WORLD SOLAR CHALLENGE

Regulations

for the

2009

World Solar Challenge
Part 2 - Technical

ISF
International Solarcar Federation

Technical Regulations of the
World Solar Challenge 2009

Part 2 - Technical Regulations

Explanatory notes are displayed in shaded boxes, such as this one.

A Vehicle classes

A.1 Challenge Class: vehicles conforming to the Challenge Class specifications defined in these technical regulations.

A.1.1 Challenge Class Open: There are no limitations on the nature of the technology that may be used.

A.1.2 Challenge Class Silicon: Solar vehicles deriving power exclusively from silicon based photovoltaic materials.

A.2 Olympia Class: Vehicles holding FIA Olympia Class technical passport.

A.3 Adventure Class vehicles built for any previous ISF event.

A.3.1 Adventure Class vehicles are not in competition with Challenge Class or Olympia class vehicles.

A.3.2 Adventure Class vehicles must comply with all clauses of these regulations, except where stated otherwise.

A.3.3 The progress of Adventure Class vehicles is subject to the control of the Clerk of the Course (q.v. 6.2.1.1)

A.4 Technology Class designed to provide a forum to demonstrate fuel-efficient technology and low carbon fuels; to increase public awareness that transport modalities demonstrating a reduced environmental impact can be a practical proposition.

A.4.1 **Eligibility**
Any production or prototype vehicle that, in the opinion of the selection committee, meets the aims and objectives of the event.

A.4.2 The progress of Technology Class vehicles is subject to the control of the Clerk of the Course.

Notes

- *An important aspect of selection criteria for Technology Class entrants is that vehicles should be able to maintain a reasonable average speed.*
- *The Technology class is not time competitive.*
- *All World Solar Challenge regulations of an administrative and safety nature must be adhered to.*
- *The organisers will endeavour to locate overnight stops at venues capable of offering a range of accommodation. Prospective participants should be aware that the event passes through some of the remotest parts of the country, and such options may, at times, be limited.*
- *Supplementary regulations for the Technology class are available from the Organisers.*

B Solar Car Specifications

B.1 Minimum speed

B.1.1 The vehicle must be able to maintain a minimum average speed of 50 km/h between control stops. Allowance may be made for poor weather.

B.2 Size

B.2.1 Challenge Class vehicles: When in motion, the vehicle may be no longer than 5.000m, no wider than1.800m, and no taller than 1.600m. Adventure Class vehicles must meet the provisions of Regulation A3.

B.3 Seats

B.3.1 Each occupant must be provided with an appropriately constructed seat consisting of a base (squab) and backrest.

B.3.2 Challenge Class vehicles: The angle of the (drivers) seat must not be greater than 27°. Drivers must demonstrate the ability to sit, road ready, (helmet on, hatch closed), with their back flush against the seating elements measured in accordance with the provisions of Appendix 3 .

Operating a vehicle in an extremely inclined position induces fatigue, prevents the driver from securing sufficient visibility and may interfere with the effective functioning of the seatbelt in the event of collision.

B.3.3 The use of safety belts is mandatory for all occupants. The minimum standard is that belts shall be a commercially manufactured lap and harness type automotive safety belt, installed and attached to provide adequate occupant restraint in the event of a collision or vehicle roll over. (Challenge class with upright seating may have 3 point belts. Adventure Class vehicles with inclined seating must have 5 point belts). Anchorages must be designed and installed in accordance with sound engineering practice.

B.3.4 All vehicles shall be constructed or adapted to protect, as far as is reasonably possible, the occupant(s) in the event of collision or vehicle roll-over. Steps should be taken to ensure that vehicle components, accessories or other components do not impinge on the occupant space.

B.3.5 Challenge Class vehicles must incorporate a structural roll bar in accordance with appendix 2.

It is strongly recommended that existing vehicles be modified to incorporate this standard.

B.3.6 Occupants of the solar cars must wear a helmet whilst participating in the event. The helmet must meet or exceed the Snell95/DOT/ISO motorcycle standards.

B.4 Doors and openings

B.4.1 Challenge Class vehicles must be designed to allow occupants to enter and exit the vehicle without assistance. The doors must be able to be secured and released from both inside and outside the vehicle. Teams will be required to demonstrate that occupants can enter and exit the vehicle unassisted in no more than 15 seconds for each action.

Defining the time of entry is to encourage practicality in the chosen design.

B.4.2 Adventure class entrants will be required to demonstrate that occupants can exit the vehicle unassisted in no more than 15 seconds. If emergency egress involves permanent damage to the vehicle then the Team Manager will need to declare the method of extraction to the satisfaction of the Chief Scrutineer at time of scrutineering.

B.4.3 Emergency opening points must be clearly indicated on the exterior of the vehicle.

