Clenergy
Innovating renewable energy

# PV-ezRack® SolarRoof™

Code-Compliant Planning and Installation Guide V4.0
Complying with AS/NZS1170.2-2011 AMDT 2-2016

# Introduction

## 1. 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.

### List of Contents



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 sales@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 5033-2014 AMDT 2 2-2018;
- 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: 2014.
- Verifying atmospheric corrosivity zone of installation site by referring to AS 4312-2008 or consulting local construction business to determine appropriate products and installations.



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## 2. Planning

### 2.1 Determine the wind region of your installation site


Regions are marked with the letters A (A1 to A5), B, C and D. Coastal region boundaries are smooth lines set in from a smoothed coastline by 50, 100, 150 and 200 km. Islands within 50 km of the coast are designated in the same region as the adjacent coast.

### 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.



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## 2.2 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 few or no obstructions and enclosed, limited-sized water surfaces at serviceability and ultimate wind speeds in all wind regions, e.g. flat, treeless, poorly grassed plains; rivers, canals and lakes; and enclosed bays extending less than 10km in the wind direction.

Terrain Category 1.5 (TC1.5) – Open water surfaces subjected to shoaling waves at serviceability and ultimate wind speeds in all wind regions, e.g. near-shore ocean water; larger unenclosed bays on seas and oceans; lakes; and enclosed bays extending greater than 10km in the wind direction. The terrain height multipliers for this terrain category shall be obtained by the linear interpolation between the values for the TC1 and TC2.

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

Terrain Category 2.5 (TC2.5) – Terrain with a few trees or isolated obstructions. This category is intermediate between TC2 and TC3 and represents the terrain in developing outer urban areas with scattered houses, or larger acreage developments with fewer than ten buildings per hectare. The terrain-height multipliers for this terrain category shall be obtained by linear interpolation between the values for the TC2 and TC3.

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 sized obstructions per hectare, e.g. suburban housing or light industrial estates.

Terrain Category 4 (TC4) – Terrain with numerous larger, high (10m to 30m tall) and closely-spaced 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.

## 2.3 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.



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## 2.4 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.

## 2.5 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°.

## 2.6 Determine the Installation Area of Roof

Please refer to PV-ezRack® SolarRoof Interface Spacing Table in Certification Letter.

## 2.7 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.

## 2.8 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.

## 2.9 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.

## 2.10 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.



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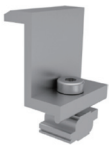
# Tools and Components

## 3. Tools and Components
### 3.1 Tools

| Tools | | |
|---|---|---|
|  |  |  |
| Angle Grinder with Stone Disk | Screw Driver<br>(for M8 Hexagon Socket Screw) | Torque Spanner |
|  |  |  |
| Spanner | 5m Tape | String & Marker Pen |

### 3.2 Components

| Component list | | | |
|---|---|---|---|
|  |  |  |  |
| ER-EC-ST<br>End Clamp | ER-IC-ST<br>Inter Clamp | C-U/30/46-G<br>Universal Clamp | C-U/30/46<br>Universal Clamp |
|  |  |  |  |
| ER-EC-DU35/40<br>End Clamp, Dual 35 or 40mm | ER-EC-DU40/46<br>End Clamp, Dual 40 or 46mm | ER-R-ECO<br>ECO Rail | ER-SP-ECO<br>Splice for ECO Rail |



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# Tools and Components

## Component list

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

ER-I-05
Tin Interface

ER-I-05/CM
Tin Interface with Click Module

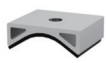
ER-I-05A/EZC/ECO
Tin Interface A with ezClick connection

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

EZ-GC-ST
Grounding clip

EZ-GL-ST
PV-ezRack Grounding Lug with Copper Pipe

IS-SR265/111
Isolator Shade, non-assembly (Mill Finish)

AB-SR/IS/260
Angle Bracket



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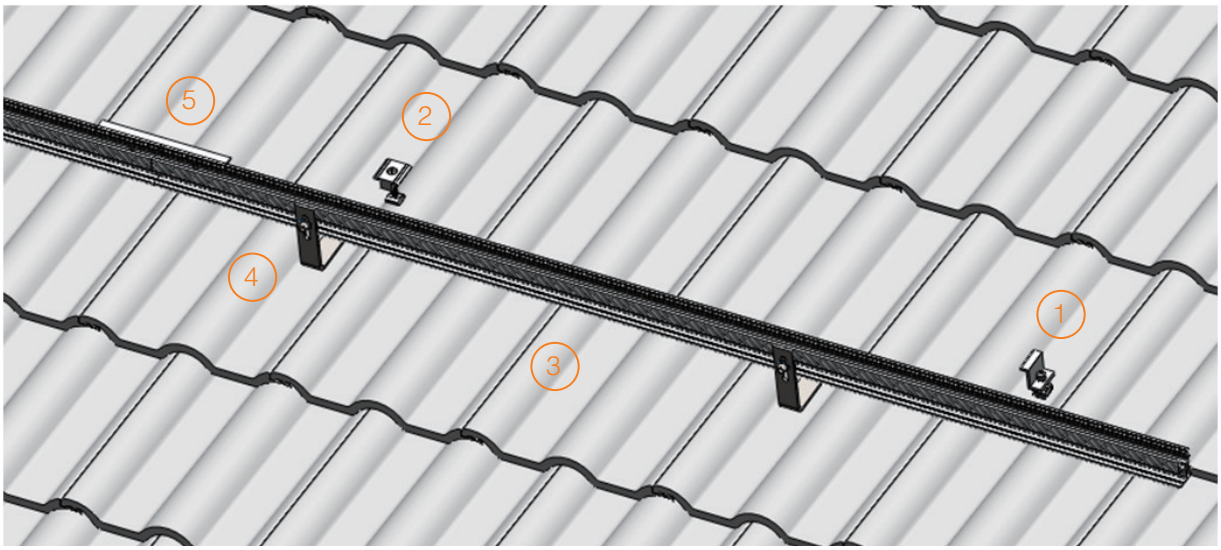
## 4. System Overview
### 4.1 Overview of PV-ezRack SolarRoof
- Tile Roof




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



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## 4.2 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.

### 4.2.1 General installation instructions:

(1) Apply force to fasteners in the direction of thread

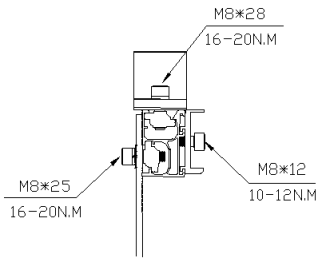
(2) Apply force uniformly, to maintain the required torque

(3) Professional tools and tool belts are recommended

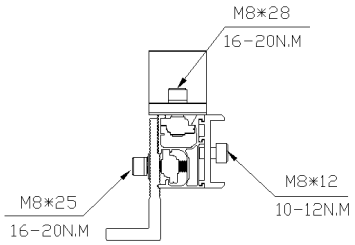
(4) In some cases, fasteners could be seized over time. As an option, if want to avoid galling or seizing of thread, apply lubricant (grease or 40# engine oil) to fasteners prior to tightening.

### 4.2.2 Safe Torques

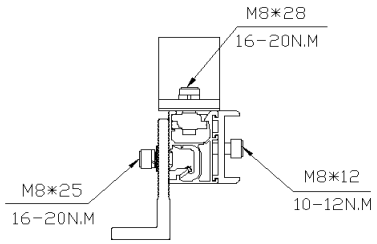
Please refer to safe torques defined in this guide as shown in the figures below. When fixing mid and end clamps, if the torques range specified by the panel manfuacturer is different, it should be used instead. In case power tools are required, Clenergy recommends the use of low speed only. High speed 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.



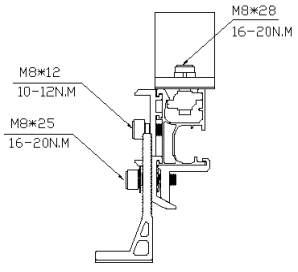

ER-I-01 and other tile interfaces




ER-I-05 and ER-I-25




ER-I-05/CM




ER-I-05A/EZC/ECO



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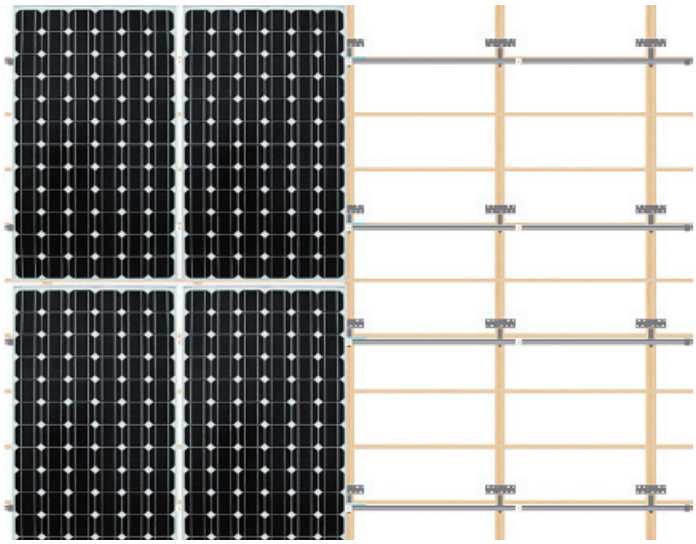
### 4.3 Installation Dimensions

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.

## 5. 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.

**Note: 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.



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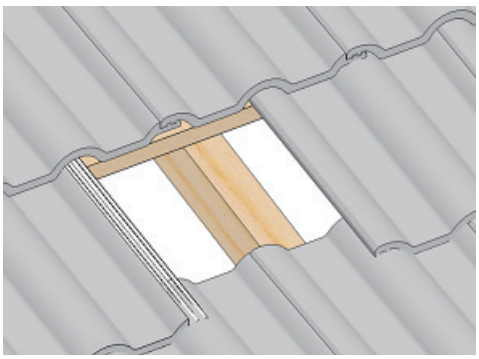
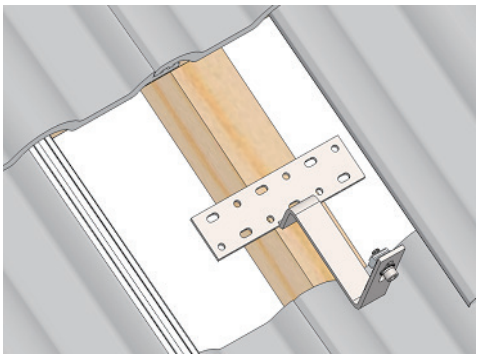
## 5.1 Tile Interface Installation

5.1.1 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.



