vikramsolar

CREATING CLIMATE FOR CHANGE

INSTALLATION AND MAINTENANCE MANUAL

With G12 HJT cells

APPLICABLE MODELS

SURYAVA Bifacial Glass-Glass Modules:

SURYAVA VSMDH.66.AAA.05 [AAA = 700-725]

SURYAVA VSMDH.60.AAA.05 [AAA=635-660]

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01. DISCLAIMER OF LIABILITY

- The usage of this manual, installation, handling of Vikram Solar modules are beyond Vikram Solar's control. Vikram Solar does not assume any responsibility against failure to follow instructions resulting into any Loss, Damage, Injury or Expense due to Improper Installation, Handling, Usage or Maintenance.
- Vikram Solar assumes no Responsibility for Infringement of Intellectual Property Rights or other rights of third parties that may result from use of the module. No license is granted in this regards whether expressly or impliedly by Implication or under any patent rights.
- All information given in this manual is based on Vikram Solar knowledge and experience. Vikram Solar reserve the rights to change this manual and module specification without prior notice

02. SAFETY PRECAUTIONS

- Vikram Solar modules are Application Class A and qualified for Safety Class II that states 'Protection against electric shock'. PV modules generate electricity upon direct exposure to light, which can produce electrical shock. Use of insulated tools and gloves is recommended while working with modules in sunlight. No metallic contacts should be on the human body.
- No one should stand on the front and backside of the PV module as non -uniform localized pressure might cause damage to the solar cells inside the module.
- The front surface of the module constructed with tempered glass and hence it should be handled with utmost care. If the glass breaks then human contact with the surface can lead to electric shock particularly when the ambient condition is wet. Broken modules cannot be repaired and it should be disposed of properly.
- All electrical connectors should be well protected against corrosion and soiling. Ensure that connectors are corrosion free, cleaned with absolutely no gaps between the contacts. Gap can result into an Electrical Arcing causing a Fire Hazard.
- For personal safety do not install/ handle PV modules under adverse environmental conditions viz. gusty winds, wet frosted roof surfaces.
- Ensure the polarity of the modules or strings are not reversed considering the other modules in the string.
- Concentrating artificial sunlight on solar module is not allowed as it will degrade its performance and life span.
- Vikram Solar modules are certified for operating in installations at voltages below 1500 Vdc. SURYAVA VSMDH.66.AAA.05 have 1500VDC max system voltage. Consider this value while designing the power plant considering the temperature ranges in the location of power plant. Mixing of power classes in one string is not allowed and can be harmful. Damages of modules due to this mixing can lead to invalidity of product warranty.
- To allow for increased output of a module or panel resulting from certain conditions of use, the installation instructions for a module or panel shall include the following statement or the under normal conditions, a photovoltaic module is likely to experience conditions that produce more equivalent current and/or voltage than reported at standard test conditions.
- 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, and size of controls connected to the PV output.

02.1 FIRE SAFETY

VSL PV Modules have a Type 1 Class C fire resistance rating for glass to back-sheet module and Type 29 Class C fire resistance rating for glass to glass module in accordance with UL 61730/ IEC 61730 certification. "The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions." Rooftop installations should be placed over fire resistant roof coverings only. Roof constructions and installations may affect the fire safety of a building; improper installation may create hazards in the event of a fire.

Unskilled installation procedure, using defective/worn out parts may result in an electrical hazard during operation. In order to prevent the risk of fire in this case, SPV modules should not be installed near highly inflammable liquids/gases, or locations with hazardous materials.

In the case of a fire, SPV modules may produce dangerous voltage/surge current, even if they have been disconnected from the inverter, or have been partly or entirely destroyed, or the naked wiring destroyed. In the event of fire, inform the fire/safety team 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 mitigate the risk.

03. UNPACKING AND STORAGE

- At receipt of PV modules, verify the product details as it had been ordered. Packing list pasted outside the box contains all details including the serial no of modules
- In case of vertically landscape packaging Do NOT stack packing boxes (pallets) more than 2 boxes high. If pallets are stored temporarily outside, then the external protective cover to be placed and stack height should not be more than 1 pallet high and vertically portrait packaging, stacking is not allowed
- Unpacking of PV modules should always be done in the vertical manner as shown in the diagram by two persons. Also care should be taken for falling over one module to the other inside the packaging box
- PV module surfaces may get damaged/scratched if not handled carefully. No paint or adhesive to be applied to any of the surfaces including frame
- Do NOT connect male & female connectors of the Junction box cable of the module
- Do NOT use a knife to cut the zip-ties, but use wire cutting pliers
- Do NOT place module directly on top of each other
- Do NOT uplift modules by their cables or junction boxes
- Since, vertically portrait packages have a high center of gravity and those are not allowed from unpacking on uneven surface or soft grounds to avoid personal injury or even death
- For vertically portrait packaging proper stand should be used to slant modules during unpacking, Do NOT use any tottering objects to support the modules from back side.
- While unpacking of vertical portrait packaging Do NOT stand on the back of the supporting tool

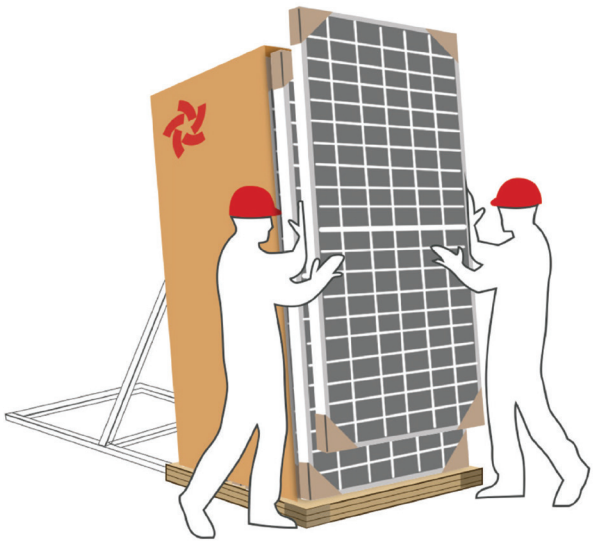


Fig 1:
Correct way to unpack modules

03.1 MODULE IDENTIFICATION

Each module has a unique serial number, which is laminated behind the glass. Please do not tamper with the serial number of the module and always record the serial numbers during an installation for your future records. A nameplate containing model name, electrical and safety characteristics of the module is also affi xed to the back side.

