



Regulations for the 2013 World Solar Challenge

In line with our history of major reviews every five years, the requirements for 2013 will once again ensure the World Solar Challenge evolves to present opportunities for significant innovation and achievement:

- new Solar EVs must comply with new roadworthiness requirements
- new Challenger Class Solar EVs must have four wheels
- introduction of a new Cruiser Class for more practical Solar EVs
- introduction of the Evolution Class, to demonstrate vehicles designed to make a significant reduction in the environmental impact of personal mobility.

General regulations and technical regulations have been combined into this single PDF document.

This document is organised, as much as possible, in the order that information is required.

The World Solar Challenge® asserts its moral right to be identified as the owner of the intellectual property contained in these regulations.

The information contained herein is written for the purposes of conducting the 2013 World Solar Challenge and must not be regarded as definitive instructions as to how a Solar EV should be constructed or operated.

Version: June 16, 2012

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Diagram credits:

- The headroom diagram is from Section LK of the [National Code of Practice for Light Vehicle Construction and Modification](#).
- The rear vision diagram is from UNECE Regulation 46, Section 15.

Instructions


The process of entering the 2013 World Solar Challenge includes the completion of the form fields and checkboxes in this document.

Once complete, this document should be saved and emailed to the Organisers. Further details will be given to registered entrants.

Entrant number:

Team name:

Solar EV name:

 *Entrant number will be confirmed upon acceptance of your entry—see Regulations [1.34](#), [1.55](#) and [1.56](#).*

Document control

Use the table below to track versions submitted to the Organiser. Any changes allowed in accordance with Regulation [1.25](#) must be recorded and this document resubmitted. For each version submitted, add a line below giving the date (YYYY-MM-DD) and a brief description of the changes.

Date

Changes

1 Entering the World Solar Challenge

Scope

1.1 These regulations apply to the 2013 World Solar Challenge® (the Event), which comprises participants' eligibility, pre-event preparation, scrutineering, testing, on-road components and associated activities. These regulations supersede regulations for any previous event.

1.2 The Event will be conducted under the regulations described in this document and any Further Regulations that may be issued, all of which comprise the Regulations of the Event.

1.3 Teams and individuals requesting entry into the Event are assumed to know the Regulations of the Event. The participation of teams and individuals in the Event will constitute an acceptance of the Regulations of the Event.

1.4 The Event is recognised by the International Solarcar Federation (ISF).

The Event

1.5 The purpose of the Event is to stimulate research into and development of sustainable transport.

1.6 The Challenge is to design and build a Solar EV as described in the Regulations of the Event, and drive it across the continent of Australia.

1.7 Other award categories (e.g., for Technical Innovation) will be announced in Further Regulations.

1.8 The Correct Title of the Event is the 'World Solar Challenge®'.

1.9 Entrants shall use the Correct Title in all references to the Event.

1.10 The Official Language of the Event is English.

Entrants and eligibility

1.11 The Entrant is the legal entity completing the Participation Agreement.

i *The Participation Agreement forms part of the entry documentation which can be download from the World Solar Challenge web site.*

1.12 Eligible Solar EVs will be those described in the Regulations of the Event and approved for use on public roads by the civil authorities.

1.13 The Organiser is:

South Australian Motor Sport Board (ABN 43 976 679 496)
PO Box 663
Kent Town 5071
AUSTRALIA

Telephone: +61 8 8212 8500
Facsimile: +61 8 8212 6700
E-mail: teams@worldsolarchallenge.org

1.14 Technical Committee: Chris Selwood, Dr David Rand, Prof. John Storey, Dr Bill Boyd, Dr Peter Pudney, Paul Gwan, Dr David Snowdon.

1.15 Stewards of the Event shall be appointed by the International Solarcar Federation.

Officials

1.16 The Officials of the Event shall be appointed by the International Solarcar Federation and announced in Further Regulations.

Date and Venue of the Event

1.17 The Event will commence with the opening of the Registration Desk in Darwin on 1 October 2013 and conclude at the close of the Awards Ceremony in Adelaide on 13 October 2013.

1.18 The Event will be held on public roads between Darwin and Adelaide, and such other venues as approved by the Organiser.

Entries

1.19 Application for participation must be made on the approved form and, together with the Participation Agreement, be signed by the Entrant.

1.20 Applications will be opened on publication of these regulations and will close at noon (Adelaide time) on 31 May 2013, when the maximum number of entries is reached, or when otherwise determined by the Organiser. Late entries may be accepted at the discretion of the Organiser. Late entry fees will apply.

1.21 The number of Solar EVs will be limited to thirty, or such number as the Organiser determines.

1.22 Entries received after capacity has been reached may be put on a reserve list.

1.23 The Organiser reserves the right to accept or reject any entry at their absolute discretion. No correspondence will be entertained.

1.24 All entries are subject to qualifying.

Change of entry details

1.25 Once the specification of the Solar EV has been lodged with the Organiser, technical changes (defined as those items required by this form and by other compulsory documentation) may be made only with the agreement of the Chief Scrutineer.

1.26 Changes may be made to team members up to the time of Team Registration. Changes to drivers may be made up to the time of Scrutineering.

1.27 No guarantee is given that any changes will appear in Event publicity.

1.28 Once a Solar EV and its drivers have passed scrutineering, no technical changes (see Regulation [1.25](#)) or changes to drivers will be permitted.

Financial

1.29 The entry fee for the 2013 Event is AU\$6000.00 plus Australian Government tax at the rate prevailing at the time of invoice. (At the date of publication this is 10%, making a total of AU\$6600.00).

1.30 Early Bird Discount: Fees invoiced before 30 October 2012 will qualify for a discount of 10%. Should the amount remain outstanding after the due date for payment, a supplementary invoice reversing this discount may be issued.

1.31 Any entry request granted after 31 May 2013 will attract a Late Entry Fee of an additional 5%.

1.32 The South Australian Motorsport Board will issue invoices on behalf of the World Solar Challenge®.

1.33 All invoices are payable by the date shown thereon.

1.34 Places on the entry list will be confirmed only upon receipt of entry fees.

1.35 Entries will become void if payment or documentation deadlines are not met.

1.36 Bank and currency transaction charges are the responsibility of the Entrant.

i *Small variations due to currency fluctuations may be adjusted at Registration in Darwin. Credit card facilities will be available.*

1.37 All outstanding financial matters must be finalised before the start of the on-road component of the Event.

1.38 Withdrawing from the Event:

- Entrants withdrawing on or before 31 May 2013 will be entitled to a full refund of monies paid.
- Entrants withdrawing after 31 May 2013 and on or before 31 July 2013 will be entitled to a refund less a cancellation fee of AU\$550.
- Entrants withdrawing after 31 July 2013 will forfeit all monies paid.

Structure

1.39 Regulations of the Event may be amended or supplemented by the issue of Further Regulations.

1.40 The Stewards of the Event are the only authority empowered to make a decision on the interpretation of the Regulations of the Event.

1.41 Exclusion will occur if the Stewards deem an Entrant to have departed from the spirit of the Event by deliberately acting to gain unfair advantage over other Entrants.

1.42 Entrants who have not, by 30 June 2013, satisfied the Chief Scrutineer that they will achieve compliance with the Regulations of the Event, will fail to qualify for the Event and their place may be offered to a team on the waiting list.

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

1.44 The Chief Scrutineer's decision is final and no correspondence will be entertained.

Route

1.45 The on-road component of the Event shall be conducted over the authorised route, primarily the Stuart Highway between Darwin, Northern Territory and Port Augusta, South Australia, and then Highway One between Port Augusta and Adelaide—a distance of approximately 3000 km—and such other roads as detailed in the official route notes.

1.46 Registration/Permits issued by the relevant authority are required to run Solar EVs on public roads (Government fees apply). It is a legal requirement, and an Event requirement, that any conditions imposed by the road transport authorities to use public roads are observed.

Compulsory documentation

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

- indicate their intention to comply with the Regulations of the Event
- allow arrangements to be made with civil authorities
- provided background material for event publicity.

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

1.48 This document, with text fields and checkboxes filled in, and with additional documentation specified in these or Further Regulations, must be submitted electronically on or before 30 June 2013. Further details will be supplied to registered entrants.

1.49 The Entrant must also submit, by 30 June 2013:

- Solar EV Draft Structural Integrity Certificate (see Regulation [2.2](#))
- Electrical System Specification (see Regulation [2.72](#))
- Solar Collector Specification (see Regulation [2.79](#))
- Energy Storage System Specification (see Regulation [2.88](#))
- Battery Incident Plan (see Regulation [2.91](#))
- Safety Plan (see Regulation [5.31](#))
- Observer Arrangements (see Regulation [6.25](#))
- publication-quality information and photographs of the team and Solar EV.

1.50 Any discrepancy found in documentation will be resolved by reference to the latest version received.

Driver's and Entrant's qualifications

1.51 All Solar EV drivers must present a current and valid motor vehicle driver's licence recognised by Australian authorities. Driving licences issued by other countries must include a photograph of the holder, the class of vehicle for which the licence applies and the expiry date. If these details are not in English, an International Driving Licence or a certified translation of the original licence must also be presented.

i *Driving licences will be inspected and verified by the Australian Road Transport Authorities at Registration and Scrutineering.*

1.52 All Solar EV drivers shall have a minimum experience of 12 hours driving the Solar EV as demonstrated by presentation of a logbook and a signed declaration by the Team Manager.

1.53 The minimum number of Solar EV drivers is two and the maximum number is four.

1.54 Any participant under the age of 18 shall be duly vouched for through the submission of a Parental Consent Form and written acceptance of responsibility by the Team Manager.

i *Supervision and responsibility for persons under the age of 18 is vested in the relevant Team Manager. As a biennial event with international volunteers, it is not practical for the Event to require an Australian Police Check Certificate for each member of staff, official or volunteer. Written permission to participate in the Event, acknowledging these facts, must be given by the parent or legal guardian of any proposed participant under the age of 18.*

Entrant numbers

1.55 Solar EVs will be allocated Entrant numbers on acceptance of entry.

1.56 Special requests for the use of a particular Entrant number may be submitted. Requested numbers should contain two digits. Allocation is at the sole discretion of the Organiser.

