

Installation Instructions for REC Solar Photovoltaic Modules

IMPORTANT INFORMATION!

These installation instructions should be read carefully before beginning any work on the installation, operation and servicing of the PV system. Failure to do so can lead to injury to persons and damage to property. National and local electrical installation codes and regulations should be referred to and observed at all times. A copy of these instructions should be included in the system documentation.

Installing a PV system requires specialized knowledge, especially the installation and wiring of the PV modules. This work should only be carried out by suitably qualified and authorized persons. Children and animals should not be allowed near the installation while work is being carried out.


General safety information

Solar modules should only be used for the purposes for which they are intended, see Module installation for further details.


All work on the PV system, i.e. installation, commissioning, servicing and repairs, should be carried out by qualified and authorized personnel only.

During installation all local and national electrical and building codes and regulations, health and safety regulations, and accident-prevention regulations should be strictly observed. The safety instructions for all system components should be followed.

Before beginning work


 All protective measures regarding working at heights and preventing falls specified in national and local health and safety codes and regulations should be implemented before and during all work on roof-mounted and other PV array structures, and all necessary scaffolding and other protective measures applied at the site of the installation. Protective helmets, gloves and footwear should be worn during installation work. Protective goggles should be worn when carrying out drilling, cutting or grinding work. Safety harnesses may be required in some situations.

Working with DC electricity

 Short circuits on the DC side of the installation can cause arcing. This is a burn and fire hazard.

Unlike arcs occurring in conventional low voltage AC wiring, these arcs are not self extinguishing. The high temperatures generated by these arcs can destroy contacts and connectors. If not handled and installed according to instructions, solar modules can present a lethal hazard.

Fire safety

 The following fire safety points need to be observed when installing the modules:

- Check with local authorities for guidelines and requirements concerning fire safety for any building or structure that the modules will be mounted on or attached to.
- Take extra care when mounting to a flammable surface. Flammable roofing materials should be replaced with non-flammable materials where possible
- Consideration should be given for the safety and access of fire fighting personnel in the event of a building fire. Check with local authorities for any applicable regulations concerning setbacks or other placement restrictions that may apply for roof mounted PV arrays.
- Use of DC Ground Fault Interrupters is recommended, and may be required by local and national codes.

Warning notices

 **DANGER! ELECTRIC SHOCK HAZARD**

Solar modules generate voltage and produce electricity whenever exposed to light. The voltage produced by one module is below the safety extra low voltage (SELV) level. However, when modules are connected in series (voltages are added together) or in parallel (currents are added together), this can give rise to voltage and current levels which can present a danger. While the fully insulated plug contacts on

the module's output cables provide touch-safe protection, the following points need to be observed when handling the modules in order to avoid the risk of sparking, fire hazard, burn risk, and lethal electric shocks.

- No metallic or otherwise conductive objects should be inserted into the plugs or sockets.
- Make sure that all electrical connections are completely dry before they are assembled. Materials, tools and working conditions need to be clean and dry.
- The utmost caution should be exercised when wiring the modules and the work should be carried out using appropriate safety equipment, i.e. insulated tools, insulated gloves, etc.
- Do not use any damaged solar module. Broken front glass or damaged laminate back sheet can expose personnel to hazardous voltages. Modules should not be disassembled.
- No paints, adhesives, or detergents should be applied to the back of the laminate. Do not mark the module using sharp or pointed objects.



DANGER! ELECTRIC SHOCK HAZARD

Solar modules generate direct current (DC) when exposed to light. Breaking or opening a connection under load, i.e. when current is flowing, can give rise to an electrical arc which will not self extinguish. It is therefore recommended that the modules are covered with a non-transparent cover during installation work. Opening or breaking the connection on a string of modules in which current is flowing, e.g. disconnecting a DC cable from the inverter while it is under load/connected to the grid, can give rise to a potentially lethal electrical arc.

- The solar array (generator) should never be disconnected from the inverter while the inverter is connected to the public grid. The inverter AC fuse/circuit breaker should first be removed/opened in order to disconnect the inverter from the grid.

- When an inverter is switched off/disconnected, it is necessary to wait for the time specified by the manufacturer before working on it. Its high voltage components need sufficient time to discharge.
- Module wiring should be carefully carried out. Beware of damaged cable ends, split cable ends, dirt, etc.
- The inverter manufacturer's installation, handling and operating instructions should be followed at all times.

