

HELIENE

PHOTOVOLTAIC MODULES

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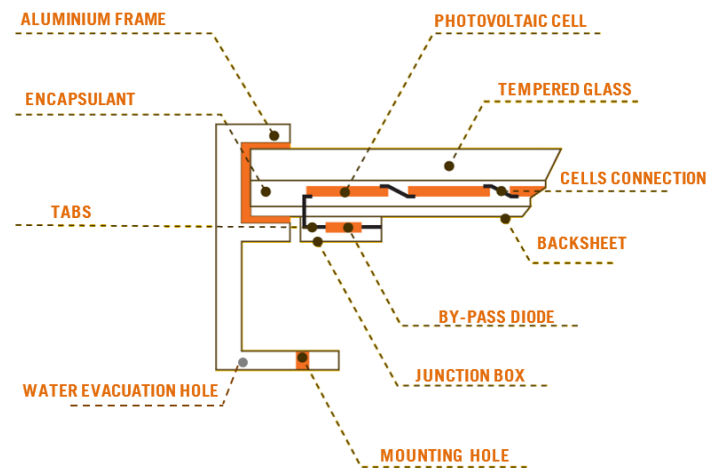
1. Introduction for this User Manual

This Manual contains information regarding the installation, maintenance and use of the series solar modules manufactured by Heliene Inc. All instructions should be read and understood before attempting installation. Failure to follow these safety instructions could result in personal injury or property damage. Installation and operation of solar modules require specialized skills, and only professional personnel can engage in the work. The term “Module” Or “PV module” in this Manual refers to one or more series solar modules. Please keep this Manual in a safe place for future reference.

2. General

Heliene Solar Modules includes the latest technology of mono-crystalline and multi-crystalline solar cells designed and manufactured by industry leading suppliers. The absorption surface and innovative design provide a world class power output and an unmatched aesthetic presence.

- Ordinary Location Modules comes with a permanently attached junction box and #12 AWG (4 mm²) wire terminated in PV Multi-Contact (MC4 type) connectors.
- Hazardous Location Modules (Class I Division 2) comes with a permanently attached junction box that requires field assembly according to local code since cables, glands or connectors are not included. Exercise caution when wiring or handling modules exposed to sunlight.
- Photovoltaic solar modules convert light energy to direct-current electrical energy, and are designed for outdoor use. Proper design of support structures is the responsibility of the system designer and installer.



CROSS-SECTION OF A MODULE IDENTIFYING BASIC COMPOSITION.

2.1 Applicable Products

This document is applicable to the series of solar modules as listed below:

36 Cell Mono (Max. Power Range: 165 – 185W)

60 Cell Mono (Max. Power Range: 285 – 305W)

36 Cell Poly (Max. Power Range: 145 – 160W)

60 Cell Poly (Max. Power Range: 250 – 270W)

72 Cell Mono (Max. Power Range: 340 – 370W)

96 Cell Mono (Max. Power Range: 460 – 490W)

72 Cell Poly (Max. Power Range: 310 – 340W)

96 Cell Poly (Max. Power Range: 415 – 430W)

Make sure the installation of modules is within the maximum permitted system voltage and rating current.

3. Module Specification

Electrical Values

The rated electrical values at Standard Test Conditions (STC) of Heliene Modules can be found in the table below. The Electrical characteristics are within +/- 10% of the indicated values of I_{SC} , V_{OC} , and P_{MAX} under STC (irradiance of 1000W/m², AM 1.5 spectrum, and a cell temperature of 25°C (77°F)).

36M

Peak Rated Power	P _{mpp} (W)	185	180	175	170
Maximum Power Voltage	V _{mpp} (V)	20.2	19.62	19.2	18.93
Maximum Power Current	I _{mpp} (A)	9.43	9.3	9.22	9.11
Open Circuit Voltage	V _{oc} (V)	23.87	23.79	23.4	23.29
Short Circuit Current	I _{sc} (A)	9.77	9.74	9.63	9.5
Module Efficiency	Eff (%)	18.50	18	17.5	17
Maximum Fuse Rating	MF (A)	20	20	20	20
Power Output Tolerance		[- 0 , + 4.99] Wp			