Insurance

1.57 All Entrants will be covered by the Organiser's Public Liability policy.

1.58 Insurance covering the cost of damage to Third Party Property caused by the operation of the Solar EV whilst participating in the Event will be arranged by the Organiser on behalf of the Entrant.

1.59 Insurance covering emergency medical evacuation, air-ambulance and emergency hospital treatment will be arranged by the Organiser on behalf of the Entrant. These arrangements require the payment of a nominal Registration Fee (expected to be about AU\$20) for each individual team member; team members without this cover will not be allowed to participate in the Event.

1.60 Comprehensive vehicle insurance is the responsibility of the Entrant.

i *Australian law regulates the provision of insurance advice. Registered entrants will be provided with further details.*

i *Third Party Bodily Injury insurance is a component of Motor Vehicle Registration, a fee for which is payable to the Motor Vehicle Registration Authority.*

2 The Solar EV

Classes

2.1 Solar EVs must belong to one of the following Event classes:

Challenger Class Solar EVs are designed primarily for efficiency rather than comfort or practicality. They need carry a driver only. The winner of the Challenger Class is the first Challenger Class Solar EV to reach Adelaide.

Cruiser Class Solar EVs are designed primarily for practicality. They are designed to carry two or more occupants, each facing forwards. They will be judged on external energy use, the time taken to complete the course, payload carried, and practicality.

Adventure Class is for entry-level teams wishing to campaign Solar EVs built for previous International Solarcar Federation events that do not comply with the dimension and configuration requirements of the Challenger Class.

Evolution Class is designed as a forum for demonstrating vehicles which have been designed, equipped or modified to demonstrate a significant reduction in environmental impact. These may be practical or concept vehicles that meet the requirements for individually constructed vehicles but not the requirements of the Solar EV classes. The Technical Committee will determine the eligibility of any vehicle submitted for the Evolution Class.

i *Cruiser Class Solar EVs may be driven from Darwin to Adelaide without passengers—see Regulation 6.95.*

i *FIA Olympia Class vehicles may participate in the Adventure Class.*

i *Evolution Class vehicles that are not road registered must meet the requirements of the Northern Territory Road Transport Authority for Conditional Registration. They should comply with the same regulations as Cruiser Class Solar EVs, with the following exceptions:*

- *energy sources are not restricted*
- *energy storage capacity is not restricted*
- *the energy storage system does not have to be sealed or removed from the vehicle.*

Entrants in the Evolution Class may apply to the Organiser for further exemptions. The decision of the Organiser will be final.

Vehicle class:

Roadworthiness

i *All Solar EVs must meet the roadworthiness requirements described in the Regulations of the Event, which are based on UNECE requirements for road vehicles. Solar EVs will be subjected to a detailed inspection by the Northern Territory Road Transport Authority.*

i *Entrants wishing to build Cruiser Class Solar EVs that can be registered for general on-road use should consult the road transport authority in their own country to determine additional requirements.*

2.2 Entrants in all Solar EV classes must have their Solar EV certified by a qualified professional engineer as having the structural integrity to be driven on public roads. A draft Structural Integrity Certificate must be submitted by 30 June 2013 in PDF format, called

'xx_structural_integrity_certificate.pdf', where xx is the Entrant number. The original must be presented to the Road Transport Authority at the time of scrutineering or in support of any application for pre-Event on-road testing permits made to an Australian Road Transport Authority. The approved form will be supplied to registered entrants.

i *Solar EVs do not have to be road registered prior to the Event; they will be scrutineered as part of the Event and Solar EVs complying with the Regulations of the Event can apply for Conditional Registration allowing them to participate in the Event. Conditional Registration includes the issue of a commemorative registration plate, and is the authority for Solar EVs to travel on the public roads used by the Event. Please note that fees are charged by the Authorities to cover registration and compulsory third party injury insurance. These charges are payable directly to the Northern Territory Government at the time of issue and are approximately \$70.*

2.3 The Organisers reserve the right to determine the Class of any Entrant. Solar EVs that do not meet all requirements for Challenger Class may be allowed to run in the Adventure Class, at the discretion of the Clerk of the Course. Solar EVs that do not meet all requirements for Cruiser Class may be allowed to run in the Evolution Class, at the discretion of the Clerk of the Course.

2.4 Regulations that do not specify Classes apply to all Classes.

Dimensions and configuration

2.5 When moving in a straight line, Challenger Class and Cruiser Class Solar EVs must be no more than 4500 mm in length, no more than 1800 mm in width and no more than 1800 mm in height.

i *When turning a corner, the wheels and wheel spats are permitted to exceed this envelope.*

Length:	mm
Width:	mm
Height:	mm

i *Temperature, humidity and gravity can change the size of a Solar EV. The Solar EV will be measured at Static Scrutineering in Darwin.*

2.6 When seated in a road ready position, the driver's eyes must be not less than 700 mm above the road.

2.7 A Solar EV must have two front wheels and two rear wheels, arranged so that the tyre contact points are symmetrical about the longitudinal centreline.

2.8 The distance between the front tyre centres and the distance between the rear tyre centres must both be not less than half the maximum width of the Solar EV.

i *The Northern Territory Road Transport Authority will require the Solar EV to pass a high-speed lane change test at Dynamic Scrutineering. Details will be provided to registered Entrants.*

i *Entrants must design their Solar EVs to have good aerodynamic stability. In particular, it is important that the centre of pressure is such that if the nose lifts, aerodynamic forces will push the nose downwards.*

Construction

2.9 Solar EVs must be constructed or adapted to protect, as far as is reasonably possible, the occupants in the event of collision or roll-over. Steps should be taken to ensure that components or accessories do not impinge on the occupant space.

2.10 All sharp edges or pinch points must be covered when in use, and internal components or cargo must be secured.

2.11 Adequate ventilation must be provided to all occupants.

i *Ambient temperature during the World Solar Challenge can be over 40° C, and the interior of a Solar EV can be 10° C above the ambient temperature. Ventilation is particularly important for evaporative cooling of Solar EV occupants.*

2.12 Occupants of Solar EVs must wear helmets that meet or exceed DOT or ISO standards for motorcycle helmets.

2.13 The design and construction of the Solar EV must be such that, in the event of a front-end collision, any part of the Solar EV structure (especially the solar array) will be deflected away from the driver/passenger compartment.

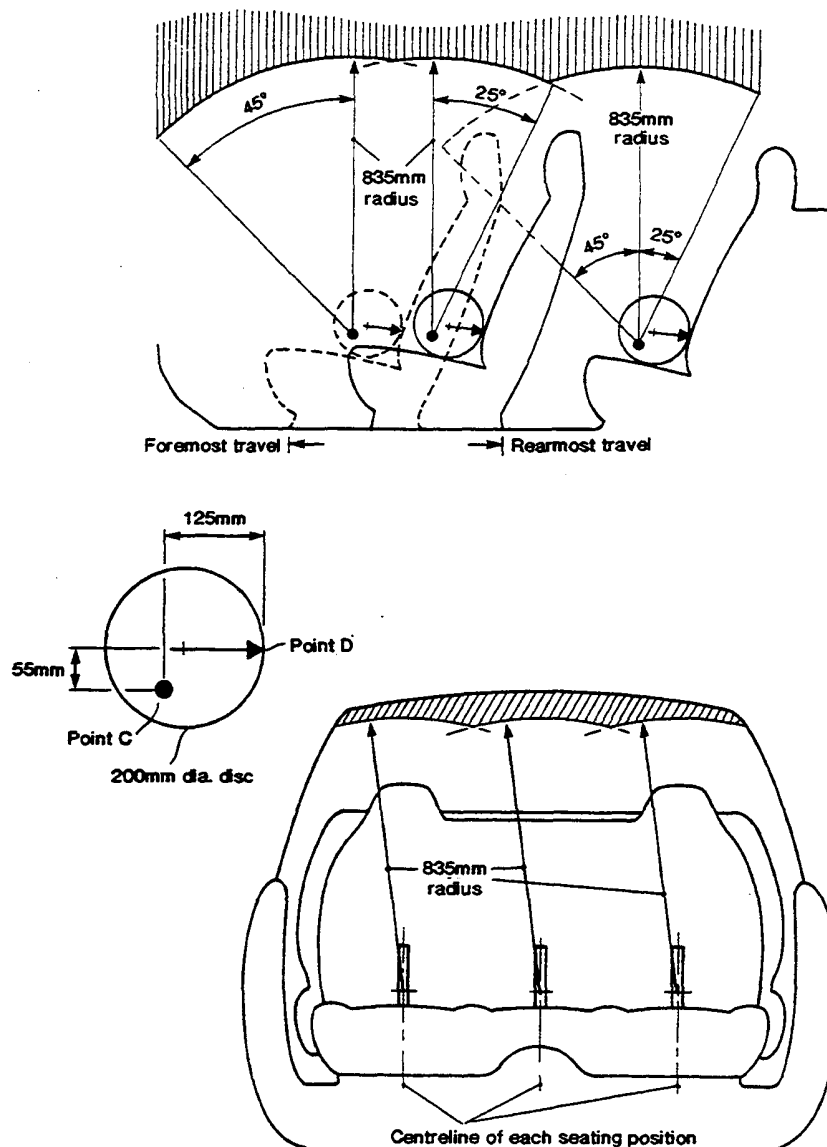
2.14 Drivers of Challenger Class Solar EVs must be enclosed in a safety cage capable of protecting the driver from an impact of 5 G from any direction.

2.15 Cruiser Class Solar EVs must be fitted with roll bars or roll cages which meet or exceed the requirements of Section LK of the Australian [National Code of Practice for Light Vehicle Construction and Modification](#) or regulations from an equivalent road authority.

2.16 Adventure class Solar EVs must be fitted with a roll bar or roll cage meeting or exceeding the roll bar requirements of the Technical Regulations of 2011 World Solar Challenge.

Regulation to which roll bar or roll cage complies:

2.17 For Challenger and Cruiser Class Solar EVs, head space must comply with Section LK of the [National Code of Practice for Light Vehicle Construction and Modification](#), as shown in the following diagram.



