

# AC75 CLASS RULE

v2.0

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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 37<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 The **AC75 Class Yacht** shall be propelled by sails only.
- 1.5 **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), providing 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 absolute 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</b> and <b>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 Rule 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 Where certificates are required for a category in Rule 2.4:
- (a) **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;
  - (b) **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; and
  - (c) as an exception, material certificates are not required for glass, polyethylene, polyester or polypropylene fibre.
- Further requirements on material certificates may be included in the **Measurement Procedures**.
- 2.8 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.
- 2.9 **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 physical or chemical 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.
- 2.10 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.
- 2.11 The limit on “Material not listed above” 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.
- 2.12 For all categories in Rule 2.4, **Competitors** must submit a declaration that the material used in all components satisfies Rule 2.

2.13 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

2.14 For metal materials where evidence is required, this evidence shall report:

- (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<sub>p0.2</sub>) of the three specimens;

and
- (b) density 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.

2.15 For all categories in Rule 2.13, **Competitors** must submit a declaration that metal materials in **foil wings, foil flaps** and **rudders** satisfy Rule 2.13.

2.16 Hydraulic tubing containing more than trace quantities of titanium is prohibited, but this does not preclude the use of titanium in other hydraulic devices or fittings.

2.17 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.

2.18 Gases shall have a minimum density of 1.1 kg/m<sup>3</sup>, 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**;

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

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

$$k_{MOULD} = \begin{cases} 2, & \text{if a mould is not required} \\ 1, & \text{if at least 10\% of the total mass of carbon reinforcement used in the mould is from} \\ & \text{recycled sources} \\ 1, & \text{if the mould is constructed from fibres with low embodied energy (e.g. basalt)} \\ 1, & \text{if the mould is constructed of sustainably sourced material (e.g. timber)} \\ 1, & \text{if at least 50\% of the fibre reinforcement, by mass, used in the mould is natural fibre} \\ & \text{(e.g. flax)} \\ 0, & \text{otherwise} \end{cases}$$

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 its 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 5.4, 5.5, 5.6 and 5.7, the outermost layer of the **hull, foils** (excluding foil systems controlled by Rule 10.3) 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 As an exception to Rule 5.1, occasional regions in the outermost layer of the **hull, foils** and **rudder** may be unpainted, providing that:
- (a) each region is no more than 0.001 m<sup>2</sup>; and
  - (b) the total area of these regions does not exceed 0.05 m<sup>2</sup> on each **hull, foil** or **rudder**.
- 5.5 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. Where sanding has unintentionally broken through a permitted surface finish leaving occasional regions of no more than 0.001 m<sup>2</sup> each, these regions are permitted to expose metal, **FRP** or filler as the outermost surface layer of the **hull, foils** and **rudder**.
- 5.6 **Competitors** may apply vinyl or plastic film over the paint for the purpose of branding, providing it complies with Rule 5.8.
- 5.7 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.

5.8 Devices and finishes whose primary purpose is altering the structure of the boundary layer are prohibited. For the avoidance of doubt:

- (a) this prohibition includes, but is not limited to:
  - (i) electric, magnetic, sonic, thermal and chemical devices;
  - (ii) patterned or textured finishes, LEBUs; and
  - (iii) active devices that suck fluid from or blow fluid on to the surface of a component;but
- (b) this rule does not prohibit:
  - (i) surface finishing permitted by Rule 5.5;
  - (ii) passive macroscopic devices such as slots or slats; or
  - (iii) 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 ( $x, y, z$ ). The table is for reference only, and Rule 6.1 does not in itself impose any requirements on the **AC75 Class Yacht**. However, other rules do stipulate requirements by making reference to the data tabulated herein.

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</b> pins and bearings	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>Media equipment</b>	112	8.90
<b>Mast</b> (excluding parts weighed with <b>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>Media equipment</b>	22.3	
<b>Mainsail</b> (excluding parts weighed with <b>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>716 – 744</b>	
Crew	*680 – 700	
Crew's <b>carried equipment</b>	*32 – 40	
† <b>Crew supplied media equipment</b>	4	
<b>Total</b>	<b>6876 – 6944</b>	

\*Measured, †Supplied equipment

- 6.2 **Foils** shall be weighed and their centres of mass, in a plane parallel to **TRP**, shall be determined according to the **Measurement Procedures**. During measurement the **foil flap** angle shall be set to an angle chosen by the **Competitor**. 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 15.14 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 as described by Rule 17.22.
- 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 comprise exactly:

- (a) one **hull**;
- (b) two **foils**;
- (c) one **rudder**;
- (d) one **mast**, which shall include one set of **supplied rigging**;
- (e) one **mainsail**; and
- (f) 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 27.2 (e) and **media equipment** 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, **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;
    - (i)  $7.5^\circ \pm 0.5^\circ$  as shown in Figure 10.2;
    - (ii)  $41.41^\circ \pm 0.5^\circ$  as shown in Figure 10.1; or
    - (iii) any other angle agreed between the **Competitor** and the **Measurement Committee** provided that the cant angles of both **foils** are the same;
  - (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 limited with reference to an elliptical prism (a solid right elliptic cylinder) which has a major axis of 450 mm, minor axis of 200 mm and a height of 600 mm. When viewed from above and orthogonal to **MWP**, no more than 35% of the area of the prism **projected** to **MWP** shall be capable of being covered by any part of the **yacht** above the prism other than the **mast**, sails and rigging, where:
- (a) 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**);
  - (b) 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
  - (c) 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 Within Rules 7.10 and 7.11, parts of the **yacht** that *move* or are *moved* are defined to be those parts that have a degree-of-freedom of movement with respect to the part of the **yacht** to which they are attached, where such movement is applicable:
- (a) whether the degree-of-freedom of movement is through a kinematic or compliant connection; and
  - (b) whether the parts *moves* as a result of **external forces**, due to the action of the crew or due to the action of another part of the **yacht**.



7.10 Apart from permitted movement of **foils, foil arm drums, control surfaces** and the flexible covers permitted in Rule 7.11 (b):

- (a) the only parts of the **yacht** that may *move* are:
- (i) parts *moved* to control movement of a **control surface**, including electrical and hydraulic components attached to **control systems**;
  - (ii) hand-held devices whose only purpose is to house **passive input devices** and/or **crew indication devices**;
  - (iii) parts *moved* in preparation for, or to organise after controlling a **control surface** (e.g. setting a **jib** car prior to tacking, charging a **hydraulic accumulator** or stowing sheets);
  - (iv) within the **FCS**;
  - (v) access panels being opened or closed (which must not be into the **hull**);
  - (vi) drainage flaps permitted by Rule 8.21;
  - (vii) a simple mechanical wind indicator that has no purpose other than indicating the apparent wind direction;
  - (viii) mechanical components within electrical systems, such as a cooling fan, a bilge pump, a line or quadrant connecting a string potentiometer to part of a **control system** or **control surface**;
  - (ix) 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;
  - (x) zips or similar linear closing devices to close covers permitted by Rule 7.11 (b);
  - (xi) slack rigging or hoses;
  - (xii) **woollies**;
  - (xiii) parts *moved* solely for safety reasons; or
  - (xiv) parts *moved* as the result of an unintended breakdown, as determined by the **Measurement Committee**;
- and
- (b) those parts that *move* shall have no significant effect on:
- (i) aerodynamic loads;
  - (ii) hydrodynamic loads;
  - (iii) the angular momentum of the **yacht**; or
  - (iv) the centre of mass of the **yacht**.

- 7.11 Components shall not be designed to deform in order to affect the aerodynamic performance of the **yacht**, except for:
- (a) **control surfaces**, as a result of:
    - (i) **external forces**;
    - (ii) permitted movements of **flight controls**; or
    - (iii) permitted movements of **rig controls**;and
  - (b) flexible covers that fair rebates or penetrations, in the **deck** or in hardware attached to the **deck**, around or through which a **rig** or **rig control system** component (the *component*) moves, providing that:
    - (i) the deformation is caused by the movement of the *component*;
    - (ii) when not deformed, the flexible cover restores the **deck** or hardware towards its fair shape in the absence of the rebate or penetration;
    - (iii) the only purpose of the flexible cover is to reduce the aerodynamic drag or maintain attachment of flow in the vicinity of the rebate or penetration; and
    - (iv) any change in shape of the covered region, caused by movement of the *component*, is confined to a local area around the *component*.

## 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 8.18 (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 is 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 constrained to 0° of heel and 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) 0.300 m at 15° of heel; and
- (c) 1.000 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 Any distinct retained water volume in a deck recess, cockpit, or other location on the **yacht**, shall be self-draining with the following criteria:
- (a) at any water level, a drainage area of at least 0.050 m<sup>2</sup> for every 1.000 m<sup>3</sup> of retained volume shall be present below that level;
  - (b) the drainage area shall be:
    - (i) open to drainage in the absence of a flotation waterplane; and
    - (ii) free from obstruction, except for fairing flaps permitted by Rule 8.21;
  - (c) retained 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) the 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;and
  - (e) the following regions are exempt from the above requirements:
    - (i) porous and textured surfaces provided the **Measurement Committee** is satisfied that these are no larger than necessary; and
    - (ii) a total volume of no more than 3.0 litres comprising incidental features such as hatch gutters and fitting recesses.

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 Two **foil wet boxes** and one **rudder wet box** are permitted within the **hull surface**, where:
- (a) each **foil wet box** shall enclose a floodable volume of no more than 300 litres;
  - (b) the **rudder wet box** shall enclose a floodable volume of no more than 30 litres;
  - (c) each **wet box** shall be self draining according the criteria in Rules 8.16 (a), 8.16 (b) and 8.16 (d);
  - (d) volumes of non-porous foam or other material within a **wet box** may be subtracted from the **wet box** volume for the purposes of Rules 8.17 (a), 8.17 (b), 8.17 (c); and
  - (e) 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.
- 8.18 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.

- 8.19 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 and shall be in a position that enables **media equipment** to be installed in its specified location.

- 8.21 Fairing flaps on the **hull lower surface**, which are considered open for the purposes of Rule 8.16, are permitted for closing penetrations or conduit exits, provided that they:

- (a) are no larger than required to close the drainage area specified by Rule 8.16 (a);
- (b) have no purpose other than:
  - (i) fairing the **hull** surface when water is not draining; and
  - (ii) preventing reverse flow; and
- (c) are incapable of retaining more than 25 L of water, in total, within the **yacht**. As an exception to Rule 8.4, this Rule shall be tested empirically by the **Measurement Committee**, at one or more orientations of the **yacht** not exceeding the range of heel and trim prescribed by Rule 8.16 (d).

## 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 only:
- (a) one **foil arm** and one **foil wing**, which shall be connected to each other according to a detail provided within the **foil arm stock** specification.
  - (b) one **foil flap**; and
  - (c) one or more **foil** systems.
- 10.2 A **foil** excludes:
- (a) the removable pins and bearings identified in the **foil arm stock** specification referenced in Rule 32.3;
  - (b) any **foil arm drum**; and
  - (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**;
  - (c) that are above the upper extent of the **foil wing box** when **WSP** is vertical shall be contained entirely within the **foil arm**; and
  - (d) that are below the upper extent of the **foil wing box** when **WSP** is vertical:
    - (i) shall be contained entirely within the **foil wing box**; and
    - (ii) shall have a total combined volume lying outside both the **foil wing hydrodynamic surface** and the **foil flap hydrodynamic surface** that does not exceed 1% of the combined volume enclosed by the **foil wing hydrodynamic surface** and the **foil flap hydrodynamic surface**. This condition shall be satisfied at all **foil flap** angles and twists;
- and
- (e) shall not themselves produce any hydrodynamic or aerodynamic forces that are significant with respect to the total forces acting on the **yacht**.
- 10.4 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.
- 10.5 The entire **foil** must lie between planes 10.000 m and 12.000 m forward of **TRP**.
- 10.6 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 10.2.
- 10.7 The **foil** shall be capable of reaching **cant** angles of 7.6° and 119.5°.
- 10.8 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**.



- 10.9 **Foil** measurement condition shall be with:
- the **yacht** levelled in a cradle;
  - the **foil** unloaded by **external forces**, except gravity;
  - the **foil wing** correctly mounted on the **foil arm**;
  - the **foil flap** correctly mounted on the **foil wing**;
  - the **foil** systems connected to the **foil wing** and **foil flap**; and
  - the **foil arm** canted such that **WSP** is vertical.

The cant angle in **foil** measurement condition corresponds to a theoretical cant angle of  $41.41^\circ$ . Where a numerical cant angle is given in the Rule, unless specifically referring to an **FCS**-measured cant angle, this cant angle of  $41.41^\circ$  shall be used as a datum for defining other cant angles, with a raising of the **foil** from this position corresponding to an increase in cant.

10.10 **Control surface actuators** are permitted within **foil** systems to rotate **foil flaps** about the axis described in Rule 13.11. Any deformation in the **foil** resulting from this actuation is restricted by Rule 13.14. No other devices are permitted to modify the shape of a **foil**.

10.11 No part of a **foil** except the ODA Lower Belt Assembly and the ODA Head Assembly identified in the **foil arm stock** specification may touch any part of the **yacht** except:

- a **foil arm drum**;
- hydraulic connections for **foil** systems; and
- electrical and optical fibre connections.

