



*the boat the world sails*

## **RIG INSPECTION GUIDE**

(Ver. 2 05/2009)

(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 rig 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 mast/boom bench/table. Dimensions should be at least 7m in length for the mast part and 2,80m for the boom one, with a width of at least 30cm, 50cm being better. Normal table heights of around 80-90cm are fine. Melamine-coated planks are the best but in many cases we see plain plywood which should be the absolute minimum -regarding the surface quality standard. The most important thing is the construction of the set: they must be rigid, level and securely fixed to the ground so they don't move. Simple taped connections should be rejected, going for screw joins instead. In most cases the mast table is made up of at least 2 or 3 parts so we will have one or two joins to look after; the boom can be made of only one, but it must be securely fixed to the mast table itself, positioned around the lower limit point (~1,055m) and at right angles to the reference line (see Fig.1). Proper cutouts have to be made for the spreaders, and preferably for the compass bracket and any fittings near the bottom of the mast.

In addition, there must be space for the mast weight scale. A separate small table can be used, but if space (table width) permits and if you have a separate scale for the foils, you can use the mast table itself (Fig.1)

In general, avoid at all costs a setup using trestles because a) you will need measuring tapes to do the inspection instead of template marks (which are the fastest!) and b) the spars will bend so they will not be straight. See ERS H.4.1 and always remember that when checking permanently bent spars, measurements are taken along the spar! That might make a slight difference in masts with external sail tracks like the Goldspar where the top section is not inline with the bottom part.

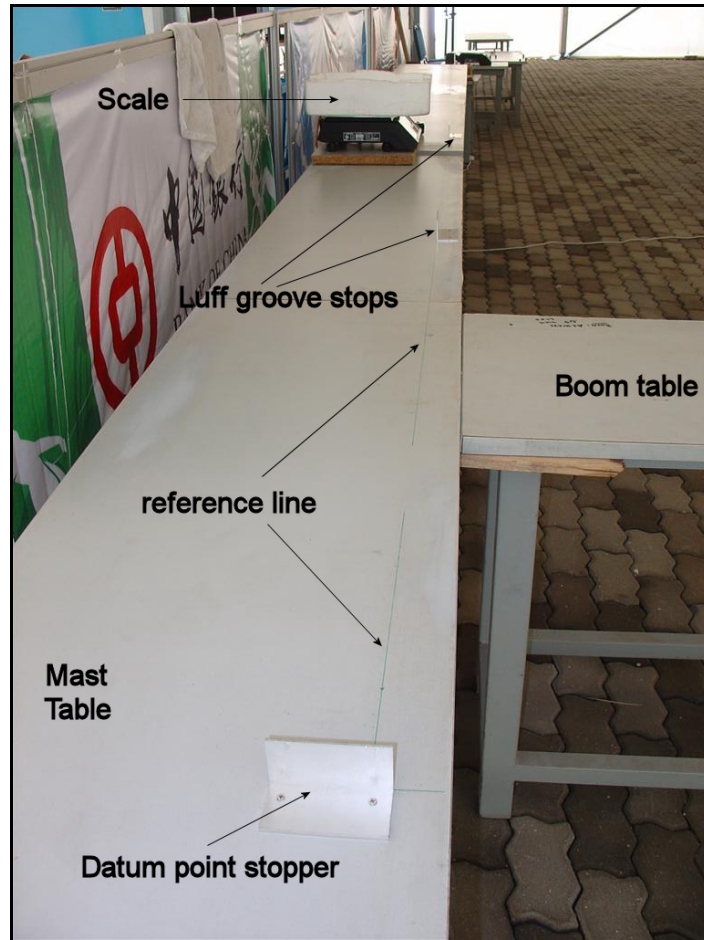


Fig.1 Basic mast/boom table setup

Fig.1 shows the standard mast/boom table arrangement including a scale for mast weighing. This example is made up of two parts, joined around the spreader height position. Since they were normal tables, they were joined by using a separate wooden piece screwed on top of them (Fig. 1b, under the scale); in case of a disposable plywood surface, a cutout for the spreaders may be accommodated instead (Fig. 1a), around 10-15cm long and ~10cm inside the axis line.



