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Installation Manual for solar Photovoltaic Module

Installation Manual for SPV Modules (Application class Rating A)

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01. DISCLAIMER OF LIABILITY

- The use of this manual, the installation, and the handling of Insolation energy modules are beyond Insolation energy control. Insolation energy assumes no responsibility for failure to follow instructions resulting in any loss, damage, injury or expense due to improper installation, handling, usage or

Maintenance.

- Insolation energy assumes no responsibility for the infringement of intellectual property rights or other rights of third parties that may result from use of the module. No license is granted in this regard, either expressly or implicitly, nor under any patent rights.
- All information given in this manual is based on Insolation energy's knowledge and experience. Insolation energy.
- Solar reserves the right to change this manual and module specification without prior notice.

02. SAFETY PRECAUTIONS

- PV modules generate electricity upon direct exposure to light, which can result in electric shock. Use of insulated tools and gloves is recommended while working with modules in sunlight. No metallic contact points should be on the human body.
- No one should stand on the front or rear surfaces of the PV module, as non-uniform, localized pressure might cause damage to the solar cells inside the module.
- The front surface of the module is constructed with tempered glass and hence it should be handled with the utmost care. If the glass breaks, human contact with the surface can lead to electric shock, particularly when the ambient conditions are wet. Broken modules cannot be repaired and should be disposed of properly.
- All electrical connectors should be well protected against corrosion and soiling. Ensure that connectors are corrosion free and clean with absolutely no gaps between the contacts. Gaps can result in electrical arcing, causing a fire hazard.
- For your personal safety, do not install/handle PV modules in adverse environmental conditions such as gusty winds or wet frosted roof surfaces.
- Ensure the polarity of the modules or strings is not reversed in relation to the other modules in the string.
- Concentrating artificial sunlight on solar modules is not allowed as it will degrade their performance and lifespan.
- Insolation energy modules are certified for operation in Class A installations at voltages below 1000V DC. This value should be taken into consideration when designing the power plant, as should the temperature ranges present at the site. The mixing of power classes in one string is not allowed and can be harmful. Damage to modules due to such mixing can lead to the invalidity of product warranties.

- "Under normal conditions, a 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 size of controls connected to the PV output."

03. UNPACKING AND STORAGE

- Upon receipt of the PV modules, verify that the product details correspond to those ordered. The packing list affixed to the outside of the box contains all details including the serial numbers of the modules.
- Do NOT stack packing boxes (pallets) more than 2 boxes high. If pallets are temporarily stored outside, an external protective cover should be placed over them and the stack height should not be more than 1 pallet high.
- PV modules should always be unpacked vertically by two people .
- Should also be taken to prevent one module falling over and knocking another inside the packaging box.
- PV module surfaces may become damaged/scratched if not handled carefully. No paint or adhesive should be applied to any of the surfaces including frames.
- Do NOT connect the male & female connectors of the junction box to the cable of the module.

03.1 PRODUCT IDENTIFICATION

Each module has a unique serial number engraved/paste sticker on the bussing connector inside the glass and another one on the back sheet of the module. Please do not tamper with the serial number of the module and always record all the serial numbers in an installation for your future records. Apart from this Each Module have "INA " brand Logo .

04. INSTALLATION ENVIRONMENT

04.1 CLIMATE CONDITIONS

- Ambient temperature: -40°C to $+50^{\circ}\text{C}$.
- Operating temperature: -50°C to $+40^{\circ}\text{C}$.
- Storage temperature: -20°C to $+50^{\circ}\text{C}$.
- Humidity: $< 85 \text{ RH}\%$

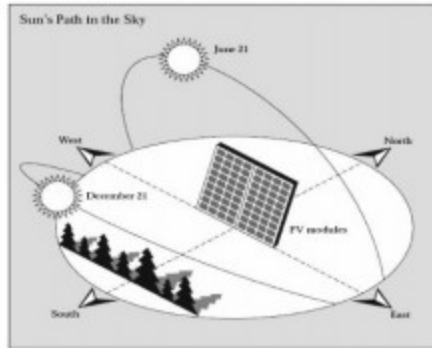
- Mechanical load pressure*: 2400 Pa on the front and 2400 Pa on the rear side

05. SITE SELECTION

1. PV modules should be installed in a place where no shading occurs throughout the year. Shading can be minimized by ensuring that the distance between an obstruction and the solar array is more than three times the height of the obstruction.
2. PV modules should be installed in a place where no shading occurs throughout the year. Shading can be minimized by ensuring that the distance between an obstruction and the solar array is more than three times the height of the obstruction.
3. For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. If the PV module is placed at a different angle or orientation, this could have a direct impact on the power output.
4. Avoid using mounting methods where drainage holes are blocked.
5. PV modules should not be installed in such a way that they will be immersed under water under any circumstances, and should also not be installed on moving vehicles/vessels.

