

Installation and User Manual



Jyotitech
Solar
Energising Future™

INTRODUCTION

This manual contains information regarding installation, operation, maintenance and safety of Jyotitech Solar LLP (Jyotitech Solar™) Photovoltaic modules (PV modules). The installation of solar PV modules require a great degree of skills, it should only be performed by a qualified and licensed professional, including, without limitation, licensed contractors and electricians (called "installer" or "installers"). Before installation or using the PV modules, it is important to read this manual and understand the instructions carefully.

PRODUCT IDENTIFICATION

Each module has the following information:

- | | |
|--|------------------------------|
| a) Electrical data under standard test conditions: rated power, rated current, rated voltage, open circuit voltage, short-circuit current incl. measurement tolerance, | c) Maximum system voltage, |
| b) Maximum electric current, | e) Safety warning, |
| d) Application Class, | g) Barcode and serial number |
| f) Name and address of manufacturer. | |

SERIAL NUMBER NOMENCLATURE :

JTSXZNNPPYYMMDDABCD

JTS: JYOTITECH SOLAR

X: CELL SIZE = 6

Z: F or C (F=full cell, C=cut cell)

NN: Two Digit Numbers (indicates Number of cells in module)

P: PID Free (Potential Induced Degradation)

P: Polycrystalline cells

YY: Two digit number indicates year of module manufacturing

MM: Two digit number indicates month of module manufacturing

DD: Two digit number indicates date of module manufacturing

ABCD: Four digit serial number

DISCLAIMER OF LIABILITY

Jyotitech 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. Jyotitech Solar assumes no responsibility for any infringement of patents or other rights of third parties, which may result from using Jyotitech Solar PV modules. No licence 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. Jyotitech Solar reserves the right to make changes to its PV modules and other products, their specifications, or this manual without prior notice.

Jyotitech Solar PV modules are designed to meet the requirements for the standards IEC 61215 and IEC 61730, application class A. Modules 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. Modules qualified for safety Through IEC 61730-1 and IEC 61730-2 and within this application class are considered to meet the requirements for safety class II.

SAFETY

General

You must understand and follow all applicable local, state, and federal regulations and standards for building construction, electrical design, fire, and safety, and must check with local authorities to determine applicable permitting requirements before attempting to install or maintain PV modules.

Rooftop PV systems should only be installed on dwellings that have been formally analyzed for structural integrity, and confirmed to be capable of handling the additional weighted load of PV system components, including PV modules, by a certified building specialist or engineer.

For your safety, do not attempt to work on a rooftop until safety precautions have been identified and taken, including without limitation fall protection measures, ladders and stairways.

For your safety, do not install or handle PV modules under adverse conditions, including without limitation strong or gusty winds, and wet or frosted roof surfaces. No paint, adhesives or chemical detergents should be applied to the modules. If not otherwise specified, it is recommended that the requirements of the National Electric Code (NEC) be followed.

ELECTRICAL

PV modules can produce current and voltage when exposed to light of any intensity. Electrical current increases with higher light intensity. DC voltage of 30 Volts or higher is potentially lethal. Contacting the live circuitry of a PV system operating under light can result in lethal electric shock.



De-energize PV modules by removing them entirely from light or by covering their front surface with an opaque material. Regard the safety regulations for live electrical equipment when working with modules that are exposed to any light. Use insulated tools and do not wear metallic jewelry while working with modules.

In order to avoid arcing and electrical shock, do not disconnect electrical connections, work on wiring, disconnect connectors or modules under load. Faulty connections can also result in arcing and electrical shock. Keep connectors dry and clean, and ensure that they are in proper working condition. Never insert metallic objects into the connectors, or modify them in any way in order to secure an electrical connection.

Do not touch or handle PV modules with broken glass, separated frames or a damaged backsheet unless the PV modules are first disconnected. Avoid handling PV modules when they are wet unless cleaning the PV modules as directed in this manual. Never touch electrical connections that are wet without protecting yourself with insulated gloves.

Keep children away from modules. Inverters are any other electric components while transporting or installing the system.

