

# **STATION ONE: Meeting General Requirements**

I certify that the \_\_\_\_\_ solar car team has successfully passed scrutineering station one.

\_\_\_\_\_  
Chief Judge, Station One

## **Station One: General Scrutineering**

The purpose of this station is to ensure that the team is complying with Solar Car Challenge Rules (Rules, Appendix, Amendments, Interpretations), and to determine the general roadworthiness of the vehicle. Emphasis should be given to ***encouraging*** the teams rather than criticizing them. Be sure that if corrections are necessary that you ask the ***student*** to make those corrections, rather than you getting directly involved in the repairs.

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
1-1.	Qualifying for level: Classic _____ Advanced Classic _____ Advanced _____ Electric-Solar _____ Cruiser _____	N/A	
Documentation			
1-2.	[Rule 3.6] The team has accurate mechanical drawings		
Vehicle Size [Rule 5.1.1]			
1-3.	Length [Max 5.0 m; N/A for E-S] _____m		
1-4.	Width [Max 1.8 m; N/A for E-S] _____m		
1-5.	Height [Min 1.0 m, Max 1.6 m; N/A for E-S] _____m  <i>[Fins, antennas, and other aesthetic components may not be used to meet the minimum height requirement. Antennas may extend above the maximum height requirement.]</i>		
Safety Cell			
1-6.	[Rule 5.2.1] The car is equipped with a safety cell that provides rigid protection encompassing the entire driver and is a fixed integral part of the solar car structure		
1-7.	[Rule 5.2.1.1] There is at least 5 cm of clearance in all directions between the safety cell and the driver seated in the normal driving position		
1-8.	[Rule 5.2.1.1] What material is used for the safety cell tubing? _____	N/A	

