

INSTALLATION MANUAL

FRAMED SOLAR PV MODULES



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1. INTRODUCTION

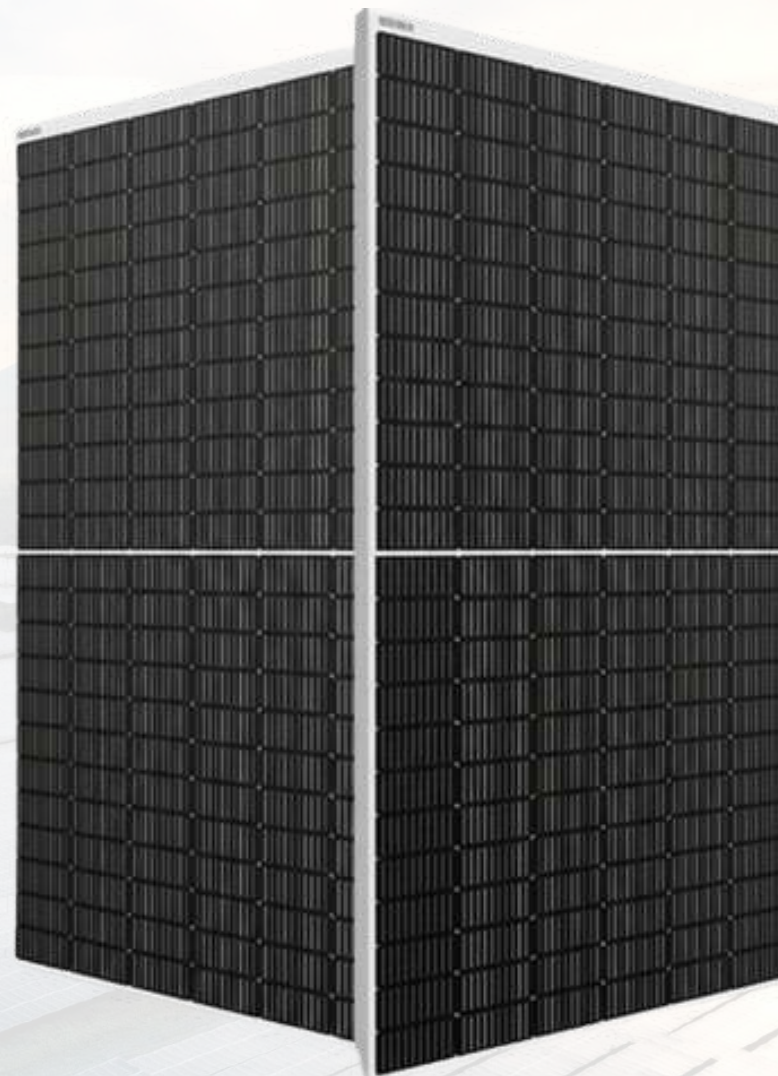
This manual contains information regarding safe handling, installation, operation, and maintenance of ARMY Photovoltaic (PV) Modules. Before installation or using the PV Modules, it is important to read this manual and understand the instructions carefully.

2. DISCLAIMER OF LIABILITY

Since the installation and Maintenance of the Module are beyond (ARMY) company's control; ARMY does not assume responsibility and disclaims liability for loss, damage, injury, or expense arising out of or in any way connected with such installation, operation, or use or maintenance of the Modules.

ARMY assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of the Module. No license is granted by implication or otherwise under any patent or patent rights.

The information in this Manual is based on our knowledge and experience and is believed to be reliable, but such information, including product specifications (without limitations) and suggestions do not constitute a warranty, expressed or implied. ARMY reserves the right to make changes to the product, specifications, or this manual without prior notice.



3. GENERAL INFORMATION

The installation of solar PV Modules requires a great degree of skill, It should only be performed by a qualified and licensed professional, including, without limitation, licensed contractors and licensed electricians. The installer assumes the risk of all injuries that might occur during installation, including, without limitation, the risk of electric shock

For your safety and the safety of others, please read the entire Installation, operation, and maintenance manual carefully before installing, wiring, operating, and performing maintenance of PV modules. Also, carefully read the Module Data Sheet provided with this product. Determine local permits, installation, and inspection requirements before installing module(s). If not otherwise specified, it is recommended that the requirements of the regional & National Electric Code (NEC) should be followed.

The photovoltaic Module produces electricity when exposed to the sunlight, even at low light levels or when other sources illuminate the front face. The voltage of a single Module is less than 50 V DC and around or over 50V DC for a bifacial module. However, the voltage increases as Modules are connected in series, and the available current increases as the Modules are connected in parallel. Thus, for a Module connected within a system, contact with electrically active parts of the Module such as terminals, can result in lethal shock, sparks, and burns. The only way to eliminate this hazard is to prevent exposure of the Module(s) to light.

To avoid the hazard of electric shock and injury when installing, wiring, operating, and maintaining the PV modules, the following guidelines shall be strictly followed



Warning



Caution



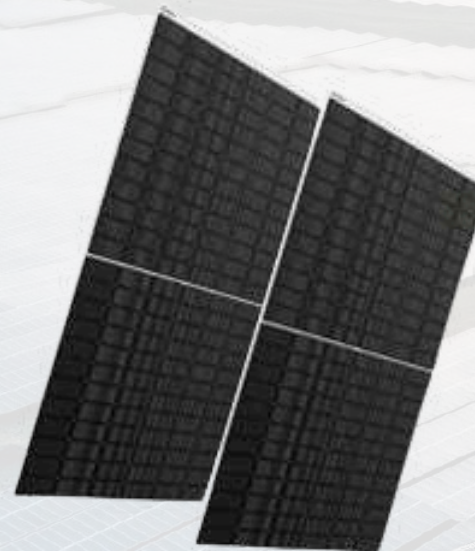
4. SAFETY PRECAUTION

- Potentially lethal DC voltages can be generated whenever PV Modules are exposed to a light source; therefore, avoid contact with electrically active parts and be sure to isolate live circuits before attempting to make or break any connections.
- Only authorized and trained personnel should have access to or perform work on the modules or solar system, always wearing safety gloves and safety shoes.
- When working on electrical connections, remove all metallic jewelry, use properly insulated tools and wear appropriate personal protective equipment to reduce the risk of electric shock.
- Since sparks may occur, do not install the Module where flammable gases or vapors are present.
- For modules under IEC investigation, under normal conditions, a solar photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{sc} and V_{oc} marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes, and the size of controls connected to the PV output
- For modules under UL investigation, most of the time, the solar module is likely to produce more power or current than that rated at standard test conditions. Accordingly, the value of I_{SC} marked on the back label of the module should be multiplied by a factor of 1.25 when determining the conductor current ratings, fuse sizes, and size of controls connected to the PV output. Refer to Section 690.8 of the National Electric Code to check when an additional multiplying factor of 1.25 may be applicable.

- Where common grounding hardware (nuts, bolts, star washers, split-ring lock washers, flat washers, etc.) is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.
- Rated electrical characteristics are within the production tolerance of measured values at Standard Test Conditions of 1000 W/m^2 , $25 \text{ }^\circ\text{C}$ cell temperature, and AM 1.5 solar spectral irradiance, according to IEC 60904-3.
- The module is considered to be in compliance with UL1703/UL 61730 only when the module is mounted in the manner specified by the mounting instructions.
- Broken modules cannot be repaired, and contact with any module surface or frame can lead to electrical shock. Do NOT use a module with broken glass or a torn substrate.
- Do NOT disassemble the modules or remove any part of the module.
- Protect the electrical plug contacts against corrosion and soiling. Make sure that all connectors are corrosion-free and clean before making the connection.
- Do NOT install or handle modules when they are wet or during periods of high wind.
- Make sure that the polarity of each module or a string is not reversed, considering the rest of the modules or strings. The similar witness of polarity shall be checked at the combiner box/ array junction box/ inverter and/or at an appropriate level.
- Use the module for its intended function only.
- Be sure that all other system components are compatible, and they do not subject the Module to mechanical or electrical hazards.

- Do not touch terminals while the module is exposed to light or during installation. As a precaution, use properly insulated tools only.
- Do not damage or scratch the back sheet of the Module. Do not expose the back sheet directly to sunlight.
- Do not drop the Module or allow objects to fall on the Module. Do not stand or step on the Module.
- Do not disassemble, modify, or adapt the Module or remove any part or labeling installed/ pasted by the manufacturer.
- When carrying a Module, two or more people should carry it by its frame, wearing non-slip gloves (to avoid injury by a slipped Module, or by the edge of the frame, and so on).
- Only PV Modules with the same cell type, same power output, and size should be connected. Avoid uneven shade on the PV Module surface. Shaded cells may become hot (hot spot phenomenon), which may result in permanent damage to the Module.
- Do not drill holes in the frame or glass of the Module, it may compromise the frame's strength and cause corrosion of the frame, and also void the warranty.
- Do not treat the back sheet and front surface of the Module with paint and adhesives. Such cases will void the warranty.
- Artificially concentrated sunlight shall not be directed onto the front or back face of the PV module.
- Be sure to completely ground all Modules. Do not use the junction box to hold or transport the Module
- The maximum open circuit voltage of an array must not be greater than the specified maximum system voltage. Voltage is directly proportional to the number of PV Modules in series and is affected by weather conditions.

