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IRSA Interpretation 2020-IOM-1 of the International One Metre Class rules

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ABBREVIATIONS

IRSA	International Radio Sailing Association
IOM ICA	International One Metre International Class Association
CR	Class Rules
ERS	Equipment Rules of Sailing
RRS	Racing Rules of Sailing

DEFINITIONS

The following words and phrases have these definitions in this interpretation.

bold, italics	A term in bold is defined in the ERS, whereas a <i>term</i> in italics is defined in the RRS.
Member	A DNM, an Associate Member, or a Provisional Member of IRSA.
shall/may	In this document, the word “shall” specifies a mandatory action or procedure, while the word “may” is permissive.
will	In this document, the word “will” specifies an intention.



Requests received

I will like to address an issue related to evolving building technologies, and in particular 3D printing and related raw materials.

According to CR D.2.1 (a) (8), the hull, (...) shall be made of and joined using one or more of the following materials

(8): Thermoplastic, which may be moulded, containing only permitted materials.

With the new technologies, in particular 3D printing using thermoplastic thread, parts can be made by overlapping several lays of raw material on the basis of a digital model. The thermoplastic thread may contain unauthorized materials for hull building (trace of carbon for example).

We have two related questions:

Q1: For IOM, can a hull and fittings be made by 3D printing using authorized material as defined in D.2.4 (a)?

Q2: What is the accepted ratio (in percentage) of unauthorized materials in the composition of the thermoplastic thread used for hull building?

Joseph Ynesta,

Chairman Technical Committee (For the French NCA).

Relevant rules (2018 edition of the IOM CR)

The rules in Part II are **closed class rules**. Certification shall be carried out in accordance with the ERS except where varied in this Part.

D.2 HULL

D.2. MATERIALS

(a) Subject to (b) and (c), the hull, excluding fittings and remote control equipment but including any supports and containers for such items, shall be made of and joined using one or more of the following materials:

- (1) Metal,
- (2) Wood; wood based products containing only permitted materials,
- (3) Resin, which may be coloured and/or reinforced with glass fibres,
- (4) Adhesive,
- (5) Varnish; paint,
- (6) Film covering materials which may be reinforced by means of polyester fibres,
- (7) Elastomer,
- (8) Thermoplastic, which may be moulded, containing only permitted materials.



- (b) With the exception of elastomer, materials shall not be: expanded, foamed, honeycombed.
- c) Unrestricted by (a) and (b):
 - (1) A builder's mark may be applied,
 - (2) The **hull** registration number shall be applied.

D.2.2 CONSTRUCTION

Construction is unrestricted subject to the following:

The **hull** shall be a monohull.

- (a) Except for trunking for the **keel** and **rudder**, the **hull** shall not have:
- (b) Voids in the **waterplane** and/or the underwater profile,
 - (1) Hollows in the plan view that exceed 3 mm,
 - (2) Hollows in the underwater profile that exceed 3 mm,
 - (3) Transverse hollows in the undersurface of the **hull** that exceed 3 mm when tested parallel to the **waterplane** as in figure H.2.
- (c) The forward 10 mm of the **hull** shall be made of elastomer.
- (d) The **rudder** shall be attached to the **hull** aft of where the **keel** is attached.

D.2.3 CONSTRUCTION TECHNIQUES

Construction techniques for forming a **hull** are unrestricted subject to Compliance with D.2.1.

D.2.4 FITTINGS

Fittings are unrestricted except that:

- (a) Fittings that can contribute to the stiffness and/or strength and/or watertight integrity of the **hull** shall be of materials permitted by D.2.1.
- (b) Ball and/or roller bearings may only be used for: **sheet** control line blocks, **mainsail boom sheet** blocks and **headsail boom sheet** blocks.
- (c) Fittings shall not project outboard of the **hull** shell or deck.

Discussion

Q1: For IOM, can a **hull** and fittings be made by 3D printing using authorized material as defined in D.2.4 (a)?

3D printing of the hull

Construction techniques for forming a **hull** are unrestricted according to the CR D.2.3. The "3D printing" is one of construction techniques which may be used for **hull** forming.