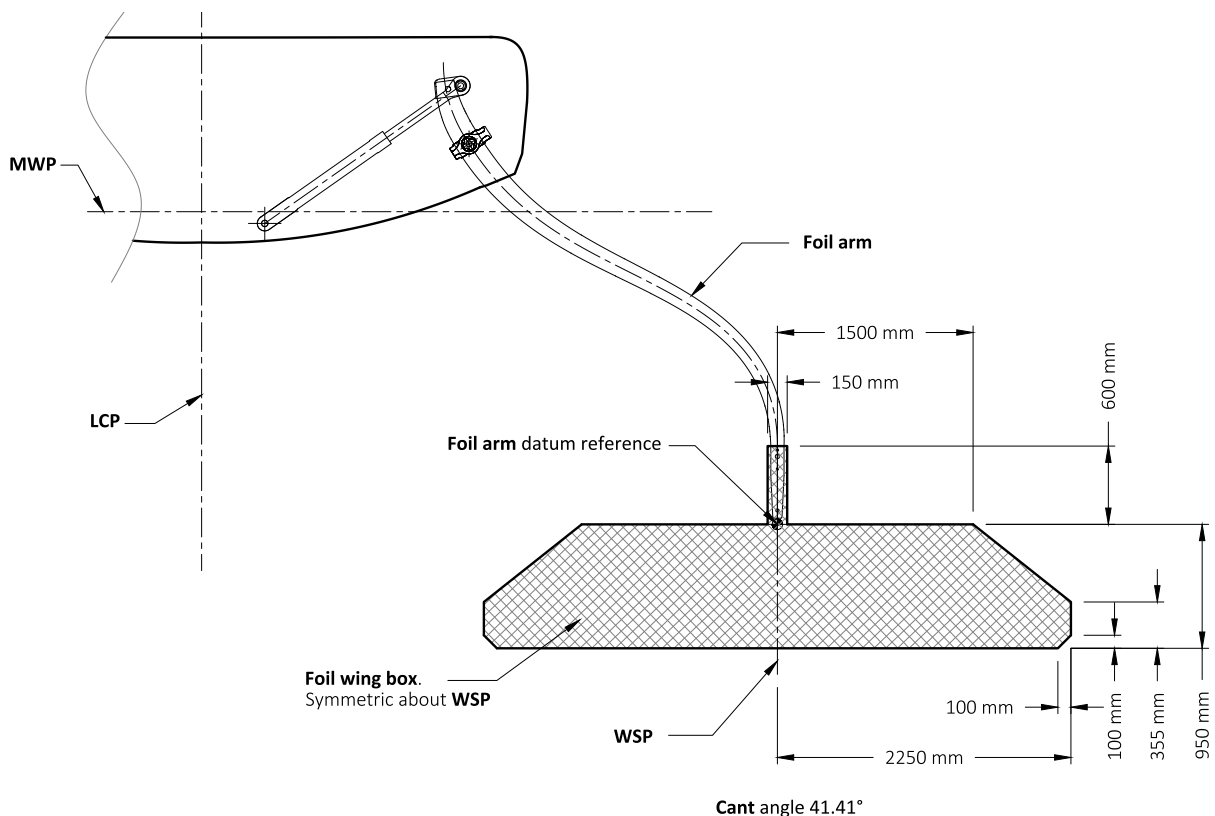


Figure 10.1: The extents of the **foil wing box** are defined by the shaded region in this figure.

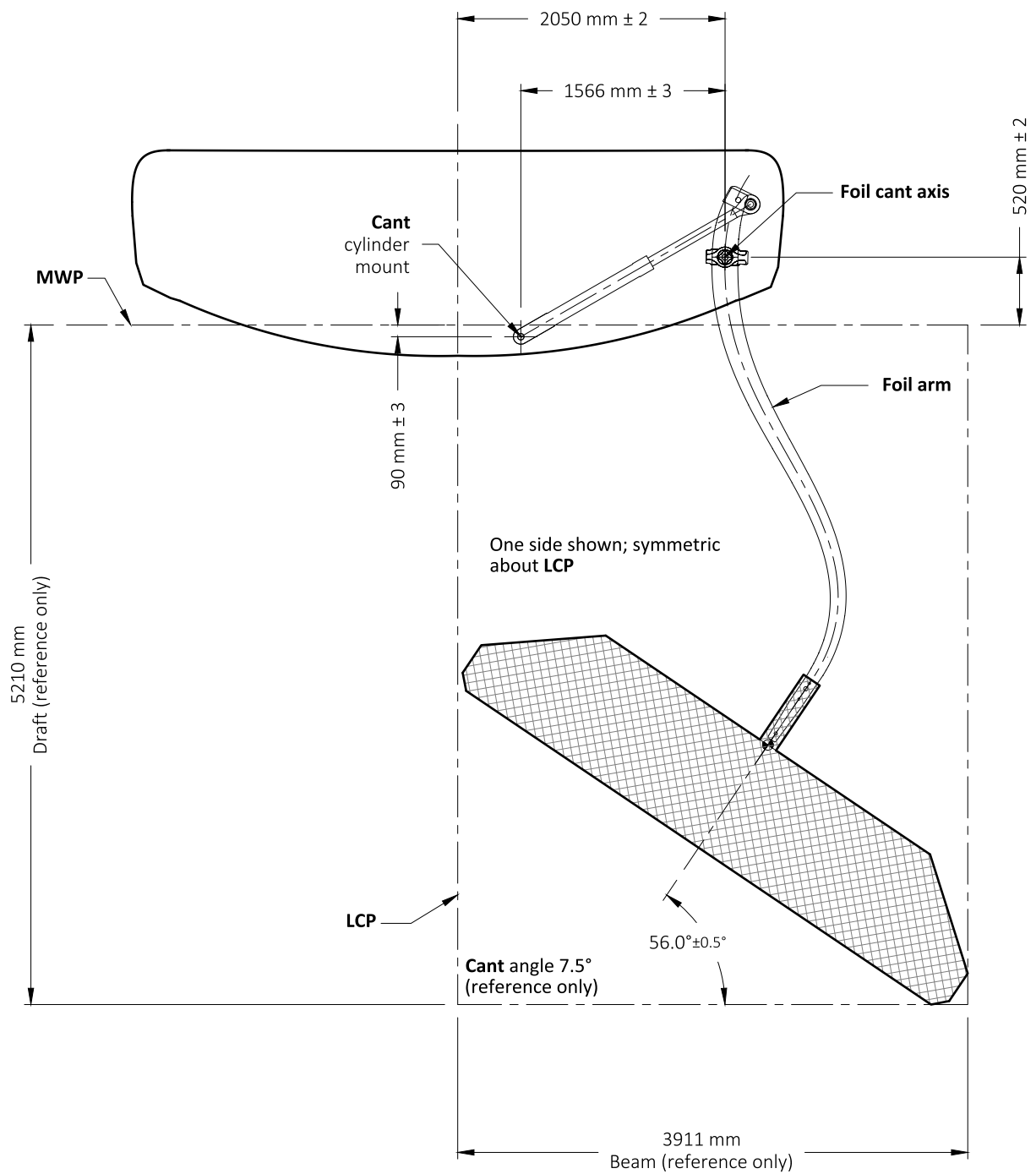


Figure 10.2: FCS geometry

## 11 Foil arms

- 11.1 Each **foil arm** shall be a **linear component** comprising 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 32.3.
- 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 and fairing over, providing any additional grooves cut for placement of the optical fibres are in the surface of the **foil arm stock** and no wider or deeper than the grooves already provided;
  - (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 tolerances specified in the **Measurement Procedures**.
- 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 A **foil wing** shall be a **linear component**.

12.2 The **blueprint** for a **foil wing** shall be an IGES file that includes:

- (a) the **foil wing's hydrodynamic surface**;
- (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.

12.3 A **foil wing** shall match its **blueprint** within tolerances specified in the **Measurement Procedures** 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.

12.4 A **foil wing** must be **symmetric** about **WSP**, with a build tolerance of 3.0 mm.

12.5 **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 12.4.

## 13 *Foil flaps and flexures*

- 13.1 A **foil flap** shall comprise one or more *flap segments*, each of which shall be a **linear component**.
- 13.2 The **blueprint** for a **foil flap** shall be an IGES file representing an assembly that includes:
- (a) each *flap segment's hydrodynamic surface*, positioned relative to each other as they are assembled into the **foil**, which together form the **foil flap's hydrodynamic surface**;
  - (b) surfaces specifying any regions of **foil flap** segments classified as **foil flexure**;
  - (c) surfaces specifying any regions of **foil flap** segments classified as *segment end regions*; and
  - (d) 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 specified in the **Measurement Procedures**. 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 *Segment end regions* referred to in Rules 13.2, 13.5 and 13.10 (a) (i) are permitted within cross-sections parallel to **WSP** through a maximum combined total span of 450 mm, where span is measured perpendicular to **WSP**.
- 13.5 Except within *segment end regions*, at any cross-section parallel to **WSP** there shall be no more than one *flap segment*.
- 13.6 The following shall be **symmetric** about **WSP**:
- (a) the number and arrangement of **foil flap** segments, where a *flap segment* may cross **WSP** providing it is **symmetric** about **WSP**;
  - (b) the **foil flap**, with a build tolerance of 3.0 mm;
  - (c) the **foil flap** hinge axes, with a build tolerance of 3.0 mm; and
  - (d) the ranges of rotations and twists that can be achieved.
- 13.7 A **foil flexure** must be classified as a region of:
- (a) a **foil wing**;
  - (b) a **foil flap**; or
  - (c) material that is partly **foil wing** and partly **foil flap**, with a virtual split line delineating the boundary.

- 13.8 Within Rules 13.9 and 13.10 (b) (i):
- (a) the stated requirements apply at all cross-sections parallel to **WSP** and all **foil flap** rotation angles;
  - (b) 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;
  - (c) 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;
  - (d) the following shall be neglected when determining *chord length*:
    - (i) the **foil arm** and any **foil** system;
    - (ii) any part of the **foil wing** that is aft of the aft most point of the **foil flap** in any cross-section; and
    - (iii) 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**.
- 13.9 The *chord length* of a **foil flap** shall be no more than 50% of the *chord length* of the **foil**.
- 13.10 At any cross-section parallel to **WSP**:
- (a) within *segment end regions*:
    - (i) the *chord length* of a **foil flexure** shall be no more than 50% of the *chord length* of the **foil**;
  - (b) elsewhere:
    - (i) the *chord length* of a **foil flexure** shall be no more than 20% of the *chord length* of the **foil**; and
    - (ii) a **foil flexure** shall not extend to the aft most point of the cross-section.
- 13.11 At any cross-section parallel to **WSP**, the only permitted movement of a **foil flap** relative to a **foil wing**, except for deformation restricted by Rule 13.14, 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, provided that play is not designed to produce a non-stationary hinge axis; 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**.
- 13.12 Every tangent to a hinge axis shall subtend an angle of at least 45° to **WSP**.
- 13.13 At any cross-section parallel to **WSP**, a **foil flap** shall not rotate about the hinge axis by more than  $\pm 45^\circ$  from a central position.
- 13.14 The cross-sectional shapes of the **foil wing** and **foil flap** shall lie within  $\pm 2.0$  mm of their **blueprint's** local cross-section, except over the surface of any **foil flexure**, to be satisfied:
- (a) at any cross-section through a **foil** perpendicular to the local **foil flap** hinge axis;
  - (b) for all **foil flap** rotation angles and twists; and
  - (c) in the absence of **external forces** except gravity.

13.15 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**.

## 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) the **rudder's hydrodynamic surface**; 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 specified in the **Measurement Procedures**. 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 3 mm of **LCP**;
  - (b) an upper bearing, whose **bearing centre** can move, but must always lie within 3 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 the **steering control 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 32.3 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) legacy **mast tube** modification procedures.
- The word *specification* within Rule 15 refers to the parts of this **mast** specification.
- 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. The **mast tube** can be either:
- (a) a new **mast tube** built according to the specification; or
  - (b) a legacy **mast tube** modified according to the legacy **mast tube** modification procedures detailed in 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 horizontally in two cradles, with the aft face upwards, positioned 3.0 m and 20.9 m above the ball:
- (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 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.
  - (c) openings or covers over openings in legacy **mast tubes** for legacy one-design fittings that are no longer in the **mast surface specification**.

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 *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 **rig 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 in the aft face used for the attachment of fittings as permitted in Rule 15.5 (b) 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 **rig control systems** within the **mast lower zone** for the purpose of controlling the **mainsail**;
- (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 **rig 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 **media equipment**.
- 15.14 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.