- In the case of a fire, SPV modules may produce dangerous voltage/surge current, even if they have been disconnected from the inverter, or have been partly destroyed, or the naked wiring destroyed.
- In the event of fire, inform the fire/safety team 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 mitigate the risk.
- Before mounting the module, please consult your local building department to determine approved roofing materials.
- Any module or panel mounting system has limitations on specific inclination required to maintain a specific System Fire Class C Rating.
- The fire rating of the module is valid only when mounted in the manner specified in the mechanical mounting instructions.
- A minimum slope of 5 in/ft. for installation over a roof is required to maintain the fire class C rating is required. Refer to your local authority for guidelines and requirements for building or structural fire safety. For roof application, the Modules should be mounted over a fire-resistant covering rated for the application.
- Ensure that all connections are securely made with no gap between the contacts. Any gap can result in electrical arcing that can cause a fire hazard and/or an electric shock.
- Do NOT use water to extinguish fires of an electrical origin.



5. STORAGE, UNPACKING & HANDLING OF PV MODULE

This manual provides guidelines for the safe handling of ARMY PV Modules during transportation, unpacking, and storage. Improper handling may result in module damage, which can have an impact on both module performance and safety. The manual uses the term "module" or "PV module" to refer to one or more ARMY Solar PV modules. The manual applies to all types of vertical landscape package (short-side vertically placed) solar PV modules, including both mono-facial and bifacial PV modules.

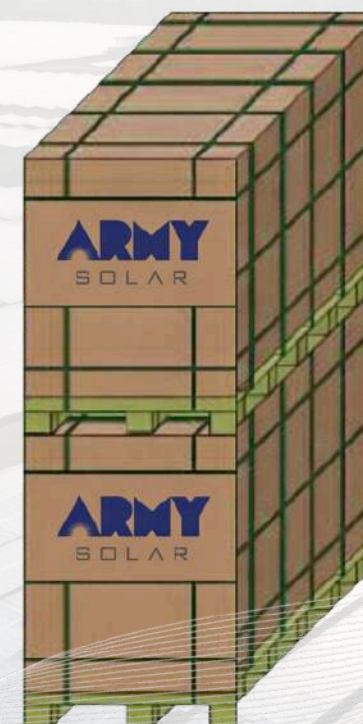
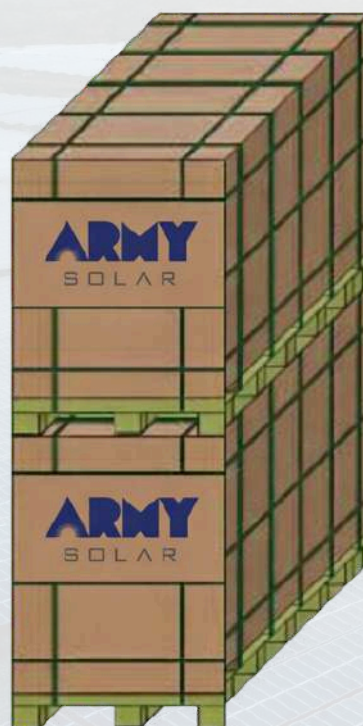
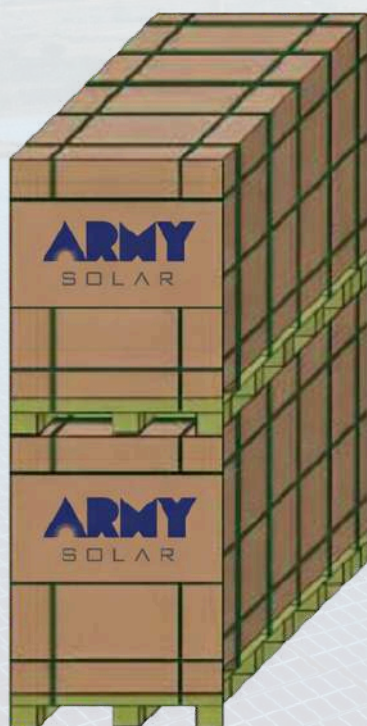
5.1 PRECAUTIONS FOR FORKLIFT HANDLING

- Only authorized persons shall operate the forklift
- In the process of loading and Unloading, selection of the appropriate forklift is mandatory with respect to pallet dimensions and the weight of the pallet. (Thumb Rule: Forklift capacity should be double the pallet weight).
- The spacing of the forks should be adjusted with respect to the pallet dimension and weight, ensuring the load is equally distributed on the overall forks.
- If the fork length is less than $\frac{3}{4}$ of the size of the pallet, extensive sleeves should be fitted over the forks before performing the activity.
- For unloading the goods from the length side of the module, a higher capacity and longer-length forks are used to ensure less vibration and steady unloading of the module.
- Sharp objects (Forklift fork corners) contact with the module box or pallet collision should be avoided, so as not to damage the internal PV modules.
- At least one engineer must be present during the loading and unloading activity, ensuring the appropriate commands are directed to the forklift driver.
- Ensure smooth lifting and shifting of the PV modules inside the container to avoid vibrations and turbulence during transportation.



5.2 UNLOADING OF PV MODULES WITH A FORKLIFT

- ARMY uses industry best practices to load PV modules in shipping containers for transportation.
- Do not allow the use of poor or damaged equipment for the unloading of the PV modules.
- Maintain a safe distance during the operation of the forklift to ensure the safety of individuals in the vicinity.
- When unloading the modules, it is important to select a forklift that has the appropriate tonnage based on the weight of the modules.
- When unloading, it is important to ensure that the forks are inserted into the pallet at a depth of at least 75% of the pallet's length.
- The 3-D images of the vertical landscape package and vertical portrait packages are shown below. However, ARMY follows vertical landscape packaging for the domestic and export packaging.



5.3 GENERAL INSTRUCTIONS AND SAFETY PRECAUTIONS

- Follow the ARMY Company's unpacking procedure to unpack the PV modules.
- Firstly, upon arrival, ensure that the packaging box is in good condition.
- Do not allow unprofessional workers to perform the handling and unloading activity at the site or the warehouse.
- If pallets are required to be stored onsite, we recommend that the pallet packaging be kept intact to protect the panels inside from direct exposure to the environmental conditions. The pallets can be stored in an outside environment with no further requirement for extrashielding or tarping.
- Do NOT stack more than the maximum amount of allowable pallets on top of each other.
- Carefully read the unpacking instructions provided by the manufacturer (supplier).
- It is important to verify the product type, serial number, and other information provided with the packaging box.
- The handling of modules requires great diligence. Therefore, caution is required while unpacking, transporting, and temporarily storing these Modules.
- Use a knife/cutter to carefully remove the packaging strip and wrap.
- Verify the barcodes and details of the modules with the information provided in the packaging box.
- Use insulating gloves when handling the modules.
- Do NOT place modules directly on top of each other without corner protectors. Do not carry the Module on your head.
- Always carry a Module with the help of two or more people by its frame and wear non-slip gloves (to avoid injury by a slipping Module, cuts by the edge of a frame, etc.). Do not leave the Module unsupported or unsecured before installation.
- After unpacking, if all the modules are not utilized, the remaining modules shall be placed horizontally with an aligned frame on the flat, solid surface and repackaged. Horizontal stack of the modules shall not contain more than 16 modules per stack.
- Do not place Modules on an uneven surface, for example, wind can cause a Module which is leaning against a fence to fall and break.
- Avoid applications of excessive bending or twisting of the Module, as it may cause severe micro-cracks at the cell level, which in turn may compromise Module reliability.
- Avoid handling and lifting modules with the junction box and cables.
- At the installation site, take care to keep Modules and particularly their electrical contacts clean.
- A Module with broken glass or a torn backsheet cannot be repaired and must not be used since contact with any Module surface or the frame can produce electrical shock.
- Take proper anti-tilting measures while removing the inner packaging strip.
- Broken or damaged Modules must be handled carefully and disposed of properly. Broken glass can be sharp and may cause injury if not handled with appropriate protective equipment.
- Do not stand, step, walk, and/or jump on the Module. Do not drop or place objects on the Modules (such as tools)
- Do not mark the Modules with a sharp instrument. Particular attention should be taken to avoid the module backsheet coming into contact with sharp objects, as scratches may directly affect product safety and reliability.

5.4 UNPACKING THE PALLET OF MODULES

STEP 1: REMOVE THE STRETCH WRAPPING FILM FROM THE PACKING

STEP 2: BOX USING A CUTTER

STEP 3: CUT THE STRIPS ON THE OUTER BOX

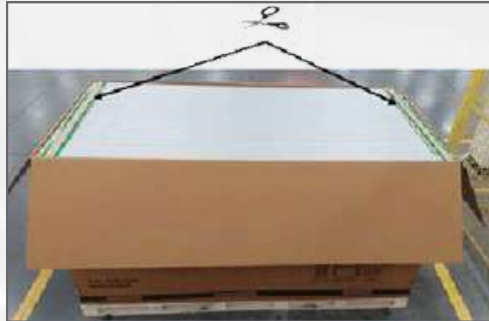
STEP 4: OPEN THE FLIPH

STEP 5: PLACE THE STAND TO PROVIDE SUPPORT AS SHOWN IN THE IMAGE & CUT THE STRIPS FROM THE OPPOSITE SIDE OF THE STAND (E.G., AS SHOWN MARKS IN THE IMAGE)



5.6 UNPACKING OF PV MODULES FOR THE INSTALLATION

- Cut off the outer strapping strip and remove plastic wrap across the pallet using pliers/cutter.
 - Open the box from top and cut off top inner strapping strip.
- Lift the outer box and cut off bottom inner strapping strip.