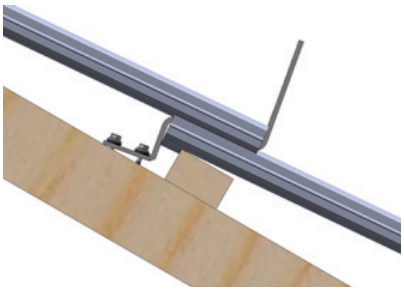
5.1.2 Fix the Roof Hooks to the rafter using Clenergy provided Buildex 14 gauge Hex Head Zips screw with minimum 25 mm embedment as shown in the figure on the right following the Buildex screws installation guide below:



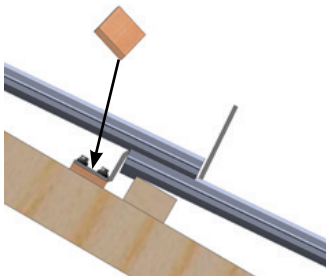
- Use a 3/8" Hex Socket.
- Use a mains powered or cordless screw driver with a drive speed of 3,000 RPM maximum.
- Fit the driver bit into the screw and place at the fastening position.
- Apply consistently firm pressure (end load) to the screw driver until the screw is fastened.

5.1.3 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.

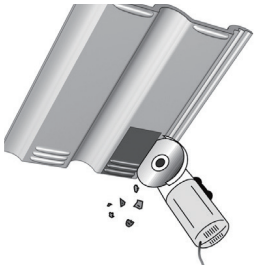
Incorrect

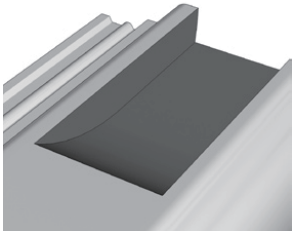


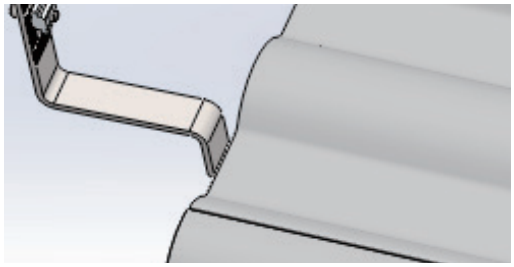
Correct



5.1.4 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.









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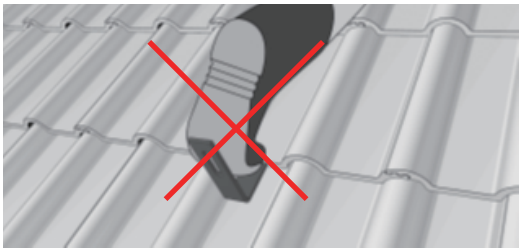
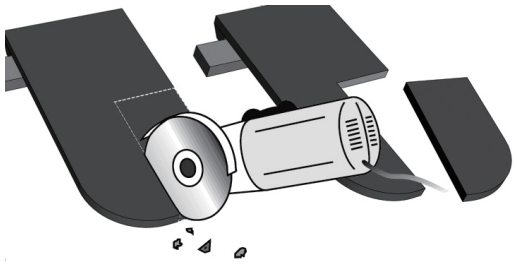
5.1.5 Caution! Do not use fitted roof hooks as a ladder, as this extreme point load could damage the tile below.

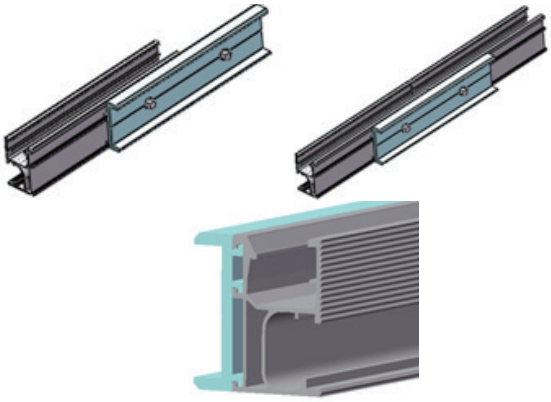


5.1.6 Variation for installation on plain tile roofs with plain tile roof cladding: A recess must be cut into the tiles around the position of the roof hook.The tile flashing should be used if necessary to prevent ingress of water.

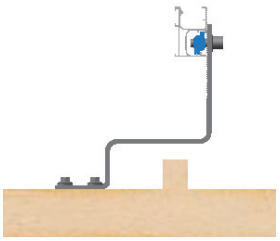


## 5.2 Rail Installation

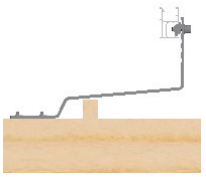
5.2.1 To connect several rails together, slide half of the splice into the rear side of the rail. Fasten the first M8 Bolt using an Allen key, and slide the next rail into the splice. Tighten the second M8 Bolt using an Allen key. The total rail length is recommended not to be over 30 meters considering rails thermal expansion problem. 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.



5.2.2 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.



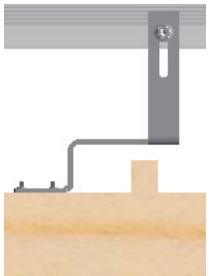
ER-I-01



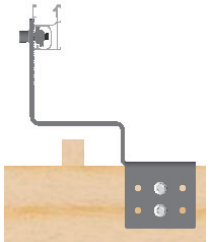
ER-I-02

ER-I-01/EZC/ECO

ER-I-51



ER-I-23



ER-I-26



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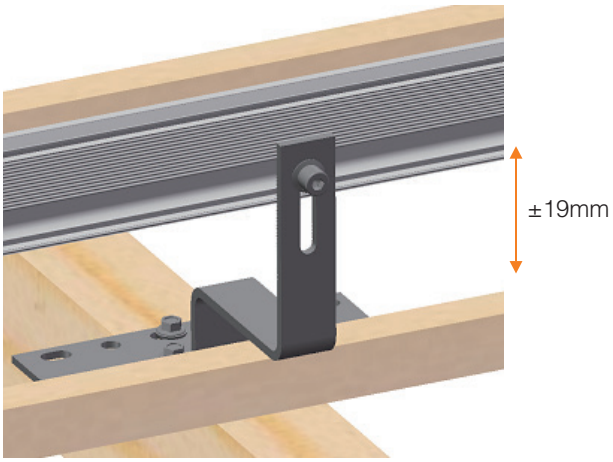
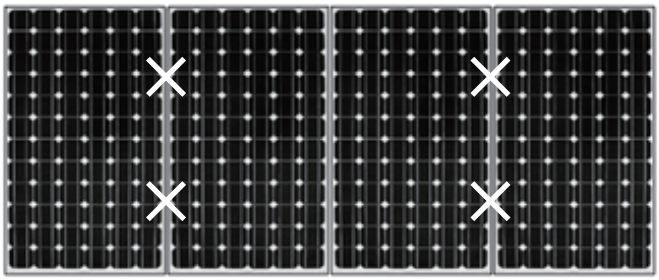
5.2.3 Adjust the vertical and horizontal positioning using the long hole in the Roof Hook and the loosely connected Z Module in the rail, as shown in the figure on the right. The roof hook should not protrude over the rail after the adjustment.
The recommended torque is 16 ~20Nm.

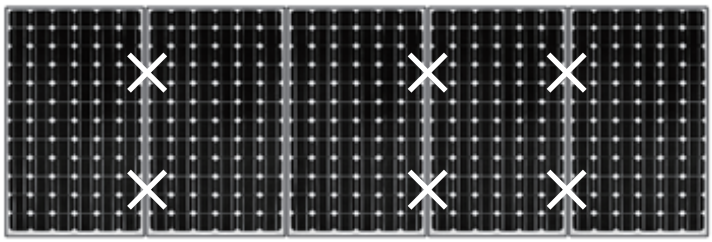



## 5.3 PV Module Installation

5.3.1 Deployment of Grounding Clips
1) When there is an even number of PV Module in each row:
Install the grounding clips at the positions marked X in the figure shown. Then the number of Grounding Clips = number of PV Module.
Eg; 4 grounding clips in the figure shown.

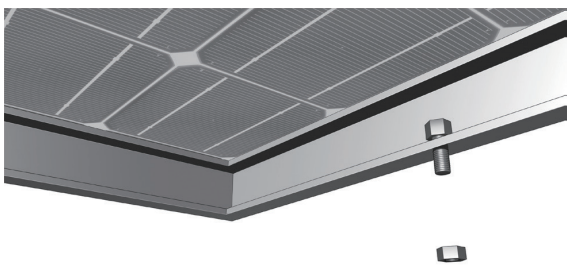


2) When there is an odd number of PV Module in each row:
Install grounding clips at positions marked X in figure shown.
Then the number of Grounding Clips = number of PV Module +1. Eg; 6 grounding clips in figure shown.



**Important Notes:**
- When replacing defective PV Modules, it is required to replace the grounding clips under the defective PV Modules.
- When removing defective PV Modules, it is required to keep sufficient grounding clips to maintain all other PV modules' earthing continuity with the rail. It is required to install grounding clips under end clamps when necessary to achieve this.

5.3.2 Before installing the PV modules on horizontal rail installations, add anti-slip protection to the lowest row of PV modules. To do this, fasten M6 x 20 mm bolts (with the shank downwards) to the lower mounting holes of the PV module frame. When installing large modules (e.g. ASE250) M8 x 20 mm bolts must be used.





