

Solar PV Module Handling, Storage, Installation and Maintenance Manual

Applicable to Mono PERC & TOPCon
With M10 Cells
Bifacial Glass-Glass Modules.

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1. Introduction

This manual contains information regarding installation, operation, maintenance and safe handling of Solar modules supplied by M/S INDOSOL SOLAR PRIVATE LIMITED. Bifacial Glass to Glass Modules. Before installation or using the PV Modules, it is important to read this manual and understand the instructions carefully.

(Note: For the purposes of this document, M/S INDOSOL SOLAR PRIVATE LIMITED shall hereinafter be referred to as 'ISPL')

Trade Mark:




2. Disclaimer Of Liability


- Since Installation and Maintenance of the Module are beyond (ISPL) company's control; ISPL does not assume any responsibility and expressly disclaims liability for loss, damage, injury or expense arising out of or in any way connected with such installation, operation, use or maintenance of the Modules.
- ISPL 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.
- ISPL 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 great degree of skills, 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 injury that might occur during installation, including without limitation, the risk of electric shock.

 <p>Warning</p>	<ul style="list-style-type: none"> • For your safety and the safety of others, please read the entire Installation, operation and maintenance manual carefully prior to 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) be followed.
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- This photovoltaic module produces electricity from both the sides when exposed to the sunlight, even at low light levels or when other sources illuminate its faces. The open circuit voltage from the front face of Module is 50 V DC. 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.

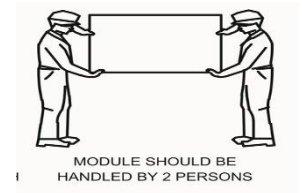
 <p>Caution</p>	<p>To avoid the hazard of electric shock and injury when installing, wiring, operating and maintaining the PV modules, below guidelines shall be strictly followed.</p>
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4. Safety Precautions

- 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 or perform work on the modules or solar system, always wearing rubber gloves and boots with maximum working voltage not lower than 1500 V DC
- 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.

- Cover the entire front & back surface of the Bifacial PV Module with a dense, opaque material such as cardboard box, during installation and handling of the Modules.
- Important: ISPL's Bifacial Modules produce Voltage when exposed to light also on backside
- Since sparks may occur, do not install the Module where flammable gases or vapors are present.
- Under normal operating conditions, a photovoltaic module may produce more current and/or voltage than reported at Standard Test Conditions (STC).
 - *For modules under IEC investigation, the values of I_{sc} and V_{oc} marked on the module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacity, fuse sizes, and the size of controls connected to the PV output.*
 - *For modules under UL investigation, the value of I_{sc} marked on the back label of the module should be multiplied by a factor of 1.25 when determining conductor current ratings, fuse sizes, and the size of controls connected to the PV output. Refer to Section 690.8 of the National Electrical Code (NEC) to determine 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 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.
- Rated electrical characteristics are within ± 10 percent of measured values at Standard Test Conditions of 1000 W/m², 25°C cell temperature and AM 1.5 solar spectral irradiance.
- The module is considered to be in compliance with UL1703 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 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.
- Use 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.
- When carrying a Module, two or more people should carry it by its edges, wearing non-slip gloves (to avoid injury by a slipped Module, or by the edge of frame, and so on).
- Do not disassemble, modify or adapt the Module or remove any part or labeling installed/ pasted by the manufacturer
- Do not touch terminals while Module is exposed to light or during installation. As a precaution use properly Insulated tools only.
- Do not drop Module or allow objects to fall on the Module.
- Do not stand or step on the Module.
- Only PV Modules with the same cell type and size should be connected in series.
- 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 treat back and/or front surface of the Module with paint and adhesives, such cases will void Warranty. Do not artificially concentrate light on the Module.
- Be sure to completely ground all Modules.
- **Meaning of crossed-out wheeled dustbin:** Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of inland fills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.
- 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.



4.1 Fire Safety.

- 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 or entirely 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.
- Any module or panel mounting system has limitations on specific inclination required to maintain a specific System Fire Class Rating.
- The fire rating of the module is valid only when mounted in the manner specified in the mechanical mounting instructions
- 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

- The pallet packaging is not water or weatherproof. Prior to installation, and to avoid any damage or degradation to the packaging or panel components, pallets and panels must be stored in a protected environment, ideally in internal storage conditions, where it is shielded from the elements, e.g., rain, dust, direct sunlight. If overnight external storage in an uncontrolled environment is unavoidable, the panels and the pallet packaging must be protected from direct exposure to the elements and from contact with the ground, including earth, mud etc.
- If pallets are stored temporarily outside, then place a protective covering over the pallet to protect it from direct weathering and Do NOT stack more than the maximum number of allowable pallets on top of each other.
- Do NOT place modules directly on top of each other. Do not carry the Module on Head.



