

INSTALLATION MANUAL

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1. General Information

1.1 Overview

Thanks for choosing AE SOLAR PVmodules. In order to ensure the PV modules are installed correctly, please read the following installation instructions carefully before modules are installed and used.

Please remember that these products generate electricity and certain safety measures need to be taken to avoid danger.

Make sure the module array is designed in such a way not to exceed the maximum system voltage of any system component such as connectors or inverters and only use compatible connectors of the same type.

The assembly is to be mounted over a fire resistant roof covering rated for the application. Before mounting the module, please consult your local building department to determine approved roofing materials.

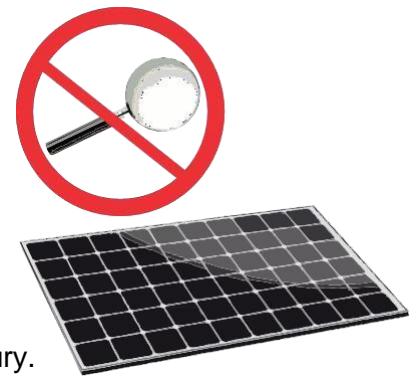
The modules are qualified for Class II: which can be used in systems operating at 50 V DC or >240W.

Where general contact access is anticipated; When the modules are for rooftop application, it is necessary to take the overall fire rating of the finished structure as well as operation and maintenance into account. The roofing PV system shall be installed after being evaluated by construction experts or engineers and with official analysis results for the entire structure. It shall be proved capable of supporting extra system bracked pressure, including PV module weight.

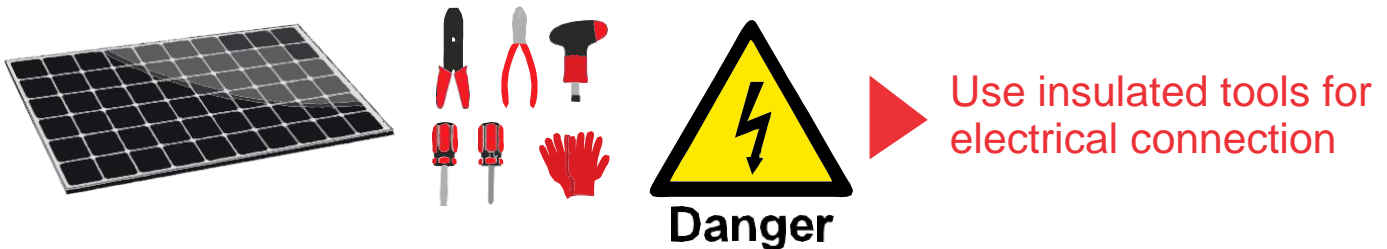
1.2 Warnings



- ❑ PV modules generate DC electrical energy when exposed to sunlight or other light sources. Active parts of module such as terminals can result in burns, sparks, and lethal shock.
- ❑ Artificially concentrated sunlight shall not be directed on the module or panel.
- ❑ Front protective glass is utilized on the module. Broken solar module glass is an electrical safety hazard (may cause electric shock or fire). These modules cannot be repaired and should be replaced immediately.
- ❑ To reduce the risk of electrical shocks or burns, modules may be covered with an opaque material during installation to avoid injury.
- ❑ The installation work of the PV array can only be done under the protection of sun-sheltering covers or sunshades and only qualified person can install or perform maintenance work on this module.
- ❑ Follow the battery manufacture's recommendations if batteries are used with modules.
- ❑ Do not use this module to replace or partly replace roofs and walls of living buildings.
- ❑ Do not install modules where flammable gas may be present.
- ❑ Do not remove any part installed by AE Solar or disassemble the module.



- All instructions should be read and understood before attempting to install, wire, operate and maintain the module.
- Don't lift up PV modules using the attached cables or the junction box.
- Do not touch live terminals with bare hands. Use insulated tools for electrical connections.



- All PV systems must be grounded to earth. If there is no special regulation, please follow the National Electrical Code or other national code.
- 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 value of I_{sc} and V_{oc} marked on the module should be multiplied by 1.25 when determining PV system component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output.
- Once the PV module has been shipped to the installation site, all of the parts should be unpacked properly with care.
- Only the modules with the same type and the capacity should be connected in series inside the string.
- During transporting modules, please attempt to minimize shock or vibration to the module, as this may damage the module or lead to cell micro cracks.
- During all transportation situations, never drop the module from a vehicle, house or hands. This will damage module.
- Do not clean the glass with chemicals. Only use tap water. Make sure the module surface temperature is cool to the touch. Cleaning modules with cool water when module surface temp is high may result in glass breakage.
- Do not stand or step on the PV module like below pictures show. This is prohibited and there is a risk of damage to the module and cause injury for you.



- Do not disconnect modules from the circuit, when they are operating in the system and deriving electrical load.
- When looking at PV modules with anti-reflection (AR) coating technology, it will be normal to see some cells with a slight color difference at different angles. Modules with LRF (light reflective film) and without LRF should not be built in the same array or roof.
- Connector of junction box cannot be contacted with oily substances, for example, lubricant, rust inhibitor etc.
- The maximum altitude the PV module is designed for $\leq 2000\text{m}$.
- Do not carry a module on your head, with the backsheet facing towards to your helmet, if it is not avoidable, please make sure that, the module is facing with the glass side to your helmet.
- The maximum irradiance is $1300\text{W}/\text{m}^2$ for module with transparent and white backsheet rear.
- Meaning of crossed –out wheeled dustbin:
Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.
Contact your local government for information regarding the collection systems available.
If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.
When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.



2. Installation

2.1 Installation Safety

- Always wear protective head gear, insulating gloves and safety shoes (with rubber soles).
- Keep the PV module packed in the carton until installation.
- Do not touch the PV module unnecessarily during installation. The glass surface and the frame may be hot. There is a risk of burns and electric shock.
- Do not work in rain, snow or windy conditions.
- Due to the risk of electrical shock, do not perform any work if the terminals of the PV module are wet.
- Use insulated tools and do not use wet tools.
- When installing PV modules, do not drop any objects (e.g., PV modules or tools).
- Make sure flammable gasses are not generated or present near the installation site.
- Insert module connectors fully and correctly. An audible "click" sound should be heard. This sounds confirms the connectors are fully seated. Check all connections.
- The module leads should be securely fastened to the module frame, Wire Management should be

done in a way to avoid the connector from scratching or impacting the back sheet of the module.

- Do not touch the junction box and the end of the interconnect cables (connectors) with bare hands during installation or under sunlight, regardless if the PV module is connected to or disconnected from the system.
- Do not expose the PV module to excessive loads on the surface of the PV module or twist the frame.
- Do not hit or put excessive load on the glass or back sheet, this may break the cells or cause micro cracks.
- During the installation or operation, don't use sharp tools to wipe the back sheet and glass. Scratches can appear on the module.
- Do not drill holes in the frame. It may cause corrosion of the frame.
- When installing modules on roof mounted structures, please try to follow the "from top to bottom" and/or "from left to right" principle, and don't step on the module. This will damage the module and would be dangerous for personal safety fire tested according ANSI-UL-790:2004.

