



# INTERNATIONAL 420 CLASS ASSOCIATION

## SAILS INSPECTION GUIDE

Ver. 1 - 07/2008

### INTRODUCTION

This guide is meant to help standardizing the inspection process at the 420 Class main events. Class Measurers are encouraged to improve on the described process, but at least they should follow this basic pattern to ensure that sail inspection is done properly and on the same quality level each and every time. It is essential that the required steps are explained clearly to the assistants who do the job, and this guide is made with that task in mind.

### SETUP

The standard specification for a 420 event inspection preparation calls for a sail table in trapezoidal shape. Dimensions should be at least 6m (length) and 3,5m & 1m for the two bases respectively. Normal table heights of around 80-90cm are fine and should not be exceeded because it will be difficult to reach the middle of the table without climbing on top. Melamine-coated panels are the best for the table surface but in many cases we see plain plywood which should be the absolute minimum regarding the surface quality. The most important thing is the construction of the set: the supports must be rigid, level and the top panels securely fixed to them so they don't move. All the top panel connections and the edges around the table must be taped, to avoid damage to the sails, especially to spinnakers.

A table of that size is enough to measure all three sails but not at the same time: if it is necessary to measure spinnakers/jibs at the same time with mainsails, then two tables are needed, one as described above for mainsails and one rectangular, 5,5m X 2m for jibs and spinnakers. This guide describes the procedure when one table is used, but the way to prepare the second table is exactly the same. The table should be made as shown in fig.1, with the prescribed sails arrangement: Mainsail on the right side, spinnaker on the left and jib at the mid to bottom part of the table. Mainsails and jibs shall be positioned so that their port side is facing up. This is because the event limitation stamps shall be positioned at the port side clew area.

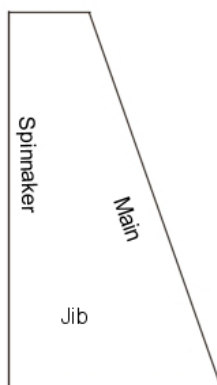


Fig.1 Sail table arrangement (not in scale!)

When the table is positioned and fixed in a satisfactory way, then you can proceed to the template mark preparation. The following description is for a setup with grid panels to eliminate the need for folding the sails to find leech points:

### **Mainsail**

- a) Draw the reference line, which is the axis for leech length measurement. It doesn't have to be actually drawn on the table all the way from the head to the clew but only around the following areas: near the clew, around the half-leech length and near the top. Use a laser beam pointer as straight edge instead of the traditional string: it is faster and more accurate. Use thin pencils and permanent marker pens. To do it properly and avoid surprises later on, first put a mainsail on the table, flake and flatten the leech and see how close you can get to the table edge without getting any part of the sail outside the table!
- b) Decide on the datum point position (in our case the head-point of the mainsail) and mark it clearly on the table. Measure along the reference line up to the 5400 mm maximum leech length, and also up to the middle point ( $5400/2=2700$  mm) and mark these points.
- c) To use proper marks to find the  $\frac{1}{2}$  point on the leech, you need to know the roach width at that point of contemporary mainsails. From measurements done during the 2007 season, it was found that this dimension varies between 25 and 28 cm, so a width of 270 mm should be Ok for most mainsails. To do it properly, one has to draw a line perpendicular to the reference at the leech midpoint of 2700mm from the datum, and mark the point on it at 270 mm from the reference line. This new point (called " $\frac{1}{2}$  leech") should be at a distance of 2713,5 mm from datum and max clew point.
- d) Draw new lines between the  $\frac{1}{2}$  leech and the datum and max clew points with the laser pointer. Their middle points (at 1356,75mm) show us where to look for the  $\frac{3}{4}$  and  $\frac{1}{4}$  leech points respectively, but since there is also some roach there, we need to compensate for that amount: at  $\frac{3}{4}$  leech, this measurement varied between 170 and 200mm, and at  $\frac{1}{4}$  between 40 and 90 mm. So, a line has to be drawn perpendicular to each of the new reference lines, and the  $\frac{3}{4}$  point marked at 190 mm from the reference, while the  $\frac{1}{4}$  point at 60 mm respectively.
- e) Having marked the leech points, one can then position the respective grid panels. Make sure they are oriented along the correct reference lines!
- f) For the head, one may use either a rotating template which includes the headboard measurement limits, or draw a square on the table following the position of the test mainsail as used in step (a), so that the sails will rest more or less in position without needing significant rotation.
- g) From the head point, draw a 600 mm radius to mark the upper leech point. Use a sail to guide you in order to avoid moving the sail too much when positioned on the table.
- h) For the sail widths, new datum points (cross-hairs) have to be positioned near the leech measurement points, and then the respective radii drawn on the table (20-