TRANSPORTATION, HANDLING AND UNPACKING

Jyotitech Solar PV modules must be transported in the supplied packing only and kept in the packaging until they are ready to be installed. Protect pallets against movement and exposure to damage during transportation. Secure pallets from falling over. Do not exceed the maximum height of pallets to be stacked, as indicated on the pallet packaging. Store pallets in a cool and dry location until the PV modules are ready to be unpackaged.

Jyotitech Solar PV modules are heavy, and should be handled with care. PV modules shall be handled at the frame; never use the junction box or cables as a grip. Do not exert mechanical stress on the cables. Never step on PV modules or drop or place heavy objects on them. Be careful when placing PV modules on hard surfaces, and secure them from falling. Broken glass can result in personal injury. PV modules with broken glass cannot be repaired and must not be used. Broken or damaged PV modules must be handled carefully and disposed of properly.

For unpackaging PV modules from Jyotitech Solar supplied packaging first remove the pallet lid (after removing securing straps, if provided). Remove PV modules one at a time by sliding them up the channel in the package. You may need to secure the remaining PV modules in the pallet packaging to prevent them from falling over.

Check PV modules for damage due to transportation before they are installed; do not install damaged modules. Contact the company you purchased the Jyotitech Solar PV modules from in order to obtain information on making claims for defective PV modules.

PV module surfaces are susceptible to damage that could affect the performance or safety of the PV module; do not damage or scratch the PV module surfaces, and do not apply paint or adhesive to any of the surfaces, including the frame. For your safety, do not disassemble or modify Jyotitech Solar PV modules in any way. Doing so may degrade performance or cause irreparable damage and will void any applicable warranties.

FIRE

Jyotitech Solar PV Modules have a Class C fire resistance rating in accordance with the IEC 61730-2 certification. When PV modules are mounted on rooftops, the roof must have a fire resistant covering suitable for this application. PV modules are electrical generating devices that may affect the first safety of a building.

The use of improper installation methods and/or defective parts may result in the unexpected occurrence of electrical arc during operation. In order to mitigate the risk of fire in this event, PV modules should not be installed near flammable liquids, gases, or locations with hazardous materials.

In the event of a fire, PV modules may continue to produce a dangerous voltage, even if they have been disconnected from the inverter, have been partly or entirely destroyed, or the system wiring has been compromised or destroyed. In the event of fire, inform the fire crew about the particular hazards from the PV system, and stay away from all elements of the PV system during and after a fire until the necessary steps have been taken to make the PV system safe.

CLIMATE CONDITIONS

Jyotitech Solar PV modules must be mounted on appropriate mounting structures positioned on suitable buildings, the ground, or other structures suitable for PV modules (e.g. carports, building facades or PV trackers). PV modules must not be

mounted on moving vehicles of any kind. Jyotitech Solar PV modules must not be installed in locations where they could be submerged in water.

Jyotitech Solar PV modules must not be sited in locations where aggressive substances such as salt or salt-water, or any other type of corrosive agent, could affect the safety and/or performance of the PV modules. Although some types of Jyotitech Solar PV modules have passed the IEC 61701 salt-mist corrosion test with a salt concentration of 5% by weight, galvanic corrosion can occur between the aluminium frame of the PV module and mounting or grounding hardware if such hardware is comprised of dissimilar metals. Jyotitech Solar recommends that only stainless steel and aluminium metal directly contact PV modules in seaside installations to limit corrosion. The PV module should not be subjected to direct artificially concentrated light.

ENVIRONMENT

- Ambient temperature: -40°C to +50°C.
- Operating temperature: -40°C to +85°C.
- Storage temperature: -20°C to +50°C.
- Humidity: <85 RH%

*Note:

The mechanical load bearing capacity depends upon the installer's mounting methods and failure to follow the instructions in this manual may result in different capabilities to withstand snow and wind loads. The system installer should ensure that the installation methods used meet these requirements as well as any local codes and regulations.

DESIGN CONSIDERATIONS

Partial or complete shading of a PV module(s) can significantly reduce system performance. Jyotitech Solar recommends minimizing the amount of shade throughout the year to increase the amount of energy produced by the PV modules.

PV modules should typically face south in the northern hemisphere and north in the southern hemisphere. Jyotitech Solar modules can be mounted either in landscape or portrait orientation, however the impact of dirt shading the solar cells can be minimized by selecting portrait orientation.