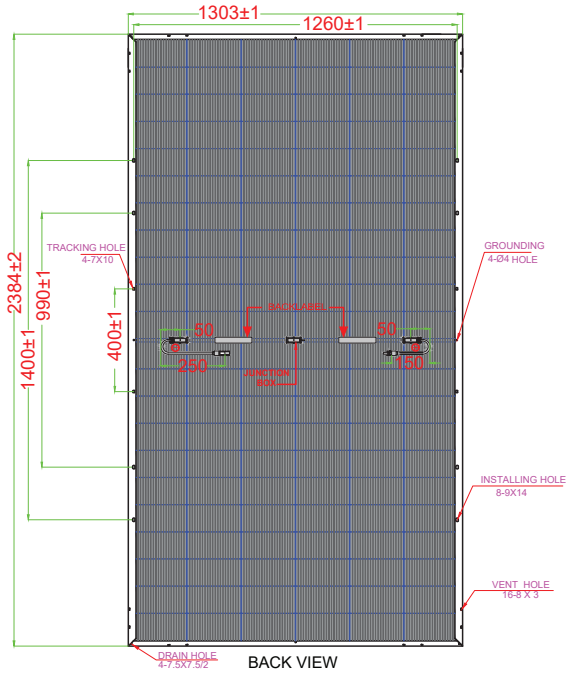


Fig 2: BACK VIEW GLASS TO GLASS BIFACIAL MODULE

04. INSTALLATION ENVIRONMENT

04.1 CLIMATE CONDITIONS

- Vikram Solar modules are certified for UL61730, IEC 61215, IEC 61730-I &II, IEC 62804-1. In addition to the required IEC certification to meet European standards, Vikram Solar products have also been tested and certified for resistance to ammonia fumes (IEC 62716) that may be present in barns sheltering cattle, pigs, as well as sustainability for Installation in Humid (coastal) areas of high sand storms. Although Vikram Solar PV modules have passed Salt mist (IEC 61701) corrosion test with a salt concentration of 5 % by weight, galvanic corrosion can occur between the aluminium frame and mounting or ground materials if such materials are made of dissimilar metals. Stainless steel and aluminium metal direct contact is recommended for seaside installations to avoid metal corrosion.

Please consult the Vikram Solar Limited technical support department for more information on the use of modules in special climates, such as an altitude greater than 2000m, heavy snow, severe hail storm, hurricane etc

ENVIRONMENT

- Ambient temperature: - 40 °C to +50 °C
- Module temperature rating 70 °C
- Operating temperature: - 40 °C to the upper limit set by a 98th percentile module operating temperature of 70 °C.
- Storage temperature: - 20 °C to +50 °C
- Humidity: < 85 RH%

- Mechanical load pressure*: Test Load of 3600 Pa on the front and 1600 Pa on the rear with a safety factor for mechanical load of 1.5
- For bifacial modules both front and rear side is designed for prolonged exposure of sunlight. (for Front side exposure of direct sunlight >300 W/m2 and for Rear side exposure of Indirect sunlight >300 W/m2)
- The maximum rated altitude the PV module is designed for is ⩽2000m
- Modules can be installed anywhere in the world as long as they are mounted to allow unrestricted airflow
- It is possible that modules installed with restricted airflow are not allowed for use in some hot locations, depending on the system parameters. Installers should assess if the system design at a specific geographical location will result in a 98th percentile module operating temperature greater than 70 °C (80 °C or 90 °C if tested to level 1 or level 2 conditions)

  Example:
  a) site specific environmental conditions: irradiance,temperature, wind speed
  b) system design: mounting distance, array size,array spacing and anti-nesting features which could reduce airflow

Note1: Specific geographic restrictions can apply, maps in IEC TS 63126 provide exmples

Note2: An IEC document describing a method for estimating the 98th percentile module operating temperature for different mounting and geographical combinations is in progress

*** NOTE:**

The mechanical load bearing capacity depends upon the Installer's mounting methods and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads. The system installer should ensure that installation methods used meet these requirements and any local codes and regulations.

