

TECHNICAL REGULATIONS



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General information

Rules & regulations units of measure

All units of measure in this document unless otherwise stated for dimensions and weight are in millimeters (mm) and kilograms (kg). Conversion calculations are the responsibility of the team.

R1.0 Definitions

The Boat must be designed and manufactured according to following rules for the purpose of participating on the provided tracks in the Boats4Schools finals. The boats must (mandatory) be designed using CAD software and manufacturing according the rules of this document. It's important that the teams follow this technical guide to perform an acceptable final work and maximizing the total of points.

R2.0 **IMPORTANT:** Mandatory rules

The below some rules are classified as mandatory regulations. If a team don't accomplish any one or more of these mandatory rules they will not be eligible to win the following awards or becoming the Regional or National Champions.

We advise to take extra time and attention to check your boat manufacturing and assembly that doesn't going against any of the below mandatory Rules.

- R3.1 Hull length
- R3.2 Overall length
- R3.3 Overall Hull Beam
- R3.4 Hull Depth
- R6.1 Boat weight
- R7.0 Boat Hull manufacturing
- R8.1 The propulsion must be carried out by a DC motor
- R8.2 All batteries must be sealed

R2.1 Boat rules

Each team is required to produce a fluctuating boat that satisfies the Boats4Schools technical rules. The boat must be manufactured as much as possible by the team members and judges may ask teams to

prove how the boat has been produced. Any work done on the boat not by a team member must be listed as an outsourced item and must have engineering drawings, product descriptions and design briefs along with information of the manufacturer. The boat must be wind powered (wind boat challenge) or solar/electric powered (solar boat challenge).

The boat assembly must consist of the following components (depending of the chosen challenge):

- A hull
- Power unit (wind boats): sail installed
- Power unit (electric boats) : Any mechanical propulsion system may be attached to electric power (thruster, paddle, etc.). However, all moving parts must have a protection.
- Navigation aids.

Navigation aids (Sailing boats): teams can add rudder systems, or other, to improve the navigation.

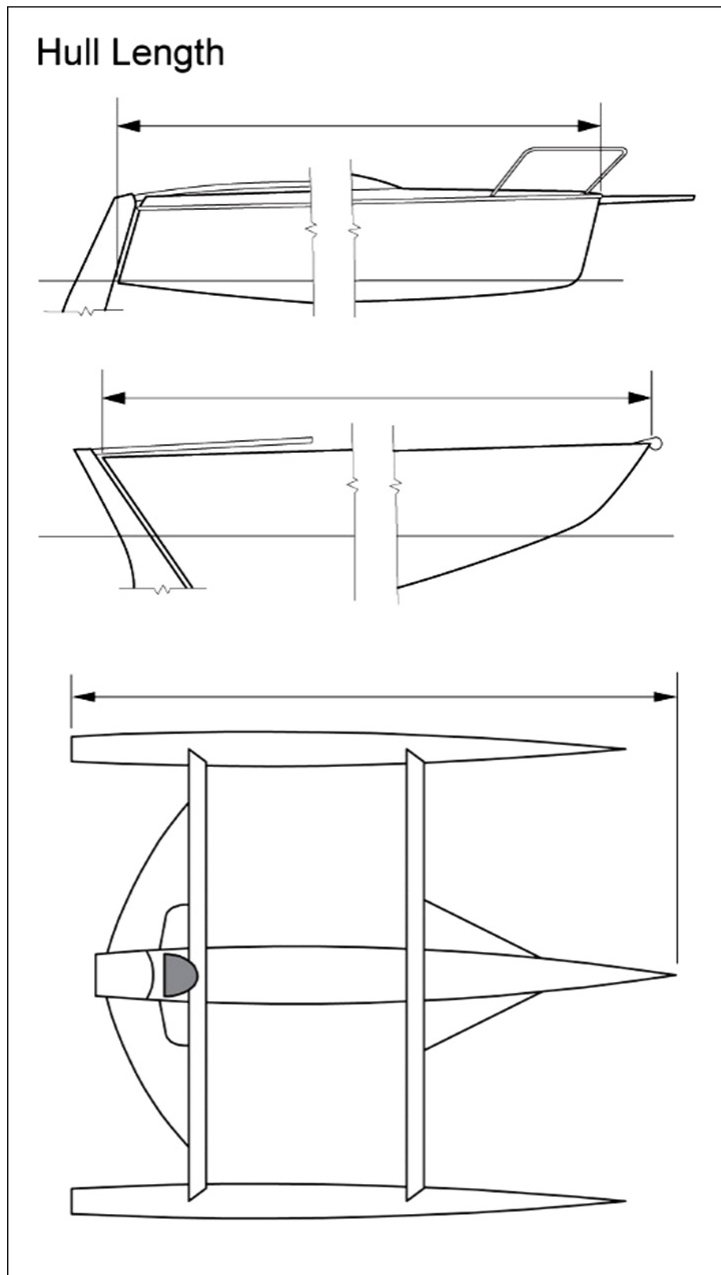
Navigation aids (Electric boats): These boats must have a remote navigation system (remotely piloted by a radio control) that can provide a distance control of the boat. This technical electronic system is a team choice. If the remote controller is turned off, vehicle must instantaneously disconnect power from all boat electronic system. Controlling the boat through a laptop application will not permitted.

