

Dong Energy Solar Challenge

Technical Regulations 2012

Version April 28th,2011

The Technical Regulations presented in this document were drawn up to serve as directives for the race. Situations that are not covered by the Rules will be decisively resolved at the sole discretion of the jury.

1. General

The rules stipulated herein apply to the Dong Energy Solar Challenge, hereinafter referred to as the "race".

The rules apply to the race to be held in 2012.

All participants in the race are expected to have read, understood and agreed to the Technical Regulations. The organization will penalize all participants and teams that ignore or violate the Technical Regulations. Penalization could be meted out in the form of warnings or disqualification and elimination from further participation.

All questions concerning the interpretation of the Technical Regulations must be submitted to the organization in writing. The rules will be published on the website and are binding for all participants. If deemed necessary by the organization, she has the right to amend these regulations.

2. Technical condition and safety

All participants are at all times responsible for the technical condition and safety of their vessels during the course of the race. The design must be made such that the vessel can safely participate in the challenge taking into account all aspects of the Challenge (sailing, hoisting storage in the paddock, etc.).

Approval of the design and approval during the inspection will under no circumstances exempt the participant of due responsibility.

3. Definitions

See Annex A.

4. Categories

4.1 The race is open to three boat categories:

- A. Challenge class vessels with one single crew member (one person challenge class)
- B. Challenge class vessels with two crew members (two person challenge class)
- C. Top class vessels.
Exactly two crew members must be on board of a two-person vessel during the race.

4.2 The following are the maximum dimensions per class:

Category	A (1-person)	B (2-person)	C (top class)
Length	6.0 m	8.0 m	8.0 m
Width	2.4 m	2.4 m	2.4 m
Height above waterline	1.0 m	1.0 m	1.0 m

- 4.3 The length is the overall length from the front end of the vessel up to and including the rear end of the vessel, and including the propulsion system. Exceeding the maximum length by more than 0.5% of the allowed length will result in a penalty issued by the jury.
- 4.4 The height above the waterline must be limited to the specified height in both static and sailing conditions. Any mechanism used to adjust variable height must be electrically operated from the main battery. It is not allowed to install a secondary power source for that purpose.
- 4.5 No maximum draught is prescribed for the vessels. Participants must however take into account the fact that the depth of the water is limited in certain sections of the route. The actual depth may vary from one month to the next.
- 4.6 Propellers may be changed at all times and in all classes during the course of the race.
- 4.7 No maximum mass is prescribed for the vessels. Participants must however keep in mind that the boats may need to be lugged across dry land in several (probably two) locations in the course of the race.

- 4.8 The height above the waterline is the height excluding the registration panel and transponder fitted. Please be aware that complying with this limitation in height will be no guarantee that the boat will be able to pass underneath all bridges in the route. It is the responsibility of the participants to investigate this and take appropriate action.

5. The Vessel

- 5.1 All vessels must be fitted with solar panels, which will serve as the sole source of energy. The use of wind energy and/or energy derived from manpower or animals will not be permitted.
- 5.2 No prescriptions apply to the use of materials with the exception of the following limitations:
- The use of flexible materials that might serve as sails is not allowed.
 - The use of materials that may pollute the environment is not allowed.
- 5.3 The use of energy storage systems, other than batteries for storing electrical energy, is allowed (e.g. flywheels, super capacitors, etc.). The total onboard energy storage capacity is limited to 1 kWh (=3.6 MJ). This capacity includes the storage capacity of batteries for storing electrical energy.
- 5.4 The skipper must have a clear field of view and have unobstructed hearing at all times.
- 5.5 The stability of the vessels must be such that a prescribed rolling moment of 150 Nm applied to the vessel with the vessel loaded with a load of 70 kg at the location of seat of the skipper, will not result in lean over exceeding 12.5 degrees averaged over a measurement period of 5 seconds.
- In that case none of the openings in the hull, such as the outlet opening of the bilge-pump(s) or the edge of the deck or any of the solar panels may be submerged below the waterline.
 - In case (additional) floats are being used, the floats on either side must have an additional volume of at least 50 dm³.
 - It is allowed to use more than one (additional) float on either side of the vessel. In that case the total displacement of the combined floats on either side must be 50 dm³ or more.
 - A vessel having floats or multiple hulls must be designed such that the highest floater touches the water surface before reaching a roll-angle of 5 degrees.
- 5.6 As the headroom of many of the bridges along the planned route are below the maximum allowed heights, it is allowed to adjust the height of the vessels when passing under bridges.

