Photowatt®

INSTALLATION MANUAL FOR STANDARD MODULES

For professional use only

INDEX

1.0
GENERAL INFORMATION

This general manual provides important safety information relating to the installation, maintenance and handling of PW-series solar modules.

Professional installer must read these guidelines carefully and strictly follow these instructions. Failure to follow these instructions may result in death, injury or property damage. The installation and handling of PV modules requires professional skills and should only be performed by qualified professionals. The installers must inform end-users (consumers) the aforesaid information accordingly. The word «module» or «PV module» used in this manual refers to one or more solar modules.

This manual is only valid for the standard module types PW72HT-C, PW60HT-CP, PW72LHT-C, PW60LHT-C, PW78LHT-C, PW60MAX-C and PW66MAX-C.

Please retain this manual for future reference. We recommend checking www.photowatt.com regularly for the most updated version.

1.1
INSTALLATION MANUAL DISCLAIMER

The information contained in this manual is subject to change by EDF ENR PWT without prior notice. EDF ENR PWT gives no warranty of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein.
In the event of any inconsistency among different language versions of this document, the English version shall prevail. Please refer to our product lists and documents published on our website at www.photowatt.com as these lists are updated on a regular basis.

1.2
LIMITATION OF LIABILITY

EDF ENR PWT shall not be held responsible for damages of any kind, including – without limitation – bodily harm, injury or damage to property, in connection with handling PV modules, system installation, or compliance or non-compliance with the instructions set forth in this manual.

2.0
SAFETY PRECAUTIONS

Warning: Before attempting to install, wire, operate and / or service the module and other electrical equipment, all instructions should be read and understood. PV module connectors pass direct current (DC) when exposed to sunlight or other light sources. Contact with electrically active parts of the module, such as terminals, can result in injury or death, irrespective of whether or not the module and the other electrical equipment have been connected.

GENERAL SAFETY

All modules must be installed by licensed electricians in accordance to the applicable electrical codes such as, the latest National Electrical Code (USA) or Canadian Electric Code (Canada) or other national or international applicable electrical codes.

Protective clothing (non-slip gloves, clothes, etc.) must be worn during installation to prevent direct contact with 30 V DC or greater, and to protect hands from sharp edges.

Prior to installation, remove all metallic jewelry to prevent accidental exposure to live circuits.

When installing modules in light rain, morning dew, take appropriate measures to prevent water ingress into the connector

Do not allow children or unauthorized persons near the installation site or storage area of modules

- Do not install modules in strong wind.
- Use electrically insulated tools to reduce the risk of electric shock.
- If the disconnects and Over Current Protection Device (OCPD)'s cannot be opened or the inverter cannot be powered down, cover the fronts of the modules in the PV array with an opaque material to stop the production of electricity when installing or working on a module or wiring.
- Do not use or install damaged modules.
- Contact with module surfaces or frames may cause electric shock if the front glass is broken or the backsheet is torn.
- The PV module does not contain any serviceable parts. Do not attempt to repair any part of the module.
- Keep the junction box cover closed at all times.
- Do not disassemble a module or remove any module part.
- Do not artificially concentrate sunlight on a module.
- Do not connect or disconnect modules when current from the modules or an external source is present.

3.0
MECHANICAL / ELECTRICAL SPECIFICATIONS

Module electrical ratings are measured under Standard Test Conditions (STC) of 1000 W/m2 irradiance, with an AM1.5 spectrum, and a cell temperature of 25°C. Detailed electrical and mechanical characteristics of EDF ENR PWT crystalline silicon PV modules can be found on **www.photowatt.com.** Main electrical characteristics at STC are also stated on each module label. Please refer to the datasheet or the product nameplate for the maximum system voltage.

Under certain conditions, a module may produce more current or voltage than under its Standard Test Condition's rated power. As a result, the module short-circuit current under STC should be multiplied by 1.25, and a correction factor should be applied to the open-circuit voltage (see Table 1 below), when determining component ratings and capacities. Depending on your local regulations, an additional 1.25 multiplier for the short-circuit current (giving a total multiplier of 1.56) may be applicable when sizing conductors and fuses.

TABLE 1. LOW TEMPERATURE CORRECTION FACTORS FOR OPEN-CIRCUIT VOLTAGE

Lowest Expected Ambient Temperature (°C/°F)	Corrector Factor
24 to 20 / 76 to 68	1.02
19 to 15 / 67 to 59	1.04
14 to 10 / 58 to 50	1.06
9 to 5 / 49 to 41	1.08
4 to 0 / 40 to 32 -1 to -5 / 31 to 23	1.10 1.12
-6 to -10 / 22 to 14	1.14
-11 to -15 / 13 to 5	1.16
-16 to -20 / 4 to -4	1.18
-21 to -25 / -5 to -13	1.20
-26 to -30 / -14 to -22	1.21
-31 to -35 / -23 to -31	1.23
-36 to -40 / -32 to -40	1.25

Alternatively, a more accurate correction factor for the open-circuit voltage can be calculated using the following formula :

$$C_{VOC} = 1-\alpha_{VOC} x\ (25 - T)$$

T is the lowest expected ambient temperature at the system installation site.

α_{VOC} (%/°C) is the voltage temperature coefficient of the selected module (refer to corresponding datasheet).
Electrical calculations and design must be performed by competent engineer or consultant.

Please contact EDF ENR PWT's technical support team for additional information pertaining to engineering optimization and approval of project specific module string lengths.

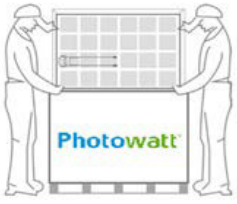
4.0
UNPACKING AND STORAGE
PRECAUTIONS

- Modules should be stored in a dry and ventilated environment to avoid direct sunlight and moisture. If modules are stored in an uncontrolled environment, the storage time should be less than 3 months and extra precautions should be taken to prevent connectors from being exposed to moisture or sunlight, like using connector endcaps. In any circumstance, for pallets of modules packaged in landscape orientation, stacking of no more than two layers is allowed, for pallets of modules packaged in portrait orientation, stacking is not allowed.

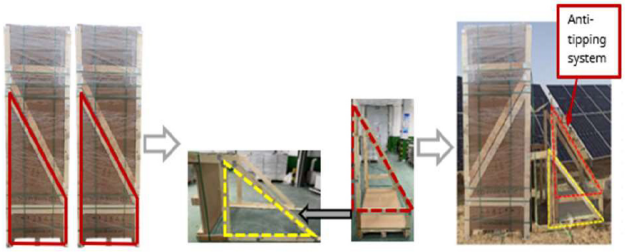
- When unloading module pallets from a flatbed truck, please use a crane or forklift to remove the module pallets. When unloading pallets of modules from containers, please use a forklift to remove the module pallets and the forklift should be close to the ground in order to avoid the top of module pallets touching the top of the cabinet door. For unloading PW66MAX-C and PW60MAX-C modules, the thickness of the forklift tines should be less than 75mm, the length of the forklift tines should be more than 1250mm and the width of the forklift tines should be more than 600mm (from the middle to the middle of the forklift teeth). Consult your EDF ENR PWT representative for more detailed unloading instructions.