B.4.4 Securing of any egress canopy or hatch with adhesive tape is not permitted.

B.5 Brakes

B.5.1 The vehicle must have a balanced, dual braking system so that if one system should fail, the vehicle can still be stopped.

B.5.2 The vehicle must be able to stop with an average deceleration of 3.8 ms^2 from any speed that the vehicle is capable of travelling. The vehicle must demonstrate the ability to stop in 25m from 50 km/h and in 12.5m from 35 km/h.

B.5.3 Challenge Class vehicle must be equipped with a parking brake capable of holding the vehicle (including driver) on an incline of 18°.

The braking systems for the solar car should be designed and modelled in accordance with sound automotive engineering practice. Experience has shown that, in general, bicycle type brakes are inappropriate to the application and are unlikely to pass scrutineering. Note that regenerative braking does not contribute to the requirement of a dual braking system.

B.6 Tyres

B.6.1 Tyres must be suitable for highway use and able to withstand the loads and forces imposed by the vehicle mass, speed capability and braking. Tyres must be suitably designed and rated and used in accordance with manufacture's recommendations. Tyres must have a tread pattern across the section width that normally comes into contact with the road, at least 1.5 millimetres deep in a band that runs continuously around the circumference of the tyre, and must be free of any apparent defect.

It is noted that that some tyres carry the endorsement "Not for Highway Use" on the sidewall. This is sometimes simply due to manufacturer not having submitted a tyre of an experimental nature for the ISO approval process required for it to enter full scale production. If a team wishes to use such a tyre, they must obtain and submit a written statement from the manufacturer stating the reasons that "not for highway use" has been applied to the product together with the manufacturers datasheet detailing the load and speed ratings of the product.

B.7. Windows and windscreens

B.7.1 All windows must be made of a material which is highly resistant to breaking or major damage. Windows which are necessary to ensure the driver's vision must be made of glass or similar transparent material that does not distort vision.

B.7.2 The window may not be tinted or coloured to the extent that the condition of the driver cannot be easily observed from outside the car.

B.8 Vision

B.8.1 The driver must have vision in all directions to the satisfaction of the Chief Scrutineer. Rear vision may be electronic and/or mirror. Electronic rear vision systems must operate whenever the vehicle is in motion under its own power; When seated "road ready" (helmet on, hatch closed), minimum height for driver's eye is 700mm above the road.

The suitability of the vehicle to be driven on the public highway is also considered by the inspectors of the road traffic authority.

B.9 Steering

B.9.1 For Challenge Class vehicles, the steering system must be controlled by a steering wheel which has a continuous circumference/perimeter (q.v. Appendix 1).

B.9.2 Solar cars must be able to make a U-turn in either direction within a 16m lane (kerb to kerb).

B.10 Lights and indicators

B.10.1 Rear brake lamps, front and rear turn indicators and front and rear hazard lamps are required. These must be visible in sunlight by other road users at a distance of 30m.

B.10.2 An audible warning device (horn, hooter, klaxon etc.) must be permanently fitted to the vehicle and demonstrated to the satisfaction of the scrutineer.

B.11 Electrical

B.11.1 All electrical equipment must well constructed according to sound engineering practice. Where the system voltage exceeds 32 volts, the vehicle must be constructed in such a way that it is impossible for any occupant of the vehicle to touch live wires or terminals, or for any person working on the vehicle to touch live wires or terminals without having first removed a protective cover.

B.11.2 High Voltage warning signs must be fitted throughout the vehicle adjacent to all covers which, when removed, expose live wires or terminals where a potential of more than 32 volts may be present.

The preferred symbol is a black flash inside a yellow triangle with a black border (ISO standard.)

B.11.3 The driver must be able to electrically isolate the solar panel from the rest of the car while seated in a driving position and without releasing the seat belt. Soft (e.g. MOSFET) switching is permissible.

B.11.4 The driver must be able to able to electrically isolate the battery from the rest of the car while seated in a driving position and without releasing the seat belt. Soft switches are not permitted; the isolator switch must be a circuit breaker, contactor, or other mechanical type. The isolator switch must be internal to the battery pack (as defined in section E2). If two battery packs are employed, a separate isolator is required in each battery pack.

B.11.5 For emergency use, a means of electrically isolating both the solar panel and the battery from each other and from the rest of the car must be provided on the exterior of the car. The activation device must be able to be operated instantly and without hesitation by someone unfamiliar with the car, and without removing any panels or tape. Soft (e.g. MOSFET) switching is permissible for the solar panel. Battery isolation must be effected through the use of a mechanical device internal to the battery pack(s) (as defined in section E2) q.v. B.11.4.

