



ISH SOLAR

PV MODULE Installation Manual

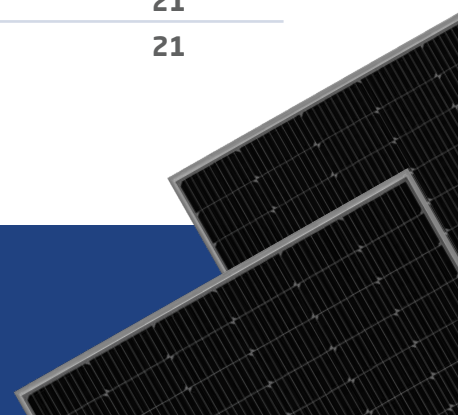
2GW
Manufacturing
Capacity



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**CLEAN PANELS
GENERATE MORE POWER.**





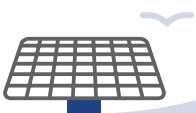
DISCLAIMER OF LIABILITY / INTRODUCTION

- This manual contains information regarding installation & safe handling of ISH Photovoltaic (PV) Modules. Since, installation and handling of ISH PV modules is beyond ISH's direct control, ISH disclaims any responsibility for Loss, Damage, Injury or Expense resulting from failure to follow instructions for proper Installation, Handling, Usage or Maintenance.
- ISH also disclaims responsibility for any infringement of Intellectual Property Rights or other rights of third parties that may arise from the use of the module. No license is granted, whether expressly or impliedly under any patent rights in this regard.
- All information provided in this manual is based on ISH's knowledge and experience. ISH reserves the right to modify this manual and module specifications without prior notice.
- The installation manual applies to 1500V DC series modules. It is advised to verify and obtain confirmation from the manufacturer regarding the rated system voltage of the product prior to panel use.



SAFETY MEASURES

- When exposed directly to sunlight, PV modules generate electricity which can cause electric shock. It is recommended to use installation equipment and as a precaution, wear safety gloves to protect yourself from electrical risks when working with modules exposed to direct sunlight. Additionally, it is recommended to avoid letting any metal come into contact with human skin
- People should not stand on the front or back side of the PV module. since uneven localized pressure could harm the solar cells within.
- PV modules require extra care. while handling because it is composed of tempered glass. It is recommended to avoid direct contact if glass breaks for any reason. Any direct contact with the broken glass surface in a moist atmosphere could result in electrical shocks. Glass in the module must be destroyed or disposed of after being removed from string once string has been separated from the load.
- Any loose connection in the PV module's connectors might result in electrical arcing and a fire danger. It is advised that onnectors should remain fully engaged/securely connected.. Additionally, make sure that every connector is free of corrosion and protected from dirt and rust. It is completely prohibited to cut or remove any PV module connector in order to make installation easier for the customer or installer. If this is done, the module will no longer be covered under warranty.
- Installing or handling PV modules in poor weather conditions such as strong winds, wet or cold roof surface is not advised for your own safety.
- Make sure that the polarity of modules (in other modules) and string (in other strings) are not inverted.
- It is not advised to focus artificial sunlight on PV modules as this may reduce their lifespan. & performance.
- ISH PV modules can be installed below a set voltage level 1500V DC and are certified to work in Class A conditions. Take this voltage range into account when building the power plant. When developing the power plant, this value should be taken into account in accordance with the temperature ranges found at the location. Combining several power classes in a single string is not recommended & may even be dangerous. Product warranties may become void if such combination causes damage to modules.
- PV modules have the ability. to produce more current and voltage than those measured under STC standards in various environmental circumstances. Water and snow reflect light which raises the intensity of the sun's rays and increases current flow and power production. For module under IEC Investigation, Under normal condition, a solar photovoltaic module may produce more current or voltage than expected during standard testing. To determine component voltage ratings, conductor current ratings, fuse sizes and controls connected to the PV output, multiply the I_{sc} and V_{oc} values marked on the module by a factor of 1.25.



A. FIRE SAFETY

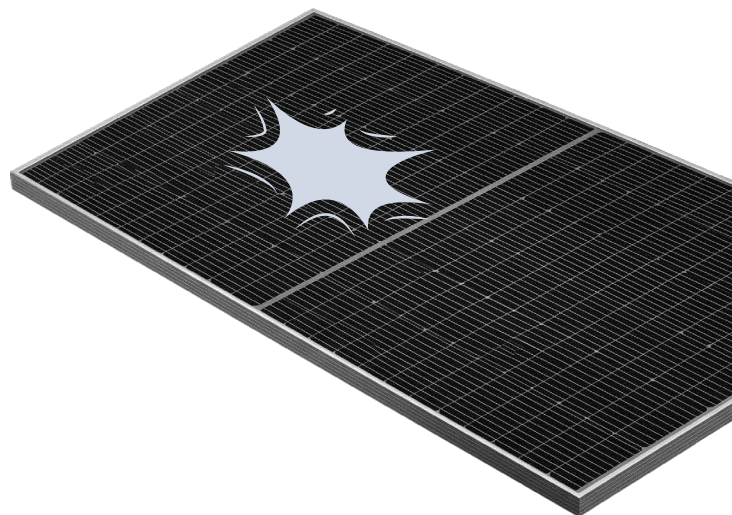
- The building's fire safety may be impacted by the top structure and installation; poor installation may result in fire hazards. Fuse and ground fault cut-out devices should be used as directed by the local authorities.

Please avoid placing the panel next to any equipment or in areas where explosive gases could be present.

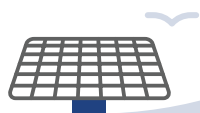
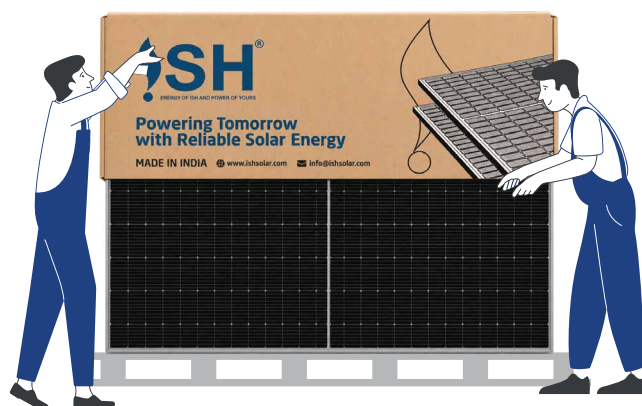
- According to IEC 61730 certification, ISH PV Modules (for modules covered by UL standard) have a Class A fire resistance rating. This PV module's fire rating is only applicable when placed in the way described in the mechanical installation instructions. Roofs with PV modules installed on them need to have a covering that is suitable for this type of fire resistance. PV modules are electricity generating equipment that could compromise a building's fire safety.
- PV modules may generate hazardous voltage or surge current in the event of a fire, even if they are disconnected from the inverter, have been partially or completely destroyed, or have had the exposed wiring destroyed. In the event of a fire, alert the fire/safety team of the specific risks presented by the PV system and avoid contact with any PV system components both during and after the fire until all essential steps have been taken to reduce the risk

PV MODULE UNPACKING, HANDLING AND STORAGE

 Please handle solar panels with care! Avoid dropping any sharp or heavy objects on them, as this can cause damage. Ensuring their safety helps maintain their efficiency and longevity



- Verify the product information as requested when the PV modules are received. The packing list, which is pasted outside the box has all the information including the module serial number.
- Pallets or packing boxes should not be stacked higher than two boxes high. Pallets should have an external protective cover put if they are being temporarily stored outside and the stack height shouldn't be higher than one pallet.
- As seen in the picture, two persons unpack from the vertical side throughout this process.



1. PRECAUTIONS FOR FORKLIFT HANDLING

- Only authorized personnel should be allowed to operate forklifts.
- Loading and unloading requires selection of a suitable forklift based on the pallet dimensions and weight. (As a rule of thumb, the forklift capacity should be double the pallet weight).
- The fork spacing should be adjusted based on the pallet dimensions and weight to ensure that the load is evenly distributed between the forks.
- Forks that are less than $\frac{3}{4}$ of the size of the pallet should be equipped with substantial sleeves before carrying out the activity.
- To ensure minimal vibration and smooth unloading of the modules, utilize bigger capacity and longer length forks.
- Avoid contacting the module box or pallet with sharp objects such as forklift fork corner to prevent damage to the internal PV modules.