Unpacking and storing the modules

Warnings and instructions on the packaging should be observed. A record of the module serial numbers should be made before installation and this should be included in the system documentation. If it is necessary to put the modules into temporary storage, they should be kept in dry and properly ventilated room. Modules should be handled with care. The following points need to be observed when the modules are being unpacked, transported or stored:

- Modules should be carried using both hands; the junction box should NOT be used as a grip.
- Modules should not be allowed to sag or bow under their own weight when being carried.
- Modules should not be subjected to loads/stresses and should not be stepped on or dropped.
- All electrical contacts should be kept clean and dry.

Module installation

Maximum permitted module loadings/stresses:

The maximum load the module should be subjected to must not exceed 112.8 pounds per square foot (5.4 kN/m²). Site-specific loads such as wind and snow need to be taken into consideration to ensure that this weight loading is not exceeded.

Bonding of modules and module frames to Earth Ground

Connection of all PV module metallic frames, and mounting structures and mounting components, to Earth Ground (bonding), shall be done in compliance with all local and national electrical practices and codes.

If a module is electrical bonded to a conductive mounting structure, the module itself does not have to be grounded as long as the mounting structure is properly grounded.

U.S. and Canada only

All PV modules must be grounded by electrical connection from the module frames to ground. The following methods of performing this task are acceptable.

- A UL-listed grounding lug may be used, such as the ILSCO GBL-4DB lay-in lug or equivalent. The existing grounding holes in the module frames should be used as the point of attachment to the module frame. To ensure a conductive connection, i.e. to penetrate the nonconductive coating on the frame, a combination of screw, star washer and lock nut must be used to mount the grounding lug onto the frame. The star washer must be placed between the frame and the grounding lug. Use all stainless steel hardware to mount the lug to the module frame.
- Modules may be grounded using an approved bonding device listed for this application. If the PV modules are electrically bonded to the mounting system, then the mounting system must be connected to Earth Ground using suitable methods approved by the manufacturer of the bonding device.

Hazardous locations and environmental factors

The modules are designed to be installed in moderate/temperate climatic conditions.

The modules are not suitable for installation in potentially explosive or flammable environments. In cases where there is a potential risk of snow loads and/or snow slides, counter measures should be taken to ensure that module frames on lower roof edges cannot be bent or displaced. The modules should not be installed at the following locations:

- Near sources of flammable gases and vapors, such as gas/petrol stations, gas storage containers, spray paint facilities.
- Near open flames.
- Underwater or in a fountain or other similar water feature.
- Where they are exposed to salt.
Recommended distance from the sea: 1600 feet (500m)
- Where they are exposed to sulfur, such as near sulfur springs or volcanoes, because of the danger of corrosion.
- Where they can be exposed to corrosive chemicals.

System electrical and technical specifications

The modules should only be used in systems where they meet the specific technical requirements of the system as a whole. Ensure that other system components will not cause mechanical or electrical damage to the modules.

If the modules are to be connected together in series they should have the same amperage. If they are to be connected in parallel they should have the same voltage. String configuration should be planned and carried out in accordance with inverter manufacturer's instructions. The number of modules connected to an inverter should be within the inverter voltage limits/operating range and the design of the string configuration(s) should comply with the

inverter's manufacturer's guidelines. The modules should not be configured in such way that they create a voltage higher than the permitted system voltage. National electrical codes and regulations should be followed.

Mounting specifications

These modules are not suitable for installation as overhead or vertical glazing.

The array mounting structure should be able to withstand anticipated wind and snow loads. At the bottom of the module frames there are openings which allow rain water to flow away.

NOTE: Do not cover the corner draining holes shown in Figure 1.



Figure 1 Drainage Holes

Optimum orientation and tilt

To maximize system output the modules should be installed at optimum orientation and tilt angles. This will depend on location and needs to be ascertained by the system designer. The ideal angle is when the sun's rays are perpendicular to the module surface. In any one series string, all the modules should have the same orientation and tilt in order to avoid under-performance due to mismatching of each module's outputs.

Shade and shadows

Even small and partial shading of the modules/array will cause reduced array/system output. A module is considered shade-free when it is free from shade or shadows all year round and is exposed to several hours of direct sunlight even during the year's shortest days.

Fastening the modules to the mounting structure

Each module must be securely fixed to the mounting structure at a minimum of four points. The long sides of the module frame have been stress tested and are to be used for fixing the modules to the mounting structure. See Figure 2.

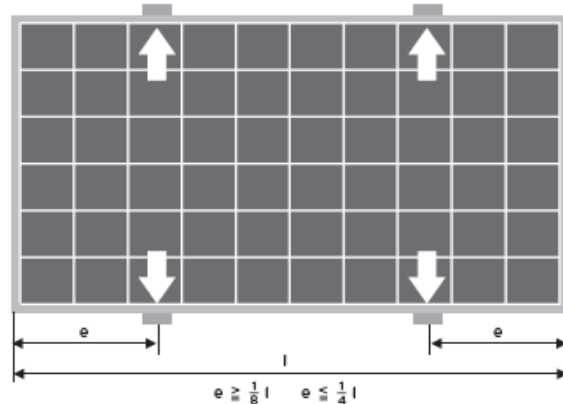


Figure 2 Long Side Mounting

The short sides of the modules should not be used for this purpose. See Figure 3.