R3.0 Boat Dimensions

R3.1 Hull Overall length - [Mandatory regulation | Penalty -10 pts]

Measured from the longest points on the hull and navigation systems or power systems.

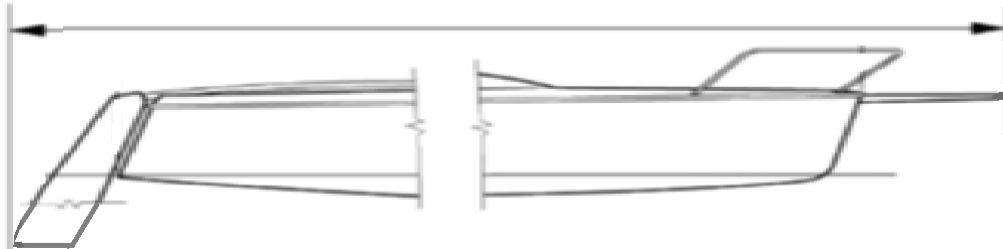
Dimension: 160mm minimum / 260mm(sail boats) / 300 mm (solar boats) maximum



R3.2 Overall length - [Mandatory regulation | Penalty 15 pts]

Measured from the widest points on the boat.

Dimension: 160mm minimum / 300mm maximum (Both challenges)

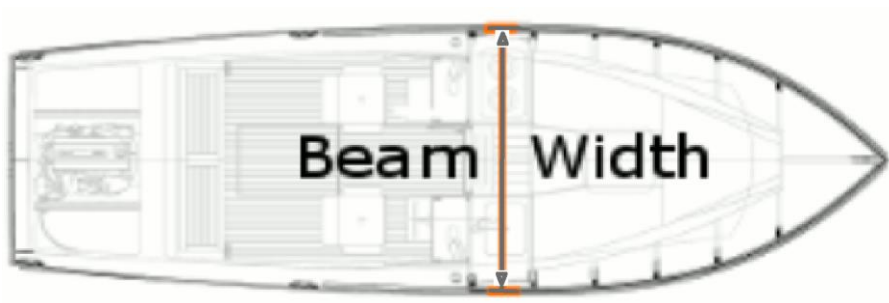


Overall boat width

R3.3 Overall Hull Beam - Mandatory regulation | Penalty -10 pts]

The maximum transverse distance between the outermost points of the **hull(s)** including fittings.

Dimension: 60mm minimum / 100mm (sail boats) – 150 mm (solar boats) maximum



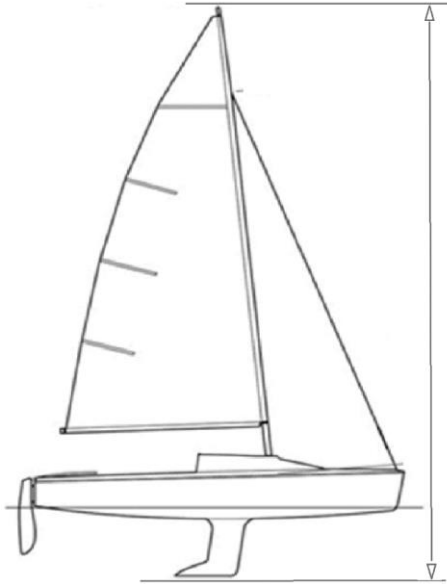
Hull Beam

R3.4 Overall height - [

Measured from the lower level to higher level including all assembled devices (keel, ballast, etc).

Dimension: free

Note: Pay attention to boat balance.