During loading and unloading, at least a single professional must be present to direct the forklift driver with proper directions.

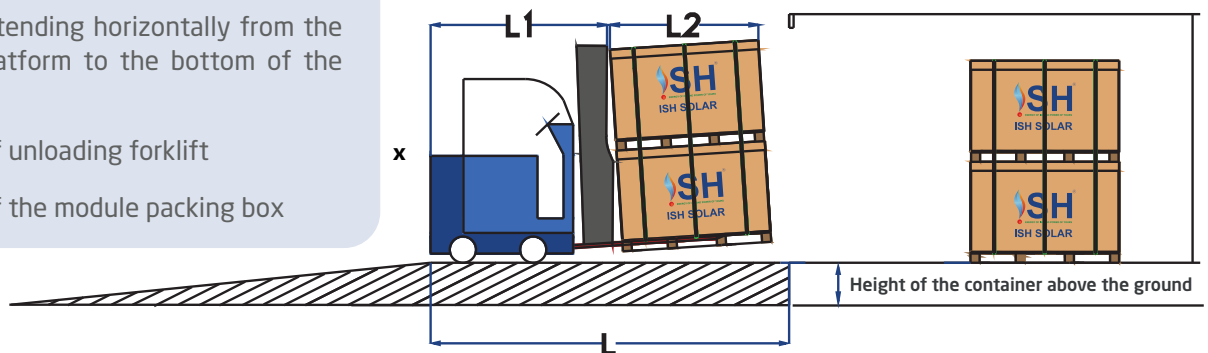
Smoothly insert and shift the PV modules within the container to prevent vibrations and turbulence during transportation.

$$L \geq L1 + L2$$

L: Length extending horizontally from the unloading platform to the bottom of the container

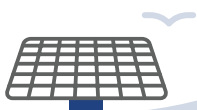
L1: Length of unloading forklift

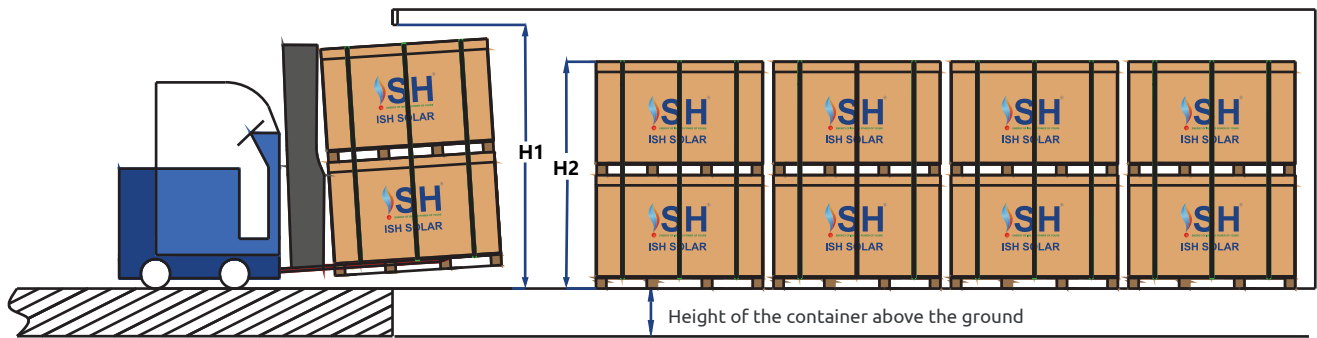
L2: Length of the module packing box



2. UNLOADING OF PV MODULES WITH A FORKLIFT

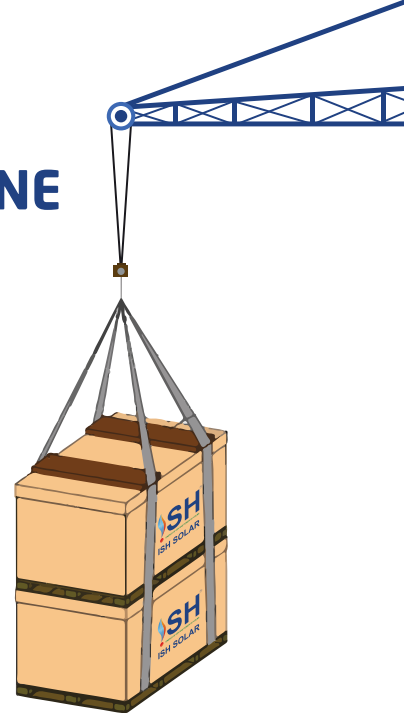
- ISH uses industry best practices to pack PV modules in shipping containers for transportation.
- Do not allow the use of defective or broken equipment for unloading PV modules.
- Maintain a safe distance when operating the forklift for everyone safety in the vicinity.
- When unloading modules, use a forklift with the right tonnage for the weight of the modules. When unloading, make sure the prongs are inserted at least 75% of the pallet length
- The 3-D pictures for the vertical landscape and vertical portrait packages are presented below. ISH uses vertical landscape packaging for both domestic and export packaging.
- Under no circumstances should PV module pallets be stacked higher than two levels. When the packing box blocks the view, it is recommended that you operate the forklift in reverse for safety. Proper monitoring and clear instructions are essential to prevent accidents and damage to modules or workers.
- The PV module pallets should be stored on a dry, flat and robust surface in the warehouse and at the installation site.





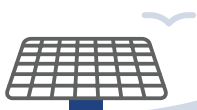
3. UNLOADING ACTIVITY USING HOIST CRANE

- The appropriate component of the hoist crane truck is required and the equipment must be checked by an experienced professional to verify it is fit for the operation.
- The sling strip material should match the weight and capacity of the PV module pallet
- To prevent the case body from falling to one side during lifting, distribute weight evenly across both sides of the slings.
- To avoid module tilting, ensure that the box is balanced before lifting To avoid sling marks and damage to the box and PV modules, ensure that all necessary fittings are in place while lifting the modules with slings.



4. INSTRUCTIONS FOR HANDLING PV MODULES

- Professional installers have to carefully review and adhere to these rules. Failure to follow these directions can lead to death, injury, or property damage.
- Installation and handling of PV modules need professional expertise and should only be undertaken by certified experts. Installers must advise end-users (consumers) of the above information.
- Loading of PV modules must be done on a flat surface; slanted or uneven ground may compromise module safety.
- The unloading platform and ramp construction should be kept at a nominal level with the bottom of the container/open-trailer. The suggested height tolerance is $\pm 10\text{mm}$.
- To ensure smooth downward movement, the unloading ramp length should be equal to the width of the forklift and the length of the goods from the container/open-trailer.
- When unloading PV modules on the platform or ground, proper equipment should be used to move the items out of the container smoothly, avoiding bumps created by the space between the container/open trailer and the platform.
- To prevent forklift collisions with the container's top, keep the inclination angle between the fixture and pad under 5° .
- To ensure appropriate weight distribution, forklift arms should be evenly spaced in the horizontal direction of the pallet. Modules should be pulled out slowly and smoothly.

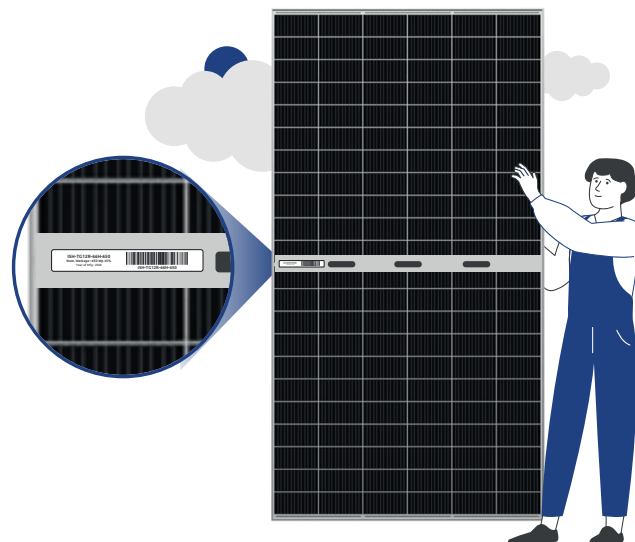


- During the PV module fork-out operation, maintain a space of 2-3 cm between the module and the box walls before slowly pushing back to avoid the box from being damaged by the modules or neighboring pallets.
- When the products leave the container port, please lower the fork height and slow down; ensure that the bottom and top heights of the container are equal to avoid collision; and transfer the entire pallet slowly out of the container.
- Allow enough space between two pallets to ensure safety and prevent scratching during moving.



