



*the boat the world sails*

# **SAILS INSPECTION GUIDE**

(Ver.1 02/2008)

(For Use By the Int.470 Class International Measurers)

## **1) INTRODUCTION**

This guide is meant to help standardizing the inspection process at the 470 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.

## **2) SETUP**

The standard specification for a 470 event inspection preparation calls for a sail table in trapezoidal shape. Dimensions should be at least 6,5m (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.

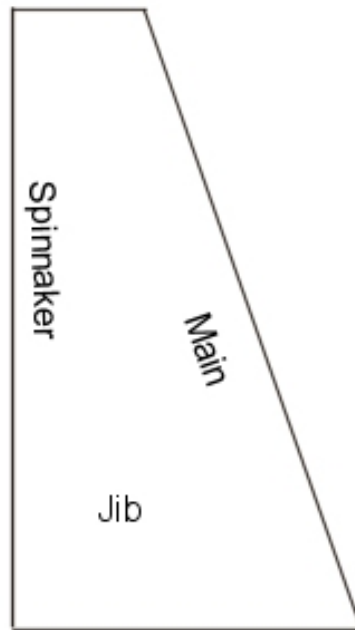


Fig.1 Sail table arrangement (not in scale!)

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 6265mm maximum leech length, and also up to the middle point ( $6265/2=3132,5\text{mm}$ ) 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 23 and 27 cm, so a mean width of 250mm should be Ok for most mainsails. To do it properly, one has to draw a line perpendicular to the reference at the leech mid point of 3132,5mm from the datum, and mark the point on it at 250mm from the reference line. This new point (called " $\frac{1}{2}$  leech") should be at a distance of 3142,5mm from datum and max clew point (3142,46 to be exact...)
- 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 1571,25mm) 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 125 and 150mm, and at  $\frac{1}{4}$  between 30 and 60mm. So, a line has to be drawn perpendicular to each of the new reference lines, and the  $\frac{3}{4}$  point marked at 140 mm from the reference, while the  $\frac{1}{4}$  point at 50mm 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) 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 1050mm, 1790mm and 2340mm for  $\frac{3}{4}$ ,  $\frac{1}{2}$  and  $\frac{1}{4}$  widths respectively).
- h) Finally, two marks have to be positioned to control the top batten position at 1680mm and 1780mm 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 (g)).

#### 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:
  - Upper measurement point @ 200mm
  - Upper width @ 350mm
  - $\frac{3}{4}$  point @ 1090mm
  - $\frac{3}{4}$  width @ 1830mm
  - $\frac{1}{2}$  point @ 2180mm
  - Foot length @ 3000mm
  - $\frac{1}{2}$  width @ 3450mm
  - Max leech @ 4360mm
  - Foot median @ 5100mm
- c) Fix the appropriate grid panels at  $\frac{3}{4}$ ,  $\frac{1}{2}$  and max leech points.

#### 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 30mm! Measure and mark the max luff (tack) and max leech (clew) points at 4100mm and 3750mm respectively.
- c) Use the tack position as datum for the foot length and mark the clew end at 1950mm.
- d) Mark the foot median length of 3950 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.