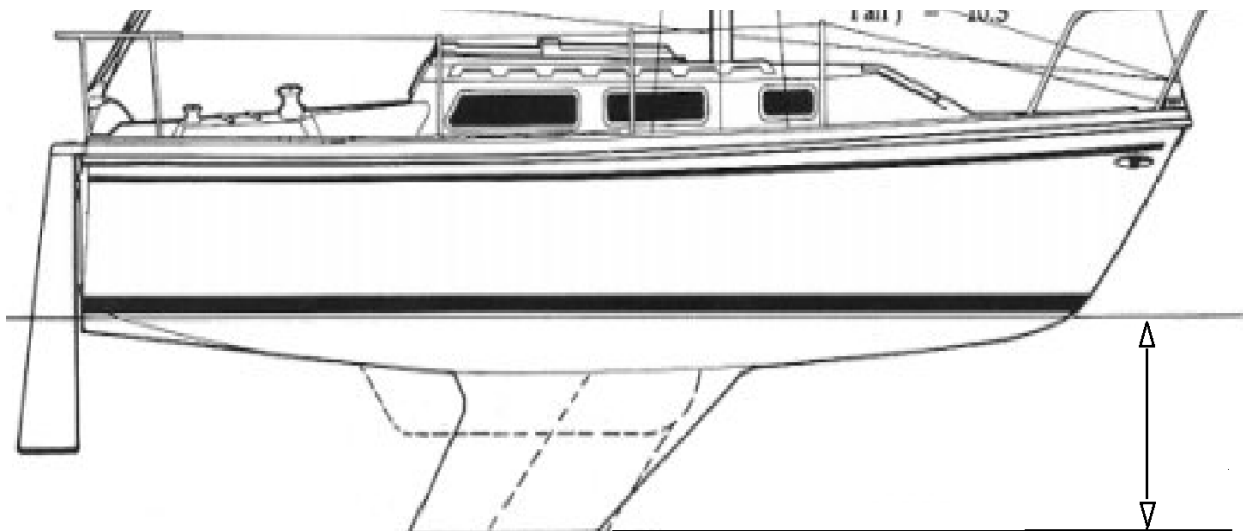


Overall height

R3.5 Hull Depth [Mandatory Penalty | Penalty -10 pts]

The vertical distance between the waterplane and the lowest point of the hull. Including underwater parts.

Dimension: 60 mm maximum - (120 mm for solar boats)



Hull Depth

R5.0 Navigation [Penalty -5 pts]

The boat must be delivered in the start line, by one member team, and only touch on the finish line. If the boat have some problems (sink, stuck, etc), the race judge can allow one member of the team to solve the problem one time. Additional interventions, it will be penalized by 5 points per intervention.

R6.0 Boat weight

R6.1 Maximum weight - [Mandatory rule | Penalty -15 pts]

The boat must not exceed

- a) 500 grams in weight for sail boats
- b) 1000 grams for electric/solar power boats.

R7.0 Boat Hull manufacturing [Mandatory rule | Penalty -15 pts]

The boat hull (sail or electric/solar) must be manufactured using additive technologies (3D printing) and the final hull must fit in a square with 200 mm side. The printing material is a free choice for teams.

For wind power boats, teams can to choose the power system (sails or others) with the shape or material that they consider optimal and don't interfere to the accomplish of the previous rules (dimensions, weight).

R8.0 SOLAR/ELECTRIC POWER BOATS

A self-assembled miniature boat – which carries a payload (P_u) – equipped with a DC (direct current) engine must complete the circuit inside a water tank maximizing the following parameters:

t: time taken / spent (will have to be minimum) [s]

P_u : payload carried (will have to be maximum) [Kg]

W: power consumption (only the propulsion part) (will have to be minimum) [Wh]

A quality coefficient Q that is proportional to P_u (payload) and inversely proportional to t (time) and to W (power consumption) will measure the boat performance.

R8.1 The propulsion must be carried out by a DC motor [Mandatory rule | Penalty -10 pts]

The motor power will be supplied by rechargeable batteries, housed on board, sealed, with total voltage, with a maximum of 7.4V.

R8.2 All batteries must be sealed to reduce possible hazards in contact with water. [Mandatory rule | Penalty -10 pts]

The open circuit voltage of any battery (or battery system).

The batteries will be recharged on the ground using a solar energy system. In case the available natural light in a specific competition place is weak, the competition organization will provide artificial light for this charging process (specifying the procedure of charging)

R8.3 Each Team must propose a measurement system of energy used during the entire race. [Penalty -10 pts]

Consumption must be measured by measuring voltage and current at the motor terminals at intervals of 1 second. The data will allow to obtain as a product the power absorbed at the time of reading and an estimate of the average Wh in the interval Δt of a second; so the total consumption by adding the energy used in the total time taken by the entire route [time expressed in seconds].

R8.4 Data acquisition [Extra-points -20 pts].

Teams are advised to register data and get it at the end of race or transmit remotely. Teams that achieve this feature will win extra points.

