

MISCELLANEOUS INFORMATION - MIT 22

Ten Rater Series Sails

helping to design a suit of sails based on the
SAILSetc Ten Rater Series Sails
to closely match any existing sail plan

see also the area calculation program MIT23 – excel required for use

dispelling the myths!

There is nothing magical about any particular sail plan. A suit of sails will give good results if they are made of the right material, have the correct shape cut in, and if the luff curves are matched to the mast and forestay shapes.

Likewise there is nothing magical about any particular rig proportion. Provided the centre of effort of the entire rig is correctly placed with respect to the foils, and provided the sail shape can be maintained by spars which do not deflect unduly under load, then the rig will give good results.

What does give sparkling results is the correct choice of mast section and properly designed rigging which will permit easy tuning of the rig which itself is correctly positioned on the yacht all matched to a well cut suit of sails.

How we arrive at that is partly determined by the yacht's hull, foil and sail plan design, and partly by the choices you make regarding rig choice.

This set of notes will help you determine the dimensions of a Ten Rater Series suit of sails to match an existing or suggested sail plan for your yacht such that the original balance of the rig and yacht is not affected.

choosing rigs for a Ten Rater

This is discussed in the document MIT 03. The main choices are described and various options/variations are listed. The information relates specifically to the SAILSetc Shroudless Rig Kits. The sails provided with these kits are made to the SAILSetc 10 Rater Series sail patterns. The detail choice of sail plan is covered in this document.

Buying these rig kits is a simple and straightforward solution to producing top quality rigs for a Ten Rater. All the necessary component parts are included as well as a plan and instructions. If you want to design your own rigs then downloading the plan RP 15E can be a good starting point.

choosing Series Sails for a Ten Rater

The freedom which the class rules gives to designers encourages them to draw rigs with a wide variety of headsail/main proportions and aspect ratios. There is nothing wrong with that except that custom sails are more expensive to produce and the increased cost may limit the number of sails you have. The Series Ten Rater sails have been designed to permit a large choice of headsail/main proportions and aspect ratios. They are standardised in the sense that roach shapes and the luff lengths are fixed. This enables the sails to be made from a smaller number of patterns and cost is kept down. Quality is enhanced because more sails are cut from the same patterns and greater knowledge is accumulated about the way these sails behave and perform.

Virtually any classical sail plan (not swing rig) for a Ten Rater can be closely matched by one of the Ten Rater Series suits. To do this follow the steps below. If all this is too complex for you, simply send a copy of the original sail plan to us and we will carry out the calculations for you, letting you know the sizes in advance if you request.

rig height/mainsail luff length

Ten Rater Series mainsails are available with luff lengths of 2200 mm down to 1000 mm in 100 mm steps. Choose the size nearest to the sail plan you have, or the next shorter one if you are fitting sails to an existing mast. It will most likely be Series No 1, 2 or 3.

calculate the mainsail foot length

For each of the mainsail luff lengths likely to be chosen (suits No 1 to 3) a formula is shown below for the mainsail area shown as $AREA_{main}$. If your mast is an appropriate one for the yacht, it is not necessary to take into account the area bounded by the curved luff of the sail; that is taken account of in the formula. For example:

For Series No 3 Suit

Required measured mainsail area ($AREA_{main}$)	953 square inches		(0.615 m ²)
Area in square metres	953/1550	=	0.615 m ²
Formula for Series No 3 mainsail area	0.129 + B/1000	=	0.615
	B/1000	=	0.486
	B	=	486 mm

