

STATION ONE: Meeting General Requirements

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

Chief Judge, Station One

Structural Integrity:

Roll Cage

The car is equipped with a roll cage that encompasses the entire driver and is a fixed integral part of the solar car structure? [Rule 5.2.3] Yes No

Is there at least 5 cm of clearance in all directions between the roll cage and the driver seated in the normal driving position? [Rule 5.2.3.1] Yes No

What material is used for the roll cage tubing? [Rule 5.2.3] _____

What is the roll cage tubing outside diameter? [Rule 5.2.3.1; Min = 1.9 cm] _____

Is the roll cage tubing outside diameter greater than 1.9 cm? Yes No

If not, has a waiver been granted for the roll cage? [Rule 5.2.3.2] _____
Technical Dir. Approval

Roll Bar

Is the car equipped with a structural frame member that extends above the driver's head, protecting the driver in the event of a roll over? [Rule 5.2.4] Yes No

What material is used for the roll bar tubing? [Rule 5.2.4] _____

Structural Integrity (Cont.):

What is the roll bar tubing outside diameter? [Rule 5.2.4.1; Min = 5 cm] _____

What is the roll bar tubing wall thickness? [Rule 5.2.4.1; Min = 1.0 mm chromoly steel, 1.5 mm carbon steel, 3.2 mm aluminum] _____

Does the roll bar meet the minimum size set in Rule 5.2.4.1? Yes No

If not, has a waiver been granted for the roll bar? [Rule 5.2.4.2] _____
Technical Dir. Approval

Crush Zones

Does driver, when seated, have 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? [Rule 5.2] Yes No

Vehicle Points:

Critical points are lock-nutted, double-nutted, or otherwise secured [Rule 5.17] Yes No

Steering	Yes	No
Braking	Yes	No
Drive	Yes	No
Seat Belts	Yes	No

Is throttle free to return to zero [Rule 5.12] Yes No

Vehicle Points (cont.):

External signals visible for 30m [Rule 5.10.1]	Yes	No
Five-point harness system [Rule 5.11.1]	Yes	No
Are the belts attached securely to a structural component or main frame member of the solar car? [Rule 5.11.1]	Yes	No
Are the belts attached with bolts at least grade 8 and 3/8" in diameter [Rule 5.11.1]	Yes	No
Is there a "sound device" or horn with 92 dB readily available to the driver? [Rule 5.10.2]	Yes	No
Is the horn mounted as far forward in the vehicle as possible, facing forward, and outside the driver compartment? [Rule 5.10.2]	Yes	No

Driver Conditions:

Driver's head higher than feet [Rule 5.6]	Yes	No
Driver's eyes are a minimum of 70 cm above ground [Rule 5.7]	Yes	No
Forward vision [Requires 8m in front] [Rule 5.7.1]	Yes	No
Forward vision – Driver Can see a minimum of 10° from horizon [Rule 5.7.1]	Yes	No

Driver Conditions (cont.):

Side vision to 90 degrees [Rule 5.7.2]	Yes	No
Rear vision [Requires 15m behind car] [Requires 45° to each side, Rule 5.7.3]	Yes	No
Does the drivers seat provide neck and back support minimizing the chance for whiplash in case of an accident or sudden stop? [Rule 5.11.11]	Yes	No
Driver's compartment is ventilated and separate from battery area [Rule 5.5.2]	Yes	No
Have all sharp points and edges in the cockpit within reach of the driver been padded? [Rule 5.11]	Yes	No

Student Involvement:

If in the Advanced division, was the mold purchased from another team? [Rule 12]	Yes	No
Is the car obviously constructed by the students? No “hand-me-down” cars are allowed. [Rule 3.8]	Yes	No
Were the students adequately able to answer judges’ questions concerning the principles and operation of the mechanics of the car? [Rule 3.8]	Yes	No

STATION TWO: Electrical and Battery Requirements

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

Chief Judge, Station Two

Please do the following:

- (1) Check off all parts of the Electrical and Battery Evaluation Sheet.
- (2) Place non-removable seals on only those batteries carried on that solar vehicle. This prevents teams from switching-out batteries during the race. If teams need additional batteries during the race, they can apply to the Technical Director for new seals.
- (3) Supplemental batteries need not be “sealed” so long as they comply with the provisions set out in Rule 5.3.2.
- (4) Inform the solar teams that the “team judges” will inspect these batteries each morning to ensure that the “sealed” batteries are in place.

