

# Penetrative Tilt Legs

Code-Compliant Planning and Installation Guide V 2.0 (New Zealand)  
Complying with AS/NZS 1170.2-2021



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# Introduction

The Clenergy PVezRack® SolarRoof Tilt Legs 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 PVezRack® SolarRoof Tilt Legs. This manual provides:

- 1) Supporting documentation for building permit applications relating to PVezRack® SolarRoof Tilt Legs Universal PV Module Mounting System,
- 2) Planning and installation instructions.

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The PVezRack® SolarRoof Tilt Legs parts, when installed in accordance with this guide, will be structurally sound and will meet the AS/NZS 1170.2 - 2021 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 New Zealand.

### Product Warranty:

Please refer [PVezRack® Product Warranty](#) on our website.

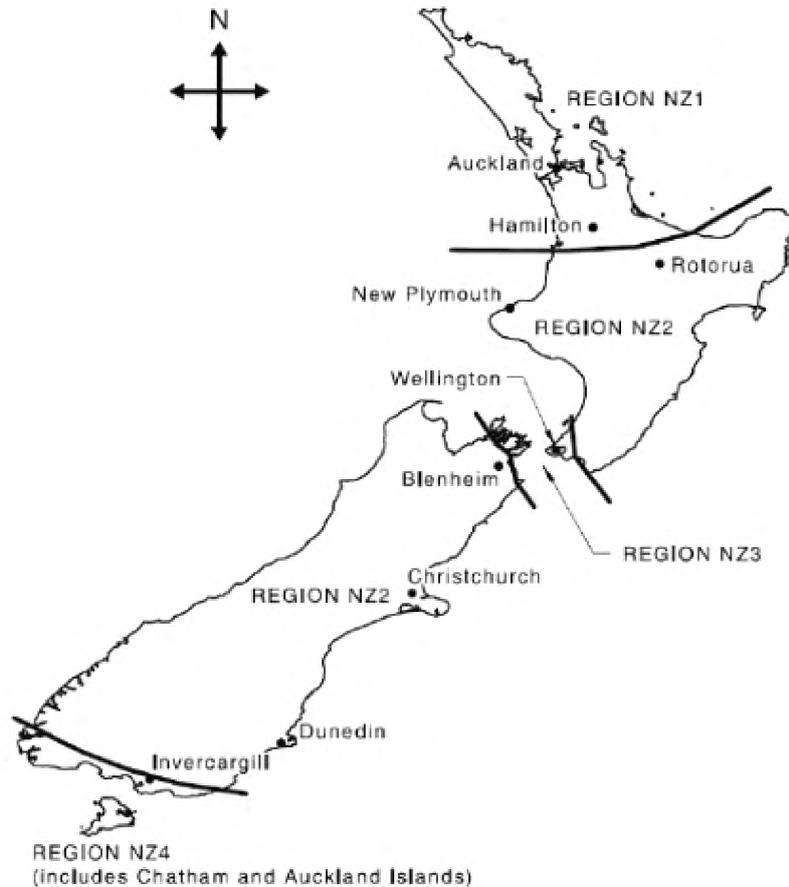
### The installer is solely responsible for:

- 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 PVezRack® 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 SNZ TS 3404:2018 or consulting local construction business to determine appropriate products and installations.

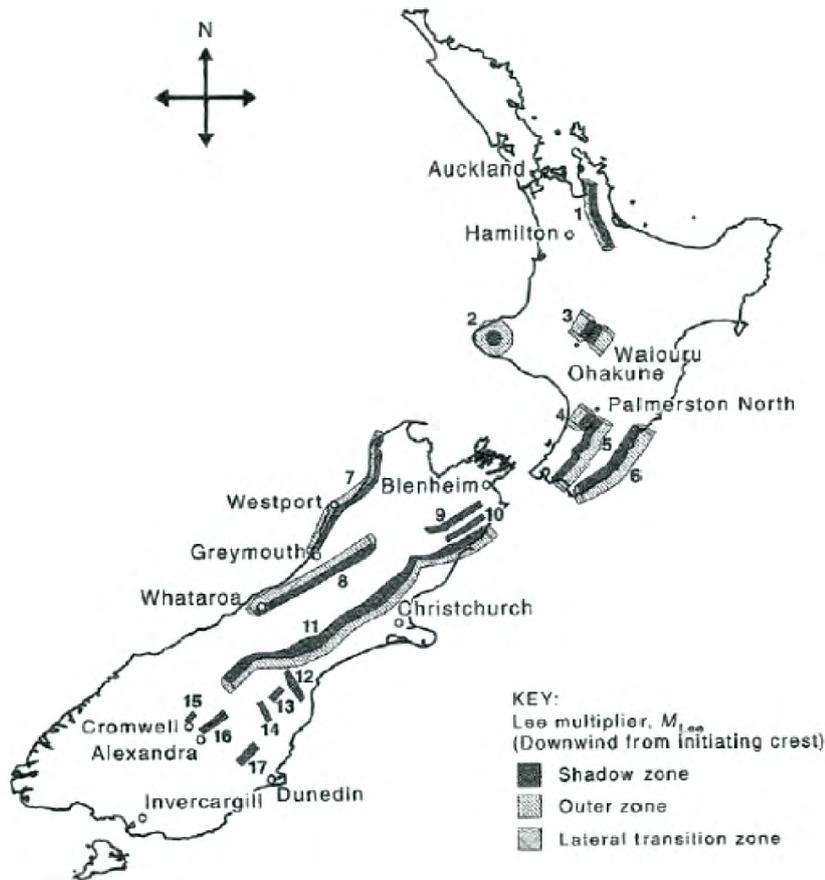
# Planning

## Determine the wind region of your installation site

Wind regions map below shows 4 different wind regions in New Zealand: NZ1, NZ2, NZ3 and NZ4.



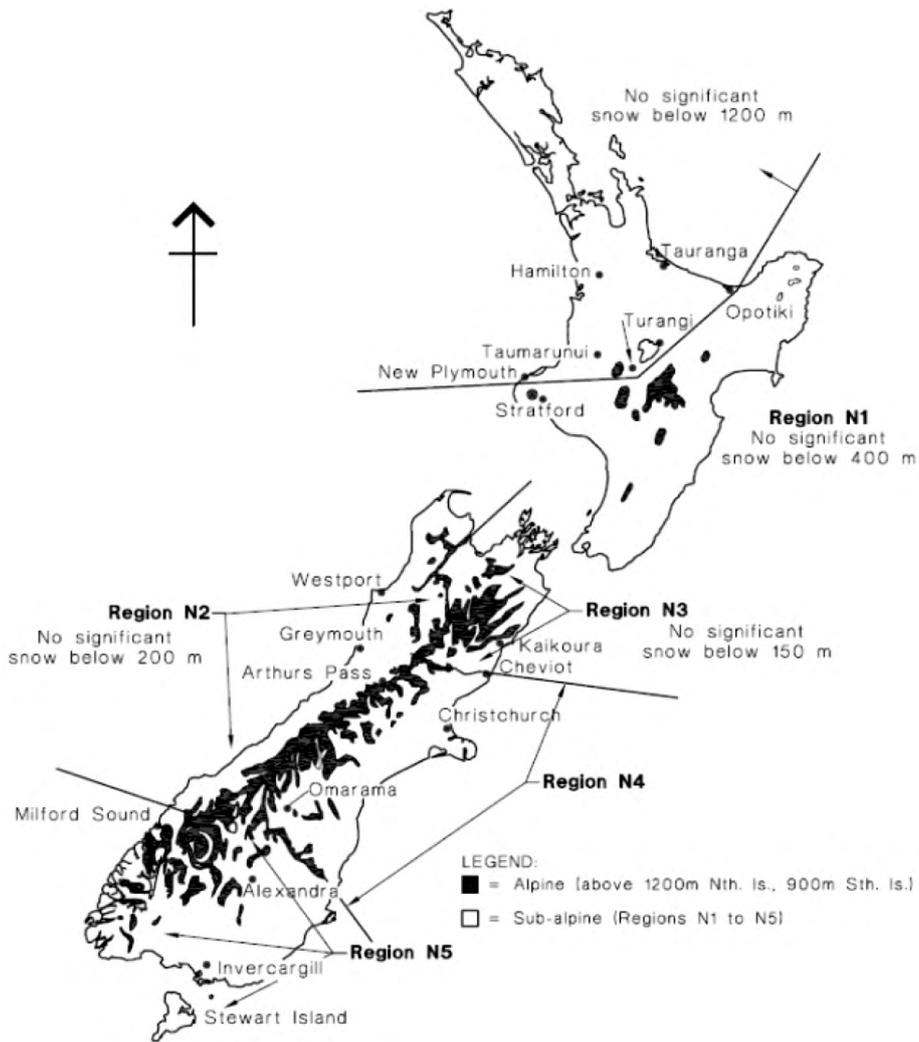
The lee (effect) multiplier ( $M_{1ee}$ ) shall be evaluated for New Zealand sites in the lee zones below. In wind regions of NZ1 and NZ2 with  $M_{1ee}$  over 500 m above sea level, the interface spacing reduction is applied. Please refer to note 25 of engineering certificate.



Locations of New Zealand lee Zones

For installation sites located in Sub-alpine Regions (shown on the map below), please refer to Note 26 of engineering certificate for maximum interface spacing and see “Examples” in certificate to understand how to use maximum spacing in Sub-alpine Regions.

If your installation site is in Alpine regions, please contact Clenergy to obtain a project specific engineering certificate to support your installation.



New Zealand – Approximate Locations of Alpine and Sub-alpine Regions

## Determine the Terrain Category

It requires to determine the right terrain category to ensure the installation meets the maximum interface spacing specified in the engineering certificate.

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 1.5 m to 5 m, with no more than two obstructions per hectare (e.g. farmland and cleared subdivisions with isolated trees and uncut grass).

Terrain Category 3 (TC3) – Terrain with numerous closely spaced obstructions having heights generally from 3 m to 10 m. 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 large, high (10 m to 30 m tall) and closely spaced constructions, such as large city centres and well-developed industrial complexes.

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

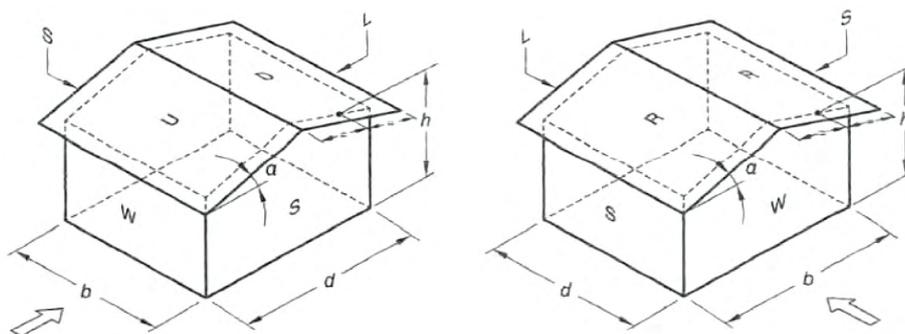
## Verify Atmospheric Corrosivity Zone of Installation Site

Please refer “SNZ TS 3404:2018 Durability Requirements for Steel Structures and Components” or consult local construction business to verify corrosivity category of installation site to determine appropriate corrosivity class roof interface screw.