36P

Peak Rated Power	P _{mpp} (W)	160	155	150	145
Maximum Power Voltage	V _{mpp} (V)	19.00	18.73	18.46	18.19
Maximum Power Current	I _{mpp} (A)	8.59	8.43	8.27	8.11
Open Circuit Voltage	V _{oc} (V)	22.77	22.49	22.21	21.93
Short Circuit Current	I _{sc} (A)	9.26	9.10	8.94	8.78
Module Efficiency *	Eff (%)	16.0	15.5	15.0	14.5
Maximum Fuse Rating	MF (A)	15	15	15	15
Power Output Tolerance		[- 0 , + 4.99] Wp			

60M

Peak Rated Power	P _{mpp} (W)	305	300	295	290	285
Maximum Power Voltage	V _{mpp} (V)	33.44	33.14	32.84	32.537	32.236
Maximum Power Current	I _{mpp} (A)	9.196	9.127	9.06	8.989	8.92
Open Circuit Voltage	V _{oc} (V)	39.981	39.83	39.68	39.528	39.38
Short Circuit Current	I _{sc} (A)	9.673	9.59	9.51	9.424	9.34
Module Efficiency *	Eff (%)	18.9	18.6	18.3	18.0	17.7
Maximum Series Fuse Rating	MF (A)	20	15	15	15	15
Power Output Tolerance		[- 0 , + 4.99] Wp				

60P

Peak Rated Power	P _{mpp} (W)	270	265	260	255	250
Maximum Power Voltage	V _{mpp} (V)	31.317	31.011	30.705	30.395	30.089
Maximum Power Current	I _{mpp} (A)	8.713	8.636	8.561	8.483	8.408
Open Circuit Voltage	V _{oc} (V)	38.399	38.199	37.999	37.799	37.599
Short Circuit Current	I _{sc} (A)	9.162	9.077	8.996	8.914	8.830
Module Efficiency *	Eff (%)	16.8	16.5	16.2	15.9	15.6
Maximum Series Fuse Rating	MF (A)	15	15	15	15	15
Power Output Tolerance		[- 0 , + 4.99] Wp				

72M

Peak Rated Power	P _{mpp} (W)	370	360	350	345	340
Maximum Power Voltage	V _{mpp} (V)	40.233	39.713	39.133	38.843	38.503
Maximum Power Current	I _{mpp} (A)	9.26	9.13	9.01	8.95	8.90
Open Circuit Voltage	V _{oc} (V)	48.66	48.10	47.54	47.26	46.95
Short Circuit Current	I _{sc} (A)	9.77	9.71	9.65	9.57	9.49
Module Efficiency *	Eff (%)	19.3	18.8	18.3	18.0	17.8
Maximum Series Fuse Rating	MF (A)	20	20	20	15	15
Power Output Tolerance		[- 0 , + 4.99] Wp				

72P

Peak Rated Power	P _{mpp} (W)	330	325	320	315	310
Maximum Power Voltage	V _{mpp} (V)	37.54	37.42	37.40	37.33	37.20
Maximum Power Current	I _{mpp} (A)	8.85	8.745	8.64	8.50	8.40
Open Circuit Voltage	V _{oc} (V)	46.26	46.11	45.96	45.81	45.66
Short Circuit Current	I _{sc} (A)	9.13	9.05	8.97	8.89	8.81
Module Efficiency *	Eff (%)	17.3	17.0	16.7	16.5	16.2
Maximum Series Fuse Rating	MF (A)	15	15	15	15	15
Power Output Tolerance		[- 0 , + 4.99] Wp				

96M

Peak Rated Power	P _{mpp} (W)	490	480	470	465	460
Maximum Power Voltage	V _{mpp} (V)	52.664	52.262	51.860	51.659	51.458
Maximum Power Current	I _{mpp} (A)	9.359	9.235	9.111	9.049	8.987
Open Circuit Voltage	V _{oc} (V)	62.985	62.587	62.189	61.990	61.791
Short Circuit Current	I _{sc} (A)	10.056	9.91	9.764	9.691	9.618
Module Efficiency *	Eff (%)	19.3	18.9	18.5	18.3	18.1
Maximum Series Fuse Rating	MF (A)	20	20	20	20	20
Power Output Tolerance		[- 0 , + 4.99] Wp				