30cm arcs at 480 mm, 995 mm, 1630 mm and 2130 mm for upper leech,  $\frac{3}{4}$ ,  $\frac{1}{2}$  and  $\frac{1}{4}$  widths respectively). If the sail presents a hollow between the Batten Pockets (common case in the 420, especially for the upper and  $\frac{1}{2}$  widths) remember to add the difference between the straight line and the hollow to the width measurements taken (see fig. 2)

- i) Finally, two marks have to be positioned to control the top batten position at 1420 mm and 1470 mm from datum. Again use the test mainsail in the opened position to find the correct area so that the control will be done with a minimum of movement of the sail itself (also for step (h)).
- j.) At last mark the minimum length of the Foot Bolt rope near the Foot starting close to the Clew point.

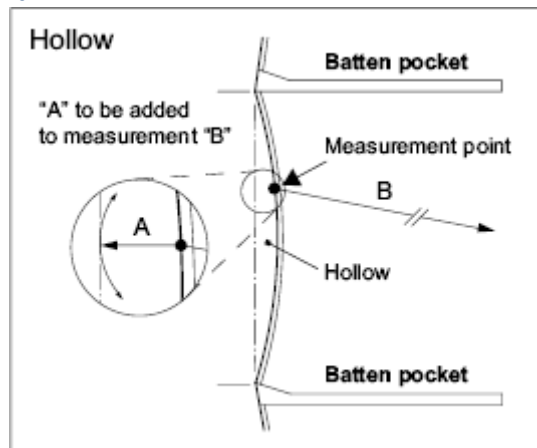


Fig. 2 Hollows at Width Measurement

### Spinnaker

- a) Draw a reference line along the left edge of the table and about 10-15 cm inboard, which become the axis for all measurements. It doesn't have to be drawn all the way from the datum start to the other end but only around the measurement areas. Again use a laser beam pointer as straight edge.
- b) Decide on the datum point position, which will double as a datum both for length and width measurements, and mark it clearly on the table. Measure along the reference line and mark the following points:
  - $\frac{1}{2}$  point @ 2000 mm
  - Foot length @ 2220 mm
  - $\frac{1}{2}$  width @ 2840 mm
  - Max leech @ 4000 mm
  - Foot median @ 4650 mm
- c) Fix the appropriate grid panels at  $\frac{1}{2}$  and max leech points.
- d) Do not forget to check the maximum allowed panels (not more than seven) and the tucks in the lower and upper panels.
- e) Sail Numbers should be between 40 and 60 % of the Foot median so in each sail it varies a bit but mainly they should be between 1860 mm and 2790 mm measured along the centerfold from the Head point.

### Jib

- a) Put a jib on the table to see how close you can get to the table edges without getting any part of the sail out of the table.
  - b) Decide on the datum point position (in our case the head-point of the jib) and mark it clearly on the table. Again a rotating template is ideal but a square drawn on the table should be OK. Include the head width of 30 mm! Measure and mark the max luff (tack) and max leech (clew) points at 3500 mm and 3200 mm respectively.
  - c) Use the tack position as datum for the foot length and mark the clew end at 1750 mm.
  - d) Mark the foot median length of 3360 mm around the foot middle point.
- Cover all marks/grids with clear tape to protect them from water and chafing.
  - Try to use different color marker pens for each sail, to make identification easier for the assistants.
  - To save time, ignore the mainsail  $\frac{1}{4}$  width so don't put any marks for the  $\frac{1}{4}$  leech point.
  - Attach a copy of the class rules (section G) at one table corner for quick reference.
  - Try to write down short explanations for each mark to help the assistants.