Field of view

2.18 The driver must have clear forwards vision. For Challenger and Cruiser Class Solar EVs, the driver must be able to see the following points:

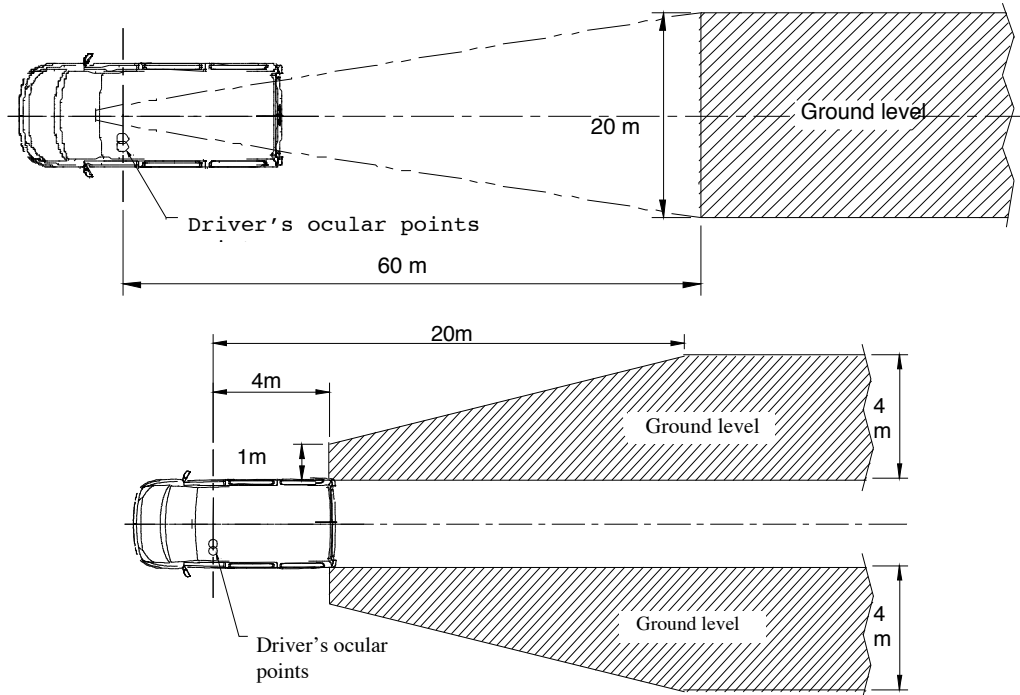
- ground height, 11 m in front of the Solar EV (Australian Design Rule ADR 08/..)
- every point between 0.70 m below eye level and 0.70 m above eye level at a distance of 4.0 m from the driver's eyes, at every forward angle.

2.19 Rear vision systems may be electronic, mirrors, or both.

Type of rear vision system:

2.20 Electronic rear vision systems must operate whenever the Solar EV is in motion under its own power. The image must be oriented so that objects on the right of the Solar EV are on the right of the image.

2.21 The driver must be able to see the shaded areas shown in the following diagram using the rear vision system (UNECE Regulation 46, Section 15).



Windows and windscreens

2.22 All windows must be made of a material that is highly resistant to breaking or major damage. Windows that are necessary to ensure the drivers field of view must be made of glass or similar transparent material that does not distort vision or colour.

2.23 Windows must have an optical transmittance not less than 75% (UNECE Regulation 43).

Optical transmittance of windows: _____ %

i *It must be possible to see the occupants from outside the Solar EV.*

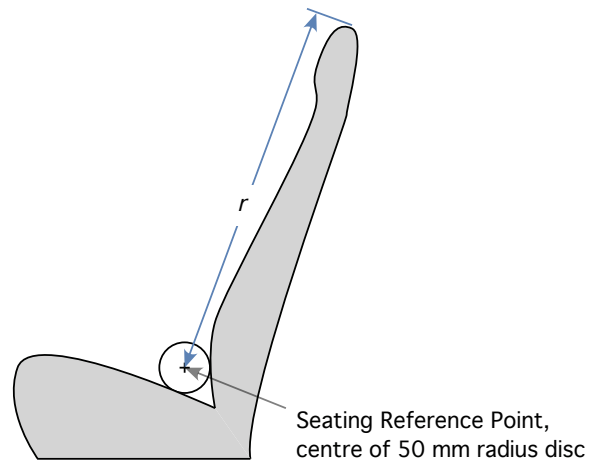
Seats

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

2.25 Cruiser Class Solar EVs must have two or more seats, each facing forwards.

Cruiser seating configuration:

2.26 For Challenger Class and Cruiser Class Solar EVs, each seat must have a head restraint. The distance r from the Seating Reference Point to the top of the head restraint must be not less than 800 mm for front seats and not less than 750 mm for rear seats (UNECE Regulations 17 and 25). For the purpose of the Event, the Seating Reference Point will be approximated as shown in the diagram below, and the top of the head restraint must be outside a radius $r = 800$ mm for front seats and outside a radius $r = 750$ mm for rear seats.



2.27 For Challenger Class and Cruiser Class Solar EVs, each occupant's heels must be below the lowest point on their seat base, and the angle between the shoulders, hips and knees must not be less than 90 degrees.

2.28 Adventure Class Solar EVs must meet the seat angle requirements specified in the Technical Regulations of the 2011 World Solar Challenge.

Seatbelts

2.29 Seatbelts must be fitted for each seating position.

2.30 Seatbelts must be compliant with UNECE Regulation 16 or US FMVSS 571.209 and have an (E) or equivalent compliance marking.

2.31 For Challenger Class and Cruiser Class Solar EVs, seatbelt anchorages must meet the intent of UNECE Regulation 16.

i *Section LK of the Australian [National Code of Practice for Light Vehicle Construction and Modification](#) gives examples of how this can be met.*

2.32 Adventure Class Solar EVs must have adequate seatbelt anchorages. Adventure Class Solar EVs with seats inclined more than 27° must have five point belts.

i *Under Australian law, the use of seatbelts is mandatory for all occupants of motor vehicles, including Solar EVs and support vehicles.*

Doors and openings

2.33 Challenger Class Solar EVs must be designed to allow the driver to exit the Solar EV without assistance. Doors or access points must be able to be secured and released from both inside and outside the Solar EV. Entrants will be required to demonstrate that each driver can exit the Solar EV unassisted in no more than 15 seconds.

2.34 Cruiser Class Solar EVs must be designed to allow occupants to enter and exit the Solar EV without assistance. Doors must be able to be secured and released from both inside and outside the Solar EV. Entrants will be required to demonstrate that all occupants (one

per seat) can enter and exit the Solar EV unassisted in no more than 15 seconds for each action.

2.35 Adventure Class Entrants will be required to demonstrate that occupants can exit the Solar EV unassisted in no more than 15 seconds. If emergency egress involves permanent damage to the Solar EV then the Team Manager will need to declare the method of extraction to the satisfaction of the Chief Scrutineer at time of scrutineering.

2.36 Emergency opening points, and the method of opening, must be clearly indicated on the exterior of the Solar EV.

2.37 Securing of any egress route, canopy or hatch with adhesive tape is not permitted.

Brakes

i *Braking requirements for Solar EVs are based on UNECE Regulation 13-H.*

i *The Solar EV must have a balanced, dual-circuit braking system as is standard automotive practice. In general, bicycle brakes are not sufficiently dimensioned to be considered not liable to failure.*

2.38 The Solar EV must be equipped with two independent mechanical (not including regenerative) braking systems, so that if one system fails the other can still stop the Solar EV.

2.39 The following brake components can be regarded as not liable to failure if they are amply dimensioned and readily accessible for maintenance:

- a brake pedal and its bearing
- hydraulic cylinders and their pistons
- hydraulic control valves
- brake cylinders and their pistons
- brake lever and cam assemblies.

Hydraulic brake hoses and lines are regarded as liable to failure.

i *Components regarded as not liable to failure need not be duplicated; these components may be shared by the two independent braking systems.*

Primary braking system:

Secondary braking system:

2.40 Braking must not cause the Solar EV to yaw.

2.41 Mechanical braking effort must be applied to at least two wheels.

2.42 For Solar EVs without anti-lock brakes, the front wheels must lock up before the rear wheels.

2.43 The Solar EV must be able to stop within distance $0.1v + 0.0060v^2$ metres from any speed v , in km/h, that the Solar EV can achieve, up to 100 km/h.

Measured braking distance from 50 km/h: m

Measured braking distance from 75 km/h: m

Measured braking distance from 100 km/h: m

i Braking performance will be tested at Dynamic Scrutineering. The Solar EV must demonstrate the ability to stop in less than 20 m from 50 km/h.

i This is a higher braking rate than in previous Events, but is the rate at which other vehicles on the road can brake.

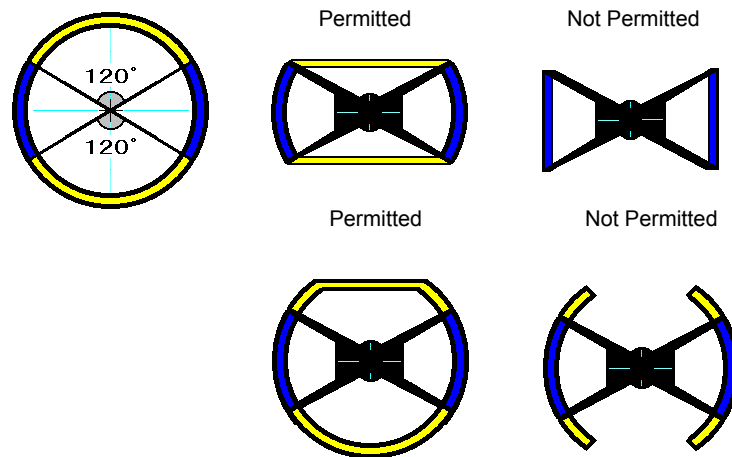
2.44 Cruiser Class Solar EVs must be equipped with a park brake capable of holding the vehicle and occupants on an 20% gradient.

i The force, in Newtons, required to hold a vehicle and its occupants with combined mass m on a gradient of 20% is approximately $1.9 m$.

Steering

2.45 The Solar EV must be able to make a U-turn in either direction within a 16 m lane, kerb to kerb.

2.46 The steering system must be controlled by a steering wheel which has a continuous perimeter. Acceptable designs are shown in the following diagram.



