Spark Solar

Powered By The Sun

GLOBAL INSTALLATION AND OPERATION MANUAL

INTRODUCTION

Thank you for choosing Spark Solar PV panels. Spark Solar panels are ideal for delivering long-lasting and reliable power output. The panels have been created through smart design and are manufactured to the highest quality and environmental standards. With correct installation and maintenance, Spark panels will provide clean, renewable energy for many years.

This manual contains important information pertaining to the electrical and mechanical installation and maintenance of PV panels, and contains safety information that you must read carefully and be familiar with before handling, installing, and/or maintaining Spark Solar PV panels. Failure to do so may lead to injury or damage to property.

Spark Solar does not assume responsibility and expressly disclaims liability for losses, damages, or expenses arising out of, or in any way connected with this Installation and User Manual. Spark Solar assumes no responsibility for any infringement of patents or other rights of third parties, which may result from using Spark Solar PV panels. No license is granted expressly or by implication or under any patent or patent rights. The information in this manual is believed to be reliable, but does not constitute an expressed or implied warranty. Spark Solar reserves the right to make changes to its PV panels and other products, their specifications, or this manual without prior notice.

Spark Solar and its subsidiaries are not liable for any damages caused by inappropriate installation, use, or maintenance of Spark Solar PV panels, including without limitation damages, losses, and expenses caused by non-observance of the instructions of this manual or caused by or in connection with products of other manufacturers.

Spark Solar PV panels are designed to meet the requirements for the standards IEC 61215 and IEC 61730, application class A. Panels rated for use in this application class may be used in systems operating at greater than 50 V DC or 240 W, where general contact access is anticipated. In the course of the PV panel certification process, the compliance of this manual with the certification requirements has been verified by an independent certification laboratory.

This document may be produced in different languages. If there is any conflict, the English language version shall be definitive.
Failure to comply with the requirements listed in this manual will invalidate the Limited Warranty for PV Panels as provided by Spark Solar at the time of sale to the direct customer. Additional recommendations are provided to enhance safety practices and performance results. Please provide a copy of this manual to the PV system owner for their reference, and inform them of all relevant aspects of safety, operation, and maintenance.

INTENDED USE

This installation manual describes the procedures for mounting all Spark Solar panels in a photovoltaic array including panel variants with a black back sheet and/or a black frame (but excluding 72-cell panels) The drawings within refer to all frame, back sheet and cell

colour types and are meant to be a generic representation of the instructions detailed in the text.

Symbols and Labels

The following symbols and labels are used throughout the installation manual for ease of use.

SYMBOL	DESCRIPTION
	**Indicates potential for damage to the array or property or personal safety.**
	**Indicates important notes on best practice to help with the installation.**

Safety Regulations

Installers are responsible for the safe and effective installation and operation of the photovoltaic system and for adhering to all local and national standards and regulations. Prior to installation, check all applicable regulations and permits concerning solar systems and ensure all local directives are observed.

• Ensure the Spark Solar panels are in a suitable condition for use and appropriate for the particular installation and environment
• Use only parts that convene to the specifications set out in this manual
• Ensure a safe installation of all aspects of the electrical array

All equipment should be properly maintained and inspected prior to use.

ELECTRICAL INSTALLATION

Electrical Requirement

i) Application Class

SPARK Solar panels are rated for use in electrical application class A: Hazardous voltage (IEC 61730: higher than 50V DC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated (panels qualified for safety through EN IEC 61730-1 and -2 within this application class are considered to meet the requirements for Safety Class II).

ii) System Requirements

SPARK Solar panels are only for use where they meet the specific technical requirements of the complete system. Ensure other components will not cause mechanical or electrical damage to the panels. Only panels of the same type and power class should be connected.

iii) String configuration
When using string configuration, plan and execute it according to inverter manufacturer's instructions. The number of panels connected to an inverter must be within the inverter voltage limits and operating range. Do not exceed the total system voltage permitted by the manufacturer, nor under any circumstance exceed the maximum system voltage of 1000V.