2.2 Installation Condition

2.2.1 Climate Condition

Please install the modules in the following conditions:

- a) Operating temperature: within -40°C (-40°F) to 85°C (185°F)
- b) Humidity: $< 85\text{RH}\%$

* Note: The mechanical load bearing (include wind and snow loads) of the module is based on the approved mounting methods. The professional system installer must be responsible for mechanical load calculation according to the system design.

2.2.2 Site Selection

In most applications, AE Solar PV modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the module 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 lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from 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 photovoltaic modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though the factory fitted bypass diodes of the PV module will minimize any such loss.

Do not install the PV module near open flame or flammable materials.

When solar modules are used to charge batteries, the battery must be installed in a manner, which will protect the performance of the system and the safety of its users. Follow the battery manufacturer's

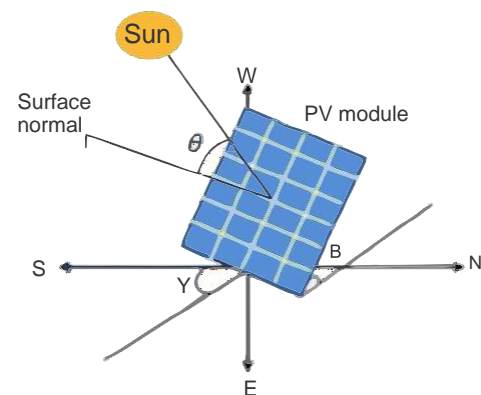
guidelines concerning installation, operation and maintenance recommendations. In general, the battery (or battery bank) should be away from the main flow of people and animal traffic. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging, which can be explosive. Do not light matches or create sparks near the battery bank. When a battery is installed outdoors, it should be placed in an insulated and ventilated battery case specifically designed for the purpose.

Do not install the PV module in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.

2.2.3 Tilt Angle Selection

The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface (Figure 1). The PV module generates maximum output power when it faces the sun directly.

For standalone systems with batteries where the PV modules are attached to a permanent structure, the tilt angle of the PV modules should be selected to optimize the performance based on seasonal load and sunlight. In general, if the PV output is adequate when irradiance is low (e.g., winter), then the angle chosen should be adequate during the rest of the year. For grid-connected installations where the PV modules are attached to a permanent structure, PV modules should be tilted so that the energy production from the PV modules will be maximized on an annual basis.



2.3 Mechanical Installation Introduction

Solar PV modules usually can be mounted by using the following methods: bolts and clamps.

Note:

- 1) All installation methods herein are only for reference, and AE solar will not provide related mounting components, the system installer or trained professional personnel must be responsible for the PV system's design, installation, and mechanical load calculation and security of the system.
- 2) Before installation, the following items should be addressed:
 - a) Visually check the module for any damage. Clean the module if any dirt or residue remains from shipping.
 - b) Check if module serial number stickers match.
- 3) AE Solar modules are designed to meet a maximum positive (or downward) pressure of 3600Pa (Only

referring to the mentioned module type in this manual) and negative (or upward) pressure of 1600Pa. This design load was then tested with a safety factor of 1.5 times. AE Solar modules are tested under a maximum downward pressure of 5400Pa and upward pressure of 2400Pa. When mounting modules in snow-prone or high-wind environments, special care should be taken to mount the modules in a manner that provides sufficient design strength while meeting local code requirements.

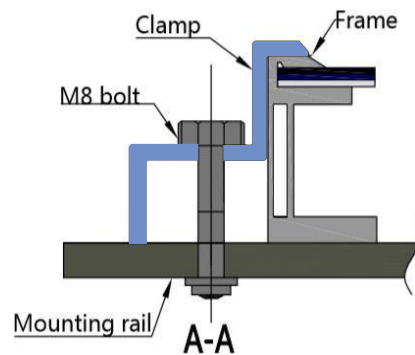
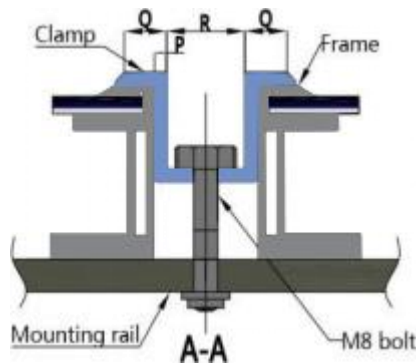
Please take in note, that the limitation of Tilt angle / slope is maximum 60 °. According to IEC61215, solar modules are rated as a class C Flame-Spread Ratings product according to NSF/ANSI342 standards

2.3.1 Mounting with clamps

The module clamps should not come into contact with the front glass and must not deform the frame. 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, please be sure to use at least four clamps on each module, two clamps should be attached on each long sides of the module. Depending on the local wind and snow loads, if excessive pressure load is expected, additional clamps or support would be required to ensure the module can bear the load. The applied torque value should be big enough to fix the modules steadily (Please consult with the clamp or support's supplier for the specific torque value). Please find detailed mounting information in the below illustration, the mounting place distance is suggested bigger than J and less than K. The installation diagram of clamp is shown in figure 5.

Note: The Movement of the mounting rail and the clamps center line are recommended to be within the black arrow area.

The min length of clamps is 50mm.



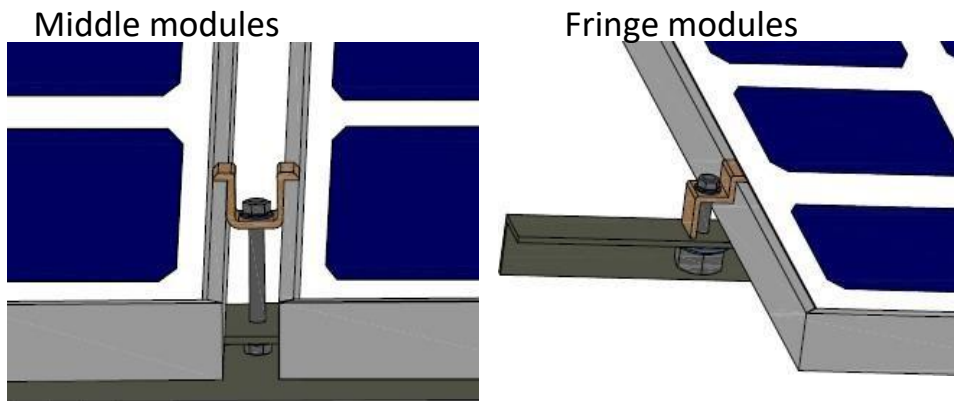


Figure 5: PV module installed at the side with Clamp fitting method

When installing modules using clamps on the long side of the frame, the applicable product types and installation locations are shown in figure 6 and table 4.

When installing modules using clamps on the short side of the frame, the applicable product types and installation locations are shown in figure 7 and table 5.

When installing modules using clamps on the long side & short side of the frame, the applicable product types and installation locations are shown in figure 8 and table 6.

