

## Photovoltaic Module Installation Instructions


### Overview

This document provides information for the safe installation and operation of your GE Energy photovoltaic module. Carefully read this entire instruction sheet prior to product installation. Information about system sizing, design, safety, and operation are available from your respective distributor.

Determine local permit, installation and inspection requirements before installation. If not otherwise specified, it is recommended that the requirements of the U.S. National Electrical Code (NEC) or respective European Code be followed.

### Applicable Products

This document is applicable to all GE Energy solar module products.



**Electric Shock and Burn Hazard**  
This photovoltaic module produces electricity when exposed to the sun or other light sources.

Cover the module's front face completely with opaque material to halt the production of electricity before making any electrical connections. Before working on a solar module, disconnect it from other sources of electricity, such as batteries.

Only trained personnel familiar with the principles of electricity and electrical equipment should install solar modules. Use properly insulated tools and appropriate protective equipment.

Solar modules have a protective glass front. Broken solar module glass is an electrical safety hazard (electric shock and fire). These modules cannot be repaired and should be replaced immediately.

Make sure the modules are arranged such that the current and voltage characteristics of the array are within the tolerances of the device to which the array will connect. Modules sold in the US are rated up to 600V while some European modules may be rated up to 1000V.

In actual usage, a photovoltaic module may experience conditions that result in more current and/or voltage than reported at standard test conditions. The module's Isc rating should be multiplied by a factor of 1.25 when determining component ratings. NEC 690.8 requires an additional multiplying factor of 1.25 for conductor and fuse sizing. Refer to NEC Table 690.7 for voltage correction factors that are based on ambient air temperatures. If NEC Table 690.7 is not available, a factor of 1.25 should be used to adjust voltage.

This module has a Class C Fire Rating and must be installed over a roof of appropriate fire resistance. Consult your local building department to determine approved roofing materials. Do not install this module integral with a roof or wall of a habitable structure. *Exception, only the GEPVp-066-G module can be installed integral with a roof.*

Do not artificially concentrate sunlight on modules. Do not install modules where a flammable gas may be present. Do not remove any part installed by GE Energy or disassemble the module.

### Handling and Use

Protective gloves should be worn when handling solar modules. The gloves will protect against sharp objects and burns.



There are typically two or four modules to a shipping container. These containers are heavy. To safely transport these containers multiple people and/or equipment should be used to avoid injury.

This GE Energy module is made using a glass front cover. Although tough, it is subject to breakage if not properly handled and installed. Always transport and store the module in the shipping container provided. Do not leave the module unsupported prior to installation. For example, wind can cause a module that is leaning against a fence to fall and break. Avoid application of excessive bending or twisting forces to the module. Avoid stepping on the module or subjecting it to impact.

### Mounting

GE Energy solar electric modules can be mounted using the four mounting holes located on the solar modules frame or may also be mounted using pressure clips that compress the frame from the top to the mounting rail (figure 1). The mounting rails must be within one inch (1") [2.54 cm] of the frame mounting holes (Figure 2) and run perpendicular to the length of the module.



Improper mounting of solar modules can lead to the frame separating from the glass, the glass breaking, and/or the solar module (or component used to construct the solar module) may become a falling object.

Secure the module using the four mounting holes provided and ¼ in. (6mm) corrosion-resistant hardware. Lock washers should be used with this hardware for long-term security.

**Module Specification** -GE Energy solar modules have been designed and tested to a maximum loading of +/- 50 psf (pounds per square foot). This loading can be any

combination of snow, ice, or wind. In order for the solar modules to withstand this loading the frame must be properly supported. The frames include four mounting holes at the proper locations to distribute loading.

