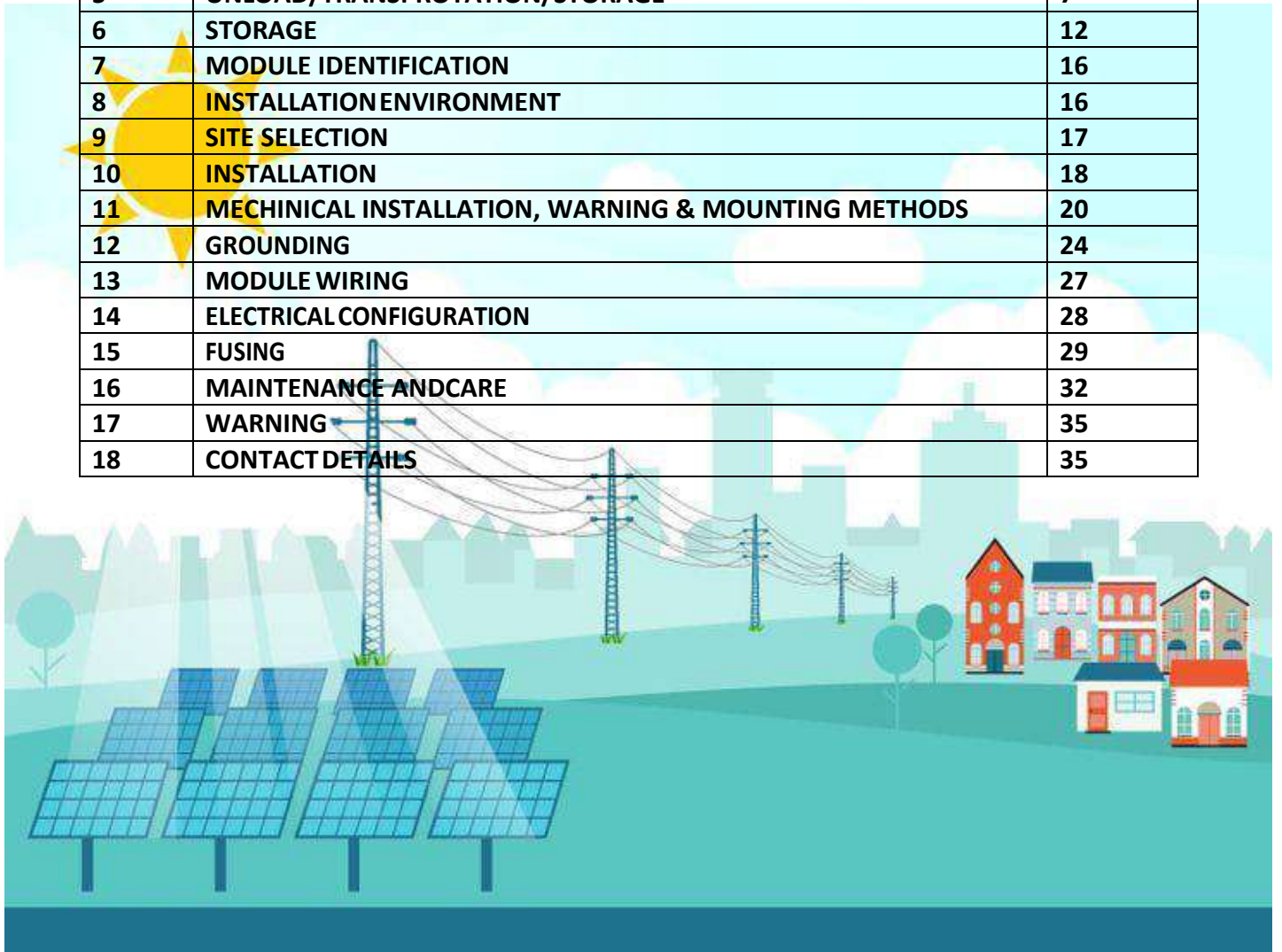




USER MANUAL OF
INSTALLATION
GUIDE

TABLE OF CONTENT

SR. NO.	CONTENT DETAILS	PAGE NO.
1	INTRODUCTION FOR USER MANUAL	3
2	DISCLAIMER	3
3	LIMITATION OF LIABILITY	3
4	SAFETY PRECAUTIONS	4
5	UNLOAD/TRANSPORTATION/STORAGE	7
6	STORAGE	12
7	MODULE IDENTIFICATION	16
8	INSTALLATION ENVIRONMENT	16
9	SITE SELECTION	17
10	INSTALLATION	18
11	MECHANICAL INSTALLATION, WARNING & MOUNTING METHODS	20
12	GROUNDING	24
13	MODULE WIRING	27
14	ELECTRICAL CONFIGURATION	28
15	FUSING	29
16	MAINTENANCE AND CARE	32
17	WARNING	35
18	CONTACT DETAILS	35



1 INTRODUCTION FOR USER MANUAL

- 1.1.1 This Manual applies to the installation, maintenance and use of the framed series solar modules manufactured by GREEN BRILLIANCE. (hereinafter referred to as “GreenBrilliance Renewable Energy LLP”). Failure to follow these safety instructions could result in personal injury or property damage.
- 1.1.2 Installation and operation of solar modules require specialized skills, and only professional personnel can engage in the work. Please read the “Safety and Installation Instructions” carefully before using and operating the modules. The installer must inform the end customer (or consumer) of the above matters accordingly.
- 1.1.3 The term “Module” or “PV Module” in this Manual refers to one or more framed series solar modules. Please keep this Manual for future reference.

2 DISCLAIMER

- 2.1.1 GREEN BRILLIANCE reserves the rights to change this User Manual without prior notice. Failure of the customer to follow the requirements outlined in this Manual during the installation of the module will result in the invalidity of product's limited warranty.
- 2.1.2 Limited warranty statement is not covered or claimable in case of Failure To comply with requirements of GREEN BRILLIANCE user manual or not following GREENBRILLIANCE user manual instruction.

3 LIMITATION OF LIABILITY

- 3.1.1 The usage of this manual, installation, handling of GreenBrilliance modules are beyond GreenBrilliance's control. GreenBrilliance 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.
- 3.1.2 GreenBrilliance 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.
- 3.1.3 All information given in this manual is based on GreenBrilliance knowledge and experience. GreenBrilliance reserve the rights to change this manual and module specification without prior notice.

4 SAFETY PRECAUTIONS

4.1 WARNING

4.1.1 Before installing, wiring, operating, or maintaining GREEN BRILLIANCE modules, you should read and understand all safety precautions. Direct current (DC) is generated when the battery surface of the module is exposed to direct sunlight or other light sources, and direct contact with the live parts of the module, such as terminals, may result in death of personnel whether connected to the module or not.

4.1.2 GreenBrilliance 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.

4.2 GENERAL SAFETY

4.2.1 All installation work must comply with the local codes and the relevant international electrical standards.

4.2.2 GREENBRILLIANCE recommends that PV module installation is conducted by personnel with experience in PV system installation. Operation by personnel who are not familiar with the relevant safety procedures will be very dangerous.

4.2.3 Do NOT install modules with damaged glass or damaged backsheet.

4.2.4 Do NOT allow unauthorized persons to access the installation area or module storage area.

4.2.5 Do NOT disassemble or move any part of the module.

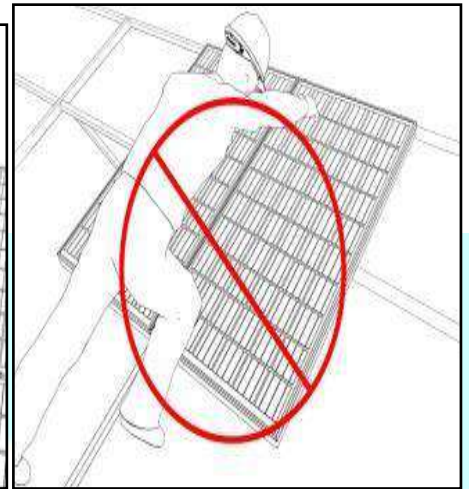
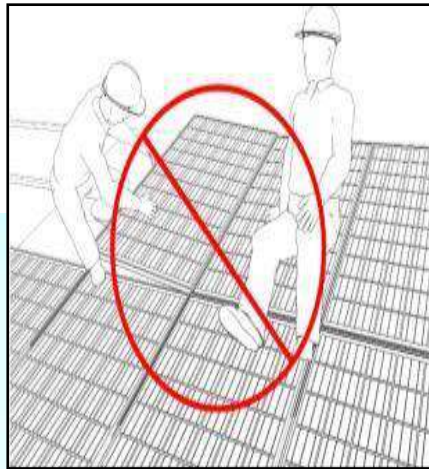
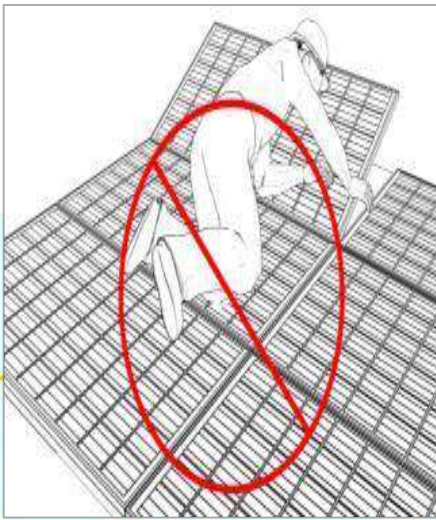
4.2.6 Do NOT artificially focus the light on the module.

4.2.7 Do NOT connect or disconnect the module when it is energized or connected with the external power supply

4.2.8 For personal safety do not install/handle PV modules under adverse environmental conditions viz. gusty winds, wet frosted roof surfaces.

4.2.9 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.