When installing modules using clamps on the long side of the frame, the applicable product types and installation locations (The without C transparent backsheet series module) are shown in figure 9 and table 7.

2.3.1.1 Clamp Mounting on Long Sides of the Frames

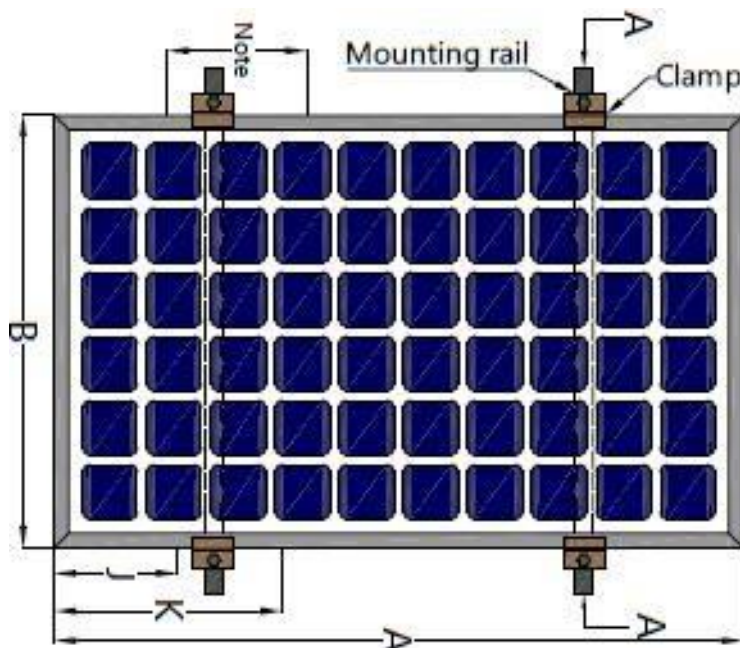


Figure 6: Installation of clamps on long side of frames

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar	
		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
36 cells	M	AE185MA-36	1480*670	140	390
		AE190MA-36	1480*670	140	390
		AE195MA-36	1480*670	140	390
		Height of the frame (mm)	35		
60 cells	M	AE310MA-60	1650*992	145	395
		AE315MA-60	1650*992	145	395
		AE320MA-60	1650*992	145	395
		Height of the frame (mm)	35		
72 cells	M	AE370MA-72	1956*992	143	433
		AE375MA-72	1956*992	143	433
		AE380MA-72	1956*992	143	433
		AE385MA-72	1956*992	143	433

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar	
		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
36 cells	M	AE185MB-36	1530*680	165	415
		AE190MB-36	1530*680	165	415
		AE195MB-36	1530*680	165	415
		AE200MB-36	1530*680	165	415
		Height of the frame (mm)	35		
60 cells	M	AE320MB-60	1665*996	166	416
		AE325MB-60	1665*996	166	416
		AE330MB-60	1665*996	166	416
		AE335MB-60	1665*996	166	416
		Height of the frame (mm)	35		
72 cells	M	AE385MB-72	1979*996	154.5	444.5
		AE390MB-72	1979*996	154.5	444.5
		AE395MB-72	1979*996	154.5	444.5
		AE400MB-72	1979*996	154.5	444.5

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar	
		Module dimensions(mm) A*B		J	K
		Height of the frame(mm)	35		
60 cells	M	AE325MB-120	1692*996	166	416
		AE330MB-120	1692*996	166	416
		AE335MB-120	1692*996	166	416
		AE340MB-120	1692*996	166	416
		AE345MB-120	1692*996	166	416
		Height of the frame(mm)	35		
72 cells	M	AE390MB-144	2015*996	172.5	462.5
		AE395MB-144	2015*996	172.5	462.5
		AE400MB-144	2015*996	172.5	462.5
		AE405MB-144	2015*996	172.5	462.5
		AE410MB-144	2015*996	172.5	462.5
		AE415MB-144	2015*996	172.5	462.5

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar	
		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
36 cells	M	AE185SMB-36	1530*680	165	415
		AE190SMB-36	1530*680	165	415
		AE195SMB-36	1530*680	165	415
		AE200SMB-36	1530*680	165	415
		Height of the frame (mm)	35		
60 cells	M	AE320SMB-60	1690*996	165	415
		AE325SMB-60	1690*996	165	415
		AE330SMB-60	1690*996	165	415
		AE335SMB-60	1690*996	165	415
		Height of the frame (mm)	35		
72 cells	M	AE385SMB-72	2020*996	175	465
		AE390SMB-72	2020*996	175	465
		AE395SMB-72	2020*996	175	465
		AE400SMB-72	2020*996	175	465

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load	Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar		
			Module dimensions(mm) A*B	J	K
		Height of the frame (mm)	35		
36 cells	M	AE210MC-72	1580*702	110	360
		AE215MC-72	1580*702	110	360
		AE220MC-72	1580*702	110	360
		AE225MC-72	1580*702	110	360
		AE230MC-72	1580*702	110	360
		Height of the frame (mm)	35		
48 cells	M	AE280MC-96	1412 *1038	181	431
		AE285MC-96	1412 *1038	181	431
		AE290MC-96	1412 *1038	181	431
		AE295MC-96	1412 *1038	181	431
		AE300MC-96	1412 *1038	181	431
		AE305MC-96	1412 *1038	181	431
		Height of the frame (mm)	35		
54 cells	M	AE315MC-108	1580 *1038	110	360
		AE320MC-108	1580 *1038	110	360
		AE325MC-108	1580 *1038	110	360
		AE330MC-108	1580 *1038	110	360
		AE335MC-108	1580 *1038	110	360
		AE340MC-108	1580 *1038	110	360
		AE345MC-108	1580 *1038	110	360
		Height of the frame (mm)	35		
60 cells	M	AE350MC-120	1755 *1038	197.5	447.5
		AE355MC-120	1755 *1038	197.5	447.5
		AE360MC-120	1755 *1038	197.5	447.5
		AE365MC-120	1755 *1038	197.5	447.5
		AE370MC-120	1755 *1038	197.5	447.5
		AE375MC-120	1755 *1038	197.5	447.5
		AE380MC-120	1755 *1038	197.5	447.5
		AE385MC-120	1755 *1038	197.5	447.5

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar	
		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
66 cells	M	AE385MC-132	1918 *1038	124	414
		AE390MC-132	1918 *1038	124	414
		AE395MC-132	1918 *1038	124	414
		AE400MC-132	1918 *1038	124	414
		AE405MC-132	1918 *1038	124	414
		AE410MC-132	1918 *1038	124	414
		AE415MC-132	1918 *1038	124	414
		AE420MC-132	1918 *1038	124	414
		Height of the frame (mm)	35		
72 cells	M	AE420MC-144	2094 *1038	212	502
		AE425MC-144	2094 *1038	212	502
		AE430MC-144	2094 *1038	212	502
		AE435MC-144	2094 *1038	212	502
		AE440MC-144	2094 *1038	212	502
		AE445MC-144	2094 *1038	212	502
		AE450MC-144	2094 *1038	212	502
		AE455MC-144	2094 *1038	212	502
		AE460MC-144	2094 *1038	212	502