CR D.2.3 is limiting the construction techniques so they have to be in compliance with the CR D.2.1.

Materials permitted for making a hull are listed in the CR D.2.1 so the 3D printing of a hull is permitted only if materials listed in the CR D.2.1 are used.

CR D.2.1(a)(8) is allowing thermoplastic as material for forming a hull. It is also stating that thermoplastic may be moulded. Moulding is a construction technique. Construction techniques are dealt with in the CR D.2.3 and they are unrestricted so this redundancy in the wording is probably not necessary.

Material(s) used for 3D printing of the hull are certainly thermoplastic. For the purpose of this interpretation following definition of the thermoplastic shall be used: "Thermoplastic is a material, usually a plastic polymer, which becomes softer when heated and hard when cooled. Thermoplastic materials can be cooled and heated several times without any change in their chemistry or mechanical properties. When thermoplastics are heated to their melting point, they melt to a liquid. They freeze to a glassy state when cooled below their glass transition temperature." ABS, PVC, PC, PLA, PETG and NYLON are some examples of plastic polymers mentioned in the above definition of thermoplastic.

CR D.2.1(a)(8) is also stating that thermoplastic shall contain only permitted materials i.e. only those materials listed in the CR D.2.1(a). None of listed permitted materials are likely to be included in the thermoplastic except perhaps metal. The fact that the resin (listed in CR D.2.1(a)(3)) may be reinforced with glass fibres means that resin may include glass fibres but does not mean that glass fibres are permitted in thermoplastic material.

Reference is also made to the IOM Q&A: "Are "pellettised" thermoplastics with unknown additives permitted?":

Start of quote

Question:

Are "pellettised" thermoplastics with unknown additives permitted?

Question details:

"Thermoplastic" mentioned in IOM Class Rule D.2.1(a)(8) means "Softens when heated, re-hardens on cooling". It is assumed that the rule permits vacuum formed hulls made from ABS PVC etc. but does it permit more materials? Are "pellettised" thermoplastics with unknown additives permitted?

Reference to the old interpretation issued before year 2017

Interpretation 2003-IOM-4 on the IOM CR – edition 2002

Answer:

Pelletised thermoplastics are allowed for the construction of the hull if they are in the compliance with the IOM class rule D.2.1(8) i.e. if containing only permitted materials.

End of quote



Pigments used to dye a thermoplastic used for 3D printing is allowed as constituent part of the 3D printing filament.

CR D.2.1(b) does not permit honeycombed material. The use of a 3D printing process known as "infil" can result in a honeycomb like structure and therefore this process is not permitted.

3D printing of the fittings

According to the CR D.2.4, fittings are unrestricted except as stated in the D.2.4(a) so fittings may be 3D printing using not only material listed in the D.2.1 providing such fittings are not contributing to the stiffness and/or watertight integrity of the **hull**.

Q2: What is the accepted ratio (in percentage) of unauthorized materials in the composition of the thermoplastic thread used for **hull building**?

International One Metre Class are **closed class rules** in which anything not specifically permitted by the **class rules** is prohibited.

Materials that are not specifically permitted are prohibited. No unauthorized materials are permitted.

Conclusions

Answer on Q1

Hulls and fittings that can contribute to the stiffness and/or strength and/or watertight integrity of the **hull** made with 3D printing are permitted using thermoplastic without any reinforcing in the filament. A 3D printing process known as "infil" is not permitted.

Signed declaration by the builder on the Certification Control Form is required stating that only permitted materials have been used for **hull** manufacturing. The moulder of the **hull** may wish to add a declaration for this purpose to his moulder's tag.

Other fittings which are not contributing to the stiffness and/or strength and/or watertight integrity of the **hull** may be 3D printed without restrictions.

Answer on Q2

No unauthorized materials are permitted.



Action required

The wording of the CR D.2.1 should be improved. Thermoplastic material(s) intended for 3D printing, vacuum forming or used in any other construction technique have to be clearly listed. Wording “,which may be moulded,” to be deleted as redundant because construction techniques are explained in the CR D.2.3.

If the IOM ICA want to allow reinforced thermoplastic material(s) used for 3D printing, amendment of the IOM CR is needed.

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