IRC MEASUREMENT MANUAL

IRCRATING.ORG

Updated November 2026

This edition of the IRC Measurement Manual has undergone a major review. Please read all sections carefully as text may have moved or changed from previous editions.

IRC MEASUREMENT MANUAL

Table of Contents

1. INTRODUCTION 3
2. GENERAL ROLE OF AN IRC MEASURER 3
3. RULES AND DOCUMENTATION 3
4. EQUIPMENT 4
5. ACCURACY 4
6. TECHNIQUES 5
7. PREVIOUS MEASUREMENTS 5
8. WEIGHING 6
   - 8.1 Weighing Equipment 6
   - 8.2 Weighing Condition 6
   - 8.3 Weighing Method 7
   - 8.4 Alternative Weighing Methods 7
   - 8.5 Load Cells 8
9. HULL 8
   - 9.1 LH – Hull Length 8
   - 9.2 Hull Beam 8
   - 9.3 Draft 9
   - 9.4 Overhangs 10
   - 9.5 Interceptors 12
10. HULL APPENDAGES 13
    - 10.1 Fin Keel Types 13
    - 10.2 Other Keel Types 13
    - 10.4 Lifting Appendages 15
11. SPARS AND RIG 16
    - 11.1 P, E, J and FL 16
    - 11.2 STL 18
    - 11.3 SPL 19
    - 11.4 Rig Types 20
    - 11.5 Aft Rigging 21
12. SAILS 23
    - 12.1 Mainsail 24
    - 12.2 Headsail 24
    - 12.3 Flying Headsail 25
    - 12.4 Spinnaker 25
    - 12.5 Storm Sails and Heavy Weather Jibs 26
13. PHOTOGRAPHY FOR RATINGS 28
14. OTHER ISSUES 30

APPENDIX 1. WEIGHING ON COMPRESSION LOAD CELLS 31
APPENDIX 2. OVERHANGS & WEIGHING OF SUPERYACHTS 32
APPENDIX 3. IRC ENDORSEMENT – PROCESS, MEASUREMENT & DATA STANDARDS 33
APPENDIX 4. MAINSAIL MEASUREMENT 33
APPENDIX 5. HEADSAIL AND FLYING HEADSAIL MEASUREMENT 34
APPENDIX 6. SPINNAKER AND FLYING HEADSAIL MEASUREMENT 36
APPENDIX 7. BULB WEIGHT MEASUREMENT 37
- A7.1 Weigh the bulb. 37
- A7.2 Designer/builder declaration. 39
- A7.3 Volume measurement. 40

APPENDIX 8. LEAD IN KEEL FINS 41
APPENDIX 9. FOILS MEASUREMENT 42
APPENDIX 10. LIST ANGLE MEASUREMENT 43
- A10.1 Equipment 43
- A10.2 Preparation 43
- A10.3 Movable Ballast 43

1. INTRODUCTION

The guide is intended to ensure good and consistent measurement practice by IRC measurers around the world. In addition to describing each measurement, some of the common mistakes and errors are noted.

Measurers should always consult the latest versions of the documents referenced in this Manual. This edition refers to the IRC Rules 2027: https://ircrating.org/irc-rule/

Terminology
The term 'measurer' is used generally in this Manual to describe both an IRC Measurer and, where the context permits, may include an owner measuring their own boat. It does not imply appointment or recognition as a **Certification Measurer** as defined by the ERS.

The term 'IRC Measurer' means a person appointed or recognised by the IRC Rating Authority or a Rule Authority to undertake measurement for IRC. This terminology explains how the term is used in this manual; it does not introduce or amend a definition in the IRC Rules. Where **certification control** is required, the relevant requirements and terminology of the ERS apply.

2. GENERAL ROLE OF AN IRC MEASURER

IRC Measurers should note the following:

- The IRC Measurer's responsibility is to achieve a fair and accurate result, rather than the optimum result for the particular owner. While you are measuring a boat for the owner you are also acting on behalf of the rest of the fleet to ensure fair racing.

- A professional approach and attitude is very important. The owner is paying for your services and wants to have confidence in the measurements you take, both on their own boat and also on their competitors' boats. The owner needs the confidence that you will be fair and accurate. In this context, if you are not sure refer to the rule book or contact the IRC Rating Authority (via your local IRC Rule Authority) for clarification.

- Always explain what you are doing and show the owner the measurement outcome, particularly if it you do not believe it is their favour. The owner may get an unpleasant surprise anyway when the certificate arrives; better that they should know there and then and understand why. Measurers should NOT however discuss the effect on TCC of changes. Owners should be advised to contact the IRC Rating Authority through their Rule Authority.

In the case of measurement for an Endorsed certificate, owners should contact their local IRC Rule Authority in the first instance who shall direct the owner to an IRC measurer.

PLEASE NOTE: Measurers should **NEVER** interpret IRC rules. If an owner asks you to interpret, or you are in doubt as to the meaning or application of a rule, you should contact the IRC Rating Authority through your local Rule Authority. Measurers do not have the authority to interpret IRC Rules. That right lies solely with the IRC Rating Authority.

3. RULES AND DOCUMENTATION

Measurers will need to have the following documentation available to them:

Document	Source
IRC Measurement Documentation	https://ircrating.org/irc-certificate/measurement/
IRC Rules	https://ircrating.org/irc-rule/
World Sailing Equipment Rules of Sailing (ERS)	https://www.sailing.org/inside-world-sailing/rules-regulations/equipment-rules-of-sailing/

The Racing Rules of Sailing (RRS) and Offshore Special Regulations (OSR) should also be available as they may be relevant to the measurement being undertaken.

The IRC Rules incorporate the ERS and use the convention that a word printed in IRC Rules in **bold** is being used in the ERS defined sense. This has then been extended such that a word printed underlined is being used in its IRC defined sense. IRC definitions are contained within IRC Rules as Appendix A. ERS definitions are not repeated in IRC Rules. Apart from direct quotes from IRC Rules or definitions, this convention has generally NOT been followed in this manual.

4. EQUIPMENT

With the exception of weighing, complicated measuring equipment is not needed. If full measurement is the target, the following will be required:

Essential:	
Steel tape measures:	5m and 30m (50 metres for large boats), EC Class II accuracy
Wooden (floating!) rulers:	1m and single hinge 2m
Spirit level with 45° bevel:	0.5m (minimum)
2 plumb bobs	
Sundry string	
Basic tools:	pliers, screwdriver, PVC tape, masking tape
Desirable:	
3, 8 and/or 10m steel tape measure	2m multiple hinge wooden ruler, EC Class II accuracy
2 more plumb bobs	0.15m - 0.20m spirit level
Callipers (internal and external)	Optical or laser level

5. ACCURACY

IRC Rule 8.10 states

8.10 Rated Dimensions

*8.10.1 Values stated on certificates for **LH**, **Hull Beam,** Bulb Weight, **Draft**, x, P, E, J, FL, MUW, MTW, MHW, HLUmax, HSA, FSA, PY, EY, LLY, LPY, Cutter Rig HLUmax, SPA, STL, SPL, STLFHmax are maximum values.*

*8.10.2 Values stated on certificates for **Boat Weight**, BO, h, SO, y, and **Internal Ballast** are minimum values.*

*8.10.3 If during **Equipment Inspection** by an **Equipment Inspector**, or during measurement carried out under Rules 10.2 or 13.6, any rated dimension is found to exceed a maximum value or to be less than a minimum value, then the **boat** is not in compliance with its certificate.*

8.10.4 Attention is drawn to Rule 13 and to RRS 78, Compliance with Class Rules; Certificates.

This defines clearly when a boat is not in compliance with her certificate. It is relevant to a measurer acting as an Equipment Inspector at an event.

The introduction to IRC Rule 9 states:

9 Rating review
Rule 9 does not apply to **Equipment Inspection** at an event.

Question: Who applies IRC Rule 9?
Answer: The Rating Authority.

Question: Who applies IRC Rule 10 (which refers to IRC Rule 9)?
Answer: The Protest Committee and the Rating Authority. A measurer never has any decision to take in the application of IRC Rules 9 or 10.

Attempts have occasionally been made to take the protest limits of IRC Rule 9.8 as measurement 'tolerances'. In other words, measured linear dimensions are adjusted by the protest limits. This is NOT the purpose of IRC Rule 9.8. **Measurers shall report the actual measurements found, which will be used for rating the boat.**

6. TECHNIQUES

Please note the following pointers to good measuring practice:

- Ensure horizontal measurements are truly horizontal. For instance, when measuring from a reference point to a plumb line, hold the end of the tape on the reference point and arc the tape behind the plumb line looking for the minimum figure.

- Ensure vertical measurements are actually vertical. For instance, when measuring draft ashore, allow the tape to hang freely. If it does not hang above your lower reference point, move so that it does.

- When measuring to a plumb line, hold the tape behind the plumb line. The required measurement is then clearly marked by the tape.

- Never measure between two plumb lines, always between each plumb line and a fixed reference point.

- Be very aware of the environment, particularly the effect of wind and/or current on plumb lines and free hanging tapes. On a windy day, use a weight to steady the tape.

- Never attempt to identify the waterline (e.g. for draft or overhangs) by reference to for example discoloured anti-fouling. This is firstly inaccurate in itself and secondly; this may be misleading if the boat was not floating in the correct trim.

- Whenever possible repeat a measurement, including any setting up. This practice is a good example of not only doing a good job but being seen to do so by the owner. Their confidence will be affected not only by your measurement but by the presentation of your measurement.

7. PREVIOUS MEASUREMENTS

Many boats will have had either ORCi, ORC Club, or certificates under other local measurement rules in the past. With care, some of the figures on the most up to date certificate may be directly useable. Others will require checking. In general, hull measurements will not have changed unless the boat has been modified. Others, such as rig and sail measurements will often need physically checking. Care should be taken to ensure that the data on a boat's certificate under another rule is real data as opposed to 'class standard' data which may be the case under for instance ORC Club and some local rules. Additionally, IRC definitions are in many cases not the same as definitions under other rules. Great care should be exercised in this respect.

Terminology and measurement abbreviations differ between rating and measurement systems. Different names may describe comparable dimensions, while the same name or abbreviation does not necessarily indicate an identical definition or measurement method.

For example, dimensions described as LH and Hull Beam under IRC may be recorded as LOA and BMax on an ORCi certificate, but the labels alone do not establish that the values are suitable for IRC. Particular care is needed with IRC STL and ORCi SPL, as IRC defines STL differently, and with sail dimensions, for which definitions may also differ.

Before using any previously recorded value, check the applicable IRC definition, the measurement points and method, whether the value is an actual measurement rather than class-standard data, and whether subsequent modifications or changes to the boat, rig or sails have affected it. Where equivalence or continued validity cannot be established, the dimension should be checked by measurement.

8. WEIGHING

8.1 Weighing Equipment

The weight of boats causes possibly the most dispute of any measurement; while an apparently simple procedure, it occasionally results in wildly anomalous figures. In most cases, this can be ascribed to inadequate weighing equipment.

When weighing for Endorsed Certificate purposes, an officially owned load cell shall be used unless otherwise agreed by the Rating Authority. Measurers should refuse to use a load cell that has not been approved by the Rating Authority or the local IRC Rule Authority. Experience has shown that weighings using officially owned or sanctioned equipment are close to 100% reliable. When other load cells are used, of the order of 50% of weighings are subsequently proved to be inaccurate.

The shackles for the load cells have to be carefully sized, not only for strength, but for match to the holes in the load cell. A minimum freedom of movement has to be allowed, otherwise any torsion or twist when lifting will be directly transmitted into the load cell, giving a potentially erroneous answer or damaging the load cell. If too much freedom of movement is given, the measurement can also be wrong.

The load cells can be susceptible to temperature changes., Care should be taken to avoid large temperature changes prior to weighing i.e. storing in a warm office prior to weighing on a cold day or a cold (air conditioned) areas before weighing in hot climates. When arriving on site open up the load cell and set up to allow as much acclimatisation as possible. Load cell battery level is also important. If in doubt, change or charge the batteries.

8.2 Weighing Condition

There are a number of traps the measurer can fall into when setting up the boat weighing condition. It is absolutely essential that the boat is EMPTY (see measurement condition in IRC rule 17). The measurer must be pedantic, inspecting every locker, lifting every board, and insisting on the removal of EVERYTHING, down to the toilet rolls.

Among things to watch for are:

- Bilges full of water.
- Mainsail on the boom.
- Anchors 'forgotten' under bunks.
- Water fuel and holding tanks. Watch for second (and third and fourth….!) water tanks.
- Chart tables full of charts and other rubbish.
- Portable electronic equipment (laptop computers etc.)
- Safety gear: horseshoe rings and Dan buoys on the transom.
- Gas bottles (and spares!).
- Fire extinguishers.
- Are removable cockpit boxes on board?
- Fenders and mooring lines as the boat is lifted.
- Running rigging shall be slack.

Do not treat the above list as exhaustive. Vigilance is the only answer.

Measurers should complete a weighing report form which should note any bunk cushions. The number of batteries on board should also be noted.

Water and holding tanks should be pumped dry and water ballast tanks shall also be empty. Fuel is more difficult and it is acceptable to deduct a known weight of fuel from the gross weight. If doing the latter, two means of estimating quantity should be sought. For instance, a fuel gauge, and a measurement of tank volume together with either dipping the tank or a sight glass. The fuel gauge alone should be a last resort. Diesel has a specific gravity of 0.85, i.e. 1 litre weighs 0.85 kg.
The only loose items aboard should now be fitted (but not necessarily fixed) bunk cushions, loose bunk boards, floorboards and washboards, and spinnaker pole(s). Make a note of the number of loose cushions for our records. Note: also, the number, identification if possible, and size of batteries (if there are an unusually large number of batteries, check that they are actually connected), and the quantity of internal ballast. In the case of production boats any deviations from standard, e.g. addition/removal of furniture such as doors and tables should also be noted.

8.3 Weighing Method

Having emptied the boat, the weight of lifting gear below the load cell (i.e. spreader bars, straps, shackles, etc.) must be found for deduction from the gross weight. Unless using an internal centre lift point, if the boat is to be lifted from the water, the slings should first be immersed. On some load cells, this weight can be zeroed out. It is left to the measurer's discretion whether they do this or notes the reading for later deduction.

When a boat is weighed, the overhangs should always be measured simultaneously. A weighing report should be produced defining what was on board and what was not, quantity of fuel and water, and overhang measurements.

The IRC Rating Authority's strongly preferred method of weighing is hanging the boat from a single point beneath a load cell. This may be either using a boat's built in lifting point or straps around the hull with or without a lifting frame/spreader bars. Provided that the weight of whatever lifting gear is used is tared off, it doesn't matter which. Experience over the years has shown that single point lifting to be by far the most reliable and repeatable method of weighing boats.

The boat should now be weighed twice, with all weight removed from the load cell between weighings. If any significant (+/-10kg) difference is seen, STOP AND FIND THE PROBLEM. Re-weigh the strops etc. to check finally that nothing has shifted. Again if any significant difference is seen STOP AND FIND THE PROBLEM.

Attention is drawn to the current IRC Endorsement Standards, available through the reference in Appendix 3. Consult those standards for the acceptable methods of establishing boat weight and any requirements for approval by the relevant authority.

Be rigorous in recording everything, and input all weights, notes and comments. Please do NOT 'adjust' the figures.