4.3 HANDLING SAFETY



- 4.3.1 Do NOT stand, walk on or step on the module directly.
- 4.3.2 Do NOT damage or scratch the front or backside surfaces of the module.
- 4.3.3 Do NOT scratch the output cable or bend it with force. The insulation of output cable can break and may result in electricity leakage or shock.
- 4.3.4 Do NOT use water to extinguish fires of an electrical origin
- 4.3.5 Do NOT install or handle modules when they are wet or during periods of high wind. At the installation site, take care to keep modules and in particular their electrical contacts, clean and dry before installation. If connector cables are left in damp conditions then the contacts may corrode. Any module with corroded contacts should not be used.
- 4.3.6 Please do NOT loosen or unscrew the PV module bolts, which may lead to the module loading drop or even fall down.
- 4.3.7 Do NOT drop PV modules or allow objects to fall down on the PV modules.
- 4.3.8 Do NOT touch the terminal box or the ends of the output cables (connectors) with bare hands under sunlight, regardless of whether the PV module is connected to or disconnected from the system.

- 4.3.9 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 Fire Hazard.
- 4.3.10 Ensure the polarity of the modules or strings are not reversed considering the other modules in the string.
- 4.3.11 GreenBrilliance modules are certified for operating in installations at voltages below 1500 Vdc. GREEN BRILLIANCE- 60 Cell (GB-250-275Wp) and GB-72 Cell (GB-300-325Wp) Modules have 1500 V 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. Damage of modules due to this mixing can lead to invalidity of product warranty.
- 4.3.12 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.

4.4 Fire Safety

- 4.4.1 GreenBrilliance PV Modules have a Class C fire resistance rating in accordance with IEC 61730 certification. The fire rating of this module is valid only when mounted in the manners 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.
- 4.4.2 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.
- 4.4.3 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.




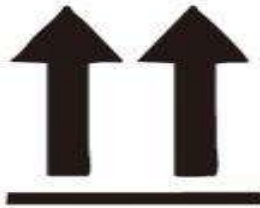

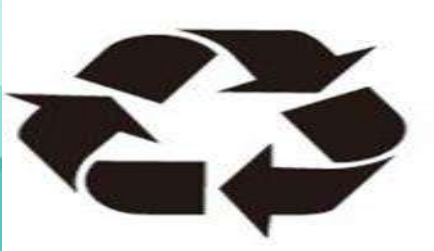

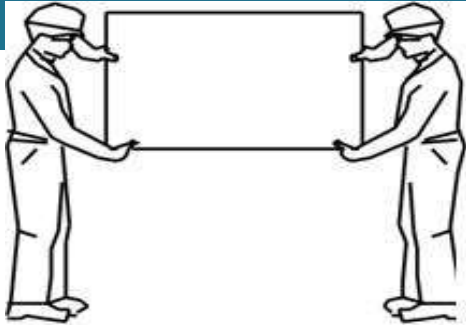
5 UNLOAD/TRANSPROTATION/STORAGE

5.1 Precautions and general safety rules:

- 5.1.1 The modules should be stored in the original package before installation. Protect the package from damage. Unpack the modules as per the recommended unpacking procedures. The whole process of unpacking, transport and storing should be handled with care;
- 5.1.2 Do NOT stand, climb, walk or jump on unpacked pallets of modules;
- 5.1.3 Before installation, ensure that all modules and electrical contacts are clean and dry;
- 5.1.4 If the modules are required to be stored temporarily, they should be stored under dry and ventilated conditions;
- 5.1.5 Unpacking must be carried out by two or more persons at the same time. It is forbidden to pull the wires or junction boxes of the modules to carry the modules. Handling the modules requires two or more people with non-slip gloves; do NOT handle the modules in an overhead way or stack the modules;
- 5.1.6 Do NOT put the modules in a place that is not supported or fixed;
- 5.1.7 Do NOT allow the modules to come in contact with sharp-pointed objectives to prevent them from scratches, avoiding a direct impact on the safety of modules.

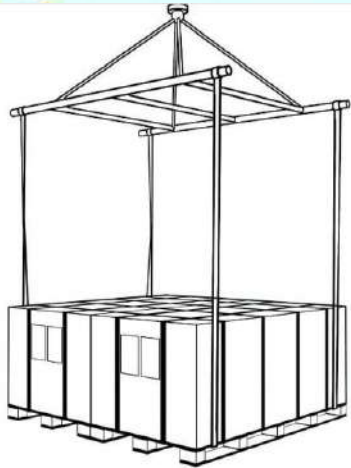


5.1.8 MAKERS ON OUTER PACKAGING

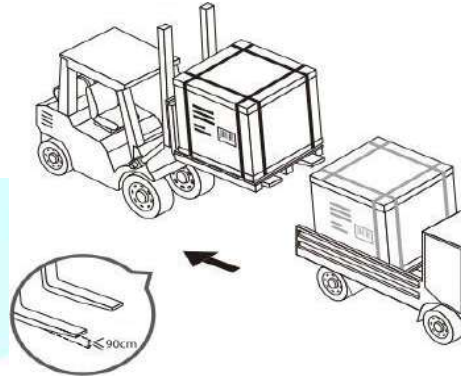
<p>1. Do NOT discard the modules at will; special recycling is required</p>  <p>EU-28 WEEE COMPLIANT</p>	<p>2. Modules shall be kept dry, not exposing to the rain or moisture</p> 
<p>3. Modules in carton are fragile, which shall be handled with care</p> 	<p>4. The packaging shall be transported upright</p> 
<p>5. Do NOT step on the package and module</p> 	<p>6. The carton can be recycled</p> 
<p>7. Modules shall be stacked as required, not exceeding the maximum number of layers printed on the outer packaging. (n = 2 means no more than two layers and n = 3 means no more than three layers)</p> 	<p>8. One module shall be handled by two persons together</p> 

5.1.9 UNLOADING WARNING

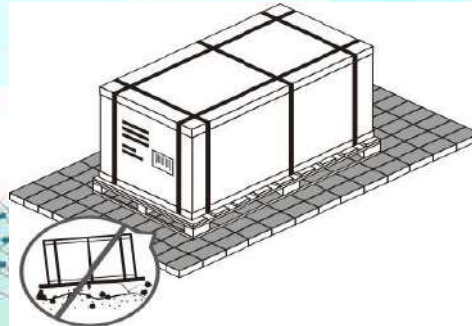
1... Use the correct (as picture) lifting fixture to handle, no more than 2 pallets for one time lifting. Before lifting, please confirm whether the tray and the carton are damaged and the hoisting rope is firm and solid or not. Before lifting touchdown, two persons shall support at two sides of the righting carton gently to put it on a relatively flat place.



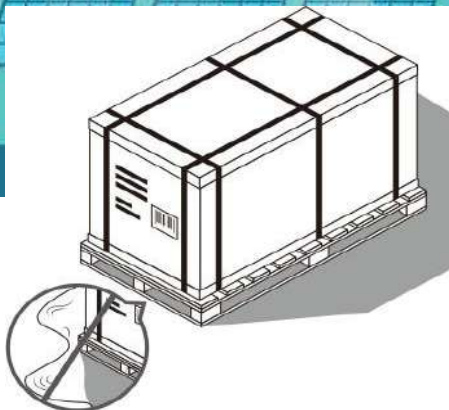
2. If the condition permits, use a fork lift to remove the module from the truck



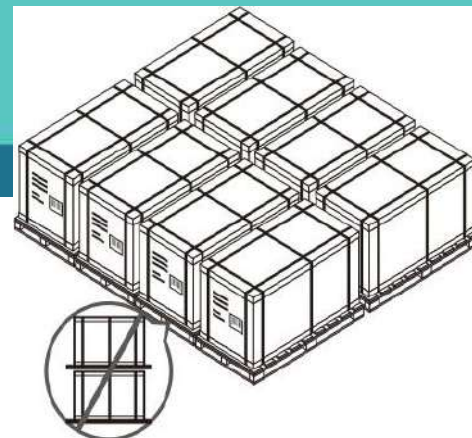
Put the module on the level ground



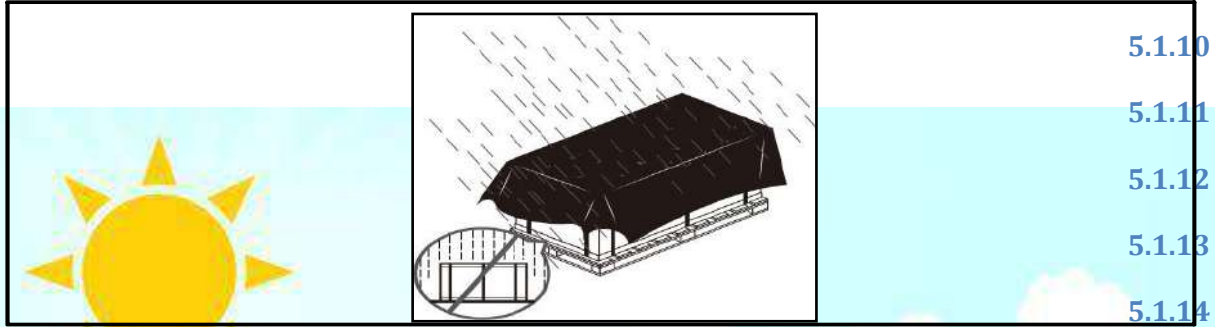
3.2.3 Store the module in a dry and ventilated place



3.2.4 No stacking the modules at the project place



3.2.5
Cover the module with waterproof cloth to prevent it from moisture

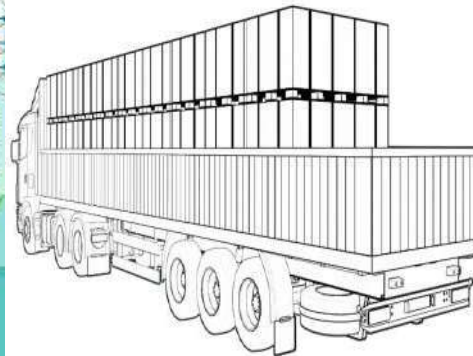


5.1.15 SECONDARY TRANSPORT AND WARNING

1. Do NOT remove the original packaging if the modules require long-distance transport or long-term storage.



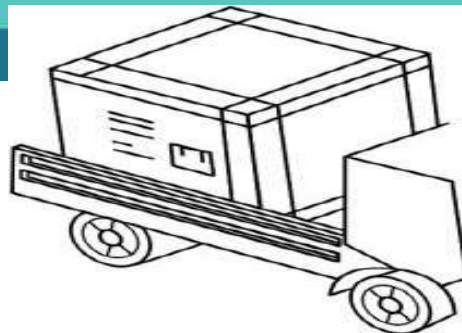
2. The finished package can be transported by land, sea or air. During transport, make sure that the package is fixed to the shipping platform without moving.



