ROYAL NEW ZEALAND YACHT SQUADRON

Circolo della Vela Sicilia

AC75 Class Rule

v1.1

29 June 2018

Contents

1 Introduction

1.1 This document defines the rules that govern an **AC75 Class Yacht**, the class of **yacht** chosen to compete in the 36th America's Cup.

1.2 The **AC75 Class Yacht** is a 75 foot 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;

(f) provide a safe position for a guest racer on board the **yacht**; and

(g) incorporate practical requirements for the launching, retrieval and transportation of the **yacht**.

1.3 An **AC75 Class Yacht** shall comply with the **AC75 Class Rule** when racing, and at other times as required by the **AC75 Class Rule** and the **Protocol**.

1.4 **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 and/or structural integrity shall result from compliance with the whole or any part of this **AC75 Class Rule**. Any structural testing required for compliance with the **AC75 Class Rule** does not guarantee safety or structural integrity nor does it relieve the **Competitor** of this responsibility.

2 Language

2.1 The official language of the **AC75 Class Rule** is English.

2.2 Within the **AC75 Class Rule**, the word "Rule" is a reference to a rule of this **AC75 Class Rule**.

2.3 Where words or phrases are printed in bold type their meaning is defined in Rule 35. Bold terms defined as singular may be used in their defined sense as plurals, and vice versa.

2.4 In some document viewers, the definition of terms in bold may be seen as a tooltip. Although these tooltips are intended to provide the correct and full definitions, they should not be relied upon; the text printed in Rule 35 is the only authoritative source.

2.5 The interpretation of words not defined in bold shall be made with reference to the most appropriate definition within the **Official Dictionary**, as determined by the **Rules Committee**. If no appropriate definition exists therein, the **Rules Committee** shall determine the most appropriate definition from another authoritative source.

2.6 The words "can" and "may" are permissive, but the permission is restricted when followed by the word "only" or similar. The words "will", "must", and "shall" are mandatory.

2.7 The phrase "for the avoidance of doubt" indicates that the subject that follows is already controlled by a more general Rule, but the specific Rule is included to remove any potential uncertainty in interpretation.

3 Reference frames and units

3.1 The Measurement Waterline Plane, **MWP** is defined as the horizontal reference plane of the yacht.

3.2 The Longitudinal Centre Plane, **LCP** is defined as a vertical reference plane, orthogonal to **MWP**.

3.3 The Transom Reference Plane, **TRP**, is defined as the vertical reference plane orthogonal to **MWP** and **LCP**.

3.4 The reference planes **MWP**, **LCP** and **TRP** are fixed to the **yacht**, translating and rotating as the yacht moves in space.

3.5 Except where otherwise specified, terms such as "above", "below", "forward" and "aft" refer to relative positions in the **yacht**-fixed reference frame, where:

(a) the origin is at the intersection of **TRP**, **LCP** and **MWP**;

(b) *x* is the **longitudinal** axis, positive forward;

(c) *y* is the **transverse** axis, positive to port;

(d) *z* is the vertical axis, positive up.

3.6 The **mast** and **mainsail** shall be measured in a **mast**-fixed reference frame, where:

(a) the origin is at **MRP**;

(b) *u* is an axis perpendicular to the shear web of the **mast tube**, positive towards the front of the **yacht**;

(c) *v* is an axis perpendicular to *u* and *w*, positive towards port; and

(d) *w* is an axis parallel to the intersection of the shear web of the **mast tube** with the **mast centre plane**, positive up.

3.7 The aftmost point on the **hull surface** shall lie on **TRP**.

3.8 The **hull** shall have three measurement reference points. These points shall be located:

(a) on **MWP** and on **LCP**, at 20.700 m from **TRP**; and

(b) on **MWP** and on **TRP**, offset 2.000 m either side of **LCP**.

3.9 Three screws shall be installed on the **hull surface** for the purpose of locating the reference points. 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.

3.10 The **hull IGES** shall include the three measurement reference points and the exact locations of the three screws in Rule 3.9.

3.11 The following tolerances shall be applied to all dimensions specified in this **AC75 Class Rule**:

(a) where a measurement is required to be a specific value:

(i) where decimal places for a unit are given, the measurement shall be accurate to the least significant figure indicated. For example, if a Rule states that a length must be 5.0 m, that length must be at least 4.95 m and less than 5.05 m;

(ii) where decimal places for a unit are not given, the measurement shall be accurate to within 1% of the figure indicated. For example, if a Rule states that a component must weigh 1000 kg, that component must weigh between 990 kg and 1010 kg inclusive; and

(b) where a measurement is required to be "at least", "at most", "a minimum", "a maximum", "between", "within a range", or other similar wording, no tolerance beyond that limit or outside that range is permitted, but the permitted measurement is inclusive of the limit value. For example, if a Rule states that a length must be no more than 5 m, that length must be no more than 5.000000 m.

4 General arrangement

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

(a) one **hull**;

(b) two **foils**;

(c) one **rudder**;

(d) one **bowsprit**;

(e) one **mast**;

(f) one set of **supplied rigging**;

(g) one **mainsail**;

(h) one **jib** or equivalent ballast (see Rule 10.5);

(i) one **code zero** or equivalent ballast (see Rule 10.5); and

(j) other systems, hardware, fittings and rigging except where prohibited herein.

4.2 The **AC75 Class Yacht** shall be propelled by sails only.

5 *Component limits and modifications*

5.1 The components in the table below are restricted as detailed in the following rules:

Component	Rule	Quantity	Change allowance
Hull surfaces	Open	2	As per **Protocol**
Foil arm stocks	Supplied	4	-
Foil arm fairings	Open	6	20% mass
Foil wings	Open	6	20% mass
Foil flaps	Open	20	20% mass
FCSs	Supplied	2	-
Rudder uppers	Open	4	20% mass
Rudder lowers	Open	4	20% mass
Mast tubes	Specified	3	20% mass
Supplied rigging sets	Supplied	3	-
Mainsails	Open	*10	25% area
Headsails	Open	*29	25% area

**See Rule 5.8.*

5.2 In Rule 5.1, the terms in the column "Rule" have the following meaning:

(a) *Open*: The shape and construction is open to design, within the constraints specified for that component in this **AC75 Class Rule**.

(b) *Specified*: The outer shape and some aspects of construction are specified by this **AC75 Class Rule**, but other aspects of construction are open to design.

(c) *Supplied*: The component is supplied as standard to all **Competitors**. Modifications to supplied components are prohibited except where specifically permitted by this **AC75 Class Rule**.

5.3 **Competitors** may request clarification of the construction or operational requirements of items marked as "Specified" or "Supplied" from the **Rules Committee** who, after consultation with the designers of those parts, will issue a clarification notice to all **Competitors**.

5.4 In accordance with Rule 34, a template spreadsheet will be issued to track components listed in Rule 5.1, including fields for identifying a specific component, recording the date each component was first installed, the modification status of each component, and where applicable the component's weight.

5.5 When a component listed in Rule 5.1 is:

(a) first installed on an **AC75 Class Yacht**; or

(b) modified and re-installed on an **AC Class Yacht**,

and that **yacht** is afloat, the **Competitor** shall declare that component to the **Measurement Committee** within 24 hours by emailing an updated version of the spreadsheet described in Rule 5.4.

5.6 A component must be declared and counted in the limits described in Rule 5.7 regardless of whether that component satisfies the specific Rules controlling its parameters in this **AC75 Class Rule**. Any component that serves or partly serves the purpose of a listed component shall be counted.

5.7 In Rule 5.1, the values in the column "Quantity" are the maximum numbers of each component that a **Competitor** may declare.

5.8 Beyond the allowances specified in Rule 5.1, the **Defender** is permitted to install on either of its **AC75 Class Yachts**:

(a) 2 additional **mainsails**; and

(b) 6 additional **headsails**,

provided that the **sail skins** that make up these sails are built to the same original designs as **sail skins** that have already been installed on one of its **AC75 Class Yachts**. Any subsequent modifications to the **sail skins** of these additional sails, as permitted by Rule 5.11 (a), are not required to be the same modifications that were made to the **sail skins** of the original sails.

5.9 For **hulls**:

(a) When a **hull** is first afloat, or modified and afloat according to Rule 5.5, the **Competitor** must declare to the **Measurement Committee**:

(i) a **hull IGES** that the **hull surface** was designed to, further described in Rule 11.1; and

(ii) drawings showing the construction of the **hull shell**.

(b) With the measurement reference points described by Rule 3.8 aligning the **hull** to the **hull IGES**, the **hull surface** must match the **hull IGES** according to a measurement procedure and associated tolerances to be issued by the **Rules Committee**.

(c) Where the **Protocol** permits a **Competitor** to modify the exterior shape of a **hull** as determined when the respective hull was launched, the "exterior shape", or "Original Hull Surface" is defined herein as the **hull surface**.

(d) For a **hull surface** that is permitted by the **Protocol** to be modified by *R*% of its area, all declared **hull IGES** files for that **hull** must match over a common portion of area which must be at least 100% – *R*% of the original **hull IGES** area.

(e) The portion of area of a **hull IGES** that matches another **hull IGES** is determined by aligning the surfaces according to the reference points required by Rule 3.10, and determining the proportion of area on one surface that exactly overlays the other surface.

(f) The **hull shell** corresponding to the unmodified area in a **hull IGES** must be the same material substance as in the original **hull**, except where modified to open, close or change penetrations permitted by 11.16.

(g) Material that has been replaced with identical or equivalent material only classifies as an unmodified area of **hull shell** where replacement was carried out as a repair permitted by Rule 5.12.

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5.10 For components listed in Rule 5.1 that have a "Change allowance" mass percentage:

(a) When such a component is first declared according to Rule 5.5, the **Competitor** must declare to the **Measurement Committee**:

(i) a component mass;

(ii) an IGES file of an exterior component shape; and

(iii) construction drawings showing the internal structure of the component.

(b) At all times when that component is installed on an **AC75 Class Yacht** with that **yacht** afloat:

(i) at least 80% of the mass of the component must match the original component; and

(ii) a common portion of at least 80% of the mass of the original component must remain unmodified and must match all declared versions of the component.

(c) The portion of mass of a component that matches another version of that component is determined by aligning the unmodified portion of the original and modified components and determining the mass of all regions where the material substance remains unmodified and in the same place in both versions of the component.

(d) Material that has been replaced with identical or equivalent material only classifies as an unmodified region where replacement was carried out as a repair permitted by Rule 5.12.

(e) When checking the shape of such a component against a declared IGES file, the **Measurement Committee** may make an allowance for unintended distortion of a component during manufacture.

(f) **Competitors** may declare a hypothetical "original component" which must comply with the relevant rules for that component type, but is not required to be identical to the component when it is first installed and afloat. In this case, the "original component" comprises those regions of the actual component as-launched that match the hypothetical component, combined with the regions in the hypothetical component that do not match the as-launched component and are presumed to have been removed/modified to achieve the as-launched component. The component as first launched must have corresponding declarations which must satisfy the permitted changes with respect to the hypothetical "original component".

(g) If the component when it is first installed and afloat does not comply with the relevant rules for that component type, the **Competitor** must declare a hypothetical component that does comply with those rules, in accordance with Rule 5.10 (f).

5.11 For **mainsails** and **headsails**:

(a) Up to 25% of any **sail skin** may be replaced and the replaced area is cumulative. For example, one 12.5% area of a **sail skin** can be replaced twice only.

(b) Addition of material for repairs shall not count as replaced area provided the original **sail skin** remains.

(c) Any modification to a **sail skin** shall not alter any girth measurement by more than 15%.

(d) The limits on sails in Rule 5.1 apply only to the **sail skins** that make up the **mainsail** or **headsail**; replacement of components such as **control systems**, **sail hardware** or **battens** is not limited.

5.12 Except for **mainsails** and **headsails**, it is permitted to repair or replace any component marked in Rule 5.1 as "Open" or "Specified" to restore it to its original state or a permitted modification of its original state, where:

(a) the material substance need not be the same material as in the declared component, providing that except where modification is permitted, surface geometry is identical and the material specification is equivalent to the satisfaction of the **Measurement Committee**; for example, dry fibre may be substituted for an equivalent pre-preg fibre, or two plies of 150 g/m^2 may be substituted for one ply of 300 g/m^2;

(b) any construction forming part of the repair or replacement is built or prepared only once that component has been taken out of service, and that component is not installed again on a **yacht** afloat until that repair is complete;

(c) the restriction in Rule 5.12 (b) does not apply to the construction of:

(i) flat monolithic plate which has a uniform construction across the plate; or

(ii) flat sandwich panel which has a uniform construction across the panel,

but does apply to any incorporation of those components within a repair;

(d) a **Competitor** must inform the **Measurement Committee** when commencing any repair or replacement, and must provide the **Measurement Committee** with documentation they require; and

(e) a **Competitor** alone shall decide whether to repair or replace a component, and no evidence of damage is required.

5.13 Components marked in Rule 5.1 as "Supplied" may be repaired to their original condition, but such repair must be approved by the **Measurement Committee**. If a "Supplied" part is damaged beyond repair, as demonstrated to the **Measurement Committee**, that part may be replaced by a new "Supplied" part.

5.14 If a component listed in Rule 5.1, other than a **mainsail** or **headsail**, is unintentionally damaged and a repair or replacement in accordance with Rule 5.12 or 5.13 cannot be completed in time for the **Competitor's** next race, the **Measurement Committee** may permit a temporary repair using alternative materials and construction methods, providing that:

(a) the repair is no larger than required;

(b) the repaired component is no lighter than prior to the damage;

(c) the repaired component provides no performance advantage over a repair satisfying Rule 5.12 or 5.13;

(d) the outside shape of the repaired component is as close as possible to its shape prior to the damage;

(e) after the repair, the **yacht** still satisfies the **AC75 Class Rule**; and

(f) the temporary repair is replaced by a repair in accordance with Rule 5.12 or 5.13 as soon as possible.

A temporary repair that satisfies this Rule shall not count as a modification under Rule 5.5 (b).

6 Materials

6.1 Rule 6 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, proving that:

(i) they have no significant structural contribution;

(ii) each assembly is limited to a maximum density of 11,400 kg/m^3; and

(iii) materials with a density greater than 11,400 kg/m^3 are not used in volumes that have any significant effect on the distribution of mass throughout the **yacht**.

6.2 Material property values detailed herein are to be evaluated at 20°C and 1 atmosphere pressure.

6.3 Materials shall have a maximum density of 11,400 kg/m^3.

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

Material category	Maximum Modulus (GPa)	Certificates Required
Fibre reinforcement in **foils**, **rudders**, **masts**, **battens** and **bowsprits**	395	Yes
*Fibre reinforcement in thermoplastic components	Unlimited	No
Uncontrolled components	Unlimited	No
Fibre reinforcement in components not listed above	300	Yes
Core material in all components	75	No
Surface treatments	Unlimited	No
Other material	220	No

**As described in Rules 7.3.*

6.5 Fibre modulus in Rule 6.4 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.

6.6 For the avoidance of doubt, modulus limits on fibre and other materials in Rule 6.4 apply to **FRP** resin additives, such as nanoparticles and microspheres.

6.7 The limit on **core** material in Rule 6.4 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.

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

(a) aluminium honeycomb (3000 or 5000 series only, which may be surface treated to prevent corrosion);

(b) meta-aramid (Nomex or equivalent) honeycomb;

(c) timber; or

(d) plastic foam.

For the avoidance of doubt, para-aramid **cores** (N636 or equivalent) are prohibited.

6.9 The "Surface treatment" category in Rule 6.4 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.

6.10 The limit on "Other material" in in Rule 6.4 applies to all materials that do not fall into the other categories, and refers to the maximum modulus in any direction.

6.11 Where certificates are required for a category in Rule 6.4, **Competitors** must submit copies of material certificates for each roll of fibre used for that category, together with a declaration that all components of that 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.

6.12 For all categories in Rule 6.4, **Competitors** must submit a declaration that the material used in all components satisfies Rule 6.