What can go wrong? Obviously, equipment still aboard will not help! There are however also many more subtle things. Wind and rain can have noticeable effects. Directly, wet decks and topsides can hold significant quantities of water. Wind will also always increase the figure read. Ideally, weighing should be carried out in light winds, preferably 10 knots or less and dry weather. It is recognised however that this will often not be practical. With care, satisfactory results can be achieved in stronger winds. It is also sometimes possible to find a sheltered location. It is therefore left entirely to the discretion of measurers when to abandon a weighing because of conditions. Measurers must always report actual conditions to the IRC Rating Authority.

When noting the weight of strops etc, read the sign (+ or -) on the display. Negative values are quite possible if the display has not been zeroed before use.

Please also note that the IRC Certificate now also includes Bulb Weight for boats with keel types 10, 11 and 12. How to establish this, if needed is detailed in Appendix 7.

8.4 Alternative Weighing Methods

Compression Load Cells

Historically, weighing on compression load cells was generally acceptable for an Endorsed certificate. Now, for the purposes of endorsement, this method has been moved to 'at the discretion of a Rule Authority'. This change was made firstly as a result of concerns over general reliability and secondly because the local IRC Rule Authority is the only body in a position to properly review the proposed process in each case. See Appendix 1 for more information.

Currently weighing a boat hung in a travel lift rolled onto compression load cells is **NOT** an approved method of weighing.

Recording the load in each sling of a travel lift by either load cell or the travel lift's in-built equipment is **NOT** acceptable. The latter particularly has been shown to be capable of errors of up to 50%! The former is erroneous to the extent that the slings are not vertical, either athwartships or fore and aft. Simple geometry shows that very small errors in sling angles rapidly combine to produce gross errors.

Multiple Hanging Load Cells

Weighing using an arrangement of two load cells is quite sensitive to alignment. The load cells need to be at the same height and angle, otherwise there is a risk of introducing error into the measurement.

The arrangement is also more sensitive to wind and independent crane movement using two lifting points.

Recording the load by multiple hanging load cells is **NOT** acceptable. A single-point lift remains by far the preferred approach.

Calculation
For very large boats, generally longer than 30.5m or weight in excess of 20 tonnes, the Rating Authority may approve calculation of weight from flotation followed by calculation and declaration of weight by the Rating Authority. See Appendix 2 for more information. The Rating Authority may delegate this task to the designer. If this approach is to be taken, the Rating Authority must first be contacted to discuss the proposed method.

8.5 Load Cells
Load cells shall be professionally calibrated at least once per year.

The accuracy of the weighing equipment must be sufficient for the measurement. The IRC Rating Authority uses load cells with a quoted accuracy of +/-0.2% of maximum capacity: +/-20 kg for a 10-tonne cell or +/-40 kg for a 20-tonne cell. A load cell should not be used to weigh a boat weighing less than 15% of its maximum capacity, unless the Rule Authority waives this requirement on an individual case basis; see section 8.5.

Compression load cells should generally follow the above standards. It is however recognised and noted that the ultimate accuracy of weighing on compression load cells is a function of the combined accuracy of all the cells rather than the accuracy of each individual cell and also of the methodology adopted. Rule Authorities are therefore advised to exercise care in approving compression load cells.

See also Appendix 3: IRC Endorsement – Process, Measurement & Data Standards.

9. HULL

9.1 LH – Hull Length
This is best done ashore. Owners should be informed in advance that the boat has to be set up level with the waterplane in Measurement Condition, which is a task that has to be performed before the measurer arrives. Hang plumb bobs on the centreline over the bow and stern. Measure from a convenient point on the keel or underbody to each plumb line and total for LH.

DO NOT: Include pulpits, pushpits, stemhead fittings, runner/backstay tangs, bowsprits, etc.

DO NOT: Measure LH with the boat out of level fore and aft. You will get the wrong answer. On occasion, measurers may find that a boat has been deliberately levelled bow up to minimise measured LH. Measurers are quite within their rights to require that the boat be re-levelled.

If necessary, LH can be measured afloat by dividing the boat into convenient sections, measuring each and totalling. E.g.: (Stem to mast) + (mast) + (mast to forward face of cockpit), etc. If doing this, be careful and check that reference vertical surfaces are actually vertical.

9.2 Hull Beam
Inspect for maximum hull beam station by sighting from off the boat. It is very desirable to do this from both ahead and astern of the boat if possible. It is easy to be fooled by the shape of the boat! Maximum beam is nearly always further aft than you think. If in doubt, check several stations to find a maximum value.

Having found the right station:

If afloat: Using a level held vertically at the point of maximum hull beam (ignoring rubbing strakes) measure inboard to a convenient point on the deck of the boat. Repeat from the other side. This method is not recommended as it is far less precise than ashore.

If ashore: Hang plumb bobs at the required station and measure in from each to a reference point on the hull or keel. Again, NEVER measure directly between two plumb lines.

9.3 Draft

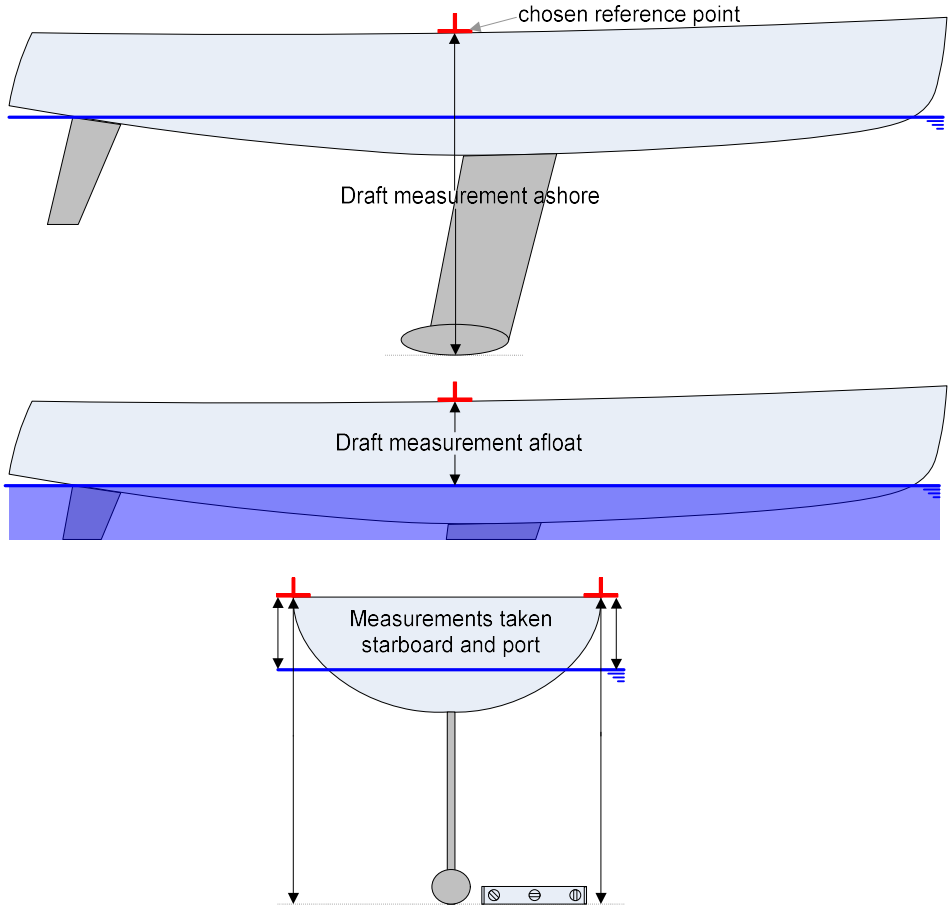
The boat will need to be seen by the measurer both ashore and afloat. It doesn't matter which is first. It is better to start ashore to determine the lowest point of the keel. As with overhangs, draft is measured in IRC measurement condition (see IRC Rule 17).

Ashore: Ensuring first that the boat is in level trim, establish a convenient reference point on each side of the boat above the waterline in way of the section at maximum keel depth. Using a spirit level, project horizontally from the underside of the keel outboard to vertically below the reference point each side. Measure vertically down from each reference point. Alternatively, if available, a surveyor's level may be used.

If measuring a drop keel boat, measurements will be needed with the keel fully up and fully down.

Afloat: Ensure first that the boat is in measurement condition (IRC rule 17), that everybody is off the boat(!), and that the boat is in level trim both fore and aft and athwartships. If doing the afloat measurement first, mark the reference points on the hull as above.

Using a wooden ruler, measure vertically downwards from the reference point each side to the water surface. By subtraction from the ashore figures, and then averaging the results, draft is found.



Draft = Draft measurement ashore – Draft measurement afloat

9.4 Overhangs

Please refer to the attached diagrams before taking any measurements. Before an IRC certificate can be issued, BO, SO, y, x, and h are required for EVERY BOAT.

The boat should first be inspected to ensure she is, as required by IRC rule 18, in measurement condition (rule 17). Other considerations are as follows:

- The measurement position for mast rake is with the forestay set to its maximum length and no tension is applied to aft rigging only the slack taken out.
- Centreboards, drop keels, canting keels and lifting rudders shall be down. Other hull appendages shall be in the up or retracted position.

If the required keel position cannot be achieved for measurement, contact the Rating Authority through the local Rule Authority before proceeding. Any alternative position and subsequent correction must be agreed with the Rating Authority, and the actual measurement position must be recorded.

Overhang measurements should only be taken in still water. Any current will offset the plumb line positions; even small waves can make overhang measurement very difficult.

Note that on boats with skegs, stern overhang is measured to the intersection of the actual hull (the canoe body) with the water, ignoring the skeg.

If the upper end of the rudder is above the waterline, it is preferable to measure SO on both sides.

Hang a plumb line over the bow and stern, ensuring that they are on the centreline and do not include any hull fittings.

Bow (BO): Using a floating ruler, position one end of the ruler against the bow at the waterline. Pivot the rule about this point towards the plumb line. Repeat as many times as is necessary to achieve a consistent result.

Stern (SO): Measurement can be difficult, particularly with modern designs with transoms low to the water. A dinghy or float is essential with an assistant to hold this in position. As with the bow, position the end of a floating ruler against the required measurement point and pivot the ruler about this point towards the plumb line. Repeat as many times as necessary to achieve a consistent result.

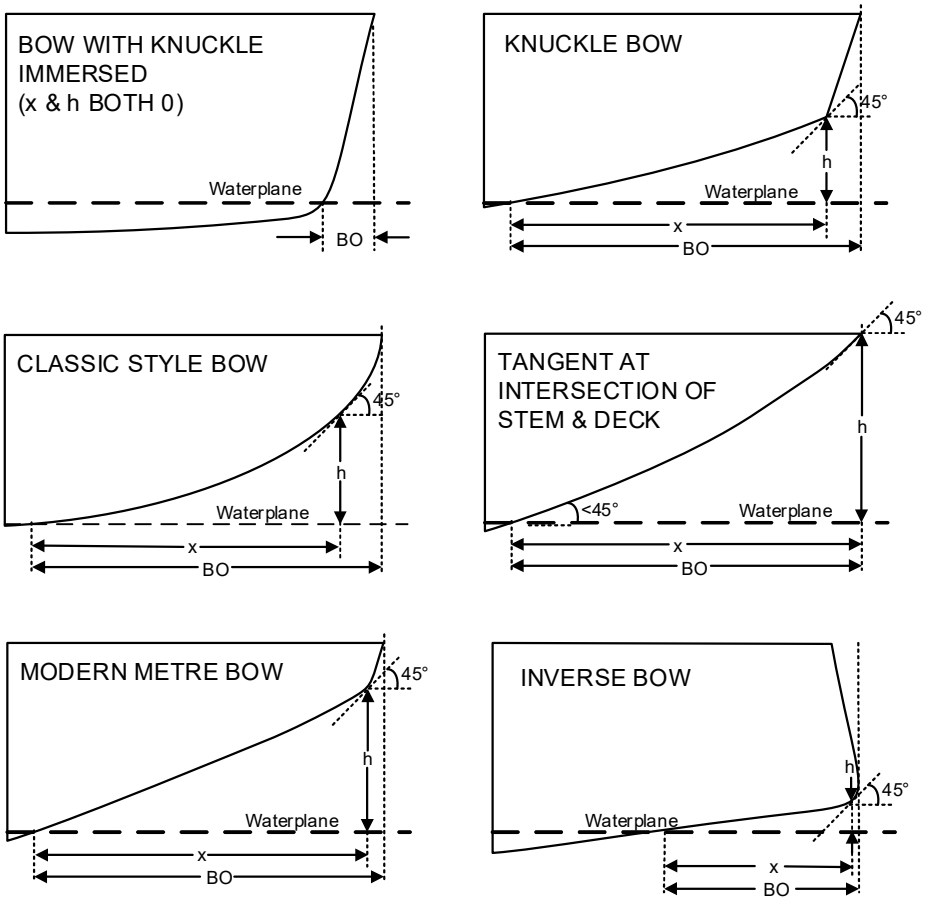
y: In all cases, the dimension 'y' should also be supplied. Note that if the transom is immersed the amount of immersion should be declared as a negative y value. Measurement is straightforward.

x and h: If the boat has a flying bow, measure also x and h. Note that *any boat* on which the stem leaves the water at an angle of less than 45^0 has a flying bow. This includes boats with 'classic' bow shapes and *this tangent may be at the intersection of the stem and the deck.* The diagrams define the exact measurement points. x can be awkward to measure. h is straightforward once the measurement point has been established. If there is no flying bow, please say so and input 0 figures for x and h.

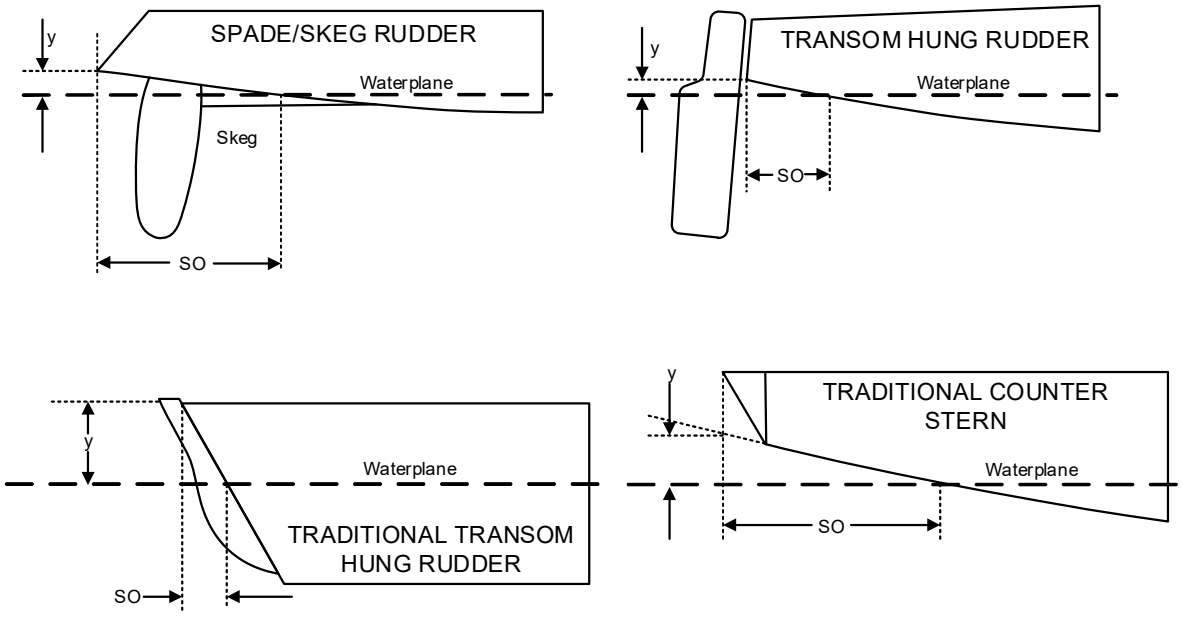
As an alternative to direct measurement of BO, x and SO, if the bow and stern profiles are known (or have been measured ashore), then measurements of y and h (the easier and more accurate measurements to take directly) can be used to find BO, x and SO by either calculation or graphical methods.