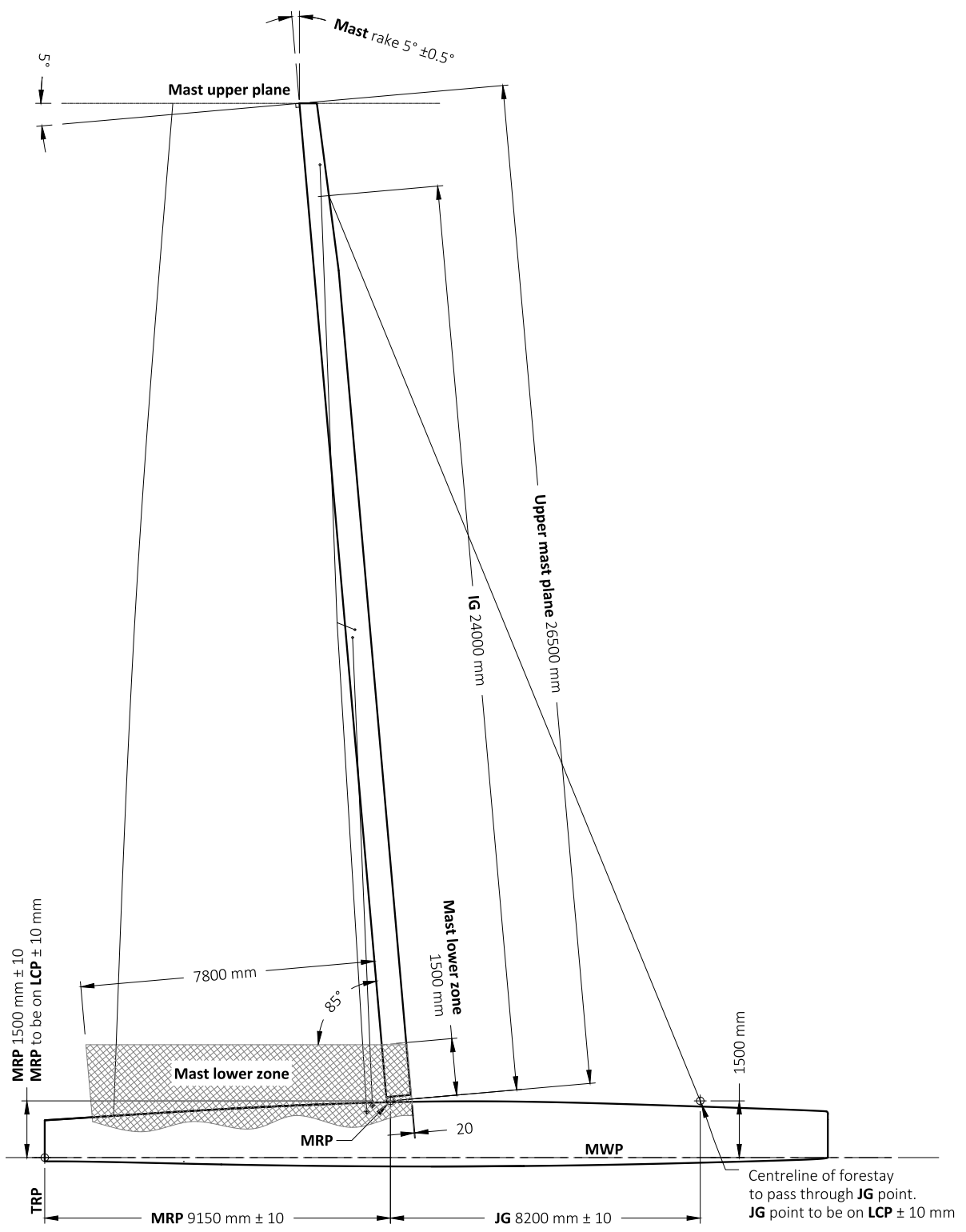


Figure 15.1: Rig Plan

## 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 changes with respect to the previous version of the **sail skin**;
  - (c) the immutable area of the **sail skin**; and
  - (d) the total area of sail skin bounded by the luff, head, leech and foot.
- 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 whilst racing. This rule does not prohibit access panels that are fully covered and closed whilst racing. Penetrations may exist that are either small such as those created by stitching, or filled such as penetrations used for attaching **sail hardware**. Control lines shall not pass from one side of a **sail skin** to the other.
- 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 17.19;
  - (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) **rig control systems** as described in Rule 17.20;
  - (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 17.21;
  - (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:

$$130.0 < \frac{26.5}{12} \times (G_F + 4G_{25} + 2G_{50} + 4G_{75} + G_H) < 145.0$$

For the avoidance of doubt, this formula is a girth restriction only and shall not be used as a measurement of sail area.

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**.

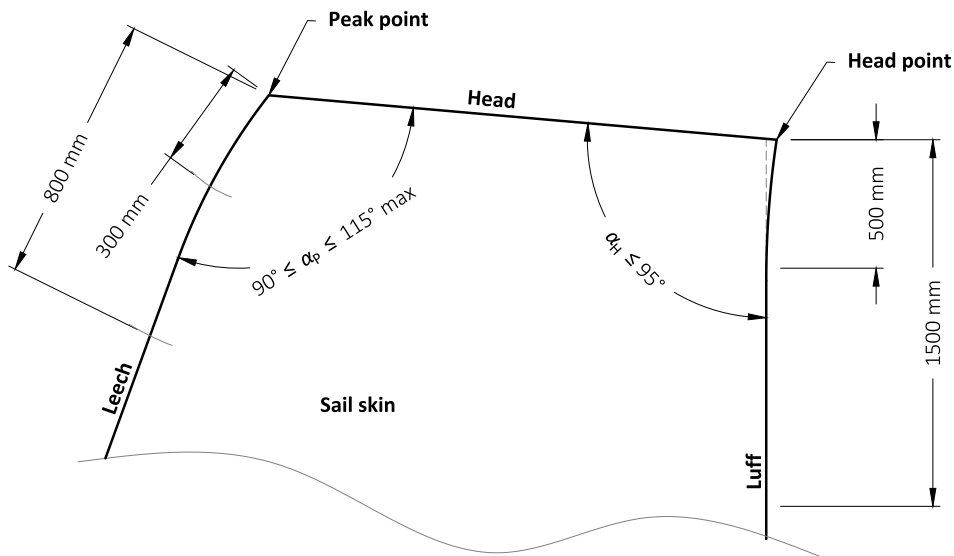


Figure 17.1: Example measurement of  $\alpha_p$  and  $\alpha_H$

- 17.8 The **head points** of both **skins** of a **mainsail** shall be below the **mast upper plane**.
- 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  $5^\circ$ . 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:
- (a) fairing **rig control systems**, where they shall lie entirely within the **mast lower zone**, may be flexible, and may be attached to the **sail skins**; and
  - (b) sealing the area between **sail skins**, where they shall be flexible and shall only be 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 The **mast** and **mainsail** shall not have features such as flaps, excess **sail skin** material, or **rig control system** fairings designed to cover or fair the crew in their normal sailing positions except occasionally when the **mainsail** is well-eased.

- 17.18 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**.

- 17.19 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 17.19 (a).

Within the **mast lower zone** there are no restrictions on connections between **sail skins** or **battens**.

- 17.20 **Rig 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.

- 17.21 A supplied **mainsail** buoyancy system, as defined in the **mast** specification 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 **mast** specification.

- 17.22 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.

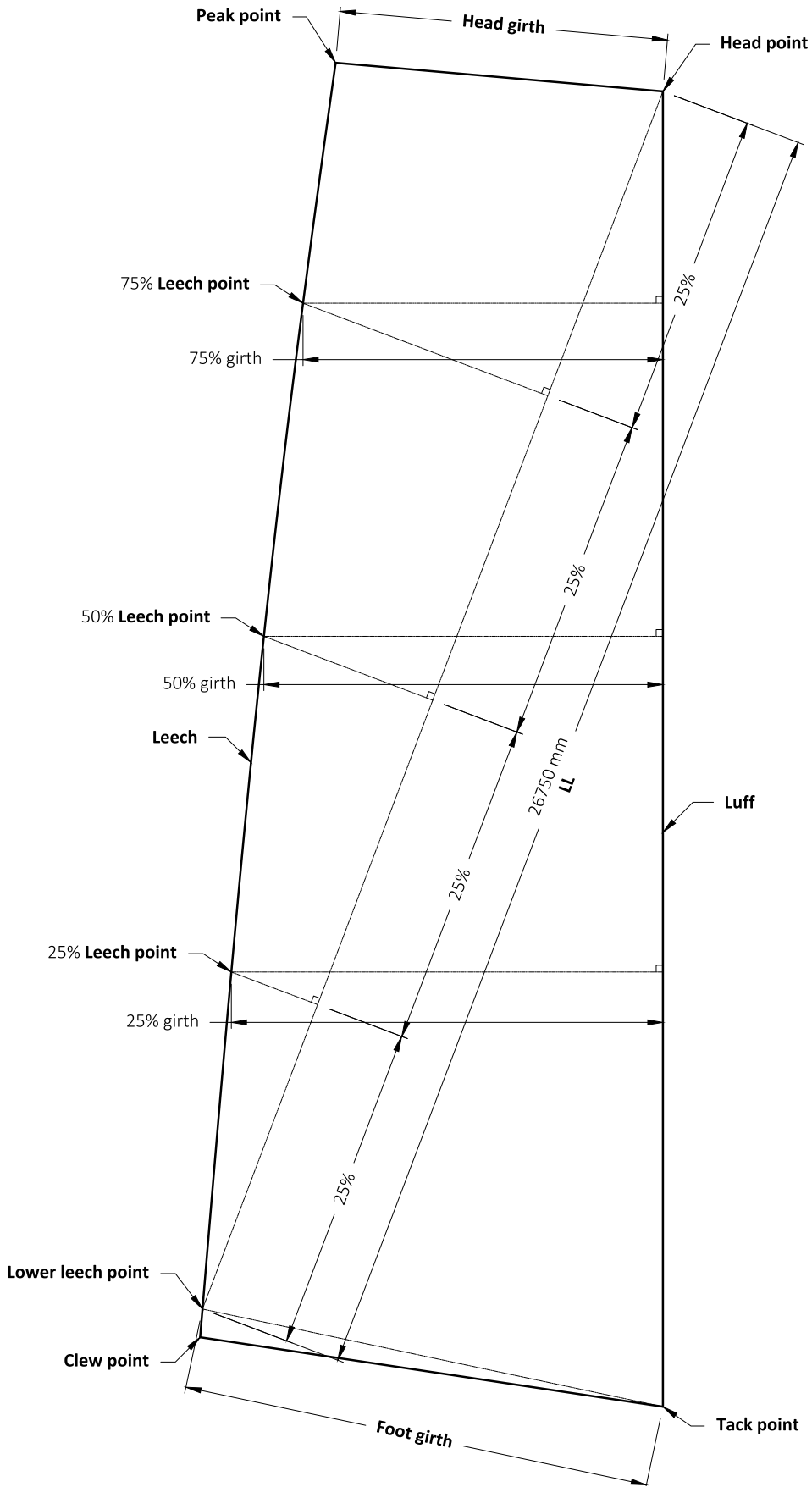


Figure 17.2: **Mainsail** Measurement

## 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** 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>

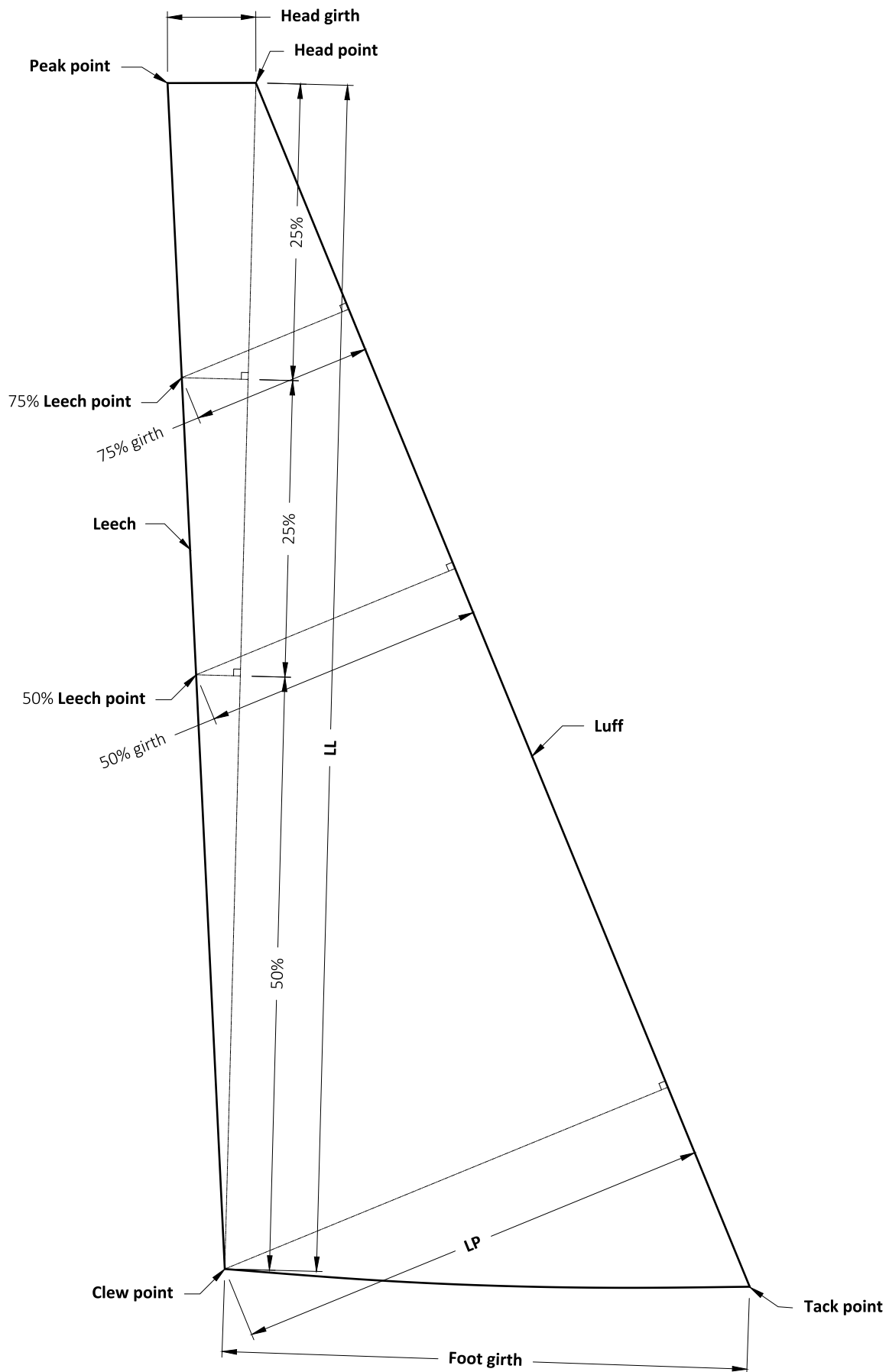


Figure 18.1: **Jib** Measurement

## 19 *Hydraulics*

- 19.1 Rule 19 applies to all components except the **FCS**.
- 19.2 Hydraulic circuits and components are permitted only as part of an **HCC**.
- 19.3 Hydraulic circuits and components are permitted only for the purpose of adjusting **control surfaces** with **control surface actuators**, and for managing the flow of hydraulic fluid to and from these actuators.
- 19.4 **Hydraulic actuators** are permitted only as:
- (a) parts of **control surface actuators**;
  - (b) **transmission actuators**; and
  - (c) **master actuators**.
- 19.5 Components in an **HCC** must be sized appropriately for their permitted use. It is prohibited to use additional, oversized or highly-deformable components or plumbing:
- (a) to control the mass distribution on the **yacht**;
  - (b) to act as a **yacht state** sensor;
  - (c) to store energy (except in permitted **hydraulic accumulators**); or
  - (d) for any purpose other than that permitted by Rule 19.3.

