



THE SUN TRIP 2020

Technical Regulation

1. Overview

These "Technical Regulation" are provided by the organization to serve as a design guide for solar bicycles on the Sun Trip 2020 so as to ensure fairness between participants. Its content is written in good faith and must be interpreted as such. Amendments may be issued by the organization to clarify or adjust minor elements of design for technical inspection.

The more general "Adventure Regulations" are published separately.

The Sun Trip allows to experience freedom starting from bicycle design. Participants are free to build their bike themselves or to receive assistance from experts or professionals.. However, participants must comply with the regulations set out in this document as well as all other instructions that the organization may have to state.

Participants may under no circumstances be followed by a technical team of any kind during the journey. In case of technical problems, they must fend for themselves, relying on the help of the people encountered during the trip.

Participants are allowed to be in touch with their team or technical advisor by phone or via Internet. Sending spare parts further on the course is permitted, as detailed in the Adventure Regulation.

A preliminary technical inspection will be carried out about three months before departure via the Technical Logbook, to be completed and handed to the Technical Team.

A few days before departure, the Technical Team will conduct a compliance check on all machines.

Other compliance checks will also take place during the adventure or upon arrival, including by local commissioners appointed by the organisers to inspect Solar Challenge participants' luggage to ensure that a mains charger is not used.

The Technical Team may allow derogations to this Technical Regulation before departure for participants with disabilities or illnesses or in case of force majeure.

The rules of common law of liability will be applicable in the case of a bodily or material accident participants could suffer to themselves or to their machines, in case of any damage caused to a

third party or to goods belonging to a third person. The concept of third party applies also between participants.

The organizer cannot be held responsible for any problems that may be caused by a solar bicycle before, during or after The Sun Trip 2020 event.

2. Types of Cycles

2.1 Cycles

The Sun Trip adventure is open to a variety of human-powered electric vehicles : upright and recumbent bikes, upright and recumbent tricycles, handbikes, tandems and velomobiles.

The cycle cannot be fitted with more than 3 wheels, excluding the trailer.

Teams may choose to equip one cycle per person or to use a tandem. Unless otherwise indicated, the technical specifications of these Regulations apply to each cycle individually.

2.2 Trailer and Definition of a Machine

The bike may be equipped with a trailer fitted with no more than two wheels. A cycle and its potential trailer are what we define as a “machine” hereafter.

2.3 Dimensions

Overall, the machine width may not be over **99 cm** in its riding configuration. There is no maximal width for the machine when it is **stopped**.

If the participant wishes to take advantage of the cargo repatriation, its total length should not exceed **5.50 m** and the solar panels should be removable.

There are no obligations on the machine's height, but our experience shows that lower

machines tends to be less visible in road traffic and therefore potentially more exposed to traffic incidents

2.4 Bodywork and Fairing

The bike may be equipped with an aerodynamic fairing, provided that the face of the pilot remains exposed (i.e. not enclosed in a cockpit).

2.5 Breaks

The cycle must be equipped with at least two distinct braking systems impacting on two wheels. Those breaks must be controlled mechanically or hydraulically. A regen system on an engine isn't considered a braking system.

3. Solar-Electric System

All cycles shall be equipped with one or more assisting engine, one or more batteries and one or more solar panels.

Pedals (or their handbike equivalent) should however remain as a means of propulsion and the crankset should be physically linked to :

1. a wheel of the cycle via a chain, strap or universal joint (parallel transmission)
2. an electrical power generator (serial transmission)
3. a combinations of both is possible possible for tandems.

3.1 Engines

The machines shall be fitted one or two engines.

The choice of the type of motor is left to the decision of participants.

The electrical assistance may be triggered through a cadence sensor or a throttle handle.

The chosen engine should not have the capacity to assist the cycle beyond 45 km/h by design. To reduce the risk of fraud during the adventure, electronic clamping is not deemed acceptable as a way to limit the top speed, except for series Speedpedelec bicycles licensed for 45 km/h.

