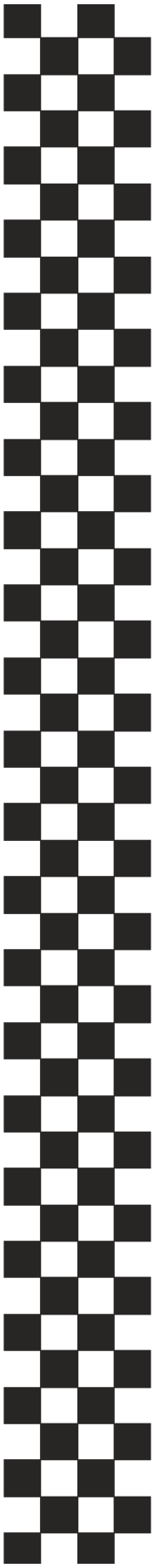


2011 Regulations

Rev E
March 28, 2011

Contents

1. Purpose

1.1 Fundamental Vision

The Formula Sun Grand Prix (FSGP) seeks to promote and celebrate educational excellence and engineering creativity. Fueled by the spirit of friendly competition and teamwork, the FSGP champions the creative integration of technical and scientific expertise across a range of exciting disciplines.

1.2 Missions

1.2.A The support and encouragement of bright young minds to succeed in the fields of engineering, the sciences, mathematics, business, in multi-disciplined experiential learning, and in subsequent careers.

1.2.B To establish an annual event that will promote solar car racing leading to higher engagement in American Solar Challenge events.

2. Administration

2.1 Application of Regulations

These Regulations will apply to the Formula Sun Grand Prix (the "Event"), which includes the selection of teams, registration of teams, the inspection of solar cars ("Scrutineering"), and the track competition (the "Rayce").

2.2 Supplemental Documents

Additional documents may be distributed to all teams entered in the Event to supplement these Regulations. These documents will clearly state that they are a supplement to the Regulations and they will have the same force and effect as these Regulations. If there is a conflict between a supplemental document and these Regulations, the document having the later date shall take precedence. The organizers reserve the right to revise these Regulations at any time.

2.3 Acceptance of Regulation

All persons or groups selected to participate in the Event are assumed to know these Regulations. Their participation in the Event will constitute acceptance of them.

2.4 Interpretation of Regulations

Prior to Scrutineering, all official interpretations will be posted to the Internet under "FSGP 2011 Official Interpretations" on the ASC web site. During and after Scrutineering, all official interpretations will be announced at Briefings, posted at Headquarters. The only group authorized to interpret the regulations is the Regulations Committee.

2.5 Advertising, Promotion, and Publicity

All advertising, sales promotion, and publicity material produced by the teams or their sponsors concerning or referring to the Event will refer prominently to the Event as "Formula Sun Grand Prix". If in fact a naming sponsor is secured, teams will be required to append the Sponsor Name and to display the entire Event name, i.e. "The Acme – Formula Sun Grand Prix". All teams, by entering the Event, specifically agree to abide by this regulation. By entering the Event, all teams and team members agree to the use of their names and their likenesses in any publicity materials (brochures, magazines, videos, photographs, etc.) that may be issued by the Event's sponsors or organizers.

2.6 Headquarters

During Scrutineering, and the Rayce, a Headquarters will be established at a site appropriate to each function and will assume the management functions for the Event.

2.7 Officials

A team of Officials to conduct Registration, Scrutineering, the Qualifier, and the Event will be selected by the Organizers. Officials having specific duties shall be announced to the teams through the briefings.

2.8 Jury

A Jury will be formed to evaluate protests on conformity with these Regulations, to resolve team disputes, and rule on penalty appeals. In addition, the Jury is empowered to decide cases not specifically covered by these Regulations. The jury will be available to teams during the Rayce. Jury meetings will be held in private. A representative of the team(s) involved may attend the deliberations, but not the vote. The Jury will consist of:

2.8.A The event organizer, who will chair the jury and only vote in the case of a tie

2.8.B The chief inspector or his/her designate. All inspectors may attend the meeting, but only the chief inspector may vote

2.8.C Selected members of the FSGP advisory board

3. Entries

3.1 Entry Registration

The Event is open to all to participate. Registration and payment of the Entry Fee will occur as described below.

3.1.A Registration = Initial Fee

Each team wishing to participate in the Event must submit a registration package consisting of a (1)Team Entry Form, (2) Team Participation Form, (3) Proof of Insurance, and (4) the initial entry fee, **US$1000**. This portion of the entry fee is non-refundable. No team will be considered registered until the registration package is received in full by Headquarters.

3.1.B Registration – Track Fee

The track fee, **US$3000**, must be paid to complete the registration process. This portion of the entry fee is also non-refundable.

3.1.C Grants

Teams with demonstrated financial need, and technical potential, may apply for a grant from the event organizers to cover all or part of the entry fees.

3.2 Registration Deadlines

Registration deadlines are as follows: registration package is due **December 1, 2010**; track fee is due **February 1, 2011**. Registration package is due December 1, 2010. Teams submitting late registration packages should make contact with Headquarters to inform the FSGP staff of their team's situation.

3.3 Faculty Advisor

Teams representing an educational institution must have at least one faculty advisor who will provide guidance as needed throughout the solar car design, building, and testing process. The faculty advisor will be the official contact between the Event and institution.

3.4 Technical Documents

Technical documents describing the solar car's structure, electrical system, batteries, and solar cells must be submitted to Headquarters for approval. Early submissions will receive prompt review and feedback by Headquarters. The technical information provided in these documents will not be made public prior to the end of the Event. The information contained in each team's final submission must match the solar car presented at Scrutineering. Safety should be the primary concern with regard to the structural development and fabrication of the solar cars.

Teams that are returning with a solar car previously raced in the American Solar Challenge 2010 need only submit a copy of their previous report with a pre report indicating changes made to the vehicle. If changes are significant inspectors may require a new report to be completed to properly evaluate the car design for entry into the Event.

3.4.A **Document Format:** All technical reports will be submitted in PDF format.

3.4.B **Mechanical Report:** A detailed mechanical report must be submitted to Headquarters by February 1, 2011. The mechanical report must present the as-built design; addressing the design issues involved in impact, roll over and suspension scenarios. It must also address vehicle stability, including center of gravity and relative weights on each wheel. Documentation with calculations and/or testing should be provided. Photos, drawings and anecdotal references are acceptable. The entire document including appendices shall not exceed fifty (50) pages (not sheets) in length. Detailed instructions will be provided to registered teams.

3.4.C **Electrical Report:** An electrical drawing must be submitted to Headquarters by February 1, 2011. The drawing must show all essential power circuits and electrical equipment of the solar car in schematic form. The drawing should include power generation devices (array, regen, etc.), power storage (batteries, etc.), switching and isolation mechanisms, battery protection systems, motor, motor controller, and any auxiliary circuits. Detailed instructions will be provided to registered teams.

3.4.D **Battery Approval:** All storage batteries used in the solar car must be approved by Headquarters. Battery forms must be submitted to Headquarters by February 1, 2011. Mass and cost will be based on manufacturer's data. If an intermediate supplier is used, submit the only the cell manufacturer's data required on the Battery Approval Form. Please note the definitions included in Reg. 5.4.A. Each team must provide a copy of the manufacturer's battery specification sheet, the Material Safety Data Sheet (MSDS) obtained from the battery manufacturer, and a battery approval form with the following battery information:

- **3.4.D.1** Manufacturer's name, and contact information
- **3.4.D.2** Stock number, type, or description
- **3.4.D.3** Cell & Module voltage (e.g., 1.2, 4, 6, 12, or 24 V)
- **3.4.D.4** Bus voltage
- **3.4.D.5** Number of modules to be used in the solar car
- **3.4.D.6** Manufacturer's specifications, including capacity (kWh), weight (kg), and cost (US$)
- **3.4.D.7** Spill/damage protocols and procedures (if these are not provided in the MSDS then the team must obtain this information from the manufacturer and submit it to Headquarters with the MSDS).
- **3.4.D.8** A description of the battery box(es) and their mounting. Include the chemical compatibility of the box material and the electrolyte in case of leakage.
- **3.4.D.9** Description of battery protection system per Reg. 5.4.