- In the case of the use of electrical energy, the power must be supplied by the solar panels or the main battery,
 - It is not allowed to use an extra energy source for this purpose,
 - It is allowed to detach the solar panels from the boat when passing under bridges and over/under other types of obstacles,
 - Where participants opt for the latter action, the fastening system of the solar panels must be designed to ensure due safety during this operation.
- 5.7 All vessels must be fitted with a commercially available and approved dead man's switch that will remain fully functional at all times while the skipper and/or other crew members are on board.
- This will be tested during the evacuation test,
 - The functionality must be such that when removed the motor stops running and that when replaced it requires at least one more additional action to have the motor start running again.
- 5.8 The vessel may not have a closed cabin.
- 5.9 If the vessel is loaded with ballast, it must be properly fixed to the vessel. The ballast required to make up for a deficiency in a skipper's or sailor's mass must be placed in or near their seat. It must be easy accessible for inspection.
- 5.10 It is mandatory for all vessels to be fitted with one or more electrical and automatic bilge-pumps.
- The pumps must be designed to empty all compartments that house passengers or electrical components.
 - The system must be designed to ensure that each of the above-mentioned compartments can be pumped empty automatically and independently.
 - The pump must have a minimum flow rate of 1,500 litres per hour.
 - The pipe(s) and/or hoses that are connected to the pump must have a minimum internal diameter that is no smaller than the pump's outlet.
 - The pipes and/or hoses must be installed such that all bilge water is pumped overboard.
 - If the vessel is a multi-hull design, the pump capacity may be distributed; in other words, a catamaran may be fitted with two pumps, one in each hull, and each with a capacity of 750 litres per hour.
 - If floats are fully watertight it is not compulsory to install an electrically driven bilge pump in the floats.
- 5.11 All rotating components in or on the vessel must be adequately shielded to prevent unintentional contact.
- This applies both on the water and on land.

- In the case of the use of a flywheel for power storage purposes, it must be fitted into a protective housing that is capable of containing all released components in the case of disintegration of the system.
- The latter characteristic must be demonstrated by means of a suitable test or calculation.

5.12 All vessels must be designed to ensure that all crew members will be able to evacuate the vessel within 5 seconds without any form of outside assistance.

- The latter characteristic must be demonstrated by means of an evacuation test.
- The dead man's switch must also be activated simultaneously during the evacuation without having a delaying effect of any nature whatsoever on the evacuation.
- Hatches that need to be opened before a crew member can evacuate the vessel are not allowed
- The minimum width of the cabin is 50 cm.
- When two crew members are sitting next to each other the minimum width is 100 cm.
- The cabin must have a suitable seat for each crew member.

5.13 The use of safety belts is not allowed on board the vessels.

5.14 The cabin may not have any potential hazards for the crew members.

5.15 All fastening systems used on board the vessel must be mechanically secured.

- All connections that may rotate during operation must be secured with the use of a cotter pin.
- The use of securing means, such as "loctite" is not allowed, except with the special permission of the organization.
- Permission will only be granted based on a prior written application to the organization with due motivation.
- The application must also include a design description and a description of the need for the use of this type of securing means.
- In a bolt and nut connection the thread of the bolt must stick out of the nut with a minimum of two full turns.
- The same holds for threaded rods.
- When using self locking nuts the thread must stick out of the plastic locking ring with a minimum of two full turns.
- The use of locking washers is advised. The use of washers in bolted connections is compulsory.
- The use of Velcro is allowed under the condition that this has been clearly indicated in the design and approved by the technical committee prior to the technical inspection.
- The technical committee may ask additional connections to be installed at all times, especially when it concerns the solar panels or items that influence the safety of the crew members or the operation.

