

Taking lines off a hull

First steps to making a lines drawing

Introduction

It is useful to be able to take an accurate set of measurements off a hull or master when required. Checking the symmetry of a master plug, and/or its faithfulness to the original lines, can be a reassuring step before finishing the surface prior to taking off the mould. Creating the lines of an existing hull may be a necessary step before starting remedial or re-building work. Establishing the lines of an existing design for which plans are not available can give insight into what makes a boat tick.

The process involved in taking those measurements is described below using a 6 Metre hull as the subject.

Tools required

600 mm or longer straight edge

Steel rule

Square

Surface gauge

Template gauge

Pens, pencils

Preparation for the work

Use a flat surface large enough to support the hull inverted and leave working space all around.

Draw a straight centreline with perpendicular lines at a spacing equal to one-tenth of the expected waterline length on the work surface (a large sheet of paper taped securely to the work surface is recommended). If you don't know the true waterline length, just take a guess.



Label the perpendicular lines. The traditional way is to label the aft waterline ending as 'zero' as that is usually the zero datum for all fore and aft dimensions.



The process

Place the hull on the grid with the aft waterline ending on the zero datum and the centre of the bow and stern over the centreline.



Check the height above the working surface of the forward waterline ending. A surface gauge makes this an easy task. Repeat the process for the aft waterline ending and, if the heights are not the same, use parallel blocks to raise the lower end of the hull.



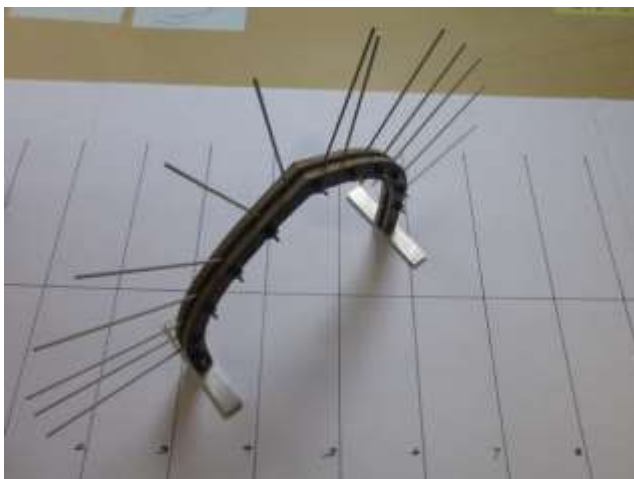
Check the heights again to ensure they are the same. The process described is not dependent on this being achieved with high accuracy but the lines will be more representative of the normal floating condition if this is reasonably correct.

Note the height of the aft waterline ending above the working surface. It is 130 mm in this case.

