Measuring the shape of the hull

Defining the hull shape requires the use of special equipment – a measuring jig or a measuring bar to check and mark the measuring distances of the hull.

(i) Measurement of the hull when using a jig

The rulebook diagram "*Section D - Principles of hull measurement when using a jig*" shows the principle of the measurement jig and how to set the hull in the jig.

The measurement starts with positioning the hull upside down on the jig. The jig shall consist of a horizontal frame showing distances from the hull datum point (HDP) to Sections in the horizontal plane and of a vertical frame showing the base line above the keel. This allows positioning the hull at the required distances from the base line on Station 0 and Station 8.

The boat has to be firmly supported, bottom up on the horizontal frame in such a way that the base line is set exactly at x + 201 mm at the HDP and x + 52 mm at a point 4000 mm forward, measuring along the base line, x being constant for the particular jig. It is practical that the bar defining the base line must rest horizontally. Although the principle of measurement only requires right angles between the elements of the jig and hull, situating the bar horizontally allows for a number of points to be found with spirit level.

The beams of the jig should be situated at least at Stations 1, 2, 4, 6, 8 (i.e. 500, 1000, 2000, 4000 mm horizontally from the HDP. They serve, together with the vertical posts on the horizontal bar, to define planes of sections where templates are applied or cockpit measurements made.

Using the measurement jig during Major Championships and the Olympic regatta still creates inconvenience. The transport of a precise jig, which is strong enough, is difficult, while building the new one for every regatta in different places is expensive and time consuming. Instead of the jig, the measurement bar system can be used.

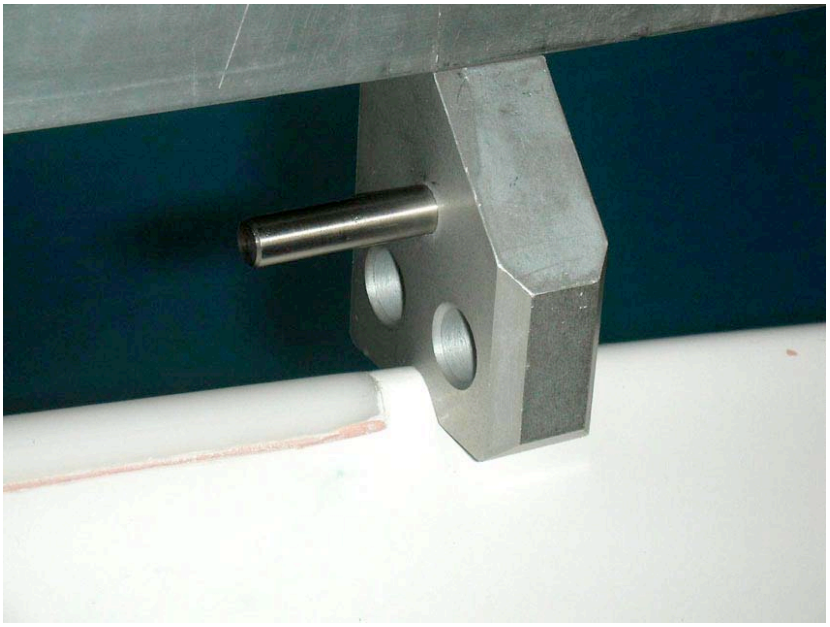
(ii) Measuring the hull when using measuring bar (Strongback)

Tools: A set of approved Finn templates, Strongback, level (water or laser), sheer finding gauge, small angle, angle with long arm (in case Strongback has no swinging arm), ruler 30 cm, straight wooden bar 160 cm long, plasticine, 4 wooden wedges 1-10 mm to hold the templates in place, masking tape 15 mm, pencil and felt pen, scissor-type car jack, 2 trestles approximately 50 cm high.

The 'Strongback' is a straight aluminium bar approximately 4700 mm long with a cross-section of 100 mm x 18 mm x 2.5 mm, for example 6063-T6 (EN-AW-6063) SAPA profile no. 910-2041. Using proper joints it is possible to make the bar from three pieces. This way it is easy to fit the bar in the car or for airplane transport.

On one side, the lines across the bar for positioning of HDP, Stations 1, 2, 4, 6, 8 on the keel line and the nominal length of the hull (4495 mm) should be marked. Two supports of 201 (Station 0, Hull Datum Point) and 52 mm (Station 8) are used to fix the bar onto the hull so that the bar side lines are related to HDP, hull centreplane and the lower right edge is aligned to the hull base line. (See diagram and photos). The supports and the way they are fixed to the bar and the hull must keep the Strongback located the right way up and keep it in the position to mark the points on the hull.

One possible way is to build the bar and supports and keep them in the position, see photos:



Here, a vacuum foot and sticky masking tape is used.

Before measuring, the boat must be levelled on the horizontal bar and/or trestles at the end of cockpit and a scissor type car jack under the stem using a water tube or precise laser level. The Strongback's upper surface must be level.

(iii) Marking the position of sections and taking measures

Using the Strongback cross lines, mark the station points on the keel.