Again put the cover down and peel of the retainer strip from one module.

Peel of the retainer strip one by one module.



- Always lift the module with the help of two people from the module's short edge.



- Sequentially remove the PV modules from the package and handle the package carefully to prevent tilting or falling sideways.
- Please keep this manual for future reference. We recommend visiting www.armysolar.com regularly for the most updated version of this manual.
- For any further information or clarification, please contact ARMY SOLAR.
- Avoid drilling holes in the module's frame. Doing so will void the product warranty, compromise the frame's loading capacity, and may result in frame corrosion.

Don'ts:

- Don't alter the integrity of the frame of the PV module.
- Don't unpack modules on wet, soft, or inclined surfaces.
- Don't use sharp or unstable structures for support.
- Don't walk, stand, or jump on the PV module.
- Don't remove the packaging and strips if not installing immediately.
- Don't stack more than the recommended number of PV modules.
- Don't hit the module with sharp or heavy objects.



6. ENVIRONMENTAL CONSIDERATION AND SITE SELECTION



Environmental Conditions:

Ambient Temperature: -40 °C to +50 °C
Operating Temperature: -40 °C to +85 °C
The relative humidity shall be below 85%.
Statement: The maximum installation altitude is up to 2000 m.

ARMY SOLAR modules are certified for IEC 61215, IEC 61730-I & II, and IEC 62804. In addition to the required IEC certification to meet European standards, ARMY SOLAR products have also been tested and certified for resistance to ammonia fumes (IEC 62716) that may be present in barns sheltering cattle and pigs, as well as suitability for installation in humid (coastal) areas and regions with high sandstorms. Although ARMY SOLAR PV modules have passed the Salt Mist (IEC 61701) corrosion test with a salt concentration of 5% by weight, galvanic corrosion can occur between the aluminum frame and mounting or grounding materials if such materials are made of dissimilar metals.

NOTE:

Rated electrical characteristics are within the production tolerance of measured values at Standard Test Conditions (STC) of:

1000 W/m² irradiance

25 °C cell temperature

AM 1.5 solar spectral irradiance

According to IEC 60904-3 standards.

The mechanical load-bearing capacity depends upon the installer's mounting methods. Failure to follow the instructions in this manual may result in reduced capability to withstand snow and wind loads. The system installer must ensure that installation methods meet these requirements as well as any applicable local codes and regulations.



6.1 SITE SELECTION

Solar modules are recommended to be installed at an optimized tilt angle to maximize energy output. As a rule of thumb, the tilt angle is approximately equal to the latitude of the project site and should face toward the equator. However, the plant must always be designed according to local site conditions to determine the optimum configuration.

PV modules should typically face:

South in the Northern Hemisphere

North in the Southern Hemisphere

ARMY SOLAR modules can be mounted in either landscape or portrait orientation. However, the impact of dirt shading on solar cells can be minimized by installing the modules in portrait orientation.

Modules shall be mounted at the orientation and tilt angle required to ensure consistent seasonal and yearly performance.

The selected location must have direct access to sunlight from 9:00 A.M. to 3:00 P.M. on the shortest day of the year.

A minimum slope of 5 in/ft is required for roof installations to maintain the Fire Class C rating. Refer to local authorities for guidelines and requirements related to building or structural fire safety. For roof applications, the modules must be mounted over a fire-resistant covering rated for the intended use.

PV modules should be installed in a location free from shading throughout the year. Shading can be minimized by ensuring that the distance between any obstruction and the solar array is more than three times the height of the obstruction.

If you want, I can now polish the full document into a complete ARMY SOLAR-branded installation manual format.

6.2 MODULE SPECIFICATION



7. MOUNTING INSTRUCTIONS

- Site-specific loads such as wind and snow must be taken into consideration to ensure that the pressure from such loads does not exceed the specified maximum load of the module. Always follow the instructions and safety precautions provided with the ARMY SOLAR Module.
- The mounting structure and all hardware components, such as bolts, nuts, and washers, should be made of stainless steel to eliminate the possibility of rust and corrosion.
- When installing a free-standing ground-mounted system, ensure the appropriate height of the support module mounting structure is selected. The height must be sufficient to prevent the lowest edge of the module from being covered by snow for extended periods in regions that experience heavy snowfall.
- If snow accumulates on the PV modules, regular cleaning of snow and other foreign particles is highly recommended to ensure long-term reliability. Failure to do so may result in deformation or damage to the module, which will not be covered under warranty.
- Note: All installation methods listed are for reference only. The EPC contractor or system installer is responsible for PV system design, mechanical load calculations, installation, and system safety.
- Modules must be firmly secured in a manner capable of withstanding all expected loads, including wind and snow. Mounting holes are provided for proper mechanical installation.
- Modules shall be installed so that the junction box remains in the uppermost position to minimize moisture or water ingress.
- Appropriate materials must be used for mounting hardware to prevent corrosion of the module frame, mounting structure, and associated components.
- When installing solar modules on a roof, always maintain a safe working distance between the roof edge and the outer edge of the solar array.
- Avoid mounting methods that block the drainage holes in the module frame. Drain holes must remain unobstructed at all times during installation and operation.
- A minimum spacing of 10 mm to 10.5 mm should be maintained between two modules to accommodate the linear thermal expansion of the module frames.
- Adequate clearance between the module frame and mounting surface is required to allow cooling air circulation behind the module. This helps dissipate condensation or moisture. Modules must never be sealed directly to the mounting surface in a way that prevents airflow underneath.
- For roof-mounted systems, ensure sufficient rear ventilation with a minimum gap of 100 mm (4 inches) for proper cooling of the modules.



7.1 MECHANICAL MOUNTING METHODS

A. MOUNTING WITH BOLTS

ARMY SOLAR modules must be mounted using the designated mounting holes located on the rear side of the frame, along with appropriate stainless steel nuts, bolts, and washers. Only stainless steel fasteners are recommended to ensure durability and corrosion resistance.

Module mounting must utilize the pre-drilled mounting holes provided in the frame. The length of the mounting screw should be selected by maintaining a clearance of 5–10 mm between the back face of the module and the screw face to prevent damage during tightening.

Recommended Tightening Torque:

For M6 bolts and nuts: 12 Nm (8.85 ft-lbs)

For M8 bolts and nuts: 15–20 Nm (11.06–14.75 ft-lbs)

Ensure that all clamps, bolts, and associated hardware are made from corrosion-resistant materials.

Note:

Do not drill additional mounting holes in the frame or glass surface of the module.

Doing so will void the product warranty.

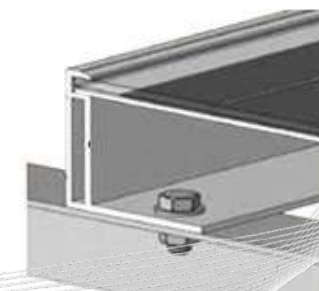
Applied torque must comply with the mechanical design standards corresponding to the bolt type being used.

For mounting hole size 8 x 12 mm – Use M6 bolts.

For mounting hole size 9 x 14 mm – Use M8 bolts.



1. Aluminium Frame Appropriate
2. Stainless Steel bolts
3. Flat Stainless Steel washer Spring
4. Stainless Steel washer
5. HEX Stainless Nut



B. MOUNTING WITH CLAMPS

Each ARMY SOLAR module must be securely fixed to the mounting structure at a minimum of four points.

Module clamps must:

- Not come into contact with the front glass
- Not deform the module frame
- Avoid causing shadowing effects on the module

The clamp must overlap the module frame by at least 8 mm (0.32 in) and no more than 11 mm (0.43 in).

The module frame must not be modified under any circumstances.

When using the clamp-mounting method:

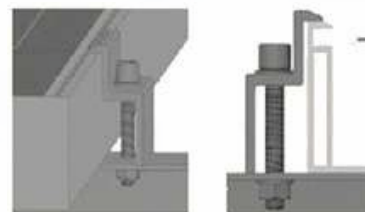
- Use at least four clamps per module
- For portrait orientation: two clamps on each long side
- For landscape orientation: two clamps on each short side

Depending on local wind and snow load conditions, additional clamps may be required to ensure adequate load-bearing capacity.

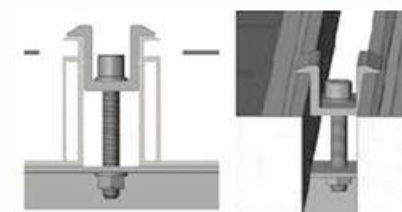
The applied torque must be sufficient to secure the module firmly. For safety, always follow the clamp manufacturer's torque recommendations.

End and mid clamps should be tightened using a standard drill or, preferably, a torque wrench. Clamp materials must be stainless steel or anodized aluminum alloy to ensure corrosion resistance.

End Clamp installation



Middle Clamp installation



Guidelines for Bifacial Module Installation:

1. Regular 2P Arrangement

A regular 2P arrangement may be considered, using bolt and/or clamp mounting along with the purlin for bifacial module installation.

2. Landscape Arrangement

Landscape arrangement may be used with the purlin positioned between module spaces/frames.

3. End Clamp Installation

Maintain a minimum distance between the MMS purlin and the rear side of the bifacial module to prevent hotspot generation.

