PV-ezRACK®

SolarRoof

Code-Compliant Planning and Installation Guide V 4.4
Complying with AS/NZS1170.2-2011 AMDT 2-2016

SOLAR ROOF

Last Updated - Mar. 2022

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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, Z-Module technology and telescopic mounting technology eliminates custom cutting and enables 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,

2) Planning and installation instructions.

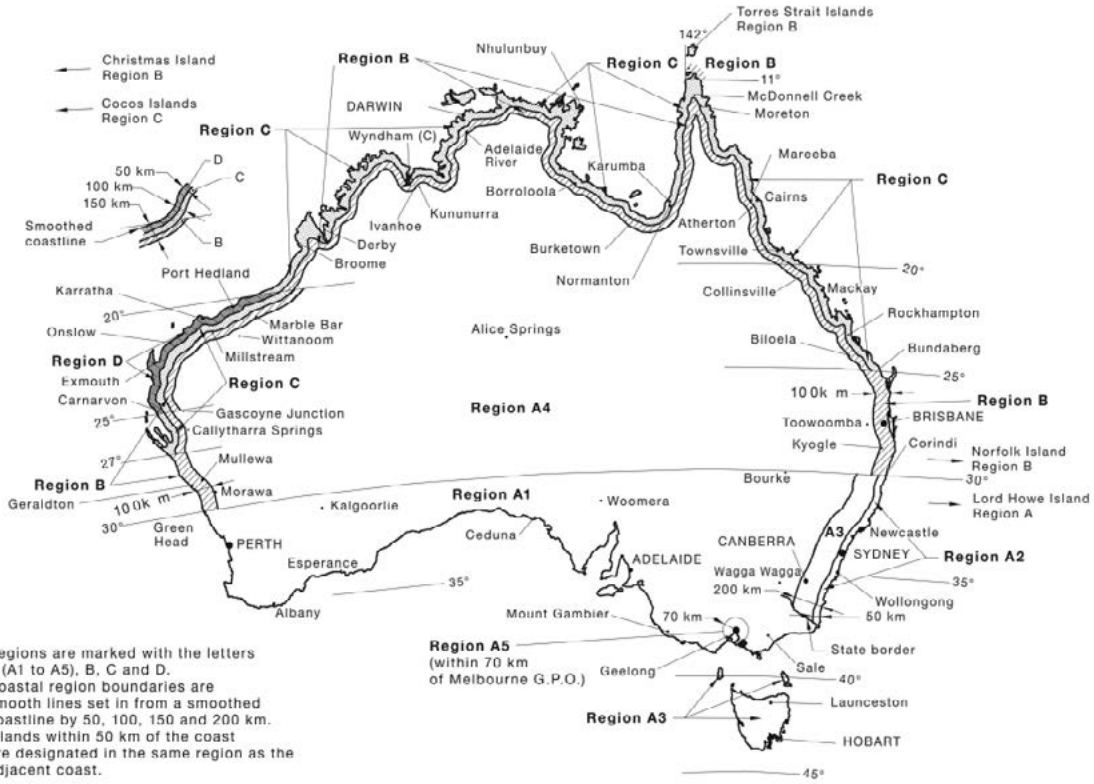
The PV-ezRack® SolarRoof parts, when installed in accordance with this guide, will be structurally sound and will meet the AS/NZS1170.2:2011 Amdt 2- 2016 standard. During installation, and especially when working on the roof, please comply with the appropriate Occupational Health and Safety regulations. Please also pay attention to any other relevant State or Federal regulations. Please check that you are using the latest version of the Installation Manual, which you can do by contacting Clenergy Australia via email on tech@clenergy.com.au, or contacting your local distributor in Australia.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any updates that may supersede this manual;
- Ensuring that PV-ezRack and other products are appropriate for the particular installation and the installation environment;
- Using only PV-ezRack parts and installer-supplied parts as specified by PV-ezRack project plan (substitution of parts may void the warranty and invalidate the letter of certification);
- Recycling: Recycle according to the local relative statute;
- Removal: Reverse installation process;
- Ensuring that there are no less than two professionals working on panel installation;
- Ensuring the installation of related electrical equipment is performed by licenced electricians;
- Ensuring safe installation of all electrical aspects of the PV array, This includes adequate earth bonding of the PV array and PV-ezRack® SolarRoof components as required in AS/NZS 5033: 2021.
- Ensuring that the roof, its rafters/purlins, connections, and other structural support members can support the array under building live load conditions;
- Ensuring that screws to fix interfaces have adequate pullout strength and shear capacities as installed;
- Maintaining the waterproof integrity of the roof, including selection of appropriate flashing;
- Verifying the compatibility of the installation considering preventing electrochemical corrosion between dissimilar metals. This may occur between structures and the building and also between structures, fasteners and PV modules, as detailed in AS/NZS 5033: 2021.
- Verifying atmospheric corrosivity zone of installation site by referring to AS 4312-2008 or consulting local construction business to determine appropriate products and installations.

Planning

Determine the wind region of your installation site



Region Definition:

Wind regions are pre-defined for the whole 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 Wind Velocity of 43 m/s with wind average recurrence of 200 years.
- Some areas are designated Region B (52 m/s). Local authorities will advise if this applies in your area.
- Region C areas (64 m/s) are generally referred to as Cyclonic and are generally limited to northern coastal areas. Most Region C zones end 100km inland.
- Region D (79 m/s) is Australia's most extreme Cyclonic Region, located between the town of Carnarvon and Pardoo Station in Western Australia.

At the condition of the wind average recurrence of 500 years, regional wind speeds of A, B, C and D are 45, 57, 69 and 88 m/s, respectively.

Whether the system applies for the wind average recurrence of 200 or 500 years is depending on the building importance level.

Example of building importance level 2 (corresponding to the wind average recurrence of 200 years) is residential shed or garage, small isolated warehouses, isolated farm sheds, residential carports, medium ground mount installations (up to 100 kw) and one or double storey dwelling.

Example of building importance level 3 (corresponding to the wind average recurrence of 500 years) is buildings and facilities where a large group of people can congregate in one area, commercial buildings, schools, aged cares, large office buildings, large commercial warehouses, large ground mount installations, multi-storey dwelling and churches.

Determine the Terrain Category

You will need to determine the terrain category to ensure the installation meets the required standard.

Terrain Category 1 (TC1) – Very exposed open terrain with very few or no obstructions, and all water surfaces, e.g. flat, treeless, poorly grassed plains; open ocean, rivers, canals, bays and lakes.

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 some trees or isolated obstructions, terrain in developing outer urban areas with scattered houses, or larger acreage developments with more than two and less then 10 buildings per hectare.

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

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

If your installation site is not at TC 2, 2.5 or 3, please contact Clenergy to obtain a project specific engineering certificate to support your installation.

Verify Atmospheric Corrosivity Zone of Installation Site

Please refer to"AS 4312-2008 Atmospheric Corrosivity Zones in Australia"or consult local construction business to verify corrosivity category of installation site to determine appropriate products and interface spacing. When standard products are installed in high corrosivity zones, like C4/C5, interface spacing reduction factor need to be applied. Please refer to the generic notes of Certification Letter for the details.

Note:
Clenergy provided screws for Tin interfaces are suitable for up to C3 corrosive environments only.

Determine the Height of the Installation Site

This document provides sufficient information for the PV-ezRack® SolarRoof system installation up to heights of 30 meters. If your installation site is more than 30 meters high please contact Clenergy to obtain project specific engineering certificate to support your installation.

Determine Roof slope

The PV-ezRack® SolarRoof system can be used for roof slopes up to 60°. Please verify that the Installation site roof slope is between 0° and 60°.

Determine the Installation Area of Roof

Please refer to the last notes of Certification Letters to determine the installation area based on building height, length and width. Please be aware at certain building conditions there is an Exclusion Zone for flush installation, which is the minimum distance between PV solar panel and roof edge of "2s", where "s" is the gap between the underside of the panel and the roof surface.

Verify Rafter/Purlin Properties of Building

Please verify rafter/purlin properties of building, which could affect the interface spacing. For example, tin interface spacing on the metal purlin in the certification letter is based on steel purlin G450 1.5 mm thick. If the steel purlin is less than 1.5 mm thick, the corresponding reduction factor of interface spacing will be applied. Please refer generic notes for details.

Determine the Maximum Rail Support Spacing

Please refer to the Certification Letter and Interface Spacing Table. If a project specific Certification Letter has been provided, please refer to the support spacing in this letter.

Verify Maximum Rail End Overhang

Rail end overhang should be not over 40% of the interface spacing. For example, if the interface spacing is 1500mm, the Rail end overhang can be up to 600mm only.

Acquire PV Modules Clamping Zone Information

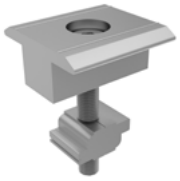
It is recommended to acquire PV modules clamping zone info. from PV modules manufacturer, which can help to plan interfaces positions on the roof and rails orientation and positions.

Tools and Components

Tools

 Angle Grinder with Stone Disk	 Screw Driver (for M8 Hexagon Socket Screw)	 Torque Spanner	 Spanner	 5m Tape
 String & Marker Pen				

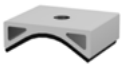
Components

				
ER-EC-ST End Clamp	**ER-IC-ST** Inter Clamp	**C-U/30/46-G** Universal Clamp	**C-U/30/46** Universal Clamp	**ER-EC-DU35/40** End Clamp, Dual 35 or 40mm
				
ER-EC-DU40/46 End Clamp, Dual 40 or 46mm	**ER-R-ECO** ECO Rail	**ER-SP-ECO** Splice for ECO Rail	**SCO-ECO/380** Side Channel Cover for Cutter-Rail, length 380 mm	

				
ER-I-41/EZC/ECO Adjustable Tile Interface with ezClick connection, 120 mm horizontal arm	**ER-I-61/EZC/ECO** Adjustable Tile Interface with ezClick connection, 170 mm horizontal arm	**ER-I-01** Tile Interface	**ER-I-01/CS** Tile Interface, Carbon Steel	**ER-I-01/EZC/ECO** Tile Interface with ezClick connection for ECO-Rail
				
ER-I-02 Flat Tile Interface	**ER-I-04** Slate Interface	**ER-I-23** Tile Interface -Landscape	**ER-I-26** Tile Interface -Side mount	**ER-I-51** Tile Interface, 118mm horizontal arm

Components

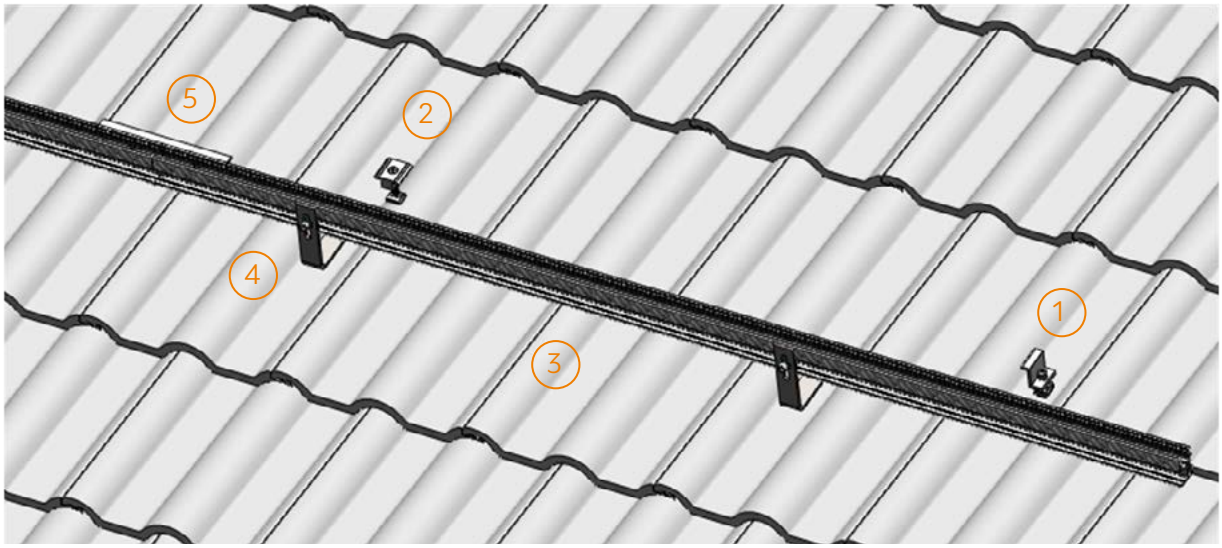
			
ER-I-05 Tin Interface	**ER-I-05/CM** Tin Interface with Click Module	**ER-I-05A/EZC/ECO** Tin Interface A with ezClick connection	**ER-I-25** Tin Interface with Curved Base for Corrugated Roof

			
ER-HB-8/150 Hanger Bolt for wood purlin	**ER-HB-MP/8/150EP** Hanger Bolt for metal purlin	**EZ-RE-200** Roof Hook Extender	**EZ-AD-C43** Adapter (Puck) for Corrugated Iron Roof

System Overview

Overview of PV-ezRack® SolarRoof

Tile Roof



1. End Clamp 2. Inter Clamp 3. ECO Rail 4. Tile interface 5. Splice for ECO Rail

Tin Roof

1. End Clamp 2. Inter Clamp 3. ECO Rail 4. Tin interface 5. Splice for ECO Rail

Precautions during Stainless Steel Fastener Installation

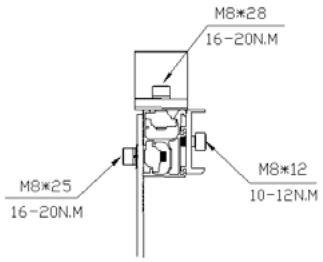
Improper operation may lead to deadlock of Nuts and Bolts. The steps below should be applied to stainless steel nut and bolt assembly to reduce this risk.

General installation instructions:

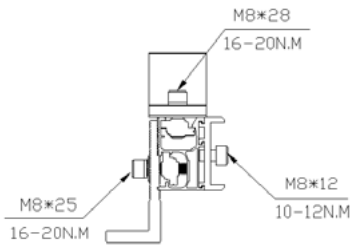
(1) Apply force to fasteners in the direction of thread
(2) Apply force uniformly, to maintain the required torque
(3) Professional tools and tool belts are recommended
(4) In some cases, fasteners could be seized over time. As an option, if want to avoid galling or seizing of thread, apply lubricant (grease or 40# engine oil) to fasteners prior to tightening.

Safe Torques

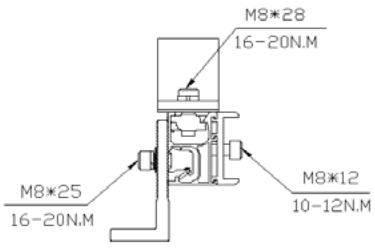
Please refer to safe torques defined in this guide as shown in the figures below. In case power tools are required, Clenergy recommends the use of low speed only. High speed and impact drivers increase the risk of bolt galling (deadlock) If deadlock occurs and you need to cut fasteners, ensure that there is no load on the fastener before you cut it. Avoid damaging the anodized or galvanized surfaces.



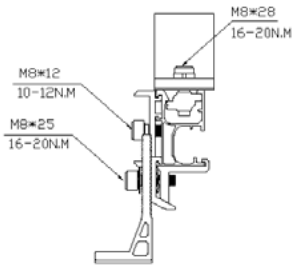
ER-I-01 and other tile interfaces



ER-I-05 and ER-I-25



ER-I-05/CM



ER-I-05A/EZC/ECO

Installation Instructions

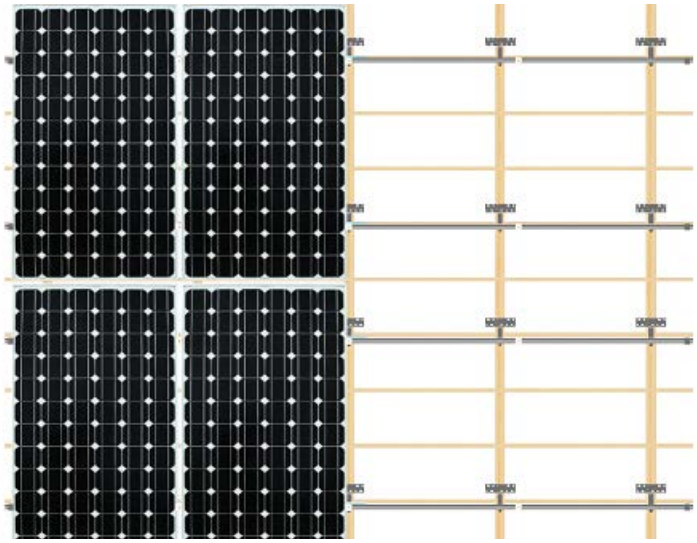
Installation Dimensions

All drawings and dimensions in this Installation Guide are a generic reference only. PV-ezRack® SolarRoof is to be optimized to suit specific conditions for each project and should be documented in a construction drawing.