MODULE IDENTIFICATION

Every module has a unique serial number which can be found on the backside of the module. Kindly ensure that the module's serial number is not tampered with and always note the serial number during installation for your records in the future. On the back of the module there is a back label with the electrical and safety specifications of the module along with the model name.



ENVIRONMENTAL CONSIDERATIONS

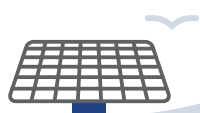
- Ambient temperature: -40°C to $+50^{\circ}$
- Operating temperature: -40°C to $+85^{\circ}\text{C}$
- Storage temperature: -20°C to $+50^{\circ}\text{C}$
- Humidity: $< 85\text{ RH}\%$
- Mechanical load pressure*: 5400 Pa (112.8lb/ft²) on the front and 2400 Pa on the rear (50.12lb/ft²)

Note: The mechanical load bearing capability is dependent on the Installer's mounting techniques; if the manual instructions are not followed, the system may not be able to endure wind and snow loads. These specifications, as well as any applicable local codes and regulations, should be met by the system installer during installation



SITE SELECTION

- It is best to install PV modules in an area that is not shaded for every day of the year. By keeping a gap greater than three times the height of the obstruction between the solar array and the obstruction, shading can be reduced.
- In general, PV modules should face north in the southern hemisphere and south in the northern. ISH modules. can be installed in either a landscape or portrait orientation although mounting the panel in a portrait orientation reduces the effect of dirt blocking the solar cells.



- It is necessary to select a sufficient row-to-row distance and place PV modules properly between two rows so that throughout the year, the PV module never suffers shadows from the inter row spacing.
- Solar modules are normally installed facing the equator at an angle to the horizontal plane equal to the installation's latitude for maximum energy generation. The power output may be directly impacted if the PV module is positioned at a different angle or orientation.



- Any slope less than 1:2.4 is necessary to keep the fire class rating in place.



- Do not use mounting methods where drainage holes are blocked.



- PV modules should never be placed by immersing them in water under any conditions and should not be installed on moving objects like vehicle or vessel.

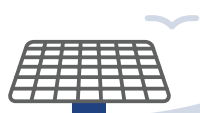


MOUNTING INSTRUCTIONS

A. MOUNTING METHODS

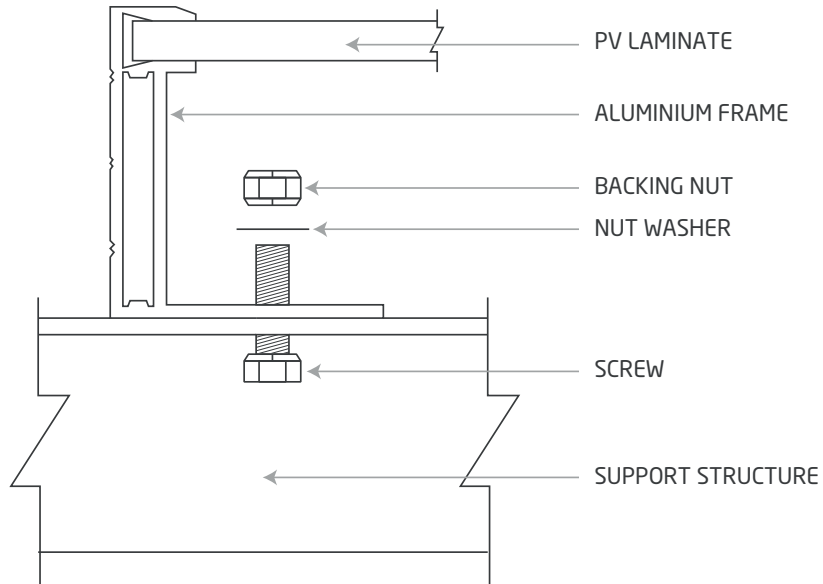
MOUNTING GUIDELINES FOR PV MODULES

- PV modules can be fixed or installed using a clamp or bolt method. When using corrosion-resistant M8 bolts for bolt type fixing, mounting techniques need to make sure of the following:
 - There must be a minimum of 200 mm of clearance between the module frame and the surface of the wall or roof.
 - 10.50 mm is the minimum gap between two modules.
 - Drainage holes are not blocked under any circumstances.
- PV modules are not to be subjected to wind or snow loads exceeding the maximum permissible loads and should not be subjected to excessive forces due to thermal expansion of support structures damages which are not covered under warranty. When modules are ground mounted, select the height of the mounting system in such a way to prevent the lowest edge of the module from being covered by snow for a long time in winter in area's that experience severe snow fall. If snow settles on the PV modules, regular cleaning of snow and other foreign particles are highly recommended for long term reliability of the PV modules, failure to comply may result in damage of the module resulting in deformation which is not covered under warranty.
- As directed below, the module or panel must be secured to the roof using the least amount of mechanical force. When mounting a non-integral module or panel, it is necessary to place the assembly above a fire-resistant roof covering that is suitable for the intended use.

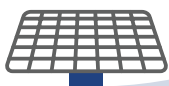
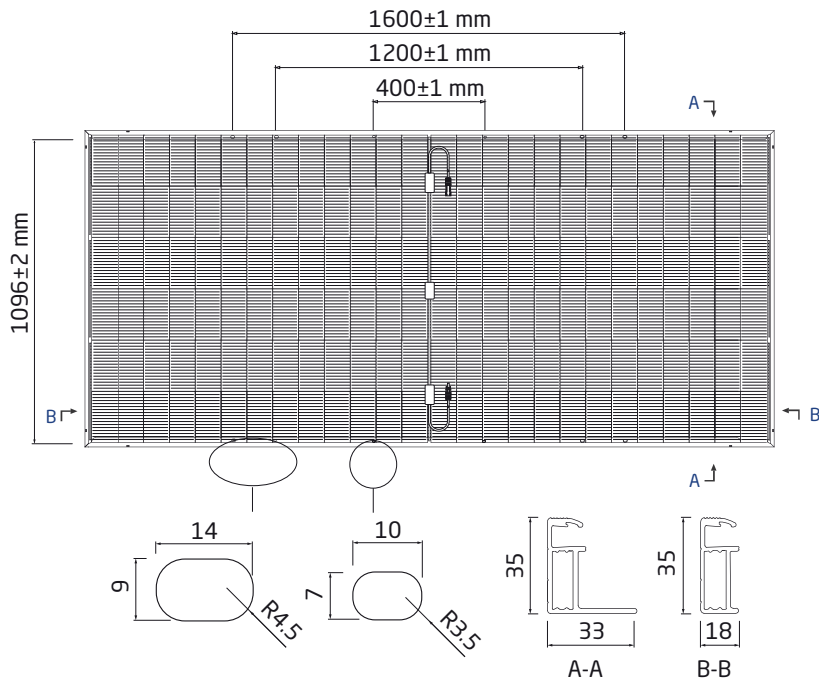