Figure 1: Typical pressure clamp

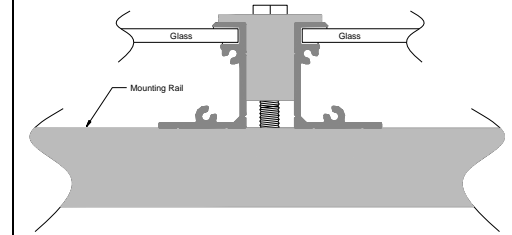
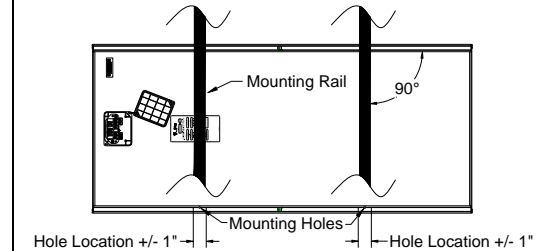


Figure 2: Mounting and placement



**Drag Force** - If the installation is located in an area that has heavy snow loading or an area with repetitive freeze thaw cycles, the solar modules will be subjected to a drag force. This drag force is the force pulling the modules at a downward angle (figure 3). To resist the drag forces the solar module must have support on the lower edge of the module frame. It is recommended that the mounting rails be oriented vertically, placing the module mounting hardware at the lower module edge. The solar system designer must determine the amount of drag force, as more than 2 mounting clamps may be required for some sites.



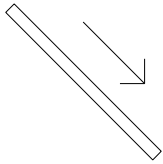


Figure 3: Drag force on module surface

**Expansion and Contraction** - As the solar module heats and cools a change in dimension will occur. As solar modules are racked side by side this normally small dimension change soon becomes rather large at approximately ¼" per 15 feet for aluminum. To properly account for this change in dimension, the maximum length of any array section should not exceed 30 feet. Once this maximum length is reached the solar modules and mounting structure will require an expansion joint. The solar modules should not straddle the mounting structure's expansion joint.

### Mounting of GEPVp-066-G ONLY

The GEPVp-066-G module is mounted in a manner similar to conventional flat concrete tile roofing products. The exception is that an approved Class C (or better) Fire Rated roofing product must be installed on the roof deck before installation of the GEPVp-066-G module array.

Selection of the user-supplied substrate-roofing product depends on local code requirements, building design and user preference (an example of a potentially suitable substrate material is asphalt-fiberglass composite shingle with Class A Fire Rating). In the plane of the roof where the GEPVp-066-G modules are installed, the substrate roof product should cover the entire surface, including areas where flat concrete tile will be installed.

Spacing of the GEPVp-066-G modules should be set so that reveal length is no more than 13.5" and no less than 13.0". In order to minimize shading losses at low sun angles, the reveal should be kept as close as possible to 13.5". The GEPVp-066-G module array should be located on the roof so that there will be a uniform border of standard concrete roofing tiles.

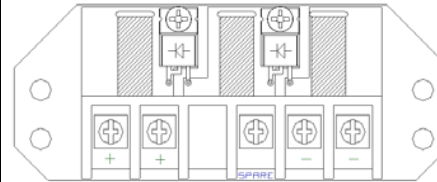
GEPVp-066-G modules are secured to the roof deck by means of Z-brackets on the lower module edge and roofing screws installed through the upper flange of the module frame. Once a starter course of concrete roofing tiles is in place, Z-brackets are installed over the top edge of the concrete tiles, two per module. A GEPVp-066-G module is installed by capturing the lower module edge under each Z-bracket. The upper edge of the module is then secured with three #8 x 1.5" roofing screws with EPDM bonded washers, using the predrilled holes in the upper flange of the module frame.

Repeat the installation procedure until the first row is complete. Complete the installation of each GEPVp-066-G module row in the same manner. Successive rows of modules should stagger the module joint as in a typical flat concrete tile installation (approximately 6 inch offset). Care should be taken when installing concrete tiles above the solar modules. The overlap should not shadow the photovoltaic cells.

The remainder of the roof installation should be completed in a manner consistent with accepted concrete tile roofing practices and procedures.

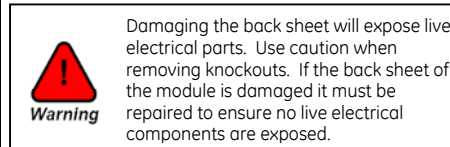
### Wiring

**Conduit-Ready Junction Box**- Remove the junction box cover being sure to save the original screws. The terminal strip identifies the positive (+) and negative (-) module output polarities (see picture below).

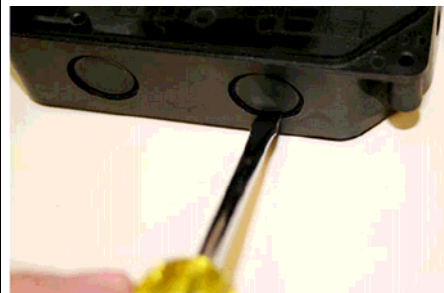


A waterproof cord grip should be used to prevent water intrusion and wire strain.