- The handling of Bifacial / Glass –glass Modules requires great diligence. Therefore, caution is required while unpacking, transporting and temporarily storing these modules.
- Do NOT use a knife to cut the zip-ties, always use wire cutting pliers.
- When carrying the bigger Module, two or more people should carry it by its edges properly and wear non-slip gloves (to avoid injury by a slipping Module). Do not leave the Module unsupported or unsecured prior to installation.
- Store Modules in a dry and ventilated room.
- 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, it may cause severe micro-cracks at the cell level, which in turn may compromise Module reliability.
- A Module with broken glass cannot be repaired and must not be used since contact with any Module surface or the frame can produce electrical shock.
- At the installation site, take care of Modules and ensure that their electrical contacts clean.
- Broken or damaged Modules must be handled carefully and disposed 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 sharp instrument.

CAUTION: In any case DO NOT STAND OR STEP on the modules, do not drop or place objects on the module(s) (such as tools), do not thump / give extra pressure on the surface of the module(s) as localized high loads can induce severe micro - cracks at the cell level, which in turn may compromise module reliability. Failure to comply with above caution will void ISPL's warranty.



Wrong methods of installing a solar PV module

5.1 Product Identification

- Each module has a unique serial number, which is laminated between the glasses. Please do not tamper with the serial number of the module in any ways and always record the serial numbers during an installation for your future records. A nameplate containing model name, electrical and safety characteristics of the module are also affixed to the module

Decoding of the solar PV Module serial number:

Model Type: ISTD3M16BN4590	
IS	Company Name (IS - Indosol Solar)
T	Cell Technology (M – Monofacial, B – Bifacial, H – HJT, T – TOPCon, I – IBC, G – Gapless)
D	Module Type (D – Glass2Glass, T – Glass2Transperant back sheet, W – Glass2White back sheet, B – Glass2 Black Backsheet)
3	Cell Size (0 – 166 mm, 1 – 182mm, 2 – 210mm, 3 – 183.75mm)
M16	No. of Busbars (M9 – 9BB, M10 – 10BB, M12 – 12BB, M16 – 16BB, M18 – 18BB)
B	No. of cut/cell (B – 1/2, C – 1/3, D – ¼, F - 1/6)
N4	No. of Cut Cells/Module (N0-108, N1-120, N2-132, N4-144, N5-156)
XX X	Wattage of the Module.

Serial Number: IS1XXYYA00000	
IS	Company Name (IS - Indosol Solar)
1	Plant No
XX	Work week
YY	Year
A	Alphabet
00000	Running Serial Number

5.2 Maximum Power Output Through Bi-faciality.

- Output power is increased proportionally to the light received by rear side of modules.
- The available light that hits the back of the module is directly related to the height (and tilt angle) of the module installed over the surface.
- Choose the highest possible Surface Reflectivity/Albedo, such as a white roof or white ground surface covering.
- Avoid shading the back side of the module by the support rack.
- Elevate the modules above the mounting surface at an appropriate height to avoid loss of irradiance
- With tilted rooftop installation, ensure an appropriate ventilation on back to reduce an accumulation of heat with adverse effects on the performance.
- A comprehensive simulation study is recommended prior to the installation of a power plant.

6. Environmental Consideration and Site Selection

- ISPL Solar modules are certified to BIS, IEC 61215, IEC 61730 (Parts I & II), and IEC 62804. In addition to the required IEC certifications to meet European standards, ISPL Solar products have also been tested and certified for resistance to ammonia corrosion (IEC 62716), making them suitable for installation in environments such as barns housing cattle and pigs. Furthermore, the modules have been validated for durability in humid coastal climates and areas with high sand and dust exposure.
- Although ISPL PV modules have passed Salt mist (IEC 61701) corrosion test with a salt concentration of 5 % by weight, galvanic corrosion can occur between the supporting frame and mounting or ground materials if such materials are made of dissimilar metals

Environmental Conditions:

- Ambient temperature: -40 °C to +50 °C
- Operating temperature: -40 °C to +85 °C.
- The relative humidity shall be below 85 %.
- Design Load: “Design load (with safety factor 1.5): -1600 Pa/+3600 Pa”

NOTE:

- The mechanical load bearing capacity depends upon the Installer's mounting methods and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads. The system installer should ensure that installation methods used meet these requirements and any local codes and regulations.
- Rated electrical characteristics are within 10% of the values measured at Standard Test Conditions (STC) of 1000 W/m² irradiance, 25 °C cell temperature, and AM 1.5 spectrum.