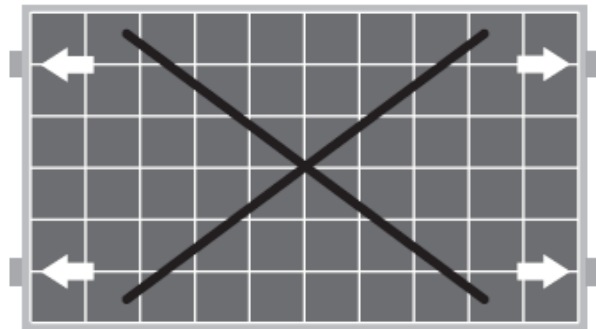


Figure 3 Short Side Mounting

Preventing galvanic corrosion

To avoid galvanic corrosion, sometimes called dissimilar metal corrosion, use of stainless steel fastening materials are the preferred choice, but galvanized or hot dipped zinc plated fasteners are acceptable.

Fixing the modules to an array mounting structure

Option 1

Clamps (see Figure 4). Follow the mounting equipment manufacturer's instructions and recommendations at all times.

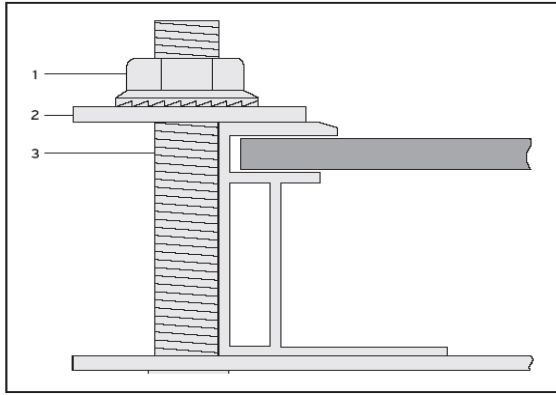


Figure 4 Mounting

NOTE: Refer to the section of this manual that covers Earth Ground bonding methods.

Option 2

Nuts and bolts (see Figure 5). Serrated lock nuts should be used. Additional electrical bonding to Earth Ground is required for the metal support structure. A torque wrench should be used to tighten nuts and bolts to specification. The applied torque required when using ¼” bolts (or M6 bolts), as shown in illustration 5, must be within a range of 6-9 ft/lbs (8-12Nm). The existing holes in the frame should be used. NOTE: The warranty will be voided if additional holes are made in the frame. All fixing and fastening materials should be corrosion resistant.

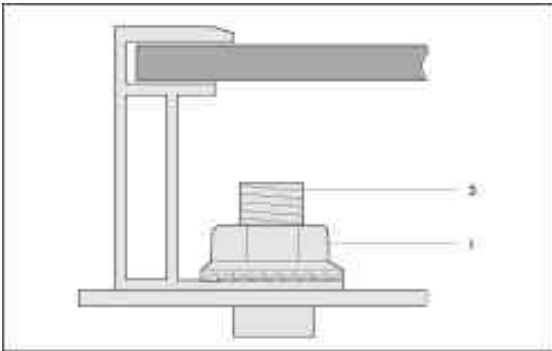


Figure 5 Mounting

Wiring

Wiring layout and configuration

In order to minimize voltage surges which could be induced by indirect lightning strikes, DC cables of the same string should be bundled together so that loops are kept as small as possible. String configurations should be checked before system commissioning. If the open circuit voltage(Voc) and the short circuit current(Isc) deviates from the specifications, this could indicate a configuration

fault. Correct DC polarity should be observed at all times.

Connection of plug connectors

All connections should be secure, tight and electrically and mechanically sound.

Accessories and materials

UV-resistant cables and connectors approved for outside use should be used. Ensure that they are electrically and mechanically sound. Conductor gauge should be chosen so as to ensure that DC power losses (voltage drop) are kept to a minimum (less than 1% is preferred). National electrical codes and regulations need to be followed when selecting cables. For field connections, use minimum 4 mm² or #12 AWG copper wires insulated for a minimum of 90°C

Protecting the cables

Cables should be secured to the array mounting system using UV-resistant cable ties, or other sunlight-resistant device. Loose and unsecured cables should be protected from mechanical damage. Avoid, as far as possible, exposing the cables to direct sunlight.

