



*the boat the world sails*

## COMMON MEASUREMENT PROBLEMS & SOLUTIONS

JANUARY 2024

The main measurement problems still found in the 470 Class are the incorrect positioning of the mainsail on the mast and boom with the associated stopper devices, missing spar limit marks and the lack of proper certificates for the hull. These are addressed below, along with some other less commonly found problems.

### A. SPAR STOPPERS

(Class rule C.17.4.b.4) The sail shall be set so that the highest visible point of it, projected at 90° to the mast spar, shall not be higher than the **upper point**; the aft most visible part of the leech, projected at 90° to the boom, is forward of the **outer point** on the boom.

According to the Equipment Rules of Sailing, the Upper point is the lowest point of the **upper limit mark** (the so-called “black band” at the top of the mast) at the aft edge of the spar (at the sail track). The outer point is the point on the boom **outer limit mark** (the “black band” at the aft end of the boom) at the upper edge of the spar, nearest the fore end of the spar (i.e. towards the mast)

To help sailors avoid disqualification, the class has adopted mandatory stopper devices on mast and boom. These should be separate devices if the halyard /outhaul arrangements do not ensure compliance with the class rules. Below you will find some acceptable solutions, but you may also try your own ideas. However, you should always ask for advice from the class measurers before you actually try them! It is better not to ask mast manufacturers to pre-install spar stoppers because they don't know the exact shape of the mainsail head used by their customers.

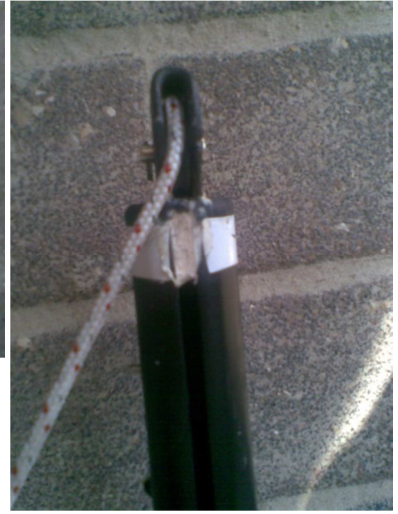
Solution No1: Mast head lock. Those who have this kind of fitting installed don't need a separate stopper since this arrangement offers only a single position for the mainsail. Just make sure your sail fits within the limits! In case of trouble, you may need to change the shackle to a longer one, or even trim the mainsail headboard a bit.



Solution No2: Tooth rack (for wire halyards only). If you use the last position (as shown by the arrow) or if there is only one, then it acts like a stopper, since you have only one possible position for the mainsail like the masthead lock. If the correct position for the halyard is the middle one for example, you must cut out the remaining teeth, or use another stopper solution.



Solution No3: Screw, rivet or other obstacle inside the sail track. This is an easy solution for masts with rope halyards and a clam-cleat.



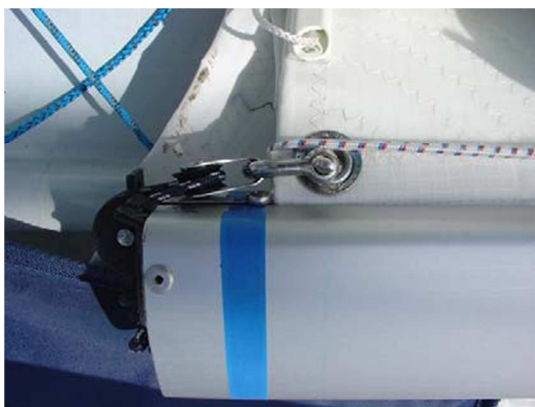
In these examples, the stoppers are positioned for mainsails with square-cut boltrope at the head. In the following picture, you see that if you change into a mainsail with cut-down boltrope, then the stopper for a normal mainsail will not work because the mainsail can be set higher than the limit point. In that case the stopper must be installed in the position shown by the arrow in the following picture:



A RIVET USED AS A STOPPER CAN EASILY DAMAGE THE MAINSAIL, CUTTING THROUGH THE TABLING AND NEGATING THE STOPPER EFFECT AFTER A FEW DAYS OF RACING. SOLUTIONS LIKE THE ONE SHOWN BELOW ARE MUCH BETTER.