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
1-9.	<p>[Rule 5.2.1.1] The safety cell tubing outside diameter is greater than 1.9 cm</p> <p>If not, has a waiver been granted this year for the safety cell?</p> <p>_____</p> <p><i>[Waivers: Team must present a copy of the waiver and the Technical Director must sign here before this step can be passed]</i></p>		
1-10.	<p>[Rule 5.2.1.3] The safety cell and roll bar have sufficient padding where a driver may contact in a collision</p>		
Roll Bar			
1-11.	<p>[Rule 5.2.2] The car is equipped with a structural frame member where the bottom extends at least 5 cm above the driver's head, protecting the driver in the event of a roll over</p>		
1-12.	<p>[Rule 5.2.2] The roll bar is a continuous piece of metal (not multiple pieces of metal welded together) and rolled with no kinks or buckles (e.g. excessive wrinkling)</p>		
1-13.	<p>[Rule 5.2.2.2] What material is used for the roll bar tubing?</p> <p>_____</p>	N/A	
1-14.	<p>[Rule 5.2.2.2] The roll bar tubing outside diameter is at least 5 cm</p> <p>If not, has a waiver been granted this year for the roll bar?</p> <p>_____</p> <p><i>[Waivers: Team must present a copy of the waiver and the Technical Director must sign here before this step can be passed]</i></p>		
1-15.	<p>[Rule 5.2.2.2] The roll bar tubing wall thickness meets the minimum specified in the rules  <i>[1.0 mm chromoly steel, 1.5 mm carbon steel, 3.2 mm aluminum]</i></p> <p>If not, has a waiver been granted this year for the roll bar?</p> <p>_____</p> <p><i>[Waivers: Team must present a copy of the waiver and the Technical Director must sign here before this step can be passed]</i></p>		
1-16.	<p>[Rule 5.2.2.1] Roll bar is welded to frame at no less than two points on each side</p>		
1-17.	<p>[Rule 5.2.2] If driver's head rises above the top of the solar car body, car has additional roll bars to deflect body over the driver in event of a collision</p>		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Crush Zones			
1-18.	<p>[Rule 5.2.3.3] If the car participated in the 2022 event or earlier, the team has explicit permission from the Event Director to comply with 2022 crush zone rules.</p> <hr/> <p><i>[Explicit Permission: Team must present a copy of the email authorizing use of 2022 rules and the Technical Director must sign here before this step can be passed]</i></p> <p><i>[Note: Perform Inspection Step 1-19 and skip Inspection Steps 1-21 to 1-23 below.]</i></p>		
1-19.	<p>[Rule 5.2.3.3] If the car participated in the 2022 event or earlier, left side and right side crush zone structures encompass the driver's head, upper body, and lower body and run from 15cm in front of the driver's feet to 15cm behind the driver's seat. <i>[Note: Skip Inspection Steps 1-21 to 1-23 below.]</i></p>		
1-20.	<p>[Rule 5.2.3.1] Front and Rear crush zone structures extend outside the safety cell by at least 15 cm</p>		
1-21.	<p>[Rule 5.2.3.1] Left side and right side crush zone structures extend outside the safety cell by at least 15 cm</p>		
1-22.	<p>[Rule 5.2.3.2] Left side and right side crush zone structures are at least 30 cm tall</p>		
1-23.	<p>[Rule 5.2.3.2] Left side and right side crush zone structures encompass the driver's lower torso</p>		
1-24.	<p>[Rule 5.2.4] If composite materials are used for the safety cell, roll bar, or crush zone, the team has provided a report of destructive testing proving its adequate structural strength. N/A if composite materials are not used.</p>		
Suspension			
1-25.	<p>[Rule 5.1.2.1] Each shock has at least 50% of travel remaining when fully loaded.</p>		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Vehicle Points			
1-26.	[Rule 5.18] Suspension critical points are lock-nutted, double-nutted, or otherwise secured		
1-27.	[Rule 5.18] Steering critical points are lock-nutted, double-nutted, or otherwise secured		
1-28.	[Rule 5.15] Steering linkages are shielded from the contact of the driver		
1-29.	[Rule 5.11] Steering wheel is round and has a continuous perimeter		
1-30.	[Rule 5.18] Braking critical points are lock-nutted, double-nutted, or otherwise secured		
1-31.	[Rule 5.18] Drive train critical points are lock-nutted, double-nutted, or otherwise secured		
1-32.	[Rule 5.14] Throttle is free to return to zero when released		
1-33.	[Rule 5.18] All nylon locking nuts are secured where the bolt extends past the nut by at least two threads		
1-34.	[Rule 5.18] All double nuts are secured where the bolt extends past the nut furthest from the bolt head		
1-35.	[Rule 5.14, 7.5] If the solar car is equipped with cruise control, it has an automatic shut-off when the brake is activated <i>[Solar cars may only be equipped with a cruise control system during closed-track events]</i>		
1-36.	[Rule 5.14] All accelerator mechanisms (manual throttle or cruise control) are directly operated by the driver		
1-37.	[Rule 5.14] At least one accelerator mechanism is foot-operated		
1-38.	[Rule 5.12.1(b)] External signals (turn indicators/hazard lights) are visible for 30m		
1-39.	[Rule 5.12.1(b)] Stop lights are visible at 100 meters and mounted to maximize rear visibility		
1-40.	[Rule 5.12.1(a)] Stop lights are red in color Turn indicators and hazard lights are amber in color		
1-41.	[Rule 5.12.1(a)] Stop lights are independent of turn indicators and hazard lights		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
1-42.	[Rule 5.13(a)] Seats are equipped with five-point lap and shoulder belt (harness system) that is unexpired per manufacturer's expiration date		
1-43.	[Rule 5.13(a)] The harness belts attached securely to a structural component or main frame member of the solar car per manufacturer's instructions. The belt was not punctured by mounting hardware.		
1-44.	[Rule 5.13(a)] The harness belts are attached with at least 3/8" diameter grade 8 bolts		
1-45.	[Rule 5.13(a)] The shoulder belts are mounted to a harness bar between 0 and 20 degrees lower than the smallest driver's shoulder		
1-46.	[Rule 5.18] Seat belt critical points are lock-nutted, double-nutted, or otherwise secured		
1-47.	[Rule 5.12.2] There is a "sound device" or horn that is at least 92 dB readily available to the driver		
1-48.	[Rule 5.12.2] The horn is mounted as far forward in the vehicle as possible, facing forward, and outside the driver compartment		
1-49.	[Rule 5.12.2] The horn is not an air horn (including train horn, fog horn, or emergency air horn)		
1-50.	[Rule 5.20] Tires are inflated per manufacturer's guidelines (pressure is less than tire sidewall or manufacturer's data sheet)		
Driver Conditions			
1-51.	[Rule 5.8] The driver's head higher than their feet when in the normal seating position		
1-52.	[Rule 5.9] All drivers driver's eyes are a minimum of 70 cm above ground		
1-53.	[Rule 5.9.1] Forward vision: All drivers can see a point on the ground 8m or less from the front of the car		
1-54.	[Rule 5.9.1] Forward vision: All drivers can see a minimum of 10° from horizon		
1-55.	[Rule 5.9.2] Side vision: From the normal driving position, all drivers can see, without artificial assistance, 90 degrees to either side at all times		
1-56.	[Rule 5.9.3] Rear vision: All drivers can see a vehicle 15 meters directly behind the solar car		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
1-57.	[Rule 5.9.3] Rear vision: All drivers can see vehicles 45 degrees in each direction approaching from the rear		
1-58.	[Rule 5.9.3] Rear vision: If electronic rear vision system is used, there is no separate switch that turns the system on/off (to ensure that it is operating whenever driver is in vehicle)		
1-59.	[Rule 5.13(d)] Windshield provides protection for the entire head of the driver		
1-60.	[Rule 5.13(l)] No windows are tinted (unless above driver's head)		
1-61.	[Rule 5.13(g)] Solar car has space for a plastic liquid container for the driver; container cannot roll underneath brake/throttle		
1-62.	[Rule 5.1.3, 5.13(h)] Cockpit is equipped with a full belly pan consisting of a solid material resistant to puncture throughout the driver compartment		
1-63.	[Rule 5.13(i)] Forced air ventilation is provided for the solar car's driver		
1-64.	[Rule 5.13(j)] Driver seat is rigid (no mesh seats)		
1-65.	[Rule 5.13(j)] When the driver is seated in the normal driving position, the driver's seat provides back and neck support for the driver		
1-66.	[Rule 5.13(j)] The driver's seat is attached to main structural frame using at least grade eight bolts 3/8" in diameter		
1-67.	[Rule 5.13(j)] If the seat is mounted on adjustable rails, a seat back brace is mounted (or racing seats are installed per manufacturer's specifications)		
1-68.	[Rule 5.4.3(f)] Driver's compartment is ventilated separately from the battery area		
1-69.	[Rule 5.13(b)] All sharp objects and frame members within the driver area are padded to help protect the driver		
1-70.	[Rule 5.13(b)] If the car has body shells, shells are securely attached to each other		
1-71.	[Rule 5.13(c)] All vehicle components are secured to the main frame to prevent shifting during impact		
1-72.	[Rule 5.15] Vehicle's revolving parts are suitably covered to prevent accidental contact		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Student Involvement			
1-73.	[Rule 5.13] Have students explain all the safety features provided for the driver and passenger and why they chose that design	N/A	
1-74.	[Rule 3.8] Is the car obviously constructed by the students? <i>[No "hand-me-down" cars are allowed]</i>		
1-75.	[Rule 3.8] If equipped with a vehicle body taken from body molds, team shows evidence that vehicle body was constructed by students.		
1-76.	[Rule 3.8] Are the students adequately able to answer judges' questions concerning the principles and operation of the mechanics of the car?		



