



INSTALLATION & MAINTENANCE MANUAL FOR PV MODULES

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1. Disclaimer of Liability

1.The use of this manual and installation, handling, maintenance and use of modules are beyond ReneSola’s control, and ReneSola does not assume any responsibility for loss, damage, injury or expense resulting from incorrect installation, handling, use or maintenance.

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3.All information stated in this manual is based on ReneSola’s knowledge and experience, but no warranty about such information (including modules specifications) is made by ReneSola, whether expressly or implied. ReneSola reserves the right to update this manual, modules specifications or relevant information without prior notice.

2. Preface

This manual offers general installation and maintenance information of the Photovoltaic Modules (hereinafter referred to as the Modules) of ReneSola Jiangsu Ltd (hereinafter referred to as ReneSola).

Before installation, handling or maintenance, ensure that you have read and understand this manual and use the Modules correctly & safely.

The installation manual is only for glass-backsheet type Module, the model names covered are:

Module Single Glass with:

RS11-xxxP-E1,RS12-xxxP-E1, RS13-xxxM-E1, RS14-xxxM-E1, RS15-xxxM-E1, RS16-xxxM-E1, RS2-xxxM-E1, RS2-xxxM-E2, RS2-xxxM-E3, RS3-xxxM-E1, RS3-xxxM-E2, RS3-xxxM-E3, RS3-xxxM-E4, RS4-xxxM/MX/MXB-E1, RS4-xxxM/MX/MXB-E2, RS5-xxxM/MX/MXB-E1, RS6-xxxM/MX/MXB-E1, RS6-xxxM/MX/MXB-E2, RS6-xxxM/MX/MXB-E3 , RS41-xxxM/MX/MXB-E1,RS41-xxxM/MX/MXB-E2,RS41-xxxM/MX/MB-E3

Module Double glass with:

RS13-xxxMG-E1, RS14-xxxMG-E1, RS2-xxxMG-E1, RS2-xxxMG-E2, RS3-xxxMG-E1, RS3-xxxMG-E2, RS4-xxxMBG/NBG-E1, RS4-xxxMBG/NBG-E2 , RS6-xxxMBG/NBG-E1, RS6-xxxMBG/NBG-E2, RS6-xxxMBG/NBG-E3, RS41-xxxMBG/NBG-E1,RS41-xxxMBG/NBG-E2,RS41-xxxMBG/NBG-E3,RS8-xxxMBG-E1,RS9-xxxMBG-E1

Remarks

1. The “***” stands for the module power for detailed information please refer our module TDS.
2. JC indicate ReneSola, while M indicate Multiple Crystalline, S indicate Single Crystalline.
3. The brackets stand for additional information such as “bs” refer to Modules with PV back-sheet and 4 Busbar cells, “bw” refer to Modules with PV back-sheet and 5 Busbar cells, “bps” refer to the maximum system voltage of the Modules is 1500V and the Modules with PV back-sheet 4 Busbar cells, “bpw” refer to the maximum system voltage of the Modules is 1500V and the Modules with PV back-sheet 5 Busbar cells.

3.Product Identification

Nameplate: describes the product model; rated power; rated current, rated voltage, open circuit voltage, and short circuit current. All above parameters are measured in standard test conditions: irradiance of 1000W/M², AM 1.5, Module temperature 25 C.

Other information, such as weight, size, maximum system voltage and maximum fuse current are marked on the nameplate as well.

Barcode: the barcode is located in the inside the glass the Module, and contains the serial number (also displayed).

Do not remove or alter any label or marking, this will void warranty.

4.Safety

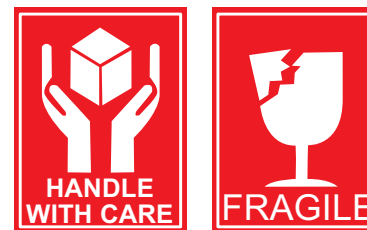


ATTENTION: Danger of death from electric shock

1. Installation, trouble shooting and maintenance of solar installations present hazards associated with electrocution, electrical arcs, burns, working from heights and manual handling; therefore, this work must only be carried out by suitably trained professionals with the appropriate safety equipment and procedures in place at all times.
2. Electrical hazards must be taken in account at all times when working on or around solar modules. Please take necessary actions to avoid possibility of electrical injuries.
3. Mating connector pairs on Module and array leads must be the same brand and type.
4. Do not strike Modules or subject Modules to impact with tools or objects.