B.11.6 The activation position of the emergency isolation device must be placed within a yellow disc (minimum 180 mm diameter) clearly marked with a blue equilateral triangle containing a red flash (minimum side length 150 mm), with the legend “Emergency Electrical Isolation”. In addition, there must be a clear instruction on how to operate the device (e.g. PULL). For Challenge Class cars the isolation device must be located below the windscreen on the left side of the car. It is recommended that all vehicles adopt this position as a standard.

B11.7 When the battery isolator switch is “open”, the only live wires permitted to emerge from the battery packs(s) are control and sensing wires that are short-circuit protected and incapable of delivering more than 5 mA under any reasonably foreseeable fault condition.

The purpose of B11.3 – B11.7 is to minimise the risk of electrical shock and fire, both during normal operation and in the event of an emergency.

B.11.8 The Entrant must submit, by the due date, an electrical drawing showing all the essential power circuits of the electrical equipment of the vehicle in schematic form. The drawing must include (but is not limited to) power generation devices (array etc.), power storage (battery/super-capacitors etc.) power bus and switching/isolation arrangements, motor, motor controller, auxiliary circuits and any umbilical cables employed.

B.11.9 The Entrant must prepare a second drawing, in plan view *(as seen from above)* that shows the layout of the above elements inside the vehicle. Clearly showing how emergency isolation is to be activated. This must be presented (prior to scrutineering) as 2 hard copy A4 format documents to form part of the event log book and emergency plan.

B.12 Occupant safety

B.12.1 All sharp edges, chains and sprockets must be covered when in use, and internal components or cargo must be secured.

B.12.2 Adequate ventilation must be provided to all occupants.

B.13 Emergency Recovery

B.13.1 Challenge Class vehicles must be equipped with towing eyes mounted as close as practicable to the front and rear extremities of the vehicle, each of which, together with their mountings hold sufficient strength to enable the vehicle to be recovered or moved from an inoperable or dangerous situation. The minimum inner diameter shall be 50 mm. Towing eyes must be painted yellow, orange or red. Covers may be used provided they are removable without the use of tools, coloured yellow, orange or red, and endorsed either with the legend “Recovery Point” or a graphic representation of a ‘hook’.

It is unlikely that the ‘roll bar’ would meet these requirements.

B.14 Reversing mechanism

B.14.1 Challenge Class vehicles must be able to be driven backwards under their own power with the driver seated in road ready position (q.v. B.3.2)

B.15 Identification

B.15.1 The vehicle must have a unique vehicle identification number (VIN), which must be permanently attached to a substantial part of the vehicle chassis or frame.

The International Solarcar Federation can record a 17 digit VIN number to ISO 3779 and provide a vehicle identification plate and for a nominal fee. For further details, contact the Organisers.

C Energy sources

C.1 Natural solar irradiation received directly by the car is the only external energy source that may be used for propulsion.

C.2 Energy recovered from the motion of the car may be used.

C.3 For Adventure Class vehicles, the solar array must comply with the

regulations for a previous ISF event. (q.v. appendix 4)

C.4 For Challenge Class vehicles, the total surface area of the solar array must be no greater than 6.000m^2.

C.4.1. Entrants must supply, by the due date, sufficient information to enable the Chief Scrutineer to determine compliance with this regulation.

C.4.2 The Chief Scrutineer's decision is final and no correspondence will be entered into.

The area of the array will be determined by summing the exposed surface area of the component cells. Entrants must supply sufficient information to enable the scrutineers to determine compliance with this regulation. The minimum requirement is documentation showing the size and number of the component cells; the calculations summing the total area; a map, with dimensions, of the cells as fitted to the car and a written declaration by a licensed professional in the country of origin (e.g. professional consulting engineer) that the array complies with the regulation.

C.5. Auxiliary panels that are deployed only when the vehicle is stationary are not permitted

D Energy Storage

D.1 Any energy storage device may be used. The total stored energy of these devices together with that of any fitted battery packs must meet the approval of the Chief Battery Scientist.

D.2 Temporary storage devices other than batteries (e.g. super-capacitors) must be shown to be in a fully discharged state at the start line.

D.3 If the energy storage system is built from commercially-available secondary cells, the allowable mass for this event is:

Pb/acid	125.000 kg
NiMH	70.000 kg
Ag/Zn	40.000kg
Ni/Zn	75.000 kg
Ni/Fe	100.000 kg
Li-ion	25.000 kg
Li-polymer	25.000 kg
$LiFePO_4$	50.000kg

D.4 If the energy storage system is not made from commercially-available secondary cells, the allowable configuration and mass will be determined by the Chief Battery Scientist.

D.5 Commercially-available instruments, computers and digital multimeters may use ancillary batteries provided that the battery is internal to the instrument and complies with the specifications set by the manufacturer of the given instrument. No external connection is allowed to the instrument battery.