Major components of PV-ezRack® SolarRoof may be provided in section sizes and lengths varying from those shown in this guide. The installation process detailed in this instruction guide remains the same regardless of changes in component size.

If you need to do any on-site modifications or alteration of the system please provide marked up drawings/sketches for Clenergy's review, prior to modification, for comment and approval.

Installation Instruction

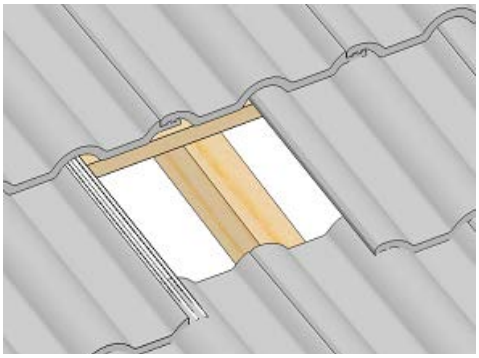


- Assess the number of modules in the vertical direction using the module height plus at least 18mm between modules (please check the installation manual of the solar module manufacturer);
- Assess the Number of modules in the horizontal direction using the module width plus 18 mm (20 mm if using Universal Clamps) between the modules.

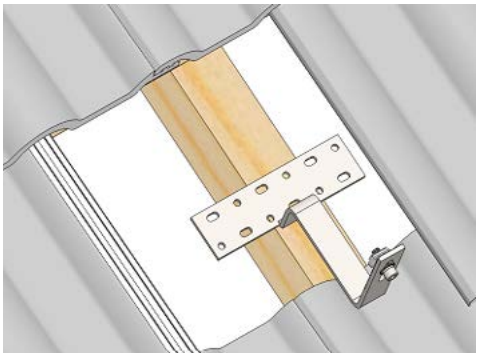
Notes:
The standard end clamp will also add 20 mm (except for dual end clamps) on each side to the space required;
- Assess the horizontal spacing of the Roof Hooks;
- Assess the vertical spacing of the Roof Hooks = approx. 1⁄2 to 3⁄4 of module height;
- Always check the installation manual of the PV-Module you use in order to determine the allowed fixing points on the module frame.

Tile Interface Installation

Determine the positions of the Roof Hooks according to your plans. Remove the roof tiles at the marked positions or, if possible, simply push them up slightly.shown in Figures 5.3C and 5.3D.



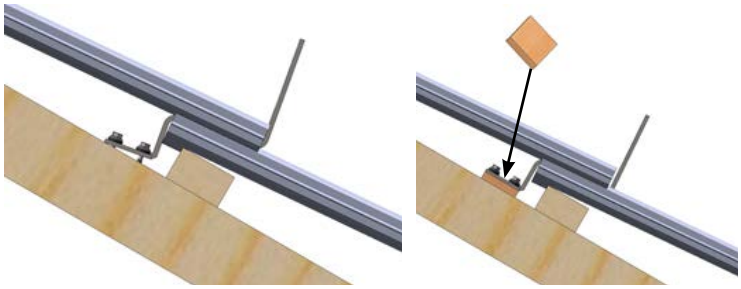
Fix the Roof Hooks to the rafter using Clenergy provided Buildex 14 gauge Hex Head Zips screw with minimum 25 mm embedment as shown in the figure on the right following the Buildex screws installation guide below:



- Use a 3/8" Hex Socket.
- Use a mains powered or cordless screw driver with a drive speed of 3,000 RPM maximum.
- Fit the driver bit into the screw and place at the fastening position.
- Apply consistently firm pressure (end load) to the screw driver until the screw is fastened.

Incorrect Correct

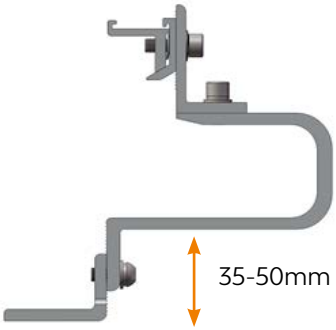
The roof hook must not press against the roof tile. If necessary, pack the roof hook with max pack height of 17 mm for Clenergy provided Buildex 50 mm long screw, with max pack height of 35 mm for Clenergy provided Buildex 65 mm long screw.



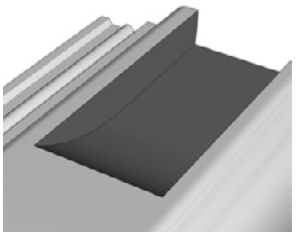
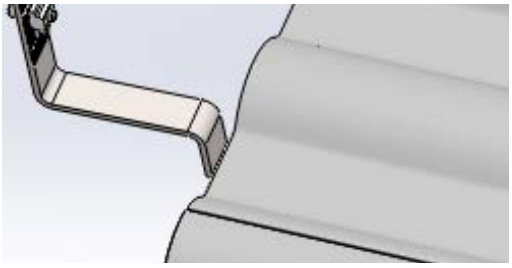
Notes:

When installing Adjustable Tile Interface (ER-I-41/EZC/ECO or ER-I-61/EZC/ECO), height can be adjustable from 35mm to 50mm.

The recommended torque of bolt for height adjustment is 16-20 N·m.

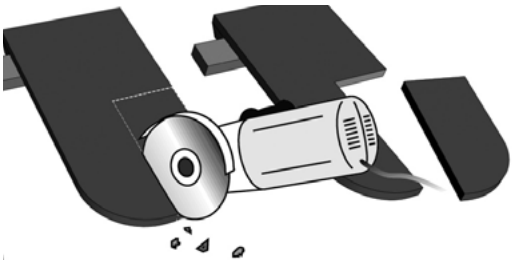


If necessary, use an angle grinder
to cut a recess in the tile covering the Roof Hook at the point where the Roof Hook extends so that the tile lies flat on the surface. If grooved tiles are used, it will also be necessary to cut a recess in the lower tile.

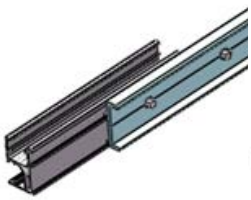
Caution! Do not use fitted roof hooks as a ladder, as this extreme point load could damage the tile below.

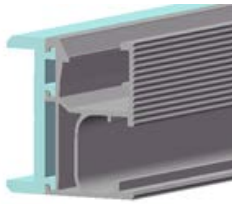
Variation for installation on plain tile roofs with plain tile roof cladding: A recess must be cut into the tiles around the position of the roof hook.The tile flashing should be used if necessary to prevent ingress of water.



Rail Installation

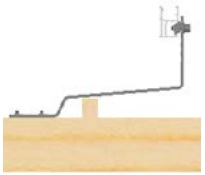
To connect several rails together, slide half of the splice into the rear side of the rail. Fasten the first M8 Bolt using an Allen key, and slide the next rail into the splice. Tighten the second M8 Bolt using an Allen key. Splice provides the electrical connection between the 2 rails through the pressure bolts. This eliminates the need of using 2 earthing lugs Recommended torque is 10 ~12 Nm.



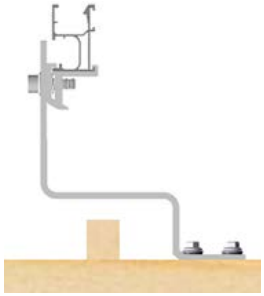


If the rails consist of different lengths, always begin with the shortest piece. Install the PV modules on the Roof Hooks and fasten loosely with M8 x 25 bolt and washers as shown in the figure on the right. Two to three screw turns are adequate for loose installation.

ER-I-01

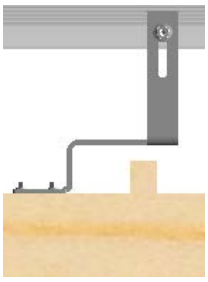


ER-I-02

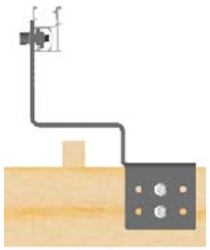


ER-I-01/EZC/ECO

ER-I-51



ER-I-23



ER-I-26

Adjustable Tile Interface (ER-I-41/EZC/ECO or ER-I-61/EZC/ECO) can adjust L profile bracket on the top to achieve rail running parallel or perpendicular to the rafter. See the figures below.

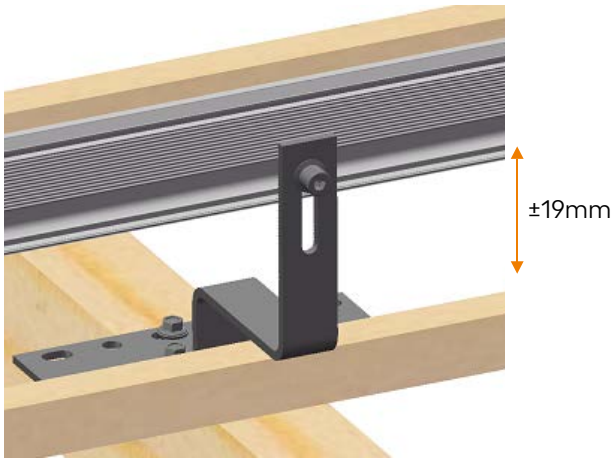
ER-I-41/EZC/ECO

ER-I-61/EZC/ECO

Notes:

1. For ER-I-41/EZC/ECO adjustable tile interface, interface spacings at 3 different scenarios above are different;
2. There is an adjustable tile interface specific engineering letter (at the end of this installation guide) for both ER-I-41/EZC/ECO and ER-I-61/EZC/ECO.

Adjust the vertical and horizontal positioning using the long hole in the Roof Hook and the loosely connected Z Module in the rail, as shown in the figure on the right. The roof hook should not protrude over the rail after the adjustment.
The recommended torque is 16~20N·m.



PV Module Installation

1) Please refer PV-ezRack® Grounding System for PV modules clamps and grounding lugs installations.
2) The installers must ensure panel clamps are installed flush mounted to the panel frame and apply correct torque value of clamp fastener as shown in section "**Safe Torques (Page 10)**".

Tin Interface Installation

For installations using ER-I-05,Tin Interface equipped with Buildex 14-11 x 70 (14 gauge, 6.3 mm, 11 TPI, 70 mm long) Hex Head Zips screw. Fix the ER-I-05 at the planned locations on metal or wood purlins as shown in the figure on the right following the Buildex screws installation guide below:

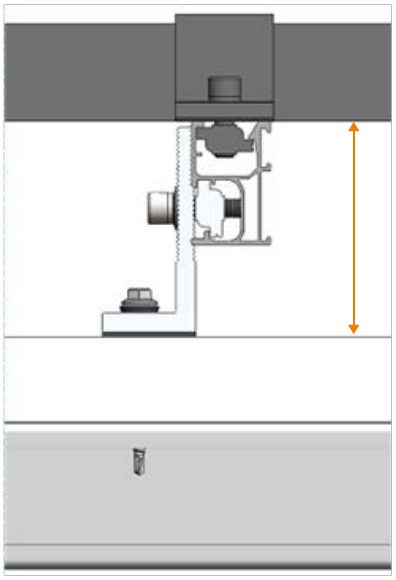
- Use a 3/8" Hex Socket.

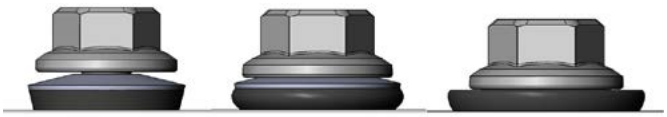
- Use a mains powered or cordless screw driver with a drive speed of 3,000 RPM maximum.

- Fit the driver bit into the screw and place at the fastening position.

- Apply consistently firm pressure (end load) to the screw driver until the screw is fastened.

- Screws with bonded washers should be tightened only until the washer is gripped firmly enough to provide a watertight seal. The screws should be neither under tightened nor over tightened to lead to water penetration. Take particular care to ensure the screw is driven perpendicular to the interface to avoid deformation of the washer.

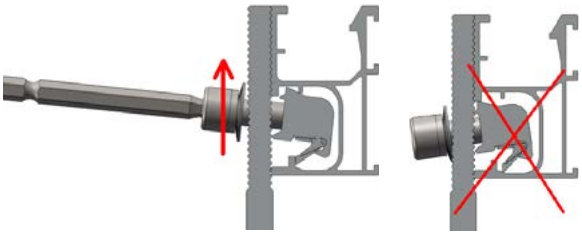




Repeat "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.

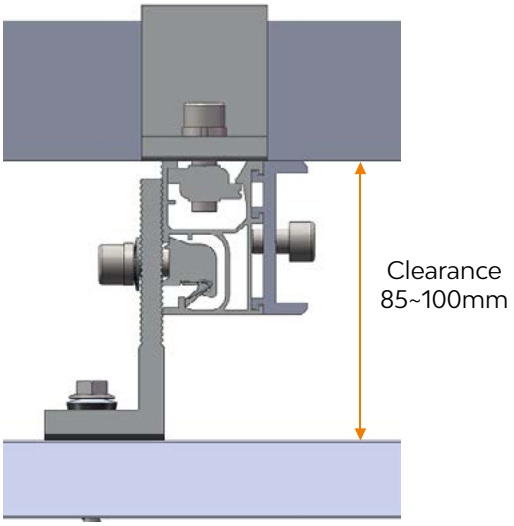
Notes:
- The purlin thickness should be no less than 0.42mm and no more than 2.4mm;
- Please refer to the recommended torques in "**Safe Torques (Page 10)**";
- Screws not exposed to frequent rain should be washed down with fresh water at least every 6 months to meet the warranty conditions of Buildex screws.

For installations using ER-I-05/CM, Tin Interface with Click Module, equipped with Buildex 14-11 x 70 (14 gauge, 6.3 mm, 11 TPI, 70 mm long) Hex Head Zips screw. . Fix the ER-I-05/CM at the planned locations on metal or wood purlins as shown in the figure on the right following the Buildex screws installation guide above. Repeat "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.



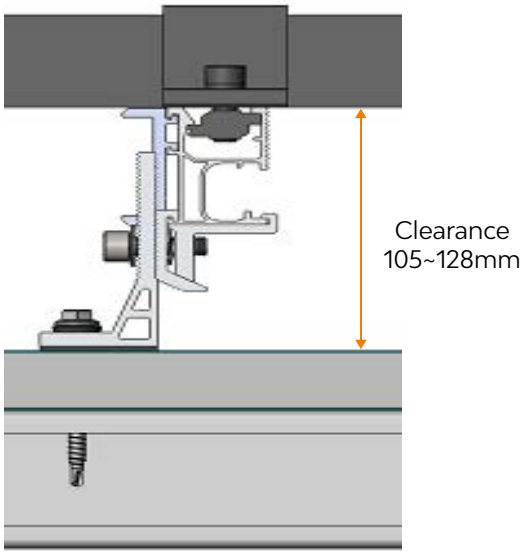
When fastening ER-I-05/CM with rail, it needs to lift up the bolt of click module to make click module well touch with upper rib of side channel of rail. So, the click module can be fixed into the rail properly as shown in the figure on the right.

Notes:
- The purlin thickness should be no less than 0.42mm and no more than 2.4mm;
- Please refer to the recommended torques in "**Safe Torques (Page 10)**";
- Screws not exposed to frequent rain should be washed down with fresh water at least every 6 months to meet the warranty conditions of Buildex screws.

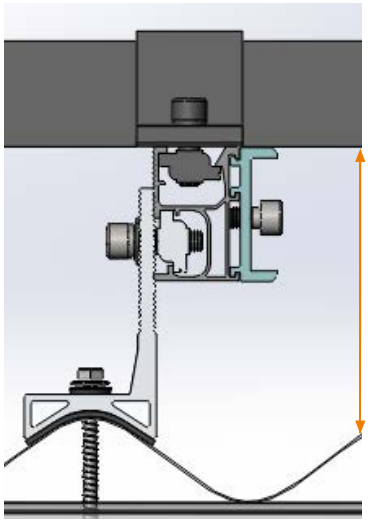


For installations using ER-I-05A/EZC/ECO, Tin Interface with ezClick connection with Buildex 14-11 x 70 (14 gauge, 6.3 mm, 11 TPI, 70 mm long) Hex Head Zips screw. Fix the ER-I-05A/EZC/ECO at the planned locations on metal or wood purlins as shown in the figure on the right following the Buildex screws installation guide above. Repeat "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install Rails and PV Modules.