## Determine Building Dimension

This document provides sufficient information for the PVezRack® SolarRoof system installation up to 20 meters building height (average roof height of structure above the ground, see the diagram below). If your building is more than 20 meters high, please contact Clenergy to obtain project specific engineering certificate to support your installation.

Building horizontal dimensions (b and d) are required to calculate the ratio of h/d to determine maximum interface spacing.



Parameters for Rectangular Enclosed Buildings

## Determine Roof slope and Tilt Leg Angle

The PVezRack® SolarRoof Tilt Legs system is suitable for rails running perpendicular to the roof slope (including standard and reverse tilt), and slope up to 10° for rails running parallel to the roof slope.

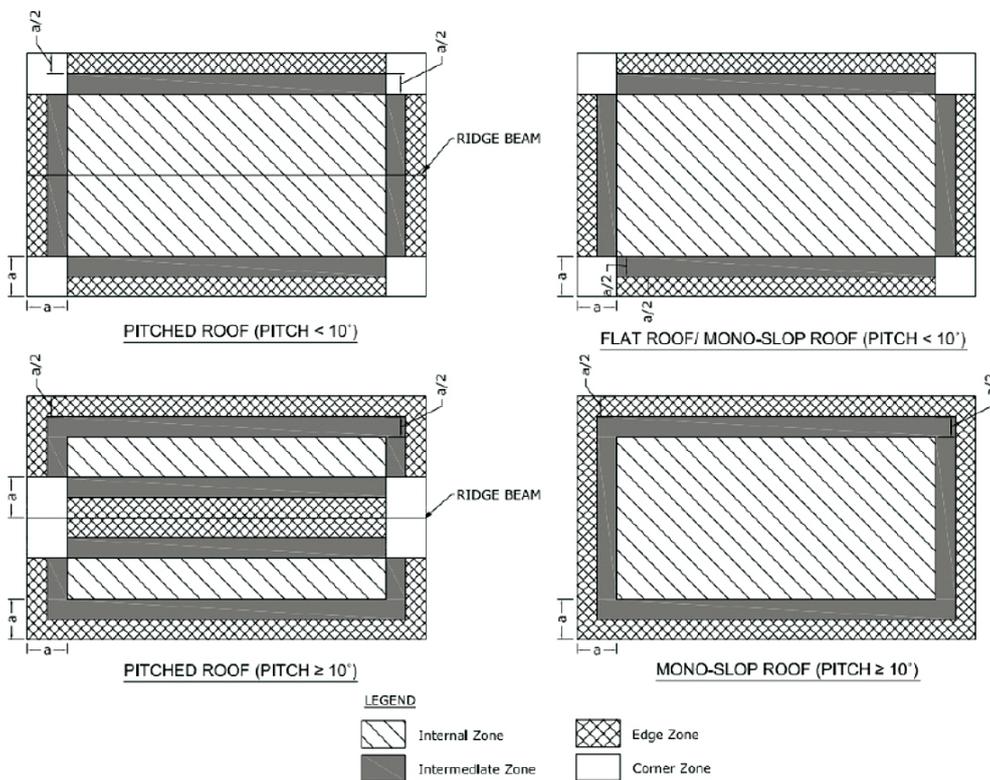
## Determine the Installation Area of Roof

There are 4 different roof zones for tilt leg installation: Internal Zone, Intermediate Zone, Edge Zone and Corner Zone. Please see diagrams and steps below to define area of each zone.

**Step 1.** Determine building height (h), width (b) and length (d) – see diagram above;

**Step 2.** The lowest value between "b x 0.2" and "d x 0.2" is "a" if h/b or h/d ≥ 0.2;

**Step 3.** "a" equates to 2h, if both h/b and h/d < 0.2,



Roof Zones Definition

## Verify Purlin Properties of Building

Please verify purlin properties of building, which could affect the interface spacing. Tilt legs spacing on in the certification letter is based on steel purlin G450 1.5 mm thick or 35 mm Timber F7 (Pine). For example, if the steel purlin is less than 1.5 mm thick, the corresponding reduction factor of interface spacing could be applied. Please refer to generic note 22 of engineering letter for details.

## Determine Two Screws or One Screw Installations of Tilt Legs

There are options of using two screws or one screw for installations of adjustable and fixed tilt legs, depending on the project scenario, such as required interface spacing, purlin spacing, rib spacing of roof sheet and so on. Please find note 22 of engineering letter for details.

## Determine the Maximum Rail Support Spacing

Please refer to the Certification Letter and Tilt Legs 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 not be over 40% of the Tilt Legs spacing. For example, if the Tilt Legs spacing is 1500mm, the Rail end overhang can be up to 600mm only.

## The application of Adjustable Tilt Legs

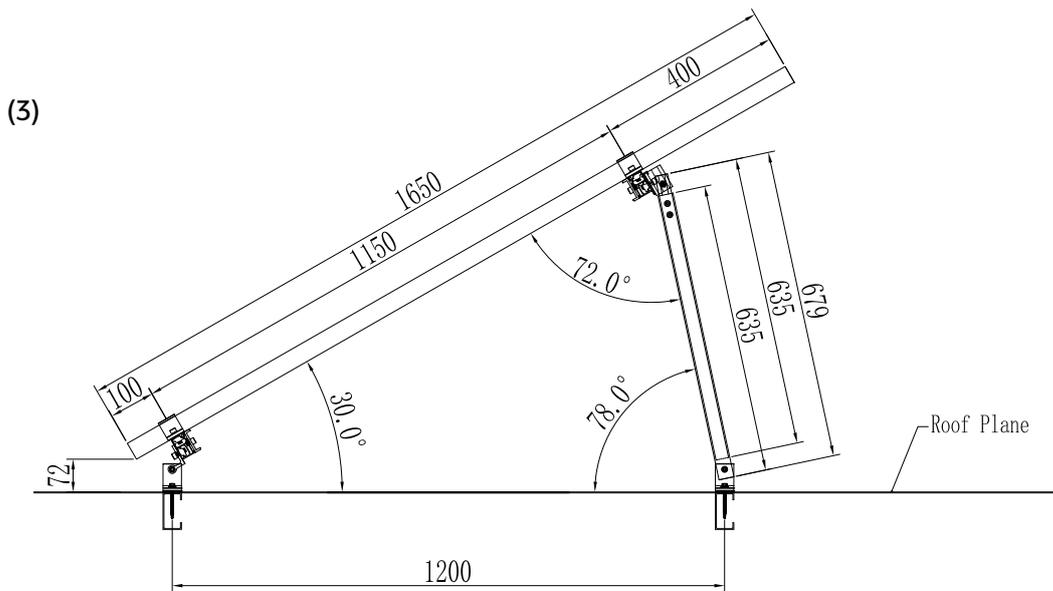
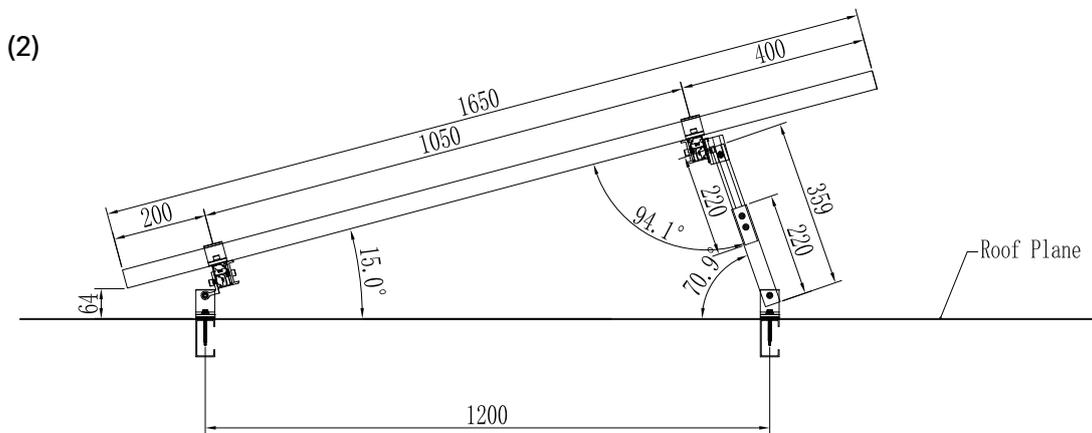
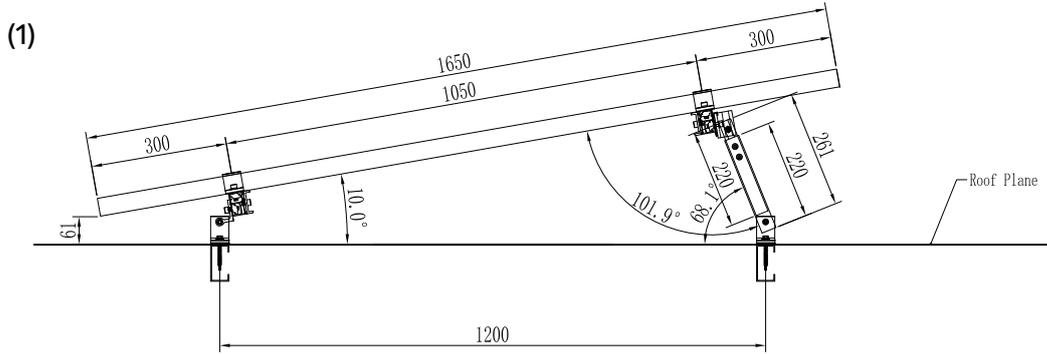
Following the tilt angle rules of Determine Roof Slope and Tilt Leg Angle on the north or south facing roof, the actual panel tilt angles using the adjustable tilt legs installed at the different purlin spacing could be applicable or not. Please see the table and side view diagrams below.

| Application of Adjustable Tilt Legs |             |          |          |          |          |     |          |          |           |           |     |         |     |           |     |     |
|-------------------------------------|-------------|----------|----------|----------|----------|-----|----------|----------|-----------|-----------|-----|---------|-----|-----------|-----|-----|
| Purlin spacing                      |             | 1200 mm  |          |          |          |     | 1400 mm  |          |           |           |     | 1700 mm |     |           |     |     |
|                                     | Product     | 10°      | 15°      | 30°      | 45°      | 60° | 10°      | 15°      | 30°       | 45°       | 60° | 10°     | 15° | 30°       | 45° | 60° |
| 1650 mm panel in portrait           | ER-TL-10/15 | ✓<br>(1) | ✓<br>(2) | ×        | ×        | ×   | ✓<br>(6) | ×        | ×         | ×         | ×   | ×       | ×   | ×         | ×   | ×   |
|                                     | ER-TL-15/30 | ×        | ×        | ×        | ×        | ×   | ×        | ✓<br>(8) | ×         | ×         | ×   | ×       | ×   | ×         | ×   | ×   |
|                                     | ER-TL-30/60 | ×        | ×        | ✓<br>(3) | ✓<br>(4) | ×   | ×        | ×        | ✓<br>(10) | ✓<br>(12) | ×   | ×       | ×   | ✓<br>(14) | ×   | ×   |
| 1960 mm panel in portrait           | ER-TL-10/15 | ×        | ×        | ×        | ×        | ×   | ✓<br>(7) | ×        | ×         | ×         | ×   | ×       | ×   | ×         | ×   | ×   |
|                                     | ER-TL-15/30 | ×        | ×        | ×        | ×        | ×   | ×        | ✓<br>(9) | ×         | ×         | ×   | ×       | ×   | ×         | ×   | ×   |
|                                     | ER-TL-30/60 | ×        | ×        | ×        | ✓<br>(5) | ×   | ×        | ×        | ✓<br>(11) | ✓<br>(13) | ×   | ×       | ×   | ✓<br>(15) | ×   | ×   |