6.13 Further details relating to the information required by Rules 6.11 and 6.12 will be issued according to Rule 34.

6.14 Boron and Beryllium are prohibited except where used in alloys in concentrations of no more than 0.00042%.

6.15 Gases shall have a minimum density of 1.1 kg/m^3, except for nitrogen used within hydraulic systems.

7 Construction methods

7.1 Rule 7 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.

7.2 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)
FRP material in **hulls**	135	1.1
FRP material in **sail skins**	Unlimited	Unlimited
Thermoplastic **FRP** material	450	Unlimited
Uncontrolled components	Unlimited	Unlimited
FRP material not listed above	135	7.0

7.3 Thermoplastic **FRP** material in Rule 7.2:

(a) may be used within any component, including the **hull**;

(b) is restricted to a maximum total mass of 15.0 kg, combining all such material within the **yacht** except that excluded by Rule 7.1; and

(c) may 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 products** and the temperature limit applies only after delivery of the component from the manufacturer.

7.4 The maximum pressures in Rule 7.2 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.

7.5 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 7.2.

7.6 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.

7.7 Construction of a **hull** must meet at least two of the following criteria (where the mould refers to the mould or moulds for at least 80% of the outside skin of the **hull surface**):

(a) the mould plug is constructed of recyclable material (e.g. PET), with that plug being delivered to a recycling plant by 1st January 2021;

(b) the mould plug is constructed of recycled material;

(c) the mould plug is constructed of sustainably sourced material (e.g. timber);

(d) at least 10% of the total mass of carbon reinforcement used in the mould is from recycled sources;

(e) the mould is constructed from fibres with low embodied energy (e.g. basalt);

(f) a life-cycle analysis is performed on the **hull** to the satisfaction of the **Measurement Committee**.

7.8 **Competitors** must submit a declaration giving details of how this Rule is satisfied.

8 Commercial products

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

(a) **Core**;

(b) pre-consolidated thermoplastic **FRP** components;

(c) paints; and

(d) **uncontrolled components**.

8.2 **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 six months; and

(c) not have been developed directly or indirectly for a **Competitor** or specific group of **Competitors**, unless prior to 31 March 2018.

8.3 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.

8.4 **Commercial products** can be added to the relevant list by **Competitors** submitting a request to the **Rules Committee**, where:

(a) requests may be made at any time; and

(b) for any item which is to be classified as a **commercial product** on a **yacht** in an **event**:

(i) requests must be made for that item at least 30 days before the first race of that **event**; and

(ii) at the latest, by the date specified in Rule 34.

8.5 On receiving a request, the **Rules Committee** shall interpret whether the item is a **commercial product** by following the procedure detailed in Rule 32. 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.

8.6 An initial list of approved paints shall include:

Manufacturer	Products
Alexseal	HS Base Coat; HS Clear Coat
Awlgrip	Awlcraft 2000; Topcoats G/H-Line
Cromax	3050S ChromaClear
Nautix	L2; NX194
Resene	Durepox; Durepox Extreme Clear; Durepox High Performance Clear

8.7 **Uncontrolled components**:

(a) are 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) if **FRP**, must be sourced as pre-consolidated and cured solid laminates in standard shapes (e.g. plate, bar, rod, tube, but not honeycomb) or standard products (e.g. a winch body).

9 *Surface finishes*

9.1 Except as permitted in Rules 9.5 and 9.6, the outermost layer of the **hull**, **foils** and **rudder** must be a **commercial product** approved by the **Rules Committee** according to Rule 8, who shall only approve paints that are comparable to those on the list provided in Rule 8.6.

9.2 **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.

9.3 Paints or additives that are designed to reduce surface friction (such as PTFE) may not be used on the outermost layer of the **hull**, **foils** or **rudder**.

9.4 After painting, surfaces may be sanded, polished and cleaned, providing that the only substances that remain on those surfaces when the **yacht** is afloat satisfy Rules 9.1, 9.2 and 9.3.

9.5 **Competitors** may apply vinyl or plastic film over the paint for the purpose of branding, providing it complies with Rule 9.7.

9.6 On areas of the **deck** where crew operate, or on fittings attached to the **deck**, **Competitors** are permitted to apply non-skid products or coatings. These areas shall be no larger than necessary and shall not extend into areas that crew do not access during racing.

9.7 Devices and finishes whose primary purpose is to reduce friction drag by altering the structure of the boundary layer are prohibited. This prohibition includes, but is not limited to:

(a) electric, magnetic, sonic, thermal and chemical devices;

(b) patterned or textured finishes, LEBUs; and

(c) devices that suck fluid from or blow fluid on to the surface of a component.

This rule does not prohibit passive surface features, such as fences or vortex generators, which extend outside the local boundary layer. The thickness of the boundary layer δ 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^3	Dynamic viscosity (Pa.s)
Air	30	1.225	1.789×10^{-5}
Water	30	1025	1.103×10^{-3}

10 Mass

10.1 The mass of components and crew on an **AC75 Class Yacht** shall be:

Component	mass (kg)	*x* or *u* (m)	*z* or *w* (m)
Yacht assembly: (*x, y, z*) frame	**6305**	**8.80 – 9.30**	**≤ 0.62**
Platform assembly: (*x, y, z*) frame	$*\boldsymbol{m}_P$	$*\boldsymbol{x}_P$	$\boldsymbol{z}_P$
Hull, **rudder**, **bowsprit**, hardware	$m_{H\&R}$		‡0.38
Port **foil**	*1215		$*z_F$
†Port **foil arm stock**	245		
Port **foil arm fairing**/**wing**/**flaps**/systems	970		
Starboard **foil**	*1215		$*z_F$
†Starboard **foil arm stock**	245		
Starboard **foil arm fairing**/**wing**/**flaps**/systems	970		
†**Foil arm** heads and bearings	168	10.35 – 11.65	0.71
†**FCS**	362	10.50 – 11.80	0.25
†Supplied media equipment	125	8.50	1.20
Mast and mainsail assembly: (*u, v, w*) frame	$*\boldsymbol{m}_M$	‡**-1.00**	$*\boldsymbol{v}_M$
Mast and **mainsail**	—		
†**Supplied rigging**	45	-0.63	10.55
†Supplied media equipment	11	0.00	19.00
Sails	**145**		
Jib	*55		
Code zero	*90		
Crew and guest racer	**1120 – 1150**		
Crew	*960 – 990		
Crew's **carried equipment**	*55		
Guest racer	*100		
Guest racer's carried equipment	*5		
Total	**7570 – 7600**		

**Measured, †Supplied equipment, ‡Assumed*

10.2 In Rule 10.1, items or assemblies marked with an asterisk will be weighed. Items not marked are not weighed individually, but included in an overall assembly weigh. The **Rules Committee** will issue procedures for weighing the specified components and assemblies.

10.3 It is not permitted for any weighed component or assembly to have a greater mass than that given in Rule 10.1. Where a mass number is not indicated, there is no mass requirement for that specific assembly.

10.4 Crew must have a mass between the minimum and maximum values shown in Rule 10.1.

10.5 If one of the components listed below has a mass lower than that shown in Rule 10.1, ballast equal in mass to the deficit shall be attached to the top of the **deck** at the following locations:

Component	Ballast location
Jib	At any point on **LCP**
Code Zero	At any point on **LCP**
Crew's **carried equipment**	On **LCP**, 5.0 m forward of **TRP**
Guest racer and their carried equipment	On **LCP**, 1.0 m forward of **TRP**

10.6 Except for crew, if a component or assembly not listed in Rule 10.5 has a mass lower than that shown in Rule 10.1, ballast shall be added to that component to achieve the required mass and/or centre of mass.

10.7 Each **foil** shall be weighed and its centre of mass in a plane parallel to **TRP** shall be determined, including only the components defined as being part of the **foil** in Rules 13.1 and 13.2 (a). When **projected** on to a plane parallel to **TRP**, the distance from the **foil cant** axis to the centre of mass of:

(a) a **foil arm stock** shall be 1.417 m; and

(b) a **foil** shall be at least 3.375 m.

The **foil** vertical centre of mass z_F in the **platform assembly** shall be computed by orienting the **foil's** measured centre of mass at an angle at which the **foil** is canted to its lowest position.

10.8 The **platform assembly** measurement condition shall be with:

(a) both **foils** canted to their lowest positions;

(b) all **foil flaps** set to the centre of their range of motion;

(c) the symmetry plane of the **rudder** aligned to **LCP**;

(d) the **rudder** rake set to the centre of its range of motion; and

(e) other components in their normal sailing positions.

10.9 The **platform assembly** mass m_P and centre of mass component x_P shall be determined in the measurement condition described by Rule 10.8. The other centre of mass components shall be:

(a) y_P assumed to equal zero; and

(b) z_P computed by:

(i) first determining $m_{H\&R}$ by subtracting other known masses from m_P; then

(ii) combining mass and vertical centre of mass positions, as shown in Rule 10.1.

10.10 The **mast** and **mainsail** assembly mass m_M and centre of mass component w_M shall be determined in the measurement condition described by Rule 20.25. The other centre of mass components shall be:

(a) u_M assumed as shown in Rule 10.1; and

(b) v_M assumed to equal zero

10.11 The **yacht assembly** mass m_Y and centre of mass (x_Y, y_Y, z_Y) shall be determined by combining:

(a) the **platform assembly's** mass m_P and centre of mass (x_P, y_P, z_P); and

(b) the **mast** and **mainsail** assembly's mass m_M and centre of mass (u_M, v_M, w_M), with an assumed **mast** rake angle of 5° as shown in Figure 20.3.

10.12 The **yacht assembly's longitudinal** and vertical centre of mass shall lie within the ranges shown in 10.1.

10.13 Nothing shall be aboard the **AC75 Class Yacht** that is not included in Rule 10.1.

11 Hull

11.1 The declared **hull IGES** geometry shall form a single closed volume, and:

(a) penetrations into the closed volume permitted by Rule 11.16 shall be closed with surfaces that connect their edges and are fair with respect to the surrounding **hull surface**;

(b) conduits through the **hull surface** permitted by Rule 11.15 (a) shall be included in the **hull IGES** 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

(c) internal structure within the closed volume shall not be included, but the positions of bulkheads required to satisfy Rule 11.8 shall be included as separate IGES surfaces.

Geometric and flotation requirements pertaining to the **hull surface** within Rule 11 will be measured using the **hull IGES** and must be satisfied exactly with no tolerance.

11.2 The **hull lower surface** shall be **symmetric** about **LCP**.

11.3 The forwardmost point on the **hull** shall be no less than 20.600 m and no greater than 20.700 m from **TRP**.

11.4 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**.

11.5 The **perimeter line** shall:

(a) have a point on **TRP** that is at least 2.000 m from **LCP**;

(b) at its greatest distance from **LCP**, be between 2.400 m and 2.500 m from **LCP**;

(c) at its intersection with a plane 17.000 m forward of **TRP**, be no more than 1.600 m from **LCP**; and

(d) at its intersection with a plane 19.000 m forward of **TRP**, be no more than 1.000 m from **LCP**.

11.6 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.

11.7 Any surface that can support the crew must be at least 0.100 m above **MWP**.

11.8 The **hull surface** shall enclose a volume of at least 70 m^3, which must include:

(a) an enclosed watertight volume of at least 40 m^3, situated entirely forward of plane that is 9.500 m forward of **TRP**, which may be subdivided; and

(b) a watertight bulkhead situated between 17.000 m and 19.000 m forward of **TRP**.

11.9 The **hull surface** shall satisfy flotation Rules 11.10, 11.12 and 11.13 with:

(a) the **yacht assembly's** mass m_Y applied at the **yacht assembly's** centre of mass (x_Y, y_Y, z_Y);

(b) buoyancy resulting only from the **hull surface** (not the **foils**, **rudder** or other components);

(c) the effect of any flooded volumes not included in the **hull surface** neglected; and

(d) an assumed water density of 1025 kg/m^3.

11.10 When floated to equilibrium under the conditions of Rule 11.9, the measurement reference points required by Rule 3.8 shall lie no more than 25.0 mm above or below the flotation waterplane.

11.11 The second moment of area of the **hull surface's** waterplane at **MWP** about the intersection of **MWP** and **LCP** shall be at least 20.000 m^4.

11.12 There must be an angle of heel (rotation of the **hull** about a **longitudinal** axis) of no more than 90° that, when constrained to such a heel angle and left free to float to equilibrium in the other degrees of freedom, under the conditions of Rule 11.9, there is a **transverse** separation of the centre of mass of the **yacht assembly** and the centre of buoyancy of the **hull surface** of at least 0.600 m.

11.13 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 11.9:

(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°.

11.14 Water shall not be retained anywhere in the **yacht**. Any deck recess, cockpit, or other surface that could retain water must be self-draining with the following criteria:

(a) **Competitors** must provide calculations to the **Measurement Committee** demonstrating that any water temporarily retained, at any water level, will drain at least 90% of its volume within 30 seconds.

(b) For any distinct retained water volume, the drainage requirement of Rule 11.14 (a) will be deemed to be met if at any water level, for every 1.000 m^3 of retained volume, an area open to drainage and free from obstructions of at least 0.100 m^2 is present below that water level.

(c) In these calculations, water volumes resulting from a sheet of water of more than 100 mm depth being uniformly deposited over the entire **yacht** need not be considered.

(d) These drainage requirements must be satisfied for the case when **MWP** is horizontal, and for a range of orientations bounded by:

(i) a rotation of the **yacht** by up to $\pm 10°$ about a **longitudinal** axis; followed by

(ii) a rotation of the **yacht** by up to $\pm 2°$ about a (rotated) **transverse** axis.

(e) These requirements shall be satisfied accounting for the presence of any fairing flaps permitted by Rule 11.17.

(f) The **Measurement Committee** may specify an alternative calculation method or drainage requirement if they believe that the above criteria are insufficient to ensure that water is not retained.

11.15 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 11.16.

11.16 The enclosed volume of the **hull surface**, including the volumes required by Rule 11.8 must be watertight except for penetrations:

(a) within 0.200 m of **LCP** and within 1.500 m of **TRP** in order to permit **rudder** rotation, providing that the volume inside the **hull surface** exposed by this penetration shall:

(i) be separated from the remainder of the enclosed volume by a watertight boundary which need not satisfy Rule 11.19;

(ii) have a total volume of no more than 20 litres; and

(iii) be self draining, and have drain area of at least 0.100 m^2 per 1.000 m^3 of floodable volume;

(b) inside 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, in order to permit **foil cant**, providing that the volumes inside the **hull surface** exposed by these penetrations shall:

(i) be entirely above **MWP**;

(ii) be entirely within the cylinder described;

(iii) be separated from the remainder of the enclosed volume by a watertight boundary which need not satisfy Rule 11.19;

(iv) have a total combined volume of no more than 350 litres; and

(v) be self draining, and have drain area of at least 0.100 m^2 per 1.000 m^3 of floodable volume;

(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 11.13; 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 11.13.

The total cross-sectional area of openings permitted by Rules 11.16 (e) and 11.16 (f) shall be no more than 0.02 m^2, after subtracting the cross-sectional area of rigging or systems passing through.

11.17 Fairing flaps on the **hull lower surface** are permitted for closing penetrations or conduit exits, provided that the flaps are no larger than required and have no purpose other than fairing the **hull** surface when water is not draining, and for preventing reverse flow.

11.18 The **hull** shall be a **linear component**.

11.19 The minimum areal density of any part of the **hull surface** shall be 2 kg/m^2. (Note that this Rule does not imply any stiffness, strength or robustness targets; it exists only to ensure that a **hull surface** is a solid structure and not, for example, a film-covered space frame structure.)

11.20 When the forestay is loaded to 10,000 kg by tensioning either the port or starboard running backstay, neither the **deck** at **TRP** nor the **rudder** yaw axis shall rotate by more than 2.5° relative to a station on the **deck** 12 m forward of **TRP**. The procedure for measuring this will be issued according to Rule 34, but is anticipated to be as follows:

(a) the **yacht** shall be afloat;

(b) the **foils** shall be in their lowest position;

(c) the rig shall be pretensioned and at a rake specified in the rig plan;

(d) the **transverse** angle between two stations on the **deck**, at **TRP** and 12 m forward of **TRP** is measured;

(e) one running backstay is loaded until a forestay load of 10,000 kg is achieved;

(f) the **transverse** angle between the two stations is measured again, and the difference when loaded must be no more than 2.5°;

(g) the procedure is repeated, loading the other running backstay.

The **Rules Committee** or **Measurement Committee** may adjust the procedure or angle measuring stations to ensure that it accurately measures the twist that is restricted by this Rule.

12 Deck fittings

12.1 A ball fitting to support the **mast** shall be positioned at **MRP** as shown in Figure 20.3 and the rig plan referred to by Rule 20.1 (e). The position of the mast ball shall not be adjusted.