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		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
36 cells	M	AE260MD-72	1724 *766	182	432
		AE265MD-72	1724 *766	182	432
		AE270MD-72	1724 *766	182	432
		AE275MD-72	1724 *766	182	432
		Height of the frame (mm)	35		
48 cells	M	AE350MD-96	1540 *1133	245	495
		AE355MD-96	1540 *1133	245	495
		AE360MD-96	1540 *1133	245	495
		AE365MD-96	1540 *1133	245	495
		AE370MD-96	1540 *1133	245	495
		Height of the frame (mm)	35		
54 cells	M	AE390MD-108	1724 *1133	182	432
		AE395MD-108	1724 *1133	182	432
		AE400MD-108	1724 *1133	182	432
		AE405MD-108	1724 *1133	182	432
		AE410MD-108	1724 *1133	182	432
		AE415MD-108	1724 *1133	182	432
		Height of the frame (mm)	35		
60 cells	M	AE435MD-120	1910 *1133	120	410
		AE440MD-120	1910 *1133	120	410
		AE445MD-120	1910 *1133	120	410
		AE450MD-120	1910 *1133	120	410
		AE455MD-120	1910 *1133	120	410
		AE460MD-120	1910 *1133	120	410
		Height of the frame (mm)	35		
66 cells	M	AE480MD-132	2094 *1133	212	502
		AE485MD-132	2094 *1133	212	502
		AE490MD-132	2094 *1133	212	502
		AE495MD-132	2094 *1133	212	502
		AE500MD-132	2094 *1133	212	502
		AE505MD-132	2094 *1133	212	502

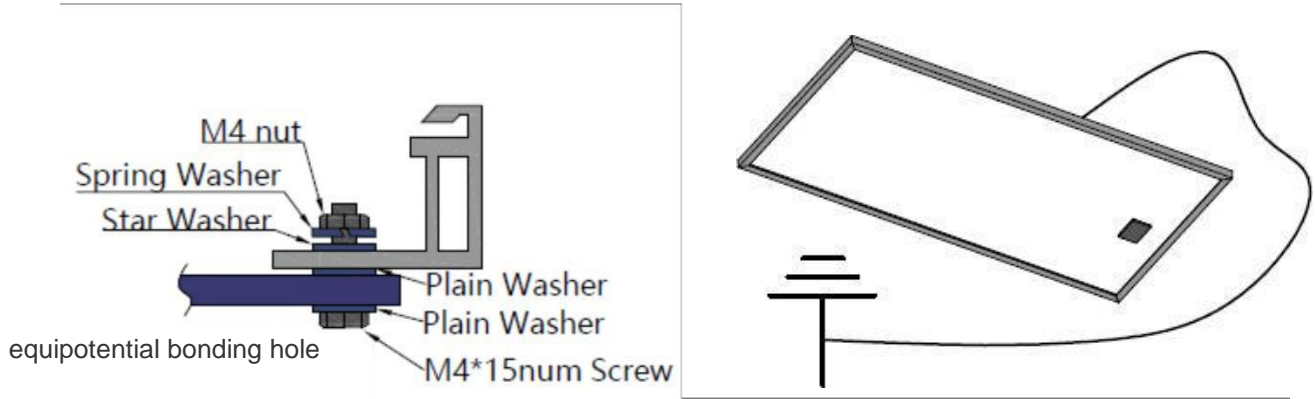
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		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
72 cells	M	AE520MD-144	2278 *1133	304	594
		AE525MD-144	2278 *1133	304	594
		AE530MD-144	2278 *1133	304	594
		AE535MD-144	2278 *1133	304	594
		AE540MD-144	2278 *1133	304	594
		AE545MD-144	2278 *1133	304	594
		AE550MD-144	2278 *1133	304	594
		AE555MD-144	2278 *1133	304	594
		Height of the frame (mm)	35		
78 cells	M	AE565MD-156	2464 *1133	397	687
		AE570MD-156	2464 *1133	397	687
		AE575MD-156	2464 *1133	397	687
		AE580MD-156	2464 *1133	397	687
		AE585MD-156	2464 *1133	397	687
		AE590MD-156	2464 *1133	397	687
		AE595MD-156	2464 *1133	397	687
		AE600MD-156	2464 *1133	397	687

Module type		Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load	Max. Design Pressure: 3600Pa (positive) &1600Pa (negative) mechanical load Note : The installation method is based on the internal results in AE Solar		
			Module dimensions(mm) A*B	J	K
Height of the frame (mm)		35			
66 cells	M	AE640ME-132	2384 *1303	357	647
		AE645ME-132	2384 *1303	357	647
		AE650ME-132	2384 *1303	357	647
		AE655ME-132	2384 *1303	357	647
		AE660ME-132	2384 *1303	357	647
		AE665ME-132	2384 *1303	357	647
		AE670ME-132	2384 *1303	357	647
Height of the frame (mm)		35			
60 cells	M	AE580ME-120	2172 *1303	251	541
		AE585ME-120	2172 *1303	251	541
		AE590ME-120	2172 *1303	251	541
		AE595ME-120	2172 *1303	251	541
		AE600ME-120	2172 *1303	251	541
		AE605ME-120	2172 *1303	251	541
		AE610ME-120	2172 *1303	251	541
Height of the frame (mm)		35			
40 cells	M	AE535ME-110	1754 *1096	357	647
		AE540ME-110	1754 *1096	357	647
		AE545ME-110	1754 *1096	357	647
		AE550ME-110	1754 *1096	357	647
		AE555ME-110	1754 *1096	357	647

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		Module dimensions(mm) A*B		J	K
		Height of the frame (mm)	35		
50 cells	M	AE480ME-T150	2176 *1096	253	543
		AE485ME-T150	2176 *1096	253	543
		AE490ME-T150	2176 *1096	253	543
		AE495ME-T150	2176 *1096	253	543
		AE500ME-T150	2176 *1096	253	543
		AE505ME-T150	2176 *1096	253	543
		AE510ME-T150	2176 *1096	253	543
		AE515ME-T150	2176 *1096	253	543
		Height of the frame (mm)	35		
40 cells	M	AE385ME-T120	1754 *1096	197	447
		AE390ME-T120	1754 *1096	197	447
		AE395ME-T120	1754 *1096	197	447
		AE400ME-T120	1754 *1096	197	447
		AE405ME-T120	1754 *1096	197	447
		AE410ME-T120	1754 *1096	197	447
		AE415ME-T120	1754 *1096	197	447