## TEMPLATE APPLICATION

### Mainsail

- a) Position the head on the template or the drawn square so that the head point rests exactly on the datum; one of the two assistants must hold it in this position firmly, checking that the headboard lies inside the limit of 115 mm.
- b) Flake and flatten the leech, rotating the sail so that the clew is properly aligned with the reference line of measurement.
- c) The second assistant shall check that the leech length is within the limit and then read the exact number on the grid where the clew point rests. Without moving the sail, the leech must be marked at the same number positions on the other grid panels. A quick look at any leech hollows shall be taken at this stage. If the hollow is considerable take a long Batten and add the hollow as shown in fig. 2. Also mark the Upper leech point at 480 mm
- d) The sail shall be opened up and the widths checked by moving the leech points on the crosshairs, flattening and rotating the sail: one must see at some point the drawn arcs on the table.
- e) Top batten position checked: flatten the luff carefully to remove all wrinkles!
- f) Use a pre-marked batten (preferred method) or a measurement tape to check the batten pocket lengths and the reinforcements.
- g) Check the numbers/letters position. Use of template is recommended.
- h) Check uniformity of ply everywhere on the sail body except for the foot panel.
- i) Finally remember to check the Foot bolt rope length on the Foot.

## **Spinnaker**

- a) Position the head on the datum; flatten and rotate the sail so that one clew is on the max leech length grid along the reference line. One of the two assistants must hold it in this position firmly.
- b) The second assistant shall check that the leech length is within the limit and then read the exact number on the grid where the clew point rests. Without moving the sail, the leech must be marked at the same number positions on the other grid panels at  $\frac{1}{2}$  leech point.
- c) The procedure is repeated for the other leech.
- d) The foot mid point is marked by folding the sail foot. Then the foot median length is to be checked against the limit mark.
- e) The sail is to be rotated 90 degrees on the table so that the foot is lying along the reference line.
- f) One clew point is to be held on the datum point and the other is positioned on the reference line, checking the foot length against the limit mark.
- g) The sails is moved to that the  $\frac{1}{2}$  width is to be controlled in the same way.
- h) Taking the sail off the table, the foot middle is positioned on the head to find the middle of the sail. Check the position of the sail numbers and letters they should be between 1860 mm and 2790 mm.