Rear-side shading loss should not exceed 5%.

ARMY SOLAR recommends increasing the steel section of the MMS structure to accommodate additional load-bearing requirements.



2400Pa (1600Pa with design safety factors $\gamma_m=1.5$ load condition)

5400Pa (3600Pa with design safety factors $\gamma_m=1.5$ load condition)

Different mounting configurations may be implemented based on the installer's structural calculations. However, failure to comply with the above recommendations may reduce load-handling capability and lead to failure under overload conditions, which will not be covered under the ARMY SOLAR warranty.

Before designing the mounting structure, the following design safety factors must be considered:

Safety Factor (γ_m) = 1.5

Positive Load = 3600 Pa

Negative Load = 1600 Pa

These parameters must be evaluated to prevent site failure.

In regions with heavy wind speeds or significant snowfall, additional countermeasures may be required, such as:

Use of additional clamps

Use of longer clamps

Installation of additional support bars

These measures help prevent potential module damage.

The PV system EPC team (Designer and Installer) is responsible for accurate load calculations and ensuring that the module supporting structure meets all applicable standards and requirements.

The ARMY SOLAR warranty will be void in cases where improper clamps or incorrect installation methods are used.



D. MOUNTING GUIDELINES FOR PV MODULES WITH TRACKER SYSTEM

Do not drill additional mounting holes in the frame or glass surface of the module. Doing so will void the ARMY SOLAR warranty.

Before installation, the following points must be addressed:

1. Carefully inspect the module for any visible damage.
2. Ensure the module is thoroughly cleaned to remove dirt, dust, or residue that may have accumulated during shipping.
3. Verify the serial numbers of the received PV modules for proper documentation and traceability.

Ensure that the backsheet or rear glass of the modules does not come into contact with brackets or mounting structures that could puncture or damage the module.

If local wind or snow conditions create the possibility of high-pressure loads, additional support may be required. This can include:

- Longer clamps
- Additional rails
- Support bumpers

These measures ensure the module can withstand high wind loading.

The mounting structure must be constructed from durable materials that are resistant to corrosion and UV radiation.

In regions with heavy winter snowfall, the height of the mounting system should be adjusted to ensure that the lower edge of the module remains free from snow accumulation.

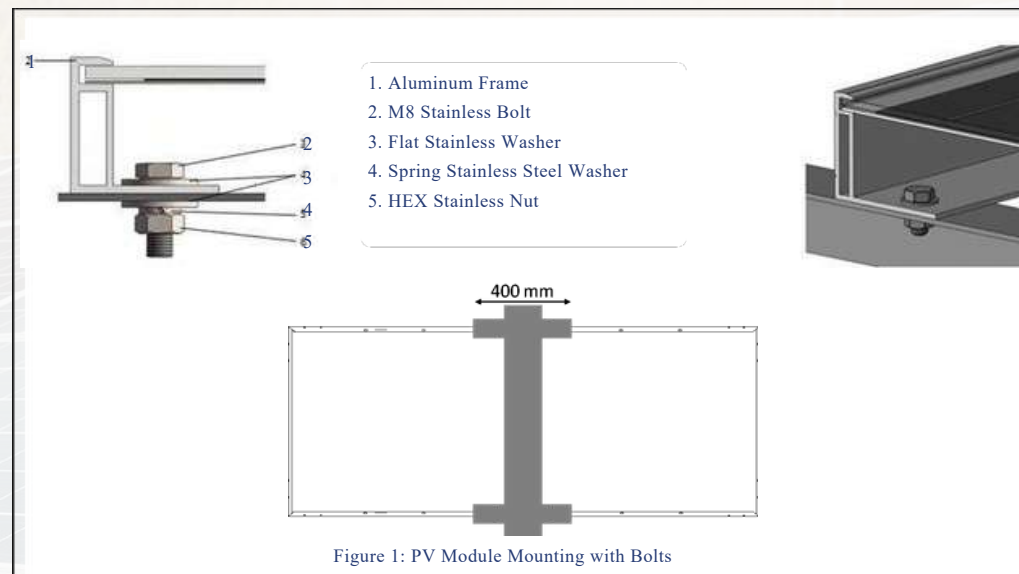
MOUNTING WITH BOLTS

The module clamps must not touch the front glass and must not cause any deformation of the frame. Ensure that clamp placement does not create shadowing effects on the module surface. When using this clamp-mounting method:

- A minimum of four clamps per module must be used.
- Two clamps should be securely attached to each of the longer sides of the module.

If high-pressure loads are expected due to local wind or snow conditions, additional clamps or structural supports may be required to ensure the module can withstand the load.

The applied torque must be sufficient to securely fasten the modules. It is recommended to follow the torque and installation guidelines provided by the clamp supplier when mounting PV modules, especially for tracking systems.



MOUNTING WITH CLAMPS

ARMY SOLAR modules are equipped with:

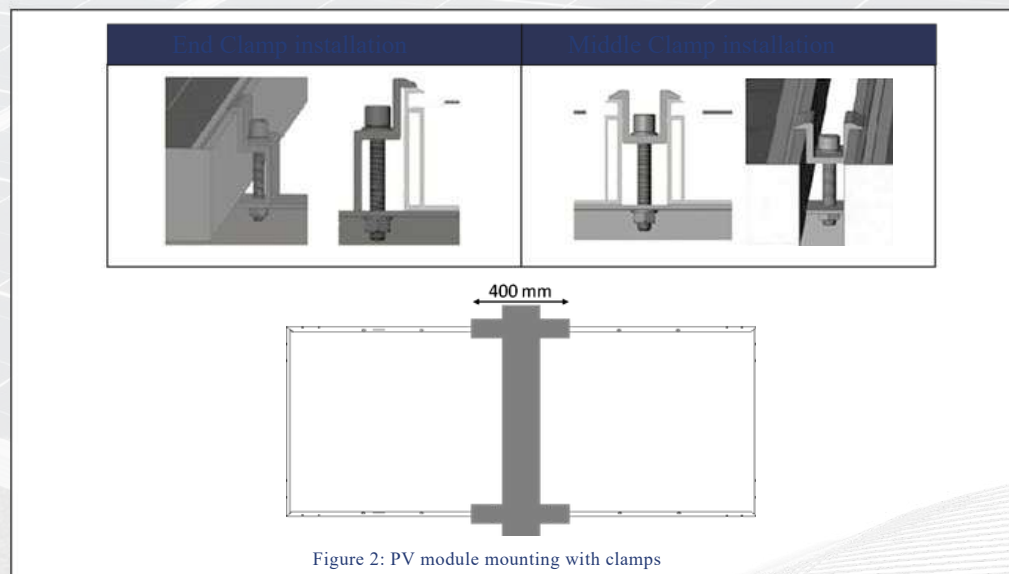
- 4 mounting holes (14 mm (L) × 9 mm (W)) compatible with M8 bolts
- 8 additional mounting holes (400 mm spacing) compatible with M6 bolts, specifically designed for connection with tracking systems

Modules must be secured to the mounting bracket by fastening bolts through the mounting holes located on the back side of the frame, as per installation design.

Recommended Tightening Torque:

- For M6 bolts and nuts: 8–12 N·m
- For M8 bolts and nuts: 12–16 N·m

Ensure that all clamps, bolts, and mounting hardware are made of corrosion-resistant materials.



E. Universal InvisiMount Clamping

(Mounting with Universal End Clamps & Universal Mid Clamps)

Position the first module of the row on top and at the end of the rails. Tilt the module as necessary to connect the module junction box (J-box) leads to the MI previously attached to the rail.

For each rail end:

- Insert the upper silver piece of the end clamp into the top channel of the rail.
- Fit the tabs of the lower black piece of the end clamp into the main channel.
- Slide the entire assembly inward while pressing on the bolt head to move the clamp as far as possible.
- Lower the module back down onto the rails.
- Verify that the module is correctly positioned and flush with the edge of the rail. Tighten each end clamp bolt to 85 +5/-0 in-lb (9.6 N·m) using a 10 mm socket. The clamp will compress and securely hold the module frame.
- Tug upward on the module to confirm that the clamp is properly engaged and securing the module.
- Position the second module next to the first. Connect the J-box leads to the MI previously attached to the rail, then lower the module onto the rails.

For each of the two mid clamps:

- Slide the clamp so one side fully engages the frame of the first module.
- Slide the second module toward the first until its frame fully engages with the other side of the mid clamp.

On the opposite side of the module:

- Insert one mid clamp into the top channel of each rail.
- Rotate the clamp 90°.
- Slide it toward the first module.
- Leave the mid clamps loose until final alignment is complete.
- Once proper alignment and spacing are confirmed, tighten all mid clamps according to the specified torque requirements.