6.1 Site Selection

- PV modules should be installed in a place where there is no shading across the location throughout the year. Shading can be minimized by having the distance between the obstruction and solar array is more than thrice the height of obstruction.
- Solar module is recommended to be installed at an optimized tilt angle to maximize the energy output. It is roughly equal to the latitude of the project site as a rule of thumb, facing to equator. But always to design based on local situations to find out the optimum one.
- PV modules should typically face south in the northern hemisphere and north in southern hemisphere.
- ISPL modules can be mounted either in landscape or portrait orientation however the impact of dirt shading the solar cells can be minimized by orienting the product in portrait.
- Modules shall be mounted at the orientation and tilt angle required to ensure consistent performance throughout the year. The installation site should provide unobstructed access to direct 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. for installation over a roof is required to maintain the fire class rating. 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.

6.2 Module Specifications.

- Please refer to the latest module datasheet for detailed specifications.
- Refer to instruction manual/booklet. Scan the QR Code available in the module data label.



7. Installation Guide:

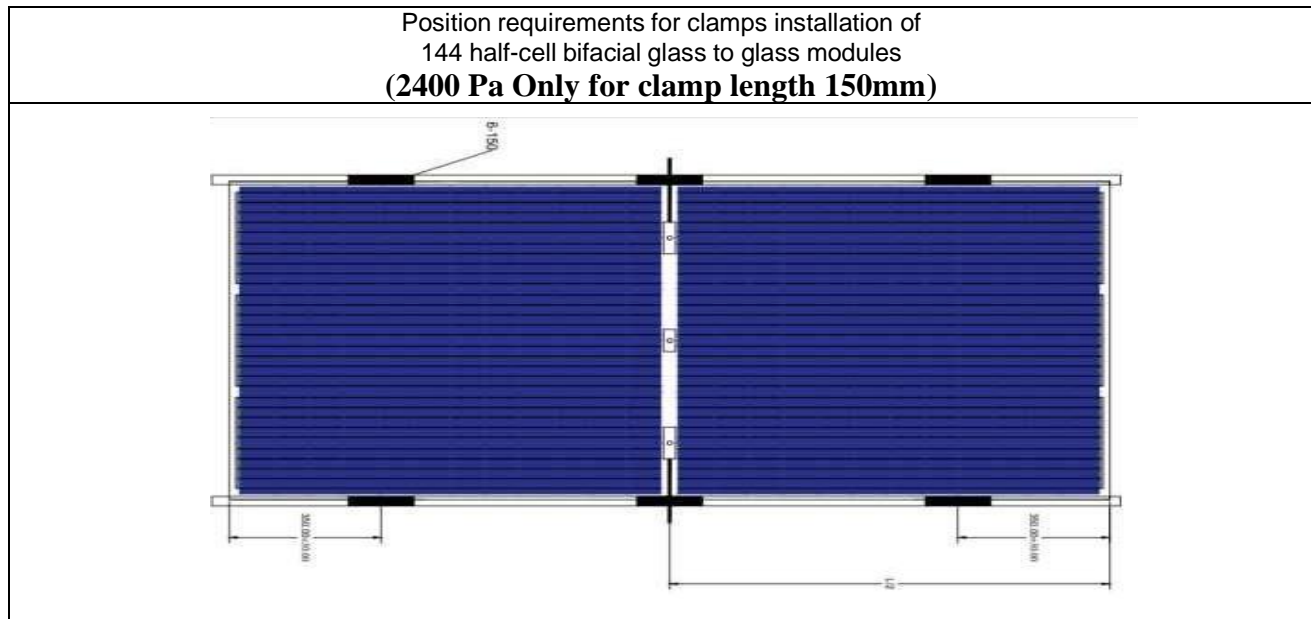
7.1 Mounting Instruction.