A rivet, screw etc inside the sail track is also a common and easily made stopper for the boom outer limit point as well, as shown in the following picture:



In this example of a boom stopper, the rivet has been installed a few mm inside the limit. Again, the exact position of the stopper depends on the shape of your sail's clew. Sometimes there is a slider which extends outwards: in that case, the stopper may be positioned outside the limit mark because any attachment like a slider is ignored for measurement purposes. Again, check your particular mainsail first and then position the stopper!

Solution 4: You may tie a knot (and fix it by stitching) at the appropriate positions on your main halyard and the outhaul rope, so that the ropes cannot pass through the sheaves.

Any other ideas are welcome, but please consult a class Int. measurer first. Also note that rivets which don't go through the mast wall eventually may get slack and move to another position when pushed by the boltrope! Check your rivet stoppers frequently!

## **B. MAST AND BOOM LIMIT MARKS**

In the rules, you must have permanently painted or permanently taped limit marks ("black bands") on your mast and boom. On the mast you have the "lower limit mark" which controls the up and down position of the boom and the "upper limit mark" which controls the setup of your mainsail head. On the boom you have the "outer limit mark" which controls the mainsail clew. Class Rule A.1.5 states that "permanent marks" are those that get destroyed when you try to remove and reposition them. Therefore, painted (sprayed or brushed) limit marks are acceptable, and of course the original tape marks as supplied by the major 470 mast manufacturers. Electric or duct tape is not an acceptable solution as you can easily reposition it without destroying it. Note that the color of the marks must make contrast with the spar (you shouldn't use black or dark blue marks on black masts!)  
**NO SPARS WILL BE ACCEPTED FOR RACING IF THEY DON'T HAVE PROPER LIMIT MARKS!!!**

**WARNING! SOME SAILORS USE DUCT TAPE TO FIX THE WINDEX AT THE MASTHEAD: IF YOU DO SO, MAKE SURE THAT THE TAPE IS NOT COVERING THE UPPER LIMIT MARK!!!**

## **C. CERTIFICATION OF SAILS**

According to the class rules, no sail can be used for racing unless it has been measured and "certified" by an official measurer. Official measurers are those that have been appointed by the National Authority (National Yachting Association or Federation) of the country that certifications takes place, to measure equipment of the 470 class. They have the authority to measure and stamp sails only within the jurisdiction of their appointing NA, i.e. only inside their home country, unless they seek permission from

another MNA as well. We are working with the NAs to ensure that only trained persons are appointed as measurers and then registered with the class, and that they have proper means to certify sails (properly designed stamps, stickers or buttons where used; PLAIN MARKER PEN SIGNATURES WILL NOT BE ACCEPTED AS CERTIFICATION MARKS BY THE CLASS MEASURERS.

NO SAIL SHALL BE ACCEPTED FOR RACING UNLESS IT HAS ALREADY BEEN MEASURED AND STAMPED BY ONE REGISTERED OFFICIAL MEASURER. Therefore, if you plan on having new sails delivered just before an event, you must make arrangements for an official measurer to certify them. Our top sailmakers have already joined the World Sailing In-house certification scheme, enabling them to sell ready to race certified equipment without the need for additional certification by an official measurer, and we hope that more will follow their example. These sails carry special WS-issued certification stickers.

Important notice: Sail certification is not just one more obligation for you: it shows that you are using class-legal equipment and speeds up the inspection process at events.

