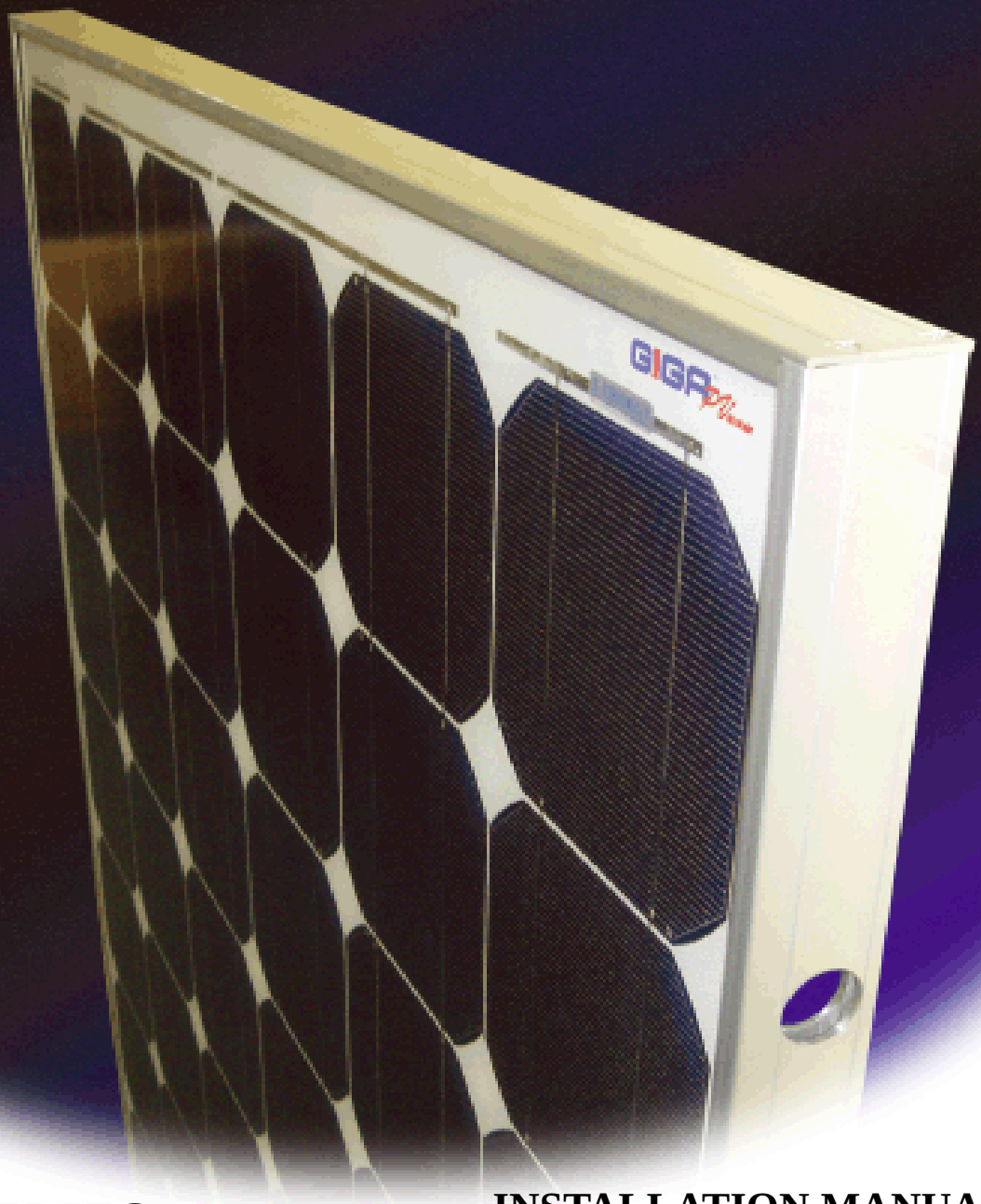
Provide the Best

S-ENERGY

PLEASE READ THIS MANUAL COMPLETELY BEFORE INSTALLING OR USING THE MODULES.

Certification

TÜV CE



SM-SERIES

PHOTOVOLTAIC POWER MODULES

INSTALLATION MANUAL

PHOTOVOLTAIC MODULE

Installation Manual for the SM-series

INTRODUCTION

S-ENERGY offers a wide range of highly efficient and reliable crystalline silicon solar photovoltaic power modules. S-ENERGY began to extensively research PV technology in 1992 and commenced manufacturing operations in 1994. Since then, S-ENERGY supplied several tens mega watt(MW) in world wide. With years experience and state of the art technology, S-ENERGY provide the highest quality PV module in a range of sizes designed to meet the requirement of the most demanding energy and power users world wide.

PHOTOVOLTAIC MODULES

S-ENERGY photovoltaic modules consist of a series of electrically interconnected crystalline solar cell. Which are permanently laminated within a pottant and encapsulated between a tempered glass cover plate and a back sheet. The entire laminate is secured within an anodized aluminum frame for structural strength; ease of installation, and to protect the cells from the most severe environmental conditions.

APPLICATIONS

SM series modules are a reliable, virtually maintenance-free direct current(DC) power source, designed to operate most efficiently in sunlight. SM series modules are ideal for utility grid-tie, powering remote homes, water pumps, telecommunication system and many other applications either with or without the use of storage batteries.