96P

Peak Rated Power	P _{mpp} (W)	430	425	420	415
Maximum Power Voltage	V _{mpp} (V)	50.320	50.140	49.960	49.800
Maximum Power Current	I _{mpp} (A)	8.594	8.529	8.464	8.389
Open Circuit Voltage	V _{oc} (V)	61.655	61.585	61.515	61.440
Short Circuit Current	I _{sc} (A)	9.065	8.995	8.925	8.855
Module Efficiency *	Eff (%)	17.0	16.8	16.6	16.4
Maximum Series Fuse Rating	MF (A)	15	15	15	15
Power Output Tolerance		[- 0 , + 4.99] Wp			

4. Safety Precaution

4.1 Warnings:

Before unpacking, installing, wiring, operating or maintaining Heliene Modules, responsible personnel should read and understand all safety precautions. Each module produces a continuous current (DC) when exposed to sunlight or other light source. Contact with any of the electrically active parts, such as terminals of the modules, can result in injury or death whether module is connected or not.

Warning – Explosion Hazard – Do not disconnect while circuit is alive unless area is known to be non-hazardous. Please refer to the all applicable electrical safety code for additional information.

4.2 General Safety

- All installation work must comply with the local codes and relevant international electrical standards.
- PV module installation should be conducted by certified personnel in electrical and PC system installation. Operation by personnel who are not familiar with the relevant safety will result in dangerous scenarios.
- Do Not attempt to connect or disconnect the modules when it is energized or in the presence of flammable substances.
- Do Not concentrate/focus light source on the module as this will result in damage of cells.
- Do Not disassemble a module or remove any of its parts.
- Do Not install modules with broken glasses or damaged backsheet.
- The module must not be immersed or continuously exposed to water.

4.3 Handling Safety

- Do Not walk or stand on the module as this will result in broken glasses.
- Do Not drop PV modules, or put heavy object on the PV module as this will result in broken glasses.
- Do Not damage or scratch the modules' glasses or backsheet.
- Do Not bend the output cable as this might result in damage of insulation, thus leading to electricity leakage or shock.
- Avoid installing/handling modules in wet/high wind environment. The modules should be stored in a dry and temperature controlled place prior to their installation, also in a well-balanced position always.
- It is recommended to install modules under low intensity of irradiance, because of the voltage being produced in the form of current always continues as long as the unit is illuminated.

5. Précautions de Sécurité

5.1 Avertissements:

Avant de débarrasser, installer, câbler, utiliser ou entretenir les modules Heliene, le personnel responsable doit lire et comprendre toutes les précautions de sécurité. Chaque module produit un courant continu (CC) lorsqu'il est exposé au soleil ou à une autre source de lumière. Le contact avec l'une des pièces électriquement actives, telles que les bornes des modules, peut entraîner des blessures ou la mort du module météorologique connecté ou non.

Avertissement – Risque d'explosion. Ne pas débrancher tant que le circuit est sous tension, à moins qu'il ne s'agisse d'un emplacement non dangereux.

Veillez vous reporter au code de sécurité électrique applicable pour plus d'informations.

5.2 Sécurité générale

- Tous les installations doivent être conformes aux codes locaux et aux normes électriques internationales en vigueur.
- L'installation des modules PV doit être effectuée par le personnel certifié en installations électriques et systèmes PC. L'utilisation par le personnel qui n'est pas familiarisé avec la sécurité pertinente entraînera des scénarios dangereux.
- N'essayez pas de connecter ou de déconnecter les modules lorsqu'il est sous tension ou en présence de substances inflammables.
- Ne concentrez pas la source de lumière sur le module car cela endommagerait les cellules.
- Ne démontez pas un module et ne retirez aucune de ses pièces.
- N'installez pas de modules avec des lunettes cassées ou une feuille de fond endommagée.
- Le module ne doit pas être immergé ni exposé en permanence à l'eau.

5.3 Sécurité de manutention

- Ne marchez pas et ne vous tenez pas sur le module car cela pourrait briser la vitre.
- Ne laissez pas tomber les modules PV ou ne posez pas d'objet lourd sur le module PV car cela pourrait briser les vitres.
- Ne pas endommager ni rayer la vitre ou la feuille de fond des modules.
- Ne courbez pas le câble de sortie car cela pourrait endommager l'isolation et entraîner une fuite d'électricité ou un choc électrique.
- Évitez d'installer / de manipuler des modules dans un environnement humide / très venteux. Les modules doivent être stockés dans un endroit sec et à température contrôlée avant leur installation, également toujours dans une position bien équilibrée.
- Il est recommandé d'installer des modules sous un éclairage énergétique de faible intensité, car la tension produite sous la forme d'un courant continu toujours tant que l'unité est allumée.