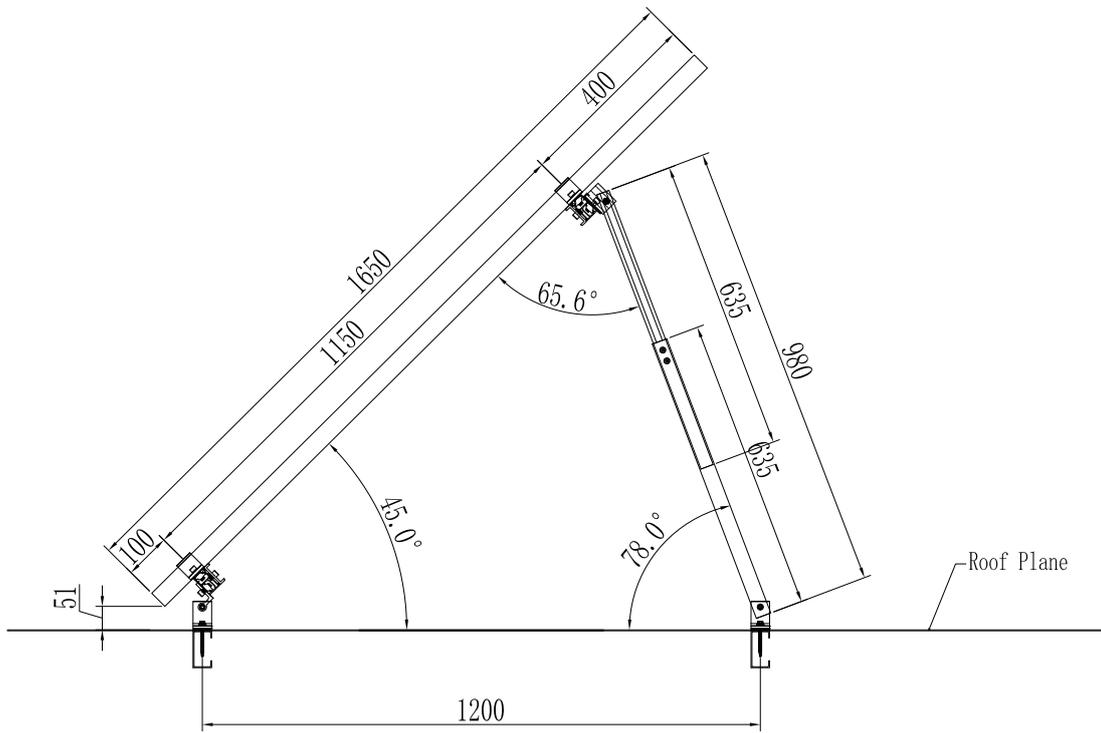
Note: ✓ indicates applicable; × indicates not applicable

The table above is based on:

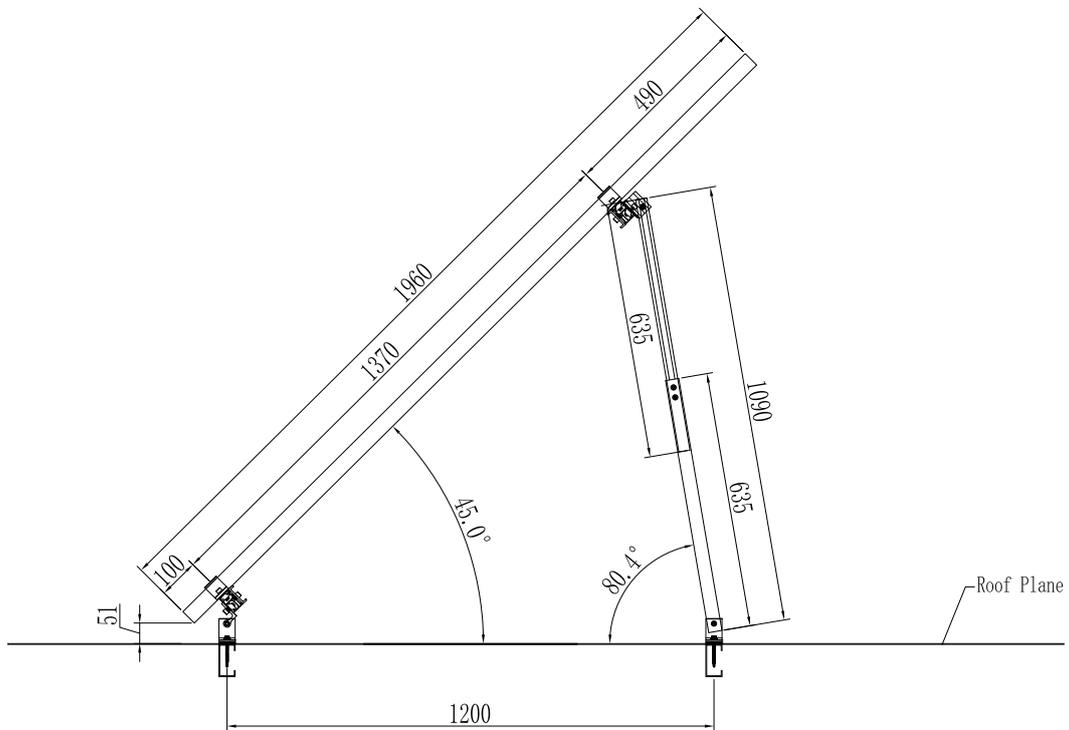
- The panels are clamped within one quarter of panel length;
- Rear leg adjustable range: ER-TL-10/15: 260-375 mm; ER-TL-15/30: 390-635 mm; ER-TL-30/60: 675-1205 mm;
- If the info. is different from the table and diagram, it could have different results. Please contact the Clenergy to confirm its applicability.**

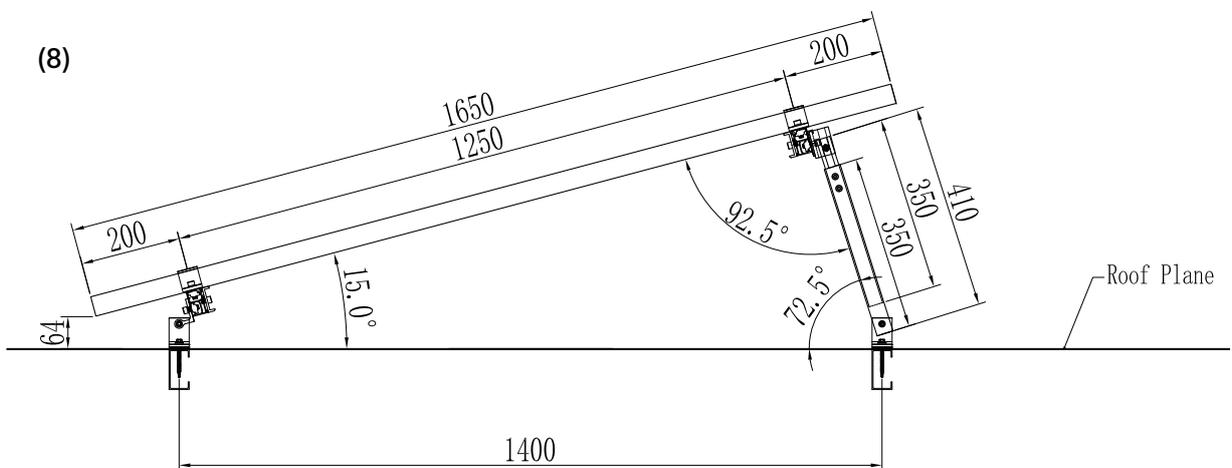
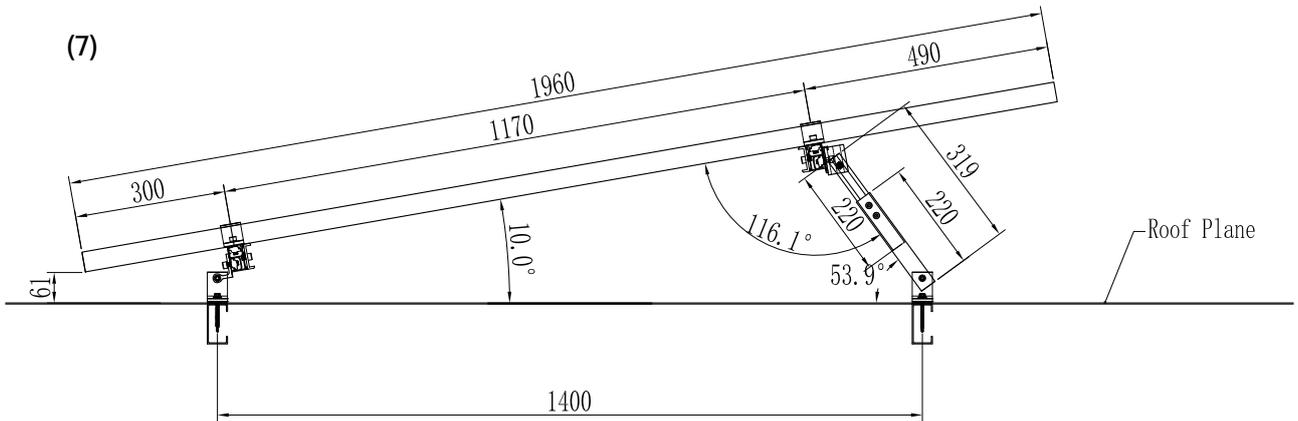
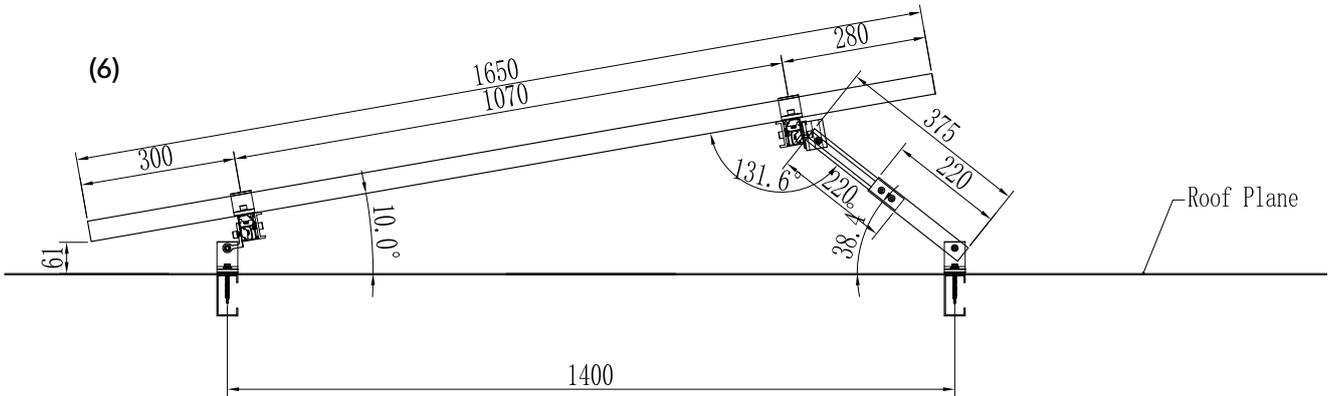