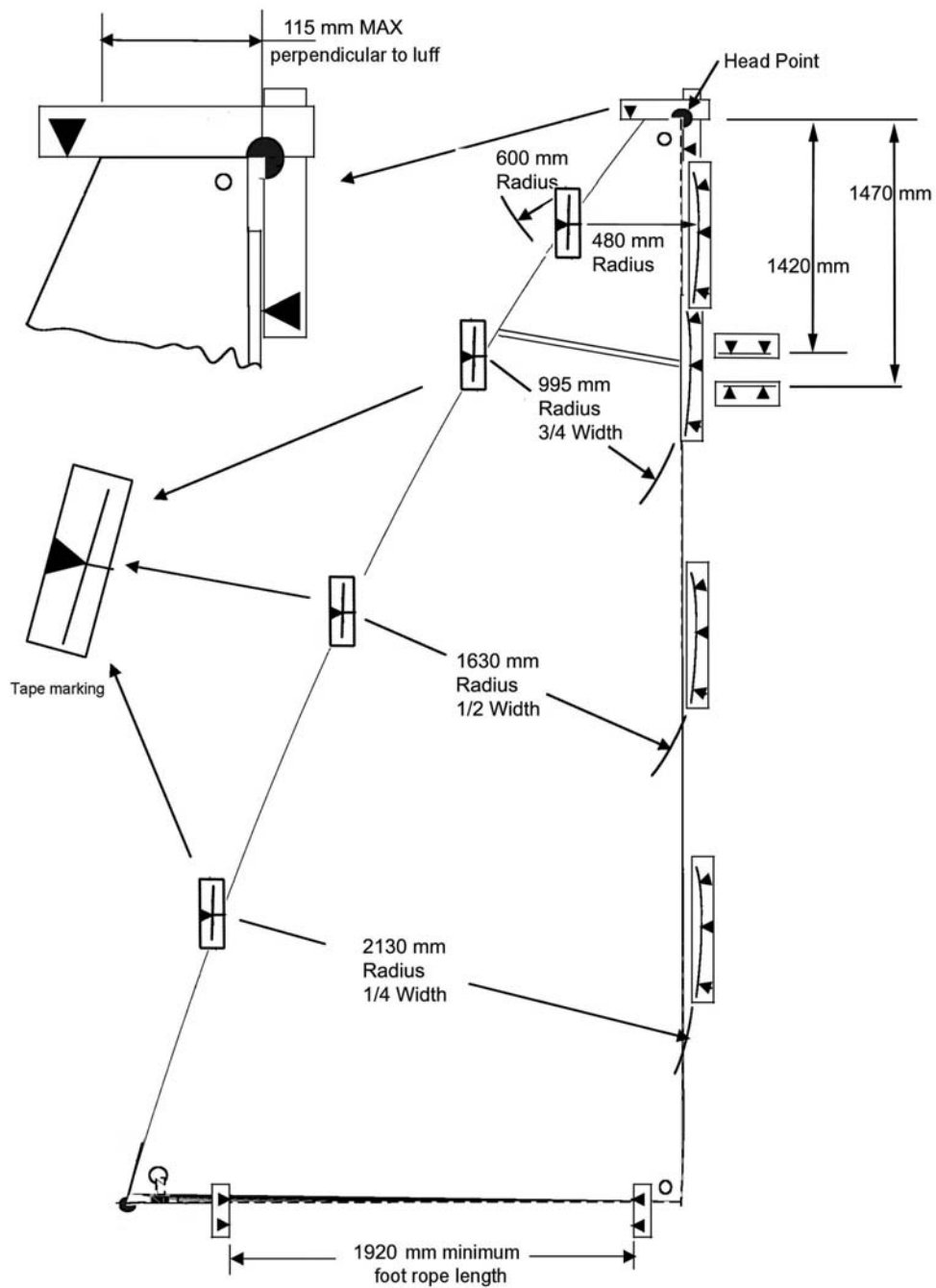
## **Jib**

- a) Position the head on the template or the drawn square so that the head point rests exactly on the datum; one of the two assistants must hold it in this position firmly, checking that the head lies inside the limit of 30mm.
- b) Flake and flatten the leech, rotating the sail so that the clew is properly aligned with the reference line of measurement. The second assistant shall check that the leech length is within the limit and that the leech is not convex.
- c) Flake and flatten the luff, rotating the sail so that the tack is properly aligned with the reference line of measurement. The second assistant shall check that the luff length is within the limit.
- d) Fold the foot and find the middle. Flatten and check the foot median
- e) Release the head and put the tack on the foot length datum point, flattening the foot. One assistant holds the sail there and the other checks the foot length at the clew end.
- f) Check batten pocket lengths, reinforcements and window dimensions with a pre-marked batten or tape.

- Mark all sails at the clew on the port side; write the sail number on the jib clew.

## **FINAL NOTES**

The use of grids can reduce dramatically the total time needed for sail inspection because it eliminates the need for folding sails to find the measurement points. Therefore it is highly recommended for the World and European Championships, where we have fleets of 150+ boats and half of them have to be fully measured. The recommended offsets for the mainsail roach widths have to be checked from time to time as new designs may emerge which will modify these numbers a bit. Always make sure that the assistants understand and follow the instructions for flaking and flattening properly the sails! Finally, explain clearly to the assistants what to check on sail numbers/letters, even the most obvious ones like the starboard-on-top issue!



