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## 1 Introduction

- 1.1 This document defines the rules that govern an **AC75 Class Yacht**, the class of **yacht** chosen to compete in the 36<sup>th</sup> America's Cup.
- 1.2 This **AC75 Class Rule** shall be read and interpreted in conjunction with the **AC Technical Regulations**, which together form the **AC75 Class Rules**.
- 1.3 The **AC75 Class Yacht** is a high-performance monohull intended to:
  - (a) promote head-to-head match racing and close competition;
  - (b) spearhead the development of sailing through innovative technology, and maintain the America's Cup as the world's premier sailing event;
  - (c) ensure the class is relevant to the sport of sailing with connection to the community of sailors;
  - (d) be demanding to sail, rewarding the top level of skill for all sailors on the **yacht**;
  - (e) provide competitive racing in light and stronger wind conditions; and
  - (f) incorporate practical requirements for the launching, retrieval and transportation of the **yacht**.
- 1.4 An **AC75 Class Yacht** shall comply with the **AC75 Class Rules** when racing, and at other times as required by the **AC75 Class Rules** and the **Protocol**.
- 1.5 The **AC75 Class Yacht** shall be propelled by sails only.
- 1.6 **Competitors** are ultimately and solely responsible for the safety and structural integrity of the whole (and any part or parts) of their **AC75 Class Yacht**. No express or implied warranty of safety, stability or structural integrity shall result from compliance with the whole or any part of the **AC75 Class Rules**. Any structural testing required for compliance with the **AC75 Class Rules** does not guarantee safety or structural integrity nor does it relieve the **Competitor** of this responsibility.

## 2 Materials

- 2.1 Rule 2 applies to all components except:
  - (a) supplied components, such as the **foil arm stocks**, the **FCS** and the **supplied rigging**;
  - (b) material specified in the supplied **mast** drawing package;
  - (c) electrical and electronic components, and their enclosures or housings (for the avoidance of doubt this includes hall effect sensor magnetic shielding materials), proving that:
    - (i) they have no significant structural contribution;
    - (ii) each assembly is limited to a maximum density of 11,400 kg/m<sup>3</sup>; and
    - (iii) materials with a density greater than 11,400 kg/m<sup>3</sup> are not used in volumes that have any significant effect on the distribution of mass throughout the **yacht**.
- 2.2 Material property values detailed herein are to be evaluated at 20°C and 1 atmosphere pressure.
- 2.3 Materials shall have a maximum density of 11,400 kg/m<sup>3</sup>.

2.4 Materials shall have a maximum elastic modulus as detailed below:

Material category	Maximum Modulus (GPa)	Certificates Required
Fibre reinforcement in <b>foils, rudders, masts and battens</b>	395	Yes
*Fibre reinforcement in thermoplastic components	Unlimited	No
Fibre reinforcement in <b>commercial pre-consolidated FRP</b>	Unlimited	No
<b>Commercial hardware</b>	Unlimited	No
Fibre reinforcement in components not listed above	300	Yes
<b>Commercial core</b> material in all components	75	No
Surface treatments	Unlimited	No
Material not listed above	220	No

*\*As described in Rules 3.3.*

2.5 Fibre modulus in Rule 2.4 is to be measured by one of the following methods, or an equivalent method approved by the **Rules Committee**:

- (a) SACMA-SRM16;
- (b) ASTM D 4018;
- (c) TY-030B;
- (d) JIS R 7601; or
- (e) ISO 10618.

2.6 For the avoidance of doubt, modulus limits on fibre and other materials in Rule 2.4 apply to **FRP** resin additives, such as nanoparticles and microspheres.

2.7 The limit on **commercial core** material in Rule 2.4 refers to the maximum solid compressive modulus of elasticity, in any direction, of the constituent material. For example:

- (a) for aluminium honeycomb, the limit applies to the modulus of aluminium, approximately 70 GPa; and
- (b) for a composite **core**, the limit applies to the modulus of the **core** laminate, not the individual fibres or matrix.

2.8 **Core** materials must be **commercial core**. Unexpanded honeycomb may be expanded, and **core** material may be cut and shaped for its intended purpose, but it must not be processed to alter its fundamental structure (e.g. it is not permitted to 3D print a **core** material from plastic, since this would be changing the structure of the material). Only the following **core** materials are permitted:

- (a) aluminium honeycomb (3000 or 5000 series only, which may be surface treated to prevent corrosion);
- (b) meta-aramid (Nomex or equivalent) honeycomb;
- (c) para-aramid (N636 or equivalent) honeycomb, except in the **hull shell** below the **perimeter line**;
- (d) timber; or
- (e) plastic foam.

2.9 Metal materials in **foil wings, foil flaps** and **rudders** shall not exceed the following values:

Material category	Maximum Yield Strength (MPa)	Maximum Density (kg/m <sup>3</sup> )	Evidence Required
Lead alloys with greater than 95% lead content by mass	Unlimited	11400	No
<b>Commercial hardware</b>	Unlimited	11400	No
High strength metals	1500	8000	Yes
Low strength metals	500	8100	No

2.10 For metal materials where evidence is required, this evidence is defined as:

- (a) yield strength measured by tensile tests:
  - (i) of a minimum of three witness specimens from the same material batch and subjected to the same heat treatment cycle or other post processing technique;
  - (ii) performed in accordance with ISO 6892-1 or ASTM E8M by an external testing laboratory accredited by a signatory to the International Laboratories Agreement Cooperation (ILAC) Mutual Recognition Agreement (MRA); and
  - (iii) with the reported value being the average 0.2% offset yield strength ( $R_p0.2$ ) of the three specimens; and
- (b) density is measured by:
  - (i) a manufacturer’s technical datasheet showing the composition and nominal density; and
  - (ii) a mill certificate showing the material meets the composition in the manufacturer’s technical datasheet.

2.11 For all categories in Rule 2.9, **competitors** must submit a declaration that metal materials in **foil wings, foil flaps** and **rudders** satisfy Rule 2.9.

2.12 The “Surface treatment” category in Rule 2.4 only applies to material that is:

- (a) contained in a surface layer not more than 0.5 mm thick; and
- (b) for the purpose of:
  - (i) improving resistance to wear, fatigue, or corrosion; and/or
  - (ii) fairing or modifying the appearance of a surface.

2.13 The limit on “Other material” in Rule 2.4 applies to all materials that do not fall into the other categories, and refers to the maximum modulus in any direction.

2.14 Where certificates are required for a category in Rule 2.4, **Competitors** must submit copies of material certificates for each roll of fibre used for that category, where each roll must satisfy the material restrictions herein.

2.15 **Competitors** must supply a declaration that all components of a category only used fibre for which certificates have been supplied. It is not necessary to submit documentation indicating which rolls of material have been used in each individual part.

2.16 As an exception to the requirements listed in Rule 2.4, material certificates are not required for glass, polyethylene, polyester or polypropylene fibre.

2.17 For all categories in Rule 2.4, **Competitors** must submit a declaration that the material used in all components satisfies Rule 2.

- 2.18 Further details relating to the information required by Rules 2.14, 2.15 and 2.17 will be issued according to Rule 33.
- 2.19 Boron and Beryllium are prohibited except:
- (a) where used in alloys in concentrations of no more than 0.00042%;
  - (b) in **commercial hardware**; and
  - (c) as part of neodymium magnets included in hall effect sensors and clothing.
- 2.20 Gases shall have a minimum density of  $1.1 \text{ kg/m}^3$ , except for nitrogen used within hydraulic systems.

### 3 Construction methods

3.1 Rule 3 applies to all components except:

- (a) supplied components, such as the **foil arms stocks**, the **FCS** and the **supplied rigging**; and
- (b) electrical and electronic components, provided they have no significant structural contribution.

3.2 Applied temperatures and compaction pressures of **FRP** material shall not exceed the following values at any stage during construction, or after construction:

Category	Maximum Temperature (°C)	Maximum Compaction Pressure (bar)
<b>FRP material in hulls*</b>	135	1.1
<b>Quasi-isotropic FRP plate in hulls</b>	135	7.0
<b>FRP material in sail skins</b>	Unlimited	Unlimited
Thermoplastic <b>FRP</b> material	450	Unlimited
<b>Commercial pre-consolidated FRP</b>	Unlimited	Unlimited
<b>FRP in commercial hardware</b>	Unlimited	Unlimited
<b>FRP material not listed above</b>	135	7.0

*\*Except thermoplastic **FRP** material or **commercial pre-consolidated FRP** in hulls*

3.3 Thermoplastic **FRP** material in Rule 3.2:

- (a) may be used within any component, including the **hull**;
- (b) shall be restricted to a maximum total mass of 15.0 kg, combining all such material within the **yacht** except that excluded by Rule 3.1; and
- (c) may only be sourced as either:
  - (i) constituent material (e.g. pre-preg tape or cloth); or
  - (ii) pre-consolidated solid laminates in standard shapes (e.g. plate, bar, rod, tube, but not honey-comb), in which case they must be **commercial pre-consolidated FRP** and the temperature limit applies only after delivery of the component from the manufacturer.

3.4 The maximum pressures in Rule 3.2 refer to the average pressure applied over the surface of a component, or to that part of a component under pressure. Local regions of higher pressure may be applied, for example by hand clamps or mechanical fastenings, provided the average is not exceeded.

3.5 The component of pressure applied by conventional wrapping and winding methods (for construction around a mandrel, or similar) is excluded from the pressure limits given in Rules 3.2.

3.6 Electron beam or other non-thermal radiation cure of **FRP** components is prohibited. This does not prohibit curing **FRP** components by passing electrical current through them to generate heat.

3.7 Construction of a **hull** shall meet the following criteria:

$$k_{LCA} + \sum_{i=1}^n a_i(k_{i,PLUG} + k_{i,MOULD}) \geq 2.5$$

where:

$a_i$  is the proportion of the **hull surface** manufactured by a distinct tooling approach;

$n$  is the total number of distinct tooling approaches required to build the **hull surface**;

$$k_{LCA} = \begin{cases} 1, & \text{if a life-cycle analysis is performed on the } \mathbf{hull} \text{ to the satisfaction of the} \\ & \mathbf{Measurement Committee} \\ 0, & \text{otherwise} \end{cases}$$

$$k_{PLUG} = \begin{cases} 2, & \text{if a plug is not required} \\ 1, & \text{if the mould plug is constructed of recyclable material (e.g. PET), with that plug} \\ & \text{being delivered to a recycling plant by 1st January 2024} \\ 1, & \text{if the mould plug is constructed of recycled material} \\ 1, & \text{if the mould plug is constructed of sustainably sourced material (e.g. timber)} \\ 0, & \text{otherwise} \end{cases}$$

$$k_{MOULD} = \begin{cases} 2, & \text{if a mould is not required} \\ 1, & \text{if at least 10\% of the total mass of carbon reinforcement used in the mould is from} \\ & \text{recycled sources} \\ 1, & \text{if the mould is constructed from fibres with low embodied energy (e.g. basalt)} \\ 1, & \text{if the mould is constructed of sustainably sourced material (e.g. timber)} \\ 0, & \text{otherwise} \end{cases}$$

3.8 The life-cycle analysis in Rule 3.7 shall;

- (a) be submitted as a written report to the **Measurement Committee**;
- (b) follow the guidelines defined by ISO 14040/14044; and
- (c) be a cradle-to-gate life-cycle analysis with at least:
  - (i) the carbon footprint represented in kgCO<sub>2</sub>e; and
  - (ii) the production of solid waste represented in kg,

associated with the construction of the **hull**, including the sourcing of material, in addition to the transport of the **hull** by sea or air to the Match venue but excluding the use and disposal phases.

## 4 Commercial products

4.1 **Commercial products** shall fall into the following categories:

- (a) **commercial core**;
- (b) **commercial pre-consolidated FRP**;
- (c) **commercial hardware**; and
- (d) **commercial paint**.

4.2 **Commercial products** shall:

- (a) be readily available for purchase by all **Competitors** at a reasonable market price;
- (b) have a lead time to delivery of no more than twelve months;
- (c) not have been developed directly or indirectly for a **Competitor** or specific group of **Competitors**, unless prior to 31 March 2018; and
- (d) be detailed on the relevant list of approved commercial products referenced by Rule 4.3.

4.3 The **Rules Committee** shall maintain a list of approved **commercial products** in each category. Such products can be approved and listed en masse, for example by approving an entire catalogue of products from a supplier, providing the details of the specific catalogue (e.g. publication year) are included and a permanent record of that catalogue's contents is available.

4.4 **Commercial products** can be added to the relevant list by **Competitors** submitting a request to the **Rules Committee** at any time prior to 6 months before the first race of the Match. The request must clearly define the **commercial product** and the category for which approval is being requested.

4.5 On receiving a request, the **Rules Committee** shall interpret whether the item is a **commercial product** by following the procedure detailed in the Interpretation and Amendment section of the **AC Technical Regulations** to determine whether the requested product satisfies Rules 4.2 (a), 4.2 (b) and 4.2 (c). However, they may delay the start of the procedure by up to one month after receiving the request in order to deal with multiple requests in a single batch.

4.6 **Commercial pre-consolidated FRP**:

- (a) is restricted to a maximum combined mass of 150 kg on each **AC75 Class Yacht**;
- (b) shall make up no more than 15.0 kg of a **hull**;
- (c) shall not be used in a **foil arm fairing, foil wing, foil flap or rudder**; and
- (d) shall be sourced as pre-consolidated and cured solid laminates in standard shapes (e.g. plate, bar, rod, tube, but not honeycomb).

4.7 **Commercial hardware**:

- (a) is restricted to a maximum combined mass of 150 kg on each **AC75 Class Yacht**;
- (b) shall make up no more than 15.0 kg of a **hull**;
- (c) shall not be processed to alter their fundamental structure or shape (e.g. machined, re-shaped, melted down or heat-treated), except that pins and fasteners may be trimmed to length; and
- (d) may contain **FRP** but must not be entirely made of **FRP**.

4.8 An initial list of **commercial paints** shall include:

Manufacturer	Products
Alexseal	HS Base Coat; HS Clear Coat
Awlgrip	Awlcraft 2000; Topcoats G/H-Line; HDT Clearcoat
Cromax	3050S ChromaClear
GRS Deltron BC	Global Refinish System Deltron Basecoat
MaxNeyer	Matt Semi-Gloss Clear 1-360-0710/ 1-360-0750
Nautix	L2; NX194
Resene	Durepox; Durepox Extreme Clear; Durepox High Performance Clear
Spies Hecker	Plastic automotive paint; Permasolid HS Automotive Topcoat 27*

*\*This excludes the Permasolid Texture Component SA 101 and SA 102 that are part of the Spies Hecker Plastic system.*

4.9 Approved **commercial pre-consolidated FRP** and **commercial hardware** shall only be counted in the mass limits of Rules 4.6 and 4.7 where those products do not satisfy the other Rule requirements, such as material and construction limits, at the locations in which they are used.

## 5 Surface finishes

- 5.1 Except as permitted in Rules 5.5 and 5.6, the outermost layer of the **hull, foils** (excluding foil systems controlled by Rule) and **rudder** must be either
- (a) a **commercial paint** approved by the **Rules Committee** according to Rule 4, who shall only approve paints that are comparable to those on the list provided in Rule 4.8; or
  - (b) an unpainted steel surface.
- 5.2 **Competitors** must not alter the chemistry of paints except with products that are a standard part of an approved paint system and used in compliance with the manufacturer's standard guidelines.
- 5.3 Paints or additives that are designed to reduce surface friction (such as PTFE) shall not be used on the outermost layer of the **hull, foils** or **rudder**.
- 5.4 Surfaces may be sanded, polished and cleaned, providing that the only substances that remain on those surfaces when the **yacht** is afloat satisfy Rules 5.1 (a), 5.2 and 5.3.
- 5.5 **Competitors** may apply vinyl or plastic film over the paint for the purpose of branding, providing it complies with Rule 5.7.
- 5.6 On areas of the **deck** where crew operate, or on fittings attached to the **deck**, **Competitors** are permitted to apply non-skid products or coatings. These areas shall be no larger than necessary and shall not extend into areas that crew do not access during racing.
- 5.7 Devices and finishes whose primary purpose is to reduce friction drag by altering the structure of the boundary layer are prohibited. This prohibition includes, but is not limited to:
- (a) electric, magnetic, sonic, thermal and chemical devices;
  - (b) patterned or textured finishes, LEBUs; and
  - (c) devices that suck fluid from or blow fluid on to the surface of a component.

This rule does not prohibit surface finishing permitted by Rule 5.4, passive surface features, such as fences or vortex generators, which extend outside the local boundary layer. The thickness of the boundary layer  $\delta$  shall be determined using the formula:

$$\delta = \frac{0.37x}{Re_x^{0.2}}$$

where

$x$  is the local distance from the forward most point of the object;

$Re_x$  is the local Reynolds number (based on  $x$ );

and the following properties and speeds shall be used:

	Velocity (knots)	Density kg/m <sup>3</sup>	Dynamic viscosity (Pa.s)
Air	30	1.225	$1.789 \times 10^{-5}$
Water	30	1025	$1.103 \times 10^{-3}$

## 6 Mass

- 6.1 The table below lists masses and **longitudinal** centres of gravity (LCGs) in the **yacht**-fixed frame ( $x, y, z$ ) which are referred to by other Rules. The table does not impose any requirements except those referred to in other Rules.