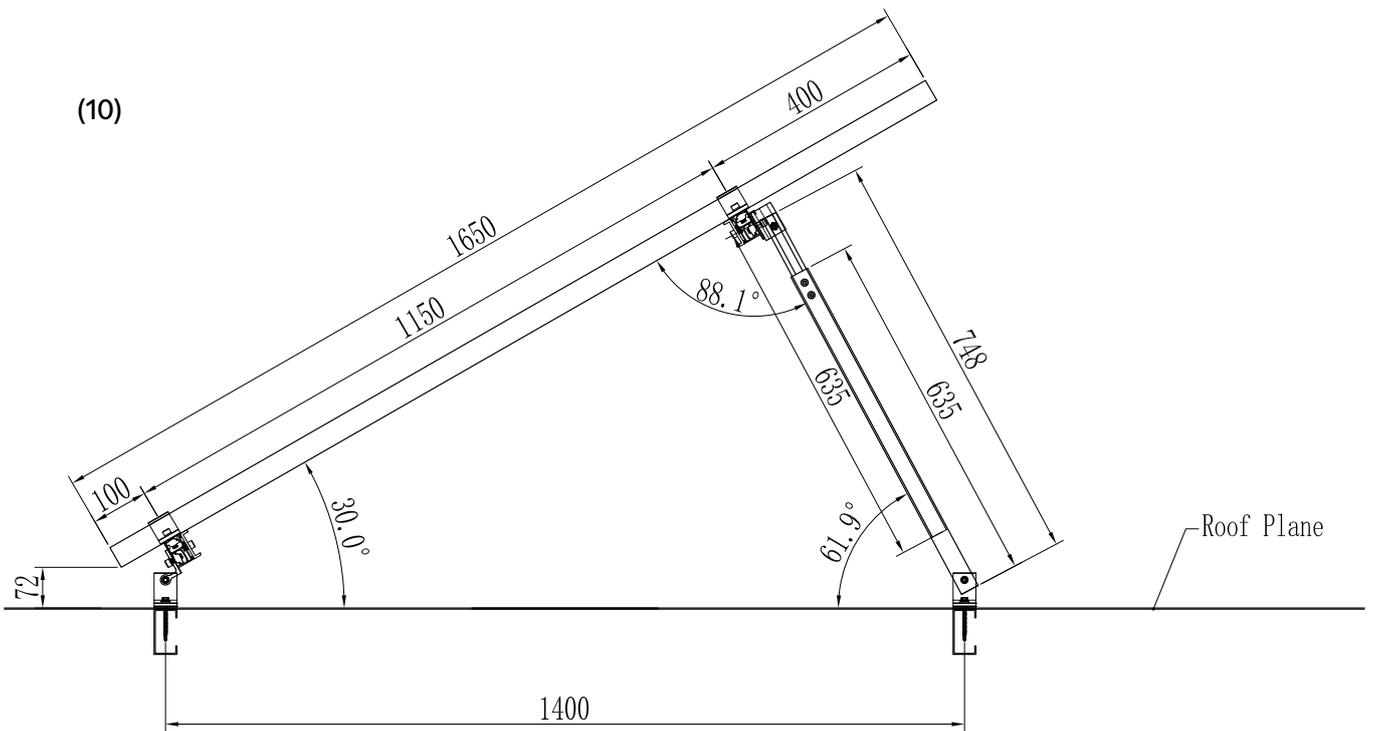
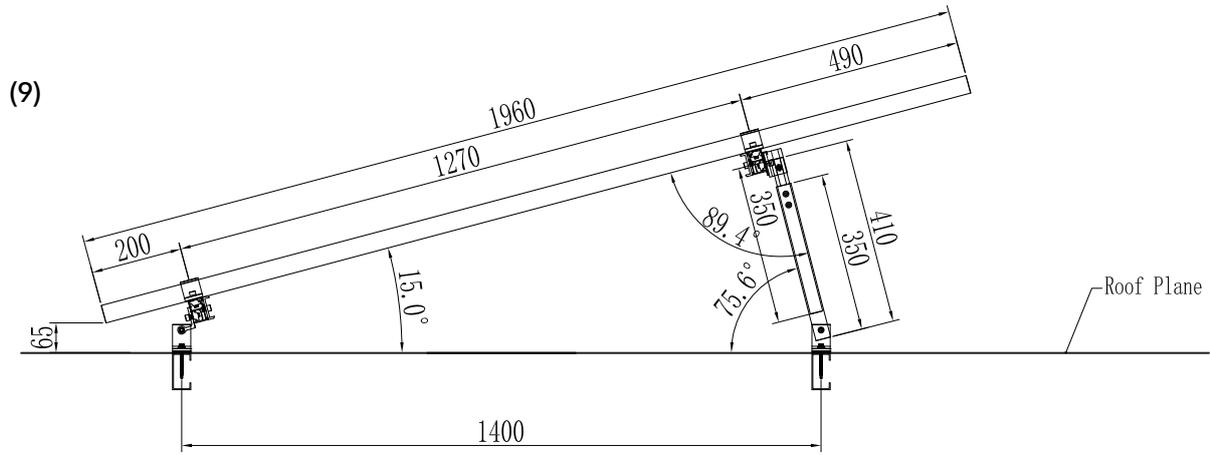
(4)

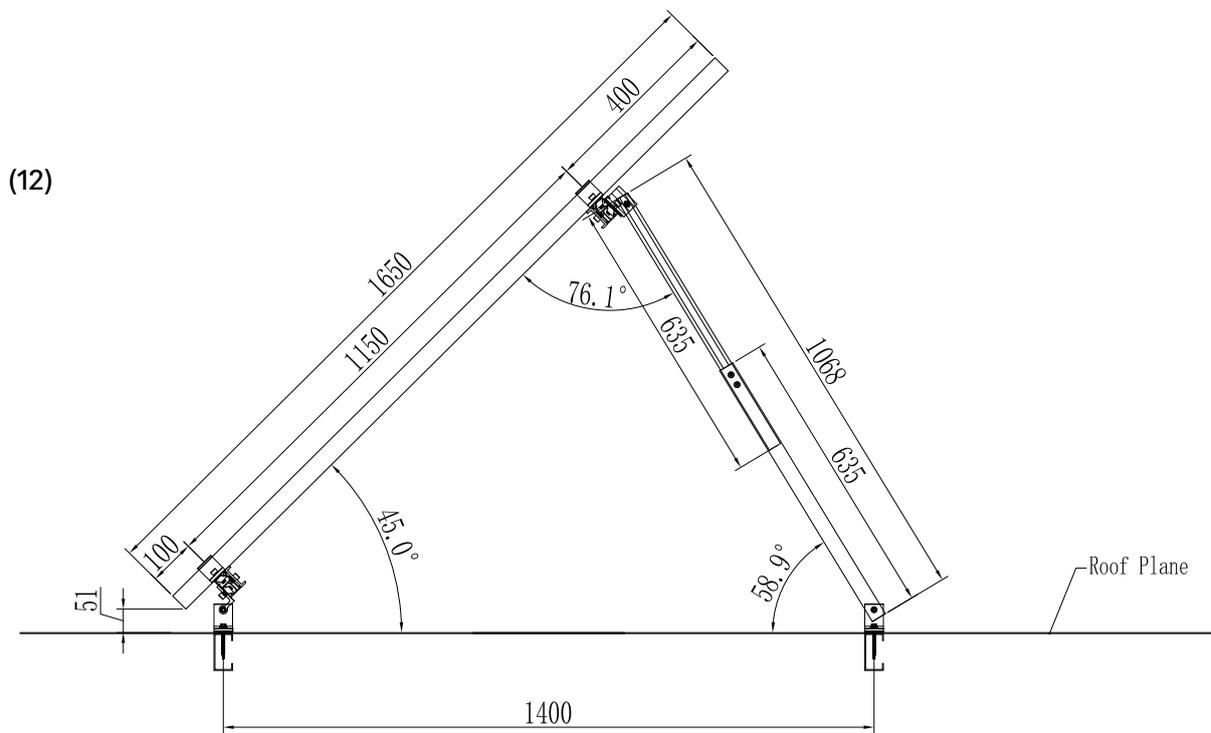
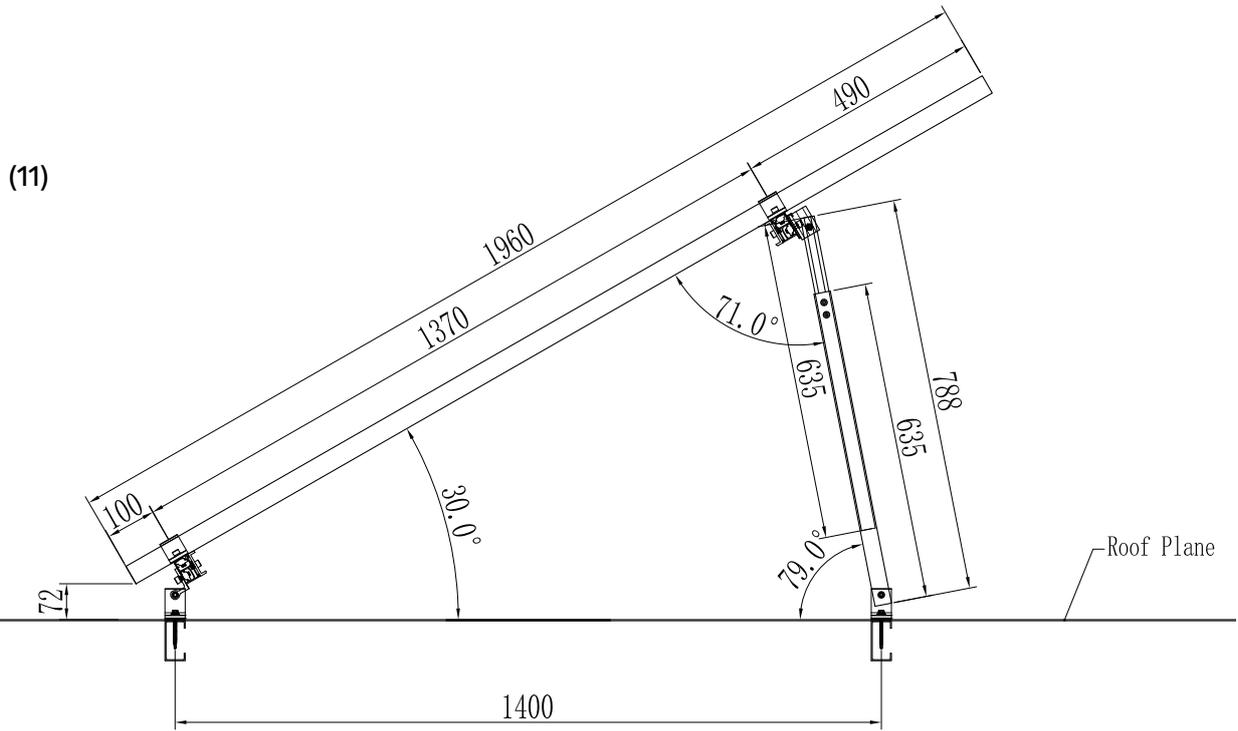


(5)