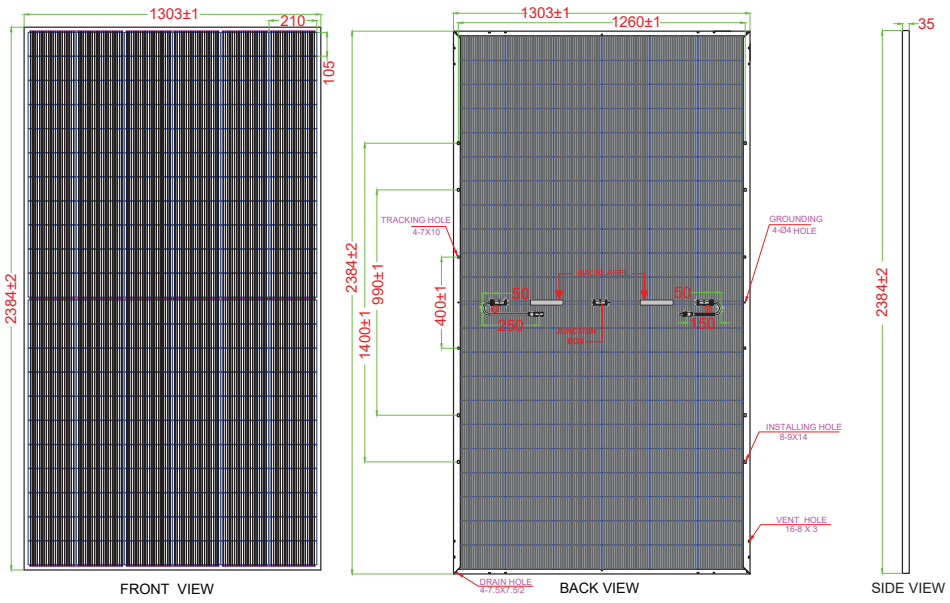


Fig 3: FRONT VIEW & BACK VIEW

05. SITE SELECTION

- PV modules should be installed in a place where there is no shading across the location throughout the year. Even minor partial shading (e.g. from dirt deposits) reduces yields. A module can be considered to be unshaded if its entire surface is free from shading all year round shading can be minimized by having the distance between the obstruction and solar array is more than thrice the height of obstruction.
- Constant shading conditions can affect module service lifetime, due to accelerated ageing of the encapsulation material and thermal stress on the bypass diodes.

- PV modules are not suitable for long-term exposure to corrosive environments, including sulfur, acids, alkalis, acid rain or chemical pollutants. Avoid installation in areas with excessive hail, heavy snow, flue gas, air pollution, salt, or other corrosive substances that may compromise safety and performance.
- PV modules should typically face south in the northern hemisphere and north in southern hemisphere. Vikram Solar modules can be mounted either in landscape or portrait orientation however, the impact of dirt shading the solar cells can be minimized by orienting the product in portrait.
- For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. If the PV module is placed at a different angle or orientation, then it could have a direct impact on the generation output.
- Any slope of less than 1:2.4 is required to maintain the fire class rating; Glass to back-sheet Modules are Type 1 Class C fire resistance rated and glass to glass IEC Class C / UL type 29 fire resistance rated.
- Avoid using mounting methods where drainage holes are blocked.
- PV modules should not be installed in such a way it will be immersed under water under any circumstances and should not be also installed in a moving vehicle / vessel.
- The module is considered to be in compliance with UL 61730 only when the module is mounted in the manner specified in this manual. A module with exposed conductive parts is considered to be in compliance with UL 61730 only when it is electrically grounded in accordance with the VSL's instructions and the requirement of the National Electrical Code, ANSI/NFPA 70 (2014-2017).

06. MOUNTING INSTRUCTIONS

06.1 MOUNTING METHODS

Corrosion proof M8 bolts to be used on the PV modules mounting holes, which are on the rear side of the module. PV modules can be fixed either by bolt method or by the clamp method. Regardless of the mounting method, the modules should ensure that:

- 120 mm clearance is provided between module frames and the surface of the roof or the wall.
- Minimum distance of 10.50mm between 2 modules
- Drainage holes are not blocked under any circumstances

PV modules are not to be subjected to wind or snow loads exceeding the maximum permissible loads, and should not be subjected to excessive forces due to thermal expansion of support structures. When modules are ground mounted, select the height of the mounting system in such a way to prevent the lowest edge of the module from being covered by snow for a long time in winter in area's that experience severe snow fall. If snow settles on the PV modules regular cleaning of snow and other foreign particles are highly recommended for long term reliability of the PV modules, failure to comply may result in damage of the module resulting in deformation and not covered under warranty measures shall be taken to prevent electrochemical corrosion between dissimilar metals. This may occur between structures and the building and also between structures, fasteners and PV modules. Stand-off materials shall be used to reduce electrochemical corrosion between galvanically dissimilar metal surfaces, for example nylon washer and rubber insulators. IEC 60950-1 standard recommends metal combinations not exceed an electrochemical potential difference of 0.6V

The minimum mechanical means is to be used for securement of the module or panel to the roof as per the instructions below, For a non-integral module or panel, the assembly is to be mounted over a fire resistant roof covering rated for the application

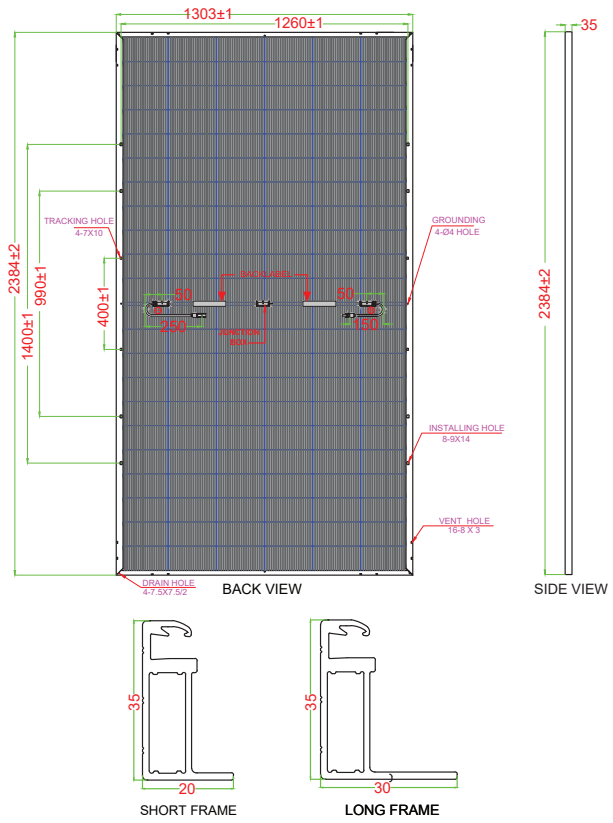


Fig 4: Mechanical Drawing of PV module SURYAVA VSMDH.66.AAA.05

Fig 4.1: Sectional view of Al-Profile-132 half-cells module

A. MOUNTING WITH FRAME BOLT HOLES

The frames of each module has 8* (9 mm*14 mm) mounting holes. Vikram Solar strongly recommends the use of corrosion proof (stainless steel) fixings. The modules to be secured with a M8 - Grade 8.8 (1/4"-20 Grade B7) coarse thread bolt , two flat washers, spring washer and a nut as shown in figure 6. The assembly should be tightened to a torque of minimum 16-20 Nm.