Sun Arc Table:

Latitude	10°	15°	20°	25°	30°	35°	40°	45°
Summer	12.71°	13.02°	13.34°	13.7°	14.08°	14.54°	15.02°	16.62°
Winter	11.54°	11.24°	10.92°	10.58°	10.21°	9.80°	9.33°	8.76°



Tilt Angle Selection :

More sunlight per square foot falls on a perpendicular surface (90 deg to the sun's ray is optimal). Less sunlight falls on a vertical surface & horizontal surface.

The module tilt angle is measured between the solar modules and the ground

Tilt angle Table:

Site Latitude in Degrees	0° to 15°	15° to 25°	25° to 30°	30° to 35°	35° to 40°	40°
Fixed tilt angle	15°	same as latitude	latitude +5°	latitude +5°	latitude +5°	latitude +5°

06. MOUNTING INSTRUCTIONS

06.1 MOUNTING METHOD

Corrosion proof M6 bolts are to be used in the PV module mounting holes, which are on the reverse side of the module. PV modules can be fixed using only the bolt method the installer should ensure that:

1. 120 mm clearance is provided between module frames and the surface of the roof or the wall.
2. There is a minimum distance of 10.50 mm between two modules.
3. 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 the thermal expansion of support structures.
4. When modules are ground mounted, select the height of the mounting system in such a way as to prevent the lowest edge of the module from being covered by snow for a long time in winter in areas

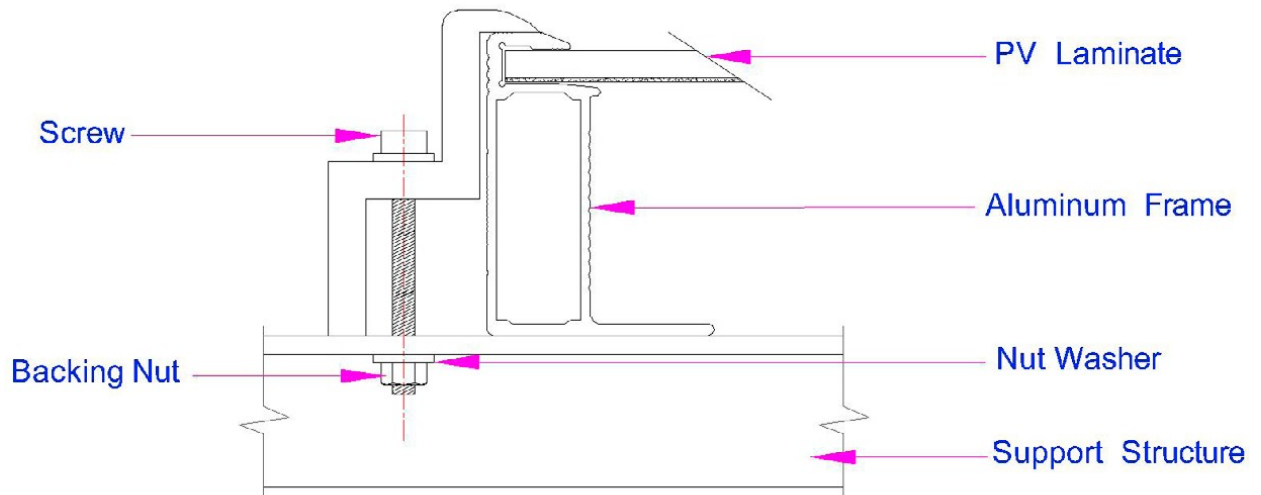
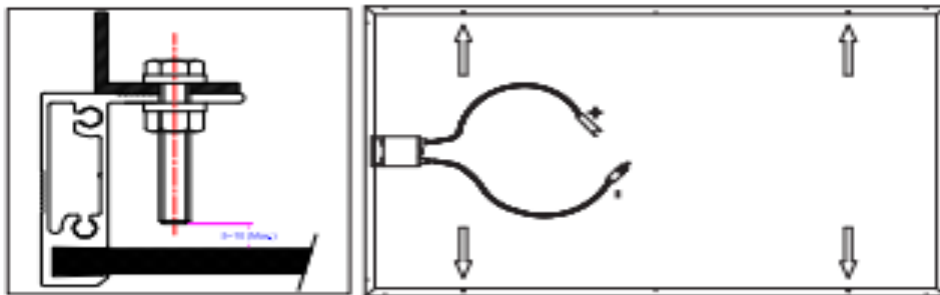
that experience severe snow fall. If snow settles on the PV modules, the regular clearing of snow and other foreign particles is highly recommended to ensure the long-term reliability of the PV modules.