- Unpack module pallets carefully, following the steps shown on the pallet. Unpack, transport and store the modules with care.

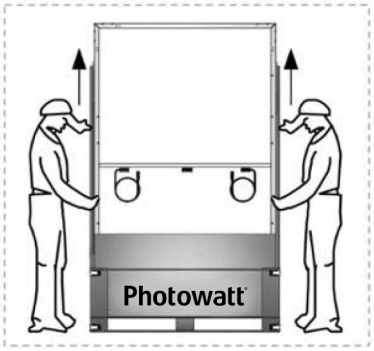
- Modules must always be unpacked and installed by two or three people. Always use both hands when handling modules.



For modules vertically packed lying on the short side (PW60MAX-C et PW66MAX-C), it is recommended to support the unpacked modules by one person during the unpacking process. Please use an anti-tipping structure that can be built with the pallet's own wooden frame according to the instructions below:



- During unpacking, the unpacked modules should be properly fixed. After unpacking, it is recommended to place the remaining modules in the pallet shall be placed horizontally on a pallet not exceeding the total number 12 of in one stack. Visit our website or contact your EDF ENR PWT representative for more detailed unpacking requirements.



- Do not lift modules by their wires or junction box, lift them by the frame.

- Do not allow the panels to sag or bow under their own weight when being carried.

- Stacks of modules should contain no more than 12 modules, and the frames should be aligned.

- Do not place excessive loads on the module or twist the module frame.

- Do not stand, step, walk and / or jump on modules under any circumstances. Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability and void EDF ENR PWT's warranty.

- Do not leave the module backsheet directly in contact with the support structure underneath when handling or installing the module.
- Do not carry modules on your head.
- Do not drop or place objects (such as tools) on the modules.
- Do not use sharp instruments on the modules. Particular care should be taken to avoid module backsheets being damaged by sharp objects, as scratches may directly affect product safety.
- Do not leave modules unsupported or unsecured.
- Do not change the wiring of bypass diodes.
- Keep all electrical contacts clean and dry at all times.
- Do not expose the modules and its electrical contacts (junction boxes, connectors) to any unauthorized chemical substance (e.g. oil, lubricant, pesticide, petrol, white flower oil, activating collaterals oil, mold temperature oil, machine oil (such as KV46), grease (such as Molykote EM-SOL, etc.), lubricating oil, antirust oil, stamping oil, butter cooking oil, propyl alcohol, ethyl alcohol, essential oil, bone-setting water, Tianna water, mold release agent (such as Pelicoat S-6, etc.), glue and potting glue that can generate oxime gas (such as KE200, CX-200, Chemlok, etc.), TBP (plasticizer), cleaning agents, pesticide, paint strippers, adhesives, antirust agent, disincrustant, emulsifying agent, cutting oils and cosmetics, etc.) as modules may incur damages. Please contact your EDF ENR PWT representative for more detailed requirements.

PRODUCT IDENTIFICATION

Each module has three identical barcodes (one in the laminate under the front glass, the second on the rear side of the module and the third on the frame) that act as a unique identifier. Each module has a unique serial number containing 14 digits or 16 digits.

A nameplate is also affixed to the rear of each module. This nameplate specifies the model type, as well as the main electrical and safety characteristics of the module. It also includes the barcode with the module unique serial number as mentioned above.

5.0 MODULE INSTALLATION

PRECAUTIONARY MEASURES AND GENERAL SAFETY

- Prior to installing modules please obtain information about any requirements and necessary approvals for the site, installation and inspection from the relevant authorities.
- Check applicable building codes to ensure that the construction or structure (roof, facade, support, etc.) can bear the module system load.
- Check applicable building codes to ensure that the construction or structure (roof, facade, support, etc.) can bear the module system load.
- PW-series solar modules have been qualified for Application Class A (equivalent to Safety Class II requirements). Modules rated under this class should be used in systems operating at voltage above 50 V or power above 240 W, where general contact access is anticipated.
- EDF ENR PWT modules have been certified as Type 1 or Type 2 according to IEC 61730-2 for fire class performance, please refer to the datasheet or the product nameplate for the detailed types.
- Consult your local authority for guidelines and requirements for building or structural fire safety.

UL 61703 SYSTEM FIRE RATING REQUIREMENTS

- Photovoltaic systems composed of UL 61730 certified modules mounted on a UL 2703 certified mounting system should be evaluated in combination with roof coverings in accordance with UL 61730 standard, with respect to meeting the same fire classification as the roof assembly.
- Mounting systems with a System Fire Class Rating (Class A, B or C), tested in conjunction with fire rated "Type 1" or "Type 2" rated modules, are considered acceptable for use with EDF ENR PWT modules, provided that the mounting system does not violate any other requirements of this manual.
- Any mounting system limitations on inclination or accessories required to maintain a specific System Fire Class Rating should be clearly specified in the installation instructions and UL 2703 certification of the mounting system supplier.
- When installing modules, assembly is mounted over a fire-resistant roof covering rated for the application.
- The fire rating for this module is only valid when the product is installed as specified in the mechanical mounting instructions.

ENVIRONNEMENTAL CONDITIONS

- PV modules are intended for use in general open-air climates, as defined in IEC 60721-2-1: Classification of environmental conditions Part-2-1: Environmental conditions appearing in nature - Temperature and humidity.

- It is recommended that PV modules are installed in an environmental temperature range of -40°C to + 40°C. For modules operating under such conditions, the 98thpercentile of the module operational temperature must be of 70°C or lower. This environmental temperature range encompasses many locations and installation styles in these locations. Annex B provides the reader with modelled PV module temperature examples, at the 98th-percentile depending on different mounting methods and worldwide locations.

- Please consult the EDF ENR PWT technical support department for more information on the use of modules in special climates, , such as an altitude greater than 2000 m.

Do not install modules near open flames or flammable materials.

Do not immerse modules in water or constantly expose modules to water (either fresh or salt) (i.e. from fountains, sea spray).

- Exposing modules to salt (i.e. marine environments) or sulfur (i.e. sulfur sources, volcanoes) incurs the risk of module corrosion.

NOTICE

- EDF ENR PWT modules have passed salt mist corrosion resistance test according to IEC 61701, but the corrosion may still occur on where the modules frame is connected to the bracket or where the grounding is connected. Should the installation location be near the ocean, EDF ENR PWT recommends stainless steel or aluminum materials be used in the areas with direct contact with the PV modules, and the connection point should be protected with anti-corrosion measures. For more information, pleasecontact EDF ENR PWT technical support team.

INSTALLATION REQUIREMENTS

- Ensure that the module meets the general technical system requirements.

- Ensure that other system components do not damage the module mechanically or electrically.

- Modules can be wired in series to increase voltage or in parallel to increase current. To connect modules in series, connect the cables from the positive terminal of one module to the negative terminal of the next module. To connect in parallel, connect the cables from the positive terminal of one module to the positive terminal on the next module.

- The quantity of bypass diodes in the module's junction box may vary depending on the model series.

- Only connect the quantity of modules that corresponds to the voltage specifications of the inverters used in the system. In addition modules should not be connected together to create a voltage higher than the maximum permitted system voltage stated on the module nameplate, even under the worst local temperature conditions (see Table 1 for the correction coefficients that apply to opencircuit voltage).