Component	Mass (kg)	LCG (m)
<b>Yacht assembly</b>	<b>6160 – 6200</b>	<b>9.000 – 9.350</b>
<b>Platform</b>	<b>*<math>m_p</math></b>	<b>*<math>x_p</math></b>
<b>Hull, rudder, and other parts or components</b>	—	
Port <b>foil</b>	*1265 – 1270	
<b>Foil arm fairing/wing/flap/systems</b>	806	
<b>†Foil arm stock</b>	464	
Starboard <b>foil</b>	*1265 – 1270	
<b>Foil arm fairing/wing/flap/systems</b>	806	
<b>†Foil arm stock</b>	464	
<b>†Foil arm pins and bearings</b>	64	10.37 – 11.66
<b>†FCS</b>	343.5	10.50 – 11.80
<b>Platform</b> -weighed <b>Mast</b> and <b>Mainsail</b> hardware	—	
<b>†Supplied media equipment</b>	112	8.90
<b>Mast (excluding parts weighed with platform)</b>	<b>*<math>m_{MAST}</math></b>	<b><math>x_{MAST}</math></b>
<b>Mast tube</b> and attached components, etc.	—	
<b>†Supplied rigging</b>	39.5	
<b>†Supplied media equipment</b>	22.3	
<b>Mainsail (excluding parts weighed with platform)</b>	<b>*<math>m_{MAIN}</math></b>	<b>5.70</b>
<b>Jib</b>	<b>*53 – 55</b>	<b>12.00</b>
<b>Crew &amp; gear</b>	<b>712 – 740</b>	
Crew	*680 – 700	
Crew's <b>carried equipment</b>	*32 – 40	
<b>†Crew supplied media equipment</b>	4	
<b>Total</b>	<b>6920 – 6940</b>	

*\*Measured, †Supplied equipment*

- 6.2 **Foils** shall be weighed and their centres of mass, in a plane parallel to **TRP**, shall be determined in **foil** measurement condition. The following restrictions apply:
- (a) Each **foil** must have a mass within the range specified for “Port **foil**” and “Starboard **foil**” in Rule 6.1.
  - (b) When **projected** on to a plane parallel to **TRP**, the distance from the **foil cant** axis to the centre of mass of:
    - (i) a **foil arm stock** shall be 1.204 m; and
    - (ii) a **foil** shall be at least 2.890 m.
- 6.3 The **platform** mass  $m_p$  and LCG  $x_p$  shall be determined in the measurement condition described by Rule 7.7.
- 6.4 The **mast** mass  $m_{MAST}$  and centre of mass  $(x_{MAST}, y_{MAST}, z_{MAST})$  shall be determined in the **mast** measurement condition described by Rule 15.15 where:
- (a) centre of mass components in the **mast**-fixed reference frame shall be:
    - (i)  $u_{MAST}$  assumed to equal 0.0 m; and
    - (ii)  $v_{MAST}$  assumed to equal 0.0 m; and
    - (iii)  $w_{MAST}$  as measured; and
  - (b) converted into a **yacht**-fixed LCG  $x_{MAST}$  by assuming a **mast** rake of 5°.
- 6.5 The **mainsail** mass  $m_{MAIN}$  shall be determined in **mainsail** measurement condition.
- 6.6 The **Jib** must have a mass within the range specified for “Jib” shown in Rule 6.1.
- 6.7 The **yacht assembly** mass  $m_y$  and longitudinal centre of mass  $x_y$ :
- (a) shall be determined by combining the following masses and LCGs:
    - (i) **platform** mass  $m_p$  at LCG  $x_p$ ;
    - (ii) **mast** mass  $m_{MAST}$  at longitudinal centre of mass  $x_{MAST}$ ;
    - (iii) **mainsail** mass  $m_{MAIN}$  at the LCG specified in Rule 6.1; and
    - (iv) the **jib** mass taken as the middle of the allowable range specified in Rule 6.1, with an LCG as specified in Rule 6.1; and
  - (b) must lie within the mass and LCG ranges specified for “**Yacht assembly**” in Rule 6.1.
- 6.8 Crew must have a mass within the range specified for “Crew” shown in Rule 6.1.
- 6.9 Crew’s **carried equipment**:
- (a) must have a mass no greater than the upper end of the range specified for “Crew’s **carried equipment**” shown in Rule 6.1; and
  - (b) may have a mass less than the lower end of the specified range, in which case, ballast shall be added such that the sum of the **carried equipment** mass and the ballast mass lies within the range. Any such ballast:
    - (i) shall be attached to the top of the **deck** between 6.0 m and 7.0 m forward of **TRP**; and
    - (ii) shall either be on **LCP**, or be split evenly and located in two parts symmetrically about **LCP**.
- 6.10 Nothing shall be aboard the **yacht** that is not included in Rule 6.1.

## 7 General arrangement

7.1 The **AC75 Class Yacht** shall have:

- (a) one **hull**;
- (b) two **foils**;
- (c) one **rudder**;
- (d) one **mast**;
- (e) one set of **supplied rigging**;
- (f) one **mainsail**; and
- (g) one **jib**.

In addition to those required components listed above, the **AC75 Class Yacht** may also include any other parts or components except where prohibited within the **AC75 Class Rules**.

7.2 Except where otherwise specified, components that are described separately within the **AC75 Class Rules** may be physically constructed as single parts, with virtual splits delineating boundaries across which different rules or declarations may apply.

7.3 No part of the **yacht** except the fairing flaps permitted by Rule 8.21, **foils** and the **rudder** shall lie below the **hull lower surface**.

7.4 No part of the **yacht** except the **mast**, sails, rigging, **foils**, equipment permitted in Rule 27.1 (d), supplied media equipment and wind instrumentation shall lie more than 1.700 m above **MWP**.

7.5 When **projected** on to **MWP**, no part of the **yacht**, other than the **foils**, **rudder**, **mast**, sails, rigging, supplied media equipment and instrumentation permitted by Rule 27, shall lie outside of the area **projected** by the **hull** on to **MWP**.

7.6 The **yacht** shall be capable of being lifted:

- (a) by a crane, from one or more primary lifting points located forward of **MRP**, with secondary lines led aft; and
- (b) by gantry cranes for measurement, from three or four separate lifting points, where:
  - (i) lifting points must be arranged symmetrically about **LCP**;
  - (ii) there must be a lifting point at least 1.5 m either side of **LCP**;
  - (iii) at least one lifting point must be **longitudinally** separated from two others by at least 8.0 m; and
  - (iv) each lifting point must attract at least 10% of the weight of the **yacht** in **platform** measurement condition.

7.7 The **platform** measurement condition shall be with:

- (a) the **hull** levelled with **MWP** horizontal;
- (b) both **foils** canted to an **FCS** angle of  $7.5^\circ$  as shown in Figure 26.1;
- (c) both **foil flaps** set to the centre of their range of motion;
- (d) the symmetry plane of the **rudder** aligned to **LCP**;
- (e) the **rudder** rake set to the centre of its range of motion;
- (f) those components of the **mast** and **mainsail** not included in their respective measurement conditions located on the **deck** in positions representative of their longitudinal centres of mass with the rig stepped and the **mainsail** hoisted; and
- (g) other components in their normal sailing positions.

7.8 Parts of the **Yacht** that can cover the crew shall be controlled as follows:

- (a) an elliptical prism (a solid right elliptic cylinder) is defined with:
  - (i) a major axis of 450 mm;
  - (ii) a minor axis of 200 mm; and
  - (iii) a height of 600 mm;
- (b) when viewed from above and orthogonal to **MWP**, no more more than 35% of the prism shall be capable of being covered by any part of the **yacht** other than the **mast**, sails and rigging;
- (c) this Rule shall be satisfied for any orientation of the prism, and for any position that the crew are permitted to occupy whilst racing, and which the prism can fit into (whether or not the prism can be moved into this position from outside the **yacht**);
- (d) movable and squashable parts of the **yacht** which are attached to the **yacht**, such as grinding handles, steering wheels and foam blocks, shall be considered in all of their possible positions, both to determine the maximum extent of positions and orientations of the prism, and to determine the maximum coverage of the prism; and
- (e) with respect to unattached hand-held movable devices, or devices only attached to the **yacht** by cables or lines, such as top handles for winches or **passive input devices**, only those devices that are usually used by a crew member in the approximate position of the prism shall be considered to determine maximum possible coverage of the prism.

- 7.9 Apart from permitted movement of **foils, foil arm drums** and **control surfaces**, the only parts of the **yacht** that may move or be moved are:
- (a) parts moved to control movement of a **control surface**;
  - (b) hand-held devices whose only purpose is to house **passive input devices** and/or **crew indication devices**;
  - (c) parts moved in preparation for controlling a **control surface** (e.g. setting a **jib** car prior to hoisting or charging an accumulator);
  - (d) rigging or deck gear being organised after controlling a **control surface** (e.g. stowing sheets);
  - (e) within the **FCS**;
  - (f) access panels being opened or closed (which must not be into the **hull**);
  - (g) drainage flaps permitted by Rule 8.21;
  - (h) a simple mechanical wind indicator that has no purpose other than indicating the apparent wind direction;
  - (i) mechanical components within electrical systems, such as a cooling fan, a bilge pump, a wind indicator, a line or quadrant connecting a string potentiometer to part of a **control system** or **control surface**;
  - (j) seals of penetrations into the **hull**, e.g. a flexible boot, provided such parts move only as a result of permitted **control surface** movements and have no purpose other than preventing water ingress;
  - (k) hydraulic hoses and electrical cables moving as the result of the permitted movement of a component (e.g. a hose whose movement follows the displacement of a ram attached to a boom);
  - (l) slack rigging or **woollies**;
  - (m) parts moved solely for safety reasons; or
  - (n) parts moved as the result of an unintended breakdown, as determined by the **Measurement Committee**.
- 7.10 Other than the permitted movement of **foils, foil arm drums** or **control surfaces**, movement of parts of the **yacht** permitted by Rule 7.9 shall have no significant effect on:
- (a) aerodynamic loads;
  - (b) hydrodynamic loads;
  - (c) the angular momentum of the **yacht**; or
  - (d) the centre of mass of the **yacht**.

## 8 Hull geometry

- 8.1 A **hull's blueprint** shall be an IGES file that represents the geometry that the **hull surface** was designed to. The geometry shall form a single closed volume, and:
- (a) shall include three measurement reference points, located:
    - (i) on **MWP** and on **LCP**, at 20.700 m from **TRP**; and
    - (ii) on **MWP** and on **TRP**, offset 2.000 m either side of **LCP**.
  - (b) penetrations into the closed volume permitted by Rule 8.19 shall be closed with surfaces that connect their edges and are fair with respect to the surrounding **hull surface**;
  - (c) conduits through the **hull surface** permitted by Rule 8.17 (a) shall be included in the **blueprint** and their walls shall be deemed to be part of the **deck**; any boundary with the **hull lower surface** shall be where the conduit's exit meets the fair extension of the surrounding **hull lower surface**; and
  - (d) internal structure within the closed volume shall not be included, but the positions of bulkheads required to satisfy Rule 8.11 shall be included as separate IGES surfaces.
- 8.2 Three screws shall be installed on the **hull surface** for the purpose of locating the reference points of Rule 8.1 (a). If a reference point does not lie on the **hull surface**, the screw shall be installed at declared offsets from the reference point, as close as reasonably possible to the reference point, and the exact location of the screw shall be included in the **hull blueprint**.
- 8.3 When aligned with the reference points of Rule 8.1 (a), the **hull surface** must match its **blueprint** according to a measurement procedure issued by the **Rules Committee**, with tolerances of:
- (a)  $\pm 5$  mm over the **hull lower surface**; and
  - (b)  $\pm 10$  mm over the **deck**.
- 8.4 Geometric and flotation requirements pertaining to the **hull surface** within Rule 8 will be measured using the **blueprint** and must be satisfied exactly with no tolerance.
- 8.5 The aftmost point on the **hull surface** shall lie on **TRP**.
- 8.6 The **hull lower surface** shall be **symmetric** about **LCP**.
- 8.7 The forwardmost point on the **hull** shall be no less than 20.600 m and no greater than 20.700 m from **TRP**.
- 8.8 Any line that connects two points on the **perimeter line projected** on to **MWP** shall lie on or inside that projection of the **perimeter line**.
- 8.9 The **perimeter line** shall:
- (a) lie entirely above **MWP**;
  - (b) at its greatest distance from **LCP**, lie between 2.400 m and 2.500 m from **LCP**;
  - (c) at its intersection with a plane 17.000 m forward of **TRP**, lie no more than 1.600 m from **LCP**; and
  - (d) at its intersection with a plane 19.000 m forward of **TRP**, lie no more than 1.000 m from **LCP**.
- 8.10 At any **transverse** cross-section through the **hull lower surface**:
- (a) no horizontal line shall cut the cross-section more than twice; and
  - (b) no vertical line shall cut the cross-section more than once below **MWP**.

Parts of a cross-section within cylindrical regions of length 4.000 m and diameter 1.250 m centred on each **foil cant reference point**, and whose axes are aligned with the **foil cant** axes, are excluded from this Rule.

- 8.11 The **hull surface** shall enclose a volume of at least 60 m<sup>3</sup>, which must include:
- (a) a watertight bulkhead situated more than 9.000 m forward of **TRP** that forms the aftermost extent of an enclosed watertight volume of at least 35 m<sup>3</sup>, where that volume may be subdivided; and
  - (b) a watertight bulkhead situated between 17.000 m and 19.000 m forward of **TRP**.

For the purposes of this Rule, a bulkhead is considered watertight if it able to withstand a uniform pressure of 10 kPa from either side, compliance of which shall be demonstrated by analysis.

- 8.12 The **hull surface** shall satisfy flotation Rules 8.13, 8.14 and 8.15 with:
- (a) the **yacht assembly's** mass  $m_v$  assumed to be equal to 6200 kg;
  - (b) the **yacht assembly's** centre of mass  $(x_v, y_v, z_v)$  assumed to be equal to (9.350, 0.000, 0.750);
  - (c) an assumed water density of 1025 kg/m<sup>3</sup>;
  - (d) buoyancy resulting only from the **hull surface** (not the **foils, rudder** or other components); and
  - (e) hydrostatic pressure acting on all parts of the **hull surface** below the flotation water plane, neglecting flooding of:
    - (i) volumes that would remain dry assuming that any fairing flaps permitted by Rule 8.21 remain closed; and
    - (ii) volumes not included in the **hull surface** such as the **foil** and **rudder wet boxes**.

8.13 When floated to equilibrium under the conditions of Rule 8.12, the measurement reference points required by Rule 8.1 (a) shall lie no more than 25.0 mm above or below the flotation waterplane.

- 8.14 When constrained in heel and left free to float to equilibrium in the other degrees of freedom, the centre of mass of the **yacht assembly** and the centre of buoyancy of the **hull surface**, when both are projected on to the resulting flotation waterplane, must be separated by at least:
- (a) 0.050 m at 7° of heel;
  - (b) 0.260 m at 15° of heel; and
  - (c) 0.975 m at 35° of heel.

- 8.15 When constrained to 90° of heel (such that **MWP** is held perpendicular to a flotation waterplane) and left free to float to equilibrium in the other degrees of freedom, under the conditions of Rule 8.12:
- (a) the centre of buoyancy of the **hull surface** shall be at least 0.820 m above **MWP**; and
  - (b) the angle between **LCP** and the flotation waterplane shall be no more than 5°.

- 8.16 Except within the **foil** and **rudder wet boxes**, the **yacht** shall be self-draining such that no more than 3.0 litres of water is capable of being retained on the deck, in any deck recess, any cockpit, or any other location on the **yacht**. Compliance with this Rule shall be demonstrated as follows, in the absence of a flotation waterplane:
- (a) **Competitors** must provide calculations to the **Measurement Committee** demonstrating that any water temporarily retained, at any water level, will drain at least 90% of its volume within 30 seconds.
  - (b) For any distinct retained water volume, the drainage requirement of Rule 8.16 (a) will be deemed to be met if at any water level, for every 1.000 m<sup>3</sup> of retained volume, an area open to drainage and free from obstructions of at least 0.050 m<sup>2</sup> is present below that water level.
  - (c) In these calculations, water volumes resulting from a sheet of water of more than 100 mm depth being uniformly deposited over the entire **yacht** need not be considered.
  - (d) These drainage requirements must be satisfied for the case when **MWP** is horizontal, and for a range of orientations bounded by:
    - (i) a rotation of the **yacht** by up to  $\pm 10^\circ$  about a **longitudinal** axis; followed by
    - (ii) a rotation of the **yacht** by up to  $\pm 2^\circ$  about a (rotated) **transverse** axis.
  - (e) Porous and textured surfaces are also exempt provided the **Measurement Committee** is satisfied that these are no larger than necessary.
  - (f) These requirements shall be satisfied accounting for the presence of any fairing flaps permitted by Rule 8.21.
  - (g) The **Measurement Committee** may specify an alternative calculation method or drainage requirement if they believe that the above criteria are insufficient to ensure that the **yacht** is self-draining.
- 8.17 The **hull lower surface** shall form a continuous surface bounded only by the **perimeter line**, with no openings, except for:
- (a) the exits of watertight conduits through the **hull** to provide drainage, which shall be:
    - (i) no larger than required for their permitted purpose; and
    - (ii) entirely above **MWP**; and
  - (b) penetrations into the closed volume of the **hull** permitted by Rule 8.19.
- 8.18 Two **foil wet boxes** and one **rudder wet box** are permitted within the **hull surface**, where:
- (a) each **wet box** shall be self draining in the normal sailing conditions when the entire **wet box** is above the water, and have drain area of at least 0.050 m<sup>2</sup> per 1.000 m<sup>3</sup> of floodable volume;
  - (b) the watertight boundary that separates each **wet box** from the remainder of the enclosed **hull** volume need not satisfy the **hull** structural requirements detailed in Rule 9.2;
  - (c) each **foil wet box** shall enclose a volume of no more than 300 litres; and
  - (d) the **rudder wet box** shall enclose a volume of no more than 30 litres.