#### **D. BOAT CERTIFICATES**

Each 470 owner must have two different document sets: One is the measurement form, which lists all the dimensions of the particular hull as checked by an official measurer before leaving the boat builder's premises. The other is the boat certificate, which is issued by the owner's National Authority or the National 470 class Association (the Certification Authorities). The certificate is obligatory if you want to actually race a 470 (rule A.11). It is the obligation of each owner to send his boat's measurement form (and a fee in some cases) to his NA and request a certificate. The certificate shows all the details of the boat, including the assigned sail number. Some NAs issue certificates using their own form, but it is not really necessary as the Measurement form of the boat actually includes a blank "certificate" page which they can fill and stamp. This Certificate template is also available on the ISAF website, so every MNA/NCA can print the two pages (cover sheet and the actual certificate) and fill them. Certification Authorities should retain the original measurement forms and issue stamped copies to the owners, together with the certificates. Please note that only original forms or certified true copies will be accepted!

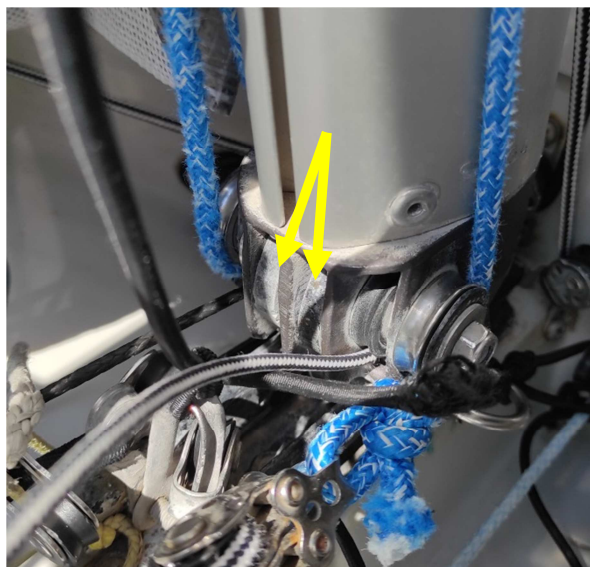
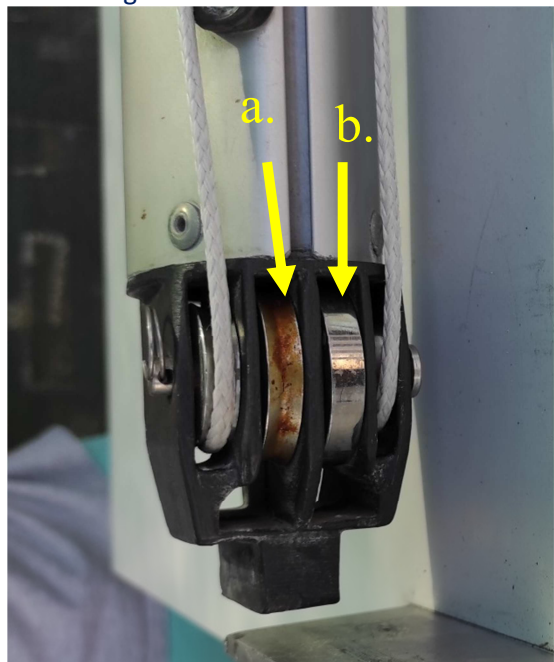
A last note on sail numbers: The certificate must show the sail number assigned to your boat, and there is also space for the numbers of other boats you might own, as you can use these numbers on any of your boats, and also the personal sail number you may have. Personal numbers are issued by your MNA or Class Association, upon request (and quite possibly for an extra fee). Make sure that your sail numbers are valid, and that the certificate shows them clearly. In case of using charter or borrowed boats, make sure you have a letter from your MNA/NCA that shows your official / personal numbers.

