



9° MONACO ENERGY BOAT CHALLENGE

POWERED BY
YACHT CLUB DE MONACO
4-9 JULY 2022

TECHNICAL RULES Monaco Energy Class

The Yacht Club de Monaco welcomes all teams interested in participating in the Monaco Energy Boat Challenge 2022.

The Monaco Energy Boat Challenge is owned and managed by the Yacht Club de Monaco;

The Monaco Energy Class was launched in 2018 and has seen a rise in interest from teams worldwide.

The participation of a team in Monaco is subject to a validation & invitation by a Selection Committee.

The Yacht Club de Monaco put at the disposal of each selected team a hull, the teams will design and build the cockpit and propulsion system as per the rules stated below.

This Technical Rule sets out the rules of the Monaco Energy Class and may be subject to modifications which, if necessary, will be communicated on the website of the Monaco Energy Boat Challenge. www.energyboatchallenge.com

DOCUMENT CONTROL

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by Yacht Club of Monaco

Changes to version 4.1 are highlighted in yellow



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1. General

- 1.1. The Monaco Energy Boat Challenge is owned and managed by the Yacht Club de Monaco.
- 1.2. The Yacht Club de Monaco will provide for the race a set of hull to each team available in Monaco.
- 1.3. Teams will have to build a cockpit including the propulsion system with controls & steering and fit it to the hull.
- 1.4. The rules are published on the YCM's website and are binding for all participants and teams.
- 1.5. The Technical Regulations presented in this document serve as directives for the races. Situations that are not covered by the Rules will not be authorised.
- 1.6. This Technical Rule sets out the rules of the Monaco Energy Class and may be subject to modifications which, if necessary, will be communicated on the website of the Monaco Energy Boat Challenge. www.energyboatchallenge.com
- 1.7. All questions concerning the Technical Regulations must be submitted to the Organisation in writing: energychallenge@ycm.org
- 1.8. For the purpose of these rules, an Event (ie: the Monaco Energy Boat Challenge) will be made of several Races.



2. The Hull

2.1. The hull is made of 2 hulls and 2 beams bolted together. The beams are round carbon fibre poles. They will be used to support and secure the cockpit.

2.2. Dimensions

Overall Length	5 m
Overall Width	2.5 m
Free board height	0.45 m
Beam Diameter	10cm
Longitudinal distance between beams	3m
Total Weight of hulls + beams	55kg

2.3. The hull has been designed to comply with French Category C meaning that the hull has been designed to sustain winds up to 6 Beaufort and a 2-metre significant wave height.

2.4. Hulls have been constructed to be unsinkable. This is achieved by means of watertight compartments and buoyant materials integrated to the hull.

2.5. Participants are not allowed to modify or transform the hulls and beams at any time during construction, testing or the event.



3. The Energy Source

- 3.1. At any moment the maximum energy onboard is limited and measured to 10Kwh energy arriving in the engine, (whatever the type of energy) and the maximum pressure will be 700 bars. The calculation of the amount of energy onboard will have to be submitted to the technical committee 2 months before the event. Failure to comply will be subject to penalties in the Fleet Race. The use of energy storage over the 10Kwh capacity is banned.
- 3.2. A data logger may be provided by the Organiser, the team must install & make operational the system before the start of the race.
- 3.3. Teams using fuel cells are to provide calculation/demonstration of fuel cell efficiency otherwise 70% efficiency will be considered by the Technical Committee.
- 3.4. The energy source can be controlled at any time during the event by the Technical Committee.
- 3.5. Containers of the energy source will have to conform to current transport regulations. (Décret n° 2001-386 du 3 mai 2001 modifié + Arrêté du 3 mai 2004 modifié + Arrêté du 29 mai 2009 modifié + ISO 21487:2012). **Adequate pressure relief devices are mandatory for all gas pressure systems**, The pressure relief valve has to be oriented toward the back of the boat (as far away from the pilot as possible).
- 3.6. **Each enclosed space susceptible to contain H2 should be equipped with a hydrogen leak detector, or be ventilated at a sufficient ratio to remain below 2% H2 concentration in case of leak. In the event of a leak or detection of hydrogen, all gas pressure systems should be shut down automatically. Compartment ventilation should be on a separate circuit and continue to function after this automatic shutdown.**
- 3.7. Hydrogen containers onboard and stored onshore will have to be fitted with a gas cylinder gripping tulip. Containers and their fittings onboard and onshore must be either TPED, EC79 or R134 compliant.
- 3.8. **Statement of testing and service for all hydrogen gas bottles dating no further back than 11 July 2021.**
- 3.9. Batteries shall be used within their nominal capacity and operating temperature range.
- 3.10. The energy source must be properly fixed/stored onboard to withstand the sea conditions defined in the French Category C weather classification. An energy container cannot be placed inside the area where the pilot is seated or under the pilot seat. Any ventilation from the energy source must be orientated to blow away from the pilot. Please refer to Chapter 5 for additional rules.
- 3.11. A dedicated battery can be installed to provide power for any visualisation, communication, satellite positioning and telemetry equipment. It is mandatory that batteries will require a temperature monitoring system shared with the onshore team.