Documentation:

[Rule 3.6] [Collect from teams]

Electrical schematic	Yes	No
Solar cell documentation <i>[including list price and cell efficiency]</i>	Yes	No
Battery documentation <i>[including type, weight, and capacity]</i>	Yes	No

Please check specifically for the following:

Are the propulsion batteries secure from front, rear, or lateral impact? [Rule 5.5.2]	Yes	No
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Are the propulsion batteries enclosed in a sealed battery box that provides adequate ventilation? (Note: The battery box does not yet need to be sealed by event officials) [Rule 5.5.2]	Yes	No
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Do the battery box fans cycle air within the Battery box at least 4 times per minute? [Rule 5.5.2]	Yes	No
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Are the supplemental batteries secure from front, rear, or lateral impact? [Rule 5.3.3]	Yes	No
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Are connections clear from entanglement and protected? [Rule 5.5.2]	Yes	No
Do the batteries in the car match the documentation submitted by the team? [Rule 3.6]	Yes	No

Total Battery System Energy Capacity:

Computations:

Battery Capacity	_____
Number of batteries	_____
Total Battery Capacity	_____

Maximum 5 kWh

Motor and Controller Information:

Motor Manufacturer: _____

Motor Model: _____

Controller Manufacturer: _____

Controller Model: _____

Is the motor type allowed in the entered division? [Rule 12]	Yes	No
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Assisting Devices:
[Rule 5.5.6]

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)

Supplemental Battery System:

Is the supplemental battery totally isolated from the propulsion batteries? Yes No
[Rule 5.3.3]

Is the driver aggressively warned when the supplemental battery voltage is low? Yes No
[Rule 5.3.3]

Advise the teams 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.

Is the auxiliary power system isolated from the vehicle frame? [Rule 5.5.6] Yes No

Electrical System Check:

Are High Voltage “points” properly identified and insulated? [Rule 5.14]

Battery connections	Yes	No
Motor controller	Yes	No
Switches or fuses	Yes	No
Un-encapsulated solar cells	Yes	No

Are all conductors properly insulated? Yes No
[Rule 5.14]

Propulsion System:

Battery type is appropriate for division? Yes No
[Rule 5.5.1]

Batteries are contained in enclosures that have been sealed by race officials? Yes No
[Rule 5.5.2]

The enclosure is equipped with a forced air ventilation system that vents to the exterior of the car. [Rule 5.5.2] Yes No

Propulsion System (cont.):

Motor disconnect is accessible to the driver, is operable from the outside of the car, and is properly marked? Yes No
[Rule 5.5.5]

If multiple motor disconnects are used, are they wired in series? Yes No
[Rule 5.5.5]

Array disconnect is operable from the outside of the car and is properly marked? Yes No
[Rule 5.5.4]

Separate fuse is placed in series with main battery? Yes No
[Rule 5.5.3]

Check to see that the fuse does not exceed 200% of expected current draw. [Rule 5.5.3] Fuse Rating: _____
Peak Current Draw: _____

If car has a cruise control system, does applying the brake disengage it? [Rule 5.8] Yes No
[Have team demonstrate system.]

Solar Array:

No reflecting devices Yes No
[Rule 5.3.1]

Size of the Array _____ m²
[Rule 5.3.1]

Solar Cells:

Terrestrial Grade Cells? [Rule 5.3.1]	Yes	No
Number of cells/modules	_____	
Watts per cell/module? [Rule 3.6]	_____	watts
Verified with documentation?	Yes	No
Efficiency of cells/module [Rule 3.6]	_____	%
Verified with documentation?	Yes	No
Computed peak wattage	_____	watts
List price per Cell [Rule 3.6]	\$_____	
Verified with documentation?	Yes	No
Cost per watt for each cell [Rule 3.6]	_____	
The solar cells meet all the requirements for the division that the team intends to compete in? [Rule 12]	Yes	No

Cell Verification:

The cells on the solar car match the documentation that has been submitted to the race?