For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. If the PV module is placed at a different angle or orientation, this could have a direct impact on the power output. We recommend that PV modules be mounted at a minimum tilt angle of 10 degrees to allow for proper self-cleaning from normal rain showers. Avoid using mounting methods where drainage holes are blocked. PV modules should not be installed in such a way that they will be immersed under water under any circumstances, and should also not be installed on moving vehicles/vessels.

Lightning protection is recommended for PV systems that are to be installed in locations with high probability of lightning strikes.

High system voltage could be induced in the event of an indirect lightning strike, which could cause damage to PV system components. The open area of wire loops should be minimized, in order to reduce the risk of lightning induced voltage surges.

ELECTRICAL INSTALLATION

Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at Standard Test Conditions (STC: 1000 W/m², AM 1.5, and 25°C cell temperature). The short circuit current (ISC) should be multiplied by a factor of 1.25 and the open-circuit voltage (VOC) should be multiplied by a factor of up to 1.25 based on the lowest ambient temperature recorded for the installation location when determining component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output.

Voltages are additive when PV modules are connected directly in series, and module currents are additive when PV modules are connected directly in parallel, as illustrated in Figure. PV modules with different electrical characteristics must not be connected directly in series. The use of suitable third-party electronic devices connected to PV modules may enable different electrical connections and must be installed according to the manufacturer's specified instructions.

The maximum number of PV modules that can be connected in a series string must be calculated in accordance with applicable regulations in such a way that the specified maximum system voltage of the PV module and all other electrical DC components will not be exceeded in open-circuit operation at the lowest temperature expected at the PV system location.

An appropriately rated overcurrent protection device must be used when the reverse current could exceed the value of the maximum fuse rating of the module. An overcurrent protection device is required for each series string if more than two series strings are connected in parallel.

ELECTRIC WIRING

Use field wiring with suitable cross sectional areas that are approved for use at the maximum short circuit current of the PV module. Jyotitech Solar recommends installers use only sun light resistant cables qualified for direct current DC wiring in PV systems. The minimum wire size should be of 4 mm².

- All wiring should be done in accordance with applicable cable codes.
- All wiring should be done by a qualified, licensed professional. Wiring should be protected to help ensure personal safety and to prevent its damage.
- Modules can be wired in series to increase Module voltage. All modules connected in series should be of the same model number and/or type.
- Connect Modules in parallel to increase current. do not connect modules in parallel without using a connection box.
- Jyotitech Solar Modules contain factory installed bypass diodes if the modules are incorrectly connected to each other, the bypass diodes, cables, or junction box may be damaged.
- The term "array" is used to describe the assembly of several modules on a support structure with associated wiring. Use wire that is sunlight resistant and rated for at least 90°C and is insulated to withstand the maximum possible system open circuit voltage.
- The maximum open circuit voltage of the system must not be greater than the specified maximum system voltage for the module. The module open-circuit (Voc) voltage increases with decrease in temperature and therefore allowable maximum system voltage must take into account the lowest temperature that is attainable in the area where the module is intended to be used.
- When reverse currents can exceed the value of the maximum protective fuse a properly rated and certified over current device (fuse or circuit breaker) must be connected in series with each module or string of modules.
- Match the polarities of cables and terminals when making the connections.
- Connecting Modules in reverse polarity to a high current source, such as a battery, will destroy the bypass diodes and render the module inoperative. Bypass diodes are not user replaceable.
- The junction box, cable and connectors shall not be alter in any case.
- Modules with suspected electrical problem should be return to Jyotitech Solar for inspection and possible repair or replacement as per the warranty policy shall be provided by Jyotitech Solar.

CABLE PROTECTION

- Secure the cables to the mounting system using UV-resistant cable ties.
- Protect exposed cables from damage with appropriate precautions.
- Avoid exposure to direct sunlight
- Ensure that the cables will be away from areas where water can form puddles.
- When disconnecting wires under load, and electric arc may result. Such arc may start fires and may otherwise create problems.

