PV-ezRack® SolarRoof™
Adjustable Tilt Legs

Code-Compliant Planning and Installation Guide

Complying with AS/NZS1170.2:2011 ADMT 2-2012

Image: ER-TL15/30 installed by Todae Solar

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Introduction

The Clenergy PV-ezRack® SolarRoof™ has been developed as a universal PV-mounting system for roof-mounting on pitched and flat roofs. The use of patented aluminium base rails, the Z-Module technology and the telescopic mounting technology eliminates custom cutting and enables particularly fast installation.

Please review this manual thoroughly before installing PV-ezRack® SolarRoof™. This manual provides (1) supporting documentation for building permit applications relating to PV-ezRack® SolarRoof™ Universal PV Module Mounting System, and (2) planning and installation instructions.

The PV-ezRack® SolarRoof™ parts, when installed in accordance with this guide, will be structurally adequate and will meet the AS/NZS1170.2:2011 ADMT 2-2012 standard. During installation and especially when working on the roof please comply with the appropriate occupational health and safety regulations. Please also pay attention to other relevant regulations of your local region. Please check that you are using the latest version of the installation manual, which you can do by contacting Clenergy Australia via email on sales@clenergy.com.au, or contacting your local distributor in Australia.

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Planning

The installer is solely responsible for:

- Complying with all applicable local or national building codes and Clean Energy Council guidelines including any that may superseded this manual;
- Ensuring that PV-ezRack® SolarRoof™ and other products you use are appropriate for the particular installation and the installation environment;
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under building live load conditions (this total assembly is hereafter referred to as the roof rafter assembly);
- Using only genuine PV-ezRack® parts (substitution of parts may void the warranty and invalidate the letter of certification);
- Ensuring that lag screws have adequate pull-out strength and shear capacities as installed;
- Maintaining the waterproof integrity of the roof, including selection of appropriate flashing; and
- Ensuring safe installation of all electrical aspects of the PV array

This document is designed to support for installations using PV-ezRack® SolarRoof™ PV Module Mounting System, manufactured by Clenergy (Xiamen) Technology Co., Ltd. Follow the six steps below and the installation instructions section to install this product in compliance with the AS/NZS1170.2:2011 ADMT 2-2012.

Before proceeding, note the following:

- This document addresses only wind loads on the assumption that wind produces the maximum load factor affecting an installation. Verify that other local factors, such as snow loads and earth quake effects, do not exceed the wind loads. Give precedence to any factor that does. Wind loads are considered to act on the entire projected area, or may be perpendicular to any surface.
- The roof on which the PV-ezRack® SolarRoof™ will be installed must have the capacity to resist the combined Design Dead Load and Live Load per footing.

To determine the parts (Bill of material) you need you can use our PV-ezRack® SolarRoof™ Calculator.

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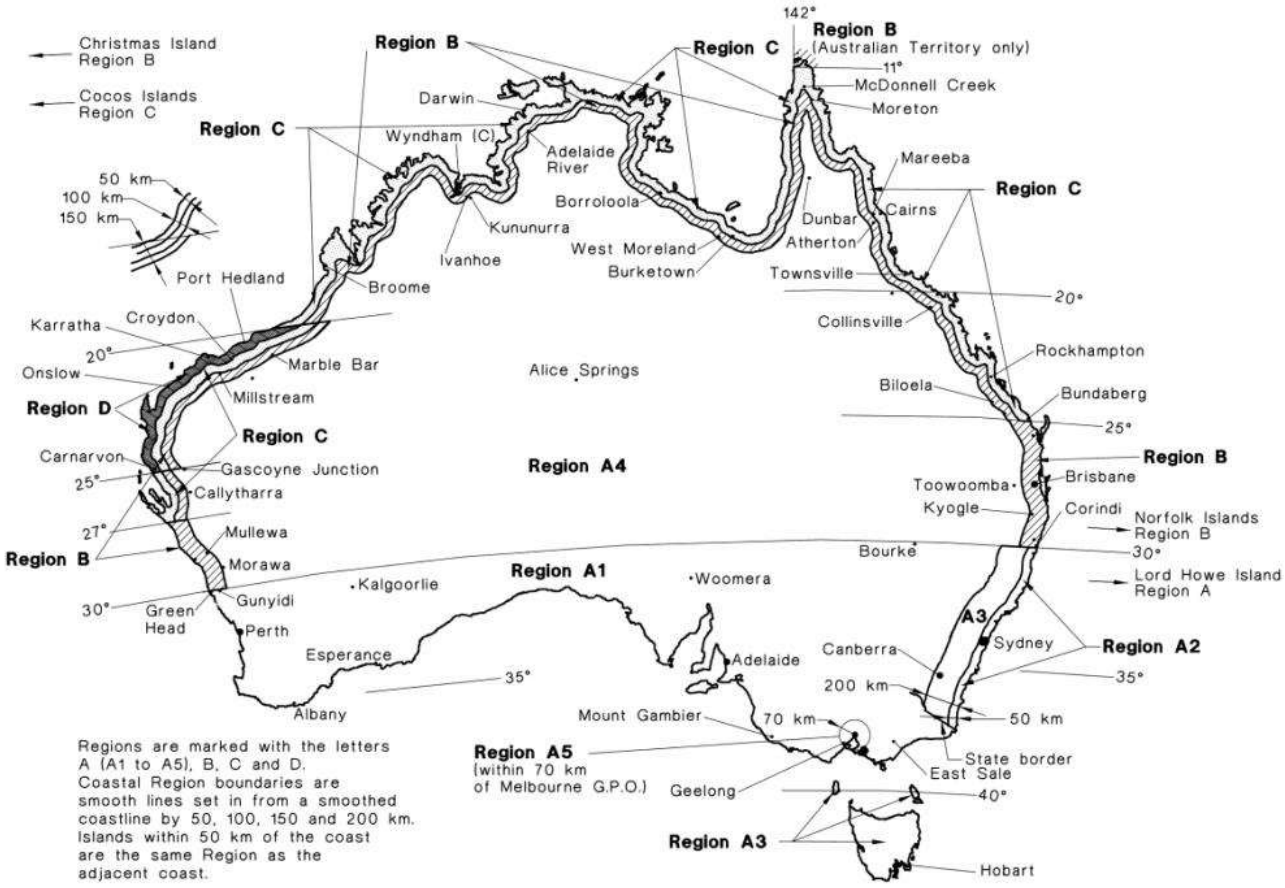
1. Determine the wind region of your installation site



Region Definition:

Wind regions are pre-defined for all of Australia by the Australian Standard 1170.2. The Wind Region is an independent factor of surrounding topography or buildings.