Sample plan for Width, Head and Foot Boltrope marks for Mainsail

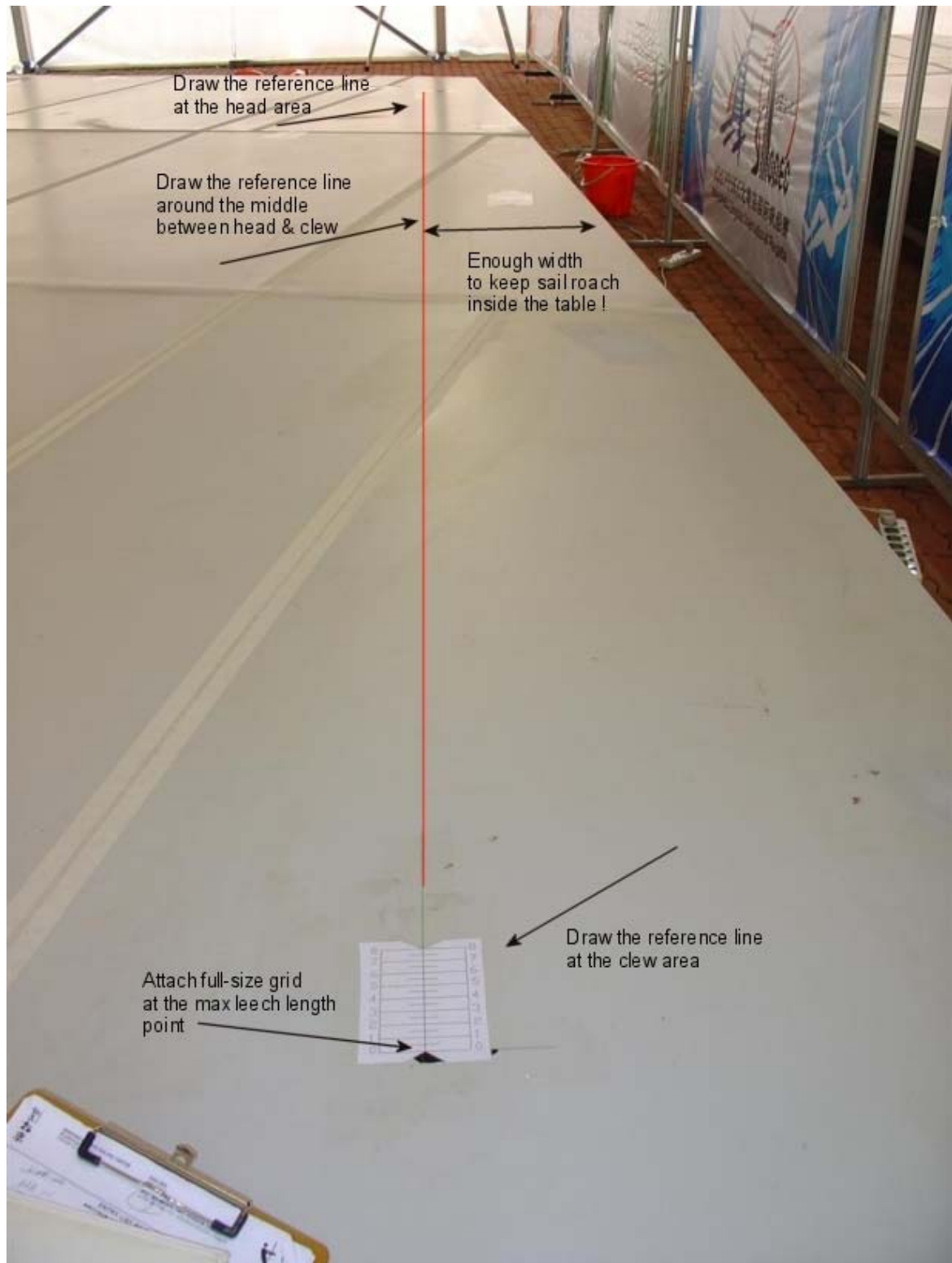


Fig.3 Positioning of Mainsail leech reference line



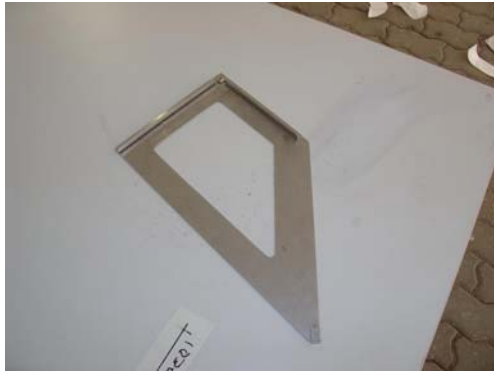


Fig.4 Mainsail head rotating template (Finn)