# **STATION TWO: Electrical and Battery Requirements**

I certify that the \_\_\_\_\_ solar car team has successfully passed scrutineering station two.

\_\_\_\_\_  
Chief Judge, Station Two

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Documentation			
2-1.	[Rule 3.6] The team has accurate electrical schematics		
2-2.	[Rule 3.6] The team has accurate solar cell documentation, including list price and cell efficiency		
2-3.	[Rule 3.6] The team has accurate motor and controller documentation		
2-4.	[Rule 3.6] The team has accurate main fuse documentation		
2-5.	[Rule 3.6] The team has accurate disconnect switch documentation		
Propulsion Battery System			
2-6.	[Rule 5.4.3(a)] Propulsion battery box is rigid		
2-7.	[Rule 5.4.3(b)] Propulsion batteries are strapped down or held in place in event of a rollover		
2-8.	[Rule 5.4.3(g)] Propulsion battery box is securely fastened to the vehicle's structure		
2-9.	[Rule 5.4.3(c)] Inside of propulsion battery box insulated or non-conductive		
2-10.	[Rule 5.4.3(d)] Propulsion battery box not used as dedicated crush zone		
2-11.	[Rule 5.4.3(d)] Propulsion battery box is not located at front of vehicle frame		
2-12.	[Rule 5.4.3(d)] Propulsion battery box is not in the path of egress		
2-13.	[Rule 5.4.3(e), 5.4.3(f)] Propulsion batteries enclosed in a sealed battery box <i>Note: The battery box does not yet need to be sealed by event officials.</i>		
2-14.	[Rule 5.4.3(e)] For flooded PbAcid batteries (required) or if equipped (for other battery chemistries), ventilation intake or exhaust does not open into the driver's compartment (there are no holes in the battery box facing the driver's compartment).		
2-15.	[Rule 5.4.3(e)] For flooded PbAcid batteries, propulsion battery box fans cycle air within the battery box at least 4 times per minute		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
2-16.	[Rule 5.4.3(e)] For flooded PbAcid batteries, propulsion battery box is equipped with a forced air ventilation system that vents to the exterior of the car		
2-17.	[Rule 5.4.3(e)] Forced air ventilation systems have at least 3 cm of clearance between any device inside the battery enclosure and the intake or exhaust vent (N/A if car is not equipped with a forced air ventilation system)		
2-18.	[Rule 5.4.3(f)] Propulsion battery box is air-tight other than forced air ventilation system intake and exhaust		
2-19.	[Rule 5.5] Propulsion system isolated from the vehicle frame (resistance > 1 MΩ)		
2-20.	[Rule 3.6] Propulsion batteries match documentation submitted by the team		
2-21.	[Rule 3.6, 5.4.1.3] If Li-based batteries are used, the batteries are protected by a battery management system monitored at the cell level (w/ accurate documentation)		
2-22.	Battery Capacity _____ (@20 hr rate for PbAcid, nominal capacity for Li-based)  Number of Batteries _____  Total Battery Capacity _____  [Rule 5.4] Total Battery Capacity is less than 5.25 kWh (10.5 kWh for Cruiser Division)		
2-23.	[Rule 5.4, 10] Battery type is appropriate for division (Non PbAcid or LiFePO4 batteries are restricted to Advanced/Cruiser Divisions)		
2-24.	[Rule 5.4.1.2] Measure voltage on each propulsion battery. Propulsion batteries are not supercharged (e.g. do not exceed 16% of nominal voltage)		
Supplemental Battery System			
2-25.	[Rule 5.4.4, 5.5] Auxiliary power system, including supplemental batteries, is isolated from the propulsion batteries (other than telemetry systems)		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
2-26.	[Rule 5.4.4(b)] Driver aggressively warned with audible alarm when supplemental battery voltage is low <i>Note: Advise the team that a supplemental battery should be removed from the car before charging. Teams should never give the appearance that they are charging their main battery pack when they are just charging their supplemental battery.</i>		
2-27.	[Rule 5.4.4] Telemetry systems are isolated from propulsion batteries or draw a low current		
2-28.	[Rule 5.5] Auxiliary power system isolated from the vehicle frame (resistance > 1 MΩ)		
2-29.	[Rule 5.4.4(c)] Supplemental battery is securely fastened to vehicle structure so it will not move in event of crash or rollover (e.g. Velcro was not used to mount battery)		
Wiring			
2-30.	[Rule 5.7.1] Wires clear from entanglement and protected (with use of a grommet when passing through a bulkhead)		
2-31.	[Rule 5.7.1] All wires connected from the battery to the motor controller and relay/contactors are properly sized for expected continuous system current		
2-32.	[Rule 5.7.1] All wires connected from the battery to the output of the solar array and relay/contactors are properly sized to expected continuous system current		
2-33.	[Rule 5.7.2] Propulsion system connectors are properly insulated. Electrical tape cannot be used for propulsion system connectors.		
2-34.	[Rule 5.7.1] There are no wires conducting more than 36 volts in the driver's compartment		
2-35.	<i>Glance at all electrical connections throughout the solar car, with focus on high-voltage connections.</i> [Rule 5.7.3] All electrical connections are rated for voltage, current, and temperature		
2-36.	[Rule 5.7.3] There are no wire nuts in the system		
2-37.	[Rule 5.7.3] All electrical connections are properly tightened		
