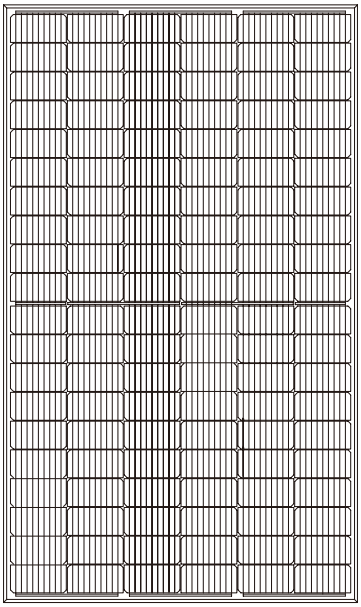
ALTIUS

PROTECT YOUR WARRANTY

This unit must be installed by a registered, licensed installer as required by Government regulations.



PV Module

Installation Manual

Model Numbers:

AS-380B-PV-MHL / AS-380S-PV-MHL / AS-410B-PV-MHO / AS-410S-PV-MHO / AS-450B-PV-MHO / AS-450S-PV-MHO

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Important Safety Information

IMPORTANT SAFETY INSTRUCTIONS
READ CAREFULLY AND KEEP FOR FUTURE REFERENCE

Read this manual thoroughly before first use, even if you are familiar with this type of product. The safety precautions enclosed herein reduce the risk of fire, electric shock and injury when correctly adhered to. Keep the manual in a safe place for future reference, along with the completed warranty card, purchase receipt and carton. If applicable, pass these instructions on to the next owner of the appliance.

Always follow basic safety precautions and accident prevention measures when using an electrical appliance, including the following:

WARNING: Electric shock hazard - professional installation only!

- This appliance must be professionally installed to an appropriately earthed wiring system by a licensed installer, following the instructions in this manual.
- Ensure to make these instructions available to the installer. Failure to install the appliance correctly could invalidate any warranty or liability claims.
- Alterations to the domestic wiring system must only be made by a qualified electrician. Failure to follow this advice may result in electric shock or death.

General usage conditions and restrictions

- **Installation location:** This solar is designed for outdoor use only.
- **Intended purpose:** Only use this solar module for its intended purpose, in its intended environment and as described in this manual. Any other use may cause fire, electric shock or injury.
- **Follow instructions:** Make sure to observe all rules and provisions in this manual. These instructions are not intended to cover every possible condition and situation. As with any product such as this, use common sense and caution when installing, operating and maintaining.

Electrical Safety

- **WARNING! High Voltage:** Any object - particularly a wet object - coming into contact with a high voltage power supply (directly or indirectly) can cause serious injury or death.
- **Tools:** When working with high voltage and AC power, be sure to only use the required, special-purpose tools.
- **Static electricity:** Any static electricity could damage veneer on the electrostatic sensitive components. Before touching the plug in, circuit board or chips, be sure to use correct electrostatic prevention measures.
- **WARNING! Power supply:** When installing or maintaining this solar module, the power supply must be disconnected first.

Important Safety Information (Cont.)

- **Solar module top:** Do not rest any items on top of the solar module.
- **CAUTION! Ambient temperature range:** The temperature range at which the solar module can be located is -20°C to +40 °C. Placing the module at temperatures outside of this range may cause damage to the module and/or its surroundings. Keeping the module outside of this temperature range may also harm the performance of the module or reduce the its life expectancy.
- **CAUTION! Operating temperature range:** The temperature range at which the solar module can be operated is -40°C to +85 °C. Use of the module outside of this temperature range may damage the performance of the module or may reduce its life expectancy.
- **CAUTION! Storage temperature range:** The temperature range at which the solar module can be stored is -40°C to +40 °C. Storage of the module outside of this temperature range may damage the performance of the module or may reduce its life expectancy.
- **WARNING! Hazardous Voltage:** The solar module system operates with hazardous voltages. Installation, maintenance and repairs must ONLY be carried out by qualified personnel.
- **WARNING! Disconnecting:** Before carrying out any kind of service and/or maintenance, disconnect the modules and verify that no current is present and no hazardous voltage exists.
- **WARNING! Authorised personnel:** Only certified electricians may replace solar modules and supervise operations. Unauthorized persons must be kept well away from the modules.
- **WARNING! Do not open or destroy solar modules.**
- **WARNING! Connection wire:** Do not cut the connection wire under the loading.
- **WARNING! Movement:** Do not modify the solar module, or move any labels or other parts.
- **WARNING! Chemicals:** Do not use chemicals on solar module surfaces.
- **WARNING! Concentrated Sunlight:** Do not expose solar modules to sunlight that is concentrated with mirrors, lenses or similar means.
- **WARNING! Local laws and regulations:** Solar module installation must adhere to local laws and regulations.
- **WARNING! Items:** Do not wear/use items - such as rings, metal jewelry, diamond jewelry or tools - which can scratch/damage the surface of module during the installation process.

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Important Safety Information (Cont.)