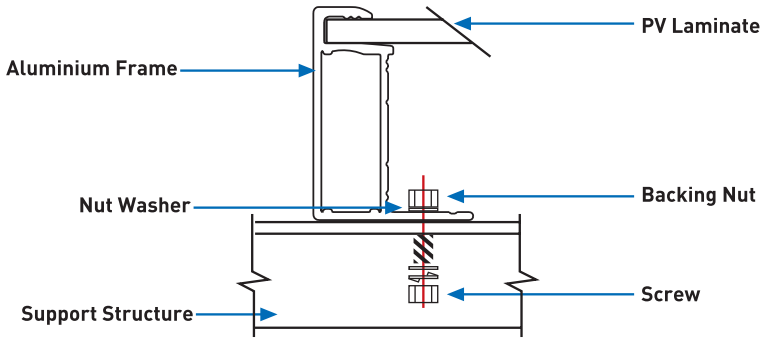


Fig 5: Modules Installed with Screw Fitting Method

B. MOUNTING WITH CLAMP FIXING

- Vikram Solar has tested modules with a number of clamps and suggests to use clamps which has a EPDM or any other insulating washer.
- To fix the modules on the mounting rail, a minimum of 4 (min clamp length 50mm) clamps.
- The clamps should never touch the glass and cause any breakage and also clamps should not cause any shadow effects on the module.
- The customer should not do any modification to the frame under any circumstances.

When modules are mounted using clamp mounting method at least 4 clamps need to be used. Two clamps on each of the long side of the module and 2 clamps on each of the short side of the module. Vikram Solar modules are certified for 2400 Pa (50.12 lb/ft2) (Wind Load) and 5400 Pa (112.8 b/ft2) (Snow Load) on the front side. Fringe Type Module Installation and Middle Module installation Diagrams are given below:

Fringe Type Module Installation and Middle Module Installation Diagrams are given below:

FRINGE MODULE INSTALLATION

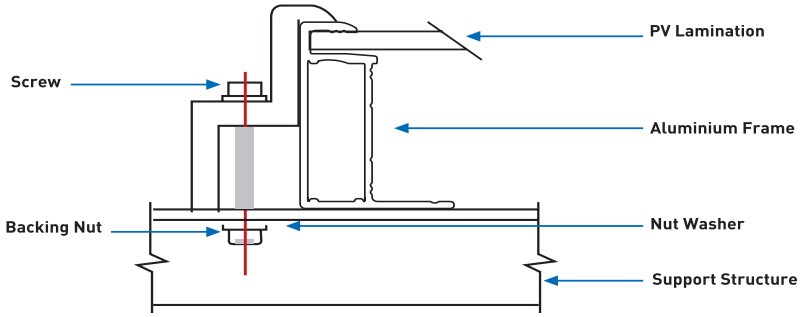


Fig 6: PV modules installed using fringe clamping method

MIDDLE MODULE INSTALLATION

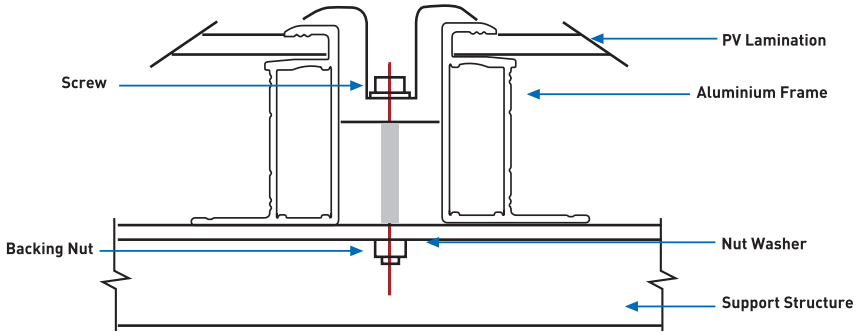
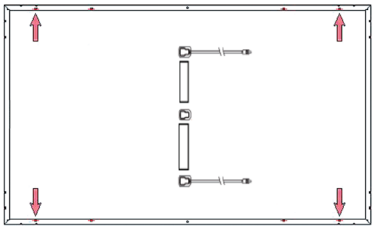
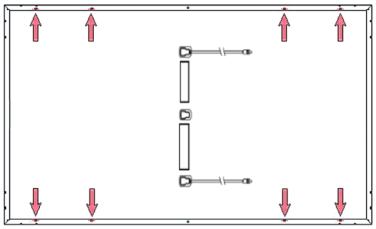
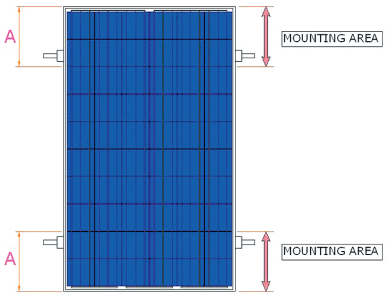
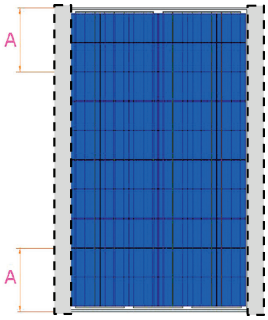
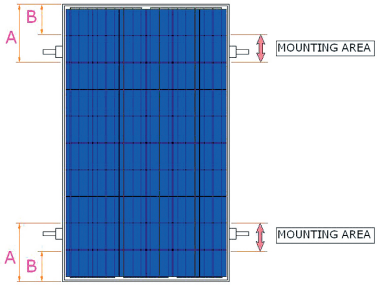
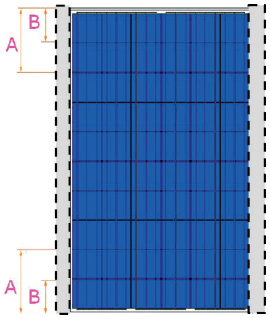
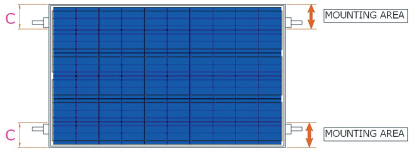
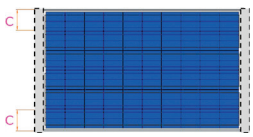
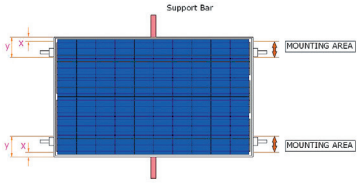
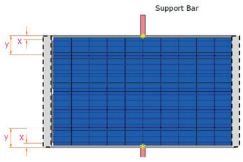