Failure to comply may result in damage to the module and lead to deformation not covered under warranty.

A. Mounting with Frame holes use Nut Bolt :

The frames of each module have minimum 4 No (7*10mm) mm mounting holes or 8No(9*14mm) oval shape. Insolation energy strongly recommends the use of corrosion-proof (stainless steel) fixings.

The modules are to be secured with an M6 bolt and nuts and washers. and a flat washer or spring washer and nut as shown in the figure. The assembly should be tightened to a torque of at least 16-25Nm.



Modules installed using screw fitting method Middle Module Installation

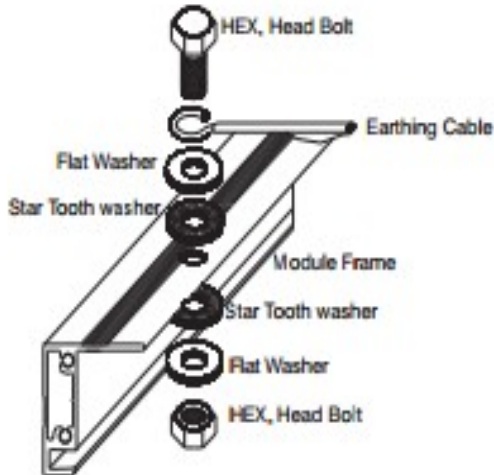
Cells and cells size with matrix	MODEL Name	Watt power (where AAA)	Module length in mm (±1.5mm)	Module width in mm (±1.5mm)	holes distance Center to center long side in mm(±1.5mm)	holes distance Center to center width side in mm (±1.5mm)
72 Full cells Module	INA72P XXX INA 7MPXXX	250-375	1970	990	980 and 1500	950
72 cut cells Module	INA72PXXX	250-275	1710	990	980	950

72 cut cells Module	INA72P XXX	200-245	1650	990	980	950
72 cut cells Module	INA72PXXX	180-240	1425	990	980	950
60 Full cells Module	INA60PXXX	250-320	1650	990	980	950
	INA60MPXXX					
60 cut cells Module	INA60P XXX	200-250	1425	990	980	950
54 Full cells Module	INA54PXXX	230-280	1495	990	980	945
	INA54MPXXX					
48 Full cells Module	INA48PXXX	200-250	1335	990	980	945
	INA48MPXXX					
36 Full cells Module	INA36PXXX	150-180	1495	670	980	643
	INA36MPXXX					
36 cut cells Module	INA36PXXX	130	1335	670	980	643
36 cut cells Module	INA36PXXX	120-140	1275	670	750	643
36 cut cells Module	INA36PXXX	90-100	1010	670	500	643
36 cut cells Module	INA36PXXX	105-115	1090	670	500	643
36 cut cells Module	INA36PXXX	70-85	775	670	400	643
36 cut cells Module	INA36PXXX	60-65	645	670	400	643
36 cut cells Module	INA36PXXX	45-55	538	670	300	643
36 cut cells Module	INA36PXXX	37-40	430	670	200	643