2.47 Failure of any non-mechanical component of the steering system must not prevent effective steering of the Solar EV.

2.48 Any steering shaft must be designed so that it will not spear the driver in a crash.

i Steering wheels should be fitted with a collapsible boss to reduce steering wheel impacts.

Tyres

2.49 Solar EVs must be fitted with tyres compliant with UNECE Regulation 30 or US FMVSS 571.109, and must have E or DOT approval markings.

2.50 All front tyres must be of the same type. All rear tyres must be of the same type.

2.51 Tyres must be rated to withstand the loads and forces imposed by the Solar EV mass, speed, steering and braking.

2.52 Tyres must have a tread pattern across the section width that normally comes into contact with the road, at least 1.5 mm deep in a band that runs continuously around the circumference of the tyre, and must be free of any apparent defect.

2.53 Tyres must, at all times, be used in accordance with their manufacturers recommendations.

Number of front wheels:

Front tyre make and model:

Front tyre size (e.g. 90/80R16, 2.50-16):

Front tyre load rating:

kg

Front tyre speed rating:

km/h

Front tyre has an E or DOT approval mark:

Front wheel static load:

N

Front tyre recommended rim sizes:

Front rim size:

Number of rear wheels:

Rear tyre make and model:

Rear tyre size (e.g. 90/80R16, 2.50-16):

Rear tyre load rating:

kg

Rear tyre speed rating:

km/h

Rear tyre has an E or DOT approval mark?

Rear wheel static load:

N

Rear tyre recommended rim sizes:

Rear rim size:

2.54 Entrants must bring a spare tyre of each type to Static Scrutineering.

Lights and indicators

2.55 Rear stop lamps and front and rear direction indicators (turning indicators) are required. For Cruiser Class Solar EVs, lamps must be compliant with UNECE Regulations 6, 7 and 37 or the SAE/DOT equivalents. For Challenger Class and Adventure Class Solar EVs, lamps must be visible in sunlight by other road users at a distance of 30 m.

i *Complying lamps are readily available, and will have an E or SAE/DOT compliance marking.*

i *Headlamps, retro-reflecting devices, illumination for rear registration plates, end outline lamps, fog lamps, reversing lamps and parking lamps are not required for the Event. If fitted, however, they must comply with UNECE or SAE/DOT regulations.*

2.56 For Challenger Class and Cruiser Class Solar EVs, the positions of lamps must comply with UNECE Regulation 48:

- Direction indicator lamps must be within 400 mm of the extreme outer edge of the Solar EV on each side, at least 600 mm apart (400 mm apart if the Solar EV is less than 1300 mm wide), and not less than 350 mm above the ground. They must be visible 15° up, 5° down, 80° outward and 45° inward.
- Brake lamps must be at the rear of the Solar EV within 400 mm of the extreme outer edge of the Solar EV on each side, at least 600 mm apart (400 mm apart if the Solar EV is less than 1300 mm wide), and not less than 350 mm above the ground. They must be visible 15° up, 5° down and 45° to the left and right.
- A centre eye-level brake lamp is required, not more than 150 mm below the rear wind-screen or not less than 850 mm above the ground. It must be visible 10° up, 5° down and 10° to the left and right.

2.57 Direction indicators must flash at 90 ± 30 flashes per minute.

2.58 It must be possible to flash the left and right direction indicator lamps simultaneously, as a hazard warning signal.

Reversing mechanism

2.59 Cruiser Class Solar EVs must be able to be driven backwards under their own power with the driver seated in the normal position.

Horn

2.60 An audible warning device must be permanently fitted to the Solar EV. It must be capable of giving sufficient audible warning of the presence of the Solar EV, and have a constant amplitude and frequency (UNECE Regulation 28).

Identification

2.61 The Solar EV must have a unique Vehicle Identification Number (VIN), which must be permanently attached to a substantial part of the Solar EV chassis or frame.

i See the FAQ file at worldsolarchallenge.org for details of how a Entrant may create its own VIN meeting ISO 3779.

2.62 Solar EVs successful in scrutineering will be issued with a Northern Territory Government licence plate (fees apply), which must be displayed on the Solar EV in such a manner as to be visible from the rear (material: aluminium; size: 215 mm × 97 mm). The licence plate must be mounted without bending it, and with its normal no more than 10 degrees from the direction of travel.

2.63 An unbroken rectangular space, 200 mm in height × 500 mm in width and clearly visible to a person standing 5 m from the Solar EV, must be provided on each of the right and left sides of the Solar EV, for Event signage.

i Event signage will be provided to qualifying entrants by the Organiser at scrutineering.

2.64 An unbroken rectangular space, 200 mm × 200 mm and clearly visible to a person standing 5 m from the Solar EV, must be provided on each of the right and left sides of the Solar EV for the purpose of Entrant number signs. The number must be clearly displayed

on each side of the Solar EV and on the rear of the Primary Escort Vehicle. Event numbers shall be in contrasting colours to their background and acceptable in every way to the Chief Scrutineer.

2.65 For Challenger Class and Cruiser Class Solar EVs, an unbroken rectangular space, 300 mm × 1500 mm and clearly visible to a person standing 5 m in front of the Solar EV, must be provided. The name of the Entrant, the name of the Solar EV, and the country of origin should be shown at the leading edge of the Solar EV. A 300 mm × 300 mm portion of this space must be reserved for the Event Logo.

i *The Event Logo will be provided to qualifying entrants by the Organiser at scrutineering.*

2.66 The national flag of the country of entry must be displayed on the Solar EV, fixed adjacent to the windscreen. Minimum size is 70 mm × 40 mm.

Electrical

2.67 The electrical system must meet the following requirements of Section 5 of [UNECE Regulation 100](#):

- All high-voltage parts must be protected by covers or protection grills that are reliably secured and marked with the approved high voltage symbol.



- Covers that can be reached by Solar EV occupants while driving must be designed to exclude objects larger than 1 mm diameter (Ingress Protection rating IPxxD). All high voltage covers must be designed to exclude fingers (Ingress Protection rating IPxxB).
- The insulation resistance between any exposed conductive part and each terminal of the energy storage system must exceed $100V$ ohms, where V is the nominal voltage of the energy storage system.
- The insulation resistance between any exposed conductive part and each terminal of every solar cell must exceed $100V$ ohms, where V is the maximum circuit voltage of the solar array.

i *The term high voltage means more than 60 V DC or more than 30 V RMS AC.*

i *Teams should regularly check that there is no electrical breakdown between either side of the energy storage system and any exposed conductive part, or between or any part of the solar array and any exposed conductive part.*

i *Carbon fibre is conductive. Exposed carbon fibre is considered to be an exposed conductive part and so must be isolated from the energy storage system and from the solar array.*

2.68 The driver must be able to electrically isolate the solar panel from the rest of the Solar EV while seated in a driving position and without releasing the seatbelt. The isolator switch must be a circuit-breaker, contactor, or other mechanical or electro-mechanical type. Any conductive parts that could remain at high voltage when the solar collector is isolated must be double insulated. If the isolator is on the energy storage system side of the Maximum Power Point Trackers, the trackers themselves must also be double insulated and the only live wires permitted to emerge from the trackers, when isolated, are control and sensing wires that

are short-circuit protected and incapable of delivering more than 10 mA under any reasonably foreseeable fault condition.

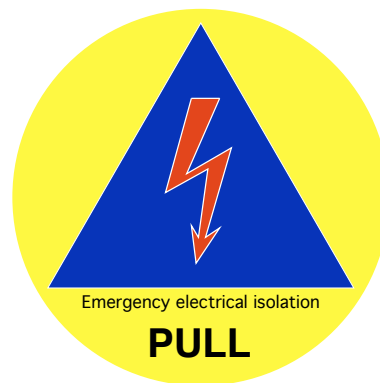
Solar panel isolation method:

2.69 The driver must be able to electrically isolate the energy storage system from the rest of the Solar EV while seated in a driving position and without releasing the seatbelt. The isolator switch must be a circuit-breaker, contactor, or other mechanical or electro-mechanical type. The isolator switch must be internal to the energy storage pack. If two energy storage packs are employed, a separate isolator is required in each energy storage pack. When the energy storage system isolator switch is open, the only live wires permitted to emerge from energy storage packs are control and sensing wires that are short-circuit protected and incapable of delivering more than 10 mA under any reasonably foreseeable fault condition.

Energy storage system isolation method:

2.70 For emergency use, a means of electrically isolating both the solar panel and the energy storage system from each other and from the rest of the Solar EV must be provided on the exterior of the Solar EV. The activation device must be able to be operated instantly and without hesitation by someone unfamiliar with the Solar EV, and without removing any panels or tape. The isolation devices may be the same as those used in compliance with Regulations 2.68 and 2.69, or may be additional circuit-breakers, contactors or mechanical or electro-mechanical devices that achieve the same result.

2.71 The activation position of the emergency isolation device must be placed within a yellow disc with a minimum diameter of 180 mm and clearly marked with a blue equilateral triangle (minimum side length 150 mm) containing a red flash, with the legend 'Emergency Electrical Isolation'. In addition, there must be a clear instruction on how to operate the device (e.g. 'PULL' or 'PRESS'). The isolation device must be located within 50 mm of the lower edge of the windscreen on the left side of the Solar EV.



2.72 The Entrant must submit, on or before 30 June 2013, an Electrical System Specification in PDF format, called 'xx_electrical_system.pdf', where xx is their Entrant number. This specification must include a schematic electrical diagram showing all the essential power circuits of the electrical equipment of the Solar EV, including:

- power generation devices
- chargers
- energy storage devices
- power bus and switching/isolation arrangements

- motor and motor controller
- auxiliary circuits
- any umbilical cables employed.

i *Entrants are not required to provide internal details of the motor, motor controller, power point trackers or chargers.*

Energy sources

2.73 For Challenger Class and Adventure Class Solar EVs, solar irradiation received directly by the Solar EV is the only external energy source that may be used by the Solar EV.

i *Devices used to concentrate solar irradiance may be used, provided they are a permanent part of the Solar EV and provided that the Solar EV does not exceed the maximum allowable dimensions at any time. External devices intended to increase the irradiance on the Solar EV may not be used at any time.*

2.74 Cruiser Class Solar EVs may be recharged from the electricity grid at Tennant Creek, Alice Springs or Coober Pedy (or any combination of these locations). The energy of each utilised recharge session will be deemed to be equal to the capacity of the energy storage system.