3.4.E **Solar Array Report:** All solar cells must be approved by Headquarters. Solar cell reports must be submitted to Headquarters by February 1, 2011. Each team must provide a copy of the manufacturer's solar cell specification sheet, and a solar array report with the following solar array information:

3.4.E.1 Manufacturer's name and contact information

3.4.E.2 Stock number, type, or description

3.4.E.3 Manufacturer's quote for cell area (cm^2)

3.4.E.4 Manufacturer's quote for performance

3.4.E.5 Cost (US$) per cell

3.4.E.6 Cell area (cm^2)

3.4.E.7 A detailed layout map of the vehicle, showing all cell types/sizes and locations, as well as calculations of total area

3.5 Team Data

Each team must submit a team photo and data sheet to Headquarters by March 15, 2011. The photo and data will be publicly released and used in Event promotions. Late submissions will be omitted. Early submissions will not be made public prior to April 1, 2011 without permission of the team representative.

3.5.A **Team Photo:** The team photo must clearly show the solar car and team members. Team members in the photo must be identified by name and by their company or institution when there is more than one company or institutional sponsor. The photos will be used in programs and other publications. Additional instructions will be provided.

3.5.B **Data Sheets:** The data sheet must include solar car weight (Rayce-ready, without driver), solar car dimensions, motor type and rating, solar cell type and manufacturer, estimated peak solar array power in Raycing configuration (overhead sun, clear sky), battery weight and estimated capacity, chassis description, braking system, and wheel type and size. All specifications must be provided in metric units (SI). The team leader, crew members, designated drivers, and faculty advisor(s) must also be listed.

3.6 Participant Registration

All participants in the Event must be registered with Headquarters and be 18 years of age or older. This includes team members, sponsors, officials, and the media. All participants must present themselves at Registration to complete all required forms. Badges will be issued and used to obtain access to restricted areas. These badges must be visible at all times.

3.7 Driver Requirements

Only registered solar car drivers will be allowed to drive in solar cars during the Event. Each team shall have a minimum of two drivers available at all times and may register at most four drivers. Solar car drivers must be 18 years old or older and must present a valid driver's license. All Drivers will submit an informational form and a copy of their driver's license before scrutineering.

3.7.A **Weight:** The official weight of each driver, including driving clothes, helmet, and shoes, will be 80kg. If a driver weighs less than 80kg, ballast will be added to make up the difference. If a driver weighs more than 80kg, no credit will be given. Drivers must supply their own ballast material.

3.8 Insurance

All teams need to maintain vehicular liability and general public liability insurance with limits of liability for (1) bodily injury of not less than US$1,000,000 for each person and US$1,000,000 for each occurrence, and for (2) property damage of not less than US$1,000,000 for each accident and US$1,000,000 in the aggregate. Teams will be required to provide a certificate of such insurance or proof of self-insurance.

3.9 Graphics

Solar cars must prominently display their assigned number, institution(s) name, and the Event logo such that they are clearly visible from a roadside vantage point. Additional graphics related to the team's institution(s) or sponsors are permitted, provided they are neither offensive nor disruptive.

3.10 Solar Car Numbers

Each team registered for the Event will have a unique number approved by Headquarters (positive integer, 3 digits maximum). This number must be clearly displayed on both sides of the solar car. Each number must have a minimum of 5 cm of unobstructed background color on all sides. These colors can be black on white, white on black, or another high-contrast color approved by Headquarters. The numerals themselves must be a minimum of 25cm high, 12cm wide (except the numeral one), and have a minimum brush stroke of 4cm. Numbers containing more than one digit must have a minimum of 2.5cm spacing between the digits.

3.10.A Number Assignment: Teams which participated in ASC 2010 may have priority for retaining their 2010 car number. Car numbers will be confirmed as teams complete registration paperwork and submit entry fees.

3.10.B Number Conflict: If a car number conflict arises, Headquarters will determine the numbers assigned.

3.11 Institution Name(s)

The name of the Institution(s) or organization sponsoring the team must be displayed on the solar car. Headquarters must approve the use of abbreviations or initials. The Institution's name shall be larger and more prominent than any team sponsor logo or name.

3.12 Event Logo

The Event logo must be applied on both sides of the solar car. The logo will be provided by Headquarters and will measure no more than 20cm in height by 30cm in width.

3.13 Demonstration Class

Vehicles that do not meet these regulations (i.e. fuel cell, older solar cars) will not be allowed to compete in the Event but may be allowed to participate as demonstration vehicles, with the permission of the organizers. Teams wishing to participate in Demonstration Class must submit a proposal by January 15, 2011. For more information contact Headquarters.

4. Event Components

4.1 Scrutineering

Each team registered for the Event must submit their entry for inspection prior to the Rayce to verify compliance with these Regulations. In addition, spot checks for regulation compliance may take place during and immediately after the Rayce. The top five overall finishing cars may be impounded immediately following the Rayce for a final inspection.

4.1.A Scrutineering Time and Location: The date and location of Scrutineering for the Event is yet to be determined. Order of inspection will be determined by drawing. Teams that fail to present their solar car at their designated time will drop to the back of the queue and risk not having enough time to complete the Scrutineering process. Additionally, teams failing to participate in mandatory team meetings may be given last priority for Scrutineering and risk not having enough time to complete the process.

4.1.B Scrutineering Format: Scrutineering will involve inspection stations for sizing, driver, body, electrical, mechanical, dynamic tests to verify handling and braking performance, and support vehicles. Instructions for Scrutineering and a detailed description of the Scrutineering tests will be distributed in advance to all registered teams.

4.1.C Configuration and Drivers for Scrutineering: All Drivers must be present for designated scrutineering inspection stations. The driver selection and car configuration are at the discretion of the inspectors for each station. Teams may be required to repeat tests with different drivers and/or configurations as directed by the inspectors.

4.2 The Rayce

Solar cars must rayce in the same configuration as approved during Scrutineering. The team with the most official laps during official raycing hours will be declared the winner of the Rayce.

4.2.A **Authority:** Headquarters reserves the right to cancel the track activity at any time for the event as a whole or for any particular team.

4.2.B **Flag Signals:**

4.2.B.1 **Master Flag Position:** The Master Flag Position will be near the starting line and display flag(s) to represent the overall condition of the track. Corner workers will be located at various Flag Positions around the course to display "local" flag conditions.

4.2.B.2 **Green Flag:** Track clear; proceed at your chosen speed. This flag will be displayed at the starting line only.

4.2.B.3 **Static Yellow Flag:** Caution ahead, proceed at your chosen speed, passing is allowed. This flag will be displayed at corners to alert drivers to unusual conditions ahead that do not immediately interfere with the track (such as a car stopped off of the track). The corner worker will be holding the flag in a stationary position.

4.2.B.4 **Active Yellow Flag**: Caution, obstruction on or near track. An active yellow flag means that cars are to slow down and no passing is allowed unless waved around by a track official. The corner worker will be actively waving the flag. The no passing rule will continue to apply until the solar car reaches a Flag Position where no flag is displayed. Whenever an active yellow flag is somewhere on the track, the Master Flag Position will display both the green and yellow flags.