- **WARNING! Water exposure:** Do not install PV modules in a location where they will be immersed in water or continually exposed to water from a sprinkler or fountain, etc.
- **WARNING! Angle of modules:** If solar modules (except for smart modules) as part of the same installation are mounted at different angles or orientations, then energy production can normally be optimized by connecting the different orientations to different inverters (or different MPPT if the inverter has more than one MPPT). Refer to inverter guidelines for further information.
- **Personnel:** More than one person may be required to install this PV module. All personnel must be licensed installers.
- **WARNING! Power tools:** Only use suitable power tools. Inspect power tools before using them
- **WARNING! Back side of module:** Keep the back side of solar module surfaces free of foreign objects
- **WARNING! Covering the module:** Completely cover solar module with opaque materials when wiring to halt productions of electricity.
- **WARNING! Do not install or handle modules when they are wet or during periods of high wind.**

General Safety Information

- You must understand and follow all applicable local, state, and federal regulations and standards for building construction, electrical design, fire, and safety, and must check with local authorities to determine applicable permitting requirements before attempting to install or maintain PV modules.
- Rooftop PV systems should only be installed on dwellings that have been formally analyzed for structural integrity, and confirmed to be capable of handling the additional weighted load of PV system components, including PV modules, by a certified building specialist or engineer.
- For your safety, do not attempt to work on a rooftop until safety precautions have been identified and taken, including without limitation fall protection measures, ladders or stairways, and personal protective equipment (PPE).
- For your safety, do not install or handle PV modules under adverse conditions, including without limitation strong or gusty winds, and wet or frosted roof surfaces.

Important Safety Information (Cont.)

- The flat-plate PV module construction consists of a laminated assembly of solar cells encapsulated within an insulating material with a rigid glass surface and an insulated substrate. The laminated assembly is supported by an aluminum frame that is also used for mounting the module. See Fig. 1 for an illustration of the PV module components.

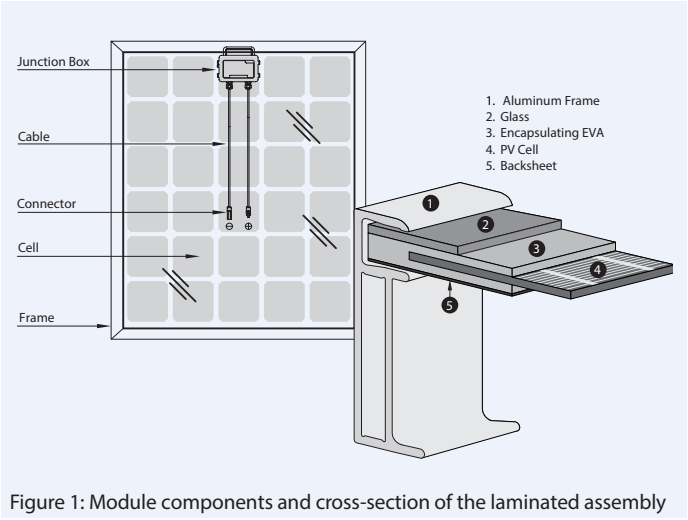

Figure 1: Module components and cross-section of the laminated assembly

Electrical Safety Information

- PV modules can produce current and voltage when exposed to light of any intensity. Electrical current increases with higher light intensity. DC voltage of 30 Volts or higher is potentially lethal. Contacting the live circuitry of a PV system operating under light can result in lethal electric shock.
- De-energize PV modules by removing them entirely from light or by covering their front surface with an opaque material. Regard the safety regulations for live electrical equipment when working with modules that are exposed to any light. Use insulated tools and do not wear metallic jewelry while working with PV modules.
- In order to avoid arcing and electrical shock, do not disconnect electrical connections under load. Faulty connections can also result in arcing and electrical shock. Keep connectors dry and clean, and ensure that they are in proper working condition. Never insert metallic objects into the connectors, or modify them in any way in order to secure an electrical connection.

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Important Safety Information (Cont.)

- Do not touch or handle PV modules with broken glass, separated frames or a damaged back sheet unless the PV modules are first disconnected and you are wearing proper PPE. Avoid handling PV modules when they are wet unless cleaning the PV modules as directed in this manual. Never touch electrical connections that are wet without protecting yourself with insulated gloves.

Transport and handling

- PV modules must be transported in the supplied packaging only and kept in the packaging until they are ready to be installed. Protect pallets against movement and exposure to damage during transportation. Secure pallets from falling over (see Fig. 2). Do not exceed the maximum height of pallets to be stacked, as indicated on the pallet packaging. Store pallets in a cool and dry location until the PV modules are ready to be unpacked.

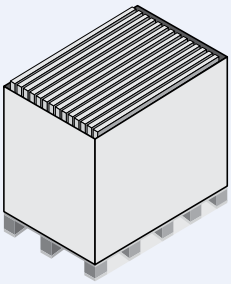


Figure 2: Pallet of PV modules

- These Solar PV modules are heavy, and should be handled with care. PV modules shall be handled at the frame; never use the junction box or cables as a grip. Do not exert mechanical stress on the cables. Never step on PV modules or drop or place heavy objects on them. Be careful when placing PV modules on hard surfaces, and secure them from falling. Broken glass can result in personal injury. PV modules with broken glass cannot be repaired and must not be used. Broken or damaged PV modules must be handled carefully and disposed of properly.