#### **E. MAST WEIGHT CONDITION (CR F.3.7)**

- 1) Only the fittings attached permanently to the mast shall be included. Vang shackles, jib halyard tension system blocks and ropes shall be removed before weighing the mast.
- 2) Timer and timer bracket (including the part which is attached to the compass bracket) shall be removed for weighing of mast (and boat). A typical timer bracket weighs around 50 grams so it is a considerable weight and cannot be ignored as "light".
- 3) All fittings, fastenings and local reinforcement for fittings shall be only for their normal purpose and shall not be used to increase the weight of the boat or its parts. This is CR C.6.4(b) and applies everywhere in the boat. Steel sheaves found in the mast heel fitting and which are not used for any system are contravening this class rule and have to be removed from the mast and boat. Such sheaves (sheave a in picture below) typically weigh 50 –and some solid sheaves (sheave b in picture below) up to 60 grams- each, so they are a considerable weight addition which cannot be ignored. These fittings shall



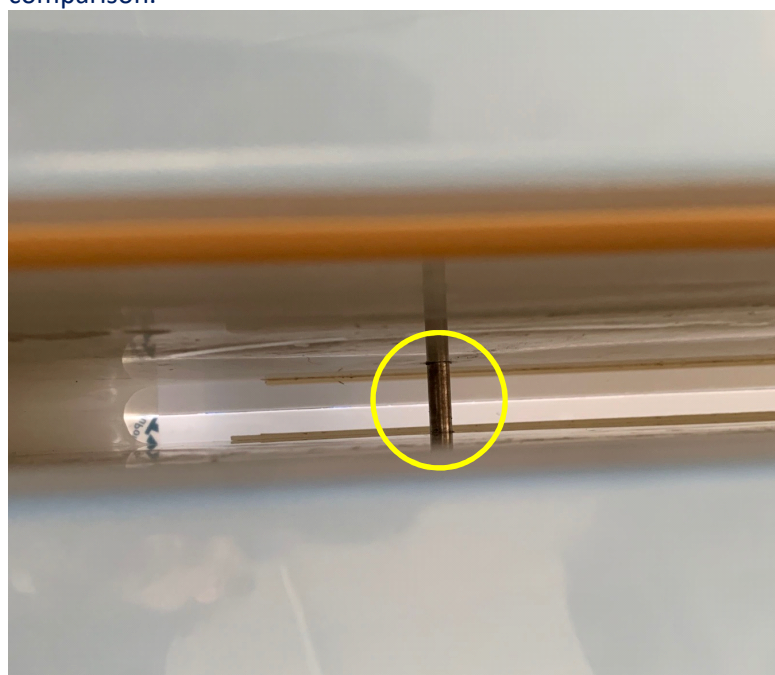
not be accepted at any class event but they may be retained if it is not easy to remove, as long as the mast weight and the boat weight meet the minimum limits without them (i.e. mast weight must be at least 100 grams over the limit if there are two such sheaves at the heel plug fitting).



Heavy fittings such as oversized vang or jib tension attachment points are noted in the inspection forms by our measurers and their presence is checked during the regatta. The same applies to heavier than usual trapeze handles and loops. Be advised that very heavy trapeze system parts are not only dangerous but may be rejected by a measurer because of CR C.6.4(b).