Fig 7: Middle modules installed using clamping method

Type of mounting method	2400 Pa Load Condition	5400 Pa Load Condition
Bolt type mounting system	 USE FOUR MOUNTING HOLES	 USE EIGHT MOUNTING HOLES
Clamp system: attachment to the **long side of the frame**	 Below configuration is applicable for SURYAVA VSMDH.66.AAA.05 only 	 Below configuration is applicable for SURYAVA VSMDH.66.AAA.05 only 
Clamp system: attachment to the **short side of the frame**	 Mounting rails should run parallel to the short side of the frame. If the expected load is greater than 1600 Pa, a support bar should be inserted. Below configuration is applicable for SURYAVA VSMDH.66.AAA.05 only 	 Mounting rails should run parallel to the short side of the frame. An additional support bar should be used below the module. Below configuration is applicable for SURYAVA VSMDH.66.AAA.05 Make Sure the Support bar do not pass under the module and are clamped at * location. 

Different mounting configurations can be tried as per Installer's calculations; however, failure to comply with the above suggestions may result in a lowering of load handling capabilities and may lead to failure of any overload situation, which may not be covered under product warranty.

Dimensions depending on module type (mm)	Cell Type & cell size	Model name	Length	Breadth wise mounting hole distance	x	y	A	B	C
	132 Cell, Half Cut Cell Modules	SURYAVA VSMDH.66.AAA.05	2384	1260	65.15	260.6	596	298	325.75

06.2 GROUNDING

- All the module mounting frames and mounting racks need to be grounded according to the National Electric codes and local electrical codes. Grounding device must penetrate the anodic oxide film of the module frame and make full contact with the interior of the aluminium alloy to ensure a good electrical contact. Use recommended connector type or an equivalent for the grounding device.
- Bonding the module frame and all metallic structural members together achieve proper grounding continuously using a suitable grounding conductor. Grounding conductor or strap may be copper, copper alloy, or other material acceptable for use as an electrical conductor. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.
- There are grounding holes with a diameter of 4mm on the long side of the module's back side frame. The grounding hole on the frame is marked with the grounding symbol (⏚) according to IEC 61730-1:2023 standard. These grounding holes cannot be used for module installation. Please refer to the "Product Catalogue" link for detailed grounding hole location and size at www.vikramsolar.com.
- Vikram Solar modules can be installed with the use of third party listed grounding devices for grounding the metallic frames of PV modules. The devices must be installed in accordance with the grounding device manufacturer's specified instructions. Do not punch the frame with additional holes and no damage should be done to the module frame or the grounding wire.
- We also recommend the suitable grounding methods below. However, the following requirements need to be met:

  a) It is the Installer's sole responsibility to select an appropriate grounding system.

  b) The selected grounding system must adhere to relevant electrical codes.

  c) The modules must be properly grounded.

  d) The choice of grounding method does not impact the Vikram Solar's module Power and Product Warranty in any manner.

Note: Vikram Solar assumes no responsibility for any failure or defect resulting from the chosen grounding method.

METHOD 1: GROUNDING BOLT # 2058729-1:

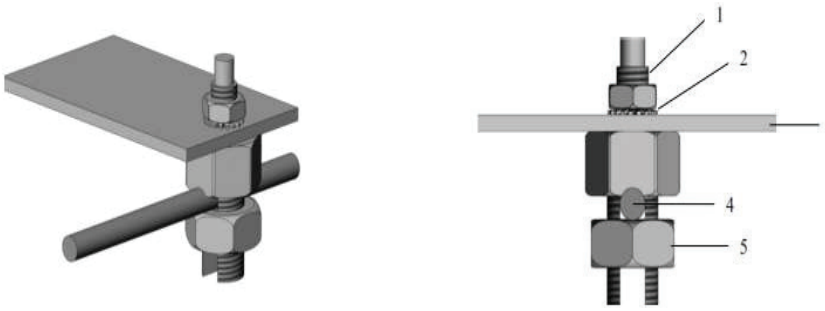


Fig 8: Grounding bolt # 2058729-1

01) Wire bolt and slot
02) Mounting wash hex nut
03) Aluminium frame
04) 4 to 16 mm^2 cable
05) HEX nut

- Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut
- Electrical contact is made by penetrating the anodized coating of the aluminium frame, and tightening the mounting
- Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt
- The wire binding bolt should be tightened to the proper torque of 45 in lb

METHOD 2: GROUNDING BOLT #1954381-2:

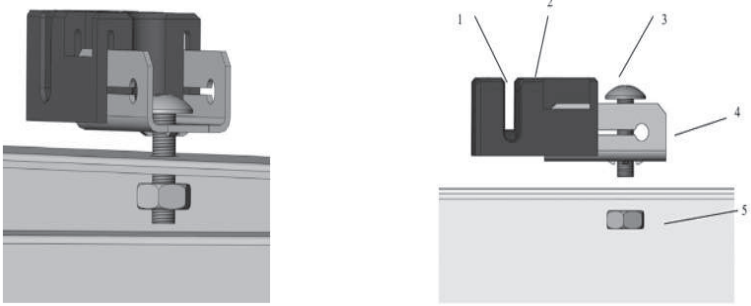


Fig 9: Grounding bolt # 1954381-2

01) Wire slot (available for 4-6 mm^2 cable)
02) Slider
03) Bolt
04) Base
05) Nut

- Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut
- Electrical contact is made by penetrating the anodized coating of the aluminium frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25 in lb
- Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt
- The wire binding bolt should be tightened to the proper torque of 45 in lb
- The Tyco grounding bolt is only listed for use with 6 to 12 AWG bare solid copper wire

METHOD 3: ERICO GROUNDING BOLT # EL6CS14-6

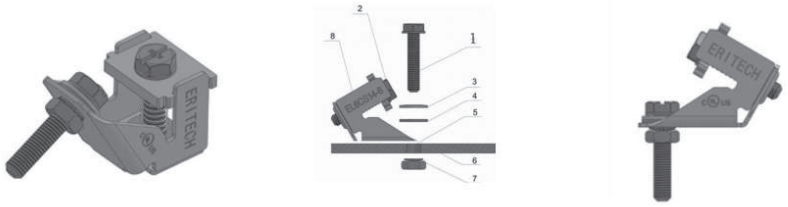


Fig 10: ERICO grounding bolt # EL6CS14-6

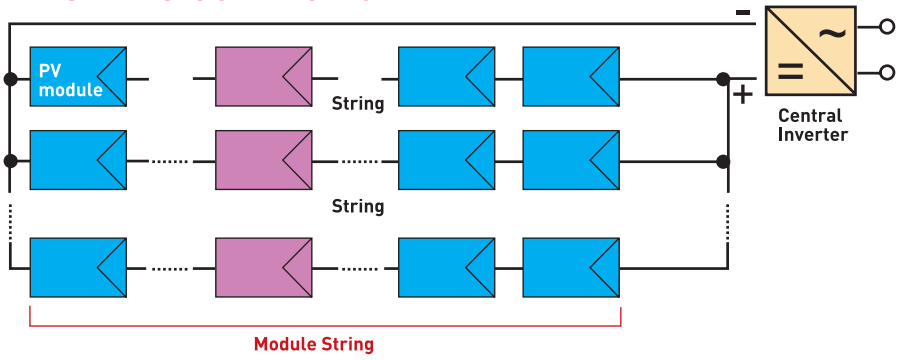
01) Machine bolt A
02) Machine bolt B
03) Belleville washer
04) Flat washer
05) Clearance hole for #10[M5] machine bolt
06) Aluminium frame
07) Machine bolt hex nut with lock washer
08) Grounding bolt

- The lug should be installed on a surface that is larger than the bottom surface of the lug
- The lug should be installed in the grounding holes provided on the PV module
- Machine bolt A should be torqued to 35 in lb, to secure the grounding bolt to module frame
- The grounding bolt is only listed for use with 6-12 AWG bare solid copper wire
- For proper wire binding, machine bolt B should be torqued to 35 in lb

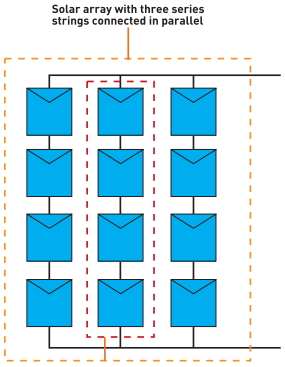
Where common grounding hardware I nuts, bolts, star washers, spilt-ring lock washers, flat washers and the like] is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions. Common hardware items such as nuts, bolts, star washers, lock washers and the like have not been evaluated for electrical conductivity or for use as a grounding devices and should be used only for maintaining mechanical connections and holding electrical grounding devices in the proper position for electrical conductivity. Such devices, where supplied with the module and evaluated through the requirement in UL61730/ IEC 61730 , may be used for grounding connections in accordance with the instructions provided with the module

06.3 MODULE WIRING

SERIES CONNECTION:

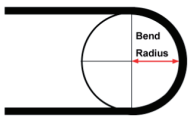


PARALLEL CONNECTION:

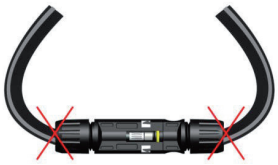


- All wiring should be performed, by qualified installers, in accordance with the local codes and regulations.
- Modules can be connected in series to increase the operating voltage by plugging the positive plug of one module into the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion free, clean and dry.
- The connectors used for interconnecting the modules and connectors used for connecting the strings and/or to the String Combiner Box, i.e. field connectors shall be of same make and same part no. of connector which is fixed with module junction box for better compatibility. Vikram Solar does not guarantee the safety of products and technical parameters consistency if the connecting heads and tools used are not officially specified by Vikram or are not installed according to the official requirements.
- Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10 V between strings then check the string configuration before making the connection. Module wiring should be performed by professional expert installers in accordance with local regulations and national codes.
- For high power density modules blocking diodes should be used in each PV array module string as exclusive mean of protection against reverse currents where three or more strings are connected in parallel. Blocking diodes shall not be used as an alternative to overcurrent protection devices.
- PV modules can be connected in Series to have an increase in the Operating Voltage. The positive connector plug of module is connected to the negative connector plug of another module until there is a click sound. Only if there is a click sound assume the modules are connected.
- Overcurrent in a PV array can result from wiring faults, short circuits in modules, combiner boxes, or module wiring. An over-current protection device must be incorporated in series with each string in the PV system.