To exit the junction box four knockouts are provided for the field installation of conduit or waterproof strain relief. Only remove the knockout selected for use, unused knockouts must be plugged with an outdoor rated knockout seal.



Damaging the back sheet will expose live electrical parts. Use caution when removing knockouts. If the back sheet of the module is damaged it must be repaired to ensure no live electrical components are exposed.



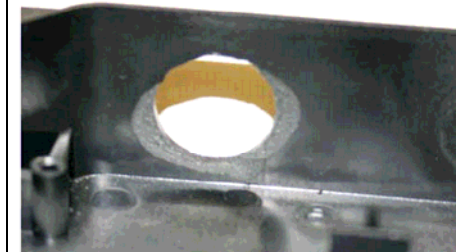
Place a flat tip regular screwdriver on the bottom of the knockout recess as shown above.



Placing the screwdriver at the top of the knockout recess could overly stress and damage the junction box.



Using a blunt tool of medium weight, lightly strike the end of the screwdriver.



When the knockout is removed it will typically remove a small amount of the surrounding plastic. This is completely normal and expected.

Strip wire insulation back 5/8 inch (16mm), insert through the cord grip and under the appropriate terminal screw. Tighten this screw securely to 16 in-lb (1.8 N-m). Tighten the cord grip. When all wires are installed, re-install the cover using the original screws.

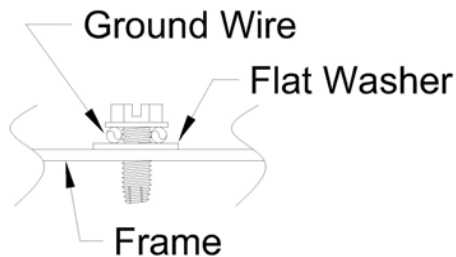
To maintain the applicability of the module's UL Listing, use Type USE-2 copper wire, rated sunlight resistant and 90°C, for all wiring exposed to the weather. The wire may be stranded or single conductor. The minimum



wire size is 12 AWG (4 mm<sup>2</sup>). The maximum wire size is 8 AWG (10 mm<sup>2</sup>). For modules that are certified up to 1000V, use TUV approved 4.0mm<sup>2</sup> solar cable.

**Junction box with Multi-Contact or Solarlok Leads** - When using optional Multi-Contact (MC) or Solarlok (MS) connectors, there are no user serviceable parts in the junction boxes. Do not open the junction box or change inter-module wiring, as all wiring connections are performed in the factory. The MC or MS connectors cannot be opened under load. Modules may be connected and disconnected when current is not flowing through the connector, under open circuit voltage conditions. Always observe proper precautions when connecting or disconnecting modules exposed to light since hazardous voltage may be present.

**Grounding**- Size and earth the equipment grounding conductor in accordance with local requirements or the NEC. Attach the equipment grounding conductor to the module frame using the hole and hardware provided. Note that a stainless steel flat washer is used between the ground wire and the module frame (see picture below). This washer is used to avoid corrosion due to dissimilar metals. Tighten the screw securely.



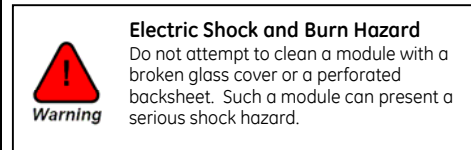
For optional methods of grounding a solar module refer to GE Energy Document "Optional Ground Methods".

**Bypass Diodes**- Bypass diodes are pre-assembled in each GE Energy module. Typically modules are supplied with a 12 or 18 Amp diode. Do not remove these diodes.

**Blocking Diodes and Charge Controllers**- Blocking diodes can prevent the solar module from discharging the battery at night. GE Energy modules do not include blocking diodes. It is recommended that a charge controller be used to prevent the batteries from being overcharged and discharged at night.