Important Safety Information (Cont.)

- For unpacking PV modules from the supplied packaging, first remove the pallet lid (after removing securing straps, if provided). Remove PV modules one at a time by sliding them up the channel in the package (see Fig. 3). You may need to secure the remaining PV modules in the pallet packaging to prevent them from falling over.

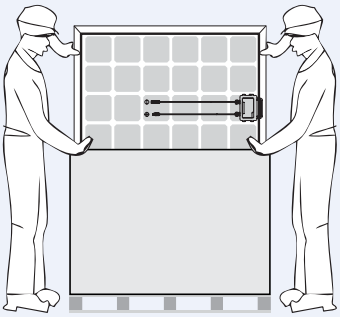


Figure 3: Removing PV modules from a pallet

- Check PV modules for damage due to transportation before they are installed; do not install damaged modules. Contact Tempo for further information if required.
- Solar PV modules from in order to obtain information on making claims for defective PV modules.
- PV module surfaces are susceptible to damage that could affect the performance or safety of the PV module; do not damage or scratch the PV module surfaces, and do not apply paint or adhesive to any of the surfaces, including the frame. For your safety, do not disassemble or modify Solar PV modules in any way. Doing so may degrade performance or cause irreparable damage and will void any applicable warranties. If it is necessary to store PV modules prior to installation, the PV modules should remain inside the packaging and protected from exposure that could compromise the durability of the packaging.

Important Safety Information (Cont.)

Fire

- These Solar PV Modules have a Class C fire resistance rating in accordance with the IEC 61730-2 certification. When PV modules are mounted on rooftops, the roof must have a fire resistant covering suitable for this application. PV modules are electrical generation devices that may affect the fire safety of a building. The use of improper installation methods and/or defective parts may result in the unexpected occurrence of an electrical arc during operation. In order to mitigate the risk of fire in this event, PV modules should not be installed near flammable liquids, gases, or locations with hazardous materials.
- In the event of a fire, PV modules may continue to produce a dangerous voltage, even if they have been disconnected from the inverter, have been partly or entirely destroyed, or the system wiring has been compromised or destroyed. In the event of fire, inform the fire crew 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 make the PV system safe.

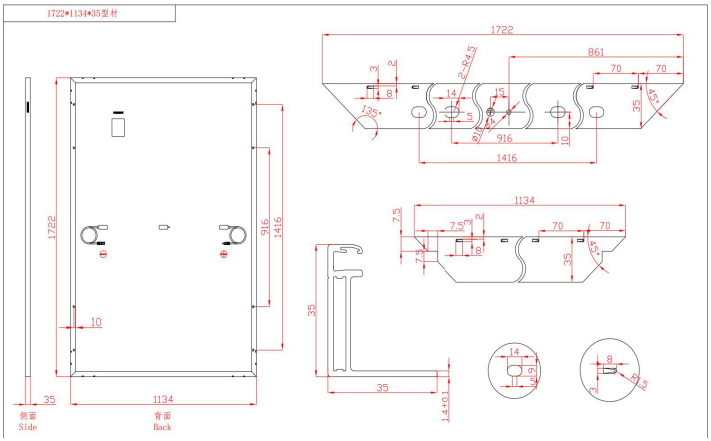
Product Overview

Rear and Side View Dimensions of the Module Series with 35 mm Frame

Units: mm

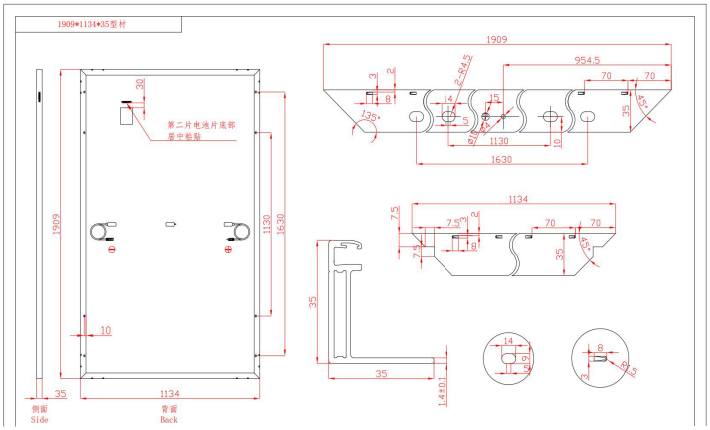
108 Cells

1724*1134*35(mm)



120 Cells

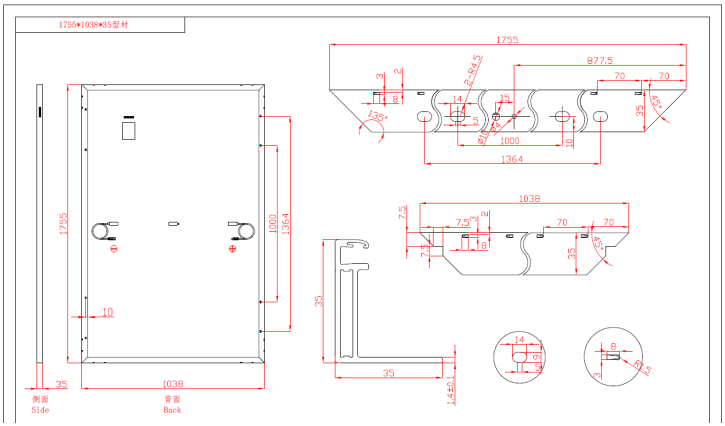
1909*1134*35(mm)



Product Overview (Cont.)