1. BOLT TYPE FIXING

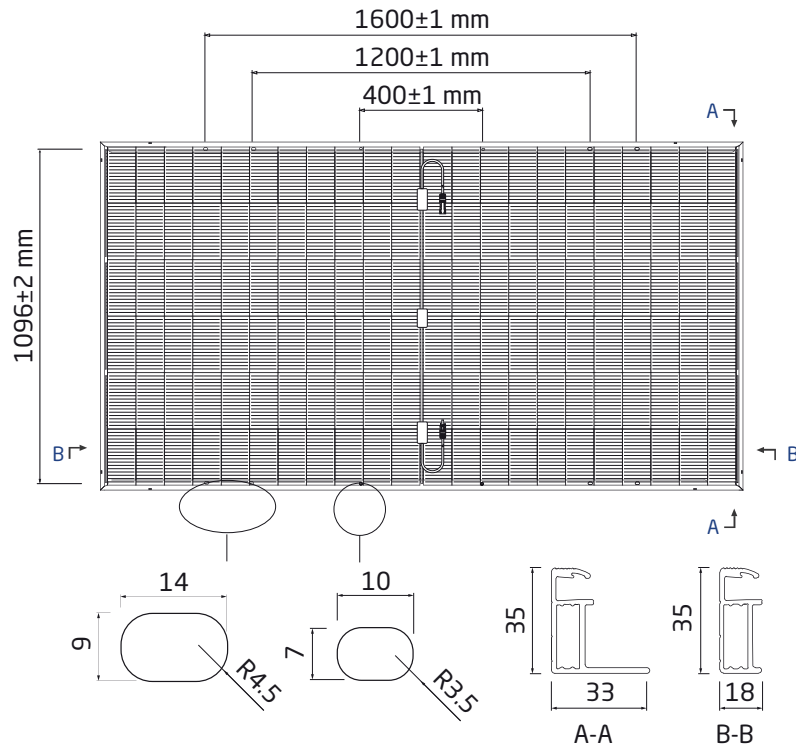
- Each module frame contains 8 mounting holes of 9 mm X 14mm. ISH advises using corrosion-resistant stainless steel fixing. The module should be fixed with the support of M8 bolt, washer and nut. Please refer to the image below for reference. It is recommended to tighten the M8 bolt, nut, washer and PV module assembly to a minimum torque of 16-25 Nm.



Mechanical Drawings of PV Module **Prime Series**

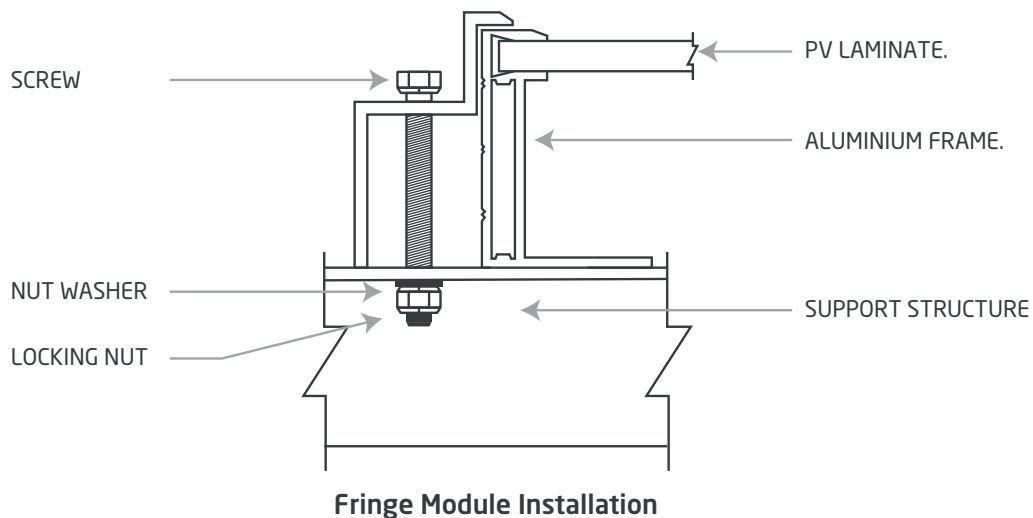


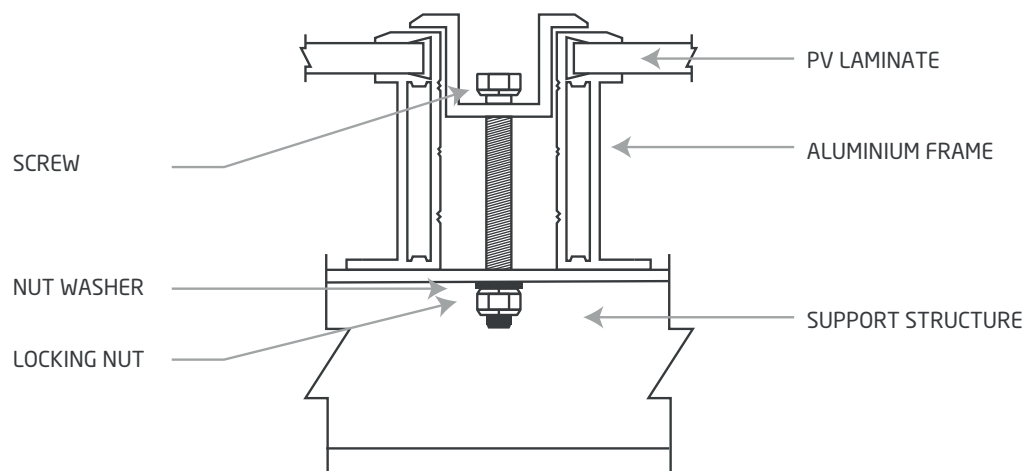
Mechanical Drawings of PV Module **Supreme Series**



2. CLAMP TYPE FIXING

- It is advised to only use clamps with EPDM or insulating type washers, according to the findings of several tests conducted on clamps by ISH.
- In order to secure the PV module on the structure or mounting rail, a total of four clamps are needed.
- Clamps should not come into contact with glass and their shadow should not appear on the front surface of the module in order to prevent any type of glass breaking.
- It is not authorized to modify or change the module frame's structure.
- When modules are fixed using the clamp fixing method., 4 clamps are required to fix the module, 2 clamps on each long side frame and 2 clamps on each short frame side. The front side of modules is certified to withstand 2400 Pa wind stress and 5400 Pa snow load. The module can be fixed with a greater number of clamps to support this load.

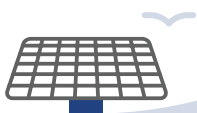




Middle Modules Installation

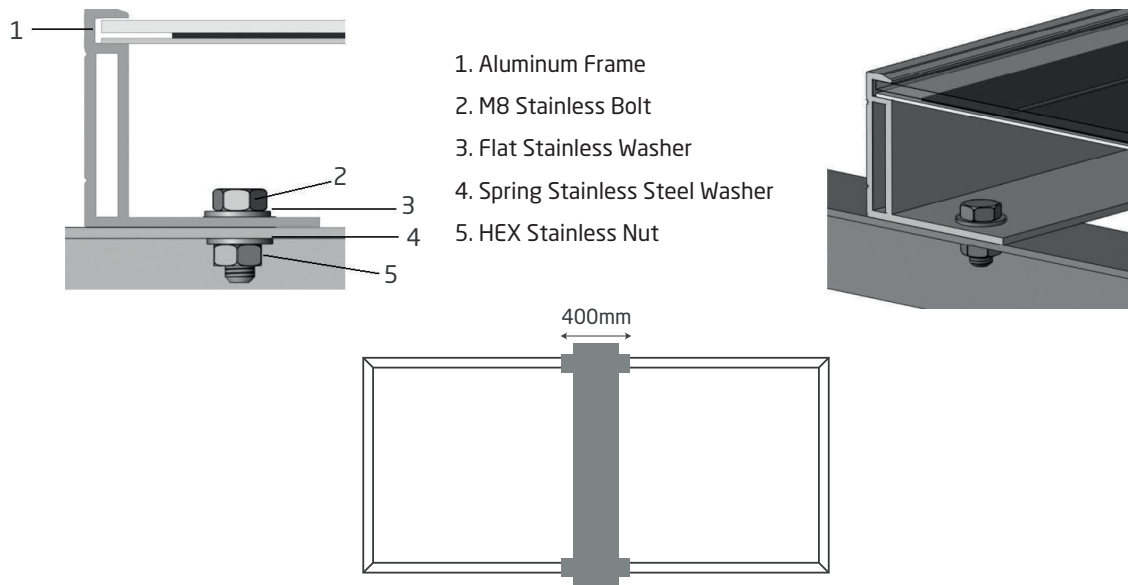
MOUNTING GUIDELINES FOR PV MODULES WITH TRACKER SYSTEM

- Prior to installation, it is necessary to fix the following issues:
 - (i) Thoroughly examine the module for evidence of damage. Ensure that the module is carefully cleaned to remove any dirt or debris that may have collected during transportation.
 - (ii) Check the serial numbers of the PV modules you received..
- The mounting structure should be made of sturdy materials that are resistant to corrosion and UV radiation.
- In places with heavy winter snowfall, it is critical to adjust the height of the mounting system so that the lower edge of the module remains clear of snow building up. Furthermore, it is necessary to ensure that the lower half of the module is not covered up by vegetation, trees or vulnerable to harm by flying sand or stone.
- Make sure the module glass doesn't come into contact with any mounting structures or brackets that can shatter or puncture them.
- In order to ensure that the module can sustain the high wind loading, extra support in the form of longer clamps, rails or bumpers may be required if there is a chance of high-pressure load because of local wind and snow conditions.
- Avoid drilling extra mounting holes in the module's frame or glass surface. The warranty will be voided if this is done.