- Most of Australia is designated Region A which indicates a Regional Ultimate Basic Wind Velocity of 45m/s.

- Some areas are designated Region B (57m/s). Local authorities will advise if this applies in your area.

- Region C areas (66m/s) are generally referred to as Cyclonic and are generally limited to northern coastal areas. Most Region C zones end 100km inland.

- Region D (80m/s) Australia's worst Cyclonic Region between Carnarvon and Pardoo in Western Australia.

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2. Determine the Terrain Category

You will need to determine the terrain category that is most applicable to the installation.

- Terrain Category 1 (TC1) – Very exposed open terrain with few or no obstructions and enclosed, limited-sized water surfaces at serviceability and ultimate wind speeds in all wind regions, e.g. flat, treeless, poorly grassed plains; rivers, canals and lakes; and enclosed bays extending less than 10km in the wind direction.

- Terrain Category 1.5 (TC1.5) – Open Water surfaces subjected to shoaling waves at serviceability and ultimate wind speeds in all win regions, e.g. near-shore ocean water; larger unenclosed bays on seas and oceans; lakes; and enclosed bays extending greater than 10km in the wind direction.

- Terrain Category 2 (TC2) – Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5m to 5m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.

- Terrain Category 2.5 (TC2.5) – Terrain with a few trees or isolated obstructions. This category is intermediate between TC2 and TC3 and represents the terrain in developing outer urban areas scattered houses, or larger acreage developments with fewer than ten buildings per hectare.

- Terrain Category 3 (TC3) – Terrain with numerous closely spaced obstruction having heights generally from 3m to 10m. The minimum density f obstructions shall be at least the equivalent of 10 house sizes obstructions per hectare, e.g. suburban housing or light industrial estates.

- Terrain Category 4 (TC4) – Terrain with numerous larger, high (10m to 30m tall) and closely-spaced constructions, such as large city centres and well-developed industrial complexes.

Note: In this installation manual we have used terrain category 3, if it is outside of this please refer to the accreditation letter.

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3. Determine the height of the installation site

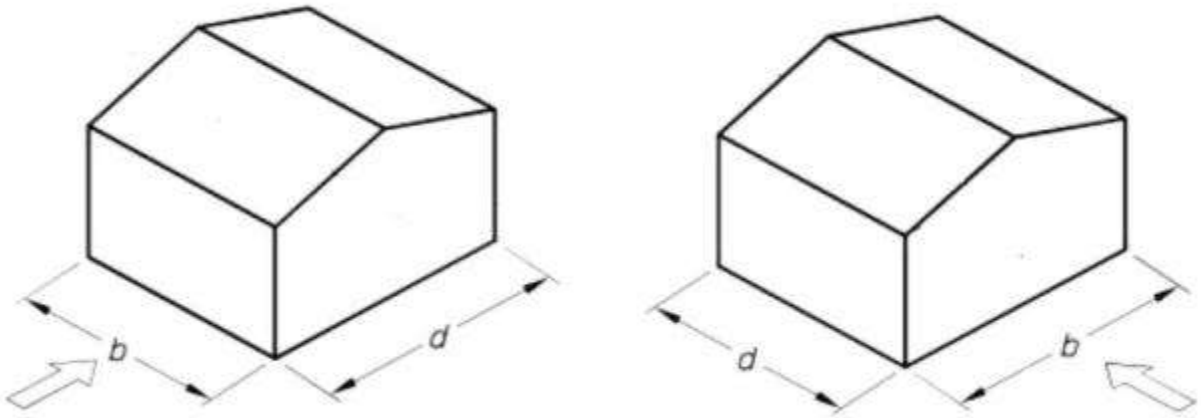
This document provides sufficient information for the PV-ezRack® SolarRoof™ system installation up 20 meter height. If your installation site is more than 20 meters please contact Clenergy to obtain additional engineering certificate to support your installation.

4. Determine installation slope

The PV-ezRack® SolarRoof™ Adjustable Tilt Leg system can be used for North facing roof as well as south and east-west facing roof.

5. Determine the installation area on the roof

PV-ezRack® SolarRoof™ may be installed anywhere on a roof but fixing centres are required to be reduced at ridges and edges. The diagram below shows the definition of "b" and "d" according to AS/NZS1170.2. The middle of the roof (Roof 1) is defined as a minimum of 0.2b and 0.2d from a roof edge or ridge (where "b" and "d" are the plan dimension of the building).



Roof (area) 1	Roof centre - at least 0.2b and 0.2d from the edges
Roof (area) 2	Roof edges - within the 0.2b and 0.2d

Roof area 2 is exposed to higher wind load/pressure (as Roof 1), therefore on this section of the roof the spacing between interfaces (such as roof hooks) is generally reduced. The following table will help you determine the maximum rail support spacing for your project. Also note that if the roof slope is less than 10 degree the reduction on spacing does not apply.

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6. Determine the Maximum Rail Support Spacing

North Facing Roof

Please use the following table to determine the base rail support spacing for sheet metal roof installations.