BYPASS DIODES

The junction boxes used with Jyotitech Solar PV modules contain bypass diodes wired in parallel with the PV cell strings. In the case of partial shading, the diodes bypass the current generated by the non-shaded cells, thereby limiting module heating and performance losses. Bypass diodes are not overcurrent protection devices

Bypass diodes divert current from the cell strings in the event of partial shading. See Figure for a diagram showing how the cell strings are electrically connected with the diodes.

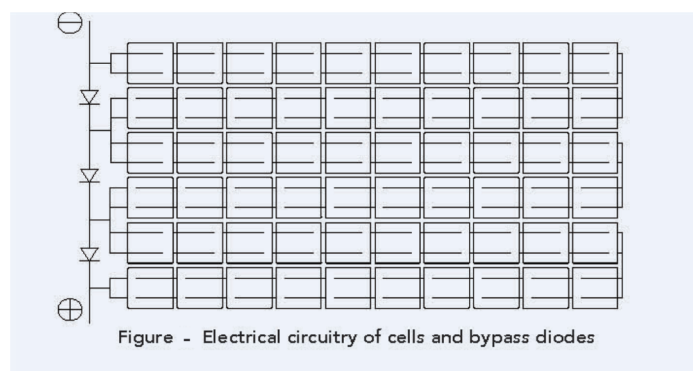


Figure - Electrical circuitry of cells and bypass diodes

BLOCKING DIODES

Blocking diodes are typically placed between the battery and the PV Module output to prevent the battery discharge at the night. Jyotitech Solar Modules do not contain a blocking diode when shipped from the battery. It is recommended that a charge controller be used to prevent the batteries from being overcharged and discharged at night.

Note:- The non-use of blocking diodes or any reverse current protection in battery operated system will void all applicable warranties.

PV ARRAY GROUNDING

For optimal performance, Jyotitech Solar recommends that the negative pole of the PV array be connected to ground.

Equipment Grounding

The frame of the PV module, as well as any exposed non-current-carrying metal parts of fixed equipment that are able to become energized by the PV system, must be connected to the equipment grounding conductor (EGC) in order to prevent electrical shock. Even when applicable regulations, code requirements, and standards do not require safety - related grounding, Jyotitech Solar recommends grounding all PV Module frames in order to ensure the voltage between electrically conductive equipment and earth ground is zero in all circumstances.

Proper equipment grounding is achieved by bonding all exposed non-current-carrying metal equipment continuously to one another using an appropriately sized EGC or racking system that can be used for integrated grounding (see Option B in Grounding Methods below).

Jyotitech Solar PV modules employ a coated aluminium frame for corrosion resistance. In order to properly ground the module frame, the coating must be penetrated.

The potential for corrosion due to the electrochemical reaction between dissimilar metals is minimized if the electrochemical voltage potential between the dissimilar metals is low. The grounding method must not result in the direct contact of dissimilar metals with the aluminium frame of the PV Module that will result in galvanic corrosion. An addendum to UL Standard 1703 "Flat Plate photovoltaic Modules and Panels" recommends metal combinations not exceed an electrochemical potential difference of 0.5 Volts

The frame rails have preDrilled holes marked with grounding sign. These holes should be used for grounding purposes and must not be used for mounting the PV modules. Do not drill additional holes into the frame rails.

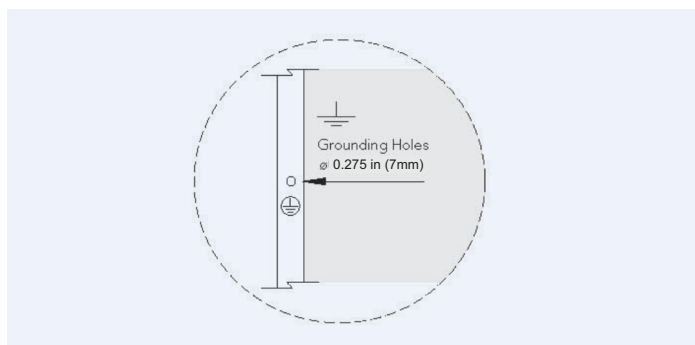


Figure : Grounding hole detail

The following grounding methods are available:

Option A: Screw Assembly (see Figure)

1. A grounding screw assembly must be attached at a designated grounding hole location using only stainless steel hardware. Insert an M8 stainless steel screw first through the stainless steel cup washer, and then through the grounding hole.
2. Loosely engage a stainless steel backing nut and toothed lock washer to the screw.