iv) String connection
Panels connected in series must have the same amp rating. The maximum number of panels that can be connected in series depends upon system design, type of inverter and environmental conditions. There are no restrictions on the number of panels that may be connected in parallel. Panel configuration must correspond to the specifications of other system components e.g. inverter. Refer to the reverse current rating of the panel (indicated in the Technical Characteristics chapter or on the panel datasheet). Cables rated to the maximum system voltage must be used for connections between panels and inverters.

v) Wiring layout
To minimize voltage surges (e.g. indirect lightning strikes), cables of the same string must be bundled together so loops are as small as possible. String configurations must be checked before commissioning. If open circuit voltage (Voc) and short circuit current (Isc) deviate from specification, this may indicate a configuration fault. Correct DC polarity is to be observed at all times.

vi) Junction box, cables, connectors
The junction box on Spark Solar panels is rated IP67. All connectors and cables must be secure and tight as well as electrically and mechanically sound. UV-resistant cables and connectors approved for outdoor use must be used. Conductor gauge must be chosen to ensure DC power losses (voltage drop) are kept to a minimum (<1%).
Observe all local regulations when selecting cables. For string connections, use minimum 4 mm^2 of copper wires insulated for a maximum operating temperature of 90°C. Secure cables using UV-resistant cable ties or other device. Loose and unsecured cables must be protected from damage (e.g., mechanical, abrasion, sharp objects, and animals). Avoid exposing cables to direct sunlight and permanent tension.

⚠ **Spark Solar prohibits any modification to the panel, including the cutting of cables in order to change the connector type or the opening of the junction box unless explicitly authorized by Spark Solar. Doing so will invalidate the warranty.**

vii) Electrical Ratings
Electrical ratings are within 5% of measured values at Standard Test Conditions (STC). Allow for increased output of a panel as a result of conditions different to STC by multiplying the values of I_{SC} and V_{OC} by a factor of 1.25 (or according to local regulations for electrical system installation).

Safety Measures

All relevant codes and regulations should be referred to and observed as well as regulations on working at heights and fall protection.

i) Safety in the working area
Installation of Spark Solar panels may involve rooftop work. Ensure all local regulations regarding working at heights are followed. Before beginning work on a photovoltaic system, ensure all working surfaces are structurally sound and capable of bearing the weight of employees and required equipment. Remember to isolate the system from the grid before carrying out any maintenance or repair work.

ii) Preventing current generation
To prevent the panels automatically generating current (electricity) when exposed to light, shield the system with a non-transparent cover during installation, maintenance or repair work.

iii) Specific hazards of DC electricity
Solar panels generate direct current (DC). Once current is flowing, breaking or opening a connection (e.g. disconnecting two panels) can cause an electrical arc. Unlike low voltage AC wiring, DC arcs are not self-extinguishing. They are potentially lethal burn and fire hazards:
• Follow panel and inverter manufacturers' installation, handling and operating instructions.
• Remove/open the inverter AC fuse/circuit breaker before disconnecting from the public grid.
• Switch off or disconnect the inverter and wait for the time specified by the manufacturer before commencing work. High-voltage components need sufficient time to discharge.

iv) Safety requirements
The voltage produced by a single panel and panels connected in series (voltages added together) or in parallel (currents added together) can be dangerous. Although the fully insulated plug contacts on the panel's output cables provide touch-safe protection, the following points must be observed during handling to avoid the risk of sparking, fire hazards, burns and lethal electric shocks.
• Exercise extreme caution when wiring panels and look out for damaged or dirty cables etc.
• Never insert metallic or other conductive objects into plugs or sockets.
• Ensure that all electrical connections are completely dry before assembly.
• Keep all materials, tools and working conditions dry and tidy.
• Use appropriate safety equipment e.g. nonslip footwear, insulated gloves and insulated tools.
• Solar panels produce current when exposed to sunlight. Do not connect the system to the inverter during solar exposure.

MECHANICAL INSTALLATION

Fire Guidelines

Spark Solar PV Panels have a Class C fire resistance rating. Utilize the following fire safety guidelines when installing Spark Solar panels:

• Consult your local authority for guidelines and requirements for building or structural fire safety.
• Roof constructions and installations may affect the fire safety of a building; improper installation may create hazards in the event of a fire.
• Use components such as ground fault circuit breakers and fuses as required by local authority.
• Do not use panels near equipment or in places where flammable gases may be generated. The panel must therefore be mounted over a fire retardant roof covering rated for the application and a distance of 60 mm between the panel and the mounting surface, allowing free circulation of air beneath the panels must be respected at all times.