Max PV panel length: 2000mm. Max panel weight: **15 kg/m²**.
Roof Angle: ≤10°. Terrain Category 3.

a) 10 to 15°

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Edge	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**
A	**1675**	**1950**	**1675**	**1950**	**1600**	**1850**	**1550**	**1775**
B	**1650**	**1900**	**1650**	**1900**	**1575**	**1800**	**1525**	**1750**
C	**1475**	**1700**	**1475**	**1700**	**1350**	**1625**	**1225**	**1550**
D	**1000**	**1450**	**1000**	**1450**	**875**	**1350**	**775**	**1200**

b) 15 to 30°

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Edge	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**
A	**1400**	**1575**	**1400**	**1575**	**1350**	**1525**	**1300**	**1475**
B	**1300**	**1550**	**1300**	**1550**	**1125**	**1500**	**1450**	**1000**
C	**850**	**1300**	**850**	**1300**	**725**	**1125**	**650**	**1000**
D	**550**	**825**	**550**	**825**	**475**	**725**	**425**	**650**

c) 30 to 60°

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Edge	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**
A	**1325**	**1500**	**1325**	**1500**	**1275**	**1425**	**1125**	**1375**
B	**1050**	**1475**	**1050**	**1475**	**900**	**1375**	**800**	**1250**
C	**675**	**1050**	**675**	**1050**	**600**	**900**	**525**	**800**
D	**450**	**675**	**450**	**675**	**375**	**575**	**350**	**525**

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South or East/West Facing roof (Reverse Tilt)

In case of installation on south facing roof with a slope between 5° and 15° please use the following tables to determine the base rail support spacing for sheet metal roof installations. Furthermore the same tables apply roofs with East/West orientation.

Max PV panel length: 2000mm. Max panel weight: **15 kg/m²**.
Type of Interface: 30°-60° Adjustable Tilt Leg
Terrain Category 3.

Roof Angle (Φ) ≤10°

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Edge	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**
A	**1325**	**1500**	**1325**	**1500**	**1275**	**1425**	**1125**	**1375**
B	**1050**	**1475**	**1050**	**1475**	**900**	**1375**	**800**	**1250**
C	**675**	**1050**	**675**	**1050**	**600**	**900**	**525**	**800**
D	**450**	**675**	**450**	**675**	**375**	**575**	**350**	**525**

Roof Angle (Φ) ≤20°

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Edge	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**
A	**1400**	**1575**	**1400**	**1575**	**1350**	**1525**	**1300**	**1475**
B	**1300**	**1550**	**1300**	**1550**	**1125**	**1500**	**1000**	**1450**
C	**850**	**1300**	**850**	**1300**	**725**	**1125**	**650**	**1000**
D	**550**	**825**	**550**	**825**	**475**	**725**	**425**	**650**

Roof Angle (Φ) – ≤30°

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Edge	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**	**Edge**	**Middle**
A	**1675**	**1900**	**1675**	**1900**	**1600**	**1825**	**1550**	**1750**
B	**1625**	**1875**	**1625**	**1875**	**1575**	**1775**	**1525**	**1725**
C	**1450**	**1675**	**1450**	**1675**	**1350**	**1600**	**1200**	**1550**
D	**1000**	**1450**	**1000**	**1450**	**875**	**1325**	**775**	**1175**

- Please consult Clenergy for installing PV modules with a greater length than 2000mm or heavier than **15 kg/m².**

- Each Foot should be fixed to the purlins using at least two 12g (6mm) screw through sheet metal roofs with gasket.

- Please note that the screws provided with our products are designed for mounting in to wooden structures (10TPI). Clenergy recommend using 12G 14TPI screws (or M6 Buildex RoofZips®) to fix to steel purlins.

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General Notes

- Recommended screws

Metal Purlins/Battens	Fasteners to use
0.55 mm – 1.5 mm	M6-11 TPI RoofZips
1.9 mm	M6-11 TPI RoofZips OR 12g-14 TPI Teks screws
2.4 mm and Above	12g-24 TPI Teks screws

Wood purlins and Rafter	Fasteners to use
Pine and Hardwood (35mm embedment and above)	M6 (12g) with 10 TPI

- Screws minimum embedment length into timber 35 mm
- For the adjustable tilt legs:
    - Maximum back leg angle to horizontal - 90°
    - Minimum Back leg angle to horizontal - 30°

7. Verify acceptable Rail End Overhang

Rail End Overhang must equal 50% or less of foot spacing. Thus, if foot spacing is 1200mm, the Rail End Over hang can be up to 600mm. In this case, two feet can support a rail of as much as 2400mm (1200mm between the feet and 600mm of overhang at each end).

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Component list

Overview of system components

Part name	Picture	Part name	Picture
PV-ezRack® Standard Rail		Front Foot	
PV-ezRack® Standard Splice		Back Legs	
Inter Clamp		End Clamp	
M8*25 Hex head bolt		Hex head bolt M8*55	
Pan-head 5/8" Wood Screw 6*90		Set Screw M10*10	

Installation tools

- 6 mm and 4mm Allen key
- Cordless drill
- **Use ONLY stainless steel sockets**
- Open-end spanner set 9, 10, 17, 19 mm (required only for mounting with Nut)