Grounding

Module frames should be connected to an Earth Ground. See the section on Module Installation for further information.

Electrical characteristics

General module characteristics:

Number of cells: 60
Max series fuse: 15A
UL rated system voltage: 600V maximum

Values at Standard Test Conditions:

Irradiance level 1000W/m², Cell temperature 25°C, spectrum AM 1.5.

MODULE TYPE	SCM SERIES					
MODEL	SCM205	SCM210	SCM215	SCM220	SCM225	SCM230
ELECTRICAL DATA						
Peak Power Watts - Pmpp (Wp)	205	210	215	220	225	230
Power Output Tolerance - Pmpp (%)	±3	±3	±3	±3	±3	±3
Maximum Power Voltage - Vmpp (V)	28.1	28.2	28.3	28.7	29.1	29.4
Maximum Power Current - Impp (A)	7.3	7.5	7.6	7.7	7.7	7.8
Open Circuit Voltage - Voc (V)	36.1	36.1	36.3	36.6	36.8	37.1
Short Circuit Current - Isc (A)	7.9	8.1	8.1	8.2	8.2	8.3
Temperature Coefficient of Pmpp (%/°C)	-0.452	-0.452	-0.452	-0.452	-0.452	-0.452
Temperature Coefficient of Voc (%/°C)	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34
Temperature Coefficient of Isc (%/°C)	0.074	0.074	0.074	0.074	0.074	0.074
Cell Efficiency (%)	14.0	14.4	14.7	15.1	15.4	15.8
Module Efficiency (%)	12.4	12.7	13.0	13.3	13.6	13.9
Max Series Fuse Rating (A)	15	15	15	15	15	15
Values at Standard Test Conditions STC (Air Mass AM1.5, Irradiance 1000 W/m ² , Cell temperature 25 °C)						
NOCT (Nominal Operating Cell Temperature)	47.5°C ±2					
The NOCT values are reached at an irradiance of 800 W/m ² , at an ambient temperature of 68 °F [20 °C] and a wind speed of 1 m/s.						
Performance measurements at different low irradiance levels: 800 W/m ² = -19.6%, 500 W/m ² = -49.8%, 200 W/m ² = -80.6%.						

Values for Isc, Voc and Pmpp at STC are within tolerance of +/-10%.

Values at NOCT (Normal Operating Cell Temperature):

Irradiance level 800W/m², spectrum AM 1.5, wind velocity 1m/s, Tamb 20°C.

Module type	205Wp	210Wp	215Wp	220Wp	225Wp
Pmpp (Wp)	153.3	157.0	160.7	164.5	168.2
Impp (A)	5.91	6.05	6.12	6.20	6.31

Underwriters Laboratories Information (U.S. and Canada only)

Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at Standard Test Conditions. Accordingly, the values of Isc and

Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to the PV output.

Refer to section 690.8 of the US National Electric Code (NEC) for an additional multiplying factor of 125% (80% derating) which may be applicable.

Maintenance

If the array has a sufficient tilt-it will generally not be necessary to clean the modules - the rain will usually do so. Dirt on the module surfaces causes cell shading and can lead to reduced power output. If necessary, clean the modules with plenty of water (using a hose) - without cleaning agents - with a soft cleaning implement (sponge). Under no circumstances should dirt be scraped or rubbed off the modules when dry, as this can cause micro-scratches on the surface of the modules and reduce the transparency of the module glass. The system should be inspected regularly and the following items checked:

- All fasteners are secure, tight and free of corrosion.
- All electrical connections are secure, tight, clean, and free of corrosion.
- The mechanical integrity of the cables is intact.
- All bonding points to Earth Ground are tight, secure, and free of corrosion to ensure continuity between the modules and ground.

Liability limitation

REC Solar AS accepts no liability for the usability and functionality of its solar modules if the instructions in this guide are not followed. Since compliance with this guide and the conditions and methods of installation, operation, use and maintenance of the modules are not checked or monitored by REC Solar AS, REC Solar AS accepts no liability for damage arising from improper use or incorrect installation, operation, use or maintenance. This does not apply to damages due to a module fault, in cases of loss of life, bodily injury or damage to health or in the event of a grossly negligent breach of obligations on the part of REC Solar AS and/or in the event of an intentional or grossly negligent breach of obligations by a legal representative or vicarious agent.

Disposal considerations

This product must be disposed of in accordance with all relevant local, state and federal laws and regulations. It is the responsibility of the customer to ensure that this product is disposed of properly.

Please contact your local REC Solar AS representative concerning the proper disposal of this product.



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REC Solar AS reserved the right to change specifications without notice.