6. Transport/Unpack/Storage of PV Modules

6.1 Transportation and General Rules

- Heliene recommend the modules be stored in its original packaging strapped to pallets until they reach the destination of installation site.
- Do not remove any strapping or packaging materials if the modules require secondary transportation/long-term storage.
- Do Not transport modules in an upright position, only transport them in box strapped to pallet as supplied by Heliene Inc. on a level surface.
- Load and Unload with a forklift avoiding hitting, banding, dropping or damage to the packaging.
- Always keep electrical contacts clean and dry.
- Do not Stand, Step on, Walk or Jump on the Modules.
- Always set the modules onto surfaces bigger than the module perimeter size, as module weight must sit on the aluminum frame ONLY. Please refer Dimensions of the module in Heliene Modules' Specification Sheet.

6.2 Unpacking

- Before unpacking, have module box in a level, dry area, free of excessive dust, debris. Read the unpacking instructions carefully and follow the steps accordingly. This process requires two people minimum.
- Cut the straps with blade or scissors, remove box top vertically and lift it over to the side.
- Be carefully when removing the packaging, do not scratch the frame or glass.
- Remove modules with two hands at each side, each person lifting on opposite ends. Never lift by Junction Box Cables or Box.
- Never leave a module unsupported or lean it on the mounting posts.
- If there are modules left in the box after unpacking, the remaining modules shall be repackaged to prevent from external damages. 26 modules maximum per pallet.

6.3 Storage

- Store pallets of modules on a levelled surface, in a dry and ventilated room.
- Pallet are not weatherproof and modules are not meant to be exposed to weather element until completely unpackaged.
- Store modules where there is not any potential of falling objects onto modules.
- Stack only 2 boxes/pallets high at maximum, and never put any other materials on top of them.

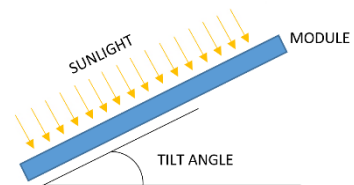
7. Installation Requirements

7.1 Site Selection and Preparation

- To maximize the power output, it is recommended to install PV modules at an optimized tilt angle. The module must be facing towards the equator for optimum performance. Refer to standard solar photovoltaic installation guides and incorporate other local requirements.
- The module should not be shaded at any time of the day. Try to install the modules in a site where there is rare shading throughout the year to minimize the chances of shading.
- Never install the modules near the location/equipment where flammable gasses are generated.

7.2 Module Tilt-Angle

The tilt angle of the PV module is measured between the PV module and a Horizontal ground surface. For different location or projects there are different mounting angles, for maximum power output it is the best for PV modules to face the sun directly. Ensure to comply with local regulations or follow recommendations of experienced PV module installers.



7.3 Installation Method

7.3.1 General

- The module is considered to be in compliance with UL 1703 only when the module is mounted in the manner specified by the mounting instructions below.
- A module with exposed conductive parts is considered to be in compliance with UL 1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code.
- Any module without a frame (laminated) shall not be considered to comply with the requirements of UL 1703 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field inspection certifying that the installed module complies with the requirements of UL 1703.
- Installation must comply with All local building codes. The Mounting Design must be certified in the USA and Canada by a registered professional engineer. Also mounting design and procedure shall comply with local codes and all authorities having jurisdiction.
- Tools used to connect the modules must comply with all applicable electrical safety regulations. They must be dry and have the correct level of insulation.

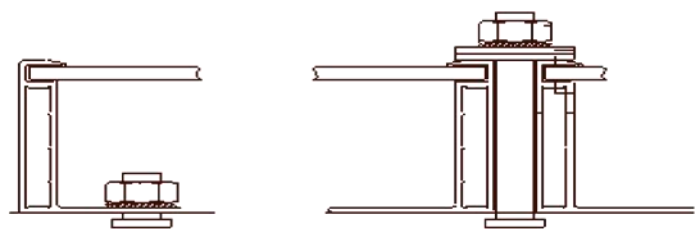
7.3.2 Mechanical Mounting Instructions

- Using a torque wrench for installation (Torque to amount specified by professional engineer). Please follow instructions below for methods of fastening a module to a support structure.
- Modules shall be bolted or clamped to support racking with spans and overhangs less than the allowable in the table below. Any additional mounting outside of these limits without **Written Approval** from Heliene Inc. will void the Warranty by doing so.