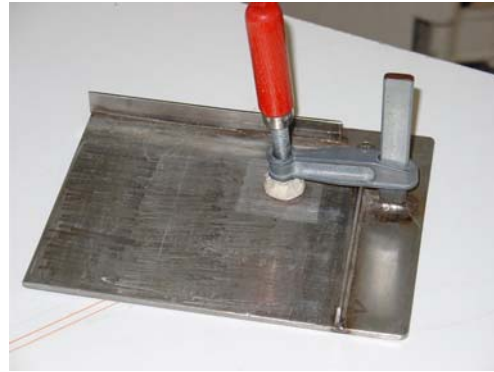


Fig.5 Rotating template with clamp (Europe)

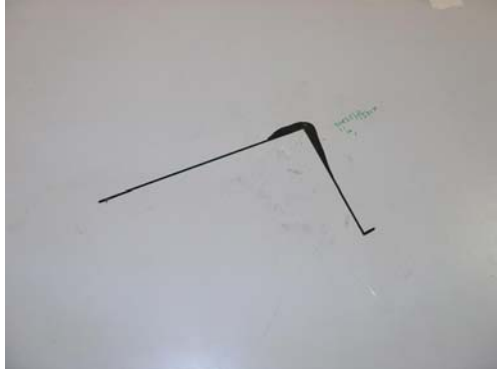


Fig.6 Simple Head mark drawn on table



Fig.7 Fix Full size grid at max leech length

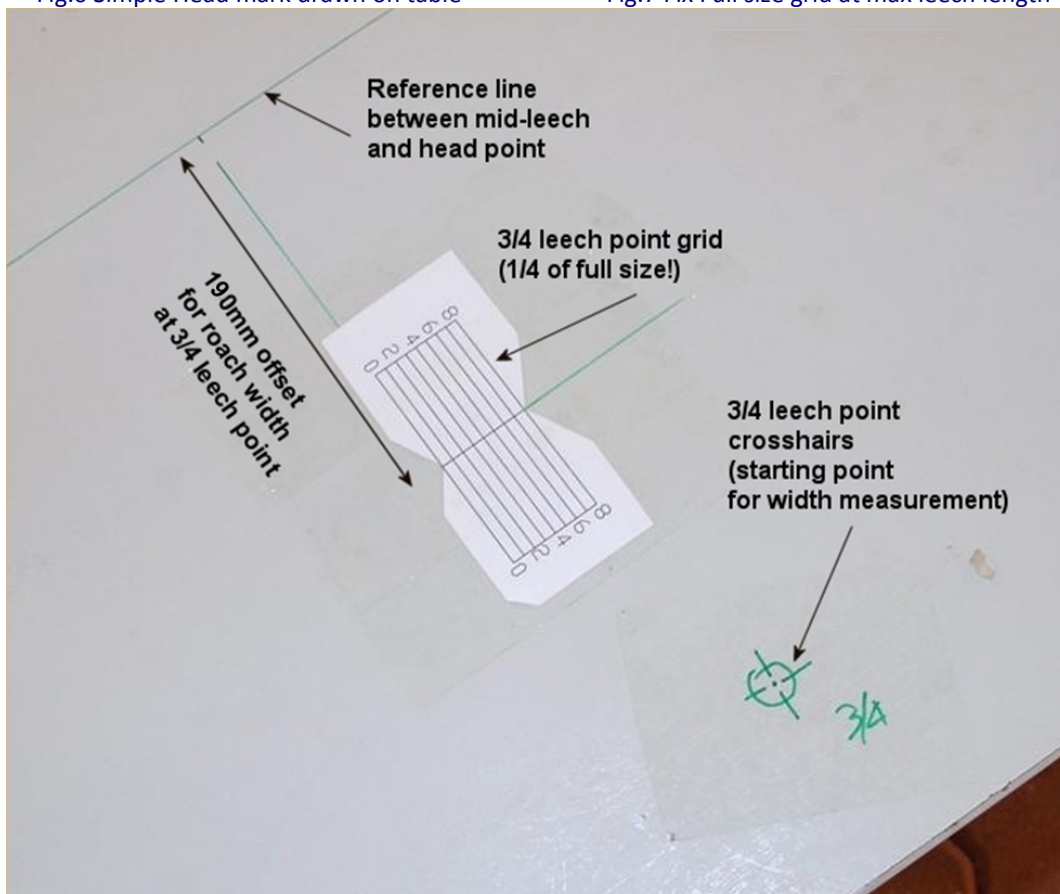


Fig.8 Grid at  $\frac{3}{4}$  leech point and width measurement crosshair datum



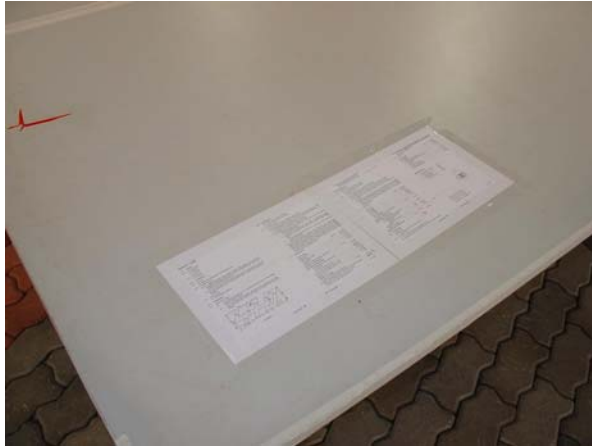