2-38.	[Rule 5.7.3] All electrical connections more than 36 volts (especially battery terminals) are secured with locking washers		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Disconnect Switches			
2-39.	[Rule 5.4.5, 5.4.5(d)] Internal motor disconnect switch is accessible to the driver and is securely fastened to vehicle structure		
2-40.	[Rule 5.4.5(e), 5.4.5(d)] External motor disconnect switch is accessible/visible to bystanders external to the vehicle and is securely fastened to vehicle structure		
2-41.	[Rule 5.4.5(a)] Motor disconnect switches are push-pull or push-rotate type		
2-42.	[Rule 5.4.5(a)] Motor disconnect switches are normally open (Off when pushed)		
2-43.	[Rule 5.4.5(b)] Motor disconnect switches are labeled as "Motor Disconnect" with marked "ON" and "OFF" positions or with operating instructions (like "Push for Off")		
2-44.	[Rule 5.4.5(c)] Motor relay/contactors are rated for the expected voltage and current		
2-45.	[Rule 5.4.5(f)] Motor disconnect switches controlling motor relay/contactors are wired in series		
2-46.	[Rule 5.4.5(f)] Motor relay/contactors are connected to the positive connection of the motor controller		
2-47.	[Rule 5.4.5(f)] Motor relay/contactors are located with the high voltage enclosure outside the battery box		
2-48.	[Rule 5.4.5, 5.4.5(d)] Internal array disconnect switch is accessible to the driver and is securely fastened to vehicle structure (N/A for E-S)		
2-49.	[Rule 5.4.5(e), 5.4.5(d)] External array disconnect switch is accessible/visible to bystanders external to the vehicle and is securely fastened to vehicle structure		
2-50.	[Rule 5.4.5(a)] Array disconnect switches are push-pull or push-rotate in type		
2-51.	[Rule 5.4.5(a)] Array disconnect switches are normally open (Off when pushed)		
2-52.	[Rule 5.4.5(b)] Array disconnect switches are labeled as "Array Disconnect" with marked "ON" and "OFF" positions or with operating instructions (like "Push for Off")		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
2-53.	[Rule 5.4.5(c)] Array relay/contactor is rated for the expected voltage and current		
2-54.	[Rule 5.4.5(b)] Array disconnect switches controlling array relay/contactor are wired in series		
2-55.	[Rule 5.4.5(f)] Array relay/contactor is connected to the positive connection of the solar panels or power trackers (if used)		
2-56.	[Rule 5.4.5] Array relay/contactor is located with the high voltage enclosure outside the battery box		
Main Battery Pack Fuse			
2-57.	[Rule 5.4.2(b)] Main fuse is rated for the appropriate DC voltage (greater than propulsion system voltage) and not rated for AC		
2-58.	[Rule 5.4.2(c)] Fuse Rating: _____ Peak Current Draw: _____ Main fuse is rated for no more than 125% of the expected peak current draw		
2-59.	[Rule 5.4.2(d)] Main fuse is placed in an enclosure separate from battery and power tracker enclosures		
2-60.	[Rule 5.4.2] Main fuse is directly connected to the positive terminal of the propulsion battery (e.g. no switches in between fuse and terminal)		
Electrical System Check			
2-61.	[Rule 5.16] High Voltage “points” properly identified and insulated for battery connections (if greater than 36 volts)		
2-62.	[Rule 5.16] High Voltage “points” properly identified and insulated for motor controller (if greater than 36 volts)		
2-63.	[Rule 5.16] High Voltage “points” properly identified and insulated for switches and fuses (if greater than 36 volts)		
2-64.	[Rule 5.16] High Voltage “points” properly identified and insulated for solar cells/panels		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Motor and Controller Information			
2-65.	Motor Manufacturer: _____ Motor Model: _____ Controller Manufacturer: _____ Controller Model: _____ [Rule 10.1] Motor type allowed for division (Hub motors are restricted to the Advanced Division)		
Assistance Devices			
2-66.	[Rule 5.6] I (we) certify that all devices used to assist the start, stop, or powering of the car (umbilical cords, soft start devices, etc.) are carried on the car and are a permanent part of the electrical system. _____ Signature of team captain(s)	N/A	
Solar Array			
2-67.	[Rule 5.3.3] Solar array has no reflecting devices		
2-68.	[Rule 3.6] Number of cells/modules: _____ Watts per cell/module: _____ W <i>Note: Verify with documentation</i> Computed peak wattage: _____ W	N/A	
2-69.	[Rule 5.3.1, 10] Efficiency of cells/module: _____ % <i>Note: Verify with documentation.</i>	N/A	
2-70.	[Rule 10] Solar cells meet all the requirements for the division that the team intends to compete in. Cell/module efficiency greater than 22.0% must race in the Advanced Division.		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
2-71.	<p>The cells of the solar car match the documentation that has been submitted to the race</p> <hr/> <p>Signature of Chief Judge, Station 2</p> <p>The team acknowledges that the cell documentation submitted is correct and matches what is on the solar car</p> <hr/> <p>Signature of Team Captain(s)</p>	N/A	
Student Involvement			
2-72.	[Rule 3.8] The students were adequately able to answer judges questions concerning the principles and operation of the electronics of the car		



# STATION THREE:

## Tilt and Turning Radius Checks

I certify that the \_\_\_\_\_ solar car team has successfully passed scrutineering station three.