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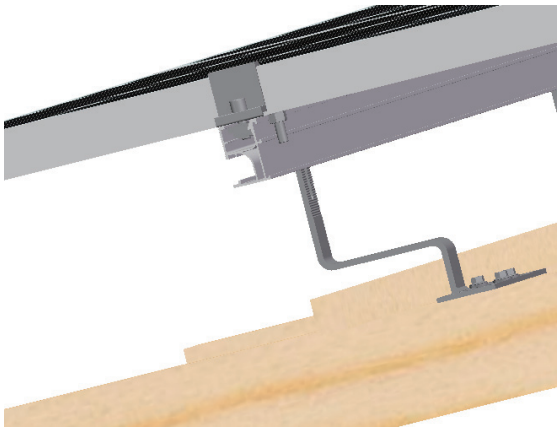
# Installation Instruction

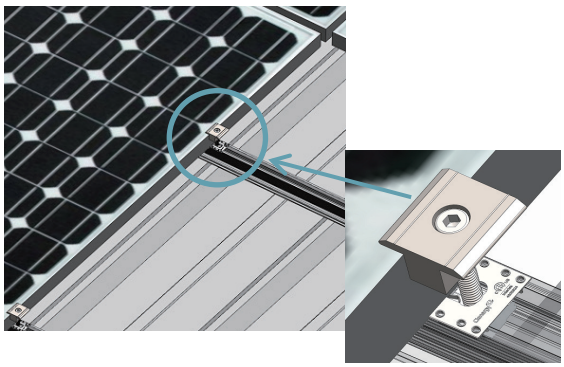
5.3.3 Place the PV Modules on to the rails and fix with End Clamps, Inter Clamps or Universal Clamps. Fasten with the Allen key. Please use Solution 1 or 2 below according to your project.



-Solution 1 (Apply Standard Clamps)

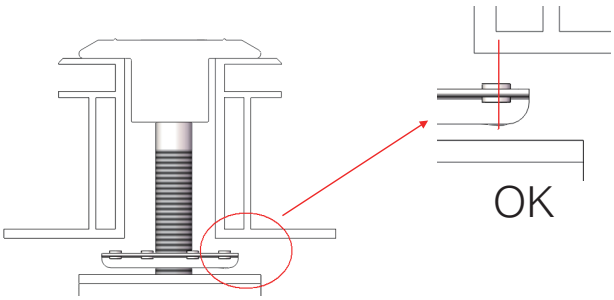
-Step 1 Place the first PV Module on the Rail according to your plan, and fix it in place using the End Clamps. Then fasten lightly with the Allen Key as shown in the figure on the right.

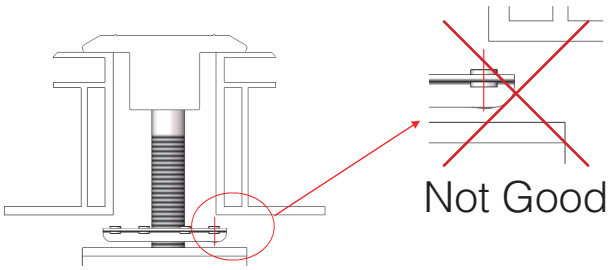
-Step 2 Slightly lift the PV Module and slide Inter Clamps and Grounding Clips into position. The teeth on Grounding Clip will automatically align when the Inter Clamp is properly installed as shown in the figure on the right.



-Step 3 loosely place the next framed PV Module into the other side of the Inter Clamp and Grounding Clip as shown in the figure on the right.

Important Notes:
-To fix the Grounding Clip properly, ensure the frames of PV Modules are completely pressed against the Inter Clamps and Grounding Clips. Visually check that Grounding Clips are positioned properly.



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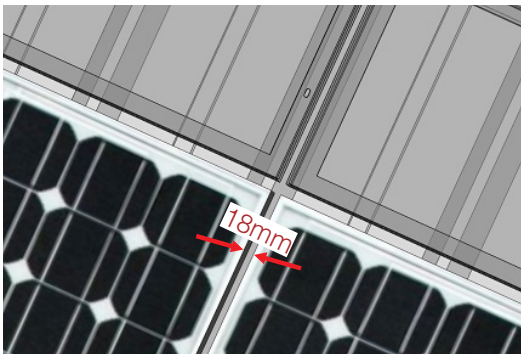
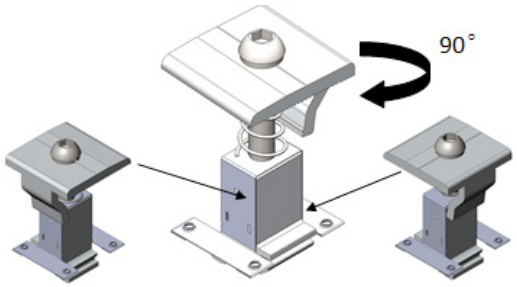
# Installation Instruction

-Grounding Clips are intended for SINGLE USE ONLY! Only fasten the bolts down when the position of the PV Module is finalized. (Only slightly tighten bolts to keep PV Modules in place prior to the final check)

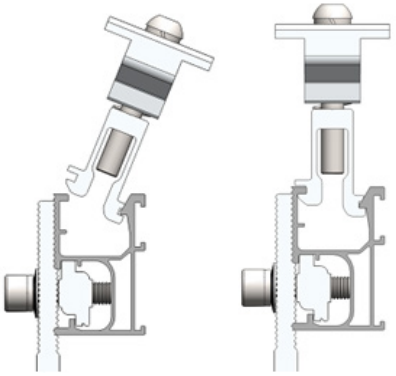
-Solution 2 (Apply Universal Clamps)




Step 1 Twisting the head of the Universal Clamp changes the functionality from End to Inter Clamp as shown in the figure on the right.
NOTE: Please ensure the Universal Clamp C-U/30/46 or Universal Clamp with Grounding Clip C-U/30/46-G is positioned correctly according to 5.3.1: Deployment of Grounding Clip.

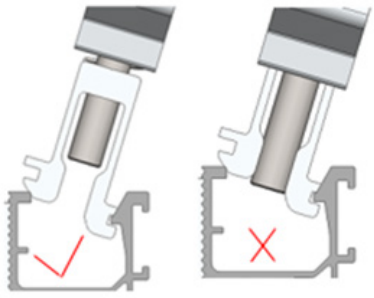



Step 2 Incline the Universal Clamp to fit the lower channel against the lower channel of the Rail, and press the Universal Clamp down towards the other side to securely fit the upper channel against the upper rail channel, as shown in the figure on the righ



Note: Before installation, make sure there is enough clearance between the screw and lower module of Universal Clamp as shown in the figure on the right.

Step 3 Place the first PV Module on the Rails and apply the Universal Clamp in the End Clamp position and fasten slightly with the Allen Key. Make sure the frame of the PV Module is fully in contact with the Universal Clamp as shown in the figure on the right. Visually check the Universal Clamp and PV module are properly installed.





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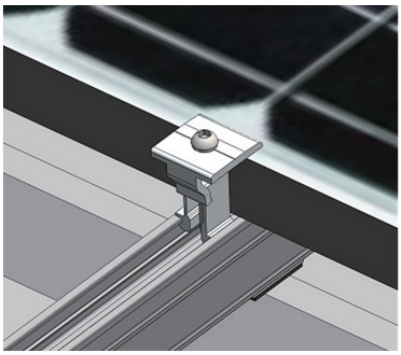
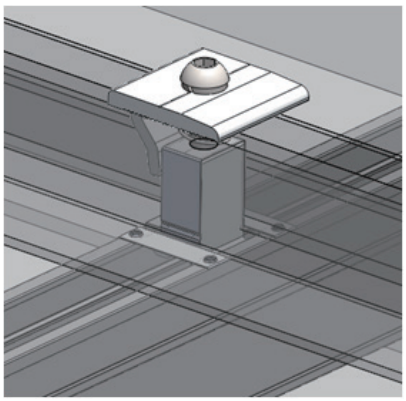
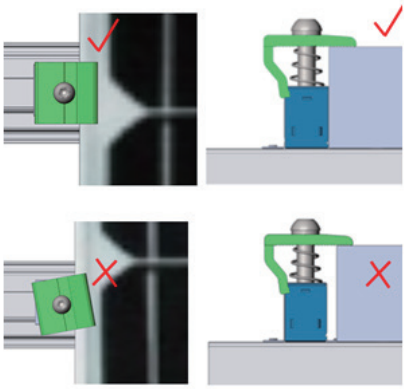
# Installation Instruction

Step 4 When using as an Inter Clamp, click the Universal Clamp into the rail channel and slightly lift the framed PV Module to ensure the Grounding Clip is fully covered as shown in the figure on the right.



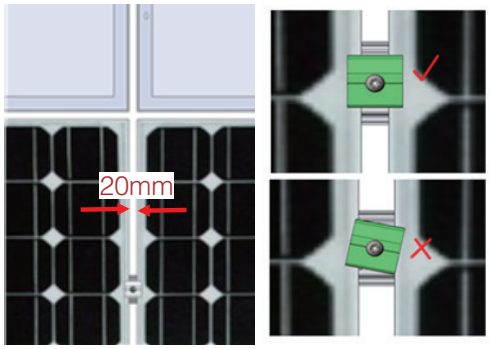


Step 5 Loosely place the next framed PV Module into the other side of the Universal Clamp. Ensure the Grounding Clip is fully covered and ensure the frame of the PV Module is in close contact with Universal Clamp as shown in the figure on the right.



Step 6 Repeat steps above to install all PV Modules. Visually check the Universal Clamps and PV modules are properly positioned and then fasten all Clamps.

When you using Universal Clamps, the gap between two adjacent PV Modules is 20mm.
The recommend torque for Universal Clamps in the End Clamp position is 13~14N·m.
The recommend torque for Universal Clamps in the Inter Clamp position is 16~20N·m.