Fig.9 Rules attached on table corner

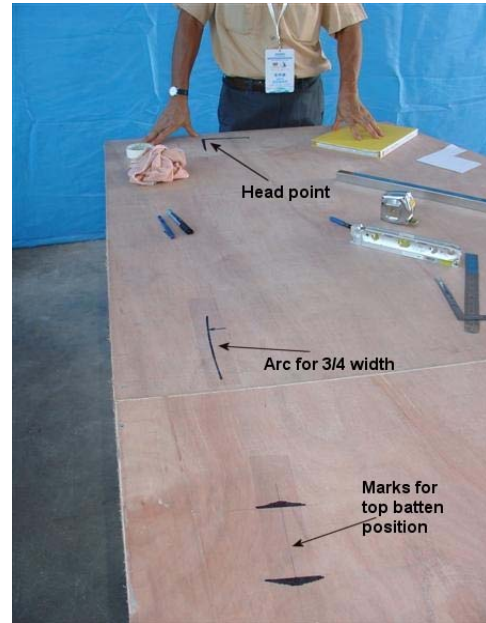


Fig.10 Width arc and top batten marks

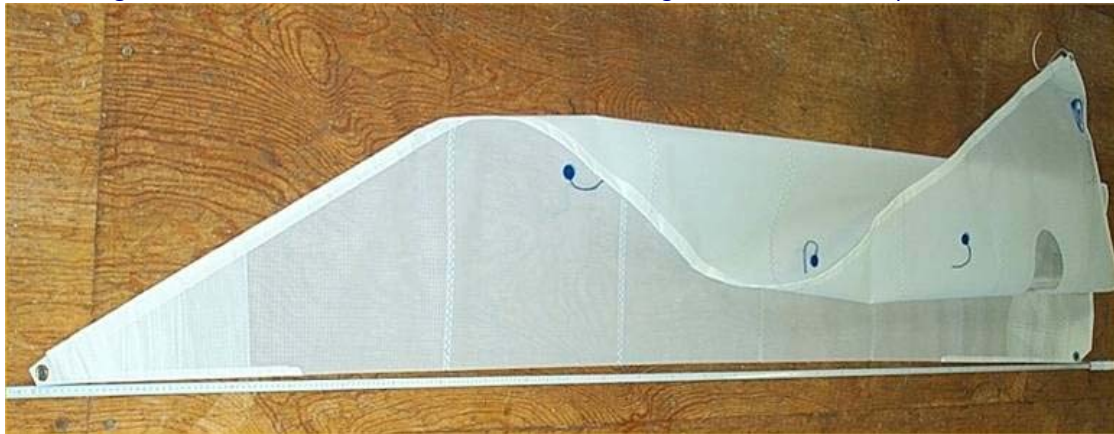


Fig.11 Always flake the sails to flatten them properly (taken from the ISAF Sail measurement guide)

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&  
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