WARNING

Solar module generate electricity when exposed to light. Array of many modules can cause lethal shock and burn hazard. Only authorized and trained personnel should have access to these modules. To reduce the risk of electrical shock or burns, modules may be covered with an opaque material during installation. Do not touch live terminals with bare hands. Use isolated tools for the connections. This module is not a module of the condensing type which uses a lens or reflector. Do not perform condensing use.

Please note that all modules distributed by

S-ENERGY CO., LTD.
10th., E&C Venture Dream Tower VI, 197-28
Guro-dong, Guro-gu, Seoul 152-719 KOREA
TEL : +82-2-801-7100
Fax : +82-2-801-8788
www.s-energy.co.kr

SM series PV module

- PV Module
  - High efficiency crystalline cell
  - Laminated between EVA (Ethylene vinyl acetate) sheet and glass

- Low Iron Glass
  - High transmittance
  - Crash worthiness (250kg, 170Hr)
  - Low reflexibility
  - Self cleaning

- Frame
  - Anodized Aluminum
  - High durability (against 60m/sec wind velocity)

- EVA film
  - High transmittance
  - Protection against external factors

- Junction Box
  - Easy connectional connector
  - Bypass diodes included

- Maintenance
  - Remove obstacles (shadow, fallen leaves, etc.)
  - Check the electrical and mechanical connection

Maintenance Item

Period	Contents	Management	Remarks
Day	- Existence of shade in front of PV module? - Existence of hazardous material (fire & explosion)?	Remove	
Week	- Breakage of PV module? - Obstacles of module surface?	Replacement Water cleaning	
Month	- Transformation of module frame? - Bad electrical connection?	Replacement Repair	
Year	- Poor mechanical connection from surface? - Existence of corrosion	Repair Replacement	

Installation Manual for the SM-series

1. Installation and Operation

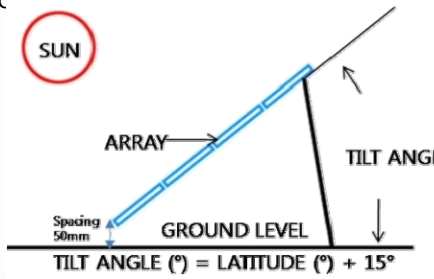
- Systems should be installed by qualified personnel only. The system involves electricity, and can be dangerous if the personnel are not familiar with the appropriate safety procedures.
- When installing and servicing the solar power modules, observe the current regulations and safety instructions for the installation of electrical devices and systems and any regulations from the responsible energy/utility provider regarding the network-parallel operation of solar power systems.
- The solar power modules are electrical supply points with the respective potential danger. Even at low luminous intensity, the full no-load voltage must be calculated.
- Electrical commissioning for the solar power modules may only be carried out by a qualified PV installer.
- Treat the solar power modules like glass products. They are not suitable to walk on.
- Although SM series modules are quite rugged, the glass can be broken (and the module will no longer work property) if it is dropped or hit by tools or other objects.
- Sunlight shall not be concentrated on the module..
- The back of the module shall not be exposed to direct sunlight.
- The solar module has to be installed property on the mounting structure to avoid any galvanic corrosion.
- A gap between PV module frame and installation object is necessary for cooling air circulation. Do not seal this gap.
- The recommended standoff height is minimum 4 inch to conform with UL First Class C.
- Module support structures that are to be used to support SM series modules should be wind rated and approved for use by the appropriate local and civil codes prior to installation.

2. Site Selection

In most applications, SM modules should be installed in a location where they will receive maximum sunlight throughout the year. In the northern hemisphere, the modules should typically face south, and in the southern hemisphere, the modules should typically face north. Modules facing 30 degrees away from true South(or North) will loose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from the true South(or North), the power loss will be 20 to 30 percent. When choosing a site, avoid trees, buildings or obstructions which could cast shadows on the solar modules especially during the winter months when the arc of the sun is lowest over the horizon.

3. Module Tilt Angle

SM series modules produce the most power when they are pointed directly at the sun. The solar module tilt angle is measured between the solar modules and the ground.