Oil reservoirs shall be no larger than required for supplying permitted **HCCs**, including appropriate reserve volumes.

- 19.6 **COR/D** will specify a standard human-powered hydraulic pump, a standard combination of pump and gearbox, or a range of permitted pumps and gearboxes. These pumps shall be the only type of pump used to convert power transmitted through **primary force input devices** by the crew into hydraulic power within an **HCC**. The drive ratio, being the ratio of the rotational velocity of the input to the specified pump or specified gearbox, divided by the rotational velocity at which the crew provides power into the **primary force input device**, shall be fixed for each **primary force input device** to pump or specified gearbox connection, and shall not be adjusted whilst racing. A minimum and maximum permitted fixed drive ratio shall be specified when the details of the pump are published. This Rule does not prohibit the use of **hydraulic intensifiers** downstream of the standard pumps.
- 19.7 Hydraulic pumps and hydraulic motors that have a continuously variable displacement are prohibited except within the **flight power pack**.
- 19.8 **Valves** within a **control surface actuator** need not be physically mounted on the **hydraulic actuator**, but for each **control surface actuator** a single closed boundary on a hydraulic circuit diagram representative of the **yacht's HCCs** shall:
- (a) enclose all parts of an **HCC** that are part of that **control surface actuator**; and
  - (b) exclude all other hydraulic lines or components of the **yacht**.

Any parts of an **HCC** that are part of a **control surface actuator** shall not be part of any other **control surface actuator**.

19.9 The **flight HCC** shall have the circuit layout indicated in figure 19.1, with no additional branches or lines, where:

- (a) the **flight HCC** shall be entirely self-contained and disconnected from any other **HCC**;
- (b) there shall be a single **flight power pack** which shall provide only a single pressure supply port;
- (c) the box labelled “PRV” indicates that a pressure relief valve is permitted downstream of the **flight power pack**;
- (d) the pressure supply line shall then branch to supply the three **appendages**;
- (e) the three boxes labelled “Valves” indicate that **valves** are permitted to control flow out of the **flight power pack** or to each **appendage**. Any combination of **valves** not elsewhere prohibited are permitted within these boxes;
- (f) the high pressure circuit shall then branch to supply each **control surface actuator** (labelled “CSA”) driving each **flight control**;
- (g) a check valve to prevent reverse flow shall be present immediately upstream of each **control surface actuator**;
- (h) any combination of **transmission actuators** not elsewhere prohibited are permitted within each **control surface actuator**;
- (i) the dashed lines indicate that each **foil flap control system** may contain one or more **control surface actuators**;
- (j) each **control surface actuator** shall return oil to a common **low pressure circuit**;
- (k) outside of the **flight power pack**, the boxes labelled “Valves” and the **control surface actuators**, there shall be no hydraulic components other than those indicated and inline passive devices such as filters, radiators, lines and connectors.

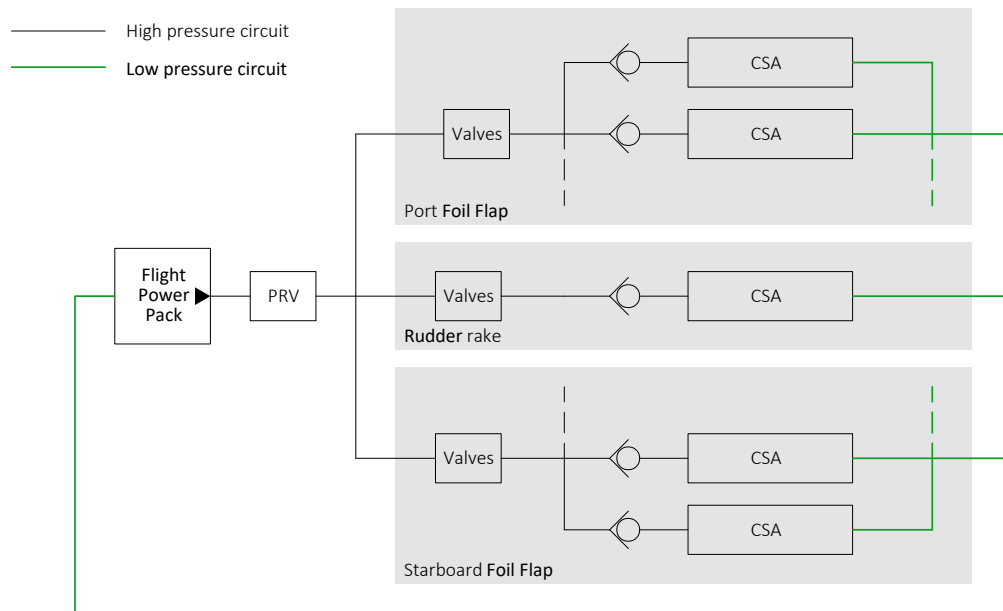


Figure 19.1: **Flight HCC**

19.10 Within the **flight HCC**, **hydraulic intensifiers** and **master actuators** are only permitted within the **flight power pack**.

19.11 Standard pressure relief valves shall:

- (a) be manufactured by HYDAC with a model code of the form “DB4E-01X-xxxPyyy” where:
  - (i) “xxx” indicates the upper extent of the valve’s pressure range; and
  - (ii) “yyy” indicates the factory-preset opening pressure;
- (b) be set to open at a maximum pressure of 600 bar;
- (c) be present in any circuit downstream of:
  - (i) pumps powered by **primary force input devices**;
  - (ii) the **flight power pack**;
  - (iii) any **hydraulic accumulator** permitted by Rule 19.13 (a);
  - (iv) any **hydraulic actuator** chamber from which oil can be **recovered**;
  - (v) any **master actuator**; and
  - (vi) any **hydraulic intensifiers** that are capable of increasing pressure (i.e. pressure intensifiers).

For each device (i) to (vi) above, the pressure relief valve shall be located at any point within that part of a circuit downstream of the device that is always subject to the output pressure of the device; that is, before any other valves or restrictions; and
- (d) vent to a **low-pressure circuit**.

This Rule is a minimum requirement for pressure relief valves, and does not prohibit the use of additional pressure relief valves, nor the use of pressure relief valves of a different type elsewhere within an **HCC**.

19.12 **Hydraulic actuators** and **hydraulic intensifiers** are permitted to incorporate a gas spring return providing:

- (a) any gas volumes:
  - (i) shall contain a constant mass of gas, except for unintended leakage;
  - (ii) may be physically separate from the **hydraulic actuators** and **hydraulic intensifiers** they operate on;
  - (iii) may be shared between **hydraulic actuators** and **hydraulic intensifiers**; and
  - (iv) are subject to Rule 19.5;
- (b) any **hydraulic actuator** or **hydraulic intensifier** that:
  - (i) is capable of draining oil that can be **recovered**; or
  - (ii) contains gas which, when expanding, can do work on a **control surface**;

shall have a pressure relief valve on the gas volume set to open at a maximum pressure of 30 bar, which shall be manufactured by R. Conrader Company with model number SRV250; and
- (c) the total swept volume of gas within **hydraulic actuators** and **hydraulic intensifiers** that satisfy Rule 19.12 (b), combining all such devices, does not exceed 6 litres.

19.13 Energy may only be stored within **HCCs**:

- (a) by one supplied high-pressure **hydraulic accumulator** per **yacht** with a maximum capacity (gas plus hydraulic fluid) of 2.0 litres, the specification of which shall be issued according to Rule 32.3;
- (b) by one or more high-pressure **hydraulic accumulators** in the **flight HCC**;
- (c) by gas in low-pressure **hydraulic accumulators** with a maximum gas pressure of 6 bar;
- (d) by gas in **hydraulic actuators** as permitted by 19.12; and
- (e) as elastic energy resulting from the compression of hydraulic fluid, any entrained air and the expansion of plumbing, subject to Rule 19.5.



## 20 Power sources

- 20.1 Power that does work on a **control surface** to adjust its shape, position or orientation can only be supplied:
- (a) through **control systems** as permitted by Rules 20.2 and 20.3;
  - (b) by **external forces** acting on that **control surface**; or
  - (c) by the release of stored energy permitted by Rule 20.4.
- 20.2 The **flight HCC** shall only be powered by batteries via a single **flight power pack**. The **flight power pack** shall only supply power to components within the **flight HCC**.
- 20.3 The **Steering control system** and **rig control systems** may be powered by the crew, via **force input devices**.
- 20.4 The only forms of energy storage and release to move a **control surface** permitted under Rule 20.1 (c) are:
- (a) the storage of elastic energy within the structure and rigging of the **yacht** and its:
    - (i) uncontrolled release as the structure and rigging returns towards its natural condition; or
    - (ii) controlled release and recovery via an **HCC**, where not elsewhere prohibited;
  - (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 **rig control system**; and
  - (c) the storage of energy permitted by Rule 19.13, and its release into another part of an **HCC**.
- 20.5 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.
- 20.6 Pneumatic components shall not be used in **control systems**, except that gas may be used within an **HCC** where permitted by Rules 19.13 (c) and 19.12.
- 20.7 All electrical systems must be powered by supplies operating at no more than 60 V.
- 20.8 Batteries or regulated power supplies:
- (a) are permitted to be shared between **ECCs**, the **ILS**, the **CIS** and any **CCTV systems**, provided that where these systems are required to be **isolated**, the **isolated** wiring begins at the first junction point beyond these supplies;
  - (b) will be supplied with the **FCS** and the **Media System**, which may be separate supplies or a combined supply providing power to both systems; and
  - (c) that are provided with the **FCS** or the **Media System** may be shared with the systems listed in Rule 20.8 (a) if permitted by the **FCS** and **Media System** specifications respectively.

## 21 Control systems

21.1 **Control surfaces** shall only be controlled by:

- (a) direct contact of the crew on a **control surface**; or
- (b) the crew using one or more **control systems**.

21.2 **Flight controls** shall only be controlled by a **flight control system** where:

- (a) **transmission actuators** are only permitted within the **flight control system**
    - (i) as part of the **flight power pack**; and
    - (ii) as permitted by Rules 19.9 (e) and 19.9 (h);
  - (b) a **rudder** or **foil flap** shall have as many **flight controls** as it has separately controlled **control surface actuators**, where a **control surface actuator** is separately controlled if, from a hardware and wiring perspective (i.e. irrespective of software), it is possible to control it independently from other **control surface actuators**;
  - (c) control signals sent to a specific **control surface actuator** within the **flight control system** shall be derived only:
    - (i) from the **internal state** of that **control surface actuator**; and
    - (ii) as permitted by Rule 21.2 (e);
  - (d) control signals sent to the **flight power pack** shall be derived only:
    - (i) from the **internal state** of the **flight power pack**; and
    - (ii) as permitted by Rule 21.2 (e);
  - (e) control signals sent to **control surface actuators** within the **flight control system** and the **flight power pack** are further permitted to be derived from:
    - (i) the **steering wheel** rotation angle about its rotation axis, providing that the **steering wheel** angle is not modulated by the **steering control system** or **rig control systems** to transmit information to the **flight control system** that is unrelated to the steering function of the **rudder**;
    - (ii) status flags supplied by the **FCS** to the **ECC**;
    - (iii) signals supplied by the crew via **passive input devices**; and
    - (iv) the **internal state** of any **ECC** that controls the **flight control system**.
- and
- (f) it is prohibited to:
    - (i) adjust any **flight control** by any means other than through **control surface actuators**; or
    - (ii) connect different **flight controls** together with **control systems** to achieve feedback between different **flight controls**.

21.3 The **steering control** shall only be controlled by the **steering control system** where:

- (a) **steering wheels** shall be connected to the **steering control** such that, except for elasticity and play in the connection, there shall be an immutable relationship between each **steering wheel** angle and the **steering control**. This connection shall be either:
  - (i) a **mechanical** connection; or
  - (ii) a hydraulic master-slave connection utilising one or more **master actuators mechanically** connected to the **steering wheels**;
- (b) **steering wheels** shall only be adjusted by:
  - (i) the crew; and
  - (ii) the **steering control system**, including **external forces** acting on the **rudder** transmitted to the **steering control system**;and
- (c) any **passive input devices** whose purpose is to modulate the **steering control** shall operate only in a discrete and occasional sense; that is, to adjust a setting. This does not prohibit continuous or proportional **passive input devices** being used to modulate the **rig control system** which may share the same **HCC** as the **steering control system**, providing such inputs do not provide a practical means by which the crew can control the **steering control**.