- 8.19 The enclosed volume of the **hull surface**, including the volumes required by Rule 8.11 must be watertight except for penetrations:
- (a) into the **foil wet boxes**, providing that the penetrations lie entirely within regions defined by cylinders of length 1.600 m and diameter 1.250 m centred on each **foil cant reference point** and whose axes are aligned with the **foil cant** axes;
  - (b) into the **rudder wet box**, providing that the penetration lies entirely within 0.200 m of **LCP** and 1.500 m of **TRP**;
  - (c) on the **deck** and covered by watertight hatches which must not be opened while racing;
  - (d) for the ejection of water from a bilge pump;
  - (e) for the passage of systems or rigging, which must be at least 0.500 m above **MWP** and at least 0.200 m above the flotation waterplane in the condition specified by Rule 8.15; or
  - (f) sealed by means of installed hardware. Openings in installed hardware that would allow passage of water into the watertight volume of the hull must be at least 0.500 m above **MWP** and at least 0.200 m above the flotation waterplane in the condition specified by Rule 8.15.

The total cross-sectional area of openings permitted by Rules 8.19 (e) and 8.19 (f) shall be no more than 0.02 m<sup>2</sup>, after subtracting the cross-sectional area of rigging or systems passing through.

- 8.20 A hatch in the **deck** shall provide access to the media hold for installation and servicing of media equipment. The hatch shall be no smaller than an ellipse measuring 400 by 600 mm.
- 8.21 Fairing flaps on the **hull lower surface** are permitted for closing penetrations or conduit exits, provided that the flaps are no larger than required by Rule 8.16 (b) and have no purpose other than fairing the **hull** surface when water is not draining, and for preventing reverse flow.

## 9 Hull structure

- 9.1 The **hull** shall be a **linear component**.
- 9.2 The minimum areal density of any part of the **hull shell** shall be  $2 \text{ kg/m}^2$ . (Note that this Rule does not imply any stiffness, strength or robustness targets; it exists only to ensure that a **hull shell** is a solid structure and not, for example, a film-covered space frame structure.)
- 9.3 Any **core** used in the **hull shell** shall have a nominal density greater than or equal to  $48 \text{ kg/m}^3$ . Up to 10% of the **hull shell**, by area, shall be exempt from this **core** density limit provided:
- (a) the exempt areas are entirely above the **perimeter line**;
  - (b) no single exempt area exceeds 5% of the **hull shell**; and
  - (c) the exempt areas still satisfy Rule 9.2.
- 9.4 The **hull** shall be fitted with stanchion sockets for the attachment of lifelines when the **yacht** is ashore. The following requirements apply:
- (a) Sockets shall be located on the edge of the working deck along the full length of the **hull** sides and across the transom, at a maximum spacing of 2.200 m.
  - (b) As an exception, sockets are not required in regions where a cockpit wall close to the **perimeter line** forms its own barrier, provided that:
    - (i) the **hull surface** extends to at least 600 mm above the cockpit floor;
    - (ii) there is no more than 120 mm width of cockpit wall, deck or topside surface, measured from the **perimeter line** to the drop to the cockpit floor;
    - (iii) the cockpit is at least 500 mm wide at the required depth, that floor width not to be obscured by **hull surface** or another surface acting as a deck when viewed from above (fittings, pedestals, etc. are permitted to obscure the floor);
    - (iv) widths herein are measured parallel to **MWP** and perpendicular to the local **perimeter line**; and
    - (v) the first socket beyond the end of the cockpit is a maximum of 300 mm from the last point at which these criteria are met, measured parallel to **MWP** as a girth around the **perimeter line**.
  - (c) Sockets shall suit 31.8 mm (1¼") stanchions with a minimum depth of 100 mm.
  - (d) Sockets must be capable of resisting a test load, whereby:
    - (i) a stiff test stanchion shall be placed in the stanchion socket;
    - (ii) a load of 350 N shall be applied to the test stanchion at 600 mm above the top of the stanchion socket, in any direction normal to the stanchion;
    - (iii) the load application point must translate by no more than 100 mm; and
    - (iv) there must be no damage to the stanchion socket.
  - (e) Sockets may be covered or plugged when sailing, providing any such cover or plug can be quickly removed.

## 10 Foils

10.1 Each **foil** shall comprise exactly:

- (a) one **foil arm** and one **foil wing**, which must form a single **linear component**;

The shear pin connection between the foil arm and foil wing used in AC36 does not satisfy the requirements of a linear component. COR/D is reviewing whether to continue using this connection; if it is maintained, this Rule will be updated to allow for this non-linearity in the component junction.

- (b) one **foil flap**;
- (c) one or more **foil systems**.

10.2 A **foil** excludes:

- (a) the removable pins and bearings identified in the **foil arm stock** specification, see Rule 30.1 (c);
- (b) any **foil arm drum**; or
- (c) any other components inside the **hull surface** that are disconnected from a **foil** when it is removed from the **yacht**.

10.3 **Foil systems**:

- (a) shall only comprise mechanical, electrical and hydraulic components, or optical fibres designed to:
- (i) connect a **foil wing** to a **foil flap** and control its movement;
  - (ii) connect segments of a **foil flap**; and/or
  - (iii) provide sensor information to the **yacht**;
- (b) must not contribute significantly to the structure or surface area of the **foil wing** or **foil flap**; and
- (c) must be contained predominantly within the **foil wing**, **foil arm** and/or the **foil flap** such that there are no significant fluid dynamic forces on any parts of those systems.

10.4 For each **foil**, the Wing Symmetry Plane, **WSP**, is identified in Figure 10.1 and is fixed to the **foil wing**, rotating as the **foil arm** cants.

10.5 **Foil** measurement condition shall be with:

- (a) the **yacht** levelled in a cradle;
- (b) the **foil** unloaded by **external forces**, except gravity;
- (c) the **foil wing** correctly mounted on the **foil arm**;
- (d) the **foil flap** correctly mounted on the **foil wing**;
- (e) the **foil systems** connected to the **foil wing** and **foil flap**; and
- (f) the **foil arm** canted such that **WSP** is vertical.

10.6 The **foil wing** and **foil flap**, **projected** to **TRP**, must lie entirely within the **foil wing box** in **foil** measurement condition. This Rule shall be satisfied at all **foil flap** rotation angles and twists.

10.7 Actuators are permitted within foil systems to rotate **foil flaps** about the axis described in Rule 13.10. Any deformation in the **foil** resulting from this actuation is restricted by Rule 13.12. No other devices are permitted to modify the shape of a **foil**.

10.8 The entire **foil** must lie between planes 10.000 m and 12.000 m forward of **TRP**.

- 10.9 The only **foil arm** movement permitted relative to the **hull** is **cant**, being a rotation about the **foil arm cant** axis, a **longitudinal** axis whose position is defined in Figure 26.1.
- 10.10 In **Foil** measurement condition, the cant angle of the foil shall be defined as **FCS** angle  $41.41^\circ$ , with a raising of the **foil** from this position corresponding to an increase in cant.
- 10.11 The **foil** shall be capable of reaching **cant** angles of  $7.5^\circ$  and  $115.0^\circ$ .
- 10.12 No part of a **foil** except the ODA Lower Belt Assembly and the ODA Head Assembly identified in the **foil arm stock** specification, see Rule 30.1 (c), may touch any part of the **yacht** except:
- a **foil arm drum**;
  - hydraulic connections for **foil** systems; and
  - electrical and optical fibre connections.

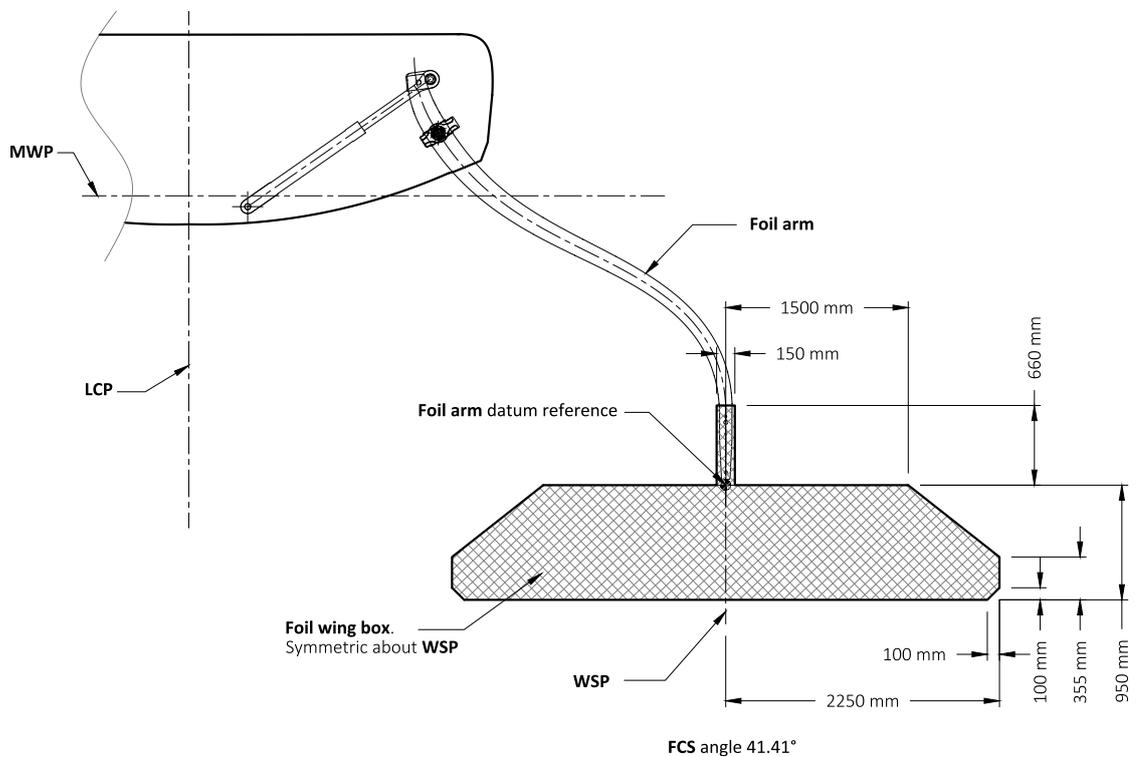


Figure 10.1: The extents of the **foil wing box** are defined by the shaded region in this figure.

## 11 Foil arms

- 11.1 Each **foil arm** shall comprise exactly:
- (a) one **foil arm stock**;
  - (b) one **foil arm fairing**; and
  - (c) additional material as permitted by the **foil arm stock** specification.
- 11.2 The **foil arm stock** specification is defined by the document referenced in Rule 30.1 (c).
- 11.3 The **foil arm stock** must match the **foil arm stock** specification. No modifications are permitted except for:
- (a) the surface finish (sanding and painting as permitted in the **foil arm stock** specification);
  - (b) the installation and repair of optical fibres in the provided groove or grooves and fairing over;
  - (c) the attachment of permitted **foil arm fairings**, which shall only involve the addition of material bonded to the **foil arm stocks**; no part of the **foil arm stock** may be removed, except for surface preparation prior to bonding and sanding to fair the surface after bonding;
  - (d) repairs that return the **foil arm stock** to its original state after being damaged in accordance with the **AC Technical Regulations**; and
  - (e) the addition of material to the **foil arm** leading edge conduit to seal or avoid water retention.
- 11.4 Except as permitted in Rule 11.3, nothing may be added within a **foil arm stock**, except that **foil** systems may pass through the conduit in the **foil arm** leading edge.
- 11.5 **Foil arm fairings** are only permitted in the regions indicated in the supplied **foil arm** drawings [Need to detail this], and are not permitted in the **foil wing box**.
- 11.6 In the region indicated in the supplied **foil arm** drawing, the outside surface shape of the **foil arm fairing** must match the shape specified in that drawing within a tolerance to be specified by the **Measurement Committee**.
- There will be a standard symmetric trailing edge design away from connection to Foil Wing.
- 11.7 **Foil arm** fairings shall not be capable of transmitting any significant bending, shear or torsional loads between the **foil wing** and the **foil arm**.
- 11.8 Penetrations into the **foil wet boxes**, as permitted by Rule 8.19 (a), may be closed by a **foil arm drum**, which:
- (a) must fit entirely within the cylinder described in Rule 8.19 (a);
  - (b) must be a **linear component** and, in the absence of **external forces**, must remain undeformed at all **foil cant** angles;
  - (c) must not translate, and may only rotate about the relevant **foil cant** axis;
  - (d) may only rotate as a result of **foil cant** rotation; and
  - (e) may either:
    - (i) be attached to the **foil arm**, providing it can be disconnected to allow removal of the **foil arm** from the **yacht**; or
    - (ii) not be attached to the **foil arm** but rotate as a result of contact with the **foil arm**.

## 12 *Foil wings*

- 12.1 The **blueprint** for a **foil wing** shall be an IGES file that includes:
- (a) surfaces that corresponds to the **foil wing's** outside surface shape;
  - (b) surfaces specifying any regions of the **foil wing** classified as **foil flexure**; and
  - (c) a point that corresponds to the **foil arm** datum reference; and
  - (d) a line or lines indicating the **foil flap** hinge axes.

These geometries shall represent the geometry that the **foil wing** was designed to.

- 12.2 A **foil wing** shall match its **blueprint** within tolerances issued by the **Rules Committee**, with the **foil wing** in an unloaded, undeformed condition, except that if the **foil wing** is measured when hanging or supported by the **foil arm**, an allowance shall be made for deformation due to self-weight.
- 12.3 A **foil wing** must be **symmetric** about **WSP**, with a build tolerance of 3.0 mm.
- 12.4 **Foil wings** shall include at least one cavity of 80 mm in length and 15.6 mm internal diameter that contains an ultrasonic transmitter supplied by Sonotronics Inc., with model number CHP-87-L, or a casing of equivalent size and weight. For the avoidance of doubt, these cavities shall comply with Rule 12.3.

## 13 Foil flaps and flexures

- 13.1 A **foil flap** is one or more **linear components**, each a “flap segment”.
- 13.2 The **blueprint** for a **foil flap** shall be an IGES file representing an assembly that includes:
- surfaces that corresponds to each flap segment’s outside surface shape, positioned relative to each other as they are assembled into the **foil flap**;
  - surfaces specifying any regions of **foil flap** segments classified as **foil flexure**; and
  - a line or lines indicating the **foil flap** hinge axes.
- These geometries shall represent the geometry that the **foil flap** was designed to.
- 13.3 A **foil flap** shall match its **blueprint** within tolerances issued by the **Rules Committee**. Measurement shall be carried out with the **foil flap** in an unloaded, undeformed condition, except that if the **foil flap** is measured when hanging or supported by the **foil wing**, an allowance shall be made for deformation due to self-weight.
- 13.4 Except as permitted by Rule 13.14, at any cross-section parallel to **WSP** there shall be no more than one flap segment.
- 13.5 The following shall be **symmetric** about **WSP**:
- the number and arrangement of **foil flap** segments, where a flap segment may cross **WSP** providing it is **symmetric** about **WSP**;
  - the **foil flap**, with a build tolerance of 3.0 mm;
  - the **foil flap** hinge axes, with a build tolerance of 3.0 mm; and
  - the ranges of rotations and twists that can be achieved.
- 13.6 A **foil flexure** must be classified as a region of:
- a **foil wing**;
  - a **foil flap**; or
  - material that is partly **foil wing** and partly **foil flap**, with a virtual split line delineating the boundary.
- 13.7 Within Rules 13.8 and 13.9 (b):
- the stated requirements apply at all cross-sections parallel to **WSP** and all **foil flap** rotation angles;
  - the “chord length” at a given cross-section and a given **foil flap** rotation angle is the linear distance, measured perpendicular to **TRP**, between the foremost point and the aft most point in the cross-section;
  - the chord length of a **foil flexure** means the total chord length measured from the foremost point of any **foil flexure** to the aft most point of any **foil flexure** in that cross-section;
  - the following shall be neglected when determining chord length:
    - the **foil arm** and any **foil** system;
    - any part of the **foil wing** that is aft of the aft most point of the **foil flap** in any cross-section; and
    - hinges or other parts of a **foil flap** or **foil wing** which occur at occasional cross-sections for connection between the **foil wing** and **foil flap**.
- 13.8 The chord length of a **foil flap** shall be no more than 50% of the chord length of the **foil**.

- 13.9 The chord length of a **foil flexure** shall be:
- (a) at connections between **foil flap** segments permitted by Rule 13.14:
    - (i) no more than 50% of the chord length of the **foil** at that cross-section; and
  - (b) elsewhere:
    - (i) no more than 20% of the chord length of the **foil** at that cross-section; and
    - (ii) no more than the chord length of that part of a **foil flap** that lies entirely aft of the **foil flexure**.
- 13.10 At any cross-section parallel to **WSP**, the only permitted movement of a **foil flap** relative to a **foil wing** is a rotation about a hinge axis that:
- (a) must be designed to be stationary with respect to the **foil wing** at that section;
  - (b) may have some movement resulting from play in a mechanical bearing or deformation of a soft hinge; and
  - (c) need not lie inside the cross-section of the **foil wing** or **foil flap**, but must be at a finite distance from the **foil**.
- 13.11 Every tangent to a hinge axis shall subtend an angle of at least 45° to **WSP**.
- 13.12 At any cross-section of a **foil** perpendicular to the local **foil flap** hinge axis, and in the absence of **external forces** except gravity, neither the cross-sectional shape of the **foil wing**, nor that of the **foil flap** shall deform by more than  $\pm 1.0$  mm from its shape when in the middle of its rotation range, except over the surface of any **foil flexure**.
- 13.13 In the absence of **external forces**, a **foil flexure** shall only deform as the result of differential rotation between those parts of:
- (a) a **foil wing** and a **foil flap**; or
  - (b) different **foil flap** segments,
- that are not classified as **foil flexure**. A **foil flexure** may touch or come into contact with a **foil** system, provided that contact does not significantly affect the external surface shape of the **foil flexure**.
- 13.14 The exceptions referred to in Rules 13.4 and 13.9 (a) are permitted within cross-sections perpendicular to **WSP** through a maximum combined total of 10% of the span, where span is measured perpendicular to **WSP** from the furthest extent of the **foil wing box** on one side of **WSP** to the furthest extent on the other side.