- PV modules may be fixed either by the **bolt method** or by the **clamp method**.
- **Corrosion-proof M8 bolts** shall be used in the PV module mounting holes located on the rear side of the module.
- Regardless of the mounting method, the following requirements must be ensured:
 - A minimum clearance of **120 mm** between the module frame and the surface of the roof or wall.
 - A minimum distance of **10 mm** between adjacent modules.
 - **Drainage holes** on the module frame must remain unobstructed at all times.
- PV modules should be installed in a place where there is no shading across the location throughout the year. Shading can be minimized by having the distance between the obstruction and solar array is more than thrice the height of obstruction.
- PV modules should typically face south in the northern hemisphere and north in southern hemisphere. ISPL modules can be mounted either in landscape or portrait orientation however, the impact of dirt shading the solar cells can be minimized by orienting the product in portrait.
- For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. If the PV module is placed at a different angle or orientation, then it could have a direct impact on the generation output.
- PV modules should not be installed in such a way it will be immersed under water under any circumstances and should not be also installed in a moving vehicle / vessel.

- The module is considered to be in compliance with UL 61730 only when it is mounted in the manner specified in this manual. A module with exposed conductive parts is considered compliant with UL 61730 only when it is electrically grounded in accordance with ISPL’s instructions and the requirements of the National Electrical Code (NEC), ANSI/NFPA 70 (2014–2017).

7.1.1 Clamp fixing Method

- The following load conditions are applicable for installations in most environments:
 - Back side (double-glass modules):** Maximum design static load – **2400 Pa** (wind load).
 - Front side:** Maximum design static load – **5400 Pa** (wind and snow load).
- For **144 half-cell bifacial modules**, a **6-point clamping method** is recommended, based on appropriate structural calculations.



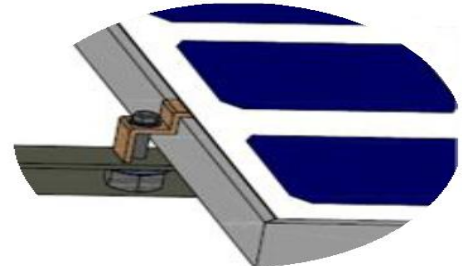
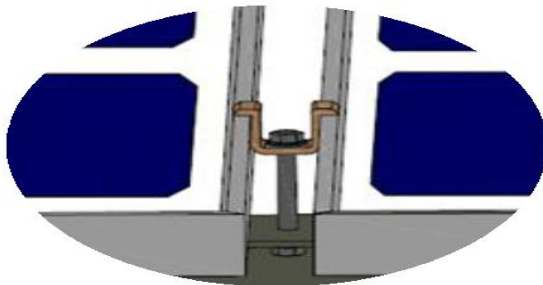
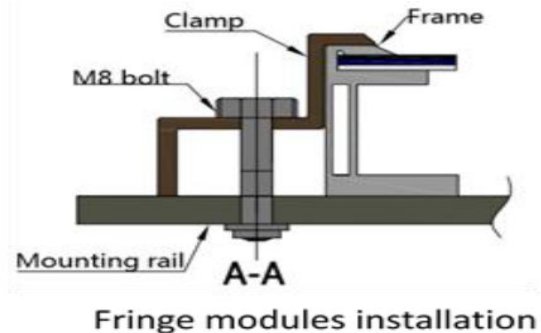
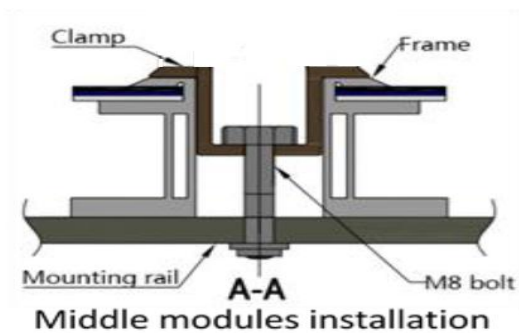
- The clamps must overlap from the edge of the module by at least 10mm but should avoid shading the cells in the module. The applied torque used to attach the clamps to the module/racking should refer to the mechanical design standard for the specific bolt in use.
- Depending on local snow and wind conditions, more than 4 clamps may be needed to ensure that the modules can withstand the expected load.

- For loads larger than 4000Pa (50psf), ensure that each clamp has a minimum length of 120mm. Do not use clamps with a length smaller than 80mm unless approved by ISPL. When installing modules in an array, please allow for a minimum lateral air gap of at least 10mm between the exposed edges of the adjacent modules to account for thermal expansion and contraction of PV system elements in the field.
- Module need metal clamp to be fixed on the racks. ISPL recommends you use clamps as below Specifications or clamps approved by system installer.