3.12. Solar, wind, hydraulic, thermal, pneumatic and / or kinetic energies are the only sources of energy authorised in addition to the primary source listed above. These energies must be created and used during the race. The energy created cannot be used for any other following races. They can also be installed and removed at the beginning of any race. Solar panel must not be in use prior to the start of the race.

The energies will be limited as follows:

Solar	3m ² including mounting frame
Wind	10m ² & 5m air draft
Waste	Maximum weight of the boat ready to sail

3.13. It is forbidden to replace the Primary Energy Source once a boat has started a race. See paragraph **3.12** for replenishments. It is forbidden to remove and modify any component from the energy system once the Technical Committee has inspected the boat.

3.14. In order to measure and perform the reliability of the energy chain. A cumulated hour counter will be mandatory on each component of the chain. Teams are to provide accumulated hours for their energy systems (fuel cell, battery, ...).

4. The Engine, Propulsion & Steering

4.1. Each boat must be able to move and be manoeuvrable in forward and reverse gear.

4.2. The steering gear of the boat must be of a size for adequate controllability, must operate smoothly and must be free of play both in loaded and unloaded conditions. If requested by the race organisation it must be capable of being operated without power and without any modifications to the system.

4.3. Each boat must be capable to sail at a speed of at least 3 knots.

4.4. Engine/Propeller may be changed between races. See paragraph 11.

5. The Cockpit

5.1. The cockpit must be secured using non-destructive lashings to the beams.

5.2. The cockpit & energy system must be connected to grounding when ashore.

5.3. Foils and any appendices having an horizontal projection are forbidden.

5.4. The driving position must be such as the feet of the pilot are positioned in front of his body and be free of any potential hazards. Seats must include a headrest.

5.5. The pilot must have a clear field of view and always have unobstructed hearing. The pilot must be able to evacuate the boat within 5 seconds without any form of outside help. This must be demonstrated by means of an evacuation test.

5.6. The cockpit must include a seating position for the pilot that must not be fully enclosed. Hatches that need to be opened before the pilot can evacuate the boat are not allowed.



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- 5.7. The Pilot must not be restrained by any means to the boat. Safety belts are also not allowed.
- 5.8. The cockpit may be streamlined and must be self-draining
- 5.9. The weight of the cockpit must not exceed 185kg. This means that the TOTAL weight of the finished boat with pilot (full load displacement) must not exceed 310kg. Exceeding TOTAL weight will mean disqualification.
- 5.10. The cockpit must be fitted with high visibility tape to reflect the sunlight.
- 5.11. The organiser reserves the right to add a large and draggy identification flag if the colour of the boat is not compliant with the regulation.
- 5.12. A rigid Bulkhead must safely isolate and seal the boat's propulsion and energy storage systems from the driver's compartment.
- 5.13. A bulkhead is an upright partition separating the driver's compartment from the energy compartment. This means engines, fuel cells, fuel tanks, batteries (propulsion or accessory), hydrogen cylinders, supercapacitors, etc. must be placed outside the driver's compartment behind the bulkhead. The purpose of this bulkhead is that in the event of a fuel leak, fire or battery release incident, it prevents liquids and/or flames from reaching the driver. Avoid having any gaps or holes between the body and the bulkhead. It is recommended to seal gaps with materials such as metal/aluminium sheeting or aluminium tape.
- 5.14. The bulkhead must be able to protect the driver from an open flame in the energy compartment.
- 5.15. The bulkhead must prevent manual access to the energy compartment by the Driver.
- 5.16. If holes are made in the bulkhead to pass through wires or cables it is essential that the wires and cables are protected by a grommet or similar protective material to prevent chafing or damage. All gaps and holes must be filled.