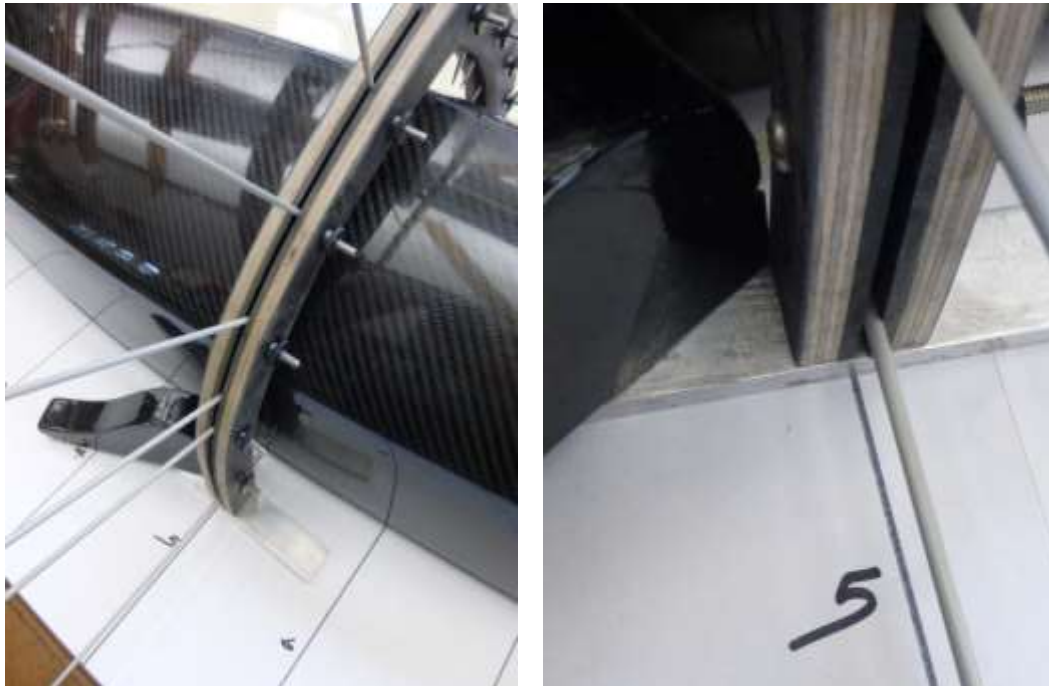


The template gauge used at SAILSetc comprises two shaped pieces of 9 mm ply that clamp together, using a series of M4 bolts and lock wheels, onto a number (*) of 3 mm diameter alloy rods with pointed ends (knitting needles). The pointed ends are smoothed to prevent damage to the hull surface. The inner faces of the shaped pieces are covered with 3 mm thick rubber sheet to provide a good grip on the rods. The whole is provided with 'feet' that support the frame perpendicular to the working surface.

(*) The recommended number of rods is between 13 for a smaller or narrower hull and 17 or possibly 19 for a larger or wider hull. It is an odd number because one rod will be used near the middle of the gauge to identify a point on or close to the hull centreline, while the remaining rods will be spaced around the gauge, half on one side and half on the other.



Slacken the lock wheels and withdraw the rods so that the template will clear the major section of the hull. Place the template gauge over the hull and position the plane of the rods accurately on the largest section – normally 4 or 5. Hold it in place with weights.



Once it is held firmly in place start to move the rods in towards the surface so the points are just lightly touching it. Start with the lowest rod on each side which should have its point placed on the deck edge. If the hull has a radiused deck edge, either estimate the point that the deck edge would have been at before the radius was added, or take the 'deck edge' as the point on the hull which is 10 mm, say, below the deck level.

Move the other rods in towards the surface until they are all just touching the surface. It is not very important to keep the rods themselves equally spaced or in a particular fan pattern, but it is useful to have the points of the rods spaced so that: (a) one point lies on or close to the hull centreline, (b) one point lies close to each estimated waterline, and (c) the other points are distributed around the hull surface so they are a little closer where the surface shows a tighter radius, and correspondingly are a little further apart for a more open or flat surface.

Lastly, mark the hull centreline clearly on the hull surface – white mark in the photo.

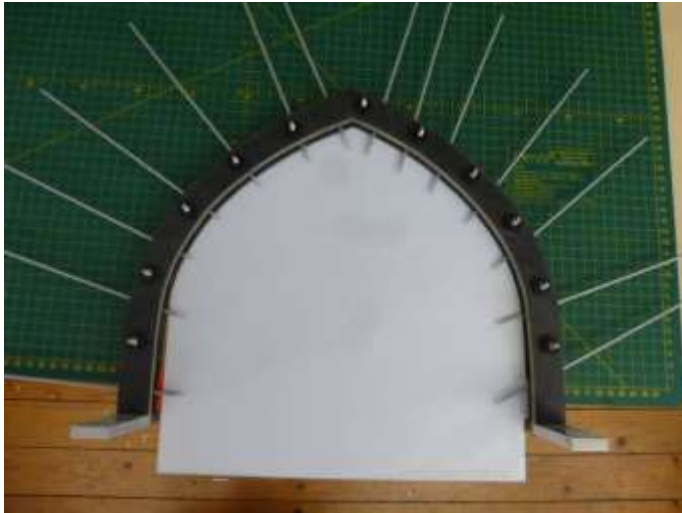
Check that the fore and aft position of the gauge is correct and tighten all the lock wheels. Withdraw the gauge, taking care not to disturb any of the rods.



Use small tabs of double sided tape to stick a sheet of paper or light card to a piece of timber carrier which is shaped to closely match the inside of the template gauge – in fact it is the timber cut out of the frames. Trim the paper to the shape of the timber carrier.



Place the template gauge over the timber carrier and its paper. If the timber carrier does not closely match the aperture of the template gauge, secure the carrier in place in the gauge with light self-adhesive tape such as masking tape. Take care not to disturb any of the rods.