2.75 Any charger used to recharge the energy storage system must meet the following safety requirements:

- the charger output must be either permanently wired to the Solar EV high voltage system, or connect to the energy storage system using an appropriate connector
- the charger output must be electrically isolated from the AC input
- the charger must stop charging automatically when the energy storage system is fully charged
- the battery monitoring system (Regulation [2.90](#)) must operate while charging.

i *The Organiser will use its best endeavours to ensure the provision of a dedicated 10 A (230 V 50 Hz single phase) power supply for each Cruiser Class Team at designated charging locations (Tennant Creek, Alice Springs and Coober Pedy). It is the responsibility of the Entrant to satisfy themselves that such arrangements are suitable for their needs. Cruiser Class Teams may make other arrangements for charging at Tennant Creek, Alice Springs and Coober Pedy.*

i *Australian electricity supply is 230 V AC, 50 Hz. A domestic outlet can supply up to 10 A; 15 A outlets may be available at some caravan parks. 15 A plugs have a wider earth pin than 10 A plugs, and cannot be used in 10 A sockets.*

i *Residual Current Devices may not be present on older supply circuits in Australia. Teams should use portable Residual Current Devices when charging.*

2.76 Energy recovered from the motion of the Solar EV may be used.

2.77 For Challenger Class and Cruiser Class Solar EVs, if photovoltaic cells are used then the allowable area of photovoltaic cells is:

- no more than 6.000 square metres for Solar EVs using silicon photovoltaic cells of any efficiency, or other technologies with a cell efficiency not more than 22.5%

- no more than 3.000 square metres for Solar EVs using non-silicon-based photovoltaic cells with efficiency exceeding 22.5%.

i *Challenger Class and Cruiser Class Entrants wishing to use a mix of silicon and other photovoltaic cells, or other types of solar collector, should contact the Organiser.*

i *The area of photovoltaic cells will be determined by summing the exposed surface area of the component photovoltaic cells. Entrants must supply sufficient information to enable the scrutineers to determine compliance with this regulation. The minimum requirement is:*

- *documentation showing the make, model, type, size and number of component cells*
- *calculations summing the total area, calculated to four significant figures*
- *a drawing, with dimensions, of the cells as fitted to the Solar EV*
- *a written declaration by a licensed professional in the country of origin (e.g. a professional consulting engineer) that the array complies with this regulation.*

Solar collector type:

2.78 For Adventure Class Solar EVs, the solar collector must comply with the Technical Regulations of the 2011 World Solar Challenge.

Adventure Class solar collector (type, area):

2.79 The Entrant must submit, on or before 30 June 2013, a Solar Collector Specification in PDF format, called 'xx_solar_collector.pdf', where xx is the Entrant number. A template will be provided to registered Entrants.

Energy storage

2.80 Any energy storage devices that can be recharged using energy from the solar collector may be used. The configuration and stored energy capacity of these devices must be specified on or before 30 June 2013, and meet the approval of the Chief Energy Scientist.

2.81 Primary or secondary cells used

- to power a real time clock when the Solar EV is turned off
- to retain data when the Solar EV is turned off
- to power wireless sensors such as tyre pressure sensors

are not considered to be part of the energy storage system. All such cells must be declared. The total energy capacity of these cells must not exceed 10.0 Wh. These cells may not be replaced or recharged from an external charger during the Event, but may be removed if it is unsafe to leave them in the Solar EV (see Regulation [2.89](#)).

i *Batteries or cells inside devices such as handheld radios, mobile telephones and wristwatches that are not electrically connected to the Solar EV or its instrumentation or control systems and are carried by the driver are not considered to be part of the energy storage system.*

i *Other auxiliary batteries or cells are not permitted. Low voltage power for instrumentation and control may be provided from a DC/DC converter powered from the energy storage system.*

2.82 Capacitors not designed for traction energy storage are not considered to be part of the energy storage system if their total energy storage capacity is less than 10.0 Wh.

2.83 All energy storage devices must be declared at Static Scrutineering. Failure to declare any energy storage device will lead to disqualification.

2.84 For Challenger Class and Adventure Class Solar EVs, if the energy storage system is a secondary electrochemical battery then the sum of the nominal cell masses, as specified by the cell manufacturer, may not exceed the following limits:

Li-ion	21.0 kg
Li-polymer	22.0 kg
LiFePO ₄	40.0 kg
Ag-Zn	40.0 kg
Ni-MH	70.0 kg
Ni-Zn	75.0 kg
Ni-Fe	100.0 kg
Pb-acid	125.0 kg

i *Ni-Cd cells are not permitted, except as allowed by Regulation 2.81.*

2.85 For Cruiser Class Solar EVs, if the energy storage system is a secondary electrochemical battery then the sum of the nominal cell masses, as specified by the cell manufacturer, may not exceed the following limits:

Li-ion	63.0 kg
Li-polymer	66.0 kg
LiFePO ₄	120.0 kg
Ag-Zn	120.0 kg
Ni-MH	210.0 kg
Ni-Zn	225.0 kg
Ni-Fe	300.0 kg
Pb-acid	375.0 kg

i *Solar EVs may use less energy storage than the limits specified. Scoring of the Cruiser Class depends on the capacity of the energy storage system and on the number of times it is recharged—see Regulation 6.95.*

2.86 If cells are not easily visible inside the assembled energy storage packs, a sample cell of each type must be brought to Static Scrutineering.

2.87 Teams wishing to use an energy storage system not covered by Regulations 2.84 or 2.85 must contact the Organiser. The allowable configuration and mass, and any other requirements, will be determined by the Chief Energy Scientist.

Energy storage type:

2.88 The Entrant must submit, on or before 30 June 2013, an Energy Storage System Specification in PDF format, called 'xx_energy_storage.pdf', where xx is their Entrant number. A template will be provided to registered Entrants.

2.89 Cells must not be removed from any energy storage pack unless it would be dangerous to leave them in. Any cells removed must be replaced by ballast of equal or greater mass. Cells must not be replaced. Additional cells must not be added to the Solar EV. If a cell or module fails, it may be bypassed.

i *Previous regulations have allowed cells to be replaced, with an designated time penalty. Replacing cells will no longer be allowed.*

2.90 If the energy storage system is an electrochemical battery, the Solar EV must be equipped with a battery monitoring system designed to detect any component cell becoming overcharged, undercharged, or too hot.

Maximum allowable cell voltage:	V
Minimum allowable cell voltage:	V
Maximum allowable discharge current:	A
Maximum allowable charge current:	A
Maximum allowable cell temperature:	°C

How are cell voltages detected?

What action is taken if a cell voltage is too high?

What action is taken if a cell voltage is too low?

How are cell currents detected?

What action is taken if discharge current is too high?

What action is taken if charge current is too high?

How are cell temperatures detected?

What action is taken if a cell is too hot?

Who will take control of an incident involving the battery?

i *A poorly designed or poorly implemented battery management system can cause problems.*

i *The mechanisms for detecting and handling out-of-range voltages, currents and temperatures must be specified in detail in the Battery Incident Plan (Regulation 2.91).*

i *Other types of energy storage system must have equivalent safety systems designed to prevent uncontrolled release of energy.*

2.91 Entrants using an electrochemical battery must submit, on or before 30 June 2013, a Battery Incident Plan in PDF format, called 'xx_battery_incident_plan.pdf', where xx is their Entrant number. The Battery Incident Plan must be relevant to the battery chemistry employed and include a statement of intent with regard to preventing, detecting and managing a battery incident and handling and disposal of cells, batteries, or component materials. This statement should include all items employed in the Solar EV, support vehicles, or other team equipment.

2.92 The energy storage system must not exceed two packs.

Number of energy storage packs:

2.93 The main energy storage packs must be housed in boxes with lids (preferably transparent). For Challenger Class Solar EVs, the boxes must be removable from the Solar EV.

i *Energy storage packs may be removed from the Solar EV each night (see Regulations 6.79 and 6.80).*

2.94 Energy storage packs must be constructed so that each pack can be sealed using a tamper-evident plastic seal. With a seal fitted, it must not be possible to remove any cell from a pack without breaking the seal. Seals will be provided and fitted by the Organiser at Static Scrutineering.

i *Entrants are responsible for the design and implementation of the sealing system. Specifications of the tamper-evident plastic seals (which will be similar to small plastic cable ties) will be provided to registered Entrants.*

2.95 Energy storage packs must be securely fixed to the Solar EV.

i *Australian requirements for individually constructed electric vehicles are that the battery will be restrained in a 20 G acceleration. Cable ties will not meet this requirement.*

2.96 Chemical spill-proof barriers must exist between the Solar EV occupants and any electrochemical battery pack. The arrangements for chemical barriers must be declared in the Energy Storage System Specification.

2.97 Energy storage packs shall be provided with adequate airflow vented to the exterior of the Solar EV. The airflow must be described in the Energy Storage System Specification.

3 Preparing for the trip to Darwin

Transport to Australia

i *Detailed information designed to help you and your team navigate Australian import regulations, customs, quarantine, immigration and visas will be provided to registered Entrants.*

Support Vehicles

3.1 The Entrant must supply Front and Rear Escort Vehicles (see Regulation 6.44), a means of transporting the Solar EV, and sufficient additional vehicles to transport, and support, their team during the Event.

i *Most vehicle hire companies in Australia require the hirer and all drivers to be at least 21 years of age.*

Communication equipment

3.2 Each Entrant shall carry a satellite telephone, and notify the Organiser of its number. This notification will be required at Registration.

i *Experience shows that an external antenna is required when using a satellite telephone in a vehicle.*

3.3 Every Solar EV shall have means of two-way voice radio communication with the Primary Escort Vehicle (see Regulation 6.45), and must demonstrate this capability at scrutineering.