Panel Orientation

To maximize system output, panels should be installed at the optimum orientation and tilt angle. The specifics of this depend on location and can be calculated by a qualified system designer.

Dependent on local conditions, a lower angle of installation will potentially increase the requirement for regular cleaning.

The optimal mounting position of panel's results in the sun's rays falling perpendicular (i.e. at 90°) to the surface. All panels in a string should, wherever possible, have the same orientation and tilt to ensure the system does not underperform due to mismatched outputs.

Environmental Factors

Spark Solar panels are designed to provide durable and stable output. Ambient operating temperatures must be between -40 and +85°C.
The panels are not suitable for installation in potentially hazardous locations nor should they be installed in the following locations:
• Near sources of flammable gases or vapours e.g. gas stations, gas containers or spray paint facilities.
• Near open flames.
• Under water or in water features.
• Where exposed to sulphur e.g. near sulphur springs or volcanoes.
• Where the panels may be exposed to harmful chemicals.

Ensure panels are not exposed to direct contact with salt water/spray and avoid installation in areas subject to high salt mist content.

Handling Safety

Panels should be handled with care and protected from damage at all times. All warnings and instructions on the packaging should be observed. Follow these guidelines when unpacking, transporting or storing the panels:

• Do not lift the panel by grasping the panel's junction box or electrical leads.
• Do not drop the panel or allow objects to fall on the panel.
• Do not place any heavy or sharp objects on the panel.
• Be cautious when placing the panel down onto a surface, particularly when placing it in a corner.
• Inappropriate transport and installation may break the panel and void the warranty.
• Do not attempt to disassemble the panels, and do not remove any attached nameplates or components from the panels.
• Do not apply paint or adhesive to the panel top surface or back sheet.
• To avoid damage to the and cells, do not scratch, dent or hit the back sheet. During the transportation, do not to apply direct pressure on the back sheet or front glass.
• Do not drill holes in the frame. This may compromise the frame strength, cause corrosion of the frame and void the warranty.
• Do not scratch the anodized coating of the frame (except for grounding connections at the grounding connection point on the back side of the panel). It may cause corrosion of the frame or compromise the frame strength.
• Work only under dry conditions, and use only dry tools. Do not handle panels under wet conditions unless wearing appropriate protective equipment.
• When storing uninstalled panels outdoors for any period of time, always cover the panels and ensure that the glass faces down on a soft flat surface to prevent water from collecting inside the panel and causing damage to exposed connectors.

⚠ **A panel with broken glass or torn back sheet cannot be repaired and must not be used since contact with any panel surface or the frame can cause an electric shock.**

MOUNTING THE PANELS

The junction box on the rear of the panel is protected to IP67 and allows panels to be mounted in any orientation.

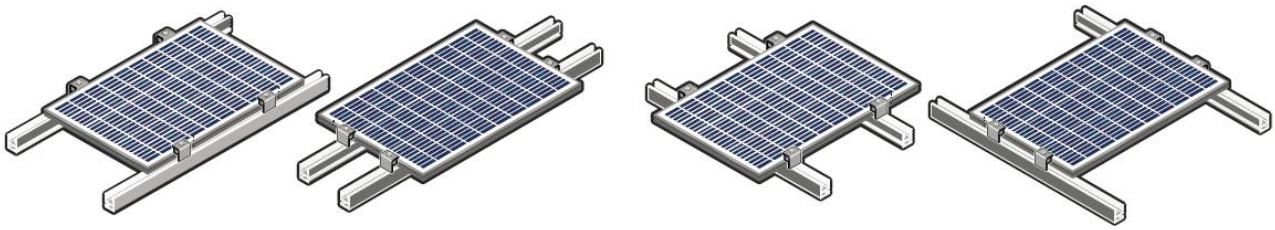
⚠ **The panels must be installed so that the cells are not shaded as this will drastically reduce electrical output. If partial shading is inevitable at certain times of the day or year, it must be kept to an absolute minimum.**

There are different options for securing an Spark Solar panel, depending on the design of the array. Ensure the mounting structure design can withstand anticipated loads. Follow the mounting hardware manufacturer's instructions and recommendations at all times.