6. Electrics/Electronics

- 6.1. The use of adequately sized fuses or circuit breakers are mandatory just after any source of energy.
- 6.2. Electronics must be housed in a watertight compartment and cooled. Any boat failing to comply with the IP55 standard for the on-board electronics shall not take part in the event. IP67 being the most recommended standard. A water resistance test will be performed during technical checks. Exception for the fuel cells that have to use the air as input. In that case an automatic stop is required on the system and has to prove to the technical committee that the system is safe for the pilot and safety teams.





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- 6.3. All of the electrical circuits on board the boat must be protected in order to avoid personal injury and short circuits.
- 6.4. Protection may take the form of limitation or interruption of the current, circuit breaker(s) or by the insertion of individual circuit fuses.
- 6.5. Grounding of the system must be accessible from outside.

7. Kill cord & Emergency stop push button (pictures used for clarity)

7.1. Each boat must be fitted with a killcord.

7.1.1. It is designed to cut the power supply to the engine as soon as the pilot loses control of the boat or when the pilot leaves the boat, whether voluntarily or involuntarily.

7.1.2. One end of the kill cord must be always secured to the pilot when sailing and the other end to a device onboard set to cut off the power/ignition of the engine if the kill cord is pulled.

7.1.3. When the cord is replaced, at least one more additional action must be taken to enable the engine to start running again.



7.2. Each boat must be fitted with an emergency stop push button (Kill switch with "mushroom" head).

7.2.1. When activated, it must isolate all power sources from the boat. Except for a sail where isolation does not apply to velic thrust from sails.

7.2.2. When deactivated, at least one more additional action must be taken to enable the engine to start running again.

7.2.3. It must be clearly marked and visible.

7.2.4. It must be located on the starboard side so that it can be activated by the pilot from its seating position and whilst evacuating the boat without it delaying the evacuation.

7.2.5. It must be accessible by external personnel, orientated toward the outside of the boat, within one meter of the hull external side and located starboard.

7.2.6. It must remain functional at all times while the pilot is onboard.





8. Safety & Safety Equipment

- 8.1. When off the water, the propellers need to be adequately protected.
- 8.2. No sharp edges will be authorised.
- 8.3. All rotating components in or on the boat must be adequately shielded to prevent unintentional contact while on and off the water. In the case of the use of a flywheel, it must be fitted into a protective housing that is capable of containing all released components in the case of disintegration of the system.
- 8.4. All boats must be fitted with the following safety equipment, that must be readily available to the pilot at all times:
 - 8.4.1. A towing floating bridle of at least 10mm diameter must be fitted to the boat. The bridle must reach the cockpit and be accessible to the pilot.
 - 8.4.2. A Floating towline of at least 10 meters and a minimum diameter of 10mm must be secured to the bridle.
 - 8.4.3. A paddle with a minimum overall length of 100cm, a minimum blade length of 30 cm and a minimum blade width of 13 cm
 - 8.4.4. A boat hook with a minimum length of 100cm that may be combined with the paddle.
 - 8.4.5. A uniformly coloured orange or red warning flag with a minimum size of 30 cm x 30 cm attached to a stick or similar structure with a minimum handle length of 100 cm. This flag must not be secured to the paddle or the boat hook.
 - 8.4.6. An audible warning system, such as a ship's horn audible at reasonable distance, such as an orally operated horn, an air horn or an electrically operated horn, a whistle fixed to the lifejacket will also be accepted as audible warning system,
 - 8.4.7. An approved fire extinguisher with a minimum capacity of 1 kg of extinguishing material suitable for extinguishing fires on board, preferably with a foam based means of extinguishing. Only fire extinguishers showing a valid approval are allowed. The approval should show the date the fire extinguisher was tested last and the date when the next test is due. The fire extinguisher must be mounted in a position such that it can be reached easily by the pilot from their normal seating position in the cockpit. It can be fitted under, in front aside of the pilot, but can't be fitted in the back of his seat. It should also be prevented from being dropped into the water after taking it out of its housing attachment. In addition to the manually operated fire extinguisher an automated means of fire extinguishing may be installed.



