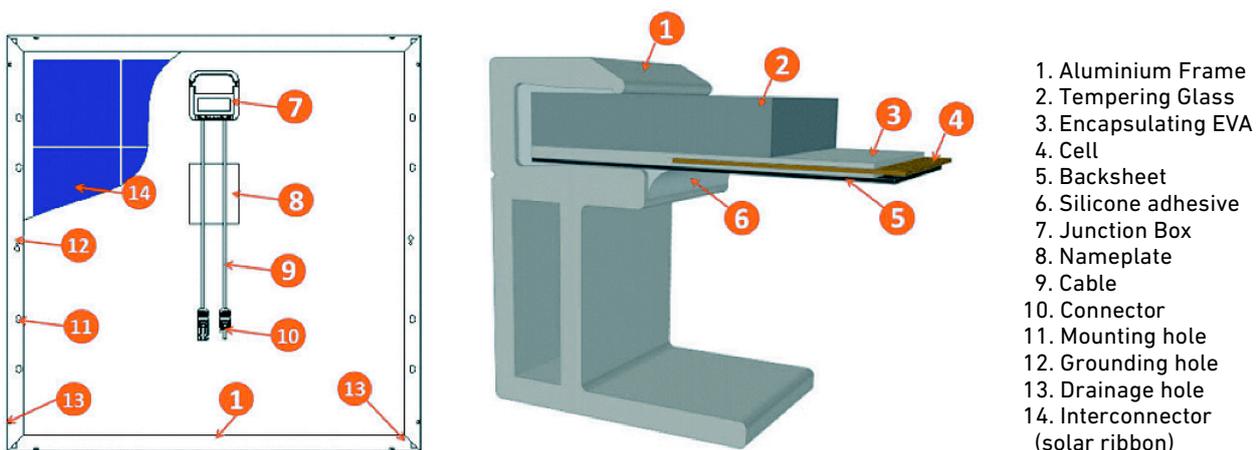


# INSTALLATION MANUAL

General Installation Manual for JONSOL PV Solar Module

Please read this manual carefully before installing the modules.

Module components and cross-section



## 1. WARNING

Please read this manual completely before installing JONSOL solar module. This module produces electricity when exposed to light. Follow all applicable electrical safety precautions. Only qualified personnel should install or perform maintenance work on this module. Do not handle modules when they are wet. Do not use mirrors or other magnification device or artificially concentrate sunlight onto the modules.

## 2. INTRODUCTIONS

JONSOL solar modules come in various sizes to satisfy a full range of applications. Each module is made of crystalline-silicon cells. To protect the cells

from the most severe -environmental conditions, modules are made of high transmission rate and low iron tempered glass, anti-aging encapsulation material, and high climate resistant and insulation back sheet by hot lamination, with anodized Aluminum alloy frame and permanently attached junction box.

## 3. APPLICATIONS

Modules are reliable, designed to operate efficiently in sunlight. By modules, the solar radiant energy is transformed into electrical energy for using. Modules, usually are used as one fitting of PV solar system. A set of basic PV solar system is consisted of PV solar modules, controller, inverter, and storage battery.

Modules can be used in roof PV solar systems, PV stations, building, and other electric generation application etc widely.

#### **4. CODES AND REGULATIONS**

The mechanical and electrical installation of PV systems should be performed in accordance with all applicable codes; including electrical codes, building codes, and electric utility interconnect requirements.

Requirements may also vary with system voltage, and for DC or AC application. Contact local authorities for governing regulations. Whatever district, local standards should also be followed in such installations.

Use only stranded or solid copper single –conductor type PV wire or USE-2 cable, rated sunlight resistant, for modules and interconnect wiring that is exposed to weather.

#### **5. MECHANICAL INSTALLATIONS**

##### **5.1 Mounting site**

Modules can be used on land except for corrosive salt area and sulfurous area.

Excluded applications include, but are not limited to, installations where modules are likely to come in contact with any salt water or where likely to become partially or wholly submerged in fresh or salt water, examples of which include use on boats, docks and buoys. Don't install modules in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.