4.2.B.5 **Black Flag:** Return to the pit area immediately. A black flag is given to an individual car at which point the driver must return to the pit area. The black flag will appear at the last corner before pit entry. The black flag will be deployed to all teams at 4:58:45 PM.

4.2.B.6 **Red Flag:** Total stoppage due to major accident or some other reason. All cars must pull to the side and stop where they are on the track without passing. Proceed only when instructed to do so by track officials.

4.2.B.7 **White Flag:** Last lap. This flag will be displayed at the starting line only at 4:57:00 PM and signifies that there is less than 3 minutes remaining in the race day.

4.2.B.8 **Black and White Checkered Flag** – On the last day, the black and white checkered flag will be given to each car as it completes its final lap of the track rayce.

4.3 Safety

Each team is responsible for the road-worthiness of its solar car. Passing Scrutineering or implementing changes suggested in comments on the team's technical documents does not relieve the team of any liability. All solar cars and support vehicles must be maintained in a safe, road-worthy condition and be operated safely at all times. A team may be disqualified and withdrawn from the Event at any time if it is judged to be operating in an unsafe manner.

4.3.A **Team Safety:** Each team is required to have at least one member trained in basic First Aid, including CPR. Proof of training will be required.

4.3.B **Safety Equipment:** Teams are required to have their battery spill kit available in the pit area at all times. Teams shall have first aid supplies in their pit area at all times. Additionally, any team member in the hot pit or going on the track to assist with a broken down vehicle must be wearing a safety vest.

4.4 Withdrawals

Any team wishing to withdraw must notify Headquarters in writing. All written withdrawals signed by the team representative are final. Headquarters may withdraw teams that do not meet the technical document deadlines or fail to present a solar car at Scrutineering.

5. Electrical

Solar Cars must meet the minimal qualifications listed here or be able to pass the ASC 2012 tech regulations concerning ELECTRICAL.

5.1 Power

Natural solar radiation received directly by the solar car is the only source of energy that can be used for propulsion, except for energy stored in the solar car's battery system at the beginning of the first day of Raycing. Energy recovered from the motion of the car may also be used.

5.2 Solar Array

Solar Arrays can be either a maximum of:

- $6.00m^2$ of any solar cells.
- $9.00m^2$ of solar cells that are listed on the ASC 2010 Approved List.

Solar Arrays will be measured by summing the total exposed area of each solar cell (including all exposed bus bars, junctions and internal structure) from manufacturer's data sheets, validated through measurements. All portions of the solar array and all electrical connections between the solar array and the solar car must be carried by the solar car.

5.2.A **Cell Type Limits:** Teams may use no more than 6 types/sizes of solar cells.

5.2.B **Validation Documentation:** At scrutineering, teams must provide sample cells of each type or size installed on the vehicle as well as a detailed map of the vehicle array for validation per Reg. 3.4.E.6. Additional instructions will be provided to registered teams.

5.2.C **ASC Approved List:** Cells on the ASC 2010 Approved List have been determined to be available to all teams at a price not exceeding US$10/Watt for bare cells. Teams may spend additional money on cutting, tabbing, or lamination of cells, however substantial modification of crystal structure, junction, or metallization will constitute manufacture of a new cell and disqualify it from the List.

5.3 Energy Storage

All solar cars are allowed to store solar-generated energy in an energy storage system composed of individual cells having a weight determined by the technology used.

Adherence to weight limitations does not imply automatic battery approval. Battery approval forms must be submitted to Headquarters before official approval may be issued. Officials reserve the right to refuse approval of modules.

5.3.A **Battery Weight Limits:** Cars are limited to the following amounts of commercially available battery technologies:

Sealed Pb-Acid	125 kg
Ni-Fe	100 kg
Ni-Zn	75 kg
NiMH	70 kg
$LiFePo_4$	50 kg
Li-Ion	25 kg
Li-Polymer	25 kg

5.3.B **Other Energy Storage Methods:** Other energy storage technologies not mentioned (such as other battery technologies or fuel cells) will need to be evaluated by Headquarters. Samples and details of proposed systems must be submitted before January 15, 2011.

5.3.C **Supplemental Batteries:** Supplemental, replaceable batteries carried in the solar car may be used to power: main disconnect relay, radios, commercially available electronic panel meters with internal batteries, driver ventilation fans (if solely for driver ventilation), and the horn. Supplemental battery power may be used to momentarily power the battery protection system as defined by Reg. 5.4 to verify safe battery parameters before energizing the main power switch.

5.3.D **Other Storage Devices:** If any other energy storage devices are used, they must be shown to be storing no energy and fully discharged before the start of each Rayce day.

5.4 Protection Circuitry

All batteries must have protection circuitry appropriate for the battery technology used. Proof is required at scrutineering that the protection system is adequate. Testing procedures will be provided, and the protection system design should allow for such testing. All measurement leads should be fused or current limited to less than 1mA for non-isolatable sinks in the measurement circuitry. All protection circuitry should be contained in the battery enclosures per Reg. 5.5.

5.4.A Definitions:

5.4.A.1 Cell - The smallest available source of energy in the battery pack as purchased from a manufacturer. A single electrochemical cell.

5.4.A.2 Module - The smallest easily removable group in a battery pack.

5.4.A.3 String - The smallest group of cells needed in a battery pack to provide the required voltage.

5.4.A.4 Protection Limit - The measured level determined to be adequate to protect from an event

5.4.A.5 Active Protection– System in which measurements are constantly monitored and where actions can be taken immediately without operator intervention.

5.4.B Types:

5.4.B.1 Li-Based - All lithium based battery packs must have **active** protection such that over-voltage, over-temperature, over-current and under-voltage cause the pack to electrically isolate the source or sink from the battery pack. The level of protection measurement is required down to the module level at a minimum and may be required at a cell level depending on the cell manufacturer. Fuses are not acceptable for over-current protection, but are required as per Reg. 5.6. MOSFETs or other solid state switches that could fail in a closed circuit state are not acceptable for isolating Li-Ion Packs.

5.4.B.2 Ni-Based - All nickel based battery packs must be protected from over-temperature and over-voltage. Isolation is not required but recommended if active protection is unavailable.

5.4.B.3 Pb-Acid - All lead based battery packs must be protected from over-voltage. Isolation is not required but recommended if active protection is unavailable.

5.5 Battery Enclosures

All battery modules, battery protection circuitry per Reg. 5.4, and main fuses per Reg. 5.6 must be fully contained in enclosures that are electrically isolated from the solar car. The enclosures must be constructed from non-conductive, electrolyte-resistant material. No more than two separate such enclosures may be used. Enclosures must be designed such that they can be removed from the vehicle and placed in impound.

5.5.A Isolation: The resistance measured between the battery terminals and any portion of the solar car chassis shall be greater than 1MΩ for applied potentials up to 500V. Any covers allowing access into the enclosures must be firmly secured.

5.5.B Mounting: The battery enclosures must be secured to the solar car chassis so as to prevent them or the modules within from coming loose in the event of an accident or rollover.

5.5.C Marking: The top of each battery enclosure must be marked using 10-mm-high letters with “Caution: Chemical Hazard” and “High Voltage” and any other standard hazard markings specific to the type of battery enclosed. The type (i.e. Li-ion, Pb-Acid) of the battery must be marked on the top of the battery enclosures(s) in 10-mm-hight letters.

5.5.D Ventilation: Battery enclosures must be equipped with a forced ventilation system rated at a minimum of 280L/min exhaust flow. Such ventilation systems must pull exhaust to the exterior of the solar car and must be powered by the battery system. It must operate whenever the battery system is electrically connected to the solar car or to the solar array.

5.6 Main Fuse

A separate DC-rated fuse (not a circuit breaker) must be placed in series with the battery system. The fuse rating must not exceed 200% of the maximum expected current draw. All low-voltage taps from the battery system must be separately fused. All fuses must be placed first in series with the battery starting at the positive connection.