21.4 Adjustment of the **rig** shall only be controlled by a **rig control system** where:

- (a) each **rig control** shall be declared by a **Competitor** to the **Measurement Committee**, and must satisfy the definition of a **rig control**; not every **rig** degree-of-freedom must be declared as a **rig control**, but the rules that refer to **rig controls** apply to all those **rig controls** that are declared;
- (b) **rig controls** are restricted to:
  - (i) **mast** rotation permitted by Rule 15.9 (a);
  - (ii) degrees-of-freedom of **control systems** that are only attached to or only bear upon the **main-sail** within the **mast lower zone**;
  - (iii) **mainsail leech** line adjustment;
  - (iv) **jib** sheet degrees-of-freedom, including car position;
  - (v) **jib** cunningham extension and retraction; and
  - (vi) **jib leech** line adjustment;and
- (c) each **control surface actuator** used within a **rig control system**:
  - (i) shall be assigned, by declaration, to a single **rig control**;
  - (ii) shall have the primary function of adjusting the declared **rig control**; and
  - (iii) may influence other **rig controls**.

21.5 Control signals sent to **transmission actuators** within the **steering control system** and **rig control system** shall be derived only from:

- (a) **passive input devices**, subject to Rule 21.3 (c);
- (b) the orientation and angular velocity of, and the load applied to **primary force input devices** (which shall not use the wireless power meters required by Rule 21.13 (d));
- (c) the **steering control** degree-of-freedom;
- (d) torque about the **rudder** yaw axis between the **rudder** and the **steering control system**;
- (e) **steering wheel** rotation angle or torque about its rotation axis;
- (f) the position, deflection or orientation degree-of-freedom declared as a **rig control** that has at least one **control surface actuator** assigned to it, according to Rule 21.4 (c), such as traveller or **jib** car position;
- (g) **mast** rotation, whether or not it is declared as a **rig control**;
- (h) loads applied by **rig control systems** to the **rig**, or to devices functioning as a **rig control**, such as **jib** sheet or car loads; and
- (i) the **internal state** of **control surface actuators**, **transmission actuators**, **hydraulic intensifiers** and **master actuators** within the **steering control system** and **rig control systems**;
- (j) status and diagnostic messages transmitted from the **FCS** to the **ECC**; and
- (k) pressures or temperatures within **HCCs** that form part of the **steering control system** or **rig control systems**;
- (l) fluid levels or piston positions within **hydraulic accumulators** within **HCCs** that form part of the **steering control system** or **rig control systems**; and
- (m) the **internal state** of an **ECC** that controls the **steering control system** or **rig control systems**.

21.6 Control signals sent to the **FCS** to adjust **foil cant** shall be derived only from:

- (a) **passive input devices**;
- (b) status and diagnostic messages transmitted from the **FCS** to the **ECC**; and
- (c) the **internal state** of an **ECC** that manages the relevant **passive input devices** and communication with the **FCS**.

21.7 **Control surface actuators** shall be designed and used only for transmitting load to or from **control surfaces** to control their position, orientation or deformation. It is prohibited for **control surface actuators** to be installed if their primary purpose is to provide declared degrees-of-freedom which are measured rather than controlled.

- 21.8 The **hydraulic actuator** within a **control surface actuator** is restricted as follows:
- (a) The **hydraulic actuator** shall control only a single **flight control, steering control** or **rig control**.
  - (b) The **hydraulic actuator** shall be connected **mechanically** between two **points of action**, where one **point of action** shall lie on a **control surface** and the other shall lie:
    - (i) on a part of the **yacht** that the **control surface** is permitted to move or deform about; or
    - (ii) on a different part of the same **control surface**.
  - (c) The force or torque generated or reacted between parts of the **hydraulic actuator** shall only be reacted or generated **mechanically** between the two **points of action**.
  - (d) The translation or rotation generated or experienced between parts of the **hydraulic actuator**, through the **mechanical** connection, shall result in, or be the result of, translation, rotation or deformation of the **control surface**.
  - (e) The **mechanical** connection may at times be slack such that force, torque, translation or rotation may not always be coupled, providing it sometimes satisfies, or could satisfy, conditions 21.8 (c) and 21.8 (d).
  - (f) The **hydraulic actuator** may be **mechanically** supported through additional contact points, providing no additional functionality is gained in terms of controlling **control surfaces**.
  - (g) The **mechanical** connections between the **hydraulic actuator** and the two **points of action** may be distributed contacts or connections, subject to Rule 21.8 (a).
- 21.9 **Transmission actuators** within a **control surface actuator** are only permitted as:
- (a) **valves**, subject to Rule 19.8; and
  - (b) **stops and locks**, whose only function shall be to restrict or stop movement between two parts of the **hydraulic actuator**, or between the **hydraulic actuator's** two **points of action**.
- 21.10 Neither of a **master actuator's points of action** shall lie on a **control surface** or on a part of a **control system** that transmits load to, or is subject to load from a **control surface**.
- 21.11 **Passive input devices** are restricted as follows:
- (a) The electrical control signal produced by a **passive input device** shall relate only to a crew member's manual input. Neither the device nor the signal produced by it shall be significantly affected by the **yacht state**, except for unintended manual input caused, for example, by a crew member falling on to a button.
  - (b) No part of a **control system** shall:
    - (i) modify the limits of travel or operation of a **passive input device**;
    - (ii) physically aid a crew member to operate a **passive input device**; nor
    - (iii) control or provide any feedback to a **passive input device**.

21.12 Only the following **force input devices** are permitted:

- (a) **primary force input devices**, restricted to either:
  - (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**, which;
  - (i) need not be circular, but must rotate to control **rudder** yaw angle; and
  - (ii) must have a perimeter that lies entirely outside a circle of diameter 0.450 m centred on the axis of rotation;and
- (c) **force input devices** permanently connected to a single **rig control** that:
  - (i) operate on that **rig control mechanically**; and
  - (ii) are only operated by a single crew member at once.

21.13 **Primary force input devices** shall:

- (a) comprise handles or pedals connected to crank arms;
- (b) be turned by crew such that those parts of a crew's body that deliver power to a **primary force input device** shall move in a circular motion transmitting power into the handles or pedals;
- (c) not provide any means of crew inputting power other than that described by Rule 21.13 (b);
- (d) incorporate a power meter on at least one of every pair of crank arms that shall:
  - (i) use an ANT+ protocol for transmitting power data;
  - (ii) be suitably waterproofed;
  - (iii) provide accurate power data to the satisfaction of the **Measurement Committee** and **AC Media**;
  - (iv) shall measure all the power that the crew input to **primary force input devices**, except that if only measuring power input by one arm or one leg, it may be assumed that power input by the other arm or leg is identical; and
  - (v) be paired with the **Media System** to the satisfaction of **AC Media**.

21.14 Rules 21.2, 21.3, 22.2 and 22.3 may be satisfied by a combination of the hardware and software used within a **control system**.

## 22 *Electronic control circuits*

- 22.1 Sensors within, or inputs to an **ECC** shall measure only:
- (a) those properties that are permitted by Rules 21.2 (c), 21.2 (d) and 21.5 to be inputs to the **flight control system, steering control system** and **rig control systems**;
  - (b) the **internal state** of an **ECC**;
  - (c) the status of a float switch within a bilge pump;
  - (d) the ambient outside air temperature;
  - (e) the air temperature within the **hull**.
- 22.2 Proxy measurements can be used to estimate any measurement permitted by Rule 22.1, providing those proxies do not supply any additional useful information. For example:
- (a) a linear displacement may be a proxy for a permitted angular rotation measurement;
  - (b) a **foil flap** angle may be a proxy for the extension that forms part of the **internal state** of a **hydraulic actuator**, and need not be sensed directly at the **point of action** of the corresponding actuator providing it does not supply additional useful information;
  - (c) a pressure sensor at the outlet of a **flight power pack** may be a proxy for the pressure at the inlet of a **control surface actuator**, providing:
    - (i) there are no valves, restrictions or other means of changing the pressure, except normal pipe losses, between the two locations of the **flight HCC**; and
    - (ii) no additional useful information is gained by using a sensor located there rather than at the **control surface actuator** itself;and
  - (d) the **steering control** may be a proxy for **steering wheel** angle, providing it does not supply information that is more useful than the **steering wheel** angle; but
  - (e) the measurement of a **foil flap** angle, remote from the **point of action** of a **hydraulic actuator**, used to estimate the twist induced by hydrodynamic load is not a proxy for actuator extension; and
  - (f) sail twist is not a proxy for **mainsail** sheet load or extension.
- 22.3 Multiple direct and proxy measurements can be used to estimate any measurement permitted by Rule 22.1, provided that:
- (a) any additional measurements are used for redundancy only;
  - (b) the multiple measurements are processed to provide a single estimate of a measurement permitted by Rule 22.1 before being used in a **control system**; and
  - (c) the combination of measurements provides no useful information to the crew or to a **control system** beyond:
    - (i) that which would be supplied by an accurate and reliable measurement permitted by Rule 22.1; and
    - (ii) an indication of a sensor failure.
- 22.4 Time, as supplied by the **Media System**, or as an internal clock within the **ECC**, may be used within all **control systems** within an **ECC**, whether or not it is explicitly permitted in any Rules that govern particular **control systems**.
- 22.5 **ECCs** shall not contain sensors that measure the state of the **FCS**.

- 22.6 Only the following **electric actuators** are permitted within an **ECC**:
- (a) **transmission actuators**;
  - (b) motors of the **flight power pack**;
  - (c) cooling devices and bilge pumps inside the **hull surface**, providing they have no significant effect on the aerodynamic or hydrodynamic performance of the **yacht**; and
  - (d) devices within electronic circuits that affect only the circuits themselves, and have no other influence on a **control system** or the **yacht state**, such as CPU cooling fans and relays.
- 22.7 Except as permitted in Rules 22.6, an **ECC** must be incapable of having any significant effect on the **yacht state**.
- 22.8 An **ECC** shall:
- (a) be **hardwired**; and
  - (b) have wiring that is **isolated** from other devices and systems, except for:
    - (i) connections shown in Figure 26.1; and
    - (ii) connections from common power supplies permitted by Rule 20.8 (a).



## 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 26.1; and
    - (ii) connections from common power supplies permitted by Rule 20.8 (a);
  - (c) not be capable of having any significant effect on the **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) strain and load sensors, subject to Rule 23.3;
  - (b) sensors that measure the **internal state** of the **ILS**; and
  - (c) an input from the **Media System** as detailed in Rule 26.6.
- 23.3 Strain and load sensors within the **ILS**:
- (a) shall only be capable of directly measuring strain or load:
    - (i) at the sensor location; and
    - (ii) transmitted through the primary load paths of the **hull, appendages** and **mast**, and not for example within a pressure sensor;
  - (b) may include temperature sensors for thermal compensation;
  - (c) shall not be located on, nor measure strains within sails or **battens**;
  - (d) shall provide no **yacht state** information other than:
    - (i) load, strain, and quantities derived from those measurements; and
    - (ii) temperature where needed for compensation.
- 23.4 It is prohibited to measure the flying shapes of the sails or the deformed shape of the **mast**, except with strain gauges that lie entirely within the **mast tube**.

## 24 Information and display systems

### 24.1 The **CIS**:

- (a) shall be incapable of measuring any part of the **yacht state**;
- (b) shall not be capable of having any significant effect on the **yacht state**; and
- (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 26.8.

### 24.2 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 **yacht state**; and
- (c) must be incapable of significantly affecting the **yacht state**.

### 24.3 Only the following sensors are permitted within a **CIS** or **crew indication device**:

- (a) the state of user input controls on **passive input devices**;
- (b) those sensors required to perform its permitted function, such as an ambient light sensor;
- (c) WiFi and Bluetooth transceivers, where permitted within the **CIS**; and
- (d) sensors that measure the **internal state** of the **CIS**.

### 24.4 As an exception to Rules 24.2 (b) and 24.3, 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 **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
- (e) the **Competitor** provides the **Measurement Committee** with access to the Samsung Knox administration account so they can audit the device profiles.

24.5 Stand-alone **CCTV systems** are permitted providing that:

- (a) they are **hardwired**;
- (b) cameras are installed either:
  - (i) in a **foil**; or
  - (ii) entirely below 1.700 m above **MWP**;
- (c) neither the camera nor any hardware or software stabilises the image, whether mechanically or digitally, such that any image shown on a screen moves according to the part of the **yacht** to which the camera is attached;
- (d) they do not display (or communicate in another manner) any **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.; and
- (e) except for cameras' image sensors, such systems shall be incapable of measuring any part of the **yacht state**; and
- (f) they shall not be capable of having any significant effect on the **yacht state**.

## 25 *Foil cant system*






- 25.1 Details of the **FCS**, the system to control the **cant** rotation of the **foils**, are specified by the document referenced in Rule 32.3. When racing, the **FCS** must be configured as required by the specification.
- 25.2 The **FCS** shall be installed in the **yacht** with the **cant** cylinder mounts and **foil cant** axes located as shown in Figure 10.2.
- 25.3 **Foil cant** shall only be physically controlled using the **FCS**.
- 25.4 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**, including a status flag to indicate when a **foil** is in a fully raised position (within a tolerance detailed by the specification);and
  - (b) a port for transmitting data to the **Media System**, where:
    - (i) the **Media System** will provide non-delayed channels to the **CIS** providing **foil** cant cylinder pressures, which will only be transmitted when the cant of both **foils** is no more than 90° as measured by the **FCS**; and
    - (ii) the **Media System** will provide all supplied **FCS** channels to the **ILS** for logging and re-transmission to the **CIS** according to Rule 26.8 (d).