5. Do not install a panel that has been damaged, glass smashed or back-sheet torn.
6. Do not touch exposed parts, cables or connectors.
7. Do not dismantle, disassemble or modify any parts of the Modules and do not remove or alter in anyway the labels or markings on Modules.
8. Do not step or walk on the modules. Doing so may damage and crack parts of modules.
9. Do not expose modules to chemicals, for instance paints, solvents, adhesives.
10. Keep the Modules away from inflammable gas, hazardous chemicals or flammable explosive items.

5.Transportation and Handling



HANDLE WITH CARE – FRAGILE GLASS

Solar Modules are glass and contain very fragile Silicon wafers inside them and must be transported and handled with the utmost care. Do not strike, drop or bend a Solar module

1. Never transport other items (eg. Inverters) on top to a solar module pack.
2. Store the modules safely in cool and dry area. The packaging is not weatherproof.
3. Leave modules in their packaging until they are to be installed, the modules must avoid rain and sand erosion after unpacking.
4. Unpacking PV modules from the original package:

Step 1: Remove securing straps.

Step 2: Remove the pallet lid.

Step 3: Unpack the Modules one by one and stack them (surface glass side down) without removing the cardboard edge protector.

Step 4: Remove the cardboard edge protector from the Modules before installing.



Figure 1 Unpacking

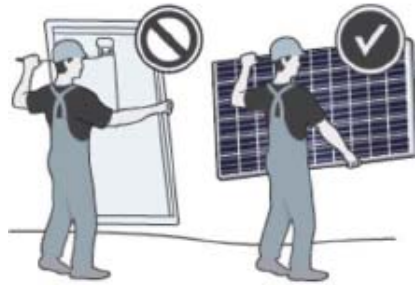


Figure 2. Carry the Modules



Figure 3. Stack the Modules

5. Check the module for damage due to transportation before the installation.
6. Use extreme caution if stacking modules for transport of less than a pallet at a time line up the modules with their edge protectors in place and wraps, strap and fasten them so that they cannot move around or rattle and fall. Care must be taken with fasteners that secure modules but do not bend or damage the modules in any way.
7. The Modules should be transported in their original packaging where possible with any free space in the box securely filled with soft packaging materials to prevent the panels from moving around.
8. Never move modules by pulling their cables.
9. Carry the modules with both hands and with their glass surface facing the operator when absolutely necessary (one operator available) (please see Figure 2). Do NOT stack the modules back-sheet side down to avoid glass scratch and electric shock risk (please see Figure 3).
10. Do not step or walk on the Modules. Doing so may damage modules (please see Figure 4).
11. Do NOT carry wet or hot Modules dropping a module from an height and the impact of falling tools may affect the electrical performance or break the module (see Figure 4).

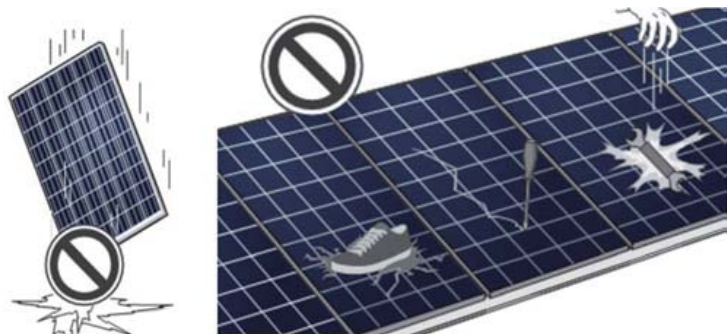


Figure 4. Handling Precautions

12. The surface oxide layer of the frame may be damaged by sharp objects, do not destroy or scratch the frame of the Modules.

13. Glass surface, back-sheet and aluminum frame are susceptible to damage that could affect the performance or integrity of the PV module; do not damage or scratch the surfaces, and do not spray any non-validated chemicals paints, solvents or adhesive to any of the surfaces, including the frame. Doing so may degrade performance or cause irreparable damage and will void any applicable warranties.