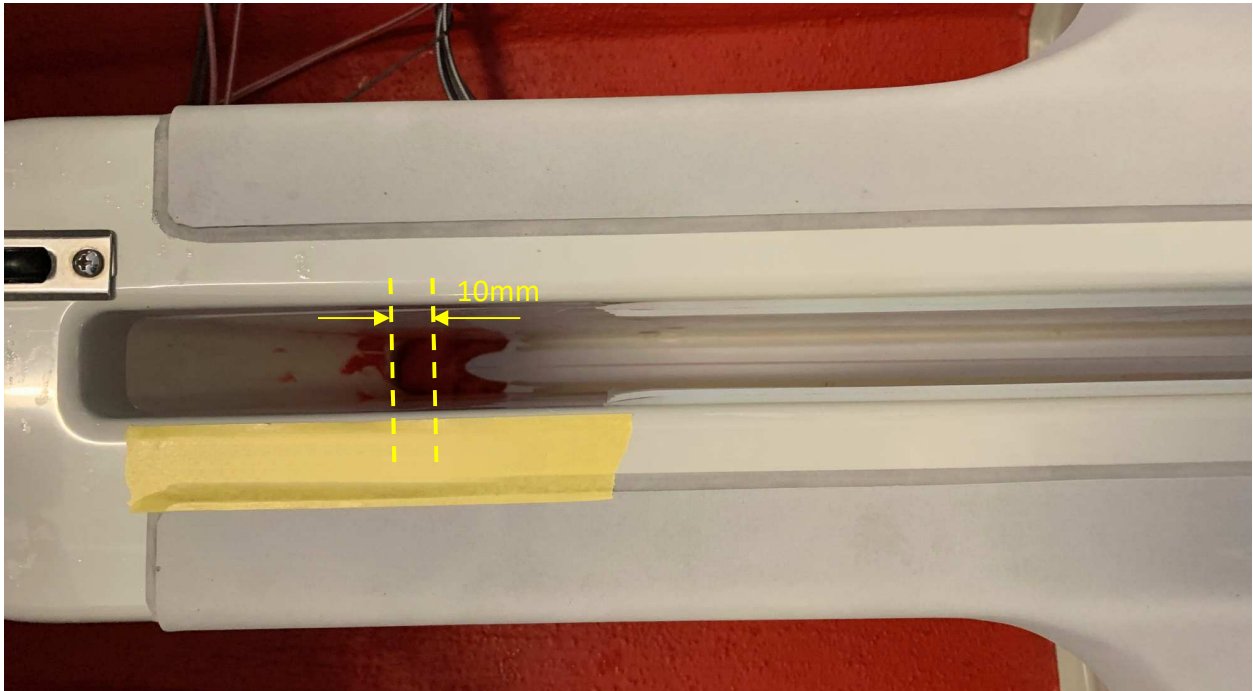
#### **F. CENTREBOARD CASE, CENTREBOARD PIVOT PIN**

The diameters of the centreboard pin holes on the centreboard case and the centreboard itself must be related to the diameter of the pivot pin itself. The differences permitted by the rules are small and only meant to allow wear and tear on the case sides. The pivot pin is to be presented during inspection for comparison.



The low friction material strips permitted on the case sides are only meant to close the gap between the case and the centreboard and cannot be placed in a way that allows the centreboard to gybe. They must have a uniform thickness in each side, and they should be placed so that they touch the maximum possible part of the flat section of the centreboard when it is fully down. See new Class Rules C.8.2(b)i and C.8.2(b)ii for the exact positions specified in the latest rules, for such strips at the lower and upper edge of the centreboard case.

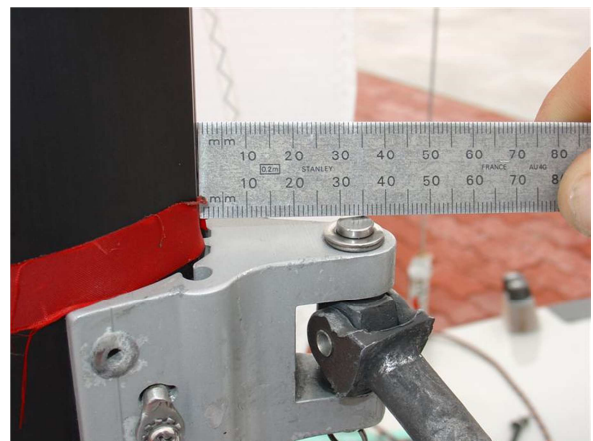
The front end of the centreboard case cannot be closed except by placing a 10mm thick bumper at the bottom end.