Notes:
- The purlin thickness should be no less than 0.42mm and no more than 2.4mm;
- Please refer to the recommended torques in "**Safe Torques (Page 10)**";
- Screws not exposed to frequent rain should be washed down with fresh water at least every 6 months to meet the warranty conditions of Buildex screws.



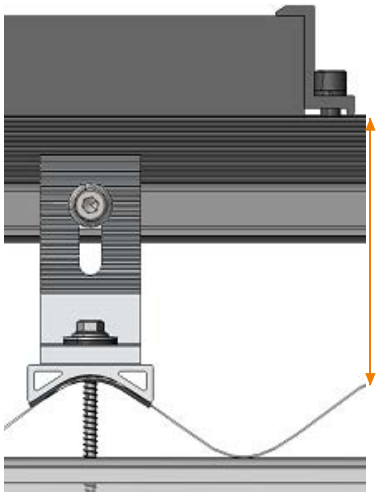
For installations using ER-I-25, Tin Interface with Curved Base for Corrugated Roof with Buildex 14-11 x 70 (14 gauge, 6.3 mm, 11 TPI, 70 mm long) Hex Head Zips screw. Fix the ER-I-25 at the planned locations on metal or wood purlins as shown in the figure on the right following the Buildex screws installation guide above. Repeat "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install Rails and PV Modules.



Clearance
89~104mm

Notes:
- The purlin thickness should be no less than 0.42mm and no more than 2.4mm;
- Please refer to the recommended torques in "**Safe Torques (Page 10)**";
- Screws not exposed to frequent rain should be washed down with fresh water at least every 6 months to meet the warranty conditions of Buildex screws.

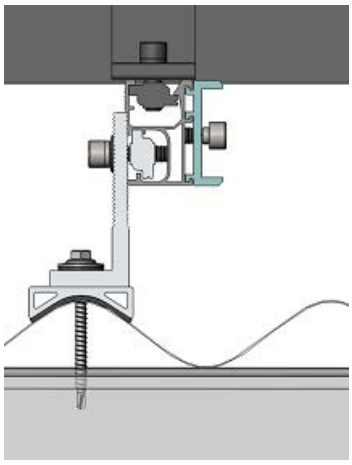
For installations using EZ-AD-C43 and ER-I-05, Adapter (Puck) for Corrugated Iron Roof and Tin Interface. Attach the EZ-AD-C43 on the planned position and then fix the ER-I-05 on metal or wood purlins as shown in the figure on the right following the Buildex screws installation guide above. Repeat "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install Rails and PV Modules.



Clearance
89~104mm

The rail is perpendicular to the Rib of metal sheet roof

Notes:
- The purlin thickness should be no less than 0.42mm and no more than 2.4mm;
- Please refer to the recommended torques in "**Safe Torques (Page 10)**";
- Screws not exposed to frequent rain should be washed down with fresh water at least every 6 months to meet the warranty conditions of Buildex screws.



Clearance
89~104mm

The rail is parallel to the Rib of metal sheet roof

NOTE:
WHEN USING TIN INTERFACES FOR INSTALLATION WORKS, SCREWS NOT EXPOSED TO FREQUENT RAIN SHOULD BE WASHED DOWN WITH FRESH WATER AT LEAST EVERY 6 MONTHS TO MEET THE WARRANTY CONDITIONS OF BUILDEX SCREWS.

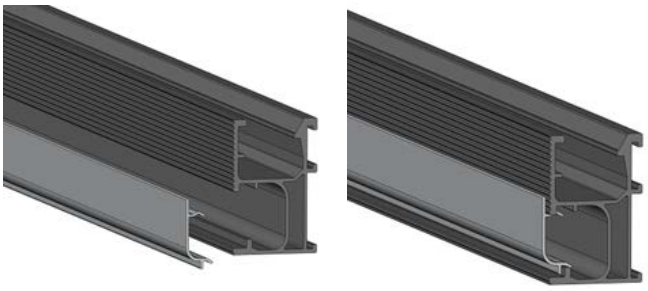
Side Channel Cover for Cutter-Rail Installation (optional)

After cables going into the side channel of Cutter-Rail, click covers into side channel of Cutter-Rail at the required places shown in Figures at the right side.

Notes:
1. Side channel cover is made of mill finish aluminium, which is only compatible with Cutter rail;

2. The main purpose of side channel cover is to cover the cables running through side channel of Cutter rail. To achieve the cable management purpose is also to require ezclick tile or tin interfaces only as they can leave side channel full open and not cause any obstruction or damage to the cables;

3. If requires the position adjustment, it is recommended to slide it on the channel rather than uninstallation and reinstallation, which could deform it due to very thin thickness.



Hanger Bolt Installation

Hanger Bolt for Tile Roof Installation

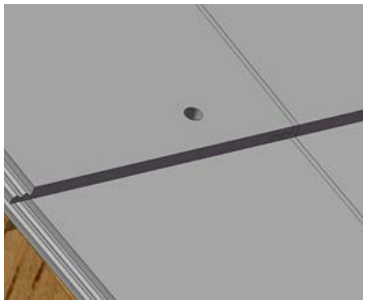
Hanger bolt (ER-HB-8/150) installation on tile roof is only applicable for tile having some part of flat surface, where the rubber seal of hanger bot can mount flush on the tile not to cause waterproof problem. Please note it is installer's responsibility to verify feasibility of tile brackets penetration and to ensure tiles are not cracked and damaged in hanger bolt installation.

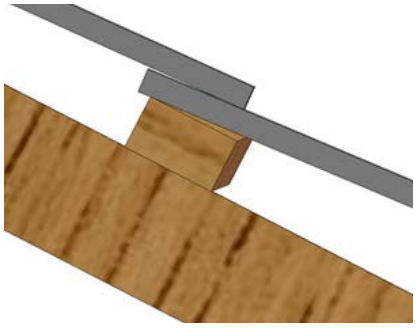
1. Purlins are to be identified when opening tiles and their positions are marked out on the tiles.
2. Based on installation plan and Hanger bolt spacing info., hanger bolt locations are marked on the tiles.

Note:
Please find tin interface spacing in the certification letter for hanger bolt spacing.

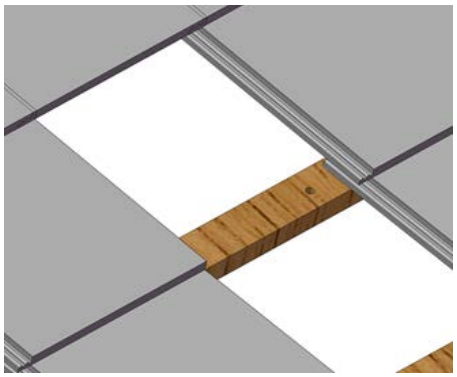
3. Drill 10 mm hole on the marked location of tile and stop when reaching the purlins.

Note:
For some installations, it needs to drill through two tiles (overlap) to reach the purlin;



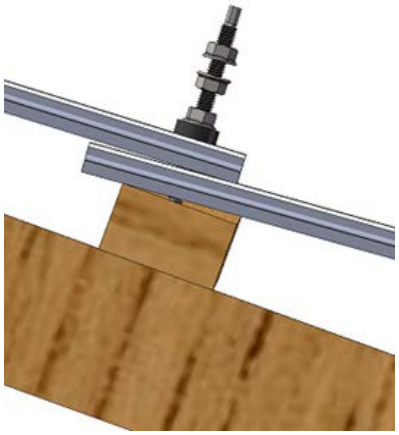


4. Through 10 mm hole on the tiles, pre-drill 6.5 mm hole on the wood purlin for hanger bolt. The tiles are not removed when drilling this hole. After the drilling, clean the dust around 10 mm hole.



5. Adjust the position of rubber seal on the hanger bolt (ER-HB-8/150) to ensure hanger bolt have minimum 25 mm penetration depth into the wood purlin.

Drive and press the hanger bolt firmly in an axial manner to the wood purlin till the rubber seal is firmly flush on the tile and turn the nut down till touching the rubber seal. Please apply for low rotational speed of drive, preferably less than 300 rpm to reduce threads damage. Please turn another 4 threads cycle to press the rubber seal.



Note:
1) Purlin thickness and tile thickness need to be verified to decide position of rubber seal for appropriate penetration depth;
2) It is recommended to apply Sikaflex on the area around 10 mm hole of the tile before fixing hanger bolt. Please refer Sikaflex instructions for use.

6. Screw out the top nut of hanger bolt, connect and adjust tin foot position and tighten the top nut with the recommended torque of 16~20 N·m.

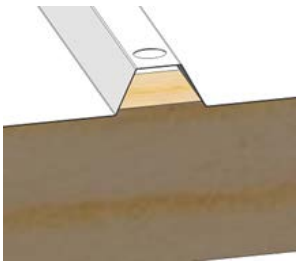
Follow sections "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.

Hanger Bolt Installation

Hanger Bolt for Tin Roof Installation

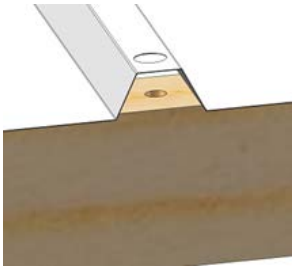
1. Hanger Bolt for wood purlin Installation

Hanger bolt (ER-HB-8/150) installation on tin roof is recommended for trapezoidal profile of roof or similar one having flat surface on the rib.



Drill 11 mm hole on the marked location of roof sheet according to installation plan.

Through 11 mm hole on the roof sheet, pre-drill 6.5 mm hole on the wood purlin for hanger bolt.

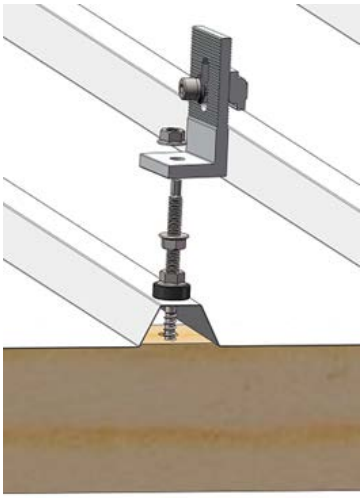


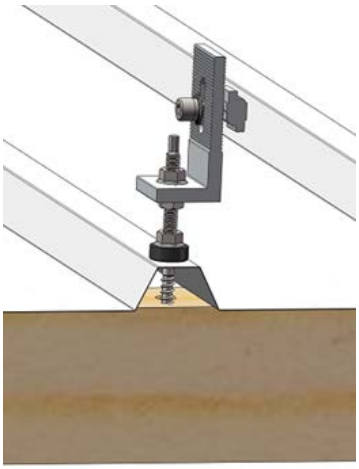
Adjust the position of rubber seal on the hanger bolt (ER-HB-8/150) to ensure hanger bolt have minimum 25 mm penetration depth into the wood purlin.

Drive and press the hanger bolt firmly in an axial manner to the wood purlin till the rubber seal is firmly flush on the tile and turn the nut down till touching the rubber seal. Please apply for low rotational speed of drive, preferably less than 300 rpm to reduce threads damage. Please turn another 4 threads cycle to press the rubber seal.

Notes:
1) Penetration depth into the wood purlin is used to decide position of rubber seal;
2) It is recommended to apply Sikaflex on the area around 11 mm hole of tin roof before fixing hanger bolt. Please refer Sikaflex instructions for use.
3) The roof sheet should not have visible deformation after hanger bolt installation.

Screw out the top nut of hanger bolt, connect and adjust tin foot position and tighten the top nut with the recommended torque of 16~20 N·m.

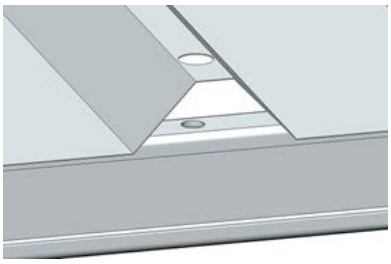




Follow sections "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.

2. Hanger Bolt for metal purlin Installation

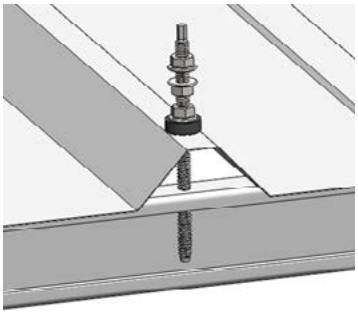
Hanger bolt (ER-HB-MP/8/150EP) installation on tin roof is recommended for trapezoidal profile of roof or similar one having flat surface on the rib.



Drill 11 mm hole on the marked location of roof sheet according to installation plan.

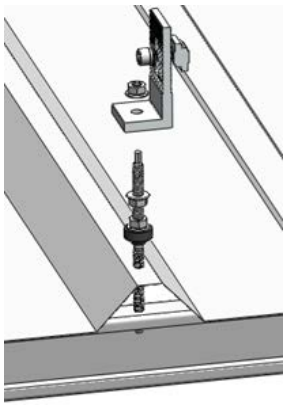
Through 11 mm hole on the roof sheet, pre-drill 6.5 mm hole on the metal purlin for hanger bolt.

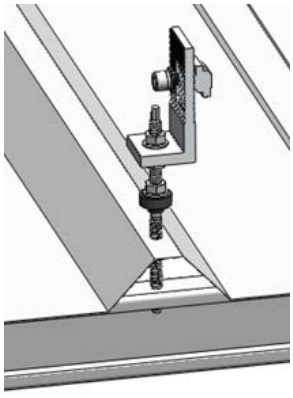
Drive and press the hanger bolt (ER-HB-MP/8/150EP) firmly in an axial manner to the metal purlin till the rubber seal is firmly flush on the tile and turn the nut down till touching the rubber seal. Please apply for low rotational speed of drive, preferably less than 300 rpm to reduce threads damage. Please turn another 4 threads cycle to press the rubber seal.



Notes:
1) It is recommended to apply Sikaflex on the area around 11 mm hole of tin roof before fixing hanger bolt. Please refer Sikaflex instructions for use.
2) The roof sheet should not have visible deformation after hanger bolt installation.

Screw out the top nut of hanger bolt, connect and adjust tin foot position and tighten the top nut with the recommended torque of 16~20 N·m.





Follow sections "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.

Roof Hook Extender Installation

1. Roof Hook Extender with Tile Interface Installation

Install the roof hook extender with Tile Interface as shown in the figures on the right.

Either use circular hole or elongated hole of roof hook extender to connect with Tile Interface is allowed.

Recommended torque of M8 bolt is 16~20N·m

Follow sections "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.

Tile Interface connection with circular hole

Tile Interface connection with elongated hole

2. Roof Hook Extender with Tin Interface Installation

Install the Roof hook Extender with L feet as shown in the figure on the right.

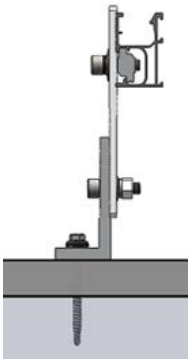
Either use circular hole or elongated hole of roof hook extender to connect with Tin Interface is allowed.

Recommended torque of M8 bolt is 16~20N·m

Follow sections "**Rail Installation (Page 13)**" and "**PV Module Installation (Page 15)**" to install the Rails and PV Modules.

Tin Interface connection with circular hole

Tin Interface connection with elongated hole



Standard Certification Letter

(Wind average recurrence of 200 years)

MW Engineering Melbourne

CIVIL & STRUCTURAL ENGINEERS
RESIDENTIAL - INDUSTRIAL - COMMERCIAL - PRODUCT DEVELOPMENT
info@mwengineering.melbourne
Phone: 1300 MWENG-0 (1300 69364-0)
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ABN 37 605 815 585

14 July 2021

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

CERTIFICATION LETTER

Clenergy PV-ezRack Solar Roof Certification – TC2, 2.5, 3 – Wind Region A, B, C, D. Internal REF: **00115.**
Project REF: **CL-10088-SM-REV-I.**

MW Engineering Melbourne, being Structural Engineers within the meaning of Australian regulations, have calculated the maximum spacings for the PV ez-Rack rail system for the following conditions:

- **Wind Loads to AS 1170.2-2011 AMDT 4-2016**
  - **Wind Terrain Category 2, 2.5 and 3**
  - **Wind average recurrence of 200 years**
  - **Wind Region A, B, C, D**
- **Solar panel length up to 2.4m**

Attached are the tables showing the spacings according to Wind Region, roof pitch, and building height.