	UL Design Rating 30 lbs/ft ²		UL Design Rating 50 lbs/ft ²		UL Design Rating 70 lbs/ft ²	
	<=2400Pa (50.1 lbs/ft ²)		<=3590Pa (75 lbs/ft ²)		<=5400Pa (112.8 lbs/ft ²)	
Module Size	overhang	span	overhang	span	overhang	span
36M/36P	<=402mm	<=1450mm	<=402mm	<=1380mm	<=402mm	<=1180mm
60M/60P	<=402mm	<=1600mm	<=402mm	<=1380mm	<=402mm	<=1180mm
72M/72P	<=402mm	<=1906mm	<=402mm	<=1380mm	<=402mm	<=1180mm
96M/96P	<=402mm	<=1906mm	<=402mm	<=1380mm	<=402mm	<=1250mm

For Clamping Racking System:

- Each clamp must have a minimum 5mm x 25mm surface clamping onto top surface from the side.
- If the clamps are being used to support two modules (at corner of each), it must have a minimum of 25mm on each module frame surface.



- Use at minimum 4 clamps to attached modules to the mounting rails.
- Frames must not be deformed by modules clamps, also clamps should not come into contact with the glass.

For Rooftop installation:

- Ensure to comply with all local building codes.
- Freestanding modules turn a Class B rooftop into a Class C rooftop.
- Use appropriate corrosion-proof fastening materials.
- Top or Bottom clamping methods will vary and are dependent on the mounting structures.
- Follow mounting guidelines recommended by the PV racking Suppliers.

7.3.3 Electrical Installation

- All wiring should be performed by registered installer and comply with local codes & regulations.
- The wiring must ensure that the loss of nominal voltage is less than 2%, it is recommended to maintain this loss around 1% of the nominal power.
- Heliene modules are provided with stranded copper cables – with exception of Class I Division 2 (CID2) products.
- The maximum voltage of the system must be less than the maximum certified voltage, the maximum input voltage of the inverter and the other electrical devices installed in the system. Heliene’s modules are rated from 600V ~ 1500V, please check your specification sheet and ask your manufacturer for confirmation.
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. The requirements of the National Electrical Code (NEC) in Article 690 shall be followed to address these increased outputs. In installations not under the requirements of the NEC, the values of I_{SC} and V_{OC} marked on this module should be multiplied by a factor of **1.25** when determining component voltage ratings, conductor ampacities, overcurrent device ratings, and size of controls connected to the PV output.
- For CID2 rated modules, glands and cables are not provided with the product, wiring methods shall be per the CEC, NEC and/or applicable local codes. All cable fittings shall be suitable for hazardous locations and environmental applications.

Wiring

- PV modules that are connected in series should have similar current, and PV modules that are connected in parallel should have similar voltage. The number of modules in series and in parallel shall be designed reasonable according to the system configuration.
- All Heliene modules contains installed bypass diodes, if the modules are incorrectly connected to each other this will result in damage of bypass diodes, cables or junction boxes.

Class I Division 2 Field Wiring:

To connect the modules, remove the knockout plugs on the junction box and install $\frac{3}{4}$ inch cable glands fittings (torque to 33 in-lb) suitable for hazardous locations and environmental applications. Wires can then be connected to the positive and negative screw terminals. These terminals are identified by a positive and negative sticker. Make sure to use the screw terminals that are not holding bypass diodes.

The recommended rating for wiring connections is 6 mm² and never less than 4 mm², 10 AWG recommended and never less than 12 AWG. Only use cable listed by UL4703 PV wire, 90°C thermal insulated in accordance with all the local fire, building and electrical codes.