Fig. 1a



Fig. 1b

When the tables are positioned and fixed in a satisfactory way, then you can proceed to the template mark preparation:

- a) Draw the reference line, which is the axis of mast measurement (Fig.1). It doesn't have to be drawn all the way up the top of the mast but only around the areas where you take a measurement. That is near the heel, the gooseneck, the pole fitting, the spreader bracket, the hounds and the top. Use a laser beam straight edge instead of the traditional string: it is faster and more accurate. Use thin pencils and permanent marker pens. The thinner your lines, the better. Use color-coded marks when there are a lot of them nearby (e.g. at the hounds)
- b) Decide on the datum point position and draw a line perpendicular to the reference. That will be the mark for the datum point (heel) stopper.
- c) Mark the various measurement points. Near the spreader bracket you may use a reference mark lower than the actual point (2,790-2,810m), because of the cutout. Then you can use the reference point to check the actual spreader height. Fig. 2 shows a reference point at 2,700m. You may also use pre-formed templates for the shroud, trapeze, forestay and spinnaker halyard points (fig. 3), to minimize the time spent in hand-drawing marks. You will only need to find one point on the table, and then attach the template.



Fig. 2



Fig. 3

- d) Draw a line perpendicular to the reference line at the gooseneck position (1,055m from the datum). Use a laser square or the 3/4/5 triangulation method to set and verify the line. That will become the reference axis for boom measurement. On that line, mark the 2,650m point for the outer limit.
- e) Draw a line for the spinnaker pole on the boom table. Mark the 1,900m length at both ends.

At this point you are ready to install the blocks/angles which are needed to set the mast on the table.

- f) For the mast heel (datum point for most measurements), use a very strong aluminum angle as a datum point stopper (Figs 1 & 4). Normal aluminum angles are good enough, provided they are thick enough! Recommended sizes are 50X50X2.5 or 3mm (width-height-thickness), 100mm long. Fig. 4 shows a special thicker angle used by the Finn class. Whatever equipment you use, make sure it is square (vertical face is really vertical, and perpendicular to the axis of measurement (aft edge of spar), especially if you use a wooden block. Use screws to fix the stops tightly and mark their outlines on the table with a marker pen.



Fig. 4 Datum point stopper

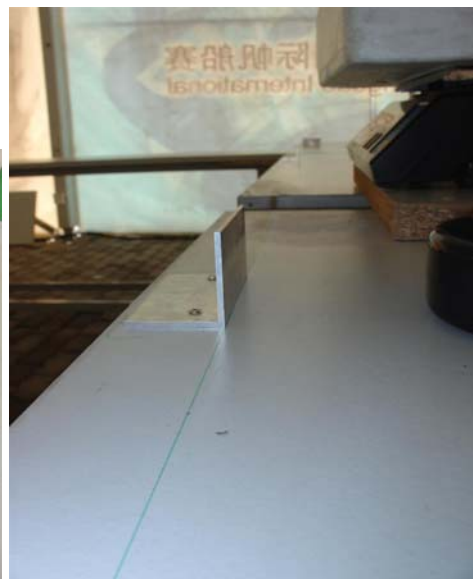


Fig. 5 Top luff groove stop

- g) To align the mast properly on the table, especially for checking the boom outer point, use at least two angles/blocks (luff groove stops in Fig. 1): one should be positioned about 50~60 cm above the gooseneck and the other above the spreaders (Fig. 5).
- h) Fix two more aluminum angles as spinnaker pole length limits at the marks made in step (e) (Fig. 6). These stops can be smaller in length (50mm).