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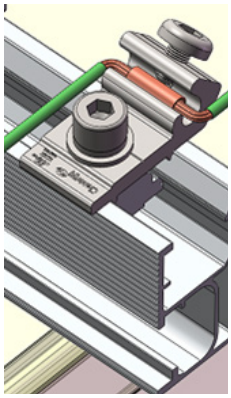
# Installation Instruction

5.3.4 Apply one pre-assembled Grounding Lug per Rail. Slide the Grounding Lug into to the rail channel and fasten the bolt M8*25 with 16~20 N·m. Strip earthing cable (the maximum size is 10 $mm^2$) and insert the conductor into the provided copper tube. Place the copper tube into the channel of Grounding Lug and tighten M6*10 with 5~6 N·m to ensure the earthing cable is tight.

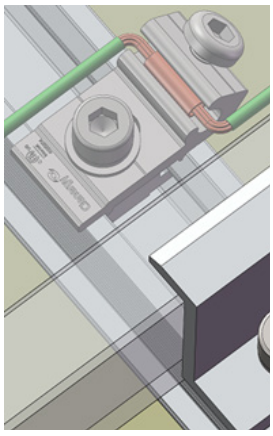
Note: Check the electrical resistance between rail and earthing cable conductor to ensure the bonding is made.

There are three solutions for Grounding Lug installation:

-Solution 1
Fix the Grounding Lug into the top channel of Rail as shown in the figure on the right.



-Solution 2
Fix the Grounding Lug into the top channel of Rail where just under the PV Module as shown in the figure on the right.



-Solution 3
Fix the Grounding Lug at the side channel of Rail as shown in the figure on the right.



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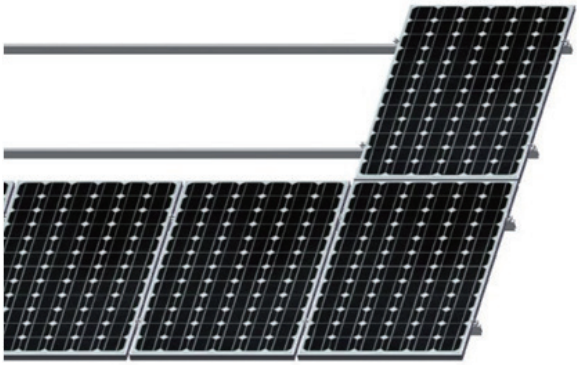
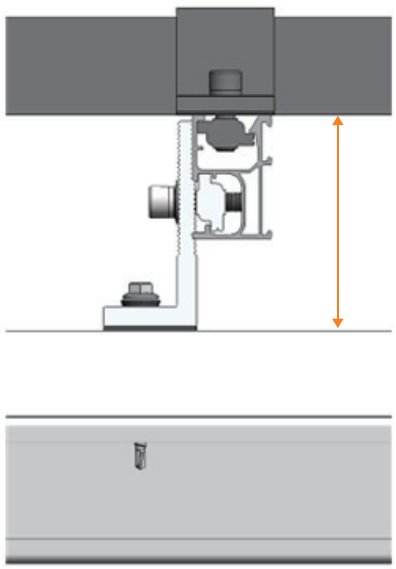
5.3.5 Slide the first PV module of the second row onto the corresponding module of the first row. Separation from the lower PV module can be maintained for aesthetic reasons. An Inter Clamp can be used as a separator, so that the vertical and horizontal separation of the PV modules is identical. Continue mounting the modules as described in steps 5.3.1 to 5.3.6 until all PV modules are installed.



## 5.4 Tin Interface Installation

5.4.1 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.



Clearance
85~100mm

Repeat 5.2 and 5.3 to install the Rails and PV Modules.

Note:

- The purlin thickness should be no less than 0.75mm and no more than 2.4mm;
- Please refer to the recommended torques in 4.2.3 Safe Torques;
- 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.



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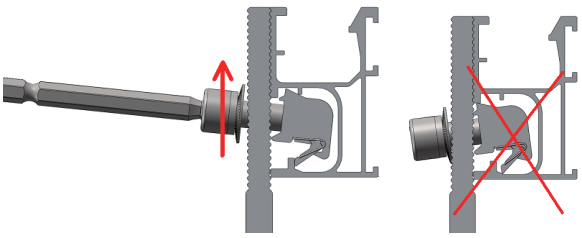
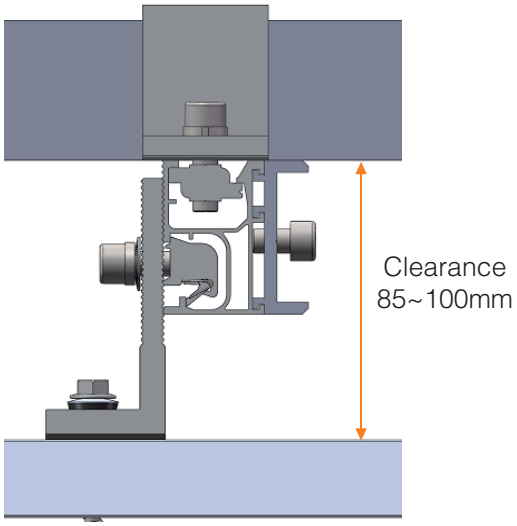
# Installation Instruction

5.4.2 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 5.2 and 5.3 to install the Rails and PV Modules.

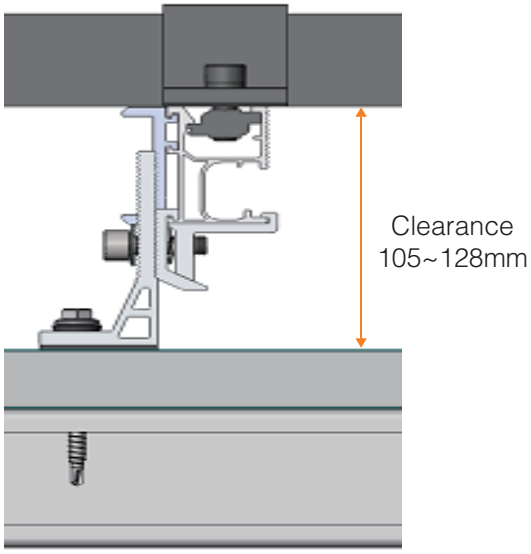


When fastening ER-I-05/CM with rail, it needs to lift up the bolt of click module to make click module well touch with upper rib of side channel of rail. So, the click module can be fixed into the rail properly as shown in the figure on the right.




Note:
- The purlin thickness should be no less than 0.75mm and no more than 2.4mm;
- Please refer to the recommended torques in 4.2.3 Safe Torques;
- 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.

5.4.3 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 5.2 and 5.3 to install Rails and PV Modules.




Note:
- The purlin thickness should be no less than 0.75mm and no more than 2.4mm;
- Please refer to the recommended torques in 4.2.3 Safe Torques;
- 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.



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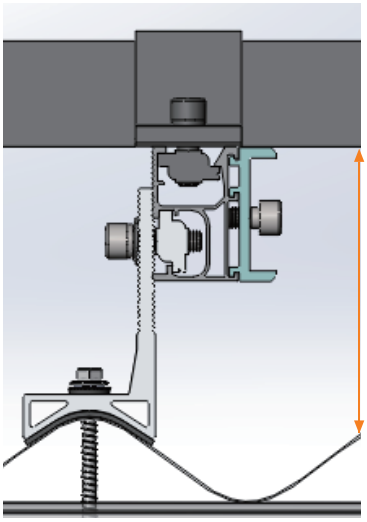
# Installation Instruction

5.4.4 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 5.2 and 5.3 to install Rails and PV Modules.

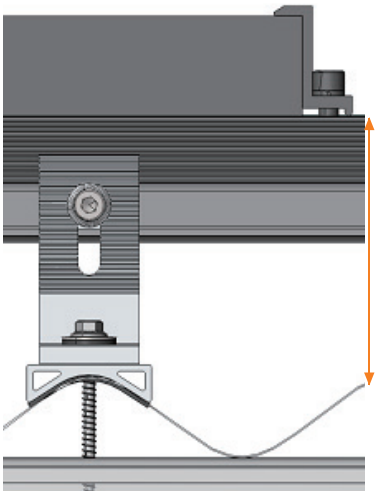
Note:
- The purlin thickness should be no less than 0.75mm and no more than 2.4mm;
- Please refer to the recommended torques in 4.2.3 Safe Torques;
- Screws not exposed to frequent rain should be washed down with fresh water at least every 6 months to meet the warranty conditions of Buildex screws.



Clearance
89~104mm

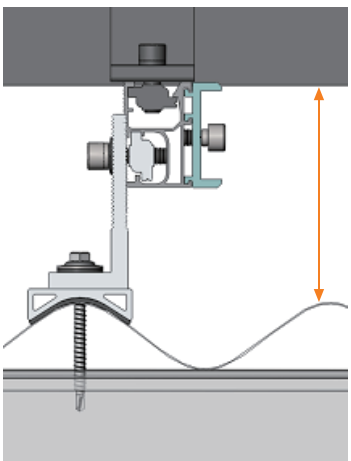
5.4.5 For installations using EZ-AD-C43 and ER-I-05, Adapter (Puck) for Corrugated Iron Roof and Tin Interface. Attach the EZ-AD-C43 on the planned position and then fix the ER-I-05 on metal or wood purlins as shown in the figure on the right following the Buildex screws installation guide above.
Repeat 5.2 and 5.3 to install Rails and PV Modules.
Note: The purlin thickness should be no less than 0.75mm and no more than 2.4mm.

Note:
- The purlin thickness should be no less than 0.75mm and no more than 2.4mm;
- Please refer to the recommended torques in 4.2.3 Safe Torques;
- 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 perpendicular to the Rib of metal sheet roof



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.**



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## 5.5 Hanger Bolt Installation

5.5.1 Hanger Bolt for Tile Roof Installation

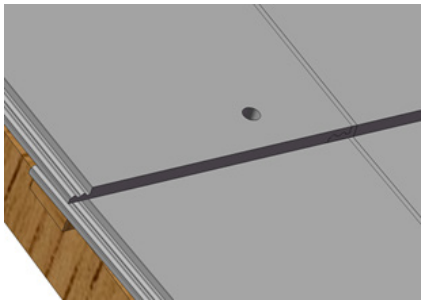
Hanger bolt (ER-HB-8/150) installation on tile roof is only applicable for tile having some part of flat surface, where the rubber seal of hanger bot can mount flush on the tile not to cause waterproof problem.