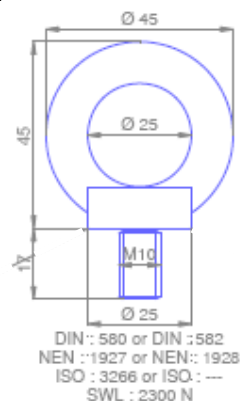
- 5.16 All vessels must be designed with a minimum freeboard of 25 cm over the first 2 m measured from the front end of the vessel and a freeboard of at least 20 cm over the rest of the vessel.
- Both freeboards must be determined in fully loaded condition,
 - The connection between the hull and the deck must be watertight.
- 5.17 All vessels must be designed to be capable of generating sufficient buoyancy under full load.
- In this context 'sufficient' is defined as the capacity required to carry the complete construction with the crew member(s) with a minimum reserve capacity of 100%. In other words: the watertight volume above the waterline has to be equal or larger than the displacement of the hull.
 - The latter capacity must be demonstrated by means of a calculation and a weighing.
 - In addition, the vessel must also be designed such as to ensure that it is incapable of sinking the moment it fills up with water.
 - In the case of the occurrence of the latter situation, it may be assumed that the crew members will not be on board any more.
- 5.18 All vessels must be fitted with a fastening point for a towline (catamarans must have a fastening point on each hull).
- The fastening point(s) and its supporting structure must be capable of holding a minimum load of at least twice the vessel's own weight.
 - The minimum internal diameter of the fastening point(s) must be 20 mm.
 - All vessels must be provided with a floating towline of a minimum length of 10 m and a minimum diameter of 8 mm.
 - Catamarans must be fitted with two floating towlines, of a minimum length of 10 m and a minimum diameter of 8 mm, one attached to each of the two hulls.
 - Towlines may not be manufactured out of steel wire or any other type of material that is hard to cut in the case of an emergency situation.
 - The towline(s) must be attached to the front of the hull(s)
- 5.19 All vessels must be fitted with a minimum of two types of signaling systems
- An uniformly coloured orange or red warning flag with a minimum size of 30 x 30 cm attached to a stick or similar structure with a minimum length of 100 cm.
 - The warning flag may not be combined with the required boat hook.
 - An audible warning system, such as a ship's horn audible at reasonable distance, e.g.
 - An orally operated horn
 - A horn operated by a compressed air bottle
 - An electrically operated horn

- 5.20 All vessels must be fitted with a clearly visible yellow or orange marker buoy with a diameter of at least 12 cm. that is permanently connected to the vessel by a buoyant rope with a minimum length of 5 m
- The connection and storage of this buoy must be such that when the vessel disappears under the water surface the buoy starts floating on the water surface and thereby indicates the position of the vessel
- 5.21 All vessels must be fitted with at least one paddle per crew member.
- The paddle must be functional such that it is possible for the skipper/sailor to paddle the vessel from the normal seating position in the cockpit
 - The paddle(s) must have a minimum overall length of 60 cm, a minimum blade length of 30 cm and a minimum blade width of 13 cm
 - The paddle(s) must be fastened in an easily-accessible location on board the vessel.
- 5.22 All vessels must be fitted with an approved fire extinguisher with a minimum capacity of 1 kg of extinguishing material suitable for extinguishing fires, including electrical fires (category E).
- Due to the fact that it is hard, if not impossible to find category E extinguishers, participants are also allowed to use category A (solid materials) fire extinguishers.
 - Only fire extinguishers showing a valid approval are allowed
 - The fire extinguisher must be mounted in a position such that it can be reached easily by all crew members from the normal seating position in de cockpit and cannot drop into the water after taking out of its attachment.
- 5.23 All vessels must be equipped with a boat hook with a minimum length of 1 m and a non-metallic hook.
- 5.24 The vessels must be equipped with a life jacket for every person onboard the vessel. The capacity of the life jacket must be 150 Newton classed or equivalent.
- 5.25 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.
- Wherever possible this must be done under the supervision of the organization.
 - In the case of major repairs/replacements, e.g. in the case of the replacement of a battery, the organization will determine the need for a time penalty.
 - All repairs to the vessels' electrical systems must be reported to the organization in advance.
 - Repairs to other parts of the vessels must be reported subsequently.

- Replacement or recharging of batteries will result in the issuing of a time penalty of one minute for the next stage for each percentage point of the allowed maximum battery mass. Stages that have already been started will be counted as complete stages (e.g.: installing a new lead-acid battery of 10 kg or recharging it during or after the second stage will yield a time penalty of $10 \text{ kg} / 25 \text{ kg} \times 100\% \times 1 \text{ minute} = 40$ minutes for the third stage).
- If a battery is changed or recharged during the last stage the time penalty will be given for the last stage
- Modifications to the vessel are not allowed anymore after the vessel has been technically approved by the technical committee
- Modifications demanded by the organisation however must be incorporated before the given deadline
- While performing a modification, participation in the race is suspended until the modification has been inspected and approved

5.26 All vessels must be fitted with four lifting hook eyes with a minimum inner diameter of 25 mm.

- The lifting eye hooks must be made out of solid metal of the type as indicated in the picture.