For the avoidance of doubt, the **FCS** will not transmit ram extension, ram pressure or **cant** angle to the **ECC**.

- 25.5 **COR/D** might specify system updates which must be installed by all **Competitors**, these updates being frozen according to Rule 32.3. Any further system updates after the time of freezing can only be specified by unanimous agreement of all **Competitors**.

## 26 Systems communication

### Legend

-  Supplied system
-  Hardwired link
-  Wireless permitted
-  Media System's internal logic
-  Available outside of racing

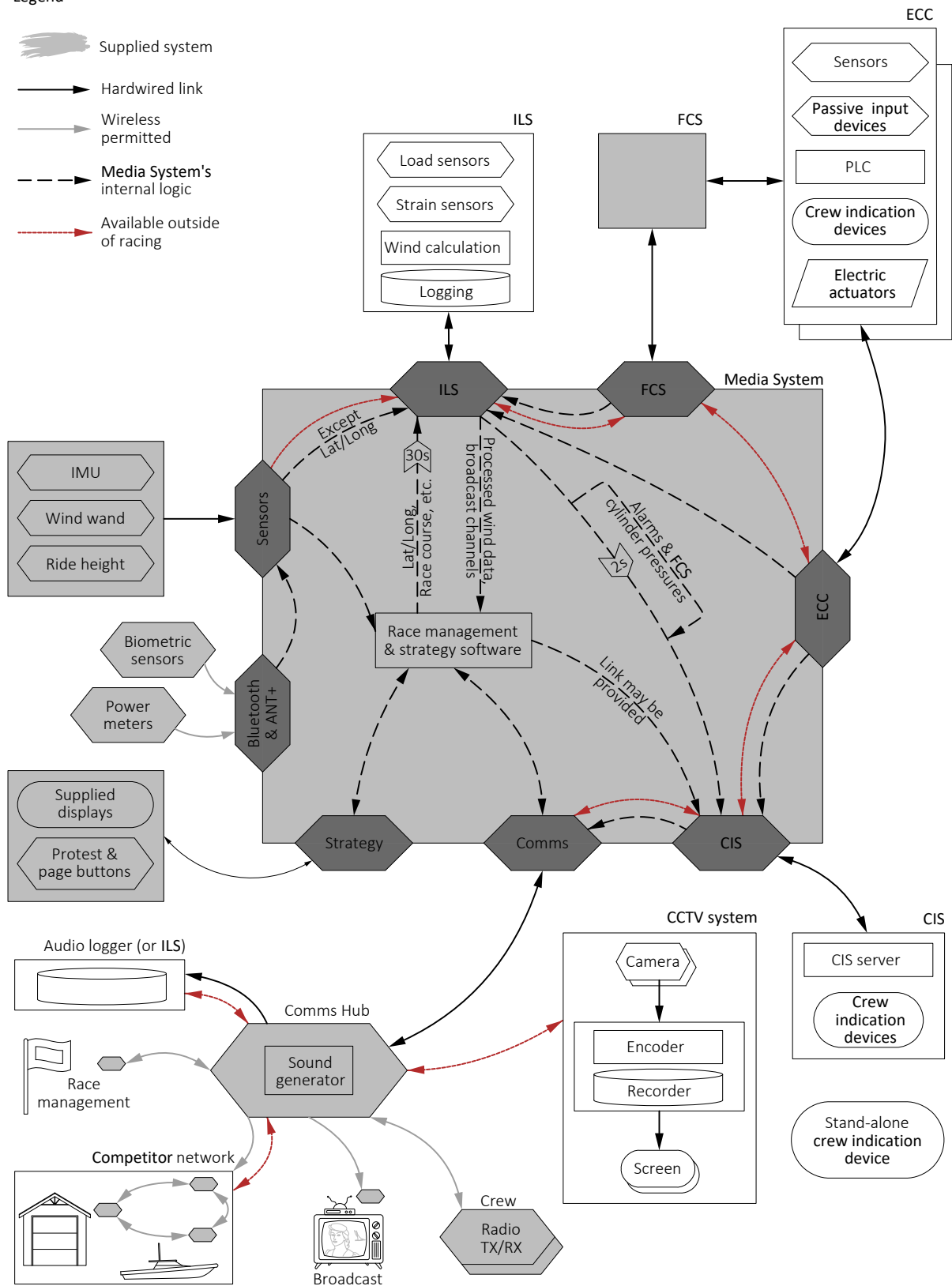


Figure 26.1: Permitted communication between electronic systems

- 26.1 Electric or electronic components or circuits are permitted only as:
- (a) part of an **ECC, ILS, CIS, FCS** or **CCTV system**;
  - (b) shared power supplies permitted by Rule 20.8 (a);
  - (c) stand-alone **crew indication devices**, such as wristwatches, that are incapable of measuring or receiving any part of the **yacht state**;
  - (d) devices for data and audio communication with **Competitors'** chase boats and shore bases, only as shown in Figure 26.1 and subject to Rule 26.12;
  - (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 electrical or electronic function.
- 26.2 No information exchange between any electrical systems is permitted except as shown via specified communication arrows in Figure 26.1, 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;
  - (b) a supplied **Media System** will provide communication between systems as shown by the "**Media System's** internal logic", where the specific implementation of this information exchange will be further detailed in the **Media System** specification referenced in Rule 32.3; and
  - (c) the dark hexagonal ports drawn on the boundaries of the **Media System** represent communication nodes, where any information shown flowing in is permitted to be re-transmitted out, where indicated by directional arrows.
- 26.3 Communication between any systems on the **yacht** permitted by Rule 26.2 must be **hardwired** except where wireless communication is expressly permitted by arrows marked "wireless permitted" in Figure 26.1.
- 26.4 **ECC** hardware, **ILS** hardware and any **CCTV system** hardware shall be incapable of communication by any means other than **hardwired** information transfer.

- 26.5 The combination of the **ECC**, **ILS**, and **CIS** shall provide a data stream to the **Media System**, which:
- (a) shall include data channels specified by:
    - (i) **AC Media** for broadcast, such as, but not limited to: true wind speed, true wind angle and true wind direction, **hydraulic accumulator** pressure and **rudder** angle; and
    - (ii) the **Measurement Committee** for verification of compliance with the **AC75 Class Rules**, such as, but not limited to: **control surface** positions and crew inputs to **passive input devices**;
  - (b) shall be:
    - (i) the most accurate data available;
    - (ii) measured using **Competitor**-supplied sensors, unless the **media equipment** specification or the **Measurement Committee** specifies supplied sensors for certain measurements or permits certain channels to be estimated rather than measured; and
    - (iii) at the specified frequency;
  - (c) shall use a protocol to be specified in accordance with Rule 32.3; 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.
- 26.6 The **Media System** will transmit to the **ILS**:
- (a) non-delayed data from the **FCS**;
  - (b) a non-delayed data stream supplied by any connected **ECC**;
  - (c) the following non-delayed data channels from any supplied fibre-optic gyro IMUs, wind wands and ride-height sensors:
    - (i) velocity components in a ground-fixed frame;
    - (ii) acceleration components in a yacht-fixed frame;
    - (iii) rotation rates in a yacht-fixed frame;
    - (iv) heading, heel, trim and their derivatives;
    - (v) IMU diagnostic or status information;
    - (vi) raw wind wand data;
    - (vii) ride-height sensor data;
    - (viii) altitude above water (if an altitude estimate is implemented within the **Media System**); and
    - (ix) a timestamp;
  - (d) non-delayed **primary force input device** power meter data received over ANT+ as required by Rule 21.13 (d);
  - (e) a non-delayed estimate of tidal current velocity and direction; and
  - (f) the following channels delayed by approximately 30 s, transmitted with original timestamps so that the data can be re-synchronised for logging:
    - (i) latitude and longitude;
    - (ii) race course information, which might include start time, boundary lines, mark positions, and penalties; and
    - (iii) tactical race information such as time-to-kill and time-to-boundary.
- 26.7 It is prohibited for any non-supplied system to estimate the latitude, longitude or position of the **yacht** on the race course, whether absolute or relative to marks or lines of the course, using integration of data provided in Rule 26.6 (c) or otherwise.

- 26.8 The **Media System** will transmit to the **CIS**:
- (a) a non-delayed data stream supplied by any connected **ECC**;
  - (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;
  - (c) non-delayed **FCS** cant cylinder pressures, subject to Rule 25.4 (b) (i); and
  - (d) the data stream supplied by the **ILS**, delayed by approximately 2.0 s;
- 26.9 The **Media System** will include a tactical pre-start and race boundary application developed by **AC Media** in conjunction with **COR/D**. The system will include screens to display tactical information to the crew, and the option for some audio cues to be transmitted to crew radios. A *Tactical Software Specification* will be provided according to Rule 32.3, and 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) time-to-start information;
  - (c) predictions of time-to-kill to the start line;
  - (d) time-to-boundary predictions;
  - (e) lay-lines information; and
  - (f) other tactical information.
- It is prohibited to provide any other pre-start or tactical race information to the crew, or to process or modify the **Media System** supplied pre-start or tactical information.
- 26.10 The *Tactical Software Specification* might include:
- (a) the provision of a small subset of non-delayed tactical race data to the **CIS**, such as time-to-start, time-to-kill, time-to-boundary and heading, for display on **Competitors'** screens; or
  - (b) the option of supplied tactical race data screens to display **Competitor**-generated data channels.
- 26.11 The **Media System** will transmit the time of day to all connected systems, from an NTP server synchronised by GNSS; for clarity, this is not shown in Figure 26.1.
- 26.12 Figure 26.1 shows a supplied *Comms Hub*, a communications system providing audio and data communication between the **Media System**, the crew, **Competitors'** chase boats and shore bases, race management, and broadcast, where:
- (a) the scope of this system is subject to amendment and will be further detailed according to Rule 32.3;
  - (b) where elements of the system are supplied, they will be the only communication systems permitted for the functions they fulfil;
  - (c) if elements of the system (other than broadcast and race management) are not supplied, this Rule will be updated to allow **Competitors** to implement their own systems with similar capabilities; and
  - (d) if the supplied system does not provide audio and data communication off the **yacht** to **Competitors'** chase boats, communication antennae for this purpose may be installed on the **aft media post** in the regions detailed by Rule 27.5, subject to the approval of the **Measurement Committee**.
- 26.13 When not racing, the **Media System** will open communications ports between the **ECC**, **ILS**, **CIS** and the *Comms Hub*, and provide a test mode for **Competitors** to test the race configuration. The **Media System** will broadcast a flag to connected systems to indicate whether or not it is in race mode.



26.14 In the event of electrical or radio interference between a **Competitor's** systems and **media equipment**, **Competitors** will work with **AC Media** to find a practical solution, to the satisfaction of the **Measurement Committee**.

## 27 *Media equipment*

- 27.1 The Rules in this section define the most significant design constraints imposed in order to accommodate the **media equipment**. Additional requirements shall be detailed by the **media equipment** specification documentation referenced by Rule 32.3.
- 27.2 **Media equipment** includes, but is not limited to:
- (a) a **Media System**;
  - (b) a Comms Hub, subject to Rule 26.12;
  - (c) a **media bowsprit**, including:
    - (i) a wind wand, B&G model WS310 or similar;
    - (ii) a ride-height sensor; and
    - (iii) possibly radiators for cooling the **FCS** and **Media System**;
  - (d) an IMU fixed to the **hull**, and possibly a second IMU near the masthead;
  - (e) an **aft media post**;
  - (f) masthead unit, including:
    - (i) antennae; and
    - (ii) possibly a wind wand, B&G model WS310 or similar if supplied;
  - (g) cameras and microphones;
  - (h) brackets or other mounting devices;
  - (i) cabling; and
  - (j) cable management hardware.
- 27.3 The areas shown in Figures 27.1, 27.2 and 27.3 shall be reserved for the **media equipment**. Additional reserved areas for cameras, microphones, sensors, processors, cabling and batteries shall be detailed in the **media equipment** specification.
- 27.4 The reserved area for the internal **media equipment** hold, shown in Figure 27.1, shall have an additional clearance volume around the hold which is defined by:
- (a) a extrusion in the x direction of the the forward face of the cuboid by 700 mm; and
  - (b) an extrusion of 375 mm of the planes parallel with **LCP** away from **LCP**.
- This additional volume may be shared with **Competitor** equipment subject to the approval of the **Measurement Committee** and **AC Media**.
- 27.5 As an exception to Rule 27.3, **AC Media** shall permit **Competitors** to install communications antennae within the aft-most reserved area shown in Figure 27.1 on the **aft media post** as further detailed in Figure 27.4.
- 27.6 The **media equipment** specification:
- (a) will identify a region close to the centre of the **yacht** within which the supplied IMU must be mounted; and
  - (b) may provide an option to lease the supplied IMU in advance of the **Media System** being installed.

- 27.7 The **hull** shall be fitted with interfaces specified by the **media equipment** specification documentation for the attachment of the:
- (a) **Media System** and associated **media equipment**;
  - (b) **aft media post**, mounting details given in Figure 27.4; and
  - (c) **media bowsprit**.
- 27.8 The mounting surfaces for the **aft media post** and **media bowsprit** shall be submitted to the **Measurement Committee** for approval. Mounting details for the **aft media post** are shown in Figure 27.4.
- 27.9 **media equipment** shall be installed by **AC Media**.