D.6 Batteries powering vehicle systems and ancillary devices (including computers, telemetry equipment, and non-commercial instrumentation) are considered to be part of the overall energy storage system and will be subject to clause D.3

The combined energy content of dissimilar batteries may result in a time penalty as

determined by the Chief Battery Scientist. (NB no NiCd batteries, other than those in devices with internal batteries approved by the manufacturer, are permitted).

E Battery installation

For the purposes of the event, battery packs are defined as the outer container holding a complement of cells/modules, associated internal control equipment, and safety isolator described in B.11.4

E.1.1 Battery packs must be housed in boxes with lids (preferably transparent). In Challenge Class vehicles, the boxes must be removable from the vehicle in which they are installed.

E.1.2 Battery packs must be constructed such that tamper-evident devices such as seals can be applied by the scrutineers.

Once the battery pack(s) have been passed by the scrutineers, seals will be applied to ensure that no cell or battery can be removed without breaking the seal. It is recommended that the battery box be pre-drilled with 3 mm diameter holes to allow seals (e.g.string/ties) to be passed across the top of the cells/battery within the box (a typical seal is shown in the photograph in the appendix). If the design of the box is such that, once sealed, the lid cannot be opened without breakage of the seals, then cell/battery monitoring must be conducted by an internal or a remote battery-management system (see also B11.5). The battery scrutineer may need to drill the battery box(es) if pre-drilled holes are not suitable.

E.1.3 Battery packs must be securely fixed to the car.

Fixing by the use of cable ties is unlikely to meet this requirement.

E.1.4 Chemical spill-proof barrier(s) must exist between the vehicle occupants and all battery packs.

E.1.5 Battery packs shall be provided with adequate airflow vented to the exterior of the car.

E.2 Challenge Class traction battery must not exceed two packs.

F Charging

F.1 After the start of the event, batteries may be charged only from the vehicle solar array. Energy may also be recovered from the movement of the vehicle (e.g. regenerative braking). Any such devices employed must be declared and passed by the Chief Battery Scientist.

F.2 Charging of batteries from any other sources will lead to exclusion from The Event.

G Battery replacement

G.1 The vehicle must travel along the entire course with the same make and number of rechargeable cells or modules that were passed by the Chief Battery Scientist as constituting the total traction battery plus any auxiliary batteries installed under regulation D.6

G.2 Cells, modules or battery packs may not be replaced for any reason other than in the case of accident or malfunction.

G.3 The Chief Battery Scientist must approve any replacement of a cell or battery module. Each time a set of cells or battery modules is replaced, the team will incur a penalty calculated thus: Time Penalty (in minutes) = 100 × 1.225m × n/N × E where m is the number of times a complete battery pack has been changed previously, n is the number of cells or battery modules to be replaced, N is the total number of cells or battery modules in the pack, and E is the total energy (in kWh, 20 hour rate) of the battery pack as determined from the manufacturer's specification or by the specific energy (Wh/kg) of the electrochemical composition of the battery as determined by Chief Battery Scientist, whichever is the greater.

H Chemical incident contingency plan

H.1 Teams must submit a chemical incident contingency plan relevant to the battery chemistry employed and include a statement of intent with regard to handling and disposal of cells, batteries or component materials. This should include all cells used in ancillary equipment used by the team as well as that in the competing vehicle.

(The prefix I is not used)

J Impounding the battery

J.1 Challenge Class teams must supply a lockable box suitable to ensure for compliance with clause J.2.

J.2 Between sunset and sunrise, the team must impound the battery pack in a lockable box which is to be placed in a position acceptable to the Observer.

J.3 Adventure Class teams should supply a lockable box suitable to ensure compliance with clause J.2. If, due to the design of the car, it is not possible to remove the battery, the whole car shall be considered impounded and placed in a position acceptable to the Observer.

J.3.1 No work of any kind may be performed on a vehicle impounded in accordance with Regulation J.3.

K Submission of Vehicle and Team Data

Entrants are required to supply such data as is required to:

1. Indicate their intention to comply with these regulations.

2. Allow arrangements to be made with civil authorities.

3. Provided background material for event publicity.

Adherence to timelines is an essential part of qualification for the event.

K.1 Vehicle and team data must be submitted by 1 June 2009

K.2 **Electrical drawings**

K.2.1 Electrical drawings complying with the requirements of regulation B.11.8 and B.11.9

K.3 Battery Information

K.3.1 Chemistry, Manufacturer, Capacity, Weight and quantity of cells/modules.

K.3.2 Manufacturer's specification sheet for each type.

K.3.3 Details of any battery management system.

K.3.4 Battery pack configuration.

K.4 Tyre information

K.4.1 Number, Make, Type and Size of tyres to be used.

K.4.2 Manufacturers specification sheet detailing speed and load ratings.

K.4.3 Manufacturers statement of suitability of purpose (q.v. footnote to B.6.1).