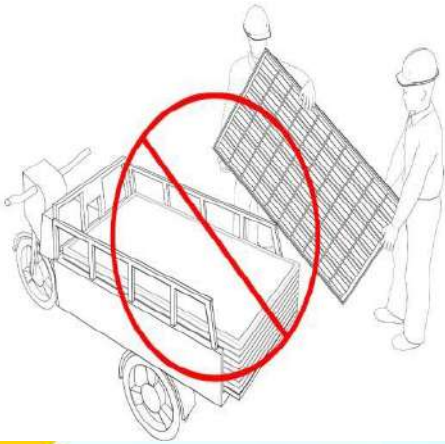
3. Transport: stacking no more than two layers by truck normally;



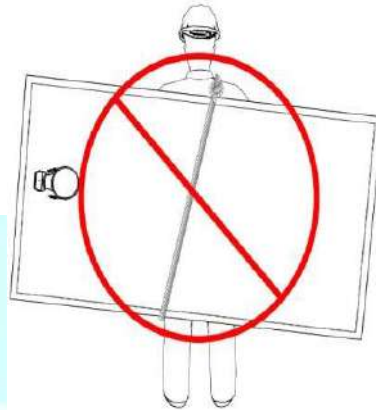
4. One layer stacking for transport is only allowed at project site



5. No transport or handling by pedicab as below;



6. No handling the module with rope



7. No carrying the modules on the back of one person;



6 STORAGE

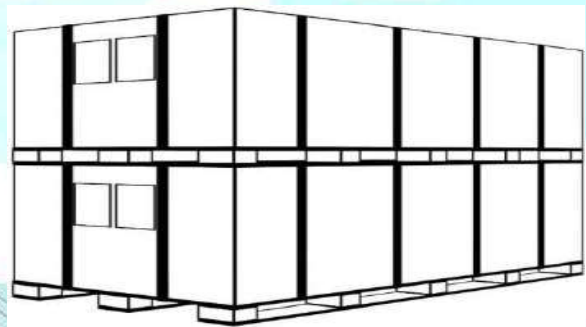
6.1.1 Do NOT expose the modules to rain or moisture. Store the finished product in a ventilated, waterproof and dry place.

6.1.2 Do NOT remove the original packaging if the module requires long-distance transport or long-term storage.

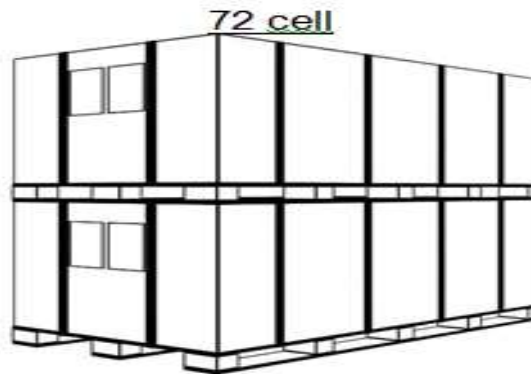
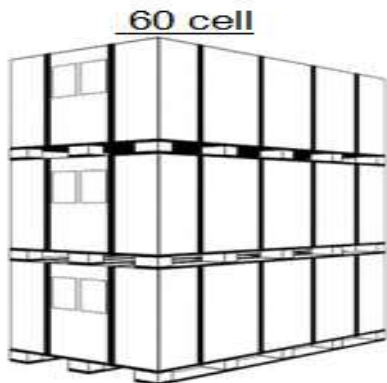
6.1.3 Do NOT open the original packaging if modules not going to use for long time.

6.1.4 Openly stored panels or openly stacked panels not acceptable or not covered in warranty statements.

1. Storage in project site warehouse (moisture < 85%, temperature in the range from -20°C to + 50 °C): 60-cell frame module and 72-cell frame module to be stacked separately in two groups
2. Openly stored panels or openly stacked panels not allowed.



3. Normal warehouse storage (moisture < 85% and temperature in the range from - 20°C to + 50 °C): 60-cell frame module to be stacked no more than three layers and 72-cell frame module to be stacked no more than two layers (take 72-cell frame module for example)

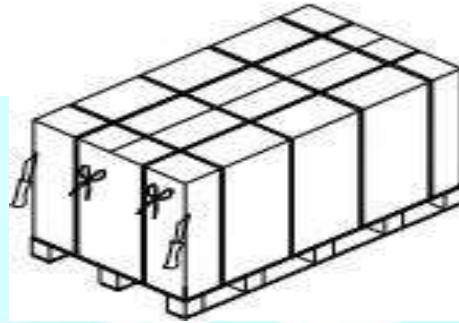


6.1.5 UNPACKING STEP

1. Before unpacking, please check the product name, serial number and related suggestions on the A4 paper. Please read the unpacking instructions.



2. Cut the two packing belt at shorter sides of the tray with blade or scissors, and unpack the side surface of the carton along the vertical direction.



3. After cutting all belts than remove upper cover of packaging box.



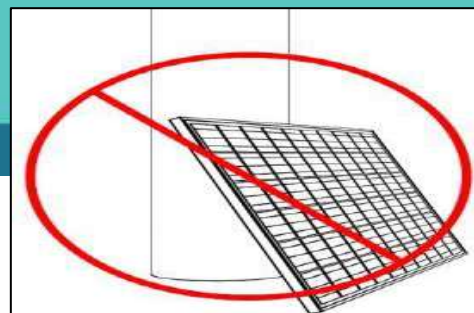
4. When unpacking on a level surface, take out the module from one side of package to the other, and then carry it with two persons.



5. Two person compulsory required to handle the solar panels as shown in picture.

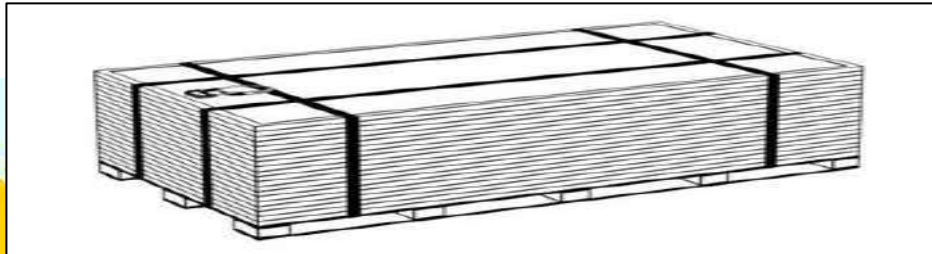


6. Do NOT climb modules on mounting posts, walls or on



packaging box.

7. If all the modules are NOT removed after unpacking and some of them are left in the package, the remaining modules shall be laid flat and repackaged to prevent from falling down. Must be placed by horizontal. The stacked number of modules: 60-cell frame modules to be stacked NOT more than 20 pieces, 72-cell frame modules NOT more than 16 pieces and stacked modules should be covered with corrugated packing.



6.1.6 TAKE CARE OF DEFECTS WHICH MAY TAKE A PLACE WHILE HANDLING PANELS.

1. Do not put modules on walls or any other support.



2. Do not put module on structure poles support.



3. Do not put modules on each other crossly glass side as shown image.



4. Do not put module on each other by backsheet side as shown image.



5. Do not put module on each other as corners of frame is touched or contact with glass



6. Do not put modules on on each other as corners of frame is touched or contact with backsheets.



7. Do not put any other load vertically on modules from glass side



8. Do not put any other load vertically on backsheets side.



9. Do not touch module glass side or backsheets side with sharp edge tools or materials.



10. Do not walk on modules.



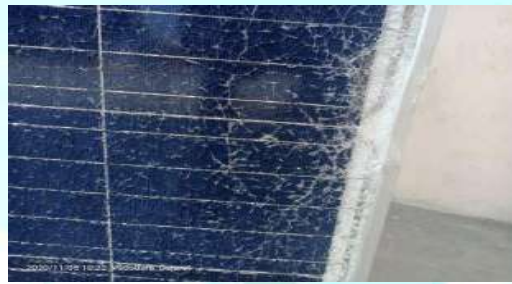
11. Do not hold panels by junction box wire.



12. Do not remove the junction box cover.



13. Various punch defects.



7 MODULE IDENTIFICATION

7.1.1 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.

8 INSTALLATION ENVIRONMENT

8.1 Climate Conditions

8.1.1 GreenBrilliance modules are certified for IEC 61215 & IEC 61730-I&II. In addition to the required IEC certification. Stainless steel and aluminium metal direct contact is recommended for seaside installations to avoid metal corrosion.