- The lifting eye hooks may be made removable but must be carried onboard the vessel during the course of the race.
- The lifting eye hooks must be positioned above the solar panels.
- The lifting eye hook and the supporting structure must be designed and manufactured such that each of the individual lifting eye hooks can carry the full weight of the vessel
- The hook eyes must be positioned such as to make it possible to lift the vessel, with the installed solar panels, in and out of the water.
- The longitudinal distance between the lifting hook eyes is between 1 and 4 m
- In the latter situation the vessel must remain horizontal to the greatest extent possible.
- A maximum deviation of 10 degrees from the horizontal position is allowed.
- The structural integrity of the vessel must not be compromised during hoisting.

- 5.27 The average speed of the vessels in the challenge classes must be at least 8 km/h. The average speed of the vessels in the top class must be at least 12 km/h. This will be tested during the prologue to the race. During the prologue a distance of 10 km will have to be sailed.
- 5.28 All sharp edges of the vessel must be adequately protected.
- 5.29 The steering gear of the vessel must be sized for adequate controllability must operate smoothly and be free of play both in loaded and unloaded condition.
- 5.30 Adding removable parts to the vessel is allowed. These additional parts have to meet all necessary requirements of these technical regulations
- The removable parts must either be installed or carried in the boat during the complete race.
 - During step 3 of the design process it must be clearly indicated that you want to apply this rule and this has to be approved
 - The boat will have to pass the technical inspection both with and without the removable parts installed
 - Marking parts as removable parts after having passed step 3 in the design process is not allowed
 - Certain parts will not be allowed to be classified as removable parts. They include at least:
 - parts necessary for achieving the required stability, for example floats
 - solar panels

6. Solar panels

- 6.1 All participants in challenge classes are bound to fit their vessels with the standard solar panels provided by the organization, namely the solar panels loaned by the sponsors. Participants in the one person challenge class are provided with 4 panels with an overall peak capacity of approximately 952 Wp, and participants in the two person challenge class are provided with 5 panels on loan with an overall peak capacity of approximately 1190 Wp. The technical specifications for the panels will be made available on the website of the race.
- 6.2 No prescriptions apply with respect to the area of the solar panels used in the top class as long as they do not exceed the maximum size of the vessel given in section 4 of these regulations.
- The maximum power output of the solar panels is limited to 1750 Wp.
 - Participants are required to submit a drawing and calculation of the power of the solar panel during Step 3 of the design process to enable the technical committee to unambiguously determine the total power output of the solar panel.

- This calculation must be based on the technical data sheet of the solar cells used as supplied by the manufacturer (no supplier brochure) where the power output is reported.
- The data supplied by the manufacturer must be in accordance with IEC 61215, terrestrial application in standard test condition (STC) for Silicon solar cells.
- For other than terrestrial Silicon solar cells the power output has to be reported on the basis of the outcome of a measurement performed in accordance with IEC 1829. During the technical inspections a check on the total power output may be performed.

6.3 The solar panels must be placed horizontally on all vessels.

- The maximum deviation from the horizontal position is 10 degrees.
- This also holds for the maximum deviation from the horizontal position for curved solar panels.
- The use of adjustable systems is allowed provided they are operated manually or on electrical energy derived from the solar panels or the main battery.

6.4 Each applied solar panel must be mechanically secured to the vessel, either in a frame or otherwise.

- The design of the fastening system must be such that it will be wind- and water resistant in all directions, including, turbulence, waves and gusts.
- This must be demonstrated during the design phase by means of a calculation in step 3 of the design process
- All parts of the solar panel sticking out of the hull as well as the frames used to attach the solar panels must be provided with protection of sharp edges.

7. Electronics

7.1 The vessels may be fitted with a battery pack with a maximum nominal capacity of 1 kWh. All further references to the battery pack will refer to the 'main battery'. The nominal capacity is based on a discharge time of 20 hours. To be able to properly judge this requirement, the figures in the list below are used to evaluate the different types of batteries. The battery pack will be weighed during the technical inspection in order to determine whether the battery capacity exceeds the maximum allowed values.