120 Cells

1755*1038*35 (mm)



Installation

Climate Conditions

Only install these modules in the following conditions:

Ambient temperature: -20°C to +40 °C

Operating temperature: -40°C to +85 °C

Storage temperature: -40°C to +40 °C

Humidity: Below 85%RH

Maximum altitude: 2000 m

Fire safety class: Class C according to UL 790

Corrosion resistance: Except for corrosive salt area and sulfurous areas.

Mechanical load tolerance: 2400Pa / 5400Pa.

Location Conditions

- Whenever possible, install this unit so that it is directed towards the equator.

Installations facing east and west are also possible, although the amount of power generated will be lower.

- Install in a location that has good sun exposure throughout the year. Less power is generated in shaded locations.

- The output of a series string of solar modules is connected to the input of the inverter. Always install solar modules so that all elements of the array receive the same amount of sunlight.

- It may not be possible to install solar modules in regions where the maximum snow accumulation exceeds the maximum allowable load.

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Installation (Cont.)

Installation Restrictions

- These Solar PV modules must be mounted on appropriate mounting structures positioned on suitable buildings, the ground, or other structures suitable for PV modules (e.g. carports, building facades or PV trackers). PV modules must not be mounted on moving vehicles of any kind. These Solar PV modules must not be installed in locations where they could be submerged in water.
- These Solar PV modules must not be sited in locations where aggressive substances such as salt or salt-water, or any other type of corrosive agent, could the safety and/or performance of the PV modules. Although some types of Solar PV modules have passed the IEC 61701 salt-mist corrosion test with a salt concentration of 5% by weight, galvanic corrosion can occur between the aluminum frame of the PV module and mounting or grounding hardware if such hardware is comprised of dissimilar metals.
- We recommend that only stainless steel and aluminum metal directly contact PV modules in seaside installations to limit corrosion.
- Artificially concentrated light must not be directed on these Solar PV modules.
- We recommend that PV modules be mounted at a minimum tilt angle of 10 degrees to allow for proper self-cleaning from normal rain showers.
- Partial or complete shading of a PV module or modules can reduce system performance.
- We recommend minimizing the amount of shade throughout the year to increase the amount of energy produced by the PV modules.
- Lightning protection is recommended for PV systems that are to be installed in locations with high probability of lightning strikes.
- High system voltages could be induced in the event of an indirect lightning strike, which could cause damage to PV system components. The open area of wire loops should be minimized (Fig. 4), in order to reduce the risk.

Installation (Cont.)

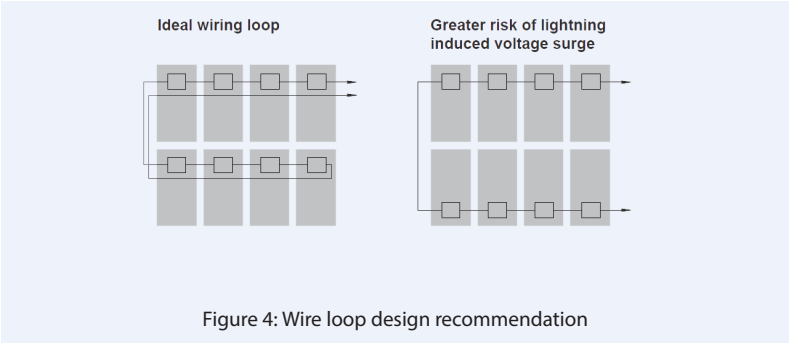

Figure 4: Wire loop design recommendation

Electrical Installation

Electrical Configuration

- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at Standard Test Conditions (STC: 1000 W/m^2, AM 1.5, and 25°C cell temperature). The short-circuit current (ISC) should be multiplied by a factor of 1.25 and the open-circuit voltage (VOC) should be multiplied by a factor of up to 1.25 based on the lowest ambient temperature recorded for the installation location when determining component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output.
- Voltages are additive when PV modules are connected directly in series, and module currents are additive when PV modules are connected directly in parallel (Fig. 5). PV modules with different electrical characteristics must not be connected directly in series. The use of suitable third-party electronic devices connected to PV modules may enable different electrical connections and must be installed according to the manufacturer's specified instructions.

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Installation (Cont.)