06.2 GROUNDING

- 1.The module frame must be properly grounded (refer to NEC clause 250). The grounding wire must be properly fastened to the module frame to ensure good electrical contact. Use the recommended connector type, or an equivalent, for this wire.
2. If the support frame is made of metal, the surface of the frame must be electroplated and have excellent conductivity.
- 3.First, carefully strip 16 mm of the insulating jacket from the end of grounding wire to avoid nicking or cutting conductors.
- 4.For grounding and bonding requirements, please refer to regional and national safety and electricity standards. If grounding is required, use a recommended connector type, or an equivalent, for the grounding wire.
- 5.If grounding is required, the grounding wire must be properly fastened to the module frame to ensure adequate electrical connection. The grounding conductor must then make a connection to earth using a suitable ground electrode. Recommended Torque rating Min. 8.5 Nm , Use uncoated, stranded copper ,Bonding and grounding wire size has to be minimum wire size of conductor from module i.e. 12AWG/

4Sq.mm , ELECTRICAL GROUNDING OF MODULE USING HEX, BOLT & NUT (M4 size) with using Flat and star tooth washer as per below image.



Grounding assembly of PV module

Insulation energy Solar modules can be installed with the grounding devices manufactured by third parties and listed for the grounding of metal PV module frames. The devices must be installed in accordance with instructions specified by the grounding device manufacturer.

06.3 MODULE WIRING

1. Module wiring should be performed by professional expert installers in accordance with local regulations and national codes.

2. PV modules can be connected in series to obtain an increase in the operating voltage. The positive connector plug of the module is pushed into the negative connector plug of another module until a click is heard. Only assume the modules are connected if a click is heard.

3. Irreparable damage can be done if the array strings are connected in reverse polarity, i.e if the positive end is connected to negative input of the string combiner box and vice versa. Proper connection in the right polarity is therefore recommended, and if any reverse polarity is seen or any difference of more than 10V is observed, the string configuration connection needs to be checked and connected appropriately.

4. Insulation energy modules are provided with standard copper cables with a 4mm² cross-sectional area and are rated at 1500V for maximum system voltage, 90°C and are UV-resistant. Ensure the cables are not exposed to water-logged areas.

Note : Do Not to disconnect under load .

5. The maximum voltage of the system should be less than the certified system voltage (typically 1500V) 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:

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

Where

X - Number of modules which are connected in series

Voc - Open circuit voltage of each module (refer to the data sheet)

T α -voc - Thermal coefficient of open circuit voltage for the module as a percentage (refer to Insolation energy spec sheet)

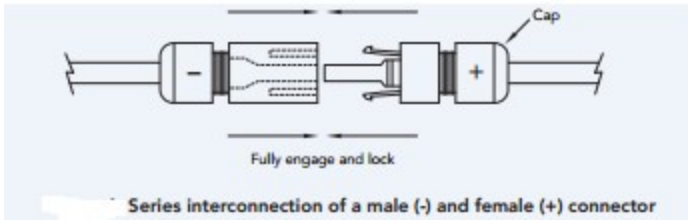
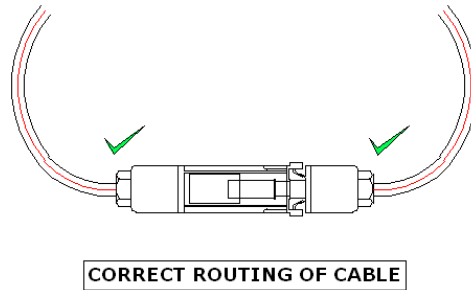
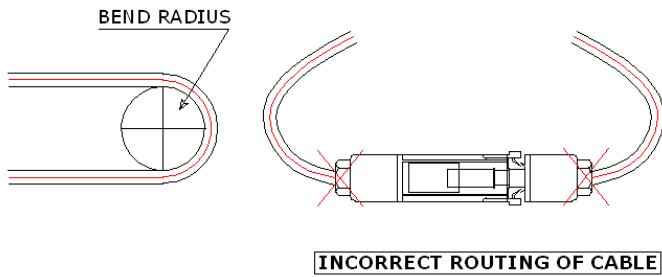
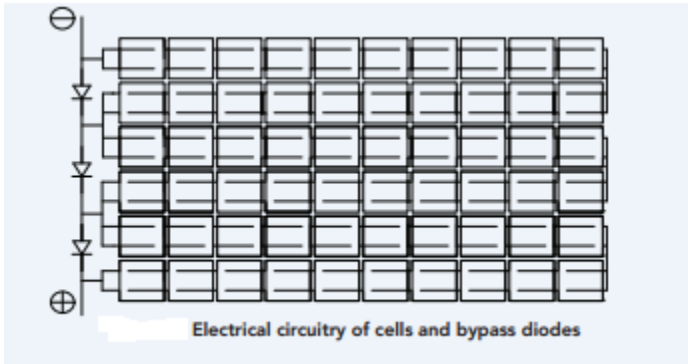
Tmin - Minimum ambient temperature of the location of the plant

1.The minimum and maximum outer diameters of the cable are 5mm and 7mm .