The values shown on these tables will be valid unless an amendment is issued on any of the following codes:

- **AS/NZS 1170.0- 2002 AMDT 4-2016** **General Principles**
- **AS/NZS 1170.1- 2002 AMDT 4-2016** **Imposed Loadings**
- **AS/NZS 1170.2- 2011 AMDT 4-2016** **Wind Loadings**
- **AS/NZS 1664.1- 1997 AMDT 1:1999** **Aluminium Code**

Should you have any queries, do not hesitate to contact us.

Best Regards,

Alberto Escobar
Civil/Structural Engineer
BEng MIEAust NER
BRP EC 46542
RPEQ 18759
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July 2021

STRUCTURAL DESIGN CERTIFICATION

PV-ezRack^{R} SolarRoof tin and tile flush interface spacing tables according to AS/NZS 1170.2:2011 Amdt 4-2016

Within Australia

Terrain Category 2, 2.5 & 3

Client: Clenergy Australia

REF: CL-10088-SM – REV I

Date: JUL 2021

Limitation: This report has been prepared for the exclusive use of Clenergy Australia, and is subject to and issued in connection with the provisions of the agreement between MW Engineering Melbourne and Clenergy Australia. MW Engineering Melbourne accepts no liability or responsibility whatsoever for any use of or reliance upon this report by any third party other than Clenergy's clients.

Internal REF: 00115

Client: Clenergy Australia

Project: PV-ezRack SolarRoof tin and tile flush interface spacing tables

Australian Standards

AS/NZS 1170.0:2002 (R2016)	**General Principles**
AS/NZS 1170.1:2002 (R2016)	**Imposed loadings**
AS/NZS 1170.2:2011 (R2016)	**Wind Loadings**
AS/NZS 1664.1:1997-Amdt 1:1999	**Aluminium**

Wind Terrain Category: 2, 2.5 & 3

Wind average recurrence: 200 years

Designed: SM

Date: JUL 2021

Disclaimer: From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

Clenergy

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1488	1637	1444	1588	1369	1506	1354	1490	1310	1441
B	1086	1195	997	1097	893	982	819	900	700	769
C	692	761	647	712	566	622	513	565	454	499
D	417	458	402	442	365	401	327	360	290	319

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1459	1604	1415	1556	1342	1476	1327	1460	1284	1412
B	1065	1171	977	1075	875	963	802	882	686	754
C	678	746	634	698	554	610	503	554	445	489
D	408	449	394	433	357	393	321	353	284	313

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1444	1588	1400	1540	1328	1461	1314	1445	1270	1397
B	1054	1159	967	1064	866	953	794	873	679	746
C	671	738	628	691	549	603	498	548	440	484
D	404	445	390	429	354	389	318	349	282	310

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1414	943	707	471	1371	914	686	457	1301	867	651	434	1287	858	644	429	1244	829	622	415
B	1032	688	516	344	947	631	474	316	848	565	424	283	778	519	389	259	665	443	333	222
C	657	438	329	219	615	410	308	205	537	358	269	179	488	325	244	163	431	287	216	144
D	396	264	198	132	382	255	191	127	346	231	173	115	311	207	156	104	276	184	138	92

Clenergy

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1560	1717	1514	1665	1436	1579	1420	1562	1373	1511
B	1139	1253	1046	1150	936	1030	858	944	733	807
C	726	798	679	747	593	652	538	592	476	524
D	437	481	421	463	382	421	343	378	304	335

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1529	1682	1483	1632	1407	1548	1392	1531	1346	1480
B	1116	1228	1025	1127	918	1009	841	925	719	791
C	711	782	665	732	581	639	528	580	466	513
D	428	471	413	454	375	412	336	370	298	328

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1514	1665	1468	1615	1393	1532	1377	1515	1332	1465
B	1105	1215	1014	1116	908	999	833	916	711	783
C	704	774	658	724	575	633	522	574	462	508
D	424	466	409	450	371	408	333	366	295	325

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1482	988	741	494	1438	959	719	479	1364	909	682	455	1349	899	675	450	1305	870	653	435
B	1082	721	541	361	993	662	497	331	889	593	445	296	815	543	408	272	697	465	349	232
C	689	459	345	230	645	430	323	215	563	375	282	188	511	341	256	170	452	301	226	151
D	415	277	208	138	400	267	200	133	363	242	182	121	326	217	163	109	289	193	145	96

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1665	1832	1615	1777	1532	1685	1515	1667	1465	1612
B	1216	1337	1116	1227	999	1099	916	1008	783	861
C	774	852	724	797	633	696	575	632	508	559
D	466	513	450	495	408	449	366	403	325	357

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1632	1795	1583	1741	1501	1652	1485	1634	1436	1580
B	1191	1311	1093	1203	979	1077	898	987	767	844
C	759	835	710	781	620	682	563	619	498	548
D	457	503	441	485	400	440	359	395	318	350

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1615	1777	1567	1724	1486	1635	1470	1617	1422	1564
B	1179	1297	1082	1191	969	1066	888	977	759	835
C	751	826	703	773	614	675	557	613	493	542
D	452	498	436	480	396	435	355	391	315	346

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1582	1055	791	527	1535	1023	768	512	1455	970	728	485	1440	960	720	480	1392	928	696	464
B	1155	770	578	385	1060	707	530	353	949	633	475	316	870	580	435	290	744	496	372	248
C	736	491	368	245	688	459	344	229	601	401	301	200	546	364	273	182	483	322	242	161
D	443	295	222	148	427	285	214	142	388	259	194	129	348	232	174	116	308	205	154	103

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1579	1737	1496	1646	1469	1616	1432	1575	1377	1515
B	1368	1505	1157	1272	1047	1151	964	1060	900	990
C	890	980	734	808	670	737	624	687	588	646
D	542	596	506	556	431	475	395	434	367	404

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1574	1732	1492	1641	1460	1606	1423	1565	1372	1510
B	1359	1495	1157	1272	1042	1146	955	1050	895	985
C	881	969	730	803	661	727	620	682	583	641
D	532	586	464	510	422	465	386	424	358	394

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1570	1727	1487	1636	1460	1606	1418	1560	1368	1505
B	1359	1495	1148	1262	1037	1141	950	1045	890	980
C	877	964	725	798	661	727	620	682	583	641
D	532	586	464	510	422	465	386	424	353	389

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1561	1041	781	520	1469	979	735	490	1423	949	712	474	1386	924	693	462	1359	906	680	453
B	1331	887	666	444	1102	735	551	367	1010	673	505	337	936	624	468	312	872	581	436	291
C	863	575	432	288	707	471	354	236	597	398	299	199	615	410	308	205	578	385	289	193
D	532	355	266	177	459	306	230	153	413	275	207	138	376	251	188	125	349	233	175	116

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1671	1838	1616	1777	1561	1717	1487	1636	1469	1616
B	1460	1606	1359	1495	1221	1343	1111	1222	1010	1111
C	1001	1101	890	980	789	868	725	798	652	717
D	624	687	569	626	505	555	459	505	422	465

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1666	1833	1611	1772	1551	1707	1478	1626	1460	1606
B	1450	1595	1359	1495	1216	1338	1106	1217	1005	1106
C	996	1096	881	969	780	858	725	798	643	707
D	620	682	565	621	500	550	450	495	418	459

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1662	1828	1607	1767	1551	1707	1473	1621	1455	1601
B	1450	1595	1354	1489	1212	1333	1102	1212	1001	1101
C	987	1086	877	964	776	853	721	793	643	707
D	620	682	565	621	496	545	454	500	413	454

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1652	1101	826	551	1561	1041	781	520	1515	1010	758	505	1469	979	735	490	1359	906	680	453
B	1395	930	698	465	1304	869	652	435	1193	795	597	398	1092	728	546	364	964	643	482	321
C	955	637	478	318	863	575	432	288	771	514	386	257	716	477	358	239	643	429	322	214
D	615	410	308	205	551	367	276	184	487	325	244	162	441	294	221	147	404	269	202	135

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1744	1919	1735	1909	1671	1838	1597	1757	1450	1595
B	1528	1681	1524	1676	1423	1565	1285	1414	1148	1262
C	1102	1212	1092	1202	946	1040	845	929	753	828
D	689	757	679	747	606	666	532	586	468	515

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1735	1909	1726	1898	1666	1833	1588	1747	1446	1590
B	1524	1676	1519	1671	1418	1560	1276	1404	1138	1252
C	1102	1212	1088	1197	936	1030	840	924	748	823
D	684	752	670	737	601	661	523	576	464	510

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1680	1848	1662	1828	1597	1757	1524	1676	1377	1515
B	1515	1666	1423	1565	1368	1505	1248	1373	1102	1212
C	1203	1323	1065	1171	918	1010	826	909	725	798
D	776	853	652	717	588	646	514	565	450	495

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1671	1114	836	557	1662	1108	831	554	1597	1065	799	532	1524	1016	762	508	1377	918	689	459
B	1441	961	721	480	1423	949	712	474	1368	912	684	456	1248	832	624	416	1102	735	551	367
C	1074	716	537	358	1065	710	533	355	918	612	459	306	826	551	413	275	725	483	363	242
D	661	441	331	220	652	435	326	217	588	392	294	196	514	343	257	171	450	300	225	150

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General Notes

Note 1. Tile roof interface spacing tables based on a minimum depth into **F7 (Pine) timber of 25mm** whereas **Tin roof interface** spacing tables based on a minimum depth into **F7 (Pine) timber of 35mm** and **Steel Purlins G450 1.5mm thick**.

Note 2. This engineering document was designed to cater for most common installation scenarios however, it does not cater for all of them. Contact Clenergy if you are unable to comply with any of the installation specifications listed on this document.

Importance level	Structure type examples	Annual probability of exceedance for a design working life of 25 years
1	Fences, utility posts, isolated minor facilities, minor temporary facilities and small ground mount installations (up to 20 kw).	1/100 - 100 years
2	Residential shed or garage, small isolated warehouses, isolated farm sheds, residential carports, medium ground mount installations (up to 100 kw) and one or double storey dwelling.	1/200 – 200 years
3	Buildings and facilities where a large group of people can congregate in one area, commercial buildings, schools, aged cares, large office buildings, large commercial warehouses, large ground mount installations, multi-storey dwelling and churches.	1/500 – 500 years
4	Buildings and facilities designated as essential facilities such as medical emergency or surgery facilities, universities, police stations, emergency shelters, High rise buildings (more than 40 storeys) airports and government buildings.	1/1000 – 1000 years

Note 3. Standard screws shipped for tin and tile Roof Interfaces

Metal Purlins/Battens	**Fasteners to use**
0.42 mm to 0.75 mm	Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer on G550 Steel Battens or a screw that has an equal or a higher pullout capacity.
1.2 mm to 2.4 mm	Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer or a screw that has an equal or a higher pullout capacity.
Wood Purlins and Rafters	**Fasteners to be used**
Timber F7 (Pine) and Timber 17 (Hardwood).	**Tin Interface:** Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer or a screw that has an equal or a higher pullout capacity.
	Tile Interface: Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer or a screw that has an equal or a higher pullout capacity or 14-10 x 50 Hex Head T17 with 16mm ABW Climaseal 3 or 14-10 x 65 Hex Head T17 Climaseal 3 or other screw of pullout value not less than screws above.

Note 4. Tin interface increase or reduction factors depending on the type of tophat, purlin or batten as per the below table

Purlin Material	Purlin thickness (mm)	Min. embedment (mm)	Spacing +/- (WR A)	Spacing +/- (WR B)	Spacing +/- (WR C)	Spacing +/- (WR D)
Timber (Pine F7)	-	25	- 25 %	- 35 %	- 35 %	- 35 %
Timber (Pine F7)	-	30	- 20 %	- 25 %	- 25 %	- 25 %
Timber (Pine F7)	-	35	-	-	-	-
Timber (Hardwood F17)	-	25	-	-	+ 5 %	+ 10 %
Timber (Hardwood F17)	-	30	-	-	+ 10 %	+ 15 %
Timber (Hardwood F17)	-	35	-	-	+ 10 %	+ 20 %
Metal (G550)	0.42	-	-75%	-80%	-80%	-80%
Metal (G550)	0.48	-	-60%	-70%	-70%	-70%
Metal (G550)	0.55	-	-50%	-65%	-65%	-65%
Metal (G550)	0.75	-	- 25 %	- 30 %	- 30 %	- 30 %
Metal (G450)	1.2	-	- 20 %	- 30 %	- 30 %	- 30 %
Metal (G450)	1.5	-	-	-	-	-
Metal (G450)	1.9	-	-	-	+ 5 %	+ 10 %
Metal (G450)	2.4	-	-	-	+ 5 %	+ 10 %

Note 5. Minimum number of screws to be used when installing **tile** (ER-I-01) interface to be two (2) and when installing **tin** (ER-I-05) interface to be one (1).

Note 6. Spacings on tile interfaces will be reduced as follows:

Interface	% of Reduction
ER-I-01/CS, ER-I-51 & ER-I-01/EZC/ECO	-
ER-I-02	-50%
ER-I-04	-50%
ER-I-23	-28%
ER-I-26	-28%

Note 7. The most conservative spacing has to be used if one panel or panel row fall between two roof zones.

Note 8. The following components are satisfied for use according to AS/NZS 1664.1:1997-Amdt 1:1999 and AS/NZS 1170.2:2011 Amdt 4-2016

Components	Part No.	Description
ECO-Rail	ER-R-ECO/XXXX	ECO Rail
Splice	ER-SP-ECO	PV-ezRack Splice for ECO rail
Australian Made Mill Finish ECO Rail	R-ECO/XXXX/AUMF	PV-ezRack Australian Made Mill Finish ECO Rail

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Components	Part No.	Description
ST-Rail	ER-R-STXXXX	Standard Rail
Splice	ER-SP-ST	PV-ezRack Splice for Standard Rail 200mm
ECO Rail Black	ER-R-ECO/XXXX/BA	ECO Rail Black
Black Splice ECO Rail	ER-SP-ECO/BA	Splice ECO Rail Black
Inter Clamp	ER-IC-STXX	Inter Clamp = clamp + Z-Module + Bolt.
End Clamp	ER-EC-STXX	End Clamp = clamp + Z-Module + bolt
Clamp	C-U/30/46-G	Universal Clamp for Frame Height 30-46mm with Grounding Clip
Clamp	C-U/30/46	Universal Clamp for Frame Height 30-46mm
End Clamp	ER-EC-DU35/40	End Clamp dual 35 or 40mm
End Clamp	ER-EC-DU40/46	End Clamp dual 40 or 46mm
Inter Security Clamp	ER-IC-STXX/S	Inter Clamp = Clamp + Z-Module + Security Bolt
End Security Clamp	ER-EC-STXX/S	End Clamp = Clamp + Z-Module + Security Bolt
Interface	ER-I-01, 02, 04, 23, 26 and 51	Tile Interface
Interface	ER-I-01/CS	Carbon Steel Tile Interface
Tile Interface with ezClick connection for ECO-Rail	ER-I-01/EZC/ECO	PV-ezRack SolarRoof, Tile Interface with ezClick connection for ECO-Rail
Interface	ER-I-05	Tin Interface
Black Interface	ER-I-05/BA	Black Tin Interface
Interface	ER-I-05/CM	Tin Interface with Click Module
Interface	ER-I-05A/EZC/ECO	ezClick connection for ECO-Rail
Interface	ER-I-25	Tin Interface with curved Base for corrugated Roof
Black Interface	ER-I-25/BA	Black Tin Interface with curved Base for corrugated Roof

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Components	Part No.	Description
End Clamp (*)	EC-FL/GE/XX/XX	End Clamp for Frameless Module (glued EPDM)
Inter Clamp (*)	IC-FL/GE/XX/XX	Inter Clamp for Frameless Module (glued EPDM)
End Clamp (*)	ER-EC-FL/XX/XX	End Clamp for Frameless Module
Inter Clamp (*)	ER-IC-FL/XX/XX	Inter Clamp for Frameless Module
Black End Clamp (*)	EC-FL/GE/XX/XX/B	Black End Clamp for Frameless Module (glued EPDM)
Black Inter Clamp (*)	IC-FL/GE/XX/XX/B	Black Inter Clamp for Frameless Module (glued EPDM)
Adapter for Corrugated Roof	EZ-AD-C43	Adapted for Corrugated Iron Roof for Tin interface ER-I-05
Black Adapter for Corrugated Roof	EZ-AD-C43/BA	Black Adapted for Corrugated Iron Roof for Tin interface ER-I-05
Corrugated Adapter	EZ-AD-C110	PV-ezRack Adapter for Corrugated Iron Roof.
Roof Extender (*Reduction Factor*)	ER-RE-200	Roof Hook Extender, Suitable for ER-I-01,02,04,05,23,26, 51 and 01/CS
Connector Clamp	CRC-R/ECO-ZBW	Cross Connector Clamp for ECO-Rail
Hanger Bolt	ER-HB-10/200A	PV-ezRack, Hanger Bolt M10*200mm
Hanger Bolt	ER-HB-MP/8/150EP	PV-ezRack Hanger Bolt for metal purlin M8*150mm
Hanger Bolt	ER-HB-8/150	Hanger bolt without mounting plate M8x150. Fixed to timber purlin only
Mid Clamp XX Black	ER-IC-STXXB	Inter Clamp XX Black
End Clamp XX Black	ER-EC-STXXB	End Clamp XX Black
Black Universal Clamp	C-U/30/46-BA	Black Universal Clamp
Black Universal Clamp	C-U/30/46-G-BA	Black Universal Clamp with grounding clip

(*) Subject to the panel manufacturer's installation guide.