It should also be noted that in the case of a compound multipart measurement, (LWP for example), the final accuracy is dependent on the accuracy of the component parts. To demonstrate: if LH, BO and SO all have errors of 50mm, then LWP could be in error by as much as 150mm. Unlikely perhaps, but to be borne in mind by the measurer.

BOW OVERHANGS



STERN OVERHANGS



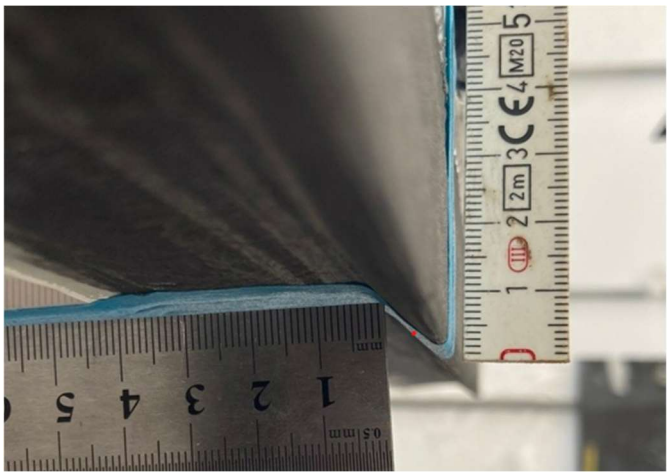
9.5 Interceptors

An interceptor is a plate which is fitted vertically to the transom of a boat, covering the main breadth of the transom and protruding with its lower edge several centimetres below the transom. The principle is to create a virtual trim wedge below the transom.

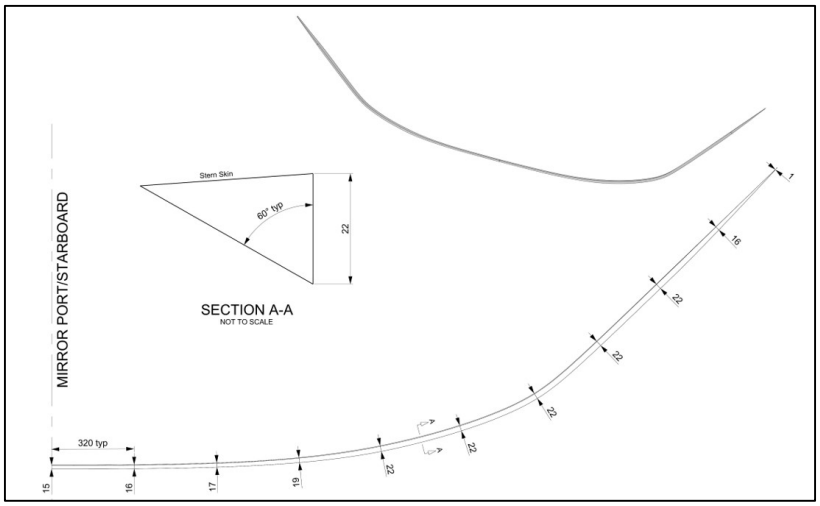
Movable/adjustable interceptors are rated differently from fixed interceptors and shall be reported to the Rule Authority.

The location of an interceptor is relevant to whether the installation constitutes a modification of the hull shell and may affect Age Date. Record whether the interceptor forms part of the transom or is installed forward of it, and refer any uncertainty to the Rating Authority through the local Rule Authority with relevant photographs.

The definition of Hull Shell in Appendix A1 of the IRC Rules is clear that an interceptor which is part of the transom is excluded from the hull shell. If an interceptor is installed forward of the transom, it shall be reported to the Rule Authority.







If an interceptor is fitted the measurer shall note:

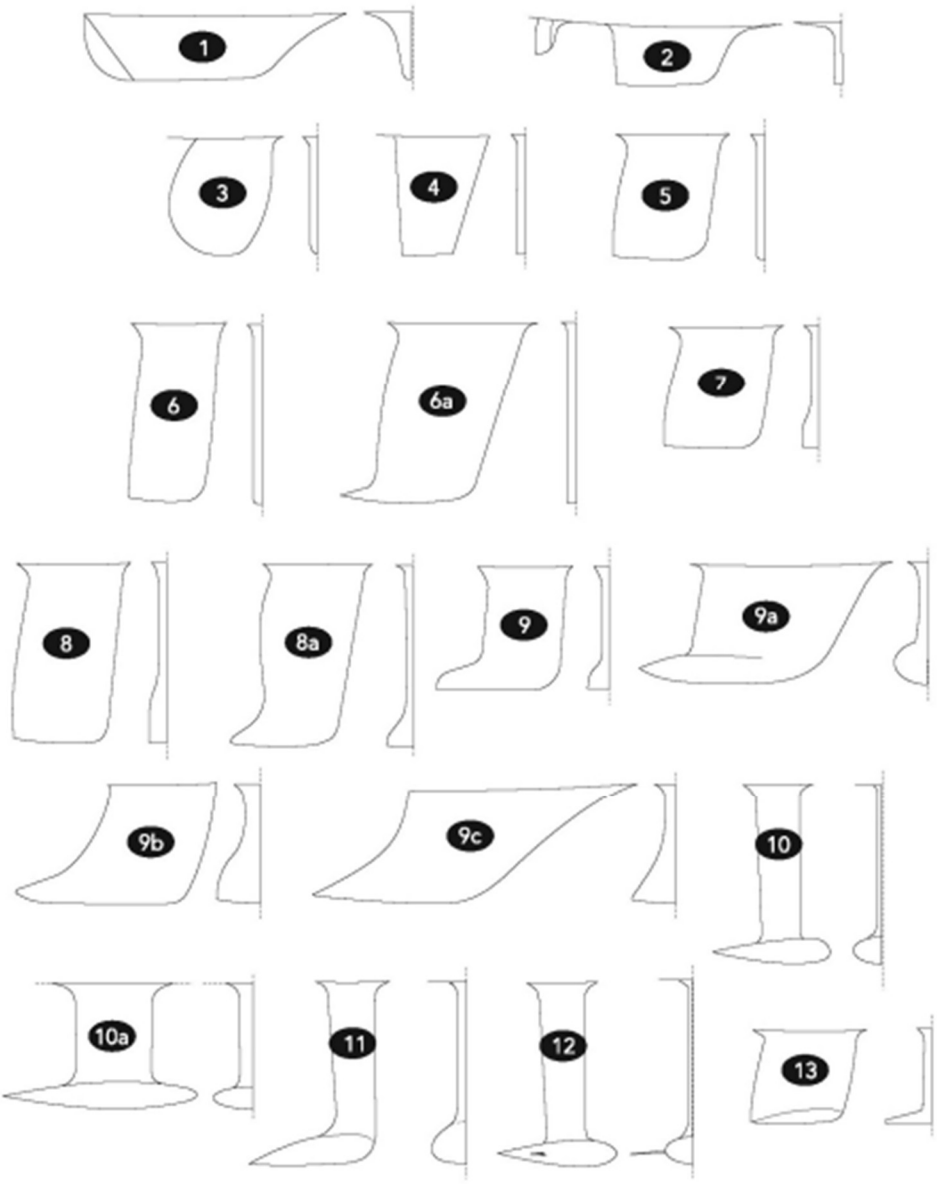
- Interceptor Maximum Depth (Note – Sometimes this is not on centreline)
- Interceptor depth on centreline
- If retro fitted is there an increase to LH?
- Is it adjustable? (Note that adjustable afloat may be either by means of hydraulic ram or adjustable bolts that are set for the day. In any case this shall be reported so that the applicable rating impact can be applied.)
- If the interceptor is an extension of the transom and not set further forward.

NOTE: “y” is measured to the lowest point on the interceptor on the centreline. (Hence value of “y” reduces if interceptor fitted)

10. HULL APPENDAGES

10.1 Fin Keel Types

Please provide notes, photographs and any relevant details to the Rule Authority. The Rating Authority will apply the option that most closely represents the actual configuration of the boat being measured. The selection will be based on the physical form and arrangement of the keel as fitted, rather than on the designer's, builder's or owner's description alone.



10.2 Other Keel Types

Drop Keels

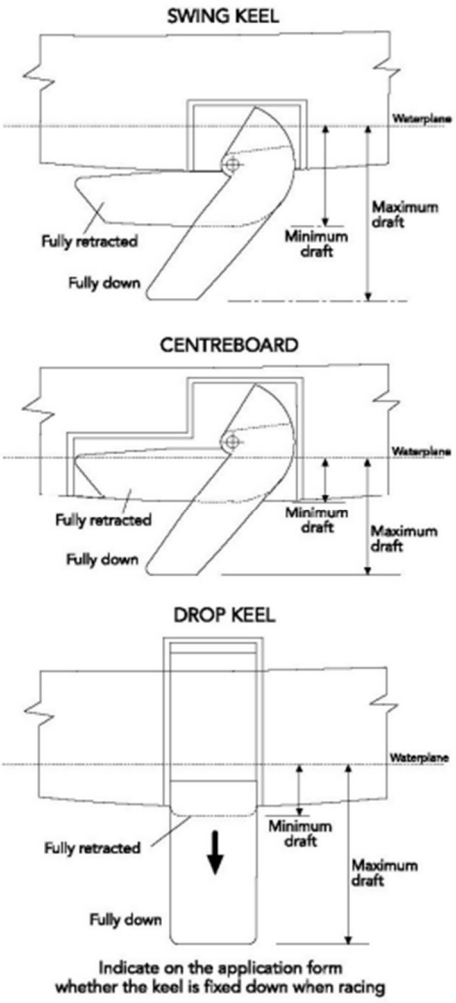
If the boat is fitted with a drop keel, lifting keel, centreboard-type keel or any other vertically adjustable keel arrangement, the draft measurements should be taken with the keel in the position that gives the greatest draft and also in any alternative position that may be used while racing, unless otherwise agreed with the Rating Authority.

The measurer shall record the details of the system. The purpose is to identify the configuration actually fitted to the boat and to ensure that the declared data reflects the keel as it may be used while racing.

Where the arrangement is not straightforward, or where there is doubt about whether the keel should be treated as fixed, lifting, adjustable or otherwise, the matter should be referred to the Rating Authority through the local Rule Authority.

The following information shall be noted:

- Maximum draft with the keel fully lowered.
- Minimum draft with the keel fully raised, where relevant.
- Whether the keel is physically capable of being adjusted while racing, and the type of adjustment system.
- Whether the keel is declared to be fixed in one position while racing, and if so, how that position is secured.
- Any unusual arrangement, including partial lift positions, removable locking devices, keel cassette arrangements, or systems that allow the keel to move independently of normal manual adjustment.



Canting Keels

If the boat is fitted with a canting keel, the measurer shall record the arrangement sufficiently clearly for the Rating Authority to understand the geometry, movement limits and intended racing configuration.

The following information shall be noted:

- The maximum cant angle to port and starboard.
- List angle – see IRC Rule 22.3.2 and Appendix 10 of this manual
- The keel position used when measuring draft and any other relevant appendage dimensions.
- The type of canting mechanism fitted, for example hydraulic ram, electric drive, screw jack, manual tackle or stored power and any unusual features.
- The location and arrangement of the pivot, pin or bearing system.
- Any mechanical stops or locking devices that limit the maximum cant angle.

If the keel cannot be reliably centred, or if there is doubt about the correct measurement position, this shall be recorded and referred to the Rating Authority through the local Rule Authority.

Where possible, the measurer should ask for the keel to be moved through its normal range of travel so that the limits, stops and control system can be observed.

Where the arrangement is complex, where the cant angle cannot be verified, where the keel has more than one operating mode, or where there is any uncertainty about whether an appendage should be treated as a canting keel, lifting keel, fixed keel or lifting appendage, the matter shall be referred to the Rating Authority through the local Rule Authority.

See Appendix 10 for further guidance where applicable.

10.4 Lifting Appendages

The term ‘lifting appendages’ in IRC refers to hull appendages or foils that generate a vertical lift component, rather than those hull appendages that may be raised or lifted. The IRC definitions relating to lifting appendages can be seen in IRC Rule Appendix F.

Where a boat is fitted with a lifting appendage, foil, winglet, horizontal plane regulator, trailing edge flap or similar appendage arrangement, the measurer shall record enough detail for the Rating Authority to understand the geometry, deployment method, operating range and intended racing configuration.

If it is unclear whether an appendage is a lifting appendage, rudder, keel, daggerboard, centreboard, trim tab, horizontal plane regulator, winglet or other appendage type, the measurer shall record the facts and refer the matter to the Rating Authority through the local Rule Authority with relevant photographs. The measurer should not determine classification or rating treatment locally.

See also Appendix 9.

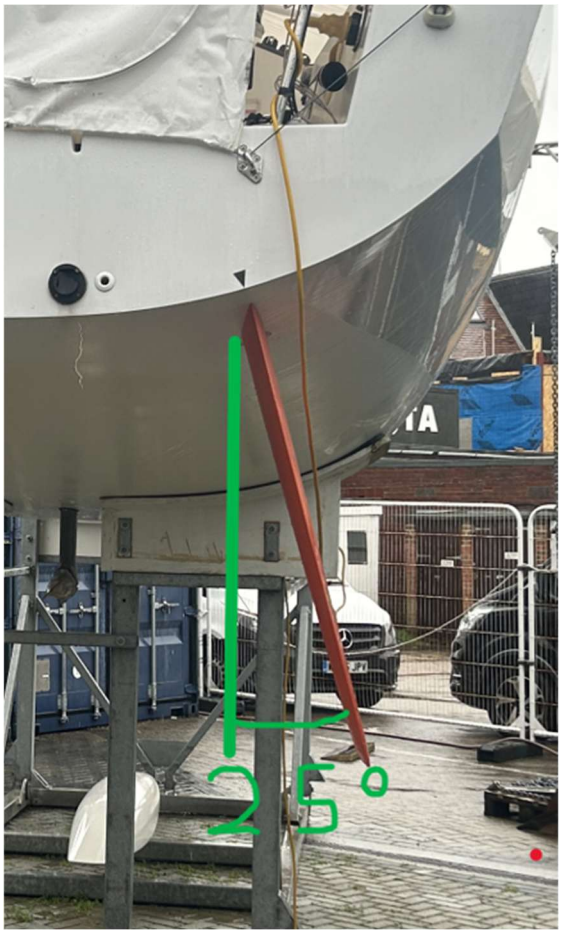
10.5 Twin Rudders

Twin rudders are excluded from the lifting appendage requirements in IRC Rule Appendix F, provided the angle between the two rudder stocks is less than 50°.

The measurer shall record the angle between the two rudder stocks, together with supporting photographs and details of how the angle was established. Where the angle or the application of IRC Rule Appendix F is uncertain, refer the arrangement to the Rating Authority through the local Rule Authority.

The purpose is to identify the configuration actually fitted to the boat and to ensure that the declared data reflects the rudders as they may be used while racing.