Length: $\geq 80\text{mm}$ or $\geq 150\text{mm}$; for bifacial glass to glass module, $\geq 150\text{mm}$

Thickness: $\geq 3\text{mm}$, Material: Aluminum alloy

Bolt: M8 Torque range : 16-20 Nm

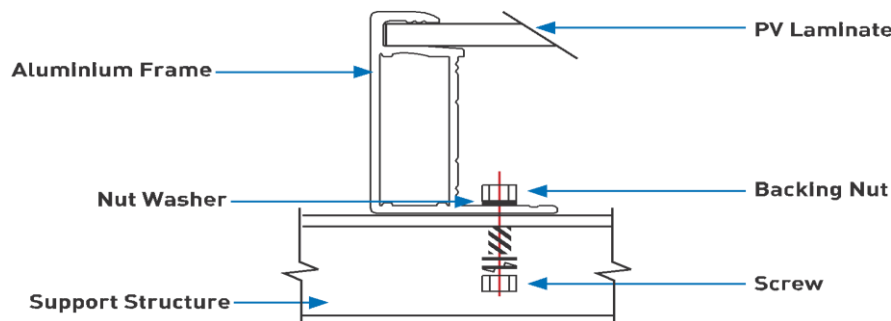


- The modules clamps must not contact the glass directly or deform/damage the glass in any cases, clamp should be embedded with the rubber washer, which plays a buffer function when install double glass module and the contact area of clamp with the glass surface must be smooth, otherwise may damage the modules. Avoid shading effects from the module's clamps. The EPC/installer needs to make sure that the bolt is not too high such that it would cast shadow over the solar module.
- Different mounting configurations can be tried as per Installer's calculations; however, failure to comply with the above suggestions may result in a lowering of

load handling capabilities and may lead to failure of any overload situation which may not be covered under ISPL’s warranty.

7.1.2 Bolts Fixing Method

- The frame of each module is provided with **8 mounting holes** (9 mm × 14 mm).
- **Corrosion-proof stainless-steel fixings** are strongly recommended.
- Each module shall be secured using an **M8 – Grade 8.8 (or 1/4”-20 Grade B7)** coarse-thread bolt, with the following hardware:
 - Two flat washers
 - One spring washer
 - One nut
- The assembly should be tightened to a torque of **16–20 Nm**, as shown in Figure.



7.2 Wiring Instruction

- All wiring should be carried out by qualified installers in accordance with applicable electrical codes and regulations.
- PV modules may be connected in series to increase the operating voltage by plugging the positive connector of one module into the negative connector of the next. Before making any connections, always ensure that the contacts are clean, dry, and free from corrosion.
- PV modules may be connected in parallel to increase the operating current by connecting all the positive connectors together and all the negative connectors together. Before making any connections, always ensure that the contacts are clean, dry, and free from corrosion.

⚠ Safety Warning

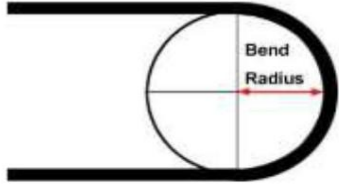


- Do not exceed the maximum system voltage and current ratings of the PV modules.
- Use properly rated fuses, circuit breakers, or protective devices in parallel connections to prevent overcurrent.
- Ensure that connectors are fully engaged and locked with an audible “click.”
- Only qualified personnel should perform electrical connections in compliance with local electrical codes and standards.

- Product can be irreparably damaged if an array string is connected in reverse polarity to another i.e., if the positive end is connected to negative input of the string combiner box and vice versa. So proper connection in the right polarity is recommended and if any reverse polarity is seen or any difference of more than 10 V is observed, the string configuration connection needs to be checked and connected appropriately.
- ISPL Solar modules are provided with standard Cables with a 4 mm² cross-sectional area and are rated for 1500V (IEC and UL) for maximum system voltage, 90°C and are UV resistant. Ensure the cables are not exposed to water logged areas.
- The maximum voltage of the system should be lesser than the certified system voltage (typically 1500) or the maximum input voltage of the inverter. Since $V_{oc} \propto (1/T)$, the open circuit voltage of the array needs to be calculated at the lowest ambient temperature for the location of power plant. This can be done using the formula below

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

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 (refer the datasheet)
- T_{min} – Minimum ambient temperature of the location of the plant.

