

## Static calibration

### Hull measurement

Checking the hull for symmetry is the first step to getting ultimate performance from your boat. Most boats are not 100% symmetrical – typically the centreboard case may be slightly out (either vertically and horizontally or both) or the mast step may not be exactly centre. Most of these imperfections can be corrected or compensated for by the boat layout, spacers in specific areas or compensating rigging settings.

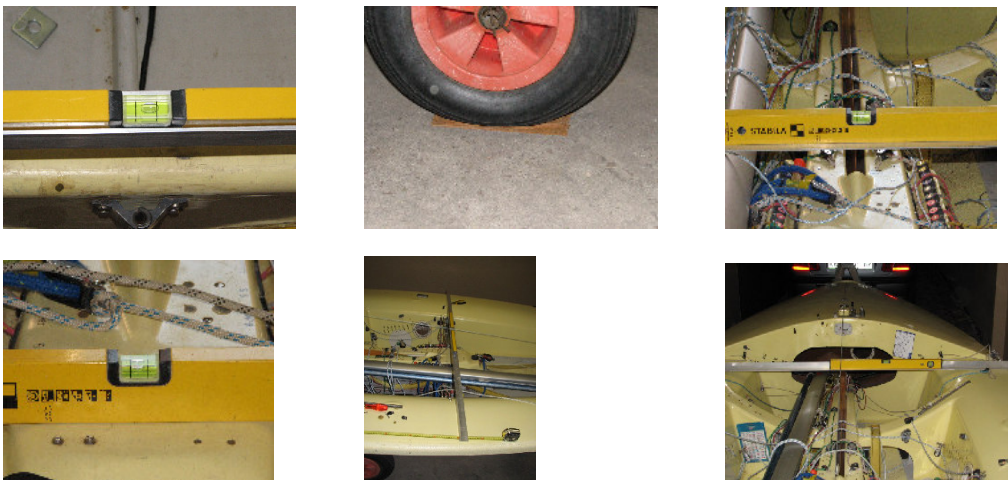
Setting the hull up for symmetry measurement requires some careful preparation as we're trying to make measurements on a rounded object – there is no straight surface that can act as reference point. Several possibilities exist here and the following is an example as applied to RSA8520. Feel free to improve!

First you need to create an accurate cross bar at the transom to allow the boat to be set-up exactly horizontal. I used two strips of wood and an aluminium angle section as follows:



Note that the wood strips are lining up with the lower limit of the last 300mm of the deck seam. Measure the amount of overhand of the deck seam over the hull (on the inside of the seam – nearest to the hull) on port and starboard. Adjust one of the wood strips to compensate for any differences. The angle section is then laid over the wood strips flush with the transom. Use masking tape (non stretch) to stick the wood strips to the hull.

The boat can now be set-up horizontally with the use of a level and some spacers under the dolly wheels. Also place the angle section at other (equal) distances from the transom and take some more levelling measurements there. You'll find that the boat is probably not 100% true (the two side tanks are not exactly parallel to each other) and you therefore have to work on averages.



Also use the leveller to find the horizontal fore / aft level of the boat by adjusting the bow up (or down) using a short stepladder and a rope for suspending the dolly from the ladder. Make some fore / aft as well as sideways levelling measurements close to the sidestay chain plates as well. Repeat the sideways and fore-aft levelling measurements until a good average is

obtained and the boat is as 'flat' as possible. Leave the leveller in place so that you can check the set-up from time to time during measurement.

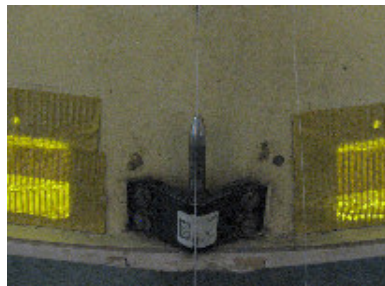
### **Forestay bolt**

Use three aluminium angle sections in an upside down triangle configuration around the bow so that the horizontal leg of the triangle is touching the forestay bolt and the other two legs are touching the side of the deck and are crossing and touching the hull near the waterline. Measure along the horizontal and the two vertical sections to see if the forestay attachment point is centre. In some cases it is possible to make a new hole in the forestay bolt that can correct a 5mm mismatch.