K.5 Array Information

K.5.1 Make, type, size and quantity of component cells.

K.5.2 Calculation of total area.

K.5.3 Verification of area by independent authority (e.g. consulting engineer).

K.5.5 Drawing (map) of cells as fitted to the car.

K.5.6 Estimated power output.

K.6 Event Publicity

K.6.1 Photographs (or computer rendered pictures of the car).

K.6.2 Completed vehicle specification sheets (as supplied by Organiser).

K.6.3 Background information about the team and the project.

N Compliance

N.1 Entrants who, within one month of the due date for submission, have not satisfied the Chief Scrutineer of compliance, will fail to qualify for the event and their place may be offered to a team on the waiting list.

N.2 Any vehicle not complying with relevant technical regulations will be subject to a penalty.

N.3 Non-compliance penalties will be imposed at the absolute discretion of the Chief Scrutineer, and may include 'Failure to Qualify'.

N.4 The Chief Scrutineer's decision is final and no correspondence will be entered into. (q.v. C4.2)

Notes:

Special notice for teams planning participation in the Challenge Class:

The Organiser acknowledges that regulations encouraging creative interpretation demand a certain amount of flexibility in the way they are viewed by the scrutineers.

In order that there is no misunderstanding, please ensure any new vehicle presented for Challenge Class meets all the published criteria, in particular:

- 6 m^2 of solar collectors. Teams must prove compliance by due date.
- Must be designed to allow occupants to enter and exit the vehicle **without assistance** (please do not ask if it is permissible for crew members to attach steps, cover cells or 'hold the canopy').
- The doors must be able to be secured and released from both inside and outside the vehicle.
- Must incorporate a structural roll bar in accordance with appendix 2.
- Must be equipped with a parking brake.
- The seat angle must not exceed 27° .
- The steering system must be controlled by a steering wheel.
- Must have a reverse gear.
- Must be able to see the driver from outside.
- Must have emergency electrical isolation activation device below the windscreen on the left side.
- Must have the battery isolation contactor internal to the battery pack
- Must have front and rear towing eyes.
- Must have provision to fit 215mm x 97mm licence plate on rear of vehicle.
- Must have provision for event signage 200mm x 500mm each side of the vehicle.
- Must have removable battery packs.
- Must provide lockable boxes for impound.

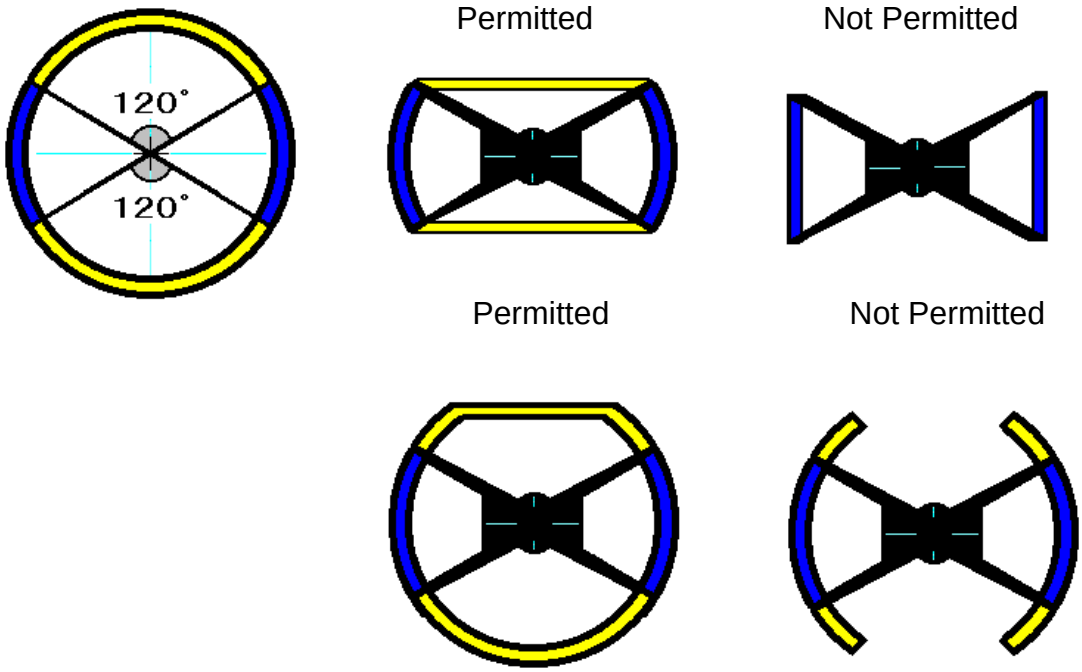
These are amongst the points which define Challenge Class and are extracted from existing regulations.