\_\_\_\_\_  
Chief Judge, Station Three

### Tilt Test:

You will want to ask the team to tilt their vehicle approximately 20 degrees. Teams will lift the solar car along a line perpendicular with the drive axle.

The purpose of this test is to check the following:

- (1) Make sure that the car won't collapse when lateral stresses are applied to the wheels and tires.
- (2) Make sure the vehicle can turn within a safe distance.

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Tilt Test			
3-1.	[Rule 5.1.2] The vehicle was able to endure the stresses associated with tilting the car approximately 20 degrees		
Weight Distribution Check [optional]			
3-2.	Weight on Front-Left tire: _____ kg	N/A	
3-3.	Weight on Front-Right tire: _____ kg	N/A	
3-4.	Weight on Rear-Left tire: _____ kg (Rear for 3 wheeled car)	N/A	
3-5.	Weight on Rear-Right tire: _____ kg (N/A for 3 wheeled car)	N/A	
3-6.	Overall Weight: _____ kg	N/A	

### Turning Radius Test:

Ask the team to drive their car and make a 180 degree turn. This should be possible within a diameter of 15 meters. The purpose of this test is to ensure that the car will be able to negotiate sharp turns on the road.

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Turning Radius Test			
3-7.	[Rule 5.1.2] The vehicle is steered using front wheels		
3-8.	[Rule 5.11.1] The vehicle was capable of making a 180 degree turn within a diameter of 15 meters		
3-9.	[Rule 5.11] The vehicle was stable while making the turn		
3-10.	[Rule 5.11] The steering and suspension mechanisms adequately handle the stresses of the turn		
3-11.	[Rule 5.11] All steering mechanisms are connected via direct mechanical linkages (no electrical actuators or controls)		

# STATION FOUR:

## Vehicle Handling – Slalom

I certify that the \_\_\_\_\_ solar car team has successfully passed scrutineering station four.

\_\_\_\_\_  
Chief Judge, Station Four

### Slalom Test:

The purpose of this test is to determine whether:

- (1) The vehicle will be able to safely avoid obstacles in the road without the car collapsing under lateral forces.
- (2) The drivers have the necessary skills to negotiate the slalom course.
- (3) Rule 5.1.2 seeks to ensure vehicle stability. Please observe the vehicle for any irregular movements during this part of the scrutineering process.

### Slalom Test Preparation:

Set up a slalom course using at least six cones, with 40 feet between each cone. Require the team to navigate between the cones at a reasonable speed that simulates road conditions. Be sure that the course is secure so that parking lot traffic, bystanders, or other solar cars will not interfere with the car being evaluated.

Ask the team to first run the slalom course at a *slow speed* to allow them to become familiar with the course. Then require the team to drive the course at a speed simulating road conditions [approximately 20 mph]. Each driver on a team must demonstrate their ability to successfully drive the course.

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Slalom Test			
4-1.	[Rule 7.6] The vehicle was able to endure the stresses associated with quick turns		
4-2.	[Rule 7.6] The vehicle appeared stable during the running of the slalom course		

Inspection Step	Scrutineering Criteria					
4-3.	<p><b>For each driver,</b></p> <p>[Rule 5.13(e)] Egress: Driver can egress from the car in 15 seconds without assistance. Everything must be in place prior to egress, including seat belts, water, and fire extinguishers.</p> <p>[Rule 7.6] Slalom: Driver appeared to have the skills necessary to avoid obstacles on the road or track.</p> <p>[Rule 5.2.1.2] Safety Cell: The driver does not extend beyond the safety cell, except arms when holding the steering wheel</p> <p>[Rule 5.2.3.1] Crush Zone: Driver has a minimum of 15 cm of horizontal distance from his or her shoulders, hips, and feet to the inside of the most exterior structural frame member.</p>					
Slalom Test						
Driver Name	Driver License	Egress Pass	Slalom Pass	Safety Cell Pass	Crush Zone Pass	Judges Initials

Inspection Step	Scrutineering Criteria					
4-3.	<p><b>For each driver,</b></p> <p>[Rule 5.13(e)] Egress: Driver can egress from the car in 15 seconds without assistance. Everything must be in place prior to egress, including seat belts, water, and fire extinguishers.</p> <p>[Rule 7.6] Slalom: Driver appeared to have the skills necessary to avoid obstacles on the road or track.</p> <p>[Rule 5.2.1.2] Safety Cell: The driver does not extend beyond the safety cell, except arms when holding the steering wheel</p> <p>[Rule 5.2.3.1] Crush Zone: Driver has a minimum of 15 cm of horizontal distance from his or her shoulders, hips, and feet to the inside of the most exterior structural frame member.</p>					
Slalom Test						
Driver Name	Driver License	Egress Pass	Slalom Pass	Safety Cell Pass	Crush Zone Pass	Judges Initials

# STATION FIVE: Braking Tests

I certify that the \_\_\_\_\_ solar car team has successfully passed scrutineering station five.

\_\_\_\_\_  
Chief Judge, Station Five



### Braking Test:

The purpose of this test is to check the following:

- (1) The vehicle will be able to safely stop under real world conditions.
- (2) The drivers have the necessary skills to make these critical stops.
- (3) To ensure that all brake components are in good working order.