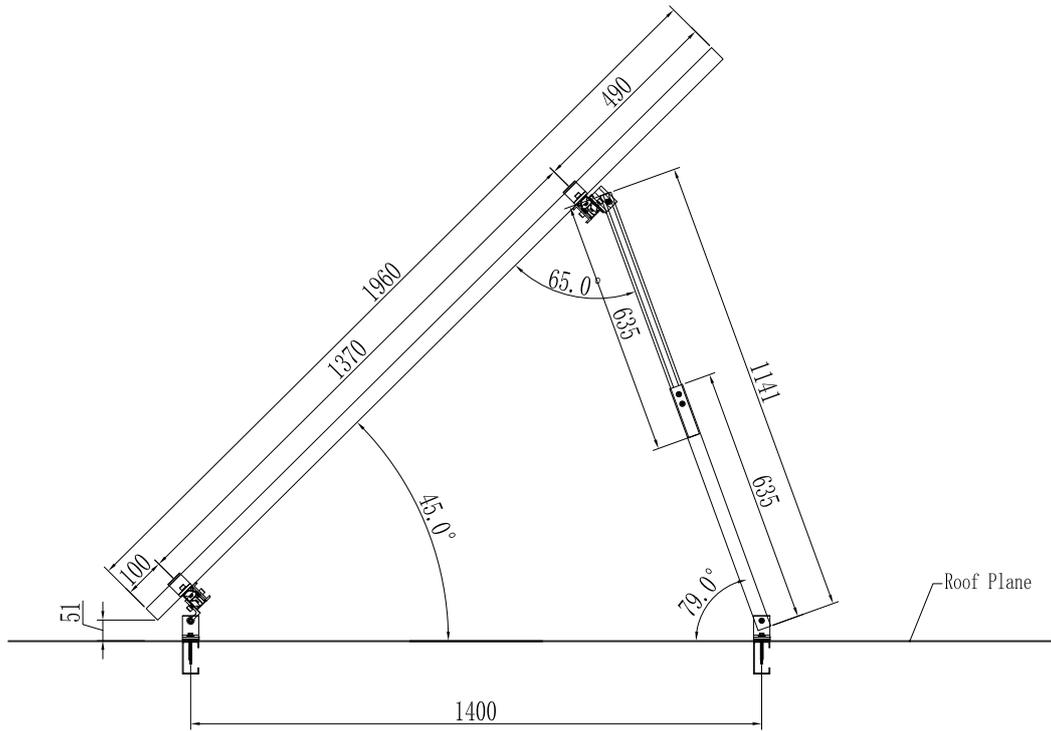




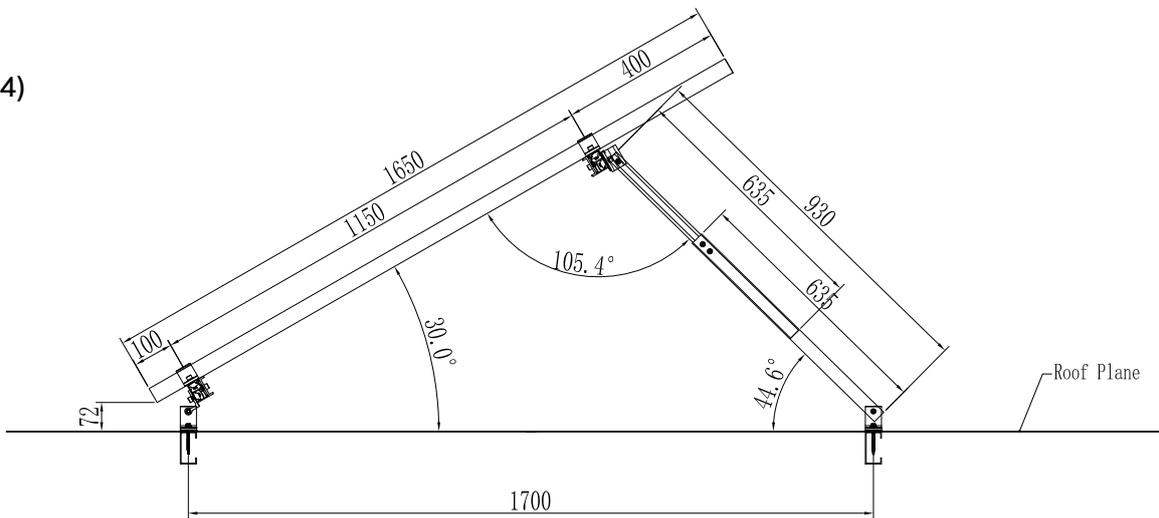




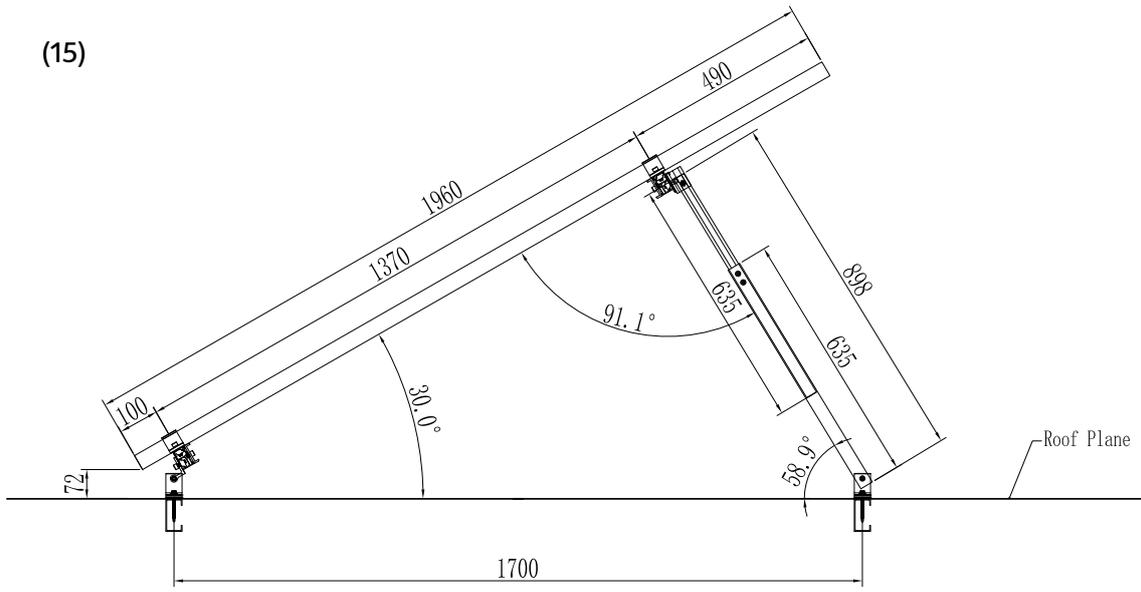
(13)



(14)



(15)



# Tools and Components

## Tools

|   |   |   |  |   |
|---|---|---|--|---|
|  |  |  |  |  |
| <b>Screw Driver</b><br>(maximum torque ≥ 34N·m)                                   | <b>Torque Spanner</b>   | <b>Socket Wrench M8</b>   | <b>5m Tape</b>   | <b>String &amp; Marker Pen</b>  |

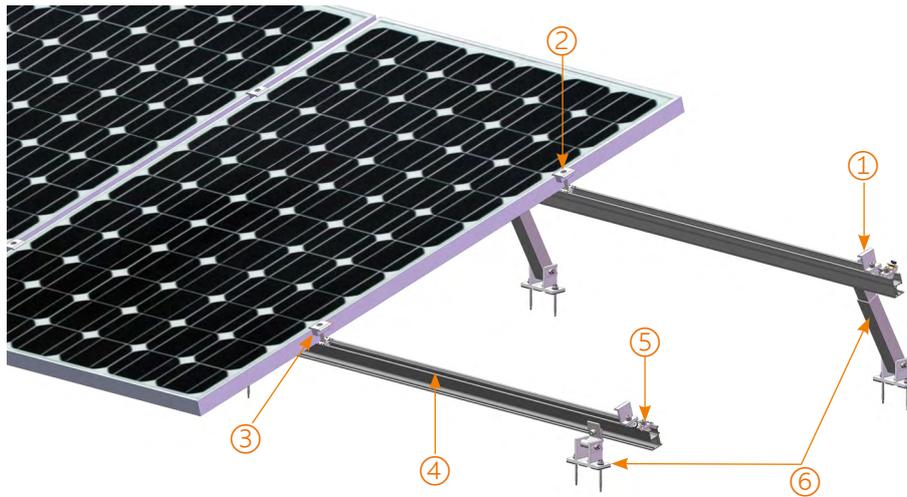
## Components

|   |   |   |   |   |
|---|---|---|---|---|
|  |  |  |          |                    |
| <b>ER-EC-ST</b><br>End Clamp  | <b>ER-IC-ST</b><br>Inter Clamp  | <b>C-U/30/46</b><br>Akashi Clamp  | <b>C-U/30/46-G</b><br>Akashi Clamp with grounding clip  | <b>ER-TL-10/15</b><br><b>ER-TL-15/30</b><br><b>ER-TL-30/60</b><br>Adjustable Tilt legs, non-preassembly |
|  |  |  |          |                    |
| <b>ER-R-ECO</b><br>ECO-Rail   | <b>ER-SP-ECO</b><br>Splice for ECO-Rail   | <b>ER-TL-10/15/PS</b><br><b>ER-TL-15/30/PS</b><br>Adjustable Tilt legs, preassembly | <b>TL-10/15/L/PS</b><br><b>TL-15/30/L/PS</b><br>Adjustable Tilt Legs with L-feet, preassembly | <b>ER-TL-5/PS</b><br><b>ER-TL-10/PS</b><br>Fixed Tilt Legs, preassembly                                 |

# System Overview

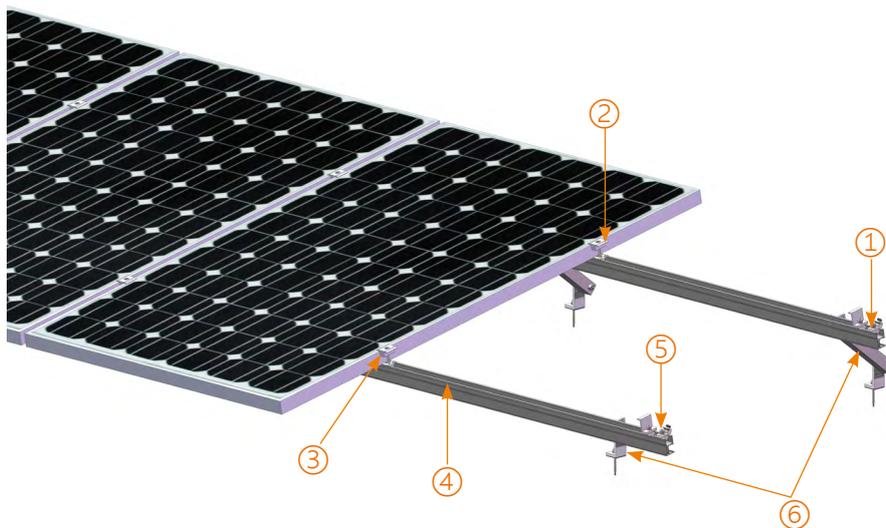
## Overview of PVezRack® SolarRoof Adjustable Tilt Legs