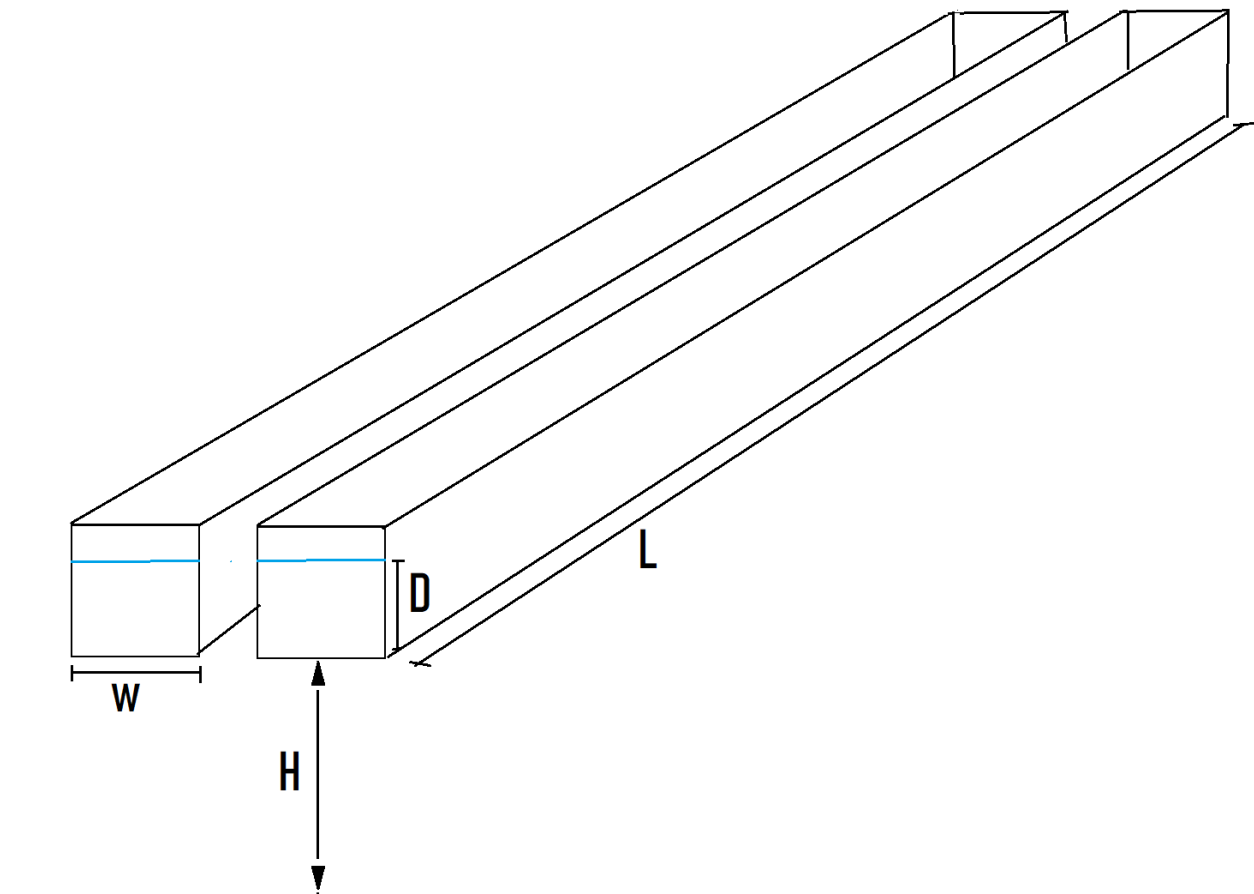
R9.0 Wind power Boats

The devices for use the wind power must designed by teams. The engineering process is very important to maximize the energy to navigate in the wind direction as well in the opposite direction. Please study the physics around this matter.

Appendix i – Water tracks for wind boats (only for indoor events)

- i.1 The event organization will provide the system track for the competition.
- i.2 The system track is be two independent water lines
- i.3 Each team will navigate the same number of times in each lane

Track technical drawing



Dimensions	Legend	Values
Track length	L	6 m to 10 m
Track width	W	100 mm to 150 mm
Water deep level	D	70 mm to 100 mm
Upper position High	H	700 mm to 800 mm