## 14 Rudder

- 14.1 A **rudder** shall be a single **linear component**.
- 14.2 For the purpose of the component limits in the **AC Technical Regulations**:
- (a) any material attached to the **rudder** below the **hull lower surface** must be declared as part of the **rudder**;
  - (b) any part that does not make up the **linear component** of the **rudder** shall not be part of the **rudder**; and
  - (c) any removable part of the **rudder linear component** that is entirely above the **hull lower surface** can optionally be declared as part of the **rudder**, but if it is declared as part of the **rudder** in the Version A declaration, it will always be controlled by the component limits in the **AC Technical Regulations**.
- 14.3 The **blueprint** of a **rudder** shall be an IGES file that includes:
- (a) a surface or surfaces showing the **rudder's** outer surface shape; and
  - (b) a point entity indicating the position of the lower **bearing centre**.
- These geometries shall represent the geometry that the **rudder** was designed to. A change in the position of the lower **bearing centre** does not in itself constitute a change according to the component limits in the **AC Technical Regulations**, but since it is defined in the **blueprint**, it does invalidate a Measurement Certificate.
- 14.4 A **rudder** shall match its **blueprint** within tolerances issued by the **Rules Committee**. Measurement shall be carried out with the **rudder** in an unloaded, undeformed condition, except for self-weight if the **rudder** is measured when hanging or supported in the **hull**.
- 14.5 The **wetted** part of the **rudder** must be **symmetric** about the **rudder** centre plane, with a build tolerance of 3.0 mm.
- 14.6 With the **rudder** centre plane aligned with **LCP**, and at all rake angles that can be achieved, no **wetted** part of the **rudder** shall extend:
- (a) aft of **TRP**; or
  - (b) forward of a **transverse** plane 1.500 m forward of **TRP**.
- 14.7 At all yaw and rake angles that can be achieved, no **wetted** part of the **rudder** shall extend further outboard than planes offset from **LCP** by 1.500 m both to port and to starboard.
- 14.8 With the **rudder** centre plane aligned with **LCP**, there must be an achievable rake angle at which the lowest 0.500 m of the **rudder**, when **projected** to **MWP**, has an area of at least 0.300 m<sup>2</sup>.
- 14.9 Only the following **rudder** movements are permitted relative to the AC75 **yacht**:
- (a) yaw, being a rotation about an axis joining the lower and upper **bearing centres**; and
  - (b) rake, being a rotation about a **transverse** axis through the lower **bearing centre**.

- 14.10 The **rudder** must not touch any part of the **yacht** except:
- (a) a lower bearing, whose **bearing centre** must be a fixed point that lies within 1 mm of **LCP**;
  - (b) an upper bearing, whose **bearing centre** can move, but must always lie within 1 mm of **LCP**;
  - (c) optical fibre and electrical connections for instrumentation within an **ILS**;
  - (d) a device whose only purpose is to react yaw moment and control yaw angle, connected to a steering system; and
  - (e) the **hull lower surface** within 0.500 m of any yaw axis as defined in Rule 14.9 (a).
- 14.11 The lower and upper **bearing centres** must be vertically separated by at least 600 mm.
- 14.12 No device shall be used to induce deformation in the **rudder**; any deformation may only be the result of **external forces** and reactions by components permitted in Rule 14.10.

## 15 Mast

- 15.1 A **mast** specification will be issued according to Rule 33 which will include details of:
- (a) the **mast surface specification**;
  - (b) the minimum required **mast tube** laminate and construction details;
  - (c) the **supplied rigging**;
  - (d) **mast** fittings and spreaders, some of which may be specified as supplied components which must be sourced from a nominated supplier;
  - (e) the rig plan, including required chainplate and **MRP** positions on the **hull**;
  - (f) the supplied **mainsail** buoyancy system; and
  - (g) optional modifications to legacy **mast tubes**.

The word “specification” within Rules 15 17 refers to the parts of this **mast** specification.

The **mast** specification will be based on the **AC36 Mast** specification. The mould shape, base laminate and uni-directional reinforcement will remain largely the same, but there will be modifications to patching and internal structure to accommodate the different rig plan, and there may be need for some additional reinforcement.

- 15.2 Except where otherwise indicated within the **AC75 Class Rules**, all components of the **mast** listed in Rule 15.1 must match the specification.
- 15.3 The **blueprint** of a **mast tube** shall be a zip file of two-dimensional drawings in PDF format that include:
- (a) complete laminate drawings of the **mast tube**; and
  - (b) details of any changes from a previous version of the **mast tube**;
- 15.4 With the **mast** unloaded and supported in cradles:
- (a) the external surface of the **mast tube** shall match the **mast surface specification** to within  $\pm 3$  mm for any cross-section orthogonal to the the aft face of the **mast surface specification**; and
  - (b) the aft face of the **mast tube** shall be straight within  $\pm 10$  mm along the length of the **mast tube**.
- 15.5 As exceptions to Rule 15.4:
- (a) rebates for the attachment of components are permitted providing such rebates are filled to match the **mast surface specification** within the tolerance required by Rule 15.4 (a); and
  - (b) additional holes with a maximum diameter of 21 mm are permitted in the **mast tube**, including through bulkheads, for fasteners used to attach fittings. Such holes must not reduce the stiffness or strength of the **mast tube** and **Competitors** may be required by the **Measurement Committee** to provide documentation supporting this.
- 15.6 The specification prescribes the minimum required laminate for the **mast tube**, which may be reinforced by:
- (a) using laminates comprising greater fibre weight, resin content, number of layers, **core** density, and/or **core** thickness than provided in the **mast** specification;
  - (b) adding laminate external to the **mast surface specification**, providing it remains within the tolerances given in Rule 15.4.

The outer layer of the **mast tube** laminate from the specification shall not be sanded other than for local repairs and reinforcements performed after the **mast tube** has been cured, but may be painted or covered in branding material such as vinyl.

- 15.7 Laminates are not required to meet the specification within 300 mm of the intersection between the aft face of the **mast tube** and the **mast upper plane**.
- 15.8 Openings in the aft face of the **mast tube**, in addition to those in the **mast surface specification**, are permitted to provide access to permitted systems, and to allow passage of **control systems** and instrumentation cables. Such additional openings shall be no larger than required, and shall have:
- (a) a maximum dimension of 150 mm;
  - (b) a maximum area of 0.018 m<sup>2</sup>;
  - (c) a minimum distance of 250 mm between the boundaries of any two openings; and
  - (d) a maximum combined total area of 0.1 m<sup>2</sup>.

Any fastener holes used for the attachment of fittings as permitted in Rule 15.4 do not count as openings in this Rule.

- 15.9 The **mast** shall be positioned and tensioned on the **hull** in a **dock tune** prescribed by the rig plan specification. Neither the **mast**, nor the positions of **MRP** and the **hull** chainplates shall be adjusted relative to the **hull** except for:
- (a) rotation of the **mast** about **MRP** by the action of a device, or devices, attached to the **mast** within the **mast lower zone**;
  - (b) movement of **control systems** within the **mast lower zone** for the purpose of controlling the **main-sail**;
  - (c) incidental movement of fairings or **mast** components in the **mast lower zone** due to contact with the crew, **hull**, deck gear, rigging or other items attached to the **hull**; and
  - (d) movement of the **mast** due to adjustment of permitted sail **control systems**.
- 15.10 The **supplied rigging** shall not be modified except for:
- (a) the addition of one fairing or vibration mitigation device per **supplied rigging** element, which when installed shall fit within a cylinder of 100 mm diameter and 600 mm length;
  - (b) maintenance permitted in the manual provided by the **supplied rigging** manufacturer; and
  - (c) other repairs approved by the **supplied rigging** manufacturer.
- 15.11 No components of the **mast**, other than rigging and components of the specification are permitted to extend more than:
- (a) 7800 mm aft of the aft face of the **mast surface specification** or 20 mm forward of the leading edge of the **mast surface specification**, within the **mast lower zone**;
  - (b) 30 mm aft of the aft face of the **mast surface specification**, between the **mast lower zone** and a plane 300 mm below the **mast upper plane**;
  - (c) 3 mm outside of the **mast surface specification**, forward of the aft face of the **mast surface specification** between the **mast lower zone** and a plane 300 mm below the **mast upper plane**;
  - (d) 100 mm aft of the aft face of the **mast surface specification** within 300 mm of the **mast upper plane**; or
  - (e) 20 mm outside of the **mast surface specification**, forward of the aft face of the **mast surface specification**, within 300 mm of the **mast upper plane**.

These restrictions will be measured at the local height in the **yacht**-fixed reference frame with an assumed **mast** rake of 5°. If components of the **mast** extend below the **mast surface specification** then for the purpose of this measurement the **mast surface specification** will be extended to the local height of the measurement.

- 15.12 As an exception to Rule 15.11, up to two rigid or flexible handles are permitted to be attached to the **mast** or to the **mainsail** within the mast lower zone, provided their only purpose is to provide handholds for the crew.
- 15.13 No part of the **mast** shall extend beyond, or be capable of extending beyond, the **mast upper plane** except for supplied media equipment and wind instrumentation permitted by Rule 15.14.
- 15.14 Wind instrumentation, including supporting structure and any instrumentation required for position sensing, shall:
- (a) extend no higher than 1.5 m above the **mast upper plane**;
  - (b) not interfere with the supplied media equipment;
  - (c) be submitted to the **Measurement Committee** for approval; and
  - (d) in the region between the 100 mm above the **mast upper plane** and 100 mm from the uppermost extent of wind instrumentation, have a maximum chord to thickness ratio of 3:1 at any cross-section perpendicular to its local lengthwise axis.
- 15.15 The **mast** in **mast** measurement condition shall:
- (a) be capable of being weighed by horizontal suspension from two points at least 20.0 m apart;
  - (b) have the **supplied rigging** positioned loosely, with lower end fittings within 100 mm of **MRP**;
  - (c) include all halyards positioned as they would be with all sails hoisted; and
  - (d) include all components that are attached to the **mast** when it is arranged in **dock tune** and remain on the **yacht** whilst racing. Other components of the **mast** shall be included in the **platform** measurement condition.



Figure 15.1: Rig Plan

## 16 Sails

- 16.1 The **blueprint** of a **sail skin** shall be a two-dimensional drawing in PDF format that includes:
- (a) dimensions for all sail measurements that are restricted by the **AC75 Class Rule**;
  - (b) details of any area distribution changes with respect to a previous version of the **sail skin**; and
  - (c) the surface area of the **sail skin**.
- 16.2 Shore based sail measurements are to be carried out with **battens** installed under minimal compressive load.
- 16.3 Openings through **sail skins** are prohibited. This rule does not prohibit access panels that are fully covered and closed whilst racing. Penetrations may exist for attaching **sail hardware** and other components permitted by Rules 18.1, 18.8, 17.1 and 17.19, however such penetrations must be completely filled or covered.
- 16.4 Stiff **sail skin** reinforcements are permitted within 1.0 m of **head points, peak points, clew points, tack points** and anywhere within the **mast lower zone**. Elsewhere **sail skins** shall be capable of being folded without clearly visible structural failure.
- 16.5 **Battens:**
- (a) shall pass through a 75 mm diameter circle;
  - (b) shall be single-piece components without hinges or other mechanisms;
  - (c) shall, when unloaded and without **external forces**, have a straight central axis to a tolerance of 5 mm over any 1000 mm length and 25 mm over their entire length;
  - (d) shall not be inflatable; and
  - (e) shall be located inside a sail pocket not exceeding 260 mm in internal width measured normal to the lengthwise axis of the **batten**.
- Battens** of the **Mainsail** that are located entirely within the **mast lower zone** are not restricted by this rule.
- 16.6 When measured on a flat surface, the **leech** of a **sail skin** can deviate in angle by no more than 10° through any distance along the **leech** from 200 mm below to 200 mm above any **batten** or associated **sail hardware**.
- 16.7 The 25%, 50% and 75% **sail skin** girths are taken from the 25%, 50% and 75% **leech points** to the nearest point on the **luff** as illustrated in Figures 18.1 and 17.2. If hollows exist in the **leech** between **battens** adjacent to a girth measurement point then the girth shall be taken beyond the **leech** to a straight line that bridges the **leech** between these **battens**.

## 17 Mainsail

- 17.1 A **mainsail** must comprise exactly two **sail skins**. Other components that may make up a **mainsail** are limited to:
- (a) **battens**;
  - (b) connections between **sail skins** and **battens** as permitted in Rule 17.18;
  - (c) **sail hardware**;
  - (d) **leech**, **head** and **foot** lines no greater than 6 mm in diameter, and no more than one line at any point along a **sail skin** edge;
  - (e) **control systems** as described in Rule 17.19;
  - (f) fairings as permitted in Rule 17.16;
  - (g) up to two safety handles as permitted by Rule 15.12;
  - (h) a supplied **mainsail** buoyancy system as prescribed in Rule 17.20;
  - (i) components of an **ECC**;
  - (j) components of **CIS**; and
  - (k) **woollies**.

17.2 When determining a specific **mainsail** measurement length or girth, the greatest value from both **sail skins** shall be taken.

17.3 When calculating a **mainsail** girth, the offset between the local **luff** of a **sail skin** and the aft face of the **mast surface specification** shall be added to the girth measurement.

17.4 The **luff** of any **skin** of a **mainsail** shall not be forward of the aft face of the **mast surface specification** at any point.

17.5 **Mainsail** girths shall be limited as follows:

		Minimum	Maximum
$G_F$	<b>Foot girth</b> (m)	7.000	7.400
$G_{25}$	25% girth (m)	6.000	6.600
$G_{50}$	50% girth (m)	5.000	5.800
$G_{75}$	75% girth (m)	3.600	4.700
$G_H$	<b>Head girth</b> (m)	2.000	3.400

17.6 **Mainsails** shall comply with:

$$130.0 < \frac{26.5}{12} \times (G_F + 4G_{25} + 2G_{55} + 4G_{75} + G_H) < 145.0$$

17.7 Angles relative to a straight line from the **head point** to the **peak point**, illustrated in Figure 17.1, are limited by:

- (a)  $90^\circ \leq \alpha_p \leq 115^\circ$  for all lines that pass through any two points, at least 100 mm apart, that lie on the **leech** between 300 mm and 800 mm from the **peak point**; and
- (b)  $\alpha_h \leq 95^\circ$  for all lines that pass through any two points, at least 100 mm apart, that lie on the **luff** between 500 mm and 1500 mm from the **head point**.

17.8 The **head points** of both **skins** of a **mainsail** shall be below the **mast upper plane**.

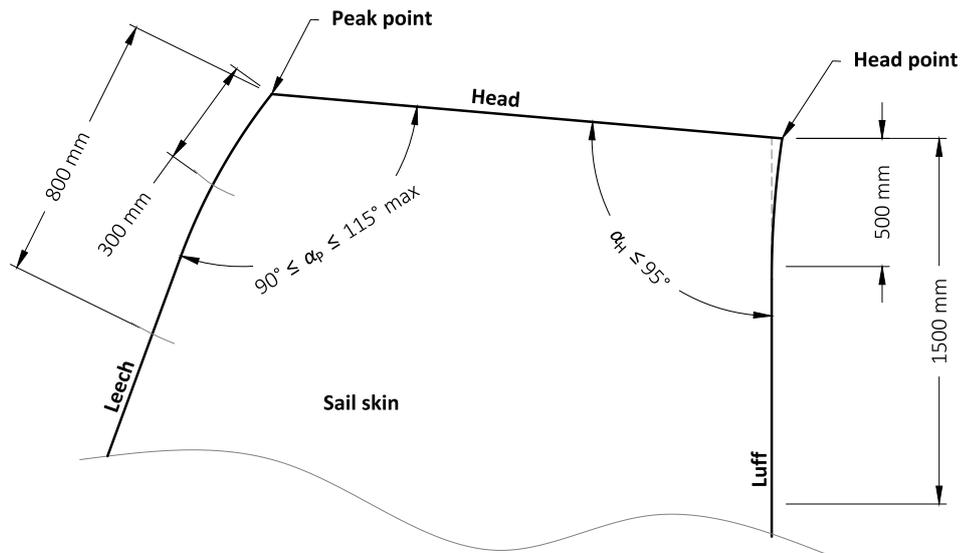


Figure 17.1: Example measurement of  $\alpha_p$  and  $\alpha_h$

- 17.9 No part of a **skin** of a **mainsail** may extend more than 10 mm above a straight line from the **peak point** to the **head point**.
- 17.10 The **mast lower zone** shall be identified on each **sail skin** with the **mainsail** in its highest possible position with the yacht at rest.
- 17.11 No part of the **mainsail** is permitted to extend more than 7800 mm aft of the local **mast surface specification**. This restriction will be applied at the local height in the **yacht-fixed** reference frame with an assumed **mast rake** of 5°. If the mainsail extends below the **mast surface specification** then the **mast surface specification** will be extended to the local height of the measurement.
- 17.12 Each **skin** of the **mainsail** shall have at least one continuous attachment to the **mast tube** from 1.5 m above **MRP** to 0.5 m below the **head point**. This attachment shall not have any gaps or overlaps that would allow a line to pass through.
- 17.13 With the exception hardware within the **mast lower zone**, the largest dimension of any **sail hardware** for a **mainsail** shall not exceed 650 mm.
- 17.14 After sailing, with the **mast** still stepped in the **yacht**, the **mainsail** shall be lowered completely below the top of the **mast lower zone** without assistance from anyone who is completely above that zone. As an exception, crew may go aloft to resolve occasional, unforeseen issues.
- 17.15 The **mainsail** shall be capable of being removed from the **mast**, with the **mast** stepped, without damage to either the **mast** or **mainsail**.
- 17.16 **Mainsail** fairings are permitted only for the purposes of:
- fairing **control systems**, where they shall lie entirely within the **mast lower zone**, may be flexible, and may be attached to the **sail skins**; and
  - sealing the area between **sail skins**, where they shall be flexible and shall only attached to each **skin**, that attachment lying entirely within 100 mm of the **head**.