★ **Ensuring sufficient airflow and adequate cooling of the panels can help improve performance. There must be a minimum distance of 60 mm between the uppermost part of the roof and the lowest part of the panel.**

i) Rail specifications
Spark Solar panels are typically installed on a rail-based mounting system. If using mounting rails, ensure they run under the frame or parallel to the frame (fig 1), directly under the clamping zones (fig 4).

Fig. 1: Rail positioning examples:



a) rails parallel to the long side

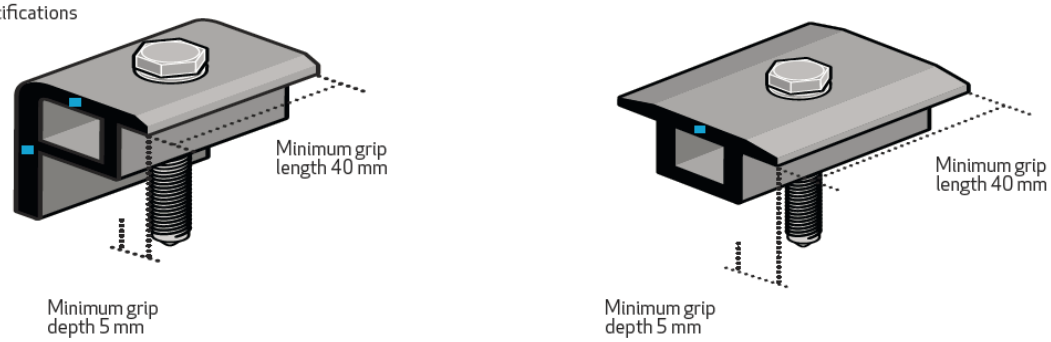
b) rails parallel to the short side

The overlap between the support rail and the outer edge of the frame must be a minimum of 6 mm.

ii) Clamp specification

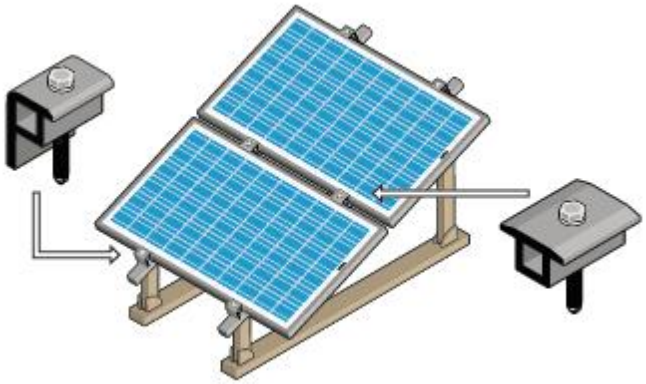
Ensure the clamps used are suitable for the planned installation and expected system design loads.

Fig. 2: Clamp specifications



• The panel must be clamped by a minimum of two clamps per side (four clamping points per panel) (fig 3).
• Minimum grip length of 40 mm, minimum grip depth of 5 mm (fig. 2). The grip must not overlap the panel frame and cause shading.
• Use appropriate bolted connections as per clamp manufacturer's instructions.
• Follow the clamp manufacturer's recommended applied torque to fasten the clamps.

Fig. 3: Panels secured at four points.



⚠ **In areas of snow build-up panels can be subjected to forces in excess of the stated limit even when snow depth does not appear extreme, causing damage to the framework. If the installation is likely to be affected by this, further suitable panel support is recommended on the lower row of panels.**