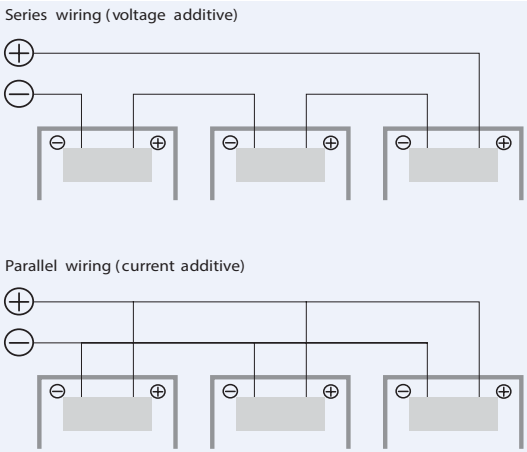

Figure 5: Electrical diagrams of series and parallel wiring

- An appropriately rated overcurrent protection device must be used when the reverse current could exceed the value of the maximum fuse rating of the module. An over current protection device and anti-reflection diode module are required for each series string if more than two series strings are connected in parallel. Reverse polarity is forbidden.
- The number of modules in series and in parallel shall be designed reasonably according to the system configuration.
- The maximum number of PV modules that can be connected in a series string must be calculated in accordance with applicable regulations in such a way that the specified maximum system voltage of the PV module and all other electrical DC components will not be exceeded in open-circuit operation at the lowest temperature expected at the PV system location.

  The value of open circuit voltage under the local minimum temperature cannot exceed the maximum system voltage specified by the modules (the maximum system is DC1500V- actually system voltage is designed based on the selected module and inverter model) and other value required for DC electrical components.

  The maximum number of the PV modules can be determined by following formula:

Installation (Cont.)

Maximum system voltage ≥N×Voc×Cvoc

Cvoc: the open-circuit voltage correction factor, it can be calculated according to the following formula:

Cvoc=1-ß Voc×(25-T)

T: the lowest ambient temperature expected at the system installation location.

ß (% /°C): the temperature coefficient of the selected module Voc (refer to the list under Other Useful Information).

If there may be a reverse current passing through the module that exceeds the maximum fuse current of the module, the module must be protected by an overcurrent protection device of the same specification. If the number of parallel connections is greater than or equal to 2 series, there must be an overcurrent protection device on each series of modules.

Cables and Wiring

- These Solar PV modules are provided with two (2) stranded, sunlight resistant output cables that are terminated with PV connectors ready for most installations. The positive (+) terminal has a female connector while the negative (-) terminal has a male connector. The module wiring is intended for series connections [i.e. female (+) to male (-) interconnections] (Fig. 6), but can also be used to connect suitable third-party electrical devices that may have alternative wiring configurations so long as the manufacturer's instructions are followed.
- Use field wiring with suitable cross-sectional areas that are approved for use at the maximum short-circuit current of the PV module. We recommend installers use only sunlight resistant cables qualified for direct current (DC) wiring in PV systems. The minimum wire size should be 4 mm^2 (see Table 1).
- Cables should be fixed to the mounting structure in such a way that mechanical damage of the cable and/or the module is avoided. Do not apply stress to the cables. Do not bend cables to a bending radius of less than 40mm. For fixing, use appropriate means, such as sunlight resistant cable ties and/or wire management clips specifically designed to attach to the PV module frame. While the cables are sunlight resistant and waterproof, where possible, avoid direct sunlight exposure and water immersion of the cables.

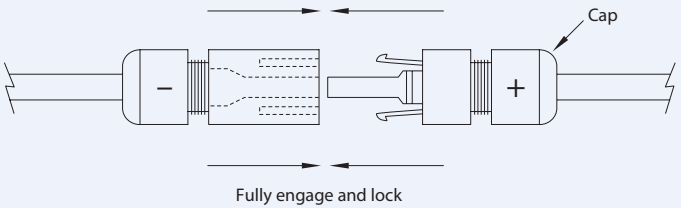

Figure 6: Series interconnection of a male (-) and female (+) connector

Table 1: Required minimum field wiring specifications

	Testing Standard	Wire Size	Temperature Rating
Required Minimum Field Wiring	EN 50618	4mm^2	-40ºC to +90ºC

Bypass Diodes

- The junction boxes used with these PV modules (not Smart Hot Spot Free module) contain bypass diodes wired in parallel with the PV cell strings. In the case of partial shading, the diodes bypass the current generated by the non-shaded cells, thereby limiting module heating and performance losses. Bypass diodes are not overcurrent protection devices.
- Bypass diodes divert current from the cell strings in the event of partial shading. See Fig. 7-1 for a diagram showing how the cell strings are electrically connected with the diodes.
- Every piece of cells from the Smart Hot Spot Free module parallels a diode, with a cell is covered by shade or occurs an exception, the paralleled diode can bypass this cell, thus avoid hot spot, and can retain the maximum power output.

Installation (Cont.)

- Bypass diodes divert current from a cell in the event of partial shading. See Fig. 7-2 for a diagram showing how the cells are electrically connected with the diodes.
- In the event of a known or suspected diode failure, installers or maintenance providers should contact the company the PV modules were purchased from. Never attempt to open the junction box of a Solar PV module yourself.

PV Array Grounding

- For optimal performance, we recommend that the negative pole of the PV array be connected to ground.