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.

5.5.1.1 Purlins are to be identified when opening tiles and their positions are marked out on the tiles.

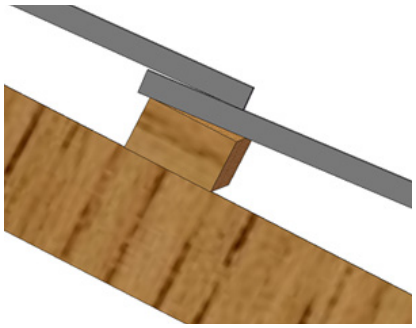
5.5.1.2 Based on installation plan and Hanger bolt spacing info., hanger bolt locations are marked on the tiles.

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



5.5.1.3 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;





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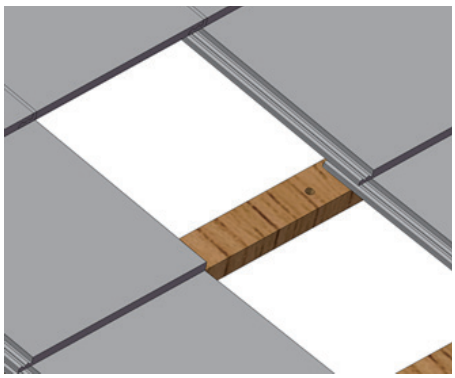
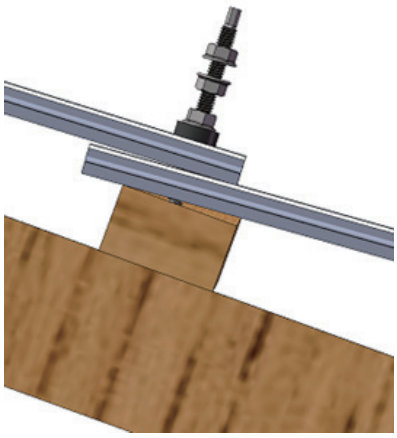
5.5.1.4 Through 10 mm hole on the tiles, pre-drill 6 mm hole on the wood purlin for hanger bolt. The tiles are not removed when drilling this hole. After the drilling, clean the dust around 10 mm hole.



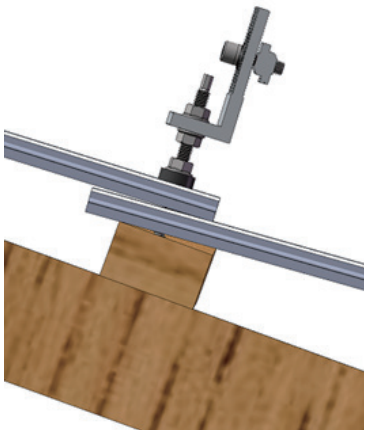
5.5.1.5 Adjust the position of rubber seal on the hanger bolt (ER-HB-8/150) to ensure hanger bolt have minimum 25 mm penetration depth into the wood purlin.

Drive the hanger bolt on the wood purlin till the rubber seal is firmly flush on the tile and turn the nut down till touching the rubber seal. 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.



5.5.1.6 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.





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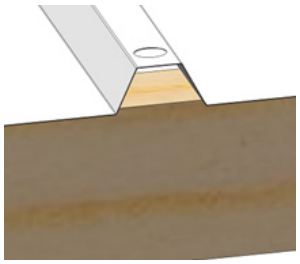
Follow sections 5.2 and 5.3 to install the Rails and PV Modules.

5.5.2 Hanger Bolt for Tin Roof Installation

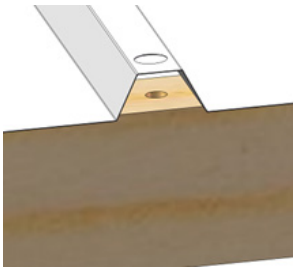
5.5.2.1 Hanger Bolt for wood purlin Installation
Hanger bolt (ER-HB-8/150) installation on tin roof is recommended for trapezoidal profile of roof or similar one having flat surface on the rib.

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 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 the hanger bolt on the wood purlin till the rubber seal is firmly flush on the tin roof sheet and turn the nut down till touching the rubber seal. Please turn another 4 threads cycle to press the rubber seal.

Note:
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.



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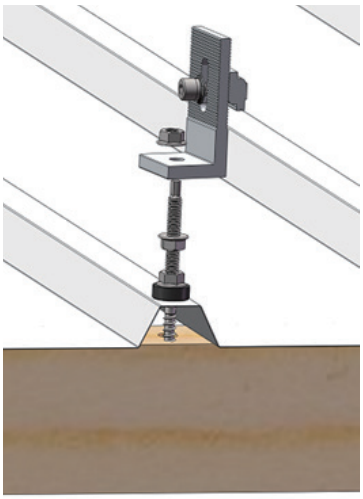
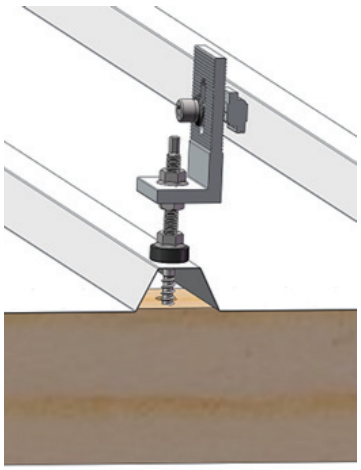
Screw out the top nut of hanger bolt, connect and adjust tin foot position and tighten the top nut with the recommended torque of 16~20 N·m





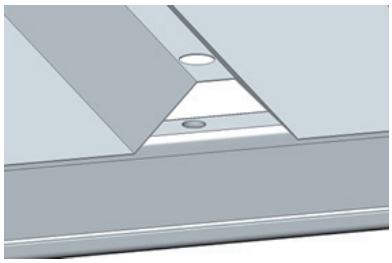
Follow sections 5.2 and 5.3 to install the Rails and PV Modules.

5.5.2.2 Hanger Bolt for metal purlin Installation

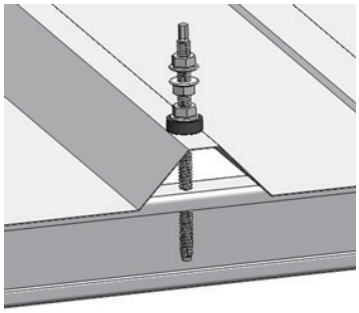
Hanger bolt (ER-HB-MP/8/150EP) installation on tin roof is recommended for trapezoidal profile of roof or similar one having flat surface on the rib.

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 mm hole on the metal purlin for hanger bolt.



Drive the hanger bolt (ER-HB-MP/8/150EP) on the metal purlin till the rubber seal is firmly flush on the tin roof sheet and turn the nut down till touching the rubber seal. Please turn another 4 threads cycle to press the rubber seal.



Note:
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.



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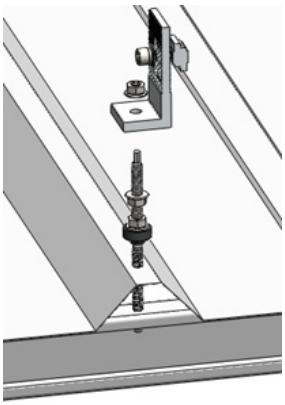
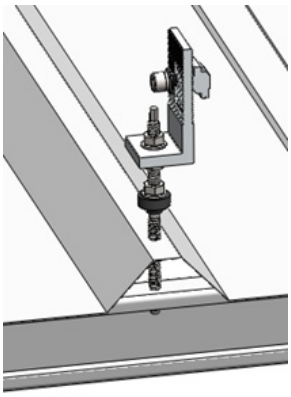
Screw out the top nut of hanger bolt, connect and adjust tin foot position and tighten the top nut with the recommended torque of 16~20 N·m.





Follow sections 5.2 and 5.3 to install the Rails and PV Modules.

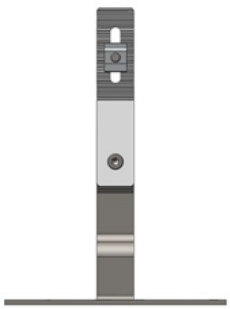
## 5.6 Roof Hook Extender Installation

5.6.1 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



Tile Interface connection with circular hole

Tile Interface connection with elongated hole

Follow sections 5.2 and 5.3 to install the Rails and PV Modules.



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# Installation Instruction

5.6.2 Roof Hook Extender with Tin Interface Installation

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

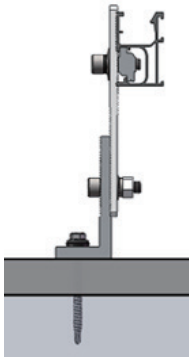
Either use circular hole or elongated hole of roof hook extender to connect with Tin Interface is allowed.

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

Follow sections 5.2 and 5.3 to install the Rails and PV Modules.

Tin Interface connection with circular hole

Tin Interface connection with elongated hole





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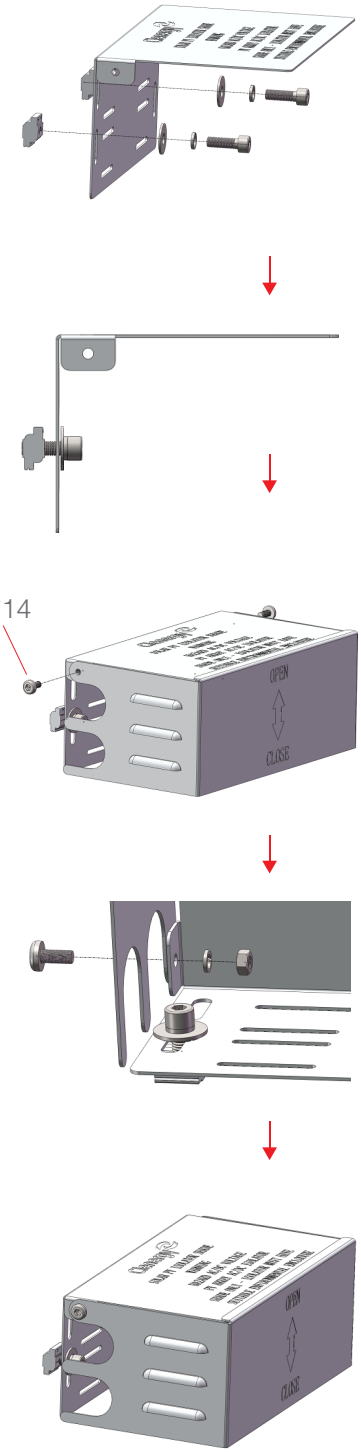
## 5.7 Accessory Installation

5.7.1 Isolator Shade Installation
- To be Fixed along the Rail

Assemble the Isolator Shade step by step as shown in the figure on the right.