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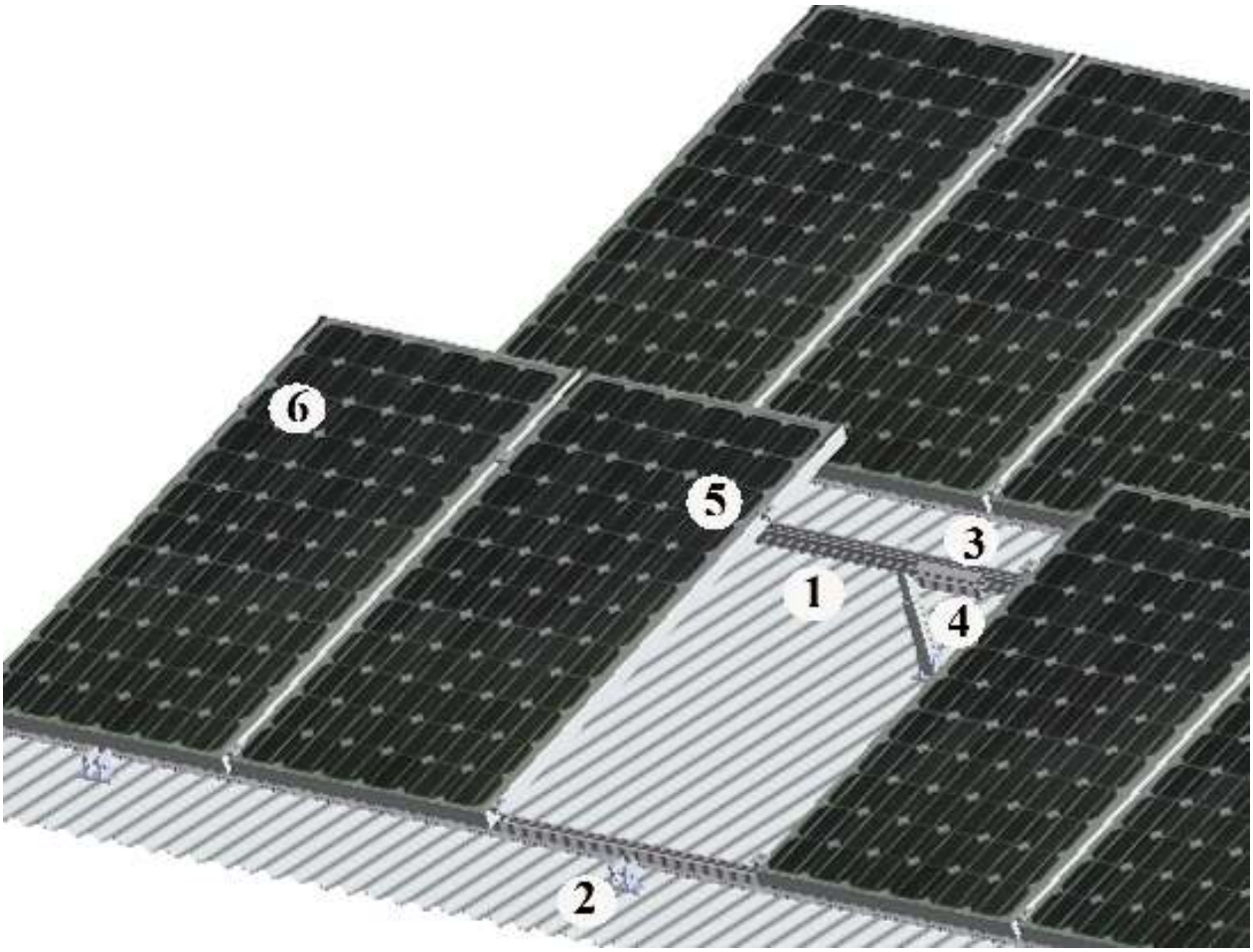
Installation preparation

Overview of system components



1. PV-ezRack® Rail
2. Front Foot
3. Splice
4. Back Legs
5. Inter Clamp
6. End Clamp

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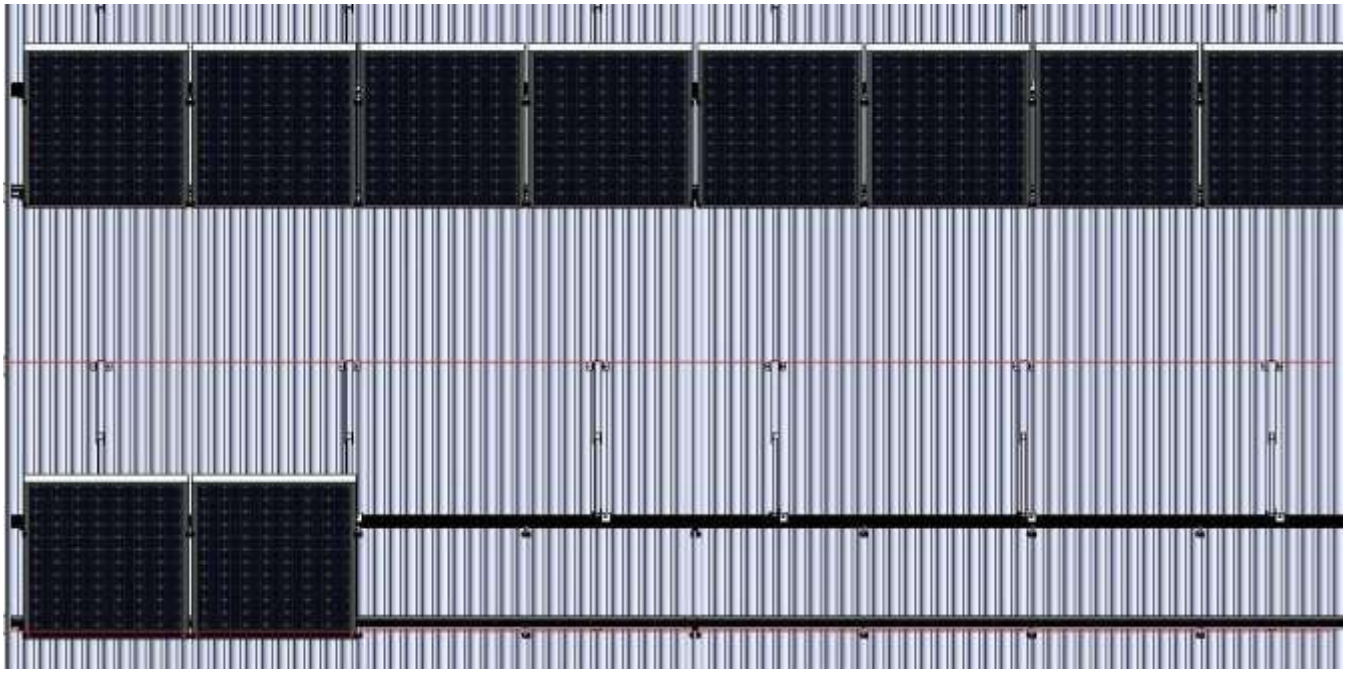
Array Planning