6. Installation

1. The electrical and mechanical installation must comply with international and local standards and principles including cable connection building codes etc.
2. The mounting structures must be designed by qualified structural engineers, and installation design and procedures shall be consistent with the relevant local standards.
3. Installers must be qualified and familiar with solar and electrical principles.
4. The working ambient temperature range is -40°C to $+85^{\circ}\text{C}$ and Relative Humidity $\leq 85\%$.
5. The Modules shall be installed so as to maximize solar exposure and to minimize shading by trees, buildings or other obstacles in the surrounding area. Generally in the Northern hemisphere Modules are ideally orientated to the South and in the Southern hemisphere Modules orientated to the North.
6. Notify ReneSola of any damage to product immediately. Do not use or install damaged Modules. Damaged Modules may cause fire or electric shock, resulting in property damage, fire and or death.
7. Do not disconnect or connect any cables under load, the bending cable radius of Junction Box must more than 45 mm.
8. Match the polarities of cables and terminals when making the connections, failure to do so may result in damage to the module. Keep the connector dry and clean and do not impact external force on the connector such as heavy snow, strong wind.
9. The maximum modules of one PV string $N = (\text{The Maximum System Voltage}) / (V_{oc})$, note the V_{oc} is the value at the lowest temperature in the project sites.
10. Suitable over current protection devices (string fuses etc.) must be installed when connecting 3 or more strings in parallel configuration.
11. Under normal conditions, a Module may be able to produce voltage and current higher than in standard test condition. Accordingly, when determining component rated voltage, conductor ampacities, fuse current and size of controls connected to the PV output, the short circuit current and open circuit voltage value marked on this module shall be multiplied by a factor (safety factor) of 1.25.*

*** Note:** The safety factor for component rated voltage, conductor ampacities, fuse current and size of controls connected to the PV output is subject to the meteorological conditions of project sites.

12. Select either method of fixing mentioned below depending on site conditions:
Screw-fixing system (Figure 5-a) \ Fixture-fixing system (Figure 5-b) .

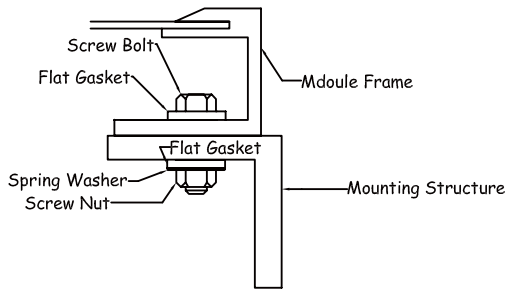


Figure 5-a Installed by nut and bolt



Figure 5-b Installed by fixture

13. Installation method and location

1)Screw-fixing :

Fix the modules on the bracket at 8 border prefabricated installation holes (Figure 6) . All the fastening pieces are made of stainless steel. The inside installing holes must be fixed with bolts in all the cases and the outside installing holes would be also used in the case of strong wind and/or heavy snow. Applied torque is recommended as 14-20 N•m for M8(diameter is 8mm)screw.

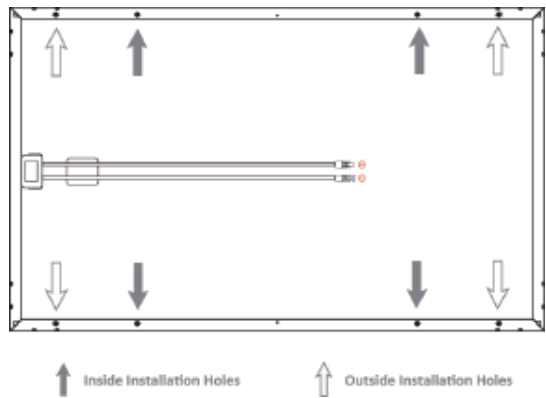


Figure 6 Screw-fixing

2) Fixture-fixing :

Fix the module safely and securely on the mounting structure. The length of clamp should be 40mm minimum. Applied torque is recommended as 7-11 Nm for M6(diameter is 6mm)screw. The clamp are made of aluminum alloy.

6mm)screw. The clamp are made of aluminum alloy.

For A Series (156-72 cell JC***M-24/A**) modules, four clamps must be used:

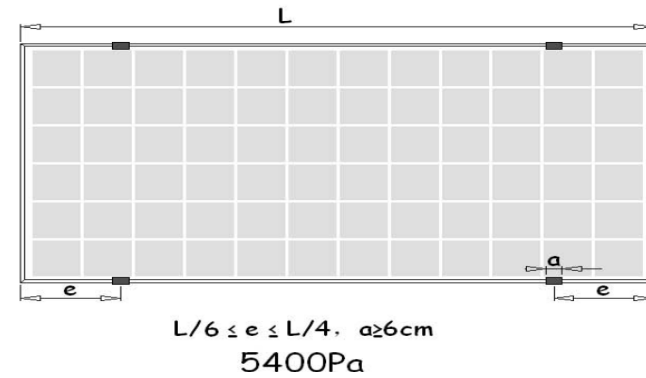


Figure 7-1 On long frame

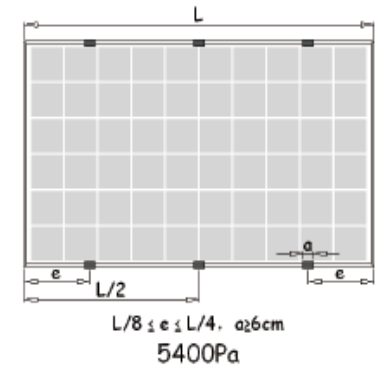
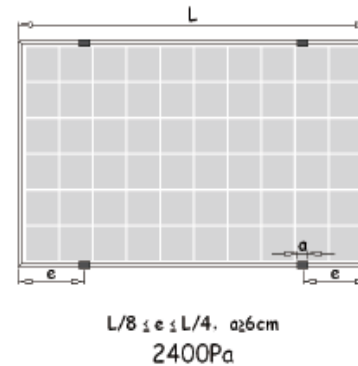


Figure 8-1 Fixing on the long sides for the other module series

For other series module, fix the module with the long sides (Figure 8-1) according to the bracket locations specified and mechanical load requirements.

3) Inserting System :

Fix the module with U type groove or flange beam. All available installation methods for A series modules (156-72 cell)(Figure 9)

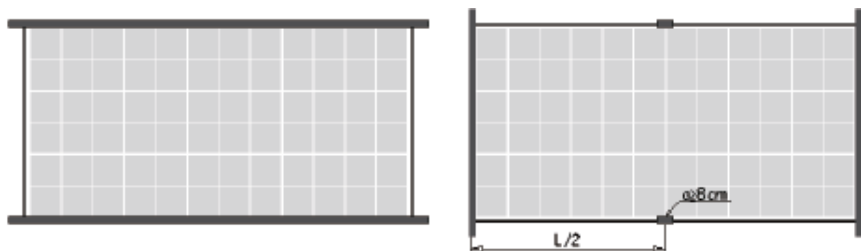


Figure 9 Fixing with sideway for A series modules

For other series module, fix the module with the long sides or short sides according to the bracket design and mechanical load requirement.(Figure 10)

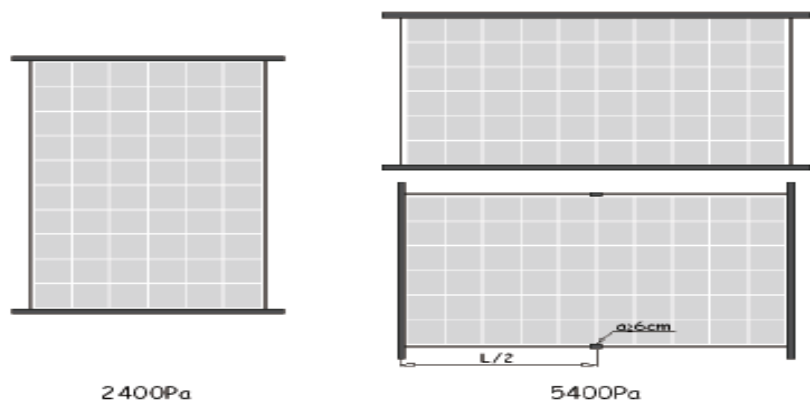


Figure 10 Fixing with sideway for the other module series

Fixing eight installation holes simultaneously is recommended according to the Security Considerations. When installed correctly, the Modules can withstand a maximum snow pressure of 5400 Pa or wind pressure of 2400 Pa.

14. When installing the Modules on the roof, ensure there is an appropriate mounting structure.

15. The minimum separation between two Modules shall be more than 10 mm; when installing on the roof, the recommended separation between the Modules and the roof surface is 100 mm to allow for air flow around the modules. When installing on ground mounts keep ground clearances to more than 450 mm.

16. Grounding

1) Grounding method shall be consistent with the local standard and regulations. Any grounding system/method, which is designed in accordance with relevant international and local standards and regulations, such as UL2703, UL467, IEC60335, NEC article 250 and section 690.V.43, etc. could be attached to the Modules.