<Figure 1>

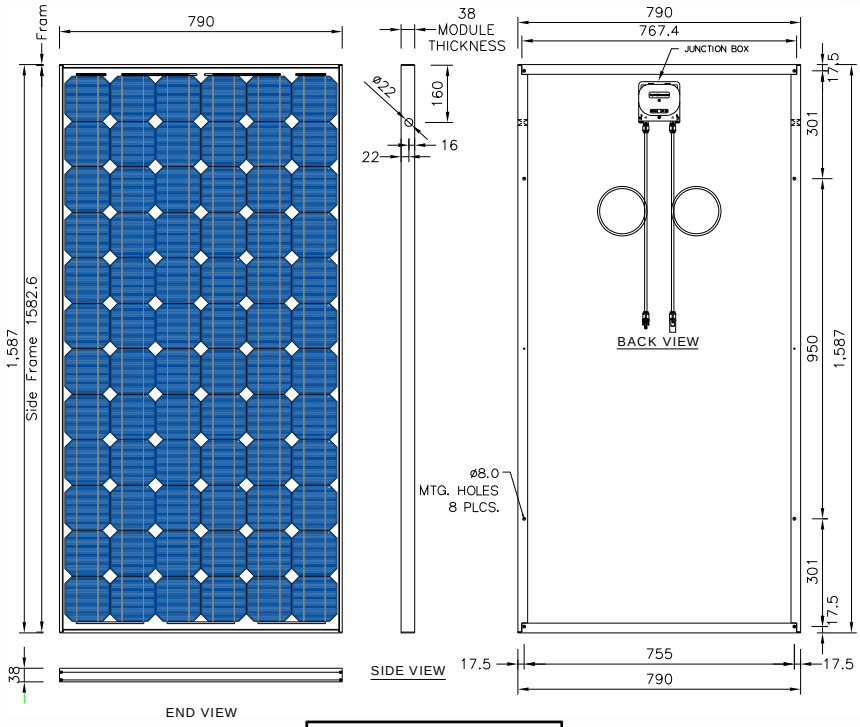
4.1 Electrical Ratings

➢ Rated electrical characteristics are within ±5 percent of Pmax under standard test conditions [irradiance of 1000 W/m^2, AM 1.5 spectrum, and a cell temperature of 25˚C (77˚F)].

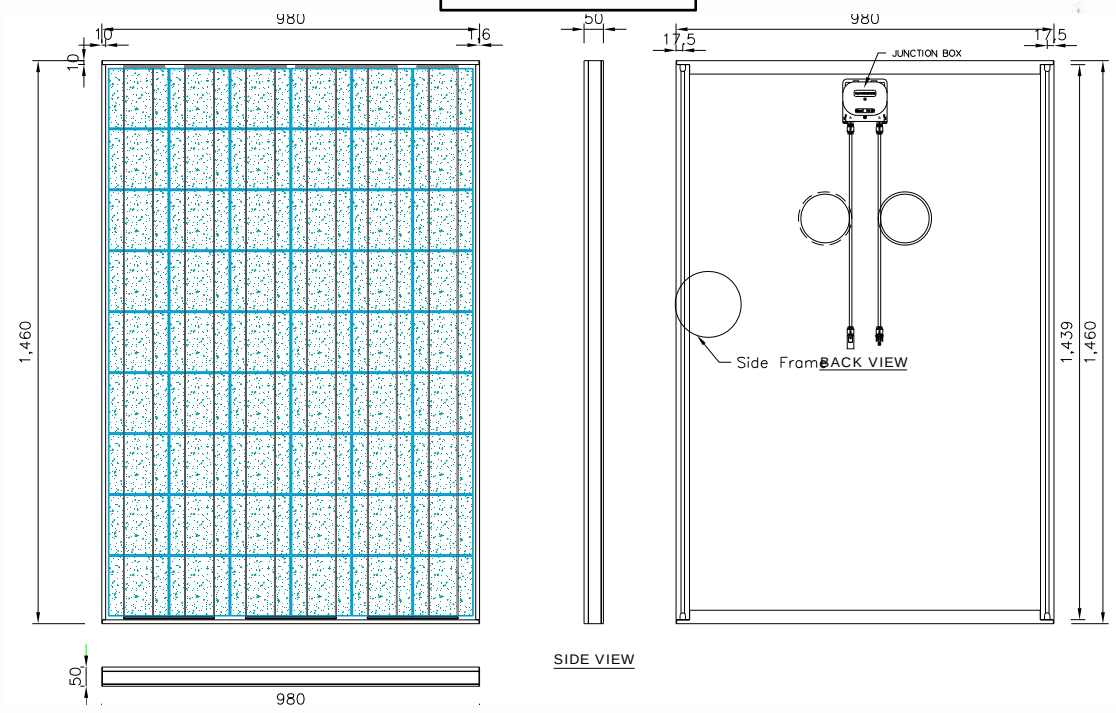
Model (SM-)	175MQ5	195PA2	200PA2	205PA2	215PA2	220PA2	225PA2
Maximum Power W(Pmax)	175	195	200	205	215	220	225
Open-Circuit Voltage V(Voc)	44.5	32.9	33.1	33.2	36.4	36.6	36.9
Short-Circuit Current A(Isc)	5.40	8.14	8.26	8.33	8.06	8.20	8.33
Operating Voltage V(Vpmax)	35.3	26.2	26.2	26.5	29.4	29.2	29.1
Current at Vpmax A(Ipmax)	4.96	7.45	7.65	7.75	7.32	7.55	7.75
Maximum System Voltage (V)	1000	1000	1000	1000	1000	1000	1000
Temperature Coefficient of Power(%/K)	-0.44	-0.46	-0.46	-0.46	-0.46	-0.46	-0.46
Application Class	A	A	A	A	A	A	A
Certification	CE	TÜVRheinland	TÜVRheinland	TÜVRheinland	TÜVRheinland	TÜVRheinland	TÜVRheinland

Model (SM-)	195PA8	200PA8	205PA8	215PA8	220PA8	225PA8
Maximum Power W(Pmax)	195	200	205	215	220	225
Open-Circuit Voltage V(Voc)	32.6	32.9	33.0	36.2	36.4	36.6
Short-Circuit Current A(Isc)	8.12	8.25	8.31	8.12	8.18	8.25
Operating Voltage V(Vpmax)	26.3	26.4	26.7	29.0	29.3	29.7
Current at Vpmax A(Ipmax)	7.42	7.60	7.69	7.42	7.51	7.6
Maximum System Voltage (V)	1000	1000	1000	1000	1000	1000
Temperature Coefficient of Power(%/℃)	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38
Application Class	A	A	A	A	A	A
Certification	TÜVRheinland	TÜVRheinland	TÜVRheinland	TÜVRheinland	TÜVRheinland	TÜVRheinland

➢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 Isc and Voc 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.