### Adjustable Tilt Legs



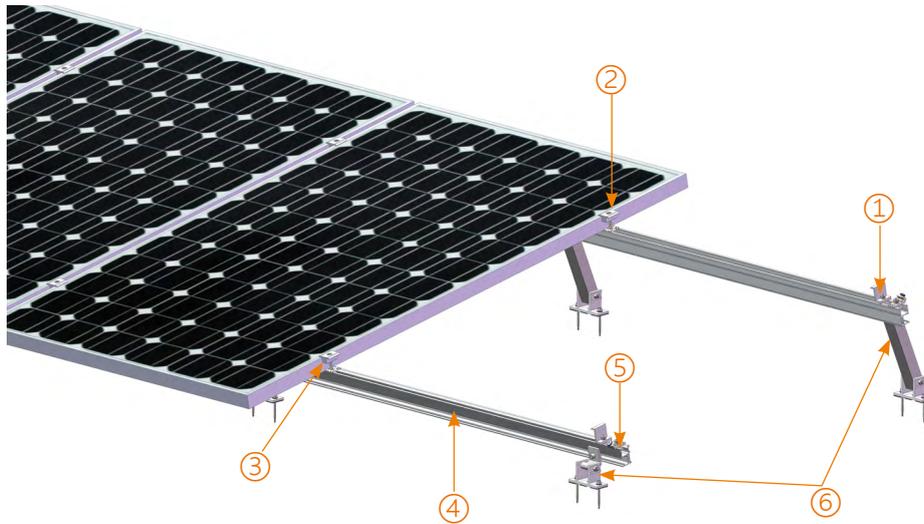
- 1. End Clamp
- 2. Inter Clamp
- 3. Grounding Clip
- 4. ECO-Rail
- 5. Grounding Lug
- 6. Adjustable Tilt Legs

### Adjustable Tilt Legs with L-feet



- 1. End Clamp
- 2. Inter Clamp
- 3. Grounding Clip
- 4. ECO-Rail
- 5. Grounding Lug
- 6. Adjustable Tilt Legs with L-feet

## Fixed Tilt Legs



1. End Clamp   2. Inter Clamp   3. Grounding Clip   4. ECO-Rail   5. Grounding Lug   6. Fixed Tilt Legs

## 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.

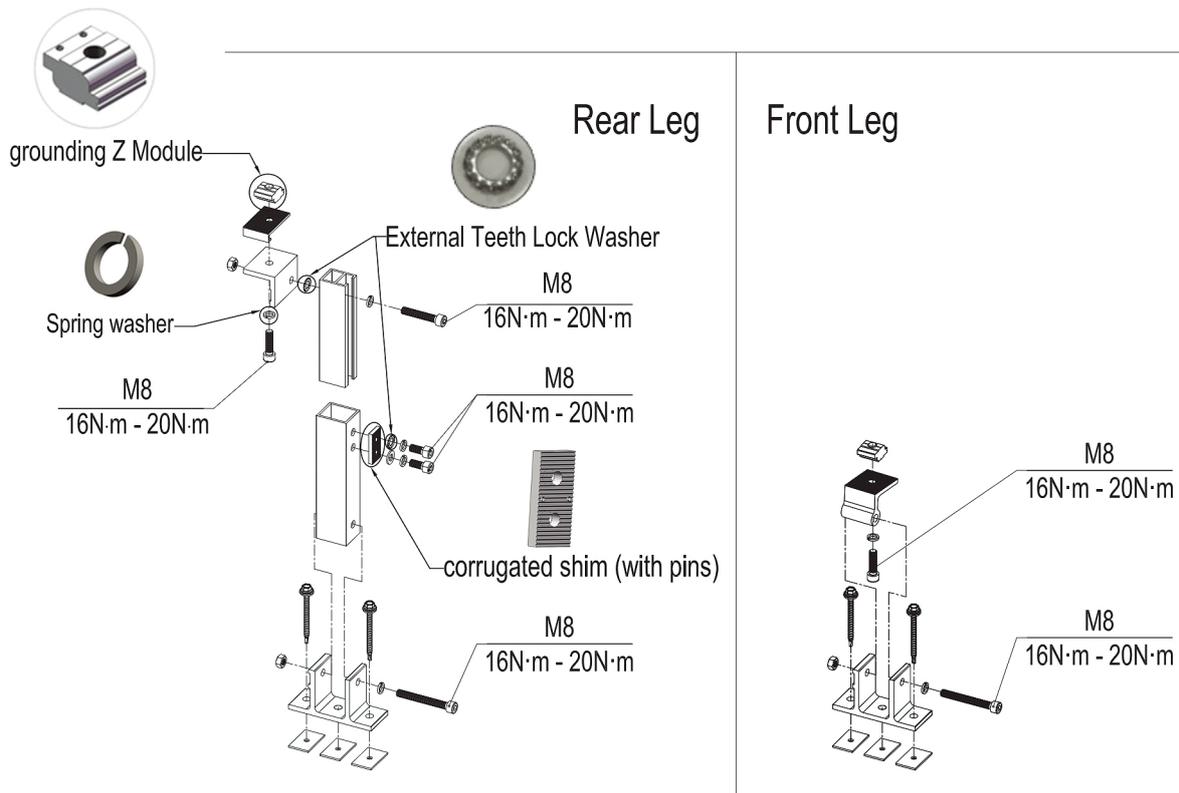
### General installation instructions:

- (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 figure below. If 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, please make sure that there is no load on the fastener before you cut it. Avoid damaging the anodized or galvanized surfaces.

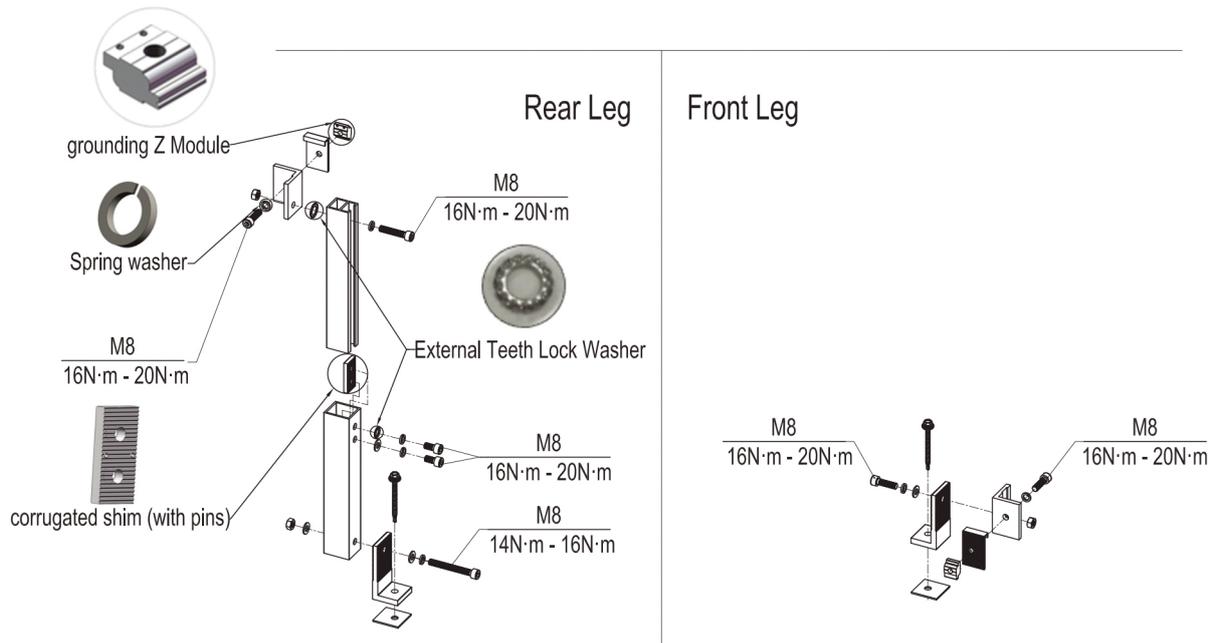
### 1) Adjustable Tilt Legs



**Note:**

Grounding Z Module, External Teeth Lock Washers, Spring washer and corrugated shim (with pins) on the diagram above are to create the electrical continuity between rail and rear leg tubes.

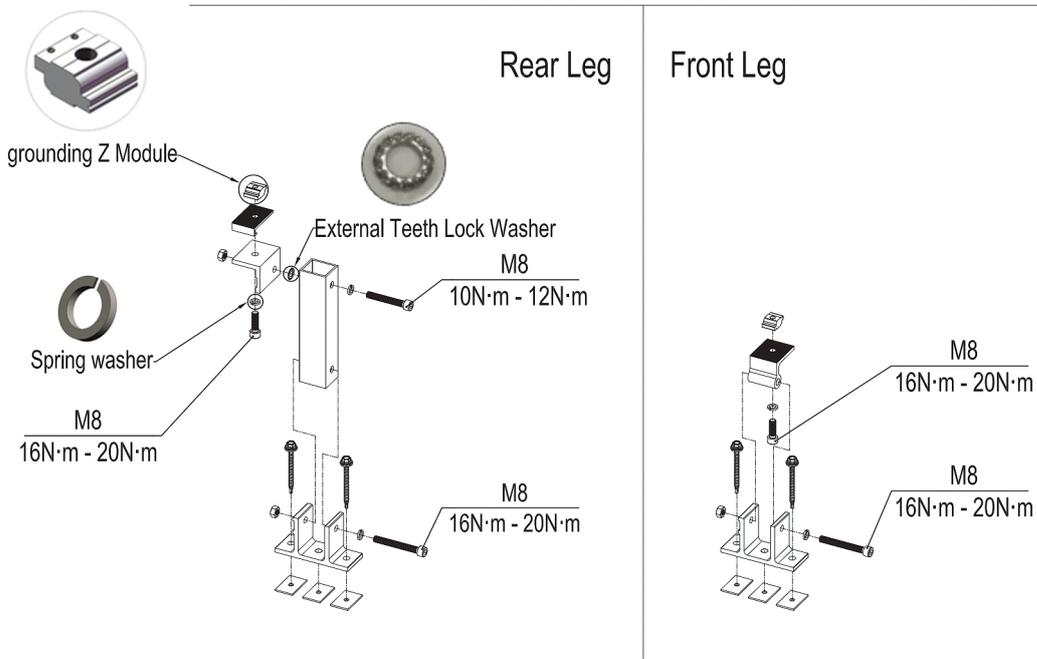
**2) Adjustable Tilt Legs with L-feet**



**Note:**

Grounding Z Module, External Teeth Lock Washers, Spring washer and corrugated shim (with pins) on the diagram above are to create the electrical continuity between rail and rear leg tubes.

**3) Fixed Tilt Legs**



**Note:**

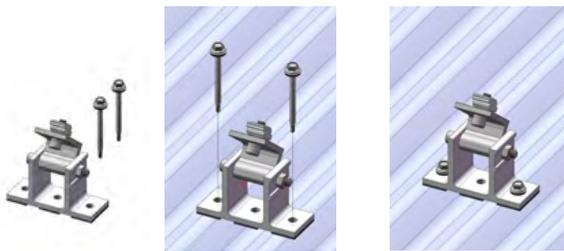
Grounding Z Module, External Teeth Lock Washer and Spring washer on the diagram above are to create the electrical continuity between rail and rear leg tubes.

# Installation Instructions

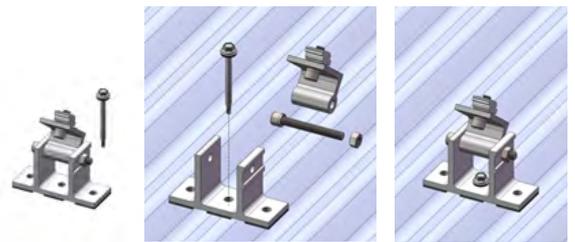
## Front & Rear Leg Installation

### Front Leg Installation

According to the installation plan, determine the mounting position and direction of the front legs. Either two screws or single screw (Buildex 14-11 x 70 Hex Head Zips screw) is required depending on the installation spacing requirement. See two screws and single screw options in Figures 1 and 2. Tin foot front leg installation is in Figure 3.