**Mainsail** fairings permitted by this shall not be considered to be part of a **sail skin**.

- 17.17 Each **sail skin** of a **mainsail** may have:
- (a) up to 10 **battens** that run from within 100 mm of the **luff** to within 100 mm of the **leech** and are above the **mast lower zone**;
  - (b) up to 6 **battens** shorter than 1.0 m that have one end terminating within 50 mm of the **leech** and are above the **mast lower zone**; and
  - (c) any number of **battens** that lie entirely within the **mast lower zone**.
- 17.18 With the exception of fairings permitted by Rule 17.16 (b), connections between **skins** of a **mainsail** or between **battens** of a **mainsail** above the **mast lower zone** may only:
- (a) be entirely within 400 mm of the **luff** or the **leech** of a **sail skin**;
  - (b) span no more than 150 mm vertically with the **mainsail** in an unloaded state; and
  - (c) be no closer than 2.0 m for any **leech** connection permitted by Rule 17.18 (a).
- Within the **mast lower zone** there are no restrictions on connections between **sail skins** or **battens**.
- 17.19 **Control systems** may not be attached to or bear upon the **mainsail** above the **mast lower zone** identified on each **sail skin** in Rule 17.10, except:
- (a) the **mast tube** through means permitted in Rule 15.9; and
  - (b) **leech** lines within 50 mm of the **leech** of a **mainsail skin** provided their purchase systems or other controls are entirely within the region identified in Rule 17.10.
- 17.20 A supplied **mainsail** buoyancy system, as defined in Rule 15.1, shall be attached to the **sail skins** of the **mainsail** so that the port and starboard position markers of the supplied **mainsail** buoyancy system remain within 100 mm of the **head** of their respective **sail skin**. **Competitors** shall adhere to any inflation regulations provided in the specification for the supplied **mainsail** buoyancy system.
- 17.21 The **mainsail** in **mainsail** measurement condition shall include all components of the **mainsail** that are attached to the **mainsail** before it is hoisted. Components of the **mainsail** that are attached to the **mainsail** during or after the hoist shall be included in the **platform** measurement condition.

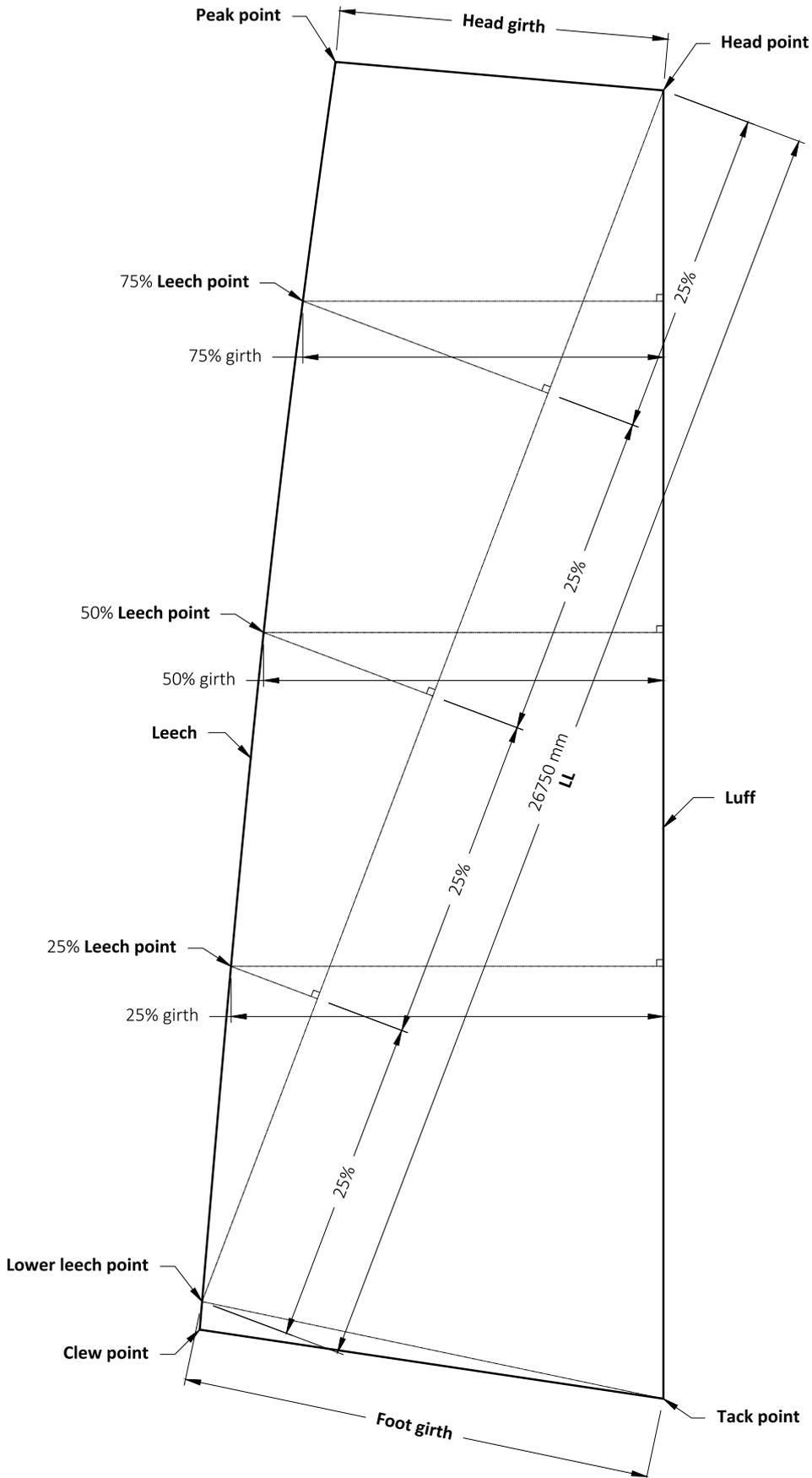


Figure 17.2: **Mainsail** Measurement

## 18 Jib

- 18.1 The components that may make up a **jib** are limited to:
- (a) exactly one **sail skin**;
  - (b) up to 8 **battens**, which can terminate on any sail edge, and shall not be adjusted while the **jib** is hoisted;
  - (c) **sail hardware**;
  - (d) **luff** attachment devices permitted in Rule 18.6;
  - (e) **head pennants**;
  - (f) **luff, leech, head** and **foot** lines no greater than 6 mm in diameter and their associated purchase systems.
  - (g) ballast, that serves no purpose other than increasing sail weight, located within 1.0 m of the **tack point**.
  - (h) components of an **ECC**; and
  - (i) **woollies**.
- 18.2 The largest dimension of any **sail hardware** for a **jib** shall not exceed 350 mm.
- 18.3 **Jibs** shall be hoisted and lowered without assistance from crew aloft. As an exception, crew may go aloft to resolve occasional, unforeseen issues.
- 18.4 The **head** of any **jib** shall be below **IG**.
- 18.5 **Jibs**, when hoisted, shall be connected to the forestay by hanks or luff pockets or a combination of both.
- 18.6 Hanks for connecting the **jib** to the forestay shall:
- (a) extend no more than 75 mm forward of the **luff**, measured perpendicular to the **luff**;
  - (b) be no more than 100 mm in length, measured parallel to the **luff**; and
  - (c) be no closer than 200 mm to each other, except within 1.000 m of the **head point** or **tack point**.
- 18.7 Other than within 100 mm of **supplied rigging** fittings, **luff** pockets of **jibs** shall be:
- (a) capable of being folded flat along the leading edge without sustaining damage; and
  - (b) no more than 150 mm wide, when measured internally with the pocket closed, perpendicular to the **luff**.

Luff pockets of **jibs** may extend up to 300 mm above the **head point** and such extensions will not be included in the evaluation of the **head**.

18.8 No component of the yacht shall be attached to, or bear upon a **jib** except:

- (a) sheets, or purchase systems of sheets, attached to a single piece of **sail hardware** within 400 mm of the **clew point**;
- (b) a halyard in 1:1 configuration attached within 400 mm of the **head point**;
- (c) a cunningham system near the **tack point**;
- (d) the forestay;
- (e) electrical wiring for the sole purpose of making connections to **ECC** or **ILS** components;
- (f) **luff, leech, head** and **foot** lines; and
- (g) the **deck**, which may be attached to the jib within 300 mm of the intersection of the **deck** and the forestay, and bear upon it elsewhere.

18.9 Maximum **jib** measurements shall be:

	<b>Jibs with LL ≤ 18.0 m</b>	<b>Jibs with LL &gt; 18.0m</b>
<b>LP</b>	7.050 m	7.050 m
50% girth	0.59 <b>LP</b>	(0.869-0.0155 <b>LL</b> ) <b>LP</b>
75% girth	0.40 <b>LP</b>	(0.859-0.0255 <b>LL</b> ) <b>LP</b>
<b>Head girth</b>	0.17 <b>LP</b>	(0.699-0.0294 <b>LL</b> ) <b>LP</b>

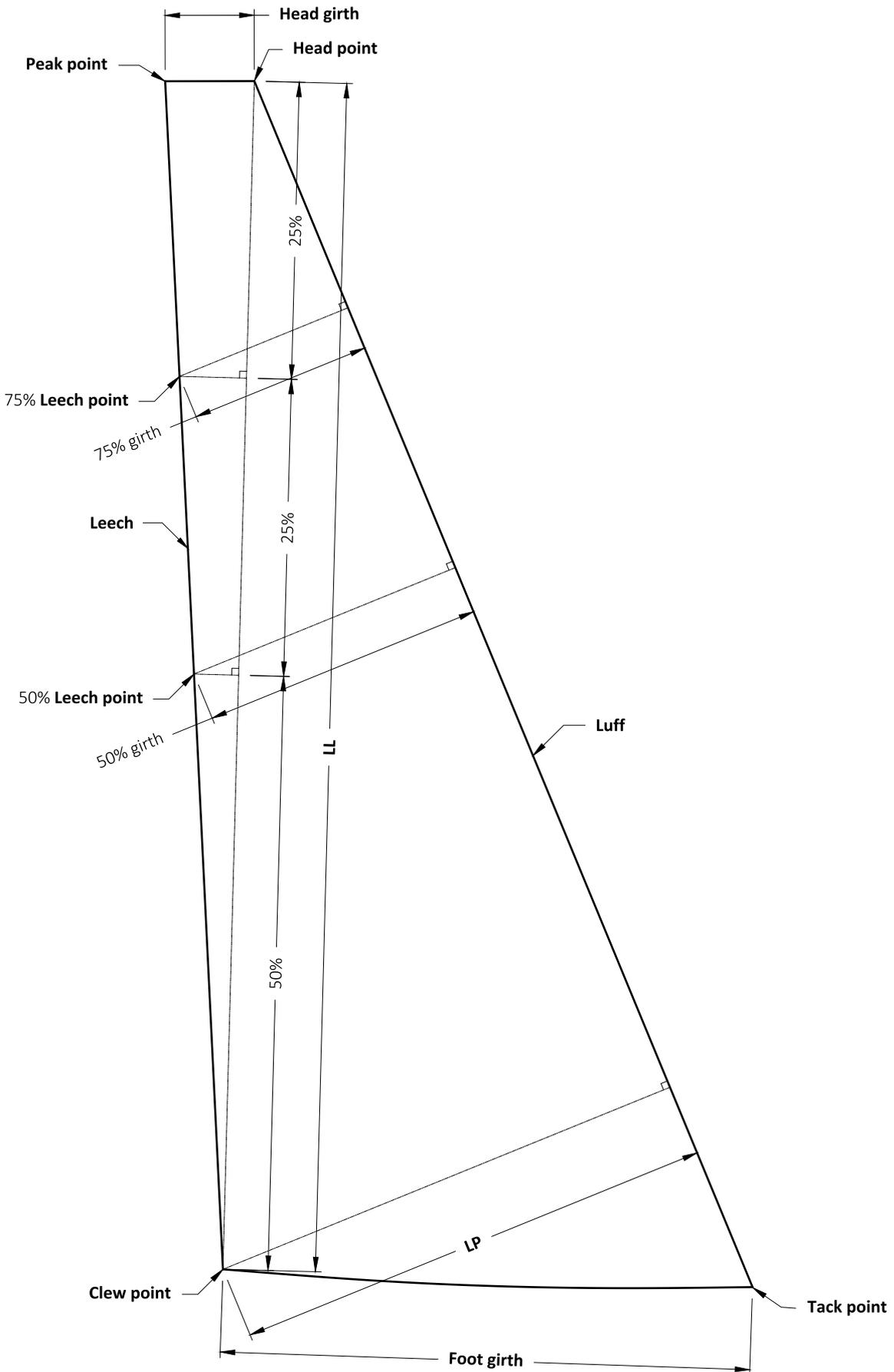


Figure 18.1: Jib Measurement

## 19 Control systems

- 19.1 The adjustment of **control surfaces** must only be controlled by:
- (a) direct contact of the crew on a **control surface**; or
  - (b) crew using one or more **control systems**.
- 19.2 **Control systems** shall be incapable of using feedback from **yacht state** to control a **control surface**.
- 19.3 Rule 19.2 may be satisfied by a combination of the hardware and software used within a **control system**. Where a measurement could provide incidental information about **yacht state**, a **control system** shall only be considered to be capable of using feedback from **yacht state** if its software uses that measurement to estimate **yacht state**. For example:
- (a) A **foil flap** may become unloaded when it exits the water, resulting in a change in pressure in a ram, or a change in rotation about the hinge axis. Sensors that measure ram pressure or **foil flap** rotation are permitted inputs to a **control system**, provided that this information is not used to estimate **yacht state**.
  - (b) A gust causes an increase in mainsail sheet load, detected by the **ECC** as an increase in ram pressure. It is permitted for a **control system** to use this information to make an adjustment to the traveller target position, provided loads or pressures measured in the **yacht** are not used to estimate part of the **yacht state**.
- 19.4 Sensors that measure, or are used to estimate **yacht state** are prohibited, except as part of an **ILS** or where supplied within the **Media System**.
- 19.5 **Rig controls** are restricted to:
- (a) **mast** rotation permitted by Rule 15.9 (a);
  - (b) degrees-of-freedom of **control systems** that are attached to or bear upon the **mainsail** within the **mast lower zone**;
  - (c) **jib** sheet degrees-of-freedom, including car position;
  - (d) **jib** cunningham extension and retraction; and
  - (e) **jib** leech line adjustment via **force input devices** permitted by Rule 19.10 (c).
- 19.6 Power that does work on a **control surface** to adjust its shape, position or orientation can only be supplied by:
- (a) **external forces** acting on that **control surface**;
  - (b) the crew, via **force input devices**;
  - (c) **electric appendage actuators**;
  - (d) the **FCS** as permitted by Rule 26; and
  - (e) the release of stored energy permitted by Rule 19.7.

- 19.7 The only forms of energy storage and release to move a **control surface** permitted under Rule 19.6 (e) are:
- (a) the storage of elastic energy within the structure and rigging of the **yacht** and its uncontrolled release as the structure and rigging returns towards its natural condition, and in the absence of any mechanism to store or recover this energy elsewhere;
- See interpretation AC36 38; the intent here is to prohibit a string-bungy accumulator, but wording could be improved.
- (b) the storage of a maximum of 50 J of elastic energy per system of springs or lines, and its controlled or uncontrolled release, where a system is a single spring or line, or a collection thereof that perform a specific function within a **control system**; and
  - (c) the storage of energy permitted by Rule 20.8, and its release into another part of an **HCC**.
- 19.8 Pneumatic components shall not be used in **control systems**, except that gas may be used within an **HCC** where permitted by Rules 20.8 (c) and 20.8 (d).
- 19.9 The use of flywheels or gyroscopes to store energy or mechanically provide stabilising forces to the **yacht** is prohibited. Any rotating mass on the **yacht** shall be no larger than required for its permitted purpose.
- 19.10 Only the following **force input devices** are permitted:
- (a) **primary force input devices**, restricted to:
    - (i) a maximum of two such devices that each allow two crew members to provide power; or
    - (ii) a maximum of four such devices that each allow a single crew member to provide power.
  - (b) steering wheels prescribed by Rule 19.11; and
  - (c) specific **force input devices** permanently connected to a single **rig control** that:
    - (i) operate on that **rig control** mechanically without an **ECC** or **HCC**; and
    - (ii) are only operated by a single crew member at once.
- 19.11 **Rudder** yaw angle shall be controlled through a steering system by a steering wheel or wheels which:
- (a) shall be **force input devices**;
  - (b) except for incidental yaw change resulting from **rudder** rake change, shall be the only input devices for controlling **rudder** yaw angle;
  - (c) need not be circular, but must rotate to control **Rudder** yaw angle; and
  - (d) must have a perimeter that lies entirely outside a circle of diameter 0.450 m centred on the axis of rotation.