- There can be irreparable damage done if the array strings are connected in reverse polarity. i.e. if the positive end is connected to negative input of the string combiner box and vice versa. So proper connection in the right polarity is recommended and if any reverse polarity is seen or any difference of more than 10 V is observed, the string configuration connection needs to be checked and connected appropriately.
- Vikram Solar modules are provided with standard copper cables with a 4 mm^2 cross-sectional area and are rated for 1500V (IEC and UL) for maximum system voltage, 90 °C and are UV resistant. Ensure the cables are not exposed to water logged area's.
- The maximum voltage of the system should be lesser than the certified system voltage (typically 1500V) or the maximum input voltage of the inverter. Since Voc α (1/T), the open circuit voltage of the array needs to be calculated at the lowest ambient temperature for the location of power plant.
- This can be done using the formula below,
  Max System voltage = X * Voc * [1 + ((T -Voc (%) x (25 - Tmin))]
- Where X - No: modules which are connected in series.
- Voc - Open circuit voltage of each module (Refer to the Data Sheet)
- T -Voc - Thermal coefficient of open circuit voltage for the module in Percentage (refer to Vikram Solar Spec sheet)
- Tmin - Minimum ambient temperature of the location of the plant



Bending radius of junction box cable should be minimum 42 mm



Incorrect routing of cable

Correct routing of cable

Fig 11:

07. ELECTRICAL CONFIGURATION

Solar array generates DC electricity once sunlight falls on the modules and the inverter is in active mode once the minimum voltage and current requirements are met and is converted into AC Power appropriately.

CAUTION:

- The modules are rated to operate at potentially lethal DC Voltages which have the potential to cause severe electric hazards in the form of shock, arcing and other fire hazards. Hence only trained professionals are requested to operate on the panels and the DC solar array and the DC combiner box. The PV modules are certified to operate at 1500V DC.
- Always a rated isolator (DC Switch) is to be used to interrupt the current flow while disconnecting the connectors. Even after disconnecting, the DC power may be active for some time, hence only expert operators are recommended to operate upon the panels, string combiner box, etc. Vikram Solar will not be responsible for any electrical accidents occurring in power plants using Vikram Solar modules

07.1 FUSING

Please rate the fuses for maximum Vdc and connected in each, non-grounded pole of the solar Array. (If the system is a floating system then fuses should be connected in both positive or negative poles). The maximum Fuse Rating connected in series with the array string is usually 30 A, but the actual module specific rating can be found on the module data sheet. The fuse rating also corresponds to maximum reverse current that a module will be able to withstand. 30 A fuse per series string is recommended.

Electrical Specifications [Nominal Values: for 132 Cell model]

- Maximum System Voltage: 1500V
- Maximum Series Fuse: 30 A
- Fire Rating Class: IEC Class C/ UL Type 29
- Dimensions: 2384 x 1303 X 35 mm
- Weight: 39.5 +/- 5% kg
- Bypass Diodes: 3 Bypass Diodes

Vikram Solar modules junction boxes contain factory-installed bypass diodes.

- If modules are incorrectly connected to each other, the bypass diodes, cables or junction boxes may be damaged.
- Keep in mind that bypass diode is not an over-current protection.
- Bypass diodes from different manufacturers should not be mated together.
- For floating projects, please contact local technical support.

OBJECT	MANUFACTURER	TYPE /MODEL	RATING
Bypass diode 1	Suzhou UKT New Energy Technology Co. Ltd.	TM3045-25	Tj max= 200 °C
		TM3045-30	
		UKTH4545-12	
		UKTH5045-12	
		UKTH5045-14	
		TM3045-25U	
		TM3045-30U	
		UKTH5045-30U	
Bypass diode 2	Taizhou Chuangda Electronic Co. Ltd.	MK5045	Tj max= 200 °C
Bypass diode 3	SMC Diode Solutions	DS4045T	Tj max= 200 °C
		DS5045T	
Bypass diode 4	Panjit Semi-Conductor	GF5045	Tj max= 200 °C
Bypass diode 5	Panjit Semi-Conductor	GF 4045	Tj max= 200 °C
Bypass diode 6	Ningbo huayu photovoltaic Technology Co. Ltd.	HY3050	Tj max= 200 °C
Bypass diode 7	Zerun Co. Ltd.	40SQ045	Tj max= 200 °C
		30SQ045	
		35SQ045	
Bypass diode 8	Zhejiang Renhe Photovoltaic Technology Co. Ltd.	FMK5040D	Tj max= 200 °C
		MK-4045	
		MK-5045	
		ML-5045	

Typically, modules consists of bypass diodes like UKTH3045-30 (Peak Inverse voltage -45 V, Forward Current- 30 A) diodes in the junction box. Rated electrical characteristics are within ±5% of measured values at standard test conditions of 1000 W/m2, 25°C cell temperature and air mass 1.5 solar spectral irradiance.