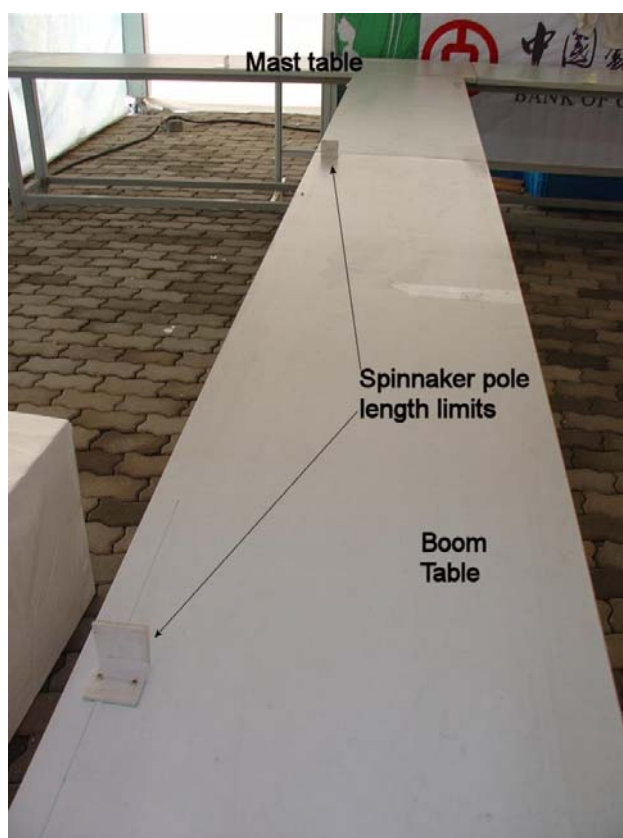


Fig. 6 Pole limits

- i) Cover all marks with clear tape to protect them from wet masts! Mark all table joints and the table legs on the floor, so it will be obvious if anything



moves during measurement time. It is also a good idea to have a copy of the rig rules taped on the mast table for quick reference, and to write down the dimensions of each mark next to it.

### 3. APPLICATION OF THE RIG TABLE TEMPLATES

Mast, boom and pole have to be clean, dry and with rigging properly fixed around the mast. Check that no extra items are "forgotten" on the mast, such as vang and jib tension shackles and/or blocks, Cunningham and inhaul ropes, and that all items are normal for their purpose: halyard tails that are two or three meters longer than necessary are obviously meant to increase weight! Extra heavy fittings and blocks are there for the same purpose and they should be removed. Use your judgment to ban this kind of items! (See at the end of the guide some examples). Ask the sailors to re-organize trapeze or other controls that are wrapped around the gooseneck and create problems for the inspector!

- a) Position the mast so the heel touches the datum point stopper; one of the two rig inspectors must hold it in this position firmly.



- b) Push the spar so the aft edge touches the luff groove stops. In this way the mast is properly aligned with the axis of measurement.



- c) Use a square tool (one aluminum angle like the stoppers, cut perfectly square at the edges is fine) to transfer the table marks on the mast spar,

especially when the inspected items are near the limits. Never check a mast without one! First item for inspection is the lower point limit mark.

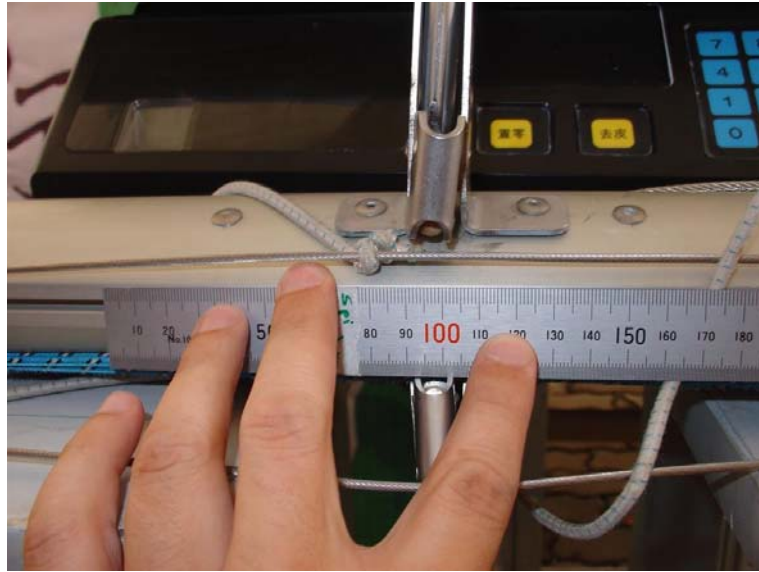


Position the tool at the reference line (left arrow) and then check the lower point on the mast (black tape, right arrow). Remember that the limit is a maximum, so the tape cannot be higher than the reference line! Do not fix a stopper at that point; the tool shown in the picture is movable!

