vikramsolar

CREATING CLIMATE FOR CHANGE

INSTALLATION MANUAL

Applicable Models

SOMERA VSMD.72.AAA.05 [AAA= 340 - 350]
ELDORA VSPG.72.AAA.05 [AAA= 320 - 330]
SOMERA VSMG.72.AAA.05 [AAA= 355 - 365]
SOMERA VSMD.60.AAA.05 [AAA= 280 -290]
ELDORA VSPG.60.AAA.05 [AAA= 265 - 275]
SOMERA VSMG.60.AAA.05[AAA= 295 - 305]

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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
- When modules have been pre-installed but the system has not been connected to the grid yet, each module string should be kept under open-circuit conditions and proper actions should be taken to avoid dust and moisture penetration inside the connectors.

02. SAFETY PRECAUTIONS

- Vikram Solar PV modules are Application Class A PV modules, 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/back surface of the module constructed with tempered/heat strength/ Float 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 1500 Vdc 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.

02.1 FIRE SAFETY

VSL PV Modules have a Class C fire resistance rating in accordance with IEC 61730 certification and Type 1 fire resistance rating in accordance with UL 1703 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.

Wrong 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
- 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
- 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
- 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 lift modules by their wires or junction box
- Do NOT stand, step, walk and / or jump on modules under any circumstances. Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability and void warranty.
- Do NOT drop or place objects (such as tools) on the modules.
- Do NOT carry modules on your head.
- Do NOT change the wiring of bypass diodes.
- Keep all electrical contacts clean and dry at all times.

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 affixed to the back side.

04. INSTALLATION ENVIRONMENT

04.1 CLIMATE CONDITIONS

- Vikram Solar modules are certified for IEC 61215 : 2016, IS/ IEC 61730-I &II, IS 14286. In addition to the required IEC certification to meet European standards. Although Vikram Solar PV modules have passed Salt mist (IEC 61701)corrosion test with a salt concentration of 5 % by weight.

ENVIRONMENT

- Ambient temperature: -40 °C to +50 °C
- Operating temperature: -40 °C to +85 °C
- Storage temperature: -20 °C to +50 °C
- Humidity: < 85 RH%
- Mechanical load pressure*: Design load of 1600Pa on the front and 1600Pa on the rear side with a safety factor of 1.5.

*** NOTE:**

The mechanical load bearing capacity depends upon the 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.

05. SITE SELECTION

- PV modules should be installed in a place where there is no shading across the location throughout the year. Shading can be minimized by having the distance between the obstruction and solar array is more than thrice the height of obstruction
- PV modules should typically face south in the northern hemisphere and north in southern hemisphere
- 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; Modules are Class C Fire Rated
- 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.

06. MOUNTING INSTRUCTIONS

06.1 INSTALLATION REQUIREMENTS

- A minimum clearance of 10 mm (0.394 in) or more between modules is required to allow for thermal expansion of the modules. The clearance is from the plastic corner protector to adjacent plastic corner protector.
- To maximize your annual yield, find out the optimum orientation and tilt for PV modules in your region. The highest yields are achieved when sunlight shines perpendicularly onto the PV modules.
- 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. Sunlight should be able to reach the module even on the shortest day of the year.
- When modules have been pre-installed but the system has not been connected to the grid yet, each module string should be kept under open circuit conditions and proper actions should be taken to avoid dust and moisture penetration inside the connectors.
- Connectors are not waterproof when unmated. When installing modules, connector should be connected to each other as soon as possible or appropriate measures should be taken to avoid moisture and dust penetrating into the connector.
- According to UL 1703, any other specific clearance required for maintaining a system fire rating should prevail. Detailed clearance requirements pertaining to system fire ratings must be provided by your racking supplier.
- Ground reflectance (Albedo) and Mounting structure height has an impact on energy yield of Bifacial modules. Higher power output can be realised optimization of Albedo and module height.