Equipment Grounding

- The frame of the PV module, as well as any exposed non-current-carrying metal parts of equipment that are able to become energized by the PV system, must be connected to the equipment grounding conductor (EGC) in order to prevent electrical shock. Even when applicable regulations, code

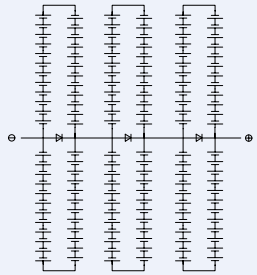

Figure 7-1: Electrical circuitry of cells and bypass diodes

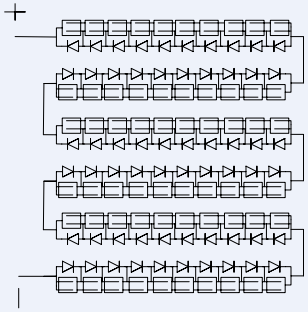

Figure 7-2: Electrical circuitry of cells and bypass diodes

requirements, and standards do not require safety-related grounding, we recommend grounding all PV module frames in order to ensure the voltage between electrically conductive equipment and earth ground is zero in all circumstances.

- Proper equipment grounding is achieved by bonding all exposed non-current-carrying metal equipment continuously to one another using an appropriately sized EGC or racking system that can be used for integrated grounding (see Option B in Grounding Methods below).
- These Solar PV modules employ a coated aluminum frame for corrosion resistance. In order to properly ground the module frame, the coating must be penetrated.
- The potential for corrosion due to the electrochemical action between dissimilar metals in contact is minimized if the electrochemical voltage potential between the dissimilar metals is low. The grounding method must not result in the direct contact of dissimilar metals with the aluminum frame of the PV module that will result in galvanic corrosion. An addendum to UL Standard 1703 “Flat Plate Photovoltaic Modules and Panels” recommends metal combinations not exceed an electrochemical potential difference of 0.5 Volts.
- The frame rails have pre-drilled holes marked with a grounding sign, as illustrated in Fig. 8. These holes should be used for grounding purposes and must not be used for mounting the PV modules. Do not drill additional holes into the frame rails.

The following grounding methods are available:

Option A: Screw Assembly (see Fig. 9)

1. A grounding screw assembly must be attached at a designated grounding hole location using only stainless steel hardware. Insert an M5 stainless steel screw first through the stainless steel cup washer, and then through the grounding hole.
2. Loosely engage a stainless steel backing nut and toothed lock washer to the screw.
3. Bend the EGC into an omega (Ω) shape to tightly fit between the partially installed screw head and cup washer. The EGC shall be exclusively in contact with stainless steel.

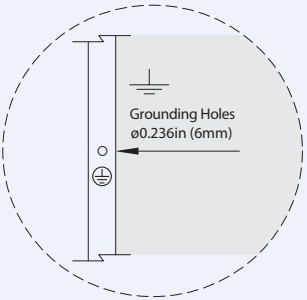

Figure 8: Grounding hole detail

Installation (Cont.)

4. Tighten the screw to 2.3 N·m torque. The toothed lock washer should be visibly engaged to the frame.
5. Route the appropriately sized EGC in such a way as to avoid contact with the aluminum module frame.

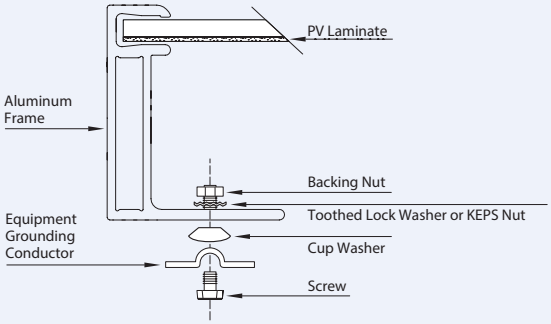

Figure 9: Grounding screw assembly detail

Option B: Racking Manufacturer Integrated Grounding Methods

- These Solar PV modules can be grounded by bonding PV modules to a grounded racking system. Integrated grounding methods must be certified for grounded PV modules and must be installed in accordance with the specified instructions of their respective manufacturers.

Option C: Additional Third-party Grounding Devices

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

Mechanical Installation

General

- These Solar PV Modules have been certified for a maximum static load on the back of the module of up to 2400 Pa (i.e. wind load) and a maximum static load on the front of the module of up to either 2400 Pa or 5400 Pa (i.e. wind and snow load), depending on the module type (please refer to the data sheet for this information.
- Mounting structures and other mechanical parts must be designed and

Installation (Cont.)

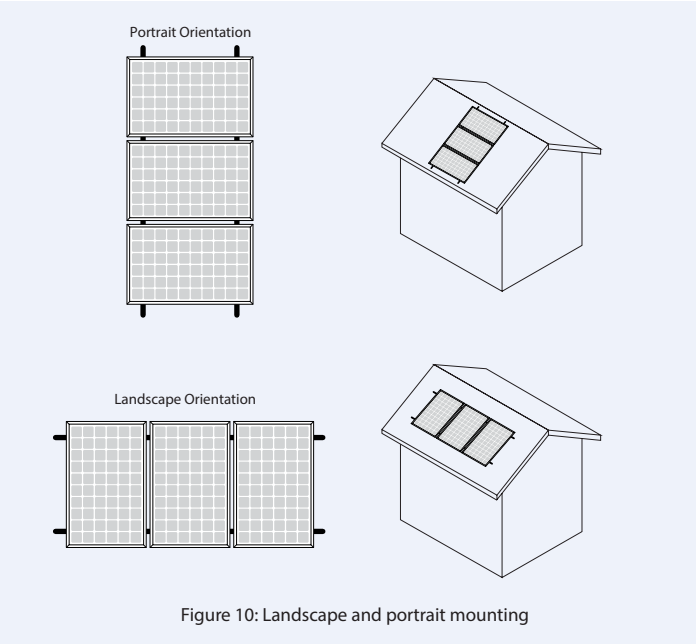

Figure 10: Landscape and portrait mounting

approved to withstand the design wind and snow loads applicable for a particular site. These Solar PV modules must not be subjected to force from the substructure, including forces caused by thermal expansion.