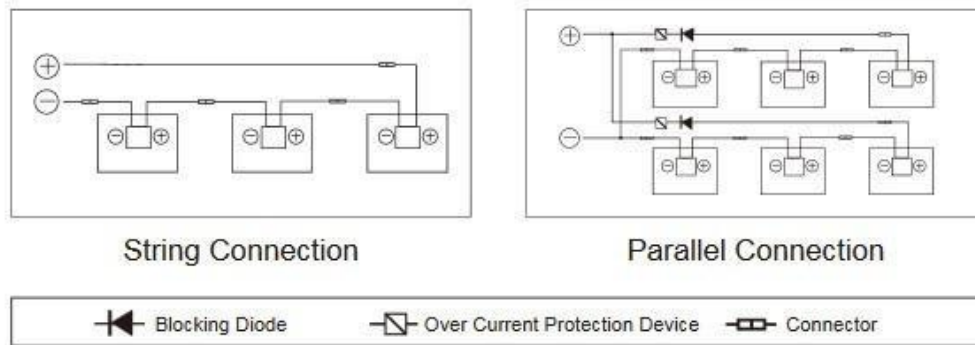
3. Wiring and Connection

- a) Before this procedure, please read the operation instructions of the PV system carefully. Make wiring by multi-connecting cables between the PV modules in series or parallel connection, which is determined by user's configuration requirement for system power, current and voltage.
- b) PV modules connected in series should have similar connectors of identical type current, and modules must not be connected together to create a voltage higher than the permitted system voltage. The maximum number of modules in series depends on system design, the type of inverter used and environmental conditions.
- c) The maximum fuse rating value in an array string can be found on the product label or in the product datasheet. The fuse rating value is also corresponding to the maximum reverse current that a module can withstand, i.e., when one string is in shade then the other parallel strings of modules will be loaded by the shaded string and the current will pass through to create a current circuit. Based on the maximum series fuse rating of module and local electrical codes and standards, make sure the modules strings in parallel are protected with the appropriate in-line string fusing.
- d) Open the combiner box of the control system and connect the conductor from the PV arrays to the combiner box in accordance with the design and local codes and standards. The cross-sectional area and cable connector capacity must satisfy the maximum short-circuit of the PV system (for a single component, we recommended that the cross-sectional area of cables current will be 4mm^2 and the rated current of connectors be more than 10A), otherwise cables and connectors will become overheating for large current. Please pay attention to the temperature limit of cables is 85°C .
- e) All module frames and mounting racks must be properly equipotential bonded in accordance with module frame using the local and national electrical codes. Attach the equipment equipotential bonded conductor to the hole and hardware provided. Note that a stainless-steel star washer is used between the ground wire and module frame (see Figure 10 below). This washer is used to avoid corrosion due to dissimilar metals. Tighten the screw securely.



Equipotential bonding installation of PV modules

When modules are in series connection, the string voltage is sum of every individual module in one string. When modules are in parallel connection, the current is sum of the individual module. Modules with different electric performance models cannot be connected in one string.



The maximum allowed quantity of modules in string connection shall be calculated according to relative regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value allowed by modules and other values required by DC electric parts (maximum system voltage is DC1000V/DC1500V— actually system voltage is designed based on the selected module and inverter model.)

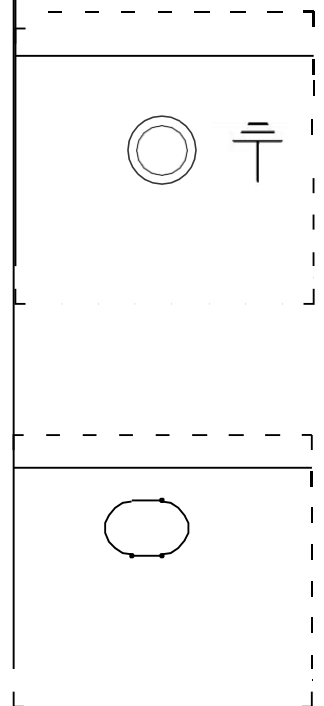
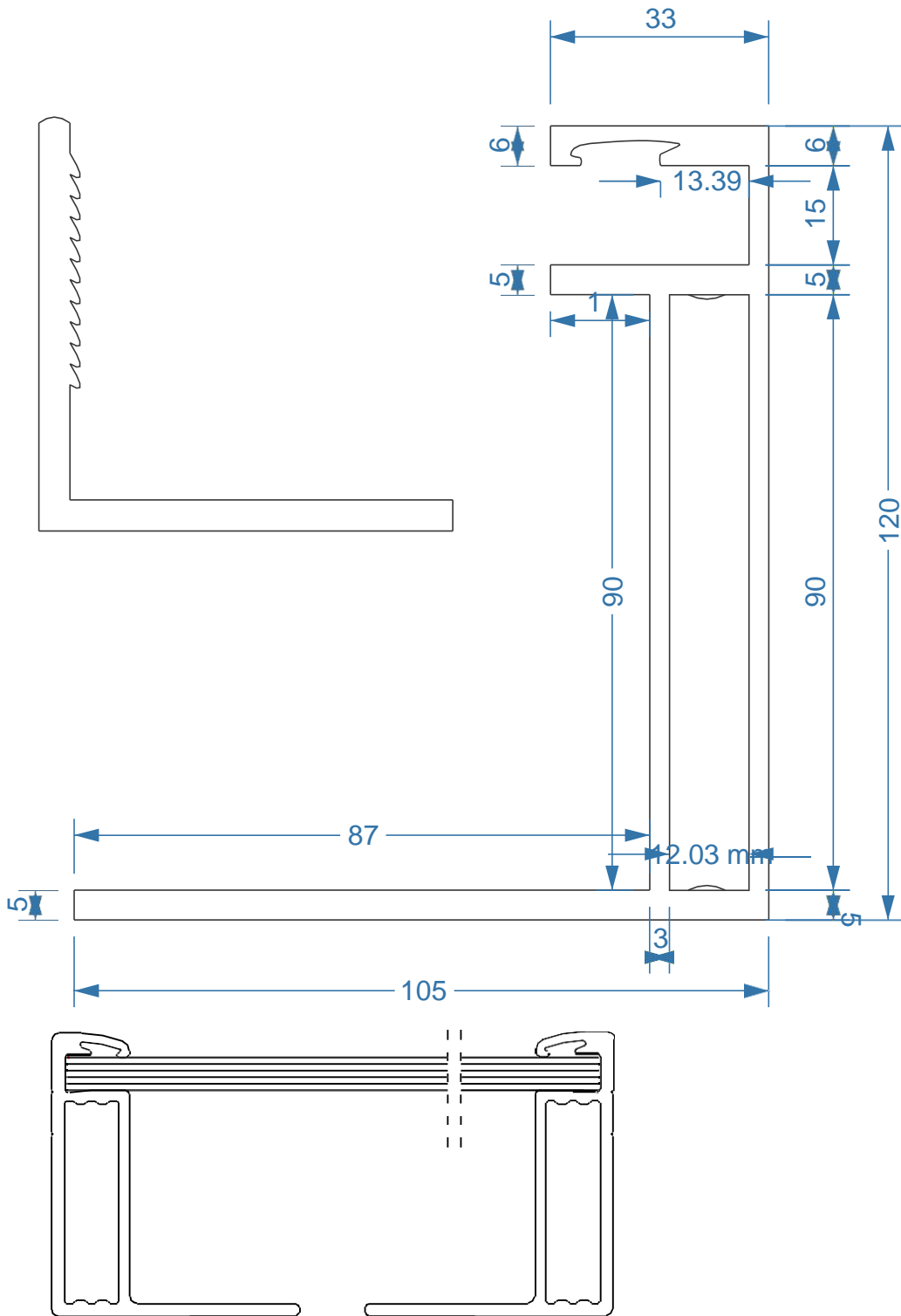
The VOC factor can be calculated by the following formula. $V_{oc} = 1 - \beta V_{oc} * (25 - T)$