- Add and tighten the last module's two end clamps.
 - Tighten each of the two mid clamps to 85 +5/-0 in-lb (9.6 N·m).
- Each module frame must be fully engaged with both sides of the mid clamp to ensure:

- Proper contact with the bonding washer
- Electrical continuity of the module-to-rail grounding path

For the last module in the row:

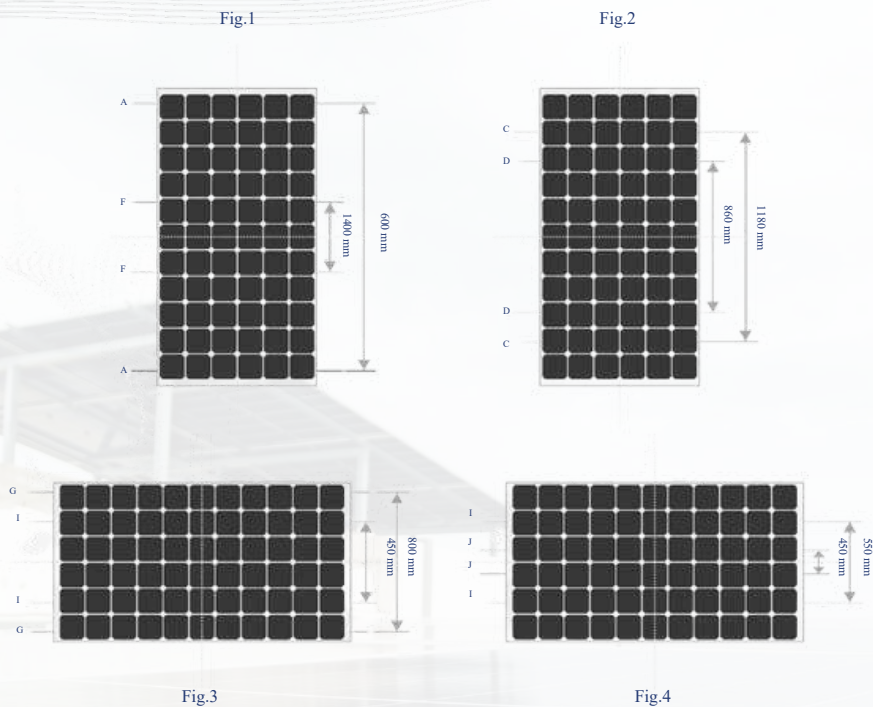
- Position the module on the rails in the desired final location.
- Mark a cut line on each rail at the edge of the module.
- Remove the module before cutting to prevent damage.
- Carefully cut the rails along the marked lines.
- The maximum permitted overhang of the module beyond the rail is 1/4 inch (0.6 cm).

After cutting:

- Reposition the module on the rails.
- Connect the junction box (J-box) leads to the MI on the rail.
- Lower the module into place.
- Install the two mid clamps (these will also secure the second-to-last module in the row).
- Tighten the mid clamps to the specified torque.
- Repeat the above steps until all modules in the row are installed, leaving only the final module to be completed as described.



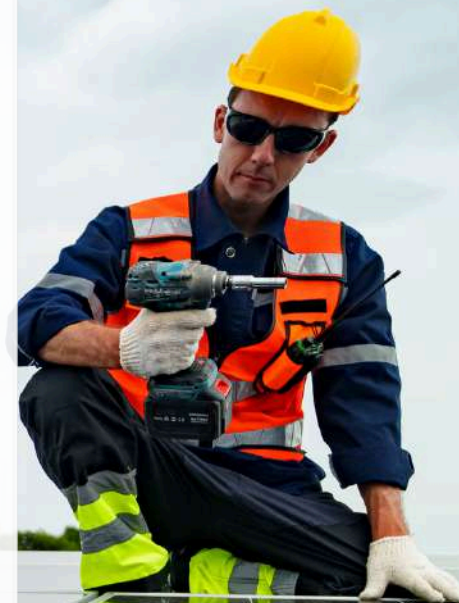
F. APPENDIX



Various Module mounting position in Portrait and Landscape configuration with maximum allowed testing loads

Module orientation	Figure	Rail Mounting Range (mm)	Test Load (Pa)
Portrait	Fig.1	A-F=1400-600	+3000/-2800
Portrait	Fig.2	C-D= 860-1180	+6000/-3600
Landscape	Fig.3	G-J = 800-450	+3000/-2000
Landscape	Fig.4	I-J = 550-450	+4500/-2000

Note: The above mentioned Test load in Pascal are the maximum test loads upward and downward considering EL, visual and electrical performance meeting the IEC 61215 & IEC 61730 requirements. Consider Test Load = Safety Factor * Design Load
 Safety Factor = 1.5



G. Guidelines to be followed while dealing with AC modules:

Introduction, Construction and Functioning of AC Modules



Figure: Army AC module along with components description



Extension Cable & Connector Components

1. Extension Cable (serviceable as a transition cable): Equipped with both female and male connectors paired with male and female end caps.
2. Male Connector: Can be used for connection with a female connector or a female end cap.
3. Female Connector: Can be used for connection with a male connector or a male end cap.
4. Female End Cap: Used for sealing a male connector.
5. Male End Cap: Used for sealing a female connector.
6. Unlocking Tool: Used for handling and safely disconnecting male and female connectors.

AC Module- List of Components and Functioning:

1. DC Module: Converts incident solar irradiation into DC power.
2. Junction Box (JB): The DC module output terminals connect to the junction box. From the JB, DC cables connect to the micro-inverter (MI) input terminals.
3. DC Cable with Male and Female Connectors: Used for connection to the micro-inverter input terminals.
4. Micro-Inverter (MI): Converts DC power generated by the PV module into usable AC power.
5. AC Module Frame: A structural system designed to protect and support the ARMY SOLAR AC Module.
6. AC Cable with Male Connector: From the MI output socket, the AC cable male connector connects to an AC cable female connector or a female end cap.
7. AC Cable with Female Connector: From the MI output socket, the AC cable female connector connects to an AC cable male connector or a male end cap.
8. Product Label: Displays product specifications and technical information.
9. Model Number: Indicates the specific model identification of the ARMY SOLAR AC Module.

The ARMY SOLAR AC Module consists of a standard DC module with a pre-installed micro-inverter mounted on the rear side of the DC module. This eliminates the need for any additional micro-inverter installation or external connection between the DC module and micro-inverter.

Working Principle

- During the daytime, the AC module converts incident solar irradiation into DC power.
- The integrated micro-inverter converts the DC power into AC power.
 - The AC power can either be consumed by home electrical appliances or supplied to the utility grid.

If the micro-inverter is not connected to the grid, the LED indicator on the micro-inverter will illuminate red.

- Communication & Monitoring
- Power Line Communication (PLC) is used as the communication medium for data collection between the micro-inverter and the communication gateway box.
 - The communication gateway box transmits data to a web server via Home Wi-Fi or LAN cable

Users can access:

- Daily energy generation data
- Monthly performance reports
- Annual energy statistics

This information is available through the online monitoring application.

The communication gateway box, along with all required cabling and accessories, will be provided and installed by the system installer.

Guidelines for Installing ARMY SOLAR AC Modules

- ARMY SOLAR AC modules must be connected using appropriate AC cables and approved accessories. Installers are strongly advised not to cut, modify, or alter any connectors or cables attached to the modules.
- To ensure proper air circulation on the rear side of the AC module, maintain a minimum gap of 10 cm (4 inches) between the roof surface and the back side of the module.
- For secure fixation and reliable electrical connection, the AC module frame and mounting racking system must be adequately fastened to prevent loosening during operation, which could result in module damage or safety hazards.
- The recommended tightening torque for the AC module fixation using bolts is 4–5 Nm.
- Maintain a minimum gap of 6 mm (0.236 inches) between two adjacent AC modules when installed on the racking system.
- The minimum recommended standoff height is 1.5 inches (3.8 cm).
- Use of alternative mounting methods may affect the UL listing or fire class rating of the module.

The modules have been evaluated by UL for:

- Maximum positive design load: 30 psf
- Maximum negative design load: 30 psf (Applicable for bolt and clamp installation methods.)

AC modules must be mounted using racking and mounting systems that are certified and listed for system fire class rating in accordance with:

- UL 1703 (Edition 2014)
- UL 2703 (Edition 2014)

When transitioning from the AC module cabling system to other wiring methods, use an appropriate AC transition cable adaptor.

The integrated micro-inverters in ARMY SOLAR AC modules are compatible with:

- 240VAC / 120VAC
- 208VAC / 120VAC

(As per system configuration and frequency requirements.)

It is highly recommended not to install AC modules at very low inclination angles, as this may result in dirt accumulation on the front glass, potentially leading to long-term performance degradation.

Grounding Requirements During installation, note that grounding is achieved through secure attachment of the module to the array frame. The array frame must be grounded in accordance with NEC (National Electrical Code) guidelines. Detailed grounding instructions are provided in the Wiring Section of this installation manual.



Guidelines for mounting AC photovoltaic module :

01) Take the rail on which PV module will be mounted (Refer Fig. 1)



(Fig. 1)

03) Insert mid clamp in rail (Refer Fig. 3 & 4).



(Fig. 3)



(Fig. 4)

05) For each mid clamp, fit one side (two teeth) of each clamp over the respective adjacent frame edge of the two modules (Refer Fig. 6 and 7).



(Fig. 6)



(Fig. 7)

After fixing and tightening, the AC module mounting on rails will be completed.

Please note : the maximum allowable test load is mentioned in below table.

Module orientation	Rail Mounting Range (mm)	Test Load (Pa)
Portrait	A-B=860-1160	+7000/- 4000

02) Insert T-bolt into side of rail and rotate and fix the L-foot (Refer Fig. 2).