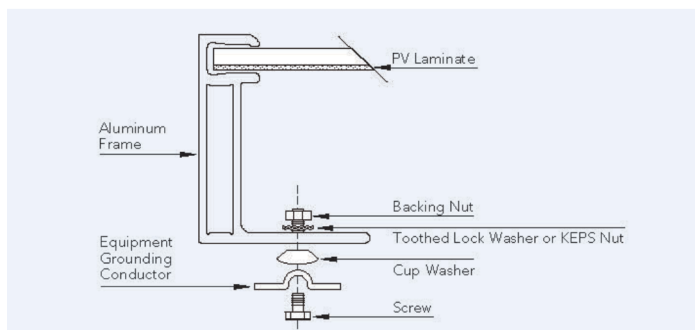


Figure : Grounding screw assembly detail

3. Bend the EGC into an omega (Ω) shape to tightly fit between the partially installed screw head and cup washer. The EGC shall be exclusively in contact with stainless steel.
4. Tighten the screw to 2.3 N.m torque. The toothed lock washer should be visibly engaged to the frame.
5. Route the appropriately sized EGC in such a way as to avoid contact with the aluminum module frame.

OPTION B: RACKING MANUFACTURER INTEGRATED GROUNDING METHODS

Jyotitech Solar PV modules can be grounded by bonding PV modules to a grounded racking system. Integrated grounding methods must be certified for grounding PV modules and must be installed in accordance with the specified instructions of their respective manufacturers.

OPTION C: ADDITIONAL THIRD-PARTY GROUNDING DEVICES

Jyotitech Solar PV modules can be grounded using third party grounding devices so long as they are certified for grounding PV modules and the devices are installed according to the manufacturer's specified instructions.

MECHANICAL INSTALLATION

General

Jyotitech Solar PV modules have been certified for a maximum static load on the back of the module of up to 2400Pa (i.e wind load) and maximum static load on the front of the module of up to either 2400 Pa or 5400 Pa (i.e wind and snow load), depending on the module type (please refer to the data sheet for this information).

Mounting structures and other mechanical parts must be designed and approved to withstand the design wind and snow loads applicable for a particular site. Jyotitech Solar PV modules must not be subjected to forces from the substructures, including forces caused by thermal expansion.

The mounting method must not result in the direct contact of dissimilar metals with the aluminium frame of the PV module that will result in galvanic corrosion. An addendum to UL Standard 1703 "Flat Plate Photovoltaic Modules and Panels" recommends metal combinations not exceed an electrochemical potential difference of 0.5 Volts.

Jyotitech Solar PV Modules can be mounted in landscape or portrait orientation, provided that the mounting method follows one of the acceptable methods.

In order to maintain the fire class rating, the distance between the PV module front surface (glass) and the roof surface shall be at least 10 cm. This spacing also allows air flow to cool the PV module. Install PV modules with a minimum spacing of 1cm between neighbouring frames to allow for thermal expansion.

The rooftop installation of solar module may affect the fireproofing of the house construction. Please leave a space between the modules of 150mm every 3 to 5 meter to allow access of fire fighting personnel in the event of a building fire. It is also possible to install the fireman's switch in the immediate vicinity of the PV module in the DC current line. The PV modules are automatically switched off by the under voltage release in the fireman's switch, should the fire crew get the electrical utility company to be de-energize the location of the fire or decide to locally accurate then switch.

The maximum load the module should be subjected to is 5.4k N/m².

MOUNTING METHODS

The following mounting methods are available:

Bolts or Clamps

Refer to the module supplement distributed with this manual to determine how many connection points are required for a specific module series. The locations of mounting holes and clamp tolerances are illustrated in the drawings located in the Module Supplement. Do not modify the existing mounting holes or drill new holes. Do not apply excessive pressure on the frame such that the frame deforms.

- Bolts: Modules must be mounted using the mounting holes located on the rear side of the long frame parts using M6 stainless steel bolts, nuts, and washers. Refer to the racking manufacturer for specific torque requirements.