### Braking Test Preparation:

Set up a braking course using a speed-sensing device. Clearly mark the starting point, and the point at which the solar cars will be required to apply their brakes.

### Conducting the test:

- (1) Physically check brake assembly to ensure that all brake components are in good working order.
- (2) Make sure that your course is clear of obstructions and cross-traffic.
- (3) Explain to the vehicle drivers exactly what is expected of them.
- (4) Physically show them where the “start” line and the “apply-the-brake” line are located.
- (5) Tell them that they have to accelerate to road speeds, and then demonstrate that they can stop within a reasonable amount of time.

<u>Vehicle Speed:</u>	<u>Required stopping time:</u>
Traveling less than 20 mph	N/A (Below qualifying speed)
20 mph	2.5 seconds
25 mph	3.0 seconds
30 mph	3.5 seconds

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Braking Test			
5-1.	[Rule 5.10] All brake components are in good working order		
5-2.	[Rule 5.18] Braking critical points are lock-nutted, double-nutted, or otherwise secured		
5-3.	[Rule 5.10] There are two separate foot pedals that are structurally sound		
5-4.	[Rule 5.10] Automotive style foot brake pedals are used (no motorcycle hand brakes or 3D printed pedals)		
5-5.	[Rule 5.10] The two separate foot pedals are not linked together		
5-6.	[Rule 5.10] With the driver engaging only the primary braking system, the car remains stationary when pushed		
5-7.	[Rule 5.12.1(c)] With the driver engaging only the primary braking system, stop lights are activated		
5-8.	[Rule 5.10] With the driver engaging only the secondary braking system, the car remains stationary when pushed		
5-9.	[Rule 5.12.1(c)] With the driver engaging only the secondary braking system, stop lights are activated		
5-10.	[Rule 5.18] All braking components are properly lock-nutted, double-nutted, or otherwise secured		
5-11.	[Rule 5.10] The vehicle was stable and in control during braking process (stayed in lane of travel)		
5-12.	[Rule 5.10] The vehicle came to a complete, safe stop within the required amount of time		
5-13.	[Rule 5.10] Braking and steering components were able to handle the stress of braking		

# STATION SIX: Endurance Test

I certify that the \_\_\_\_\_ solar car team has successfully  
passed scrutineering station six.

\_\_\_\_\_  
Chief Judge, Station Six

### Endurance Test:

The purpose of this test is to determine whether the vehicle will be able to safely travel an extended distance, to determine if there is adequate communication between the solar car and the chase vehicle, and to simulate a mechanical failure to demonstrate procedures for safely loading and unloading the solar car.

### Preparation for the test:

See that there is a clear path for the vehicles to drive from the scrutineering area to the test area. Make sure that the test area is clear of any other vehicle. Inform the team and chase personnel of the procedures that will be followed in the event that a solar car has a problem during the test.

### Procedure:

- (1) Check chase vehicle for requirements as specified below.
- (2) Make sure that the test area is clear of any other vehicle.
- (3) Explain to the solar car driver and the chase vehicle personnel exactly what is expected of them:
  - a. Solar Car: Make at least one complete lap of the test area
  - b. Chase Vehicle: Positioned ready to retrieve the vehicle in the event that a problem occurs
- (4) Have personnel check communications during the test.
- (5) Observe the performance of the solar car and its driver.
- (6) Only one driver needs to put the solar car through the endurance test.
- (7) Have driver complete one full lap at their fastest speed. This counts as the qualifying lap time.
- (8) Full Speed Panic Stop: The driver must safely make a panic stop from full cruising speed
- (9) Have solar car go out into the test area and radio that there has been a mechanical failure. Send trailer to load solar car and observe procedure.
- (10) Have the solar car returned to the scrutineering area and observe unloading procedure.

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Solar Car Inspection			
6-1.	[Rule 5.13(k)] If solar car is using PbAcid batteries, solar car has baking soda for battery spills		
6-2.	[Rule 5.13(f), 7.8] Solar car has Class C fire extinguisher		
6-3.	[Rule 7.8] Solar car has safety vest for driver		
Lead Vehicle Inspection			
6-4.	[Rule 19.2.1, 19.2.2.1] Lead Vehicle has flashing amber light (road race only)		
Chase Vehicle Inspection			
6-5.	[Rule 5.13(k)] If solar car is using PbAcid batteries, No. 1 Chase Vehicle has baking soda for battery spills		
6-6.	[Rule 5.13(f), 7.8] No. 1 Chase Vehicle has Class C fire extinguisher (or Class D for solar cars with Lithium-metal batteries)		
6-7.	[Rule 19.2.1, 19.2.2.1] Each Chase Vehicle has flashing amber light		
6-8.	[Rule 7.8] No. 1 Chase Vehicle has at least 3 traffic cones or warning triangles		
6-9.	[Rule 19.2.2.1] Each Chase Vehicle has rear Caution Sign attached (road race only)		
6-10.	No. 1 Chase Vehicle carries proof of liability insurance for solar car		
6-11.	[Rule 5.12.1(e), 19.2.2.8] Each Chase Vehicle has four amber ECCO 3510, ED3511 or 3811 lights mounted (road race only)		
Scoring			
6-12.	Driver has required skills to drive endurance course		
6-13.	Solar car able to endure the test		
6-14.	Chase Vehicle personnel have necessary skills		
6-15.	[Rule 5.17] Inter-vehicle communications work properly		
Full Speed Panic Stop			
6-16.	Car appears stable when performing the panic stop		
6-17.	Car able to come to a complete stop without any mechanical failures		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Designation of Specific Responsibilities [Rule 7.8]			
6-18.	Who is the team designated team member to handle road safety issues? _____	N/A	
Trailer Loading and Unloading			
6-19.	Teams, Drivers, and Chase Vehicle Personnel have been thoroughly informed of the procedures that will be followed in the event that a solar car has a problem on the race course.		
6-20.	Solar car was able to be safely loaded onto the trailer		
6-21.	Solar car was able to be safely unloaded from the trailer		