8.2 Environment

8.2.1 Ambient temperature: -40 °C to +50 °C

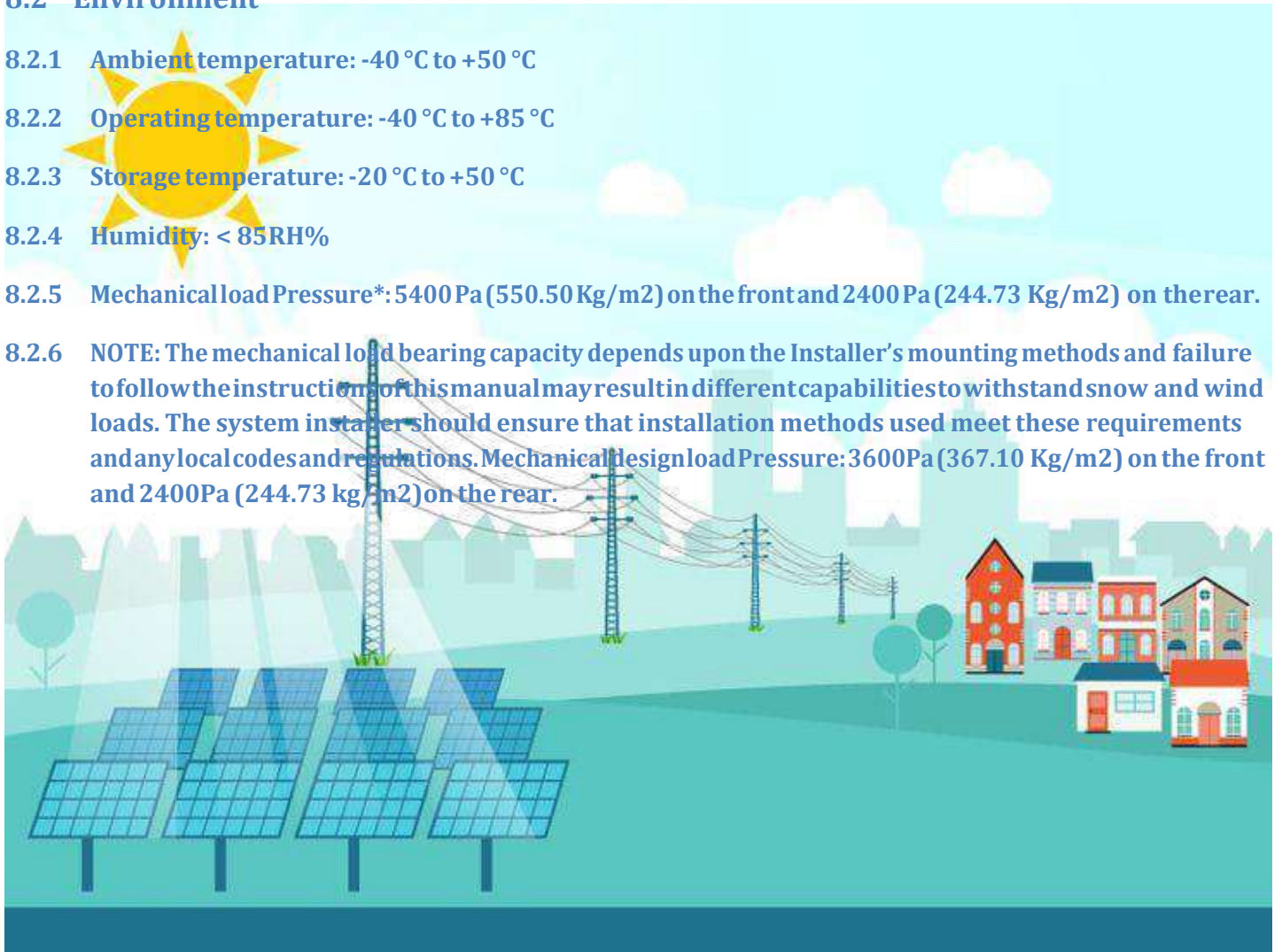
8.2.2 Operating temperature: -40 °C to +85 °C

8.2.3 Storage temperature: -20 °C to +50 °C

8.2.4 Humidity: < 85RH%

8.2.5 Mechanical load Pressure*: 5400 Pa (550.50 Kg/m²) on the front and 2400 Pa (244.73 Kg/m²) on the rear.

8.2.6 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. Mechanical design load Pressure: 3600 Pa (367.10 Kg/m²) on the front and 2400 Pa (244.73 kg/m²) on the rear.



9 SITE SELECTION

- 9.1.1 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
- 9.1.2 PV modules should typically face south in the northern hemisphere and north in southern hemisphere. GreenBrilliance 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.
- 9.1.3 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.
- 9.1.4 Any slope of less than 1:2.4 is required to maintain the fire class rating; Modules are Class C Fire Rated.
- 9.1.5 Avoid using mounting methods where drainage holes are blocked.
- 9.1.6 When installing solar modules on a roof, the roof must be covered with a layer of fireproof material applicable to this class, and adequate ventilation must be ensured between the back sheet and the installation surface. A safe working area also must be left between the edge of the roof and the external edge of the solar array
- 9.1.7 According to Intertek-conducted IEC 61701 salt mist corrosion testing of photovoltaic (PV), Green Brilliance Solar modules can be installed in corrosive salt areas within proximity of the ocean or sulfurous areas. The module must not be soaked in the water or in the environment (i.e. fountain, spindrift, etc.) where the module would touch water (pure water or brine) for a long term. If the modules are placed in an environment of salt fog (i.e., marine environment) or sulfur (i.e. sulfur sources, volcanoes, etc.) there is a risk of corrosion
- 9.1.8 In locations that are 50m – 500m from the ocean, stainless steel or aluminum materials must be used to contact the PV modules, and the installation position must be processed with anti-corrosion treatment; refer to the “Green Brilliance Solar Coastal Application White Paper” for detailed installation requirements. Please contact with local technical support or contact us from [*http://www.gbenergy.com/](http://www.gbenergy.com/)
- 9.1.9 According to IEC62716:2013 “Ammonia corrosion testing of photovoltaic (PV) modules” and DLG Fokus testing for ammonia resistance, Green Brilliance Solar modules can be safely installed in ammonia-heavy environments, such as farm houses
- 9.1.10 PV modules should not be installed in such a way it will be immersed underwater under any circumstances and should not be also installed in a moving vehicle / vessel.

9.2 Tilt ANGLE

- 9.2.1 The tilt angle measurement of the PV module refers to measuring the angle between the module and the horizontal ground surface. For different projects there are different mounting angles. Green BrillianceSolar recommends that the mounting tilt angle should be NOT less than 10°, or in accordance with local regulations or follow the recommendations of experienced PV module installers.
- 9.2.2 The tilt angle of the PV module is measured between the PV module and a horizontal ground surface
- 9.2.3 In the Northern Hemisphere, the PV modules should typically face south, and in the Southern Hemisphere, the PV modules should typically face north.
- 9.2.4 A clearance of at least 115mm (4.5in) (recommended) is provided between modules frame and the surface of the wall or roof. If other mounting means are employed this may affect the UL Listing or the fire class ratings.

10 INSTALLATION

- 10.1.1 GREEN BRILLIANCE Framed series modules may be installed in the following conditions for more than 25 years. In addition to the required IEC and UL certifications, GREEN BRILLIANCE Solar products have also been tested to verify resistance to ammonia fumes that may be present around barns sheltering cattle, as well as suitability for installation in humid (coastal) areas and areas of high sand storms.

10.2 INSTALLATION SAFETY

- 10.2.1 GREEN BRILLIANCE Modules can be mounted in landscape or portrait orientation however the impact of dirt shading the solar cells can be minimized by orienting the product in landscape.
- 10.2.2 Always wear dry insulation protection equipment: insulated tools, head gear, insulated gloves, safety belt and safety shoes (with rubber soles).
- 10.2.3 Do NOT wear metallic jewellery which can cause electric shock during installation.
- 10.2.4 Do NOT install modules under rain, snow or windy conditions.
- 10.2.5 Please keep the connector dry and clean during installation to avoid the risk of electric shock. It is recommended to install it immediately after unpacking.
- 10.2.6 Due to the risk of electrical shock, do NOT perform any work if the terminals of PV module are wet. Please install immediately after you unpacking.
- 10.2.7 The application level of Green Brilliance Solar module is Class A, which can be used in systems operating at greater than 50 V DC or 240 W, where general contact access is anticipated;

10.2.8 Keep the PV module packed in the carton until installation.

10.2.9 Please use an opaque material to completely cover the PV module surface during PV module installation and wiring.

10.2.10 Do NOT unplug the connector if the system circuit is connected to a load.

10.2.11 Do NOT stand on the module glass while installing. There is a risk of injury or electric shock if glass is broken.

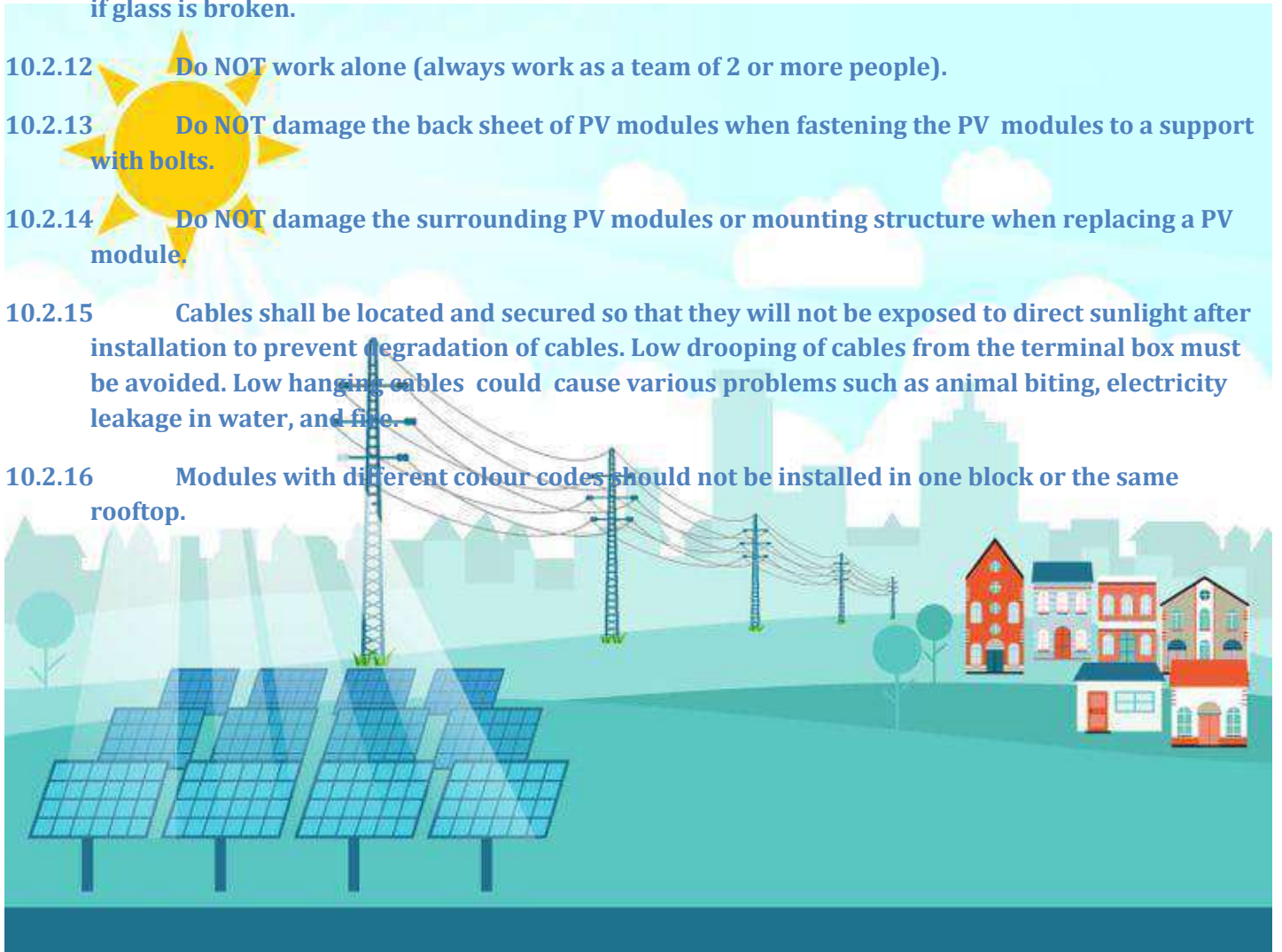
10.2.12 Do NOT work alone (always work as a team of 2 or more people).