06.2 MOUNTING METHODS

The connection of the module to the racking system can be created through the Clamps The modules must be installed according to the following examples and recommendations. If a different installation method is desired, please contact Vikram Solar customer service or technical support team for consultation. Improperly mounted modules maybe damaged. If alternative mounting method is used and not approved by Vikram, the modules will not continue to have a valid warranty.

1. Panels shall not be subjected to wind or snow loads exceeding the maximum permissible loads, and shall not be subjected to excessive forces due to the thermal expansion of the support structures.
2. To maximize mounting longevity, Vikram Solar strongly recommends the use of corrosion proof (stainless steel) attachment hardware.
3. Vikram Solar Limited recommends mounting rails with a minimum width of 40 mm for ±1600 Pa load

➔ MOUNTING WITH CLAMPS

- Vikram Solar has tested its modules with a number of clamps from different manufacturers and recommends the use of clamps which have an EPDM or similar insulating washer, mounting bolt of at least M8.
- Use at minimum 6 clamps to attach modules to the mounting rails.
- Be sure to avoid shadowing effects from the module clamps.
- When choosing this type of clamp-mounting method, use at least four clamps on each module, the 6 clamps should be attached on each long sides of the module. Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.

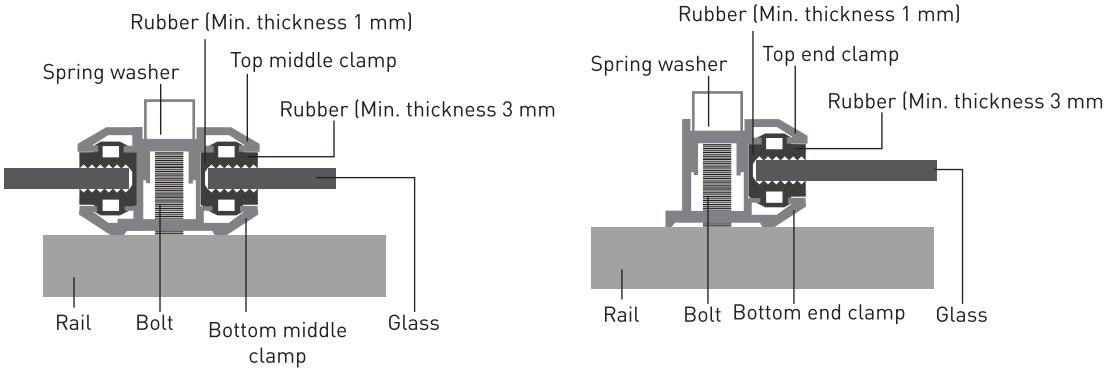


Fig 2: **Mounting with clamps**

Vikram Solar Limited warranty may be void in cases where improper clamps or unsuitable installation methods are found. When installing clamps, take measures so as:

- Not to bend the glass excessively.
- Not to cast shadow on the cells.
- Not to damage or scratch the surface of the glass.
- To ensure the clamps overlap the module by 13 mm to 15 mm.
- To ensure thickness of top and bottom rubber ≥ 3 mm, and side rubber thickness ≥ 1 mm.
- The mounting rails shall be designed to limit as much as possible shade on module rearside cells.

A. Use 6 clamps on the long side. Mounting rails run parallel to the long side frame

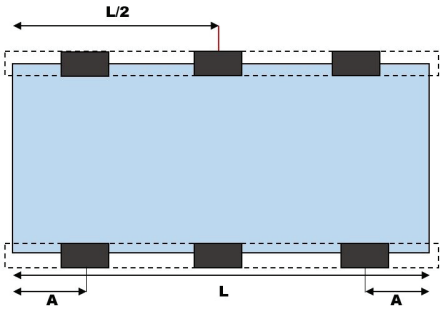
Clamp length ≥ 200 mm

A = 330 ± 20 mm

Maximum Load:

Uplift load ≤ 1600 Pa

Downforce load ≤ 1600 Pa



B. Use 6 clamps on the long side (Only for Glass-Glass mono-facial PV modules) . Mounting rails run perpendicular to the long side frame

Clamp length ⩾ 200 mm

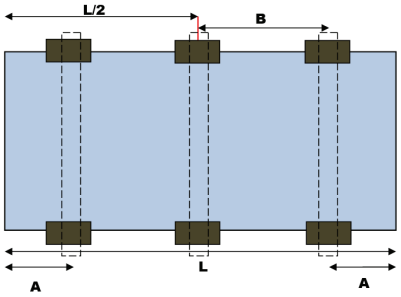
A = 330 ± 20 mm

B = 650 ± 20 mm

Maximum Load:

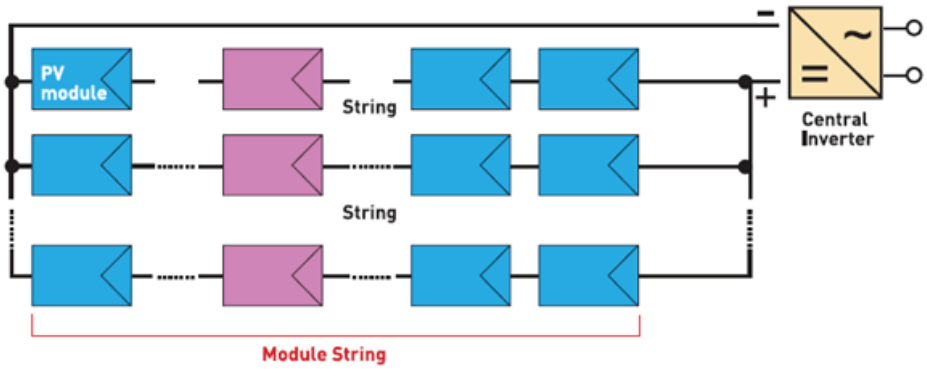
Uplift load ⩽ 1600 Pa

Downforce load ⩽ 1600 Pa

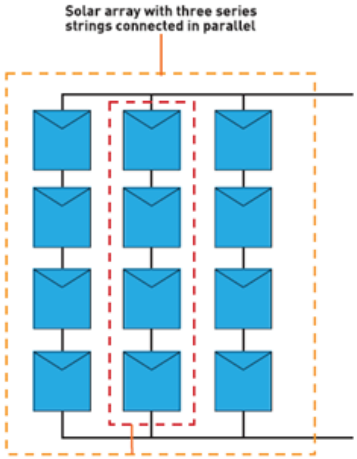


06.3 MODULE WIRING

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
- 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
- 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
- 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 areas
- A maximum of two strings can be connected in parallel without using over-current protection device (fuses, etc.) incorporated in series within each string. Three of more strings can be connected in parallel if an appropriate and certified over-current protection device is installed in series with each string.
- 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 + {(Tα-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)

Tα-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

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 20 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. 20 A fuse per series string is recommended. Under certain conditions, a module may produce more current or voltage than its STC rated power. As a result, a module open-circuit voltage and short-circuit current under STC should be multiplied by 1.25 when determining component voltage ratings, conductor ampacities, overcurrent device ratings, and the size of controls connected to the PV output. An additional 1.25 multiplier for the short-circuit current (giving a total multiplier of 1.56), may be applicable when sizing conductors and fuses, as described in section 690-8 of U.S. NEC.

- Electrical Specifications [Nominal Values: for 72 Cell model] Maximum System Voltage: 1500V
- Maximum Series Fuse: 20A @ 20% Bifacial gain
- Fire Rating Class: Fire Rating Class C / Fire Rating Type 1
- Dimensions: 1975mm*992mm*6mm
- Weight: 27 kg
- Bypass Diodes: 3 Bypass Diodes
- Typically, modules consists of bypass diodes like PST4530/T (Peak Inverse voltage -45 V, Forward Current- 30 A) diodes in the junction box. Rated electrical characteristics are within ±10% of measured values at standard test conditions of 1000 W/M2, 25°C cell temperature and air mass 1.5 solar spectral irradiance.