- A maximum of two strings can be connected in parallel without the need to incorporate an over- current protection device (fuses, etc.) in series within each string. Three or more strings can be connected in parallel if an appropriate, certified over-current protection device is installed in series within each string. And it shall be ensured in the PV system design that the reverse current of any particular string is lower than the module maximum fuse rating at any circumstances.

- Only modules with similar electrical outputs should be connected in the same string to avoid or minimize mismatch effects in arrays.

- To minimize risk in the event of an indirect lightning strike, avoid forming loops with the wiring when designing the system.

- The recommended maximum series fuse rating is stated in the product's datasheet.

- Modules should be safely fixed to bear all expected loads, including wind and snow loads.

- A minimum clearance of 6.5 mm (0.25 in) between modules is required to allow for thermal expansion of the frames.

- The small drainage holes on the underside of the module must not be blocked.

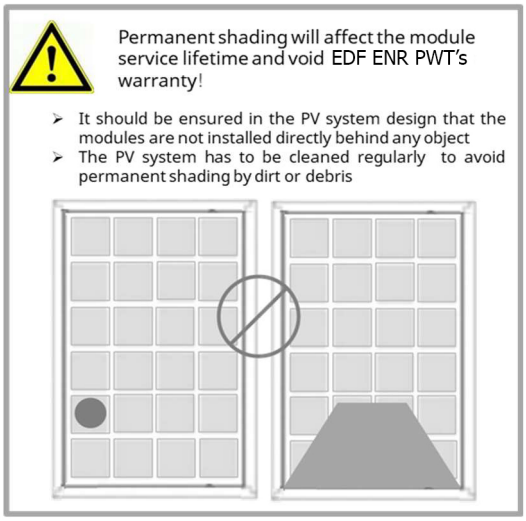
OPTIMUM ORIENTATION AND TILT

To maximize your annual yield, find out the optimum orientation and tilt for PV modules in that specific installation site. The highest yields are achieved when sunlight shines perpendicularly onto the PV modules.

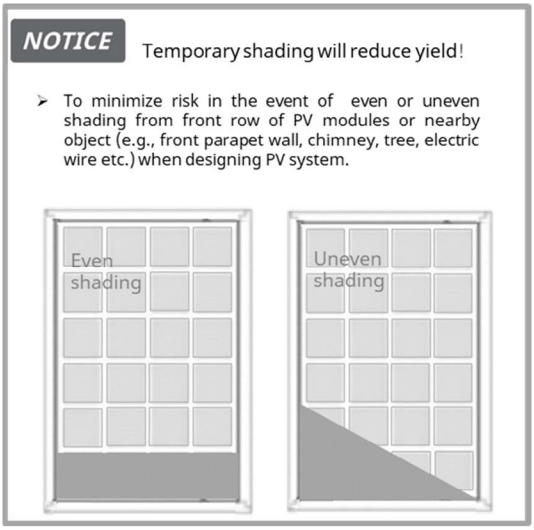
AVOID SHADING

- Modules shall not be permanently shaded (including partial shading, spot shading, even shading or uneven shading) under any circumstance. Permanent shading includes shading of the same cell, cell row, or module portion for extended and repeated periods of time (e.g. more than 200 daylight hours over the warrantied service lifetime). Power dissipated in fully or partially shaded cells will result in power loss, reduced yield and can cause localized overheating, which in turn may negatively impact the module service lifetime. Permanent shading may cause accelerated ageing of the encapsulation material and place thermal stress on the bypass diodes. This would void the module's warranty unless

properly mitigated through the use of Module Level Power Electronic (MLPE) devices.



- Regular maintenance is required to keep modules clean. Particular measures should be taken to avoid permanent shading from dirt or debris (e.g., plants, bird droppings, etc).
- Do not install modules directly behind any object (e.g., tree, antenna, etc) to prevent occurrence of permanent shading.
- Even temporary partial shading will reduce the energy yield. A module can be considered to be unshaded if its entire surface is free from shading all year round, including on the shortest day of the year.



RELIABLE VENTILATION

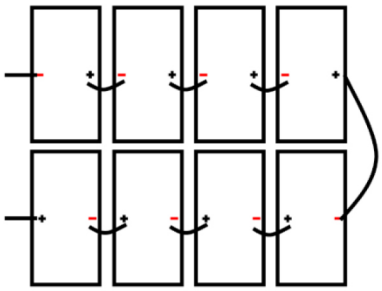
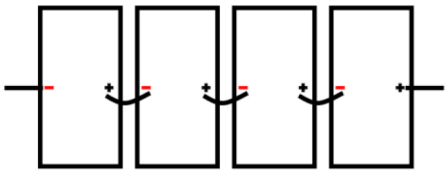
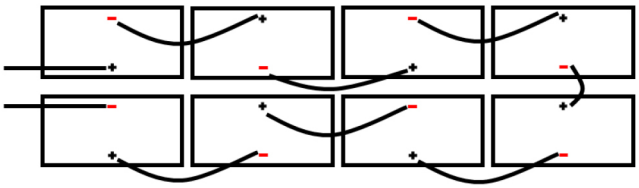
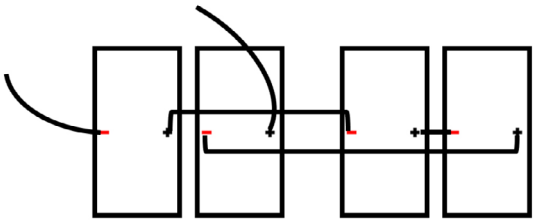
- Sufficient clearance (at least 102 mm (4.02 in)) between the module frame and the mounting surface is required to allow cooling air to circulate around the back of the module. This also allows condensation or moisture to dissipate.
- According to UL 61703, any other specific clearance required for maintaining a system fire rating should prevail. Detailed clearance requirements pertaining to system fire ratings must be provided by your racking supplier.

5.1 MODULE WIRING

CORRECT WIRING SHEME

- Cable management scheme should be reviewed and approved by the EPC contractor, in particular required cable lengths should be cross-checked considering the specificities of the tracker structure like bearing house gaps. If longer cable or additional jumper cables is requested, please contact EDF ENR PWT's sales representative in advance.
- Ensure that the wiring is correct before starting up the system. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, this indicates that there is a wiring fault.
- When modules have been pre-installed but the system has not been connected to the grid yet, each module string should be kept under open-circuit conditions and proper actions should be taken to avoid dust and moisture penetration inside the connectors.
- In case where a cable connection method not included in the below table is used, please confirm the suitable cable length with EDF ENR PWT's sales representative.
- For PW72HT-C, PW60HT-CP, PW72LHT-C and PW60LHT-C series modules, EDF ENR PWT offers optional cable specifications to match various system configurations.
- Please remember that when ordering EDF ENR PWT modules with portrait cables (short cables) extension cables is provided in each pallet.
- Recommended system cable schemes are shown in Table 2 below :

TABLE 2 : SYSTEME CABLE SCHEME FOR PW72HT-C, PW60HT-CP, PW72LHT-C, PW60LHT-C, PW78LHT-C, PW60MAX-C, PW66MAX-C

<table>
<tr><th>Modules Types</th><th>Standard cables</th></tr>
<tr><td rowspan="3">PW60HT-CP,
PW72HT-C,
PW72LHT-C,
PW60LHT-C,
PW78LHT-C,
PW60MAX-C,
PW66MAX-C</td><td> 
Portrait two rows installation
Note: Adjacent two modules (up and down) need to be rotated 180 degrees</td></tr>
<tr><td> 
Portrait one row installation</td></tr>
<tr><td> 
Landscape installation
Note: Adjacent two modules (left to right) need to be rotated 180 degrees</td></tr>
<tr><td>PW72HT-C
PW72LHT-C
PW60LHT-C
PW78LHT-C</td><td> 
Leap-frog</td></tr>
</table>

The maximum distance between two adjacent module frames should be within 50 mm (1.96 in) for the side with mounting clamps, and 25 mm (0.98 in) for the side without mounting clamps, in order to meet the system cable scheme.