Recommended torque for M6 bolts is 4-5N·m, which allows for optimal opening and closing of the isolator cover.

Note: When using Isolator Shade (black anodized), please apply External Teeth Lock Washers between Plain washer for earthing continuity.



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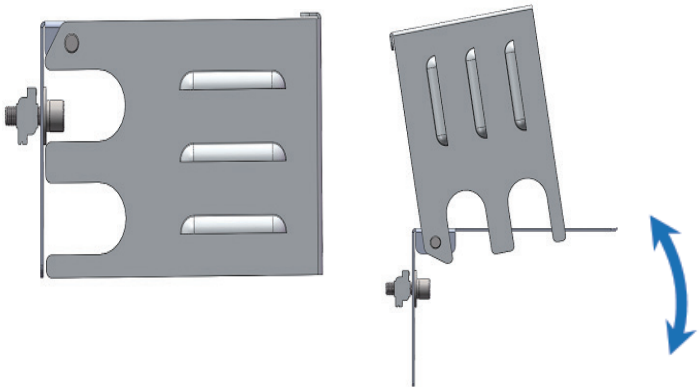
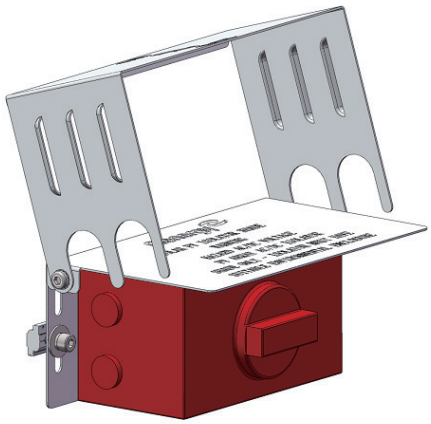
# Installation Instruction

According to your plan,  mark out the position for Isolator Shade installation on the Rail.



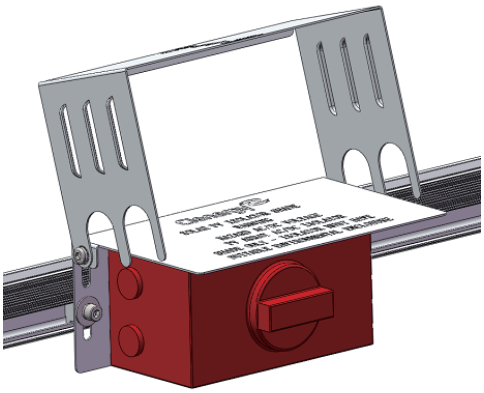
Note: Allow space above the Rail for the Isolator Shade Cover to open fully

Rotate up the Cover and fix the Isolator to the Isolator Shade according to the Isolator Installation Guide



Once the Isolator is fixed properly, position the Z Module in the Rail channel and fix the Isolator Shade with the bolts supplied.

Recommended torque for M8 bolts is 4-5 Nm.





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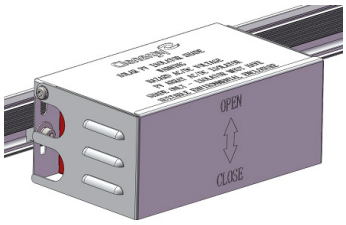
# Installation Instruction

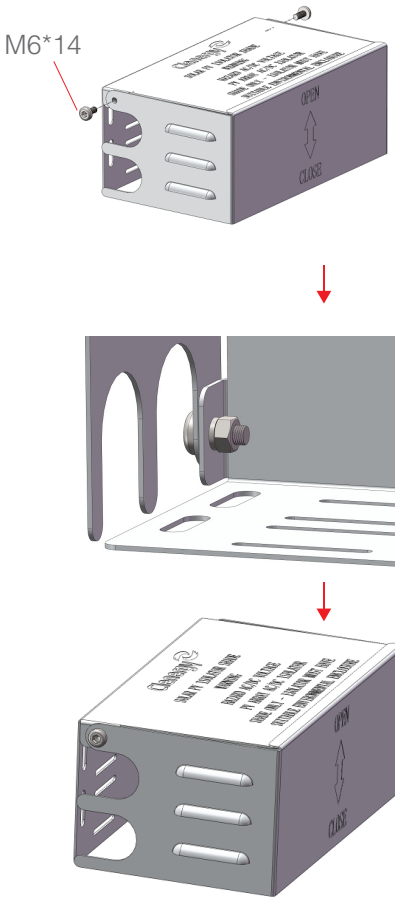
After cable installation, close the Isolator Cover as shown in the figure on the right.




- To be Fixed Rail End (Optional)

An alternative option for fixing the Isolator Shade is at the end of the rail using the Angle Bracket as below,

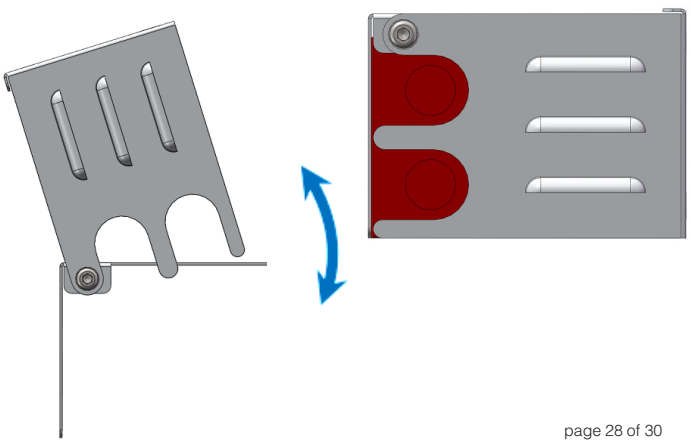
Assemble the Isolator Shade step by step as shown in the Figure on the right.




Recommended torque for M6 bolts is 4-5N·m, which allows for optimal opening and closing of the isolator cover.

Note: When using Isolator Shade (black anodized), please apply External Teeth Lock Washers between Plain washer for earthing continuity.

Rotate up the Cover and fix the Isolator to the Isolator Shade according to the Isolator Installation Guide in the Figure on the right.





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# Installation Instruction

Fix the Angle Bracket to the Isolator Shade and then fix the assembled Isolator Shade on the Rail as shown in the Figure on the right.

Note: Allow space above the Rail for the Isolator Shade Cover to open fully.

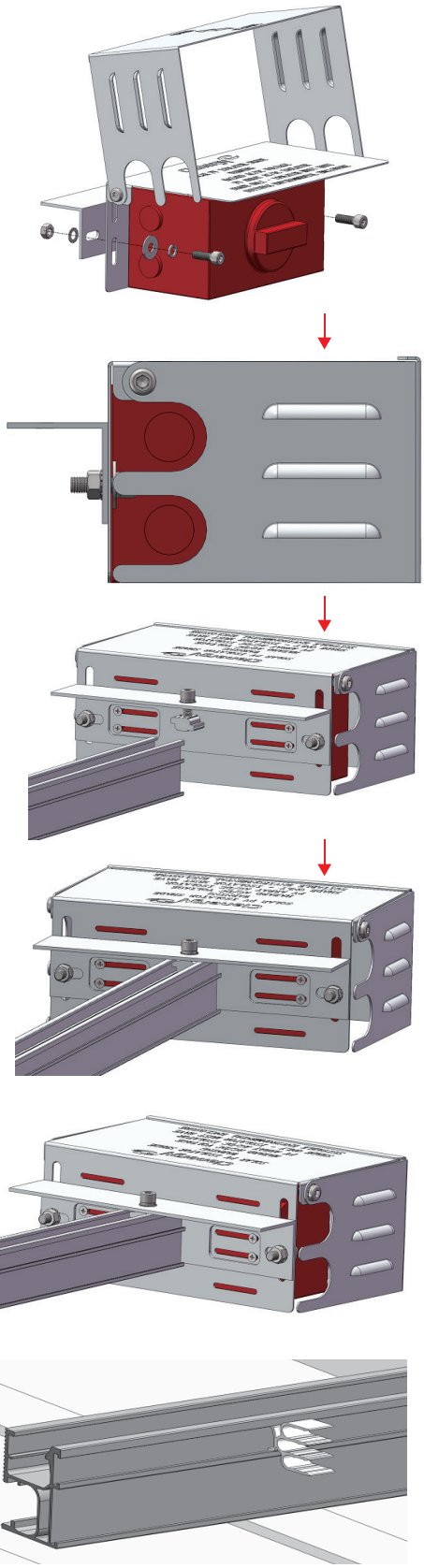
Recommended torque for M8 Bolts for fixing Angle Bracket on Isolator Shade is 8-10N·m.

Recommended torque for M8 Bolt for fixing Isolator Shade on the Rail is 16-20N·m.

After cable installation, close the Isolator Cover as shown in the Figure on the right.

5.7.2 Cable Clip Installation

- Click the top end of the Cable Clip into the channel on the back of the rail.
- Push the other end of the clip in to the rail channel, using a rubber mallet if required.