Actual maximum allowable wind speed may be influenced by module type, mounting configuration, location, and other factors. In no case should modules be exposed to pressures greater than 112.9 pounds per square foot ( $551\text{Kg}/\text{m}^2$ ) of uniformly distributed wind, snow, or other loading.

The modules have been tested by TUV for a maximum front loading of 5400 Pa, backside loading of 2400 Pa.

Don't install modules near naked flame or flammable materials.

When choosing a site, avoid trees, buildings or obstructions. Modules should be mounted to maximize direct exposure to sunlight and to eliminate or minimize shadowing. Even partial shadowing can substantially reduce module and system output. Furthermore, partial shadowing can elevate the shaded portion's internal temperature, which may lower the output and shorten module life.

##### **5.2 Orientation of installations**

Modules may be mounted at any angle from a vertical orientation to a horizontal one. The appropriate fixed tilt angle and azimuth orientation should be used in order to maximize the exposure to sunlight.

Incorrect orientation of modules installation will result in loss of power output. Modules connected in series should be installed at same orientation and angle. Different orientation or angle may cause loss of power output due to difference of amount of sunlight exposed to the modules.

In the Northern Hemisphere, modules should face south, and in the Southern Hemisphere, modules should face north.

##### **5.3 Module tilt angle**

Modules produce the most power when they are pointed directly at the sun. For installations where modules are mounted to a permanent structure, modules should be tilted for optimum winter performance. As a rule, if the PV system power production is adequate in the winter, it will be satisfactory during the rest of the year. The module tilt angle is measured between the modules and the ground.

### 5.4 Mounting

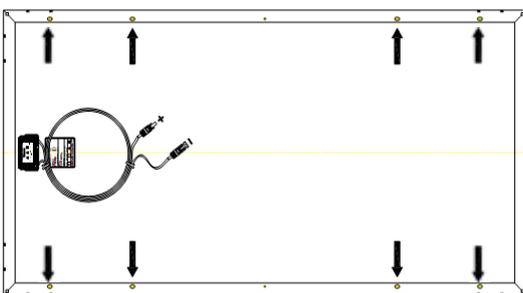
Use fasteners to fasten the modules to the mounting support structure. Modules should be bolted to support structures through mounting holes located in the frame's back flanges only. Do not drill additional holes in the frame. Doing so will invalidate the warranty. Modules should not be mounted by supports at the ends.

Mounting support structure should withstand forces from wind and snowfall pressure etc. Mounting support structure should use proper materials and corrosive treatment. Installation the modules should have proper ventilation.

Clearance behind the modules is required to permit air circulation and cooler module operation. Elevated temperatures lower operating voltage and power, and shorten module lifetime. Clearance of 1/4 inch (6.35 mm) or more between modules is required to allow for thermal expansion of the frames.

The recommended standoff height is 4.5 inch (about 115 mm). If other mounting means are employed it would cause unpredictable effect.

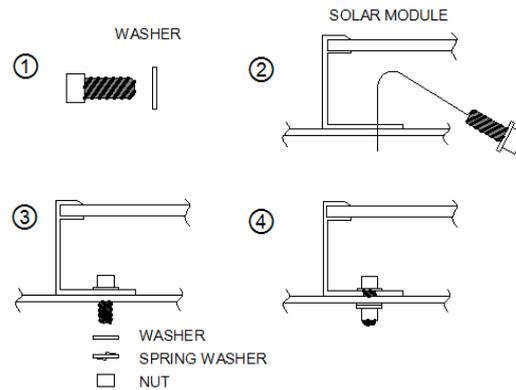
Figure 1:



↑ Mounting holes for normal installation Module must be securely attached to the mounting structure using 8 holes for normal installation as indicated in figure 1. Load calculations shall be done by the system designer or installer.

Each hole shall be installed in the order as in the following figure.