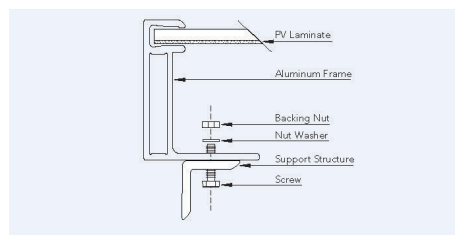


Figure : Detail of a bolt mounting attachment

- **Top-down Clamps:** Third party clamps that have been designed for the PV mounting structures are an approved mounting attachment method for the Jyotitech Solar PV Modules. Modules must be fastened using clamps applied to the top side of the long frame parts. A clamp holds two modules except for the clamps at the beginning and end of a module row. The centreline of the clamps must be in line with the mounting hole positions plus or minus a distance of 50mm. Clamps must be installed according to the manufacturer's specified instructions.

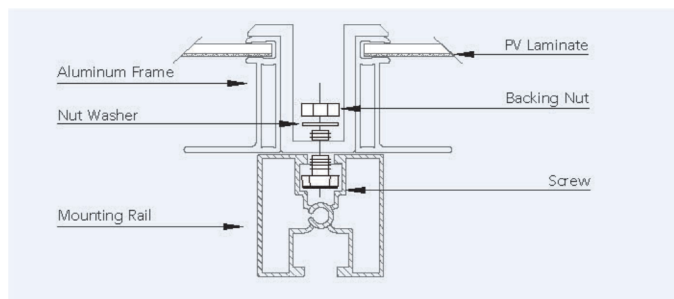


Figure : Detail of a top-down clamp mounting attachment

MAXIMUM SYSTEM VOLTAGE

Jyotitech Solar modules are designed for a Maximum System voltage of 1000V DC. Please note that the module open circuit voltage (Voc) increases with decrease in temperature and therefore allowable maximum system voltage must take in to account the lowest temperature that is attainable in the area where the module is intended to be used.

MODULES CONNECTED IN SERIES AND PARALLEL

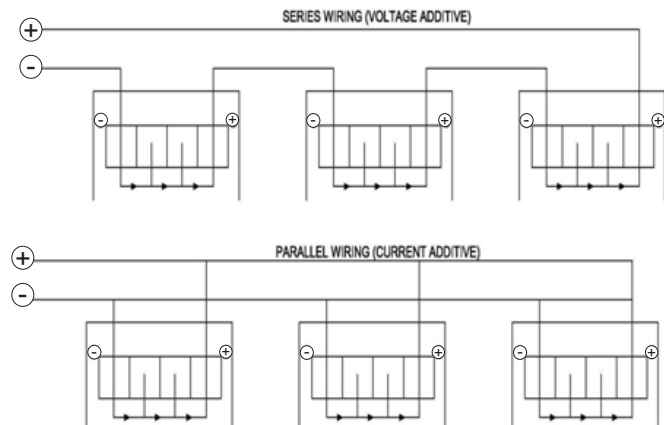
Several Modules can be connected in series or in parallel to form a PV array with specific current and voltage. If Modules are connected in series the total voltage is equal to the sum of individual voltages. If modules are connected parallel the total current is equal to the sum of individual currents. To connect the maximum amount in series, make sure that the open circuit voltage multiplied by the number of modules in series is not higher than the maximum system voltage at the lowest temperature. If 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.

MINIMUM NUMBER OF MODULES CONNECTED IN SERIES

The lowest Voltage that occurs under operating conditions is the Voltage at the Maximum Power Point (MPP) at highest temperature. If the operating Voltage of PV system goes below the MPP Voltage of the inverter with full sun irradiation during summer, the inverter will not be able to feed in the maximum possible power or even turn itself off. The minimum no of module connected in a string is the quotient of the minimum input voltage of the inverter at MPP and the voltage of the module at MPP with a temperature of minus 70 degree Celsius. The connection of module in series should be planned and carried out in accordance with inverter manufacture's instruction.