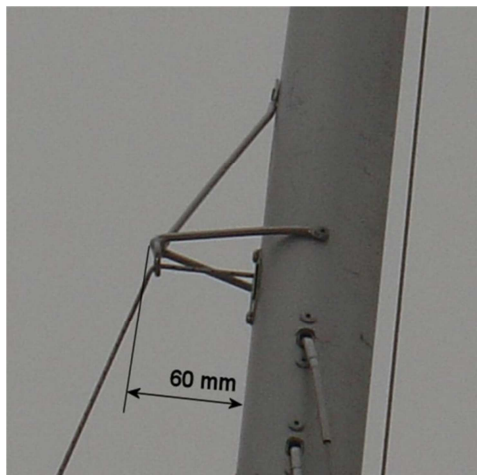
## G. OTHER ISSUES

1. Under the current rules, you may have wire, rope or both in any length for your trapeze lines. However, you should remember that masts have a minimum weight limit: A mast that is at the minimum weight when delivered from the manufacturer will go under the limit if the steel trapeze wires are changed to rope ones. The same will happen if the halyard tails are changed to very thin and light ropes.

2. Special extra-long gooseneck fittings should be installed with great care: Most of them have the pivot pin centre at or near the limit of the rule (max 35mm, the one measured in the picture is 33mm), so if you don't fix them on the mast correctly, the pivot may be a few mm outside the limit. That may happen if you leave a gap between the fitting and the mast wall.

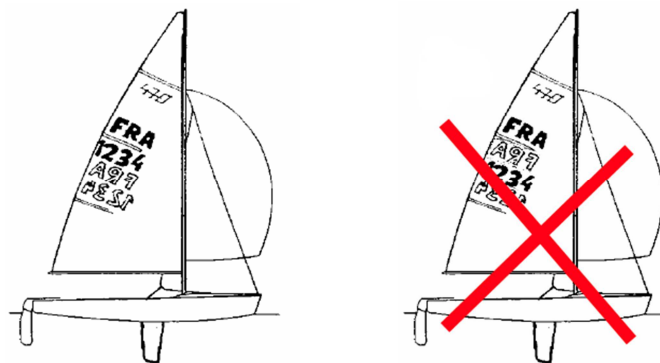


3. Spinnaker halyard cranes are to be positioned so that no part of the fitting itself is more than 60 mm from the mast spar. The measurement is taken to the outmost point of the fitting as a whole and not to the bearing point of the rope halyard!

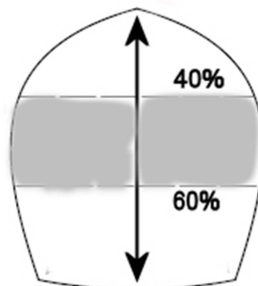


4. Towing rope is not to be carried inside the side tanks! It is safety equipment and like your personal buoyancy vests, it must be within easy reach at all times. Hatch covers are part of your safety equipment and they should remain closed at all times! An acceptable position for the rope is e.g. inside the starboard side spinnaker bag.

5. Sail numbers and national letters shall be positioned as in the diagram below:

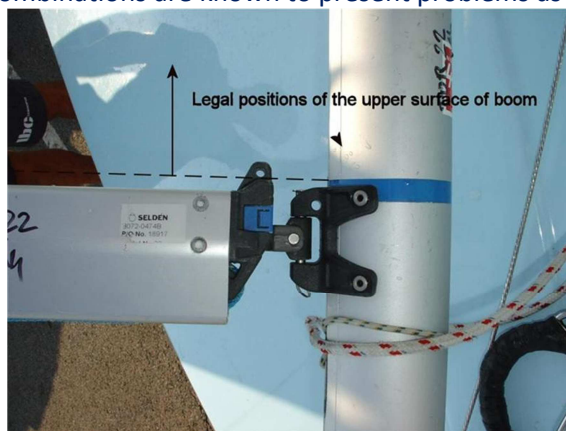


The national letters and sail number shall be displayed on the front side of a spinnaker but may be placed on both sides. You may put the letters in line with the numbers. However, they shall be displayed wholly below an arc whose centre is the head point and whose radius is 40% of the foot median and, when possible, wholly above an arc whose radius is 60% of the foot median. See diagram below:



The mainsail flag has a standard position, with a 50mm tolerance. Try to place it in the middle of this tolerance, because if positioned outside, it is very hard to remove and re-attach it without destroying it, especially so for vinyl flags.