10.2.13 Do NOT damage the back sheet of PV modules when fastening the PV modules to a support with bolts.

10.2.14 Do NOT damage the surrounding PV modules or mounting structure when replacing a PV module.

10.2.15 Cables shall be located and secured so that they will not be exposed to direct sunlight after installation to prevent degradation of cables. Low drooping of cables from the terminal box must be avoided. Low hanging cables could cause various problems such as animal biting, electricity leakage in water, and fire.

10.2.16 Modules with different colour codes should not be installed in one block or the same rooftop.



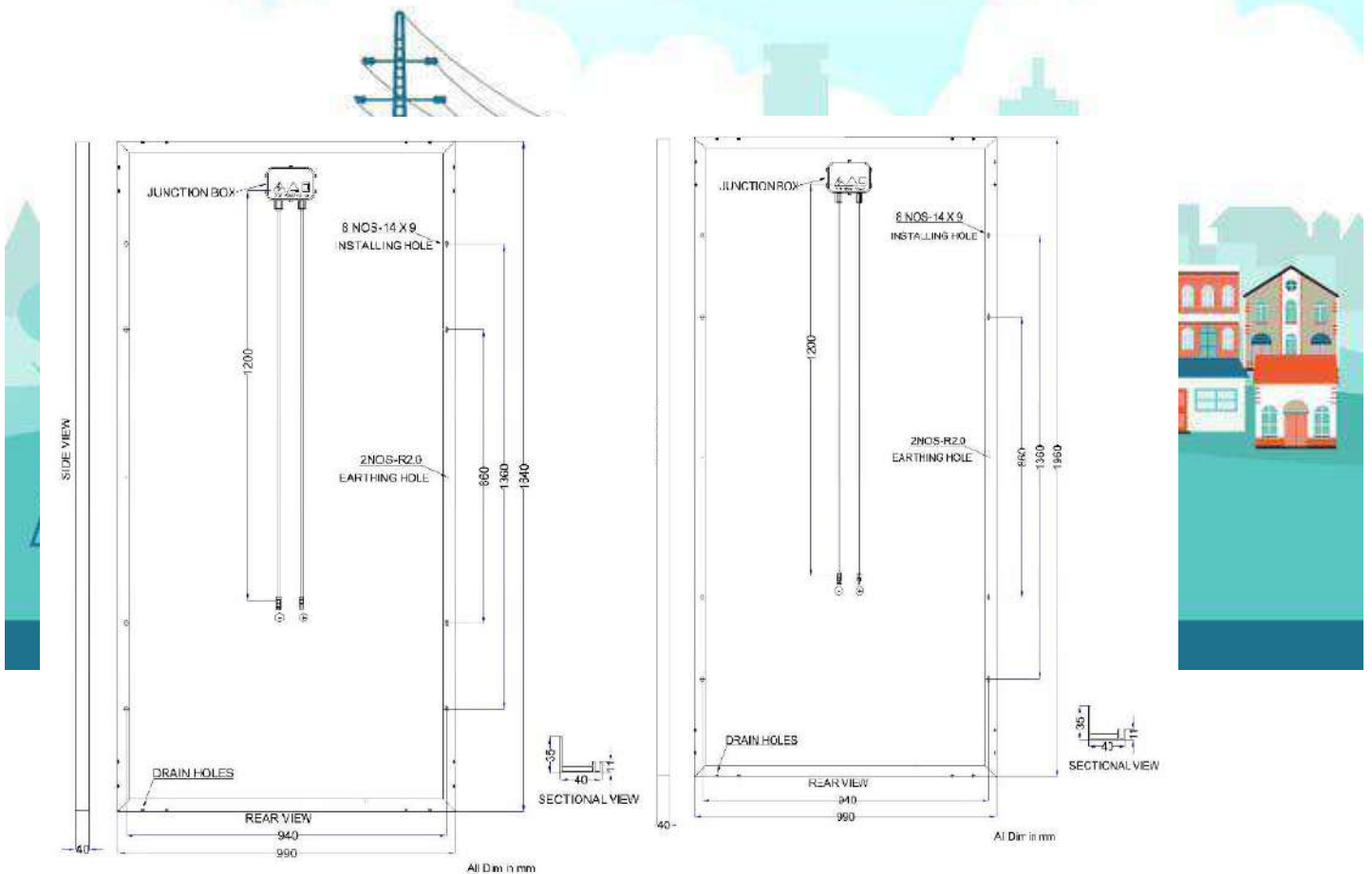
11 MECHANICAL INSTALLATION, WARNING & MOUNTING METHODS

11.1.1 The connection of the module to the racking system can be created through the mounting holes, with clamps, or an embedded system on the frame. The modules must be installed according to the following examples and recommendations. If a different installation method is desired, please contact Green Brilliance Solar customer service or technical support team for consultation. Improperly mounted modules may be damaged. If alternative mounting method is used and not approved by Trina, the modules will not continue to have a valid warranty.

11.1.2 The minimum distance between two modules is 10mm (0.4in)

11.1.3 The module frame drain holes cannot be blocked in any situation during installation or use.

11.1.4 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.



11.2 Mounting With Frame Bolt Holes

11.2.1 Modules can be attached through the mounting holes on the back frame of the module, by fixing the module to the support rails with bolts. The mounting details are shown in the following figures.

11.2.2 The frame of each module has 4- $\phi 9 \times 14$

11.2.3 mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to supporting structure.

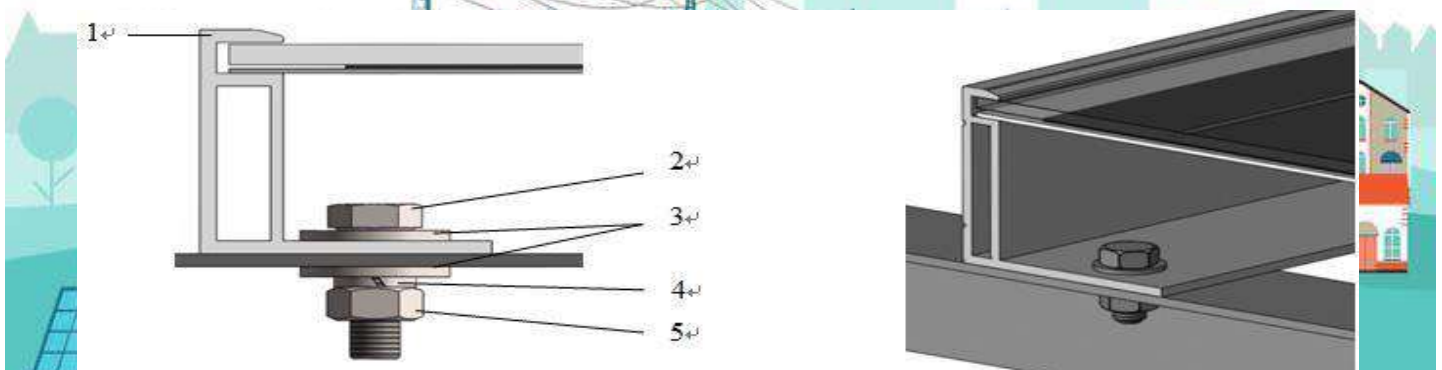
11.2.4 To maximize mounting longevity, Green Brilliance Solar strongly recommends the use of corrosion proof (stainless steel) attachment hardware.

11.2.5 Secure the module in each mounting location with an M8 bolt and a flat washer, spring washer and nut as shown in Figure 1 and tighten to a torque of 16~20 N.m(140-180lb.in.).

11.2.6 All parts in contact with the frame should use flat stainless steel washers of minimum 1.8mm thickness with an outer diameter of 20-24mm (0.79-0.94in).

11.2.7 The bolt should be made of stainless steel or the other anti-corrosion material.

11.2.7.1.1 Module Bolting Type Installation Diagram



1. Aluminium Frame
2. M8 Stainless Bolt M8
3. Flat Stainless Washer
4. Spring Stainless Washer
5. HEX Stainless Nut

11.3 Mounting with Clamp Fixing

11.3.1 GreenBrilliance has tested modules with a number of clamps and suggests to use clamps which has an EPDM or any other insulating washer, mounting bolt of at least M6.

11.3.2 To fix the modules on the mounting rail, a minimum of 4 clamps need to be fixed.

11.3.3 The clamp must overlap the module frame by at least 7mm (0.28in) but no more than 10mm (0.39in).

11.3.4 The clamps should never touch the glass and cause any breakage and also clamps should not cause any shadow effects on the module.