Figure 2:



For your reference, please use the components specified in below:

1. Bolt (inside hexagonal)  
Material: Stainless Steel  
Size and Length: M8\*16mm  
(M6\*16 for JSP-54&JS\*-60)
2. Washer  
Material: Stainless Steel  
Size:M8 (M6\*16 for JSP-54&JS\*-60)
3. Spring Washer  
Material: Stainless Steel  
Size:M8 (M6\*16 for JSP-54&JS\*-60)
4. Nut  
Material: Stainless Steel  
Size:M8 (M6\*16 for JSP-54&JS\*-60)

Remark: JS\*-60 means JSM-60 & JSP-60

Recommended torque is between 14 Nm to 20 Nm

Modules should be mounted using specialized clamps as shown in Figure 3.

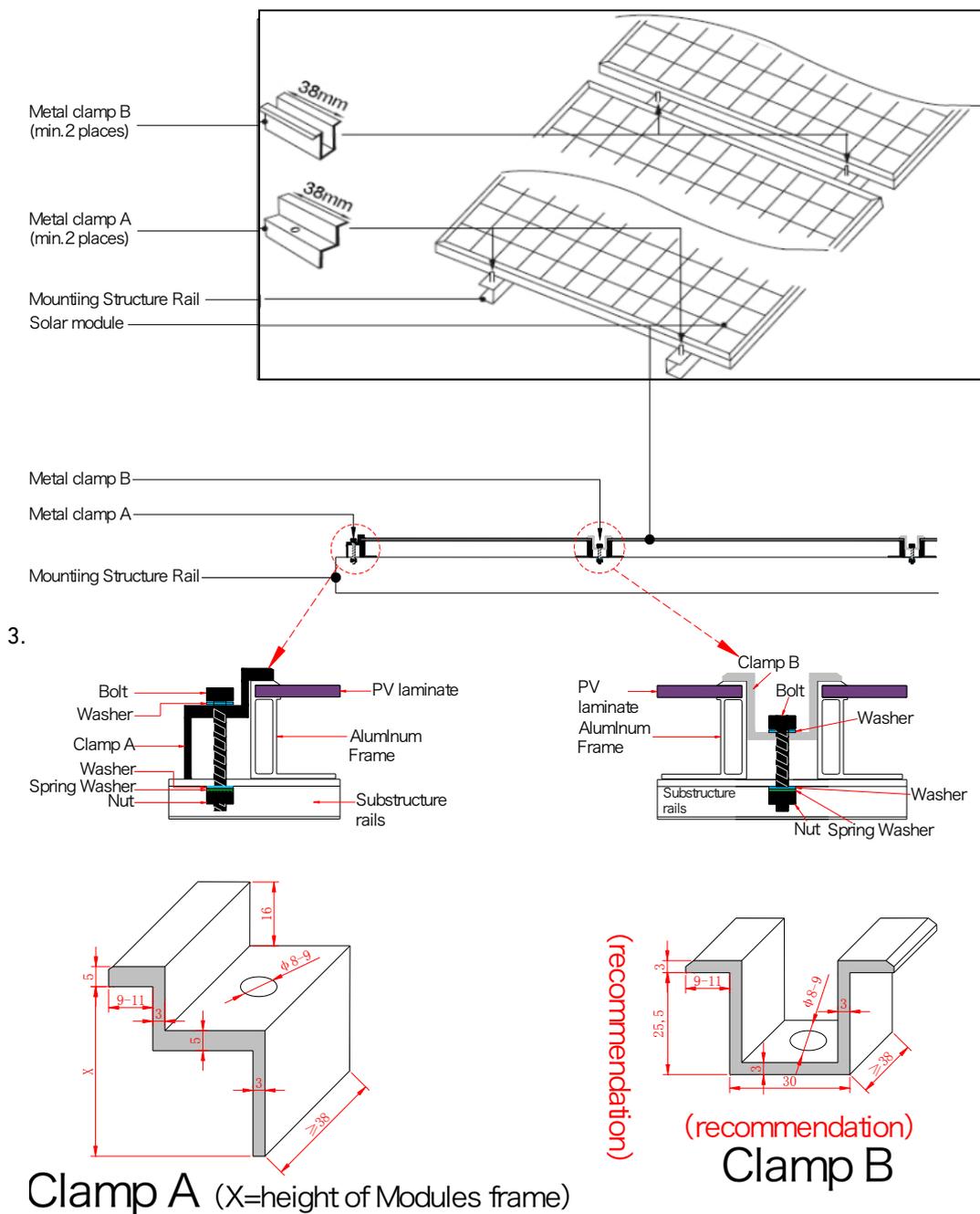
1. Modules should be attached on a supporting structure rail by metal clamps. It is recommended to use the clamps under the following condition or approved by the system installation. At the edge