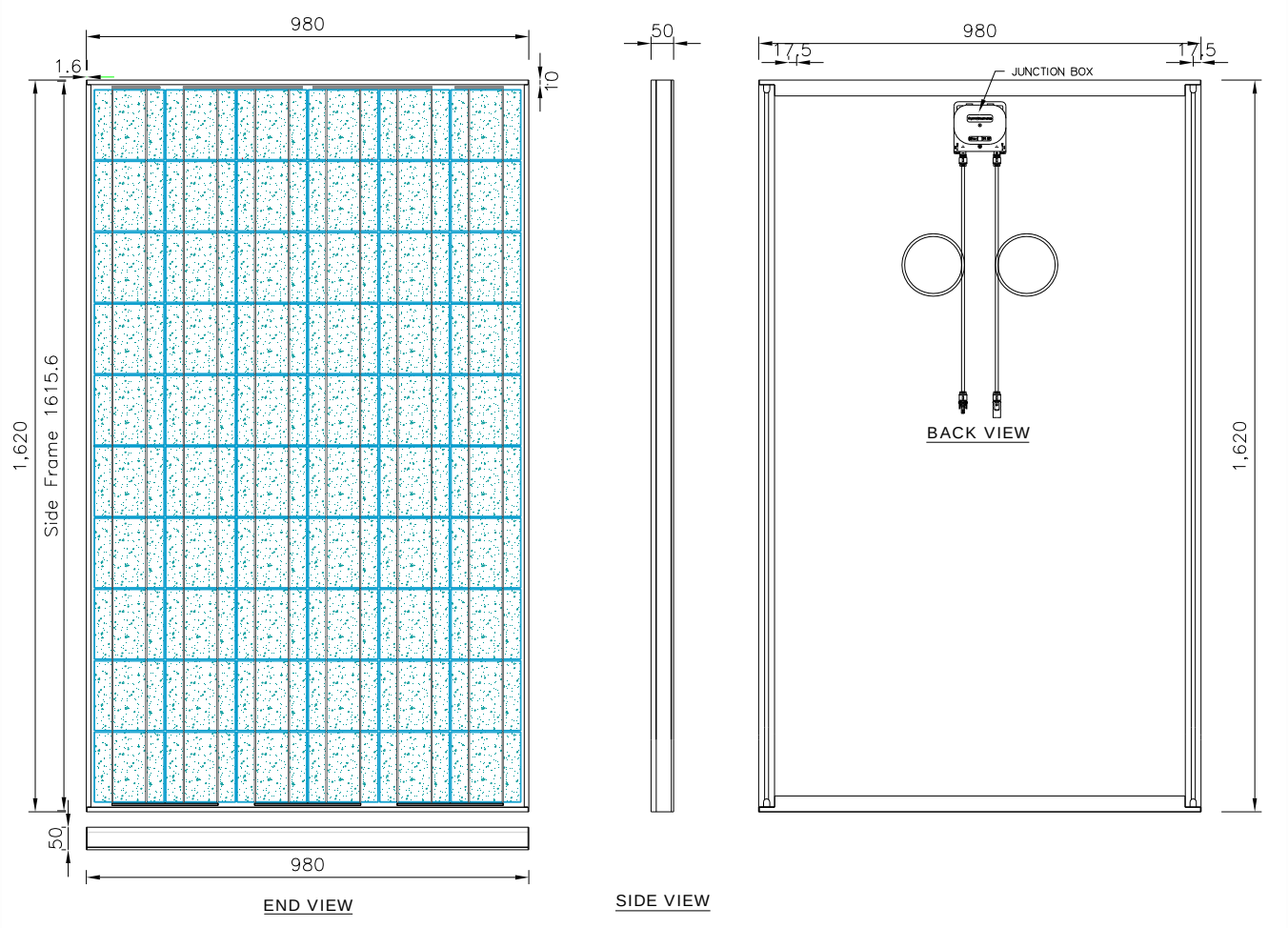


SM-175MQ5



SM-195PA2/195PA8, SM-200PA2/200PA8, SM-205PA2/205PA8

Installation Manual for the SM-series



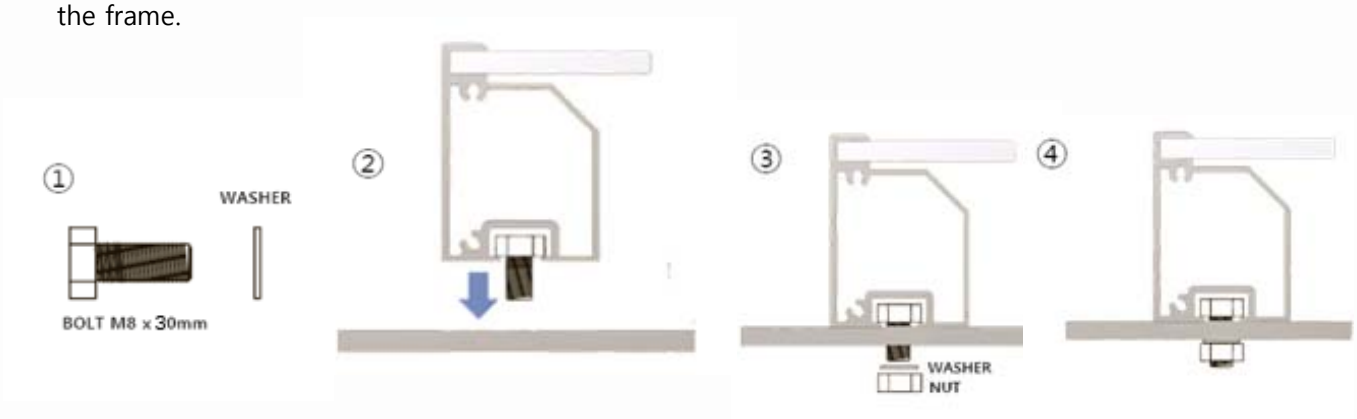
SM-215PA2/215PA8, SM-220PA2/220PA8, SM-225PA2/225PA8