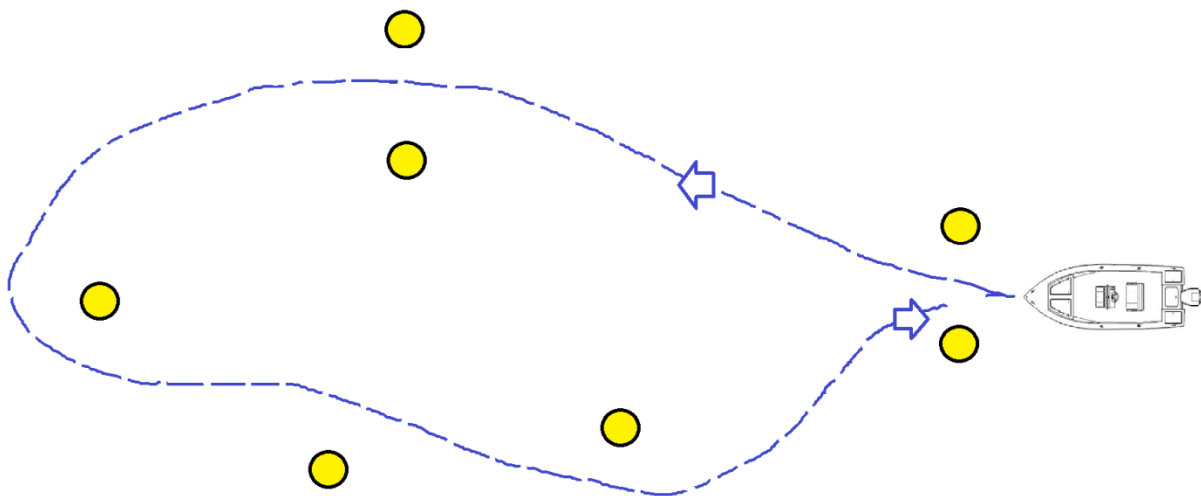
Appendix ii – Water tracks for solar boats

- i.1. The event organization will provide the race environment for the competition.
- i.2. The water track area will fit in a square around 5 m X 1,5 m, with a deep at least 0,25 m.
- i.3. The challenge request the teams to perform several courses in the water tanks; The courses could change from one final to other. An area for testing and practice will be provided, if not the organization will provide extra time for practice in the competition courses.
- i.4. -All boats must starts the course from the dock and finishing in the dock (could be a different from the start)
- i.5. – The courses could be to evaluate the control of the boat, as well the speed of performance or accomplish a mission.
- i.6. -It will be a time limit for each course and penalties according the tracks obstacles
- i.7. - The path, bordered by boundaries / buoys, will probably take an eight shape to evaluate the efficiency of the hull both in the turn to the right and to the left; the number of laps will be prefixed.

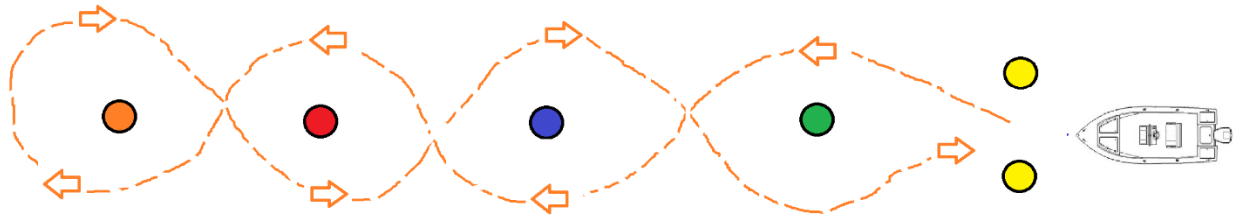
Water courses Schemas

Examples of tracks

SPEED COURSE



NAVIGATION EXPERTISE



Appendix iii – Indicative Battery & Engine System Data for Solar boats

1) ENGINETYPE= SPEED 250 / 7,2V

DATA: WEIGHT = 22gr ; ABSORPTION = 0,7 A ; MAST DIAMETER = 2mm

REDUCTION RATIO = AS PER YOURDRAFT PROJECT

2) BATTERY TYPE = LiPo 2S (7,4V) 450mA

DATA: WEIGHT = 35gr ; CHARGING CURRENT = from 450mA to 2250 mA

3) PHOTOVOLTAIC PANEL TO CHARGE BATTERIES = 12V / 10 Watt

4) CHARGER AND LOAD CONTROLLER/REGULATOR = AS PER YOUR DRAFT PROJECT

REMOTE CONTROLTYPE= AS PER YOUR DRAFT PROJECT

5) RECEIVING REMOTE CONTROL AND SERVOMECHANISMTYPE = AS PER YOUR DRAFT PROJECT

6) DC MOTOR DRIVER TYPE =AS PER YOUR DRAFT PROJECT