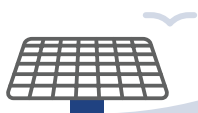
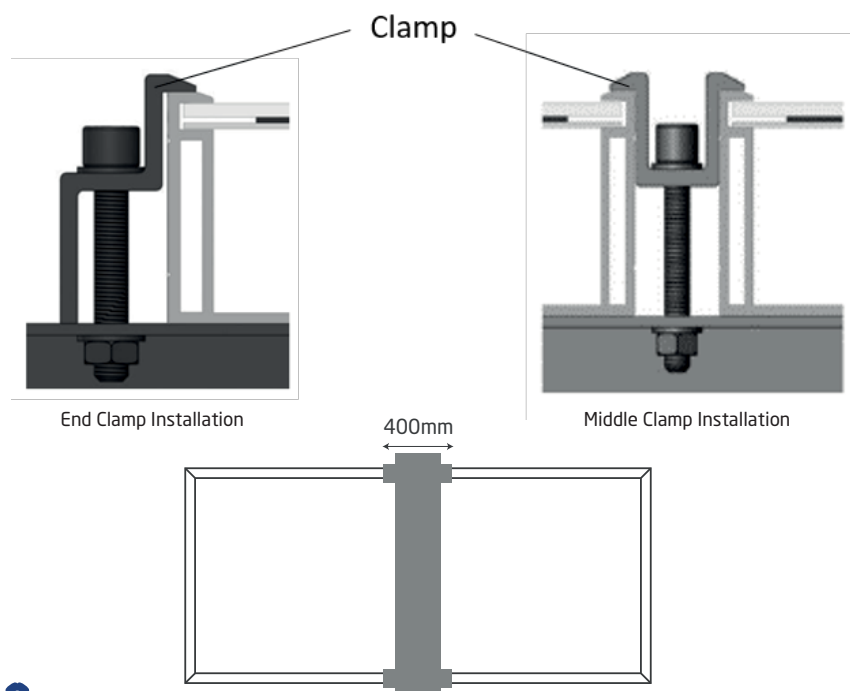
1. BOLT TYPE FIXING

- Four mounting holes on ISH modules—14 mm (L) * 9 mm (W)—that accept M8 bolts are included. There are 8 holes that can be connected to the tracking systems and are compatible with M6 bolts. As seen in Figure, connect the modules to the bracket by inserting bolts through the mounting holes on the rear frame. For M6 bolts and nuts, 8-12 N.m. is the recommended tightening torque while for M8 bolts and nuts, 12-16 N.m. Please make sure that clamps, bolts and other hardware are made of materials that are resistant to corrosion.

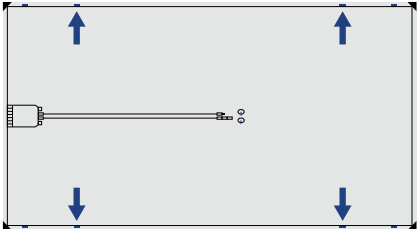
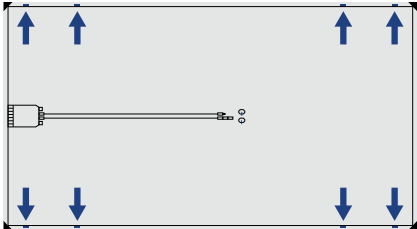
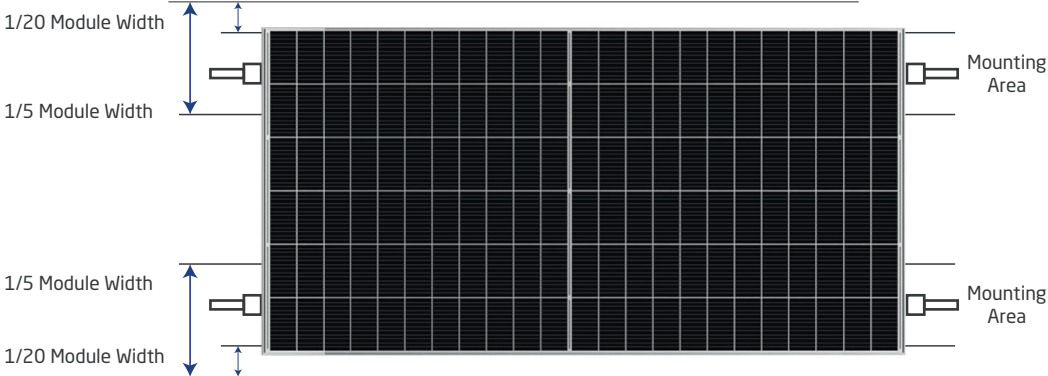
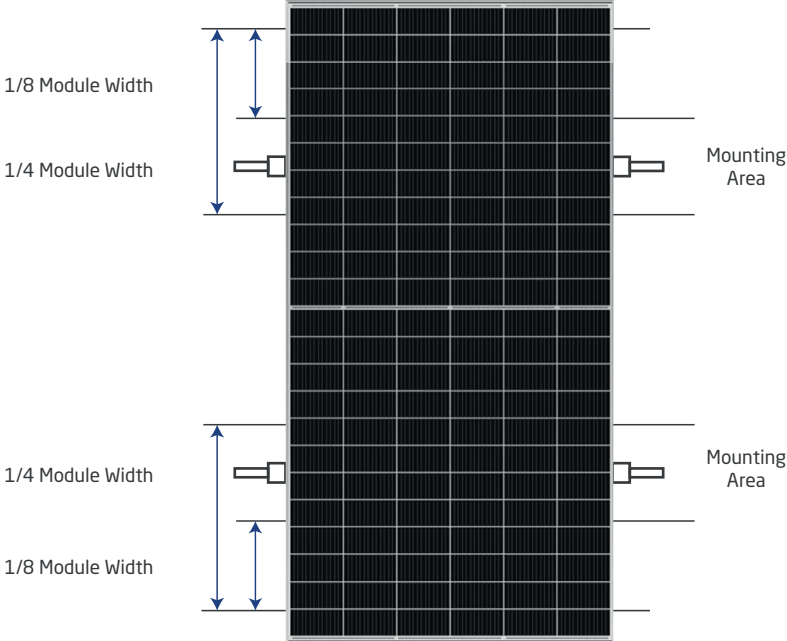


2. CLAMP TYPE FIXING

- The module clamps shouldn't damage the frame in any way or come into contact with the front glass. Be careful not to let the module clamps create any shadowing effects. It is essential to utilize a minimum of four clamps on each module when using this specific clamp-mounting technique. The module's longer sides should each have two clamps firmly fastened to them. To make sure the module can sustain the load, additional clamps or support may be required if there is a chance of a high-pressure load because of local wind and snow conditions. Make sure there is enough torque exerted to hold the modules firmly in place.



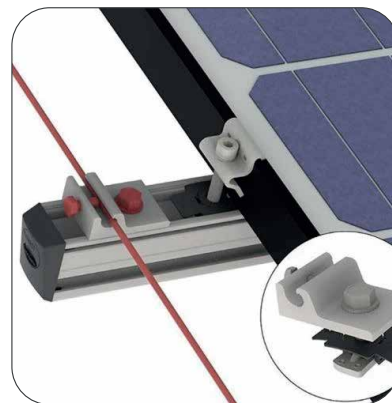
Figures to represent mounting methods and applies to ISH Prime. and Ish Supreme series of modules. Various mounting configurations can be attempted based on the installer’s calculations. However, failure to follow the above recommendations may reduce load handling capacity and could lead to failure in overload situations, which may not be covered by the product warranty.