## **PROCEDURE IF A PROBLEM OCCURS WHILE A SOLAR CAR IS ON THE RACE TRACK:**

The tower will indicate to the other teams that a problem has occurred on the track. This will be done by waving a yellow flag. Each team is also required to notify its driver by inter-vehicle radio. Drivers must use extreme caution when passing a vehicle that has pulled off the speedway. Road speeds must be appropriate for the conditions. Excessive speed will be penalized.

### **Malfunctioning Vehicle:**

- (1) The driver will attempt to drive the car off the track. The driver will exit the vehicle, maintain a safe position away from the track, and wait for the chase team. Under no circumstances is the driver to abandon the car.
- (2) If the car can not be driven off the track, the driver will do everything possible to position the car in a safe position. The driver will then exit the vehicle, maintain a safe position away from the track, and wait for the chase team.
- (3) The chase vehicle will slowly move on the track and drive to the solar car. [Yellow lights flashing!]
  - a. Minor repairs can be made on the track so long as the solar car is safely away from the flow of traffic.
  - b. Major repairs require that the car be transported to the garage area.
- (4) All flow of traffic (solar cars and chase vehicles) will be in the direction of the solar cars. No chase vehicle will attempt to drive against the flow of "traffic." Chase vehicles must yield to any approaching solar car.
- (5) Any violation of these rules will produce major penalties.

A green flag will be waved to indicate that the race course is clear. Teams will also notify their drivers by inter-vehicle communication. Normal speeds can now be resumed.

# STATION SEVEN : Road Test

(On Road Events Only)

I certify that the \_\_\_\_\_ solar car team has successfully  
passed scrutineering station seven.

\_\_\_\_\_  
Chief Judge, Station Seven



### Road Test:

The purpose of this test is to determine whether the vehicle will be able to safely travel on undivided highways with on-coming traffic. This test is not applicable for closed track events.

### Preparation for the test:

See that there is a clear path for the vehicles to drive from the scrutineering area to the test area. Make sure that the test area is clear of any traffic. Check to make sure the solar car has passed stations all other station prior to attempting this station.

### Procedure:

- (1) Make sure the solar car has passed all other stations.
- (2) Make sure that the test area is clear of any traffic.
- (3) Position the solar car and test truck on opposite sides of the test area facing each other.
- (4) Explain to the solar car driver and the test truck driver exactly what is expected of them:
  - a. Solar Car: Accelerate the solar car to road speeds and pass the test truck on the right side.
  - b. Test Truck: Accelerate the truck to normal road speeds and pass the solar car on the right side.
- (5) Observe the stability of the solar car.
- (6) Only one driver needs to put the solar car through the road test.

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Road Test			
7-1.	The vehicle was able to endure the stresses associated with the vortices created by the passing truck		
7-2.	The vehicle appeared stable during the running of the road test		

# **STATION EIGHT: Electric-Solar Powered Vehicle Station**

I certify that the \_\_\_\_\_ electric-solar powered car has successfully passed scrutineering station eight.

\_\_\_\_\_  
Chief Judge, Station Eight

### Concept:

The Electric-Solar Powered Car Division is designed to simulate a “real world” solar application. The solar car itself will be a two passenger vehicle that could easily run in a neighborhood environment. The Solar Power Charging Station simulates a permanent (or mobile) facility that would be used to charge the vehicle at home or at work.

### Preparation for the test:

Electric-Solar Powered Car Team will travel to the Charging Station Area to conduct Station Eight qualifying.

### Procedure:

- (1) Check that the E-SP vehicle for requirements as specified below.
- (2) Explain to the E-SP car driver and passenger what is expected of them:
  - a. Demonstrate the battery box has a maximum of 5.25 kW/hr
  - b. Demonstrate that the team has a system for measuring driver/passenger weight and preparing accurate ballast.
  - c. Demonstrate that the battery box can be safely installed
  - d. Demonstrate that the battery box can be safely removed
  - e. Demonstrate that the battery box is ventilated both in the E-SP car and at the Power Station.
  - f. Demonstrate that the Power Station is structurally secure
  - g. Demonstrate that the Power Station array can be safely rotated, if the team is tracking the movement of the sun.
- (3) Observe the performance of the E-SP car, driver, and passenger.
- (4) Can both the driver and passenger meet the 15-second emergency egress?