### **Rudder pintles**

With the angle section on the wood strips flush with the transom, find the centre point of the transom by measuring the distance between the intersection points of the wood strips and the angle section. Do the measurement two or three times making sure you get the best possible average result. Mark the centre of the boat on the top of the transom – I used a file to make a small (permanent) indent in the gel coat.

Using a small lead weight and a thin string (plumb line) check if the rudder pintles are in line with the centre of the transom as measured and marked above. Although this is not the final check for rudder alignment, it is very important that the pintles are as close as possible to the centre of the transom and as close as possible vertically aligned with the boat.



With the plumb line in this position, make a small (permanent) mark at the intersection point of the plumb line and the hull at the lower edge of the transom. Check that the hull is still horizontal before making permanent marks on the transom. As a cross check, measure the distance from the lower edge of the wood strips flush with the transom to the centre line on the lower edge of the transom from both sides and compare the distances. Hopefully this is equal!

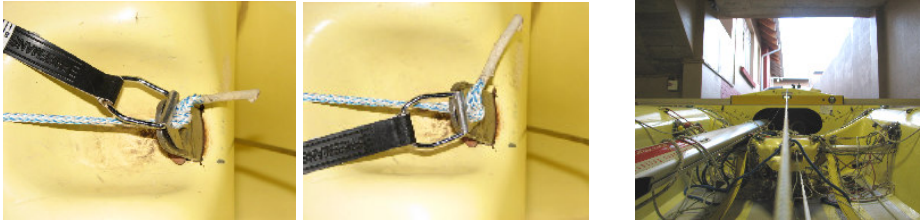
Use the mark on the lower edge of the transom to check the symmetry of the keel band. The section of the keel band visible on the transom must extend equal distances left and right of the centreline. Hopefully this is equal, too! If not, you have some work coming up ...

It is very important to get the rudder as close to the centreline as possible as an off-centre rudder will interfere with the alignment of the boat in the water which (via the centreboard) determines the lift qualities of the boat on a beat. If not centre, you will have to sail the boat with unequal weather helm on port and starboard to compensate – very confusing. It will also be difficult to align the centreboard and rudder vertically and you will not be able to get rid of that hum! If your current set-up is not good, it is best to remove the pintles, fill the holes up with class and epoxy, and refit then carefully and as close as possible to the centre of the boat and in line (vertically) with the centreboard.

### **Centreboard case**

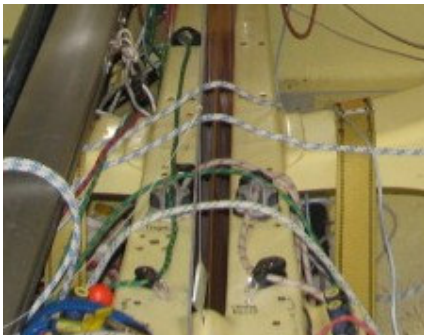
Suspend a thin line along the centre of the boat using the transom centre mark and the forestay bolt as aft and fore reference points. Lay the line over the mast gate such that the

line, if viewed from above the boat (slightly impossible), would be straight. Making the line as tight as possible and allowing it to slide over the deck at the mast gate can help you achieve this.



Attach a measuring tape to the forestay bolt (with the help of the centre line in this case) in a way that will allow as accurate a measurement as possible to both sides of the boat. The best is to use some set-up that will allow the tape measure to rotate around the centre point of the forestay bolt.

Now suspend the plumb line from the centre line rope above the centreboard case at various positions, making sure the boat remains absolutely horizontal (especially sideways). Make a mark at the point where the plumb line weight (would) touch the centreboard case and/or measure the horizontal distance between the plumb line and the top (rear) of the centreboard. This measurement is best made with the centreboard taken out of the boat.



You should make at least 10 samples of this measurement and using the average, determine the amount of offset from the centre line.