## 20 *Hydraulic control circuits*

- 20.1 Rule 20 applies to all components except the **FCS**.
- 20.2 Hydraulic circuits and components are permitted only as part of an **HCC**.
- 20.3 Hydraulic circuits and components are permitted only for the purpose of adjusting **control surfaces** with **hydraulic actuators**, and for safely managing the flow of hydraulic fluid to and from these actuators.
- 20.4 Components in an **HCC** must be sized appropriately for their permitted use. It is prohibited to use oversized components, superfluous reservoirs, etc. in order to control the mass distribution on the **yacht**, to act as a **extended yacht state** sensor, etc.
- 20.5 **COR/D** will specify a standard human-powered hydraulic pump. This shall be the only type of pump used to convert power supplied by the crew, through **primary force input devices**, into hydraulic power within an **HCC**.
- 20.6 If an **electric appendage actuator** drives a hydraulic pump within an **HCC**, that **HCC** must be entirely self-contained and disconnected from any other **HCC**.
- 20.7 Pressure relief valves set to open at 600 bar, manufactured by HYDAC with model code "DB4E-01X-630P600", must be present in any circuit downstream of:
- pumps powered by **primary force input devices**;
  - pumps powered by **electric appendage actuators**; and
  - any accumulator permitted by Rule 20.8 (a).
- For each pump or accumulator above, the pressure relief valve shall be located at any point within that part of a circuit downstream of the pump or accumulator that is always subject to the output pressure of the pump or accumulator; that is, before any other valves or restrictions.
- 20.8 Energy may only be stored within **HCCs**:
- by one high-pressure accumulator per **yacht** with a maximum capacity (gas plus hydraulic fluid) of 2.0 litres, supplied by Cariboni S.r.l. with design number ACC-A-0750-20521;
  - by one or more high-pressure accumulators in an **HCC** powered by an **electric appendage actuator**;
  - by gas in oil reservoirs with a maximum gas pressure of 6 bar;
  - by gas in **hydraulic actuators** with a gas spring return, providing the expansion of the gas volume cannot do work on a **control surface**; and
  - as elastic energy resulting from the compression of hydraulic fluid and the expansion of hoses in **high-pressure circuits** except those powered by an **electric appendage actuator**, providing that when all such circuits are pressurised to maximum pressure, no more than 350 ml of hydraulic fluid is discharged from drain ports when those ports are opened to atmosphere.
- 20.9 Tubing containing more than trace quantities of titanium is prohibited, but this does not preclude the use of titanium in **hydraulic actuators**, hydraulic pumps or fittings.

## 21 *Electrical and electronic systems*

- 21.1 Electric or electronic components or circuits are permitted only as:
- (a) part of an **ECC, ILS, or CIS**;
  - (b) standalone **crew indication devices**, such as wristwatches, that are incapable of measuring or receiving any part of the **extended yacht state**;
  - (c) standalone **hardwired** camera and display systems to aid visibility of different parts of the **yacht**, providing the video stream is not enhanced in any way that could provide **extended yacht state** information beyond that which could be seen by the naked eye. This does not preclude digitisation or global contrast enhancement of the video stream, but does prohibit the addition of overlays, edge detection, object recognition, etc.
  - (d) devices for data and audio communication with **Competitors'** chase boats, only as shown in Figure 21.1;
  - (e) supplied and required by **AC Media** or the **Measurement Committee**, including permitted devices connected to these supplied components;
  - (f) ultrasonic transmitters in **foil wings** and **rudders**; and
  - (g) components used when not racing, that when racing have been disconnected from all circuits and power sources to the satisfaction of the **Measurement Committee**, and when disconnected are incapable of providing any useful function.
- 21.2 No information exchange between **ECCs**, the **ILS**, the **CIS** and other systems is permitted except as shown via specified communication arrows in Figure 21.1, where:
- (a) data transmission must be strictly one-way where indicated by directional arrows, although two-way protocols (e.g. acknowledge and retry) are permitted provided that no two-way information is exchanged other than that required to manage the communication channel; and
  - (b) the dark hexagonal ports drawn on the boundaries of the **Media System** and the **CIS** represent communication nodes, where any information shown flowing in is permitted to be re-transmitted out, where indicated by directional arrows.
- 21.3 Communication between any systems on the **yacht** permitted by Rule 21.2 must be **hardwired** except where wireless communication is expressly permitted by arrows marked "wireless and/or hardwired link" in Figure 21.1.
- 21.4 **ECCs** and the **ILS** shall be incapable of communication by any means other than **hardwired** information transfer.
- 21.5 A **crew indication device**:
- (a) must only provide visual and/or audio feedback to the crew; tactile or other non-audio visual feedback is not permitted;
  - (b) must be incapable of measuring any part of the **extended yacht state**; and
  - (c) must be incapable of significantly affecting the **extended yacht state**.
- 21.6 Batteries or regulated power supplies are permitted to be shared between **ECCs**, the **ILS**, the **CIS**, cameras and displays provided that where these systems are required to be **isolated**, the **isolated** wiring begins at the first junction point beyond these supplies.
- See Interpretation 045; is this a satisfactory solution?
- 21.7 Communication systems may be installed on a supplied aft media post, in regions indicated in supplied documentation, subject to the approval of the **Measurement Committee**, for the purposes of communication with a **Competitor's** chase boats and for reception of GNSS signals.

21.8 **COR/D** will investigate supplied communication systems that could include:

- (a) onboard voice communication;
- (b) voice communication between the **yacht**, chase boats and shore; and
- (c) data communication between the **yacht**, chase boats and shore.

If implemented, these systems will be the only communication systems permitted for voice communication onboard the **yacht**, and/or for voice and data communication from the **yacht**.

21.9 All electrical systems must be powered by supplies operating at no more than 60 V.

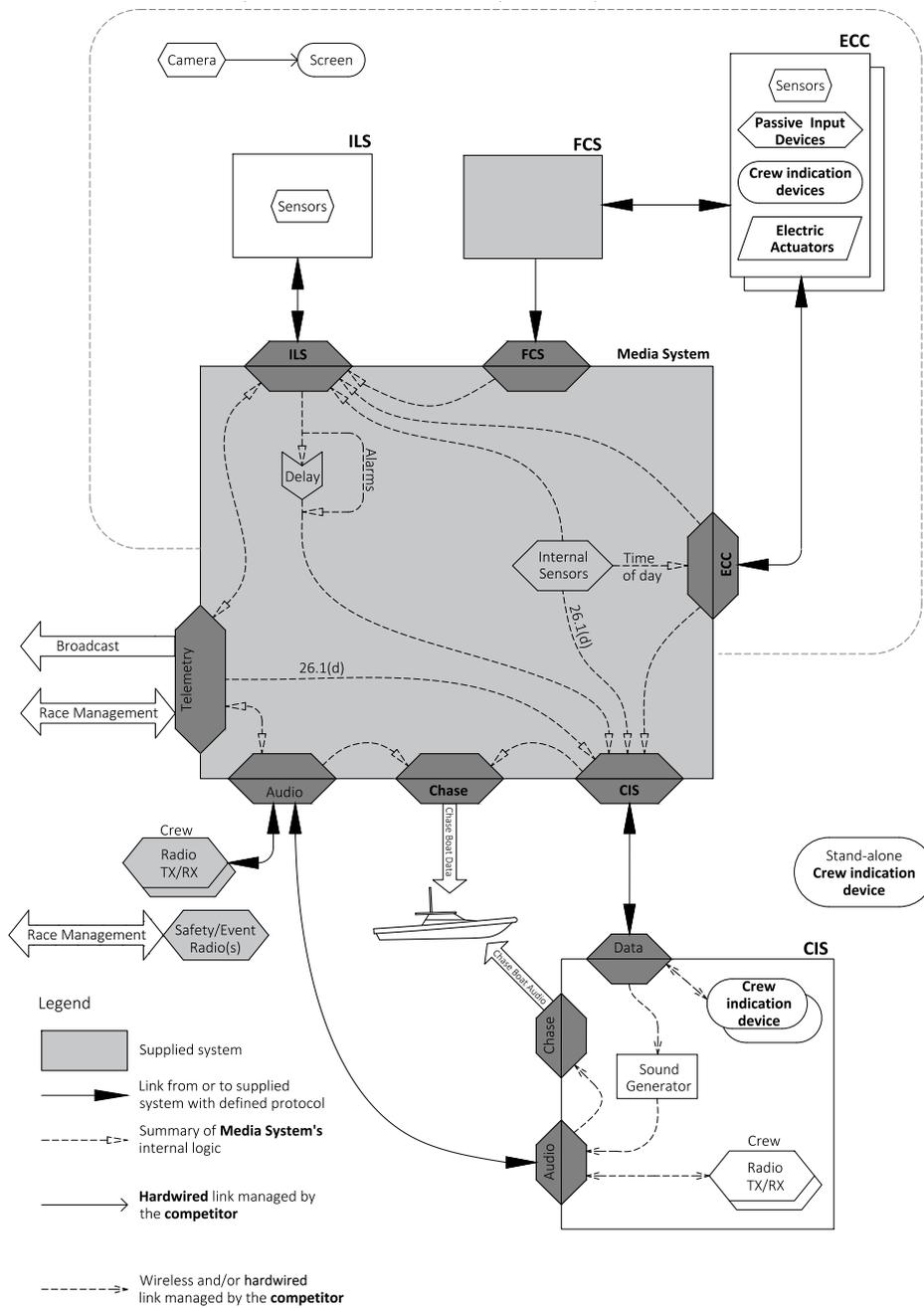


Figure 21.1: Draft permitted communication between electronic systems

Updates required:

- Conditional non-delayed FCS cylinder pressures from the FCS to the CIS;
- Pre-start software and management of wind data;
- Time of day broadcast to all systems;
- Digitisation to closed-circuit camera and screen

## 22 *Electronic control circuits*

- 22.1 Sensors within, or inputs to an **ECC** shall measure only:
- (a) the state of user input controls on **passive input devices**;
  - (b) the position or orientation of a **primary force input devices**, the load applied to a **primary force input device**;
  - (c) the orientation of steering wheels permitted by Rule 19.10 (b), the torque applied to such steering wheels;
  - (d) pressures or temperatures within an **HCC**;
  - (e) fluid level or piston position within hydraulic accumulators or reservoirs;
  - (f) the extension of **hydraulic actuators**, or the angular equivalent in the case of a rotary actuators;
  - (g) the angle of a **foil flap** relative to a **foil wing** at any number of spanwise locations along the **foil flap** hinge axis referenced by Rule 13.10;
  - (h) **rudder** rake angle relative to the **yacht**;
  - (i) **rudder** yaw angle relative to the **yacht**;
  - (j) the position, deflection or orientation that is the degree-of-freedom of a **rig control**, such as traveller, jib car position or **mast** rotation;
  - (k) loads applied by **rig controls** to the **rig**, such as **jib** sheet or car load;
  - (l) the status of a float switch within a bilge pump;
  - (m) the internal state of an **electric appendage actuator** such as current, voltage or rotational velocity; and
  - (n) the internal state of the **ECC** or **HCC**, such as voltage, current, temperature, spool position, so long as those sensors provide no **extended yacht state** information beyond that permitted elsewhere in Rule 22.1.
- 22.2 Direct proxies for the measurements listed in Rule 22.1 are permitted, providing those measurements do not supply any additional information. For example, a linear displacement sensor can measure a permitted angular rotation, but sail twist shall not be used as a proxy for **mainsail** sheet load or extension since they are not directly correlated.
- 22.3 Only the following **electric actuators** are permitted within an **ECC**:
- (a) actuators of hydraulic valves within an **HCC**;
  - (b) **electric appendage actuators**;
  - (c) actuators of drive clutches, stops or locks within a **control system**, provided that such actuators are physically incapable of doing work on a **control surface**;
  - (d) cooling fans and bilge pumps inside the **hull**, providing they have no significant effect on the aerodynamic or hydrodynamic performance of the **yacht**; and
  - (e) devices within electronic circuits that affect only the circuits themselves, and have no other influence on a **control system** or the **extended yacht state**, such as CPU cooling fans and relays.

- 22.4 **Electric appendage actuators** may only supply power to:
- (a) rotate or twist the **foil flaps**;
  - (b) rotate the **rudder** about its rake axis; and
  - (c) drive pumps supplying **high-pressure circuits** within one or more **HCCs** that control only the rotation or twist of the **foil flaps** about a hinge axis and/or the rotation of the **rudder** about its rake axis.
- 22.5 Except as permitted in Rules 22.3, an **ECC** must be incapable of having any significant effect on the **extended yacht state**.
- 22.6 An **ECC** shall:
- (a) be **hardwired**;
  - (b) have wiring that is **isolated** from other devices and systems, except for:
    - (i) connections shown in Figure 21.1; and
    - (ii) connections from common power supplies permitted by Rule 21.6.

## 23 Instrumentation and logging system

23.1 The **ILS** shall:

- (a) be **hardwired**;
- (b) have wiring that is **isolated** from other devices and systems, except for:
  - (i) connections shown in Figure 21.1; and
  - (ii) connections from common power supplies permitted by Rule 21.6;
- (c) not be capable of having any significant effect on the **extended yacht state**; and
- (d) not include any **crew indication devices** or devices which otherwise provide information to crew.

23.2 Only the following sensors within, or inputs to an **ILS** are permitted:

- (a) wind sensors that are only capable of measuring AWS and AWA within 100 mm of the sensor, and provide no other **extended yacht state** information;
- (b) strain and load sensors that are only capable of directly measuring strain or load at the sensor location, and provide no other **extended yacht state** information;
- (c) sensors measuring the internal state of the **ILS**, such as voltage, current and CPU temperature, so long as those sensors provide no **extended yacht state** information, and are not used to estimate **extended yacht state** information.

23.3 Except for permitted sensors within the **mast lower zone**, it is prohibited to measure strains within sails or **battens** of sails, or otherwise measure the flying shapes of sails when racing.

## 24 *Crew information system*

24.1 The **CIS**:

- (a) shall be incapable of measuring any part of the **extended yacht state**;
- (b) shall not be capable of having any significant effect on the **extended yacht state**;
- (c) may use short range wireless communication in **crew indication devices** and associated interface hardware (e.g. access points) for communication onboard the **yacht**, but must be configured to use only information available within the **CIS** permitted by Rule 25.4; and
- (d) may include microphones and speakers to allow direct voice communication between crew, and to play audio signals from **CIS** devices.

24.2 As an exception to Rule 21.5 (b), a **crew indication device** in the **CIS** containing sensors such as accelerometers or solid-state gyroscopes shall be considered incapable of measuring any part of the **extended yacht state** if those sensors are disabled and access to them is locked by Samsung Knox management software. This will require that:

- (a) the crew indication device is a Samsung device running Android version 10 or later;
- (b) the device is set to be in “Developer mode”;
- (c) the “Sensors Off” option in the “Quick Settings Developer Tiles” is set to be on;
- (d) in the presence of a member of the **Measurement Committee**:
  - (i) the device’s sensors are disabled by clicking the “Sensor off” button in the expanded status bar;
  - (ii) a profile from Samsung Knox Manager is applied that disables GPS, Bluetooth, Camera, External SD Card, Settings and Expand Status Bar; and

the Competitor provides the Measurement Committee with access to the Samsung Knox administration account so they can audit the device profiles.

24.3 Further details and requirements mentioned in the above Rule 23 and 24 will be provided according to Rule 33.

## 25 *Media system*

- 25.1 The combination of the **ILS**, **CIS** and **ECC** must provide a data stream to the **Media System**, which:
- (a) must use a protocol to be specified in accordance with Rule 33;
  - (b) must include specified data channels for broadcast and/or verification of compliance with the **AC75 Class Rules**, and these data channels must be:
    - (i) the most accurate data available to the **ILS**, or the best estimate available if the required data is not measured; and
    - (ii) at a specified frequency;
  - (c) may include any other data channels measured, calculated or logged by the **ILS**; and
  - (d) may include alarm event messages generated by the **ILS**, which may only contain:
    - (i) an alarm category ID code, being an integer between 1 and 10; and
    - (ii) a single floating point number representing the magnitude of an alarm value.
- 25.2 The **Media System** will make an output available for transmitting data to the **ILS** for logging.
- 25.3 The **Media System** will transmit the time of day to all connected systems.
- 25.4 The **Media System** will make an output available for transmitting data to the **CIS**, and optionally to the **ILS** for logging. This output will use a specified protocol and will include:
- (a) the data stream supplied by the **ILS**, delayed by approximately 2.0 s;
  - (b) non-delayed alarm event messages supplied by the **ILS**, which:
    - (i) once dispatched for a particular category ID, will not be dispatched again for the same category ID for 10 s; and
    - (ii) will be limited when racing to a maximum total number of alarms of 20 per race; and
  - (c) a subset of channels from the **FCS**; and
  - (d) non-delayed information from an **ECC**.
- 25.5 The **Media System** will include a pre-start and race boundary application developed by **AC Media** in conjunction with **COR/D**, and screens to display strategic information to the crew. The application shall include:
- (a) a capability to read **Competitor**-supplied performance polar data from the **ILS**, so that a **Competitor** can tune pre-start timing predictions to their **yacht**;
  - (b) predictions of time-to-kill to the start line;
  - (c) time-to-boundary predictions;
  - (d) lay-lines to marks; and
  - (e) other strategic information.
- It is prohibited to provide any other pre-start or strategic race information to the crew, or to post-process or modify the **Media System** supplied pre-start or strategy information.
- COR/D are considering implementation details of the ILS and Media System data paths, including how teams will be able to calculate their wind triangle, and how to retrieve position data from the IMU for logging.
- 25.6 The **Media System** might specify reserved radio frequency bands which must not be used by other systems on the **yacht**.