4.2 Fire Rating

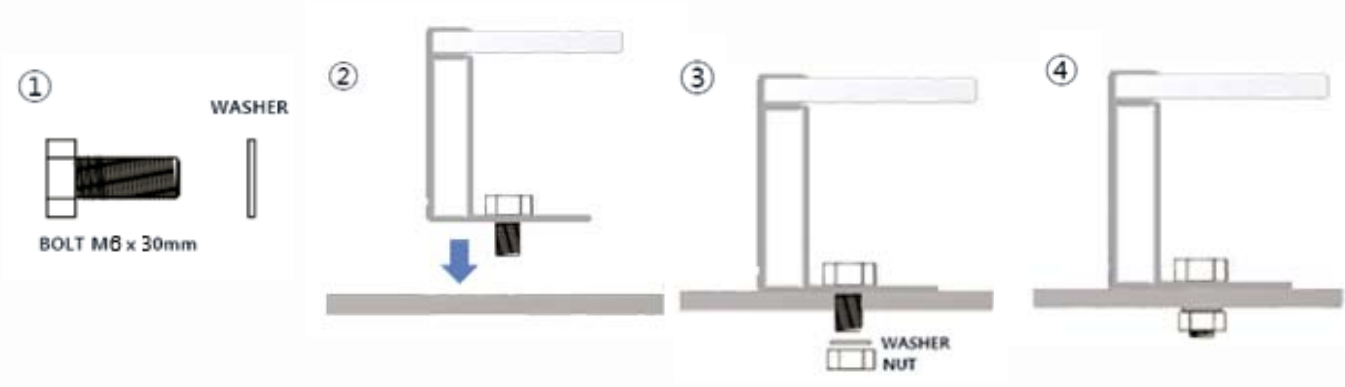
- The module is Class C fire rated.

4.3 Electrical Installation

- All solar modules must be grounded by electrical connection of the module frames to ground.
  Care must be taken to arrange the system ground so that the removal of one module from the circuit will not interrupt the grounding of any of the other modules.
  Each photovoltaic module has a hole in the side frame for either a bolt, nut and washer grounding the module to the frame, a ground lug fastened by bolt M8(5/16") or M6(1/4"). In a connection of this type, the hardware (such as a M8 bolt) must score the frame surface to make positive electrical contact with the frame.



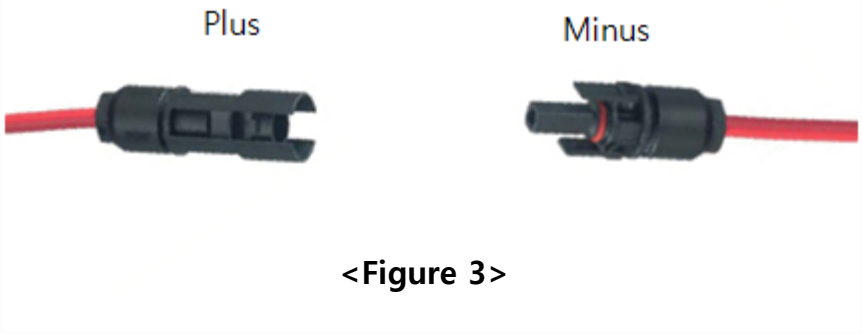
<PV MODULE INSTALLATION> SCREW FRAME TYPE



<PV MODULE INSTALLATION> CORNER KEY FRAME TYPE

4.4 Electrical Connecting Information

- Only connect series solar power modules of the same type and power category.
- It is not necessary to open the connector box with cables connected at the factory for electrical switching of the solar power modules.
- The solar cables are equipped with the Tyco-solar-look pin-and-socket connector system for photovoltaics.
- The plugs are marked with the respective polarity (see fig. 3). The Minus pole is minus-coded, the Plus pole neutrally coded.