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# Certification Letter and Interface Spacing Table



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06 July 2020

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# CERTIFICATION LETTER

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

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 2.2m**
- **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** |
| - **AS 1684.2- 2010 AMDT 2-2013** | **Residential Timber Code** |
| - **AS 1720.1- 2010 AMDT 3-2015** | **Timber Code** |
| - **AS/NZS 4600: 2005** | **Cold Formed Steel Code** |
| - **AS/NZS 1252.2-2016** | **Bolting** |

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

Best Regards,

Alberto Escobar
Civil/Structural Engineer
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## STRUCTURAL DESIGN DOCUMENTATION

# PV-ezRack® SolarRoof Interface Spacing Table 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-F**

**Date:** **6/07/2020**



**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.**

# PV-ezRack
# Engineering Certificate

**Internal REF:** **00115**

**Client:** **Clenergy Australia**

**Project:** **PV ez-Rack SolarRoof Interface Spacing table**

**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 1252.2:2016** | **Bolting** |
| **AS/NZS 4600: 2005** | **Cold-Formed Steel Structures** |
| **AS 4100-1998** | **Steel Structures** |
| **AS/NZS 1664.1:1997-Amdt 1:1999** | **Aluminium** |
| **AS 1684.2-2010/Amdt 2-2013** | **Residential Timber framing** |
| **AS 1720.1-2010/Amdt 3-2015** | **Timber design** |

**Wind Terrain Category** **2, 2.5 and 3**

**Designed:** **SM**

**Date:** **Jul-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 ez-Rack SolarRoof Interface spacing Table for Tile Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-01 (Tile Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| 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 |
| A | 1488 | 1444 | 1369 | 1354 | 1310 |
| B | 1086 | 997 | 893 | 819 | 700 |
| C | 692 | 647 | 566 | 513 | 454 |
| D | 417 | 402 | 365 | 327 | 290 |

## Roof Angle - 10° < α ≤ 20°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1459 | 1415 | 1342 | 1327 | 1284 |
| B | 1065 | 977 | 875 | 802 | 686 |
| C | 678 | 634 | 554 | 503 | 445 |
| D | 408 | 394 | 357 | 321 | 284 |

## Roof Angle - 20° < α ≤ 30°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1444 | 1400 | 1328 | 1314 | 1270 |
| B | 1054 | 967 | 866 | 794 | 679 |
| C | 671 | 628 | 549 | 498 | 440 |
| D | 404 | 390 | 354 | 318 | 282 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tile Roof (Cont.)

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-01 (Tile Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| 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 |
| A | 1414 | 1371 | 1301 | 1287 | 1244 |
| B | 1032 | 947 | 848 | 778 | 665 |
| C | 657 | 615 | 537 | 488 | 431 |
| D | 396 | 382 | 346 | 311 | 276 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tile Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-01 (Tile Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| 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 |
| A | 1560 | 1514 | 1436 | 1420 | 1373 |
| B | 1139 | 1046 | 936 | 858 | 733 |
| C | 726 | 679 | 593 | 538 | 476 |
| D | 437 | 421 | 382 | 343 | 304 |

## Roof Angle - 10° < α ≤ 20°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1529 | 1483 | 1407 | 1392 | 1346 |
| B | 1116 | 1025 | 918 | 841 | 719 |
| C | 711 | 665 | 581 | 528 | 466 |
| D | 428 | 413 | 375 | 336 | 298 |

## Roof Angle - 20° < α ≤ 30°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1514 | 1468 | 1393 | 1377 | 1332 |
| B | 1105 | 1014 | 908 | 833 | 711 |
| C | 704 | 658 | 575 | 522 | 462 |
| D | 424 | 409 | 371 | 333 | 295 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tile Roof (Cont.)

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-01 (Tile Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 2.5 |

## Roof Angle - $30° < \alpha \leq 60°$

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1482 | 1438 | 1364 | 1349 | 1305 |
| B | 1082 | 993 | 889 | 815 | 697 |
| C | 689 | 645 | 563 | 511 | 452 |
| D | 415 | 400 | 363 | 326 | 289 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tile Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-01 (Tile Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| 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 |
| A | 1665 | 1615 | 1532 | 1515 | 1465 |
| B | 1216 | 1116 | 999 | 916 | 783 |
| C | 774 | 724 | 633 | 575 | 508 |
| D | 466 | 450 | 408 | 366 | 325 |

## Roof Angle - 10° < α ≤ 20°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1632 | 1583 | 1501 | 1485 | 1436 |
| B | 1191 | 1093 | 979 | 898 | 767 |
| C | 759 | 710 | 620 | 563 | 498 |
| D | 457 | 441 | 400 | 359 | 318 |

## Roof Angle - 20° < α ≤ 30°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1615 | 1567 | 1486 | 1470 | 1422 |
| B | 1179 | 1082 | 969 | 888 | 759 |
| C | 751 | 703 | 614 | 557 | 493 |
| D | 452 | 436 | 396 | 355 | 315 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

## PV ez-Rack SolarRoof Interface spacing Table for Tile Roof (Cont.)

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-01 (Tile Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| 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 |
| A | 1582 | 1535 | 1455 | 1440 | 1392 |
| B | 1155 | 1060 | 949 | 870 | 744 |
| C | 736 | 688 | 601 | 546 | 483 |
| D | 443 | 427 | 388 | 348 | 308 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tin Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-05 (Tin Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 2 |
| Purlin Thickness | 1.5 mm |

## Roof Angle - 0° < α ≤ 10°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1579 | 1496 | 1469 | 1432 | 1377 |
| B | 1368 | 1157 | 1047 | 964 | 900 |
| C | 890 | 734 | 670 | 624 | 588 |
| D | 542 | 506 | 431 | 395 | 367 |

## Roof Angle - 10° < α ≤ 20°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1574 | 1492 | 1460 | 1423 | 1372 |
| B | 1359 | 1157 | 1042 | 955 | 895 |
| C | 881 | 730 | 661 | 620 | 583 |
| D | 532 | 464 | 422 | 386 | 358 |

## Roof Angle - 20° < α < 30°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1570 | 1487 | 1460 | 1418 | 1368 |
| B | 1359 | 1148 | 1037 | 950 | 890 |
| C | 877 | 725 | 661 | 620 | 583 |
| D | 532 | 464 | 422 | 386 | 353 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tin Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-05 (Tin Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 2 |
| Purlin Thickness | 1.5 mm |

## Roof Angle - 30° < α < 60°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1561 | 1469 | 1423 | 1386 | 1359 |
| B | 1331 | 1102 | 1010 | 936 | 872 |
| C | 863 | 707 | 597 | 615 | 578 |
| D | 532 | 459 | 413 | 376 | 349 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tin Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-05 (Tin Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 2.5 |
| Purlin Thickness | 1.5 mm |

## Roof Angle - $0° < \alpha \leq 10°$

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1671 | 1616 | 1561 | 1487 | 1469 |
| B | 1460 | 1359 | 1221 | 1111 | 1010 |
| C | 1001 | 890 | 789 | 725 | 652 |
| D | 624 | 569 | 505 | 459 | 422 |

## Roof Angle - $10° < \alpha \leq 20°$

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1666 | 1611 | 1551 | 1478 | 1460 |
| B | 1450 | 1359 | 1216 | 1106 | 1005 |
| C | 996 | 881 | 780 | 725 | 643 |
| D | 620 | 565 | 500 | 450 | 418 |

## Roof Angle - $20° < \alpha < 30°$

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1662 | 1607 | 1551 | 1473 | 1455 |
| B | 1450 | 1354 | 1212 | 1102 | 1001 |
| C | 987 | 877 | 776 | 721 | 643 |
| D | 620 | 565 | 496 | 454 | 413 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tin Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-05 (Tin Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 2.5 |
| Purlin Thickness | 1.5 mm |

## Roof Angle - 30° < α < 60°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1652 | 1561 | 1515 | 1469 | 1359 |
| B | 1395 | 1304 | 1193 | 1092 | 964 |
| C | 955 | 863 | 771 | 716 | 643 |
| D | 615 | 551 | 487 | 441 | 404 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tin Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-05 (Tin Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 3 |
| Purlin Thickness | 1.5 mm |

## Roof Angle - 0° < α ≤ 10°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1744 | 1735 | 1671 | 1597 | 1450 |
| B | 1528 | 1524 | 1423 | 1285 | 1148 |
| C | 1102 | 1092 | 946 | 845 | 753 |
| D | 689 | 679 | 606 | 532 | 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 |
| A | 1735 | 1726 | 1666 | 1588 | 1446 |
| B | 1524 | 1519 | 1418 | 1276 | 1138 |
| C | 1102 | 1088 | 936 | 840 | 748 |
| D | 684 | 670 | 601 | 523 | 464 |

## Roof Angle - 20° < α < 30°

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | H ≤ 5 | 5 < H ≤ 10 | 10 < H ≤ 15 | 15 < H ≤ 20 | 20 < H ≤ 30 |
| A | 1680 | 1662 | 1597 | 1524 | 1377 |
| B | 1515 | 1423 | 1368 | 1248 | 1102 |
| C | 1203 | 1065 | 918 | 826 | 725 |
| D | 776 | 652 | 588 | 514 | 450 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# PV ez-Rack SolarRoof Interface spacing Table for Tin Roof

| | |
|---|---|
| Type of Rail | ER-R-ECO and all other ECO - Rails |
| Type of Interface | ER-I-05 (Tin Interface) |
| Solar Panel Dimension | 2 m x 1 m |
| Terrain Category | 3 |
| Purlin Thickness | 1.5 mm |

## Roof Angle - $30° < \alpha < 60°$

| Wind Region | Building Height (m) | | | | |
|---|---|---|---|---|---|
| | $H \leq 5$ | $5 < H \leq 10$ | $10 < H \leq 15$ | $15 < H \leq 20$ | $20 < H \leq 30$ |
| A | 1671 | 1662 | 1597 | 1524 | 1377 |
| B | 1441 | 1423 | 1368 | 1248 | 1102 |
| C | 1074 | 1065 | 918 | 826 | 725 |
| D | 661 | 652 | 588 | 514 | 450 |

**Note: The above spacings are for Up Wind End and Down Wind End Zone. Increase 10% the above spacings to find out Central Zone spacings.**