11.3.5 Be sure to avoid shadowing effects from the module clamps.

11.3.6 The customer should not do any modification to the frame under any circumstances.

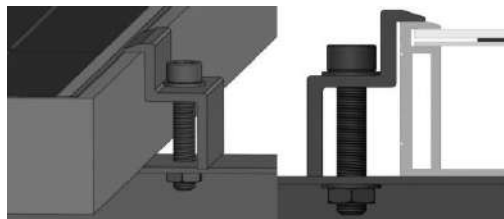
11.3.7 When modules are mounted using clamp mounting method at least 4 clamps need to be used. Two clamps on each of the long side of the module and 2 clamps on each of the short side of the module. Green Brilliance modules are certified for design load of 2400 Pa (244.73 Kg/m²) and test load of 5400 Pa (550.60 Kg/m²) considering the safety factor of 1.5 on the front side.

11.3.8 Green Brilliance modules are certified for design load of 1600 Pa (163.15 Kg/m²) and test load of 2400 Pa (244.73 Kg/m²) considering the safety factor of 1.5 on the back side. Additional clamps can be used to ensure modules can bear the load. Fringe Type Module Installation and Middle Module Installation Diagrams are given below.

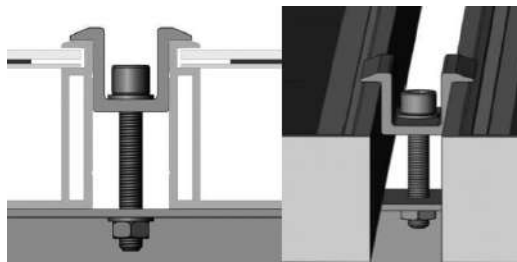
11.3.9 Applied torque should refer to mechanical design standard according to the bolt customer is using, ex: M8-16:20N.m(140-180lb.in)

11.3.10 The bolt should be made of stainless steel or the other anti-corrosion material.

End Clamp installation

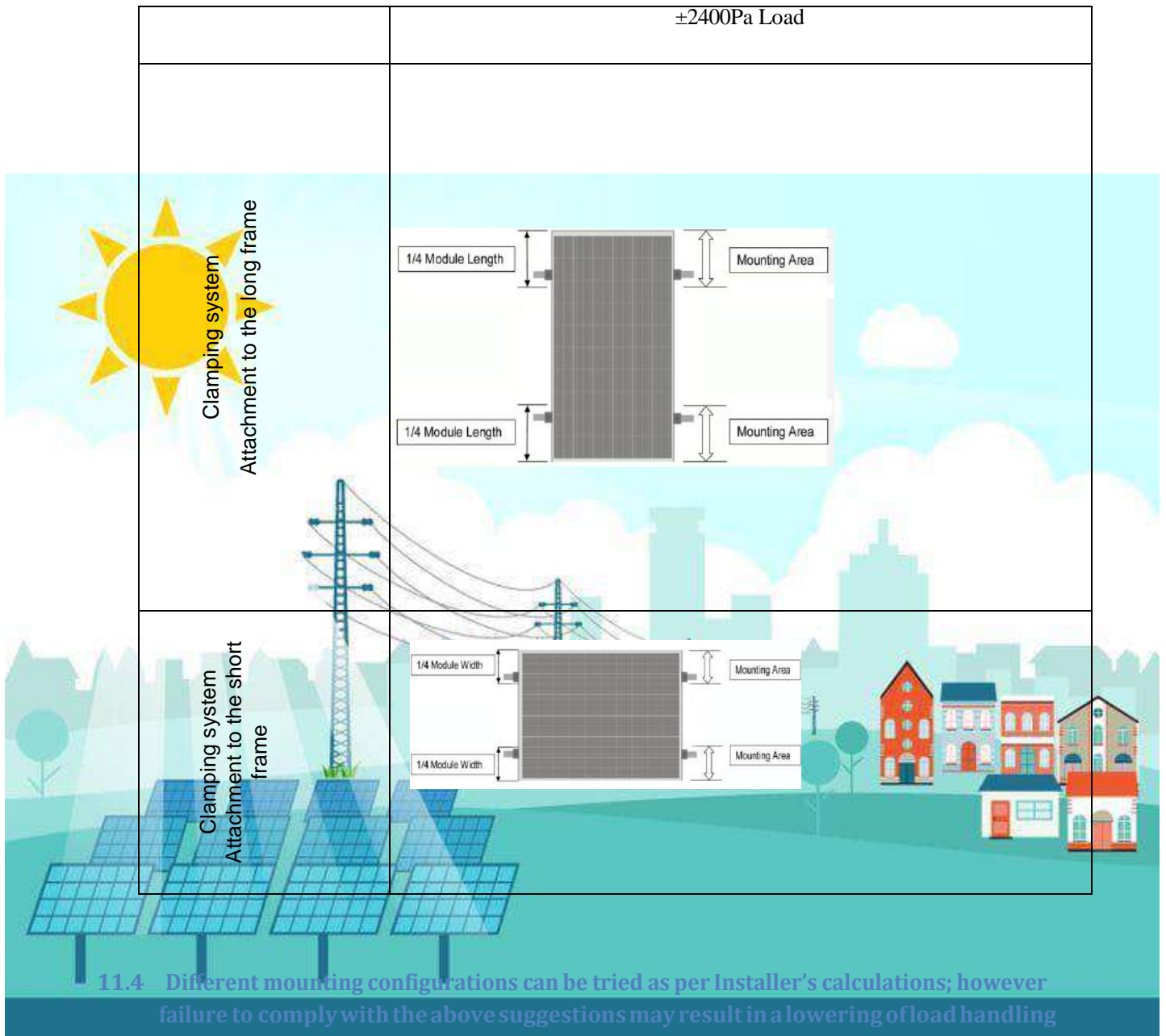


Middle Clamp installation



Fringe Type Module Installation Diagram

Middle Module Installation Diagram



11.4 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.

Module Type	Model Name	Length	Breath Wise Mounting Hole Distance	A	B
72 Cell Module	GB-300 – 320Wp	1960	940	550	300

60 Cell Module	GB-250- 270Wp	1640	940	390	140
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12 GROUNDING

12.1.1 All Module frames and mounting racks must be properly grounded in accordance with respective national electrical code. The earth grounding connection shall be done by a qualified electrician. The longersidesoftheModuleframesareequippedwith predrilledearthingholesintheircentre.These holesshallbeusedonlyforgrounding purposesandnotformountingpurpose.Thegroundingwire must be properly fastened to the Module frame to assure good electrical contact. Use the recommended type or an equivalent connector for this wire.

12.1.2 Module frames should be connected to an earth ground for safety and protection from lightning. A good connection between the grounding hardware is essential for an effective ground. The anodization on a Module frame provides a coating to minimize the corrosion due to weather and it acts as a barrier that reduces the effectiveness of the grounding connection. For an adequate ground, the grounding hardware should pierce the anodization layer. Green Brilliance Modules are provided with earthing hole and same must be used for the purpose.

12.1.3 Proper grounding is achieved by bonding the Module frame(s) and all metallic structural members together continuously using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or any other material acceptable for use as an electrical conductor. The devices have to be installed in accordance with the grounding device manufacturer's specified instructions. The grounding must be cross verified for its proper continuity.

12.2 GREEN BRILLIANCE RECOMMENDED SOME GROUNDING METHODS.

12.2.1 Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut.

12.2.2 Electrical contact is made by penetrating the anodized coating of the aluminum frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25lbf.in.

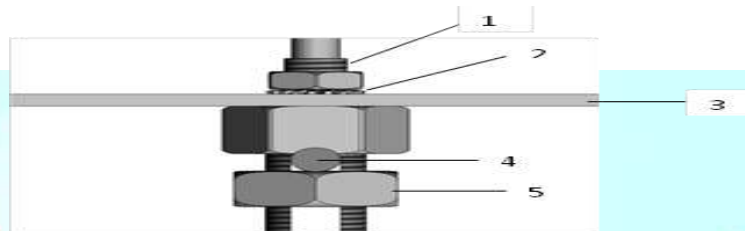
12.2.3 Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.

12.2.4 The wire binding bolt should be tightened to the proper torque of 45lbf.in

Method 1: Tyco grounding bolt

Figure. Method 1 :Tyco grounding bolt

1) Wire bolt and slot



2) Mounting wash hex nut

3) Aluminum frame

4) 0.006 to 0.025in² cable

5) Hex Nut

12.2.5 Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut.

12.2.6 Electrical contact is made by penetrating the anodized coating of the aluminum frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25lbf.in.

12.2.7 Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.

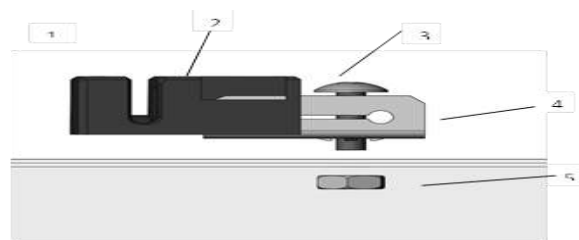
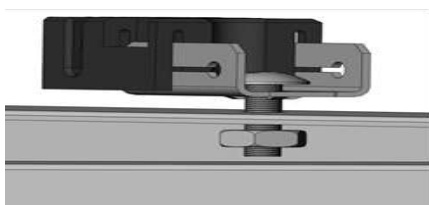
12.2.8 The wire binding bolt should be tightened to the proper torque of 45lbf.in

12.2.9 The Tyco grounding bolt is only listed for use with 6 to 12 AWG bare solid copper wire

Method 2: Tyco grounding bolt:

Figure. Method 2 :Tyco grounding bolt

1. Slider, 2. Bolt, 3.Base, 4. Nut



Method 3: ERICO grounding bolt

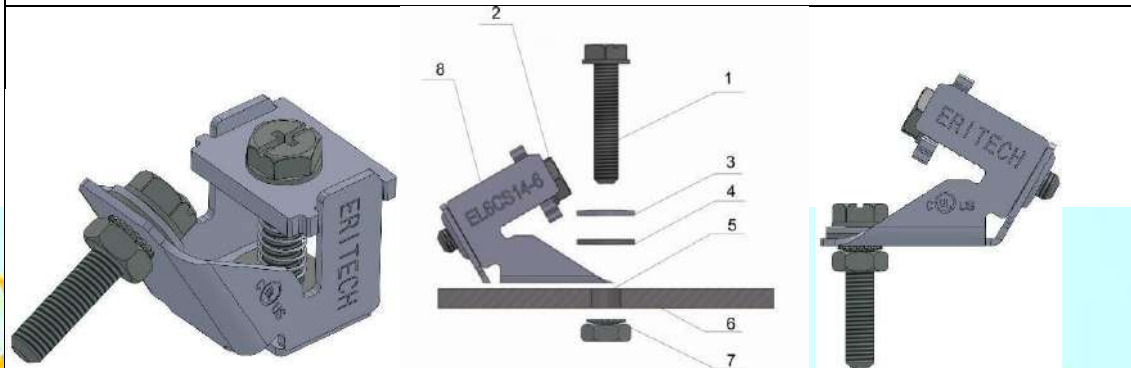


Figure 6. ERICO grounding bolt

- 1) Machine Bolt A
- 2) Machine Bolt B
- 3) Belleville washer
- 4) Flat Washer
- 5) Clearance hole for #10[M5] machine bolt
- 6) Aluminum frame
- 7) Machine box hex nut with lock washer
- 8) Grounding bolt