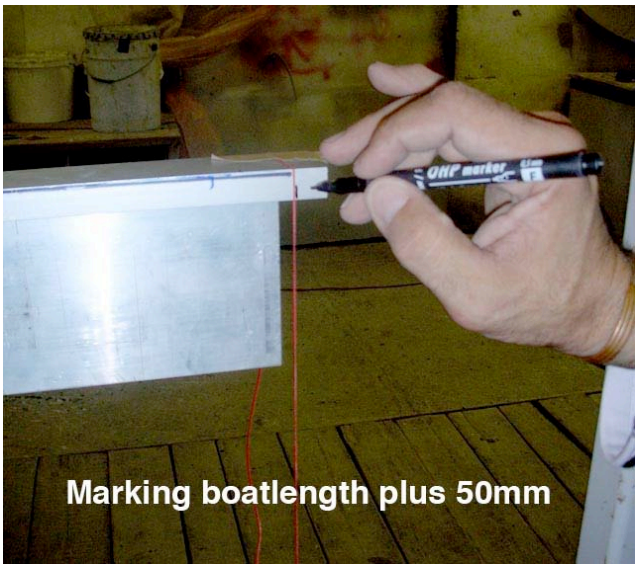
Measure the distances of the baseline, represented by the lower edge of the bar, below the hull shell at stations.

Check for verticality of the transom using an angle or spirit level. The maximum distance of the transom surface from the HDP plane (Station 0) as defined in Rule D.9.1 is 5 mm. Make notes of the distance of the transom to Station 0 for future use when checking the distance of the leading edge of the rudder to Station 0.

Using a metal angle with a long arm or, better, swinging a cross-arm with precise support (see photo) and plumb bob one can transport and mark the station points on the sheer according Section cross lines on the bar side. These points are used to locate the templates and later for cockpit measurement.

The overall length of the boat referred to the HDP (Station 0) can now be measured.

It is recommended to use a gauge similar to one used for marking sheer points on the deck.



Apply the gauge in position, using stick tape or removable adhesive. Using the plumb bob mark the horizontal distance (+ 50 mm for this particular gauge) of the bow from Station 0 on horizontal bar of the Strongback. The real distance is 50 mm shorter.

Now remove the Strongback.

Adjust and mark the position of the stem template's datum point according to the example in Rule D.9.1 - Checking stem profile with the template, (page 24 in rulebook). Measure Stem profile (outside stem band) to template, using a ruler, and Sheer above position marked on stem template.

The station points are now used to apply the templates and the clearances are measured in the plane of the stations, between the templates and the hull shell. Use wedges to position and hold the templates against the hull surface. Plasticine can be useful here. Take readings with a ruler. It is normal that a certain adjustment of the wedges is necessary to enable the template to fit correctly, while also allowing the sheer to lie within the tolerance, and also for the gap to be nowhere more than 10 mm. See diagram Section D.9.1 – Hull shape measured with templates (page 24 in rulebook).

Hull shell fairness, as in the original plans, is to be maintained throughout hull

construction according to Rule D.3.2 (f). Apply special attention to longitudinal hollows around Station 1 on the keel line. From Station 0 to Station 6, hollows in the hull form are prohibited. From Station 6 to Stem, hollows in the planes of the sections are prohibited. Minor distortion due to curing of plastic hulls is acceptable.

The keel bands and stem band are optional from Station 0 to the forward end of the centreboard slot. Forward of the centreboard slot the stem band and keel band are compulsory. Between Station 0 and 8, bands, if any, shall be made separately from the hull. The forward keel band may be tapered vertically for up to 25 mm from the forward end of the centreboard slot.

Measure the centre of the centreboard pivot pin above the underside of the keel, its fore and aft adjustment and the centreboard case slot. Check the maximum aft position of centreboard for compliance with E.2.5.(b).

(iv) Shape of decks and cockpit

Level the upright hull according to rule D.4. Mark stations 2, 3, 4, 5 and locate Station points in the cockpit floor, using a straight batten and spirit level. The way of measuring the smallest cockpit area is shown on D.4, is the same as max cockpit area. The diagram shows how cockpit limits are defined when a carling, or a bulkhead or breakwater, form a sloping surface at the cockpit ends. A sloping rear bulkhead is limited at floor level by Rule D.9.1, which is measured 30 mm above floor level. Regarding controls defined in D.9.1 and D.4 it is required that panels defined by the above-mentioned rules, when checked between measurement stations, have to be bound by imaginary straight lines connecting limits defined by the tolerances at the points controlled. Holes in the deck, covered by sheets of plastic are prohibited. Pieces of wood or any other materials to make hiking easier (such as hiking extenders) fixed to the deck, are allowed. They may be considered as fittings, but they must only be screwed or bolted onto the deck. They must not be glued, and thus made part of the deck.

Measure the top of the deck above the sheer at Station 0 according to D.4, diagram and D.9.1. Deviation of the top of the deck from the straight line should be measured according to diagram D.4 (page 20 in class rules), thwart and centreboard case dimensions according diagram D.3.2 and D.9.1., and distance from mast heel to underside of keel as stated on diagram, (page 26 in rulebook).

IFA, 2011