12.2 V1 cap shroud, D1 lower shroud and running backstay chainplates shall be positioned as shown in the rig plan (see Rule 20.1 (e)) and shall not be adjusted.

12.3 The **yacht** shall be capable of being lifted from one or more primary lifting points located forward of **MRP**, with secondary lines led aft.

12.4 No part of the **yacht** except the **foils** and the **rudder** shall lie below the **hull lower surface**.

12.5 No part of the **yacht** except the **mast**, sails, rigging, supplied media equipment and wind instrumentation shall lie more than 0.200 m above **MRP**.

12.6 When **projected** on to **MWP**, no part of the **yacht**, other than the **foils**, **mast**, sails, rigging, a **code zero** furling unit (if fitted), supplied media equipment and wind instrumentation, shall lie outside of an area that combines:

(a) an area **projected** by the **hull** on to **MWP**; and

(b) a rectangular area bounded by:

(i) **TRP**;

(ii) a plane 22.860 m forward of **TRP**; and

(iii) planes 0.400 m either side of **LCP**.

12.7 Wind instrumentation that falls outside of the area described in Rule 12.6 must be attached only to the **bowsprit** and shall be entirely:

(a) aft of a plane 23.900 m forward of **TRP**; and

(b) below a plane 1.500 m above **MRP**.

12.8 Rigging shall be nominally round and shall not be faired, except as permitted by Rules 19.1 (f) and 19.2 (e). This Rule does not apply to **supplied rigging** or the bobstay permitted by Rule 17.4.

12.9 Apart from permitted movement of **foils**, **foil arm drums** and **control surfaces**, parts of the **yacht** shall only move or be moved:

(a) to control movement of a **control surface**;

(b) in preparation of controlling a **control surface** (e.g. setting a **headsail** car prior to hoisting; turning an unloaded winch to check it is connected to a drive train; charging an accumulator);

(c) to organise rigging or deck gear after controlling a **control surface** (e.g. stowing sheets; stowing a winch handle; zipping closed a sail cover);

(d) within the **FCS**;

(e) to open or close access panels (which must not be into the **hull**);

(f) as part of a drainage flap permitted by Rule 11.17;

(g) as part of a simple mechanical wind indicator that has no purpose other than indicating the apparent wind direction;

(h) within electrical systems (e.g. a cooling fan, a bilge pump or a wind wand); or

(i) for safety reasons.

12.10 Other than the movement of **foils** or **control surfaces**, movement of parts of the **yacht** permitted by Rule 12.9 shall have no significant effect on:

(a) aerodynamic loads;

(b) hydrodynamic loads; or

(c) the centre of mass of the **yacht**.

12.11 When viewed from above and orthogonal to **MWP**, neither the crew nor the guest racer shall be covered at any time by any part of the **yacht** except the **mast**, sails and rigging, or occasionally by other components provided that only a small part of any crew member is covered, and this covering is not designed to provide aerodynamic fairing of the crew.

12.12 The **hull** shall have stanchion sockets along the full length of its sides and across the transom, at a maximum spacing of 2.200 m, for the attachment of lifelines when the **yacht** is ashore. Sockets shall be on the edge of the working deck and to suit 31.8 mm (1¼") stanchions with a minimum depth of 100 mm. The stanchion sockets may be plugged when sailing, providing such plugs can be quickly removed.

12.13 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) 2.00 m forward of **TRP**;

(b) 9.00 m forward of **TRP**; and

(c) 11.00 m forward of **TRP**.

12.14 The following items shall be secured and distributed at locations that would be easily accessible in the event of a capsize:

(a) at least six blades with lengths of no more than 150 mm;

(b) at least six 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.

12.15 Areas or volumes that will be reserved for media equipment, including, but not limited to cameras, microphones, sensors, processors, cabling and batteries, will be specified according to Rule 34.

13 Foils

13.1 Each **foil** must comprise:

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

(b) two **foil flaps**, each of which must be a **linear component**; and

(c) one or more **foil** systems.

13.2 For the purposes of Rules 5 and 10:

(a) a **foil** does not include the metal **foil arm** head, fasteners attaching the **foil arm** head to the **foil arm**, any **foil arm drum**, or any other components inside the **hull IGES** that are disconnected from a **foil** when it is removed from the **yacht**;

(b) except for parts of **foil** systems, any material that does not move relative to a **foil flap** must be part of that **foil flap**; and

(c) except for the **foil arm stock**, **foil flaps** and **foil** systems, any material within the region described in Rule 13.4 must be part of the **foil wing**.

13.3 **Foil** systems:

(a) shall only comprise mechanical, electrical and hydraulic components, or optical fibres required to:

(i) connect **foil wing** to **foil flaps** and control their movement; and/or

(ii) provide sensor information to the **yacht**;

(b) must not contribute significantly to the structure or surface area of the **foil wings** or **foil flaps**; and

(c) must be contained predominantly within the **foil wing**, **foil arm** and/or the **foil flaps** such that there are no significant fluid dynamic forces on any parts of those systems.

13.4 With the **foil arm** lowered to its minimum **cant** angle, and at all **foil flap** rotation angles and twists, the **foil wing** and **foil flaps**, **projected** to **TRP**, must lie entirely within the area shaded in Figure 13.1.

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

13.6 A **foil wing** must be **symmetric** about the **foil wing** symmetry plane, as defined in Figure 13.1, with a build tolerance of 3.0 mm, except that within 75 mm of the **foil wing** symmetry plane, non-structural fairings on the **foil wing** are not required to be **symmetric**.

13.7 The only **foil arm** movement permitted relative to the AC75 yacht is **cant**, being a rotation about the **foil arm cant** axis, a **longitudinal** axis whose position is defined in Figure 13.1.

13.8 A **foil** must not touch any part of the **yacht** except:

(a) the metal **foil arm** head and other parts of the **FCS**;

(b) a **foil arm drum**;

(c) hydraulic connections for **foil** systems;

(d) electrical and optical fibre connections; and

(e) the other **foil**, when both **foils** are in their lowest positions.

13.9 Except for the permitted rotation and twist of **foil flaps**, no device shall be used to induce deformation in the **foil**; any deformation may only be the result of **external forces** and reactions by the **FCS**.

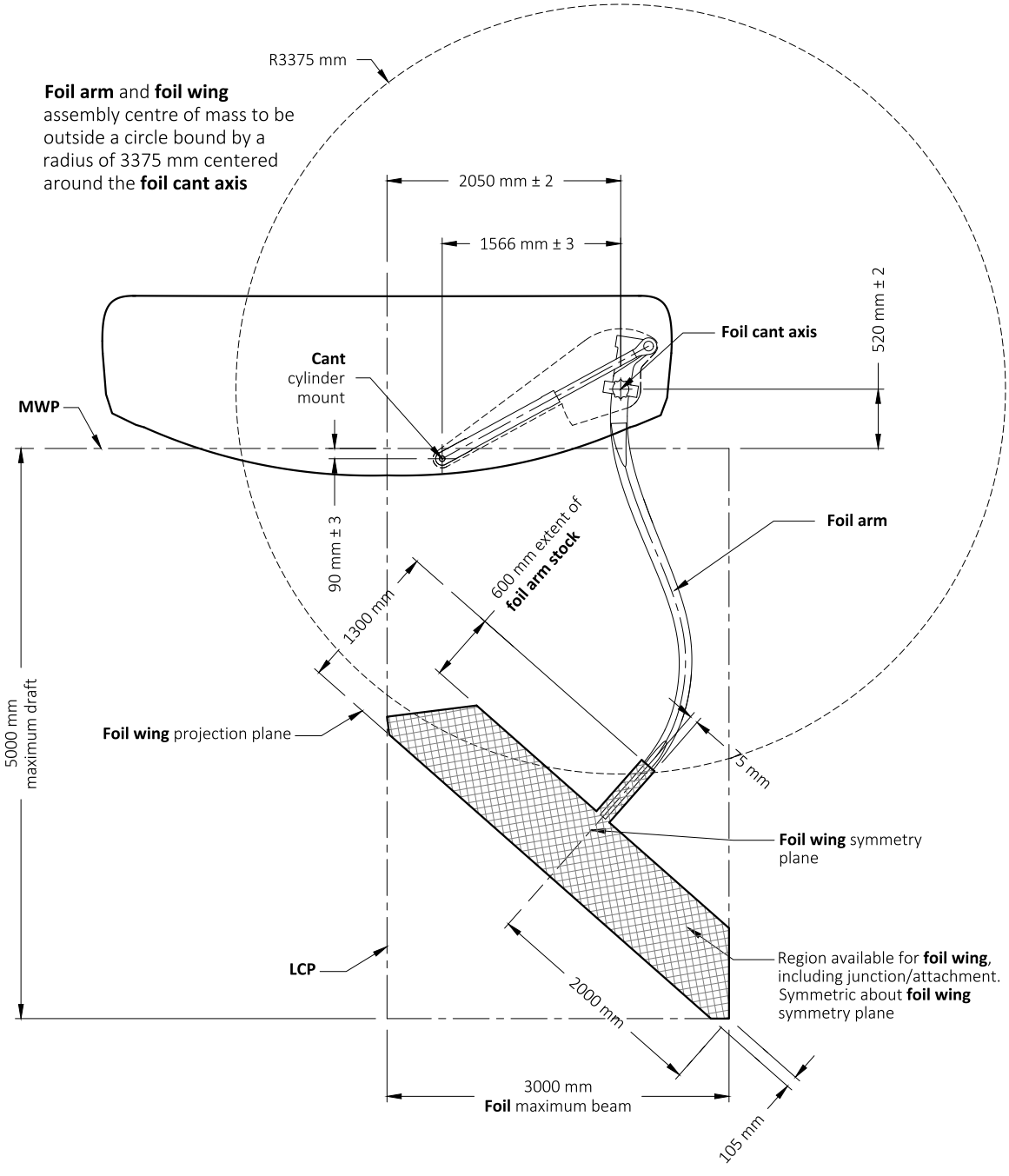

Figure 13.1: **Foil** geometry

14 Foil arms

14.1 Details of the **foil arm stocks** have been provided in a document supplied by **COR/D** and the specification will be further developed as described in that document.

14.2 Each **foil arm** shall only be constructed from:

(a) one **foil arm stock**; and

(b) one **foil arm fairing**.

14.3 For the purposes of Rules 5, except for the **foil arm stock** and **foil** systems, any part of the **foil** outside the region described in Rule 13.4 must be part of the **foil arm fairing**.

14.4 **Foil arm fairings** are only permitted in the regions indicated in the supplied **foil arm** drawings.

14.5 No modification of a **foil arm stock** is permitted, except for:

(a) the surface finish (sanding and painting as permitted in the **foil arm stock** specification);

(b) the installation and repair of optical fibres in the provided groove or grooves and fairing over;

(c) the attachment of permitted **foil arm fairings**, which shall only involve the addition of material bonded to the **foil arm stocks**; no part of the **foil arm stock** may be removed, except for surface preparation prior to bonding; and

(d) repairs that return the **foil arm stock** to its original state after being damaged in accordance with Rule 5.13.

14.6 No material may be added inside, and no **foil** systems are permitted to pass through a **foil arm stock**.

14.7 **Foil arm** fairings shall not be capable of transmitting any significant bending, shear or torsional loads between the **foil wing** and the **foil arm**.

14.8 Permitted penetrations in the **hull** to allow **cant** rotation of each **foil arm** may be closed by a **foil arm drum**, which:

(a) must fit entirely within the cylinder described in Rule 11.16 (b);

(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**.

15 Foil flaps

15.1 A **foil flap** must be a **linear component** connected to a **foil wing** by a **foil** system.

15.2 Each **foil** shall include two **foil flaps**, one lying entirely on one side of the **foil wing** symmetry plane, and one lying entirely on the other side of the **foil wing** symmetry plane.

15.3 For the purposes of Rule 15:

(a) a "cross-section" is defined locally at any spanwise location along the **rondure** of the **foil wing** as a section through a **foil wing** and **foil flap**, on a plane perpendicular to the **rondure** at that spanwise location; and

(b) the "chord length" at a given cross-section and a given **foil flap** rotation angle is the distance between the most forward point and the most aft point on the cross-section, when **projected** on to the **foil wing** projection plane shown in Figure 13.1.

15.4 At any cross-section, the only permitted movement of a **foil flap** relative to a **foil wing** is a rotation about an axis that remains approximately stationary with respect to the **foil wing** at that cross-section. This axis must be designed to be stationary, but is permitted to have some movement resulting from:

(a) play in a mechanical bearing; or

(b) a flexure or soft hinge, such as a thin flexible material joining the **foil flap** to the **foil wing**.

15.5 Through a **foil flap's** range of rotation angles and twists, a **foil flap** cross-section shall not significantly deform except as permitted in Rules 15.4, 15.8 and 15.9, or as a result of **external forces**.

15.6 Both **foil flaps** of a **foil** shall have the same range of angular rotation and twist. With both **foil flaps** of a **foil** centred in their ranges of motion, each **foil flap** shall be **symmetric** with respect to the other about the **foil wing** symmetry plane, with a build tolerance of 3.0 mm.

15.7 At any cross-section and all rotation angles, when **projected** on to the **foil wing** projection plane, the length of a **foil flap** must not be greater than 50% of the chord length. Hinges or other parts of a component which occur at occasional cross-sections for connection purposes can be excluded from the **projected** lengths.

15.8 A **foil flap** may contact a **foil wing**, and in the absence of **external forces**, and at any cross-section and rotation angle, either may cause deformation in the other in a single zone covering not more than 20% of the local chord length. Outside this zone, neither shall cause deformation in the other.

15.9 Connections between sections of a **foil flap** are exempt from Rules 13.9, 15.4 and 15.5, providing such connections span a combined total of no more than 10% of the span of a **foil wing**, where the span is measured along the **rondure**.

16 Rudder

16.1 A **rudder** must be a single **linear component**, constructed only from:

(a) one **rudder** upper that must penetrate the **hull IGES**; attached to

(b) one **rudder** lower that must not penetrate the **hull IGES**.

16.2 For the purpose of Rule 5.1:

(a) any material attached to the **rudder** below the **hull lower surface** must be declared as part of the **rudder** upper or the **rudder** lower;

(b) any part that does not make up the **linear component** of the **rudder** shall not be included in the declaration; 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** upper, but if it is first declared, will always be controlled by Rule 5.1.

16.3 The **wetted** part of the **rudder** must be **symmetric** about the **rudder** centre plane, with a build tolerance of 3.0 mm.

16.4 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) below a waterline plane 3.500 m below **MWP**;

(b) aft of **TRP**; or

(c) forward of a **transverse** plane 1.500 m forward of **TRP**.

16.5 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.

16.6 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**.

16.7 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 on **LCP**;

(b) an upper bearing, whose **bearing centre** can move, but must always lie on **LCP**;

(c) a device whose only purpose is to react yaw moment and control yaw angle, connected to a steering system; and

(d) the **hull lower surface** within 0.500 m of any yaw axis as defined in Rule 16.6 (a).

16.8 **Rudder** yaw angle shall be controlled through a steering system by a steering wheel or wheels, which shall be **force input devices**. Except for incidental yaw change resulting from **rudder** rake change, these wheels shall be the only input devices for controlling rudder yaw angle. Steering wheels need not be circular, but must rotate to control **Rudder** yaw angle, and must have a perimeter that lies entirely outside a circle of diameter 0.600 m centred on the axis of rotation.

16.9 The lower and upper **bearing centres** must be vertically separated by at least 600 mm.

16.10 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 16.7.

17 Bowsprit

17.1 The combination of the **bowsprit** and the **hull** shall form a single **linear component**.

17.2 The **bowsprit** shall extend from the **hull** to at least 22.760 m forward of **TRP**.

17.3 No part of the **bowsprit** shall be:

(a) forward of a plane 22.860 m forward of **TRP**;

(b) below a plane 0.900 m above **MWP**; or

(c) more than 0.400 m from **LCP**.

17.4 No part of the **yacht** shall be forward of the **hull** and less than 0.900 m above **MWP** except a bobstay connecting the **hull** to the **bowsprit**, which shall:

(a) have a maximum chord to thickness ratio of 3:1 at any cross-section perpendicular to its length; and

(b) fit within a tube of 40 mm diameter, except at terminations extending no more than 200 mm from either end.