- d) Check the pole fitting height (centre of fitting, mid-thickness).

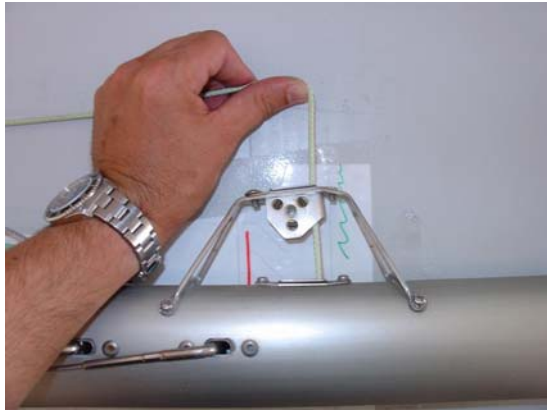


- e) Transfer the reference mark for the spreader bracket on the spar and then measure the spreader height with a ruler. A batten marked for minimum and maximum is also acceptable, but a ruler is giving clear view to the sailors who will always question our tool accuracy when their equipment is in trouble! Remember that the height is measured at the theoretical intersection of the bottom edge of the spreader with the spar wall, extended as necessary.



- f) Next, check the forestay, shrouds, trapeze and jib & spinnaker halyards. In case of doubt, remove the shrouds and the trapeze wires from the hounds to have a clear view of the rigging points. Be careful when transferring the marks from the table, and always measure with a tape from the datum point when you find items out of limits. Spinnaker halyard is to be held at right angles to the spar, and in case of a crane, always check the extension in front of the mast with the ruler or marked batten!





- g) To check the upper point, first make sure the lower limit mark is exactly on the reference line. If it is lower, then move the mast up until it hits the mark. One assistant must hold the mast in this new position before the other checks the upper point.