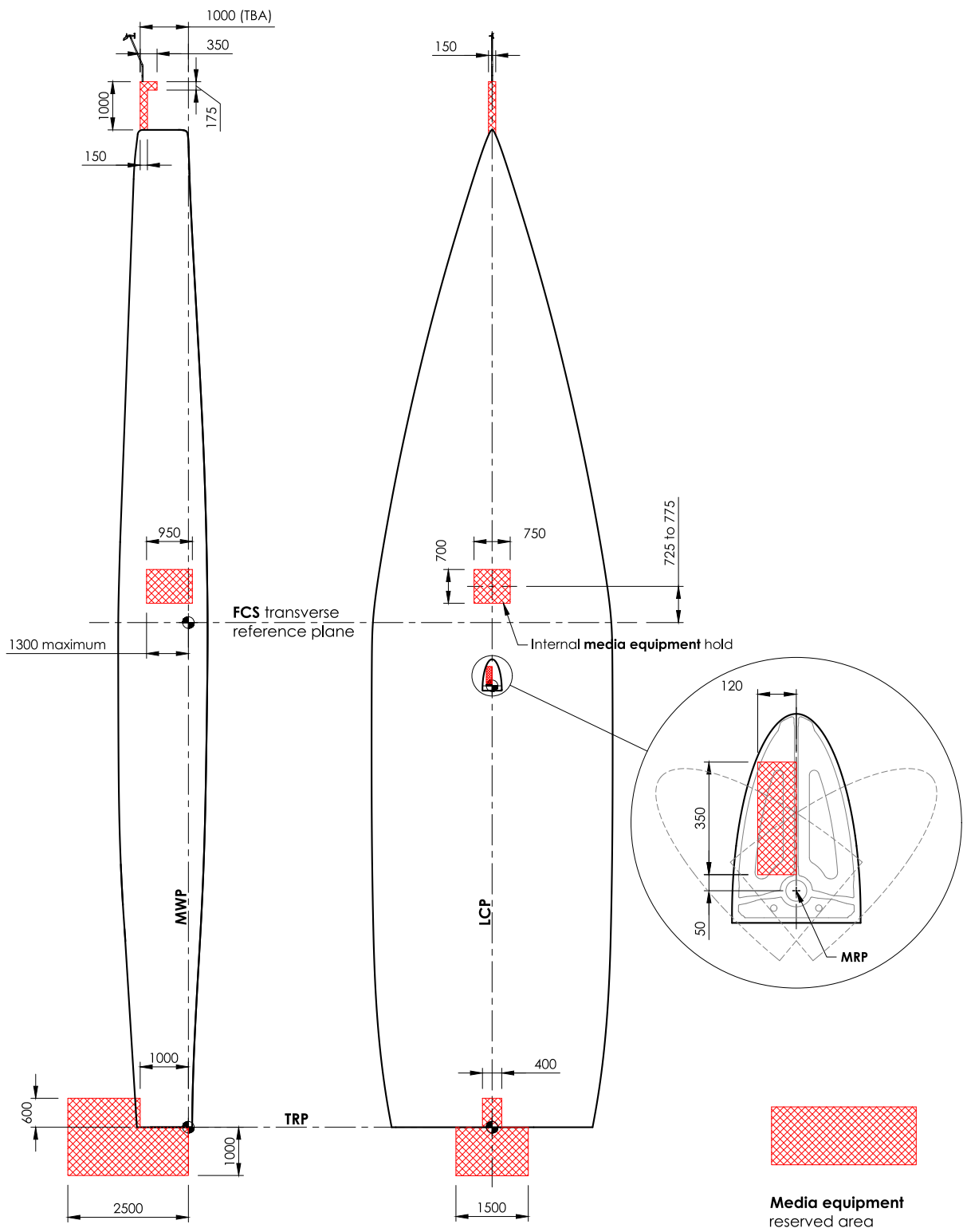


Figure 27.1: Reserved areas for **media equipment**

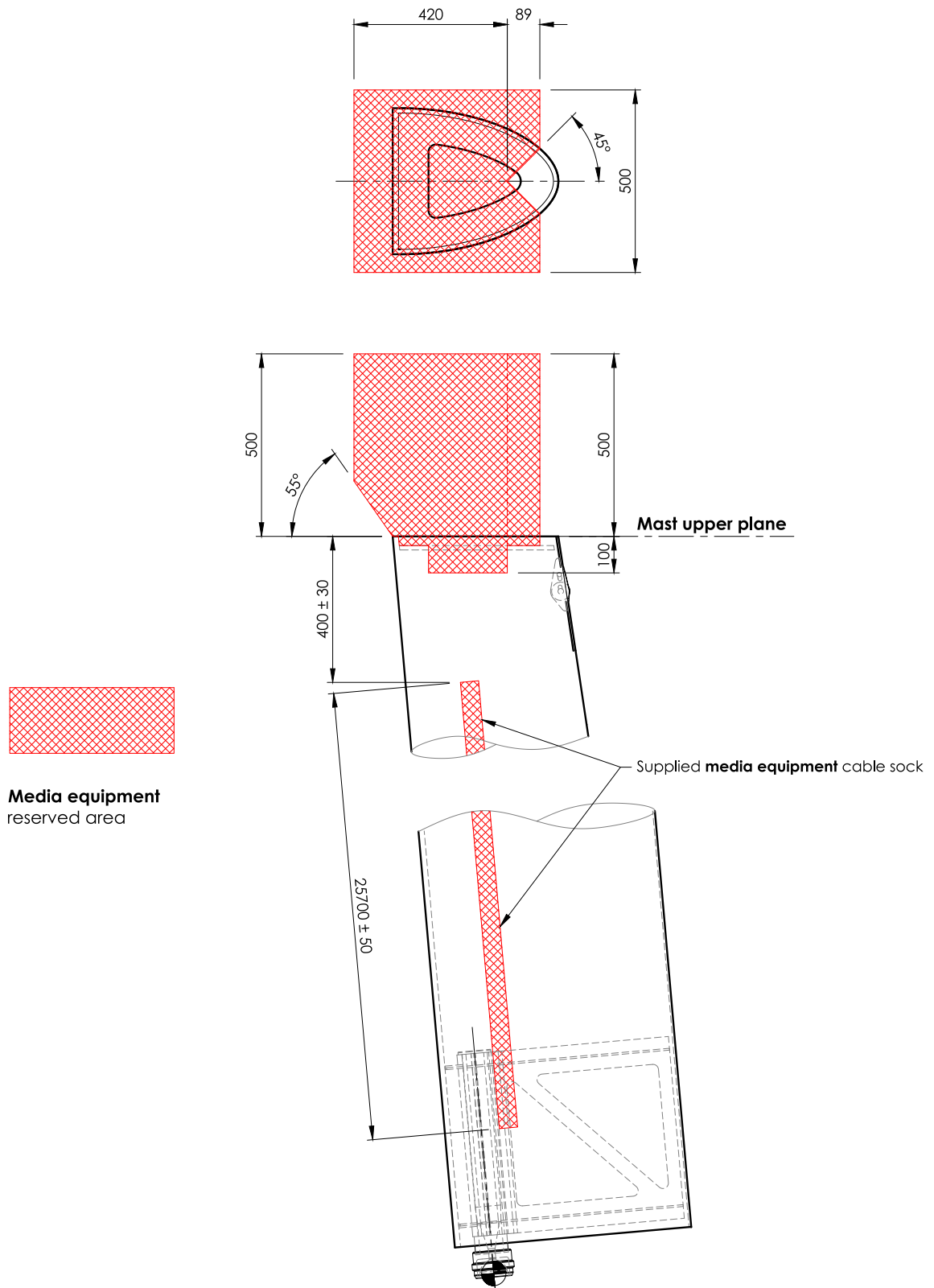


Figure 27.2: Reserved areas for **media equipment** on the **mast**

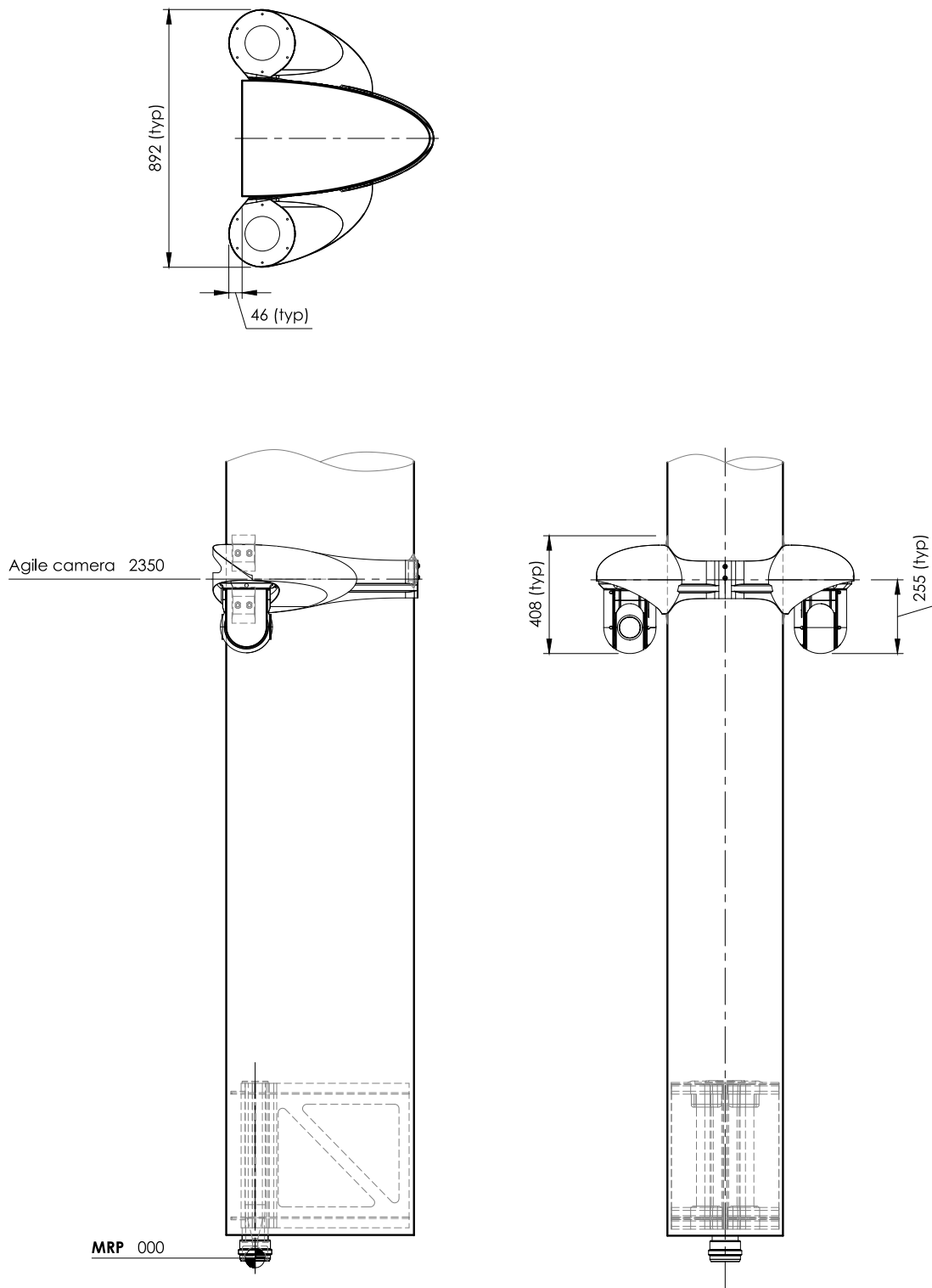


Figure 27.3: Reserved areas for **media equipment** on the **mast**

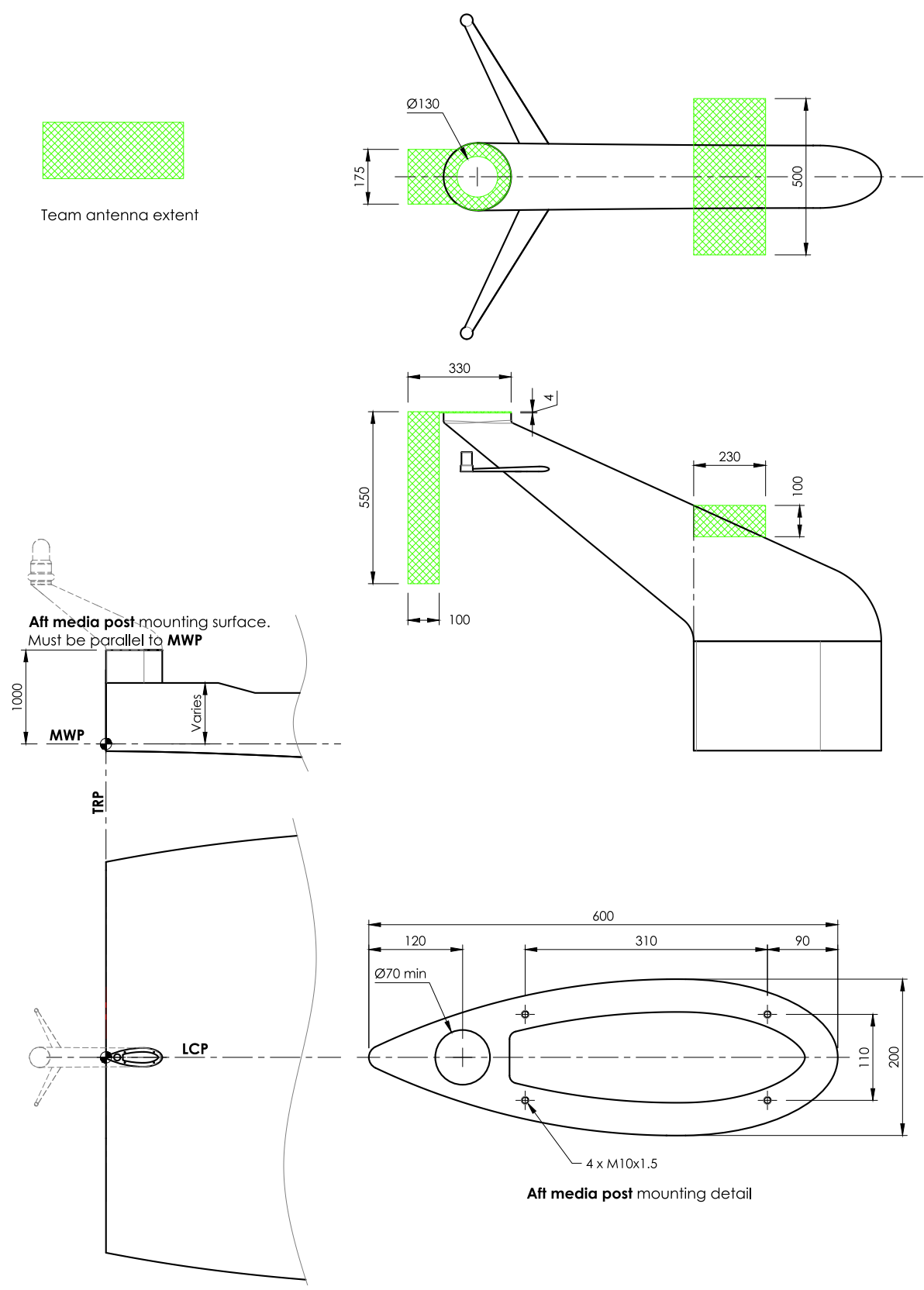


Figure 27.4: **Aft media post** mounting details and areas reserved for team antenna

## 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 the area within 6600 mm of the **mast upper plane** within the extents of the **sail skin**.
- 28.3 The **mainsail event** branding 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 32.3.