Number of modules in the vertical direction x module height (please check the installation manual of the Solar module manufacturer)
2. Number of modules in horizontal x (module width + 18mm) + 32mm
3. Horizontal spacing of the roof hooks up to 2.0 m
4. Vertical spacing of the roof hooks = approx. 1/2 to 3/4 of module height
5. Distance between the modules: 17 mm
6. Distance between 2 strings needs to be calculated based on the location
7. Always check the installation manual of the PV-Module you use in order to determine the allowed fixing points on the Module frame

* Caution: Installations that are exposed to the wind or are located on the edge or corners of the roof may make it necessary to leave smaller spaces between interfaces.

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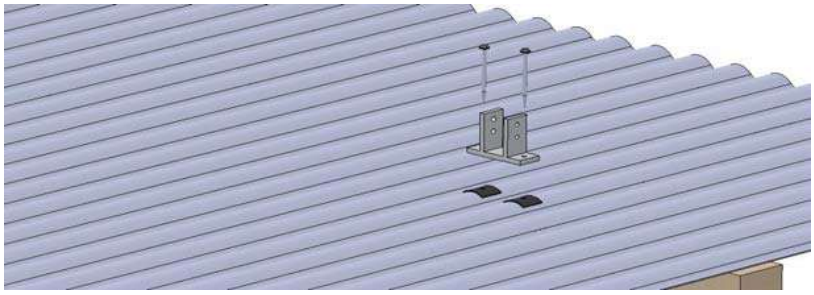
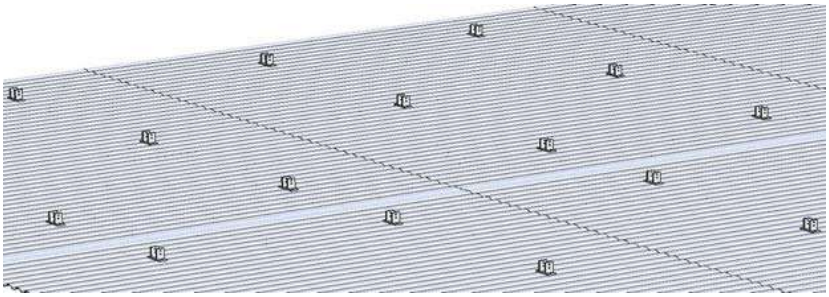
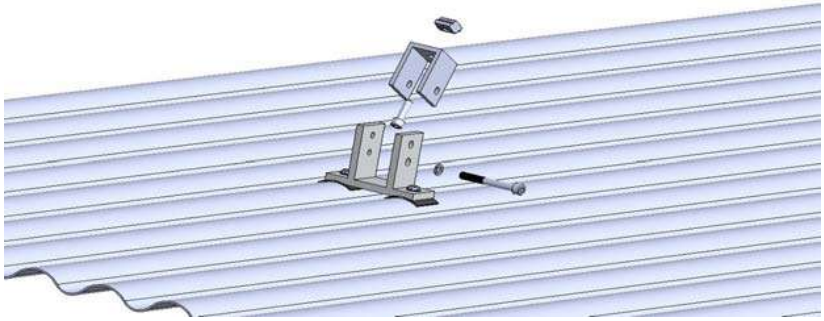
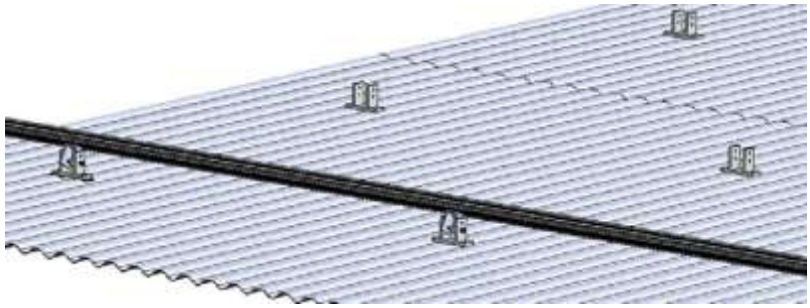
Step by step installation

1. Determine the position of the Front Foot according to your plans. Shim the Front Foot with rubber, Fix the Front Foot to the rafter using two 6 mm wood screws or in case of a metal purlin the recommended metal screws (Page 6)	
2. Fix the remaining of the Front Foot to the rafters according to your plans.	
3. The U Bracket comes pre-assembled with the Front foot. It is recommended not to tighten the M8 bolt at this stage, so it can be adjusted.	
4. For the PV-ezRack® rail installation, position the first rail to each row and inset the Z-Module in the channel on the side of the rail. Tighten the Allen bolts on the Z-Modules (recommended torque is 15-20Nm).	