Now allow the plumb line to extend all the way down the centreboard trunk with the centreboard and the centreboard gasket removed. Again taking at least 10 measurements at different positions, map out the geometry of the centreboard case and determine if the centreboard case is vertical and in line with the centreline (from forestay bolt to transom centre point). Record everything carefully on paper, making some hand drawings to remember the measurements afterwards.

Most centreboard case symmetry problems can be corrected with the use of some spacers in the right places and possibly some customisation of the centreboard, bearing in mind that the centreboard can not be a-symmetrical as it will then move away from the centre plane when the board is lifted, causing big problems on the reach and run. Don't cut the boat unless you really have a serious problem.

### **Mast step**

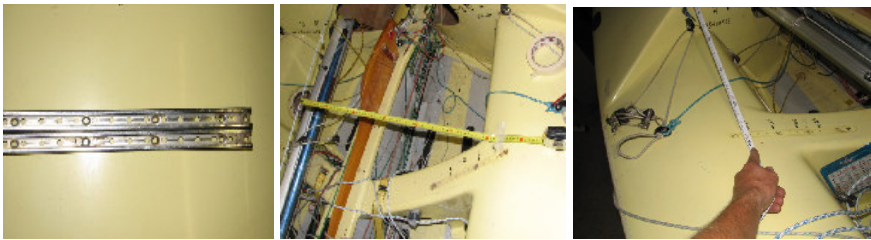
Use the same centreline and plumb line configuration to check the correct positioning of the mast step by suspending the plumb line through the mast gate. Take several measurements, check that the boat is still horizontal, get a stable average and make a permanent mark. It is also very important to get the mast step in line (parallel) with the centreline from forestay bolt to transom.

It is best to remove the mast step when this measurement is made. While removed, check that the area under the mast step is clean and make sure to seal the screws properly with silicone when refitting. The area under the (aluminium) mast step is often exposed to rain water running down the mast onto the mast step and into the boat. Have a good look at the area below the mast step down to the floor of the hull (in front of the bulk head) and get some repairs done if the glass coating is cracked or peeling off. Turn the boat on its side when you do this inspection.



### **Jib tracks and major pulley**

Make sure that the jib tracks have their corresponding holes in exactly the same position. Also make sure that (if using holes) there are enough holes to make at least 15 mm adjustments as a minimum. This is best achieved by removing the tracks and laying them next to each other.



Now use the centreline to determine equal distances from the centreline to the respective outboard limits of the left and right jib tracks. Make a few marks at different fore / aft positions.

Measure the distance from the fore stay bolt to both sides of the outer jib track settings made earlier. Take this measurement over the front deck. Make at least two measurements to both sides and find the best match. Make sure you get this measurement as accurate as possible – symmetrical jib settings are crucial! Also check that the jib cars are symmetrical and that fixed marks on the fair leads will result in equal configurations on both sides.

Measure the distance from the forestay bolt to the port and starboard fixed jib pulleys – the first pulley after the fair lead pulley normally attached to the inside of the side tank. This pulley must be as far back from the jib track as possible and as high as possible on the side tank allowing maximum jib slot adjustment range via the fair leads. Also check that the fixed pulleys are the same height above the floor.

### **Side stay anchors**

With the centre line and tape measure still set-up as above, measure the distance from the forestay bolt to the port and starboard side stay anchors, measured to the highest point on the respective side stay anchor saddle.

Make sure that the tape measure is rotating properly at the attachment point on the forestay, and try to let the tape measure follow the same (opposite) path over the deck when taking it to port and starboard. Take at least three measurements and establish an average.



With the aluminium angle section in place on the transom as described above, measure the distance between the side stay anchors and the point where the angle section intersects the wood strip. It is more important to make the front triangle (forestay to side stays) symmetric than to get the transom measurements match (hopefully they all match!), but the transom measurement can help you figure out where in the boat the symmetry problem lies (if any).

Also measure the distance between each side stay anchor and the centre line making a mark on the centre line so that the same point is measured from port and starboard.

The front triangle must be set-up as close as possible symmetric around the centreline as a mismatch in this will influence the reaction of the rig (mast) when tension and rake is applied. The front triangle, the spreaders and the stay anchor points in the mast all function as a (rather complicated) system that controls the rake and bending characteristics of the mast. First try to correct any mismatches by carefully marking and re-fitting one of the side stay anchor points until symmetry is achieved.