Yes

No

Signature of Chief Judge, Station 2

The team acknowledges that the cell documentation they submitted is correct and matches what is on the solar car?

Yes

No

Signature of Team Captain(s)

Student Involvement:

Were the students adequately able to answer judges questions concerning the principles and operation of the electronics of the car?
[Rule 3.8]

Yes

No

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.

Tilt Test:

[Rule 5.2.1]

The vehicle was able to endure the stresses associated with tilting the car approximately 20 degrees.

Yes

No

Weight Distribution Check (optional):

Weight on:

Front-left tire _____ kg

Front-right tire _____ kg

Rear-left tire (Rear for
3 wheeled car) _____ kg

Rear-right tire (N/A for
3 wheeled car) _____ kg

Overall weight of car _____ kg

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.

<u>Radius test</u> [Rule 5.9]		
The vehicle was capable of making a 180 degree turn within a diameter of 15 meters.	Yes	No
Was the vehicle stable while making the turn?	Yes	No
Were the steering and suspension mechanisms adequate to handle the stresses of the turn?	Yes	No

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 5.2.1 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.

Slalom Test:

[Rule 9.7]

The vehicle was able to endure the stresses associated with quick turns.	Yes	No
Did the vehicle appear stable during the running of the slalom course?	Yes	No

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 solar powered 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 15 mph	N/A (Below qualifying speed)
15 mph	2.0 seconds
20 mph	2.5 seconds
25 mph	3.0 seconds
30 mph	3.5 seconds

Braking:

[Rule 5.8]

Are all brake components in good working order?	Yes	No
Are there two separate foot pedals that are structurally sound?	Yes	No
If two separate foot pedals are linked, can each pedal be independently operated if the linkage fails?	Yes	No
With the driver engaging only the primary braking system, will the car remain stationary if pushed?	Yes	No
With the driver engaging only the secondary braking system, will the car remain stationary if pushed?	Yes	No
Are all braking components properly lock-nutted, double-nutted, or otherwise secured?	Yes	No
Was the vehicle stable and in control during the braking process?	Yes	No
Was the vehicle able to come to a complete, safe stop within the required amount of time?	Yes	No
Were all braking and steering components able to handle the stress of braking?	Yes	No

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 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) Full Speed Panic Stop: The driver must safely make a panic stop from full cruising speed
- (8) 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.
- (9) Have the solar car returned to the scrutineering are and observe unloading procedure.

Solar car:

Does the solar car have the required equipment?

[Rule 9.9]

Baking soda for battery spills	Yes	No
Fire extinguisher	Yes	No
Safety vest for driver (Track race only)	Yes	No

Chase Vehicle:

Does the chase vehicle have the required equipment?

[Rule 9.9]

Baking soda for battery spills	Yes	No
Fire extinguisher	Yes	No
Flashing amber light	Yes	No
At least 3 traffic cones or warning triangles	Yes	No
Rear Caution Sign Attached (Road race only)	Yes	No

Carry Proof of Liability Insurance	Yes	No
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Scoring:

Did the driver have the required skills to drive the endurance course? Yes No

Was the solar car able to endure the test? Yes No

Did the chase car personnel have necessary skills? Yes No

Did the Inter-vehicle communications work properly? Yes No

Full Speed Panic Stop:

Did the car appear stable when performing the panic stop? Yes No

Was the car able to come to a complete stop without any mechanical failures? Yes No

Designation of Specific Responsibilities:

[Rule 9.9]

Team designated team member to handle road safety issues? _____

Team designated team member to handle health issues? _____

Radios:

Will the team be using FRS or GMRS radios? Yes No

If the team is using FRS radios, what is the team's preferred channel? _____

Trailer Loading and Unloading:

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. Yes No

Was the solar car able to be safely loaded onto the trailer? Yes No

Was the solar car able to be safely unloaded from the trailer? Yes No

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.

Road Test:

The vehicle was able to endure the stresses associated with the vortices created by the passing truck.

Yes

No

Did the vehicle appear stable during the running of the road test?

Yes

No

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