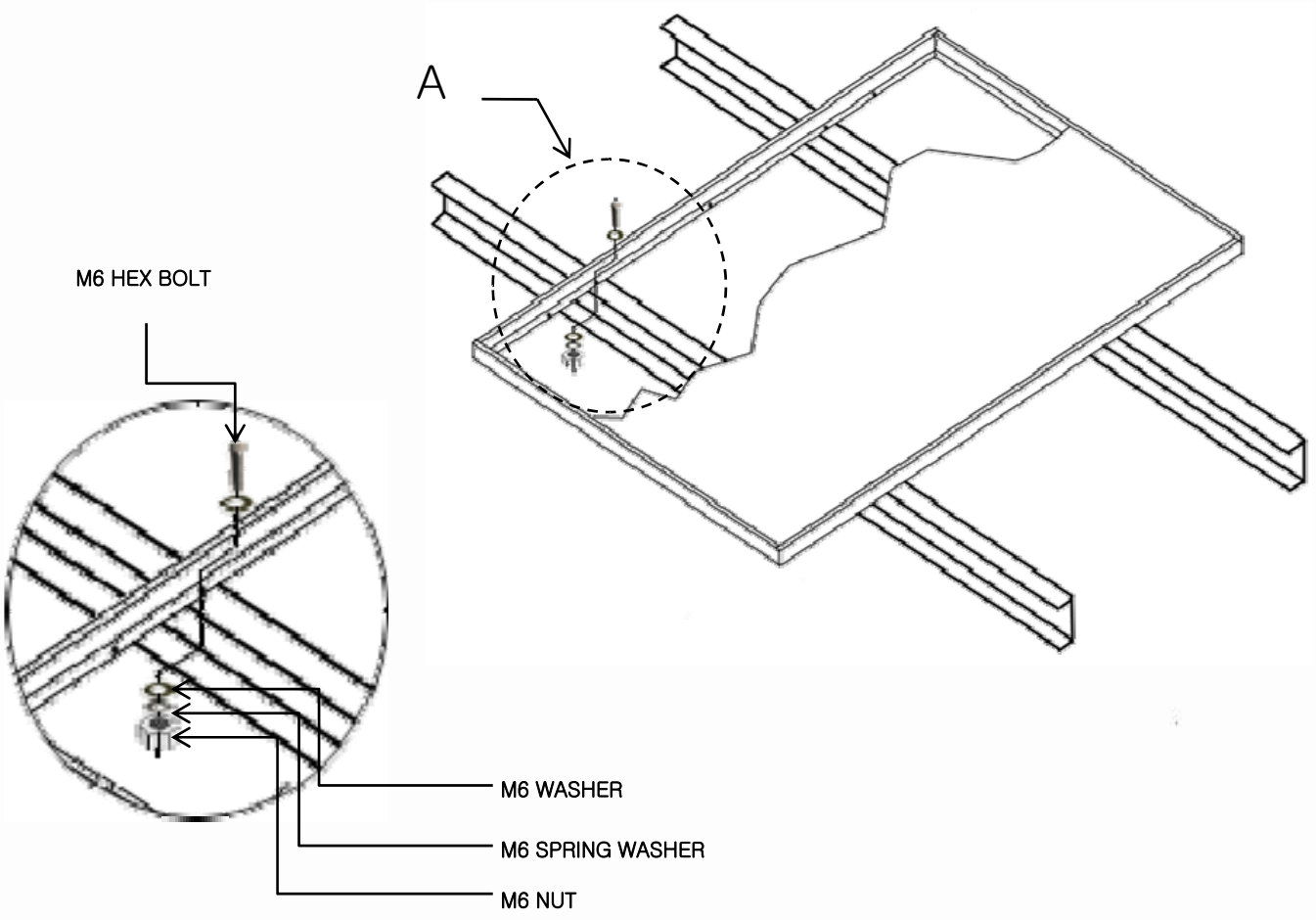
<Figure 3>

- If additional cables are needed, only use solar cables.
- Be absolutely sure to observe the solar power modules' polarity. Reverse polarity causes destruction of the protective diodes.

Attention!
Never disconnect or connect the pin-and-socket connections under electrical load!