CORRECT CONNECTION OF CONNECTORS

- Make sure that all connections are safe and properly mated. The PV connector should not be subjected to stress from the exterior. Connectors should only be used to connect the circuit. They should never be used to turn the circuit on and off.
- Connectors are not waterproof when unmated. When installing modules, connector should be connected to each other as soon as possible or appropriate measures should be taken to avoid moisture and dust penetrating into the connector.
- Do not connect different connectors (manufacturer and type) together.
- Do not clean or precondition the connectors using lubricants or any unauthorized chemical substances.
- If end caps are present on un-mated connectors, carefully remove by hand the end caps before connecting the connectors. Do not use any sharp tool which may damage the connector. The use of tools is not needed.

Positive connector endcap

Negative connector endcap

USE OF SUITABLE MATERIALS

- Only use dedicated solar cable and suitable connectors (wiring should be sheathed in a sunlight-resistant conduit or, if exposed, should be sunlight-resistant itself) that meet local fire, building and electrical regulations. Please ensure that all wiring is in perfect electrical and mechanical condition.
- Installers may only use single-conductor cable listed and labeled as or PV wire which is 90°C wet rated in North America, and single conductor cable with a cross section area of at least 4 mm^2 (12 AWG), 90°C wet rated in other areas (i.e. IEC 62930 approved), with proper insulation which is able to withstand the maximum possible system open-circuit voltage. For PW60MAX-C and PW66MAX-C, EDF ENR PWT recommends the use of a copper wire of at least 6 mm^2 (10AWG) section.
- Only copper conductor material should be used. Select a suitable conductor gauge to minimize voltage drop and ensure that the conductor ampacity complies with local regulations (i.e. NEC 690.8(D)).

CABLE AND CONNECTOR PROTECTION

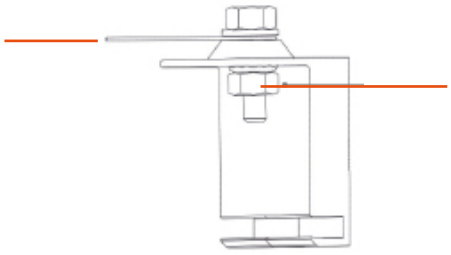
- Secure the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage by taking appropriate precautions (e.g. placing them inside a metallic raceway like EMT conduit). Avoid exposure to direct sunlight.
- A minimum bending radius of 60 mm (2.36 in) is required when securing the junction box cables to the racking system.
- Protect exposed connectors from weathering damage by taking appropriate precautions. Avoid exposure to direct sunlight.
- Do not place connectors in locations where water could easily accumulate.

5.2 GROUNDING

- For grounding requirements in North America, a module with exposed conductive parts is considered to comply with UL 61703 only when it is electrically grounded in accordance with both the instructions presented below and the requirements of the National Electrical Code. Any grounding means used with EDF ENR PWT modules should be NRTL certifi ed to UL 467 and UL 2703 standards. Please consult our technical service team for the formal approval process.
- For grounding requirements in other areas, although the modules are certifi ed to Safety Class II, we recommend them to be grounded and that module installation should comply with all applicable local electrical codes and regulations. Minimum size of equipment grounding conductors for ground raceway and equipment from NEC 690.8(D) should be considered. Grounding connections should be installed by a qualified electrician. Connect module frames together using adequate grounding cables: the use of 4-14 mm^2 (AWG 6-12) copper wire is recommended. Holes provided for this purpose are identified with a grounding symbol ⏚ (IEC 61730-1). All conductive connection junctions must be firmly fixed.
- Do not drill any extra ground holes for convenience this will void the modules warranty.
- All bolts, nuts, fl at washers, lock washers and other relevant hardware should be made of stainless steel, unless otherwise specified.
- EDF ENR PWT does not provide grounding hardware.
- The grounding method described below is recommended by EDF ENR PWT.

GROUNDING METHOD : BOLT + TOOTHED NUT + CUP WASHER

1. To fix the wire between the flat washer and cup washer, place the cup washer (concave side up) between the frame and the wire.



2. Then tighten the bolt using the toothed nut

- A grounding kit containing an M5 (3/16") SS cap bolt, an M5 (3/16") SS flat washer, an M5 (3/16") SS cup washer, and an M5 (3/16") SS nut (with teeth) is used to attach copper grounding wire to a pre-drilled grounding hole on the frame (see image above).
- Place the wire between the flat washer and the cup washer. Ensure that the cup washer is positioned between the frame and the wire with the concave side up to prevent galvanic corrosion. Tighten the bolt securely using the SS toothed nut. A wrench may be used to do this. The tightening torque is 3-7 Nm (2.2-5.2 ft-lbs).

6.0 MOUNTING INSTRUCTIONS

The applicable regulations pertaining to work safety, accident prevention and securing the construction site must be observed. Workers and third party personnel shall wear or install fall arrest equipment. Any third party need to be protected against injuries and damages.

- The mounting design must be certified by a registered professional engineer. The mounting design and procedures must comply with all applicable local codes and requirements from all relevant authorities.
- The module is considered to be in compliance with UL 61703 and IEC 61215 only when the module is mounted in the manner specified by the mounting instructions included in this installation manual.
- The system designer and installer are responsible for load calculations and for proper design of support structure.
- The approved test loads in this manual are only valid when coupled to mounting and support structures that are capable of withstanding equal or greater mechanical loads. The mounting system supplier is responsible for the strength and stability of the mounting structure, which must meet the requirements of the relevant design specifications.
- Any module without a frame (laminate) shall not be considered to comply with the requirements of UL 61730 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 61730.
- EDF ENR PWT does not provide mounting hardware.
- Standard modules can be mounted onto a support structure using one of several approved methods as described below. For information about other installation methods, please contact your local representative. Failure to use a recognized installation method will void the EDF ENR PWT warranty.
- Use appropriate corrosion-proof fastening materials. All mounting hardware (bolts, spring washers, flat washers, nuts) should be hot dip galvanized or stainless steel.
- Use a torque wrench for installation.
- Do not drill additional holes or modify the module frame. Doing so will void the warranty.
- This manual includes preliminary loading capability data which might be subject to change, please refer to official version which will be updated in coming versions

- Standard modules can be installed in either landscape or portrait orientations. Refer to the detailed instructions for further guidance. Please note that in areas with heavy snowfall (>2400 Pa) further countermeasures such the use of additional support bars should be considered to avoid snow loads damaging the lowest row of modules.