5.7 Power Switch

5.7.A Main Power Switch: The solar car must be equipped with a single throw manually operated, high current and DC-rated, multiple pole switch to quickly isolate the battery, motor, and array from each other and the electrical system of the vehicle. This switch must be capable of interrupting the maximum DC-rated voltage and the full load current. Relays or contactors used for this purpose must also be DC-Rated, normally open, and non-latching. Power for the relay may be supplied by auxiliary batteries per Reg. 5.3.C. The main power switch is independent from any active battery protection system isolation requirements in Reg. 5.4.

5.7.A.1 Location: The switch must be located within easy reach of the driver in normal driving configuration.

5.7.A.2 Marking: The switch must be plainly marked in letters at least 10mm high as the "Power Switch" with "ON" and "OFF" designations. These markings must be clearly visible to the driver inside the solar car and to rescue personnel outside the solar car. Use two sets of markings if necessary.

5.7.B External Power Cut Off Switch: The solar car must be equipped with an electrical cutoff switch that can be externally activated in emergency situations. This switch must meet the electrical requirements of Reg. 5.7.A and may be the same switch as in 5.7.A, provided it can meet all the requirements for both sections.

5.7.B.1 Location: The switch may be actuated remotely using a mechanical linkage. The switch actuator must be located on the exterior of the car, on an upper surface of the car, near the cockpit on the driver's left hand side of the car. The switch actuator must be designed such that it can be operated instantly by someone unfamiliar with the car.

5.7.B.2 Marking: This external switch actuator must be clearly marked by the international marking of a red spark within a white-edged blue equilateral triangle, with a minimum side length of 150mm. In addition, clear directions how to open the switch must be displayed using letters (10mm minimum height). Non-limiting examples of such directions would include PUSH, PULL, or OFF with another arrow pointing in the correct direction of actuation.

5.7.B.3 Covering: The switch may be covered with a colorless, transparent cover. It must be demonstrated that such a cover must be quickly removable without tools or excessive force, or that the switch may be activated normally, without tools or excessive force, through the cover. The cover must be labeled in such a manner (10 mm minimum letter height) as to simply direct the user as to how either remove the cover or how the switch can be activated through the cover. The blue triangle marking may be located on the cover, but must not obstruct the view of the switch or actuator.

5.8 Cable Sizing

All electrical cables must be properly sized to expected system currents.

5.9 Lighting

Solar cars must have amber front indicators, red or amber rear turn indicators and red brake lights which must all be clearly visible from 30m in full sunlight. Turn signals must be located at the front and rear of the vehicle. Brake lights must be located at the rear of the vehicle. The distance between turn signals and brakes lights must be at least 50% of the overall width of the vehicle. The geometric visibility of each light shall be 30° from center in both directions and 15° up and down.

5.10 Horn

Solar cars must be equipped with a horn that can be heard at a sound power level between 75 and 102 dBA at a distance of 15m in front of the solar car. The horn must be permanently mounted.

5.11 Accelerator

Accelerator mechanisms on solar cars must be free moving, and when released, must return to the zero position. If the solar car is equipped with cruise control, it must be designed with an automatic shut-off when the brake is activated.

5.12 Control

Acceleration, braking, and steering must be under the sole control of the driver.

5.13 Electrical Shock Hazards

All exposed or easily exposed conductors, junction boxes, solar cells, etc., operating at greater than 32V must be protected from inadvertent human contact and must be marked “High Voltage” in letters at least 10mm high.

6. Mechanical

Solar Cars must meet the minimal qualifications listed here or be able to pass the ASC 2012 tech regulations concerning MECHANICAL.

6.1 Solar Car Dimensions

The solar car (including solar array) may not exceed the following maximum dimensions when moving under its own power:

- Length = 5.0m
- Height = 1.6m
- Width = 1.8m

When turning corners, wheels and wheel fairings may exceed these dimensions.

6.1.A **Charging Configuration:** When stationary, the solar car body may be split into a maximum of two major components to maximize solar exposure for charging. Each component must not exceed the assembled dimensions of the solar car.

6.1.B **Raycing Configuration:** While the vehicle is moving under its own power, reorientation and reconfiguration of wheel fairings and other aerodynamic devices are allowed, however, reorientation or tilting of the solar car body is prohibited.

6.2 Body Panels

All moving or removable body panels and the array must be securely fastened to prevent unintended movement.

6.2.A **Covers and Shields:** All moving parts must be suitably covered to prevent accidental human contact when the solar car is fully assembled. The driver must be shielded from contact with all steering linkage and other moving parts.

6.2.B **Clearance:** Interference or rubbing of the wheels with the solar car’s body, wheel well, or structure at full steering lock or suspension travel is not permitted. Movement of rod-end bearings may not be obstructed in any axis throughout the full travel of suspension and steering. Other moving parts, such as the motor shaft, must not contact stationary parts except through properly designed bearings. All wheels and their suspensions, steering linkages and geometries will be inspected for safe operation in normal and adverse conditions.

6.3 Tire and Wheel Requirements

The solar car shall have a minimum of three tires in contact with the ground at all times. The wheels and tires must be designed for the intended application and able to withstand the loads and forces imparted by the vehicle’s mass, speed capability, and braking potential. Tires shall be loaded and inflated within the manufacturer’s rating at all times during vehicle operation. Each wheel and tire on a single axle must be rated for the full weight applied to that axle.

6.4 Driver Cockpit

The driver’s cockpit may not subject the driver to excessive strain during normal operation, and must be designed to protect the driver from injury in the event of an accident. The driver must be provided adequate space for safe operation of the vehicle.

6.4.A **Seating Position:** The driver must be seated at less than or at a 27° angle, as measured in Appendix C. The seat must be appropriately constructed with a solid base and back rest.

6.4.B **Belly Pan:** The cockpit must be equipped with a full belly pan to isolate the driver from the road. The belly pan must be strong enough to support the full weight of an 80kg driver.

6.4.C **Crush Space:** The driver, when seated, must have a minimum of 15cm of horizontal distance between his or her shoulders, hips, and feet and the horizontal extreme of the car's outer body surface.

6.4.D **Safety Belts:** All solar cars must be equipped with a minimum of a 5-point lap and shoulder belt harness system for the driver. The use of safety belts is mandatory. The safety belts must be installed and attached securely to main chassis structure, as recommended by the manufacturer. Only commercially manufactured safety belt systems are allowed. All modifications must be approved by the manufacturer.

6.4.E **Roll Cage:** All solar cars must be equipped with a roll cage designed and built per Appendix B. The roll cage shall be a fixed, integral part of the solar car structure. The protection provided for the driver in a collision must be documented in the team's Mechanical Report. In addition to providing collision and rollover protection, the roll cage must be designed so as to deflect body/array panels of the car away from the driver in the event of an accident.

6.4.E.1 The roll cage must be padded with energy-absorbing material, meeting SFI-45.1 or better, wherever it may come into contact with the driver's helmet. In addition, a headrest of at least 2 cm thick resilient material must be mounted behind the driver's head.

6.4.E.2 There must be 5cm of clearance in all directions between the roll cage and the helmet of the driver seated in the normal driving position. There must be at least 3cm of clearance between the driver's head and the padding to allow for free movement of the driver's head.

6.4.F **Outside Air Circulation:** Outside air, from intake vents or wheel openings and directed towards the drivers face, must be provided.

6.4.G **Egress:** The driver's cockpit must be designed to allow the driver to exit the vehicle unassisted. Such openings must be able to be secured and released from both the inside and outside of the vehicle and may not be sealed or secured with adhesive tape at any time. Teams will be required to demonstrate that the driver can exit the vehicle unassisted, standing clear of the car, in no more than 10 seconds.