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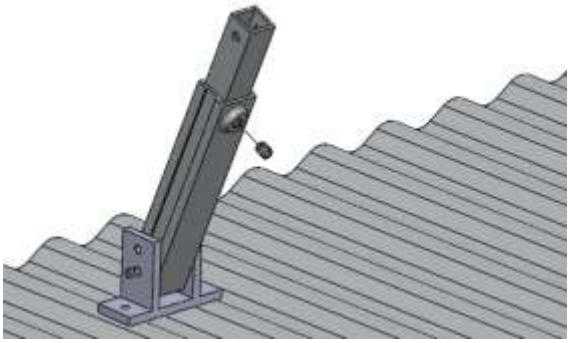
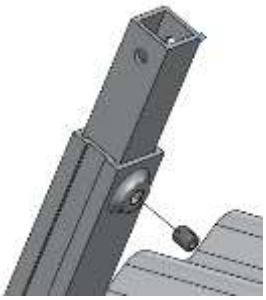
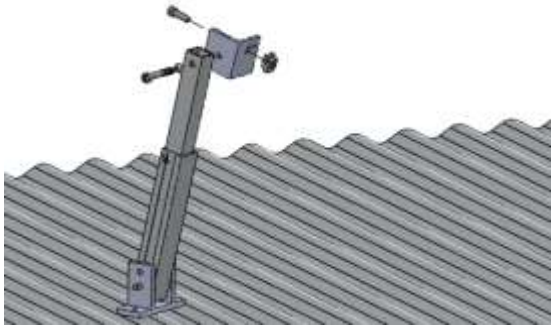
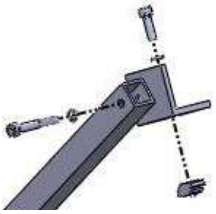
5. Install the back legs behind the front legs. Check the installation requirements (fixing points) of the PV-Module	
6. Adjust the length using a 4mm Allen key. Tighten M8*10mm pressure bolt with 17Nm torque at the desirable height.	 
7. Fix the L-shape bracket with the Leg tube by using M8X55mm bolt provided. • Maximum back leg angle to horizontal - 90° • Minimum Back leg angle to horizontal - 30°	 
8. Insert the Z-Module on the L-shape bracket in to the channel on the side of the PV-ezRack® rail (recommended torque is 15-20Nm).	

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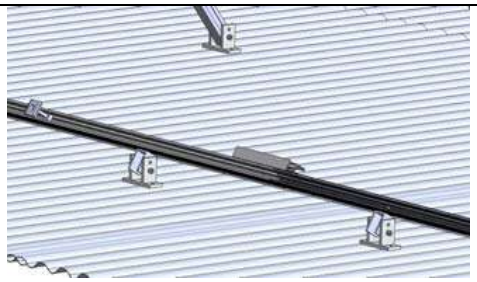
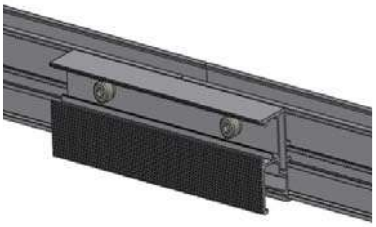
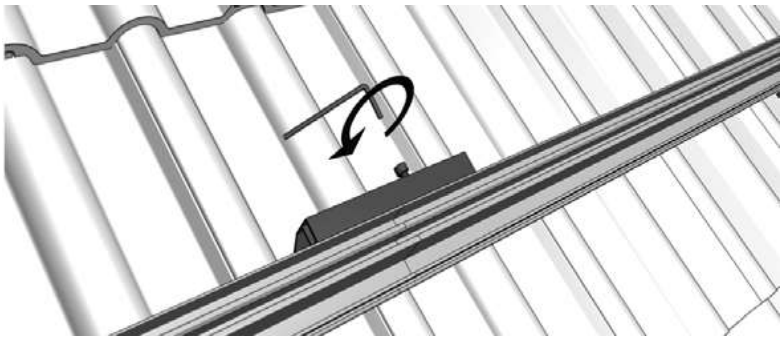
9. To connect multiple rails together, slide the splices on the rear side of the pre-assembled rails halfway to the side. Fasten the first M8 Allen bolt firmly using the Allen key. Now slide the next rail segment into the splice.	 
10. Tighten the second M8 Allen bolt using the Allen key. An expansion gap at the rail joints is recommended, leave a gap about the same width as a finger between the rail joints and then loosely tighten the M8 Allen bolt.	
11. General Information for using Z-Module connection: to ensure easy connection of the roof hooks with the rail using the Z-Module, you should make sure that the thread of the bolt does not project through the lower side of the Z-Module (max. flush). Position the Z-Module in the rail channel and fasten it loosely with 2 to 3 turns of the bolt. The bolts can be then freely moved in the rail channel. Slide the bolts to their final and fasten firmly (recommended torque is 15-20Nm).	
12. Slide the module end clamp tightly against the module and fasten tightly using the Allen bolt (recommended torque is 15-20Nm).	

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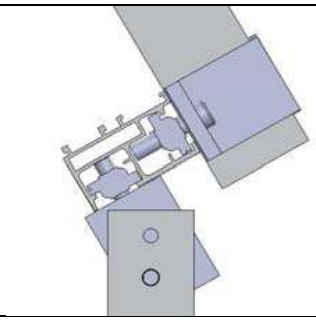
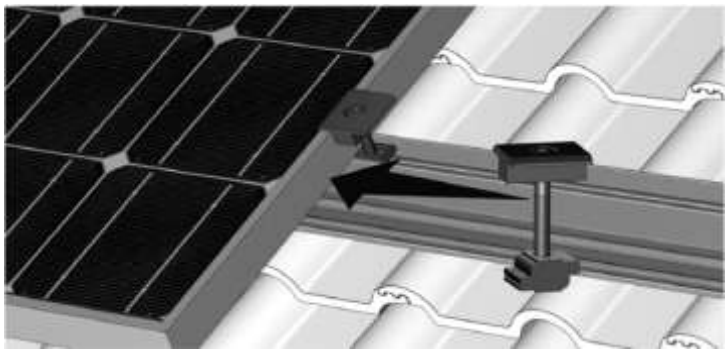
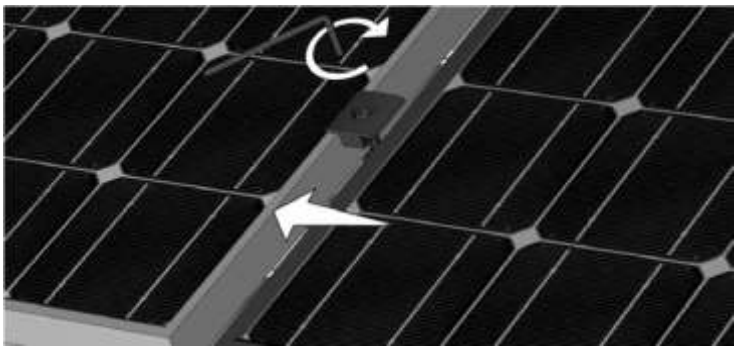
13. Cross-section of the end clamp when installation step 12 has been performed correctly.	
14. Insert the pre-assembled inter-module clamp into the rails from above, place it firmly against the module and fasten loosely (approx. 2 - 3 turns).	
15. Now slide the next module against the previously installed module. Ensure that the vertical side of the module frame is in contact with the vertical surface of the Inter-clamp (no gap between inter-clam and panel). Tighten the inter-module clamp using the Allen key (recommended torque is 15-20Nm).	
10 to 15 degree	