17.5 The **bowsprit** shall not be bonded to the **hull** and must be removable for easy replacement.

17.6 The following requirements may be specified in accordance with Rule 34:

(a) camera attachment details that must be provided on the **bowsprit**; and

(b) cable conduits from the camera attachment points into the **hull**.

17.7 The **bowsprit** shall be load tested to ensure it meets a minimum load rating. The procedure for measuring this will be issued according to Rule 34, but is anticipated to be as follows:

(a) the **yacht** shall be afloat;

(b) the **foils** shall be in their lowest position;

(c) the rig shall be pretensioned and at a rake specified in the rig plan;

(d) a **code zero**, which may be furled, shall be hoisted and locked at the **head**;

(e) the **code zero** tack line and one running backstay shall be tensioned until a load of 8,000 kg is achieved at the tack.

18 Sails (general)

18.1 Other than as required for **sail hardware**, intentional openings through **sail skins** are prohibited. This rule does not prohibit access panels that are covered or closed whilst racing.

18.2 Local hollows or distortions of **sail skin** edges shall be bridged for all sail measurements.

18.3 Stiff **sail skin** reinforcements are permitted within 1.0 m of **head points**, **peak points**, **clew points** and **tack points**. Elsewhere **sail skins** shall be capable of being folded without clearly visible structural failure.

18.4 **Battens**:

(a) shall pass through a 75 mm diameter circle;

(b) shall be single-piece components without hinges or other mechanisms;

(c) shall 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 inside a sail pocket not exceeding 260 mm in internal width measured normal to the length-wise axis of the **batten**.

18.5 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 19.1 and 20.2.

18.6 Sails might be required to have defined areas of transparent windows to improve visibility. This Rule will be amended by the **Rules Committee** under Rule 33.1 (b) (ii) if this is deemed necessary.

19 Headsails

19.1 The components that may make up a **jib** are limited to:

(a) a maximum of 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 19.8;

(e) **head pennants**;

(f) soft fairings around a **head pennant** and that part of the forestay adjacent to a **head pennant**;

(g) components of an **ILS**; and

(h) **woollies**.

19.2 The components that may make up a **code zero** are limited to:

(a) a maximum of one **sail skin**;

(b) **sail hardware**;

(c) **luff** cables no greater than 40 mm in diameter, excluding end fittings and sail attachments;

(d) **head pennants**;

(e) soft fairings around a **head pennant** and that part of a **luff** cable adjacent to a **head pennant**;

(f) components of an **ILS**; and

(g) **woollies**.

19.3 Fairings permitted in Rules 19.1 (f) and 19.2 (e) shall be capable of being folded flat along their leading edge and shall have a maximum internal width of 100 mm measured perpendicular to the leading edge.

19.4 With the exception of **battens**, the largest dimension of any **sail hardware** for a **headsail** shall not exceed 250 mm.

19.5 **Headsails** shall be hoisted and lowered without assistance from crew aloft. This should not prevent crew going aloft to resolve occasional issues.

19.6 The **head** of any **jib** shall be below **IG** and the **head** of any **code zero** shall be below **IZ**.

19.7 **Jibs**, when hoisted, shall be connected to the forestay by hanks or luff pockets or a combination of both.

19.8 Hanks, for connection of the **jib** to the forestay, shall extend no more than 75 mm forward of the **luff**, measured perpendicular to the **luff**, and shall be no more than 100 mm in length, measured parallel to the **luff**. Hanks shall be no closer than 200 mm to each other, anywhere along the **luff** of a **jib**.

19.9 Other than within 100 mm of **supplied rigging** fittings, **luff** pockets of **headsails**, shall be:

(a) capable of being folded flat along the leading edge; and

(b) no more than 150 mm wide, when measured internally, perpendicular to the **luff**.

19.10 No **control system** shall be attached to, or bear upon a **headsail** except:

(a) sheets attached to a single piece of **sail hardware** within 400 mm of the **clew point**;

(b) a halyard attached near the **head point**;

(c) a cunningham system or tackline near the **tack point**;

(d) the forestay;

(e) **luff**, **leech**, **head** and **foot** lines no greater than 8 mm in diameter and their associated purchase systems; and

(f) a furling system for the **code zero** only.

19.11 Systems that guide the sheet between the port and starboard **headsail** sheeting positions during tacks and gybes are forbidden.

19.12 A **headsail** sheet shall not be guided between the port and starboard sheeting positions through a tack or gybe.

19.13 Except during (or immediately before or after) a change of the outermost set **headsail**, the outermost set **headsail** sheet may only be controlled by:

(a) the rotary motion of a winch, controlling the length of the sheet, where:

(i) the winch may be self-tailing, but shall not be captive; and

(ii) the crew must unload a sheet from one winch and load the other sheet on to another winch to tack and gybe the **headsail**; and

(b) a deflector, being the first point of contact on the sheet after the clew of the **headsail**, where:

(i) the position of the deflector may be controlled, providing any such control is a different **control function** to the winch; and

(ii) the deflector must have no connection to the **hull** further forward than 10.150 m in front of **TRP**.

19.14 Maximum **headsail** measurements shall be as follows:

	Jibs with **LL** $\leq$ 18.0 m	**Jibs** with **LL** > 18.0m	**Code zeros**
LP	7.050 m	7.050 m	12.000 m
50% girth	0.59**LP**	(0.869-0.0155**LL**)**LP**	0.58**LP**
75% girth	0.40**LP**	(0.859-0.0255**LL**)**LP**	0.31**LP**
Head girth	0.17**LP**	(0.699-0.0294**LL**)**LP**	0.120 m

19.15 **Code zeros** shall have a minimum **LP** of 10.0m, a minium **LL** of 20.0m and shall be tacked forward of 22.760 m in front of **TRP**.

19.16 When not hoisted, **headsails** must be stowed on the upper surface of the **deck**, and once stowed, may not be moved except in preparation for hoisting. Stowed sails may be:

(a) left uncovered;

(b) stored in bags or under fabric covers attached to the **deck**, which may be zipped closed as permitted by Rule 12.9 (c); or

(c) retracted under a hard cover attached to the upper surface of the **deck**, which must not be adjusted.

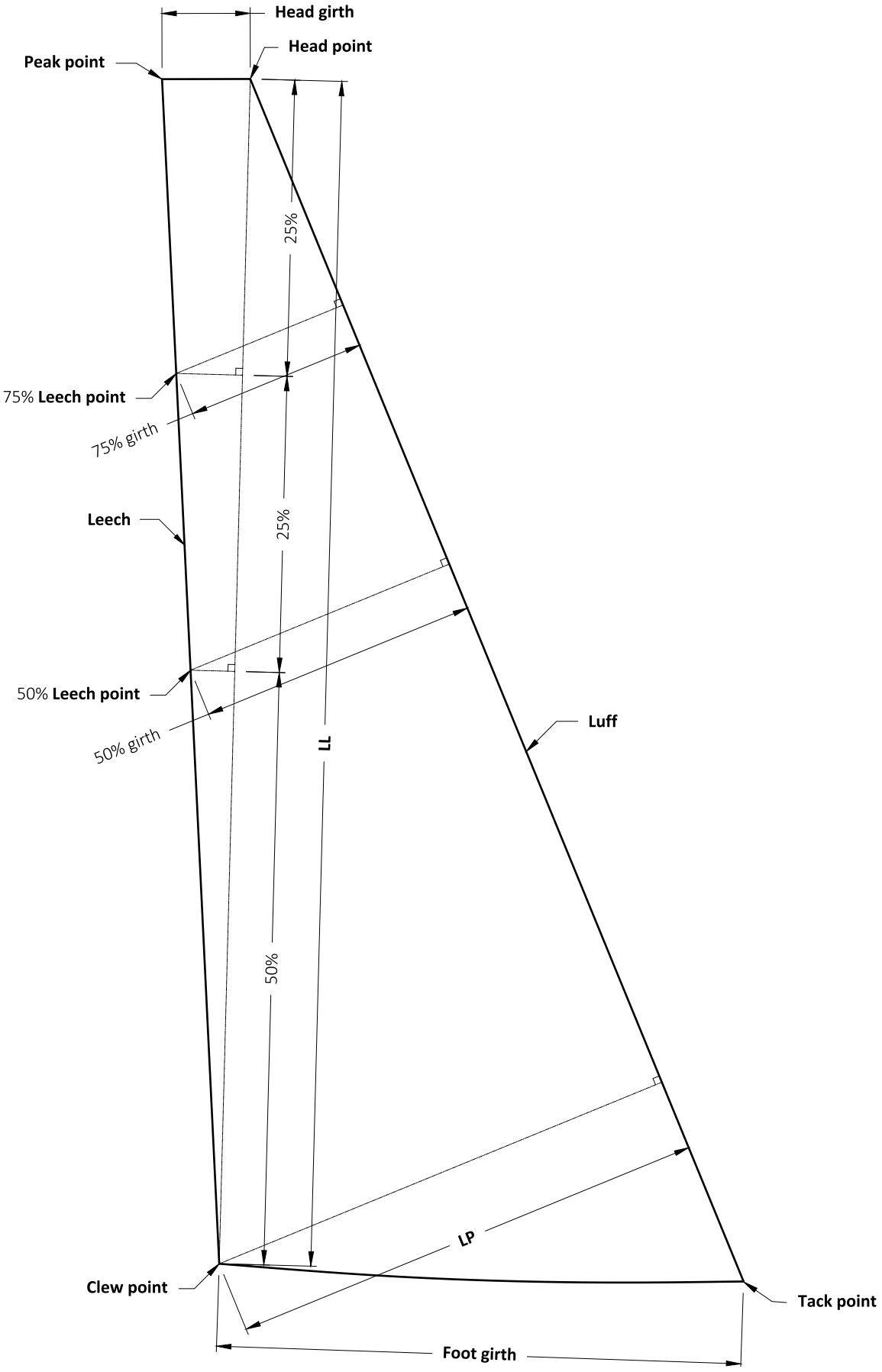

Figure 19.1: **Headsail** Measurement

20 Mast and mainsail

20.1 A drawing package for the **mast** will be issued according to Rule 34. This **mast** drawing package will include:

(a) the **mast surface**;

(b) the minimum required **mast tube** laminate and construction details;

(c) details of the **supplied rigging**;

(d) details of **mast** fittings and spreaders, some of which may be specified as supplied components which must be sourced from a nominated supplier; and

(e) the rig plan, including required chainplate positions on the **hull**.

20.2 With the **mast** unloaded and supported in cradles, the external surface of the **mast tube** shall match the **mast surface** to within ±3 mm for any cross-section parallel to the **mast lower plane**. The aft face of the **mast tube** shall be straight within ±10 mm along the length of the **mast tube**. The **mast tube** may deviate from the **mast surface** within the **mainsail** attachment zones illustrated in Figure 20.1. Rebates for the attachment of components are permitted as long as such rebates are filled to match the **mast surface** within the aforementioned tolerances. The **mast surface** includes all cutouts for required fittings and no extra openings may be made in the **mast tube** other than those permitted in Rule 20.4.

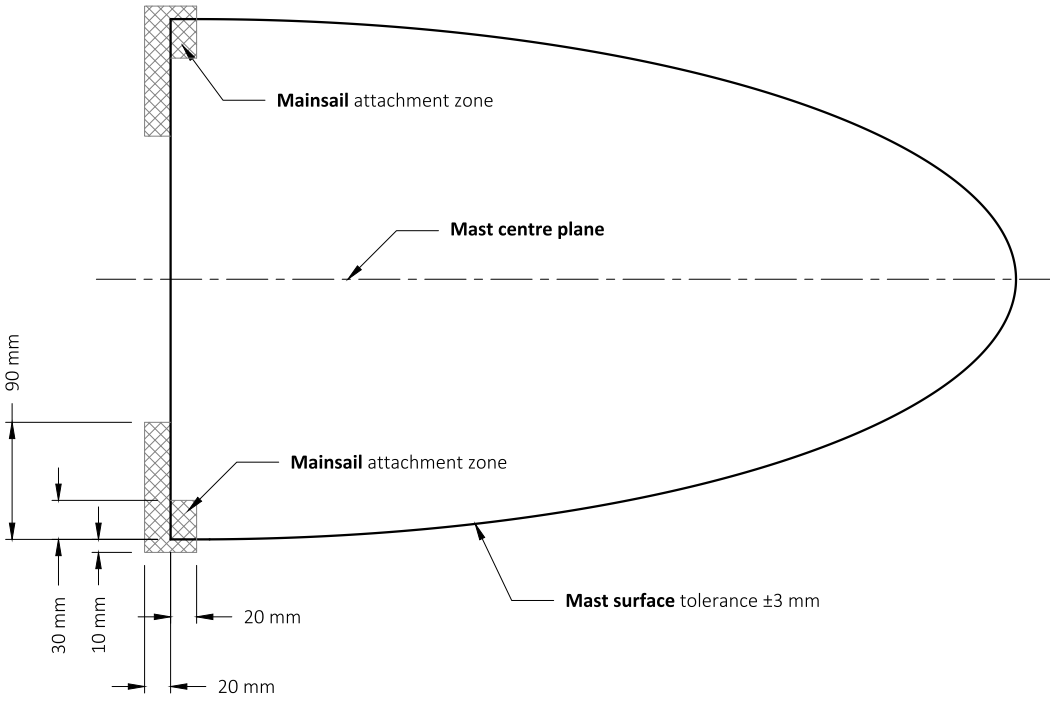

Figure 20.1: **Mast Tube** Cross-section

20.3 The **mast tube** laminate provided by Rule 20.1 (b) is a minimum required laminate. Laminates resulting in greater fibre weight, resin content, **core** density, and/or **core** thickness than specified in the **mast** drawing package are permitted. Additional reinforcements are permitted and may be external to the **mast surface** but must remain within the tolerances given in Rule 20.2. The outer laminate of the **mast tube** shall not be sanded other than for local repairs and reinforcements performed after the **mast tube** has been cured. This shall not prevent the **mast tube** being painted or covered in branding material such as vinyl.

20.4 Openings in the aft face of the **mast tube**, in addition to those already defined in the **mast surface**, are permitted for access to permitted systems as well as penetrations for **control systems** and instrumentation cables. Such additional openings shall be no larger than required and shall have a maximum dimension of 150 mm and a maximum area of 0.018 m^2. The combined total area of all such openings shall be no more than 0.1 m^2 and the boundaries of any two openings shall have at least 250 mm between them.

20.5 When stepped, the **mast** shall be positioned and tensioned on the **hull** as specified in the rig plan described in Rule 20.1 (e) .

20.6 The **mast** shall not be adjusted with respect to Rule 20.5 except for:

(a) control of the forestay, which may be disconnected when the **code zero** is hoisted;

(b) control of the running backstay;

(c) adjustment of the lower shroud turnbuckle as specified in the **supplied rigging** drawings;

(d) control of **mast** rotation about **MRP** by action of a device attached to the **mast** within the **mast lower zone**; and

(e) movement of **control systems** within the **mast upper zone** and **mast lower zone** for the purpose of controlling the **mainsail**.

(f) 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**.

20.7 All one-design **mast** fittings and spreaders shall be built and installed according to the supplied **mast** drawings provided in accordance to Rule 20.1 (d).

20.8 One fairing or vibration mitigation device is permitted per **supplied rigging** element. Such fairings and vibration mitigation devices on any **supplied rigging** elements and their terminations are limited to a maximum length of 600 mm and shall fit within a cylinder of 100 mm diameter when installed on a **supplied rigging** element.

20.9 The **supplied rigging** shall not be modified other than the addition of fairings and vibration mitigation devices permitted in Rule 20.8. Shock cords or ropes may be attached to **supplied rigging** to manage slack and prevent sails being fouled.

20.10 No components of the **mast**, other than rigging and components of the **mast** drawing package are permitted to extend more than:

(a) 7700 mm aft of the **mast surface** or 3 mm forward of the leading edge of the **mast surface**, within the **mast lower zone**;

(b) 300 mm aft of the **mast surface** or 3 mm forward of the leading edge of the **mast surface**, within the **mast upper zone**;

(c) 100 mm aft of the **mast surface**, between the **mast lower zone** and **mast upper zone**; or

(d) 3 mm outside of the **mast surface**, forward of the aft face of the **mast surface** between the **mast lower zone** and **mast upper zone**.