## 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** in accordance with the **Measurement Procedures**, 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 between 50 mm and 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 **crew supplied media equipment** with minimum dimensions 80 mm x 200 mm x 30 mm; and
  - (f) **crew supplied media equipment**, which shall be worn in a manner directed by **AC Media** to the satisfaction of the **Measurement Committee**.
- 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, each with a length between 50 mm and 150 mm; and
  - (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.
- Following the Notice of Race for an **event** being published, 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 the **Measurement Procedures**.
- 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 **Carried equipment** shall not be designed to retain water for the purpose of increasing mass.
- 29.8 **Carried equipment** shall:
- (a) not be designed to provide aerodynamic fairing of any part of the **yacht** or crew; and
  - (b) not exhibit any geometric features that extend its shape beyond that which is necessary for any permitted function.
- 29.9 Crew shall not enter the watertight volume of the **hull**.
- 29.10 In any normal sailing condition whilst foiling, no part of the crew shall be between the **skins** of the **mainsail**, or a region between the vertical extension down from the **foot** of each **mainsail skin**, other than:
- (a) briefly, to cross the **yacht**;
  - (b) to resolve unforeseen issues; or
  - (c) by accident.
- 29.11 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 29.11 (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 while racing.
  - (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.

29.12 If requested by the **Measurement Committee** for verifying compliance with Rules 29.11 (a) and 29.11 (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**.

## 30 Measurement

- 30.1 The **Measurement Procedures** shall be issued according to Rule 32.2.
- 30.2 The **Measurement Procedures** will specify measurement tolerances for quantities restricted or required by the **AC75 Class Rules**, which shall relate to the accuracy of the measurement equipment. In some cases, **Competitors** may be required to meet a **Measurement Committee's** measurement exactly; in others, a measurement that falls within the equipment's measurement tolerance may be sufficient. For example:
- (a) when first weighing a **platform** for an **AC75 event stage** the **Measurement Committee** may require the **platform** to be ballasted to meet its required mass exactly, as measured by their equipment; but
  - (b) on subsequent re-measurement, if no changes have been made by the **Competitor**, the **Measurement Committee** may require only that the **platform** matches its previously weighed mass within the tolerance of the measurement equipment.
- 30.3 **Competitors** shall permit the **Measurement Committee** to take samples of material from components of the **yacht** to ensure compliance with Rule 2.
- 30.4 **Competitors** shall permit the **Measurement Committee** to take samples of paint or vinyl from components of the **yacht** to ensure compliance with Rule 5.
- 30.5 **Competitors** shall assist the **Measurement Committee** in understanding the function and operation of mechanical, hydraulic and electrical systems onboard the **yacht**.
- 30.6 Compliance with **control system** rules may be determined by a combination of hardware inspection, code inspection, interviews and affidavits.
- 30.7 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. However, **Competitors** shall not be restricted by the **Measurement Procedures** to using hardware or software that is easy to inspect: where full code inspection is impractical, some aspects of software compliance shall rely solely on interviews and affidavits.
- 30.8 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 31.2.
- 30.9 Once a measurement certificate has been issued, some changes to the **yacht** shall be permitted without requiring re-measurement. The scope of these permitted changes shall be detailed in the **Measurement Procedures** and shall include changes such as:
- (a) routine maintenance on mechanical, hydraulic and electrical systems;
  - (b) changes to sensor calibrations; and
  - (c) changes to **ILS** and **CIS** software.

The **Measurement Committee** may further agree specifics of what can and cannot be changed without re-measurement with individual **Competitors**, based on the system design of their **yacht**. For example, classes of **ECC** settings that are incapable of affecting measurement compliance, such as soft pressure-relief valve setting and calibration of **passive input devices**, may be permitted changes. However, if there is any doubt, a **Competitor** is obliged to inform the **Measurement Committee** of any changes that have been made.

30.10 Aside from changes permitted without re-measurement, the configuration of a **yacht** with respect to other design details not recorded on her measurement certificate may be changed providing the **Measurement Committee** is able to verify compliance of those changes with respect to the **AC75 Class Rules** prior to racing. The **Measurement Procedures** shall include details of time scales required for re-measurement, which 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, 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.

A **Competitor** shall ensure that the **Measurement Committee** is available and has sufficient time to re-measure their **yacht** before making any such change.

## 31 *Yacht configuration*

- 31.1 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**.
- 31.2 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**.
- 31.3 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**.
- 31.4 The *substitution schedule* details the order of replacement components to be substituted in the event of loss or damage to a declared component, part of a component, or an associated system. A **Competitor's substitution schedule** shall remain confidential between that **Competitor** and the **Measurement Committee**. The *substitution schedule* may specify that:
- (a) damage to some sub-components of a **foil** may necessitate replacement of the other components of a **foil**, but damage to one **foil** shall not correspond to replacement of the other **foil**;
  - (b) damage to a **foil** system may necessitate replacement of a **foil**, or parts of that **foil**;
  - (c) damage to parts of a **mast** may necessitate replacement of a **mast tube**; and
  - (d) damage to specific parts of a component may necessitate changing to a different version of the same component, for example:
    - (i) a declared **yacht** configuration specifies **rudder 2** version C;
    - (ii) the *substitution schedule* states that if **rudder 2** version C is damaged only in the area of the "elevator" (which is defined by a drawing supplied by the **Competitor**), the component is to be replaced by **rudder 2** version B;
    - (iii) the *substitution schedule* states that if **rudder 2** version C is damaged elsewhere, the component is to be replaced by **rudder 1** version D;
    - (iv) regardless of where the damage occurs, **rudder 2** version C shall be reinstated on the **yacht** if and when it is repaired.
- 31.5 A **yacht's** measurement certificate shall be the form provided in Figure 31.1 with all fields completed. The information on a measurement certificate shall correspond to the declared **yacht** configuration.

- 31.6 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 31.7 are met;
  - (b) a **Competitor** is permitted to change a component according to Rule 31.8; or
  - (c) the original certificate is withdrawn and is subsequently re-instated according to procedures in the "Non-compliance with the Class Rules" section of the **AC Technical Regulations**.

31.7 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 *substitution schedule*;
- (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.

31.8 With reference to Rule 31.7, 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 *substitution schedule*, 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.

31.9 If a **yacht's** measurement certificate is withdrawn according to Rule 6.1 of the **AC Technical Regulations**, and the **Measurement Committee** determines that a declared component that has previously been measured as Rule-compliant is no longer Rule-compliant, the **Regatta Director** in consultation with the **Measurement Committee** may permit a **Competitor** to:

- (a) declare a new **yacht** configuration that specifies a different component;
- (b) declare a new version of that component, and declare a new **yacht** configuration that specifies that new component version; or
- (c) declare a new **yacht** configuration that specifies a different, previously declared version of that component;

providing that the change to the **yacht** configuration is the minimum change required to allow the **yacht** to become Rule-compliant, subject to Rule 31.10.

- 31.10 The decision as to which of the options within Rule 31.9 is permitted shall be taken by the **Regatta Director** in consultation with the **Measurement Committee** and the affected **Competitor**. The option chosen shall be the one which, out of those that are achievable within a practical time-frame, will make the least difference to the performance of the **yacht**. For example:
- (a) if a change can be made to modify a declared component to a new configuration, and that change will have less performance impact (positive or negative) than changing to a different component or previous version of a component, that option shall be chosen; but
  - (b) if the component cannot be readily made Rule-compliant, the component shall be changed to a different component.
- 31.11 With reference to Rule 31.9, the **Regatta Director** may also permit one option as a temporary solution (e.g. switch of a component to another component), to be followed by another option (e.g. modification of the original component) when there has been sufficient time for that option to be implemented. Such a permission shall only be granted if the **Regatta Director** is satisfied that the **Competitor** can gain no advantage by means of using the temporary option over their original configuration.
- 31.12 Where a **Competitor** is permitted to declare a new **yacht** configuration according to Rule 31.9, the **Regatta Director** in consultation with the **Measurement Committee** may also permit changes to be made to the component substitution schedule, providing:
- (a) they relate only to the changes in the declared **yacht** configuration; and
  - (b) any change to the component substitution schedule is the minimum change required to be compatible with the change to the declared **yacht** configuration.
- 31.13 When racing, the configuration of a **yacht** must match the configuration recorded in her measurement certificate, except:
- (a) for a change in measurement **yacht assembly longitudinal** centre of mass  $x_v$ , of up to  $\pm 25$  mm from the recorded value.
  - (b) where a specific exemption is granted according to procedures within the **AC Technical Regulations** relating to damage to the **yacht**.



# 37<sup>th</sup> America's Cup

## AC75 CLASS MEASUREMENT CERTIFICATE



<b>Competitor</b>	<b>Hull</b>
Team	Name
Yacht club	ID Version
	SHA
<b>Certificate</b>	<b>Mast</b>
Certificate number	ID Version
Supersedes number	
Date	<b>Rudder</b>
	ID Version
<b>Mass</b>	SHA
Yacht assembly mass kg	
Longitudinal centre m	
<b>Port foil</b>	<b>Starboard foil</b>
<b>Foil arm stock</b>	<b>Foil arm stock</b>
ID Version	ID Version
SHA	SHA
<b>Foil wing</b>	<b>Foil wing</b>
ID Version	ID Version
SHA	SHA
<b>Foil flap</b>	<b>Foil flap</b>
ID Version	ID Version
SHA	SHA
<b>Linear component</b>	<b>Linear component</b>
IGES filename	IGES filename
SHA	SHA
<b>Measurers</b>	
<i>Measured and found to comply with the AC75 Class Rule:</i>	
Name	Name
Signature	Signature

Figure 31.1: Measurement certificate

## 32 Documents

32.1 The following documents shall be available to all **Competitors** on the **Official Noticeboard** or other locations advised by the **Rules Committee**:

- (a) the list of approved **commercial products**;
- (b) the **Measurement Procedures**; and
- (c) the specifications listed in Rule 32.3.

32.2 The **Measurement Committee**, in consultation with the **Rules Committee**:

- (a) will issue the **Measurement Procedures** on or before 01/03/2023;
- (b) may issue parts of those procedures relevant to construction or component logging in advance of the full document; and
- (c) may amend the **Measurement Procedures** at any time, subject to Rule 32.4.

32.3 **COR/D** will issue the following specifications on or before the dates specified, and may amend them at any time subject to Rule 32.4:

Date	Rule	Item
01/07/2022	15.1	<b>Mast</b>
01/07/2022	10	<b>Foil arm stock</b>
01/10/2022	19.13 (a)	High-pressure <b>hydraulic accumulator</b>
01/10/2022	19.6	Manual hydraulic pump
01/03/2023	25.1	<b>FCS</b>
01/03/2023	27	<b>Media equipment</b>
01/03/2023	26	<b>Media System</b>
01/03/2023	26.9	Tactical software
01/03/2023	28	<b>Event</b> branding

32.4 Amendment of the **Measurement Procedures** or any of the specifications listed in Rule 32.3 shall require consultation with all **Competitors** and the approval of the **Rules Committee**. The **Rules Committee** shall approve changes that are beneficial to:

- (a) the operational requirements of an **event**;
- (b) media coverage of an **event**;
- (c) the fairness of an **event**, including the ability of the **Measurement Committee** to perform their duty;
- (d) the functionality, reliability or safety of a supplied system; or
- (e) the availability of supplied components;

providing that they are satisfied that all **Competitors** have been consulted, and that the impact of the proposed changes on all **Competitors** is commensurate with the need for the change, taking account of the state of each **Competitor's** design, construction, training and race programmes.

### 33 Agreement

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

Signed on this 17<sup>th</sup> day of March 2022

#### **Defender**



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by Grant Dalton, CEO

#### **Challenger of Record**



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by Ben Ainslie, CEO.