installation, using the similar clamp which can be matched to the clamp in figure 3.

2. Recommended bolt (M8) torque rang: 18 Nm to 24 Nm.

The Modules clamps must not contact the front glass or deform the frame in any way. Avoid shading effects from the Module clamps. Drainage holes on the Modules frame must not be closed or obscured by the clamps.

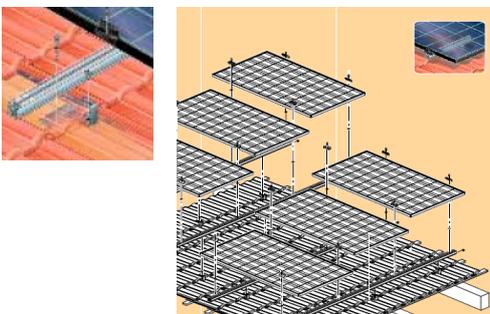
Figure 3: Clamp Details (Units: mm)



#### 5.4.1 Roof mount

Modules produce the most power when they are pointed

1. When installing a module on a roof or building, ensure that it is securely and cannot fall as a result of wind or snow loads.
2. Provide adequate ventilation under a module for cooling (5cm minimum air space between module and mounting surface).
3. The module is in a minimum fire resistance rating of Class C, and the fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions.
4. When installing module on a roof, ensure that the roof construction is suitable. In addition, any roof penetration required to mount the module must be properly sealed to prevent leaks.
5. In some cases, a special support frame may be necessary.
6. The roof installation of solar modules may affect the fireproofing of the house construction. This module has a Class C Fire Rating and must be installed over a roof which is with appropriate fire resistance.



#### 5.4.2 System mount

1. Solar modules produce electrical energy when light shines on their front surface. The DC voltage may

exceed 30 V. If modules are connected in series, the total voltage is equal to the sum of the individual module voltage. If modules are connected in parallel, the total current is equal to the sum of the individual module current. Do not disconnect during load connection for a removable connector.

2. Keep children away from the system while transporting and installing mechanical and electrical components.
3. Completely cover the module with an opaque material during installation to keep electricity from being generated.
4. Do not wear metallic rings, watchbands, ear, nose, lip rings or other metallic devices while installing or troubleshooting



Only use approved insulate tools for electrical installation work.



5. Abide with safety regulations for all other components used in system, including wiring and cables, connectors, charging regulators, inverters, storage batteries and rechargeable batteries, etc.
6. Use only equipment, connectors, wiring and support frames suitable for use in a solar electric system. Always use the same type of module within a particular photovoltaic system.

## **6. ELECTRICAL INSTALLATIONS**

### **6.1 Bypass diodes**

Modules contain bypass diodes when shipped from the factory.

If the service personnel need to replace the damaged bypass diodes, at least one diode should be installed in each string.

Only qualified personnel are permitted to install the bypass diodes.

Open the cover of junction box and install diodes in each two conductors. Only diode with the same model type is permitted to be used.

### **6.2 Over current protection**

Whenever necessary to comply with local codes, use a fuse or circuit breaker, rated for the maximum series fuse rating of the module and the system voltage.

Always fuse the connections at the battery for safety. Refer to the module rating label (on module) for recommended fuse size. Also, refer to the charge controller owner's manual.

When the modules are connected in parallel, each module or each string of module shall be provided with a fuse with the maximum series fuse rating as indicated in "Electrical Specification".