## 26 *Foil cant system*

- 26.1 Details of the **FCS**, the system to control the **cant** rotation of the **foils**, are specified by the document referenced in Rule 30.1 (b). When racing, the **FCS** must be configured as required by the specification.
- 26.2 The **FCS** shall be installed in the **yacht** with the **cant** cylinder mounts and **foil cant** axes located as shown in Figure 26.1.
- 26.3 The **cant** rotation of a **foil** can only be controlled using the **FCS**.
- 26.4 The **FCS** will provide, using specified protocols:
- (a) a port for communication with the **ECC**, where the **FCS** will:
    - (i) receive commands from the **ECC**;
    - (ii) transmit status and diagnostic messages to the **ECC**; and
    - (iii) not continuously transmit ram extension, ram pressure or **cant** angle to the **ECC**; and
  - (b) a port for transmitting data to the **Media System**, where:
    - (i) the **Media System** will provide a non-delayed channel to the **CIS** providing **foil cant** cylinder pressures, which will only be transmitted when the cant of both **foils** is no more than 90°.
- 26.5 The **FCS** will include supplied batteries. These supplied batteries are exempt from the requirements of the component limitations and repair limitations in the **AC Technical Regulations** and may be replaced as required.
- 26.6 To the extent indicated in the **FCS** specification, the following may be powered by the **FCS's** batteries:
- (a) **ECC** systems, the **ILS** and the **CIS**;
  - (b) systems required by **COR/D**, the **Rules Committee** or the **Measurement Committee**, and devices permitted to be connected to those system;
- 26.7 **COR/D** might specify system updates which must be installed by all **Competitors**, these updates being frozen according to Rule 33. Any further system updates after the time of freezing can only be by unanimous agreement of all **Competitors**.

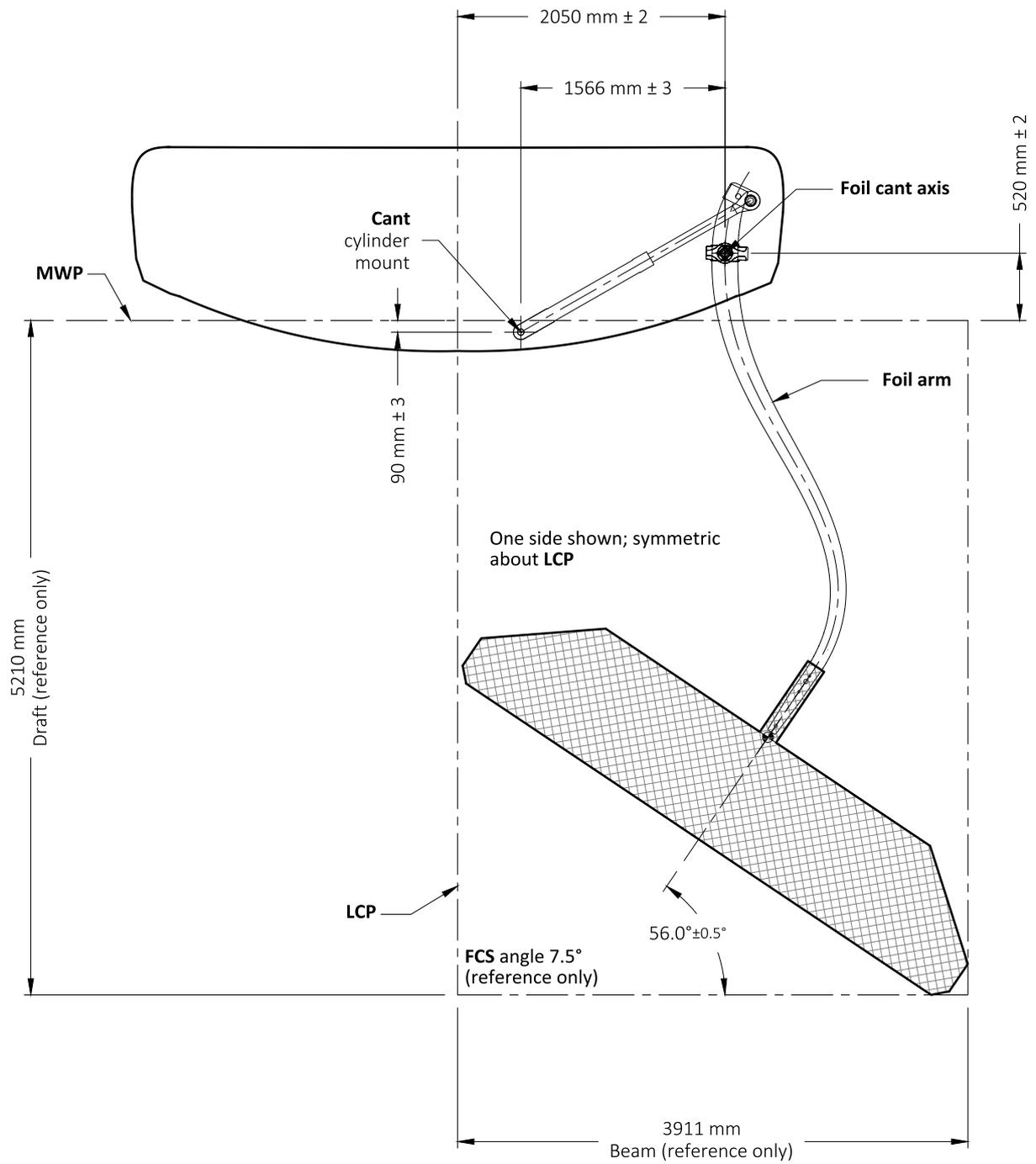


Figure 26.1: **FCS** geometry

## 27 Media equipment

- 27.1 Supplied media equipment shall include, but is not limited to:
- (a) a media hub;
  - (b) an IMU and ride-height sensor;
  - (c) a media bowsprit;
  - (d) an aft media post and media post mount;
  - (e) masthead antennae;
  - (f) cameras and microphones;
  - (g) brackets or other mounting devices;
  - (h) cabling; and
  - (i) cable management hardware.
- 27.2 Crew supplied media equipment is equipment supplied by **AC Media**, the **Regatta Director** or any other organising authority.
- 27.3 The areas shown in Figures 27.1, 27.2 and 27.3 shall be reserved for the supplied media equipment. Where not detailed herein, further specifications on these areas and additional requirements such as cable path requirements and the locations of cameras, microphones, sensors, processors, cabling and batteries, are detailed by the supplied media specification documentation, see Rule 30.1 (d).
- 27.4 The media hold shall:
- (a) be reserved exclusively for media equipment;
  - (b) be a cuboid with faces parallel with the frame specified by the **yacht**-fixed reference frame defined in the **AC Technical Regulations** with dimensions of 700 mm in the x direction,  $\pm 375$  mm either side of **LCP** and 950 mm in the z direction;
  - (c) be entirely within planes 375 and 1125 mm forward of the **FCS** transverse plane, see Rule 30.1 (b);
  - (d) be entirely below a plane 1300 mm above **MWP**;
  - (e) have a clearance volume, which may be shared with **Competitor** equipment subject to the approval of the **Measurement Committee** and **AC Media**, around the media hold which is defined by:
    - (i) a extrusion in the x direction of the the forward face of the cuboid by 700 mm; and
    - (ii) an extrusion of 375 mm of the planes parallel with **LCP** away from **LCP**,
  - (f) comply with further specifications detailed by the media specification documentation, see Rule 30.1 (d).
- 27.5 The **hull** shall be fitted with interfaces specified by the media specification documentation, see Rule 30.1 (d), for the attachment of the:
- (a) media hub;
  - (b) aft media post; and
  - (c) media bowsprit.
- 27.6 The media bowsprit shall provide a socket, area and cable path for **Competitors** to install a wind wand which shall be further detailed by the media specification documentation; see Rule 30.1 (d).

- 27.7 Wind instrumentation that falls outside of the area described in Rule 7.5 must be attached only to the media bowsprit and shall be entirely:
- (a) aft of a plane 75 feet forward of **TRP**; and
  - (b) below a plane 1.500 m above **MRP**.
- 27.8 The mounting surfaces for the aft media post and media bowsprit shall be submitted to the **Measurement Committee** for approval.
- 27.9 Media equipment shall be installed by **AC Media**.
- 27.10 Media equipment may only be modified by a **Competitor** with prior written approval from **AC Media** and the **Measurement Committee**, examples of modification include:
- (a) drilling holes;
  - (b) removal of any media equipment, or any equipment that media is attached to;
  - (c) disconnection of media cables;
  - (d) bonding or attachment to media equipment; and
  - (e) positional changes to installed media equipment.