		
<p>Minimum bending radius cables should be 43 mm (1.69in)</p>	<p>Incorrect routing of cable</p>	<p>Correct routing of cable</p>

- ISPL Modules contain pre- installed bypass diodes. If the Modules are incorrectly connected to each other, the bypass diodes, cables, or junction box may be damaged.

- As reverse currents can exceed the value of the maximum protective fuse, a properly rated and certified over current device (fuse or circuit breaker) must be connected in series with each Module or string of Modules.
- Match the polarities of cables and terminals when making the connections; 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, cable and connectors shall not be altered in any case. Modules with a suspected electrical problem should be returned to ISPL for inspection and possible repair or replacement as per the warranty policy provided by ISPL

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 efficiently convert this into grid.

Caution: Solar module is rated to operate at potentially lethal DC voltages which have the potential can cause severe electrical shock, arcing and fire hazards. Whilst some solar modules, manufactured by ISPL, are certified to operate up to 1500V 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, the DC power may be active for some time, hence only expert operators are recommended to operate upon the panels, string combiner box, etc. ISPL will not be responsible for any electrical accidents occurring in power plants using ISPL Solar modules.

8.1 Fuses

- 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 then fuses should be connected in both the positive and negative poles). While we use

a 15A fuse in regular power plant, the bifacial module produces excess current. It is thus necessary to refer to the datasheet and design the fuse rating accordingly taking the onsite conditions into consideration.

- This fuse rating value also corresponds to the maximum reverse current that a module can withstand (when one string is shaded then the other parallel strings of modules will be loaded by the shaded string and current will flow) and therefore impacts the number of strings 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, ISPL modules normally do not need to be electronically connected to earth and can operate with either galvanically isolated (with transformer) and transformer less 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 Transformer Less Inverter is used in hot humid climatic locations, The Installer should ensure the right active negative earthing kit is to be installed by EPC/installer and having assurance from the inverter supplier.

8.3 Diodes

- ISPL Solar PV modules are equipped with bypass diodes in the junction box. This minimizes module heating and current losses. Do not try to open the junction box to change the diodes even if they malfunction. Doing so can cause shock/ electrical hazard/ fire outrage in the power plant. It would further render the warranty void of the module.
- In a system using a battery, utilizing a blocking diode is recommended. Blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night.

9. Maintenance & Cleaning of PV Module

- It is common for dust and dirt particles to accumulate on the surface of the Module. This can reduce the optimal output performance of the solar Modules. Normally, the accumulated dust can be washed with water, but in some instances, some maintenance is recommended to clean the surface of the glass with water and a soft cloth or sponge to remove layer of dirt. A mild non-abrasive detergent may be applied to remove persistent dirt from both the sides of module.
- PV Module Cleaning should be done only by properly trained personnel who understand the risks of applying water to electrical components.
- It is advisable to perform periodic inspection of the Modules for damage to glass, frame, junction box or external electrical / loose connections and corrosion by the authorized professional.
- No aggressive and abrasive cleansers or chemicals should ever be used on the glass. No alkali-based chemicals should be used, including ammonia-based solutions.
- 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 operations.
- Acceptable module cleaning methods are to spray the Modules with low-pressure water closely matched in temperature to the Module or to use a dry-cleaning technique. Do not apply water that is more than 20°C warmer or colder than Module surface temperature.
- Always make sure that cleaning should not be done during generation time, the recommended time to clean module is from dusk to dawn when production is not affected and risk of electrical shock hazard is minimized. During the generation time the temperature of module is higher and washing may also cause thermal stress in module.
- Maintenance should be carried out at least once a year by trained personnel, always wearing rubber gloves and boots rated for a working voltage of at least 1500 V DC when handling 1500 V system voltage modules.
- Trim any vegetation which may shade the solar array thus impacting the albedo of the ground and/or its performance.
- Check that mounting hardware is properly tightened.

- Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.
- 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 once 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.
- 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.
- 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 more frequently.
- 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 ISPL.

10. Contact & Communication Details

Corporate Office:

Plot no:1, Survey no:83/1,
Opp. IKEA, Aurobindo Galaxy Towers,
16th Floor, A wing, Rayadurgam,
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Manufacturing Plant:

Sy.no. 584/9, 10,11, 585/2, 3, 4, 5,6, 7,8,
592/1, 2B, 3B, 4A, 4B, 5A, 5B etc., of
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Gudluru Mandal,
SPSR Nellore District,
Andhra Pradesh, India – 523291

For Service & Support Enquiry:
customersupport@indosolsolar.com