20.11 The components that may make up a **mainsail** are limited to:

(a) a maximum of two **sail skins**;

(b) **battens** as described in Rule 20.22 and their associated connections as described in Rule 20.23;

(c) **sail hardware**;

(d) a single **leech**, **head** and **foot** line per **sail skin** no greater than 8 mm in diameter;

(e) **luff** attachment devices such as bolt ropes;

(f) **control systems** and structures as permitted in Rule 20.26;

(g) fairings as permitted in Rule 20.21;

(h) components of an **ILS** and a **CIS**; and

(i) **woollies**.

20.12 For a specific **mainsail** measurement length or girth, the greatest value from all **sail skins** shall be taken.

20.13 When calculating a **mainsail** girth, the offset between the local **luff** of a **sail skin** and the aft face of the **mast surface** shall be added (if the **luff** is aft of the aft face) or subtracted (if the **luff** is forward of the aft face) from the girth measurement.

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

		Minimum	Maximum
G_F	**Foot girth** (m)	7.000	7.400
G_{25}	25% girth (m)	6.175	6.725
G_{50}	50% girth (m)	5.200	5.900
G_{75}	75% girth (m)	3.975	4.825
G_H	**Head girth** (m)	2.600	3.600

20.15 **Mainsails** shall comply with:

$$135.0 < \frac{26.5}{12} \times (G_F + 4G_{25} + 2G_{50} + 4G_{75} + G_H) < 145.0$$

20.16 With the exception of **battens**, the largest dimension of any **sail hardware** for a **mainsail** shall not exceed 650 mm.

20.17 All **sail skins** of the **mainsail** shall be continuously attached to the **mast tube** from 1.5 m above **MRP** to 1.0 m below the highest **mainsail head point**. This does not prohibit **mainsail** cars, but they are not sufficient to continuously attach a **sail skin** to the **mast tube**

20.18 Wind instrumentation, if fitted, shall extend no higher than 1.5 m above the **mast upper plane**, measured orthogonal to the **mast upper plane**. Any wind instrumentation extending above the **mast upper plane** must not interfere with the supplied media equipment, and shall be submitted to the **Measurement Committee** for approval. Wind instrumentation shall have a maximum chord to thickness ratio of 3:1 at any cross-section perpendicular to its local lengthwise axis in the region between the **mast upper plane** and 100 mm from the uppermost extent of wind instrumentation.

20.19 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. This does not prevent crew going aloft to resolve occasional issues.

20.20 The **mainsail** shall be capable of being removed from the **mast** with the **mast** stepped without damage to either the **mast** or **mainsail**.

20.21 **Mainsail** fairings are permitted within the **mast upper zone** and **mast lower zone** for the purpose of fairing **control systems** or sealing the area between the **heads** of **sail skins**. Such fairings may be flexible and shall not be considered to be **sail skins**.

20.22 Between the **mast lower zone** and **mast upper zone** each **sail skin** of a **mainsail** may have up to 6 **battens** that run from **luff** to **leech** and 6 **battens** shorter than 1.0 m that have one edge terminating at the **leech**. Additional **battens** are permitted in the **mast lower zone** and **mast upper zone** and such **battens** are not restricted by Rule 18.4

20.23 A **batten** on one **sail skin** may be connected to a **batten** on another **sail skin** provided the connection is within 0.400 m of the **leech** or **luff** of a **sail skin**, within the **mast lower zone**, or within the **mast upper zone**. In addition to these connections, tethered connections between **battens**, or **batten** pockets, are permitted anywhere provided such connections are no longer than 600 mm and cannot take compressive forces. Except for **battens** that are entirely within the **mast lower zone** or **mast upper zone**, connections between **battens** shall not be adjusted.

20.24 The **mainsail** shall be equipped with solid buoyant material or inflated air bags in order to provide positive buoyancy near the top of the **mast**. There shall be at least 300 kgs of buoyancy from all combined **mainsail** buoyancy systems when submersed in salt water with an assumed water density of 1025 kg/m^3 and the combined mass of these systems shall be at least 3 kgs. The centre of volume of all **mainsail** buoyancy systems shall be within 1.5 m of the uppermost **head** of the **mainsail** and if this centre of volume is more than 0.5 m below the uppermost **head** then the minimum buoyancy and minimum mass of the combined buoyancy systems shall be increased by 100 kg and 1 kg respectively per metre below this limit. Any ballast required to meet the minimum mass requirement of this rule shall be added at the same height above **MRP** on the **mast tube** as the centre of volume of the combined buoyancy systems.

20.25 **Mast**/**mainsail** measurement condition shall be the representative condition of the **mast** and **mainsail** whilst sailing but with the **mast** supported with the shear web of the **mast tube** horizontal and the **mainsail** hanging below. **Mast**/**mainsail** measurement condition shall:

(a) include the **mainsail** hoisted to its highest sailing position;

(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) exclude man lines; however, man lines may be replaced with polyester mouse lines no larger than 4 mm in diameter.

20.26 With the exception of **leech** lines of the **mainsail**, **control systems** of the **mainsail** shall only be attached to or bear upon **sail skins** of the **mainsail** in the **mast upper zone** or **mast lower zone**. For the purpose of this rule the **mast upper zone** and **mast lower zone** regions on the **sail skins** of the **mainsail** shall be identified in **Mast**/**mainsail** measurement condition and incidental movements of these regions outside of the **mast upper zone** and **mast lower zone** are permitted whilst sailing. **Control systems** may include structures and mechanisms that are hoisted with the **mainsail** and such **control systems** are not limited by Rule 20.16. This Rule does not prevent adjustment of the **mast tube** through means permitted in Rule 20.6 and the effect the **mast tube** has on **mainsail** shape.

20.27 In **mast**/**mainsail** measurement condition, with the exception of wind instrumentation permitted in Rule 20.18 and supplied media equipment, no part of the **mast** or **mainsail** shall extend beyond, or be capable of being extended beyond, the **mast upper plane**.

20.28 In **mast**/**mainsail** measurement condition the only components of the **mast** and **mainsail** permitted to extend wider than 250 mm from the **mast centre plane** are:

(a) **supplied rigging** and associated strops;

(b) spreaders;

(c) sensors as part of a permitted **ILS**; and

(d) structures for rotating the **mast** about **MRP** as described in Rule 20.6 (d).

20.29 In **mast**/**mainsail** measurement condition, when **projected** on to the **mast centre plane**, every part of the **mainsail** except for **woollies** shall lie:

(a) inside a **sail skin**;

(b) within 15 mm of a **leech**;

(c) within 15 mm of a **luff**;

(d) within 100 mm of a **head**; or

(e) within 100 mm of a **foot**.

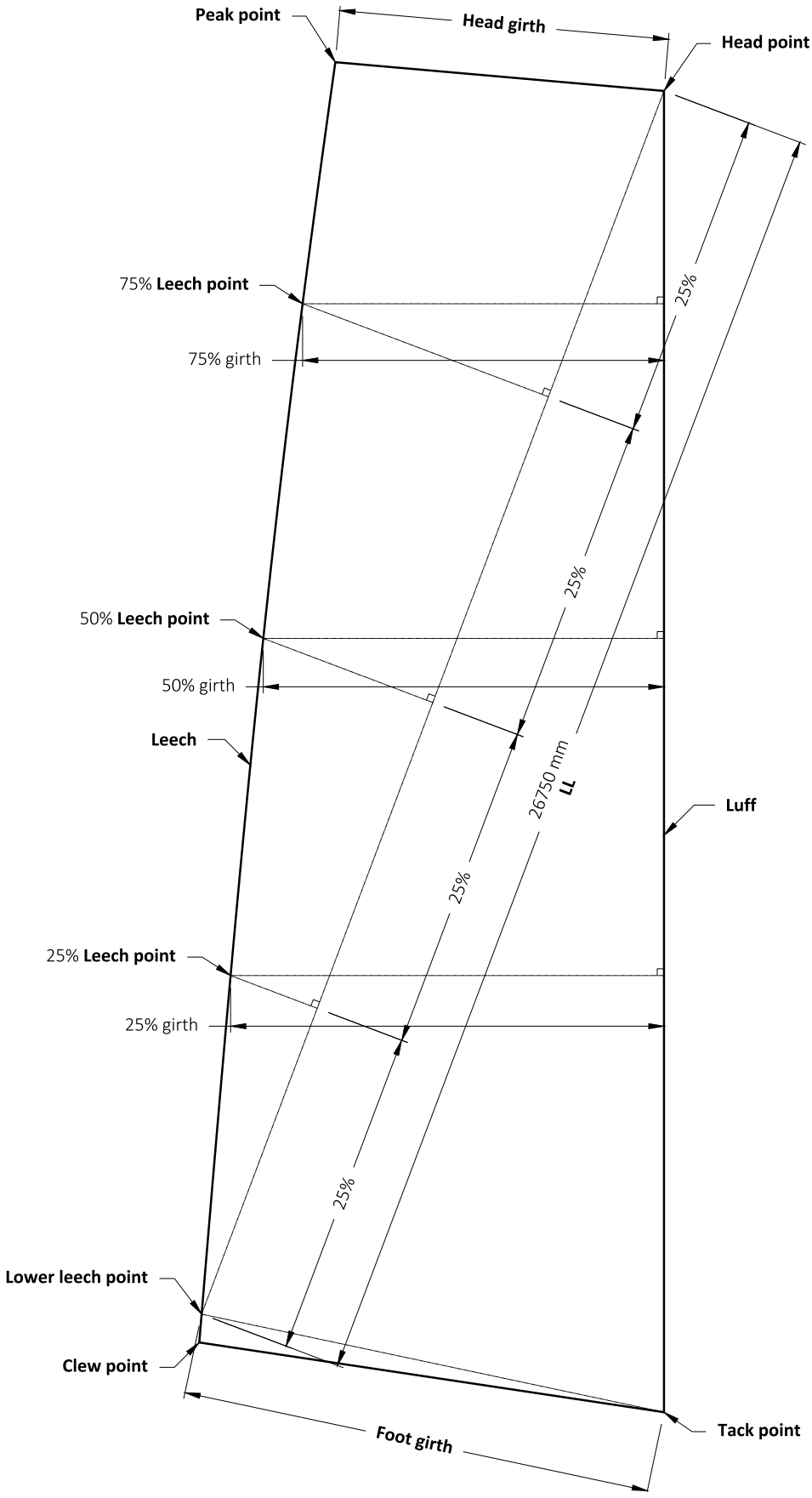

Figure 20.2: **Mainsail** Measurement

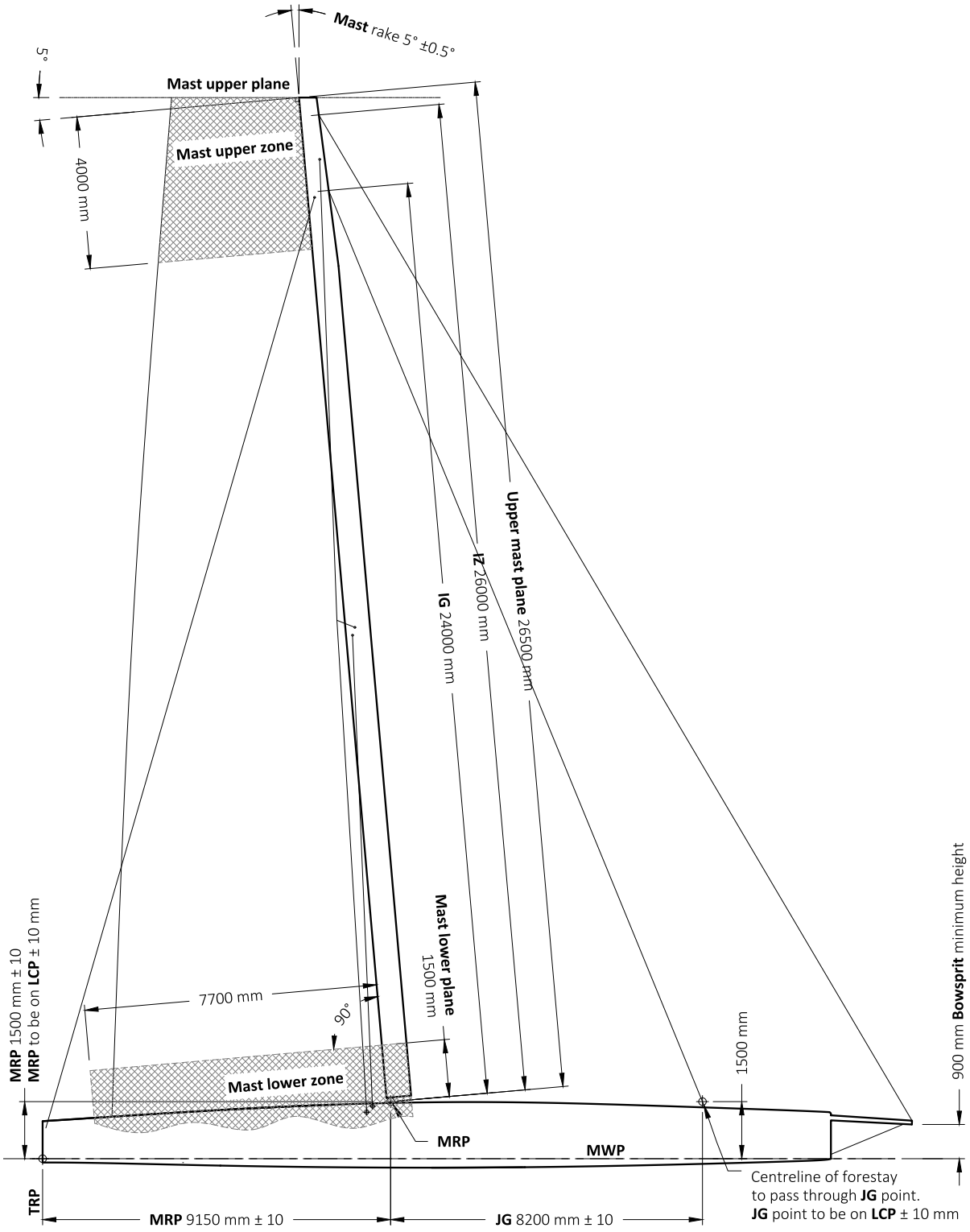

Figure 20.3: Rig Plan

21 Control systems

21.1 The adjustment of **control surfaces**, where permitted in Rules 15, 16, 19 and 20 must only be controlled by crew:

(a) by direct contact of the crew on a **control surface**; or

(b) using one or more **control systems**.

21.2 No **control system** or part thereof shall be capable of using feedback from the **yacht state** to control a **control surface**, except:

(a) motion of a **control function** may be restricted where permitted by Rule 21.3;

(b) one or more **force input devices** may be connected **mechanically** and/or through an **HCC** to a single **control surface**; forces acting on that **control surface** can only be transmitted to those **force input devices**;

(c) one or more **force input devices** may be connected **mechanically** and/or through an **HCC** to common mechanical drive trains or common pressure supply lines that provide power to multiple **control surfaces**; forces acting on those **control surfaces** can be transmitted through those mechanical drive trains or pressure supply lines to those **force input devices**;

(d) as permitted within an **HCC** by Rules 22.5 (d) and 22.5 (e);

(e) as permitted within an **ECC** by Rule 24; and

(f) a **control surface** can move passively as the result of **external forces** acting on that **control surface**, providing the above Rules are respected.

21.3 A **control system** may restrict a **control function** as follows:

(a) fixed stops, or stops engaged and disengaged **mechanically**, may limit the travel of a **control function**;

(b) locks that engage **mechanically** at (or very nearly at) either end of the extent of motion of a **control function** may be disengaged by an **ECC** and/or **HCC**, providing those extents of motion are not adjustable; and

(c) locks that limit the direction of motion of a **control function** at discrete points, e.g. ratchets, may engage **mechanically**.

However, stops and locks permitted herein shall not be combined to provide greater control of a **control function**, and shall not be used in mechanisms such as, but not limited to, escapements, to achieve the effect of indexed control or position control.

21.4 Power that does work on a **control surface** to adjust its shape, position or orientation can only be supplied by:

(a) **external forces** acting on that **control surface** where, for this Rule only, the combination of the **mast**, **mainsail** and any hoisted **headsails** shall be considered together as a single **control surface**;

(b) the crew, via **force input devices**, only as expressly permitted in Rule 21.2;

(c) the **ECC** as permitted by Rules 24.2 (d), 24.2 (e) and 24.2 (f);

(d) the **FCS** as permitted by Rule 27;

(e) no more than 50 J of elastic energy stored within springs or lines (or collections thereof).