In order to calculate the maximum assist speed of the engine, the following calculation must be performed:

a. For hub engines

$$\text{RPM/Volt} \times \text{Rated voltage of the battery (36V or 48 V)} \times \text{Wheel circumference} \times 60$$

Hub engines may be fitted with an energy regeneration system. A separate generator that can be used as an engine without major modification will be counted as an engine. 6V rim or hub dynamos for lighting or small electronics are not considered as an engine.

b. For non-hub engines (crank drive, geared)

$$\text{RPM at the axis of the wheel with the largest gear ratio} \times \text{Wheel circumference} \times 60$$

For bottom bracket motors, the crankset must include a freewheel mechanism, separating the cranks from the rotation of the chainrings, thus avoiding any risk that the pedals get in motion when switched on.

3.2 Batteries

Battery voltage when full shall not exceed 60 V.

Nominal voltage will be 36 or 48 V $\pm 5\%$, varying according battery technology.

Upright and recumbent cycles designed for one rider (with the exception of handbikes) may be equipped with batteries whose overall capacitance should not exceed 1155 Wh per machine, including emergency batteries.

Tandems and handbikes are allowed up to 1650 Wh overall battery capacitance per machine.

Battery capacitance will be calculated by multiplying the typical capacity by the nominal voltage of the cells as per the manufacturer's datasheet.

This capacitance can be divided among several batteries. Lithium battery packs must be equipped with an adequate battery management system (BMS) to handle higher and lower voltage.

Participants are free to choose the type of battery they wish to use. However, they must be full aware of the inherent risks for each type of technology and take responsibility for their choice in case of problem (explosion, fire...). In addition, batteries must be adequately protected against weather and shock damage using flexible foam or hardshell case.

The system must be fitted with an easily accessible manual circuit breaker and a suitable fuse. A plug and socket connector is acceptable.

3.3 Solar Charging

Participants are free to design their solar cells, panels and their structure however they wish.

Since it is difficult to know precisely solar cells characteristics when they are encapsulated in flexible solar panels and it is impossible to measure the exact nominal power of the arrays used by each participant, only the exposed solar panels surface is accounted for.

Machines designed for one rider must be fitted with solar arrays of at least 0.75 m² and up to 2,50 m² of exposed solar cells when moving.

Machines designed for two riders must be fitted with solar arrays of at least 1 m² and up to 3.25 m² of exposed solar cells when moving.

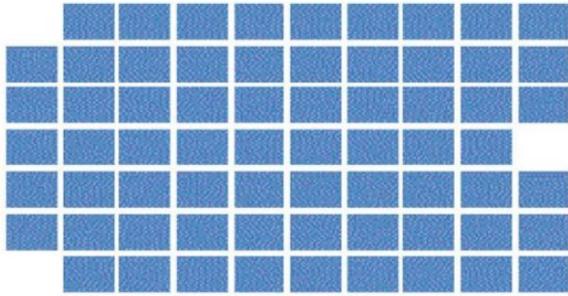
Participants are allowed to add stacked solar panels that can be deployed when at a stop. In such case, the total surface of all carried panels should not exceed 4 m².

Solar panels voltage is limited to 60 V for safety reasons.

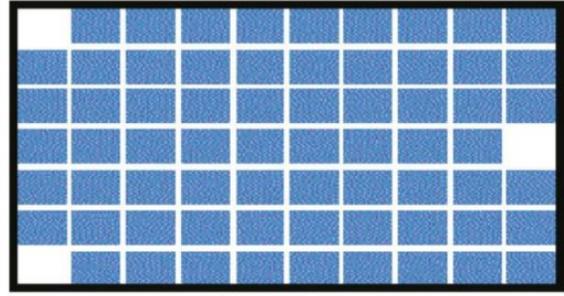
In the case where several panels are used, the total surface is the sum of individual panels envelope surfaces.

When cells are not arranged in a rectangular way, the envelope surface will be used.