Note 9. For Terrain Category (TC) definition, please refer to clause 4.2.1 of AS/NZS 1170.2:2011 (R2016).

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Note 10. Topographic Multiplier (Mt) taken as 1.0. Refer to clause 4.4 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 11. Shielding Multiplier (Ms) taken as 1.0. Refer to clause 4.3 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 12. Wind Direction Multiplier (Md) taken as 1.0. Refer to clause 3.3 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 13. From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

Note 14. This certificate only covers the assessment of the Clenergy PV mounting system, including the components listed on note 3 and 8. Assessment of the roof structure, PV panels and other fixings are to be checked by the installer/contractor, if necessary.

Note 15. Only hip and gable roofs installations are covered on this certificate. Contact Clenergy if you are planning to install on a different roof type such as curved, multi-span (pitched and saw-tooth), mansard, circular bin, silo, tank, pitched free, troughed free, hypar free, canopy, awning and cantilivered roof.

Note 16. No consideration has been taken on the effect of snow loads. In case the roof is located in a snow prone area, a special design must be made.

Note 17. No consideration has been taken on the effect of earthquake loads.

Note 18. This Engineering report is based on 2 m x 1 m panels and two rails per panel. However, a percentage increase could be applied on all interface spacings as shown on the following table.

Number of rails per panel	Panel length (mm)	Spacing +/- W.R – A & B	Spacing +/- W.R – C & D
2 rails	≤ 1700	+ 6 %	+ 10 %
3 rails	≤ 1700	+ 12 %	+ 18 %
4 rails	≤ 1700	+ 15 %	+ 20 %
2 rails	≤ 1800	+ 4 %	+ 7 %
3 rails	≤ 1800	+ 12 %	+ 18 %
4 rails	≤ 1800	+ 15 %	+ 20 %
2 rails	≤ 1900	0 %	+ 5 %
3 rails	≤ 1900	+ 10 %	+ 15 %
4 rails	≤ 1900	+ 12 %	+ 18 %
2 rails	≤ 2000	0 %	0 %
3 rails	≤ 2000	+ 10 %	+ 15 %
4 rails	≤ 2000	+ 12 %	+ 18 %
2 rails	≤ 2100	- 10 %	- 6 %
3 rails	≤ 2100	+ 10 %	+ 15 %
4 rails	≤ 2100	+ 12 %	+ 18 %

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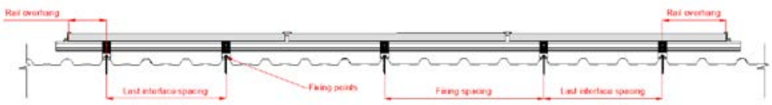
Number of rails per panel	Panel length (mm)	Spacing +/- W.R – A & B	Spacing +/- W.R – C & D
2 rails	≤ 2200	- 18 %	- 12 %
3 rails	≤ 2200	+ 7 %	+ 12 %
4 rails	≤ 2200	+ 12 %	+ 18 %
2 rails	≤ 2300	- 20 %	- 12 %
3 rails	≤ 2300	+ 5 %	+ 12 %
4 rails	≤ 2300	+ 10 %	+ 15 %
2 rails	≤ 2400	- 25 %	- 15 %
3 rails	≤ 2400	+ 5 %	+ 10 %
4 rails	≤ 2400	+ 8 %	+ 12 %

Note 19. Panel width cannot exceed 1.20 m for any of the above panel length dimensions and panel weight cannot exceed 15 kg/m^2.

Note 20. Rail overhang ends where the panel finishes and this should be less than 40% of the last installed interface spacing.



Note ... al factors leading to compression of the tile interfaces.

Note 22. All components from Clenergy must be installed according to manufacturer's specification and the instructions shown in the relevant installation manual. Please check the Clenergy Australia website or contact them for access to the most recent installation manuals.

Note 23. Capacities checked and compared against testing data from Clenergy Australia and MTS (NATA certified).

Note 24. General conditions

Note 24.1 Minimum steel purlin strength of 450 MPa and 550 MPa for tophats.

Note 24.2 Timber Grade members: F7 (Pine) and F17 (Hardwood).

Note 24.3 If any of the screws of the interfaces go into pre-existing holes, they will have to be one size up compared to the screws that were previously installed. This is to ensure that the pullout capacity remains the same or higher.

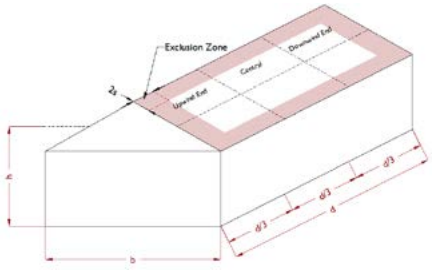
Note 25. Clamping zone of the PV panels should be according to the manufacturer's specifications.

Note 26. When using Roof Extender (ER-RE-200), reduce interface spacings by 15% on Wind Region A and B and 30% on Wind Region C and D.

Note 27. If the installation is located in ISO corrosivity category C4 reduce the interface spacing by 5%. If the installation is located in ISO corrosivity category C5 reduce the interface spacing by 25%.

Note 28. Conditions for flush mounted systems installed on flat and pitched roofs according to the D6 Appendix of the AS/NZS 1170.2:2011 (R2016).

- Roof pitch to be between 1° and 30°.
- h/d ≤ 0.5 and h/b ≤ 0.5. Being h= height, b= width and d= length of the building as per the below picture.
- Gap between the underside of the panel and the roof to be no less than 50mm and no more than 300mm.



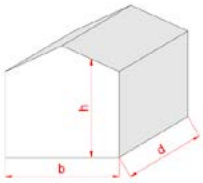
Note 29. Exclusion zone for flush installation to be the minimum distance from the edge of the roof "2 x s", where "s" is the gap between the underside of the panel and the roof.

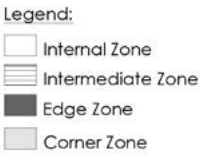
Note 30. Roof Zone definition when the installation doesn't meet the parameter on section D6 part (d) of the AS/NZS 1170.2:2011 (R2016) standard for roof angle is between 1° to 30°.

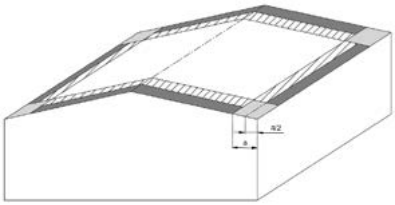
Step 1. Determine building height (h), width (b) and length (d).

Step 2. Choose the lowest value between "h", "b x 0.2" and "d x 0.2".

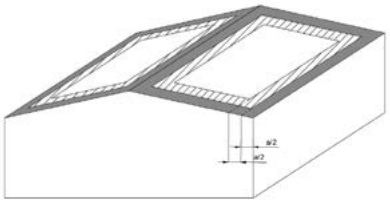
Step 3. The lowest value on Step 2, equates to a.



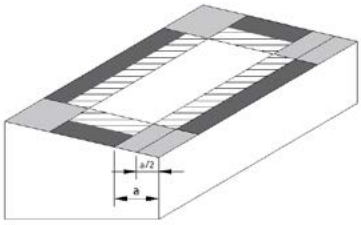




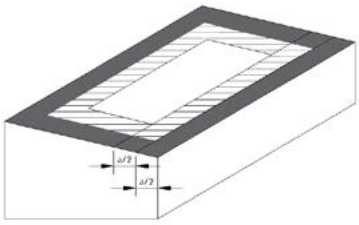
Roof Pitch < 10°



Roof Pitch ≥ 10°



Flat/Mono – Slope Roof < 10°



Flat/Mono – Slope Roof ≥ 10°

Note 31. Zone reduction factors to be the following:

Internal: Use the same spacings as central zone.

Intermediate: Divide central zone spacings by 1.5.

Edge: Divide central zone spacings by 2.

Corner: Divide central zone spacings by 3.

Note 32. For Hanger Bolt installation on either tin or tile roof, the spacing to apply with a minimum embedment depth of 25mm into F17 (Hardwood) timber or fixing to metal purlin with 1.5 mm thickness is the same as the tin roof interface spacing (ER-I-05). The Hanger Bolts for wood purlin/rafter installation are ER-HB-8/150 and ER-HB-10/200A. The Hanger Bolt for metal purlin/rafter is ER-HB-MP/8/150EP. Contact Clenergy if your project doesn't meet the above requirements.

Note 33. Neither Clenergy nor MW Engineering Melbourne will be responsible for the integrity of the roof tiles when using hanger bolts for the solar installation. It will be the clients' responsibility to check the hanger bolt installation feasibility.

Example when building parameters fall outside section D6 of the AS/NZS 1170.2:2011 (R2016) standard.

Tin roof
Wind Region A
Terrain Category: 3
Building height: 5m
Roof pitch: less than 10°
Panel dimension: 2 m x 1 m
Installation on intermediate zone to be:

- Central spacing: 1919 mm therefore,
  - Internal zone: 1919 mm
  - Intermediate zone: 1279 mm
  - Edge zone: 959 mm
  - Corner zone: 639 mm

Reduction for corrosion category C4 (-5% - Note 27)

- Internal zone: 1820 mm
- Intermediate zone: 1215 mm
- Edge zone: 910 mm
- Corner zone: 608 mm

Standard Certification Letter

(Wind average recurrence of 500 years)

MW Engineering Melbourne

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ABN 37 605 815 585

14 July 2021

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

CERTIFICATION LETTER

Clenergy PV-ezRack Solar Roof Certification – TC2, 2.5, 3 – Wind Region A, B, C, D. Internal REF: **00563.**
Project REF: **CL-693-S.**

MW Engineering Melbourne, being Structural Engineers within the meaning of Australian regulations, have calculated the maximum spacings for the PV ez-Rack rail system for the following conditions:

- **Wind Loads to AS 1170.2-2011 AMDT 4-2016**
  - **Wind Terrain Category 2, 2.5 and 3**
  - **Wind average recurrence of 500 years**
  - **Wind Region A, B, C, D**
- **Solar panel length up to 2.4m**

Attached are the tables showing the spacings according to Wind Region, roof pitch, and building height.

The values shown on these tables will be valid unless an amendment is issued on any of the following codes:

- **AS/NZS 1170.0- 2002 AMDT 4-2016** **General Principles**
- **AS/NZS 1170.1- 2002 AMDT 4-2016** **Imposed Loadings**
- **AS/NZS 1170.2- 2011 AMDT 4-2016** **Wind Loadings**
- **AS/NZS 1664.1- 1997 AMDT 1:1999** **Aluminium Code**

Should you have any queries, do not hesitate to contact us.

Best Regards,

Alberto Escobar
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BRP EC 46542
RPEQ 18759
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July 2021

STRUCTURAL DESIGN CERTIFICATION

PV-ezRack^{R} SolarRoof tin and tile flush interface spacing tables according to AS/NZS 1170.2:2011 Amdt 4-2016

Within Australia

Terrain Category 2, 2.5 & 3

Client: Clenergy Australia

REF: CL-693-S

Date: JUL 2021

Limitation: This report has been prepared for the exclusive use of Clenergy Australia, and is subject to and issued in connection with the provisions of the agreement between MW Engineering Melbourne and Clenergy Australia. MW Engineering Melbourne accepts no liability or responsibility whatsoever for any use of or reliance upon this report by any third party other than Clenergy's clients.

Internal REF: 00563

Client: Clenergy Australia

Project: PV-ezRack SolarRoof tin and tile flush interface spacing tables

Australian Standards

AS/NZS 1170.0:2002 (R2016)	**General Principles**
AS/NZS 1170.1:2002 (R2016)	**Imposed loadings**
AS/NZS 1170.2:2011 (R2016)	**Wind Loadings**
AS/NZS 1664.1:1997-Amdt 1:1999	**Aluminium**

Wind Terrain Category: 2, 2.5 & 3

Wind average recurrence: 500 years

Designed: SM

Date: JUL 2021

Disclaimer: From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

Clenergy

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	800	880	744	818	688	798	648	778	600	720
B	523	640	462	600	418	502	336	413	304	380
C	400	480	293	381	267	320	184	239	172	210
D	240	288	148	188	132	165	120	156	112	140

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	700	770	651	716	602	698	567	680	525	630
B	458	560	404	525	366	439	294	362	266	333
C	350	420	257	334	233	280	161	209	151	184
D	210	252	130	164	116	144	105	137	98	123

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	600	660	558	614	516	599	486	583	450	540
B	392	480	346	450	314	377	252	310	228	285
C	300	360	220	286	200	240	138	179	129	157
D	180	216	111	141	99	124	90	117	84	105

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PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	300	200	150	100	279	186	140	93	258	172	129	86	187	125	93	62	173	115	87	58
B	196	131	98	65	173	115	87	58	157	105	78	52	126	84	63	42	114	76	57	38
C	150	100	75	50	110	73	55	37	100	67	50	33	69	46	35	23	65	43	32	22
D	90	60	45	30	56	37	28	19	50	33	25	17	45	30	23	15	42	28	21	14

Clenergy

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	900	990	837	921	774	898	729	875	675	810
B	588	720	519	675	471	565	378	465	342	428
C	450	540	330	429	300	360	207	269	194	236
D	270	324	167	211	149	186	135	176	126	158

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	800	880	744	818	688	798	648	778	600	720
B	523	640	462	600	418	502	336	413	304	380
C	400	480	293	381	267	320	184	239	172	210
D	240	288	148	188	132	165	120	156	112	140

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	690	759	642	706	593	688	559	671	518	621
B	451	552	398	518	361	433	290	356	262	328
C	345	414	253	329	230	276	159	206	148	181
D	207	248	128	162	114	142	104	135	97	121

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	400	267	200	133	372	248	186	124	344	229	172	115	249	166	125	83	231	154	115	77
B	262	174	131	87	231	154	115	77	209	139	105	70	168	112	84	56	152	101	76	51
C	200	133	100	67	147	98	73	49	133	89	67	44	92	61	46	31	86	57	43	29
D	120	80	60	40	74	49	37	25	66	44	33	22	60	40	30	20	56	37	28	19

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1000	1100	930	1023	860	998	810	972	750	900
B	654	800	577	750	523	628	420	517	380	475
C	500	600	367	477	333	400	230	299	215	262
D	300	360	185	235	165	206	150	195	140	175

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	900	990	837	921	774	898	729	875	675	810
B	588	720	519	675	471	565	378	465	342	428
C	450	540	330	429	300	360	207	269	194	236
D	270	324	167	211	149	186	135	176	126	158

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	800	880	744	818	688	798	648	778	600	720
B	523	640	462	600	418	502	336	413	304	380
C	400	480	293	381	267	320	184	239	172	210
D	240	288	148	188	132	165	120	156	112	140

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-01 (Tile Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	500	333	250	167	465	310	233	155	430	287	215	143	312	208	156	104	288	192	144	96
B	327	218	163	109	288	192	144	96	262	174	131	87	210	140	105	70	190	127	95	63
C	250	167	125	83	183	122	92	61	167	111	83	56	115	77	58	38	108	72	54	36
D	150	100	75	50	93	62	46	31	83	55	41	28	75	50	38	25	70	47	35	23

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1360	1496	1265	1391	1170	1357	1102	1322	1020	1224
B	889	1088	785	1020	711	854	571	703	517	646
C	680	816	499	648	453	544	313	407	292	357
D	408	490	252	320	224	281	204	265	190	238

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1250	1375	1163	1279	1075	1247	1013	1215	938	1125
B	817	1000	721	938	654	785	525	646	475	594
C	625	750	458	596	417	500	288	374	269	328
D	375	450	231	294	206	258	188	244	175	219