### Other symmetry measurements

Other important symmetry issues include the position of the mainsheet pulley in the cockpit and the triangle or traveller. Measure this relative to the centre line with the plumb line.

While the boat is set-up horizontally (sideways), fit a small levelling gauge preferably on the front bulkhead where both crew and skipper can see it. This is an essential training tool.

Check the symmetry of the trapeze shock cord attachment points relative to the centre line and the forestay bolt. This should also not be more than 80mm away from the side stay anchor points avoiding the crews feet (and legs) to be placed in front of the trapeze shock cord.

There will be several other rigging items (control lines, toe straps, jib cleats) that can be checked for starboard / port symmetry around the centre line which should be corrected where possible. Making the boat as symmetrical as possible limits the amount of adjustment you have to make when changing from port to starboard, allowing you to focus better on useful things.

### Sample measurements

The following table lists the hull measurements made on RSA8520, a late model Kyrwood from 1995. Note that this will only be useful to you when used on a percentage-based comparison. For example, you can compare the ratio of the side stay chain plates to the forestay – to – station 11 measurements, and compare this to the ratio obtained on your boat. Record all the measurements (and possibly some other hull dimension measurements that you think may become useful in future) and store them safely to be used later when comparing mast measurements and rake settings.

Description	Measurement (mm)
Forestay bolt to station 11, measured over mast gate on centreline.	5756
Left side stay chain plate to station 11	2622
Right side stay chain plate to station 11	2624
Left side stay chain plate to forestay bolt	2306

Right side stay chain plate to forestay bolt	2304
Ram attachment (split pin) on deck to forestay bolt	1282
Jib track outboard limit to forestay bolt (over deck)	2450
Jib track outboard limit to centreline	886

### Hull care do's and don'ts

- Do not paint the hull, especially not in a different colour as the original gel coat. Paint only adds weight to the hull and doesn't last – especially not on the deck where your clothing will even remove the paint leaving you with a bigger mess than before. Adopt your ugly duckling the way it is – make friends with the colour, get tinted shades or avoid looking at it, it's anyway better to look outside the boat than on the deck.
- Always think five times before you drill yet another hole in the boat. Drilling holes in a boat may look like a fun thing to do, but every hole exposes the glass lay-up to more of the elements, which eventually leads to delaminating.
- Don't cut the boat. In some cases people modify (lengthen) the centreboard case in order to fit a longer centreboard. This involves cutting the floor of the boat open – don't do this! Go get some old wreck from the dump and cut that if you really need to.
- Avoid sitting or standing in the boat when parked on the dolly. In this mode, the boat is supported only by small areas on the dolly and unnecessary weight will damage the hull. It is much easier to turn the boat on its side if you need to do anything in the middle of the boat, on the centreboard or under the mast.
- Plan your work on the hull in a way that will always allow you to sail the boat more than it is being worked on. The best is to divide the work up into small tasks.
- Do not park the boat in the sun. Do what ever it takes to find a spot in the shade, or make some shelter that can be placed over the boat to avoid rainwater and the sun from letting the boat age years before its time. Make sure you open the self-bailers before leaving the boat.
- Make yourself a wooden beam that fits on the boat between the front bulkhead and the transom, parallel to the centreboard. This will stop a water puddle from forming at the back on the deck sail, which is additional weight carried by the hull while in storage. Also remove unnecessary sails (or other equipment) from the boat while storing it – limit the weight on the hull.
- Spend some money on the dolly, deck sails and under cover. No point you have the rigging and tuning under control and then you let some rusted old wagon ruin it all on your way to the venue.
- Don't use sanding paper on the hull. Only use proper gel coat repair kit, soap and burnishing compound, and lots of elbow grease. Don't repair scratches with epoxy as it will turn brown over time which will increase the urge to paint the hull – not good.
- Remove all the meatballs, bananas, wet cigarettes and sweeties from the boat after sailing. Nothing like a four week old wet meatball in the front compartment...

In the next issue we'll look at mast measurements. Please feel free to make some contributions. Most importantly, take the boat sailing!

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