Type of battery	Allowed Mass	Specific power density
Lead-acid and lead-gel batteries	25.0 kg	(40 Wh/kg)
Nickel-Cadmium	20.0 kg	(50 Wh/kg)
Nickel-metal hydride	14.3 kg	(70 Wh/kg)
Standard Lithium-Ion	7.1 kg	(140 Wh/kg)
Lithium-Polymer	6.0 kg	(167 Wh/kg)
Lithium-Iron-Phosphate	8.8 kg	(114 Wh/kg)

If a participant decides to install a different means of energy storage, which is not a battery, the total storage capacity is limited to 1 kWh (=3.6 MJ). For the use of other types of batteries not mentioned in the overview the participant is required to contact the organisation to have determined the maximum allowable mass.

- 7.2 Participants found to have installed a means of energy storage in excess of the maximum allowed levels will be issued a time penalty.
- The time penalty consists of 1 minute per remaining stage per percentage point of the excess amount of allowed maximum battery mass.
- 7.3 A dedicated, properly functioning Battery Management System is mandatory for all batteries other than lead-acid and lead-gel batteries.
- A solar controller is not allowed as a Battery Management System
 - The system must monitor both the battery's voltage and temperature, and must also be capable of shutting the system down when necessary.
 - For Lithium-based batteries the monitoring of both charge and discharge currents is required. A means of controlling too high currents must be installed.
 - The Battery Management System must be designed to monitor all individual battery cells.
 - The mass of the Battery Management System is not incorporated into the battery mass while determining the battery mass.
 - The participants must make sure that the batteries can be weighed separately.
- 7.4 The maximum allowed voltage is 52 V DC or AC RMS.
- 7.5 The maximum nominal allowed voltage of the (composed) main battery is 48 VDC. In order to be able to comply with this rule in combination with rule 7.4 also during charging, the amount of batteries placed in series will be limited. The following limitations must be taken into account:

Type of battery	Nominal voltage used	Maximum charge voltage	Maximum allowed number of batteries in series
Lead-acid and lead-gel batteries	12 V	14.4 V	3
Nickel-Cadmium	1.2 V	1.5 V	34
Nickel-metal hydride	1.2 V	1.6 V	32
Standard Lithium-Ion	3.7 V	4.2 V	12
Lithium-Polymer	3.7 V	4.2 V	12
Lithium-Iron-Phosphate	3.4 V	3.6 V	14

For the use of other types of batteries not mentioned in the overview the participant is required to contact the organisation to have determined the maximum allowed number of batteries in series.

7.6 The main battery may only be charged with the use of the installed solar panels.

- The first stage of the race may be started with a fully charged main battery.
- All solar energy available during the race may be used for purposes of propulsion and /or to recharge the means of energy storage (e.g. battery, fly wheel, super capacitor, hot water, ice, etc.).
- The solar panels may also be used in the mornings before the start of the next stage and in the evenings after the completion of the day's stage to use the available sunlight to charge the means of energy storage.
- From the start of the first stage up to and including the end of the final stage, solar energy is the only energy allowed to recharge the means of energy storage.
- It is also allowed to extract energy from the running engine with the use of short bursts of "regenerative braking" of the vessel.
- The use of other forms of energy to charge the means of energy storage during the course of the race will result in a penalty issued by the jury.

7.7 It is not allowed for a team to install additional batteries.

- Hand held navigation equipment powered by batteries is allowed as long as they are not electrically connected to the electrical system of the vessel.
- The use of (laptop) computers powered by batteries is allowed as long as they are not electrically connected to the electrical system of the vessel.

7.8 All energy conducting parts must be fully insulated such as to prevent the occurrence of hazardous situations in the case of contact and exposure to water (for instructions on how to do this, please refer to the NEN/DIN standards for example). Special care has to be taken in case of vessels made out of conducting materials (e.g. aluminium, carbon fibre, etc.).