MOUNTING METHOD	AT 2400 PA LOAD CONDITION	AT 5400 PA LOAD CONDITION
Bolt Type Fixing	Mounting Holes  Use for Mounting Holes	Mounting Holes  Use for Mounting Holes
Short Side Clamping		
Long Side Clamping		

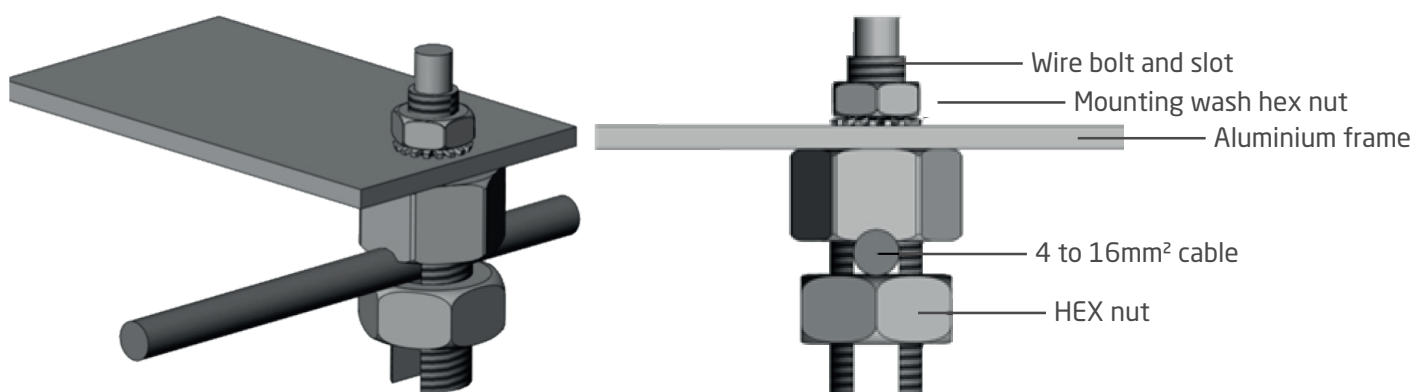


B. PV MODULE GROUNDING

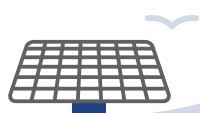
- As per National Electrical code (NEC Guidelines) all the PV Module (modules under UL spec) frames and mounting structures must be properly grounded for safety of people on the site. The module frame must be properly grounded (refer to NEC clause 250).
- The required local electrical codes must be followed for grounding all module mounting frames and mounting racks. The module frame needs to be grounded correctly. To provide a strong electrical connection, the grounding wire needs to be securely connected to the module frame. For this wire, use the suggested connection type or an equivalent.
- By frequently attaching the module frame(s) and all metallic structural parts together with an appropriate grounding conductor, proper grounding is maintained. Copper, copper alloys, or any other material suitable for use as an electrical conductor can be used as a grounding conductor or strap. After that, the grounding conductor needs to be connected to earth through the correct earth ground electrode. In case of metallic support, the surface of the frame must be electroplated.
- ISH modules can be installed with the use of third party listed grounding devices for grounding the metallic frames of PV modules. The devices have to be installed in accordance with the grounding device manufacturer's specified instructions.
- Additionally, we recommend using the following techniques to properly ground.



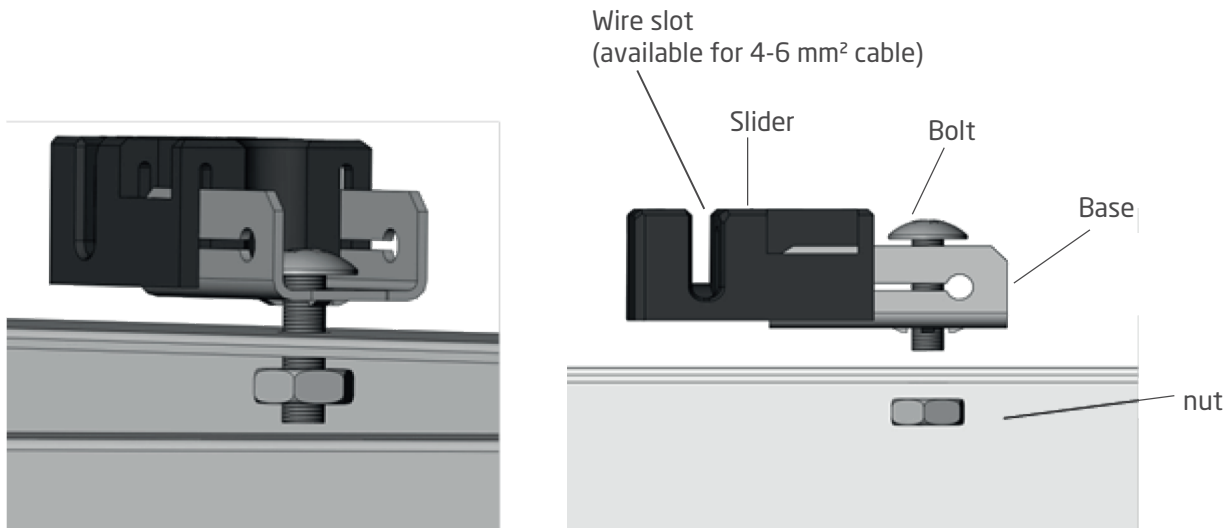
METHOD 1 : GROUNDING BOLT #2058719-1



- Tyco grounding hardware comes with grounding bolt, mounting and grounding hex nut inside the package.
- Electrical contact is made by penetrating the anodized coating of the aluminium frame and tightening the mounting.
- The grounding wire should be sized between 6 to 12 AWG using solid copper bar, and installed beneath the wire binding bolt.
- The wire binding bolt must be tightened to the recommended torque level of 45 lb.

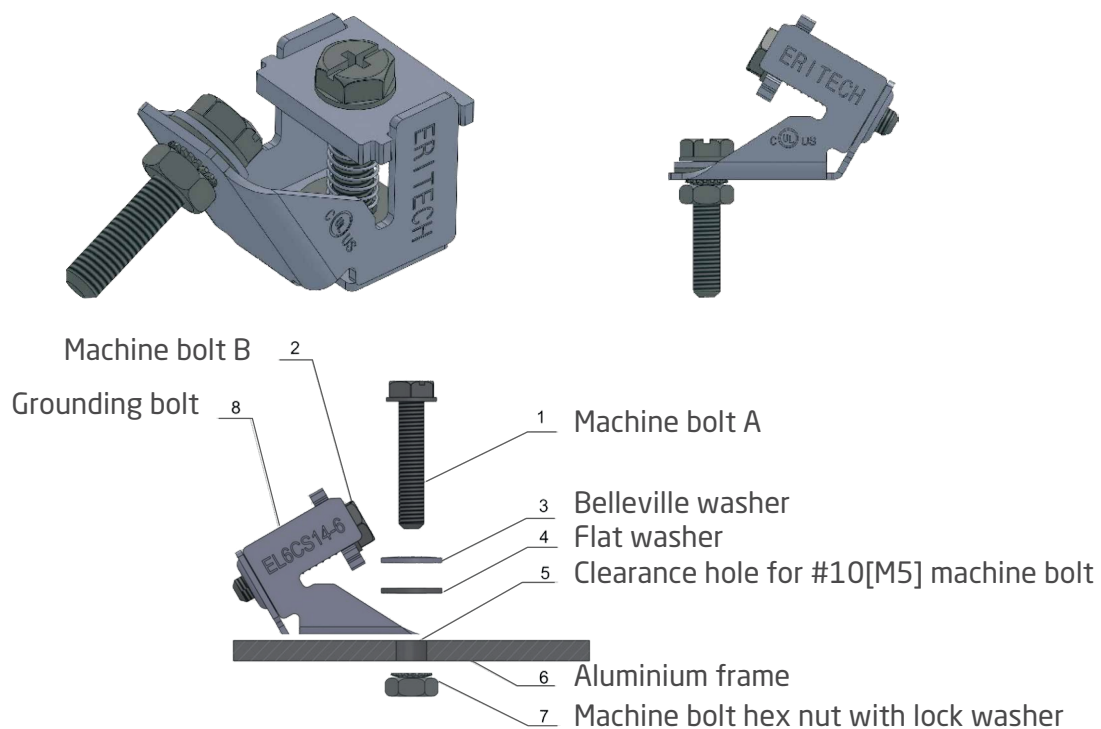


METHOD 2 : GROUNDING BOLT #1954381-2



- Tyco grounding hardware comes with grounding bolt, mounting and grounding hex nut inside the package
- When the anodized coating on the aluminium frame is penetrated and the mounting hex nut is tightened with the proper torque of 25 lb, electrical contact is created. The hex nut has a star washer included.
- The grounding wire should be sized between 6 to 12 AWG using solid copper bar, and installed beneath the wire binding bolt.
- The wire binding bolt must be tightened to the recommended torque level of 45 lb.
- The Tyco grounding bolt may only be used with bare solid copper wire that is between 6 and 12 AWG.