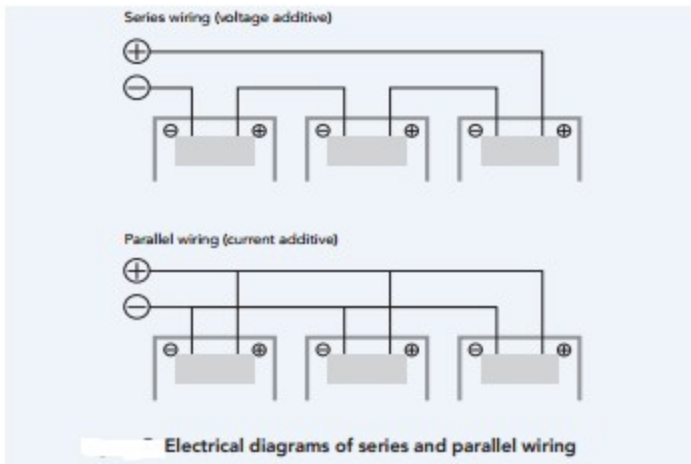
2.For field connections, please USE-2 , 4mm² cables insulated for a minimum of 90°C WET OR Dry and designated as PV wire. The Minimum bending radius of cables should be 44mm.

The maximum electrical rating of an acceptable series fuse is 15 amperes .

junction box (factory fitted). Diode rating -20A,45V (or as per model specified JB)



Series parallel wiring



- These cables & connectors can be used to easily connect all the modules in series/parallel.
- When connecting the modules in an array, the output wiring from the final module is generally run to separate array junction box. In commercial system, this wiring from the array box to the next component (i.e. Fuse box, or charge regulator, etc) is generally run in the conduit.
- The maximum electrical rating of an acceptable series fuse is 4-12 amperes. as per electrical specification with according to Models.

07. ELECTRICAL CONFIGURATION

A solar array generates DC electricity when sunlight falls on the modules and the inverter is in active mode. Once the minimum voltage and current requirements are met, this is converted into AC power accordingly.

Cautions:

1. The modules are rated to operate at potentially lethal DC voltages which have the potential to cause severe electric hazards in the form of shock, arcing and other fire hazards. Hence only trained professionals are permitted to work with the modules, the DC solar array and the DC combiner box. The PV modules are certified to operate at 1000V DC .
2. A rated isolator (DC switch) must always be used to interrupt the current flow when disconnecting the connectors. Even after disconnecting, the DC power may be active for sometime, hence only expert operators are recommended to work with the modules, string combiner box, etc. Insolation energy will not be held responsible for any electrical accidents occurring in power plants with Insolation energy modules. Maximum system Voltage 1500 V.

For min. Bypass diode rating as below-

3Rail 2 Diode JB (37wp to 180W) – 20 A/45V

4 Rail 3 Diode JB ((200wp to 375W) – 20A/45V & Split Junction Box 30A/45V

TECHNICAL DATA

Electrical Data : All Data refers to STC (1000W/m² , AM1.5G , 25°C)

Type	INA 300P	INA 315P	INA 320P	INA 325P	INA 330P
Peak Power Pmax (Wp)	300	315	320	325	330
Maximum Voltage Vmpp(V)	37.28	37.50	37.70	37.80	38.00
Maximum Current Impp(A)	8.05	8.40	8.50	8.60	8.70
Open Circuit Voltage Voc (V)	45.10	45.80	46.00	46.20	46.30
Short Circuit Current Isc (A)	8.74	8.92	9.03	9.13	9.24
Module Efficiency (%)	15.51	16.30	16.55	16.81	17.07