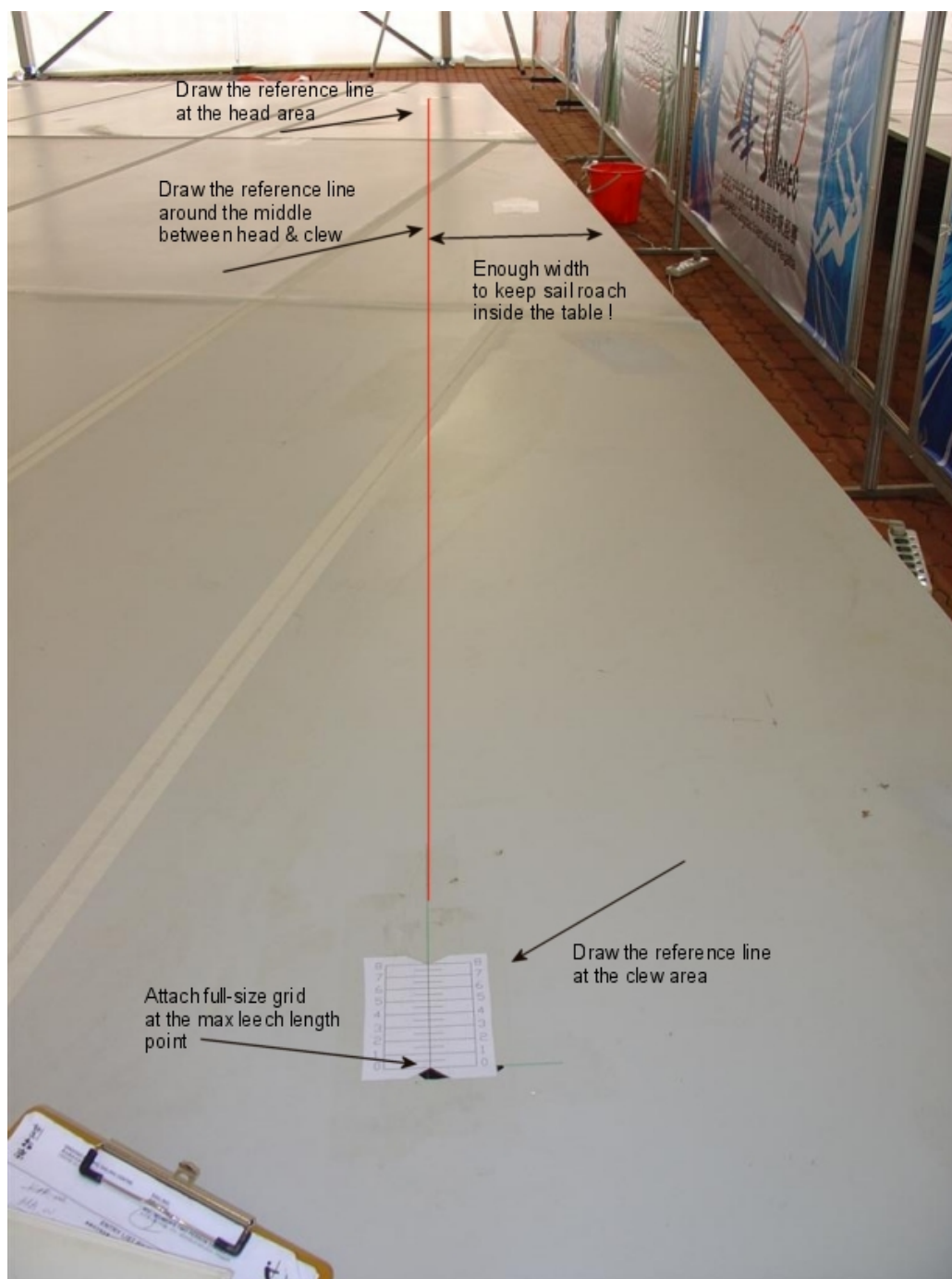


Fig.2 Positioning of Mainsail leech reference line



Fig.3 Mainsail head rotating template (Finn)

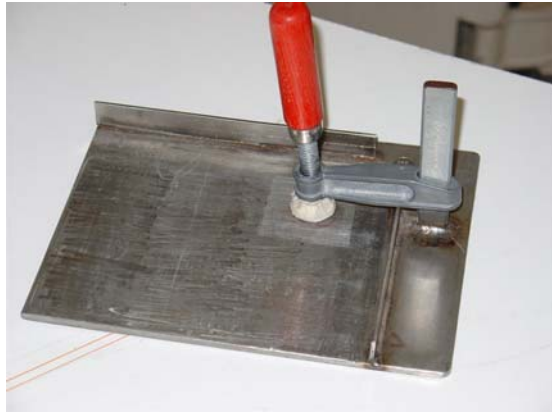


Fig.4 Rotating template with clamp (Europe)