12.2.10 The lug should be installed on a surface that is larger than the bottom surface of the lug.

12.2.11 The lug should be installed in the grounding holes provided on the PV module.

12.2.12 Machine bolt A should be torqued to 35lbf.in, to secure the grounding bolt to module frame.

12.2.13 The grounding bolt is only listed for use with 6-12 AWG bare solid copper wire.

12.2.14 For proper wire binding, machine bolt B should be torqued to 35lbf.in.

13 MODULE WIRING

13.1.1 All wirings should be performed, by qualified installers, in accordance with the local codes and regulations

13.1.2 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

13.1.3 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

13.1.4 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

13.1.5 The number of modules in series and in parallel shall be designed reasonably according to the system configuration

13.1.6 All instructions above have to be obeyed to maintain GREEN BRILLIANCE limited warranty

Connecting in series

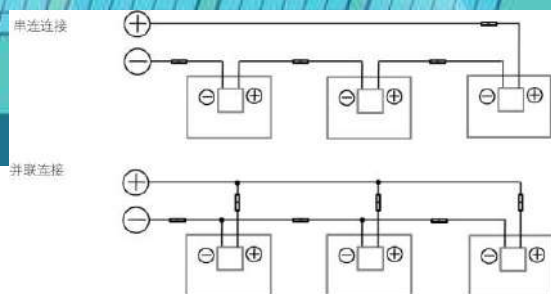


Figure 1

Connecting in parallel after connected in series

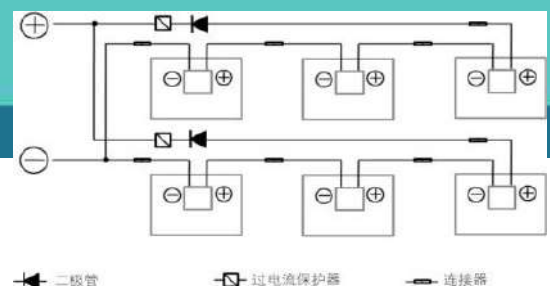


Figure 2

13.1.7 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 10V is observed, the string configuration connection needs to be checked and connected appropriately

13.1.8 GreenBrilliance modules are provided with standard copper cables with a 4 mm² cross-sectional area and are rated for 1500V/1000V (IEC and UL) for maximum system voltage, 90°C and are UV resistant. Ensure the cables are not exposed to water logged area's

13.1.9 The maximum voltage of the system should be lesser than the certified system voltage (typically 1000V) or the maximum input voltage of the inverter. Since $V_{oc} \propto (1/T)$, the open circuit voltage of the array needs to be calculated at the lowest ambient temperature for the location of power plant.

13.1.10 This can be done using the formula below, $Max\ System\ voltage = X * Voc * [1 + ((T\alpha - Voc(\%)) * (25 - T_{min}))]$ where X - No: modules which are reconnected in series. Voc - Open circuit voltage of each module (Refer to the Data Sheet) $T\alpha$ - Voc - Thermal coefficient of open circuit voltage for the module in Percentage (refer to GreenBrilliance - Spec sheet) T_{min} - Minimum ambient temperature of the location of the plant

14 ELECTRICAL CONFIGURATION

14.1.1 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.

14.2 CAUTION:

14.2.1 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 1000VDC.

14.2.2 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. GreenBrilliance will not be responsible for any electrical accidents occurring in power plants using GreenBrilliance modules.

15 FUSING

15.1.1 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 and negative poles). The maximum Fuse Rating connected in series with the array string is usually 15 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. 15 A fuse per series string is recommended.

Electrical Specifications

[Nominal

Values: for 72

Cell model]

Maximum

System

Voltage: 1000V

Maximum

Series Fuse:

15A

Fire Rating Class:

Fire Rating Class C

Dimensions:

1960mm*990mm*

40mm Weight:

22.5 kg

Bypass Diodes: 3 Bypass Diodes

15.1.2 Typically, modules consists of bypass diodes like SL1515 (Peak Inverse voltage-40V, Forward Current- 20 A) diodes in the junction box. Rated electrical characteristics are within $\pm 10\%$ of measured values at standard test conditions of 1000W/M², 25°C cell temperature and air mass 1.5 solar spectral irradiance.

15.2 Fusing

15.2.1 The values of short-circuit current and open-circuit voltage marked on this Module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current carrying capacity, fuse sizes and size of controls connected to the PV output.

15.2.2 Secure the cables to the mounting system using UV-resistant cable ties.

15.2.3 Protect exposed cables from damage with appropriate precautions (e.g. locate them within plastic conduit).

15.2.4 Avoid exposure to the direct sunlight.

15.2.5 Ensure that the cables will be away from areas where water can form puddles.

15.2.6 When disconnecting wires under load, an electric arc may result. Such arcs may start fires and may otherwise create problems. To disconnect the PV system while under load, turn off the inverter first and then switch on the DC-circuit breaker.

15.3 Diodes

15.3.1 Bypass Diode

15.3.1.1 *When the Modules are shaded partially, it may cause reverse voltage across cells or Modules, because the current from other cells in the same series is forced to flow through the shaded area. This may cause undesirable heating to occur. When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded Module, thereby minimizing Module heating and array current losses. The use of a diode to bypass the shaded area can minimize both heating and array current reduction.*

15.3.1.2 *Note: All GREENBRILLIANCE Modules are equipped with factory installed bypass diodes. The factory installed diodes provide proper circuit protection for the systems within the specified system voltage, so that you do not need any other additional bypass diodes. If your system specifications require you to add or change diodes, please contact authorized GREENBRILLIANCE representative for recommendations for the proper diode type*

15.3.2 Blocking Diode

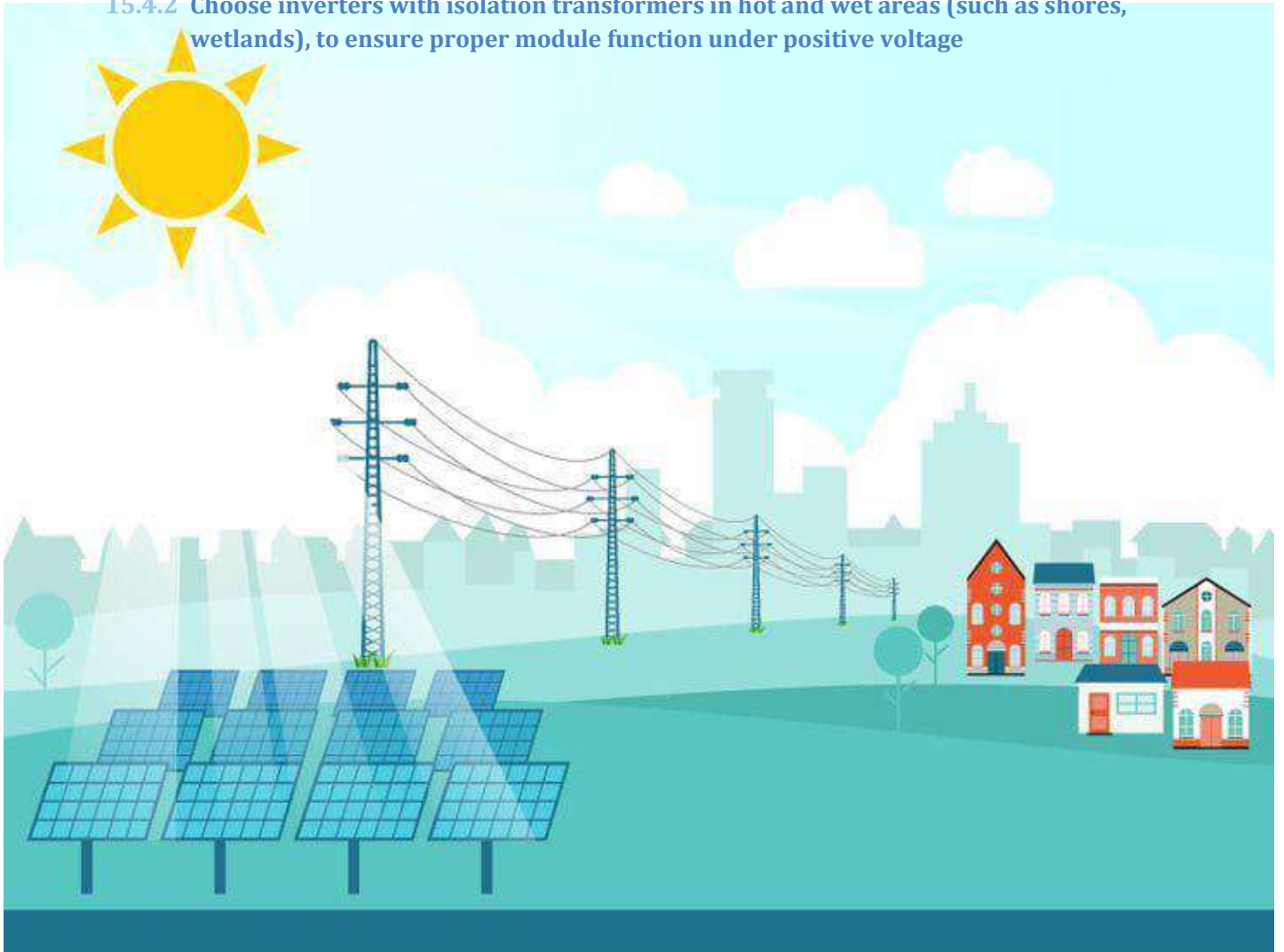
15.3.2.1 *Blocking diodes are typically placed between the battery and the PV Module output to prevent battery discharge at night. GREENBRILLIANCE Modules do not contain a blocking diode when shipped from the factory. It is recommended that a charge controller be used to prevent the batteries from being overcharged and discharged at night.*

15.3.2.2 *Note:- The non-use of blocking diode or any reverse current protection in battery operated system will void all applicable warranties.*

15.4 INVERTER SELECTION AND COMPATIBILITY

15.4.1 When installed in systems governed by IEC regulations, Green BrillianceSolar modules normally do not need to be electronically connected to earth and therefore can be operated together with either galvanically isolated (with transformer) and transformerless inverters.