- 7.9 The design of the electrical wiring and circuitry must be based on standard colour coding (NEN/DIN standards).
- A plus-cable must be coloured or marked red
 - A minus-cable must be coloured or marked black or blue
 - All cables must be provided with a suitable strain relief
- 7.10 Participants are only allowed batteries that can be recharged electrically.
- The use of other types of batteries, such as mechanically charged batteries is not allowed. The use of fuel cells is not permitted.
 - Every team is responsible for its own batteries.
 - All batteries used in the race must be commercially available.
 - The batteries may under no circumstances be modified in any way whatsoever.
 - The participants must disclose all data related to the batteries no later than during Step 4 of the design process.
 - The specified battery data must at least include a detailed description of the type of battery to be used and the so-called "materials safety data sheet" as supplied by the manufacturer thereby providing the organisation with adequate information in case of an emergency.
- 7.11 The batteries must be mounted in separate housings, such as to eliminate the risk of direct contact between the crew and the batteries and environmental pollution is prohibited.
- The purpose of the battery housing is to simplify the mounting of the battery in the vessel,
 - The batteries and the fastening systems must be designed and manufactured such that they will remain fixed in their positions in the case of the vessel capsizing and thereby prohibiting environmental pollution,
 - The battery housing may be a separate housing or may be fully integrated in the hull,
 - The battery housing must prohibit, in case of damage of the batteries, that electrolyte flows into the hull,
 - The battery housing must therefore be manufactured out of materials resistant to the electrolyte of the batteries,
 - The battery housing may not be made out of a galvanic conductive material.
 - The battery housing must be made out of a fire resistant material,
 - The battery housing when not fully integrated in the hull, must be mounted to the hull using a band with a minimum width of 35 mm,
 - The use of Velcro is not permitted,
 - Other suitable means of connection, as for instance used in cars, are allowed,
 - The minimum distance between the batteries and the crew is one metre,

- It must be possible to easily seal the housing, as well as the electrical connections. This must be done in such a way that it is not possible to charge the battery with any other source than solar energy and that it is not possible to replace the battery without breaking the seal,
- All requirement with respect to mounting he batteries and their housing also apply to other means of energy storage,
- The housing must be fitted with a forced ventilation system with a minimum capacity of 0.3 m³/minute,
- The ventilation system must be operational at all times from the time the battery is electrically connected to the vessel (= when the mains switch of the electrical system is on),
- The outlet of the ventilation system must be located at a position behind the crew or in an alternative position that is suitably distant from the crew; all subject to the sole discretion of the technical committee,
- The battery ventilation system must be designed such that upward spray and rainwater will not be able to make direct electrical contact with the battery,
- The battery ventilation system must be powered by the main battery and/or the solar panels.

7.12 All energy conducting cables must be designed in suitable dimensions to cope with the anticipated voltage and current. Minimum requirements for copper cables in free air, according to the table

Crossectional area (mm ²)	Allowed current (A)
1.5	20
2.5	27
4	36
6	46
10	62
16	80
25	105
35	125
50	155
70	195
95	235
120	270

7.13 All vessels must be fitted with an emergency mains switch that can simultaneously interrupt the power supply to the engine and the power between the solar panels and the Maximum Powerpoint Trackers / Solar Controllers in emergency situations.

- The switch must be capable of breaking the electrical power supply under full load,

- The switch must be accessible for emergency personnel from the outside of the cabin,
- The switch must be clearly marked as an emergency switch,
- The 'on' and 'off' positions must be clearly displayed,
- The lettering must be of a minimum height of 10 mm,
- It is allowed to use one or more relays in the switching system,
- In the case of the use of a relay, this relay must be suited for the application.

7.14 All electrical systems must be provided with a fuse in serial connection with the main battery.

- The fuse may under no circumstances carry more than 200% of the expected power,
- The fuse must be mounted as close as possible to the main battery,
- The rating of the fuse may not be higher than the allowed current in the thinnest wire in the relevant part of the electrical system,
- The following systems must be fused:
 - Solar panel,
 - Motor controller,
 - Battery,
 - Battery Management System.

7.15 Participants are bound to use eye-protecting eye gear at all times when assembling, mounting and / or relocating the batteries and/ or when performing any other types of activities related to the batteries.