6.5 Visibility

6.5.A **Eye Height:** In the normal driving position with ballast on board, the driver's eyes must be at least 70cm above the ground.

6.5.B **Forward Vision:** From the normal driving position, the driver must be able to see at all times, without artificial assistance, points at the following locations. Some elements of the roll cage may obstruct a portion of the forward vision. However, this view must be essentially unobstructed as much as is reasonably possible by the solar car structure.

- A point on the ground 8m in front of the solar car
- A minimum of 17° above the horizon on level ground
- A full 100° to either side of center

6.5.C **Windshield:** All solar cars must have a windshield made of shatter-resistant material. The windshield must be free of excessive distortion. The driver will be required to identify 4cm high letters at a distance of 3m through any of the required viewing angles referenced in Reg. 6.5.B. The windshield should not be tinted to the extent that the driver cannot be observed from outside the solar car.

6.5.D **Rain Clearing:** Solar cars must have a method to clear at least $0.1m^2$ of the windshield from any falling rain. The clearing method must be operable at all times and must be in use when it becomes necessary to use the windshield wipers on the team's support vehicles.

6.5.E **Rear Vision:** All solar cars must be equipped with a rear view system that at all times will allow the driver to see a vehicle 15m directly behind the solar car and up to 30° off center. The system must provide the driver with a single reflex type image and must operate without driver input. The driver will be required to identify the direction of an arrow with a 20cm thick brush stoke on a $1m^2$ board held about 1m off the ground.

6.6 Ballast

Any solar car drivers weighing less than 80 kg will require ballast to bring his or her weight to 80kg. Ballast weight

will be measured into containers provided by Headquarters.

6.6.A Ballast Carrier: Each solar car must have a single box or other suitable carrier for carrying ballast container(s). The carrier must be securely fastened to a structural member of the solar car and/or be demonstrated to hold the ballast container(s) fixed in the event of an impact.

6.6.B Ballast Access: The ballast container and its identification and security markings must be visually accessible by the observer during driver changes.

6.7 Fasteners

All fasteners must be of suitable type, strength, and durability for their application. Friction or press fit assemblies will not be accepted in critical areas as the sole means of retention. Fasteners much meet the following minimum requirements:

6.7.A Bolts: Bolts used in the steering, braking, suspension, seat mounts, safety harness, drive train, and battery box systems must at minimum meet SAE grade 5, metric grade M8.8 and/or AN/MS specifications. Bolts must be of the correct length, and extend at least two threads beyond the nut. Bolts in tension must not have shaved or cut heads. All fasteners should be properly torqued.

6.7.B Safetying of Fasteners: All structural and other critical fasteners (bolts, nuts, jam nuts) must have an acceptable form of safetying such that the fastener cannot loosen or be removed unintentionally. Acceptable methods of safetying are:

- Bolts with Flex-loc type aircraft grade nuts or other nuts that use flexure as the means of locking and are re-useable.
- Bolts with pre-drilled shafts and castle nuts with cotter pins installed to prevent loosening
- Bolts with pre-drilled nuts properly safety wired
- In blind hole applications, bolts with pre-drilled heads properly safety wired
- For rod ends or similar applications, pre-drilled jam nuts properly safety wired

Locknuts that use thread distortion as a means of locking and that are not reusable, Nylon locknuts, "lock" washers, or Loctite are not acceptable means of safetying fasteners. Other methods of safetying fasteners where the above methods are not appropriate may be considered at the discretion of the Inspector. Non-critical fasteners need not be safetied.

6.8 Brakes

Solar cars must have a balanced, co-reactive, dual braking system so that if one system should fail, the solar car can still be stopped. The two systems must be operationally independent and may be either front/rear or redundant front or rear (one-sided systems, left or right, are not permitted). Hydraulic systems must have separate master cylinders. Regenerative brakes may not be considered as one of the braking systems.

6.8.A Brake Pads: Each brake pad used in the braking systems must have a contact area with the brake disk that is greater than 6.0cm^2. Pads must initially be at least 6mm thick when installed on the car.

6.8.B Braking Performance: Solar cars must be able to repeatedly stop from speeds of 50 kph or greater with an average deceleration on level **wetted** pavement exceeding 4.72m/s^2. The time interval over which the deceleration is averaged shall be from the first indication that the driver should stop until the solar car comes to a complete halt. When braking, the solar car must not veer excessively to the left or right, or exhibit structural instability. The tire pressure and mechanical systems settings used in this test will be considered Raycing configuration.

6.9 Parking Brake

Solar cars must be equipped with a parking brake, which can hold the car in place without wheel chocks on a 10% grade. This brake must operate completely independently from the main braking system and may not be used in the performance tests specified in 6.8.A. It must be able to be locked into the “ON” position, such that the driver does not have to continue to hold it to maintain position.

6.10 Steering

All steering in the vehicle must be controlled by the driver with a steering wheel designed to have a continuous perimeter as outlined in Appendix A.

6.10.A Steering Stops: The steering system must include steering stops to prevent dangerous or

damaging steering travel.

6.10.B **Turning Radius:** Solar cars must be able to make a U-turn in either direction, without backing up, such that all wheels remain within a 16m wide lane.

6.11 Towing Hardpoint

Solar cars must be equipped with a hardpoint where an appropriate rope or strap may be attached in order to tow the car for emergency recovery purposes. The hardpoint must be either securely attached to or part of a non-moving structural component. The hardpoint may be covered while not in use. The hardpoint must allow the car to be pulled with the body installed on the car, however the canopy may be removed.

6.12 Dynamic Stability

Solar cars will be tested for dynamic stability and handling performance. A combination of the following tests may be conducted:

6.12.A **Figure-8:** Solar cars must be able to negotiate a figure-8 course in less than 9 seconds per side. The figure-8 course shall have a 5m wide lane around two 6m radius center circles, as illustrated in Figure 6-1. The vehicle shall not knock over any of the cones or exhibit signs of structural instability. No body work shall contact moving structural members per Reg. 6.2.B.

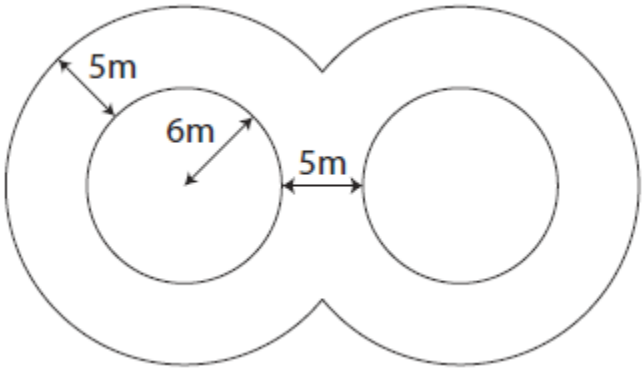


Figure 6-1 Figure-8 Course Layout

6.12.B **Stability at Speed:** Solar cars must be able to stay within a 3.5m lane for at least 250m. Cars must be able to achieve this regardless of crosswinds or gusting conditions. If a car cannot do this at 65mph, the car speed will be limited to where it can stay within a 3.5m lane for the entire event.

6.12.C **Slalom Test:** Solar cars must be able to negotiate a slalom course in 11.5 seconds. The slalom course shall be 126m long, with cones equally spaced every 18m as in Figure 6-2.