See also IRC Rule Appendix F - https://ircrating.org/irc-rule/

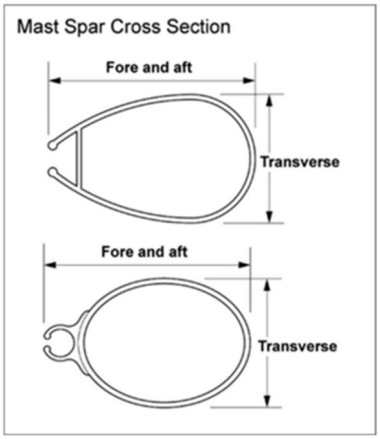


11. SPARS AND RIG

11.1 P, E, J and FL

Spar and rig measurements are generally straightforward, but measurers should be aware of subtleties in design or arrangements that may require further consideration. P and E are defined and measured exactly as most other rules, with the exception that if there are no measurement bands, P is measured from the top surface of the boom or boom track to the top of the highest sheave used for the halyard, and E is measured from the aft face of the mast spar to the extremity of the boom.

When measuring E, the measurement point on the mast may be determined by reference to the sail track. The sail track may be either an internal track or an external track bonded to the aft face of the mast spar and forms part of the mast spar, and shall therefore be used to establish the measurement point for E. Where an external sail track does not physically extend to the level of the measurement point, the line of the track shall be projected to determine the appropriate reference location.



The definition of E is as follows:
***Fittings**, local curvature, local cutaway and any increase in the fore/aft dimension of a sail track and/or sail track support, shall be ignored.*

Local interruptions, cutaways, recesses, fittings, curvature, or changes in section that are considered local shall be ignored when determining the position of the sail track. The track shall be treated as continuous across such local cutaways and projected through them as required.

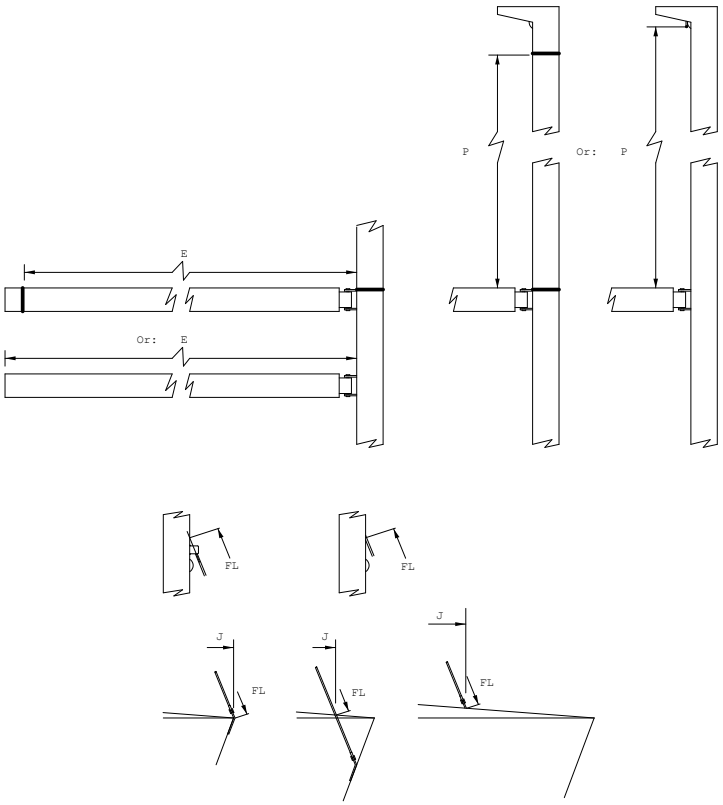
Where the sail track terminates above the level at which E is to be measured, the track shall be projected downward along its established alignment. The measurement point for E shall then be taken from this projected continuation of the track rather than from the mast tube itself.

Where a reasonable projection of the track is possible, this shall be used over measurement to the mast tube. If in any doubt as to the application of this guidance, or what would be considered a 'local cutout', the measurer shall provide photographs to the Rating Authority.

When assessing a mast with a sail track discrepancy or local cutaway:

a) Identify the normal alignment of the sail track.
b) Determine whether any interruption is local in nature.
c) Ignore local cutaways and project the track through the interruption.
d) If the track ends above the E measurement level, project the track downward.
e) Measure E from the resulting actual or projected sail track location.
f) Record any unusual arrangements and supporting rationale in the measurement notes and send photos to the Rating Authority.

Whilst there is no definition of 'local', this philosophy shall be applied consistently to all local cutaways associated with the sail track. This approach ensures consistency with the principle that local cutaways are ignored while maintaining a practical and repeatable method for determining the E measurement point.



When measuring P, hoisting a tape on the main halyard and judging its position by eye from on deck is not an accurate method. For Endorsed certificates, this is NOT acceptable. If the rig is up, sending a person aloft with the tape is the only acceptable method.

P and FL may also be measured with the rig down. In both cases however, measurement will be to a reference mark on the mast/forestay for later correction to the actual lower limit of P/FL.

The IRC definition of Forestay and the definitions of J and FL read:

Forestay — *The ERS definition of **forestay** shall not apply. Forestay is defined as: Permanently attached **rigging** providing forward support for a mast **spar**.*

FL — *The forestay length measured from the forward end of J to the forestay **rigging point.** (Note: The forestay length is a maximum value, conformation should be sought from the owner/representative to confirm the forestay is in its maximum sailing length setting)*

J — *The longitudinal distance between the intersection of the fore side of the mast **spar**, extended as necessary, and the deck including any superstructure; and the intersection of the centreline of the forestay, extended as necessary, and the deck, or bowsprit **spar**.*

FL and J are always measured to the permanent forestay.

In addition, Rule 21.3.4 and the definition of Headsail state:

21.3.4 — *RRS 55.3 is amended to the extent that a spinnaker, headsail or flying headsail may be tacked to a **bowsprit**.*

Headsail — *ERS G.1.3(d) shall not apply. Any **sail** tacked down forward of the foremost **mast** which does not meet the definition of a spinnaker or flying headsail. A headsail may be hoisted from above the forestay **rigging point**.*

These clarify that a headsail may be hoisted and tacked from outside the foretriangle.

J is therefore measured in exactly the same manner as for other common rating rules. Note that J is measured horizontally. A spirit level to project upwards from the forward measurement point to the height of the mast at deck level is nearly always necessary.

FL can be a little more complex depending on the detail of the forestay attachment. What is required is the point where the centreline of the forestay intersects the front wall of the mast, or would if extended. The only exception to this is a masthead rig where the upper limit is the top surface of the mast. The diagrams above show the various possibilities. Again, if the rig is up, sending a person aloft with the tape is the only acceptable method.

At the bottom of FL, the measurement point is as for J. The diagrams above show these measurement points.

Measurers should be clear that we want the real forestay, not a thin cable that is declared as permanent, but which clearly achieves nothing when it comes to holding the rig up.

11.2 STL

The definition of STL is as follows:

STL — The greatest horizontal distance from the forward face of the **mast spar**, ignoring any **fittings** and tracks, measured on or near the centreline of the **boat**, to the foremost tack point.

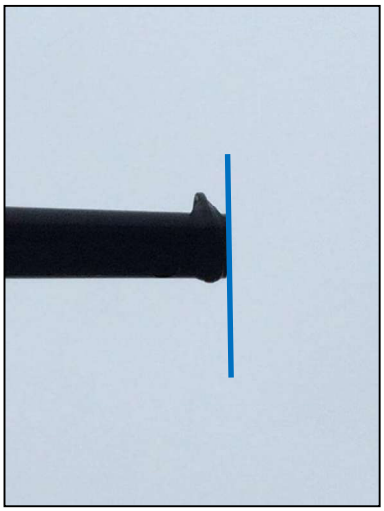
This definition makes use of a definition of tack point which was introduced for 2027 to clarify the measurements points for STL and STLFHmax. It is important to recognise that in this context, tack point is the point on the boat to which the tack of a sail is attached and should not be confused with the sail **tack point.**

The definition of tack point is:

Tack Point — The extremity of the **bowsprit**, ignoring any **outer limit marks**;
the point on a **hull** to which the **tack** of a spinnaker is **connected**;
the point on a **hull** to which the **tack** of a headsail is **connected**;
the point on a **hull** to which the **tack** of a flying headsail is **connected**,
each projected vertically as necessary.

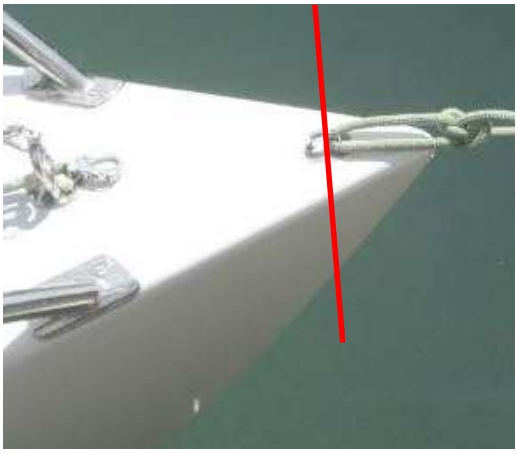
Bowsprit Extremity

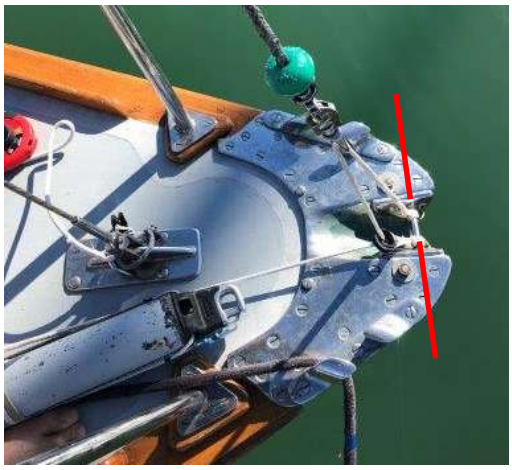
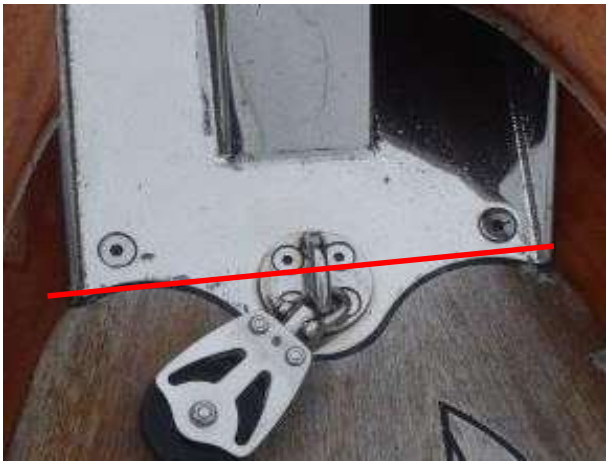
It is important to note that the measurement is taken to the extremity of the **bowsprit**, projected vertically as necessary, and not to the bearing point of any attached blocks which the tack line passes through.





Tack Point on Deck
If the tack point is on the deck the measurement is taken to the tack point on deck projected vertically as necessary. The longitudinal extend of the tack point is considered to be the centre of the fixed attachment point.



11.3 SPL

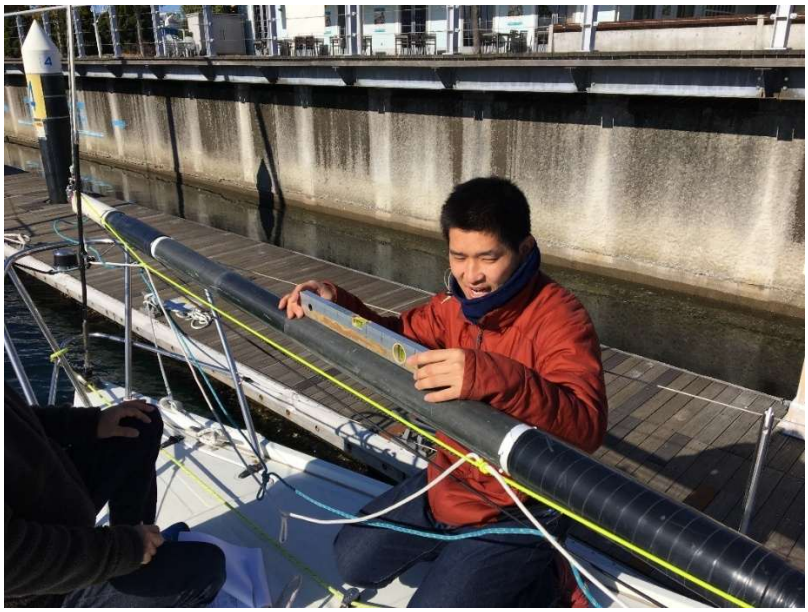
SPL The greatest horizontal distance from the forward face of the **mast spar**, ignoring any **fittings** and tracks, measured on or near the centreline of the **boat**, to the extremity of the **spinnaker pole**.

It is important to note that the measurement is taken to the extremity of the **spinnaker pole** and not to the bearing point of a spinnaker pole.

Spinnaker Pole Extremity



It is also important to note that as defined, the spinnaker pole shall be in a horizontal position when measuring SPL, which does not mean that the spinnaker pole is at right angle to the mast. The horizontality shall be checked with a spirit level placed on the pole.



11.4 Rig Types

Measurers should note the rig type and record the arrangement actually fitted, taking particular care with boats that have more than one mast. The IRC definition of aft rigging has been clarified for 2027 to specify that the declared count relates to stays and/or sets of stays connected to the **mainmast spar**, rather than to all masts.

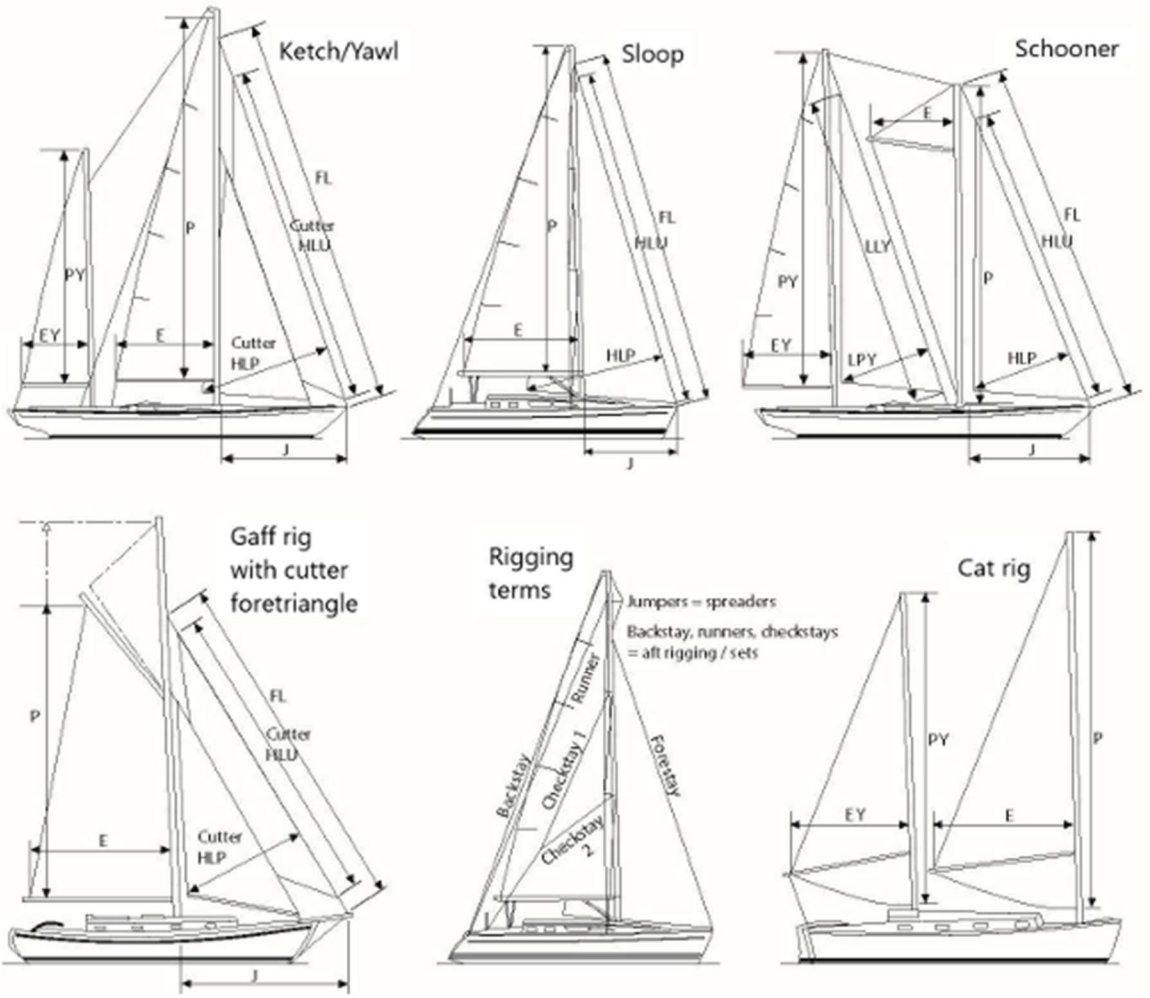
For boats with more than one mast, the measurement notes should identify each mast, its fore-and-aft position and the sails set from it. An annotated rig sketch and photographs should be provided where the arrangement is not straightforward, showing the relative mast heights, boom positions and sail attachment points. Any uncertainty over the identification of the mainmast or the applicable measurement definitions should be referred to the Rating Authority through the local Rule Authority before submitting the data.