- The mounting method must not result in the direct contact of dissimilar metals with the aluminum frame of the PV module that will result in galvanic corrosion. An addendum to UL Standard 1703 “Flat Plate Photovoltaic Modules and Panels” recommends metal combinations not exceed an electrochemical potential difference of 0.5 Volts.
- These Solar PV modules can be mounted in landscape or portrait orientation, as illustrated in Fig. 10, provided that the mounting method follows one of the acceptable methods listed below.
- In order to maintain the fire class rating, the distance between the PV module front surface (glass) and the roof surface shall be at least 10 cm. This spacing also allows air flow to cool the PV module. Install PV modules with a minimum spacing of 1 cm between neighboring frames to allow for thermal expansion.

Installation (Cont.)

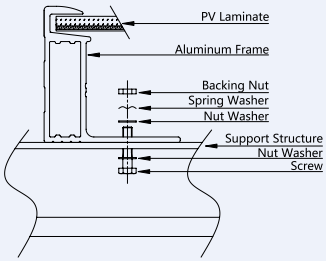

Figure 11: Detail of a bolt mounting attachment

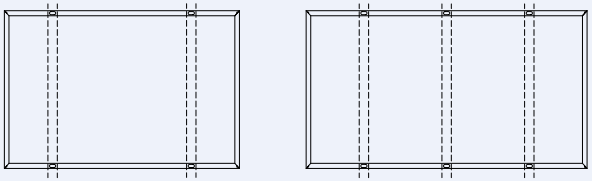

Figure 12-1 : Mounting rails must run perpendicularly to the long frame

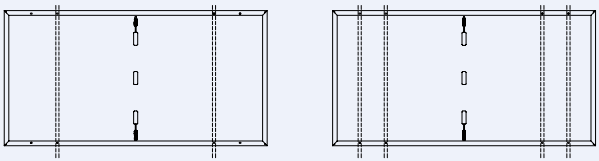

Figure 12-2 : Mounting rails must run perpendicularly to the long frame

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Installation (Cont.)

Mounting Methods

The following mounting methods are available:

Bolts or Clamps

Using the information found under the “Mounting Requirements” section (page 24) determine how many connection points are required for a specific module series. The locations of mounting holes and clamp tolerances are illustrated in the drawings located on pages 10-11. Do not modify the existing mounting holes or drill new holes. Do not apply excessive pressure on the frame such that the frame deforms.

Bolts:

- Modules must be mounted using the mounting holes located on the rear side of the long frame parts using M8 stainless steel bolts, nuts, and washers (Fig. 11, Fig 12-1 and Fig 12-2). The torque of screw tightening should between 14 N·m to 20 N·m.

Top-down Clamps:

- Third-party clamps that have been designed for PV mounting structures are an approved mounting attachment method for Solar PV modules. Modules must be fastened using clamps applied to the top side of the long frame parts (Fig. 13). A clamp holds two modules except for the clamps at the beginning and end of a module row. The centerline of the clamps must be in line with the mounting hole positions plus or minus a distance of 50mm. The module clamps should not contact with the front glass and deform the frame and avoiding shadowing from the module clamps. The module frame is not to be under any circumstances. The applied torque value should be big enough to the modules steadily. The torque of screw tightening should between 16 N·m to 24 N·m.
- The mounting bolt of the modules requires at least M8. The length of clamp ≥requires minimum of 40mm (1.57in).The clamp must overlap the module frame by at least 7mm (0.28in) but no more than 10mm (0.39in).
- Use at minimum 4 clamps to attach modules to the mounting rails. Modules clamps should not come into contact with the front glass and must not deform the frame.

Installation (Cont.)

- Be sure to avoid shadowing effects from the module clamps.
- The module frame is not to be modified under any circumstances.
- When choosing this type of clamp-mounting method, use at least four clamps on each module, two clamps should be attached on each long sides of the module (for portrait orientation) or each short sides of the module (for landscape orientation). Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.

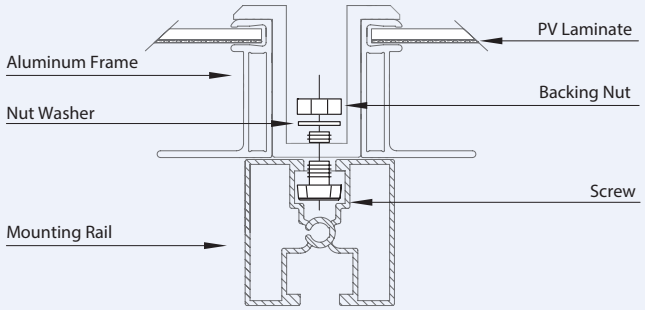

Figure 13: Detail of a top-down clamp mounting attachment

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Maintenance

General

We recommend that PV system be periodically inspected by the installer, or another qualified person.