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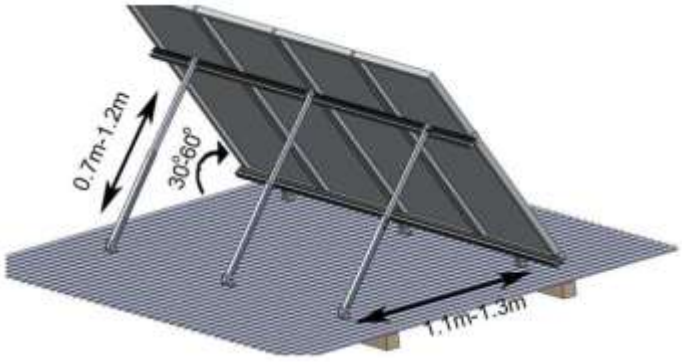
15 to 30 degree	
30 to 60 degree	

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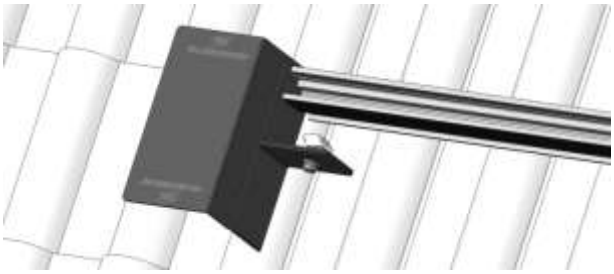
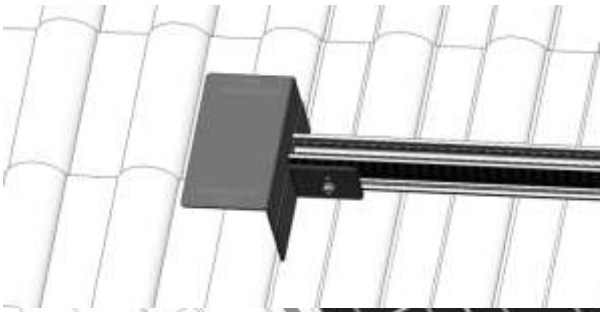
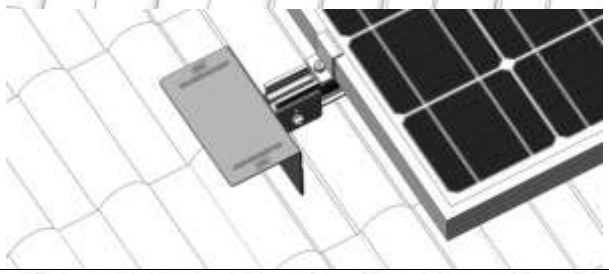
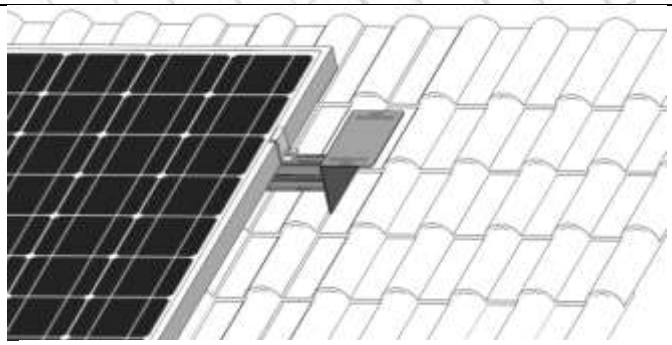
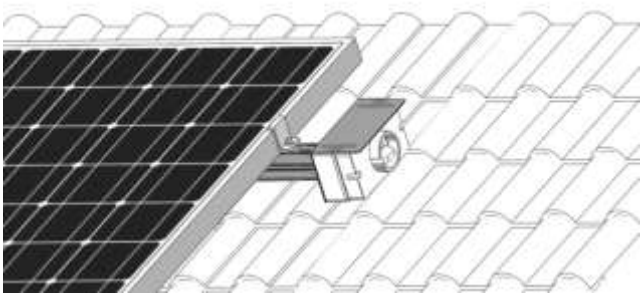
Isolator Bracket Installation	
1. Position the Z Module in the rail channel. Fix the bracket with bolt. (Recommended bolt torque 15-20Nm）	  
2. The final installation with the isolator mounted	 