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1050	1155	977	1074	903	1047	851	1021	788	945
B	687	840	606	788	549	659	441	542	399	499
C	525	630	385	501	350	420	242	314	226	275
D	315	378	194	247	173	217	158	205	147	184

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	800	533	400	267	744	496	372	248	688	459	344	229	498	332	249	166	462	308	231	154
B	523	349	262	174	462	308	231	154	418	279	209	139	336	224	168	112	304	203	152	101
C	400	267	200	133	293	196	147	98	267	178	133	89	184	123	92	61	172	115	86	57
D	240	160	120	80	148	99	74	49	132	88	66	44	120	80	60	40	112	75	56	37

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1450	1595	1349	1483	1247	1447	1175	1409	1088	1305
B	948	1160	837	1088	758	910	609	749	551	689
C	725	870	532	691	483	580	334	434	312	380
D	435	522	268	341	239	299	218	283	203	254

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1320	1452	1228	1350	1135	1317	1069	1283	990	1188
B	863	1056	762	990	690	829	554	682	502	627
C	660	792	484	629	440	528	304	395	284	346
D	396	475	244	310	218	272	198	257	185	231

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1200	1320	1116	1228	1032	1197	972	1166	900	1080
B	785	960	692	900	628	753	504	620	456	570
C	600	720	440	572	400	480	276	359	258	315
D	360	432	222	282	198	248	180	234	168	210

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	2.5

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	900	600	450	300	837	558	419	279	774	516	387	258	561	374	280	187	519	346	260	173
B	588	392	294	196	519	346	260	173	471	314	235	157	378	252	189	126	342	228	171	114
C	450	300	225	150	330	220	165	110	300	200	150	100	207	138	104	69	194	129	97	65
D	270	180	135	90	167	111	83	56	149	99	74	50	135	90	68	45	126	84	63	42

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1500	1650	1395	1535	1290	1496	1215	1458	1125	1350
B	981	1200	865	1125	785	942	630	775	570	713
C	750	900	550	715	500	600	345	449	323	393
D	450	540	278	352	248	309	225	293	210	263

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1430	1573	1330	1463	1230	1427	1158	1390	1073	1287
B	935	1144	825	1073	748	898	601	739	543	679
C	715	858	524	682	477	572	329	428	307	375
D	429	515	265	336	236	295	215	279	200	250

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1310	1441	1218	1340	1127	1307	1061	1273	983	1179
B	857	1048	756	983	685	822	550	677	498	622
C	655	786	480	624	437	524	301	392	282	344
D	393	472	242	308	216	270	197	255	183	229

PV-ezRack SolarRoof Interface spacing tables (Cont.)

Type of Rail	ER-R-ECO (Refer to **Note 8** for other compatible rails)
Type of Interface	ER-I-05 (Tin Interface)
Solar Panel Dimension	2 m x 1 m (Refer to **Note 18** for other panel sizes)
Terrain Category	3

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)																			
	H ≤ 5				5 < H ≤ 10				10 < H ≤ 15				15 < H ≤ 20				20 < H ≤ 30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1050	700	525	350	977	651	488	326	903	602	452	301	654	436	327	218	606	404	303	202
B	687	458	343	229	606	404	303	202	549	366	275	183	441	294	221	147	399	266	200	133
C	525	350	263	175	385	257	193	128	350	233	175	117	242	161	121	81	226	151	113	75
D	315	210	158	105	194	130	97	65	173	116	87	58	158	105	79	53	147	98	74	49

General Notes

Note 1. Tile roof interface spacing tables based on a minimum depth into **F7 (Pine) timber of 25mm** whereas **Tin roof interface** spacing tables based on a minimum depth into **F7 (Pine) timber of 35mm** and **Steel Purlins G450 1.5mm thick**.

Note 2. This engineering document was designed to cater for most common installation scenarios however, it does not cater for all of them. Contact Clenergy if you are unable to comply with any of the installation specifications listed on this document.

Importance level	Structure type examples	Annual probability of exceedance for a design working life of 25 years
1	Fences, utility posts, isolated minor facilities, minor temporary facilities and small ground mount installations (up to 20 kw).	1/100 - 100 years
2	Residential shed or garage, small isolated warehouses, isolated farm sheds, residential carports, medium ground mount installations (up to 100 kw) and one or double storey dwelling.	1/200 – 200 years
3	Buildings and facilities where a large group of people can congregate in one area, commercial buildings, schools, aged cares, large office buildings, large commercial warehouses, large ground mount installations, multi-storey dwelling and churches.	1/500 – 500 years
4	Buildings and facilities designated as essential facilities such as medical emergency or surgery facilities, universities, police stations, emergency shelters, High rise buildings (more than 40 storeys) airports and government buildings.	1/1000 – 1000 years

Note 3. Standard screws shipped for tin and tile Roof Interfaces

Metal Purlins/Battens	Fasteners to use
0.42 mm to 0.75 mm	Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer on G550 Steel Battens or a screw that has an equal or a higher pullout capacity.
1.2 mm to 2.4 mm	Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer or a screw that has an equal or a higher pullout capacity.
Wood Purlins and Rafters	**Fasteners to be used**
Timber F7 (Pine) and Timber 17 (Hardwood).	**Tin Interface:** Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer or a screw that has an equal or a higher pullout capacity.
	Tile Interface: Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer or a screw that has an equal or a higher pullout capacity or 14-10 x 50 Hex Head T17 with 16mm ABW Climaseal 3 or 14-10 x 65 Hex Head T17 Climaseal 3 or other screw of pullout value not less than screws above.

Note 4. Tin interface increase or reduction factors depending on the type of tophat, purlin or batten as per the below table

Purlin Material	Purlin thickness (mm)	Min. embedment (mm)	Spacing +/- (WR A)	Spacing +/- (WR B)	Spacing +/- (WR C)	Spacing +/- (WR D)
Timber (Pine F7)	-	25	- 25 %	- 35 %	- 35 %	- 35 %
Timber (Pine F7)	-	30	- 20 %	- 25 %	- 25 %	- 25 %
Timber (Pine F7)	-	35	-	-	-	-
Timber (Hardwood F17)	-	25	-	-	+ 5 %	+ 10 %
Timber (Hardwood F17)	-	30	-	-	+ 10 %	+ 15 %
Timber (Hardwood F17)	-	35	-	-	+ 10 %	+ 20 %
Metal (G550)	0.42	-	-75%	-80%	-80%	-80%
Metal (G550)	0.48	-	-60%	-70%	-70%	-70%
Metal (G550)	0.55	-	-50%	-65%	-65%	-65%
Metal (G550)	0.75	-	- 25 %	- 30 %	- 30 %	- 30 %
Metal (G450)	1.2	-	- 20 %	- 30 %	- 30 %	- 30 %
Metal (G450)	1.5	-	-	-	-	-
Metal (G450)	1.9	-	-	-	+ 5 %	+ 10 %
Metal (G450)	2.4	-	-	-	+ 5 %	+ 10 %

Note 5. Minimum number of screws to be used when installing **tile** (ER-I-01) interface to be two (2) and when installing **tin** (ER-I-05) interface to be one (1).

Note 6. Spacings on tile interfaces will be reduced as follows:

Interface	% of Reduction
ER-I-01/CS, ER-I-51 & ER-I-01/EZC/ECO	-
ER-I-02	-50%
ER-I-04	-50%
ER-I-23	-28%
ER-I-26	-28%

Note 7. The most conservative spacing has to be used if one panel or panel row fall between two roof zones.

Note 8. The following components are satisfied for use according to AS/NZS 1664.1:1997-Amdt 1:1999 and AS/NZS 1170.2:2011 Amdt 4-2016

Components	Part No.	Description
ECO-Rail	ER-R-ECO/XXXX	ECO Rail
Splice	ER-SP-ECO	PV-ezRack Splice for ECO rail
Australian Made Mill Finish ECO Rail	R-ECO/XXXX/AUMF	PV-ezRack Australian Made Mill Finish ECO Rail

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Components	Part No.	Description
ST-Rail	ER-R-STXXXX	Standard Rail
Splice	ER-SP-ST	PV-ezRack Splice for Standard Rail 200mm
ECO Rail Black	ER-R-ECO/XXXX/BA	ECO Rail Black
Black Splice ECO Rail	ER-SP-ECO/BA	Splice ECO Rail Black
Inter Clamp	ER-IC-STXX	Inter Clamp = clamp + Z-Module + Bolt.
End Clamp	ER-EC-STXX	End Clamp = clamp + Z-Module + bolt
Clamp	C-U/30/46-G	Universal Clamp for Frame Height 30-46mm with Grounding Clip
Clamp	C-U/30/46	Universal Clamp for Frame Height 30-46mm
End Clamp	ER-EC-DU35/40	End Clamp dual 35 or 40mm
End Clamp	ER-EC-DU40/46	End Clamp dual 40 or 46mm
Inter Security Clamp	ER-IC-STXX/S	Inter Clamp = Clamp + Z-Module + Security Bolt
End Security Clamp	ER-EC-STXX/S	End Clamp = Clamp + Z-Module + Security Bolt
Interface	ER-I-01, 02, 04, 23, 26 and 51	Tile Interface
Interface	ER-I-01/CS	Carbon Steel Tile Interface
Tile Interface with ezClick connection for ECO-Rail	ER-I-01/EZC/ECO	PV-ezRack SolarRoof, Tile Interface with ezClick connection for ECO-Rail
Interface	ER-I-05	Tin Interface
Black Interface	ER-I-05/BA	Black Tin Interface
Interface	ER-I-05/CM	Tin Interface with Click Module
Interface	ER-I-05A/EZC/ECO	ezClick connection for ECO-Rail
Interface	ER-I-25	Tin Interface with curved Base for corrugated Roof
Black Interface	ER-I-25/BA	Black Tin Interface with curved Base for corrugated Roof

Components	Part No.	Description
End Clamp (*)	EC-FL/GE/XX/XX	End Clamp for Frameless Module (glued EPDM)
Inter Clamp (*)	IC-FL/GE/XX/XX	Inter Clamp for Frameless Module (glued EPDM)
End Clamp (*)	ER-EC-FL/XX/XX	End Clamp for Frameless Module
Inter Clamp (*)	ER-IC-FL/XX/XX	Inter Clamp for Frameless Module
Black End Clamp (*)	EC-FL/GE/XX/XX/B	Black End Clamp for Frameless Module (glued EPDM)
Black Inter Clamp (*)	IC-FL/GE/XX/XX/B	Black Inter Clamp for Frameless Module (glued EPDM)
Adapter for Corrugated Roof	EZ-AD-C43	Adapted for Corrugated Iron Roof for Tin interface ER-I-05
Black Adapter for Corrugated Roof	EZ-AD-C43/BA	Black Adapted for Corrugated Iron Roof for Tin interface ER-I-05
Corrugated Adapter	EZ-AD-C110	PV-ezRack Adapter for Corrugated Iron Roof.
Roof Extender (*Reduction Factor*)	ER-RE-200	Roof Hook Extender, Suitable for ER-I-01,02,04,05,23,26, 51 and 01/CS
Connector Clamp	CRC-R/ECO-ZBW	Cross Connector Clamp for ECO-Rail
Hanger Bolt	ER-HB-10/200A	PV-ezRack, Hanger Bolt M10*200mm
Hanger Bolt	ER-HB-MP/8/150EP	PV-ezRack Hanger Bolt for metal purlin M8*150mm
Hanger Bolt	ER-HB-8/150	Hanger bolt without mounting plate M8x150. Fixed to timber purlin only
Mid Clamp XX Black	ER-IC-STXXB	Inter Clamp XX Black
End Clamp XX Black	ER-EC-STXXB	End Clamp XX Black
Black Universal Clamp	C-U/30/46-BA	Black Universal Clamp
Black Universal Clamp	C-U/30/46-G-BA	Black Universal Clamp with grounding clip

(*) Subject to the panel manufacturer's installation guide.

Note 9. For Terrain Category (TC) definition, please refer to clause 4.2.1 of AS/NZS 1170.2:2011 (R2016).

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Note 10. Topographic Multiplier (Mt) taken as 1.0. Refer to clause 4.4 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 11. Shielding Multiplier (Ms) taken as 1.0. Refer to clause 4.3 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 12. Wind Direction Multiplier (Md) taken as 1.0. Refer to clause 3.3 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 13. From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

Note 14. This certificate only covers the assessment of the Clenergy PV mounting system, including the components listed on note 3 and 8. Assessment of the roof structure, PV panels and other fixings are to be checked by the installer/contractor, if necessary.

Note 15. Only hip and gable roofs installations are covered on this certificate. Contact Clenergy if you are planning to install on a different roof type such as curved, multi-span (pitched and saw-tooth), mansard, circular bin, silo, tank, pitched free, troughed free, hypar free, canopy, awning and cantilivered roof.

Note 16. No consideration has been taken on the effect of snow loads. In case the roof is located in a snow prone area, a special design must be made.

Note 17. No consideration has been taken on the effect of earthquake loads.

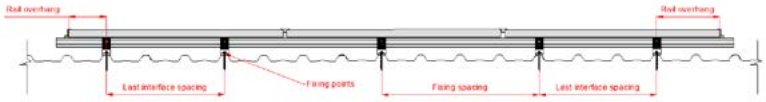
Note 18. This Engineering report is based on 2 m x 1 m panels and two rails per panel. However, a percentage increase could be applied on all interface spacings as shown on the following table.

Number of rails per panel	Panel length (mm)	Spacing +/- W.R – A & B	Spacing +/- W.R – C & D
2 rails	≤ 1700	+ 6 %	+ 10 %
3 rails	≤ 1700	+ 12 %	+ 18 %
4 rails	≤ 1700	+ 15 %	+ 20 %
2 rails	≤ 1800	+ 4 %	+ 7 %
3 rails	≤ 1800	+ 12 %	+ 18 %
4 rails	≤ 1800	+ 15 %	+ 20 %
2 rails	≤ 1900	0 %	+ 5 %
3 rails	≤ 1900	+ 10 %	+ 15 %
4 rails	≤ 1900	+ 12 %	+ 18 %
2 rails	≤ 2000	0 %	0 %
3 rails	≤ 2000	+ 10 %	+ 15 %
4 rails	≤ 2000	+ 12 %	+ 18 %
2 rails	≤ 2100	- 10 %	- 6 %
3 rails	≤ 2100	+ 10 %	+ 15 %
4 rails	≤ 2100	+ 12 %	+ 18 %

Number of rails per panel	Panel length (mm)	Spacing +/- W.R – A & B	Spacing +/- W.R – C & D
2 rails	≤ 2200	- 18 %	- 12 %
3 rails	≤ 2200	+ 7 %	+ 12 %
4 rails	≤ 2200	+ 12 %	+ 18 %
2 rails	≤ 2300	- 20 %	- 12 %
3 rails	≤ 2300	+ 5 %	+ 12 %
4 rails	≤ 2300	+ 10 %	+ 15 %
2 rails	≤ 2400	- 25 %	- 15 %
3 rails	≤ 2400	+ 5 %	+ 10 %
4 rails	≤ 2400	+ 8 %	+ 12 %

Note 19. Panel width cannot exceed 1.20 m for any of the above panel length dimensions and panel weight cannot exceed 15 kg/m².

Note 20. Rail overhang ends where the panel finishes and this should be less than 40% of the last installed interface spacing.



Note 21. Neither Clenergy nor MW Engineering Melbourne are not to be responsible for external factors leading to compression of the tile interfaces.

Note 22. All components from Clenergy must be installed according to manufacturer's specification and the instructions shown in the relevant installation manual. Please check the Clenergy Australia website or contact them for access to the most recent installation manuals.

Note 23. Capacities checked and compared against testing data from Clenergy Australia and MTS (NATA certified).

Note 24. General conditions

Note 24.1 Minimum steel purlin strength of 450 MPa and 550 MPa for tophats.

Note 24.2 Timber Grade members: F7 (Pine) and F17 (Hardwood).

Note 24.3 If any of the screws of the interfaces go into pre-existing holes, they will have to be one size up compared to the screws that were previously installed. This is to ensure that the pullout capacity remains the same or higher.

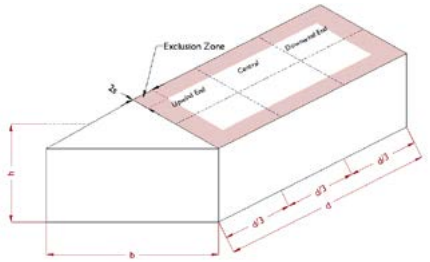
Note 25. Clamping zone of the PV panels should be according to the manufacturer's specifications.