- In cases where an additional support bar is recommended to improve both mechanical stability and long-term module performance, we recommend selecting a sufficiently resistant material. EDF ENR PWT recommends bars with a minimum thickness of 50 mm (1.97 in). The support bar centerline should be positioned within 100 mm (3.94 in) of the side frame centerline (slight shifts may be necessary to access module grounding holes).

- The loads described in this manual correspond to test loads. For installations complying with IEC 61215-2: 2016 and UL 61730, a safety factor of 1.5 should be applied for calculating the equivalent maximum authorized design loads. Project design loads depend on construction, applicable standards, location and local climate. Determination of the design loads is the responsibility of the racking suppliers and / or professional engineers. For detailed information, please follow local structural code or contact your professional structural engineer.

6.1
MOUNTING METHOD : BOLTING

- The mechanical load test with these mounting methods were performed according to IEC 61215.

- Modules should be bolted to supporting structures through the mounting holes in the rear frame flanges only.

- Each module must be securely fastened at a minimum of 4 points on two opposite sides.

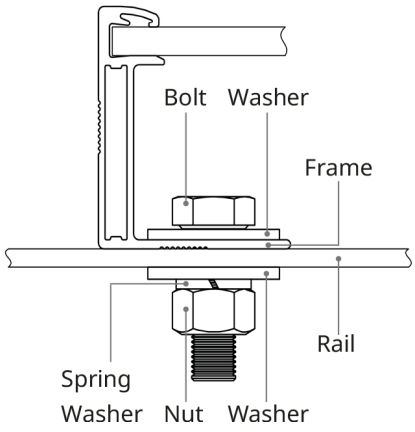
- M8 X 1.25 - Grade 8.8 (5/16"-18 Grade B7) galvanized or A2-70 stainless steel bolt and nut should be used

- The yield strength of bolt and nut should not be less than 450 MPa.

- Tightening torques should be 16~20 Nm (11.8~14.75 ft-lbs) respectively for M8 (5/16"-18) coarse thread bolts, depending on bolt class.

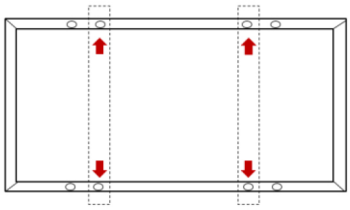
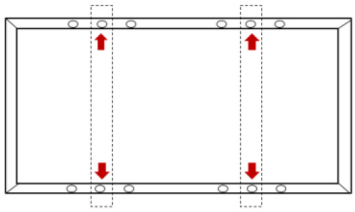
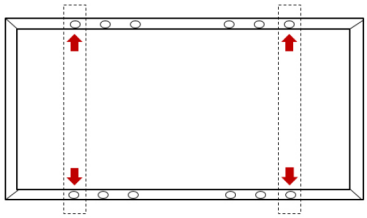
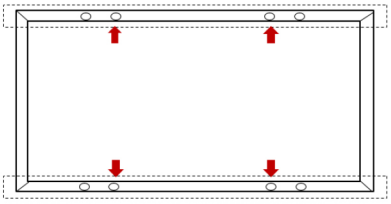
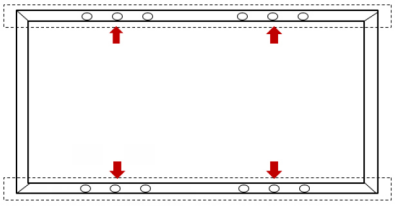
- In areas with heavy wind loads, additional mounting points should be used. The system designer and the installer are responsible for correctly calculating the loads and ensuring that the supporting structure meets all the applicable requirements.

Mounting method: Bolting



- Modules should be bolted at the following hole locations depending on the configuration and loads:

TABLE 3 : APPROVED BOLTING METHODS

Inner four holes installation method A 	Middle four holes installation method A 	Outer four holes installation method A 
Inner four holes installation method B 	Middle four holes installation method B 	

Installation Method / Module Types	Inner four holes installation method A	Inner four holes installation method B	Middle four holes installation method A	Middle four holes installation method B	Outer four holes installation method A
PW60HT-CP	+5400Pa/-2400Pa	+4000Pa/-2400Pa	/	/	/
PW72HT-C	/	/	+5400Pa/-2400Pa	+5400Pa/-2400Pa	/
PW72LHT-C	/	/	+5400Pa/-2400Pa	+3600Pa/-2400Pa	/
PW60LHT-C	+5400Pa/-2400Pa	/	/	/	/
PW78LHT-C PW60MAX-C PW66MAX-C	/	/	/	/	+5400Pa/-2400Pa

Note: The bolting installation method is based on the experimental results, "/" means not tested.

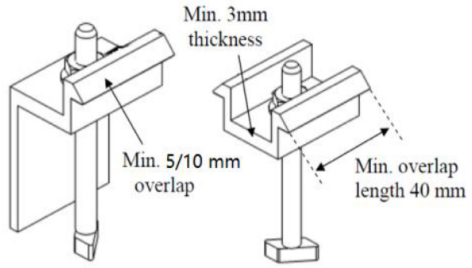
6.2
MOUNTING METHOD: CLAMPING SYMMETRICALLY TO THE MODULE AXIS

- The mechanical load test with these mounting methods were performed according to IEC 61215.
- Clamping methods will vary and are dependent on the mounting structures. Please follow the mounting guidelines recommended by the mounting system supplier.
- Each module must be securely fastened at a minimum of four points on two opposite sides. The clamps should be positioned symmetrically. The clamps should be positioned according to the authorized position ranges.
- Install and tighten the module clamps to the mounting rails using the torque stated by the mounting hardware manufacturer. M8 X 1.25 (5/16") bolt and nut are used for this clamping method.
- Tightening torques should be within 16~20 Nm (11.8~14.75 ft-lbs) for M8 (5/16") coarse thread bolts, depending on the bolt class. For the bolt grade, the technical guideline from the fastener suppliers should be followed. Different recommendations from specific clamping hardware suppliers should prevail.
- The system designer and installer are responsible for load calculations and for proper design of support structure.
- EDF ENR PWT's warranty may be void in cases where improper clamps or unsuitable installation methods are found. When installing inter-modules or end-type clamps, please take the following measures into account:

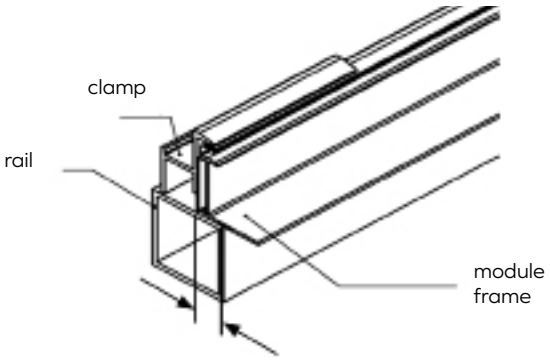
1. Do not bend the module frame
2. Do not touch or cast shadows on the front glass
3. Do not damage the surface of the frame (to the exception of the clamps with bonding pins).
4. Ensure the clamps overlap the module frame by at least **10 mm (0.4 in) for PW66MAX-C and PW60MAX-C,** 5mm (0.2 in) for the rest of the modules types).
5. Overlap in length by at least:

a) 80 mm (3.15 in) when uplift load > 2400 Pa is required.
b) 40 mm (1.57 in) when uplift load ≤ 2400 Pa is required.