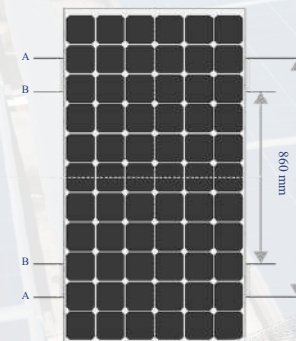


(Fig. 2)

04) Now place the PV module on rail as shown in (Fig. 5)

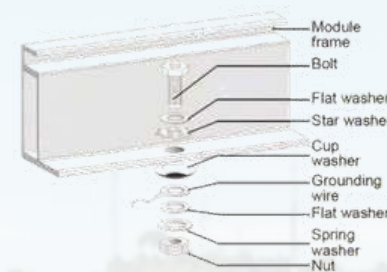


(Fig. 5)

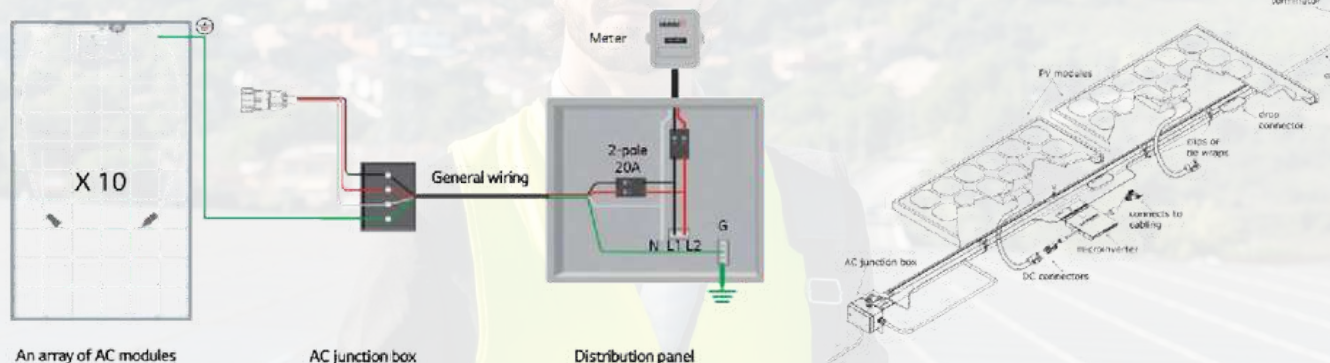


Electrical connection of AC modules & Racking System

All AC cable connectors need to be installed under the AC modules to prevent direct exposure to the sun and rain. AC cables need to be kept away from the ground or roof surface. Use proper cable clips for attaching AC cables on structure/racking system. The sizing of AC cables needs to be finalized as per the NEC 2014 guidelines.



Connection of AC modules to AC junction box and distribution panel:



AC Cable Installation & Electrical Configuration (Applicable to ARMY SOLAR AC Modules)

The AC cable is installed by rolling out the required length and cutting it to the appropriate size.

- One end of the cable is wired directly into the junction box at the head of the branch circuit, eliminating the need for a separate AC interconnect cable.
- The other end must be sealed using a Branch Terminator to protect it from environmental exposure.
- The micro-inverter AC cable connectors are then plugged into the regularly spaced connectors provided along the cable.

Connector Spacing Options The gap between connectors on the AC cable can be:

- 1.025 meters (40 inches) – Recommended for PV modules installed in portrait orientation.
- 1.7 meters (67 inches) – Recommended for PV modules installed in landscape orientation.

Proper selection of connector spacing ensures neat installation and reliable system performance.

Voltage Configurations

ARMY SOLAR AC modules are compatible with the following voltage systems:

- 240VAC Split Phase
- 208VAC Three Phase

Residential Applications

- 240VAC split phase systems include four conductors.
- This cabling may also be used for split-phase 208VAC applications.

Commercial Applications

- Three-phase 208VAC systems include five conductors.
- Typically used for commercial installations.

Transitioning & Code Compliance

- Proper transitioning cables must be used when connecting an array of ARMY SOLAR AC modules to the AC junction box.
- All wiring must comply with NEC Article 705.
- Grounding methods must comply with NEC Article 250.

Important Safety Instructions

In addition to the safety instructions mentioned in Section 4 of this installation manual, the following additional safety guidelines must be strictly followed while installing and handling ARMY SOLAR AC Modules.

Failure to comply with these instructions may result in equipment damage, serious injury, or fatal hazards to operating personnel.

General Safety Guidelines

- Do not use or install AC modules if the module is broken or damaged.
- AC modules must be stored in original packaging prior to installation.
- Artificially concentrated sunlight must not be directed onto the module.
- For proper operation, AC modules or AC module arrays should be connected only to a dedicated branch circuit.
- Removing the micro-inverter cover may void the warranty. There are no serviceable parts inside.
- Do not bend AC cables while under stress, as this may result in module damage.
- Do not install AC modules in locations where the maximum ambient temperature exceeds 65°C (149°F).
- In areas prone to frequent lightning or storms, additional grounding (direct grounding of the AC module system) may be required and must be installed by the EPC contractor.
- Always verify installation requirements and comply with applicable local electrical codes before installation.

Connector & Electrical Safety

- AC module connectors are weatherproof and sunlight-rated AC locking connectors.
- Once connected, a special tool is required for disconnection.
- Only trained and certified personnel are permitted to disconnect modules, especially while under load.
- Although AC connectors are rated to interrupt load current, it is strongly recommended to open the dedicated branch circuit breaker before plugging or unplugging connectors.
- Never disconnect cable connectors while the system is in operation to prevent electric shock or arcing hazards.
- If any damage occurs during operation & maintenance (O&M) or servicing, damaged modules must be handled using appropriate personal protective equipment (PPE).

Mounting & Mechanical Installation

- The bolting mechanism involves fixing bolts through manufacturer-provided holes on the AC module frame to the PV racking system.
- Installation may use bolts with mid-clamps or clamps/fixing plates only.
- In all cases, installation must follow ARMY SOLAR instructions along with bolt and/or clamp manufacturer specifications.
- Detailed mounting guidelines are provided in Section 7.1 A & B.
- In regions subject to extreme windstorms or hailstorms, additional structural support may be required to prevent module damage.

AC Cable Connector Guidelines

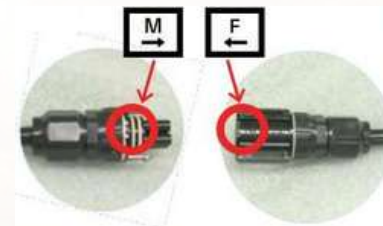
- While connecting AC cable connectors, ensure proper alignment of the “Fool-Proof System” on each connector.
- A secure connection between male and female connectors is only possible when properly matched.
- Insert the connector fully until a clear click sound is heard, confirming secure locking.

Electrical Ratings & Breaker Selection

- For IQ Cable with 12 AWG stranded conductors designed per NEC standards and applying a 1.25 safety factor:
- Maximum current per phase: 16A (as per NEC calculation).
- Breaker selection must follow:
- $\text{Circuit Current} < \text{Breaker Rated Current} < \text{Cable Current Capacity}$

System Design Recommendations

- Maximum output current per AC module: 2 Amperes
- Maximum AC modules per single-phase 240V system: 10 modules
- Recommended circuit breaker rating: 20–25 Amperes
- Recommended trunk cable capacity: 25A or above
- System Configuration Limits
- Use a multimeter to verify system voltages before installation:
- 240VAC Split Phase (L1-L2 = 240V, L1-N & L2-N = 120V)
- Maximum: 10 AC modules per 2-pole 20A breaker
- 208VAC Split Phase (L1-L2 = 208V, L1-N & L2-N = 120V)
- Maximum: 8 AC modules per 2-pole 20A breaker
- 208VAC Three Phase (L1, L2, L3, 120V Line-to-Neutral)
- Maximum: 15 AC modules total
- (Not more than 5 modules per phase)
- Use a 3-pole 20A circuit breaker



7.2 GROUNDING – ARMY SOLAR PV Modules

An ARMY SOLAR module is considered compliant with applicable standards only when it is mounted in accordance with the specified mounting instructions. A module with exposed conductive parts is considered compliant only when it is electrically grounded as per the manufacturer's instructions and the requirements of the National Electrical Code (NEC), ANSI/NFPA 70 (2014–2017). Module frames must be connected to an earth ground to ensure safety and protection against lightning. A secure and reliable connection between the grounding hardware components is essential for effective grounding. The anodized coating on the module frame provides corrosion resistance; however, it acts as a barrier that can reduce grounding effectiveness. Therefore, the grounding hardware must penetrate the anodization layer to establish proper electrical continuity.

Proper grounding is achieved by continuously bonding the module frame(s) and all metallic structural members together using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or any other material approved for use as an electrical conductor. All grounding devices must be installed strictly in accordance with the grounding device manufacturer's specified instructions, and grounding continuity must be verified to ensure proper bonding throughout the system. Please avoid negative bias of the cells with respect to the grounded frames. ARMY SOLAR modules may also be installed using third-party listed grounding devices for grounding the metallic frames of PV modules, provided that such devices are installed according to the grounding device manufacturer's instructions. Improper grounding may result in electrical hazards, equipment damage, or warranty voidance.

We also recommend using the following methods to ground installation properly under UL investigation.