6. Some mast/boom combinations are known to present problems as in the picture below:



The upper boom surface cannot be set below the “lower point”, which is the top point of the limit mark on the aft mast edge. Possible solutions for this kind of problem include:

- a) re-positioning of the limit mark at the boom level –which requires also the top mark to be moved down the same distance
- b) the modification of the gooseneck pin fitting to raise it (you need to move it up about 5mm) or
- c) the repositioning of the complete gooseneck assembly (not recommended)

You may also have problems if you mix masts and booms from different manufacturers, or modify the gooseneck fitting!

7. Personal equipment (carried by the sailors) only includes electronic or mechanical timers which may include a compass, and heart rate monitors, without additional functions/capabilities. Smartwatches do not fall into this category and are not permitted by the class rules.

8. Portable equipment (carried in the boat) may include one electronic compass using fluxgate sensors (no GPS) with specific limited capabilities, and electronic or mechanical timer(s). No other electronic devices are permitted, except those required by an event organizer in the NoR (like onboard cameras, trackers etc.)

9. The measurement form of each hull includes the actual measurements / dimensions / positions of certain fittings in the hull. The position of the jib wire on the stemhead (at the bow), the shroud holes on the chainplates and the centreboard pivot pin center in the centreboard case are such items, and their actual position is recorded in the form. If a different position (always within the tolerances) is to be used, then a re-measurement of the hull is required, followed by an amendment to the measurement form. No other position than the one recorded in the form is to be used for any item which is included in the measurement form. Any such modification without proper indication in the form is illegal and protestable at an event.

It is not so difficult to check the position of the jib wire hole with a ruler and an extension tool for the forward measurement point (FMP). The length of the hull is given in the measurement form





(from the transom to the FMP) and the jib wire hole position is measured backwards with a ruler. The value should be the same as the one in the measurement form.

#### CONDITIONS OF EQUIPMENT FOR MEASUREMENT:

According to our class rules, your equipment must be presented in a dry and clean condition. **Do not wash your boat** before presenting it for inspection and **do not go out sailing** on the day of your appointed inspection until after you finish measurement! Open the hatch covers and inspection ports and make sure there are no water and certainly no tools etc. inside the tanks! Boats that fail to satisfy these requirements will be sent away until they are dry and clean to the satisfaction of the class measurer. It is your responsibility to make the measurement time, if you are not ready before the end of the last measurement day, you risk missing the regatta altogether!

Masts shall be presented for weighing as specified in the rules: do not attach boom vang or jib halyard purchase fittings, windex and compass! A compass bracket may be included only if it is riveted or glued on the mast spar. If your mast is found to be underweight, you must first add correctors of up to 300 grams placed within 200mm of the upper point; if you still need more weight to make the limit, you will install the maximum permitted amount of correctors and then the difference can only be made up by exchanging fittings or rigging for heavier ones. Always remember rule c.6.4 "fittings shall be normal for their purpose and shall not be used to increase the weight of the **boat**"! Do not lose time in adding extra items that are not actually used for something, or swap normal for oversized fittings, because the class measurer will request their removal.

Deficiencies in boat weight shall be made up with corrector weights, unless the missing weight is in excess of 2 kilos. In that case, the maximum amount of correctors will be installed and fittings or ropes will be changed to heavier ones to make up the difference. New or modified equipment should be checked at home with the help of a national measurer: there can be no optimization once the boat is presented for inspection.

Dimitris Dimou  
Chief Measurer  
Int. 470 Class

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