All electrical components should have ratings equal or greater to the system rating. Do not exceed the maximum allowable system voltage as listed on the module label.

### **6.3 Grounding**

JONSOL Solar modules use an anodic oxidized aluminum frame to resist corrosion. So the frame of modules must be connected to the equipment grounding conductor to prevent thunder and static injury. The grounding device must be fully contact with

the inside of the aluminum alloy, and must penetrate the surface of the frame oxidation film.

Please don't drill any additional grounding hole on the frame of the modules.

For optimal performance, JONSOL Solar recommend the DC cathode of the modules array is connected to ground. Failure to comply with this requirement may reduce the performance of the system.

The grounding method must not result in direct contact of dissimilar metals with the aluminum frame of the modules that will result in galvanic corrosion. An addendum to UL standard 1703 "Flat Plate Photovoltaic Modules and Panels" recommends metal combinations not exceed electrochemical potential difference of 0.6 volts.

The frame rails have pre-drilled holes marked with a grounding ring. These holes should be used for grounding purpose and must not be used for mounting the modules. The following grounding methods are available.

There is a grounding hole 4.0mm diameter on the edge side closer to the middle of the back frame of module. All module frames should be grounded for safety. The grounding connections between modules must be approved by a qualified electrician, the grounding itself must be made by a qualified electrician. The grounding clip accepts solid uninsulated copper wire sizes 12 AWG. The wire must not be nicked.

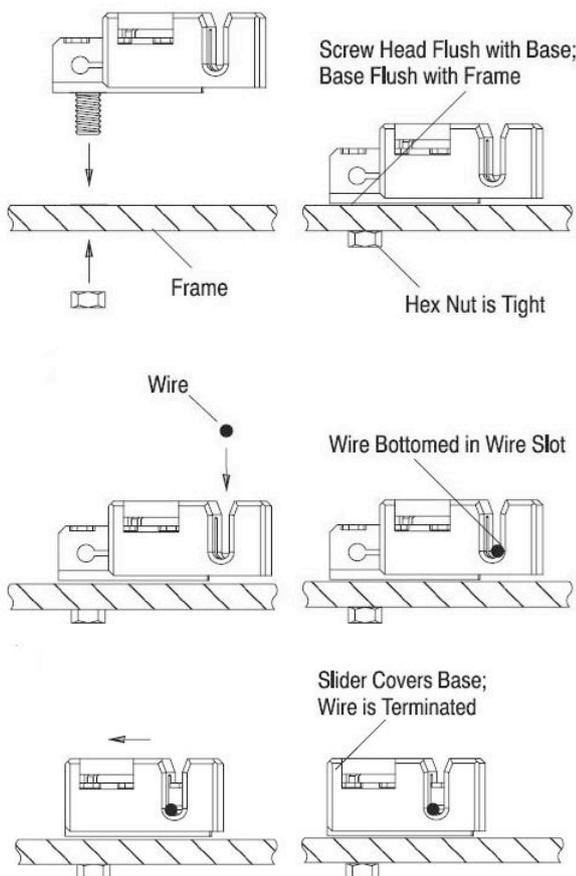
The module shall wire in accordance with the standard, the grounding method of the frame of arrays shall comply with IEC 61215. Of course, in accordance with local laws and regulations to carry out electrical installation is the best choice.

Use the UL listed grounding clip manufactured by Tyco

Electronics Corp with type name 1954381-2. Place the grounding clip onto the module frame so that the screw straddles the grounding hole, then tighten the screw and nut with a torque 2.3 to 2.8 Nm. The head of the screw must be flush with the base and the base must be flush with the frame. The copper wire should not be compressed during the installation.