The purpose of the PV system inspection is to ensure that all system components are functioning properly. At a minimum, this inspection should confirm the following:

- All cables and connector attachments are undamaged and properly secured.
- No sharp objects are in contact with de PV module surface.
- PV modules are not shaded by unwanted obstacles and/or foreign material.
- Mounting and grounding components are tightly secured with no corrosion
- **Any defects should be addressed immediately.**

Cleaning

Over time, dirt and dust can accumulate on the glass surface of the module, reducing its power output. We recommend periodic cleaning of PV modules to ensure maximum power output, especially in regions with low precipitation

In order to reduce the potential for electrical and thermal shock, we recommend cleaning PV modules during early morning or late afternoon hours when solar radiation is low and the modules are cooler, especially in regions with hotter temperatures.

Never attempt to clean a PV module with broken glass or other signs of exposed wiring, as this presents a shock hazard.

Clean the glass surface of the PV modules with a soft brush using soft, clean water (PH6-9) with a recommended pressure less than 690kPa, which is typical of most municipal water systems. Water with high mineral content may leave deposits on the glass surface and is not recommended.

Maintenance (Cont.)

These Solar PV modules may contain a hydrophobic anti-reflective coating on the glass surface to enhance power output and reduce dirt and dust buildup. In order to avoid module damage, do not clean PV modules with a power washer or pressure washer. Do not use steam or corrosive chemicals to facilitate the cleaning of modules. Do not use aggressive tools or abrasive materials that could scratch or damage the glass surface. Failure to comply with these requirements may adversely affect the PV module performance.

These Solar PV modules are designed to withstand high snow loads. However, if removing snow is desired to enhance production, use a brush to gently remove snow. Do not try to remove frozen snow or ice from PV modules.

Decommissioning

The dismantling of PV systems must be performed with the same care and safety precautions used during the initial installation. The PV system can generate hazardous voltage even after the system has been disconnected. Follow safety regulations for working with live electrical equipment.

Other Useful Information

Electrical Characteristics

- Nameplate ratings are average values.
- The electrical characteristics are within +/- 10 percent of the indicated values of Isc, Voc, and Pmax under Standard Test Conditions (irradiance of 1000 W/m^2, AM 1.5 spectrum, and a cell temperature of 25°C).
- Refer to module datasheets (or page 25) for specific power output tolerances.
- Please refer to Table 1 (page 15) to see which power classes actually exist for which module series.
- Class Protector Rating: Class II

Other Useful Information

Performance

Model Number	AS-380B-PV-MHL AS-380S-PV-MHL		AS-410B-PV-MHO AS-410S-PV-MHO		AS-450B-PV-MHO AS-450S-PV-MHO	
Test Conditions	STC	NMOT	STC	NMOT	STC	NMOT
Maximum Power (W)	380	288	410	310	450	340
Short-circuit Current (A)	11.55	9.24	13.70	10.96	13.68	10.94
Open-circuit Voltage (V)	41.7	39.13	37.34	35.39	41.4	39.2
Maximum Power Current (A)	11.04	8.83	13.14	10.51	13.01	10.41
Maximum Power Voltage (V)	34.5	32.61	31.22	29.49	34.6	32.67
Module Efficiency (%)	20.86		21.00		20.79	
Max. Overcurrent Protection Rating (A)	20		25		25	
Power Tolerance (W)	0~ +5					
Measuring Uncertainty of Pm (%)	0~ ±3					
Maximum System Voltage (V)	1500					

Maximum system voltage (V)

Junction Box	IP68		
Frame	Aluminium Alloy		
Cable	4 mm² +300,-300 mm/±1000 mm Length can be customized		
Fire Class Rating	Class C according to UL 790		
Connector	Ningbo Win Solar: Win02		
Operating Temperature (°C)	-40 to +85		
Snow Load (Pa)	5400		
Standards	IEC 61215 & IEC 61730 & ISO9001		
Dimensions (mm)	1755 x 1038 x 35	1724 x 1134 x 35	1909 x 1134 x 35
Weight (kg)	20.0	20.5	24

Temperature Characteristics

NMOT (°C)	45 ± 3
Temp Coefficient of VOC (%/ °C)	-0.28
Temp Coefficient of ISC (%/ °C)	+0.05
Temp Coefficient of Pmax (%/ °C)	-0.34

- STC (Standard Test Conditions): 1000 W/m² Irradiance, 25 °C Cell Temperature, AM 1.5.
- NMOT (Normal Module Operation Temperature): 800 W/m² Irradiance, 20 °C Ambient Temperature, Wind Speed 1 m/s.

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Installer Notes

Installer Notes

Warranty returns

Should you for any reason need to return this product for a warranty claim, make sure to include all accessories with the product.

Product does not work?

If you encounter problems with this product, or if it fails to perform to your expectations, make sure to contact our After Sales Support Centre on (AU) 1300 886 605 for advice.

For an electronic copy of this manual, please contact our after sales support centre.

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PO BOX 132, Frenchs Forest NSW 1640, Australia
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