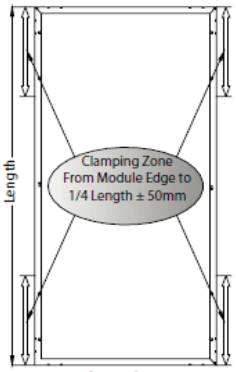
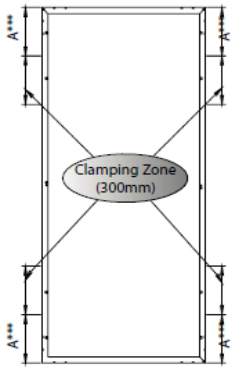
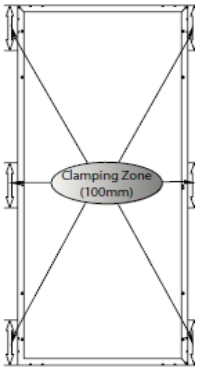
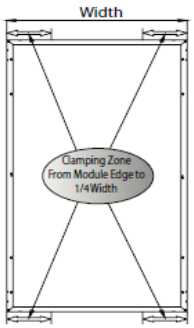
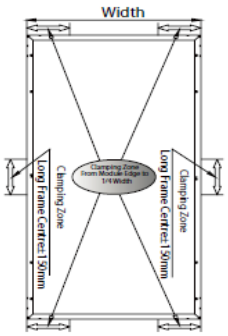
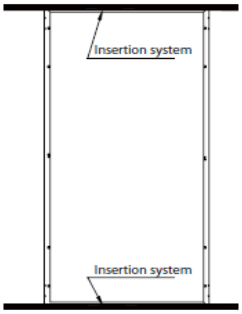
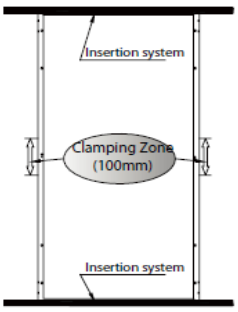
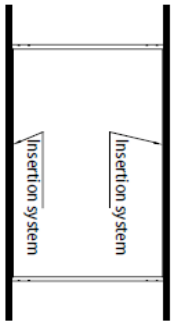
iii) Clamp mounting positions

The clamps can be fixed on both the long and the short side of the panel within the constraints shown in fig. 4 with a minimum of four clamps. The panels are built to withstand a downward force of up to 5400 Pa (550 kg/m²) or 2400 Pa (244 kg/m²) according to where they are clamped. Site-specific loads such as wind or snow which may exert forces in a different way need to be taken into consideration to ensure this limit is not exceeded for each respective mounting option.

The diagrams in the tables below are designed for illustration purpose. For each installation, modules can be installed either in portrait or landscape mode.

Panel Type	Module Dimension (mm)
Spark 60 Cell series	1640x990x40
Spark 72 Cell series	1960x990x45
Spark 120 Cell series	1665x990x45

Fig. 4: Clamping Zones.

	2400 Pa Load * *2400 Pa Wind Load* *2400 Pa Snow Load*	**3800 Pa Load** * *3800 Pa Wind Load* *3800 Pa Snow Load*	**5400 Pa Load** * *5400 Pa Snow Load* *3800 Pa Wind Load*
Mounting system			 Use eight mounting holes (Exclude Ve)  Use four mounting hole
Clamping system ** Attachment to the long frame	 Use four clamps		 Use four clamps  Use six clamps
Clamping system ** Attachment to the short frame	 Use four clamps on short frame		 Use four clamps on the short frame and two clamps at the center of each long frame
Insertion System	 Use insertion system on short frame		 Use insertion system on a short frame and two clamps at the center of each long frame  Use an insertion system on a long frame

⚠ **A minimum of four clamps must be fully located in the same zone to be certified to that value. If the panel is secured by four clamps in two different zones, it is**

certified to the lowest value only.

iv) Mounting holes

Spark Solar panels can also be secured to the mounting structure using the mounting holes (fig. 5) found on the underside of the frame. Bolts secured with locking nuts with a flange should be used to secure the frame to the mounting structure (fig. 6). Observe the following procedures when using mounting holes:

• The mounting construction should be of aluminium or galvanized steel to avoid galvanic corrosion and be appropriate for the local environment.
• Additional electrical bonding to Ground is required for the support structure (see Grounding).
• All mounting holes in the frame must be used.
• Tighten fastenings using a torque wrench according to the under structure manufacturer's instructions.