21.5 Power supplied by the crew to do work on a **control surface** must be used directly without being stored, except where permitted by Rule 21.4 (e) and by Rule 22.13 within **HCCs**.

21.6 Energy supplied by the crew to move **control surfaces** must primarily be transmitted through the crew's hands; any contact between other parts of the crew and **force input devices** must not transmit any significant power.

21.7 Where **force input devices**, or collections thereof, are designed to allow more than one crew member to supply power to a common mechanical drive train, a common pressure supply line or a common **control function**, power from the crew may only be supplied by turning handles on the **force input devices** in a circular motion with the hands, and the radius of rotation shall be no more than 350 mm. This does not prohibit the use of other **force input devices** that occasionally allow more than one crew member to provide simultaneous power (e.g. helm wheels), providing that is not their usual mode of operation.

21.8 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.

21.9 Sensors that measure, or are used to estimate the:

(a) height of the **yacht** above water;

(b) vertical velocity of the **yacht**; or

(c) vertical acceleration of the **yacht**

are permitted only as part of an **ILS**. Mechanical or other non-electronic sensors measuring these quantities are not permitted.

22 Hydraulic control circuits

22.1 Rule 22 applies to all components except the **FCS**.

22.2 Hydraulic circuits and components are permitted only as part of an **HCC**.

22.3 Hydraulic circuits and components are permitted only for the purpose of adjusting **control surfaces** with **hydraulic actuators**, and for safely managing the flow of hydraulic fluid to and from these actuators.

22.4 Components in an **HCC** must be sized appropriately for their permitted use. It is prohibited to use oversize components, superfluous reservoirs, etc. in order to control the mass distribution on the **yacht**.

22.5 The only devices permitted for controlling the flow of hydraulic fluid through an **HCC** are:

(a) **force input devices**, only as expressly permitted in Rule 21.2;

(b) **mechanically** operated valves;

(c) valves actuated by an **ECC**;

(d) two-port devices, not controlled by an **ECC**, that limit flow to one direction, regulate flow and/or regulate pressure, such as:

(i) two-port pressure relief valves;

(ii) two-port check valves;

(iii) two-port pressure-compensated flow control valves; and

(iv) two-port devices with fixed or adjustable orifices; and

(e) devices, not controlled by an **ECC**, that limit flow to one direction, regulate flow and/or regulate pressure, providing that such a device is subject to the pressure of no more than one **actuator chamber**, which shall always be the same **actuator chamber**, and is always isolated from all other **actuator chambers**.

22.6 For the avoidance of doubt, the following types of components are prohibited as they are capable of using feedback from the **yacht state** and are not listed within the permitted exceptions of Rules 22.5 (d) and 22.5 (e):

(a) external pilot-operated sequence valves;

(b) external pilot-operated counter balance valves;

(c) external pilot-operated pressure relief valves;

(d) valves that use internal feedback to control flow rate in proportion to an electrical input;

(e) hydraulic devices with more than two ports that provide logic between:

(i) different **control functions**;

(ii) different **hydraulic actuators** of the same **control function**;

(iii) different **actuator chambers** of the same **hydraulic actuator**; and

(iv) different pressure supply lines; and

(f) variable displacement pumps that change their characteristics automatically in response to pressure, unless that automation is achieved using only those devices that are permitted by Rules 22.5 (d) and 22.5 (e).

22.7 A **hydraulic actuator** within an **HCC** may only be **mechanically** connected to one **control surface**.

22.8 If power from the **ECC** is used to drive a pump within an **HCC** permitted by Rule 24.2 (f):

(a) that **HCC** must be entirely self-contained and disconnected from any other **HCC**; and

(b) one or more high-pressure accumulators are permitted to be installed in line with the pump.

22.9 Hydraulic fluid may only be discharged from an **actuator chamber** (via tubing and permitted valves) to:

(a) a **low-pressure circuit**;

(b) another **actuator chamber** of the same **hydraulic actuator**; or

(c) an **actuator chamber** of a different **hydraulic actuator**, where both **hydraulic actuators** are connected to the same **control surface**.

An **HCC** must not be capable of discharging hydraulic fluid from an **actuator chamber** to another **actuator chamber** connected to a different **control surface**, or to a high-pressure accumulator permitted by Rule 22.13 (a).

22.10 The pressure in a **low-pressure circuit** must never exceed 6 bar.

22.11 Hydraulic reservoirs in a **low-pressure circuit** may provide back pressure to **high-pressure circuits**.

22.12 Pressure relief valves set to no more than 600 bar must be present immediately downstream of all pressure sources, such as pumps, connected to **force input devices**. A standard type or minimum flow rate for these valves might be specified in accordance with Rule 34.

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

(a) by one high-pressure accumulator per **yacht** with a maximum capacity (gas plus hydraulic fluid) of 2.0 litres;

(b) by accumulators permitted by Rule 22.8 (b);

(c) by gas in reservoirs in **low-pressure circuits**;

(d) by gas in **hydraulic actuators** with a gas spring return, providing the expansion of the gas volume cannot do work on a **control surface**. Such gas volumes may be physically separate from the **hydraulic actuators** they operate on, but may only be shared between **hydraulic actuators** that act on a common **control function**; and

(e) as elastic energy resulting from the compression of hydraulic fluid and the expansion of hoses in **high-pressure circuits**, providing that when all such circuits are pressurised to maximum pressure, no more than 350 ml of hydraulic fluid is discharged from drain ports when those ports are opened to atmosphere.

22.14 Tubing containing more than trace quantities of titanium is prohibited, but this does not preclude the use of titanium in **hydraulic actuators**, hydraulic pumps or fittings.

23 Electrical and electronic systems

23.1 Electric or electronic components or circuits are permitted only as:

(a) part of an **ECC**, **ILS**, or **CIS**;

(b) standalone **crew indication devices**, such as wristwatches, that are incapable of measuring or receiving any part of the **yacht state**;

(c) standalone **hardwired** cameras and screens mounted on the **yacht** to aid visibility of different parts of the **yacht**, providing no information other than raw audio and video from the **yacht** is transmitted, played or displayed;

(d) supplied and required by **COR/D**, the **Rules Committee** or the **Measurement Committee**, including permitted devices connected to these supplied components; and

(e) bilge pumps.

23.2 No information exchange between **ECCs**, the **ILS**, the **CIS** and other systems is permitted except via specified communication channels through the **FCS** and **Media System** in accordance with Figure 23.1.

23.3 Communication between any systems on the **yacht** permitted by Rule 23.2 must be **hardwired** except where wireless communication is indicated by "wireless link" arrows in Figure 23.1.

23.4 **ECCs** and the **ILS** shall be incapable of communication by any means other than **hardwired** information transfer.

23.5 A **crew indication device**:

(a) must only provide visual and/or audio feedback to the crew; tactile or other non-audio visual feedback is not permitted;

(b) must be incapable of measuring any part of the **yacht state**; and

(c) must be incapable of significantly affecting the **yacht state**.

23.6 Batteries or regulated power supplies are permitted to be shared between **ECCs**, the **ILS**, the **CIS**, cameras and screens provided that where these systems are required to be **isolated**, the **isolated** wiring begins immediately beyond these supplies.

23.7 **ECCs**, the **ILS**, the **CIS** and **electric actuators** must be powered by supplies operating at no more than 60 V, except where and if expressly permitted by the **FCS** specification.

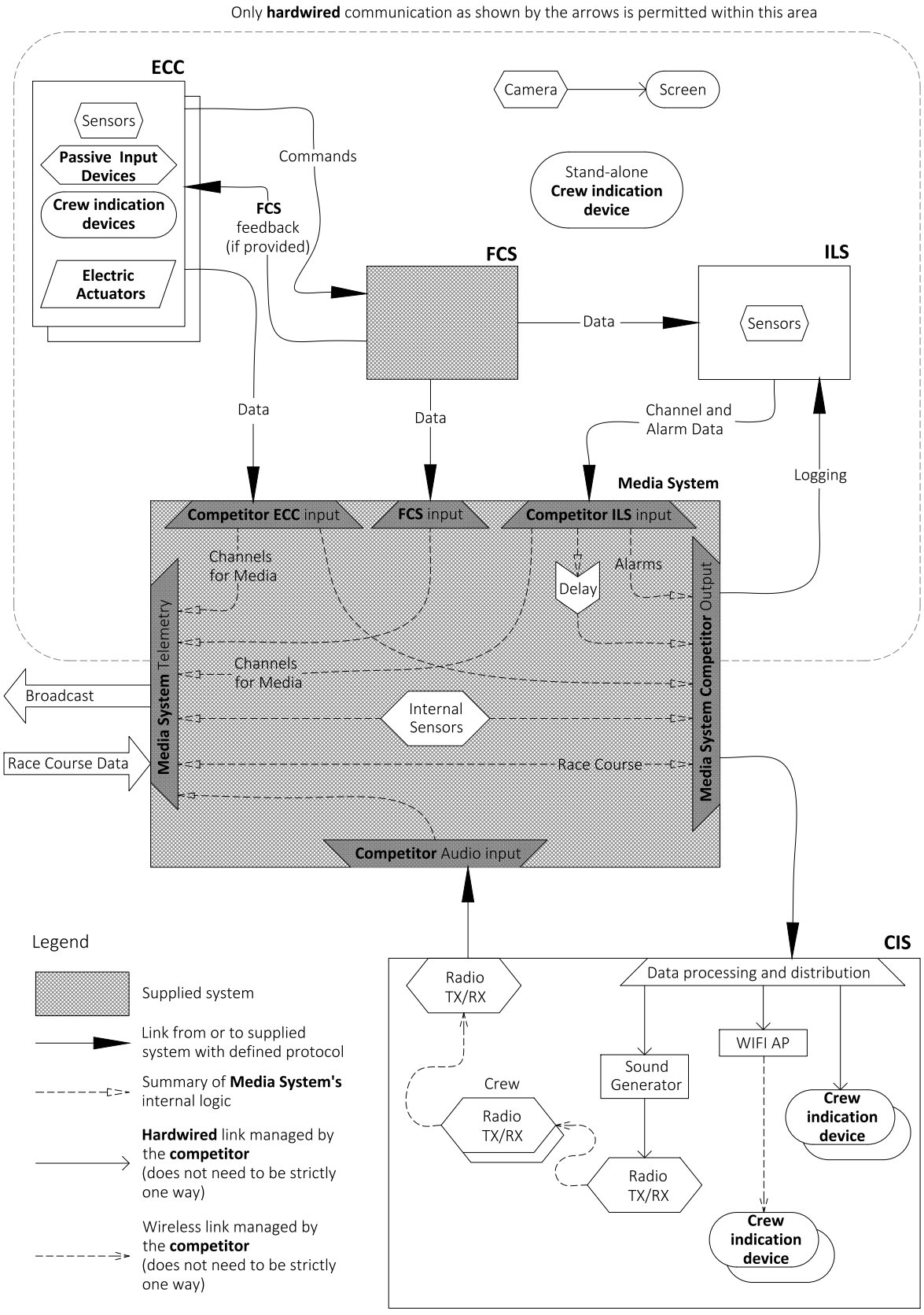

Figure 23.1: Permitted communication between electronic systems

24 Electronic control circuits

24.1 Only the following sensors within, or inputs to an **ECC** are permitted:

(a) outputs from **passive input devices**;

(b) sensors measuring the angle of a **foil flap** relative to a **foil wing**, or a proxy for that angle, at any number of spanwise locations along the **rondure** of the **foil wing**;

(c) one sensor measuring **rudder** rake angle relative to the **yacht**, or a proxy for that angle;

(d) sensors measuring the internal state of the **ECC**, such as voltage, current, CPU temperature, so long as those sensors provide no **yacht state** information, and are not used to estimate **yacht state** information;

(e) sensors measuring the internal geometric state of a **drive clutch** or **HCC** component, so long as those sensors do not directly measure **yacht state** information, and are not used to estimate **yacht state** information, for example:

(i) a sensor measuring the orientation of a cam in a hydraulic valve can be measured in order to drive that cam to a desired position, as long as the orientation of the cam is not used to estimate pressure or flow; and

(ii) current in a servo motor can be measured as part of a position control loop within the servo motor circuit, as long as the current is not used to estimate any part of the yacht state, such as control surface load; but

(iii) a sensor measuring the position of a plunger in a pressure relief valve cannot be measured, as it provides direct information about pressure in the system; and

(f) a sensor measuring the pressure of an accumulator permitted by Rule 22.8 (b).

24.2 Only the following **electric actuators** permitted within an **ECC**:

(a) actuators of hydraulic valves within an **HCC**;

(b) actuators of **drive clutches**;

(c) actuators of locks permitted by Rule 21.3 (b);

(d) actuators used to rotate or twist the **foil flaps**;

(e) actuators used to rotate the **rudder** about its rake axis;

(f) motors that drive pumps supplying **high-pressure circuits** within one or more **HCCs** that control only the rotation or twist of the **foil flaps** and/or the rotation of the **rudder** about its rake axis; and

(g) 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.

24.3 Except as permitted in Rule 24.2, an **ECC** must be incapable of having any significant effect on the **yacht state**.

24.4 An **ECC** shall:

(a) be **hardwired**;

(b) have wiring that is **isolated** from other devices and systems, except for:

(i) connections shown in Figure 23.1; and

(ii) connections from common power supplies permitted by Rule 23.6.

25 Instrumentation and logging system

25.1 The **ILS** shall:

(a) be **hardwired**;

(b) have wiring that is **isolated** from other devices and systems, except for:

(i) connections shown in Figure 23.1; and

(ii) connections from common power supplies permitted by Rule 23.6;

(c) not be capable of having any significant effect on the **yacht state**; and

(d) not include any **crew indication devices**.

25.2 The **ILS** must provide a single data stream to the **Media System**, which:

(a) must use a protocol to be specified in accordance with Rule 34;

(b) must include specified data channels for broadcast and/or verification of **AC75 Class Rule** compliance, and these data channels must be:

(i) the most accurate data available to the **ILS**, or the best estimate available if the required data is not measured; and

(ii) at a specified frequency;

(c) may include any other data channels measured, calculated or logged by the **ILS**; and

(d) may include alarm event messages generated by the **ILS**, which may only contain:

(i) an alarm category ID code, being an integer between 1 and 10; and

(ii) a single floating point number representing the magnitude of an alarm value.

26 Crew information system

26.1 The **Media System** will make an output available for transmitting data to the **CIS**, and optionally to the **ILS** for logging. This output will use a specified protocol and will include:

(a) the data stream supplied by the **ILS**, delayed by between 0.5 s and 1.0 s, this delay either being fixed or variable, to be specified;

(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 information from an **ECC**; and

(d) non-delayed information generated by the **Media System**, including:

(i) time of day, and race start time;

(ii) latitude and longitude, but not altitude;

(iii) heading and/or track, but not heel or trim;

(iv) boat speed;

(v) race course information, which might include start time, boundary lines, mark positions, penalties, and other information relevant to racing; and

(vi) possibly some information about other competing **yachts**, which might include a time or distance to a potential collision (or collision of a virtual bounding box around a **yacht**), but will not include position, speed or heading information about those **yachts**.

26.2 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**;

(c) may use short range wireless communication in **crew indication devices** and associated interface hardware (e.g. access points); and

(d) may include microphones and speakers to allow direct voice communication between crew, and to play audio signals from **CIS** devices.

26.3 As an exception to Rule 23.5 (b), **crew indication devices** in the **CIS** containing sensors such as accelerometers or solid-state gyroscopes may be considered incapable of measuring any part of the **yacht state** if a **Competitor** can demonstrate to the satisfaction of the **Measurement Committee** that those sensors cannot be accessed, for example by installation of custom firmware verified by the **Measurement Committee**.

26.4 Additional constraints on **crew indication devices** might be specified in accordance with Rule 34, including, but not limited to:

(a) standard display hardware (e.g. mobile phone model) for any **crew indication device** capable of receiving WiFi communication;

(b) custom firmware in standard display hardware (e.g. that disables sensors within a mobile phone);

(c) the display of a time-varying checksum on **crew indication devices** for verification of custom firmware;

(d) installation of screen reading software on **crew indication devices**; and

(e) installation of supplied audio visual recording equipment (e.g. small action cameras) to monitor **crew indication devices** at points requested by the **Measurement Committee**.