Appendix 1
International Solarcar Federation Steering Wheel Specifications

Steering

To reduce the possibilities of driver injury in the event of collision and to minimise impediments to emergency egress, the steering system must be controlled by a steering wheel which has a continuous perimeter.

A circular shape is preferred, however the upper part above 2/3 and/or the lower part below 2/3 of the circumference of the steering wheel may be flat as depicted in the diagram below).



Appendix 2
International Solarcar Federation Roll Bar Specifications

All vehicles must be equipped with the first and second roll bars (as shown in the specifications below) to prevent direct damage to the driver and serious cockpit deformation in the event of a collision or of a car turning over.

The first and second roll bars form the basic element of the rollover structure. These structures must be made of steel tubes or other material of sufficient tensile strength to protect the occupant from a force of 4w (w=weight of vehicle) The structure must be bolted, welded or otherwise structurally incorporated to the vehicle according to sound engineering practice. For vehicles whose bodywork fulfills the function as the first and second roll bars, the installation of additional roll bars is not necessary.

Roll bars shall meet the following dimensional criteria:

- The line extended from the top of the first roll bar to the top of the second roll bar must be above the driver's helmet when he/she is seated normally in the vehicle.

- The top of the first roll bar must be higher than the top of the steering device.

- The first roll bar must cover the steering device with steered wheel(s) in the straight position ahead when the vehicle is viewed from the front.

- The second roll bar must cover the driver’s shoulder when the vehicle is viewed from the front. In case that the bodywork of the vehicle covers the driver's shoulder, the second roll bar may cover only the driver's head.

- The second roll bar must have enough strength for lifting or towing with the driver on-board.

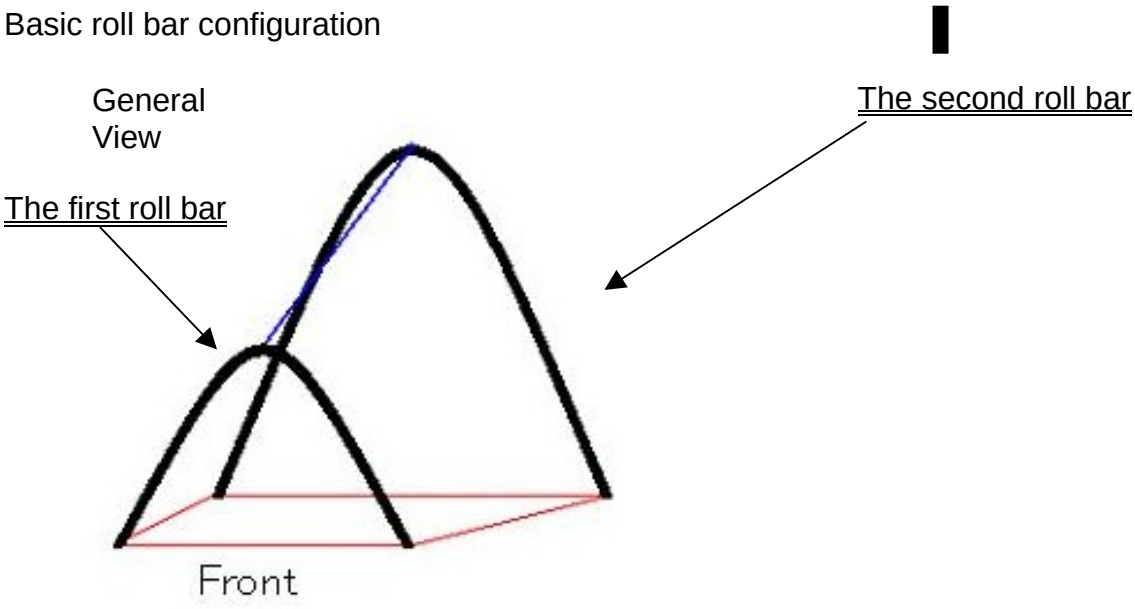
General descriptions

Roll bars must be designed and constructed so that, when correctly installed, they minimize the risk of injury to the occupant.

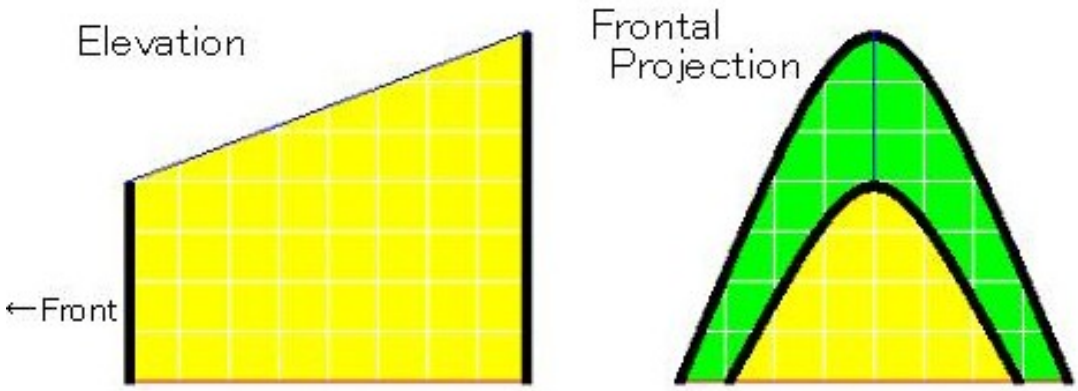
The responsibility to secure the necessary strength rests with competitors.