Note 26. When using Roof Extender (ER-RE-200), reduce interface spacings by 15% on Wind Region A and B and 30% on Wind Region C and D.

Note 27. If the installation is located in ISO corrosivity category C4 reduce the interface spacing by 5%. If the installation is located in ISO corrosivity category C5 reduce the interface spacing by 25%.

Note 28. Conditions for flush mounted systems installed on flat and pitched roofs according to the D6 Appendix of the AS/NZS 1170.2:2011 (R2016).

- Roof pitch to be between 1° and 30°.
- h/d ≤ 0.5 and h/b ≤ 0.5. Being h= height, b= width and d= length of the building as per the below picture.
- Gap between the underside of the panel and the roof to be no less than 50mm and no more than 300mm.



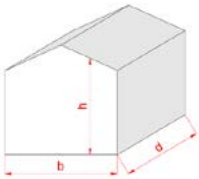
Note 29. Exclusion zone for flush installation to be the minimum distance from the edge of the roof "2 x s", where "s" is the gap between the underside of the panel and the roof.

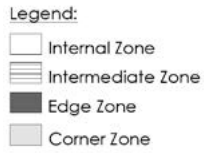
Note 30. Roof Zone definition when the installation doesn't meet the parameter on section D6 part (d) of the AS/NZS 1170.2:2011 (R2016) standard for roof angle is between 1° to 30°.

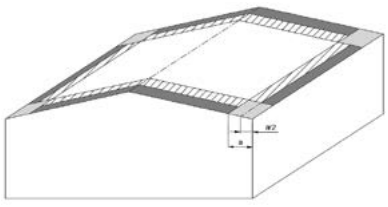
Step 1. Determine building height (h), width (b) and length (d).

Step 2. Choose the lowest value between "h", "b x 0.2" and "d x 0.2".

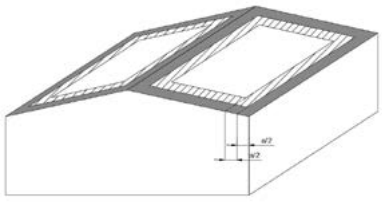
Step 3. The lowest value on Step 2, equates to a.



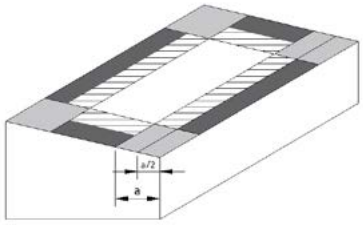




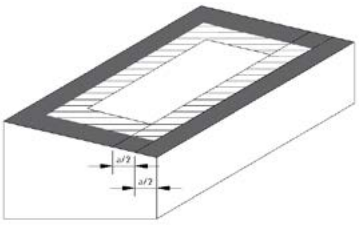
Roof Pitch < 10°



Roof Pitch ≥ 10°



Flat/Mono – Slope Roof < 10°



Flat/Mono – Slope Roof ≥ 10

Note 31. Zone reduction factors to be the following:

Internal: Use the same spacings as central zone.

Intermediate: Divide central zone spacings by 1.5.

Edge: Divide central zone spacings by 2.

Corner: Divide central zone spacings by 3.

Note 32. For Hanger Bolt installation on either tin or tile roof, the spacing to apply with a minimum embedment depth of 25mm into F17 (Hardwood) timber or fixing to metal purlin with 1.5 mm thickness is the same as the tin roof interface spacing (ER-I-05). The Hanger Bolts for wood purlin/rafter installation are ER-HB-8/150 and ER-HB-10/200A. The Hanger Bolt for metal purlin/rafter is ER-HB-MP/8/150EP. Contact Clenergy if your project doesn't meet the above requirements.

Note 33. Neither Clenergy nor MW Engineering Melbourne will be responsible for the integrity of the roof tiles when using hanger bolts for the solar installation. It will be the clients' responsibility to check the hanger bolt installation feasibility.

Example when building parameters fall outside section D6 of the AS/NZS 1170.2:2011 (R2016) standard.

Tin roof
Wind Region A
Terrain Category: 3
Building height: 5m
Roof pitch: less than 10°
Panel dimension: 2 m x 1 m
Installation on intermediate zone to be:

- Central spacing: 1650 mm therefore,
    - Internal zone: 1650 mm
    - Intermediate zone: 1100 mm
    - Edge zone: 825 mm
    - Corner zone: 550 mm

Reduction for corrosion category C4 (-5% - Note 27)

- Internal zone: 1571 mm
- Intermediate zone: 1047 mm
- Edge zone: 785 mm
- Corner zone: 523 mm

Adjustable Tile Brackets Certification Letter

MW Engineering Melbourne

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09 October 2020

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

CERTIFICATION LETTER

Clenergy PV-ezRack Solar Roof Certification – TC2, 2.5, 3 – Wind Region A and B. Internal REF: **00428.** Project REF: **CL-563-S.**

MW Engineering Melbourne, being Structural Engineers within the meaning of Australian regulations, have calculated the maximum spacings for the PV ez-Rack rail system for the following conditions:

- **Wind Loads to AS 1170.2-2011 AMDT 4-2016**
  - **Wind Terrain Category 2, 2.5 and 3**
  - **Wind average recurrence of 200 years**
  - **Wind Region A and B**
- **Solar panel length up to 2.2m**
- **Solar panel width up to 1.2m**

Attached are the tables showing the spacings according to Wind Region, roof pitch, and building height.

The values shown on these tables will be valid unless an amendment is issued on any of the following codes:

- **AS/NZS 1170.0- 2002 AMDT 4-2016** **General Principles**
- **AS/NZS 1170.1- 2002 AMDT 4-2016** **Imposed Loadings**
- **AS/NZS 1170.2- 2011 AMDT 4-2016** **Wind Loadings**
- **AS/NZS 1664.1- 1997 AMDT 1:1999** **Aluminium Code**

Should you have any queries, do not hesitate to contact us.

Best Regards,

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October 2020

STRUCTURAL DESIGN CERTIFICATION

PV-ezRack^{R} SolarRoof adjustable tile interface spacing tables according to AS/NZS 1170.2:2011 Amdt 4-2016

Within Australia

Terrain Category 2, 2.5 & 3

Client: Clenergy Australia

REF: CL-563-S

Date: OCT 2020

Limitation: This report has been prepared for the exclusive use of Clenergy Australia, and is subject to and issued in connection with the provisions of the agreement between MW Engineering Melbourne and Clenergy Australia. MW Engineering Melbourne accepts no liability or responsibility whatsoever for any use of or reliance upon this report by any third party other than Clenergy's clients.

Internal REF: 00428

Client: Clenergy Australia

Project: PV-ezRack SolarRoof adjustable tile interface spacing tables

Australian Standards

AS/NZS 1170.0:2002 (R2016)	**General Principles**
AS/NZS 1170.1:2002 (R2016)	**Imposed loadings**
AS/NZS 1170.2:2011 (R2016)	**Wind Loadings**
AS/NZS 1664.1:1997-Amdt 1:1999	**Aluminium**

Wind Terrain Category: 2, 2.5 & 3

Wind average recurrence: 200 years

Designed: SM

Date: OCT -20

Disclaimer: From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing back) – Note 26
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	1016	1466	985	1422	935	1348	924	1334	894	1290
B	693	1083	636	994	569	890	522	816	446	697

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	996	1436	966	1393	916	1322	906	1307	876	1264
B	679	1062	623	974	558	872	512	799	437	684

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	985	1422	956	1379	906	1308	897	1294	867	1251
B	672	1051	617	965	552	863	506	791	433	676

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	965	1392	936	1350	888	1281	878	1267	849	1225
B	658	1029	604	944	541	846	496	775	424	663

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing back) – Note 26
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	874	1236	848	1199	804	1137	795	1125	769	1088
B	638	940	586	863	524	773	480	708	410	605

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	856	1211	830	1175	788	1115	780	1102	754	1066
B	625	921	574	845	514	757	471	694	403	593

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	848	1199	822	1163	780	1103	771	1091	746	1055
B	619	911	568	837	508	749	466	687	398	587

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	830	1174	805	1139	764	1080	755	1068	731	1033
B	606	893	556	820	498	734	456	673	390	575

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing back)- Note 26
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	744	1064	722	1032	685	979	677	969	655	937
B	456	777	419	713	375	638	344	585	294	500

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	730	1043	708	1011	671	959	664	949	642	918
B	447	761	410	699	368	626	337	573	288	490

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	722	1032	700	1001	664	950	657	939	635	908
B	443	753	406	692	364	619	333	567	285	485

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	707	1011	686	981	651	930	644	920	622	890
B	433	738	398	677	356	606	327	556	279	475

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing front) or (Rail parallel to rafter) – Note 26
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	766	1118	743	1084	705	1028	697	1017	674	983
B	559	802	513	736	460	659	421	605	360	517

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	751	1095	728	1062	690	1008	683	997	661	964
B	548	787	503	722	450	646	413	592	353	506

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	743	1084	721	1052	684	997	676	986	654	954
B	542	778	498	715	446	640	408	586	349	501

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	728	1061	706	1030	669	977	662	966	640	934
B	531	762	488	700	437	626	400	574	342	491

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing front) or (Rail parallel to rafter) – Note 26
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	686	996	666	966	632	916	625	906	604	876
B	490	727	450	667	402	597	369	548	315	468

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	673	976	653	947	619	898	612	888	592	858
B	480	712	441	654	395	585	362	537	309	459

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	666	966	646	937	613	889	606	879	586	850
B	475	705	436	647	390	579	358	531	306	454

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	652	946	633	918	600	870	594	861	574	832
B	465	690	427	634	382	567	350	520	300	444

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing front) or (Rail parallel to rafter) – Note 26
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	580	827	563	802	534	761	528	752	511	728
B	434	645	399	592	357	530	328	486	280	415

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	569	810	552	786	523	745	518	737	501	713
B	426	632	391	581	350	520	321	476	274	407

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	563	802	546	778	518	738	512	730	495	705
B	422	626	387	575	346	515	318	471	272	403

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	551	785	535	762	507	723	502	715	485	691
B	413	613	379	563	339	504	311	462	266	395

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-61/EZC/ECO (Rail running perpendicular or parallel to rafter)
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	3

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	616	916	598	889	567	843	561	834	542	806
B	462	682	424	626	380	560	348	514	298	439

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	604	898	586	871	555	826	549	817	531	790
B	453	669	415	614	372	549	341	503	291	430

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	598	889	580	862	550	818	544	809	526	782
B	448	661	411	607	368	544	337	498	288	426

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	585	870	568	844	538	801	533	792	515	766
B	439	648	403	595	361	532	331	488	283	417

PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-61/EZC/ECO (Rail running perpendicular or parallel to rafter)
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	2.5

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	562	824	545	799	517	758	511	750	494	725
B	410	601	377	552	337	494	309	453	264	387

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	550	807	534	783	507	743	501	735	485	710
B	402	589	369	541	330	484	303	444	259	380

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	545	799	528	775	501	735	496	727	480	703
B	398	583	365	536	327	480	300	440	256	376

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	534	783	518	759	491	720	486	712	470	689
B	390	571	357	525	320	469	293	431	251	368

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PV-ezRack SolarRoof Interface spacing tables

Type of Rail	ER-R-ECO (Refer to Note 4 for other compatible rails)
Type of Interface	ER-I-61/EZC/ECO (Rail running perpendicular or parallel to rafter)
Solar Panel Dimension	1.7 m x 1 m (Refer to Note 17 for other panel sizes)
Terrain Category	2

Roof Angle - 0° < α ≤ 10°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	506	737	491	715	465	678	460	671	445	648
B	369	538	339	494	304	442	278	405	238	346

Roof Angle - 10° < α ≤ 20°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	496	722	481	700	456	664	451	657	437	635
B	362	527	332	484	298	433	273	397	233	339

Roof Angle - 20° < α ≤ 30°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	491	715	476	693	452	657	447	650	432	629
B	358	522	329	479	294	429	270	393	231	336

Roof Angle - 30° < α ≤ 60°

Wind Region	Building Height (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20		20 < H ≤ 30	
	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central	U.W & D.W	Central
A	481	700	466	679	442	644	438	637	423	616
B	351	511	322	469	288	420	265	385	226	329

General Notes

Note 1. Tile Roof Interface Spacing tables based on a minimum depth into F7 (Pine) timber of 25mm.

Note 2. Standard screws shipped for tin and tile Roof Interfaces

Wood Purlins and Rafters	Fasteners to be used
Timber F7 (Pine) and Timber 17 (Hardwood).	Buildex- 14 - 11 x 70 Hex Head Zips Climaseal 3 with 16 mm ABW or 14-10 x 50 Hex Head T17 with 16mm ABW Climaseal 3 or 14-10 x 65 mm Hex Head T17 Climaseal 3 or other screw of pullout value not less than screws above.

Note 3. This engineering document was designed to cater for most common installation scenarios however, it does not cater for all of them. Contact Clenergy if you are unable to comply with any of the installation specifications listed on this document.

Note 4. The following components are satisfied for use according to AS/NZS 1664.1:1997-Amdt 1:1999 and AS/NZS 1170.2:2011 Amdt 4-2016

Components	Part No.	Description
ECO-Rail	ER-R-ECO/XXXX	ECO Rail
Splice	ER-SP-ECO	PV-ezRack Splice for ECO rail
Australian Made Mill Finish ECO Rail	R-ECO/XXXX/AUMF	PV-ezRack Australian Made Mill Finish ECO Rail
ST-Rail	ER-R-STXXXX	Standard Rail
Splice	ER-SP-ST	PV-ezRack Splice for Standard Rail 200mm
ECO Rail Black	ER-R-ECO/XXXX/BA	ECO Rail Black
Black Splice ECO Rail	ER-SP-ECO/BA	Splice ECO Rail Black
Inter Clamp	ER-IC-STXX	Inter Clamp = clamp + Z-Module + Bolt.

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Components	Part No.	Description
End Clamp	ER-EC-STXX	End Clamp = clamp + Z-Module + bolt
Clamp	C-U/30/46-G	Universal Clamp for Frame Height 30-46mm with Grounding Clip
Clamp	C-U/30/46	Universal Clamp for Frame Height 30-46mm
End Clamp	ER-EC-DU35/40	End Clamp dual 35 or 40mm
End Clamp	ER-EC-DU40/46	End Clamp dual 40 or 46mm
Inter Security Clamp	ER-IC-STXX/S	Inter Clamp = Clamp + Z-Module + Security Bolt
End Security Clamp	ER-EC-STXX/S	End Clamp = Clamp + Z-Module + Security Bolt
Interface	ER-I-41/EZC/ECO	Adjustable Tile Interface (Aluminium)
Interface	ER-I-61/EZC/ECO	Adjustable Tile Interface (Aluminium)
End Clamp (*)	EC-FL/GE/XX/XX	End Clamp for Frameless Module (glued EPDM)
Inter Clamp (*)	IC-FL/GE/XX/XX	Inter Clamp for Frameless Module (glued EPDM)
End Clamp (*)	ER-EC-FL/XX/XX	End Clamp for Frameless Module
Inter Clamp (*)	ER-IC-FL/XX/XX	Inter Clamp for Frameless Module
Black End Clamp (*)	EC-FL/GE/XX/XX/B	Black End Clamp for Frameless Module (glued EPDM)
Black Inter Clamp (*)	IC-FL/GE/XX/XX/B	Black Inter Clamp for Frameless Module (glued EPDM)

Components	Part No.	Description
Mid Clamp XX Black	ER-IC-STXXB	Inter Clamp XX Black
End Clamp XX Black	ER-EC-STXXB	End Clamp XX Black
Black Universal Clamp	C-U/30/46-BA	Black Universal Clamp
Black Universal Clamp	C-U/30/46-G-BA	Black Universal Clamp with grounding clip

(*) Subject to the panel manufacturer's installation guide.

Note 5. For Terrain Category (TC) definition, please refer to clause 4.2.1 of AS/NZS 1170.2:2011 (R2016).

Note 6. Topographic Multiplier (Mt) taken as 1.0. Refer to clause 4.4 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 7. Shielding Multiplier (Ms) taken as 1.0. Refer to clause 4.3 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 8. Wind Direction Multiplier (Md) taken as 1.0. Refer to clause 3.3 of AS/NZS 1170.2:2011 (R2016) for more information.

Note 9. The installed frame must comply with the clamping zone of the PV Panel.

Note 10. Capacities checked and compared against testing data from Clenergy Australia and MTS (NATA certified).

Note 11. Maximum permitted rail overhang of 40%.