T: The expected lowest temperature of the installation site,

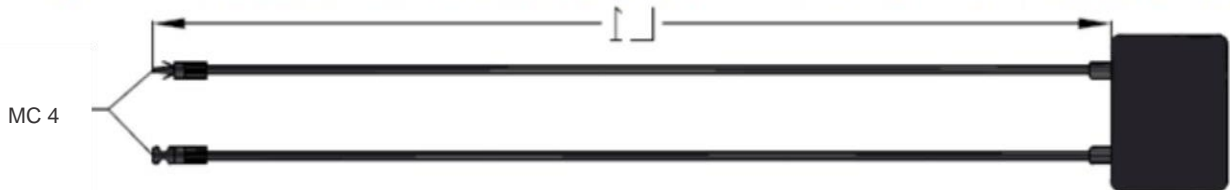
β ; VOC temperature coefficient (%/C) (refer to modules data sheet for further detail)

if there is reverse current exceeding the maximum fuse current flowing through the module, use overcurrent protection device with the same specifications to protect the module; if the parallel connection is more than 2, there must be an overcurrent protection device on each string of module.

FRAME



- f) Follow the requirements of applicable local and national electrical codes.
- g) These modules contain factory installed by pass diodes. If these modules are incorrectly connected to each other, the bypass diodes, cable or junction box may be damaged.
- h) The cable of the junction box is defined as L, as showed below in Figure 11. For AE Solar standard full cell module, L is 900/1200mm; for AE Solar standard half-cell module, L is 350mm; and for customized module, L can be based on your condition. Please take the cable length into consideration before



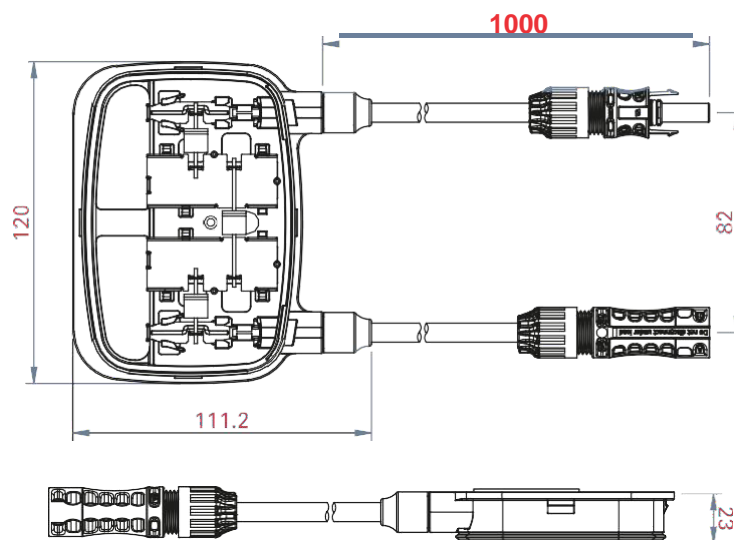
designing the wiring layout.

- i) It is recommended to use negatively grounded inverters to avoid the PID effect for non-PID free modules.
- j) If modules are connected in series, the total voltage is equal to the sum of individual voltages. The recommended as below,

$$\text{System voltage} \geq N \cdot \text{Voc} [1 + \text{TCVoc} \cdot (\text{Tmin} - 25)]$$
 Where
 N module numbers in series
 Voc Open circuit voltage (refer to product label or data sheet)
 TCVoc Temperature coefficient of open circuit voltage (refer to product label or data sheet)
 Tmin Minimum ambient temperature

4. Maintenance and Care

It is required to perform regular inspection and maintenance of the modules, especially during the warranty period. To ensure optimum module performance, AE Solar recommends the following maintenance measures:



4.1 Visual Inspection

Inspect the modules visually to find if there are any visual defects, if there are, the following items should be evaluated:

- a) If modules are observed having slight cell color differences at different angles, this is a normal phenomenon of modules with anti-reflection coating technology.
- b) Whether the glass is broken.
- c) No sharp objects are in contact with the PV module surfaces.
- d) PV modules are not shaded by unwanted obstacles and; or foreign material.
- e) Corrosion along the cells' bus-bar. The corrosion is caused by moisture intrusion through the module back sheet. Check the back sheet for damage.
- f) Check whether the back sheet is burn out.
- g) Check if screws and mounting brackets are tight, adjust and tighten as necessary.

4.2 Cleaning

- a) A buildup of dust or dirt on the module(s) front face will result in a decreased energy output. Clean the panel(s) preferably once per annum, if possible (depend on site conditions), using a soft cloth dry or damp, as necessary. Water with high mineral content may leave deposits on the glass surface and is not recommended.
- b) Never use abrasive material under any circumstances.
- c) In order to reduce the potential for electrical and thermal shock, AE Solar recommends 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.
- d) Never attempt to clean a PV module with broken glass or other signs of exposed wiring, as this presents a shock hazard.
- e) Never use chemicals when cleaning modules as this may affect the module warranty and energy output.

4.3 Inspection of Connector and Cable

It's recommended to implement the following preventive maintenance every 6 months:

- a) Check the sealing gels of the junction box for any damage.
- b) Examine the PV module(s) for signs of deterioration. Check all wiring for possible rodent damage, weathering and that all connections are tight and corrosion free. Check electrical leakage to ground.

5. Electrical Specification

The module electrical ratings are measured under Standard Test Conditions, which are 1000W/m², irradiance with AM 1.5 spectrum and 25 deg (77F°) ambient temperature. The module might produce more or less voltage or current than rated value in uncertainty condition.

6. Disclaimer of Liability

Because the use of the manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) product are beyond AE Solar's control, AE Solar does not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

No responsibility is assumed by AE Solar for any infringement of patents or other rights of third parties, which may result from use of the PV product. NO license is granted by implication or otherwise under any patent or patent rights.

The information in this manual is based on AE Solar's knowledge and experience and is believed to be reliable, but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied. AE Solar reserve the right to change the manual, the PV produce, the specifications, or product information sheets without prior notice.