The IRC Measurement Definitions include a definition of Cutter Rig and cutter-rig-specific definitions of HLU, HLP, HHW, HTW and HUW.

Cutter Rig *A cutter rigged boat is any **boat** that sets more than one headsail when on a beat to windward while racing. These values will be used in place of standard headsail dimensions where relevant in IRC Rules for a cutter rigged boat.*

The term beat to windward is defined in World Sailing Case 132
https://media.sailing.org/sailing/wp-content/uploads/2025/07/31104846/WS-Case-Book-2025-2028-v2025-07.pdf

When assessing whether the cutter-rig definitions apply, confirm with the owner or representative which headsails may be set simultaneously on a beat to windward while racing, rather than relying on the rig's description alone. Record the relevant sail combinations and their head, tack and clew positions. Cutter Rig HLU is measured parallel to the forestay from the lowest tack point to the highest head point of the headsails set simultaneously; Cutter Rig HLP uses the aftmost clew point, with the headsail set on the boat's centreline, and the foremost headsail luff that may be set simultaneously. Use the applicable cutter-rig definitions for the remaining dimensions.



11.5 Aft Rigging

Measurers should apply the counting requirements for backstays, runners, deflectors and adjusters set out in this section and record any unusual arrangements for referral to the Rating Authority through the local Rule Authority with relevant photographs.

Note that the aft rigging count includes the backstay (or a set of twin backstays).

Aft rigging: The total number of **stays** and/or sets of **stays** connected to the **mainmast spar** above the top of the boom set horizontal providing aft support and/or control.

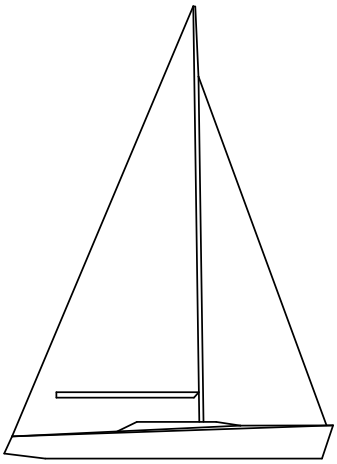
(a) Any pairs of **stays** attached to the **mainmast spar** at the same position port and starboard on the mast **spar** shall count as one set of **stays**. E.g., whether there be a single standing **backstay** or twin **running backstays** these are counted as one set of **stays**.

(b) Any deflectors or adjusters attached between the top most **stay** and the **mainmast spar** shall also be counted. Any deflectors or adjusters attached between any other **stay** and the **mainmast spar** with separation from the attachment point of the primary **stay** of 10% of P or greater shall also be considered as a separate **stay** for these purposes.

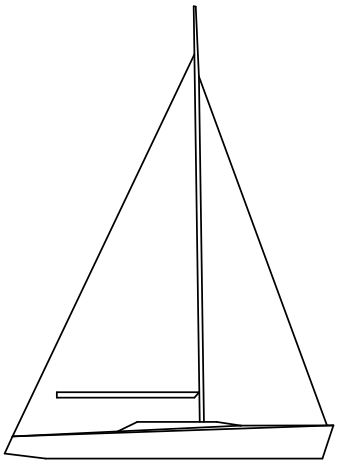
Note – The exemption for deflectors within 10% does not apply to deflectors from the top most stay.

AFT RIGGING

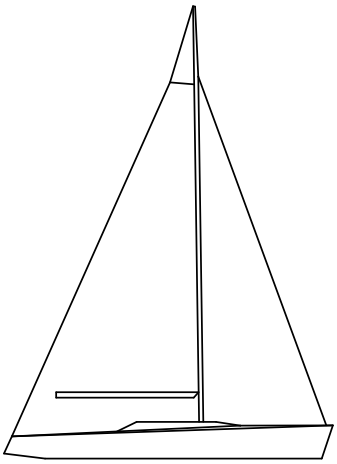
ONE STAY/
SET OF STAYS



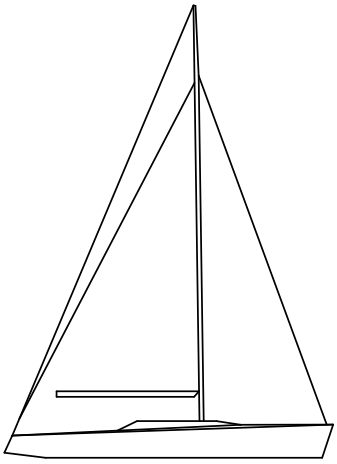
ONE STAY/
SET OF STAYS



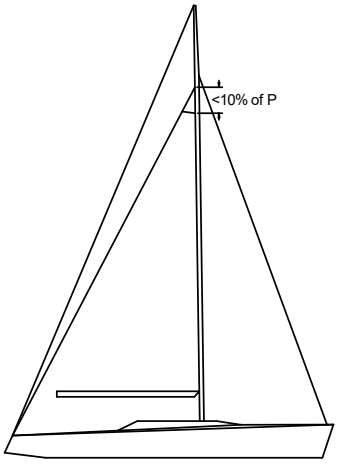
TWO STAYS/
SETS OF STAYS



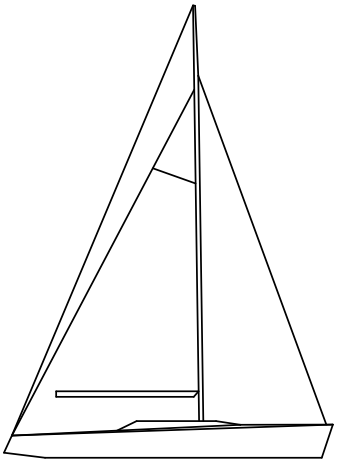
TWO STAYS/
SETS OF STAYS



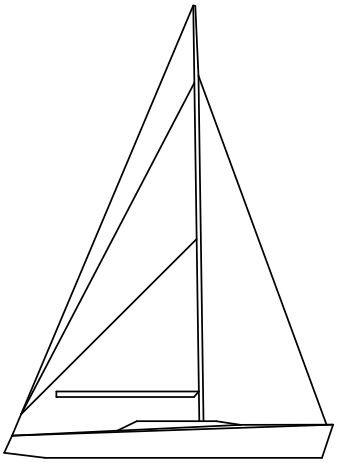
TWO STAYS/
SETS OF STAYS



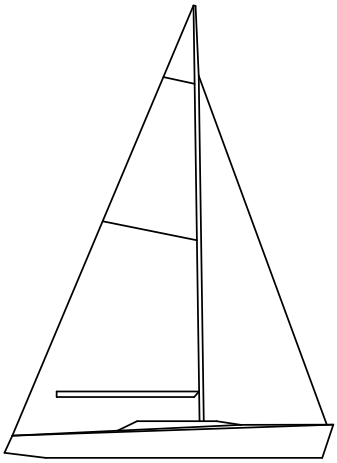
THREE STAYS/
SETS OF STAYS



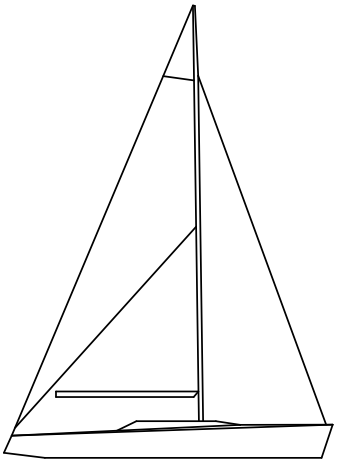
THREE STAYS/
SETS OF STAYS



THREE STAYS/
SETS OF STAYS



THREE STAYS/
SETS OF STAYS



12. SAILS

IRC sail measurement is carried out in accordance with ERS. Use the applicable ERS definitions and measurement procedures together with the IRC-specific requirements in this section. Appendices 4–6 provide practical quick-reference guidance for the measurements described here.

ERS H.5.1 specifies the condition of the sail for measurement as dry, in addition prior to measuring any consideration should be given to the environmental conditions in which the measurement is being conducted. Extremes of temperature either ambient or direct sunlight in addition to moisture can cause variances in measurements.

It is preferable that sail measurement is carried out under cover to minimise the impact of any variance through environmental factors.

Measurers should be aware that it is very common for the leech of a sail to be hollow between battens. Measurers should check all sails and bridge any hollows between battens found as described by ERS (see ERS G.2.4 and ERS H.5.2).

Every measurement taken on a sail is linked to the corner points. It is critical that corner points are correctly and accurately identified before taking any further measurements on the sail.

Measurements to be Taken

IRC sail measurement is very straightforward. Mainsails require measurement of widths, 5 measurements for headsails, 4 for spinnakers and 7 measurements for flying headsails (5 headsail measurements and in addition foot length and half-width measured as a spinnaker) Headsails and flying headsails must also be checked for Foot Offset as described below and in Appendix 5. The measurements are listed as follows:

Sail	Measurement	Dimension
Mainsails:	Half Width Three Quarter Width Seven-Eighths Width	MHW MTW MUW
Headsails:	Luff length Luff Perpendicular Half Width Three-Quarter Width Seven-Eighths Width Foot Offset	HLU HLP HHW HTW HUW
Spinnakers:	Luff length Leech Length Foot Length Half Width	SLU SLE SFL SHW
Flying Headsails: measured as a headsail	Luff length Luff Perpendicular Half Width Three-Quarter Width Seven-Eighths Width Foot Offset	FLU FLP FHW FTW FUW
Flying Headsails: measured as a spinnaker	Foot Length Half Width	FSFL FSHW

Attention is drawn to the quick reference guides to sail measurement included as Appendices to this manual.

For all measurements, light tension should be applied to the cloth, sufficient to remove wrinkles. Measurers should however be aware of the potential shortfall in luff length caused by not stretching the boltrope when measuring HLU, and if uncertain should err on the side of excessive tension.

Measurers should also be aware that sailmakers on occasion (and particularly for smaller boats with hanks as opposed to luff grooves) sometimes fit pre-stretched headsail bolt ropes which when relaxed

are significantly shorter than the luff length of the sail itself. In this context, light tension may be taken to mean firmly pulled by hand.

The IRC definition of Foot Offset is as follows:

Foot Offset	The maximum offset between the edge of a headsail or flying headsail **foot** and a straight line between **tack point** and **clew point**.

This is linked to IRC Rule 21.7.2:

It is considered unlikely that many, if any, sails will have Foot Offset in excess of 7.5% of HLP or FLP. Measurers are asked however to check and report any excessive values found.

12.1 Mainsail

A mainsail only requires MHW, MTW and MUW be measured.

Measurers should also be aware of 'square top' mainsails where the top width may be greater than the 7/8ths width due to the leech profile. If a 7/8ths leech point cannot be found on the leech, the aft head point shall be taken as the 7/8ths leech point.

12.2 Headsail

For a headsail the required dimensions are HLU, HLP, HHW, HTW and HUW of the largest area headsail. In addition, the longest luff length (HLUmax) of any headsail carried is also required. Headsail area (HSA) is calculated as follows:

$$HSA = 0.0625*HLU*(4*HLP + 6*HHW + 3*HTW + 2*HUW + 0.09)$$

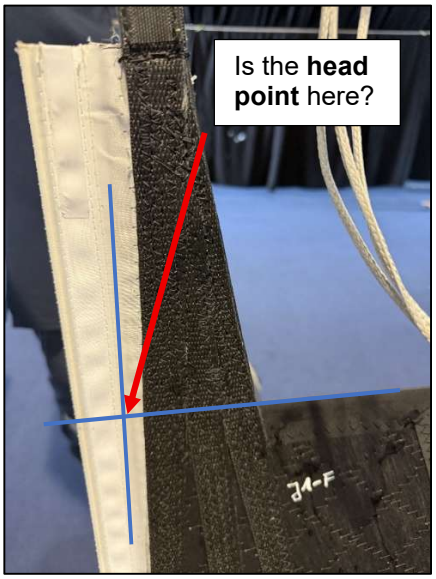
The actual dimensions of the largest area headsail (not just HSA) are needed.

The IRC rule 21.7.3 includes: *which may be used while racing.* This then formally covers the situation of a boat rated with a single roller furling headsail carrying a spare sail on board as permitted by Rule 21.8.3 without affecting her TCC.

We have also seen a recent trend towards careful placement of headsail battens to minimise 'hollows' as defined by ERS. If in doubt, please refer to ERS and/or consult your local IRC Rule Authority.

IRC Rule 21.8 gives a rating credit to boats rated for a single roller furling headsail. To be eligible, (with the exception of boats with LH greater than 30.5m and IRC DLR greater than 60) rated HLP must be greater than 1.3*J. The Rating Authority will pick up qualification in this regard.

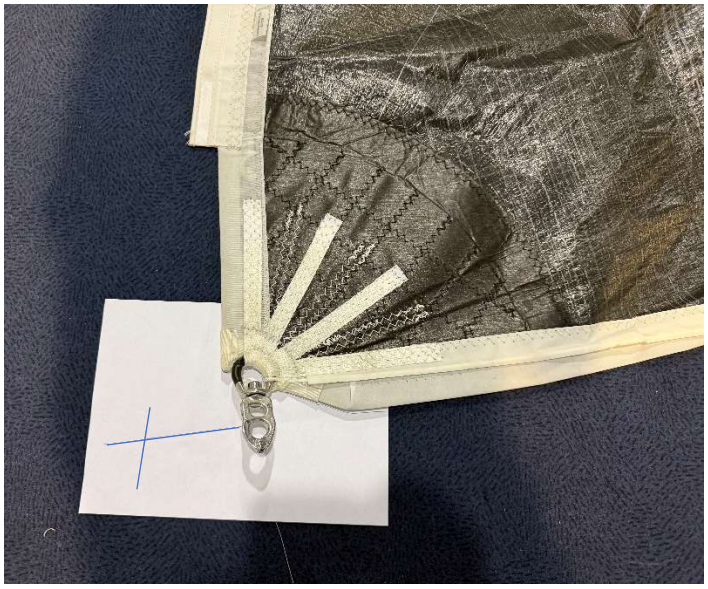
Be alert to sails constructed in a way that may mislead measurers about the true location of the corner point.