**Figure 1**  
(Front Leg Installation with Two Screws)



**Figure 2**  
(Front Leg Installation with Single Screw)



**Figure 3**  
(Tin Foot Front Leg Installation)

**Notes:**

1. Two screws shall be installed through two side holes of front leg (as shown in Figure 1);
2. Single screw shall be installed through central hole only of front leg (as shown in Figure 2).

Please follow 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.



## Rear Leg Installation

According to the installation plan, after confirming the length L of the Rear Leg, fasten two M8\*12 bolts as shown in Figure 4.

Recommended torque for M8\*12 bolts is 18~20 N·m

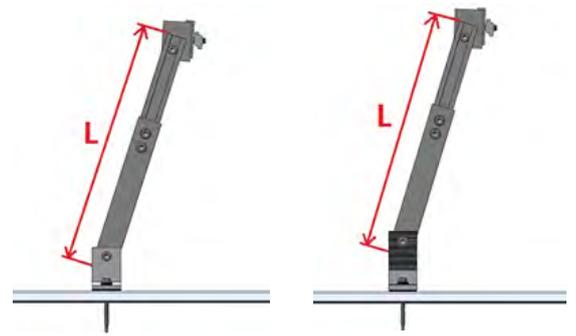


Figure 4

According to the installation plan, either two screws or single screw (Buildex 14-11 x 70 Hex Head Zips screw) is used to install rear leg. Using preassembly or non-preassembly rear legs will make installation steps a bit different as well. See the installation images in Figures 5-9.

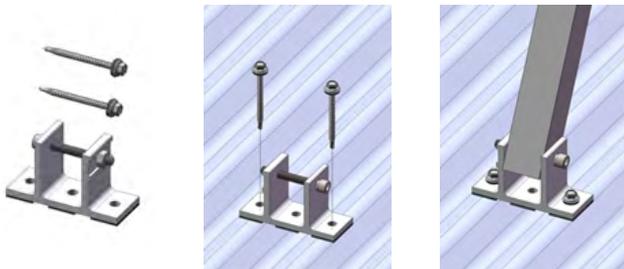


Figure 5

(Non-preassembly Rear Leg Installation with Two Screws)



Figure 6

(Non-preassembly Rear Leg Installation with Single Screw)



Figure 7

(Preassembly Rear Leg Installation with Two Screws)



Figure 8

(Preassembly Rear Leg Installation with Single Screw)



Figure 9

(Tin Foot Rear Leg Installation)

**Notes:**

1. Two screws shall be installed through two side holes of rear leg (as shown in Figures 5 and 7);
2. Single screw shall be installed through central hole only of rear leg (as shown in Figures 6 and 8).

**Install the remaining Front and Rear Legs in Figure 10.**

**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.

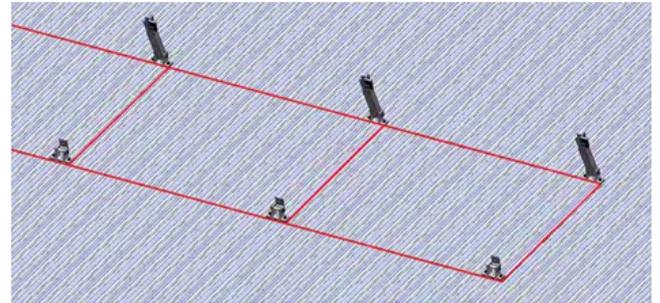


Figure 10

## Rail Installation

According to the installation plan, determine the mounting position of Rail.

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 as shown in Figure 11 and 12. 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.

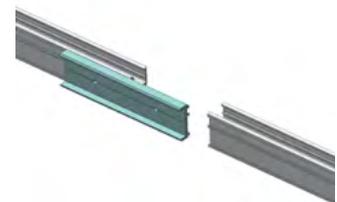


Figure 11



Figure 12

Recommended torque for M8 bolts is 10~12 N·m

After confirming the position of Rail, fasten the Front and Rear Leg, as shown in Figure 13, 14 and 15.

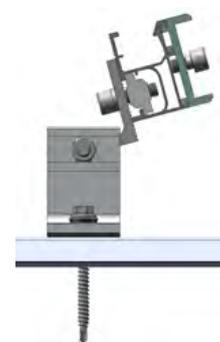


Figure 13

Recommended torque for M8 bolts is 18~20 N·m

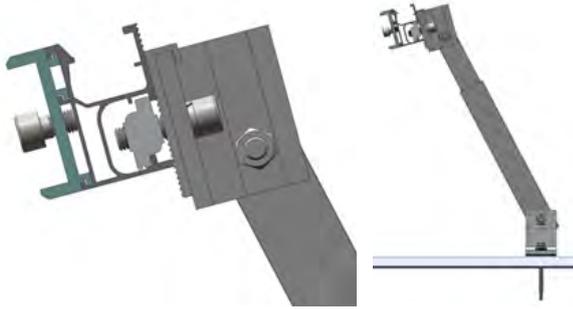


Figure 14

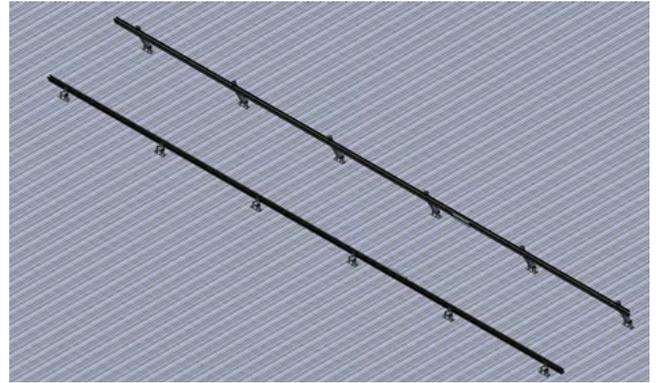


Figure 15

## PV Module Installation

- 1) Please refer [PVezRack® 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 (P18)".

# Certification



## PV Array Frame Engineering Certification

PV-ezRack SolarRoof Tilt Mount Penetrative Fixing System with ER-R-ECO Rail in New Zealand

For:  
Clenergy Australia  
Suite 1, 10 Duerdin St  
Clayton, VIC 3168

Job No.: 13708-02  
Date: 06/10/2023

Gamcorp Pty Ltd  
ACN: 665 643 658 | ABN: 86 665 643 658

**Gamcorp**  
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| <b>Report Title</b>     |            | PV Array Frame Engineering Certification                    |                    |        |                       |               |
| <b>Document ID</b>      |            | 13708-02/JD   | <b>Job No.</b>     |        | 13708                 |               |
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| <b>Client</b>           |            |   | Clenergy Australia |        | <b>Client Contact</b> | Geza Anderson |
| Rev                     | Date       | Revision Details  | Prepared By        | Author | Verifier              | Approver      |
| 0                       | 06/10/2023 | Formating update (Rev.02 of 12278-02)                       | JD                 | JD     | JG                    | JG            |
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| Approval         |   |                    |                    |
|------------------|---|--------------------|--------------------|
| Author Signature |  | Approver Signature |                    |
| Name             | Jiewen Deng   | Name               | Jianzeng Geng      |
| Title            | Structural Engineer   | Title              | Technical Director |

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Our Ref: 13708-02/JD  
06 October 2023

Clenergy Australia  
Suite 1, 10 Duerdin St  
Clayton, VIC 3168

## **PV Array Frame Engineering Certification**

### **PV-ezRack SolarRoof Tilt Mount Penetrative Fixing System with ER-R-ECO Rail in New Zealand**

Gamcorp Pty Ltd, being Structural Engineers within the meaning of Australian and New Zealand Building Regulations, have carried out a structural design check of Clenergy PV-ezRack SolarRoof Tilt Mount System installation with penetrative fixing within New Zealand. The design check has been based on the information and test reports provided by Clenergy Australia.

This certificate is **only valid** for Clenergy PV-ezRack SolarRoof. The roof structure or the building structure and PV panels shall be assessed separately and accordingly.

This certificate is **only valid** as a whole. Any information extracted from this certificate is not valid if standing alone.

We find the Installation of Clenergy PV-ezRack SolarRoof Flush Mount System for New Zealand use to be structurally sufficient based on the following conditions:

- Loading to:
  - AS/NZS1170.0:2002 – Structural design actions, Part 0: General principles;
  - AS/NZS1170.1:2002 (R2016) – Structural design actions, Part 1: Permanent, imposed and other actions;
  - AS/NZ1170.2:2021 Wind actions;
  - AS/NZ1170.3:2003 Snow and ice actions;
  - NZS 4219:2009 Seismic performance of engineering systems in buildings.
- Corrosion calculation for **corrosion zone C1 – C5** refer to
  - ISO 9223:2012-Corrosion of metals and alloys - Corrosivity of atmospheres - Classification, determination and estimation
  - ISO 9224:2012-Corrosion of metals and alloys - Corrosivity of atmospheres - Guiding values for the corrosivity categories
  - ISO 9226:2012-Corrosion of metals and alloys - Corrosivity of atmospheres - Determination of corrosion rate of standard specimens for the evaluation of corrosivity

- Importance level **2**; Design life **25 years**  
Wind average recurrence interval of **250 years**  
Snow average recurrence interval of **50 years**
- Wind region **NZ1 to NZ4**
- Snow region
  - Sub-alpines (Regions N1 to N5)
  - Alpine regions are excluded for snow assessment
- Wind terrain category **2 & 3**
- Maximum building height **20m**
- The assessed base PV panel dimensions are **2000mm x 1000mm**
- Tilt angle is measured to the roof surface
- Maximum wind pressure is limited to **5kPa**
- Maximum Weight of the PV panels to be **15 kg/m<sup>2</sup>**
- Rails to be **ER-R-ECO**
- The base interface spacing is according to fixing into minimum **1.5BMT** steel or minimum **35mm embedment** into JD4 seasoned timber (**2 screws** per each interface)
- The interface spacing chosen for installation must be the **minimum value** in the attached table, which are determined by earthquake, snow and wind loads
- Each PV panel to be installed using **2 rails** minimum in all circumstances
- No PV panel to be installed within **2xs** from edges and ridge. "**s**" is the maximum gap between the underside of the panel and the roof surface when installed on the roof (**50mm ≤ s ≤ 300mm**)
- Installation of PV panels to be done in accordance with the PV panels installation manual
- The certification **excludes** assessment of roof structure and PV panels

**Refer to attached summary table for interface spacing (Unit: mm)**

**NOTES:**

- **The recommended spacing nominated in this certification is based on the capacity of the array frame and the fixing of array frames to the roof, not the roof structure and PV panels. It is the responsibility of the installer to adopt the most critical spacing.**
- **The spacing shown in the interface tables shall be adjusted based on the assessment and requirement of the roof structures.**
- **If any of the above conditions cannot be met, the structural engineer must be notified immediately.**

Construction is to be carried out strictly in accordance with the manufacturer's instructions. This work was designed by **Jiewen Deng** in accordance with the provisions of relevant Building Regulations and in accordance with sound, widely accepted engineering principles. This certificate is only valid till 06/10/2025. Gamcorp should be contacted for future validation. Contact Gamcorp for customised system or if the site conditions are not covered by this assessment.