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax, WP)	Maximum Power Voltage (Vmp, V)	Maximum Power Current (imp, A)	Open Circuit Voltage (Voc, V)	Short Circuit Current (Isc, A)
36 cells	M	AE185MA-36	185	20.59	8.98	23.85	9.65
		AE190MA-36	190	21.01	9.04	24.06	9.73
		AE195MA-36	195	21.41	9.11	25.87	9.79
60 cells	M	AE310MA-60	310	34.42	9.01	39.77	9.71
		AE315MA-60	315	34.84	9.04	39.98	9.77
		AE320MA-60	320	35.19	9.11	40.21	9.93
72 cells	M	AE370MA-72	370	39.63	9.34	47.68	9.69
		AE375MA-72	375	39.66	9.46	47.53	9.75
		AE380MA-72	380	39.71	9.57	47.59	9.82
		AE385MA-72	385	39.73	9.69	47.81	9.95
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	15				
Nominal module operating temperature		(C°)	—40 to+85				
Power tolerance		Pmax (WP)	0~+5				
Temp. coefficients of pmax		(% /C°)	-0.38				
Temp. coefficients of Voc		(% /C°)	-0.29				
Temp. coefficients of Isc		(% /C°)	0.05				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
120 cells	M	AE325MB-120	325	33.89	9.59	41.05	10.06
		AE330MB-120	330	34.17	9.66	41.32	10.14
		AE335MB-120	335	34.44	9.73	41.61	10.22
		AE340MB-120	340	34.69	9.8	41.88	10.3
		AE345MB-120	345	34.95	9.87	42.23	10.38
144 cells	M	AE390MB-144	390	40.79	9.56	49.06	10.10
		AE395MB-144	395	41.06	9.62	49.35	10.17
		AE400MB-144	400	41.32	9.68	49.25	10.24
		AE405MB-144	405	41.59	9.74	49.53	10.31
		AE410MB-144	410	41.85	9.80	49.80	10.38
		AE415MB-144	415	42.09	9.86	50.51	10.44
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	15				
Nominal module operating temperature		(C°)	to+85		-40		
Power tolerance		Pmax(WP)	0~+5				
Temp. coefficients of pmax		(% /C°)	0.353		—		
Temp. coefficients of Voc		(% /C°)			— 0.277		
Temp. coefficients of Isc		(% /C°)	0.040				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
36 cells	M	AE185MB-36	185	19.90	9.3	24.40	9.66
		AE190MB-36	190	20.10	9.45	24.60	9.84
		AE195MB-36	195	20.30	9.61	24.80	10.02
		AE200MB-36	200	20.50	9.76	25.00	10.19
60 cells	M	AE320MB-60	320	33.40	9.59	40.90	10.15
		AE325MB-60	325	33.61	9.68	41.1	10.20
		AE330MB-60	330	33.81	9.76	41.31	10.37
		AE335MB-60	335	34.02	9.85	41.49	10.38
72 cells	M	AE385MB-72	385	40.80	9.44	49.10	9.92
		AE390MB-72	390	41.1	9.49	49.3	10.12
		AE395MB-72	395	41.4	9.54	49.48	10.50
		AE400MB-72	400	41.71	9.59	49.69	10.59
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	15				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.370				
Temp. coefficients of Voc		(% /C°)	-0.280				
Temp. coefficients of Isc		(% /C°)	0.048				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
36 cells	M	AE185SMB-36	185	19.49	9.49	23.44	10.12
		AE190SMB-36	190	19.92	9.54	23.19	10.50
		AE195SMB-36	195	20.33	9.59	23.60	10.59
		AE200SMB-36	200	20.75	9.64	24.03	10.67
60 cells	M	AE320SMB-60	320	33.40	9.59	40.90	10.15
		AE325SMB-60	325	33.61	9.68	41.1	10.2
		AE330SMB-60	330	33.81	9.76	41.31	10.37
		AE335SMB-60	335	34.02	9.85	41.49	10.49
72 cells	M	AE385SMB-72	385	40.80	9.44	49.10	9.92
		AE390SMB-72	390	41.10	9.49	49.30	10.12
		AE395SMB-72	395	41.40	9.54	49.48	10.50
		AE400SMB-72	400	41.71	9.59	49.69	10.59
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	15				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+5				
Temp. coefficients of pmax		(% /C°)	-0.37				
Temp. coefficients of Voc		(% /C°)	-0.28				
Temp. coefficients of Isc		(% /C°)	0.048				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
36 cells	M	AE210MC-72	210	19.83	10.59	23.47	11.40
		AE215MC-72	215	20.14	10.67	23.81	11.5
		AE220MC-72	220	20.45	10.75	24.15	11.6
		AE225MC-72	225	20.76	10.83	24.49	11.7
		AE230MC-72	230	20.91	11.00	24.62	11.90
48 cells	M	AE280MC-96	280	26.62	10.52	31.57	11.30
		AE285MC-96	285	26.92	10.59	31.85	11.4
		AE290MC-96	290	27.17	10.67	32.12	11.50
		AE295MC-96	295	27.43	10.76	32.40	11.60
		AE300MC-96	300	27.68	10.84	32.66	11.70
		AE305MC-96	305	27.93	10.92	32.93	11.80
54 cells	M	AE315MC-108	315	30.24	10.42	35.83	11.20
		AE320MC-108	320	30.47	10.50	36.07	11.30
		AE325MC-108	325	30.69	10.59	36.32	11.40
		AE330MC-108	330	30.92	10.67	36.55	11.50
		AE335MC-108	335	31.15	10.76	36.79	11.60
		AE340MC-108	340	31.37	10.84	37.02	11.70
		AE345MC-108	345	31.59	10.92	37.24	11.80
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.370				
Temp. coefficients of Voc		(% /C°)	-0.286				
Temp. coefficients of Isc		(% /C°)	0.057				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	M	AE350MC-120	350	33.60	10.42	40.50	11.20
		AE355MC-120	355	33.8	10.50	40.7	11.30
		AE360MC-120	360	34.00	10.59	40.90	11.40
		AE365MC-120	365	34.2	10.67	41.1	11.50
		AE370MC-120	370	34.4	10.76	41.3	11.60
		AE375MC-120	375	34.6	10.84	41.5	11.70
		AE380MC-120	380	34.8	10.92	41.7	11.80
		AE385MC-120	385	35	11.00	41.9	11.90
66 cells	M	AE385MC-132	385	36.96	10.42	43.79	11.20
		AE390MC-132	390	37.13	10.50	43.97	11.30
		AE395MC-132	395	37.31	10.59	44.14	11.40
		AE400MC-132	400	37.48	10.67	44.31	11.50
		AE405MC-132	405	37.65	10.76	44.48	11.60
		AE410MC-132	410	37.83	10.84	44.64	11.70
		AE415MC-132	415	38.01	10.92	44.80	11.80
		AE420MC-132	420	38.18	11.00	44.96	11.90
72 cells	M	AE420MC-144	210	19.83	10.59	23.47	11.40
		AE425MC-144	215	20.14	10.67	23.81	11.5
		AE430MC-144	220	20.45	10.75	24.15	11.6
		AE435MC-144	225	20.76	10.83	24.49	11.7
		AE440MC-144	230	20.91	11.00	24.62	11.90
		AE445MC-144	445	41.2	10.80	49.8	11.46
		AE450MC-144	450	41.4	10.87	50.0	11.54
		AE455MC-144	455	41.6	10.94	50.2	11.62
		AE460MC-144	460	41.8	11.00	50.4	11.70