Note 12. For the definition of roof zones, refer to Appendix D6 of the AS/NZS 1170.2:2011 (R2016) standard.

Note 13. From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

Note 14. No consideration has been taken on the effect that the solar panel will have over the roof structure. It has been assumed that the roof will be able to resist the additional loadings imposed by the installation of the solar panels in conjunction with the Clenergy Mounting System.

Note 15. All components from Clenergy must be installed according to manufacturer's specification and the instructions shown in the relevant installation manual. Please check the Clenergy Australia website or contact them for access to the most recent installation manuals.

Note 16. No consideration has been taken on the effect of snow loads. In case the roof is located in a snow prone area, a special design must be made.

Note 17. This Engineering report is based on 2 m x 1 m panels and two rails per panel. However, a percentage increase could be applied on all interface spacings as shown on the following table.

Number of rails per panel	Panel length / width (mm)	Spacing +/-
2 rails	≤ 1700/ ≤1100	0%
3 rails	≤ 1700/ ≤1100	12%
4 rails	≤ 1700 / ≤1100	17%
2 rails	≤ 2000/ ≤1100	-10%
3 rails	≤ 2000/ ≤1100	10%
4 rails	≤ 2000/ ≤1100	15%
2 rails	≤ 2100/ ≤1100	-12%
3 rails	≤ 2100/ ≤1100	8%
4 rails	≤ 2100/ ≤1100	12%
2 rails	≤ 2200/ ≤1100	-15%
2 rails	≤ 2200/ ≤1200	-20%

Note 18. This document does not cover the building frame capacity. It has been assumed that the building frame will be able to resist the additional loadings imposed by the installation of the solar panels in conjunction with the Clenergy mounting system.

Note 19. Neither Clenergy nor MW Engineering Melbourne are not to be responsible for external factors leading to compression of the tile interfaces.

Note 20. General conditions

Note 20.1 Timber Grade members: F7 (Pine) and F17 (Hardwood).

Note 20.2 If any of the screws of the interfaces go into pre-existing holes, they will have to be one size up compared to the screws that were previously installed. This is to ensure that the pullout capacity remains the same or higher.

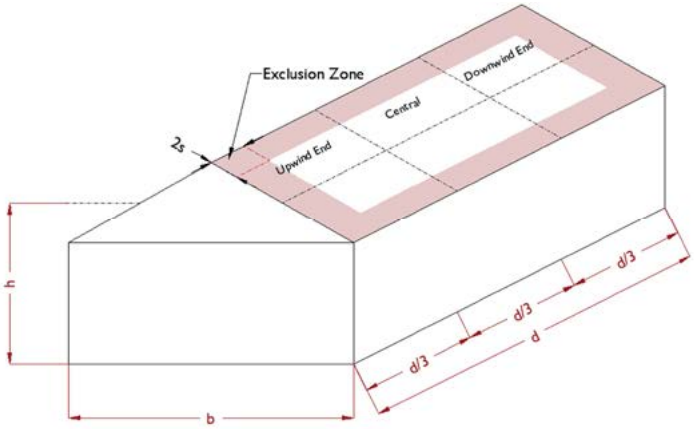
Note 21. A minimum of two (2) screws per Tile Interface will be required for installation.

Note 22. Use the same spacing listed on the tables of this certificate for panels installed in landscape.

Note 23. If the installation is located in ISO corrosivity category C4 reduce the interface spacing by 5%. If the installation is located in ISO corrosivity category C5 reduce the interface spacing by 25%.

Note 24. Conditions for flush mounted systems installed on flat and pitched roofs according to the D6 Appendix of the AS/NZS 1170.2:2011 (R2016).

- Roof pitch to be between 1° and 30°.
- h/d ≤ 0.5 and h/b ≤ 0.5. Being h= height, b= width and d= length of the building as per the below picture.
- Gap between the underside of the panel and the roof to be no less than 50mm and no more than 300mm.



Note 25. Exclusion zone for flush installation to be the minimum distance from the edge of the roof "2s", where "s" is the gap between the underside of the panel and the roof.

Note 26. Bracket orientation as per below pictures

Adjustable bracket (L-bracket facing back)

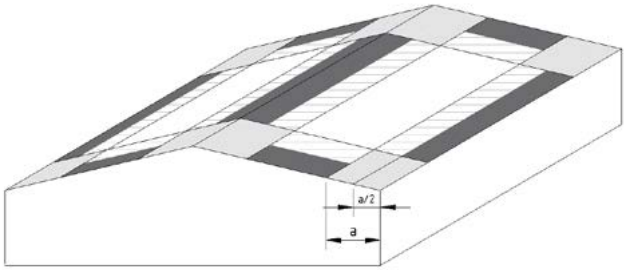
Adjustable bracket (L-bracket facing front)

Note 27. Roof Zone definition when the installation doesn't meet the parameter on section D6 part (d) of the AS/NZS 1170.2:2011 (R2016) standard for roof angle is between 1° to 30°.

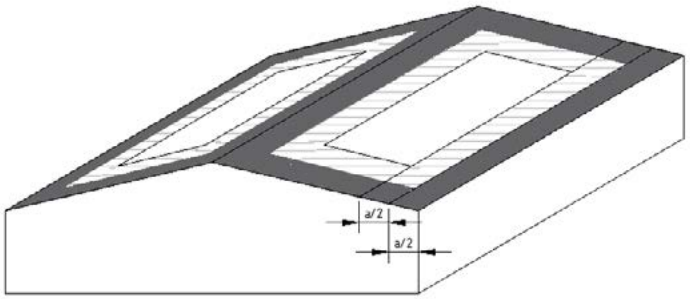
Step 1. Determine building height (h), width (b) and length (d).

Step 2. Choose the lowest value between "h", "b x 0.2" and "d x 0.2".

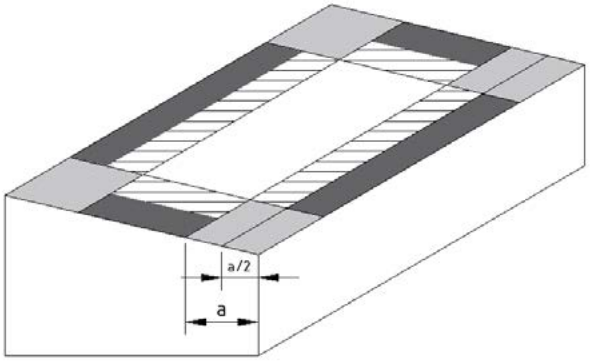
Step 3. The lowest value on Step 2, equates to a.



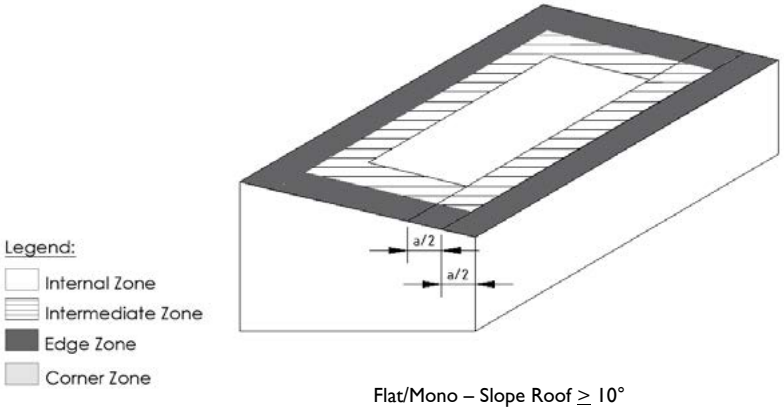
Roof Pitch < 10°



Roof Pitch ≥ 10°



Flat/Mono – Slope Roof < 10°



Flat/Mono – Slope Roof ≥ 10°

Note 28. Zone reduction factors to be the following:

Internal: Use the same spacings as central zone.

Intermediate: Divide central zone spacings by 1.5.

Edge: Divide central zone spacings by 2.

Corner: Divide central zone spacings by 3.

Example when building parameters fall outside section D6 of the AS/NZS 1170.2:2011 (R2016) standard.

Wind Region A
Terrain Category: 3
Building height: 5m
Roof pitch: less than 10°
ER-I-41/EZC/ECO (Rail running perpendicular to rafter, L-bracket facing back)
Panel dimension: 2 m x 1 m
Fixing spacings to be:

- Internal zone: 1319 mm
- Intermediate zone: 880 mm
- Edge zone: 660 mm
- Corner zone: 439 mm

Buildex C5 Screw Certification Letter

MW Engineering Melbourne

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ABN 37 605 815 585

05 July 2021

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

CERTIFICATION LETTER

MW Engineering Melbourne, being Structural Engineers within the meaning of Australian regulations, can confirm that the 14 -11 Hex Head Zips Climaseal 5 with 16 mm ABW by Buildex can be used in conjunction with the below existing generic certificates without any further changes or reductions.

The warranty of the screws will be according to Buildex specifications.

Certificate Number	Description
CL-088-S-REV H	Tin and Tile certificate
00150-REVB	Penetrative Commercial tilt certificate
CL-530-S	Penetrative tilt certificate
CL-563-S	Adjustable tile certificate

The values shown on these tables will be valid unless an amendment is issued on any of the following codes:

- AS/NZS 1170.0- 2002 AMDT 4-2016 General Principles
- AS/NZS 1170.1- 2002 AMDT 4-2016 Imposed Loadings
- AS/NZS 1170.2- 2011 AMDT 4-2016 Wind Loadings
- AS/NZS 1664.1- 1997 AMDT 1:1999 Aluminium Code

Should you have any queries, do not hesitate to contact us.

Best Regards,

Alberto Escobar
Civil/Structural Engineer
BEng MIEAust NER
BRPEC 46542
RPEQ 18759
info@mwengineering.melbourne

July 2021

Product Warranty

As the manufacturer of quality solar mounting systems, Clenergy Australia provides a warranty for all PV-ezRack® products it supplies in Australia and New Zealand ("**Products**"). The warranty provided by Clenergy Australia is subject to the conditions contained in this document ("**Warranty**"). No other warranty provision implied or otherwise is to be assumed. Your Warranty coverage is in accordance with this document.

Product Warranty Table for Installations in Corrosivity Category 1, 2, 3, 4 and 5 (ISO 9223)

<table>
<tr><th colspan="2" rowspan="2">Product</th><th rowspan="2">Material</th><th rowspan="2">Standard or Customized Product</th><th colspan="3">Product Warranty</th></tr>
<tr><th>Corrosivity Category 1, 2 and 3</th><th>Corrosivity Category 4</th><th>Corrosivity Category 5</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Aluminium Components</td><td>6005CL-T5 mill finish</td><td rowspan="2">Standard</td><td rowspan="9">10 years</td><td colspan="2" rowspan="2">10 years*</td></tr>
<tr><td>6005-T5 anodized to 10 microns</td></tr>
<tr><td>6005-T5 anodized to 15 microns</td><td rowspan="2">Customized</td><td rowspan="5">10 years</td><td>10 years*</td></tr>
<tr><td>6005-T5 anodized to 20 microns</td><td>10 years</td></tr>
<tr><td>2</td><td>Galvanized Steel Components</td><td>Galvanized Steel at 85 microns in average</td><td>Standard</td><td>Not warranted</td></tr>
<tr><td>3</td><td>Stainless Steel Components</td><td>SUS304</td><td>Standard</td><td rowspan="3">10 years</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Fasteners (bolts/ nuts/washers)</td><td>SUS304</td><td>Standard</td></tr>
<tr><td>SUS316</td><td>Customized</td></tr>
<tr><td>5</td><td>Screws for Tile Interface</td><td>Carbon Steel SAE 1022 with Climaseal C3 Rated Finish</td><td>Standard</td><td colspan="2">10 years**</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Screws for Tin Interface</td><td>Carbon Steel with C3 Rated Finish</td><td rowspan="2">Standard</td><td colspan="2">Not warranted</td></tr>
<tr><td>Carbon Steel with C5 Rated Finish</td><td>30 years</td><td>25 years</td><td>10 years</td></tr>
</table>

* Subject to interface spacing reduction as advised by Clenergy Australia. Please contact us for more details.
** The screws under tile interface are assumed to be installed in category 1, 2 or 3 micro-climate within the roof structure.

Warranty Scope

Your solar mounting Product has been manufactured to high standards, however, should any manufacturing defect arise, please contact Clenergy Australia. We will arrange for an inspection of the affected Product(s) to determine the extent of the problem.

Details are provided below as to the extent of your Warranty coverage and any exclusions that may apply. Please read these provisions carefully to ensure you receive the appropriate assistance and support in a timely manner. Please also contact Clenergy Australia if any part of this Warranty is unclear, or you wish to discuss your rights and remedies under this Warranty.

If your Product fails during the Warranty periods set out in the Warranty table above due to a defect in:

(a) materials and/or workmanship on and from the date of the Product's delivery; or
(b) structural integrity on and from the date of the Product's installation,

Clenergy Australia will at its election (after proof of purchase has been confirmed) either repair or resupply the defective Product provided that:

- The Product was installed correctly by a Clean Energy Council ("CEC") accredited or equivalent accreditation installer, following the Clenergy installation manual provided at time of purchase.
- The Product has been maintained correctly in accordance with section "Care of your Product" below.

Warranty Conditions

- Any and all costs for repair or replacement outside the Warranty period are the responsibility of the customer.
- Where Clenergy attends a site and finds that the Product is not faulty, the costs for the visit will be payable by the customer.
- Defective Products shall be uninstalled and/or reinstalled at the customer´ s expense and risk.
- Under certain conditions, the Warranty can be extended to more than 10 years at an extra cost, available upon request.

Warranty Exclusions

- Product finish (natural surface oxidation) or any natural impairment or surface corrosion that does not compromise the structural integrity.
- Products sold or installed outside of Australia and New Zealand unless approved previously in writing by Clenergy Australia.
- Damage caused by transport, mishandling, incorrect storage, improper loading or willful conduct.
- Any Product not correctly installed in accordance with our installation manual, or any specific design instruction or special conditions as advised by Clenergy Australia.
- Damage caused by the Product being modified in any way unless previously agreed to in writing by Clenergy Australia.
- The use of the Product for purposes other than the mounting of PV solar panels.
- Installations where the environment is excluded in the "Products Warranty Table" above, and for galvanized steel ground system Products, where the pH level is outside the range of 6-8, unless agreed to in writing by Clenergy Australia prior to installation.
- Damage caused by extreme weather conditions or any other natural or man-made event outside of our control.
- Damage caused by attachments not designed or approved for connection to the Product.
- Damage caused by lightning strikes or excessive currents through the earthing/grounding clamps, clips or lugs.

Our Products may come with guarantees that cannot be excluded under the Australian Consumer Law. You may be entitled under statute to a replacement or refund for a major defect in the Products. You may also be entitled under statute to have the products repaired for any defect which does not amount to a major defect. The benefits given by this Warranty are in addition to any statutory rights and remedies you may have under Australian law.

Product Care

Clenergy Products are designed to be durable with minimal care, however it is important that you maintain your mounting Product in accordance with proper practices. This includes regular maintenance and inspection to avoid damage.

The aluminum components are made from either AL 6005CL-T5 or AL6005-T5 and may also have a clear anodization. The aluminum may undergo some surface oxidization in service. Please note that this is normal and part of the natural ageing process. The result may even be beneficial to the longevity of the Product, as the oxidization can provide additional protection against degradation by pollution and atmospheric corrosion.

- You should also ensure that if the Product is stored prior to installing that it is not contaminated by contact with rusty items or other impurities such as dirt and chemicals. Should this occur, you must clean the Product and make any repairs using approved methods such as galvanized paint and antirust treatments immediately before installation. Steel components should be inspected before and after installation and any damage to the galvanizing should be treated immediately to prevent rusting. It is normal for galvanized Products to develop a surface barrier (the 'patina'), which helps to protect the surface from contaminants in the atmosphere and does not adversely affect the Product.
- The torque values of fastener connections on mounting system must be checked annually and corrected if needed in accordance with Clenergy Australia's installation manual.
- Regular cleaning to remove any soil or other possible contaminants must also be performed. Cleaning should be performed in accordance with guidelines recommended by the Standards Association of Australia (AS 1231-2000) (for aluminium Products) and the Galvanizers Association of Australia (GAA) (for steel Products supplied in Australia) or the Galvanizers Association of New Zealand (GANZ) (for steel Products supplied in New Zealand) or any other similar organisations (as applicable). When using tin interfaces for installation works, screws not exposed to frequent rain should be washed down with fresh water at least every 6 months.

PV-ezRACK®

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