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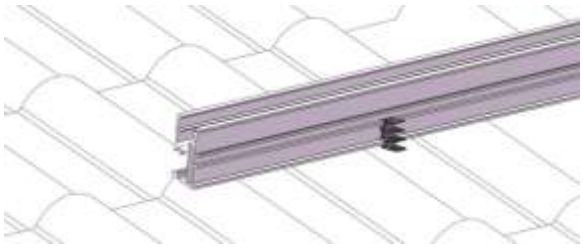
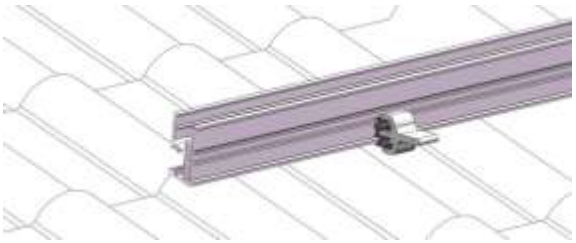
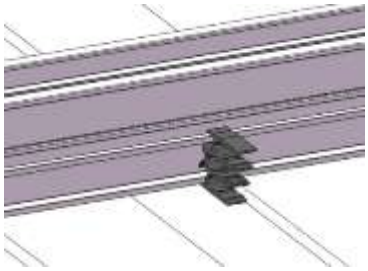
Cable Clip Installation	
1. Hook the top end of clip into the groove on the back of the rail.	
2. Push the other end of clip in to the rail groove. You can use a rubber mallet.	
3. cable clip installation completed	
4. The cable clip can hold up to 6 PV cables.	

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MT-Rail Application Note
Tilt Leg and Tin Interface Installations with MT-Rails (base-rail)

This application note is to be used with the "*SolarRoof Adjustable Tilt Legs - Installation Guide V3.0*", or eventually with "*PV-ezRack SolarRoof Fixed 30 degree Tilt Legs - Installation Guide*" depending on the interface you use.

This document is designed for installations using the PV-ezRack® SolarRoof™ MT-Rails manufactured by Clenergy. MT-Rails are mostly used on metal roofs if the roof doesn't have suitable mounting points to mount the Clenergy PV-ezRack® SolarRoof™ interfaces such as tilt legs (adjustable and fixed 30°) or the tin interface (L-feet). In these cases the MT-Rails are used as a supporting base rail.

Component list

Overview of system components

Part name	Picture	Function
ezRack MT-Rail		Base rail to mount directly on to the roof
Pan-head universal Screw 6*90		Connenction/mounting between roof and MT-Rail
Diamond module and bolt		Connenction/mounting between MT-Rail and interface
Interface	Tilt leg or Tin L-Feet	To be mounted on top of the MT-Rail with Diamond modules and bolts

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Installation preparation

Make sure that you determine the spacing of the interfaces with the PV-ezRack® SolarRoof™ calculator or by using the "*PV-ezRack® SolarRoof™ Code-Compliant Planning and Installation Guide*", "*SolarRoof Adjustable Tilt Legs - Installation Guide*", or eventually with "*PV-ezRack® SolarRoof™ Fixed 30 degree Tilt Legs - Installation Guide*" depending the interface you use.

You will require the same total length of MT-Rails as you will need for the PV-ezRack® rails. You will also require the same quantity of Diamond module and bolt assemblies (Part number: *ER-Diamond Module and bolt*) as the number of screws you would need if you would mount the interfaces (tilt legs) directly onto the roof.

Installation Instructions

It is the installer's responsibility to mount the MT-Rail securely onto the roof. Mount the MT-Rail to the purlins or rafters with the Pan Head universal screw which is provided with the tilt legs or L-Feet (tin interface). Use the same amount of wood screws to mount the MT-Rail onto the roof as you would use to mount the interfaces to the roof in that section.

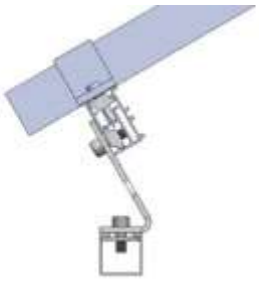
If you don't have enough mounting points on the roof you can alternatively use rivets to secure the MT-Rail to the roofing. The installer is responsible for ensuring that the structure is sound.

If you don't have enough mounting points you can use 8mm bolts and nuts with spring washers between the purlin/roof and MT-Rails as these provide a stronger connection than the universal metal screw.

Secure the MT-Rail to the roof with one of the methods mentioned above. The MT-Rails will need to be mounted parallel to the PV-ezRack® rails.

Fix the interfaces (Tilt leg or L-Feet) onto the MT-Rails with the diamond modules and bolts. From that point follow the steps according to the installation guides quoted above. Calculate the spacing between the interfaces according to our manuals or the PV-ezRack® calculator mentioned above.

MT-Rail with adjustable tilt leg



MT-Rail with fixed 30°tilt leg

MT-Rail with tin interface

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Service

10 year limited Product Warranty, 5 year limited Finish Warranty

Clenergy co. Ltd warrants to the original purchaser ("Purchaser") of product(s) that it manufactures ("Product") at the original installation site that the Product shall be free from defects in material and workmanship for a period of ten (10) years, except for the anodised finish, which finish shall be free from visible peeling, or cracking or chalking under normal atmospheric conditions for a period of five (5) years, from the earlier of 1) the date the installation of the Product is completed, or 2) 30 days after the purchase of the Product by the original Purchaser ("Finish Warranty").

The Finish Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. The Finish Warranty is VOID if the practices specified by AAMA 609 & 610-02 – "Cleaning and Maintenance for Architecturally Finished Aluminum" (www.aamanet.org) are not followed by Purchaser. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of the Product is not performed in accordance with Clenergy's written installation instructions, or if the Product has been modified, repaired, or reworked in a manner not previously authorized by Clenergy IN WRITING, or if the Product is installed in an environment for which it was not designed. Clenergy shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by Purchaser under any circumstances.

If within the specified Warranty periods the Product shall be reasonably proven to be defective, then Clenergy shall repair or replace the defective Product, or any part thereof, in Clenergy's sole discretion. Such repair or replacement shall completely satisfy and discharge all of Clenergy's liability with respect to this limited Warranty. Under no circumstances shall Clenergy be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Clenergy's limited Warranty covers only its Product, and not any related items.

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