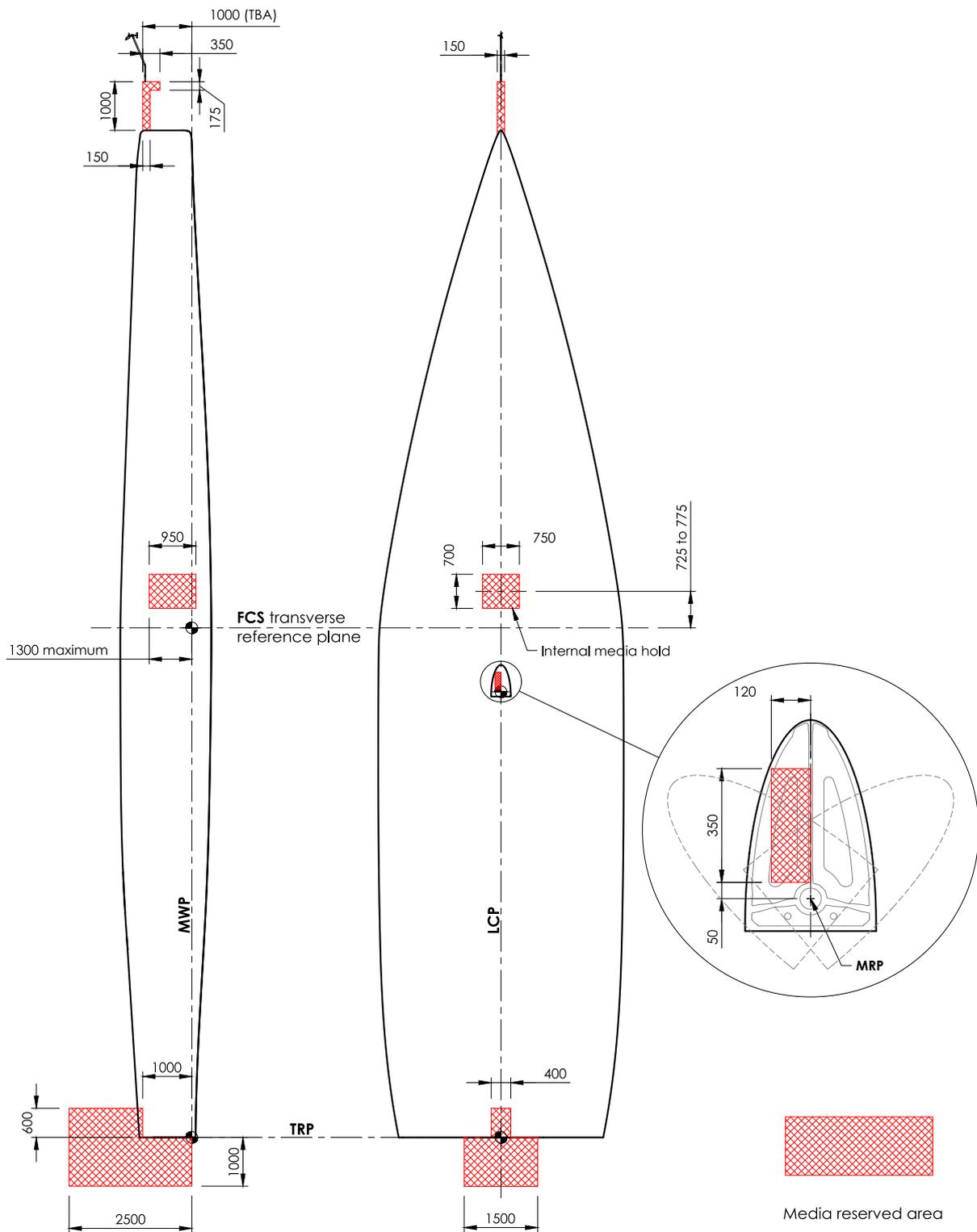


Figure 27.1: Reserved areas for media

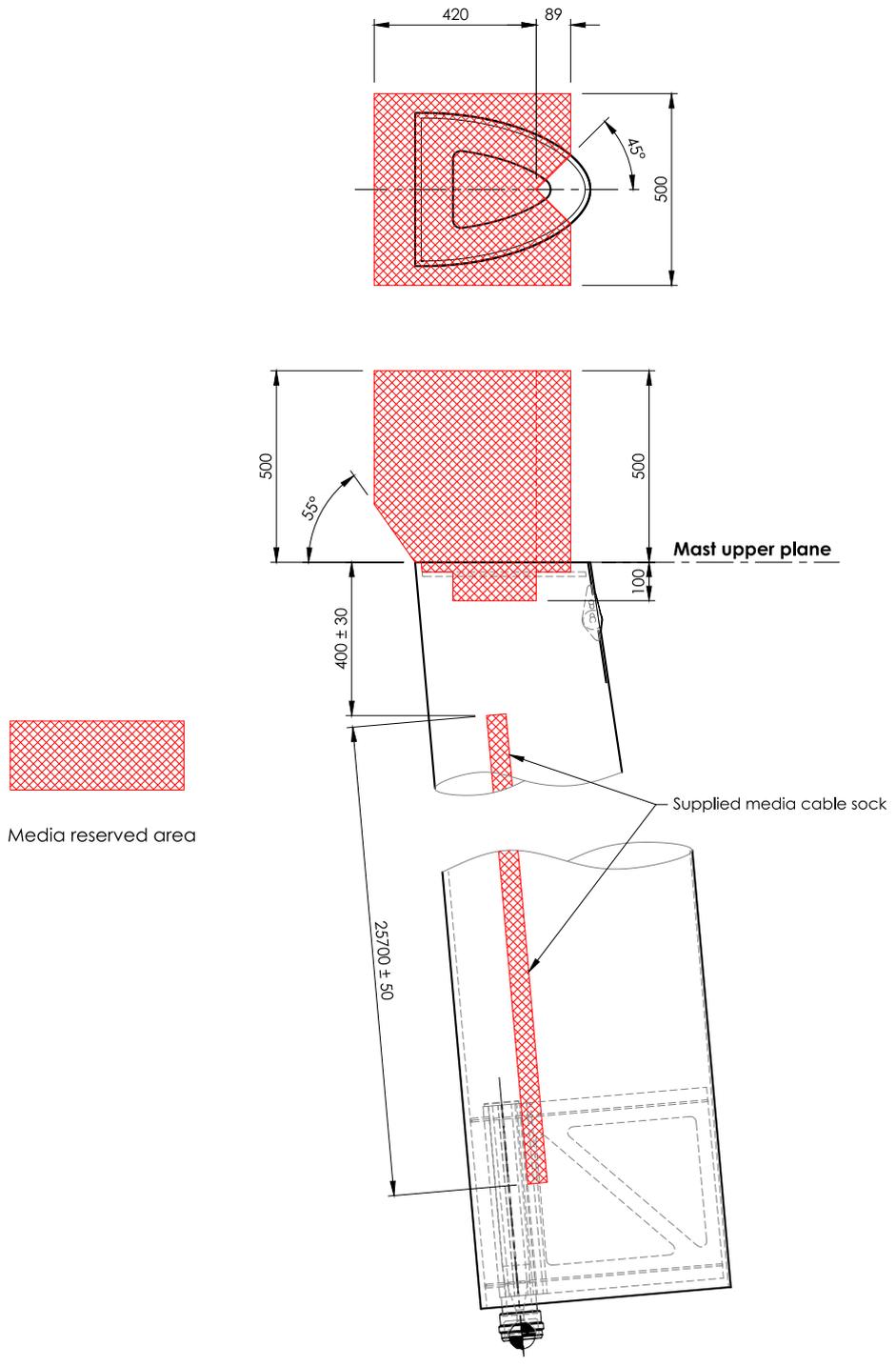


Figure 27.2: Reserved areas for media on mast

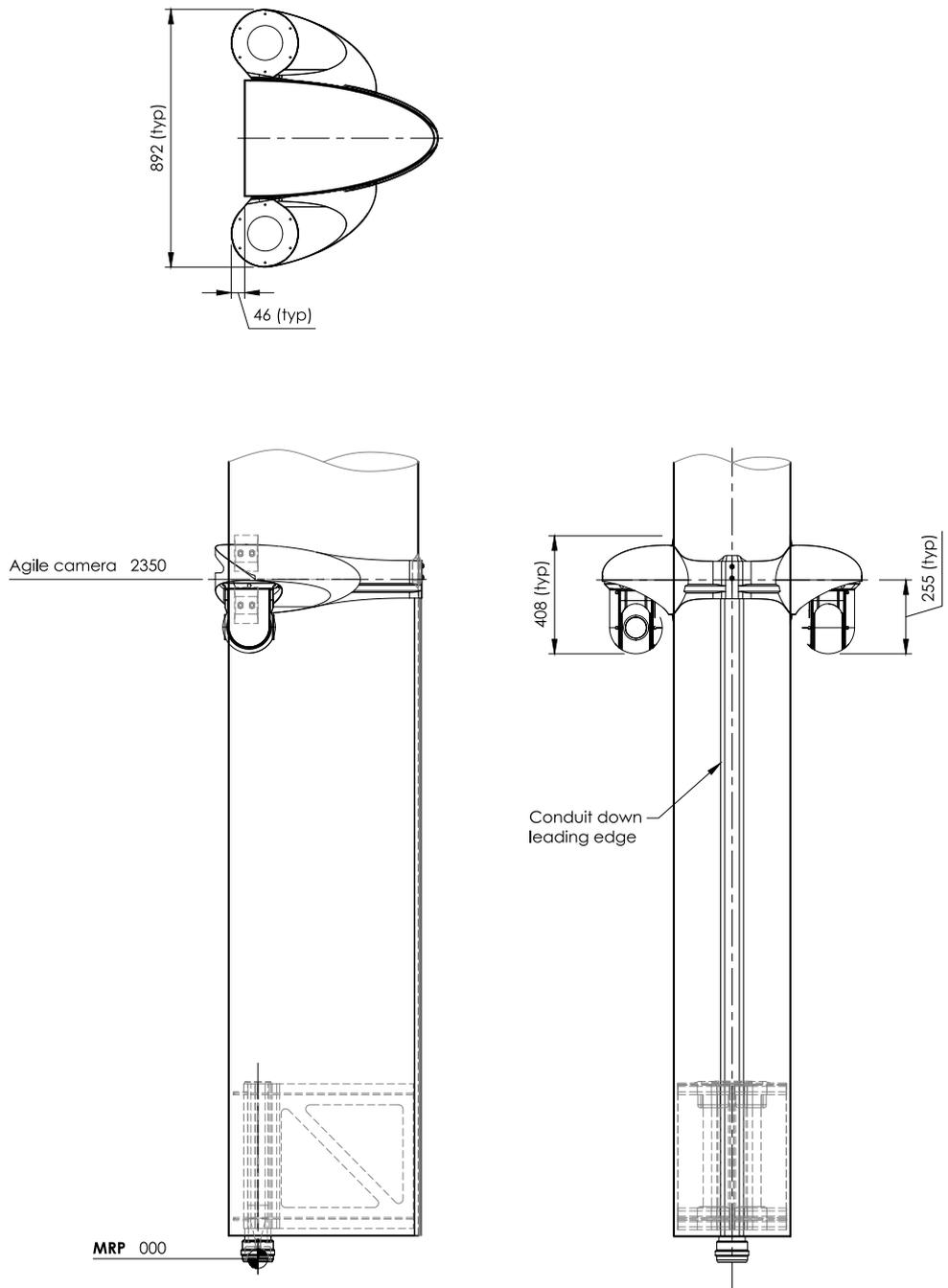


Figure 27.3: Reserved areas for cameras on mast

## 28 *Branding*

- 28.1 Areas shall be reserved for event branding and country flags on the **jib** and **mainsail**. No advertising, other signage or graphics shall be affixed within these areas.
- 28.2 On the outward facing sides of both **mainsail skins**, an area shall be reserved encompassing a rectangular area of height 6600 mm and width 2600 mm which is situated within 6000 mm of the **mast upper plane** within the extents of the **sail skin**.
- 28.3 The reservation of the area defined in Rule 28.2 shall not restrict sail girth measurements. If event branding does not fit on a particular sail then the competitor shall notify the organising authority who will mandate an alternative branding arrangement for the sail.
- 28.4 On both sides of the **jib**, an area defined by a radius of 2800 mm centred on the **tack point** shall be reserved.
- 28.5 Details of the content for the reserved areas shall be provided in the document referenced by Rule 30.1 (f).

## 29 Crew

- 29.1 There shall be eight crew members, unless reduced by accident, who shall all be human beings.
- 29.2 Crew members shall be weighed at crew weighs organised by the **Measurement Committee**, where:
- (a) crew shall be dressed only in light underwear;
  - (b) crew weighs shall take place two days prior to the first race of each **AC75 event stage**, except that if any racing is scheduled during the two days prior to that **AC75 event stage**, no new crew weigh for that **AC75 event stage** shall take place;
  - (c) the **Measurement Committee** will use the weights recorded at crew weighs for verification of compliance until the next crew weigh, at which point those recorded weights shall be updated; and
  - (d) when racing, the total of the recorded crew weights corresponding to the crew members on the **yacht** for that race shall be within the range specified in Rule 6.1.
- 29.3 Each crew member shall wear:
- (a) a buoyancy aid that meets the flotation standard of ISO 12402-5 or ISO 12402-6 (CE 50 Newtons) and that is capable of being removed or deflated in the water within five seconds;
  - (b) a helmet to a minimum standard of CE EN 1077, CE EN 966, ASTM 2040, or Snell S-98 and with at least 300 cm<sup>2</sup> of the exterior surface brightly coloured. **Competitors** shall satisfy the **Measurement Committee** that the brightly coloured region can be seen from above the water with the crew lying face down or face up in the water;
  - (c) a blade with a length of no more than 150 mm;
  - (d) at least one personal air supply containing compressed air equivalent to at least 40 litres uncompressed volume each, which does not require the use of hands when in use;
  - (e) a pocket for carrying media equipment with minimum dimensions 80 mm x 200 mm x 30 mm; and
  - (f) crew supplied media equipment as required by Rule 27.2.
- 29.4 The following items shall be secured and distributed on the **yacht** at locations that would be easily accessible in the event of a capsize:
- (a) at least four blades with lengths of no more than 150 mm;
  - (b) at least four personal air supplies containing compressed air equivalent to at least 40 litres uncompressed volume each, which do not require the use of hands when in use.
- 29.5 The total mass of **carried equipment** worn or carried by each crew member shall be:
- (a) a minimum of 2.5 kg at the start of a race, but may be reduced during a race due to consumption of food or drink;
  - (b) a maximum, when dry, that is dependent on expected air temperature as follows;
    - (i) 6.5 kg if under 18°C;
    - (ii) 5.5 kg if 18-23°C; or
    - (iii) 5.0 kg if over 23°C.
- The **Measurement Committee** shall specify which of these limits apply to an **AC75 event stage** based on the published monthly average temperature for the first day of racing in that **AC75 event stage**; and
- (c) no more than 3.0 kg in excess of the dry maximum when soaked and allowed to drain for 1 minute according to procedures issued by the **Measurement Committee**.

- 29.6 Any crew supplied media equipment or **carried equipment** brought aboard by a crew member must be worn, attached to, or carried by that crew member at all times when racing. This does not prohibit items of **carried equipment** also being attached to the **yacht**.
- 29.7 Clothing and equipment shall not be designed to retain water for the purpose of increasing mass.
- 29.8 Crew shall not enter the watertight volume of the **hull**.
- 29.9 Crew shall remain entirely aft of a plane 9.0 m forward of **TRP**, except that:
- (a) Crew may go forward of 9.0 m briefly to cross the **yacht**, to resolve unforeseen issues, or if this happens by accident.
  - (b) Any crew that go forward of a plane 11.0 m forward of **TRP** may only do so as permitted by Rule 29.9 (a), and unless they are forward by accident:
    - (i) must be tethered to either **hull** or a fitting attached to the **hull** which can withstand the same load as the tether; where
    - (ii) tethers shall comprise a harness and safety line that complies with ISO 12401, the safety line being no longer than 2 m; and
    - (iii) such fittings and tethers are not required by **Competitors** who elect to never go forward of the 11.0 m plane.
  - (c) Crew shall remain forward for no longer than required to resolve any issue.
  - (d) For a crew member to be forward of 9.0 m or 11.0 m by accident, they must find themselves there as a result of falling or stumbling. If not tethered to the **yacht**, they must not resolve any issue on the **yacht** whilst forward of 11.0 m.

## 30 Documents

This is a draft list of documents.

30.1 Documents referenced by the **AC75 Class Rules** include the:

- (a) **mast** specification;
- (b) **FCS** specification;
- (c) **foil arm stock** specification;
- (d) supplied media equipment specification;
- (e) high pressure accumulator specification;
- (f) branding requirements;
- (g) measurement procedures; and
- (h) list of approved **commercial products**,

where these documents are available on the official noticeboard (<http://noticeboard.acofficials.org/home>) and shall be updated by the **Rules Committee** in accordance with the Interpretation and Amendment section of the **AC Technical Regulations** or Rule 33.

## 31 Measurement

- 31.1 If requested by the **Measurement Committee** for verifying compliance with Rules 29.9 (a) and 29.9 (b) whilst racing, lines parallel to **TRP**, at least 50 mm wide and of a colour contrasting to the **deck** shall be marked across the **deck** such that their aft edges are no more than:
- (a) 9.00 m forward of **TRP**; and
  - (b) 11.00 m forward of **TRP**.
- 31.2 **Competitors** shall permit the **Measurement Committee** to take samples of material from components of the **yacht** to ensure compliance with Rule 2.
- 31.3 **Competitors** shall permit the **Measurement Committee** to take samples of paint or vinyl from components of the **yacht** to ensure compliance with Rule 5.
- 31.4 **Competitors** shall assist the **Measurement Committee** in understanding the function and operation of mechanical, hydraulic and electrical systems onboard the **yacht**.
- 31.5 Compliance with **control system** rules may be determined by a combination of hardware inspection, code inspection, interviews and affidavits. On request, **Competitors** shall provide the **Measurement Committee** with source code and compiled executables of any software installed on the **yacht** that the **Competitor** has access to, and shall assist them in the understanding of such code.
- 31.6 The **Measurement Committee** shall issue a measurement certificate for a **yacht** when they have:
- (a) concluded that she complies with the **AC75 Class Rules**;
  - (b) received completed declarations and affidavits as required by the **AC75 Class Rules** and as additionally required by the **Measurement Committee** or the **Rules Committee** at their discretion;
  - (c) received all documentation as required by the **AC75 Class Rules** and by other notices published by the **Measurement Committee** or the **Rules Committee**, and confirmed that the documentation is satisfactory; and
  - (d) received the yacht configuration declaration required by Rule 32.2.
- 31.7 The **Measurement Committee** shall issue procedures and time scales in accordance with Rule 33 for verifying, prior to each race, that a **yacht** remains in compliance with her Measurement Certificate and the **AC75 Class Rules**. Those procedures and time scales shall vary according to the part of the **yacht** being changed and checked, but will include provisions such as:
- (a) verification of a **yacht** assembly mass and **longitudinal** centre of mass, which is likely to be checked the morning of a race; and
  - (b) a deadline prior to a race for the measurement of any **mainsails** or **jibs**, or any permitted modifications of sails, to be determined by the **Measurement Committee** in consultation with **Competitors**, with a permission that a **Competitor** may select which pre-measured sail configurations to use for a race at any time up to the warning signal of that race.

## 32 *Yacht configuration*

- 32.1 The “declaration deadline” for an **AC75 event stage** shall be 120 hours before the scheduled start of the first race of that **AC75 event stage**.
- 32.2 Prior to the declaration deadline, **Competitors** shall declare confidentially to the **Measurement Committee**:
- (a) the **yacht** configuration to be sailed in; and
  - (b) a component substitution schedule
- for the **AC75 event stage**.
- 32.3 The declared **yacht** configuration must include:
- (a) the declared component ID, version and **blueprint SHAs** of the:
    - (i) **hull**;
    - (ii) **foil arm stocks, foil wings, and foil flaps**;
    - (iii) **rudder**;
  - (b) the declared component ID and version of the **mast tube**; and
  - (c) IGES files and corresponding **SHAs** of the port and starboard **linear components** that each combine a **foil arm stock, foil arm fairing and foil wing**.
- 32.4 The component substitution schedule details the order of replacement components to be substituted in the event of loss or damage to a declared component or associated system. A **competitor’s** schedule shall remain confidential between that **competitor** and the **Measurement Committee**. The schedule:
- (a) may specify that damage to some sub-components of a **foil** may necessitate replacement of the complete **foil**, but damage to one **foil** shall not correspond to replacement of the other **foil**;
  - (b) may specify that damage to a **foil** system may necessitate replacement of a **foil**, or parts of that **foil**;
  - (c) may specify that damage to parts of a **mast** may necessitate replacement of a **mast tube**;
  - (d) This section will be expanded to include more detail and to address the interpretation on this topic.
- 32.5 A **yacht’s** measurement certificate shall be of the form shown in Figures 32.1 and 32.2, and shall require no more and no less information than indicated. The information on a measurement certificate shall correspond to the declared **yacht** configuration.
- 32.6 Once a measurement certificate has been issued to a **competitor** for the **AC75 event stage**, it shall not be amended or replaced at any time after that **AC75 event stage’s** declaration deadline, unless:
- (a) a component listed on the certificate is damaged or lost and the conditions in Rule 32.7 are met;
  - (b) a **competitor** is permitted to change a component according to Rule 32.8; or
  - (c) the original certificate is withdrawn and is subsequently re-instated if the matter becomes resolved. In this case, any replacement certificate must still match the declared **yacht** configuration.

32.7 In the event of damage or loss to a component listed on the measurement certificate, a new measurement certificate shall only be issued subject to the following conditions:

- (a) the **Measurement Committee** must be completely satisfied that the damage or loss was unintentional, and that a repair in accordance with the **AC Technical Regulations** is not possible in time for the **competitor's** next race. The **Measurement Committee** may request sailing data, video, inspection of components, interviews with or affidavits from team members to confirm this;
- (b) if the **Measurement Committee** permits a component to be replaced, it shall only be replaced with the next component identified on the scheduled order of replacement components;
- (c) if a damaged component is replaced, and that component can be repaired, but not in time for the next race, the **competitor** shall submit to the **Measurement Committee** an estimated repair schedule and must repair the component as quickly as possible. As soon as the component is repaired, it must be reinstalled, and the original measurement certificate shall be reinstated.

32.8 With reference to Rule 32.7, if:

- (a) the damage occurs in an **AC75 event stage** in which the "Damaged" **competitor** is racing only one other **competitor** (not, for example, a fleet race or round-robin stage);
- (b) the **Measurement Committee** permits the Damaged **competitor** to replace a damaged component and issues a new measurement certificate; and
- (c) the damage is not ruled, by the Umpires or Jury, to have been caused through the fault of the other **competitor**; then

the other **competitor** competing in the **AC75 event stage** shall also be entitled, if they choose, to change the corresponding component to the next component identified on its scheduled order of replacement components, and a new measurement certificate shall be issued.

In this event, when the 'Damaged' **competitor** reinstates that repaired component, the **Measurement Committee** shall inform the other **competitor**, who can then choose whether to reinstate its original component. This choice to reinstate a component, or not, shall only be available at the time that, and if the **competitor** chooses to re-instate, they shall be required to make the change at the next available opportunity, taking into account the racing schedule and the time required to make the change.

32.9 When racing, the configuration of **yacht** must match the configuration recorded in her measurement certificate, except for:

- (a) a change in measurement **yacht assembly longitudinal** centre of mass  $x_v$ , of up to  $\pm 25$  mm from the recorded value.

32.10 The configuration of a **yacht**, with respect to aspects not recorded on her measurement certificate, may be changed prior to any race providing the **Measurement Committee** is able to verify compliance of those changes with respect to the **AC75 Class Rules** prior to racing.

Page 1 will be added here

Figure 32.1: Measurement certificate, Page 1

<b>Certificate</b>		<b>Certificate number</b>		<input type="text"/>	
<b>Mass</b>		<b>Yacht assembly mass</b>		<input type="text"/>	<i>kg</i>
<b>Mast</b>		<b>Longitudinal centre</b>		<input type="text"/>	<i>m</i>
<b>Mast</b>		<i>ID</i>	<input type="text"/>	<i>Version</i>	<input type="text"/>
<b>Port foil</b>		<b>Foil arm stock</b>		<i>ID</i>	<input type="text"/>
				<i>Version</i>	<input type="text"/>
		<i>SHA</i>		<input type="text"/>	
<b>Starboard foil</b>		<b>Foil arm stock</b>		<i>ID</i>	<input type="text"/>
				<i>Version</i>	<input type="text"/>
		<i>SHA</i>		<input type="text"/>	
<b>Foil wing</b>		<i>ID</i>	<input type="text"/>	<i>Version</i>	<input type="text"/>
		<i>SHA</i>		<input type="text"/>	
<b>Foil flap</b>		<i>ID</i>	<input type="text"/>	<i>Version</i>	<input type="text"/>
		<i>SHA</i>		<input type="text"/>	
<b>Linear component</b>		<i>IGES filename</i>		<input type="text"/>	
		<i>SHA</i>		<input type="text"/>	
<b>Linear component</b>		<i>IGES filename</i>		<input type="text"/>	
		<i>SHA</i>		<input type="text"/>	
<b>Measurers</b>					
<i>Name</i>			<input type="text"/>		
<i>Signature</i>			<input type="text"/>		

Figure 32.2: Measurement certificate, Page 2

## 33 Dates

This is a draft list of items for which dates will be specified.

33.1 The following items shall be specified no later than the dates specified:

Date	Rule	Who	Item
XX/XX/XXXX	15.1	<b>COR/D</b>	The <b>mast</b> specification.
XX/XX/XXXX	2.18	<b>Rules Committee</b>	Material certificates and declaration requirements.
XX/XX/XXXX	20.5	<b>COR/D</b>	Specified manual hydraulic pumps.
XX/XX/XXXX	24.3	<b>COR/D</b>	<b>Media System</b> details and protocols.
XX/XX/XXXX*	27.2	<b>COR/D</b>	Media equipment worn by crew.
XX/XX/XXXX*	28	<b>COR/D</b>	<b>Event</b> branding.
XX/XX/XXXX*	31.7	<b>Rules Committee</b>	Measurement procedures and documentation.
XX/XX/XXXX*	26.1	<b>Rules Committee</b>	<b>FCS</b> specification.
XX/XX/XXXX		<b>Rules Committee</b>	<b>Media System</b> updates frozen.
XX/XX/XXXX	26.7	<b>Rules Committee</b>	<b>FCS</b> updates frozen.

*\*These specifications may be amended provided they are published at least 180 days prior to the first day of racing of the **Event** in which these specifications apply.*

## 34 Agreement

**COR/D** agrees to the draft publication of this **AC75 Class Rule**.

Signed on this 17<sup>th</sup> day of November 2021

### **Defender**



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by Grant Dalton, CEO

### **Challenger of Record**



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by Ben Ainslie, CEO.