No part of roll bars must hamper the entry/exit of the occupant or take up the space designed for the occupant.

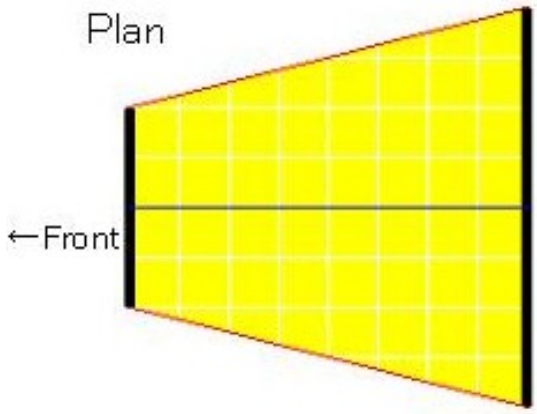
Basic roll bar configuration



The driver's helmet must, when seated normally, be contained within the defined



All driving controls must be capable of being accessed and operated within the defined area



All parts of the driver's body (including any protective clothing and equipment, must, when seated normally, be contained within the defined area

Appendix 3

International Solarcar Federation
Standard Measurement of Seating Angle

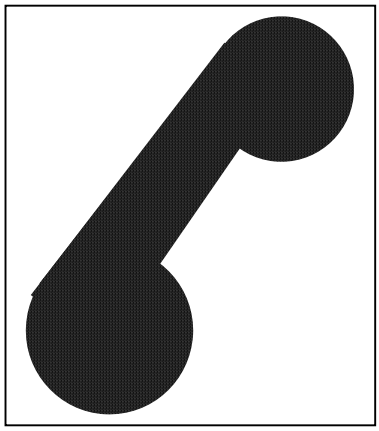
The seating angle must not exceed 27 degrees from the vertical plane.

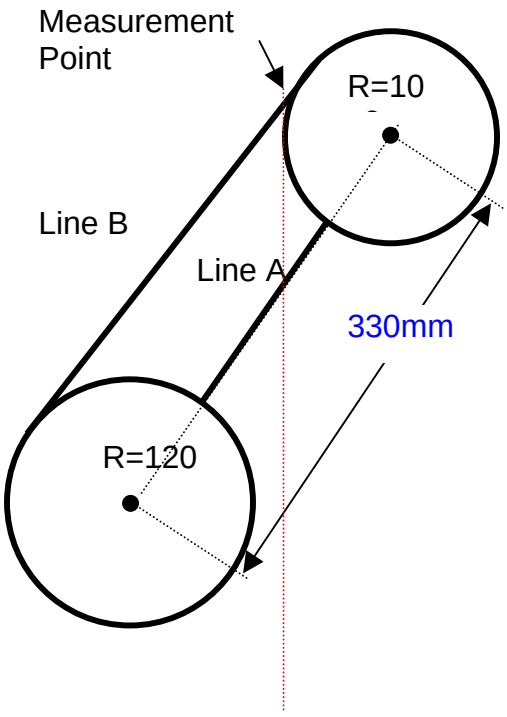
The concept of determining the seating angle is based on the measurement of torso angle in accordance with ISO/JIS Standards.

- JIS D4607 is the standard that shows the three-dimensional seated human model for measurement of automotive body interiors.

- JIS D0024 establishes the H points (hip point: rotational centre of body and thigh in the three-dimensional human model) and indicates measurement methods including the torso angle based on D4607.

For ISF scrutineering purposes, measurement is effected by using a template based on the hip and shoulders of a two-dimensional form derived from the JIS D0024 standard.





Making a Template

- Draw a circle with a radius of 120mm.
- At a point 330mm from the centre of the circle, draw another circle with a radius of 100mm
- Draw a line connecting the centre of the two circles (Line A).
- Draw a tangent to connect the circumferences of two circles (Line B)
- Cut the shape using suitable material
- Attach a plumb line to the measurement point
- The angle is measured between line A and the perpendicular.

Appendix 4

Vehicle specifications from previous ISF events.