6. Ensure the clamp thickness is at least 3 mm (0.12 in).

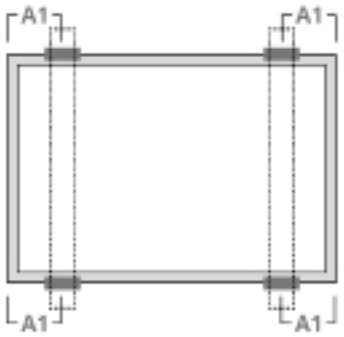


- Clamp material should be anodized aluminum alloy or stainless steel.
- Clamp positions are of crucial importance for the reliability of the installation. The clamp centerlines must only be positioned within the ranges indicated in table below, depending on the configuration and load. For configurations where the mounting rails run parallel to the frame, precautions should be taken to ensure the bottom flange of the module frame overlaps the rail by 15 mm (0.59 in) or more.



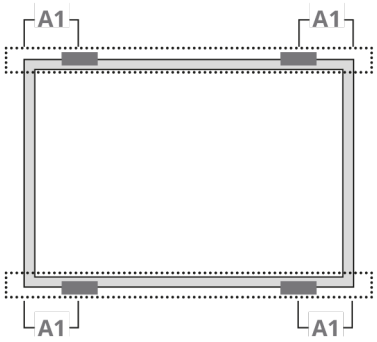
Min. 15 mm overlap width

6.2.1 FOUR CLAMPS ON LONG SIDE OF FRAME AND RAILS PERPENDICULARLY TO THE LONG SIDE FRAME



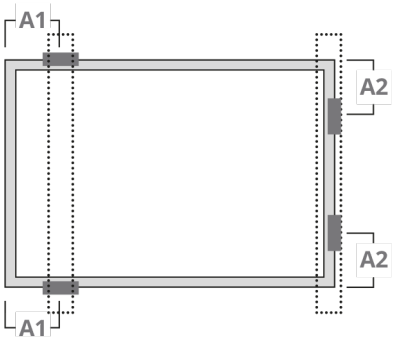
Module Types	Max Mechanical Load (Pa)		
	+2400/-2400	+5400/-2400	+5400/-3600
	A1 Range (mm)		
PW60HT-CP	331-550	/	240-330
PW72HT-C **PW72LHT-C**	340-550	/	410-490
PW60LHT-C	331-550	/	240-330
PW78LHT-C **PW60MAX-C** **PW66MAX-C**	300-600	400-500	/

6.2.2 FOUR CLAMPS ON LONG SIDE OF FRAME AND RAILS PARALLEL TO THE LONG SIDE FRAME



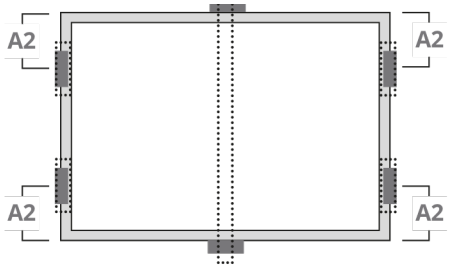
Module Types	Max Mechanical Load (Pa)	
	+4000/-2400	+5400/-2400
	A1 Range (mm)	
PW72HT-C	/	410-490
PW60HT-CP	240-330	/

6.2.3 TWO CLAMPS ON THE LONG SIDE AND TWO CLAMPS ON THE SHORT SIDE OF FRAME. RAILS RUN PERPENDICULAR TO THE LONG SIDE FRAME



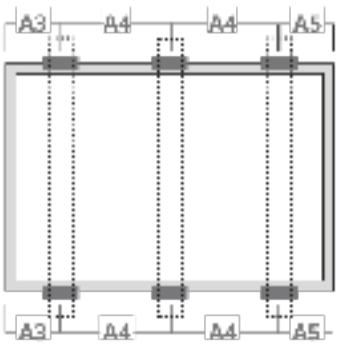
Module Types	Max Mechanical Load (Pa)	
	+2400/-2400	
	A1 Range (mm)	**A2 Range (mm)**
PW72HT-C	300-550	200-250
PW60HT-CP	100-550	200-250
PW72LHT-C	600-800	20-250
PW60LHT-C	400-600	20-250

6.2.4 FOUR CLAMP MOUNTING ON SHORT SIDE OF FRAME, AND AN ADDITIONAL SUPPORT BAR PLACED BELOW THE CENTER OF THE MODULE



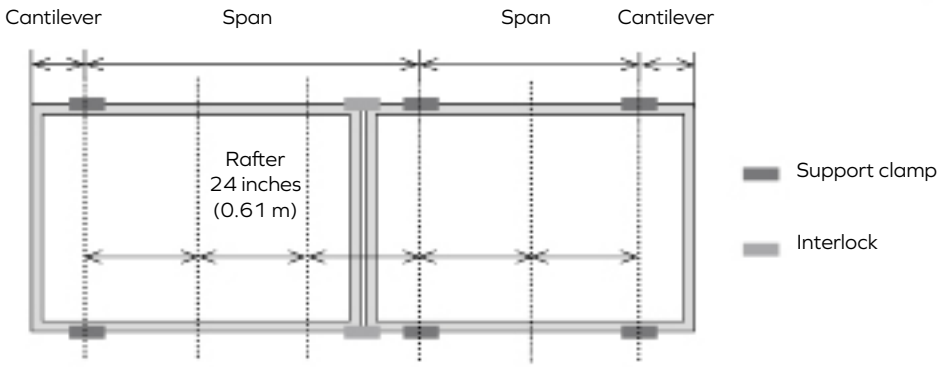
Module Types	Max Mechanical Load (Pa)
	+5400/-2400
	A2 Range (mm)
PW60HT-CP / PW72HT-C	200-250

6.2.5 SIX CLAMPS ON LONG SIDE OF FRAME AND RAILS PERPENDICULARLY TO THE LONG SIDE FRAME



Module Types	Max Mechanical Load (Pa)	
	+5400/-3600	+5400/-4000
	A3 & A5 Range (mm)	
PW60LHT-C	140-440	/
PW60HT-CP	/	80-380

6.2.6 RAIL-LESS CLAMPING



Landscape installation, clamping on long side frame

Modyle Type	Max Span	Max Cantilever length	Downforce	Uplift
PW60HT-CP	32 pouces (0.81 m)	10.7 pouces (0.27 m)	4800 Pa	2400 Pa

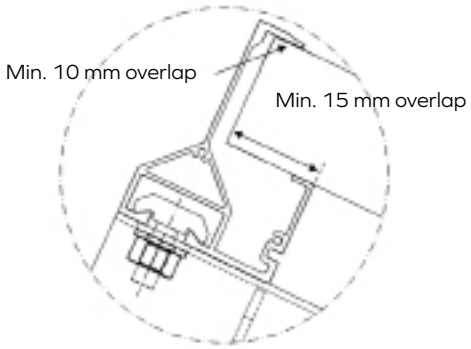
6.3
INSERTION SYSTEMS

- The mounting method has been certified by VDE and CSA, or qualified by EDF ENR PWT.