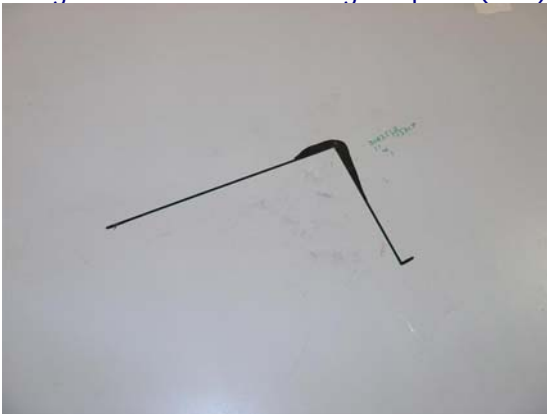


Fig.5 Simple Head mark drawn on table

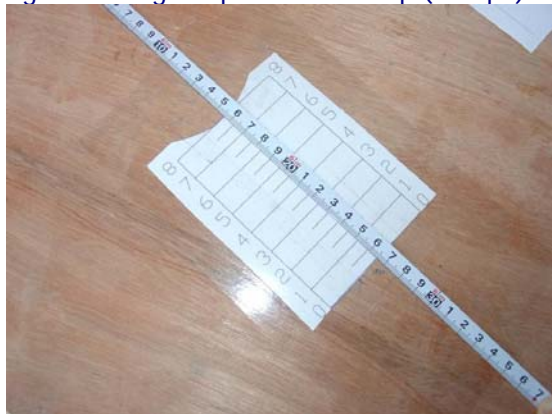


Fig.6 Fix Full size grid at max leech length

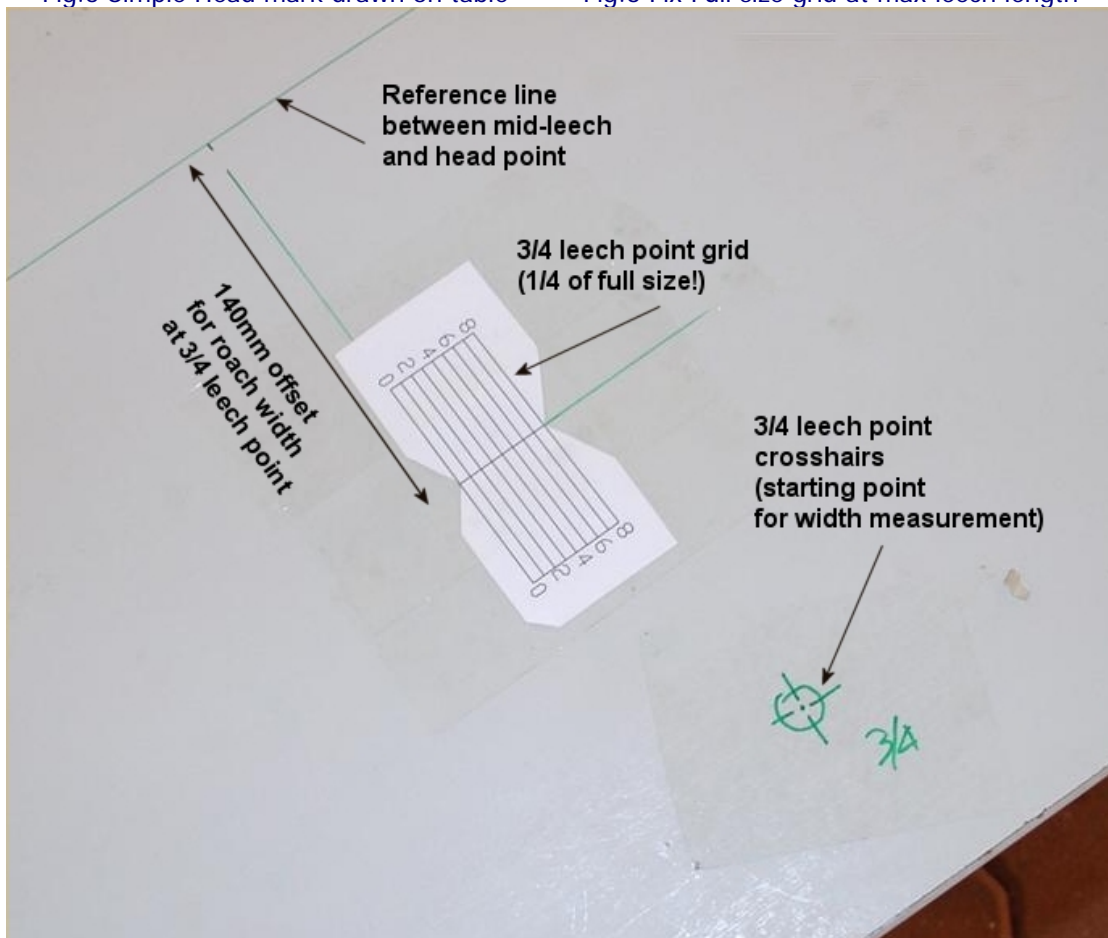


Fig.7 Grid at  $\frac{3}{4}$  leech point and width measurement crosshair datum



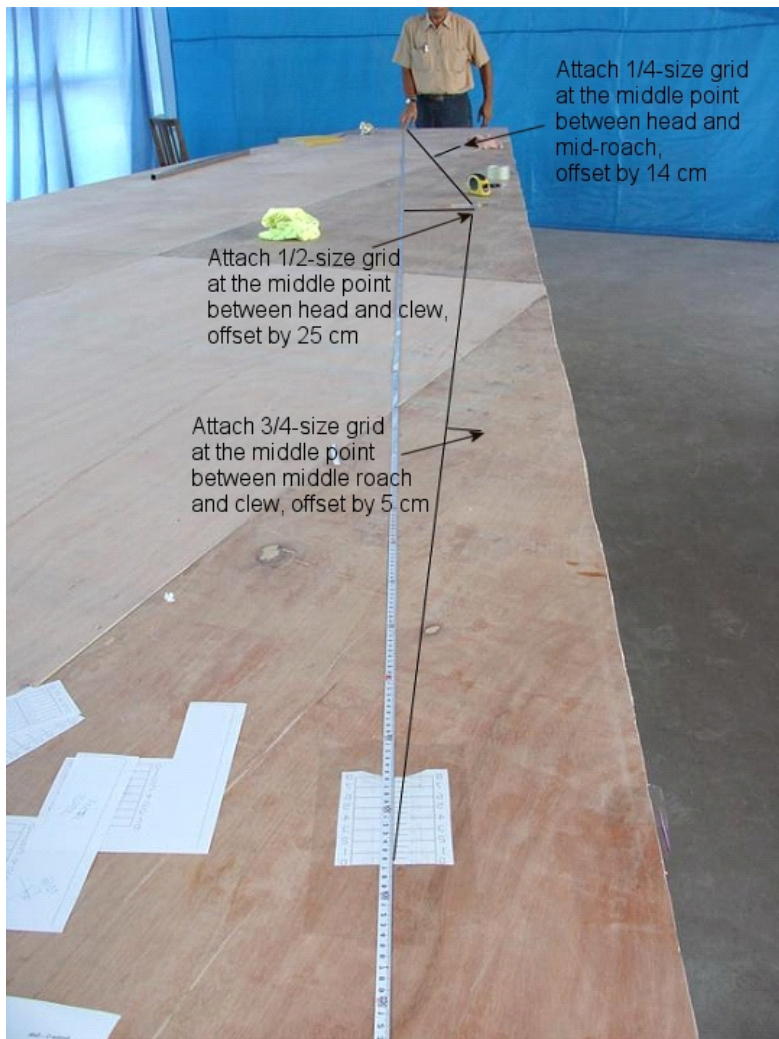


Fig.8 positioning of grids for leech points

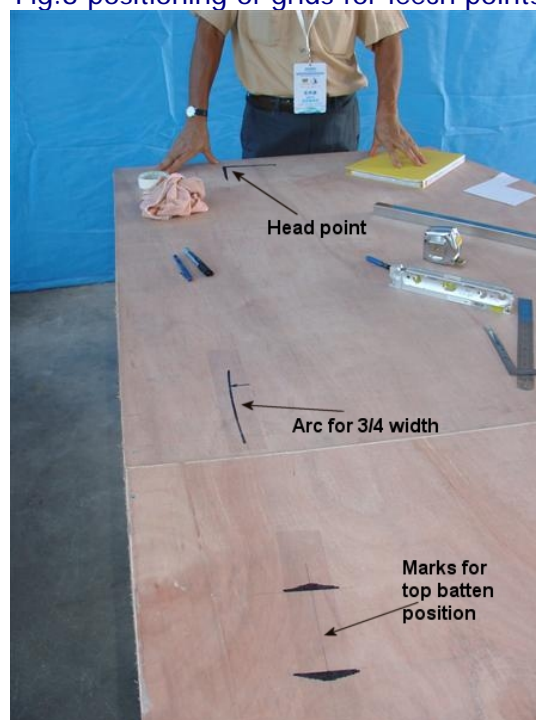


Fig.9 Width arc and top batten marks



Fig.10 Section G rules attached on table corner

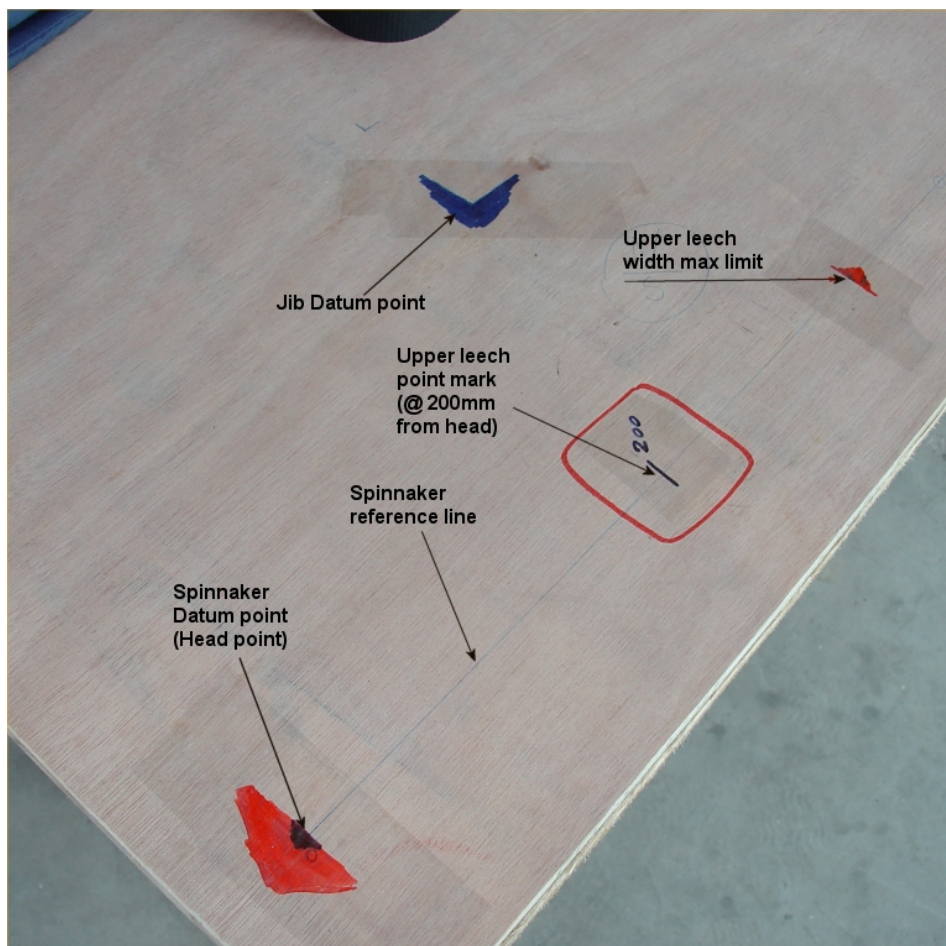


Fig.11 Spinnaker & Jib datum points; note different color!

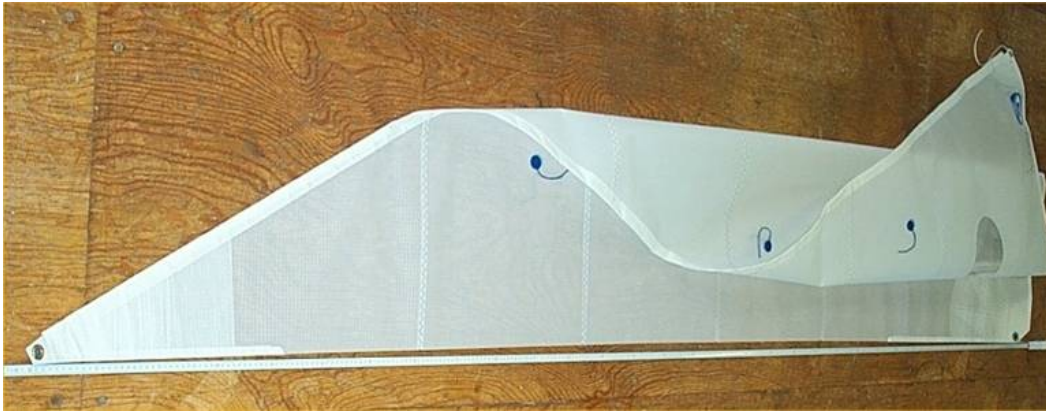


Fig.12 Always flake the sails to flatten them properly (taken from the ISAF Sail measurement guide)

### 3) 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 140mm.
- 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, although the batten pockets should be close to the measurement points (check max 100mm) and any hollow should be negligible.
- 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) Use a micrometer to check ply thickness. Ensure uniformity of ply everywhere on the sail body except for the foot panel.

#### 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  $\frac{3}{4}$  and  $\frac{1}{2}$  leech points. The upper leech point has to be marked as well.
- 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, and the the  $\frac{3}{4}$  and the upper widths.
- 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 lay within about 50 cm each side up or down of the middle. The numbers can be either in line or below the letters.
- i) Check symmetry using the diagonals measurement. A tape or another set of table marks may be used for that purpose.

#### 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; on the jib write also the sail number.

#### **4) 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. It is not so critical for the junior events but this may (and should) change in the future, taking also 50% of the fleets for full measurement. 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. Right now North Sails Japan dominates the fleets and so these numbers should fit well with the majority of sails at any event.

Always make sure that the assistants understand and follow the instructions for flaking and flattening properly the sails! Finally, explain clearly what to check on sail numbers/letters: there is nothing more embarrassing than to see a mainsail with port side markings on top of the starboard ones racing serenely with our event stamps in place for everyone to see!

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February 2008