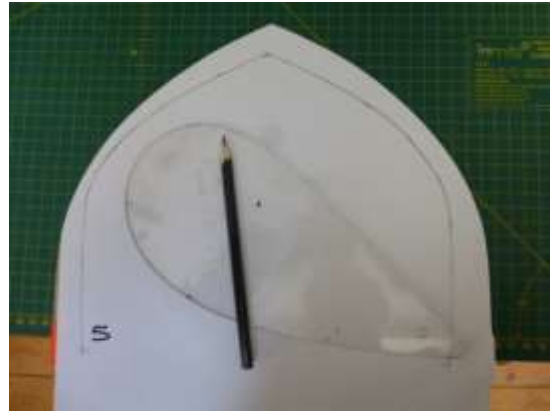
Mark the ends of the rods on the paper as shown below. Each deck edge has a right angle mark ("L"). Draw a horizontal base line on the paper representing the working surface. This may be conveniently done using a ruler resting against the gauge feet.



Loosen the lock wheels and withdraw the rods. Detach the timber carrier with its paper record from the gauge. Do not remove the paper just yet.



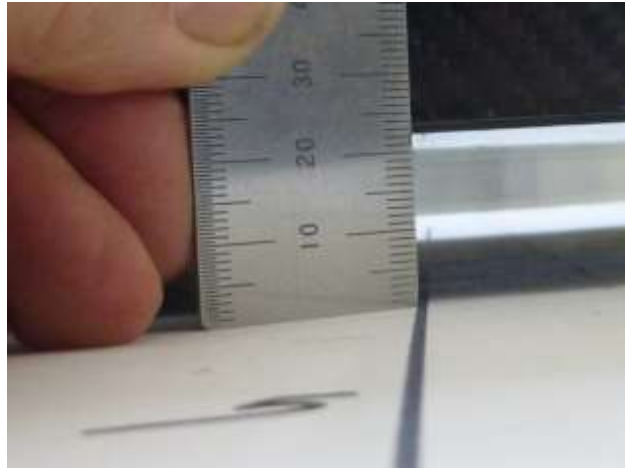
Use traditional curve tools or a flexicurve to join the marks as faithfully as you can to create a fair representation of the section.



Use the surface gauge to measure the height of the hull centreline at the station at the centreline mark made earlier.



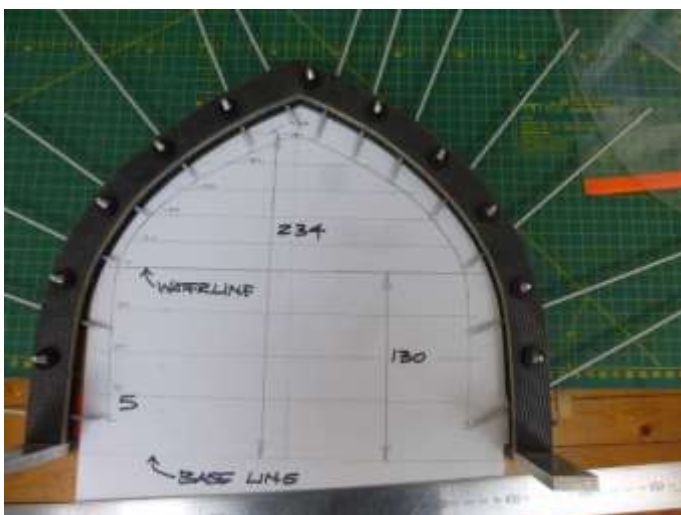
The height above the working surface is 234 mm in this case. As a precaution the height of the deck edge can also be checked – 22 mm in this case.



Check that the height measurements of 234 mm and 22 mm agree with what is found on the paper record. The 130 mm measurement is the height of the aft waterline ending taken earlier.

Draw horizontal lines at 20 mm spacing below the waterline, at the waterline, and 30 mm spacing above the waterline. Adjust these spacings as may be appropriate for smaller or larger hulls.

Carefully peel the paper off the timber carrier.



Repeat the process for each of the other progressively smaller sections at stations along the length of the hull - towards the bow in this case. Then start again at station 4 and work aft from there.

At this stage you will have accurate representations of each of the sections each marked with a datum line (the waterline) that will allow the creation of a lines plan using the traditional methods.

Tips

It may be helpful to tape the hull down to the working surface using a low tack self adhesive tape such as masking tape.

For plumb ended hulls (IOM and Marblehead) base the grid on the overall length rather than the waterline length.

Quite accurate lines can be taken off IOM and Marblehead hulls using data taken at only seven stations (bow transom, stern transom, and five others in between) if time and effort needs to be minimised. Divide the length into six for this.

For 6 Metre hulls it may be preferred to place stations exactly at the stern and bow girth stations rather than the local 1/10th stations.

Graham Bantock & Lester Gilbert