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Physical Regulations			
8-1.	[Rule 32.2.1] The electric-solar powered [E-SP] car has passed all other stations.		
8-2.	[Rule 32.2.2(a)] E-SP car has two passengers seated side-by-side		
8-3.	[Rule 32.2.2(a)] E-SP car passengers seated upright		
8-4.	[Rule 32.2.2(a)] E-SP car passengers have immediate access to a door for entry/exit		
8-5.	[Rule 32.2.8] E-SP car has an externally accessible storage container within the car body that is at least 61cm long, 46cm wide, and 30.5cm tall.		
8-6.	[Rule 32.2.3] Team has scale to measure the weight of the drivers		
8-7.	[Rule 32.2.3] Team has adequate ballast to bring driver/passenger weight to 320 lbs		
8-8.	[Rule 32.2.3] Ballast is adequately secured within the vehicle		
8-9.	[Rule 32.2.5] Car has two separate battery boxes		
8-10.	[Rule 32.2.5(a)] Each battery box has maximum of 5.25 kWh @ 20 hr rate (1C rate for LiFePO4)		
8-11.	[Rule 32.2.5(b)] Battery box is rigid and easily installed/removed		
8-12.	[Rule 32.2.5(c), 32.6] Team demonstrated that battery box can be safely installed and removed		
8-13.	[Rule 32.2.5(b), 5.4.3(f)] If flooded PbAcid batteries are used, battery box is ventilated in the E-SP car (if within driver compartment)		
8-14.	[Rule 32.2.5(b), 5.4.3(f)] If flooded PbAcid batteries are used, battery box is ventilated at the Power Station and vents exhaust away from those monitoring the station		
8-15.	[Rule 32.2.6, 5.4.5] E-SP car has an external motor disconnect accessible by a bystander, an internal motor disconnect accessible, and a relay/contacter that disconnects the motor circuit.		
8-16.	[Rule 32.2.6] E-SP power station has an array disconnect accessible by a bystander.		

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Power Station			
8-17.	[Rule 32.3.1] E-SP Charging Station array has a maximum total capacity of 2.5kW		
8-18.	[Rule 32.3.1] E-SP Charging Station array has solar cells with maximum efficiency of 23.0% or less		
8-19.	[Rule 32.3.2] If the team plans to rotate its solar panel, they demonstrated that this can be done safely		
8-20.	[Rule 32.3.3] Team demonstrated that the power station is stable during large gusts of air or rain		
8-21.	[Rule 32.3.6] E-SP Charging Station Is secured to the solar vehicle trailer (road race only)		
Power Station Maintenance & Supervision			
8-22.	[Rule 32.2.5©] Team has a defined battery box exchange procedure where electrical discharge (e.g. sparking) occurs		
Safety Issues			
8-23.	[Rule 5.13(e)] E-SP driver and passenger meet the 15 second safety egress		

Driver Name	Weight (lbs)	Passenger Name	Weight (lbs)	Egress Pass	Judges Initials

# STATION NINE: Cruiser Division Station

I certify that the \_\_\_\_\_ cruiser division car has successfully passed scrutineering station nine.

\_\_\_\_\_  
Chief Judge, Station Nine

Inspection Step	Scrutineering Criteria	Pass	Judges Initials
Physical Regulations			
9-1.	[Rule 33.2.2] The Cruiser Division car has four wheels (two in front, two in rear).		
9-2.	[Rule 33.2.3] Car has seats for four passengers, including driver		
9-3.	[Rule 33.2.3(a)] Passengers are seated in a 2x2 configuration (two front seats, two rear seats)		
9-4.	[Rule 33.2.3(a)] Each passenger has immediate access to a door		
9-5.	[Rule 33.2.4] Team has scale to measure the weight of the drivers		
9-6.	[Rule 33.2.4] Team has adequate ballast to each passenger's weight to 160 lbs		
9-7.	[Rule 33.2.4] Ballast is adequately secured within the vehicle		
9-8.	[Rule 33.2.5] Car is equipped with two roll bars, one protecting each row of passengers		
9-9.	[Rule 33.2.5] All passengers and major components of the car are enclosed by material forming the body of the car		
9-10.	[Rule 33.2.6] The solar array is attached to the exterior of the car body		
9-11.	[Rule 33.2.7] The car has an externally accessible storage container within the car body that is at least 61cm long, 46cm wide, and 30.5cm tall.		
Safety Issues			
9-12.	[Rule 33.2.4] Team has ballast in a ballast bag labeled for each driver/passenger to bring their weight to 160 lbs		
9-13.	[Rule 5.13(e)] Driver and each passenger meet the 15 second safety egress		



Driver/Passenger Name	Ballast Required (lb)	Egress Pass	Judges Initials

## Example Discrepancy Sheet

Inspection Step: _____	Write Up	Judges Initials
Issue Description	<p><i>Here is where the judge would explicitly state what the team needs to do to pass the step.</i></p> <p>E.G. The two nuts on the rack unit should be secured with Loctite or by other means and the loose nut on the steering wheel needs to be tightened.</p>	
Disposition	<p><i>Here is where we would write down what the team did to fix the problem or denote a failure to comply penalty or other as needed.</i></p> <p>E.G. Rack unit nuts were secured by double-nut. Loose nut on steering wheel was tightened.</p>	

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
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Disposition		



Inspection Step: _____	Write Up	Judges Initials
Issue Description		
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Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

Inspection Step: _____	Write Up	Judges Initials
Issue Description		
Disposition		

# Judges Comments for Director Review

Comments:

We certify that the \_\_\_\_\_ solar car team has successfully passed all scrutineering stations and have adequately demonstrated their ability to compete in the Solar Car Challenge. In addition, we certify that the team has demonstrated a sufficient understanding of their solar car's components.

\_\_\_\_\_  
Race Director

\_\_\_\_\_  
Technical Director

# Post Race Inspection

Comments:

We certify that the _____ solar car is compliant with all the regulations of this race.	
Date:_____	Time:_____
_____	_____
Race Director	Technical Director