⚠ **The product warranty will be voided if additional holes are made in the frame. All fixing and fastening materials must be corrosion resistant.**

Fig. 5: Mounting holes

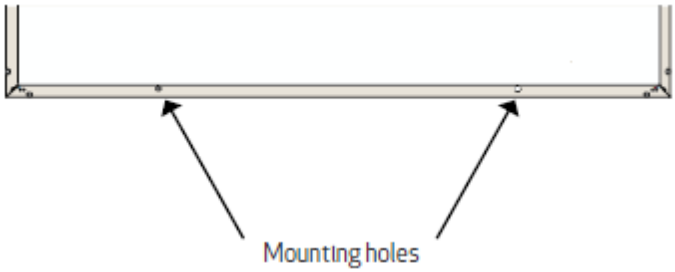
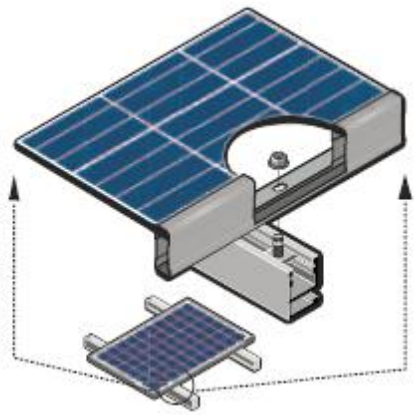


Fig. 6: Mounting using mounting holes



v) Slide-in Systems

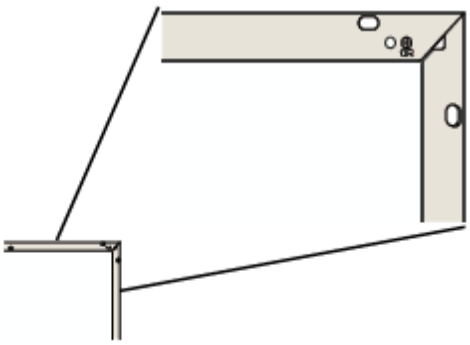
Spark Solar panels may also be installed using slide-in systems. Such mounting systems must meet the same specifications regarding grip lengths and depths as clamps and be able to withstand the correct load pressures. When installing with slide-in systems, the drainage holes (fig. 7) must not be covered. For any questions regarding installation on such systems, please contact Spark Solar directly.

vi) Drainage holes

Each corner of the panel frame has small drainage holes (fig. 7) to allow water caused by rain or snow melt to exit the frame easily and to minimize damage caused by freezing and thawing. These must not be used for mounting the panel.

⚠ **Ensure the drainage holes are not covered by the mounting structure.**

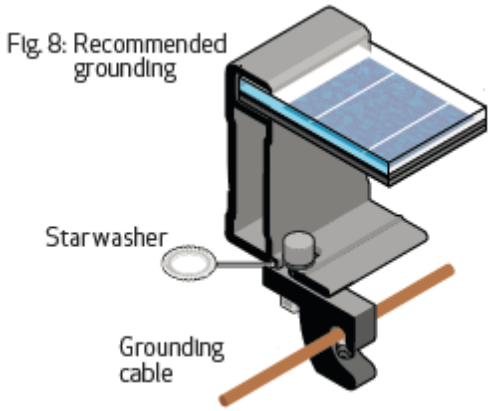
Fig. 7: Drainage holes



vii) Grounding

Spark Solar recommends always refer to local state and national code requirements for PV module grounding.

- Always use a recommended connector type for the grounding wire
- Where grounding is necessary, it must be done using an electrical connection from the panel frame
- Spark Solar highly recommends negative grounding if it's allowed by local authorities.
- Suitable grounding lugs must be used.
- Grounding cable size should be between 2.1 mm^2 - 21.2 mm^2.
- Attach grounds to the grounding holes in the panel frames.
- Fix lug to the frame using a star washer and lock nut, ensuring a conductive connection (fig. 8).
- Place the star washer between the frame and the nut, using a 5mm diameter stainless steel bolt and locking nut to mount the lug to the panel frame and tighten according to the manufacturer's recommended torque.



To avoid galvanic corrosion, stainless steel fastening materials are preferred, however galvanized or hot dipped zinc plated fasteners are equally suitable.

CONNECTIONS AND CONNECTORS

In order to ensure durable and safe connections between panels and BOS equipment, the following instructions must be followed in order to protect the electrical connections from the elements.

CONNECTORS

• Connectors must be securely joined to each other according to the manufacturer's instructions. Spark Solar explicitly excludes the cutting of cables and replacement of connectors. If this causes an issue for a particular site, contact Spark Solar via www.sparksolar.co.in for further advice.
• The use of any chemicals or lubricants on the connectors or contacts must be carried out in line with the connector manufacturer's instructions.