3.4 The Front and Rear Escort Vehicles for each Solar EV must have a UHF CB radio with a minimum of 40-channels and compliant with Australian Standards.

i *UHF CB refers to equipment operating in the range from 476.025MHz (channel 1) – 477.400MHz (channel 40). 27MHz AM devices and hand-held devices with fewer than 40 channels are not compliant with this regulation. The Organiser will use its best endeavours to facilitate the hire of suitable equipment. Further details will be provided to registered Entrants. Enquiries concerning allowable frequencies for other equipment should be directed to the [Australian Media and Communications Authority](#).*

4 Arriving in Darwin

i *Information on Australian road conditions, accommodation, hospitals, business hours etc. will be provided to registered participants.*

Pre-Event testing

4.1 The Event will provide facilities for track testing immediately prior to the Event.

4.2 Registered Entrants must not drive their Solar EV on the Stuart Highway in the Northern Territory between 1 September 2013 and 5 October 2013.

i *A condition of the Event permit issued by the Government of the Northern Territory is that Entrants will not drive or otherwise test their Solar EVs on the Stuart Highway in the weeks preceding the Event. The Organiser will arrange facilities for track testing at Hidden Valley Raceway in the days prior to the qualifying speed trials. The authorities may be willing to issue permits for the use of other roads (that they will nominate) for the purpose of on-road testing given that certain conditions are met. Any such arrangements must be made by, and at the cost of, the Entrant. Further details will be provided to registered Entrants.*

4.3 Any Solar EV being driven on a public road without the required permit is liable to exclusion.

5 Registration and Scrutineering

5.1 Registration and Static Scrutineering will take place at the Royal Darwin Showground (Foskey Pavilion) or such other place as determined by the Organiser, from 1 October 2013.

5.2 Each Entrant must attend Registration and Scrutineering at a time nominated by the Organiser. Registration and Scrutineering times for each Entrant will be posted on the Official Noticeboard at Hidden Valley before 1 October 2013.

5.3 Entrants must attend Registration and Static Scrutineering with:

- the Team Manager
- all Solar EV drivers, with their driving licences (see Regulation 1.51) and their driver training log books (see Regulation 1.52)
- all Solar EV passengers
- the Safety Officer
- the Battery Officer
- the Solar EV
- Front and Rear Escort Vehicles, including any trailer that will be attached to the Front Escort Vehicle
- the Solar EV trailer or Solar EV transport truck they intend to use in the event
- a list of all vehicles associated with the team
- a printed copy of this document, and all accompanying documentation
- a spare Solar EV tyre of each type
- a sample battery cell (if cells inside the energy storage packs are not clearly visible)
- any external charger that will be used during the Event (Cruiser Class).

i *Solar EVs must be transported to Registration and Scrutineering on the Solar EV trailer or truck.*

5.4 The Team Manager must attend all Registration and Scrutineering stations.

5.5 A Team Manager not proficient in the Official Language of the Event must provide an interpreter to attend all Registration and Scrutineering stations.

5.6 All team members must personally register by signing in.

i *With the exception of Solar EV drivers and passengers (for whom attendance at the designated time is mandatory), team members unable to attend Registration at the appointed time must attend Registration before noon on 4 October 2013. Fatigue is a serious risk in this event; team members are strongly urged to consider this when making travel plans across multiple time zones.*

Static Scrutineering

i *Static Scrutineering will check the data and checklist items in Section 2 of these regulations, and will include a regulatory compliance and structural inspection by the Northern Territory Road Transport Authority.*

5.7 Qualification must be achieved in road ready configuration. All Entrant vehicles listed in Regulation 5.3 are required to present at the designated time, in a *ready to start* condition. Vehicles unable to present at the designated time, or are not ready to start, may fail to qualify.

5.8 No more than seven Entrant team members will be allowed on the scrutineering floor at any time.

5.9 Each team must provide appropriate tools and personnel to facilitate the inspection of structural components. The dismantling and reassembly of the Solar EV required to meet this requirement must be conducted (in the sole opinion of the Chief Scrutineer) in a reasonable time.

i *One group of checks will be made with the solar panel in place, and another group of checks will be made with the solar panel removed. Checks with the panel in place include:*

- *signage*
- *Solar EV size*
- *solar collector type and size*
- *ingress (Cruiser Class) and egress—all Solar EV drivers and passengers are required*
- *vision (all Solar EV drivers required)*
- *lights, indicators, horn.*

Checks with the solar panel off include:

- *mechanical systems (seats, tyres, brakes, steering)*
- *electrical systems*
- *energy storage system*
- *roadworthiness.*

5.10 The official mass of each Solar EV driver or passenger, as weighed at scrutineering with helmet and driving clothes, shall be 80 kg.

5.11 If the mass of a driver or passenger is less than 80 kg, ballast will be added to make up the difference.

5.12 No credit will be given if a driver or passenger weighs more than 80 kg.

5.13 Cruiser Class teams may have up to five registered passengers.

5.14 Ballast will be provided by the Organiser.

5.15 Front and Rear Escort Vehicles, any trailer to be towed by the Front Escort Vehicle, and the Solar EV trailer or truck, will be checked for compliance and the required safety equipment.

5.16 The Entrant must provide, at the time of Scrutineering, two printed copies of a diagram (plan view, front of the Solar EV at the top), clearly showing how emergency isolation is to be activated. One copy will be placed in the Observer's log book; the other will be held by the Organiser.

Modifications after Static Scrutineering

5.17 After Static Scrutineering, Entrants may not modify or repair their Solar EV in any way that may effect roadworthiness or safety, without the approval of the Chief Scrutineer.

Dynamic Scrutineering

i *Dynamic Scrutineering will check the speed, stability and braking of Solar EVs.*

5.18 Dynamic Scrutineering will be held at the Hidden Valley Motorsport Complex, or such other place as determined by the Organiser.

5.19 No Solar EV may be submitted for Dynamic Scrutineering without having first passed Static Scrutineering.

5.20 Scrutineering will close two hours before the published time of the mandatory team briefing, as announced in the Official Timetable supplied to registered Entrants.

5.21 No Solar EV will be allowed to start the Event until it has passed scrutineering. Any Solar EV failing scrutineering will only be permitted to re-present at the absolute discretion of the Chief Scrutineer.

Starting position

5.22 Starting position will be determined by performance at the Dynamic Scrutineering speed trials.

Safety

5.23 The Entrant is responsible for the roadworthiness of its Solar EV. By submitting an entry, the Entrant declares the Solar EV's integrity and suitability for the Event.

5.24 The Entrant acknowledges that the scrutineering process will determine only whether the Solar EV complies with the Regulations.

5.25 No warranty or representation, whether expressed or implied, is made in relation to the mechanical or systems integrity or roadworthiness of Entrant vehicles in complying with the provisions of the Regulations of the Event.

5.26 Each Team must nominate a Safety Officer responsible of the general safety of the team.
Safety Officer:

5.27 Each Team must nominate a Battery Officer responsible for the safe operation of the battery and supervising response to any battery emergency.
Battery Officer:

5.28 Each team must provide suitable and appropriate safety equipment, including (but not limited to):

- first-aid kit
- safety glasses and gloves for handling batteries
- hazard warning cones

- yellow warning flag
- fire extinguishers, fire blankets, sand (or similar material) and a suitable containment vessel
- safety vests
- a whistle.

Such minimum safety equipment shall be located in the Primary Escort Vehicle and be available for inspection at scrutineering.

5.29 It is the Safety Officer's responsibility that safety equipment is correctly placed and appropriate warning is given to other traffic, as required.

5.30 Each Team is required to have at least one member holding a recognised first-aid certificate, current for the duration of the Event.

First Aid Officer:

5.31 The Entrant must submit, on or before 30 June 2013, an Safety Plan in PDF format, called 'xx_safety_plan.pdf', where xx is their Entrant number. A template will be provided to registered Entrants.

6 Darwin to Adelaide

i *Event staff and officials are distinguishable by the colour of their shirts. Administrative staff, support workers and guests wear blue. Official Observers wear yellow. Officials wear red. Red-Shirt Officials control the running of the event.*

i *Evolution Class vehicles must comply with all on-road requirements imposed by the Road Traffic Authorities and by the Clerk of the Course.*

Conduct of the Event

6.1 The on-road component of the Event will start in State Square, Darwin, at 08:30 on 6 October 2013, or such other place as the Clerk of the Course may direct.

i *Each team will be issued with a Start Procedure sheet at Scrutineering, which contains detailed instructions for the start. Compliance is mandatory.*

i *Each Solar EV will be given a Start Time by the Chief Timekeeper.*

i *The Clerk of the Course will appoint a Starter to control the grid, the Escort Vehicle park and Start Line.*

6.2 All Solar EVs must be in place by 07:00 in their starting grid position for final scrutineering. Any Solar EV not present may have their start time amended.

6.3 The starting grid will be classed as *parc fermé* between the hours of 07:15 and 08:15 or such other time as the Clerk of the Course may nominate.

6.4 Two team members only must stay with the Solar EV during *parc fermé* time to assist officials with final inspections.

6.5 Front and Rear Escort Vehicles must be in their designated places by 08:00.

6.6 Escort Vehicles must be in position with the Solar EV before entering public roads.

6.7 Solar EVs which have left the Start Line and whose Escort Vehicles are not able or ready to merge will be directed to return to the start area.

6.8 The Organiser reserves the right to change the time or place of the start.

Solar EV drivers

6.9 Only the registered Solar EV drivers may drive the Solar EV during Event hours.

6.10 Correct ballast must be carried in the Solar EV when driving.

6.11 Observers will check that the correct ballast is in place at each driver change.

The Course

6.12 The Challenger Class will be timed in a single stage between Darwin and Adelaide.

6.13 The Darwin to Adelaide component of the Cruiser Class will be timed in four stages:

- Darwin to Tennant Creek
- Tennant Creek to Alice Springs

- Alice Springs to Coober Pedy
- Coober Pedy to Adelaide.

6.14 Adventure Class will be timed in two stages: Darwin to Alice Springs and Alice Springs to Adelaide.

i *One copy of the Route Notes will be provided to each registered Team. Additional copies will be available for downloading from the World Solar Challenge web site by 24 September 2013.*

i *The selection (and any cost) of overnight stops shall be the responsibility of the Entrant.*

6.15 At overnight stops, the Solar EV and all other vehicles must be parked in such a manner that they, and all team activities, are conducted at minimum of 10 metres from the edge of the road.