Method 1: Tyco grounding bolt # 2058729-1:

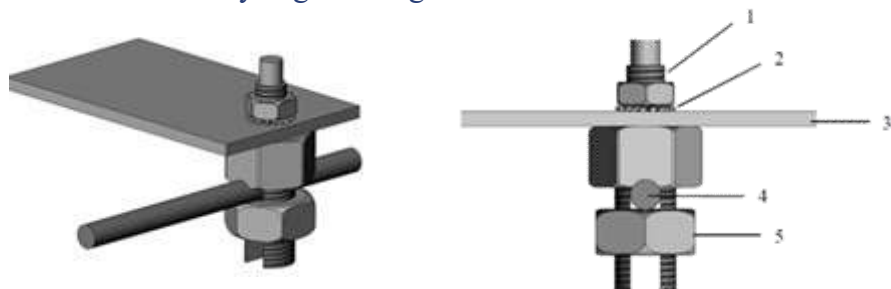


Fig: Grounding bolt # 2058729-1

- 01) Wire bolt and slot
- 02) Mounting wash hex nut
- 03) Aluminium frame

- 04) 4 to 16 mm² cable
- 05) HEX nut

Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut. Electrical contact is made by penetrating the anodized coating of the aluminium frame and tightening the mounting hex nut (come with the star washer) to the proper torque of 25lbf.in. Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.

The wire binding bolt should be tightened to the proper torque of 45lbf.in

Method 2: Grounding bolt #1954381-2:

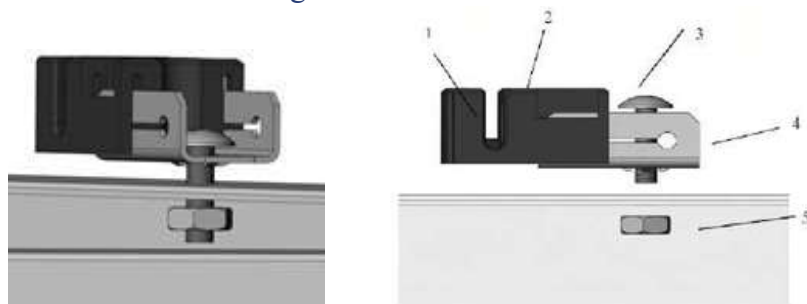


Fig: Grounding bolt # 1954381-2

- 01) Wire slot (available for 4-6 mm² cable)
- 02) Slider
- 03) Bolt

- 04) Base
- 05) Nut

Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut. Electrical contact is made by penetrating the anodized coating of the aluminium frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25 in lb. Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt. The wire binding bolt should be tightened to the proper torque of 45 in lb. The Tyco grounding bolt is only listed for use with 6 to 12 AWG bare solid copper wire.

Method 3: ERICO grounding bolt # EL6CS



Fig: ERICO grounding bolt # EL6CS

- | | |
|-----------------------|---|
| 01) Machine bolt A | 05) Clearance hole for #10[M5] machine bolt |
| 02) Machine bolt B | 06) Aluminium frame |
| 03) Belleville washer | 07) Machine bolt hex nut with lock washer |
| 04) Flat washer | 08) Grounding bolt |

The lug should be installed on a surface that is larger than the bottom surface of the lug. The lug should be installed in the grounding holes provided on the PV module. Machine bolt A should be torqued to 35 in lb to secure the grounding bolt to the module frame. The grounding bolt is only listed for use with 6-12 AWG bare solid copper wire. For proper wire binding, machine bolt B should be torqued 35 lb.

7.3 MODULE WIRING

System Design Formula

Maximum System Voltage

Max System Voltage = $X \times Voc \times \left[1 - \left(\frac{\beta}{100} \right) \times (25 - T_{min}) \right]$

Minimum String Fuse Rating

Minimum String Fuse Rating = $I_{sc} \times 1.25 \times \text{Max}(1.175 I_m)$

Parameter Definitions:

- X – Number of modules connected in series
- Voc – Open circuit voltage of each module (Refer to the Data Sheet)
- β – Temperature coefficient of open circuit voltage (in %)
- Tmin – Minimum ambient temperature at the plant location
- Isc – Short circuit current of each module at 0% bifacial gain (for bifacial modules) (Refer to the Data Sheet)
- Im (Simulated) – Highest 3-hour current average resulting from simulated local simultaneous irradiance on front and rear sides of the PV array, accounting for elevation and orientation
- Im (MPP) – MPP operating current at 0% bifacial gain (for bifacial modules) (Refer to the Data Sheet)

The maximum system voltage must be lower than the certified system voltage (typically 1500 V) and must not exceed the maximum input voltage rating of the inverter.

The actual maximum system voltage and minimum string fuse rating of the installed system should be calculated using the above formulas to determine the recommended maximum series and parallel module configurations.

Wiring Instructions:

- All wiring must be performed by qualified installers.
- All electrical work must comply with applicable local electrical codes and regulations.

Modules can be connected in series to increase operating voltage by connecting the positive connector of one module to the negative connector of the next module.

Before connecting modules:

- Ensure connectors are clean, dry, and free from corrosion.
- Confirm proper polarity before making connections.

The positive connector plug of one module must be connected to the negative connector plug of the next module until a **click sound** is heard. The click confirms a secure connection.

⚠ Warning:

The product can be irreparably damaged if an array string is connected in reverse polarity. For example:

- Positive end connected to the negative input of the string combiner box
- Negative end connected to positive input

Proper polarity must always be maintained.

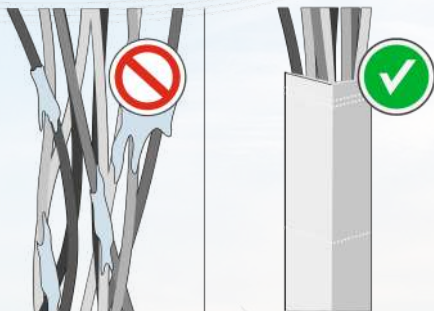
If reverse polarity or a voltage difference greater than 10 V is observed, immediately inspect and correct the string configuration.

ARMY SOLAR modules are supplied with standard cables featuring:

- 4 mm² cross-sectional area
- Rated up to 1500 V (IEC & UL)
- Temperature rating of 90°C
- UV-resistant construction

Ensure that cables are not exposed to waterlogged areas.

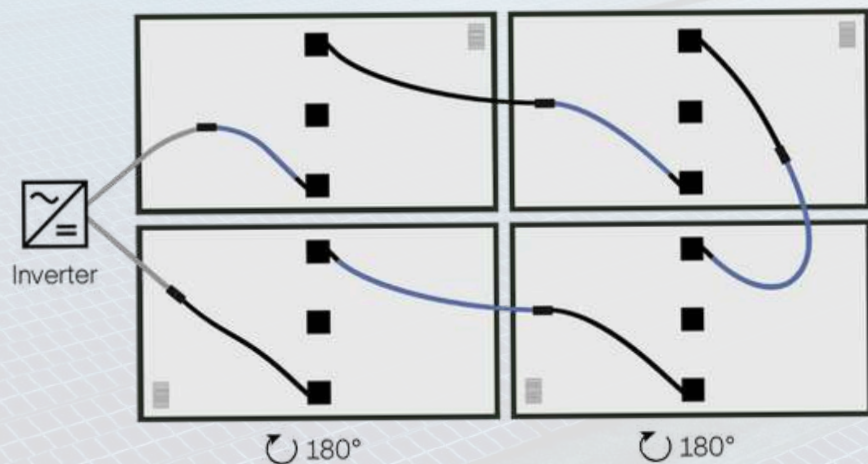




The minimum bending radius cables should be 43mm (1.69in).



- Army 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.
- When reverse currents can exceed the value of the maximum protective fuse, a properly rated and certified overcurrent 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 connections; failure to do so may result in damage to the module.
- 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, cables, and connectors shall not be altered under any circumstances. Modules with a suspected electrical problem should be returned to Army Solar for inspection and possible repair or replacement as per the warranty policy provided by Army Solar.



8. ELECTRICAL CONFIGURATION

Photovoltaic (electric) systems operate automatically and require very little day-to-day supervision. The solar array generates DC electricity whenever light falls on it. Similarly, the inverter automatically turns ON as soon as there is sufficient energy from the solar array to be efficiently connected to the grid. Solar modules are rated to operate at potentially lethal DC voltages that can cause severe electrical shock, arcing, and fire hazards. While some solar modules manufactured by Army Solar are certified to operate up to 1500 V DC, always check the module back label to confirm the actual rating of your product before making connections.

It is recommended to use a suitably rated isolator (DC switch) to interrupt the current flow before disconnecting the connectors. Even after disconnecting, DC power may remain active for some time. Therefore, only qualified and experienced personnel are recommended to work on the panels, string combiner box, and related components. Army Solar will not be responsible for any electrical accidents occurring in power plants using Army Solar modules.

8.1 FUSE

When fuses are fitted, they should be rated for the maximum DC voltage and connected in each non-grounded pole of the array (i.e., if the system is not grounded, fuses should be connected in both the positive and negative poles).

The maximum rating of a fuse connected in series with an array string can be found on the product label and in the product datasheet. This fuse rating value also corresponds to the maximum reverse current that a module can withstand. When one string is shaded, the other parallel strings of modules may be loaded by the shaded string and current will flow. Therefore, this value directly impacts the maximum number of strings that can be connected in parallel.



8.2 INVERTER SELECTION AND COMPATIBILITY

Only connect the quantity of modules that corresponds to the voltage specifications of the inverters used in the system. When installed as per IEC norms and regulations, Army Solar modules normally do not need to be electronically connected to earth and can operate with either galvanically isolated (with transformer) or transformerless inverters.