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
36 cells	M	AE260MD-72	260	20.46	12.71	24.59	13.47
		AE265MD-72	265	20.77	12.76	24.97	13.52
		AE270MD-72	270	21.08	12.81	25.35	13.57
		AE275MD-72	275	21.28	12.92	25.63	13.67
48 cells	M	AE350MD-96	350	27.54	12.71	33.10	13.47
		AE355MD-96	355	27.82	12.76	33.45	13.52
		AE360MD-96	360	28.10	12.81	33.80	13.57
		AE365MD-96	365	28.38	12.86	34.14	13.62
		AE370MD-96	370	28.64	12.92	34.48	13.67
54 cells	M	AE390MD-108	390	30.81	12.66	37.02	13.42
		AE395MD-108	395	31.08	12.71	37.36	13.47
		AE400MD-108	400	31.35	12.76	37.69	13.52
		AE405MD-108	405	31.62	12.81	38.02	13.57
		AE410MD-108	410	31.88	12.86	38.35	13.62
		AE415MD-108	415	32.12	12.92	38.67	13.67
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	25				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.350				
Temp. coefficients of Voc		(% /C°)	-0.278				
Temp. coefficients of Isc		(% /C°)	0.045				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	M	AE435MD-120	435	34.36	12.66	41.03	13.42
		AE440MD-120	440	34.62	12.71	41.35	13.47
		AE445MD-120	445	34.87	12.76	41.66	13.52
		AE450MD-120	450	35.13	12.81	41.98	13.57
		AE455MD-120	455	35.38	12.86	42.29	13.62
		AE460MD-120	460	35.60	12.92	42.60	13.67
66 cells	M	AE480MD-132	480	38.07	12.61	45.41	13.38
		AE485MD-132	485	38.31	12.66	45.75	13.42
		AE490MD-132	490	38.55	12.71	46.05	13.47
		AE495MD-132	495	38.79	12.76	46.34	13.52
		AE500MD-132	500	39.03	12.81	46.64	13.57
		AE505MD-132	505	39.27	12.86	46.93	13.62
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	25				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.350				
Temp. coefficients of Voc		(% /C°)	-0.275				
Temp. coefficients of Isc		(% /C°)	0.045				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
72 cells	M	AE520MD-144	520	41.24	12.61	49.41	13.38
		AE525MD-144	525	41.47	12.66	49.53	13.42
		AE530MD-144	530	41.70	12.71	49.65	13.47
		AE535MD-144	535	41.93	12.76	49.78	13.52
		AE540MD-144	540	42.15	12.81	49.90	13.57
		AE545MD-144	545	42.38	12.86	50.01	13.62
		AE550MD-144	550	42.57	12.92	51.44	13.67
78 cells	M	AE555MD-144	555	42.76	12.98	51.79	13.74
		AE565MD-156	565	44.73	12.63	53.75	13.39
		AE570MD-156	570	45.02	12.66	54.11	13.42
		AE575MD-156	575	45.24	12.71	54.38	13.47
		AE580MD-156	580	45.45	12.76	54.65	13.52
		AE585MD-156	585	45.67	12.81	54.92	13.57
		AE590MD-156	590	45.88	12.86	55.18	13.62
		AE595MD-156	595	46.05	12.92	55.45	13.67
		AE600MD-156	600	46.22	12.98	55.63	13.74
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	25				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.350				
Temp. coefficients of Voc		(% /C°)	-0.275				
Temp. coefficients of Isc		(% /C°)	0.045				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
40 cells	M	AE385ME-T120	385	33.60	11.46	40.60	12.00
		AE390ME-T120	390	33.80	11.54	40.80	12.14
		AE395ME-T120	395	34.00	11.62	41.0	12.21
		AE400ME-T120	400	34.20	11.7	41.2	12.28
		AE405ME-T120	405	34.40	11.77	41.4	12.34
		AE410ME-T120	410	34.60	11.85	41.6	12.64
		AE415ME-T120	415	34.80	11.93	41.8	12.73
50 cells	M	AE480ME-T150	480	42.00	11.43	49.90	12.02
		AE485ME-T150	485	42.20	11.49	51.10	12.07
		AE490ME-T150	490	42.40	11.56	51.3	12.14
		AE495ME-T150	495	42.60	11.63	51.5	12.21
		AE500ME-T150	500	42.80	11.69	51.7	12.28
		AE505ME-T150	505	43.00	11.75	51.9	12.35
		AE510ME-T150	510	43.20	11.81	52.1	12.42
		AE515ME-T150	515	43.40	11.87	52.3	12.62
		AE520ME-T150	520	43.60	11.93	52.5	12.70
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	20				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.34				
Temp. coefficients of Voc		(% /C°)	-0.25				
Temp. coefficients of Isc		(% /C°)	0.04				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
60 cells	M	AE580ME-120	580	33.60	17.26	40.70	17.81
		AE585ME-120	585	33.80	17.31	40.90	18.37
		AE590ME-120	590	34.00	17.35	41.10	18.42
		AE595ME-120	595	34.20	17.4	41.30	18.47
		AE600ME-120	600	34.40	17.44	41.50	18.52
		AE605ME-120	605	34.60	17.49	41.70	18.57
		AE610ME-120	610	34.80	17.53	41.90	18.66
66 cells	M	AE640ME-132	480	42.00	11.43	49.90	12.02
		AE645ME-132	485	42.20	11.49	51.10	12.07
		AE650ME-132	490	42.40	11.56	51.3	12.14
		AE655ME-132	495	42.60	11.63	51.5	12.21
		AE660ME-132	500	42.80	11.69	51.7	12.28
		AE665ME-132	505	43.00	11.75	51.9	12.35
		AE670ME-132	510	43.20	11.81	52.1	12.42
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	30				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.34				
Temp. coefficients of Voc		(% /C°)	-0.25				
Temp. coefficients of Isc		(% /C°)	0.04				

Electrical Specifications

Module Type		Module Serie	Maximum Power at STC (Pmax,WP)	Maximum Power Voltage (Vmp,V)	Maximum Power Current (imp,A)	Open Circuit Voltage (Voc,V)	Short Circuit Current (Isc,A)
55cells	M	AE535ME-120	535	31.00	17.28	37.30	18.36
		AE540ME-120	540	31.20	17.33	37.50	18.41
		AE545ME-120	545	31.40	17.37	37.70	18.47
		AE550ME-120	550	31.60	17.4	37.90	18.52
		AE555ME-120	555	31.80	17.45	38.10	18.56
Maximum system voltage		(V)	1500				
Maximum overcurrent protection rating		(A)	30				
Nominal module operating temperature		(C°)	-40 to +85				
Power tolerance		Pmax(WP)	0/+4.99				
Temp. coefficients of pmax		(% /C°)	-0.34				
Temp. coefficients of Voc		(% /C°)	-0.25				
Temp. coefficients of Isc		(% /C°)	0.04				

NOTE

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