6.16 If the Entrant's overnight camp is not immediately adjacent to the road, a marker cone must be placed on the roadside adjacent to the entry leading to the camp.

6.17 Any detour signs erected by the civil authorities must be observed and the correct route rejoined at the first opportunity. The Organiser may change the course at any time.

6.18 Solar EVs must maintain an average speed of 60 km/h.

Observers

6.19 An Observer shall be appointed by the Organiser to travel with each participating team.

6.20 For the purposes of the Event, Observers are considered to be Judges of Fact and no correspondence will be entertained.

6.21 Observers may be changed between Entrants throughout the Event.

6.22 The Observer's responsibilities are:

- to record their name and the time period of their observation duty
- to record start and stop times, distance covered each day, and all other incidents
- to be satisfied that the energy storage system cannot be charged or interfered with between sunset and sunrise, except as allowed by Regulation [2.74](#)
- to notify a Red-Shirt Official at the earliest opportunity if energy storage cells or modules have been changed or a energy storage system seal broken, if any breach of regulation has occurred, or if they have concerns about the actions of the team.

6.23 Observers may not interpret regulations or give advice to Entrants.

6.24 The Entrant's responsibilities to the Observer are:

- to assist the Observer in their duties at all times
- to provide reasonable food for the Observer at least three times a day, and such drinking water as the Observer may require
- to never leave the Observer alone with the Solar EV
- if requested by the Observer, to send for assistance from the Organiser or transmit information to Event Headquarters

- to provide a proper seat in the Primary Escort Vehicle
- to provide space for the Observer's luggage in the same vehicle as the Observer.

i *It is expected that the Entrant will allocate the front passenger seat of the Primary Escort Vehicle to the Observer. This includes fair and reasonable space with, for example, the foot well not being filled with computer equipment such that the passenger space is restricted.*

6.25 The Entrant must submit, on or before 30 June 2013, a PDF document called 'xx_observer_arrangements.pdf', where xx is their Entrant number, describing their arrangements for observers. A template will be provided to registered Entrants.

Control stops

6.26 Control Stops will be established at intervals along the route.

6.27 Control Stops may or may not be disclosed.

6.28 All Solar EVs will be required to stop at Control Stops and will be held by the Control Stop Manager for the designated time for that Control Stop. The Red-Shirt Official may direct any additional penalty time to be taken at a Control Stop.

6.29 Observers may be changed and Solar EVs scrutinised at any time during the Event.

6.30 It is the responsibility of the team manager to check whether any updated information is available from the Control Stop Manager.

6.31 Teams must obey the directions of the Control Stop Manager.

6.32 During Control Stop time, teams may perform only basic safety and maintenance tasks, with the agreement of the Control Stop Manager.

i *Basic maintenance or safety checks include checking and adjusting tyre pressures, cleaning or the removal of debris. The solar collector may be placed on a charging stand as long as that does not render the Solar EV incapable of being immediately moved or repositioned on request of the Control Stop Manager.*

6.33 No repairs or maintenance tasks that involve dismantling, addition or substitution of Solar EV components, including wheels or tyres, are to be undertaken.

6.34 With the exception of those associated with a hand-held multimeter or similar instrument, no external cables may be connected to the Solar EV for any reason whilst the Solar EV is held at a Control Stop.

i *It is recognised that in case of telemetry failure, Entrants may wish to download data during a Control Stop. Permission of the Control Stop Manager must be sought in advance and connection may be made only under the supervision of the incoming Observer, and the details written up in the Observer notes.*

6.35 Control Stops will be opened in time to accommodate the leading Solar EV, and remain open during Event hours. Closing times will be calculated on the minimum speed required to remain in the Event.

i *Arriving at a Control Stop location after the Control Stop has closed is an indication that the minimum average speed required by the regulations is not being achieved.*

- 6.36** Any team that has missed a Control Stop must reach the next Control Stop whilst it is open. Any team missing (or which will clearly miss) two consecutive Control Stops must contact Event Headquarters.
- 6.37** A Red-Shirt Official may direct a team to trailer their Solar EV forward to an open Control Stop. Teams wishing to move forwards must contact a Red-Shirt Official.
- 6.38** Any team that has trailed their Solar EV forward may only rejoin the route under the direction of a Red-Shirt Official.
- 6.39** Trailering may occur only during daylight hours (sunrise to sunset).
- 6.40** Teams who have not completed the full course will be ranked in order of distance travelled under solar power (and adjusted for any penalties imposed).
- 6.41** Any part of the Route traversed more than once under solar power will contribute only once to the distance travelled. The Route must be traversed in increasing order of distance from Darwin.
- 6.42** A team may withdraw by handing a withdrawal form signed by the Team Manager to a Red-Shirt Official.
- 6.43** Teams who have withdrawn may transport their Solar EV to Adelaide and take part in the displays and awards ceremonies.

Escort Vehicles / Team vehicles

- 6.44** Each Solar EV must, at all times when in motion on the highway, be accompanied by two Escort Vehicles—one immediately in front of the Solar EV and one immediately behind the Solar EV.
- 6.45** The Rear Escort Vehicle shall be designated the Primary Escort Vehicle, and shall have communications in accordance with Regulation 3.3 at all times.
- 6.46** Escort Vehicles shall display amber (yellow) flashing lights visible from all directions from a distance of at least 200 m in daylight. These lights must be operating at all times whilst the vehicles are escorting the Solar EV.
- i** *Note that xenon beacons designed as warning devices for industrial equipment are unlikely to meet the visibility requirement.*
- i** *Flashing amber lights must not be obscured by signs or other equipment on the roof of the Escort Vehicle.*
- 6.47** Whilst travelling on the open road, the Primary Escort Vehicle must be no more than 3 seconds behind the Solar EV, and must at all times maintain a safe stopping distance appropriate to the speed and conditions prevailing. The Front Escort Vehicle must, whilst travelling on the open road, maintain a distance no greater than 500 m, and no less than 2 seconds in front of the Solar EV. The Solar EV must be allowed a safe stopping distance appropriate to the speed and conditions prevailing.
- 6.48** A warning sign not less than 900 mm × 300 mm with black lettering on a yellow background, clearly visible from a distance of 30 m, must be displayed on the rear of the Primary

Escort Vehicle, stating 'CAUTION, SOLAR VEHICLE AHEAD'. No vehicle other than the Primary Escort Vehicle may carry such a sign.

6.49 All Team vehicles must carry a sign, visible from 30 m to the rear, stating the name of the Team to which they belong.

6.50 Escort Vehicles equipped with CB radio shall carry a sign, visible from 30 m to the rear, advising the selected CB channel number in use.

i *Approved seven-segment number signs will be available at Scrutineering.*

6.51 The Primary Escort Vehicle shall not be a bus, truck or large campervan, nor shall it be towing a trailer.

i *The need for this regulation is based on the identification of the perceived hazard. If approaching traffic sees a large vehicle with a flashing light, the immediate perception is that that vehicle itself is the hazard, not the Solar EV it is protecting. There have been a number of instances where members of the public have overtaken large Rear Escort Vehicles and narrowly missed the (unseen) Solar EV.*

6.52 Each Entrant must have the ability to transport the Solar EV and all associated equipment should it be required either through breakdown, poor progress, or if so directed by a Red-Shirt Official.

i *The minimum requirement is a suitable truck or trailer, which shall accompany the Team throughout the entire journey. If the Solar EV needs to be dismantled for transport it will be deemed Withdrawn.*

6.53 When stopped and parked, all wheels of all vehicles shall be clear of the road. Wherever possible, vehicles must be parked, and all team activity must occur, at least 10 m from the edge of the road.

6.54 All Entrants shall ensure that vehicles and drivers associated with their attendance at the Event comply with the provisions of all road traffic laws.

6.55 All Entrants shall ensure that all vehicles associated with their attendance at the Event are driven in a careful and courteous manner at all times.

6.56 All team members and vehicles are required to be registered with the Organiser. For the purposes of these regulations, the Organiser reserves the right to determine if any individual or vehicle is acting *de facto* as a part of a team.

6.57 All vehicles associated with the Entrant, with the exception of the Front and Rear Escort Vehicles, shall keep a minimum of 500 m from the Solar EV and each other whilst travelling on the open road, so that vehicles can be safely overtaken one at a time. Infringement of this rule will incur an automatic time penalty. Repeated infringement will lead to exclusion from the event.

NO CONVOYS!

6.58 Vehicles associated with the Entrant must not obstruct other Solar EVs or Escort Vehicles. Infringement of this rule will incur an automatic time penalty. Repeated infringement will lead to exclusion from the event.

6.59 A minimum of two drivers must be available for every vehicle associated with the Entrant.

6.60 The Entrant shall be responsible for the actions of all crew and vehicles associated with the Team.

6.61 Escort and team vehicles may be subject to scrutineering at any time during the Event to ensure compliance with the Regulations of the Event.

Timing

6.62 Timing is under the control of the Official Timekeeper assisted by Officials and Observers.

6.63 For Challenger Class and Adventure Class, the Official Start Time each day after Day 1 is 08:00 and the Official Finish Time each day is 17:00.

6.64 For Cruiser Class:

- the Official Start Time each day after Day 1 is 08:00, except for Day 4 departing Alice Springs for which the Official Start Time is 07:00
- the Official Finish Time each day is 17:00, except for Day 4 arriving at Coober Pedy for which the Official Finish Time is 18:00.

i *The Official Finish Time on Day 1 is 17:00, regardless of the time the Solar EV left the Start Line.*

6.65 A penalty of one minute will be imposed for each minute taken past Official Finish Time, up to and including 17:10. After 17:10, each additional minute over will attract a two minute penalty.

6.66 Time penalties incurred in the manner described in Regulation 6.65 will determine an adjustment of the Official Start Time the following day.

i *For example, if a team finishes at 17:07 on Day 2, the Official Start Time for Day 3 will be adjusted to 08:07. If a team finishes at 17:13 on Day 2, the Official Start Time for Day 3 will be adjusted by $1 \times 10 + 2 \times 3$ minutes to 08:16.*

6.67 A Solar EV starting before its Official Start Time will be subject to a penalty of 2 minutes for each offending minute.