2) In order to prevent electrochemical corrosion, materials in contact with module frames, should be properly selected and galvanic isolation provided where necessary

3) PID (Potential Induced Degradation) due to combined effects of high temperature, high humidity and high voltage, is most likely to be observed in similar climates and mounting surroundings such as India, Southeast Asia, floating designs. Except for equipment grounding, negative system grounding is strongly recommended as the basic solution for PID phenomenon.

4) Grounding wire shall be the bare copper wire with simple surface treatment and no insulation sleeve. Wire cable with cross-sectional area of 4mm² (10~12 AWG) and ground clamp (such as Tyco, identification of product: 1954381-2) are recommended (diagrammatic sketches are as follows).

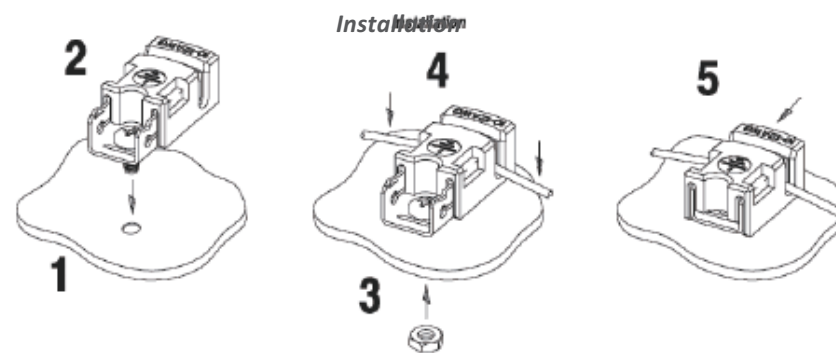


Figure 11 Grounded with Ground clamp

17. When the connecting wires of the Modules do not meet length requirements, a correctly rated electrical cable that is designed and certified for long term outdoor use along with the correct connectors can be used to extend the connections. Match the same brand and type of Module connectors to extend the connection. The cross-sectional area

for PV array wire must be no less than 4 mm², and the connection system is IP 65 rated.

18. It is better to use the Modules with same specifications same colour when connected in series.

19. Artificially concentrated sunlight shall not be directed on the module.

20. The modules should not be installed at the place which is less than 100 meters from the seashore. If the distance of the seashore and the project site is 100~1000 meters, anti-corrosion application should be taken during the installation and grounding processes.

7. Electrical Installation



. WARNING Electrical Hazard

This module produces electricity when exposed to light. Follow all applicable electrical safety precautions.

- ONLY qualified personnel can install or perform maintenance work on these PV modules.
- BE AWARE of dangerous high DC voltage when connecting module.
- DO NOT damage or scratch the rear surface of the module.
- DO NOT handle or install module when they are wet.

The wiring components shall be compatible with the PV modules.

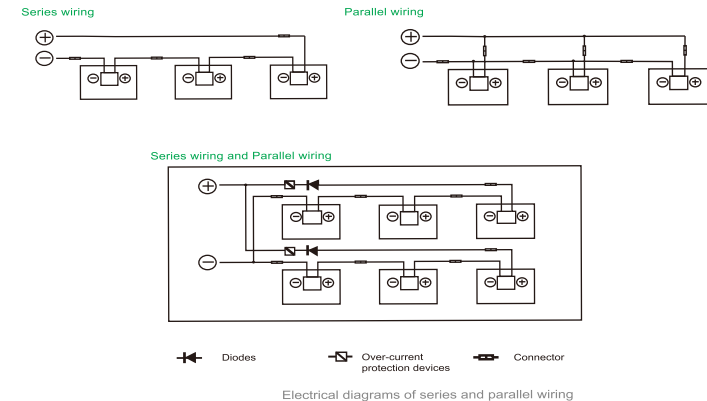
The PV modules connected in serial shall have similar current. The Voc of one PV string shall no higher than the maximum system voltage, the Voc temperature coefficient feature and the extreme low temperature of installation location must be taken into consideration when calculate the Voc of the PV string .

The PV modules connected in parallel shall have similar Voltage. The Isc tempera-ture coefficient feature and the extreme high temperature of installation location must be taken into consideration when calculate the Isc of the PV array.

Please refer to local regulations to determine the system wires size, type and temperature.

The cross-sectional area and cable connector capacity must satisfy the maximum short-circuit of PV system (For a single component, we recommended the cross-sectional area of cables is 4mm² and the rated current of connectors is more than 15A), otherwise cables and connectors will become overheating for large current. Please pay attention: the temperature limit of cables is 85° C and the temperature limit of connector is 105°C

A qualified system designer or integrator should always be consulted.