7.16 It must be possible to easily seal the energy storage system(s) (battery or any other type of energy storage).

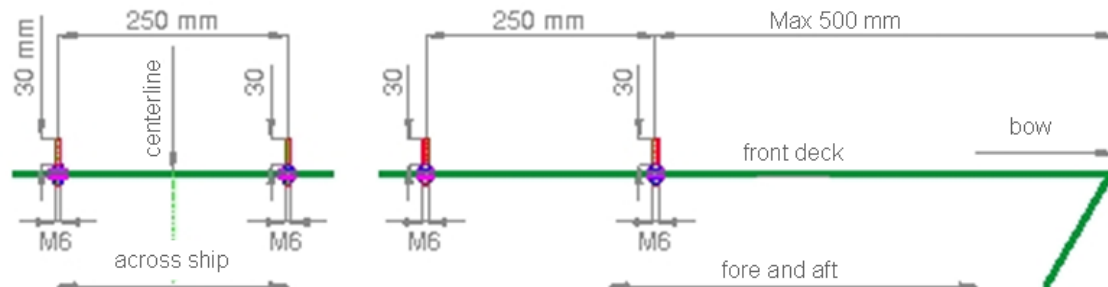
- The participating teams must make sure that the necessary means are made available such that the organisation can apply the seal in a simple and fast way,
- The organization will apply the seal after the vessel has been technically approved,
- If a participant needs to break the seal, he or she is bound to notify the organization as soon as possible,
- The vessel is prohibited from racing from the moment the seal has been broken,
- The vessel may only return to the race once it has been subjected to a technical re-inspection and a new seal has been installed.

8. Appearance of the vessels

8.1 All participating vessels must show the registration number provided by the organisation.

- Therefore all vessels must mount a registration panel on the front deck. The maximum distance between the most forward threaded rod for mounting the panel and the bow is 500 mm,
- The front deck must have 4 treaded rods, size M6, suitably attached,

- The threaded rods must protrude 30 mm above the deck and be provided with two wide washers and one locking nut each,
- The mounting of the registration panel must be done according to the drawing,



- The bottom of the registration panel may not be placed lower than the top of the solar panels,
- The registration panel with the registration number will be provided by the organisation,
- The participating team will be held responsible for the acquiring of the registration panel showing the correct registration number,
- The registration number must be visible at all times and from all angles,
- The placement of the registration panel may not hinder the accessibility of the towing eye in the prow.

8.2 Participants are allowed to finish the boat design with aesthetic embellishments of their own choice.

- Participants are also allowed to display their sponsors,
- These displays may not be in conflict with sound moral standards whatsoever,
- All subject to the sole discretion of the organization.

8.3 The registration panel will be fitted with a transponder for tracking and tracing during the race.

9. Inspections

9.1 The organization is entitled to conduct inspections of the vessels at any time of its own choosing.

- The participants are bound to cooperate with such inspections.

9.2 All skippers and crew members are expected to have a minimum mass of 70 kg during the course of the race.

- To that end, all skippers and crew members will be weighed
- The weighing will take place with the crew members wearing their bathing suits and life jacket.

- In the case of a skipper or crew member weighing in at less than 70 kg, the mass of the ballast that he or she must carry throughout the race will be determined.
- The applicable ballast will be marked with a unique mark for the applicable skipper or crew member.

9.3 The technical committee will inspect all vessels for full compliance with the requirements prior to the start of the Challenge.

- All participants will be notified in advance of the time and location of the inspections,
- The organization will invite the participants for an inspection,
- During the inspection the participants are required to present their vessel in a race-ready condition,
- Vessels that fail to comply with the applicable requirements will not be allowed to enter the race until the time they do come into full compliance and this has been confirmed by means of a re-inspection,
- All modifications to the vessel, made after the inspection, will be subject to re-inspection. In order to judge whether a modification is allowed refer to rule 5.25,
- All vessels may be subjected to additional inspections during the course of the race.

9.4 Participants are at all times responsible for the technical condition and safety of the vessel during the course of the race. Approval during the inspections will under no circumstances exempt participants of their due responsibilities.

9.5 The inspection set-up will be announced to all participants in advance by means of an inspection form that will be used during the inspection. Participants are asked to prepare themselves for the inspection by means of the inspection form, such that this will facilitate a smooth inspection.

9.6 If the vessel is able to sail faster than 20 km/h the skipper must be able to show his or her sailing permit to the organisation.

9.7 Starting from the moment the technical inspection begins the vessels are not allowed to leave the paddock anymore.

- Leaving the paddock without prior permission of the technical committee will lead to a penalty issued by the jury,
- No permission will have to be asked when a vessel is to be sailed to the sailing test, the prologue, the sprint or the starting point of a stage.