METHOD 3 : ERICO GROUNDING BOLT #EL6CS14-6

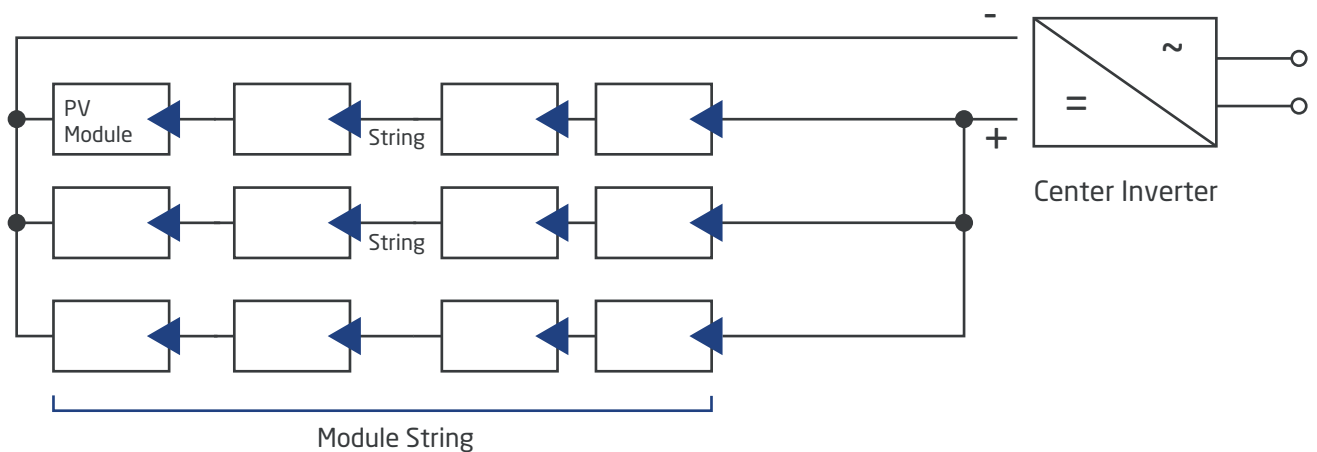


It is recommended that lug should be installed on a surface that is larger than the bottom surface of the lug.

- The lug on the PV module's grounding hole has to be fixed.
- Bolt A on the module frame has to be torqued to 35 lb in order to secure the grounding bolt.
- The grounding bolt can only be used with bare solid copper wire that is 6-12 AWG.
- For the correct wire binding, the machine bolt needs to be torqued up to 35 lb.
- Where common grounding hardware [nuts, bolts, star washers, split-ring lock washers, flat washers and the like] is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.
- Common hardware pieces like nuts, bolts, lock washers, star washers and the like should only be used to maintain mechanical connections and keep electrical grounding devices in the correct position for electrical conductivity. These items were not evaluated for electrical conductivity or for use as grounding devices.

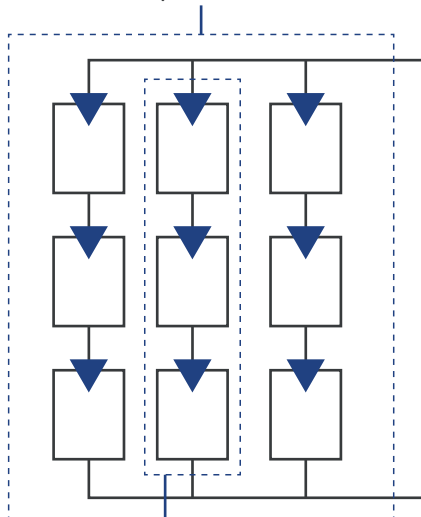
C. ELECTRICAL WIRING

• Series Connection:

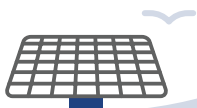
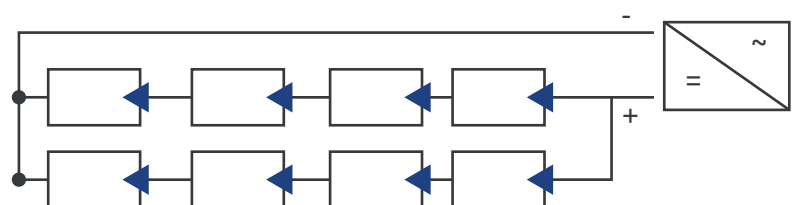


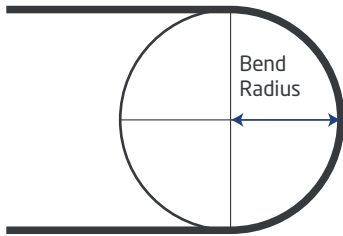
• Parallel Connection:

Solar array with three series strings connected in parallel

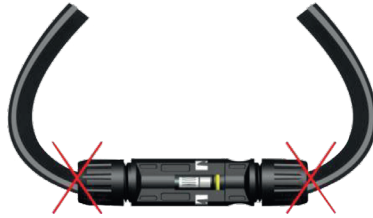


Series parallel wiring





Bending radius of junction box cable should be minimum 42 mm



Incorrect routing of cable



Correct routing of cable

- Qualified installers should complete all wiring in compliance with local codes and regulations.
- It is advised to only connect a certain number of modules in series so that at no point throughout the year, the system voltage should rise above the rated value. Based on the inverter MPPT ratings, operating voltage circumstances and environmental factors including the site's lowest temperature, the system should be designed accordingly.
- PV modules must be connected in series to raise the working voltage. To do this, the positive connection of one module is connected to the negative terminal of another.
- Please make sure that there is a click sound during series connections. A click sound indicates that the two terminals are properly connected. ISH suggests that for circuit protection, a maximum of two strings be connected in parallel with the proper string fuse.
- If any module/array/string is connected in reverse polarity, in that case, product can be damaged permanently and repair is not possible and warranty will be void. for those modules. Always check the string's polarity and voltage level before making a parallel connection. Before connecting, verify the strings' circuit or configuration if reverse polarity or a voltage differential of 10 V has been identified during the measurement. The wiring should only be performed by skilled and certified professionals.
- Blocking diodes of the proper specifications should be used in String Combiner boxes by the EPC in order to prevent any reverse current from arising from parallel strings in Grid Scale utility power plant due to voltage mismatch across strings or from storage devices if used with storage solutions.
- The maximum voltage of the system must not exceed the maximum input voltage of the inverter or the rated system voltage. $V_{oc} \propto (1/T)$, hence the power generation unit's open circuit voltage must be determined at the lowest possible ambient temperature.

Maximum voltage can be calculated using the formula below:



$$\text{System voltage} = X * V_{oc} * [1 + ((T\alpha - V_{oc} (\%) \times (25 - T_{min})))]$$

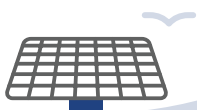
Where; X - No. of modules which are connected in series.

V_{oc} - Open circuit voltage of each module (Refer to the Data Sheet)

$T\alpha - V_{oc}$ - Thermal coefficient of open circuit voltage for the module in Percentage

T_{min} - Minimum ambient temperature of the location of the plant

- The maximum outer cable diameter is 7 mm while the minimum is 5 mm.
- It is advised to utilize 4 mm² cables labelled as PV wire that are insulated to a minimum of 90°C in outdoor applications.
- Junction box cable must have a minimum bending radius of 42 mm.