Vehicle movement

6.68 Participating vehicles must abide by any registration conditions imposed by the Police or civil authorities.

6.69 Solar EVs may not travel between sunset and sunrise.

6.70 Any participating vehicle being overtaken **must** give way. This includes Escort Vehicles.

6.71 The Solar EV may not, during Event hours, be pushed, towed or carried forward by another vehicle unless under the direction of the Red-Shirt Official, or unless abnormal circumstances prevail.

i *It is the responsibility of the Entrant to operate the Solar EV safely at all times. The Entrant may take whatever action they consider appropriate to any given situation, including*

towing the Solar EV to safety. It is the duty of the Observer to record the details of such matters, and bring them to the attention of the Clerk of the Course or a Red-Shirt Official.

6.72 Push starting the Solar EV is not allowed.

6.73 Regenerative power systems must not be on when hand pushing or towing the Solar EV the under circumstances where pushing or towing is allowed.

6.74 Slip streaming is not allowed. Whilst travelling on the open road, a Solar EV may be no closer than 2 seconds from the vehicle in front, unless overtaking.

6.75 Pressure-wave pushing is not allowed. The Rear Escort Vehicle is not allowed within 2 seconds of the Solar EV whilst travelling on the open road.

6.76 No movement of the Solar EV is allowed on the road between sunset and sunrise. Driving tests may be carried out by any qualified crew member from sunrise until 08:00, and from 17:00 until sunset.

Solar EV servicing

6.77 With the exception of ambient temperature water sprayed from a hand-held device, and then only whilst the Solar EV is stationary, cooling of solar cells from any external source is not permitted.

Energy storage system

6.78 From the official start of the Event until finish (or withdrawal), the energy storage system may never be removed from the Observer's control.

6.79 Except for Cruiser Class Solar EVs at designated charging locations (Regulation [2.74](#)), removable energy storage packs must be impounded between sunset and sunrise by placing them in a lockable container supplied by the Entrant. The container is to be placed under the control of, and in a position acceptable to, the Observer.

6.80 If a Solar EV does not have removable energy storage packs, or if the Entrant decides not to remove the energy storage packs, the whole Solar EV shall be impounded under the control of, and placed in a position acceptable to, the Observer, from sunrise to sunset. No work of any kind may be performed on the impounded Solar EV.

6.81 For Challenger Class and Adventure Class, charging of the energy storage system from any external sources will lead to exclusion from the Event.

Safety

6.82 All Solar EVs and Escort Vehicles are operated and driven at the Entrant's own risk.

6.83 It is the responsibility of the Entrant to ensure that the vehicles under their control are maintained in a safe, roadworthy condition and operated safely and within the law at all times.

6.84 A Team may be excluded from the Event at any time if, in the opinion of a Red-Shirt Official, it is operating the Solar EV, Escort Vehicles, or any other team vehicles in an unsafe manner.

6.85 Entrants should be aware that fatigue and dehydration are serious hazards in this Event. This is especially relevant to all drivers, particularly those of Solar EVs.

6.86 Australian civil law applies to drugs and to driving under the influence of drugs and alcohol. Drivers, team members and officials are to be drug free and maintain a 0% blood alcohol level whilst engaged in any duties associated with the Event.

Penalties and protests

6.87 Any Red-Shirt Official may issue an Infringement Notice requiring a 10 minute penalty for the following infringements:

1. obstructing an overtaking vehicle
2. team vehicles travelling in convoy
3. failing to get off the highway when stopped
4. overnight activities too close to the road
5. repairs (including wheel or tyre changing) during a Control Stop
6. driving without Escort Vehicles
7. Escort Vehicles driving without visible flashing lights
8. driving without effective rear vision.

Subsequent or serious contraventions will be referred to the Clerk of the Course for determination. Protests are not allowed to be made in respect of an Infringement Notice issued in accordance with this regulation, but Entrants may elect to have the matter referred to the Clerk of the Course for determination. (Entrants should note that the Control Stop Manager is obliged to review the reports entered in the Log Book. Observer reports are regarded as fact.)

6.88 Entrants committing the following offences may be subject to a penalty determined by the Clerk of the Course.

1. obstructing an overtaking vehicle
2. slip streaming, hand pushing or pressure wave pushing
3. failure to follow the route instructions
4. failure to observe a request by Police or Event Officials
5. wilful damage or interference to property
6. failing to get off the highway when stopped

7. failure to stop at a control
8. exceeding any posted speed limit
9. driving at less than 50 km/h in areas with a speed limit of 100 km/h or greater, when not constrained by traffic
10. driving without adequate visibility, due to smoke, dust or rain.

i *In normal circumstances, time penalties shall be served on the day of issue and prior to crossing the finish line.*

6.89 With the exception of an Infringement Notice issued under the provisions of Regulation 6.87, all penalties will be issued by the Clerk of the Course, who may depute any other official to serve the notice to the Entrant. Time penalties will normally be served on the day of issue by extending the time spent in a Control Stop. The Clerk of the Course may impose any other arrangements appropriate to particular circumstances.

6.90 Entrants committing the following offences will be liable to exclusion from the Event:

1. wilful obstruction or aggressive driving
2. replacement of energy storage cells
3. removing the energy storage system from Observer's care
4. charging of the energy storage system from any source other than those approved at scrutineering
5. failing the stability test
6. inability to maintain the minimum required speed
7. wilful disregard of any regulations and the spirit of the Event
8. running without a Primary Escort Vehicle
9. misrepresentation.

i *Entrants who have been excluded for inability to maintain minimum speed may trailer their Solar EV to the finish line, and take part in the display and closing ceremonies.*

Protests and appeals

6.91 Any protest must be lodged with the Clerk of the Course (or appointed delegate), in writing, within 12 hours of the incident giving rise thereto. A protest fee of AU\$100 will apply.

6.92 Any decision of a Red-Shirt Official may be appealed to the Stewards by lodgement with the Organiser of a written Notice of Appeal that details the grounds for the appeal, within one hour of the handing down of the decision giving rise thereto. The decision of the Stewards is final. No correspondence will be entertained.

6.93 The Stewards will consider all protests at the earliest practical opportunity.

Winners and Finishers

6.94 The winner of the World Solar Cup will be the first Challenge Class Solar EV to complete the entire course in accordance with the Regulations of the Event.

6.95 The winner of the Cruiser Class will be the Cruiser Class Solar EV that completes the entire course in accordance with the Regulations of the Event and has the highest Score. Cruiser Score will be the weighted sum of four scores, depending on external energy use, Darwin – Adelaide time, person-kilometres, and practicality:

- *Normalised external energy use* of a Cruiser Solar EV will be calculated as $E = (n + 1)q$, where n is the number of times the energy storage system is charged from external sources between the Start Line and the Finish Line, and q is the normalised capacity of the energy storage system. The normalised capacity of an energy storage system complying with Regulation 2.85 is the mass of cells divided by the allowable mass of cells; the normalised capacity of other types of energy storage system will be determined by the Chief Energy Scientist.
- *Time* T is the time taken to drive from the Start Line to the Finish Line, including any penalty time but not including the time allocated for Control Stops.
- *Person-kilometres* D is the sum of the distances travelled by drivers and passengers in the Solar EV between the Start Line and the Finish Line. Passenger-kilometres will be counted for each passenger seat that is occupied for a complete leg (between consecutive Control Stops).
- *Practicality* P will be judged by an Expert Panel.

The Score for a Cruiser Class Solar EV will be calculated as

$$S = \hat{E}/E + 3\hat{T}/T + 0.3D/\hat{D} + P/\hat{P}$$

where \hat{E} is the minimum normalised external energy score of any Finishing Cruiser Solar EV, \hat{T} is the minimum Darwin – Adelaide time of any Finishing Cruiser Solar EV, \hat{D} is the maximum person-kilometres score of any finishing Cruiser Solar EV, and \hat{P} is the maximum practicality score of any Finishing Cruiser Solar EV.

6.96 The winner of the Adventure Class will be the first Adventure Class Solar EV to complete the entire course in accordance with the Regulations of the Event.

6.97 To be classed as a Finisher, a Solar EV must have completed the entire course in accordance with the Regulations of the Event.

6.98 The Organiser will designate a fixed point as the Finish of Timing before travelling in the Adelaide urban area.

6.99 The Solar EV must proceed to the Finish Line under its own power to complete the course.

6.100 The route between the point designated Finish of Timing and the Finish Line will be deemed a transport stage. If two or more Entrants are in the transport stage at the same time, they must present themselves to the finish line in the order they crossed the Finish of Timing, unless an Entrant's Solar EV ceases to function. The Finish Line will close at 16:00. If an Entrant is caught between Finish of Timing and the Finish Line they should inform the Clerk of the Course and make overnight arrangements appropriate to the circumstances, (e.g., the Observer may mark the position as normal, and the team may load their Solar EV onto

a trailer and return (at a time agreed with a Red-Shirt Official) to complete the course the following day.

6.101 If no Solar EV in a Class completes every stage, the Solar EV that travels furthest in accordance with the Regulations of the Event will be the winner of that Class.

6.102 The progress of Solar EVs may be publicised during the Event. These results may not include all penalties and will, therefore, not be accurate and final.

7 Adelaide

7.1 Results will not become final until the Stewards have made a determination on any protest lodged in accordance with Regulation 6.91.

7.2 All winning teams must make themselves available for a press conference if so required.

7.3 Finishing Solar EVs shall be made available for public exhibition up to the time of the prize giving ceremony or such earlier time as the Organiser may determine.

Prizes and awards

7.4 Trophies will be awarded to each class winner.

7.5 Certificates will be provided to all finishers.

7.6 Other Special Awards and Prizes may be announced in Further Regulations.

7.7 All advertising, sales promotion and publicity material produced by, or in connection with, the Entrants or their sponsors, concerning or referring to the Event, shall refer prominently to the Event by the correct title as defined in Regulation 1.8, and all Entrants shall, by entering the Event, specifically agree to abide by this regulation.

7.8 By entering the Event, the Entrant agrees to the free use of any names, photographs (or graphic interpretation thereof) of their team, vehicles and equipment in any publicity material that may be issued by the Organiser or official Sponsors of the Event.