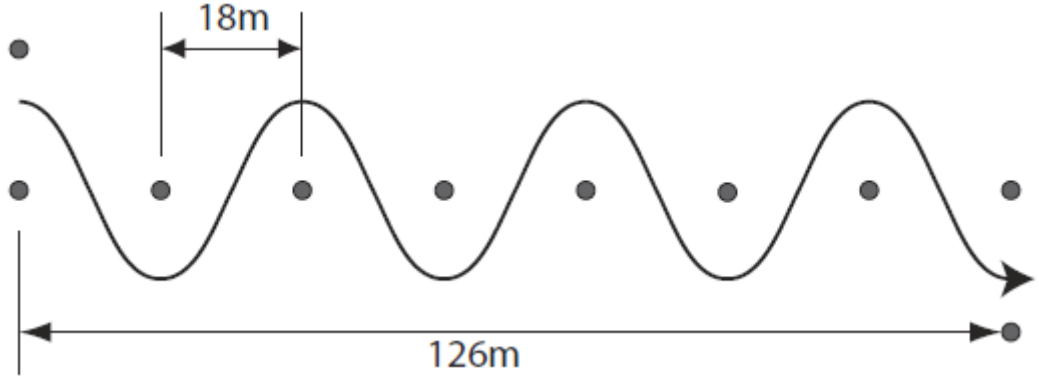


Figure 6-2 Slalom Course Layout

7. Raycing

7.1 Briefings

A Briefing will be held each day. Special meeting may be called in cases of emergency. Attendance at this meeting by a team representative is required. Briefing notes and other daily updates will be available at headquarters. All official statements, rule interpretations, and special instructions will be contained in these postings.

7.2 Team Uniforms

On all event Days from 7:00am to 8:00pm, team members shall wear uniforms representing their Institution(s). The uniforms are required to have the Institution name, car number, and FSGP logo. If team sponsors are displayed, the event sponsor(s) must also appear in a similar manner on the team uniform. Artwork for the FSGP logo and for the event sponsor(s) may be obtained from Headquarters.

7.3 Support Vehicles

All vehicles and trailers associated with a team other than the solar car itself are support vehicles. All vehicles must meet US/Canada Federal Motor Vehicle Safety Standards. All support vehicles will not be allowed on the track without prior consent by track officials.

7.3.A **Safety Vehicles:** Designated safety vehicles will be driven by a Rayce Official. If a track safety vehicle is needed, it will attempt to stay in the slow lane of the track. The same rules that apply to passing solar cars also apply to passing the safety vehicle. Teams may pass a static safety vehicle during an active yellow as well as any solar car not moving given the conditions are safe to pass.

7.4 Radios / Communication

The team must be in two-way radio communication with the solar car driver at all times. Communications should be maintained between the solar car, the pit area, and the timing area at all times.

7.4.A **7.4.B Driver Communications:** All communications by a solar car driver must be verbal and hands-free at all times.

7.5 Drivers

Only one person, the authorized driver, may ride in the solar car at any time. Drivers must be registered and have appropriate ballast per Reg. 3.7.

7.5.A **Driver Helmets:** Drivers must wear a helmet while operating the solar car. The helmet must meet or exceed the Snell95, DOT, or ISO motorcycle standards and will be inspected during scrutineering.

7.5.B **Driver Shoes:** Drivers must wear closed-toe shoes in the solar car (inspector's discretion).

7.5.C **Driver Ballast:** Drivers and their corresponding ballast will be identified with unique identification tags. The tags on the ballast carried by the solar car must match the tags on the solar car driver at all times.

7.5.D **Driving Time:** Each individual driver may not drive more than a total of six hours in a given Rayce Day.

7.5.E **Water/Fluids:** Each driver must have sufficient quantities of water/fluids in the cockpit area to stay properly hydrated. A minimum of one liter for each driver must be provided.

7.6 Timing

Timing and distance determinations for the Event will be the responsibility of Timing Officials. Headquarters will recognize no other timing or distance information. An Official Lap Count will be calculated for each entry based on actual Rayce Laps that are completed during normal raycing hours. The summation of these Laps will yield an Official Total Lap Count for the entry. Overall placing will be determined based on the highest Official Total Lap Count.

7.6.A **Timers:** Each team must provide a team member to serve as a timer. This team member must be in radio contact with both the solar car driver and the pit crew. The timer will be paired with a

timer from another team, and the two will work together to ensure that every lap is properly recorded. Timing Officials will review all timing data for consistency and accuracy.

7.6.B **Official Time:** A master clock providing the "Official Time" will be located near the starting line and timing area. A solar car must cross over the start line to begin and end an official lap. All timers must record lap start/finish times based on the official time displayed.

7.6.C **Track Hours:** The track will be open for raycing from 9:00 AM – 5:00 PM local time each of the three days. Solar cars must complete their final lap of the day prior to 5:00 PM for it to count as an official lap.

7.7 Starts

Teams are released from the Start Line in a group start. The movement of all vehicles in the Start Line area will be under the control of the Start Line Officials.

7.7.A **Starting Order:** For the first day of the Rayce, the starting order will be determined based on performance scrutineering. On subsequent days the start order will be determined based on the total number of official laps completed thus far in the rayce.

7.7.B **Start Line:** Solar cars will be released simultaneously from the starting line at the beginning of each Rayce day. Teams must report to their starting position 15 minutes prior to the beginning of the start time. Control of solar cars in the start-line area is under the direction of the Start-Line Officials. Teams not ready or who are returning to the track from the cold pit area must wait for a track official to clear them for the starting line and be sequenced into traffic.

7.7.C **Delayed Start:** The start of the Rayce, may be delayed if inclement weather or other hazardous conditions appear likely to pose a threat to the solar cars or their drivers. If the start of the Rayce is delayed, then the assigned start time for that day will be adjusted accordingly.

7.8 Charging/Impound

7.8.A **Charging:** All solar cars may begin the Rayce with a fully charged battery pack. Once the Rayce begins, charging may only occur using the solar car's array in designated charging areas.

7.8.B **Impound:** All registered and sealed batteries must be removed from the solar car and kept overnight in battery boxes/containers that will be secured by Headquarters. Batteries must be impounded by 8:00 PM each evening and will be released from impound at 7:00 AM the following morning. Failure to impound batteries will result in a loss of all official laps completed to that point.

7.9 Driving Procedures

All solar cars will proceed around the course in the prescribed direction at all times. Passing and lane information will be presented at the pre-rayce team meeting.

7.9.A **Speed Limit:** No solar car shall exceed the maximum speed of 65 mph anywhere on the track. All teams entering the pit area must slow down. A walking pace must be observed at all times in the cold pit area. While in the cold pit area a team member shall walk directly in front of the solar car to ensure that the path is clear and to warn others in the area that a car is moving.

7.10 Drafting

Drafting by a solar car is prohibited. A solar car will be considered to be drafting if it continuously follows behind another vehicle at less than a 3 second interval. The only exception to this is in congested traffic at speeds of 40kph (25mph) or less.

7.11 Pushing

Except for the following situations, solar cars may not be pushed or pulled from the time they are moved into their starting position for the Daily Start until they reach the finish line except in the cold pit areas. In no case shall regenerative braking be engaged while pushing or pulling the solar car.

7.11.A **Emergency:** In an emergency or breakdown situation, the solar car must be removed from the track as quickly as is prudent. In this circumstance, the car may be pushed or lifted off the track. Upon resuming Raycing, the solar car may then be pushed or lifted back onto the track to the same location where it left the track.

7.12 Breakdowns

Any solar car that stops on the track because of mechanical problems, lack of power, or an accident must be moved off the track as soon as possible and prior to any repairs being performed. All teams must carry a tow strap in their solar car at all times. This tow strap will be used to facilitate a tow to the pit area by the safety vehicle, if required. No team support vehicles will be permitted on the track at any time. Team members may not run across the track to their solar car unless permission is granted by a track official. All team members attending to a broken down car on the track must be wearing a safety vest. At the discretion of the inspectors, any car having a breakdown may be required to be re-inspected for safety and rules compliance

7.12.A **Accident and Re-Inspections:** All accidents involving solar cars must be reported immediately to Headquarters. In the case of an accident involving personal injury, notification of the appropriate emergency medical services and public safety officials shall take priority. If a solar car is involved in an accident it must:

7.12.A.1 Stop and be visually inspected by team members.