10. Sailing test

- 10.1 The participants are required to demonstrate the sailing performance of their boats. During this demonstration the participants have to sail a prescribed circuit. The vessel and the skipper will be judged on the following aspects:
- Controllability of the vessel,
 - Sailing skills of the skipper,
 - Stability,
 - Freeboard in sailing condition,
 - Spray characteristics.
- 10.2 In case parts have been classified as removable parts under rule 5.30 the sailing test must be passed with and without the removable parts installed.
- 10.3 Based on the results of the sailing tests the race committee may decide to exclude a participant from one or more stages of the race even if the vessel has been found technically in order. This may be a conditional exclusion based on for instance the expected weather conditions.

Annex A. Definitions

Rules: The provisions of the Notice of Race, the Technical Regulations of the 2012 Dong Energy Solar Challenge, the Rules of the 2012 DONG Energy Solar Challenge and the Inland Navigation Police Regulations (BPR for Binnenvaart Politie Reglement) together constitute the Rules, as well as any subsequent additions and / or amendments implemented by the race organizers.

Organization: The 2012 DONG Energy Solar Challenge takes place under responsibility of the organizing foundation: 'Stichting Sinneboatrace Fryslân'.

Officials: Members of the race committee, the technical committee, the race jury and the organizers, all personnel that can be recognized as such and whose instructions competitors shall promptly follow during the course of the race.

Guests: Persons who have been invited by the organizers to the locations specified as guest areas at specific times and locations, as indicated by the organizers.

Team: The group of persons registered with the organizers who as competitors enter the race with a vessel.

Solar boat: A vessel that is exclusively powered by solar energy derived from solar panels mounted on board the vessel.

Solar panel: Energy source for the propulsion of the solar boat.

Vessel: A solar boat that complies with the rules and participates in the race.

Fully loaded: The condition of the vessel in which all systems have been mounted, all systems have been installed and all systems are operational, all the necessary ballast has been installed and the crew member(s) on board is/are equipped with the prescribed safety devices.

Skipper: The team member who has qualified in accordance with the rules to pilot the vessel during the race.

Crew member: A team member in Challenge B class who accompanies the skipper in the race.

Steward's vessel: A vessel that is marked as such by means of a flag and that is used for the race-technical and safety supervision of the 2012 Dong Energy Solar Challenge.

Paddock: An area allocated by the organizers where the vessels shall be kept during the 2012 Dong Energy Solar Challenge from the moment of the technical inspection and at the times when they are not actually competing in the qualifications and the race itself.

“Kluunplaats” (lugging location): Obstacle in the route where the solar boat must be lifted from the water in accordance with the rules and relaunched to continue racing after passing the obstacle.

Safety gate: Deviation from the shortest possible route that may be introduced by the race organizers for safety reasons. The safety gate consists of 2 round, red buoys that the vessels shall pass in between from the direction of the last start or last control point.

Outside help: All assistance possible provided to any crew member or the vessel. Support by team members will not be considered outside help.

Maximum voltage: The maximum voltage, measured in Volts, which is measured with a voltmeter set between any two different points in the electrical system.

Nominal battery voltage: The nominal value of the voltage of the battery.

Dead man’s switch: A device that is designed to cut the power supply to the engine as soon as the skipper loses control of the boat or when the skipper leaves the vessel, whether voluntarily or involuntarily.

Battery: The device that is used to store the electrical energy. The following types of batteries for the storage of electrical energy are distinguished in the framework of the race: Lead-acid, Lead-gel, Nickel-Cadmium, Nickel-metal hydride, Nickel-Zinc, Silver-zinc, Nickel-Iron Lithium-ion, Lithium-Iron-Phosphate and Lithium-polymer.

Fully loaded: The condition of the vessel in which all systems have been mounted, all systems have been installed and all systems are operational, all the necessary ballast has been installed and the crew member(s) on board have been issued with the prescribed safety devices.

Freeboard: distance between the waterline in fully loaded condition and an imaginary parallel line tangent to the lowest edge of the deck or a line that connects openings in the side of the vessel, if applicable. The smallest distance is governing.

Openings: feed throughs in the main deck or the side of the vessel such as, bilge pump outlets, feed throughs of overboard tubing, feed throughs of cables, etc.

Means of energy storage: Any means, other than batteries, to store energy (e.g. super capacitors, flywheels, heated water, etc.)

Standard solar panel: a solar panel as constructed and delivered by the organisation. This includes all factory supplied wiring and housing (like aluminium frames around the panels)

Added Buoyancy: closed volume above the loaded waterline, which can take up loads on top of the static loading of the vessel.