Module connectors

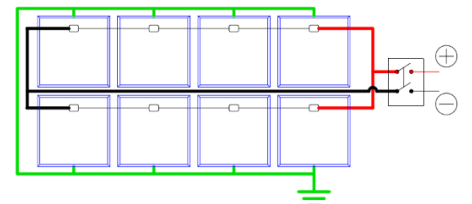
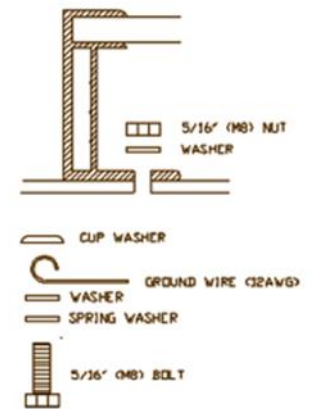
Brand	Model	Physical Appearance		Website
600V				
Multi-Contact	PV-KBT4/6LL (Male) PV-KST4/6LL (Female)			http://ec.staubli.com
Lumberg	LC4-CP30 (Female) LC4-CP31 (Male)			http://www.lumberg.com
1000V				
Zhejiang Jiaming Tianheyuan Photovoltaic Technology (JMTHY)	PV-JM601			http://en.jmthy.com
1500V				
Zhejiang Jiaming Tianheyuan Photovoltaic Technology (JMTHY)	PV-JM608			http://en.jmthy.com
Zhejiang Jiaming Tianheyuan Photovoltaic Technology (JMTHY)	PV-JM601A			http://en.jmthy.com
Taizhou Jinxiu	LIQ-1A-F/M			http://www.tzjinxiu.com
QC Solar (Suzhou) Corp.	QC 4.10			http://www.qc-solar.com/
Zhejiang ZhongHuan Sunter PV Technology Co LTD	PV-ZH202			http://www.pvzh.com
Zhejiang ZhongHuan Sunter PV Technology Co LTD	PV-ZH202B			http://www.pvzh.com



Grounding

- All module frames and mounting racks must be accordance with CEC, NEC and applicable local codes.
- It is recommended that modules be grounded. For grid connected modules in U.S and Canada: All PV modules must be grounded by electrical connection from the module frames to the ground. A UL-listed grounding lug or UL approved clamp is to be used.
- Connect modules frames to each other using cables with cable lugs. All connections on the conductive connection must be fixed. Metal containing iron in the conductive connection should be treated against corrosion and rusting.
- Another method is to ground the frame of the module to racking structure in accordance with NEC.
- Self-Tapping screw (10 x 3/4 size) can be used to attach a wire terminal loop to one of the 4mm Grounding Holes. Also Grounding connections using spikes into the surface clamping point (IE. WEEB) which are UL approved permitted.
- A UL-Listed grounding lug may be used if the mounting holes are not used for mounting (ie. Clamps. 9mm (0.354") diameter mounting/grounding hole accept M8-5/16" bolts onto the module frame).
- Where common grounding hardware (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 grounding devices and should be used only for maintaining mechanical connections and holding electrical grounding devices in the proper position for electrical conductivity. Such devices, where supplied with the module and evaluated through the requirements in UL 1703, may be used for grounding connections in accordance with the instructions provided with the module.

Ground using a bolt and nut and wire



Example of Connecting in parallel after connected in series & Grounding

7.4 Fire Rating

- The Fire Rating of this module is valid only when mounted in the manner specified in the "6.2.2 Mechanical Mounting Instructions". Heliene Inc. Modules are certified to Class C Fire rating.
- When installing the modules, please ensure the assembly is mounted over a fire resistant roof covering rated for the application and required a slope less than 5 in/ft (127mm/305mm) to maintain fire class rating.
- The Fire rating of the module is valid only when mounted in the manner specified in the mechanical mounting instructions.

7.5 Maintenance

- Visual inspection should be done on the PV array regularly for damages on glass, cable and junction box. As this will result in operation/performance and safety problems.
- Clean PV modules will improve the optical performance. It is recommended this process being done when irradiance is below 200W/m². Use clean water with low calcium concentration without any detergents or abrasives. Do not scratch the glass through the process, also it is recommended to use similar temperature liquid so thermal shock on the glass could be avoided.
- Test the wiring and connection at least once year, including the integrity and waterproof of all the parts that make up the wiring and connections. This process should be done by qualified personnel duly trained and equipped for the job.
- No serviceable parts within the PV module assembly. Consult Heliene Inc.

7.6 Warranty

- If your installation does not work properly, please inform your installer immediately. Qualified professionals should be advised to avoid any electrical shock or loss of life due to high voltage of the array.
- If you need necessary replacement in the event of accelerated deterioration of the module, please go to: <https://www.heliene.com/contact> to fill out your RMA Submission/Warranty Inquiry, a responsible personnel will reach out to you within 48 hrs.

8. Disclaimer

Heliene 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.

9. Limitation of Liability

Heliene Inc. disclaim any liability for (including but not limited to) breakage, deterioration, loss of performance, system installation error, and personnel injury or property loss resulted from failure to follow the instruction in this Manual.