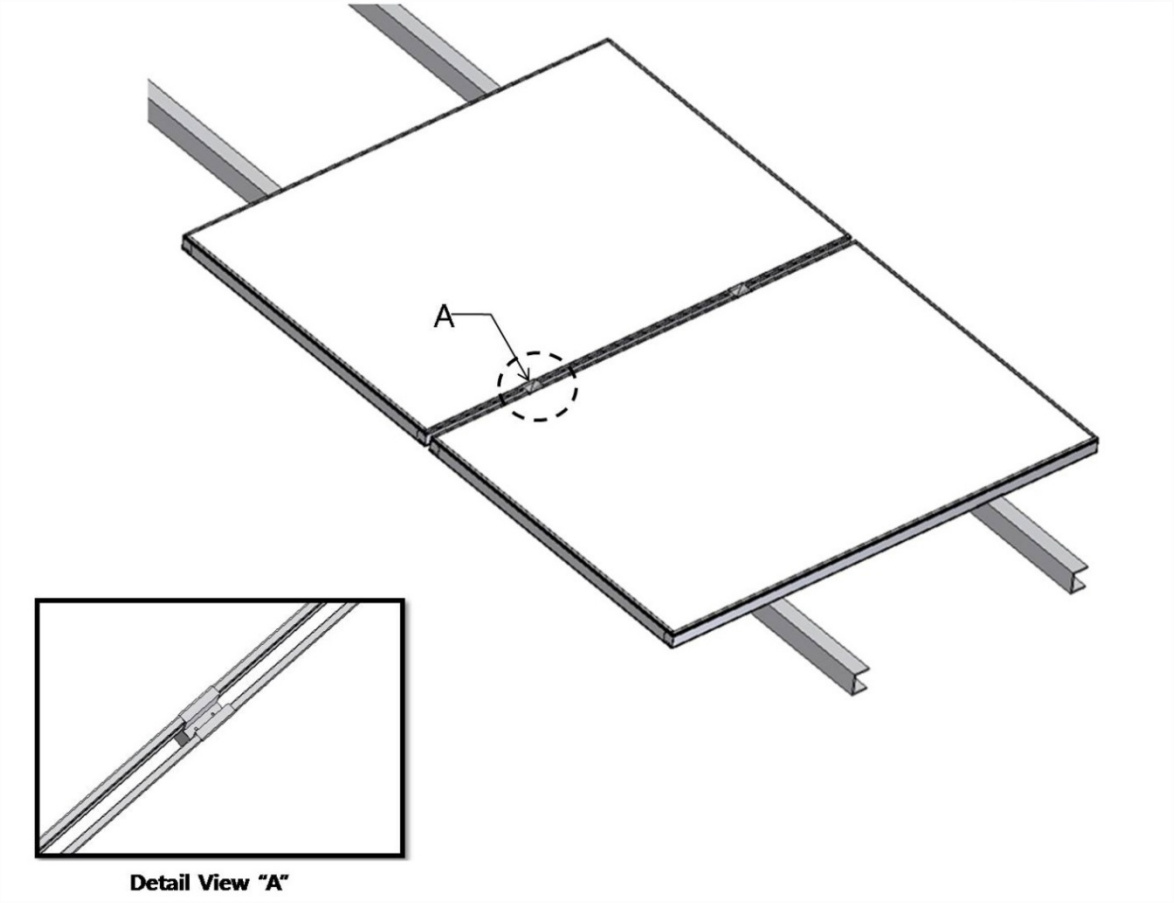
5.1 Installing SM Series Modules

- The SM series modules can either be installed vertical or horizontal.
- Assemble the SM series modules for long-term installation on a suitable jig/frame.
- SM series modules must lie flat on at least 4 points of support or linear on two opposite sides of the jig/frame.
- Observe the linear thermal expansion of the module frames (the recommended distance between 2 SM series modules is 5 mm).
- When selecting the material for the assembly system, pay attention to the electrochemical series (avoidance of contact corrosion between different materials).
- The SM series modules can be attached as desired in accordance with the information provided in Section 6 (attachment guidelines):
  - using corrosion-proof screws (M8 or M6) on the existing assembly bore holes in the module frame.
  - using suitable module clamps on the module frame
  - using insertion systems.
- The module clamps which are used must not come into contact with the front glass and must not deform the frame.
- Avoid shadowing effects from the module clamps and the insertion systems.
- The attachment must be sufficiently dimensioned to cope with the location's load requirements.
- It is not permitted to modify the module frame under any circumstances.
- Ventilation apertures in the module frame must not be closed or obscured by the jig/frame.
- Assemble SM series modules so that neither rainwater nor condensation can penetrate the screwed cable glands.
- The solar power modules must not stand in water.
- Attach the electrical cables to the jig/frame, to avoid the pin-and-socket connections being at a water-settlement level.
- Protect plug contacts against soiling.
- Do not make any plug connections using soiled plug contacts.



Detail View “A”

