

I.Y.R.U. (now ISAF) MEASUREMENT INSTRUCTIONS 1979

Part IV: Measurement and Calculation of Sail Area

As applicable to U.K. CHERUB Class Rule 4.3.2.1, Sail Area (mainsail and jib), as adopted by the CHERUB Class Owners' Association, U.K., effective from March 1997

1. General

1.1 The intention is to establish a reliable and simple method of measuring the whole driving area of the sail plan.

1.2 It is not possible to frame methods to deal with every eventuality and therefore in the case of unique or difficult shapes of rig the measurer may need to use his judgement in dividing the rig for measurement in order to calculate the area accurately. "Combination" rigs such as a soft trailing edge on a heavily shaped wing spar or a rig where the camber and shape is produced by tensioning when it is on the yacht, may be more conveniently and equitably measured in an "assembled for sailing" condition, rather than in component parts. In these cases the measurer shall record the method used.

1.3 Elements of the sail plan which are vertical, or nearly so, when the yacht is not heeled shall be measured. Elements of the sail plan which are horizontal or nearly so when the yacht is not heeled, such as fences and end plates, are not measured, provided that:

- i) the surfaces of such elements are not able to make an angle, measured at right angles to the fore and aft axis of the yacht greater than 10 degrees to the horizontal when the yacht is not heeled, and
- ii) the total area of their surfaces does not exceed ten per cent of the measured sail area excluding such surfaces.

For the purpose of calculating the area of horizontal, of nearly horizontal surfaces, only the area of one side of each fence and the surface of an end plate which is adjacent to the sail shall be included in the area.

1.4 A "soft sail" is any sail made up of cloth or other material which is flexible and can be rolled up or folded.

1.5 For the purposes of measurement of sail area the term "sail" shall be deemed to be that part of a soft sail outside the spars and includes the headboard, tabling and battens which extend beyond the edge of the sail. It shall not include cringles which are wholly outside the sail or bolt or foot ropes which are inside the spars.

1.6 The area of any hole in the sail, the maximum dimension of which does not exceed 50mm, shall not be deducted from the measured area.

2. Spars & Wing Sails

(Not applicable. The area of the spars shall not be included in the measured sail area.)

3. Soft Sails set on Spars

3.1 When the sail is set on spars and between measurement bands the distance between the bands is used to obtain the primary dimensions of the main triangle.

3.2 Area using measurement bands

3.2.1 With battens set in their pockets the sail shall be pegged out on a flat surface with just sufficient tension to remove waves or wrinkles from the edge rounds and to spread the sail, as far as possible, substantially flat. Once the sail has been pegged out in this way all the required measurements shall be taken and no alterations to the tensions shall be made.

3.2.2 Needles shall be fixed at the head and clew, making allowance for that part of the sail inside the spars so that the distance between the needles is the length of the leech. A third needle shall be fixed at a point so that it is the distance between the measurement bands on the mast from the head needle and also the distance of the boom measurement band from the mast from the clew needle. If the boom is shorter than the foot of the sail or if there is no boom, the length of the foot shall be that found by measurement with the sail set on the mast. A thin line shall be stretched round these needles to define the main triangle. See fig (3).

3.2.3 The area of the main triangle shall be calculated from one of the following formulae or by a scale drawing.

(a) $\text{Area} = v(s.(s-a).(s-b).(s-c))$

where $s = (a+b+c)/2$

and a = length of luff

b = length of leech

c = length of foot

(b) $\text{Area} = AB \times CP$ where CP is the minimum distance from C to 2 * the thread from A to B

3.2.4 The area of the luff round shall be calculated and added to or subtracted from the area of the main triangle. If the curve is fair and continuous its area shall be taken as two thirds of the product of the chord length and the maximum perpendicular offset to the chord. In fig (3) below the area of the luff round is $2g(AY)/3$. The offset to the chord shall be taken as the maximum distance between the point on the sail corresponding with the aft edge of the mast, and the thread defining the main triangle.

3.2.5 The area of the leech round shall be found as follows:
either

(a) where the leech is a continuous fair curve from point A to point C in fig (3)

the area is taken as $AC (1.16d + e + 1.16f)/4$

where AC is the leech length indicated in fig (3); d, e and f are the perpendicular offsets between the points on the thread from A to C a quarter, a half and three quarters of the distance between the leech measurement points A and C and the edge of the sail. For the purposes of the measurement of the offsets, any hollows in the leech shall be bridged.

or

(b) where the leech is not a fair curve from point A to point C in fig (3) the area of the leech round shall be found by dividing the area into trapeziums, triangles and segments and measuring each. For the purpose of this instruction the area of a segment shall be taken as two thirds of the product of the chord of the round and the maximum perpendicular offset to the chord.

3.2.6 The area of the foot round, if the sail can be pegged out substantially flat, shall be measured in the same manner as the luff round.

3.2.7 Where the foot has a "shelf" or a substantial amount of shape so that when the foot is extended there is loose or bulging material above it, then the area of the "flow" of the bulging material shall be determined as follows (see fig. 4.. A measurement shall be taken from the straight line joining the tack to the clew, in the way of the greatest fullness, to an arbitrary point where the sail does lie flat. A second measurement is then taken from the arbitrary point to the point of greatest fullness following the folds or bulges of material. The difference between the two measurements represents the offset of the rounded foot. The area of the foot round is taken as two thirds of the length between the tack and clew multiplied by the offset.

3.2.8 The area of the shape BYTX in fig (3) is not deducted from the area of the main triangle.

3.3 Where there are no measurement bands on the spars

3.3.1 With battens set in their pockets the sail shall be pegged out on a flat surface with just sufficient tension to remove waves or wrinkles from the edges and to spread the sail, as far as possible, substantially flat.

3.3.2 Needles shall be fixed at the head, tack and clew. A thin line or thread shall be stretched tight between head, tack and clew to define the main triangle.

3.3.3 The area of the main triangle shall be calculated in the manner indicated in Section 3.2.3 above.

3.3.4 The area of the luff, leech and foot rounds shall be found in accordance with the instructions 3.2.4, 3.2.5, 3.2.6, 3.2.7 above.

4. Soft Sail not set on a Spar

4.1 A soft sail which is not set on a spar, such as a headsail, set on a stay or flying, shall be measured in accordance with instruction 3.3 above, except that if the leech has an offset not exceeding 5 per cent of the leech length and is a fair curve the area of the leech the area of the leech round shall be measured in accordance with 3.2.4.

4.2 If the luff of the sail is wired, sufficient tension shall be applied to remove bends or kinks in the wire.

5. Sail of Unusual Shape

The foregoing instructions assume that the sails are essentially triangular. If a quadrilateral or multilateral sail is to be measured the sail is to be divided into suitable triangles whose area can be measured and added. The areas of the luff, foot and leech rounds shall also be added, or subtracted as the case may be. The measurer shall record the method he has used to assess the area of the sail.

6. Spinnaker

(Not applicable. See CHERUB Rules and Restrictions, 1987, Rule 4.3.4 Spinnaker.)