At first glance, the image on the left appears to be a fairly standard head attachment that should be excluded from finding the **head point** and associated measurements. On closer inspection, however, the photo on the right shows that the **body of the sail** continues behind the webbing to the top loop. The attachment length is therefore only the webbing loop, not the longer webbing lengths extending from the square-top part of the headsail.





Be aware that depending on the sail edge shape leading into a sail corner, the defined corner point may be considerably different to the physical corner of the sail.

See also Appendix 5.

12.3 Flying Headsail

A flying headsail is defined as follows:

Flying Headsail	ERS G.1.3(d) shall not apply. A **sail set flying** tacked down forward of the forestay that does not meet the definition of spinnaker and without battens and with a **half width** (measured as a spinnaker) equal to or greater than 60% of **foot length**. A flying headsail shall be tacked down no greater than STLFHmax and approximately on the **boat**'s centreline, except when it is tacked on a declared articulating **bowsprit**. A flying headsail may be entirely furled but shall not be set reefed while *racing*.

So a flying headsail concept is to allow an offwind sail that measures as a headsail, similar to the 'Code zero' concept. It is effectively a headsail without battens that is set flying with a half-width to foot length ratio greater than or equal to 60% and less than 75%. The area is calculated the same as headsail and thus the measurements are same. But to establish if it meets the half-width to foot length ratio limits, these must also be measured as if the sail is a spinnaker.

12.4 Spinnaker

IRC Rules do not differentiate between spinnaker types. All spinnakers are measured in the same way, irrespective of shape. Be aware that sail cloth can shrink/grow with time, use and sometimes moisture. The fact therefore that a sail has a measurement stamp on it does not guarantee that it measures. For Equipment Inspection at events, the only sure way is actually to measure the sail. The historic rules relating to sailcloth have now effectively disappeared. While IRC Rule, 21.2.2 refers to 'exotic materials' in sailcloth, the current exotic list is none.

IRC Rule 21.1.5 (h) prohibits sails with detachable pieces. IRC does not include any rules regarding sail reinforcement.

IRC definitions define a spinnaker as:

Spinnaker ERS G.1.3(f) shall not apply. A spinnaker is defined as a **sail** set forward of the foremost **mast** with **half width** (measured as a spinnaker) equal to or greater than 75% of **foot length** and without battens. A spinnaker may be set reefed by any means while *racing* under IRC provided that when measured in any reefed condition it continues to satisfy the IRC definition of a spinnaker.

Thus, if a sail satisfies the definition of a spinnaker (i.e. half width is equal to or greater than 75% of foot), then that is what it is: a spinnaker. Any other sail is a headsail or a flying headsail. 'Code zeros' are nearly always intended by the sailmaker to be spinnakers. Measurers should however beware. If however a sail has battens, defined in IRC as *Any material added to the **sail**, as either a removable element, permanent stiffening, or other contrivance, the purpose of which is to support and/or stiffen the **sail**.* Then it is a headsail rather than a spinnaker or flying headsail, irrespective of what the dimensions are.

For spinnakers, what is required are the dimensions of the largest area sail calculated from:

SPA = ((SLU + SLE)/2) * ((SFL + (4 * SHW))/5) * 0.83

While SPA is all that is required for rating the boat, IRC rule 21.6.2 requires that the linear measurements are declared so measurers are asked to submit all actual sail dimensions.

12.5 Storm Sails and Heavy Weather Jibs

The definitions of storm trysail, storm jib and heavy weather jib are as defined by OSR 4.26.2, 4.27.3 and 4.27.4.

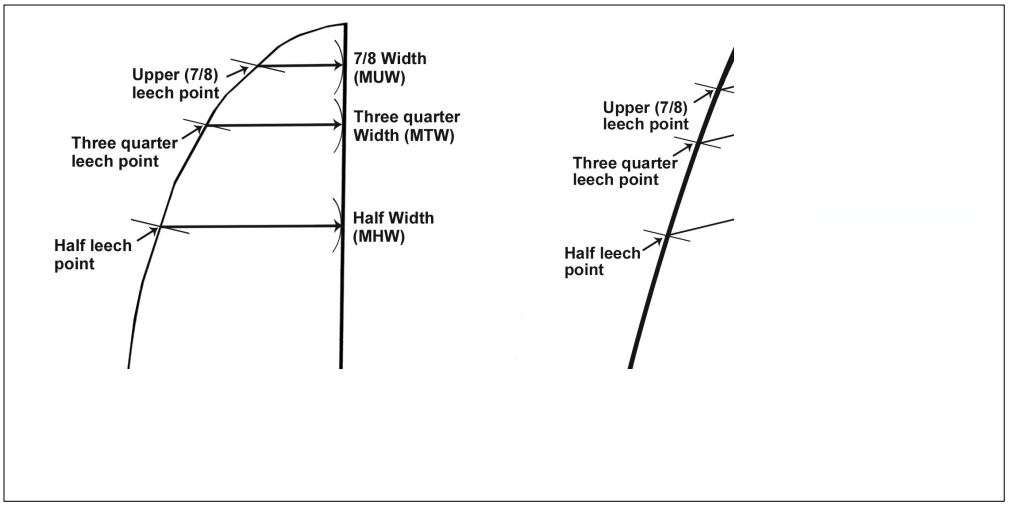
The 2025 change to Offshore Special Regulations (OSR) states that a storm jib shall not have battens and shall not be set in conjunction with any other sail set forwards of the forward mast spar (OSR 4.27.1).

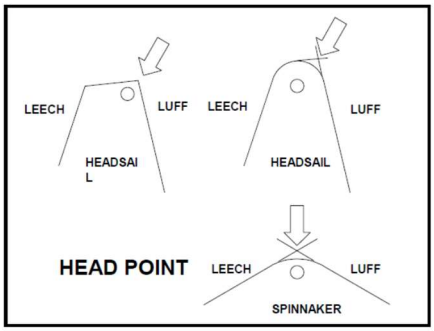
Importantly, this potentially affects the IRC declaration for number of headsails on boats that have been using an 'OSR Storm Jib' as a staysail or in combination with another sail. All headsails, including staysails, are required to be counted in the number of headsails carried when racing (except 1 x OSR Storm Jib and 1 x OSR Heavy Weather Jib).
See IRC rule 21.7.1 and the guidance on the IRC website.

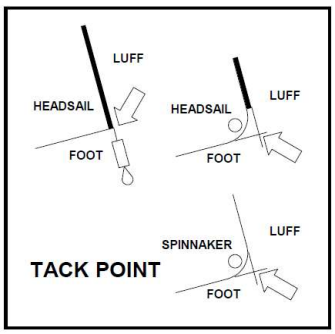
From an IRC rating perspective an orange headsail that no longer complies as an OSR Storm Jib, i.e. it has batten(s) (OSR 4.26.4) or is set alongside other headsail(s), may be used as long as it has either been counted in the number of headsails for the boat's IRC rating, or is excluded from the headsail count as their only OSR Heavy Weather Jib. The only stipulation is that such a sail shall not be declared as an OSR compliant Storm Jib for IRC rating.

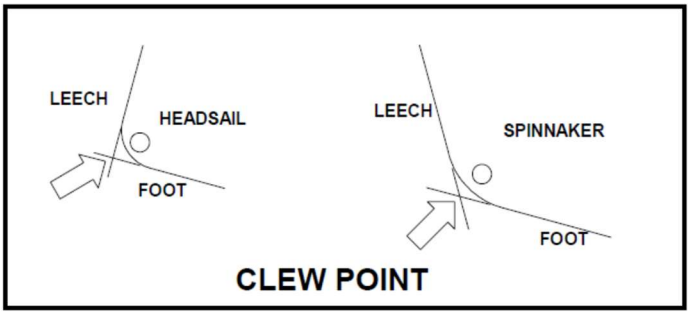
More importantly from a measurer's point of view is that, while other sails may be carried aboard, only one Storm Jib and/or one Heavy Weather Jib may be used while racing. Note that a No.3 headsail is unlikely to qualify as an OSR compliant Heavy Weather Jib.

SAIL MEASUREMENT POINTS









13. PHOTOGRAPHY FOR RATINGS

When measuring one-off boats, or endorsement generally, measurers are asked whenever possible to take photographs (keel, rudder, interior, etc) for inclusion in the boat's file.

KEEL/RUDDER:



Although this photo shows the keel type, it is taken at an angle and is obstructed



This is better!



If the keel is 'low cg' (as shown above), a fore/aft view is extremely helpful



This side profile photo shows the rudder depth and style



This clearly shows rudder and propeller



Skeg clearly visible as is propeller



This does not clearly show rudder angles



Vertical rudder angle clearly visible

RIG:





A photo of the rig showing the number of spreaders, spreader sweep and other rigging, e.g. runners/checkstays is useful

INTERIOR:





Photos facing aft are helpful. In these two you can clearly see the aft accommodation and heads





Photos showing the main cabin and forward





Clear photos of the Chart Table and Galley

14. OTHER ISSUES

Measurers should be aware of other IRC rules issues and are asked to report as much additional detail as possible for recording in a boat's file, although owners should be reminded that it is their responsibility to declare such details. For instance:

- Which version of the design? Mk I? MK II? Deep draft? Shallow draft? Etc.
- Has furniture been removed from below and not reported in contravention of IRC rule 22.1?
- Is the table standard or non-standard e.g. minimal, carbon etc.
- Note rule 17.2 (new 2024) All systems relating to living, eating, sleeping, and stowage shall operate so as to provide the service function normally associated with the system. Report any systems that you do not think complies with this rule.
- Are removable cockpit boxes on board?
- Are the correct number of spreaders and Aft Rigging declared?
- Is the mast aluminium or carbon?
- Is the standing rigging wire, rod, or composite materials. What is the forestay material?
- Quantity (if any) of internal ballast. Has ballast been added or removed?
- If originally an IOR rated boat, have the bumps and creases been faired out?
- No. of spinnakers, headsails and flying headsails carried: remind the owner that it is their responsibility to declare this
- Does the boat use stored power? See IRC rule 15.
- Does the boat have on board systems (other than conventional turnbuckles) to adjust the forestay or the mast foot? If so, will the boat use these systems while racing?

It is impossible to detail every point. Measurers are simply asked to check whatever detail is possible whenever possible.

When measuring one-off boats, or endorsement generally, or if in doubt about interior fittings, measurers should take photographs (keel, rudder, interior, etc) for reference by the Rule Authority and Rating Authority and inclusion in the boat's file.

APPENDIX 1. WEIGHING ON COMPRESSION LOAD CELLS

It is recognised that weighing on compression load cells is becoming more and more attractive from a logistical and financial perspective. However, where possible it is always recommended that single point lift be the preferred option. Event organisers may require competitors to be weighed prior to an event. In such cases the recommendation is that such boats are weighed using the single point lift method.

As with all measurement, accuracy and repeatability is paramount. There are 2 distinctly different methods of weighing on compression load cells: lowering the boat into a cradle supported on compression load cells and driving a travel lift onto pressure pads. Only the first method, lowering the boat into a cradle is acceptable for IRC weighing. Driving a travel lift onto pads and weighing the combined weight of the travel lift and boat, then deducting the weight of the travel lift is not acceptable but is currently under review.

1. There appear to be two types of compression load cells, one of which has the sensor at the top, the other has the sensor at both ends. This latter type is not desirable because it requires a totally flat clean surface underneath as well as on top. If the latter type is to be used, each cell **MUST** be stood on a clean flat steel plate.

2. Flat level ground appears to be important. If not, the load may be unevenly shared between corners (which in itself shouldn't matter) but may also vary during the weighing which will produce false readings.

3. There is also a possibility that non parallel ground/cradle surfaces may introduce errors into the readings.

4. The bearing point on each cell must be cleanly in contact with the underside of the cradle. Placing timber or other compressible material between the load cell and the cradle can result in the load being shared by the structure of the cell rather than only by the load sensitive part.
   Additionally, it is important that the bearing point on each cell bears against a flat section of cradle. Discontinuities in the cradle surface (created by welds, joints etc) must be avoided.

5. Wind can have an effect. Windage on the rig of a boat will change the distribution of load in the cradle and hence the reading on each individual cell. The total net effect should be small, BUT when each cell has to be read individually, they really then need to be read at exactly the same moment. The effects of this can be mitigated in the case of individual read-outs by laying out the read-outs in such a way that it is possible to see all of them simultaneously. Cross variation can then be seen and noted.

6. If possible use equipment with the read out from each of the four cells electronically combined. Read (if possible record) the read out at regular intervals so that a mean reading can be found. In the case of a load cell read out combining electronically the signals from each cell, windage and uneven ground effects should be minimised. This does not make them any the less undesirable.

7. As ever, dunnage and packing used when the boat is in the cradle must be replaced on the cradle for tare purposes.

8. For practical reasons, when the boats is lowered into a cradle the travel lift straps will generally remain around the boat during the weighing. Obviously, care must be taken to ensure that they are slack.

9. Accuracy. Given that 3 or 4 cells are used as opposed to 1 for a single point lift, the potential for inaccuracy is increased. Cells of the highest possible accuracy, rated as appropriately as possible for the gross weight become of greater importance.

10. Range. While for maximum accuracy, we want cells of combined total capacity as close as possible to the gross weight, care needs to be taken because placing the boat in the cradle may result in a very uneven load distribution. This should be taken account of in sizing the cells.

APPENDIX 2. OVERHANGS & WEIGHING OF SUPERYACHTS

It is recognised that for very large boats, with **Hull Length** of 30.5m and greater, it is generally impractical to bring the boat into measurement condition, and not possible to weigh the boat by single point lifting. It is also extremely difficult and costly to weigh the boat on pressure pads, as this may require a dry dock and extremely substantial custom built cradle. As such the following alternative is permitted with prior approval of the Rating Authority for these very large boats. It may also be used for smaller but very heavy boats with the prior approval of the Rating Authority.

As with all measurement, accuracy and repeatability is paramount. This method takes time, so accept that and don't rush it. It is imperative that the condition of the boat is recorded accurately as outlined below:

1. Ensure the Rule Authority is aware of the method being used, and that the Rating Authority has sanctioned it.

2. Ensure that a set of hull lines are provided by either the designer or from an ORC IMS measurement or similar, in a format that can be used to calculate the displacement and trim changes in the appropriate software. Discuss this with the designer and Rule Authority first.

3. Ensure that the boat captain is aware of the process and the time required to complete the work. Also make the boat captain aware that the closer to empty the boat is, the less chance for error there is. So ask them to empty the boat as far as reasonably possible. If sails, or other heavy items which cannot be easily weighed are to remain on board, ask the boat captain to provide weights for these items. For very large sails the sail maker will have a record of the delivery weights at least, and will probably have a record of the fully dressed sail weight. Remember to include battens where necessary. Ask that any bow anchor be dropped to the seabed if possible with a lanyard left attached only for recovery, ensuring that there is no weight on the line.

4. In an ordered manner record the fore and aft location as well as the weight of everything that should not be included in measurement condition. It is best to start at the bow and work aft, first above decks and then below decks, or vice versa, provided no location is overlooked. Fore and aft location can be recorded relative to the mast for simplicity. Multiple items, such as drinking water bottles can be counted and multiplied by the volume. Tankage can be recorded from the gauges, but remember to also record the location of each tank. It is best to compile this record on a spreadsheet so that the mean longitudinal location of the combined weigh can be calculated relative to the mast.