STC : 1000W/m² irradiance, 25°C cell temperature, AM1.5G spectrum according to EN 60904-3
Average relative efficiency reduction of < 5% at 200W/m² according to EN 60904-1

Type	INA 360MP	INA 365MP	INA 370MP	INA 375MP
Peak Power Pmax (Wp)	360	365	370	375
Maximum Voltage Vmpp(V)	39.90	40.10	40.30	40.50
Maximum Current Impp(A)	9.02	9.10	9.18	9.26
Open Circuit Voltage Voc (V)	48.50	48.70	48.9	49.1
Short Circuit Current Isc (A)	9.45	9.53	9.63	9.70
Module Efficiency (%)	18.62	18.88	19.14	19.40

Type	INA 330P	INA 335P	INA 340P
Peak Power Pmax (Wp)	330	335	340
Maximum Voltage Vmpp(V)	38.10	38.30	38.50
Maximum Current Impp(A)	8.67	8.75	8.84
Open Circuit Voltage Voc (V)	46.00	46.20	46.30
Short Circuit Current Isc (A)	9.22	9.27	9.32
Module Efficiency (%)	17.07	17.33	17.58

07.1 FUSING

Please rate the fuses for maximum V DC and connect them in each non-grounded pole of the solar Array The maximum fuse rating connected in series with the array string is usually 20A, but the actual module specific rating can be found on the module data sheet. The fuse rating also corresponds to the maximum reverse current that a module will be able to withstand.

07.2 INVERTER SELECTION AND COMPATIBILITY

When installed as per the IEC standards and regulations, Insolation energy modules do not normally need to be electrically connected to earth and can operate with either galvanic ally isolated (with transformer) or transformer less inverters. If galvanic ally isolated inverters with transformers are used, the negative pole of the array must be connected to earth.

If a transformer less inverter is used, the installer should ensure that the right active negative earthing kit is installed by consulting with the inverter supplier. Both methods are required in order to prevent the modules from potential induced degradation in the field.

08. MAINTENANCE AND CARE

Well-designed PV plants require minimum maintenance, however with further maintenance the performance and reliability of the system can be improved.

1. Yearly /periodic maintenance by a trained professional is usually advised.

2. Check that the mounting structures are properly laid and the modules are held tightly in accordance with the mounting instructions given above.

3. Ensure that no part of the light collecting area of the module is shaded, any leaves/trees or any object which causes shading must be removed accordingly.

4. Ensure all cable assemblies are tight and no part of any cable assembly is exposed to water logging.

5. Check that the string fuses in each non-earthed pole are in operation.

6. In order to clean PV modules, use a soft module cleaning kit like the Unger cleaning kit. A soft cloth with mild soft detergent can be used as an alternative. Only use water with the same temperature as that of the module, otherwise thermal shocks can be created and can damage the module. Ensure the module is cleaned without causing any damage such as micro-cracks, etc. to the module.

7. Always keep the module clean to ensure maximum power generation from the solar PV module.

8. The rear surface of the solar module does not require specific cleaning unless any dirt or debris is stuck on the back sheet. When removing dirt from the back sheet, avoid using any sharp objects, which can damage the substrate material and cause slits.

09. END OF LIFE PRODUCT RECYCLING

After the end of their useful life, products should be recycled in a useful, renewable way. Insolation Energy is a member of the PV Cycle organization, which manages a collection and recycling scheme for end-of-life Solar PV modules throughout india and can offer help and support, provided that you submit the serial numbers of the modules.

a) If recycling less than 40 modules, contact PV Cycle directly at <http://www.pvcycle.org/> to locate the nearest recycling collection point.

b) To recycle more than 40 modules, contact sales@insolationenergy.in and we will provide support on how to proceed.

10. WARNING

PV modules contain no serviceable parts.

If you have any doubts that your installation is not working properly or may not work properly, Please contact your installer immediately.

1) Contact the Insolation energy sales service team at: sales@insolationenergy.in

2) Submit the customer feedback form to: sales@insolationenergy.in or Call our Toll Free Number 1800-212-1806 and our technical sales/service representative will get in touch with you shortly.

WARNING:

While performing any electrical maintenance, the system must be completely shut down and such maintenance should be performed by experts. Failure to comply with standards may result in lethal shocks, burns and sometimes even death.