PROTECTING THE CABLES

• To prevent stress on the junction box casing, ensure the cable exits the junction box in a straight line before any bend in the cable.
• The cables on Spark Solar panels have a minimum bending radius of 30 mm to avoid damage to the insulation (Fig. 9).
• Ensure cables do not hang loose where they may be damaged through friction or stress, e.g., caused by wind or grazing animals.
• Shield connectors from falling or dropping water by locating them directly beneath a panel.
• Cables must be firmly secured to the structure, without over tightening, as this can deform the cable insulation.

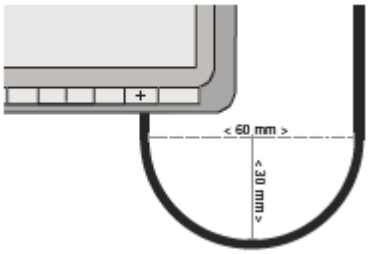


Fig. 9: Minimum bend radius of 30 mm and cable exiting the junction box

SECURING CABLES & CONNECTORS

• When securing the connector, place it away from the mounting structure with sufficient air circulation all around. This allows the connector to dry effectively and avoids the risk of damage or degradation of the connection.

• Good practice is to secure the cable either side of the connectors, ensuring no stress is exerted on the connector casing or cable entry.

To enable correct cooling and drying of the connectors, do not add extra protection to the connector, e.g., heat shrink, grease or tape.

MAINTENANCE

Cleaning Instructions

Spark Solar panels have been designed for easy maintenance. Normal rainfall will naturally clean the panels if installed at a sufficient angle. The need for cleaning will vary dependent on location, rainfall, pollution and angle of installation – the lower the angle of installation, the more cleaning will be required. To optimize electrical output it is recommended to clean the panels when dirt can be seen on the glass surface.

Cleaning of the panels should be carried out in the early morning when the panels are cool to avoid thermal shock.

If dirt remains on the panel, it may cause cell shading which will reduce power output or even cause further damage. To clean either the front or rear of the panels, use only deionized water at ambient temperature and a sponge, microfiber cloth or a soft brush to wipe away the dirt (rainwater, tap water or diluted alcohol may also be used as a secondary solution). For further cleaning a mild, biological and biodegradable washing-up liquid may be used.

When cleaning the panel, take care not to scratch the surface or introduce foreign elements that may cause damage. Ensure the water used is free from grit and physical contaminants that may damage the panel. Always rinse the panel with plenty of water. If soiling remains

on the panel, repeat the cleaning process. If stains require more effort to be removed, Iso-propyl alcohol of a concentration less than 10% may be used. Acid or Alkali detergent may not be used

⚠ **Use of high pressure hoses or cleaners is not permitted as these may damage the panel, laminate or cells.**

Using a rubber squeegee, wipe the panel surface from the top to downward motion to remove any residual water from the panel glass. Panels can be left to dry in the air or wiped dry with a chamois. Avoid putting pressure on the panel surface when drying.

System Inspection
The system should be inspected regularly to ensure that:

• Fixtures and fasteners are secure, tight and free from corrosion.
• Electrical connections and housing are secure, tight, clean, and free of corrosion.
• The mechanical integrity of the cables is intact.
• Bonding points to ground are tight, secure and free from corrosion (which could break the continuity between the panels and ground).

RECYCLING

Spark Solar has made every effort to ensure panel packaging is kept to a minimum. The paper and cardboard packaging can be recycled and the protective wrapping and panel separating blocks are also recyclable in many areas. Recycle according to local guidelines and regulations.

Disposal of Old Electrical & Electronic Equipment
(APPLICABLE TO E.U. COUNTRIES ONLY)

For installations in the European Union, this product is subject to WEEE regulations. The symbol above indicates that this product shall not be treated as household waste and must be disposed of at an appropriate collection point for the recycling of electrical and electronic equipment. The recycling of the different components and materials will help to conserve natural resources.
By ensuring Spark Solar panels are disposed of correctly, you will help prevent potential negative consequences for the environment and human health which could otherwise be caused by inappropriate waste treatment.

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