5. Once all is recorded the mooring lines should be eased as much as possible and the measurements y and h are recorded at the bow and stern as accurately as possible. For this the conditions have to be at least as good as a normal overhang measurement.

6. Provide the full information to the designer and Rule Authority so that the measured displacement and overhangs can be calculated. From this the recorded weight can then be deducted from the calculated location and the weight and overhangs adjusted and recorded for use in the IRC calculation.

7. Record as much as possible with a camera, with the boat captain's permission. Also recognise that the crew may live on the boat full time. Respect their privacy in areas of the boat where their personal belongings are kept, as well as the privacy of the owner.

8. This is a costly and time consuming process. As such ensure as much as possible is prepared beforehand, and ensure that the Rule Authority is fully aware of what you are doing. The Rating Authority will be at hand to answer any questions whenever possible. Do not be afraid to ask.

APPENDIX 3. IRC ENDORSEMENT – PROCESS, MEASUREMENT & DATA STANDARDS

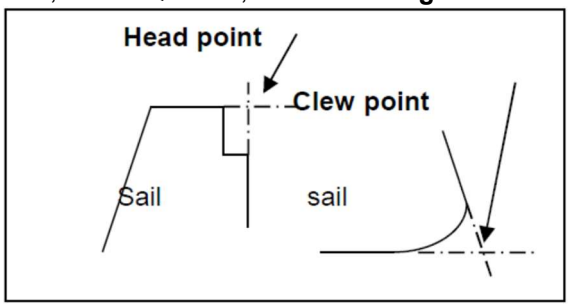
An 'Endorsed' IRC certificate is one for which the data on the certificate has been audited and if necessary verified by measurement (IRC Measurers) or other methods. The IRC Congress agreed that a set of common standards for the IRC Rating Authority and Rule Authorities to apply when endorsing a boat's IRC certificate should be developed and published.

The IRC Endorsement Standards have been updated; rather than repeat them here please see the most recent version on the IRC website on this page: https://ircrating.org/irc-certificate/measurement/

APPENDIX 4. MAINSAIL MEASUREMENT

What is being measured? **Half Width**, **Three Quarter Width** and **Seven-Eighths Width**

What are these? The distances from the H**alf**, **Three Quarter**, and **Seven Eighths Leech Points** to the **Luff**.



In practice:

1. Lay the sail out flat on a suitable surface.

2 Establish **head point** and **clew point** as shown by the diagram.

When there is a cut-out or rounded corner in the **sail edges** at a corner point, the extension of the **sail edge** shall be found using a batten as specified in ERS H.5.4.

The batten specified in ERS H.5.4.(a) shall be of constant bend characteristics to achieve a consistent and repeatable measurement, a minimum length of 1m and not longer than 25% of **foot length**. The measurer shall provide photographs to the Rating Authority.

3. Fold the **head point** to the c**lew point.** Mark the fold in the **leech.** That is **half leech point**

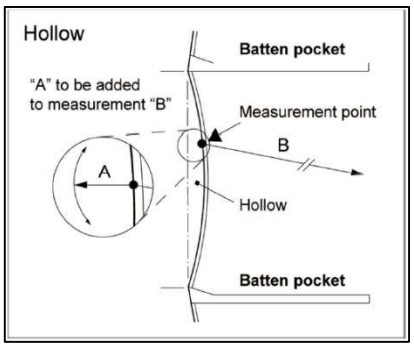
4. Fold the **head point** to the **half leech point**. Mark the fold. That is **three quarter leech point**.

5. Fold the **head point** to the **three quarter leech point**. Mark the fold. That is **seven-eighths leech point**.

6. Measure from each **leech point** to the nearest point on the **luff**. These distances are the **mainsail widths**.

7. Check for **sail leech hollows.** See ERS G.2.4 and H.5.2

8. Add any **hollow** (A) to each measured **Width** (B) to get the final **widths**.



References:

Equipment Rules of Sailing. https://www.sailing.org/inside-world-sailing/rules-regulations/equipment-rules-of-sailing/

G.4.1 and G.4.2 define **Clew Point** and **Head Point**.

G.5.2, G.5.3 and G.5.4 define **Half Leech Point, Three Quarter Leech Point** and **Seven Eighths Leech Point**

G.7.5, G.7.6, and G.7.7 define **Half Width**, **Three Quarter Width** and **Seven Eighths Width**.

G.2.4 and H.5.2 address **Sail Leech Hollows**.

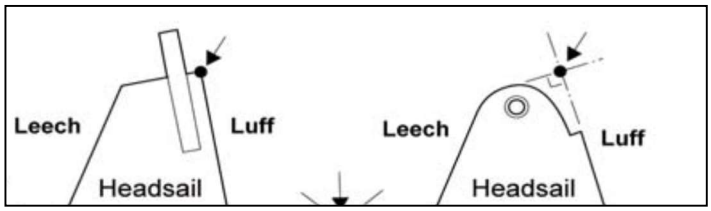
H.5.4 and IRC Rule 13.2 defines **Extended as necessary**.

APPENDIX 5. HEADSAIL AND FLYING HEADSAIL MEASUREMENT

What is being measured? **Luff Length**, **Luff Perpendicular** (HLP for a headsail or FLP for a flying headsail), **Half Width**, **Three Quarter Width** and **Seven Eighths Width**, together with Foot Offset.

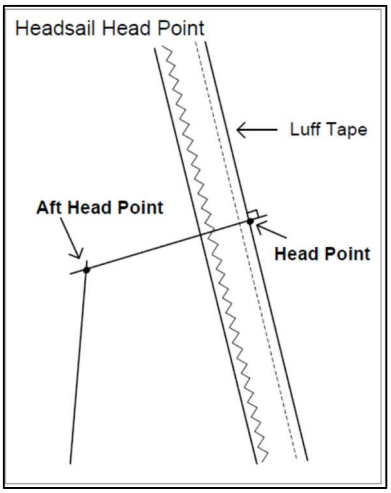
What are these? The length of the **Luff**, the distance between the **Clew Point** and the **Luff**, and the distances from the **Half**, **Three Quarter** and **Seven Eighths Leech Points** to the **Luff**.

In practice:



1. Lay the sail out flat on a suitable floor.

2 Establish **head point, tack point** and **clew point** as shown by the diagram.

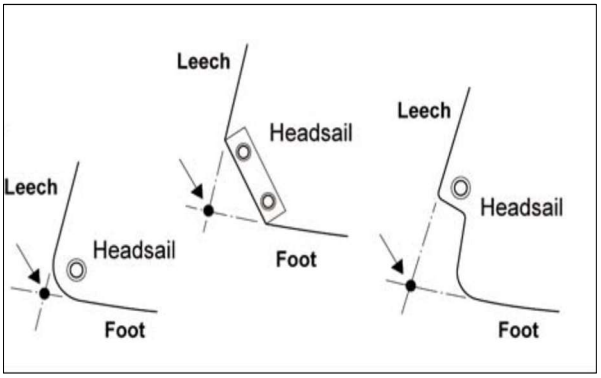


When there is a cut-out or rounded corner in the **sail edges** at a corner point, the extension of the **sail edge** shall be found using a batten as specified in ERS H.5.4.

The batten specified in ERS H.5.4.(a) shall be of constant bend characteristics to achieve a consistent and repeatable measurement, a minimum length of 1m and not longer than 25% of **foot length**. The measurer shall provide photographs to the Rating Authority.

3. Straighten the **luff** and pulling firmly measure the **luff length** between the **head point** and the **tack point**.

4. Measure **LP** from the **clew point** to the nearest point on the **luff**.

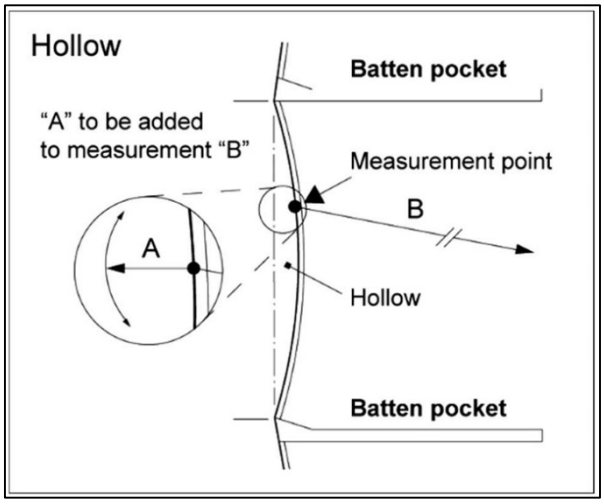


5. Fold the **head point** to the **clew point**. Mark the fold. That is **half leech point**.

6. Fold the **head point** to the **half leech point**. Mark the fold. That is **three quarter leech point**.

7. Fold the **head point** to the **three quarter leech point**. Mark the fold. That is the **seven-eighths leech point**.

8. Measure from each **leech point** to the nearest point on the **luff**. This will give the **half**, **three quarter** and **seven-eighths widths**.



9. Check for **sail leech hollows**.
See ERS G.2.4 and H.5.2

10. Add any **hollow** (A) to each measured **width** (B) to get the final **widths**.

Foot Offset

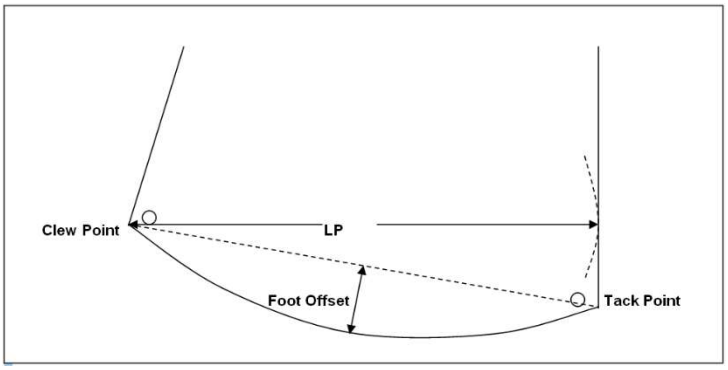
To prevent the practice of reducing headsail dimensions and the corresponding area calculations by exaggerating the curve of the foot artificially raising the tack and clew, Foot Offset is controlled.

This is referenced in IRC Rule 21.7.2

If foot offset of a headsail or a flying headsail is greater than 7.5% of HLP or FLP, then foot offset shall be declared and foot offset shall be added to HLU or FLU in the calculation of HSA or FSA.

Foot Offset is the maximum offset distance between the edge of a headsail or flying headsail foot and a straight line between **tack point** and **clew point.**

How is it Measured:



1 – Lay out the sail flake as necessary so that the foot area is flat on the floor.

2 – Determine the tack and clew points and measure luff perpendicular: HLP for a headsail or FLP for a flying headsail.

3 – Run a string line from tack to clew.

4 – Visually determine the position of the maximum distance from string line to headsail foot, measure perpendicular to the string line from headsail foot to string line at this point.

5 – Repeat the measurement from string line to headsail foot in numerous locations to ensure that the maximum dimension has been determined.

6 – Foot Offset % is calculated by 100 * Foot Offset Measurement / LP

7 – If Foot Offset exceeds 7.5% of HLP for a headsail or FLP for a flying headsail, submit the Foot Offset dimension with that sail's data on the measurement input form.

References:

Equipment Rules of Sailing
https://www.sailing.org/inside-world-sailing/rules-regulations/equipment-rules-of-sailing/

G.4.1, G.4.2 and G.4.3 define **Clew Point, Head Point**, and **Tack Point**.

G.5.2, G.5.3 and G.5.4 define **Half Leech Point**, **Three Quarter Leech Point** and **Seven-Eighths Leech Point**.

G.7.3 defines **Luff Length**.

G.7.5, G.7.6 and G.7.7 define **Half Width**, **Three Quarter Width** and **Seven-Eighths Width**.

G.7.12 defines **Luff Perpendicular**.

G.2.4 and H.5.2 address **sail leech hollows**.

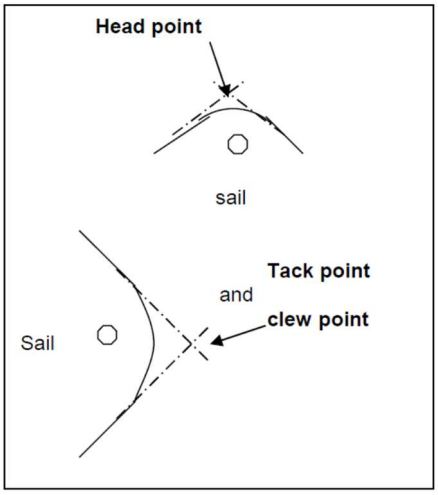
H.5.4 and IRC Rule 13.2 defines **Extended as necessary**.

APPENDIX 6. SPINNAKER AND FLYING HEADSAIL MEASUREMENT

What is being measured? Spinnaker: **Luff length**, **leech length**, **foot length** and **half width**.
Flying Headsail: **foot length** and **half width**.

What are these? The lengths of the **luff**, **leech** and **foot** and the distance from the **half luff point** to the **half leech point**.

In practice:



1. Lay the sail out flat on a suitable floor.

2 Establish **head point, tack point** and **clew point** as shown by the diagram.

Note that for a symmetric spinnaker, **luff/leech** and **tack point/clew point** are interchangeable.

When there is a cut-out or rounded corner in the **sail edges** at a corner point, the extension of the **sail edge** shall be found using a batten as specified in ERS H.5.4.

The batten specified in ERS H.5.4.(a) shall be of constant bend characteristics to achieve a consistent and repeatable measurement, a minimum length of 1m and not longer than 25% of foot length. The measurer shall provide photographs to the Rating Authority.

3. Straighten the **luff** and measure the **luff length** between the **head point** and the **tack point**.

4. Straighten the **leech** and measure the **leech length** between the **head point** and the **clew point**.

5. Straighten the **foot** and measure the **foot length** between the **tack point** and the **clew point**.

6. Fold the **head point** to the **tack point**. Mark the fold. That is **half luff point**.

7. Fold the **head point** to the **clew point**. Mark the fold. That is **half leech point**.

8. Measure from the **half luff point** to the **half leech point**. This will give you **half width**.

References:

Equipment Rules of Sailing
https://www.sailing.org/inside-world-sailing/rules-regulations/equipment-rules-of-sailing/

G.4.1, G.4.2 and G.4.3 define **clew point, head point**, and **tack point**.

G.5.2 defines **half leech point**.

G.5.7 defines **half luff point**.

G.7.1, G.7.2 and G.7.3 define **foot length**, **leech length** and **luff length**.

G.7.5 (b) defines **half width**.

H.5.4 and IRC Rule 13.2 defines **Extended as necessary**.

APPENDIX 7. BULB WEIGHT MEASUREMENT

For several years now IRC has required bulb weight to be provided for keel types 10, 11 and 12.

There are several methods which may be used to establish this, with varying levels of accuracy and reliability. In general we will not require this to be measured and if you do plan to measure it please contact the Rule Authority to confirm that it is necessary and which method is to be used as a preference. We will also base the rating calculation on the most accurately understood data that we have. However, if needed, the methods used are detailed below:

A7.1 Weigh the bulb.

Weighing the bulb is the most rigorous method. The bulb needs to be weighed separately from the keel fin, normally at a stage of manufacture and normally this is only possible when a new keel is being assembled. This needs to be done in exactly the same way as boat weight, using a single point lift with an appropriately calibrated and tested load cell. Allowance may need to be made for lifting eyes and corrector weight pockets, along with any additional lead that may be fitted into the fin to bulb recess.