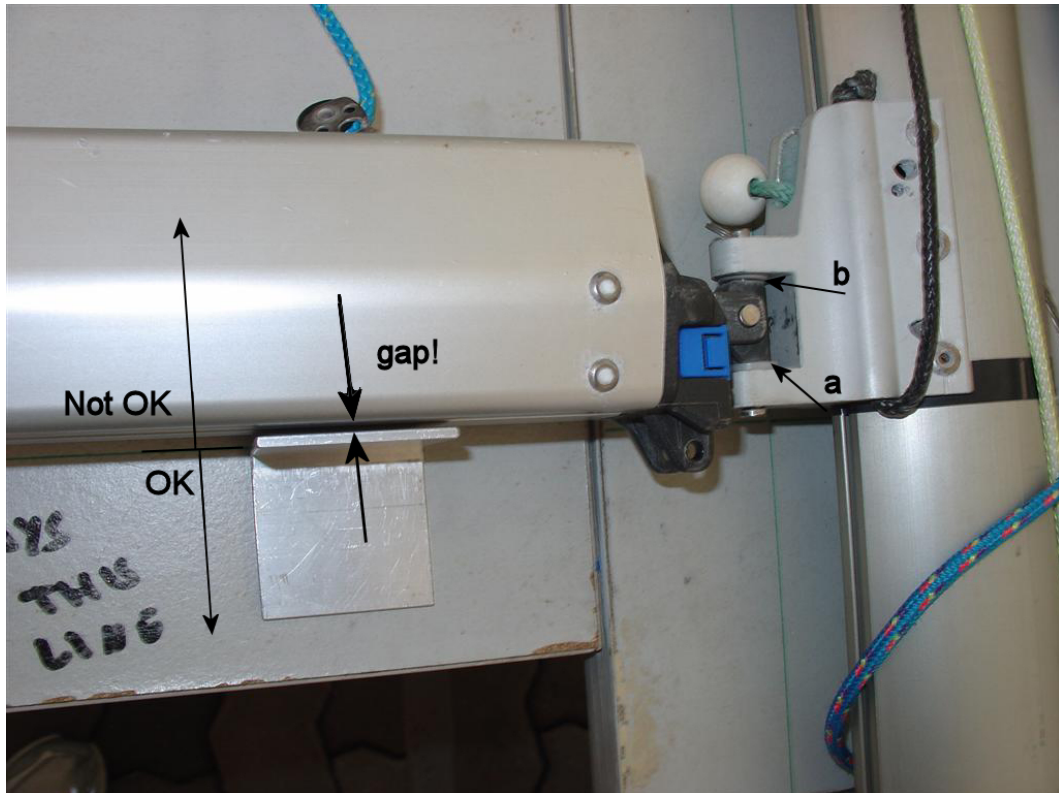


- h) With the mast in the last position, attach the boom to check both the outer limit and the height relative to the lower point.



Paint or tape at the correct position the outer limit mark, and check that the boom top surface is at the same level as the lower point or higher (it should be touching the square reference tool or pushing it over the reference line; if there is a gap, then the boom is positioned below the limit and the sailors must either a) modify the lower point –which means checking the upper point again- to match the boom or b) modify the gooseneck/boom combination to get to the correct height).





In this case, there is a gap between the boom and the reference line. However, moving the washer (a) to the other side (b), may correct all or the biggest part of the problem. Further modification of the pin by cutting the top (where it touches (a)) and extra washers at (b) may solve the remaining part of the problem. Always take extra time to EXPLAIN CLEARLY to the assistants the procedure of checking the upper point and the boom top surface! This is the most common mistake they do, and it shows immediately at the next event when you get masts "inspected" from the previous event but with the problem still there for everyone to see! Part of the problem is the full & partial inspection system we apply, so sometimes a partially inspected mast from the Europeans will be fully measured at the Worlds or one Junior Event: the problem will be revealed then because initially the mast was just marked with the event limitation sticker, and the sailor will complain that his mast was good in one event and not now! It could be a good idea to mark with a "P" or something to that effect the stickers for partially inspected equipment, both rigs and centerboards/rudders, for the next inspectors to see.

- i) Finally, just try to fit the pole within the two length limits (Fig. 6). The pole should go inside freely! Don't push it to go down, and never let the sailors do it! Your stops will be damaged in the end, and the poles are still longer! Because of that, do check again the distance between the stops from time to time to make sure it is still correct after the day's (ab)use.
- j) Mast weight is the last check: make sure there are no extras, like shroud adjusters or the vang system. For centre of gravity checks, you need to remove the trapeze adjustment systems and put the halyards in sailing position with the tails resting on the floor. Mark the 2,800m point on the spar, balance the mast there and see on which side it goes down! (The top should go down!)

#### 4) FINAL NOTES

For full measurement boats, all of the above steps have to be taken for proper inspection. For partial ones, only the limit marks have to be checked when they are missing or in bad shape, unless there is a special instruction in effect (such as data gathering, e.g. mast weight).

Mast & boom stoppers are not to be checked here. For full measurement, the fully rigged boats should be presented to the measurer and that's when it is to be done, while for partial ones, a visual check by the measurer before they enter the measurement tent is enough, unless the sailors ask for it. A quick look at the mainsail head and clew should give you a clear idea on the proper stopper position (e.g., for most North mainsails the boltrope is cut down at the top by 15~20mm, so the stopper has to go at least that distance down from the limit mark).

Always be on the lookout for strange/abnormal fittings whose only purpose is to increase the mast weight up to the 10 kilo limit. Those extra big fittings are good enough for a Soling or a J24, but not really needed in the 470 unless you are missing half a kilo of weight! Remember that from 2009, correctors MUST be used for differences up to 300 grams! No rigging/fitting changes are allowed if the mast needs less than 300 grams.

Also keep an eye for custom made gooseneck fittings! Some are made to exploit the 35mm limit for the pivot pin but if not installed correctly they can create big problems (to the sailors)! Finally, always ask the assistants to position the event limitation stickers properly (see below)!!!



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