MAXIMUM NUMBER OF MODULES CONNECTED IN SERIES

The highest voltage that can occur under operating conditions is the open circuit voltage at lowest temperature. On a sunny winter day the open circuit voltage has to be lower than the DC input voltage of the inverter to prevent any damage. The number of modules connected to an inverter should be within the inverter voltage limits/operating range. The modules should not be configured in such way that they create a voltage higher than the permitted system voltage. The maximum number of module connected in this series is the quotient of maximum input voltage of the inverter and the open circuit voltage of the module at a temperature of minus 20 degree Celsius. The connection of modules in series should be planned and carried out in accordance with inverter manufacturer's instructions.



CLEANING

Over time, dirt and dust can accumulate on the glass surface of the module, reducing its power output. Jyotitech Solar recommends periodic cleaning of the PV modules to ensure maximum power output, especially in regions with low precipitation.

In order to reduce the potential for electrical and thermal shock, Jyotitech Solar recommends cleaning PV modules during early morning or late afternoon hours when solar radiation is low and the modules are cooler, especially in regions of hotter temperatures.

Never attempt to clean a PV Module with broken glass or other signs of exposed wiring, as this presents a shock hazard.

Clean the glass surface of the PV Modules with a soft brush using soft, clean water with a recommended pressure less than 690kPa, which is typical of most municipal water systems. Water with high water content may leave deposits on the glass surface and is not recommended.

Jyotitech Solar PV Modules may contain a hydrophobic anti-reflecting coating on the glass surface to enhance power output and reduce dirt and dust buildup. In order to avoid module damage, do not clean PV Modules with a power washer or pressure washer. Do not use steam or corrosive tools or abrasive materials that could scratch or damage the glass surface. Failure to comply with these requirements may adversely affect the PV module performance.

Jyotitech Solar PV modules are designed to withstand high snow loads. However, if removing snow is desired to enhance production, use a brush to gently remove snow. Do not try to remove frozen snow or ice from PV modules.

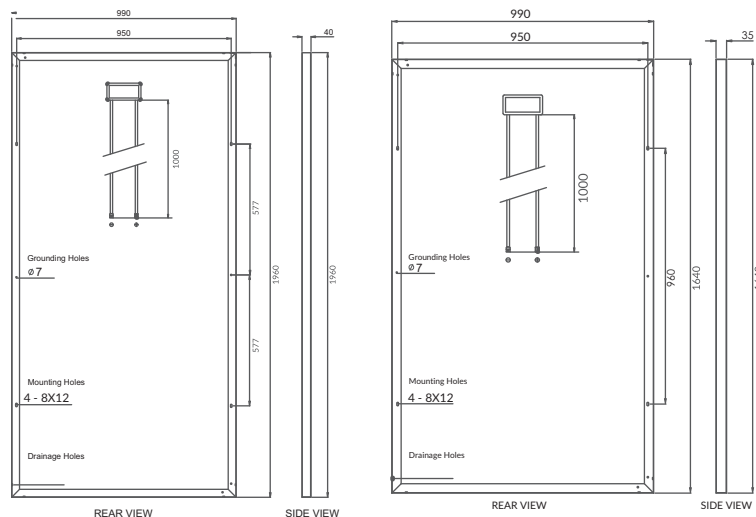
MAINTENANCE (General)

Jyotitech Solar recommends that PV systems be periodically inspected by the installer, or other qualifications.

The purpose of the PV system inspection is to ensure that all the system components are functioning properly. At a minimum, this inspection should confirm the following :

- All Cables and connectors attachments are undamaged and properly secured.
 - No sharp objects are in contact with the PV module surfaces.
 - PV Modules are not shaded by unwanted obstacles and/or foreign material.
 - Mounting and grounding components are tightly secured with no corrosion
- Defects should be addressed immediately.

MODULES DIMENSION



All dimensions are in mm

Caution: Follow Installation and User Manual instructions carefully

DECOMMISSIONING

The dismantling of PV systems must be performed with the same care and safety precautions used during initial installation. The PV system can generate hazardous voltage even after the system has been disconnected. Follow safety regulations for working with live electrical equipment.

Jyotitech Solar LLP

R-456, TTC Industrial Area, MIDC,
Rabale, Navi Mumbai - 400701, INDIA
Tel: +91-22-27605000 / 27695000
Email: sales@jyotitechsolar.com
Website: www.jyotitechsolar.com