**Note: This Engineering report is based on 2 m x 1 m panels and two rails per panel. Refer to Note 12 for further details.**

# General Notes

**Note 1** **Tile Roof Interface Spacing tables based on a minimum depth into F7 (Pine) timber of 25mm and Tin Roof Interface Spacing tables based on a minimum depth into F7 (Pine) timber of 35mm.**

**Note 2** **Standard screws shipped for Tin and Tile Roof Interfaces**

| **Metal Purlins/Battens** | **Fasteners to use** |
|---|---|
| 0.75 mm | Buildex- 14 - 11 x 70 Hex Head Zips Climaseal 3 with 16 mm ABW on G550 Steel Battens |
| 1.5 mm - 2.4 mm | Buildex- 14 - 11 x 70 Hex Head Zips Climaseal 3 with 16 mm ABW |
| **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 Climaseal 3 with 16 mm ABW or 14g (6.3 mm)<br><br>**Tile Interface:** 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 Hex Head T17 Climaseal 3 or other screw of pullout value not less than screws above |

**Note 3** **Tin and tile spacings were calculated based on Steel Purlins G450 1.5mm and Timber F7 (Pine). For 0.75 mm Steel Battens and 1.2mm purlins, all spacings shall be reduced as follows:**

| Wind Region A | Wind Region B | Wind Region C | Wind Region D |
|---|---|---|---|
| - 28 % | - 40 % | - 40 % | - 40 % |

**Note 4** **Tin Spacings were calculated based on Steel Purlins G450 1.5 mm. In case the purlin thickness is less than 1.5 mm, a site specific certificate shall be issued. Contact Clenergy for more information.**

**Note 5** **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 6** **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 |

| 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 |
| 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) |

| Components | Part No. | Description |
|---|---|---|
| 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 7** **For Terrain Category (TC) definition, please refer to clause 4.2.1 of AS/NZS 1170.2:2011 (R2016).**

**Note 8** **The installed frame must comply with the clamping zone of the PV Panel.**

**Note 9** **Capacities checked and compared against testing data from Clenergy Australia and MTS (NATA certified).**

**Note 10** **Maximum permitted rail overhang of 40%.**

**Note 11** **For the definition of roof zones, refer to Appendix D6 of the AS/NZS 1170.2:2011 (R2016) standard.**

**Note 12** **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 | + 8 % |
| 3 rails | ≤ 1700/ ≤1100 | + 12 % |
| 4 rails | ≤ 1700 / ≤1100 | + 15 % |
| 2 rails | ≤ 2000/ ≤1100 | 0 % |
| 3 rails | ≤ 2000/ ≤1100 | + 10 % |
| 4 rails | ≤ 2000/ ≤1100 | + 12 % |
| 2 rails | ≤ 2100/ ≤1100 | - 10 % |
| 3 rails | ≤ 2100/ ≤1100 | + 6 % |
| 4 rails | ≤ 2100/ ≤1100 | + 10 % |
| 2 rails | ≤ 2200/ ≤1100 | - 13 % |
| 2 rails | ≤ 2200/ ≤1200 | - 20 % |

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

**Note 18** **Topographic Multiplier (Mt) taken as 1.0. Refer to clause 4.4 of AS/NZS 1170.2:2011 (R2016) for more information.**

**Note 19** **Shielding Multiplier (Ms) taken as 1.0. Refer to clause 4.3 of AS/NZS 1170.2:2011 (R2016) for more information.**

**Note 20** **Wind Direction Multiplier (Md) taken as 1.0. Refer to clause 3.3 of AS/NZS 1170.2:2011 (R2016) for more information.**

**Note 21** **General conditions**

**Note 21.1** **Minimum grade for steel purlins/battens of 450 Mpa.**

**Note 21.2** **Timber Grade members: F7 (Pine) and F17 (Hardwood).**

**Note 21.3** **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 22** **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 23** **A minimum of two (2) screws per Tile Interface will be required for installation.**

**Note 24** **For installations on the Central Zone increase ER-I-01 & ER-I-05 Interface Spacings by 10%.**

**Note 25** **Use the same spacing listed on the tables of this certificate for panels installed in landscape.**

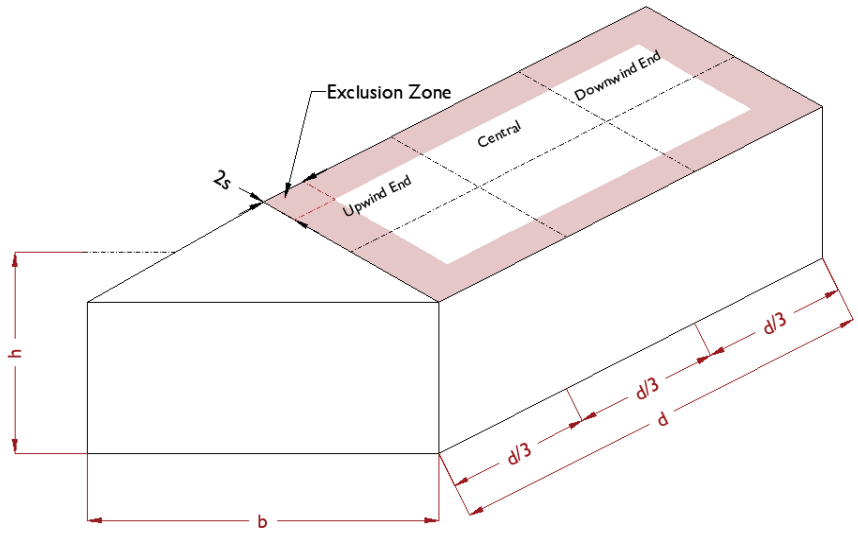
**Note 26** **When using Roof Extender (ER-RE-200), reduce interface spacings by 15% on Wind Region A and B and 30% on Wind Region C and D.**

**Note 27** **If reducing screw embedment by using EZ-AD-C43 adaptor or if attaching to a smaller timber batten/purlin, fixing spacing to be reduced/increased to timber purlins as per below:**

| | **Batten-Purlin Depth / Screw embedment** | |
|---|---|---|
| **Batten type** | **25 mm** | **30 mm** |
| **Timber F7** | Reduction of 35% | Reduction of 25% |
| **Timber F17** | Spacings remain the same | Increase of 20% |

**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 "2s", where "s" is the gap between the underside of the panel and the roof.**

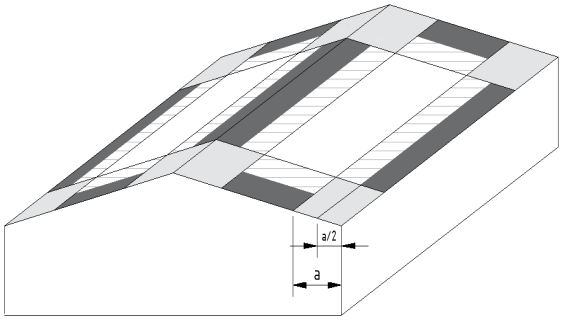
**Note 30** **If the installation is located in ISO corrosivity category C4 reduce the interface spacing by 5%. If the installation is located in ISO corrosivity category C5 reduce the interface spacing by 25%.**

**Note 31** **Roof Zone definition for flush mounted systems installed on flat and pitched roofs when <u>any</u> of the conditions listed on <u>Note 25</u> are <u>not met.</u>**

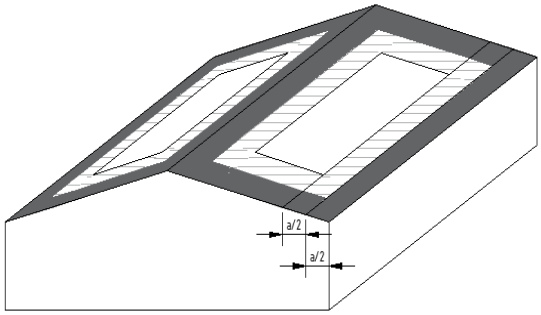
**Step 1** Determine building height (h), width (b) and length (d).

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

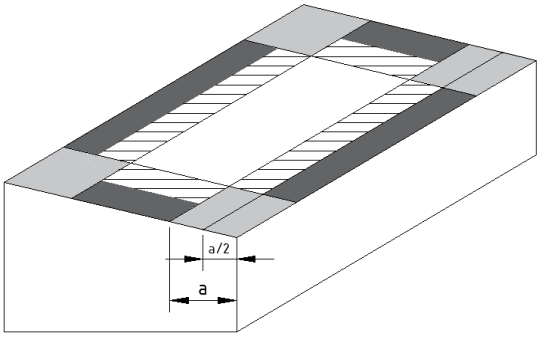
**Step 3** The **lowest** value on Step 2, equates to **a.**



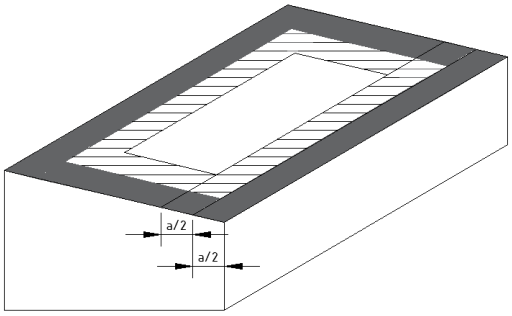

Roof Pitch < 10°




Roof Pitch ≥ 10°




Flat/Mono – Slope Roof < 10°




Flat/Mono – Slope Roof ≥ 10°

Legend:

- Internal Zone
- Intermediate Zone
- Edge Zone
- Corner Zone

**Note 32** **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.

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 from the table above: 1918 mm
Spacing calculated for intermediate zone: 1278 mm

**Note 33** For hanger bolt installation on either tin or tile roof, the spacing of hanger bolt with a minimum depth into F7 (Pine) timber of 25mm or fixing on the metal purlin of 1.5 mm thick is the same as tin roof interface spacing. Hanger bolts for wood purlin/rafter are ER-HB-8/150 and ER-HB-10/200A. Hanger bolt for metal purlin/rafter is ER-HB-MP/8/150EP.

**Note 34** 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.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## Worldwide Network