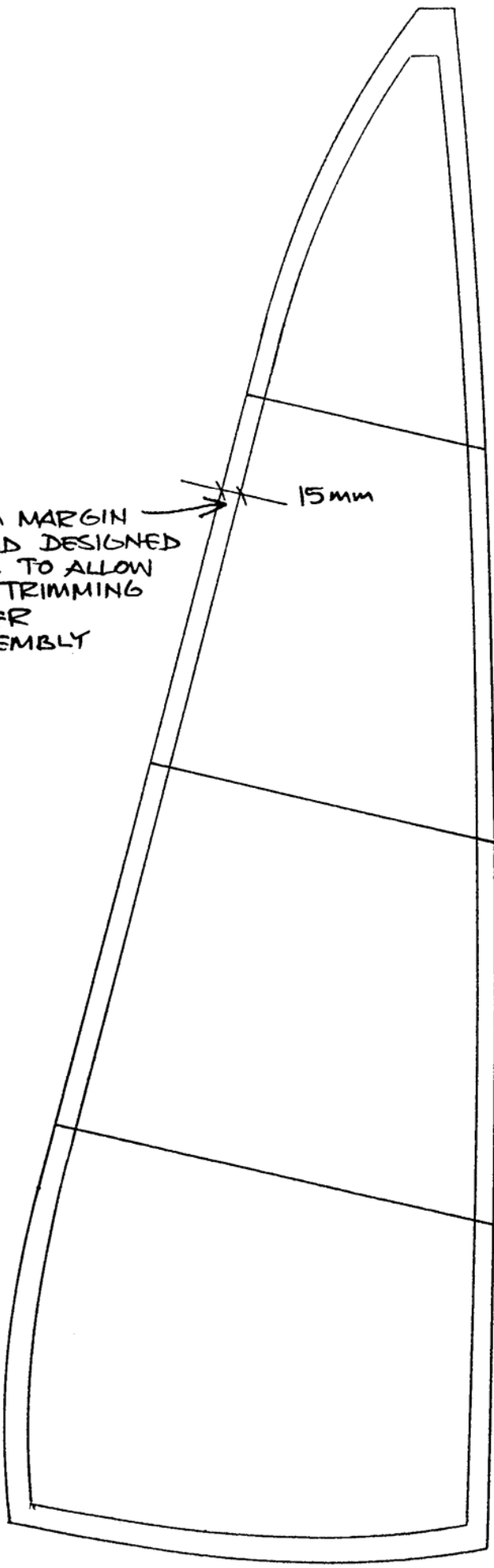
NEEDLES

We use 'leather point' needles which have a broad chisel edge to make a large hole through the cloth. This enables the thread to be pulled through the relatively hard cloth without breaking. Use a large size i.e. 100/16. If this type is unavailable use the largest round needle you can find.

If you are using Mylar drawing film or plain Mylar sheet, then a fine round needle is best.

15mm MARGIN
ROUND DESIGNED
SAIL TO ALLOW
FOR TRIMMING
AFTER
ASSEMBLY

15mm



DOUBLE SIDED TAPE
HOLDS PANEL DOWN WHILE
ADJACENT PANEL IS
STUCK DOWN.

THREAD

Use polyester thread as anything else is likely to break while sewing. In the UK there are several types available 'in the High Street'; one is 'Trylko', another is 'Polysew'. It may be possible to purchase small reels from sailmakers.

STITCH

Use a stitch of about 4 mm length. Use 4 or 5 mm width for zigzag stitch. This may be the maximum for most machines. Use enough stitch tension to keep the stitches close to the cloth but not so much that the sail shape is affected.

DEVELOPMENTS

Take the opportunity to have a good look at a large number of sails before you start to have a go yourself. It's surprising how much can be learnt from a little reconnaissance.

Keep notes of how each sail is made so that its replacement can be produced by modifying the original method/shape/dimensions rather than by starting from scratch.

Don't expect to get it right first time, or second or third.....!

Be prepared to waste some materials before you get sails which will perform well.

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