- Connector:

OBJECT	MANUFACTURER	MODEL	STANDARD
Connector 1	Suzhou UKT New Energy Technology Co. Ltd	PV-C002-xy	IEC 62852:2014
Connector 2	Stäubli Electrical Connectors AG	PVKST4-EVO2/xy_UR PVKBT4-EVO2/xy_UR	IEC 62852:2014+A1
Connector 3	DhaSh PV Technologies Private Limited	DS01	IEC 62852:2014+A1
Connector 4	Staubli Electrical connectors AG	PV-KST4-EVO2/xy_UR PV-KBT4-EVO2/xy_UR	IEC 62852:2014+A1
Connector 5	Ningbo huayu photovoltaic Technology Co. Ltd	PV-H4	IEC 62852:2014+A1
Connector 6	Zerun Co. Ltd	Z4S-abcd	IEC 62852:2014+A1
Connector 7	Zhejiang Renhe solar Photovoltaic Technology Co. Ltd	RHC2xyzu	IEC 62852:2014+A1
Connector 8	Zhejiang Renhe solar Photovoltaic Technology Co. Ltd	05-8	IEC 62852:2014+A1

07.2 ELECTRICAL PARAMETERS

TYPE NAME OR MODEL NUMBER	SURYAVA VSMDH.66.AAA.05	
Module technology	HJT	
Maximum system voltage [VDC]	1500	
Over-current protection rating [A]	30	
Dimensions L × W × H [mm]	2384 × 1303× 35	
Maximum Series Fuse (A)	30	
Module area [m2]	3.1	
Number of cells (HC)	132	
UNIT	STC	BNPI
Rated maximum power range [W]	700-725	780-808
Rated open circuit voltage range [V]	50.5-51.25	50.5-51.25
Rated short circuit current range [A]	17.4-17.7	19.4-19.7
Rated current at Pmax range [A]	16.62-16.92	18.5-18.9
Rated voltage at Pmax range [V]	42.14-42.86	42.1-42.9

TEMPERATURE COEFFICIENTS (Tc) PERMISSIBLE OPERATING CONDITIONS	
Tc of Open Circuit Voltage (β)	-0.26%/°C
Tc of Short Circuit Current (α)	0.046%/°C
Tc of Power (γ)	-0.26%/°C

1) All data measures at STC: 1000 W/m2 irradiance, 25°C (+/- 2°C) cell temperature, AM 1.5g spectrum according to EN 60904-3.
2) Measurement Uncertainty of Pmax, Voc, Isc is within +/- 2%.
3) No external or otherwise artificially concentrated sunlight is directed onto the front or back face of the PV module (if not qualified for).
4) BNPI: 1000W/M^2+ϕ.135, BIFACILITY COEFF. (ϕ) AT BNPI PMAX, ISC IS 85±5% & FOR VOC IS 99±10% , AM 1.5, 25°C
5) TOLERANCE OF RATING AT BNPI (PMPP/ ISC/ VOC) [%] : 0-3/±5/±5

07.3 INVERTER COMPATIBILITY AND PID PROTECTION

Only connect the quantity of modules that corresponds to the voltage specifications of the inverters used in the system. When installed as per IEC norms and regulations, Vikram Solar modules normally do not need to be electronically connected to earth and can operate with either galvanic ally isolated (with transformer) and transformer less inverters. PV modules may appear potential Induced Degradation under high humidity, high temperature and high voltage condition. To avoid PID effect in hot and very humid locations it is recommended to use galvanically isolated Inverters with Transformers, and the negative pole of the array must be connected to earth. If a Transformer less Inverter is used in hot humid climatic locations, The Installer should ensure the right active negative earthing kit is to be installed by consulting and having assurance from the inverter supplier.

NOTE:

Vikram Solar disclaims liability for PID loss caused by any external conditions or incorrect system design

08. MAINTENANCE AND CARE

- Well-designed PV Plant requires minimum maintenance but however with further maintenance the performance and the reliability of the system can be improved
- Yearly maintenance by a trained professional is usually advised
- Check that the mounting structures are properly laid and the modules are held tightly and are in accordance with the mounting instructions given above
- Ensure no part of the light falling area of the module is shaded, any leaves / trees or any object which causes shading has to be removed accordingly
- Ensure all the cable assembly is tight and no part of cable assembly will be exposed to water logging
- Check that the string fuses in each non/earthed pole are in operation
- For cleaning of the solar PV modules, clean the modules using a soft module cleaning kit. A soft cloth with mild soft detergent can be used as an alternative. Use water only with the same temperature as of the module else thermal shocks can be created and can damage the module
- Do not open the junction box to change the diodes even if they are defective. Please contact with PV module manufacturer in case of known or suspected diode failure
- Ensure the module is cleaned without causing any damage like micro-crack, etc. to the module
- Cover the front surface of modules by an opaque material when repairing. Modules when exposed to sunlight generate high voltage and are dangerous
- Always recommended to have the module clean and tidy for maximum power generation from the solar PV module
- The back surface of the solar module doesn't require any specific cleaning unless any dirt or debris is stuck on the back sheet. While cleaning the dirt on the back sheet avoid any sharp object, which can damage the substrate material and cause a slit
- For Cleaning of solar PV modules, RO water provides the best result. If RO water is not available rainwater, tap water with low mineral content or deionized water can be used.
- Water pressure must not exceed 35 bar (500 psi) at the nozzle. Do not apply water that is more than 20°C warmer or colder than module surface temperature.
- Water shall be free from oil and grease.
- Water requirements while cleaning:

PARAMERERS	UOM	MAX PERMISSIBLE LIMIT
pH	-	7 - 8.5
Turbidity	NTU	1
Total dissolved solids	mg/l	1200
Total hardness as $CaCO_3$	mg/l	200
Calcium hardness as Ca	mg/l	75
Magnesium hardness as Mg	mg/l	30
Chlorides as CL	mg/l	250

09. INSPECTION AFTER CLEANING

- Perform a visual inspection to ensure the module is clean, bright, and free of stains.
- Conduct a spot check for any soot deposits on the module surface.
- Examine the surface of the module for visible scratches.
- Inspect for any man-made cracks on the module surface.
- Verify that the module support structure is neither leaning nor bent.
- Ensure the connectors of the module are properly attached and not detached.
- Complete the PV module cleaning record after cleaning.

10. WARNING

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

11. CONTACT DETAILS

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