- Insertion methods can vary and depend on the mounting structures. The installer needs to follow the mounting guidelines recommended by the mounting system supplier. Each module must be securely maintained through all its length on two opposite sides. Install and tighten the insertion profiles to the support structure using the hardware and instructions provided by the mounting system manufacturer. The system designer and installer are solely responsible for load calculations and for the proper design of support structure.

- EDF ENR PWT warranty may be void in cases where improper insertion systems or unsuitable installation methods are found. When installing insertion profiles, please take the following measures into account :

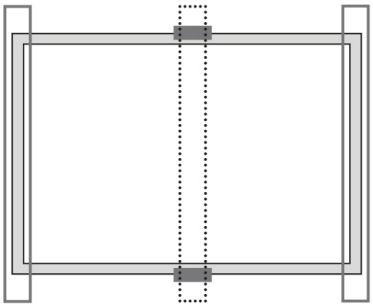
1. Do not bend the module frame.
2. Do not touch the front glass or cast shadow onto it.
3. Do not damage the surface of the frame.
4. Ensure that the insertion profiles overlap the module frame by at least 10 mm (0.39 in).
5. Ensure that the module frame (C-shape) overlaps the insertion profiles by at least 15 mm (0.59 in).
6. Ensure insertion profile thickness and tolerances suit module thickness.



Insertion Method A

Two insertion profiles run parallel to long side frame.

Insertion Method B



Two insertion profiles running perpendicularly to long side frame.
An additional support bar used with clamps

Module Type	Installation Methods	
	Insertion Method A	Insertion Method B
PW72HT-C	+5400Pa / -2400 Pa	+5400Pa / -2400 Pa
PW72LHT-C	+4000Pa / -2400Pa	_
PW60LHT-C	+4000Pa / -2400 Pa	_

7.0
MAINTENANCE

- Do not make modifications to any components of the PV module (diode, junction box, plug connectors or others).
- Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dirt spots, and dust.
- Modules with sufficient tilt (at least 15°), generally may not require cleaning (rain will have a selfcleaning effect). If the module has become soiled, wash with water and a non-abrasive cleaning implement (sponge) during the cool part of the day. Do not scrape or rub dry dirt away, as this may cause micro scratches.
- Snow should be removed using a soft brush.
- Periodically inspect the system to check the integrity of all wiring and supports.
- To protect against electric shock or injury, electrical or mechanical inspections and maintenance should be performed by qualified personnel only.

8.0
MODULE CLEANING GUIDELINES

This manual covers requirements for the cleaning procedure of EDF ENR PWT photovoltaic modules. The purpose of these cleaning guidelines is to provide general information for cleaning EDF ENR PWT solar modules. Professional installers should read these guidelines carefully and strictly follow these instructions.

Failure to follow these instructions may result in death, injury or property damage to the photovoltaic module. Damages induced by inappropriate cleaning procedures will void EDF ENR PWT warranty.

SAFETY WARNING

- Cleaning activities create risk of damaging the modules and array components, as well as increasing the potential electric shock hazard.
- Cracked or broken modules represent an electric shock hazard due to leakage currents, and the risk of shock is increased when modules are wet. Before cleaning, thoroughly inspect modules for cracks, damage, and loose connections.
- The voltage and current present in an array during daylight hours are suffi cient to cause a lethal electrical shock.
- Ensure that the circuit is disconnected before starting the cleaning procedure as contact with leakage of electrically active parts can result in injury.
- Ensure that the array has been disconnected from other active components (such as inverter or combiner boxes) before starting with the cleaning.
- Wear suitable protection (clothes, insulated gloves, etc.).
- Do not immerse the module, partially or totally, in water or any other cleaning solution.
- Rear side cleaning of the modules is not required. If cleaning the rear of a module is desired, care should be taken to ensure there is no damage caused to the backsheet by simply clearing the contaminant by hand or with a soft sponge.

HANDLING NOTICE

- Use a proper cleaning solution and suitable cleaning equipment.
- Do not use abrasive or electric cleaners on the module.
- Particular attention should be taken to avoid the module backsheet or frame to come in contact with sharp objects, as scratches may directly affect product safety.
- Do not use abrasive cleaners, de-greasers or any unauthorized chemical substance (e.g. oil, lubricant, pesticide, Gasoline, white flower oil, active oil, mold temperature oil, machine oil (such as KV46), grease (such as Molykote EM-SOL, etc.), lubricating oil, antirust oil, stamping oil, butter-cooking oil, propyl alcohol, ethyl alcohol, essential oil, bone-setting water, Tianna water, mold release agent (such as Pelicoat S-6, etc.), glue and potting glue that can generate oxime gas (such as KE200, CX-200, Chemlok, etc.), TBP (plasticizer), cleaning agents, pesticide, paint strippers, adhesives, antirust agent, disincrustant, emulsifying agent, cutting oils and cosmetics etc.) on the module. Please contact your EDF ENR PWT representative for more detailed requirements.
- Do not use cleaning corrosive solutions containing hydrofluoric acid, alkali, acetone, or industrial alcohol. Only substances explicitly approved by EDF ENR PWT are allowed to be used for cleaning modules.
- For cleaning methods using rotating brush, please consult with EDF ENR PWT's technical support before using.
- Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratches on the glass surface.
- Improper cleaning equipment design may cause localized heavy loads onto the module. Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability and void EDF ENR PWT Warranty. Please consult the EDF ENR PWT technical support department for information on the use of cleaning solutions and loading specifications.

OPERATION PREPARATION

- Noticeable dirt must be rubbed away by gentle cleaning-implement (soft cloth, sponge or brush with soft bristles).
- Ensure that brushes or agitating tools are not abrasive to glass, EPDM, silicone, aluminum, or steel.
- Conduct the cleaning activities avoiding the hottest hours of the day, in order to avoid thermal stress on the module.

CLEANING METHODS

Method A: Compressed Air

EDF ENR PWT recommends cleaning the soft dirt (like dust) on modules just with compressed air. This technique can be applied as long as the method is efficient enough considering the existing conditions.

Method B: Wet cleaning

If excessive soiling is present on the module surface, a non-conductive brush, sponge, or other mild agitating method may be used with caution.

- Ensure that any brushes or agitating tools are constructed with non-conductive materials to minimize risk of electric shock and that they are not abrasive to the glass or the aluminum frame.
- If grease is present, an environmentally friendly cleaning agent may be used with caution.

EDF ENR PWT recommends the following to be used:

- Water with low mineral content
- Near neutral pH water
- The maximum water pressure recommended is 4 MPa (40 bar)

ANNEX A: GUIDANCE ON MODULE TEMPERATURE FOR SEVERAL LOCATIONS

- The operational temperature of a PV module changes during the day and also from day to day throughout the year. The 98th-percentile temperature represents the temperature that is larger than 98% of all the temperatures, and consequently it is met or exceeded only 2% of the time.

- The 98th-percentile temperature is to be determined from measurements taken on hourly-basis, or even more frequently. For a standard year, the 98thpercentile temperature would be met or exceeded 175.2 hours.