If the system is located in hot and very humid locations, then galvanically isolated inverters with transformers must be used and the negative pole of the array must be connected to earth. It is recommended to adopt inverter negatively earthed installation to avoid the PID effect.

If a transformerless inverter is used in hot and humid climatic locations, the installer should ensure that the correct active negative earthing kit is installed by consulting and obtaining assurance from the inverter supplier.

8.3 BYPASS DIODES

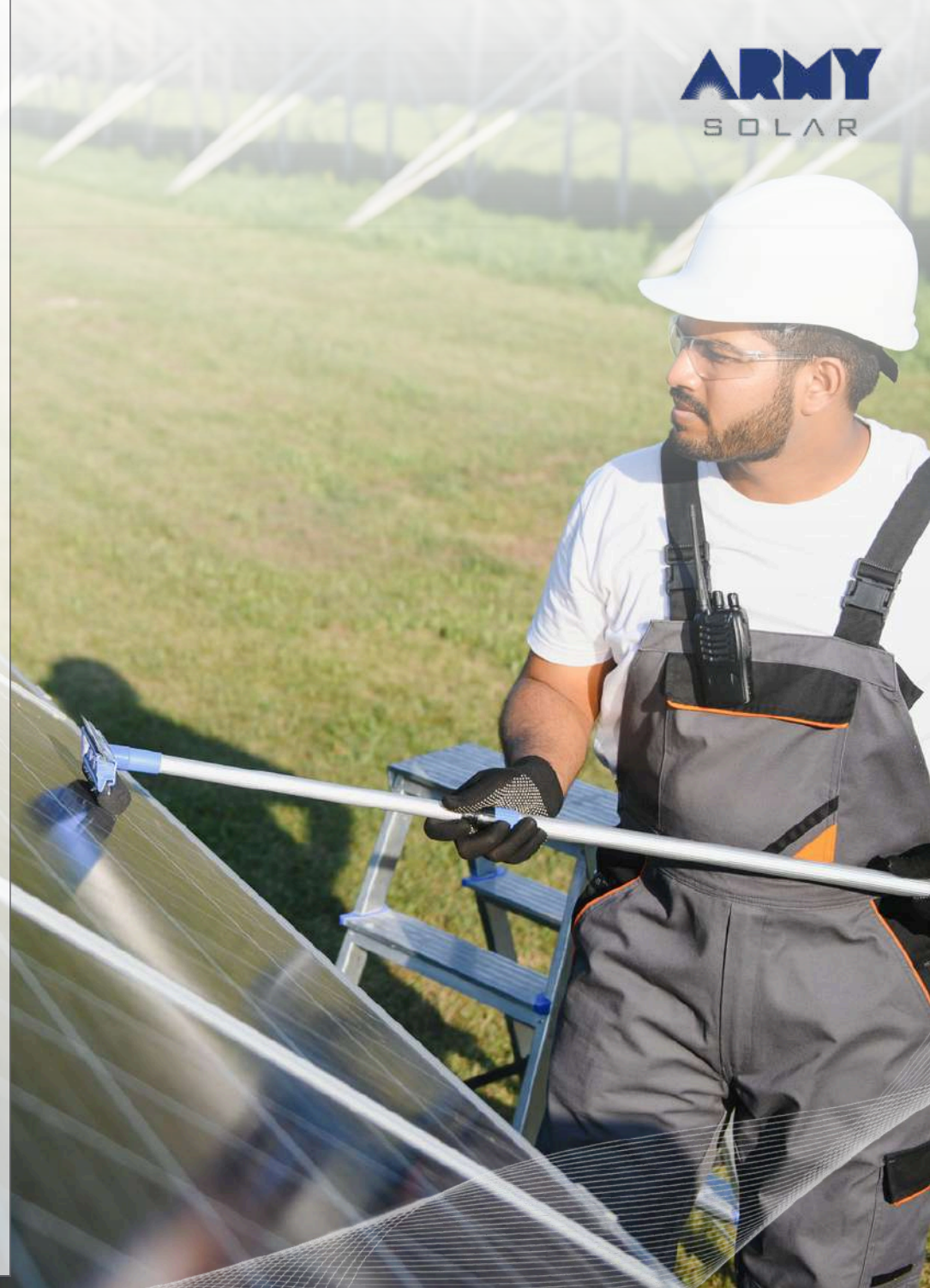
In a system using a battery, blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night.

Army Solar PV modules are equipped with bypass diodes in the junction box. This minimizes module heating and current losses. Do not attempt to open the junction box to change the diodes, even if they malfunction.



9. MAINTENANCE & CLEANING OF PV MODULE

- It is common for dust and dirt particles to accumulate on the surface(s) of Army Solar PV Modules (front and rear surfaces in the case of bifacial modules). Such accumulation can reduce optimal energy output and overall system performance.
- Under normal conditions, accumulated dust may be washed off with clean water. In certain cases, maintenance cleaning is recommended using water and a soft cloth or sponge to remove layers of dirt from the glass surface. A mild, non-abrasive detergent may be used to remove persistent dirt deposits.
- PV module cleaning must only be carried out by properly trained personnel who understand the risks associated with applying water to electrical components.
- Periodic inspection of Army Solar modules is strongly recommended. Authorized professionals should check for:
 - Damage to glass, backsheet, frame, or junction box
 - External electrical issues, loose connections, or corrosion
 - Any signs of mechanical or structural damage
 - Aggressive or abrasive cleansers and chemicals must never be used on the coated front glass. Alkali-based chemicals, including ammonia-based solutions, are strictly prohibited.
- Always wear rubber gloves for electrical insulation while maintaining, washing, or cleaning modules. Appropriate electrically insulating Personal Protective Equipment (PPE) must be worn during any cleaning or inspection activity.
- Acceptable module cleaning methods include:
 - Spraying the modules with low-pressure water that closely matches the module surface temperature
 - Using approved dry-cleaning techniques where suitable
 - Do not apply water that is more than 20°C warmer or colder than the module surface temperature. Cleaning must not be performed during power generation hours. The recommended cleaning time is from dusk to dawn, when energy production is inactive and the risk of electrical shock is minimized.
 - During generation time, module temperatures are significantly higher. Washing at this time may cause thermal stress, potentially resulting in micro-cracks in the glass or solar cells.
- Maintenance should be carried out at least once annually by trained personnel, always wearing safety gloves and safety shoes.



- Check that all string fuses in each non/earthed pole are operating.
- It is recommended to check the torque of terminal bolts and the general condition of wiring at least twice in a year. Also, check that mounting hardware is properly torqued. Loose connections will result in damage to the array.
- Replacement modules must be of same type. Do not touch live parts of cables and connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.) when handling modules.
- The amount of electricity generated by a solar module is proportional to the amount of light falling on it. A module with shaded cells will produce less energy and therefore it is important to keep modules clean.
- High pollution or close to large bird populations will require more regular cleaning.
- The back surface of the monofacial module normally does not need to be cleaned but if needed, avoid the use of any sharp projects that might penetrate the substrate material.
- For cleaning of Modules Fresh water (TDS < 1500 mg/l) may be used. If needed, a mild, non-abrasive, non- caustic detergent with a final fresh water and detergent solution mix between $6.5 < \text{pH} < 8.5$ at 25°C may be used.
- When using water, RO water provides the best results. In absence of RO water, tap water with low mineral content (total hardness <75 mg/l) or deionized water may be used. Calcium should not exceed: 75 mg/ml. Do not use solutions containing hydrochloric acid, D-Limonene, ammonia or sodium hydroxide.
- In case if soft water (with low mineral content) is not available, Module can be dry cleaned with the help of a soft cloth or with soft sponge to remove dirt, dust. One can also use wet cloth, sponge to clean dirt which is not easily removed by dry cleaning.
- Do not clean or spray water at the Junction Box.
-
- Frequency of Cleaning will vary depending upon any special conditions in the area where the Modules are installed. Modules installed in high windy or dusty areas should be inspected after more frequently: and accordingly cleaning frequency needs to be increased.

- If excessive soiling is present, a non-conductive soft brush, sponge, or other mild agitating method may be used before using water. Ensure brushes or agitating tools are not abrasive to glass.
- Module damage that arises as a result of improper cleaning will not be warranted by Army.
- To avoid dirt accumulation or white efflorescence due to water accumulation, do not install PV Modules horizontally.
- We strongly recommend cleaning of our modules on regular basis before and post installation, during commissioning and in regular operation.
- Modules when remained uncleaned for longer duration may result in formation of hotspots and other anomalies like cell burnt issues etc. which all contribute to module reliability issues. Please ensure that module front and rear surface are thoroughly cleaned for efficient generation and for prolonged useful module life.
- The soiling loss measurement needs to be performed on regular basis and decide cleaning frequency accordingly. Please ensure, in areas with snowfall or where frost accumulation may be possible, the modules needs to be cleaned on timely basis (atleast once in a month) to avoid any damage due to continuous exposure to extreme weather conditions.
- If modules are intended to operate with single axis trackers, after installation and before commissioning, the modules must be stowed at 10-20 degrees based on design and location so as to avoid water accumulation or logging on bottom edge of modules which may further lead to module damage.
- The maximum water pressure allowable for cleaning PV module is 35 bar (3.5 MPa). This pressure indicates the force with which water will hit the modules.
- For More Details, Refer to our cleaning guidelines.



Powering Strength with Sustainable Energy

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