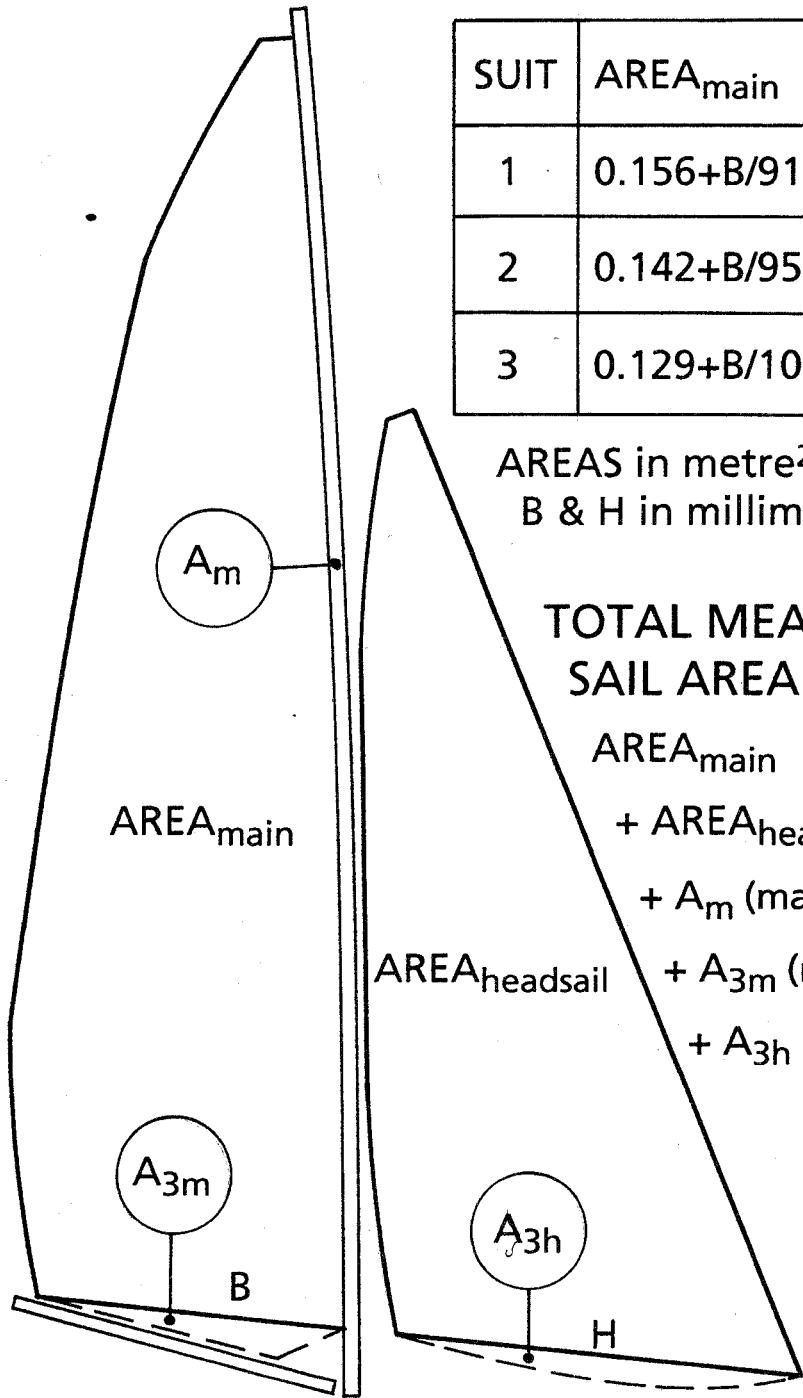
You should take into account any roach area on the foot of the sail (area A_{3m} in the diagram). Let's assume the sail plan has a triangular foot roach 40 mm deep as in the diagram. The area of the foot roach would be $0.5 \times 40 \times 486 \text{ mm}^2 = 9720 \text{ mm}^2$ or 0.0097 m^2 . Reduce the area figure in the equation above by this figure and repeat the calculation.

Area in square metres	$0.615 - 0.0097$	=	0.605 m^2
Formula for Series No 3 mainsail area	$0.129 + B/1000$	=	0.605
	$B/1000$	=	0.476
	B	=	476 mm

As this change has affected the calculated area of the foot roach by shortening the foot length you may wish to repeat the calculation. In most cases the affect will be insignificant.

SUIT	AREA _{main}	AREA _{headsail}
1	0.156+B/910	0.054+H/1330
2	0.142+B/950	0.051+H/1400
3	0.129+B/1000	0.048+H/1470

AREAS in metre²
B & H in millimetres



TOTAL MEASURED
SAIL AREA (m²) =

$$\begin{aligned}
 & \text{AREA}_{\text{main}} \\
 & + \text{AREA}_{\text{headsail}} \\
 & + A_m \text{ (mast area)} \\
 & + A_{3m} \text{ (main foot area)} \\
 & + A_{3h} \text{ (headsail foot area)}
 \end{aligned}$$



calculate the headsail foot length required

Each Series Ten Rater mainsail is matched to a headsail. The size of the matching headsail luff will produce what is commonly known as a 4/5th rig. The luff lengths are given on page 11 of the catalogue. Unless you have a specific reason for choosing something else it is recommended you use the headsail intended for the mainsail you have chosen. However, if you wish, choose a headsail from one of the other Series suits.

For each of the headsail luff lengths a formula is shown below for the headsail area shown as $AREA_{jib}$. If your mast and rigging is a appropriate one for the yacht, it is not necessary to take into account the area gained or lost on the curved luff of the sail; that is taken account of in the formula. For example:

For Series No 3 Suit

Required measured headsail area ($AREA_{jib}$)	586 square inches		(0.378 m ²)
Area in square metres	586/1550	=	0.378 m ²
Formula for Series No 3 headsail area	0.048 + H/1470	=	0.378
	H/1470	=	0.330
	H	=	485 mm

Again let's assume the plan shows a foot roach 25 mm deep but curved as in the diagram. The area of the foot roach, A_{3r} , would be $0.67 \times 25 \times 485 = 8124 \text{ mm}^2$ or 0.0081 m^2 . Reduce the required area $AREA_{jib}$ in the equation above by this amount and repeat the calculation:

Area in square metres	0.378 – 0.0081	=	0.370 m ²
Formula for Series No 3 headsail area	0.048 + H/1470	=	0.370
	H/1470	=	0.322
	H	=	473 mm

Again this may change the calculated area of the foot roach by shortening the foot length and you may wish to repeat the calculation. In most cases the affect will be insignificant.

choosing smaller suits of sails

It is normal to choose 2nd, 3rd and 4th suits of sails at 200 or 300 mm intervals below the largest suit. A well prepared 10 Rater would normally have a minimum of three suits of sails, perhaps with a 4th suit, or additional suit of Specials (super light weight largest suit), if local conditions dictate. See the document MIT 03 for a full discussion about choice of lower rigs.

measurement

Don't forget the contribution of the mast to the total measured sail area of your yacht. If required, the area of each finished sail can be checked in house by SAILSetc and a print out provided as an aid for your measurer. The charge for this is as for the measurement of additional rigs.

If these notes don't answer the questions you have, please get in touch again.

end