7.12.A.2 Be re-inspected by an Inspector. The Inspector may require repairs prior to resuming the Rayce

8. Penalties

Any team failing to comply with these Regulations during Scrutineering or the Rayce will be penalized. Penalties range from official warnings to disqualification from the Event. It is the responsibility of the Chief Inspector, with input from the other Inspectors and the track personal, to determine whether an infraction occurred, the severity of the incident, and the appropriate penalty. All time penalties will be submitted by the Chief Inspector to Rayce Headquarters for subsequent posting. Disqualification of a team from the Event requires concurrence of the Director. Penalties will generally be applied to total number of official laps.

8.1 Penalty Times

All penalty times listed are suggested minimums. If inspectors believe the teams are deliberately violating traffic or driving regulations for strategic advantage, they may impose more severe penalties.

8.1.A **Scrutineering Issues:** Scrutineering issues may result in a pre-loss of laps as determined by the inspectors prior to the beginning of the FSGP. Examples of scrutineering issues include but are not limited to: car size exceeds limits and more than one ballast box. Typically these issues are the result of receiving a blue status in any inspection area. Issues within the dynamics area may also result in a reduced speed limit for the solar car on the track.

8.2 Posting of Penalties

Penalties will be publicly posted by 8:30pm each evening. On the last day of Raycing, time penalties will be posted no later than 30 minutes after the finish of the Rayce.

8.3 Protests

Any team desiring to file a protest must do so by submitting an official protest (signed by the team leader) to Rayce Headquarters. Protests may be filed for any reason, including disputing a penalty levied against any team, correcting timing errors, or protesting the actions of another team. A “filing fee” of 5 laps will be assessed against the team’s Official Lap Count for the day on which the protest is filed. The Jury will hear all protests.

8.3.A **Opportunity to Be Heard:** Protests will normally be heard by the jury at the earliest possible jury sitting. It may be necessary in some instances for the jury to postpone the hearing on a protest.

8.4 Time Limit

Except for the last day, all protests must be filed by 8:00am the following day the penalty is posted. On the last day of Raycing, protests for any purpose must be filed within 60 minutes after the finish of the Rayce.

8.5 Protest Judgments

The decision of the Jury is final and no further appeals are allowed. The Jury will notify Rayce Headquarters of their decision, and Rayce Headquarters will then inform the affected teams. The Jury may refund some or the entire filing fee, which will be credited to the day the filing fee was assessed.

8.6 Conduct

Penalties, including disqualification from the Event, may be imposed for improper conduct or the use of alcohol or illegal substances. Improper conduct may include, but is not limited to, improper language, unsportsmanlike conduct, unsafe behavior, or cheating. Teams are responsible for the conduct of all persons associated with the team, whether or not they are officially registered.

8.7 Time Penalties

8.7.A **Speeding:** Any solar car found to be speeding shall be penalized. Penalties will be assed with a loss of a lap multiplied by the infraction count for that specific instance. Speeding infractions including a rate of speed of 70mph or greater will result in a 1 hour penalty associated with the team's fastest lap speeds.

8.7.B **Traffic Violations:** Any solar car committing a traffic violation may be penalized, up to disqualification. Any solar car driver who commits three traffic violations (including speeding) over the course of the Rayce may be individually disqualified from the Event.

8.7.C **Failure to Allow Other Traffic to Pass:** Any team failing to properly facilitate passing by traffic or other teams may be penalized 2 laps.

8.7.D **Drafting:** A 2 lap penalty may be assessed for any time a solar car drafts behind another vehicle.

8.7.E **Pushing:** a loss of the current lap will result each time a team pushes or pulls their solar car in order to advance along the track. (Except in an emergency as in Reg. 7.11)

8.7.F **Improper Ballast:** A 30min penalty associated with the team's fastest lap speeds may be assessed each time a team operates their solar car with ballast that does not match the solar car driver.

8.7.G **Unauthorized Drivers:** Any solar car that is rayced with an unauthorized driver will forfeit all laps driven with said driver

8.7.H **Non-Solar Charging of Batteries:** After the start of the Rayce until the official finish, teams will be disqualified from the Event for charging their solar car's storage batteries from any source other than those allowed by Regulation 5.1, without specific written instruction from Rayce Officials. Such charging of a solar car storage battery will constitute replacement and is subject to Regulation 8.7.J.

8.7.I **Disturbing Official Battery Seals:** Solar car batteries will be marked with an official seal. Disturbing these seals in a manner that prevents proper identification by Inspectors may be penalized as though all of the battery modules affected had been replaced as in 8.7.J.

8.7.J **Replacement of Batteries:** Decisions to exchange (or externally recharge - see 8.7.H) all or part of a battery must be communicated formally to an Inspector. The penalty will be computed as follows:

Time penalty (minutes) associated with the team's fastest lap speeds = $480 \times (n+S) / N$
where:
n = number of replacement modules
S = sum of all modules previously replaced
N = total number of modules in solar car battery pack

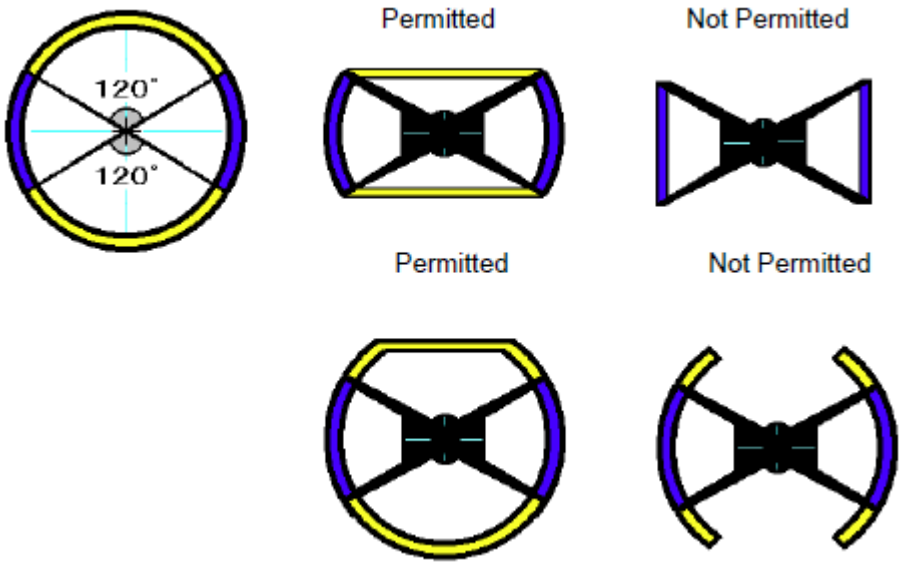
8.7.K **Failure to Impound:** A 1 lap penalty may be assessed for every minute between 8:00pm and 7:00am that a solar car's Raycing batteries are not in Impound.

Exceeding Size Specifications: Oversized solar arrays will be penalized 10 minutes per Rayce day associated with the team's fastest lap speeds per excess centimeter in each dimension beyond the allowed size specification. Oversized solar cars will be penalized 5 minutes per Rayce Day associated with the team's fastest lap speeds per excess centimeter in each dimension. If both the array and car are oversized, both penalties will be applied.