Place a 12 AWG copper wire in the wire slot then engage the slider. Detailed process is as the following:

Figure 4



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

#### 6.4 Wiring

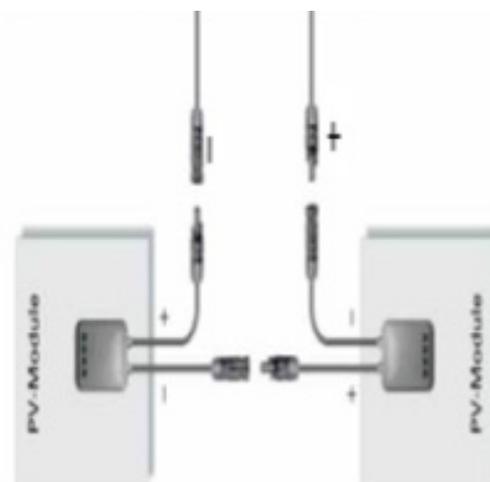
Modules are equipped with factory installed wires and quick connectors. Modules have been designed to be easily interconnected in series.

One module has a pair of male and female waterproof cables and connectors for electrical connection, that are pre-wired inside the junction box. The cables have obvious marks of the positive and the negative.

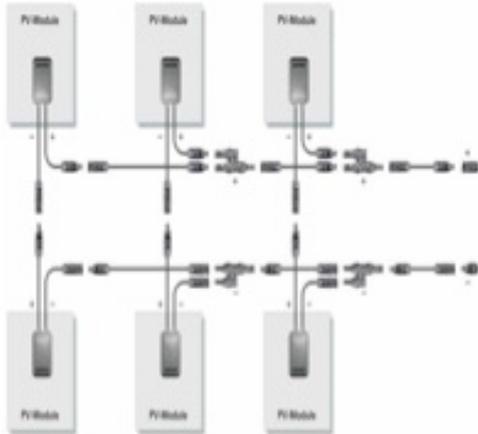
For a series electrical connection, connect positive (+) connector of one module to the negative (-) connector of the following module. For a parallel electrical connection, connect positive (+) connector of one module to the positive (+) connector of the following module.

Figure 5

1. serial -connection of modules



## 2. parallel- connection of modules



For parallel connection, additional branch connectors are needed. The module employs connectors manufactured by Multi-Contact USA with model type PV-KBT4/6II-UR (female) and PV-KST4/6II-UR (male) or connectors manufactured by other manufacturers which also can be matched to the connector of Multi-Contact, check the connectors in the module and choose branch connectors that match the connectors of the modules.

Use 12 AWG or 14 AWG PV wire or USE-2 wire for interconnection. The area of the cable mated with the connector is recommended to be  $4\text{mm}^2$ , temperature range:  $-40^\circ\text{C}$  to  $90^\circ\text{C}$ .

When connecting the modules to load or on inverter, additional wires with pre-attached connectors may be used. The wire shall be PV wire or USE-2 wire, the connectors shall be manufactured by Multi-Contact USA with model type PV-KBT4/6II-UR (female) and PV-KST4/6II-UR (male) or shall be manufactured by other manufacturers which also can be matched to the connector of Multi-Contact. Connect this wire to the module by connectors, then the other end of the wire is connecting to inverter or load by field wiring method specified by inverter/ load manufacturers.

## 7. MAINTENANCES

It is recommended to check the modules once per year. Under most conditions, normal rainfall is sufficient to keep the module glass clean. If dirt build-up becomes excessive, clean the glass with a soft cloth using mild detergent and water. Modules that are mounted, flat ( $0^\circ$  tilt angle) should be cleaned more often, as they will not self-clean as effectively as modules mounted at a  $15^\circ$  tilt or greater.

It is recommended to perform periodic inspection of the modules for damage to glass, back skin, frame, and support structure. Check electrical connections for loose connections and corrosion. Check if mounting support structure and modules are loose. Check connections of cables, connectors, and grounding.

All modules have to pass comprehensive inspection before delivery, which ensures that all modules can meet the requirements of the customers. The fault probability of the modules in the later operation is extremely low.

You can use the below fault judgment methods: appearance defects, such as break, cracks, surface stripping, etc., the electrical performance of the string or of the whole module fails.