8. Maintenance

1. Do not touch any live parts of the array wires, uninsulated cable and the connector. Use the safety equipment when working on solar equipment (insulating tool, insulating gloves etc.).
2. An opaque cloth or other non-abrasive material can be used to cover the front of the modules to eliminate sunlight exposure and reduce the chance of electrocution during maintenance when required.
3. Cleaning instructions

Periodic cleaning is recommended for solar modules .The cleaning process should be done by suitably trained professionals with the appropriate safety equipment and procedures in place at all times. When cleaning the module surface.

a) The following rules apply:

- ✓ To reduce cold and hot shock clean panels at low irradiance time.
- ✓ Only use soft cloths or sponges to clean the glass surface.
- ✓ Only use clean water as the cleaning solvent.
- ✓ The difference between water temperature and module temperature should be in the range of -5°C to +10°C.
- ✓ Water pressure should be less than 1000 Pa.

b) following notes should be taken into account:

- ✓ No other chemical should be used in cleaning process.
- ✓ No aggressive tools or coarse cleaning materials are permitted.
- ✓ Do not step or walk on the Modules.
- ✓ Do not strike Modules or subject Modules to impact with tools or objects

- √ Isolate modules during cleaning and maintenance, the modules must not be under load.
- √ Do not touch exposed cables or connectors.
- √ Do not remove dust in dry way (without water).

9. CLEANING

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 all PV modules clean.

Clean PV modules when the irradiance is below 200W/m²; liquid with a large temperature difference from the modules must not be used for cleaning the modules; It is forbidden to clean PV modules under the weather conditions of wind more than 4 grades, heavy rain or heavy snow; When cleaning with pressurized water, the water pressure on the glass surface of the module must not exceed 700 KPa (14619.80psf); the module must Not bear the extra force;When cleaning PV modules, do NOT step on the modules; do NOT spray water on the backside of the module or the cables; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do NOT use as steam cleaner;

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.

Periodically trim any vegetation which may shade the solar array thus impacting performance. 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;

If there is 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.

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.

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

Measure & record the inverter feed in current from that string Clean all modules in the string Measure the inverter feed in current again and calculate the % improvement from cleaning.

1. REQUIREMENTS FOR WATER QUALITY

- √ PH: 5 ~7;
- √ Chloride and Salinity : 0 - 3,000 mg/L

- √ Turbidity : 0-30 NTU
- √ Conductivity : 1500~3000 μs/cm
- √ Total dissolved solids (TDS): ≤1000 mg/L
- √ Water Hardness—calcium and magnesium ions : 0-40 mg/L
- √ Non-alkaline water must be used; demineralized water shall be used if the condition permits.

2. MODULE INSPECTION AFTER CLEANING

Ensure that the module under visual inspection is clean, bright and free of stains; Spot check to verify whether there is soot deposit on the module surface; Check to see there are no visible scratches on the surface of the module; Check to see there are no man-made cracks are on the module surface; Check to see whether the wiring terminals of the module are detached; After cleaning PV modules, fill out the PV module cleaning record.

10. Annual Inspection

1. Check if nuts, bolts of mounting structure are secure and not loose. Tighten the loose components again, if required.
2. Check the connecting cables, grounding cables and connectors and the performance of the ground resistance.
3. Check all electrical and mechanical connections for freedom from corrosion.
4. Check the ground resistance of metal parts such as the module frames and the mounting structures.

11. Applicable Law and Dispute Settlement

This “**Installation & Maintenance for PV Modules**” shall be governed by and interpreted under the laws of Hong Kong (irrespective of its choice of law principles).Except for the technical disputes, all disputes arising out of or in connection with this “**Installation & Maintenance for PV Modules**” shall, unless amicably settled between the parties, shall be settled by arbitration in Hong Kong under the Hong Kong International Arbitration Centre Administered Arbitration Rules in force when the Notice of Arbitration is submitted in accordance with these Rules. The language of arbitration shall be English. The award of the Arbitrators will be final and binding upon the Parties. Provided that there is any inconsistency between the sale’s contracts to which this “**Installation & Maintenance for PV Modules**” is attached, the terms and conditions of the sales contract shall prevail

This document constitutes part of the contract and valid automatically when the contract is signed.