The IRC definition of Bulb Weight is:-
The weight of the **Bulb** and any part of the **Keel** below the upper surface of the bulb (including connection plates, under-fin spacers and infills)

This is the weight of everything shown below the red line in the picture below;



It is important to document what is included. Note details & photograph where possible the items for future reference. The required weight will be made up of a combination of the following components:

- Bulb Casting
- Section of the keel fin that is below the upper surface of the bulb
- Bulb to keel fin attachment bolts including washers and any plates
- Under-fin spacers plates that fit between the keel fin and bulb
- Ballast for pockets & infill pieces

A.7.1.1 Bulb Casting

Typically, a bulb is weighed by hanging the bulb casting from a loadcell. In the same procedure for weighing a hull. Weigh at least twice to check for consistency and don't forget to correct for the weight of the strops and any other lifting gear below the loadcell.



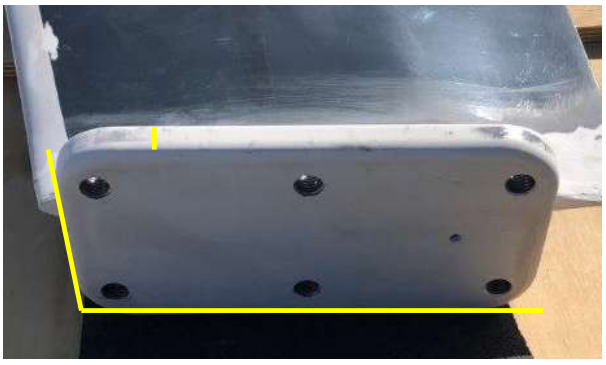


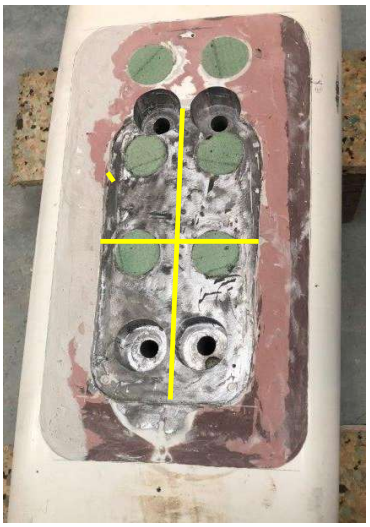
A.7.1.2 Section of the keel fin that is below the upper surface of the bulb

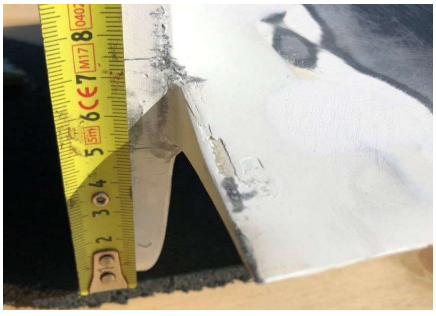
The keel fin weight below the upper surface of the bulb is not determined by weighing. Measurement is required to determine the volume of material, and the weight is calculated using the density of the keel fin material.

Either the volume of the fin foot (length, breadth & depth) can be measured or the recess in the bulb casting. If measuring the recess in the bulb casting checks should be made to ensure that the recess is not over length to allow a longitudinal position to be varied. If this is the case, then determine if the extra length check will be filled with lead or foam blocks.

The calculated volume should be submitted with the weight of the bulb and other components to allow the final full bulb weight to be calculated. The volume of the bolt holes and any other cut outs may be deducted from the overall volume.







A.7.1.3 Bulb to keel fin attachment bolts including washers & any plates.

These can either be weighed individually or included in the bulb casting weight. Either way it is important to compare the number of bolts with the number of holes to make sure that no bolts are missing.





A.7.1.4 Under-fin spacer plates that fit between the keel fin & bulb

These can either be weighed individually or included in the bulb casting weight. Either way it is important to note the number of plates and their thickness, typically these plates are used for final adjustments to a determined draft measurement.



A.7.1.5 Ballast for pockets & infill pieces

These can either be weighed individually or included in the bulb casting weight. Often bulbs are machined with pockets to allow the final weight & trim to be adjusted, especially if these are partially filled it is important to note the ballast that is included these pockets for future reference.





This is generally only an option for top level programs of new builds, and is not reliable as an option in most cases.

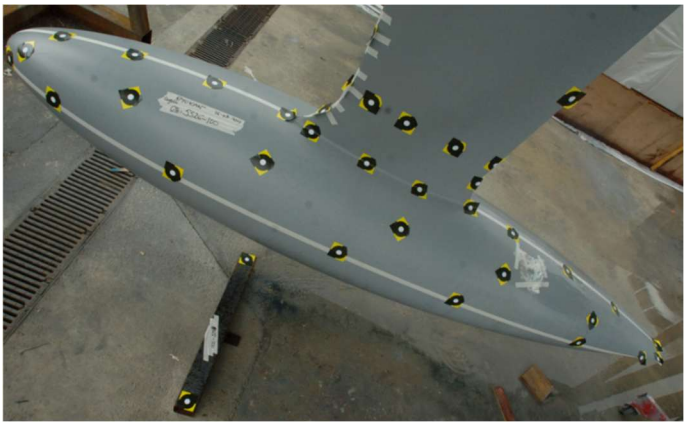
A7.2 Designer/builder declaration.

Most boat builders these days will be purchasing the keel from a sub-contractor. In these cases, it is common practice for the principal builder to require proof of weight in the purchase agreement so that they can confirm they have got what they have asked for, and that it coincides with the designer's specification. Similarly, the designer will have a target weight for the bulb even if they have not required proof of weight.

Again, whilst this information is likely to be somewhere for most boats with these keel types, records of it may be difficult to obtain for older builds and where modifications have been made. We also never really know whether an owner has filled or emptied pockets, or altered the bulb, and often the original designer and builder may not be aware of changes made. It is however a good reference point, and in the vast majority of cases will represent the actual bulb weight well.

A7.3 Volume measurement.

There are several methods that can be used, from the more complex approach of a full laser scan or photogrammetry (photo below) to simply measuring length and circumference at selected points along the length. From this a combination of cross-sectional area and Simpsons rule can be used to calculate the volume of the bulb.



The inaccuracies in this method are:

Density of the bulb:	This needs to be estimated. However, deviation is likely to be small.
Unaccounted pockets:	There are likely to be voids in the bulb for attachments and possible adjustment pockets. If detail is known of these then they can be accounted for.
Internal structure:	Some keels may have internal steel cages. These will reduce the density slightly, but it is best to ignore these unless details are available. But if details are available then we will likely also have full bulb weight details.
Defining the top of the bulb:	With a sharp intersection of the bulb to fin joint this is easy to establish. But with a large radius then some assessment is needed. Best to stop the crane at the bottom of the radius, as the joint is likely to be primarily filler and not made of lead.

For clarity, IRC considers the definition of the bulb in the following way:

IRC Bulb Weight refers to the **Bulb** as defined by the World Sailing Equipment Rules of Sailing. This document is provided as clarification that all under-fin spacers and in-fills shall be included in the total Bulb Weight.

The ERS E.1.2(e) defines **Bulb** as
A **hull appendage** containing **ballast** at the bottom of another **hull appendage** primarily used to affect stability.

The ERS C.6.3(f) defines **Ballast** as
Weight **installed** to influence the stability, flotation or total weight of the **boat**.

The ERS E.1.1 defines **Hull Appendage** as
Any item of equipment – including the items listed in E.1.2– which is:
wholly or partly below the **sheerline** or its extension when fixed or when fully exposed if retractable,
attached to the **hull** shell or another **hull appendage**, and
used to affect: stability, leeway, steerage, directional stability, motion damping, trim, displaced volume.
Any of the following shall be included in the **hull appendage**:
corrector weights,
integral **ballast**, and
associated **fittings**.

Therefore, all under-fin spacers and in-fills shall be included in the total Bulb Weight.
See also Appendix 8 regarding lead added to keel fins.

APPENDIX 8. LEAD IN KEEL FINS

IRC Rule 19.6 states:
Any material in the keel fin of a keel type 10, 11 or 12 with a specific gravity greater than 8.0 (e.g. lead) shall be declared in writing.

IRC rates bulb weight for keel types 10, 11 and 12, and bulb weight is shown on the IRC certificate. The distribution of ballast between the bulb and the keel fin is therefore relevant to the declared keel configuration.

Transferring ballast from the bulb to the lower part of the keel fin is a method of reducing the declared bulb weight at the small cost of a slight rise in the vertical centre of gravity. The declaration requirement of IRC Rule 19.6 below ensures that high-density material in the keel fin is reported and rated accordingly. A typical example might be lead shot inside a hollow steel fin.

For boats with keel types 10, 11 or 12 and keel fins made of steel, iron or composites, the weight of any material in the keel fin with a specific gravity greater than 8.0 shall be declared.

Please note that this applies to keel types 10, 11 and 12 only; and does not refer to the entire keel fin weight.

APPENDIX 9. FOILS MEASUREMENT

IRC definition for foil measurement is as follows:

LIFTING FOILS:

No. of Foils: The maximum number of foils that may be actively in use simultaneously.

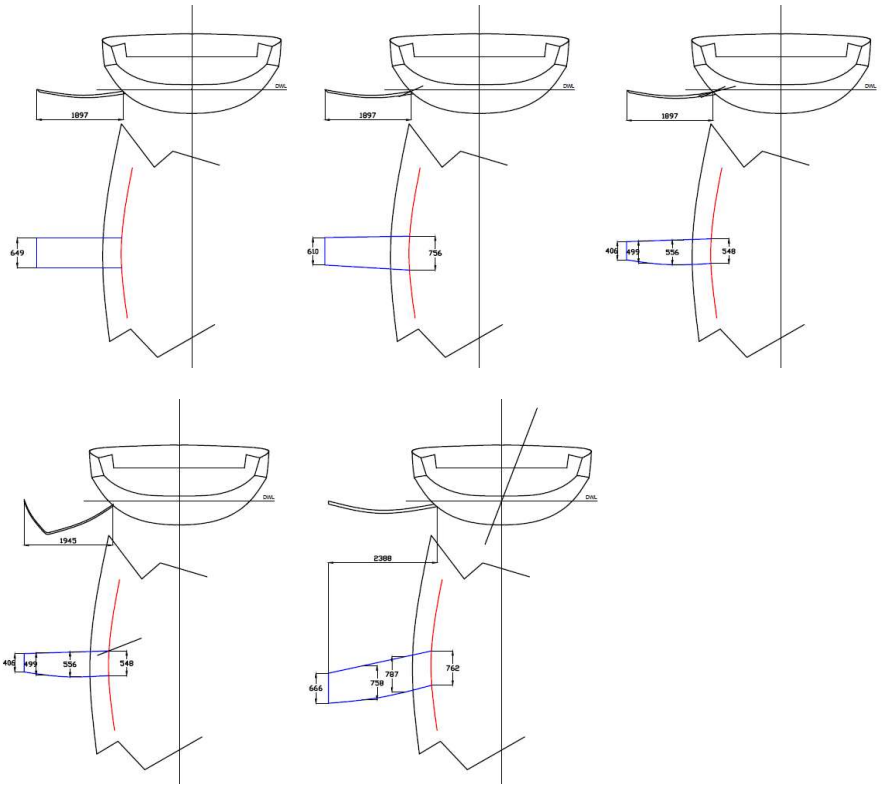
With the **boat** upright in **flotation trim,** for each foil:

Foil Span: The maximum transverse distance outside the hull shell between any two points on the foil in its fully extended position.

Foil Chord: The maximum longitudinal distance of the foil.

The IRC Rating Authority reserves the right to require additional detail to be supplied and also to modify the above definitions on a case by case basis in accordance with IRC Rule 2.8.

Examples for foil measurement are below:



APPENDIX 10. LIST ANGLE MEASUREMENT

The measurement of List Angle is to determine the maximum angle of heel due to the presence of either movable ballast (typically canting keel) or variable ballast (typically water ballast).

IRC Rule 22.3.2 defines the requirement:

22.3.2 **List angle** is measured in the **boat weight** condition (see Rule 17) with any additional **variable ballast**. There is no limit to the **list angle** with ballast tanks fully filled on one side of the **boat** and/or with **moveable ballast** moved fully to one side.

IRC Rule 22.3.5 defines the requirement for boats with both movable and variable ballast. In this case the list angle is only required to be measured specific to the movable ballast, however the volume of the variable ballast needs to be determined and declared.

A10.1 Equipment

- Inclinometer or Digital Spirit Level reading to at least the nearest 0.1°
- Flow Meter & Pump – Optional if available to measure volume of water in the tank.

A10.2 Preparation

- The boat should be afloat in the **boat weight** condition (see Rule 17), any items that may move as the boat heels should be secured to ensure that that remain in position and do not influence the measurement. e.g. Boom secured to prevent swinging.
- Consideration should be given to any current and/or prevailing wind to prevent these environmental factors impacting the result. The measurement should be carried out in light conditions but additionally the boat should be positioned to sit bow or stern into the wind ideally with the ability to rotate with any change in wind direction.
- Water and holding tanks must be empty, fuel tanks should ideally be close to empty.
- Measurements should be taken with no persons aboard the boat, if reading measurements is not possible from adjacent pontoons the measurer should be positioned in a dinghy.
- The list angle with variable ballast should be measured using salt water (1.025 Density) however if fresh water is used additional weigh should be used to correct for the weight difference – 2.5kg per 100 litres



A10.3 Movable Ballast

1. Centre the keel. Check that the keel is centred by comparing the angle of the keel head to the surrounding structure or by measurement of the keel head relative to structure port and starboard.
2. Measure the upright angle of heel.
3. Swing the keel to starboard & measure the heel angle.
4. Swing the keel to port & measure the heel angle.
5. The declared list angle is the average of the maximum measured port list angle and the maximum measured starboard list angle.

If the range of **movable ballast** is limited as permitted by IRC Rule 22.3.6. The measurer should photograph / take notes on the installation with reference measurements on the position of mechanical limit to allow for future checks.

22.3.6 A physical, mechanical limit shall be fitted to all **moveable ballast** system to prevent it being moved further than the position for the declared **list angle**. Such a system shall not rely on sensors or measurement to prevent the declared **list angle** being exceeded unintentionally.

A10.4 Variable Ballast

1. Ensure all tanks are empty, measure the upright angle of heel.
2. Check that the transverse transfer valves on centreline are closed. If the system does not have centreline valves, close the valves as close to the centreline as possible and note the distance off centreline & pipe diameter.
3. Fill starboard tank(s) with sea water with an external pump through the tank vent or using the boats onboard pump system - Check that all compartments are full with no air pockets.
4. Measure angle of heel with the starboard tank(s) full. Starboard list angle is the difference between this result and the upright heel angle measured in step 1.
5. Empty all starboard tank(s).
6. Check the boat is back to upright comparing the heel angle to the angle measured in step 1.
7. Fill port tank(s) with sea water with an external pump through the tank vent or using the boats onboard pump system – Check that all compartments are full with no air pockets.
8. Measure angle of heel with the port tank(s) full. Port list angle is the difference between this result and the upright heel angle measured in step 6.
9. Empty all port tank(s).
10. Check boat is back to upright comparing the heel angle to the angle measured in steps 1 & 6.
11. Check for consistency in the results especially in the upright heel angle measured in steps 1, 6 & 10. If in doubt repeat the measurements.
12. The declared list angle is the average of the maximum port list angle and the maximum starboard list angle.
13. Centreline ballast tanks are rated differently and shall be reported to the Rating Authority. In boats with multiple tanks maximum list angle may not be with all tanks full.

NOTES