9. Pilot Requirements and Communication

- 9.1.** The weight of the pilot ready to sail (with overalls, helmet, lifejacket, shoes and communication system) must be at least 60 kg.
- 9.1.1.** Each pilot will be weighted during the technical inspection at each event.
- 9.1.2.** Ballast if used must be properly fixed to the boat, in or near the pilot's seat and accessible for inspection.
- 9.1.3.** In case there is more than 1 pilot, the lightest pilot will be used to calculate the correct amount of ballast to be put on board.

10. Appearance of the Boats

- 10.1.** The first third of the hull forward is reserved for branding or markings provided by the Organisation aiming to promote the messages of the Yacht Club de Monaco and/or its partners. The rest of the hull and the cockpit is free for team's markings. These may not be in conflict with sound moral standards whatsoever.
- 10.2.** The Organiser reserves the right to refuse a boat that displays marking judged contrary to the values and the messages of the Yacht Club de Monaco.
- 10.3.** Each boat must fly, a flag of his/her organisation nationality. The flag must fly at least 2m above the water and must have a minimum width of 30cm.
- 10.4.** A boat will not be authorised to start a race if the markings have not been complied with.
- 10.5.** All markings to the hull must be removed at the end of each event.
- 10.6.** The Organiser reserves the right to mount a camera on each boat.
- 10.7.** A transponder for tracking and course tracing during each race may be provided by the Organisation and must be positioned on each boat.



11. Inspections / Racing Test

- 11.1.** The Organisation is entitled to conduct inspections of the boats at any time of its own choosing. The participants are bound to cooperate with such inspections.
- 11.2.** The Organiser will inspect all boats for full compliance with the Technical Rules prior to racing. During the inspection the participants are required to present their boat in a race-ready condition.
- 11.3.** During the inspections, the participants are required to demonstrate the racing performance of their boats. During this demonstration, the participants must race a prescribed circuit. The boat and the pilot will be judged on the following aspects:
- Controllability of the boat,
 - Racing skills of the pilot,
 - Freeboard in racing condition.
- 11.4.** Boats that fail to comply with the applicable Technical Rules or the racing test will not be allowed to enter a race until the time they do come into full compliance, and this has been confirmed by the Organisation by means of a re-inspection.
- 11.5.** During the Event the boats are not allowed to leave the paddock without permission. Leaving the paddock without the prior permission of the Organiser will lead to disqualification,
- 11.6.** The boat and pilot weight may be checked at any time by the Technical Committee. Daily random weight checks will be performed daily.

12. Technical Failure / Modifications

- 12.1.** In the case of the occurrence of a (technical) failure on board, the participants are entitled to repair and/or replace the failed or flawed components with identical ones. The Organiser must be informed of any technical failure.
- 12.2.** If a boat has different motorisation set up, the drawings and calculation of the different options must be submitted to the Technical Committee at least one month in advance. Additionally, the different set ups will have to be demonstrated to the Technical Committee during the Technical inspections.
- 12.3.** All modifications or repairs to the boat made after the inspection, will be subject to re-inspection.
- 12.4.** Modifying the boat during a race or after the boat has been technically inspected & approved by the Organiser, is not allowed.
- 12.5.** Modifying the boat in between races is allowed but must be reported to the Organiser before the start of the first race element after completion of the modification.
- 12.6.** A participant will only be allowed to participate in the race after any modification has been inspected and approved by the Organiser.



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ANNEX I – Hull Package

You may download the Hull Package available to all teams:

<https://yacht-club-monaco.mc/wp-content/uploads/2021/09/Technical-Documents-Energy-Class.zip>



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ANNEX II - Hull Drawings