D. CONNECTORS

- Unplugged connectors should be insulated from moisture, dust and other environmental contaminants. Only plugged connectors that are dry and clean can meet the requirements of their IP class. Before attaching the modules, make sure the connector caps are hand tight. Connectors that are dirty, moist or malfunctioning should not be used to attempt an electrical connection. Prevent the connectors from being exposed to the sun or submerged in water.. Don't let connectors rest on the ground or the roof.
- Arcs and electrical shock are potential outcomes of faulty connections. Verify that every electrical connection is firmly fixed. Verify that every locking connector is locked and fully engaged.
- PV cell strings connect in parallel with bypass diodes in the junction boxes used with ISH PV modules. Partial shading reduces module heating and performance losses by having the diodes avoid the current produced by the cells that are not shaded. Devices for overcurrent protection are not bypass diodes.
- Modules with PV wiring connectors that meet UL 6703, the Standard for connectors for use in Photovoltaic Systems must list the model number and/or specific manufacturer of the allowed mating connector(s) along with the PV connector manufacturer's contact details and/or website. The following must be included if a particular module product is offered with several PV wiring connectors from different manufacturers.

(A.) A way to recognize the products of each individual PV connection manufacturer such as an image or illustration, special physical characteristics, labels, business logos, etc.

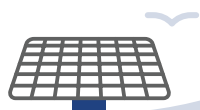
(B.) The manufacturer and model number(s) of the permissible mating connector specified for each individual cable connector manufacturer's product(s), together with the contact details and/or website of the PV connector manufacturer.

E. BYPASS DIODES

- In the case of partial shading, Bypass diodes redirect current away from the cell strings.
- Diode replacement in a potting type Junction box is not possible in case of any type of failure. The only method to fix the issue if a Bypass diode fails is to replace the entire Junction box with a new one. ISH advises contacting the provider in order to replace the Junction box.

F. CABLES AND WIRING

- ISH PV modules come with two (2) stranded, sunlight-resistant output cables with PV connectors (compatible with MC4 and Amphenol), making them suitable for most installations. The negative (-) terminal has a male connector, while the positive (+) terminal has a female connector. When following the manufacturer's instructions, the module wiring can also be used to connect compatible third-party electrical devices with different wire designs. It is designed for series connections, with female (+) to male (-) couplings.
- Use field wiring that has been certified for usage at the PV modules maximum short-circuit current and has a suitable cross-sectional area. ISH advises PV system installers to utilize only sunlight-resistant cables that meet the requirements for Direct Current (DC) wiring. 12 AWG wire should be the bare minimum. The cables should have a working temperature range of -40°C to +90°C.



- It is important to secure cables to the mounting structure in a way that prevents mechanical damage to the module or the cable. Make sure the cable has a minimum bending radius that is at least five times its diameter. Make sure the cable is routed to avoid putting tensile stress on the connectors or conductor. Use suitable fasteners such as cable ties that can withstand sunshine or wire management clips made especially to fasten to the PV module frame for fixing. Even though the cables are waterproof and resistant to sunlight, try to keep them out of direct sunlight and from submerging them in water.



ELECTRICAL CONFIGURATION:

- When sunlight hits the solar array's modules, they produce DC electricity. The inverter enters active mode and converts the necessary minimum voltage and current into AC power.

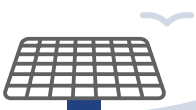
Caution:

- The modules can create serious electric dangers like shock, arcing and other fire hazards because they are rated to operate at potentially hazardous DC voltages. Therefore, only qualified professionals are asked to work on the DC solar array, DC combiner box and panels. The PV modules can run at 1500V DC according to certification.
- It is always necessary to stop the current flow while separating the connectors using a rated isolator or DC switch. Because DC power may remain active for a while even after disconnecting, it is advised that only skilled operators work on the panels, string combiner box etc. Any electrical accident that occurs in a power plant that uses ish solar modules ISH Solar shall not be liable..



A. FUSE RATING

- Connect the fuse to the solar arrays' non-grounded pole. Fuse ratings connected in series have a maximum rating of 30A.
- Actual fuse rating is mentioned in PV module specification sheet and on the PV Module's back label. Fuse rating value also indicates the maximum reverse current that can flow from the module. It is recommended to use 30 A Fuse per string.

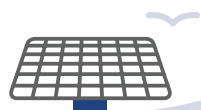


B. ELECTRICAL PARAMETERS

Type name or model number	ISHTG-12R66
Rated maximum power range (W)	610-650
Module technology	N- type TOPCon
Number of cells	132(66×2)
Rated short circuit current range (A)	15.88-16.33
Rated open circuit voltage range (V)	46.93-48.34
Maximum system voltage (VDC)	1500 (IEC)
Dimensions (L x W x H) (mm)	2382×1134×35
Maximum Series Fuse, (A)	30
Fire Class Rating	Class C
Weight (kg)	33.8

C. 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 the IEC standards and regulations, ISH modules. do not normally need to be electrically connected to earth and can operate with either galvanically isolated (with transformer) or transformer-less. inverters. The negative pole of the array needs to be linked to ground and galvanically isolated inverters with transformers must be utilized if the system is situated in an area that is extremely hot and humid. To prevent the PID effect, it is advised to use an inverter installed negatively. When using a transformer-less inverter in a hot & humid climate, the installer should check with the inverter provider to make sure the proper active negative earthing kit. is fitted.



PV MODULE MAINTENANCE AND CARE

- Well-designed PV plants require the least amount of maintenance for improved system reliability and efficiency.
- Yearly plant maintenance by qualified specialists is advised. Complete daily monitoring of PV Module performance should be done using Solar plants control and Monitoring solution or string performance analysis. Any deviation from the expected performance/behavior, should be reported to ISH Solar immediately.
- Verify the condition of the mounting structure and make sure that every module is tightly fitted on the structure and conforms to the installation guidelines mentioned above.
- Verify that the PV module is not shadowed by any trees, objects or leaves in the region where light is falling. These barriers should all be taken out right away. Early morning / Late Evening shadowing where irradiance is lesser than 200 W/m² is acceptable.
- Make sure that every cable assembly is tightly fitted and that no part of the cable is submerged or exposed to water logging.
- Verify that every non-earthed pole's string fuses are active and working correctly.
- Always use a soft module cleaning kit or, as a backup, clean the module with a soft cloth and a small amount of detergent. There are several ways to clean: with a revolving brush, a dry brush, compressed air, soft cleaning and wet cleaning.
- PV modules should not be subjected to stress during cleaning and cleaning should not result in solar cell cracks. The water used for cleaning should have the same temperature as the module and it should be tested for total dissolved solids (TDS) on a regular basis. If the water's TDS exceeds the permitted level of 500 mg/l, installing RO at the site is strongly advised. The water used for cleaning must be the same temperature as the module; otherwise, temperature differences may cause thermal shocks which could harm the PV module and void its warranty.
- Make sure the module is free from micro cracks and other types of flaws at all times when cleaning.
- It is prohibited for anyone to climb on the PV modules because doing so could permanently damage the solar cells. The PV modules should be cleaned on a regular basis to make sure they are clear of dust, debris and free of bird droppings. The PV modules' solar cells may become damaged if the same isn't cleaned.
- For maximum power output, generation and best reliability, it is recommended to keep modules clean and tidy.
- Avoid using sharp tools for cleaning since it may damage the module and have an impact on the module's performance.
- After a product's life cycle is over, it should be recycled using a practical renewable technique.
- For recycling procedures, contact ISH Solar when the product's life cycle is over.

WARNING

(1.) All electrical systems should be separated or shut down before beginning any kind of maintenance and only trained professionals should carry out the work. Failure to adhere to these instructions could lead to dangerous electric shocks, burns, other injuries, sometimes even death. Any accidents involving Power Plants that use ISH Solar panels are not the responsibility of ISH Solar.

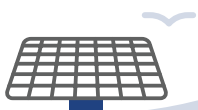
(2.) A warning not to focus external or artificially concentrated sunlight onto the front or back side of the PV module is included in the documentation.

CONTACT DETAILS

PV modules do not contain any serviceable parts. If the customer suspects that the installation is not functioning properly, they should immediately contact their installer, EPC, or O&M provider. Additionally, promptly notify ISH's Customer Service Team.

Contact ISH Solar sales and service team at info@ISHsolar.com

Email customer feedback at info@ISHsolar.com



THE FUTURE POWERED BY ISH



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