07.2 **ELECTRICAL PARAMETERS**

Type name or model number	ELDORA VSPG.72.AAA.05	SOMERA VSMD.72.AAA.05 VSMG.72.AAA.05	ELDORA VSPG.60.AAA.05	SOMERA VSMD.60.AAA.05 VSMG.60.AAA.05
Rated maximum power range [W]	315-335	340-370	265-290	295-315
Module technology	Poly Crystalline	Mono Crystalline	Poly Crystalline	Mono Crystalline
Number of cells	72	72	60	60
Rated short circuit current range [A]	8.9-9.6	9.3-10.3	8.9 - 9.7	9.4-10.3
Rated open circuit voltage range [V]	45.1- 47.5	47.5-49.5	37.5 - 39.9	39.0 - 42.5
Rated current at Pmax range [A]	8.3- 9.1	8.90 -9.7	8.4- 9.3	9.0-9.7
Rated voltage at Pmax range [V]	36.5- 38.9	38.5 - 40.8	29.5 - 32.5	31.8- 33.9
Maximum system voltage [VDC]	1500	1500	1500	1500
Over-current protection rating [A]	15	20	15	20
Dimensions	1975×992×6	1975×992×6	1658×992×6	1658×992×6
(l × w × h) [mm]				
Module area [m²]	1.959	1.959	1.959	1.959
Maximum Series Fuse, (A)	15	20	15	20

07.3 INVERTER SELETION AND COMPATIBILITY

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. If the system is located in hot and very humid locations then galvanically isolated Inverters with Transformers must be used and the negative pole of the array must be connected to earth. It is recommend to adopt inverter negatively earthed installation to avoid the PID effect. 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.

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
- Periodica maintenance by a trained professional is usually advised
- Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dirt spots, and dust.
- Modules with sufficient tilt (at least 15°), generally do not require cleaning (rain will have a self-cleaning effect).
- 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
- 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 and back 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

08.1 CLEANNING

The amount of electricity generated by a solar module is proportional to the amount of light falling on it. A module with shaded cells will produce less energy and therefore it is important to keep modules clean.

- It is recommended to check TDS of the cleaning water on regular basis. TDS should be maintained below 500 mg/L & total hardness shall be less than 75 mg/L;
- Clean PV modules when the irradiance is below 200W/m^2; liquid with a large temperature difference from the modules shall not be used for cleaning the modules;
- When cleaning with pressurized water, the water pressure on the glass surface of the module shall not exceed 700 kPa (14619.80psf); the module is prohibited to bear the extra force;
- When cleaning PV modules, do NOT step on the modules; do NOT spay water on the the cables; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do NOT use as steam cleaner;

- When cleaning the modules, use a soft cloth together with a mild detergent and clean water. Take care to avoid severe thermal shocks which might damage the module by cleaning modules with water which has a similar temperature to the modules being cleaned;
- Use dry or wet soft clean cloth to clean the PV modules; non-corrosive solvents or hard objects are strictly prohibited ,do not scrape or rub dry dirt away, as this may cause micro scratches;
- Snow should be removed using a soft brush;
- If there are greasy dirt and other substances on the surface of the PV module which are difficult to clean, conventional household glass cleaning agents can be used; Do NOT use the alkaline and strong acid solvents.