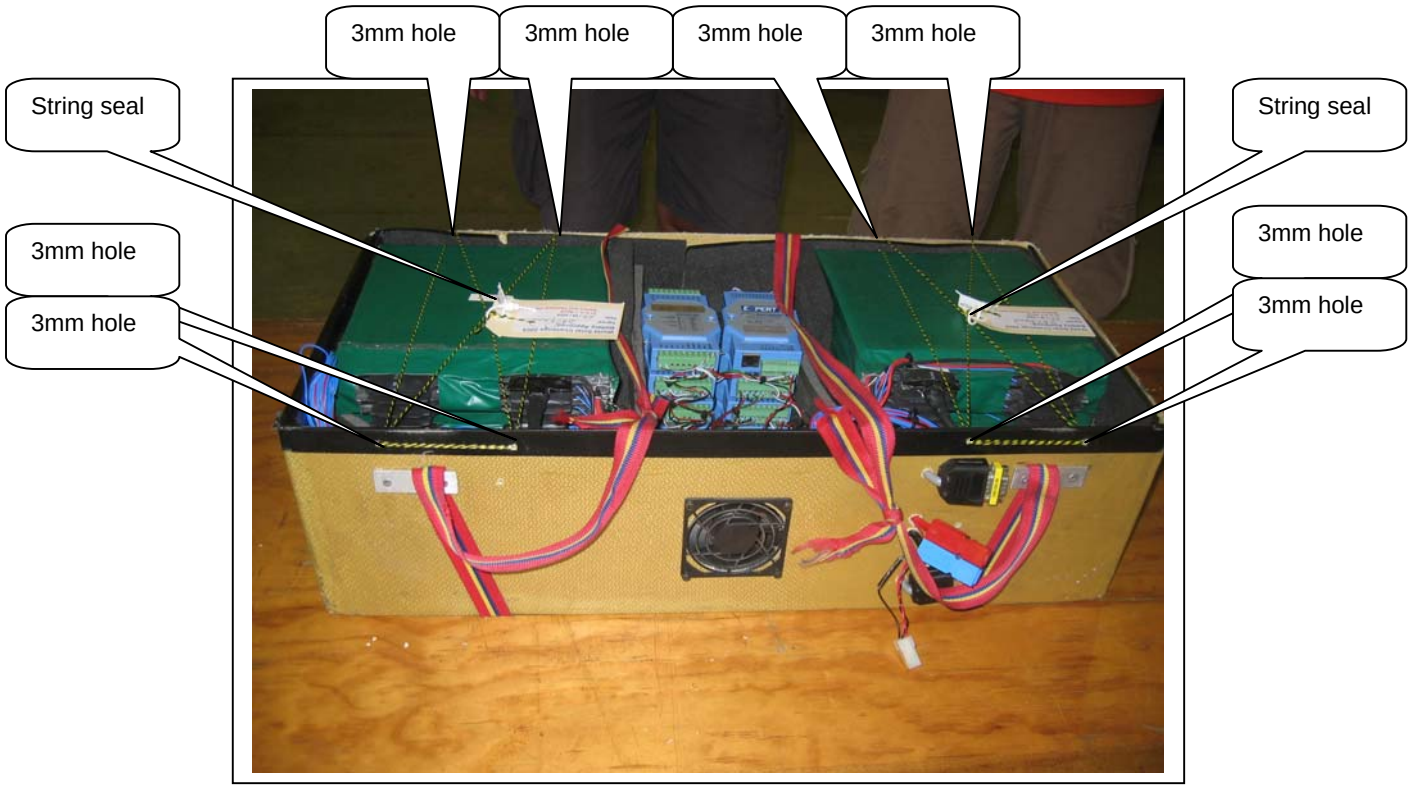
Adventure Class cars comply with any previous ISF classes which include:
***Classic WSC**: Solar collectors may be constructed in any way provided that they lie, at all times, entirely within a single right rectangular parallelepiped of dimensions A × B × C, where A ≤ 4.44m, B ≤ 2.00m, C ≤ 1.60m and A × B ≤ 8.00m2.*

***Cut Out Class:** Solar collectors may be constructed in any way provided that they lie, at all times, entirely within a single rectangular parallelepiped of dimensions A × B × C, where A ≤5.00m, B ≤ 2.00m, C ≤ 1.60m. Furthermore, the product of the length and width, less any single rectangular region not occupied by solar array components, may not exceed 8m2.*

***ISF 5000:** The solar car must have a maximum length of 5m and a maximum width of 1.8m. There is no restriction on array area.*

Appendix 5

Typical battery pack with seals applied.



Updates and Bulletins

This version issued May 2008	
1.3 proofed for distribution 1.4 minor revisions (typos)	1/6/08 3/6/08
1.5 Release copy	5/6/08
1.6 Amended Reg D3 (added provision for $LiFePO_4$) Bulletin 2009/1	1/9/08