<Installation method 1>



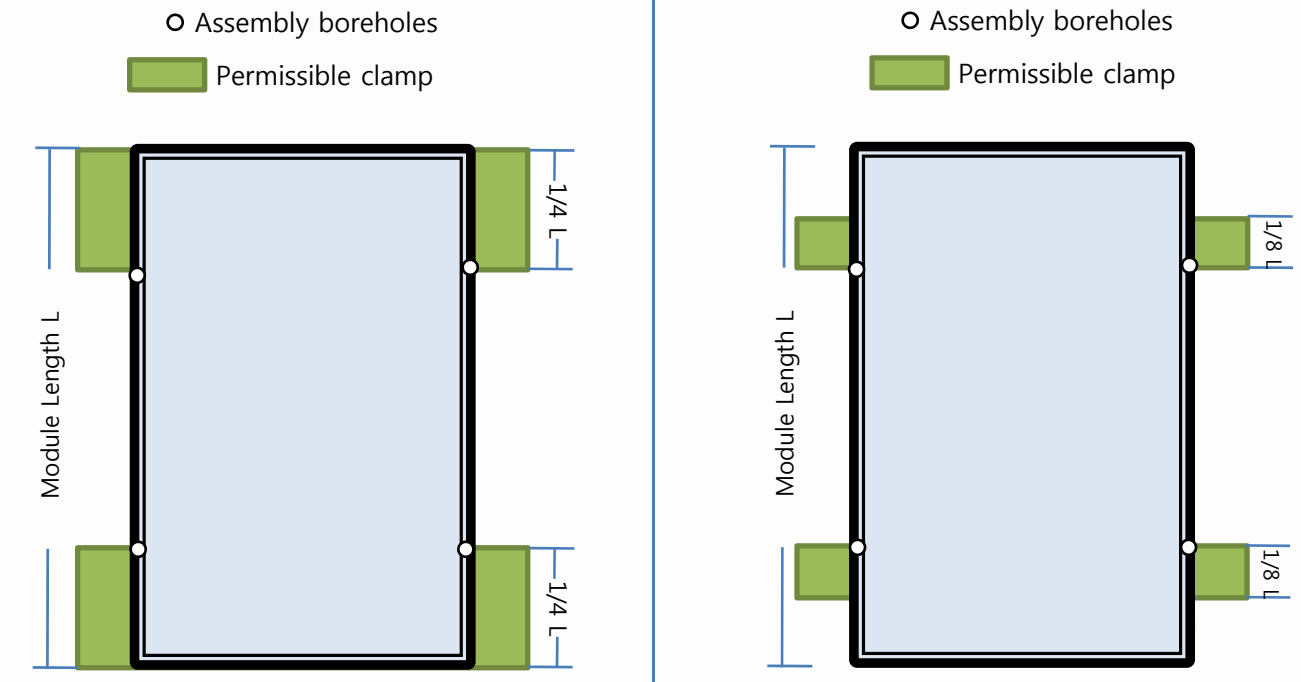
<Installation method 2>

5.2 Mounting Configurations

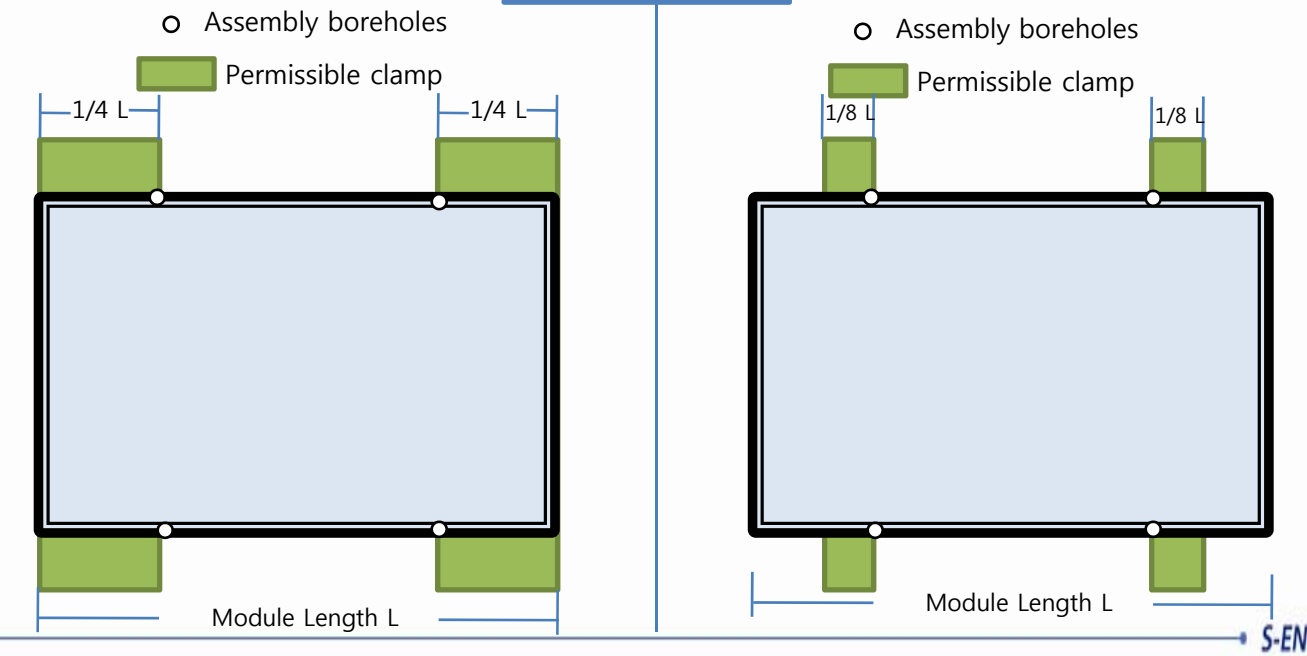
- Modules may be mounted at any angle from horizontal to vertical. Select the appropriate orientation to maximize sunlight exposure.
- In order to prevent water from entering the junction box, which could present a safety hazard, modules should not be mounted such that the front/top glass faces downward (e.g., on a tracking structure that positions the module with the junction box facing skyward during sleep mode).
- Clearance between the module frames and structure or ground is required to prevent wiring damage and allows air to circulate behind the module.
- When installed on a roof, the module shall be mounted over a fire-resistant roof covering rated for the application.
- The module is only IEC Listed for use when its factory frame is fully intact. Do not remove or alter the module frame. Creating additional mounting holes may damage the module and reduce the strength of the frame.

6. Attachment guidelines

Clamping system



Clamping system



7. Module wiring

SM series modules comes pre-wired and terminated ready for most building attached or free standing installations. Each module has stranded sunlight resistant output cables terminated with connectors. The positive (+) terminal has a female connector while the negative (-) terminal has a male connector. The module wiring is solely for series connections. Serial and parallel connections shall be made by use of sunlight resistant output cables with male and female connectors.
SM series modules and most PV system components have a maximum system voltage rating of 1000 volts DC. Like other crystalline solar modules, the open circuit voltage of the SM series module increases as the ambient temperature decreases. Maximum system voltage computes as the sun of the open circuit voltage of the series connected PV modules for the lowest expected ambient temperature. Temperature coefficients, specific to the module of use, can be used to provide the most accurate prediction of module voltage under temperature extremes.

8. Bypass diodes

Partial shading of an individual module in a source circuit string can cause a reverse voltage across the shaded cells within the module. Module output current is then forced through the shaded area by the remaining illuminated cells and other modules in series with the partially shaded module(s). The current forced through the shade cells within the module(s) causes additional module heating and serve loss of power. All SM series modules are supplied with factory installed bypass diode.
The purpose of bypass diodes is to provide a low-resistance current path around the shaded cells, thereby minimizing module heating and array current losses.

The solar modules employ bypass diodes that have:

- Rated average forward current [I F(AV)] above maximum system current at highest module operating temperature.
- Rated repetitive peak reverse voltage [V RRM] above maximum system voltage at lowest module operating temperature.