09 GROUNDING

- All module mounting frames and mounting racks need to be grounded according to the respective regional electric codes. The module frame must be properly grounded. The grounding wire must be properly fastened to the module frame to ensure good electrical contact. Use the recommended connector type, or an equivalent, for this wire
- Proper grounding is achieved by bonding the module frame(s) and all metallic structural members together 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
- 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 have to be installed in accordance with the grounding device manufacturer's specified instructions
- Please refer to the "Product Catalogue" link for detailed grounding hole location and size at www.vikramsolar.com. Double glass modules do not present any exposed conductive parts, and therefore do not require to be electrically grounded·
- We also recommend using the following methods to ground properly:

➜ METHOD 1: GROUNDING BOLT # 2058729-1:

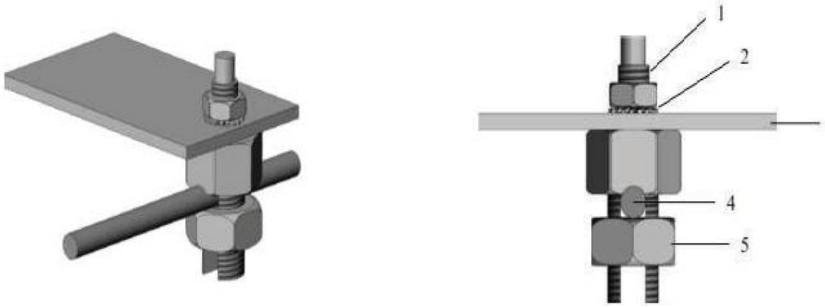


Fig 9: Grounding bolt # 2058729-1

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:

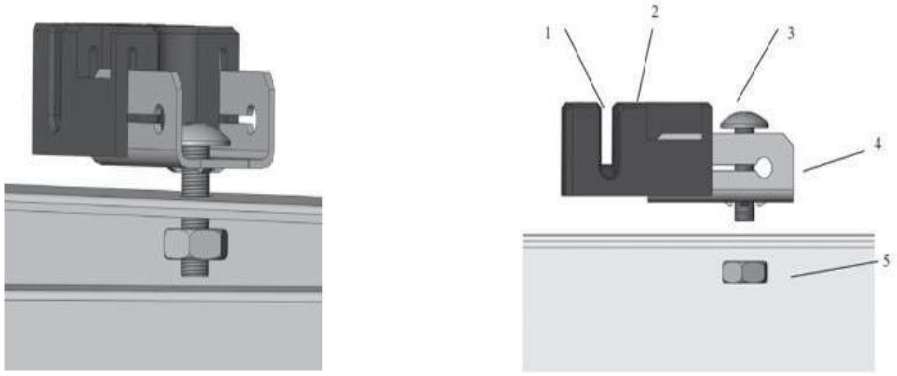


Fig 10: Grounding bolt # 1954381-2

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

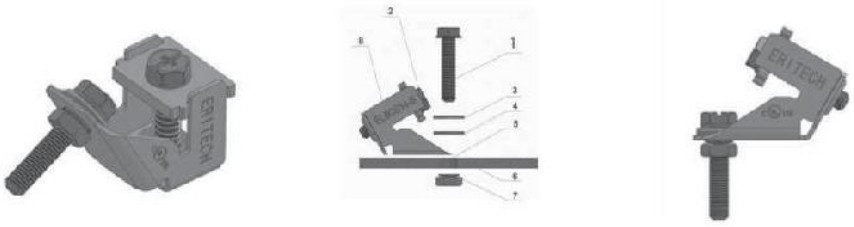


Fig 11: ERICO grounding bolt # EL6CS14-6

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.

10. END OF LIFE PRODUCT RECYCLING

After end of Useful Life, Products should be recycled in a useful renewable way. Vikram Solar is a member of PV Cycle organization which manages a collection and recycling scheme for end-of-life solar PV modules throughout Europe and can render help and support to you provided that submit the serial numbers of the modules

a) For recycling less than 40 modules, contact PV Cycle directly at http://www.pvcycle.org/ to locate nearest recycling collection point

b) For the recycling of more than 40 modules contact sales@vikramsolar.com and we will support for next steps

11. 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.

12. CONTACT DETAILS

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AMENDED EDITIONS AND DATES
Rev 00 is released in June 2019