For the fault modules, you cannot disassemble them yourself. Disassembling must be done by qualified experts. You should contact JONSOL GmbH to apply for repair or replacement of the fault modules. Modules which need to be replaced must be of the same kind and type.

Modules can operate effectively without ever being cleaned, although removal of dirt from the front glass can increase the output. The glass can be cleaned with a wet sponge. Wear rubber gloves for electrical insulation.

## **8. SAFETY PRECAUTIONS**

Module installation and operation should be performed by qualified personnel only. Children should not be allowed near the solar electric installation. Modules of unpacking, transport, installation process must be handled with care. To avoid collision with the sharp and hard objects so as not to cause damage and affect the normal use.

Module must be installed in the absence of shadowed areas, otherwise it will not work to generate electricity. If the module long shadowing state (dust and bird feces shadowed) to work, it will Breakdown caused by overheating

Avoid electrical hazards when installing, wiring, operating and maintaining the module. Modules produce DC electricity when exposed to light and therefore can produce an electrical shock or burn. Modules produce voltage even when not connected to an electrical circuit or load. Modules produce nearly full voltage when exposed to as little as 5% of full sunlight and both current and power increase with light intensity. Do not touch live parts of cables and connectors. As an additional precaution, use insulated tools and rubber gloves when working with modules in sunlight.

Fall of modules from high place will cause death, injury or damage. Do not drop module or allow objects to fall on module. Never leave a module unsupported or unsecured. If a module should fall, the glass can break. A module with broken glass cannot be repaired and must not be used.

When installing or working with module or wiring, cover module face completely with opaque material to halt production of electricity. Modules have no on/off switch. Modules when exposed to sunlight generate high voltage and are dangerous. Modules can be rendered inoperative only by removing them from

sunlight, or by fully covering the front surface with opaque cloth, cardboard, or other completely opaque material, or by working with modules face down on a smooth, flat surface when installing or maintaining.

Do not expose the artificially concentrated sunlight to a module.

JONSOL modules are designed to fulfill the criteria of Application class A requirements according to IEC61730-1. Modules rated for use in application class A may be used in systems operating at greater than 50 VDC or 240 W, where general contact access is anticipated. Modules qualified for safety through IEC61730-1 and IEC61730-2 within application class A are considered to meet the requirements for safety class II referring to IEC61140.

Modules can produce higher output than the rated specifications. Industry standard ratings are made at conditions of 1000 W/m<sup>2</sup> and 25°C cell temperature. Reflection from snow or water can increase sunlight and therefore boost current and power. In addition, colder temperatures can substantially increase voltage and power. Modules are intended for use in terrestrial applications only, thus excluding aerospace or maritime conditions or use with sunlight concentration.

It is recommended that the module remains packed in the box until time of installation. Work only under dry conditions, with a dry module and tools.

Since sparks may be produced, do not install module where flammable gases or vapors are present.

Do not drill holes into module frame as it will void warranty.

Modules are constructed with tempered glass, but still must be handled with care. If the front glass is broken or if the polymer back skin is torn, contact with any

module surface or the frame can produce electrical shock, particularly when the module is wet. Broken or damaged modules must be disposed of properly. Do not disassemble, bend, impact by sharp objects, walk on, and throw or drop etc. Keep back surface free from foreign objects. Avoid sharp edges.

Use module for its intended function only. Follow all module manufacturer's instructions. Do not disassemble the module, or remove any part or label installed by the manufacturer. Do not treat the back of the module with paint or adhesives.

If not otherwise specified, it is recommended that requirements of the latest local, national or regional electrical codes be followed.

Retain this installation manual for future reference.

#### **9. NOTES**

The installation shall be in accordance with the Standard for Electrical Installation in the respective markets.

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 voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the module output. Refer to Section 690-8 of the U.S. National Electrical Code for an additional multiplying factor of 1.25, which may be applicable.

For modules with a nominal open voltage or maximum system voltage of 45 V or more may cause an electric shock.

The current output for the modules shown in the Specifications is measured at Standard Test Conditions. These conditions may not be frequently observed in actual practice.