Example :



Photovoltaic cells layout



Envelope surface

The solar panels and their structure may not exceed 100 cm beyond the cycle's front wheel axle.

The solar-electric system must include a charge controller between the panels and the battery, suitable for the battery pack technology and voltage.

3.4 Measurement Tools

All machines will be fitted with an automated data collection tool called "Databox" that will display and record:

- Instantaneous and total daily solar power production;
- Instantaneous and total daily engine power consumption;
- The difference between those two values;
- Time, date, GPS position and speed.

This data may be used for monitoring and analysis by the arbitration panel.

An amendment will explain its use in detail, as well as its replacement fees in case of loss or theft.

The Databox may experience a failure or get stolen. Therefore, it is recommended to use another tool to measure and display solar production and engine consumption.

3.5 Mains Charger

The Sun Trip is a solar cycles adventure. Solar recharging must be functional at the moment of the departure. All participants should make a reasonable effort to live this adventure using only solar energy.

However, in case of solar recharging failure or of an exceptional situation, participants are allowed to finish the course with the help of a mains charger and must notify the organizer on the same day.

The use of this charger will automatically disqualify the participant from the Solar Challenge and will be detrimental to the Solar Adventurer Jury's Choice challenge. It will have no incidence on the People's Choice and the Best Route awards.

Prior to departure, contestants to the Solar Challenge will sign a solemn undertaking to use exclusively the solar recharge. Their mains charger will be placed in a sealed bag, which must be imperatively returned to the organizer upon crossing the finish line.

The arbitration panel could appoint commissioners on the course and ask them to inspect participants' luggage or base their decision on the data logged by the Databox during the event.

4. Mandatory Accessories

4.1 Mirrors

Every machine must be fitted with at least one rear view mirror.

4.2 Lighting and Reflective Apparel

Every bike must be fitted with front and rear lights that may be connected to the battery or run on separate batteries. Participants should also have a second emergency rear light, running on separate batteries.

Solar panels should have visible markers such as reflective tape on each edge. We recommend dulling the corners and protecting all sharp edges of the panels and of the structure.

Participants wearing a high visibility jacket must maintain them in a state of cleanliness that preserves its original visibility.

4.3 Race Plate and Sun Trip Partners Visibility

Participants are required to reserve a space on their machine for the race plate (23 x 16 cm) that will be allocated to them. The plate shall be attached to the handlebars or handlebar bag on

upright bicycles. On recumbents and other cycles type, participants shall find a visible spot in agreement with the Technical Team.

The plate will display the team name, the Sun Trip logo and the official partners of the adventure.

Participants may also give visibility to their own partners on their bikes, excluding on the race plate.

4.4 GPS Positioning Beacon

In addition to the Databox, participants will be provided with a GPS-positioning beacon that must be maintained in working order throughout the adventure. It will be powered by the machines battery. Participants must provide a proper battery connection using Anderson connectors (see photo).



Cette alimentation électrique sera disposée de sorte que la balise puisse être installée à proximité, et qu'elle soit en vue directe de la majeure partie du ciel et des satellites GPS et telecom.

These connectors must allow the beacon to be installed in a way that makes it visible to GPS satellites (facing the sky without obstruction).

5. Technical Inspection

A Technical Team will be responsible for upholding the current regulations. The composition of the team will be detailed in the Adventure Regulation, as well as its modalities of action and its links to the Arbitration Panel.

Participants will be required to fill in a Technical Datasheet detailing their machines specifications such as the engines (make, model, RPM / Volt, etc), batteries, solar panels and more generally the bike dimensions. The Technical Datasheet should be sent to the organization by email **before February 15, 2020**, supported by photographic evidence when necessary. Delays in sending the Technical Datasheet may result in exclusion from the Sun Trip.

A few days prior to departure, a real-life inspection will be performed by the Technical Team. In the case of non-compliance found during inspection, the participant will need to implement the necessary changes up to 24 hours prior to start proper.

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