Appendix A ISF Steering Wheel Specifications

To reduce the possibilities of driver injury in the event of collision and to minimize 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 B ISF Roll Bar Specifications

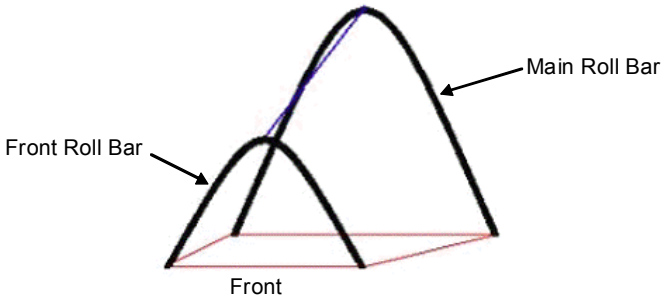
All vehicles must be equipped with front and main roll bars (as shown in the diagrams below) to prevent direct damage to the driver and serious cockpit deformation in the event of a collision or of a car turning over.

The front and main 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 front and main roll bars, the installation of additional roll bars is not necessary. Likewise, only having two roll bars may not fulfill all of the criteria below.

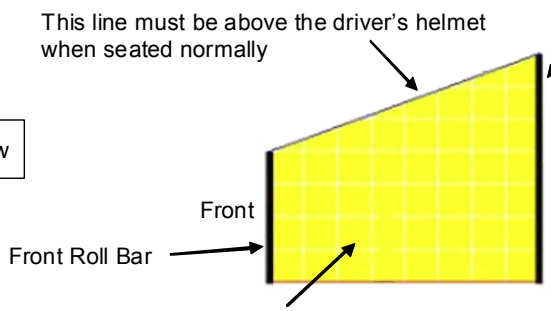
Roll bars shall meet the following dimensional criteria:

- The line extended from the top of the front roll bar to the top of the rear roll bar must be above the driver's helmet when he/she is seated normally in the vehicle.
- The top of the front roll bar must be higher than the top of the steering wheel.
- The front roll bar must cover the steering wheel with steered wheel(s) in the straight ahead position when the vehicle is viewed from the front.
- The main roll bar must cover the driver’s shoulders when the vehicle is viewed from the front. In case that the bodywork of the vehicle covers the driver's shoulders, the main roll bar may cover only the driver's head.
- The main roll bar must have enough strength for lifting or towing with the driver on-board.
- Roll bars should be designed to deflect body and array panels away from the driver in the event of an accident.

General View

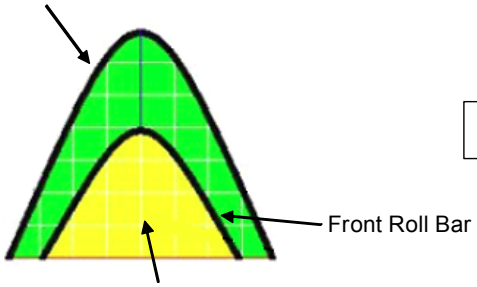


Side View



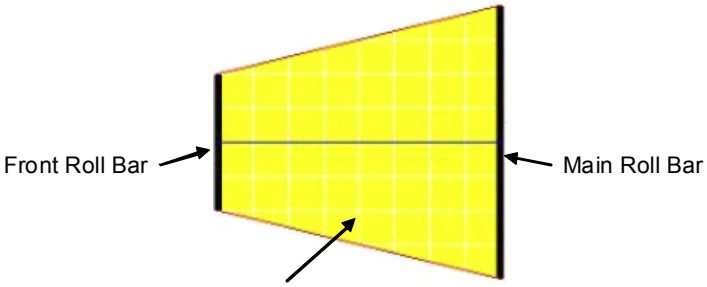
The driver's head, arms, and shoulders must be within this space when seated normally.

Front View



The steering wheel and the driver's hands with the wheels in the straight ahead position must be within this space.

Plan View

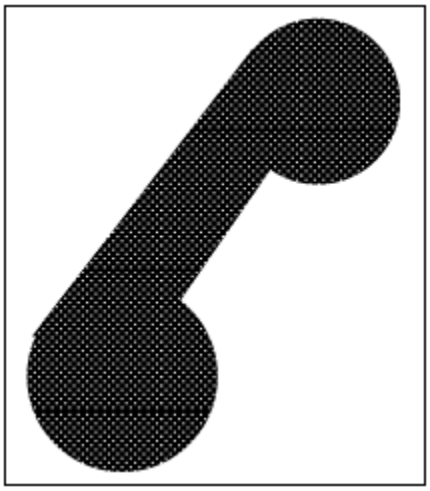


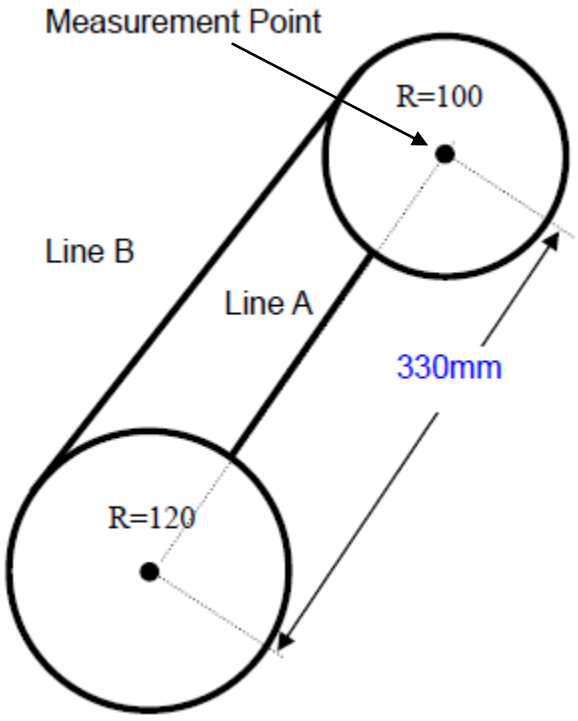
The driver's head, arms, and shoulders must be within this space when seated normally.

Appendix C ISF Standard Measurement of Seating Angle

The seating angle must not exceed 27°.

For ISF scrutineering purposes, measurement is effected by using a template based on the hip and shoulders of a two-dimensional form





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 D Recommendations

These are not binding parts of the regulations, as they are impractical to enforce fairly, but the officials believe they are essential to creating a good, safe solar car. All teams should meet these recommendations on their own.

- **Driver Training** Driver Training is essential to ensuring your car can be driven safely. Solar vehicles have substantially different controls, field of vision, and feedback from regular vehicles. We recommend that every team trains all drivers in a gradual and controlled manner. This means that a driver will begin learning to handle the vehicle in a very controlled setting (such as a large closed parking lot or track) and progress to more challenging situations as he/she gains experience. Prior to any driving, the vehicle should always be given a safety check and the driver should have properly functioning safety equipment. As training progresses, the driver (and all team members in the crew) should practice handling the following situations:
    1. Blow-outs and run flats, especially of the single rear wheel on a three wheel vehicle
    2. Loss of power
    3. Primary brake partial and complete failure
    4. Passing protocols
    5. Merging protocols
    6. Road hazard avoidance
    7. Moving to shoulder from operational speed
    8. Team communication and protocols for possible emergencies
    9. Emergency stop and egress

- **Vehicle Stability and CG** CG location has an important influence on vehicle stability. Your CG location should be a design requirement, not something you find after you build the car.

Appendix E Revision Table

Rev	Description	Date
Initial Release	Initial Release for FSGP 2011:	Oct. 18, 2010
Rev B	3.8 Insurance – Highlighting removed with no other changes from Rev. A.	Nov. 16, 2010
Rev C		Nov. 20, 2010
Rev D	3.4.B – 3.4.E – Changed the due date for reports to February 1, 2011 (from January 15, 2011)	Jan. 10, 2011
Rev E	6.4.E – Removed reference to preliminary mechanical report 7.7 – Removed reference to 1 min start order and reference to chase and lead vehicles	Mar. 28, 2011