15.4.2 Choose inverters with isolation transformers in hot and wet areas (such as shores, wetlands), to ensure proper module function under positive voltage



16 MAINTENANCE AND CARE

16.1.1 Well-designed PV Plant requires minimum maintenance but however with further maintenance the performance and the reliability of the system can be improved

16.1.2 It is recommended to perform a preventive inspection every six months without changing the components of the module. If electrical or mechanical properties are required for inspection or maintenance, qualified professionals should be advised to avoid any electric shock or loss of life

16.1.3 Check that the mounting structures are properly laid and the modules are held tightly and are in accordance with the mounting instructions given above

16.1.4 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

16.1.5 Ensure all the cable assembly is tight and no part of cable assembly will be exposed to water logging

16.1.6 Check that the string fuses in each non/earthed pole are in operation

16.1.7 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

16.1.8 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

16.1.9 Do not open the junction box to change the diodes even if they are defective. Please contact with PV module installer in case of known or suspected diode failure

16.1.10 Ensure the module is cleaned without causing any damage like micro-crack, etc. to the module

16.1.11 Cover the front surface of modules by an opaque material when repairing. Modules when exposed to sunlight generate high voltage and are dangerous

16.1.12 Always recommended to have the module clean and tidy for maximum power generation from the solar PV module

16.1.13 The back surface of the solar module doesn't require any specific cleaning unless any dirt or debris is stuck on the backsheet. While cleaning the dirt on the backsheet avoid any sharp object, which can damage the substrate material and cause a slit

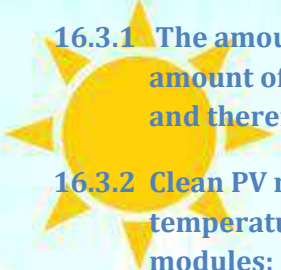
16.1.14 Do not open the junction box to change the diodes even if they are defective. Please contact with PV module installer in case of known or suspected diode failure

16.2 CONNECTOR AND CABLE INSPECTION

16.2.1 Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.

16.2.2 It is recommended to check the torque of terminal bolts and the general condition of wiring at least once a year. Also, check that mounting hardware is properly torqued. Loose connections will result in damage to the array.

16.3 CLEANNING



16.3.1 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.

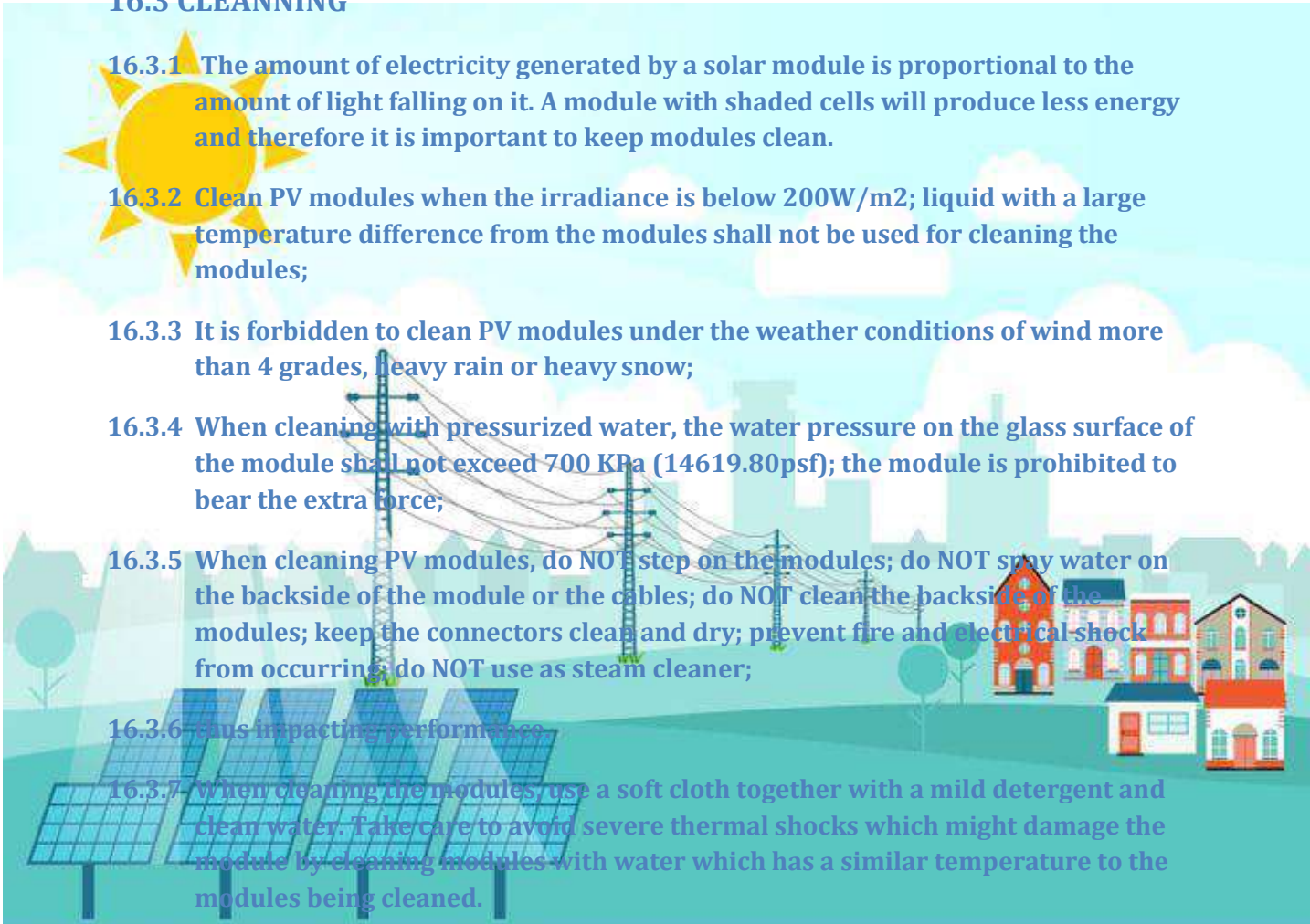
16.3.2 Clean PV modules when the irradiance is below 200W/m²; liquid with a large temperature difference from the modules shall not be used for cleaning the modules;

16.3.3 It is forbidden to clean PV modules under the weather conditions of wind more than 4 grades, heavy rain or heavy snow;

16.3.4 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;

16.3.5 When cleaning PV modules, do NOT step on the modules; do NOT spray water on the backside of the module or the cables; do NOT clean the backside of the modules; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do NOT use as steam cleaner;

16.3.6 Fans impacting performance.



16.3.7 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.

16.3.8 Use dry or wet soft clean cloth to clean the PV modules; non-corrosive solvents or hard objects are strictly prohibited;

16.3.9 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.

16.3.10 When cleaning the back surface of the module, take care to avoid penetrating the substrate material. Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will NOT "self-clean" as effectively as modules mounted at a 10° tilt or greater.

16.3.11 If you are unsure whether the array or section thereof needs to be cleaned, first select an array string that is particularly soiled, then

16.3.12 Measure & record the inverter feed in current from that string

16.3.13 Clean all modules in the string

16.3.14 Measure the inverter feed in current again and calculate the % improvement from cleaning

16.3.15 The back surface of the module normally does not need to be cleaned but, in the event this is deemed necessary, avoid the use of any sharp projects that might damage the penetrating the substrate material.

16.4 REQUIREMENTS FOR WATER QUALITY

16.4.1 PH: 5 ~7;

16.4.2 Chloride and Salinity : 0 - 3,000 mg/L

16.4.3 Turbidity : 0-10 NTU

16.4.4 Conductivity : 1500~3000 $\mu\text{s}/\text{cm}$

16.4.5 Total dissolved solids (TDS): ≤ 1000 mg/L

16.4.6 Water Hardness—calcium and magnesium ions : 0-40 mg/L

16.4.7 Non-alkaline water must be used; demineralized water shall be used if the condition permits

16.5 MODULE INSPECTION AFTER CLEANING

16.5.1 Ensure that the module under visual inspection is clean, bright and free of stains;

16.5.2 Spot check to verify whether there is soot deposit on the module surface;

16.5.3 Check to see that there are no visible scratches on the surface of the module;

16.5.4 Check to see that no man-made cracks are on the module surface;

16.5.5 Check to see that whether the module support structure is leaning or bent after cleaning;


16.5.6 Check to see that whether the wiring terminals of the module are detached;

16.5.7 After cleaning PV modules, fill out the PV module cleaning record.

16.6 TROUBLESHOOTING

16.6.1 If your installation does not work properly, please inform your installer immediately. It is recommended to perform a preventive inspection every six months without changing the components of the modules. If electrical or mechanical properties are required for inspection or maintenance, qualified professionals should be advised to avoid any electric shock or loss of life

16.7 End of Life Product Recycling



16.7.1 After end of Useful Life, Products should be recycled in a useful renewable way. GreenBrilliance 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

16.7.2 For recycling, contact PV Cycle directly at <http://www.pvcycle.org/> to locate nearest recycling collection point.

17 WARNING



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

18 CONTACT DETAILS

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Vadodara – 391760
contact@gbreenergy.com
www.gbreenenergy.com