## Cleaning

Over the life of a solar module, it is common for dust and dirt particles to accumulate on the surface of the module. This build up can reduce the performance of the module as well as contribute to the growth of moss and molds. Normally, the build up of dust particles will be washed away by periodic rainfall, but in some instances mosses and molds may appear. If significant moss or mold growth appears on the module surface cleaning may be required. To ensure maximum solar module performance, GE recommends cleaning the module surface with a sodium percarbonate solution, similar to the household-cleaning product Oxiclean™.



**Mixing the sodium percarbonate solution** - Sodium percarbonate is a dry white powder that can be mixed with warm water to create an environment-friendly oxidizing agent. The mixture of sodium percarbonate and warm water effectively breaks down organic matter. Do NOT use bleach to clean solar modules, as it is hazardous to the environment. To create the cleaning solution, mix 1/2 cup of dry sodium percarbonate with a gallon of warm water (100-120° F). The mixture will retain its cleaning power for 5 to 6 hours.

**System preparation and safety precautions**- Cleaning should only be completed by the system installer or someone with equivalent fall protection safety training. If you are going up onto the roof to clean the modules, ensure that the proper amount of fall protection is being worn. Follow all warnings at the end of this technical bulletin.

**Applying the cleaning solution to the modules** - Apply the cleaning mixture to the modules with a clean lawn sprayer. The sprayer should have a large enough chamber to hold the entire warm water / sodium percarbonate solution, it should not be a hose end sprayer. Once the cleaning mixture has been applied, let the solution stand on the modules between 20 and 30 minutes. If necessary, scrub the module surface to remove any remaining particles. Thoroughly rinse the module surface to remove the cleaning solution. Key points:

- This procedure should only be completed by the system installer or someone with equivalent fall protection safety training.
- Fall protection should be worn at all times while cleaning any modules on a roof-mounted system.
- Do not drop, allow objects to fall on, stand or step on solar modules. Do not walk, lean, sit or rest heavy objects on solar panels.

- Solar modules have a protective glass front. Broken solar module glass is an electrical safety hazard (electric shock and fire). These modules cannot be repaired and must be replaced immediately. If you have a broken module turn your system off. If your solar module is broken do not clean.
- Do not touch the solar modules or the mounting structures with your bare hands during the cleaning process. When these surfaces are exposed to sunlight they can become extremely hot. Protective gloves should be worn when touching the system components.
- Sharp edges may exist on the components. Protective gloves should be worn while cleaning the solar array system.
- Exposing the anodized aluminum frame to the sodium percarbonate cleaning solution for longer than 10 hours may cause surface staining on the aluminum.
- The sodium percarbonate cleaning solution attacks organic matter and should be kept from directly contacting plants. In the event the cleaning solution comes in direct contact with plants that you intend to keep, thoroughly rinse the plant leaves to remove the solution.

## Performance

Refer to the attached spreadsheet for performance information. Detailed product information can be found on the GE Solar website at:

[www.gepower.com/solar](http://www.gepower.com/solar)





## List of Module Nameplate Ratings

GE Model Number	Power	Voc	Isc	Ump	Imp	Bypass Diode Rating	Max. Series Fuse Rating	Max. System Voltage	Certifications	Power Tolerance
GEPVc-170-MS	170	43.9	5.1	36.5	4.7	12	15	600V	UL	+/- 5%
GEPV-085-MN	85	22.0	5.2	18.4	4.8	18	10	600V	UL/IEC	+/- 5%
GEPVp-066-GS	66	10.9	8.2	9.0	7.4	18	15	600V	UL	+/- 5%
GEPVp-130-MC/MN	130	21.9	7.6	17.6	7.3	18	15	600V	UL/IEC	+/- 5%
GEPVp-185-MC/MS	185	32.3	7.8	25.6	7.2	18	15	600V	UL/IEC	+/- 5%
GEPVp-200-MS	200	32.9	8.1	26.3	7.6	18	15	600V/1000V	UL/IEC/SKII	+/- 5%

### NOTES:

- 1) Nameplate ratings are average values
- 2) J-box/ connector: MN- Conduit Ready w/Terminal Strip; MC/GC- Standard with Multi-Contact connectors; MS/GS- j-box with Solarlok connectors
- 3) 1000V modules available for European applications only
- 4) The above values are measured at Standard Test Conditions (STC), 1000W/m<sup>2</sup>, 25 °C cell temperature and AM 1.5G. Power tolerances are +/- 5% unless noted otherwise.