26.5 The **Media System** might specify reserved radio frequency bands which must not be used by other systems on the **yacht**.

26.6 Further details and requirements mentioned in the above Rule 25 and 26 will be provided according to Rule 34.

27 Foil cant system

27.1 Details of an **FCS** to control the **cant** rotation of the **foils** have been provided in a document supplied by **COR/D** and the specification will be further developed as described in that document. The **FCS** cannot be modified except as expressly permitted in the supplied specification.

27.2 The **FCS** will allow **cant** to be changed during manoeuvres and to make low-frequency **cant** setting changes, but the system will not be designed to provide high-frequency **cant** adjustment.

27.3 Subject to physical limitations, the **FCS** will be capable of controlling the **cant** of a **foil** to:

(a) a fully raised position, being 119° ±1°; and

(b) any angle between:

(i) the fully lowered position, being 0°, as shown in Figure 13.1; and

(ii) the highest permitted sailing position, which will be confirmed in the **FCS** specification, but is likely to be between 80° and 90°.

The **FCS** will not permit the holding of **cant** angles between the highest permitted sailing position and the fully raised position, this range only being available through transitions.

27.4 The **AC75 Class Yacht** is not designed to resist righting-moment created by hydrodynamic downforce on the windward **foil**. Following sailing trials and experience gained by **Competitors**, the **Rules Committee**, with the agreement of **COR/D** and the **Regatta Director**, and in consultation with **Competitors**, may amend this Rule to place restrictions on the use of the **FCS** including, but not limited to:

(a) a restriction of:

(i) the amount of negative **cant** moment (moment in the sense of reducing **cant** angle) that may be sustained by the **FCS**; and

(ii) the **cant** angle that may be set for the windward **foil**;

(b) which may be applied at all times, or only in certain conditions, such as:

(i) when in a normal sailing mode, and not through a manoeuvre;

(ii) when within certain **yacht** speed or wind speed ranges; and

(iii) during certain stages of a race.

Such restrictions may be developed through sailing periods, but shall be frozen according to Rule 34.

27.5 The **cant** rotation of a **foil** can only be controlled using the **FCS**.

27.6 The **FCS** will provide, using specified protocols:

(a) an input for commands to be received from an **ECC**;

(b) an output for system information to be sent to the **ILS**.

27.7 The **FCS** will include supplied batteries, and this battery pack may be expanded with a specified battery model to increase overall power capacity, unless otherwise indicated in the **FCS** specification. The supplied batteries are exempt from the requirements of Rule 5.13 and may be replaced as required.

27.8 Unless otherwise indicated in the **FCS** specification, the following may be powered by the **FCS's** batteries:

(a) **ECC** systems, the **ILS** and the **CIS**;

(b) systems required by **COR/D**, the **Rules Committee** or the **Measurement Committee**, and devices permitted to be connected to those system;

27.9 Following sailing trials, **COR/D** might specify updates to the system which must be installed by all **Competitors**, these updates being frozen according to Rule 34.

28 Crew

28.1 There shall be eleven crew members, unless reduced by accident, who shall all be human beings.

28.2 The total mass of the crew, dressed only in light underwear, shall be within the range specified in Rule 10.1.

28.3 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^2 of the exterior surface brightly coloured. **Competitors** shall satisfy the **Measurement Committee** that the brightly coloured region can be seen from above the water with the crew lying face down or face up in the water;

(c) a blade with a length of no more than 150 mm;

(d) at least one personal air supply containing compressed air equivalent to at least 40 litres uncompressed volume each, which does not require the use of hands when in use;

(e) a pocket for carrying media equipment with minimum dimensions 80 mm x 200 mm x 30 mm; and

(f) media equipment as required by **COR/D** according to Rule 34.

28.4 The total mass of **carried equipment** worn or carried by each crew member shall weigh between 3.0 kg and 5.0 kg, with clothing and equipment weighed dry. The lower limit must apply at the start of a race, but can be reduced during a race due to consumption of food or drink. Any **carried equipment** brought aboard by a crew member must be carried by that crew member at all times when racing.

28.5 Clothing and equipment shall not be designed to retain water for the purpose of increasing mass.

28.6 A crew weighing schedule and procedure will be published in accordance with Rule 34.

28.7 Crew shall not enter the watertight volume of the **hull**.

28.8 Crew shall remain entirely aft of a plane 9.0 m forward of **TRP** except briefly to cross the boat, handle sails during a drop or a hoist, or resolve unforeseen issues.

28.9 Any crew that go forward of a plane 11.0 m forward of **TRP** may only do so as permitted by Rule 28.8, and must be tethered to the **hull** by a harness and safety line that complies with ISO 12401, the safety line being no longer than 2 m.

28.10 No part of the crew, except the upper body (i.e. above the waist) of a crew member that is helming, shall be in a sustained position outside an extrusion of the **perimeter line** perpendicular to **MWP**.

29 Guest racer

29.1 At the discretion of the **Regatta Director**, **Competitors' yachts** may carry a guest racer, whose mass will be limited and equalised according to Rule 10. If a guest racer is not aboard, equivalent ballast will be applied according to Rule 10.

29.2 Rules 28.3, 28.4, 28.5, 28.7 and 28.10 shall also apply to the guest racer.

29.3 The guest racer shall remain entirely behind a line 2.0 m forward of **TRP**.

29.4 The **Regatta Director** might require the guest racer to be tethered to the **yacht**.

29.5 Except by moving within the region permitted by Rule 29.3, the guest racer shall not contribute in any way to the racing of the **yacht**.

30 Branding

30.1 Parts of the **yacht** shall be reserved for **event** branding, class insignia, national flags, etc. This Rule will be amended in accordance with Rules 33.1 and 34 to specify requirements for such branding.

31 Measurement

31.1 Measurement procedures and requirements for measurement documentation will be published according to the schedule provided in Rule 34.

31.2 The **Measurement Committee** may place measurement marks or seals on **yacht** components during construction or upon their completion. These marks or seals may include, but are not limited to, reference screws, punch marks, measurers' signatures, cable ties and stickers, on components or component tooling. **Competitors** shall permit inspections, allow such marks to be placed, and shall not move, remove or alter any such marks or seals without the express consent of the **Measurement Committee**.

31.3 **Competitors** shall permit the **Measurement Committee** to take samples of material from components of the **yacht** to ensure compliance with Rule 6.

31.4 **Competitors** shall permit the **Measurement Committee** to take samples of paint or vinyl from components of the **yacht** to ensure compliance with Rule 9.

31.5 If requested, or required by a measurement procedure, **Competitors** shall provide the **Measurement Committee** with source code and compiled executables of any software installed on the **yacht** that the **Competitor** has access to, and shall assist them in the understanding of such code.

31.6 **Competitors** shall permit the **Measurement Committee** to:

(a) interview team members; and

(b) require team members to complete affidavits

relating to questions from the **Measurement Committee** on design, construction or use of components on the **yacht**.

31.7 The **hull** of an **AC75 Class Yacht** shall be allocated a sail number by the **Measurement Committee** when it is first launched. **Competitors** shall inform the **Measurement Committee** when this occurs, and sail numbers will be allocated sequentially, except that culturally objectionable numbers may be skipped at the discretion of the **Measurement Committee**.

31.8 Leading up to **events**, the **Measurement Committee** will publish dates of measurement periods, during which **Competitors** may present their **yachts** for measurement. The **Measurement Committee** will inspect the **yachts** for compliance with this **AC75 Class Rule**, and **Competitors** shall provide whatever assistance is requested by the **Measurement Committee** to facilitate this process.

31.9 The **Measurement Committee** shall use its own equipment for measuring a **Competitor's yacht**, except that a **Competitor's** equipment may be used at the discretion of the **Measurement Committee** if it is calibrated against the **Measurement Committee's** equipment and sealed to their satisfaction.

31.10 When weighing components of a **yacht**, **Competitors** shall be permitted to dry any water on the surface of those components and replace wet rigging with equivalent dry rigging.

31.11 The **Measurement Committee** shall issue a measurement certificate for a **yacht** when they have:

(a) concluded that she complies with this **AC75 Class Rule**;

(b) received completed declarations and affidavits as required by this **AC75 Class Rule** and as additionally required by the **Measurement Committee** or the **Rules Committee** at their discretion; and

(c) received all documentation as required by this **AC75 Class Rule** and by other notices published by the **Measurement Committee** or the **Rules Committee**, and confirmed that the documentation is satisfactory.

31.12 Information on a **yacht's** measurement certificate shall include, but is not limited to, her:

(a) name;

(b) the **hull** sail number and **hull IGES** reference;

(c) builder(s);

(d) owner(s);

(e) measurement **yacht assembly** mass m_Y, and **longitudinal** centre of mass x_Y; and

(f) **foil**, **rudder** and **mast** configuration.

31.13 The measurement certificate will be invalidated if:

(a) the **yacht**, in measurement condition, changes with respect to any details listed in the measurement certificate, except for:

(i) a change in measurement **yacht assembly longitudinal** centre of mass x_Y, of up to ± 25 mm from the recorded value;

(b) the **hull surface** is modified according to Rule 5.9;

(c) any **foil**, **rudder** or **mast tube** that is installed on the **yacht** is modified according to Rule 5.10;

(d) the **Measurement Committee** believe that the **yacht** no longer complies with the **AC75 Class Rule**; or

(e) the **Measurement Committee** believe that the certificate was issued in error.

31.14 **Competitors** shall inform the **Measurement Committee** immediately if they make any changes or repairs to the **yacht** that could affect her measurement certificate or her compliance with the **AC75 Class Rule**.

31.15 The **Measurement Committee** reserve the right to re-measure or inspect any aspect of a **yacht** at any time, before or after sailing, and may publish procedures for regular measurement inspections.

31.16 When a measurement period is open:

(a) if the **Measurement Committee** believes there is ambiguity as to whether an element of a **Competitor's yacht** satisfies the **AC75 Class Rule**, they shall seek the advice of the **Rules Committee**. If the ambiguity remains, the **Rules Committee** shall rule confidentially on the compliance or otherwise of the **yacht**, based on the information presented to them by the **Measurement Committee**, after which a measurement certificate may be issued or withheld;

(b) if the **Rules Committee** becomes aware of an element of a **Competitor's yacht** that may not satisfy the **AC75 Class Rule**, they shall ask the **Measurement Committee** to inspect the element and report to them. The **Rules Committee** shall then rule confidentially on the compliance or otherwise of the **yacht**, after which a measurement certificate may be withdrawn or withheld;

(c) decisions on the compliance of a **yacht** made by the **Measurement Committee** and/or the **Rules Committee** may subsequently be changed by the **Measurement Committee** or the **Rules Committee** if new information comes to light, or if they believe the original decision was made in error. Only an interpretation shall provide a **Competitor** with a guarantee of continuing compliance of an ambiguous design element; and

(d) if a measurement certificate is withheld from a **Competitor**, the **Measurement Committee** shall explain in full the reasons why the **yacht** does not comply with the **AC75 Class Rule**, including the detail of decisions made or advice given by the **Rules Committee**.

32 Interpretation

32.1 A **Competitor** may seek an interpretation of this **AC75 Class Rule** by submitting a request to the **Rules Committee**. The **Measurement Committee** or the **Rules Committee** can also initiate an interpretation, providing that the interpretation does not reveal a design characteristic that might not have been considered by some **Competitors**.

32.2 When a request for interpretation is received by the **Rules Committee**, the following process shall be followed:

(a) the **Rules Committee** may propose improved wording to the **Competitor** seeking the interpretation, which that **Competitor** is not obliged to accept;

(b) as soon as practicable, the interpretation is anonymised and circulated by the **Rules Committee** to all **Competitors**;

(c) within 5 days of receipt, **Competitors** may supply comments and/or a proposed interpretation response to the **Rules Committee**;

(d) within 7 days of the feedback from **Competitors** being due, the **Rules Committee** agree on a draft interpretation and circulate this to the **Competitors**;

(e) within 3 days from the draft being sent, **Competitors** may respond to the **Rules Committee** with comments on the draft;

(f) within 3 days of feedback from **Competitors** being due, the **Rules Committee** then either issues the previous draft as final, or modifies and recirculates the draft, in which case the process reverts to step 32.2 (e).

32.3 The **Rules Committee** may, at their discretion, shorten any of the times allowed in Rule 32.2, particularly leading up to or during **events**.

32.4 With the agreement of the **Competitor** seeking the interpretation, the **Rules Committee** may lengthen any of the times allowed in Rule 32.2.

32.5 Interpretations shall be based on the following principles:

(a) interpretations shall consider only the words in this **AC Class Rule**, not their possible intent;

(b) where wording is ambiguous, the most reasonable and natural interpretation of the written words shall be taken;

(c) interpretations shall not contradict any part of this **AC Class Rule** unless a part thereof is found to directly contradict another part, in which case a part that refers to more detail shall take precedence over a part that is more general; and

(d) where, after the above Rules are applied, there remains ambiguity or contradiction as to whether a particular feature is permitted, an interpretation shall be permissive.

32.6 The **Rules Committee** may seek the advice of independent experts, including a member of the **Measurement Committee**, when considering an interpretation.

32.7 Once an interpretation has been issued as final, it cannot be modified without the explicit agreement of all **Competitors**.

32.8 Advice or opinions on the meaning of a Rule, from a member of the **Measurement Committee** or **Rules Committee**, are not binding except through an interpretation.

33 Amendment

33.1 The **AC75 Class Rule** may be amended:

(a) at any time by unanimous consent of **Competitors** still competing;

(b) at any time by the **Rules Committee**, with the agreement of **COR/D** and the **Regatta Director**, for changes relating to:

(i) supplied or specified components;

(ii) safety;

(iii) safety equipment;

(iv) media equipment;

(v) **event** branding; or

(vi) guest racers,

including their impact on masses and centres of mass controlled by Rule 10. In making any such amendments, the **Rules Committee** shall consider the impact of their proposed changes on all **Competitors**, taking account of the state of their design and construction programmes, so that any burden imposed is proportional to the need for amendment.

34 Dates

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

Date	Rule	Who	Item
31/08/2018	20.1	**COR/D**	The **mast** drawing package.
31/10/2018	12.15, 17.6	**COR/D**	Reserved area for the supplied **Media System**.
31/10/2018	26.4	**Rules Committee**	Additional constraints on **crew indication devices**.
31/12/2018	6.13	**Rules Committee**	Material certificates and declaration requirements.
31/12/2018	22.12	**Rules Committee**	Types and positions for pressure relief valves.
31/12/2018	26.6	**COR/D**	**Media System** details and protocols.
28/02/2019	5.4	**Rules Committee**	Template spreadsheet to track components.
30/06/2019	11.20, 17.7	**Rules Committee**	Measurement procedures for loads tests.
30/06/2019*	28.3 (f)	**COR/D**	Media equipment worn by crew.
30/06/2019*	28.6	**Rules Committee**	Crew weighing schedule.
30/06/2019*	30	**COR/D**	**Event** branding.
30/06/2019*	31.1	**Rules Committee**	Measurement procedures and documentation.
30/11/2019	27.4	**Rules Committee**	**FCS** usage restrictions.
31/03/2020	8.4 (b) (ii)	**Rules Committee**	Last submission of **commercial products**.
31/08/2020	27.9	**Rules Committee**	**FCS** system updates frozen.

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

35 Definitions

35.1 **AC75 Class Rule**

The rule governing the yachts to be used in the America's Cup World Series, the Christmas Cup, the America's Cup Challenger Selection Series and the Match and/or in any other regattas sailed in AC75 Yachts (if any), including all amendments to, interpretations of and rulings regarding such class rule.

35.2 **AC75 Class Yacht**

A yacht that complies with or could comply with the **AC75 Class Rule**.

35.3 **Actuator chamber**

A volume occupied by hydraulic fluid within a **hydraulic actuator** and extending until the first valves in connected lines.

35.4 **Batten**

A beam used to locally stiffen a sail.

35.5 **Bearing centre**

The centre of rotation of a bearing.

35.6 **Bowsprit**

A spar projecting forward from the bow to which the **code zero** can be attached.

35.7 **Cant**

Rotation of a **foil** about the **foil arm** rotation axis.

35.8 **Carried equipment**

Clothing, safety equipment, other equipment, food and drink carried aboard by the crew.