- The operational module temperature is influenced by the environmental temperature but also by how the module is installed (e.g. mounting distance to rooftop, array size, array spacing and anti-nesting features), as it may allow a more efficient ventilation. The graphics below from IEC 63126 show this influence, the maps presented here are a general guidance and assumed conservative, please contact your local sales representative for further information.

- For Open-rack it can be seen how the 70°C are never exceeded in any of the locations, while for parallel to the roof mounted modules (not in-roof) this value can be surpassed for some locations.

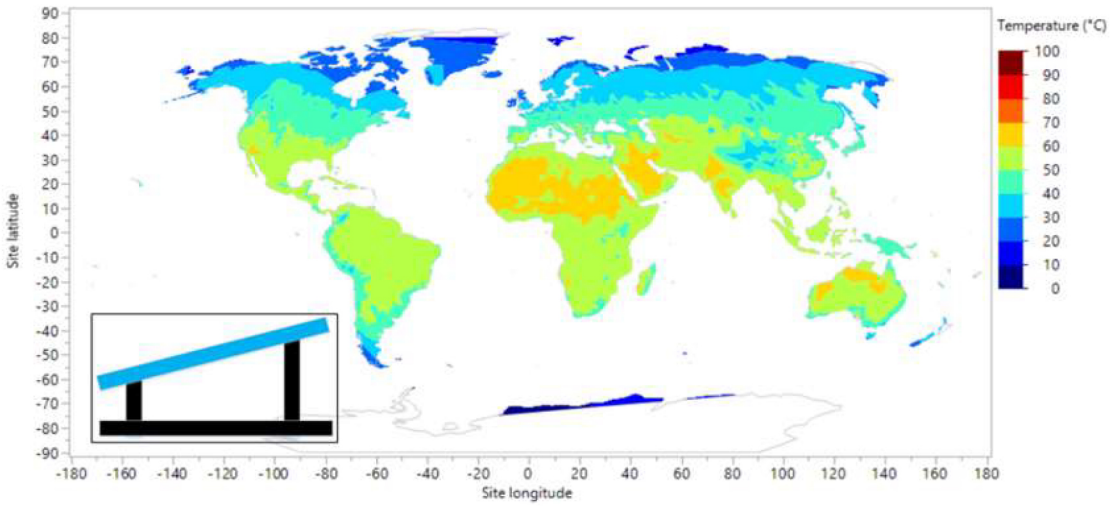


Figure B.1 – 98th-percentile temperature for an open-rack, or thermally unrestricted

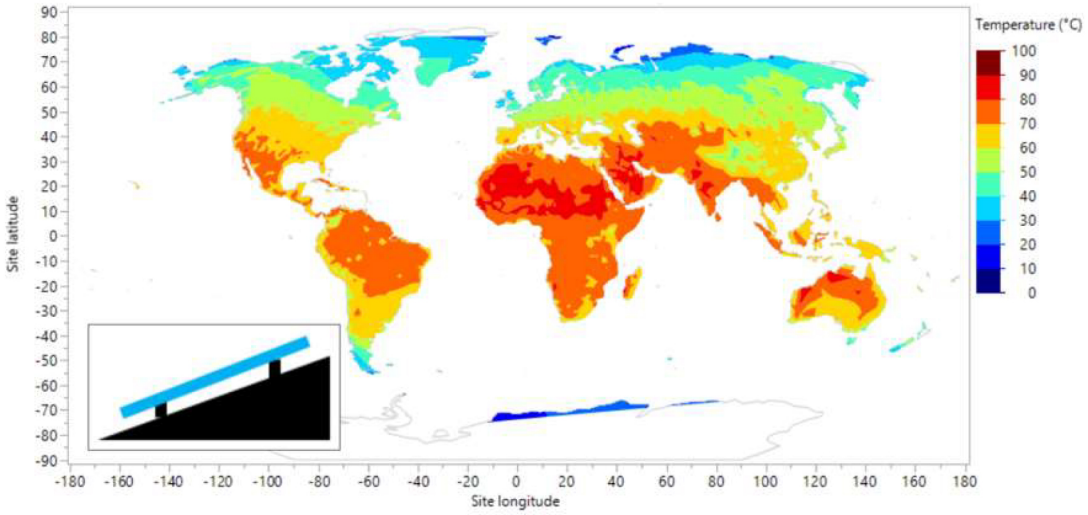


Figure B.2 – 98th-percentile temperature for a close-roof mounted

ANNEX B: INSTALLATIONS USING MODULE LEVEL POWER ELECTRONICS

- This section is applicable to all EDF ENR PWT standard module types referred to in this installation manual.
- Module-level power electronics (MLPE) are devices that can be incorporated into a solar system to improve its performance in certain conditions (especially where shade is present) and to reduce shock hazard for emergency responders. MLPE devices can be supplied as a 'retro-fit' system made by third-party supplier.
- Module certification testing does not include MLPE devices.
- When installing MLPE devices with EDF ENR PWT modules, follow the instructions of the MLPE supplier and the specific requirements given below. Ensure electrical parameters and limitations of the MLPE devices and the EDF ENR PWT modules are suitable for one another.
- Failure to comply with these instructions will void the EDF ENR PWT warranty.
- When choosing to mount the MLPE device to the module frame, follow the MLPE supplier instructions to ensure optimal mounting of the MLPE device and prevent any slippage during operation.
- EDF ENR PWT recommends the MLPE device be installed close to a corner of the module frame.
- When choosing to mount the MLPE device to the mounting structure, please refer to the instructions provided by the MLPE supplier.
- Do not cover the module nameplate or junction boxes when installing the MLPE devices on the rear of the modules.
- Do not use frame mounting holes to install the MLPE device.
- Do not drill extra holes in the frame to install the MLPE device.
- The distance between the MLPE device and the module backsheet should be larger than 20mm.

INSTALLATION

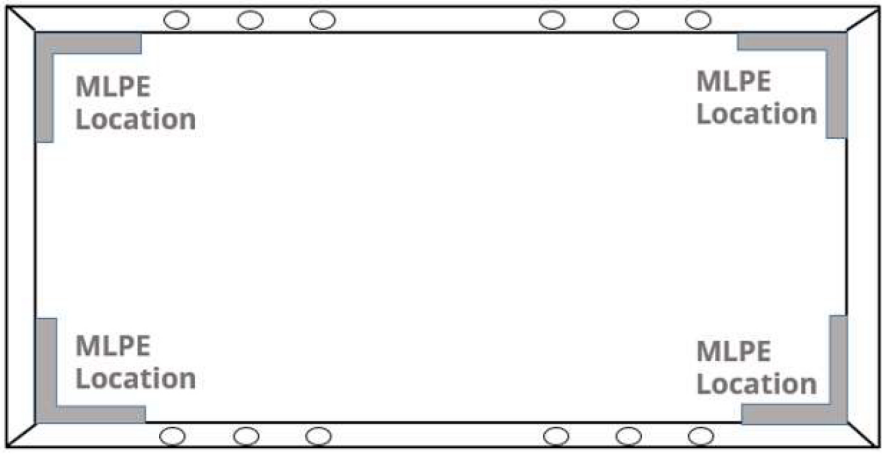


Figure C.1 - MLPE device installation zones