35.9 **Challenger of Record**

As defined in the **Protocol**.

35.10 **CIS**

Crew information system: an electronic system connected to the **Media System** to display the raw or processed **Competitor** data output from the **Media System** to the crew, and to provide voice communication between the crew.

35.11 **Clew point**

The intersection or projected intersection of the **leech** and **foot** of a **sail skin**. The intersection shall be projected when the **leech** or **foot** curvature reduces below a radius of 1.0 m.

35.12 **Code zero**

A **headsail** set forward of the forestay from the **bowsprit**.

35.13 **Commercial product**

A classification of products controlled by Rule 8.

35.14 **Competitor**

As defined in the **Protocol**.

35.15 **Control function**

A permitted degree-of-freedom of motion, or deformation, of a **control surface**. All **control functions** of a **control surface** must be distinct from each other, with no significant overlap in their functionality, and that functionality must relate to a clear **control surface** motion or deformation. Examples include **rudder** rake rotation, **rudder** yaw rotation, and permitted sail controls such as **headsail** sheet, sheeting position, cunningham, and **mainsail** sheet, traveller, head twist, etc.

35.16 **Control surface**

One of the following:

(a) The combination of a **mast** and a **mainsail** acting together;

(b) A **foil flap**;

(c) A **rudder**; or

(d) A **headsail**.

Where position, orientation or movement of a **control surface** is mentioned herein, that position, orientation or movement is implied to be relative to the **yacht**, or in the case of a **foil flap**, relative to the **foil wing** to which it is attached.

35.17 **Control system**

A system used for the adjustment of **control surfaces**, including all mechanical, hydraulic and electrical components involved in supplying or transmitting power or information used for such adjustment.

35.18 **COR/D**

The **Challenger of Record** and the **Defender** jointly.

35.19 **Core**

Material that is bonded between two structural **FRP** skins in a sandwich construction, primarily to transfer shear. **Core** includes any material that is bonded to both skins, such as a corrugated laminate between two skins, but excludes:

(a) solid laminate or metal used within edge, taper or local reinforcement details; and

(b) adhesives and resins used to bond skins and core, or to fill honeycomb cells.

35.20 **Crew indication device**

Any device that:

(a) contains an electronic system, or is connected directly or indirectly to an electronic system;

(b) displays or plays audibly information that it has received or generated internally;

(c) is worn or installed on the **yacht**;

(d) can be seen or heard by the crew, directly or indirectly; and

(e) may process data internally,

such as a display, LED or speaker.

35.21 **Deck**

The upper part of a **hull surface** that is divided by the **perimeter line**.

35.22 **Defender**

As defined in the **Protocol**.

35.23 **Drive clutch**

A device that engages and disengages a common mechanical drive train to or from a device supplying power to a **control function**.

35.24 **ECC**

Electrical control circuit: an electrical and/or electronic circuit within a **control system** and/or for sending commands to an **FCS**.

35.25 **Electric actuator**

An electric linear or rotary motor, or functionally equivalent device, that converts electric power into force and translation, and/or torque and rotation.

35.26 **Event**

Any regatta that forms part of the 36th America's Cup.

35.27 **External forces**

Forces applied from outside the **yacht** to the **yacht**, such as fluid pressure, fluid dynamic friction and gravity.

35.28 **FCS**

Foil cant system: a supplied system for controlling the rotation of the **foils** about **longitudinal** axes in the **hull**.

35.29 **Foil**

An appendage that provides side force and vertical lift.

35.30 **Foil arm**

Part of a **foil** that connects the **FCS** to the **foil wing**.

35.31 **Foil arm drum**

A fairing to close a penetration in the **hull** that allows **cant** rotation of a **foil arm**.

35.32 **Foil arm fairing**

Those parts of a **foil arm** that are not part of the **foil arm stock**. Although a **foil arm fairing** may be referred to in the singular, it can comprise several unconnected parts, each attached to a different region of the **foil arm**.

35.33 **Foil arm stock**

A supplied component forming the structural spar of a **foil arm**.

35.34 **Foil cant reference point**

The point at the intersection of the **foil cant** axis and the **FCS transverse** reference plane, as defined in the one-design **FCS** drawings.

35.35 **Foil flap**

A component attached to a **foil wing** that rotates and twists to control the **foil's** lift.

35.36 **Foil wing**

Part of a **foil** that, in conjunction with a maximum of two **foil flaps**, produces most of the **foil's** lifting force.

35.37 **Foot**

The bottom edge of a **sail skin**.

35.38 **Foot girth**

The distance from the **tack point** to the **clew point** for a **headsail sail skin** or **tack point** to the **lower leech point** for a **mainsail sail skin**.

35.39 **Force input device**

A device that is moved by one or more crew members to provide control and/or power input, and whose movement, resistance to movement or response can, where expressly permitted within the **AC75 Class Rule**, be affected by certain parts of the **yacht state**. Examples are a sheet or winch connected to a sail, a grinding pedestal connected to a mechanical drive train or hydraulic pump, and a helm wheel connected through cables to a **rudder**.

35.40 **FRP**

Fiber-reinforced polymer matrix composite.

35.41 **Hardwired**

Physically connected by electrical wires, including localised electromagnetic or optical coupling between system components (e.g. galvanic isolation of protocol bus, optical isolation of IO device) provided information exchange is confined to the wiring circuit.

35.42 **HCC**

Hydraulic control circuit: a hydraulic circuit within a **control system**.

35.43 **Head**

The top edge of a **sail skin**.

35.44 **Head girth**

The distance from the **head** point to the **peak point** of a **sail skin**.

35.45 **Head pennant**

A cable used as an extension of a halyard to accommodate a sail with reduced **luff** length.

35.46 **Head point**

The intersection or projected intersection of the **luff** and **head** of a **sail skin**. The intersection shall be projected when the **luff** or **head** curvature reduces below a radius of 1.0 m.

35.47 **Headsail**

A sail set forward of the **mast**.

35.48 **High-pressure circuit**

All hydraulic circuits within an **HCC** that are not **actuator chambers** or **low-pressure circuits**.

35.49 **Hull**

The main body of the **yacht**, including the bottom, sides, transom, **deck**, cockpit and internal structure but not the **mast**, rigging, sails, appendages or fittings.

35.50 **Hull IGES**

A geometry file representing the as-designed **hull surface**.

35.51 **Hull lower surface**

The lower part of a **hull surface** that is divided by the **perimeter line**.

35.52 **Hull shell**

The monolithic or sandwich panel construction that forms the structure of the **hull surface**, excluding internal structure and local reinforcements such as bulkheads, ring frames, longituindal beams, stringers or taping details.

35.53 **Hull surface**

The external surface of a **hull**, where:

(a) fittings such as pedestals, helm wheels and deck gear shall be excluded; and

(b) local details may be excluded, provided they have no significant aerodynamic, hydrodynamic or hydrostatic effect. Examples of such details that may be excluded are:

  (i) local reinforcements for deck hardware;

  (ii) recesses for winches; and

  (iii) local foot rests.

The **hull surface** is divided into the **deck** and **hull lower surface** by the **perimeter line**.

35.54 **Hydraulic actuator**

A hydraulic ram, hydraulic motor or functionally equivalent device that converts hydraulic pressure and flow into force and translation, and/or torque and rotation.

35.55 **IG**

The intersection of the centre line of the forestay with the leading edge of the **mast**, as shown in Figure 20.3.

35.56 **ILS**

Instrumentation and logging system: an electronic instrumentation circuit including devices such as sensors, processing units and logging systems.

35.57 **Isolated**

Electrically insulated so as to prevent the passage of electricity, and physically separated so that isolation is apparent by inspection. **Isolated** cabling may be bundled together, so long as individual cables within a bundle can be followed, but cables from two **isolated** systems must not share common connectors.

35.58 **IZ**

The intersection of the centre line of the **code zero** halyard with the leading edge of the **mast**, as shown in Figure 20.3.

35.59 **JG**

The distance between **MRP** and the intersection of the centreline of the forestay and a plane 1.500 m above MWL with the rig at dock tune as defined in Figure 20.3.

35.60 **Jib**

A **headsail** hoisted on the forestay.

35.61 **LCP**

Longitudinal centre plane.

35.62 **Leech**

The aft edge of a **sail skin**.

35.63 **Leech points**

For any **sail skin** a **leech point** is the intersection of **leech** and a line perpendicular to the line from the **lower leech point** to the **head point** taken at the corresponding percentage of **LL** from the **lower leech point**. **Leech points** are illustrated in Figures 19.1 and 20.2.

35.64 **Linear component**

A component of the **yacht**:

(a) that has no moving parts or mechanisms;

(b) for which any two points on or within it must either always be in contact, or never be in contact;

(c) whose overall deformation at any point, in response to normal sailing loads, is approximately linear; and

(d) that always returns to the same state in the absence of applied load.

Such components may be constructed from multiple parts and fastened together **mechanically**, but such fastening must be such that the final component satisfies the above conditions.

35.65 **LL**

The distance from the **head point** to the **clew point** for a **headsail sail skin** or the lower **leech point** for a **mainsail sail skin**.

35.66 **Longitudinal**

Orthogonal to **TRP**.

35.67 **Low-pressure circuit**

Hydraulic circuits within an **HCC** that return hydraulic fluid to reservoirs and supply hydraulic pumps with hydraulic fluid from reservoirs.

35.68 **Lower leech point**

For any **sail skin** of the **mainsail** the **lower leech point** is the intersection of a 26.750 m diameter circle centred at the **head point** and the **leech** or the projection of the **leech**. For any **headsail** the **lower leech point** is at the **clew point**.

35.69 **LP**

The distance, measured perpendicular to the **luff**, from the **luff** to the **clew point** of a **sail skin**.

35.70 **Luff**

The forward edge of a **sail skin**.

35.71 **Mainsail**

The combination of **sail skins** and associated components that are hoisted on the **mast**.

35.72 **Mast**

All components of the rig that are not hoisted with the **mainsail** or **headsails**. This includes **mainsail** support structures and **control systems** such as booms that are not part of the **mainsail** as well as halyards, rigging, spreaders, fittings, fairings, instrument displays, instrument sensors, cameras, cables, flotation systems and hydraulic rams that remain as part of the rig whilst sailing. Sheets shall be considered as part of the **mast** if they cannot be easily disconnected from **mast** structures and **control systems**.

35.73 **Mast centre plane**

The plane perpendicular to the aft face of the **mast surface** and coincident to the lengthwise centre line of the aft face of the **mast surface** as shown in Figure 20.1.

35.74 **Mast lower plane**

The plane perpendicular to the aft face of the **mast surface** at a height along the aft face of the **mast surface** of 1.200 m above the **MRP** as shown in Figure 20.3.

35.75 **Mast lower zone**

The lower **mast** zone as illustrated in Figure 20.3.

35.76 **Mast surface**

The external surface of the **mast tube** as given in the **mast** drawing package described in Rule 20.1.

35.77 **Mast tube**

The principal spar of the rig. This includes the one design laminate provided in the **mast** drawing package described in Rule 20.1 as well as any team designed reinforcements permitted in Rule 20.3. The **mast tube** excludes any attached components such as **mainsail** support structures and **control systems** as well as taping or local reinforcements for the connection of such components.

35.78 **Mast upper plane**

The plane oriented at 5° to the **mast lower plane** at a height along the aft face of the **mast surface** of 26.5 m above **MRP** as shown in Figure 20.3.

35.79 **Mast upper zone**

The upper **mast** zone as illustrated in Figure 20.3.

35.80 **Measurement Committee**

A committee responsible for ensuring a **yacht** satisfies the **AC75 Class Rule**.

35.81 **Mechanically**

Only through contact of components, without the use of hydraulic, pneumatic, magnetic or electrical components.

35.82 **Media System**

A supplied system for managing the flow of data, audio and video around the **yacht** and off the **yacht** for broadcast.

35.83 **MRP**

Mast rotation point. The point about which the mast base rotates relative to the **hull**.

35.84 **MWP**

Measurement waterline plane.

35.85 **Official Dictionary**

The Oxford English Dictionary as it exists in the official online dictionary available at www.oed.com (or such later official website of the Oxford English Dictionary).

35.86 **Passive input device**

A device that is moved by a crew member to produce an electrical control signal, where that control signal relates only to the crew member's manual input and is not significantly affected by the **yacht state** (except for unintended manual input caused, for example, by a crew member falling on to a button). Examples are buttons, joysticks, sliders or touch screens.

35.87 **Peak point**

The intersection or projected intersection of the **leech** and **head** of a **sail skin**. The intersection shall be projected when the **leech** or **head** curvature reduces below a radius of 1.0 m.

35.88 **Perimeter line**

The line on the **hull surface** that forms the perimeter of the **hull surface** when **projected** on to **MWP**. Where the **hull surface** is vertical on its perimeter, the **perimeter line** shall pass through the highest points on that vertical surface.

35.89 **Platform assembly**

The **hull**, **foils**, **rudder**, **bowsprit** and other systems, hardware, fittings, rigging and supplied equipment that is weighed with those components.

35.90 **Projected**

The **projected** shape of a part is the shape of a shadow cast by that part on the specified plane from a parallel light source acting normal to that plane.

35.91 **Protocol**

The Protocol of the 36th America's Cup between the Royal New Zealand Yacht Squadron and Circolo Della Vela Sicilia.

35.92 **Regatta Director**

The person appointed pursuant to Article 20 of the Protocol.

35.93 **Rondure**

A line formed by the leading edge of an appendage **projected** on to **TRP**.

35.94 **Rudder**

An appendage positioned on the centreline of the **hull** which is rotated to affect yaw and trim.

35.95 **Rules Committee**

A committee responsible for ruling on **AC75 Class Rule** interpretations and producing measurement procedures.

35.96 **Sail hardware**

Components of a sail for the purpose of attachment or applying pre-tension of sail controls and **battens**. If two or more components are rigidly connected together then they will be considered as a single piece of **sail hardware**.

35.97 **Sail skin**

A thin and predominantly flexible membrane of a **headsail** or **mainsail**. **Sail skins** include stickers, branding, **batten** pockets, **luff** pockets as well as any reinforcements such as edge tapes or corner patches.

35.98 **Supplied rigging**

The supplied forestay, V1 cap shrouds, D1 lower shrouds, and running backstays.

35.99 **Symmetric**

A component that is required to be **symmetric** must be designed to be exactly symmetric, and the built shape must lie within the specified tolerance of the designed shape everywhere on its surface. Such a component must also be designed to be almost exactly symmetric in its structure, where any structural asymmetry can only be to allow connection details or staggers in ply lay-up across the symmetry plane, to use right-handed screw threads, etc., and not to deliberately induce asymmetric structural behaviour.

35.100 **Tack point**

The intersection or projected of the **luff** and **foot** of a **sail skin**. The intersection shall be projected when the **luff** or **foot** curvature reduces below a radius of 1.0 m.

35.101 **Transverse**

Orthogonal to **LCP**.

35.102 **TRP**

Transom reference plane.

35.103 **Uncontrolled component**

A **commercial product** that is not subject to elastic modulus, construction temperature or construction pressure constraints. Examples include, but are not limited to, pre-consolidated **FRP** plate, a winch, a block, a traveller track and a hydraulic valve.

35.104 **Wetted**

The **wetted** part of a component is that part of a component that extends or can extend outside of the **hull IGES**.

35.105 **Woolly**

A piece of wool or light fabric used only for flow visualisation.

35.106 **Yacht**

AC75 Class Yacht.

35.107 **Yacht assembly**

The combination of the **platform assembly**, the **mast** and the **mainsail**.

35.108 **Yacht state**

The specific condition of the **yacht**, comprising all of the following:

(a) the position and orientation of the **yacht** in space;
(b) the position and orientation of any **control surface**;
(c) the position and orientation of a **foil**;
(d) the position and orientation of any **force input device** or part thereof;
(e) the stress, strain, tension and force in any part of the **yacht**, except in **passive input devices**;
(f) other force-related quantities in any part of the **yacht**;
(g) the volume, velocity, flow rate or pressure of fluid within, or acting on, any part of the **yacht**;
(h) all absolute measures of the above and quantities measured relative to each other;
(i) the water or wave height or velocity relative to the **yacht**;
(j) all time derivatives of the above;
(k) all quantities derived from any of the above; and
(l) all quantities from which the above can be derived or approximated.