Yours faithfully,  
Gamcorp Pty Ltd

Jianzeng Geng

Technical Director  
FIEAust CPEng NER 3108316  
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## Structural Design Documentation

### **Tilt Array Frame System Spacing Table**

**According to AS/NZS 1170.2-2021**  
with ECO Rail – Tin Roof (Pierced Fix Roof)  
**within New Zealand**  
Terrain Category 2 & 3

For: **CLENERGY AUSTRALIA**  
1/10 Duerdin St  
Clayton, VIC 3168

Job Number: 13708 (Eco Rail & Tilt)  
Date: 6 October 2023



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**Job No:** 13708  
**Client:** CLENERGY AUSTRALIA  
**Project:** Tilt Array Frame System Spacing Table  
with ECO Rail – Tin Roof (Pierced Fix Roof)  
**Address:** within New Zealand  
**Wind Terrain Category:** Terrain Category 2 & 3

### Australian/New Zealand Standards

|                    |   |
|--------------------|---|
| AS/NZS 1170.0:2002 | Structural design actions<br>Part 0: General principles                   |
| AS/NZS 1170.1:2002 | Structural design actions<br>Part 1: Permanent, imposed and other actions |
| AS/NZS 1170.2:2021 | Structural design actions<br>Part 2: Wind actions                         |
| AS/NZS 1170.3:2003 | Structural design actions<br>Part 3: Snow and ice actions                 |
| AS/NZS 1664.1:1997 | Aluminium structures<br>Part 1: Limit state design                        |
| AS/NZS 4600:2018   | Cold-formed steel structures  |
| AS 4100:2020       | Steel structures  |
| NZS 4219:2009      | Seismic performance of engineering systems in buildings                   |

**Designed:** JD  
**Checked:** JG  
**Date:** Oct-23

Client: **CLENERGY AUSTRALIA**  
 Project: **Tilt Array Frame System Spacing Table with ECO Rail – Tin Roof (Pierced Fix Roof)**  
 Address: **within New Zealand**

Job: **13708**  
 Date: **Oct-23**  
 Designed: **JD**  
 Checked: **JG**

**Tilt Array Frame System Spacing Table for Tin Roof (mm)**

Type of Rail ER-R-ECO  
 Type of Interface Tilt Leg  
 Solar Panel Dimension 2mx1m  
 Terrain category 2

**Tilt angle to roof surface ( $\alpha$ ),  $\alpha \leq 15^\circ$**

| Wind Region                           | Building Height - h (m) |      |               |          |        |      |               |          |         |      |               |          |         |      |               |          |
|---------------------------------------|-------------------------|------|---------------|----------|--------|------|---------------|----------|---------|------|---------------|----------|---------|------|---------------|----------|
|                                       | h≤5                     |      |               |          | 5<h≤10 |      |               |          | 10<h≤15 |      |               |          | 15<h≤20 |      |               |          |
|                                       | Corner                  | Edge | Intermed iate | Internal | Corner | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal |
| NZ1&NZ2                               | 545                     | 830  | 1125          | 1605     | 445    | 680  | 920           | 1420     | --      | 615  | 830           | 1280     | --      | 580  | 780           | 1205     |
| NZ1&NZ2 with M <sub>lee</sub> of 1.35 | --                      | 440  | 595           | 910      | --     | --   | 490           | 750      | --      | --   | 445           | 675      | --      | --   | --            | 635      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.20 | --                      | 565  | 765           | 1175     | --     | 465  | 625           | 960      | --      | --   | 565           | 865      | --      | --   | 535           | 815      |
| NZ3                                   | --                      | 610  | 820           | 1265     | --     | 500  | 675           | 1035     | --      | 450  | 605           | 930      | --      | --   | 575           | 875      |
| NZ4                                   | 435                     | 660  | 895           | 1380     | --     | 540  | 730           | 1125     | --      | 490  | 660           | 1015     | --      | 465  | 625           | 955      |

**Tilt angle to roof surface ( $\alpha$ ),  $15^\circ < \alpha \leq 25^\circ$**

| Wind Region                           | Building Height - h (m) |      |               |          |        |      |               |          |         |      |               |          |         |      |               |          |
|---------------------------------------|-------------------------|------|---------------|----------|--------|------|---------------|----------|---------|------|---------------|----------|---------|------|---------------|----------|
|                                       | h≤5                     |      |               |          | 5<h≤10 |      |               |          | 10<h≤15 |      |               |          | 15<h≤20 |      |               |          |
|                                       | Corner                  | Edge | Intermed iate | Internal | Corner | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal |
| NZ1&NZ2                               | --                      | 585  | 790           | 1215     | --     | 480  | 645           | 990      | --      | 435  | 585           | 895      | --      | --   | 550           | 840      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.35 | --                      | --   | --            | 640      | --     | --   | --            | 525      | --      | --   | --            | 475      | --      | --   | --            | 450      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.20 | --                      | --   | 540           | 825      | --     | --   | 440           | 675      | --      | --   | --            | 610      | --      | --   | --            | 575      |
| NZ3                                   | --                      | 430  | 580           | 885      | --     | --   | 475           | 725      | --      | --   | 430           | 655      | --      | --   | --            | 615      |
| NZ4                                   | --                      | 465  | 630           | 960      | --     | --   | 515           | 790      | --      | --   | 465           | 710      | --      | --   | 440           | 670      |

**Tilt angle to roof surface ( $\alpha$ ),  $25^\circ < \alpha \leq 60^\circ$**

| Wind Region                           | Building Height - h (m) |      |               |          |        |      |               |          |         |      |               |          |         |      |               |          |
|---------------------------------------|-------------------------|------|---------------|----------|--------|------|---------------|----------|---------|------|---------------|----------|---------|------|---------------|----------|
|                                       | h≤5                     |      |               |          | 5<h≤10 |      |               |          | 10<h≤15 |      |               |          | 15<h≤20 |      |               |          |
|                                       | Corner                  | Edge | Intermed iate | Internal | Corner | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal |
| NZ1&NZ2                               | --                      | 430  | 580           | 885      | --     | --   | 475           | 725      | --      | --   | 430           | 655      | --      | --   | --            | 620      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.35 | --                      | --   | --            | 470      | --     | --   | --            | --       | --      | --   | --            | --       | --      | --   | --            | --       |
| NZ1&NZ2 with M <sub>lee</sub> of 1.20 | --                      | --   | --            | 605      | --     | --   | --            | 495      | --      | --   | --            | 450      | --      | --   | --            | --       |
| NZ3                                   | --                      | --   | --            | 650      | --     | --   | --            | 535      | --      | --   | --            | 480      | --      | --   | --            | 455      |
| NZ4                                   | --                      | --   | 460           | 705      | --     | --   | --            | 580      | --      | --   | --            | 520      | --      | --   | --            | 495      |

Client: **CLENERGY AUSTRALIA**  
 Project: **Tilt Array Frame System Spacing Table with ECO Rail – Tin Roof (Pierced Fix Roof)**  
 Address: **within New Zealand**

Job: **13708**  
 Date: **Oct-23**  
 Designed: **JD**  
 Checked: **JG**

**Tilt Array Frame System Spacing Table for Tin Roof (mm)**

Type of Rail ER-R-ECO  
 Type of Interface Tilt Leg  
 Solar Panel Dimension 2mx1m  
 Terrain category 3

**Tilt angle to roof surface ( $\alpha$ ),  $\alpha \leq 15^\circ$**

| Wind Region                           | Building Height - h (m) |      |               |          |        |      |               |          |         |      |               |          |         |      |               |          |
|---------------------------------------|-------------------------|------|---------------|----------|--------|------|---------------|----------|---------|------|---------------|----------|---------|------|---------------|----------|
|                                       | h≤5                     |      |               |          | 5<h≤10 |      |               |          | 10<h≤15 |      |               |          | 15<h≤20 |      |               |          |
|                                       | Corner                  | Edge | Intermed iate | Internal | Corner | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal |
| NZ1&NZ2                               | 655                     | 1010 | 1375          | 1725     | 655    | 1010 | 1375          | 1725     | 565     | 865  | 1175          | 1630     | 505     | 770  | 1045          | 1565     |
| NZ1&NZ2 with M <sub>lee</sub> of 1.35 | --                      | 535  | 725           | 1110     | --     | 535  | 725           | 1110     | --      | 465  | 625           | 955      | --      | --   | 560           | 855      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.20 | 450                     | 685  | 930           | 1435     | 450    | 685  | 930           | 1435     | --      | 590  | 800           | 1230     | --      | 530  | 715           | 1095     |
| NZ3                                   | 485                     | 735  | 1000          | 1515     | 485    | 735  | 1000          | 1515     | --      | 635  | 860           | 1330     | --      | 570  | 770           | 1185     |
| NZ4                                   | 525                     | 800  | 1085          | 1540     | 525    | 800  | 1085          | 1540     | 455     | 690  | 935           | 1450     | --      | 615  | 835           | 1285     |

**Tilt angle to roof surface ( $\alpha$ ),  $15^\circ < \alpha \leq 25^\circ$**

| Wind Region                           | Building Height - h (m) |      |               |          |        |      |               |          |         |      |               |          |         |      |               |          |
|---------------------------------------|-------------------------|------|---------------|----------|--------|------|---------------|----------|---------|------|---------------|----------|---------|------|---------------|----------|
|                                       | h≤5                     |      |               |          | 5<h≤10 |      |               |          | 10<h≤15 |      |               |          | 15<h≤20 |      |               |          |
|                                       | Corner                  | Edge | Intermed iate | Internal | Corner | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal |
| NZ1&NZ2                               | 465                     | 705  | 960           | 1485     | 465    | 705  | 960           | 1485     | --      | 610  | 825           | 1270     | --      | 545  | 735           | 1130     |
| NZ1&NZ2 with M <sub>lee</sub> of 1.35 | --                      | --   | 510           | 780      | --     | --   | 510           | 780      | --      | --   | 440           | 670      | --      | --   | --            | 600      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.20 | --                      | 485  | 650           | 1000     | --     | 485  | 650           | 1000     | --      | --   | 565           | 860      | --      | --   | 505           | 770      |
| NZ3                                   | --                      | 520  | 700           | 1075     | --     | 520  | 700           | 1075     | --      | 450  | 605           | 925      | --      | --   | 540           | 825      |
| NZ4                                   | --                      | 565  | 760           | 1170     | --     | 565  | 760           | 1170     | --      | 490  | 660           | 1010     | --      | 435  | 585           | 895      |

**Tilt angle to roof surface ( $\alpha$ ),  $25^\circ < \alpha \leq 60^\circ$**

| Wind Region                           | Building Height - h (m) |      |               |          |        |      |               |          |         |      |               |          |         |      |               |          |
|---------------------------------------|-------------------------|------|---------------|----------|--------|------|---------------|----------|---------|------|---------------|----------|---------|------|---------------|----------|
|                                       | h≤5                     |      |               |          | 5<h≤10 |      |               |          | 10<h≤15 |      |               |          | 15<h≤20 |      |               |          |
|                                       | Corner                  | Edge | Intermed iate | Internal | Corner | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal | Corner  | Edge | Intermed iate | Internal |
| NZ1&NZ2                               | --                      | 520  | 700           | 1080     | --     | 520  | 700           | 1080     | --      | 450  | 605           | 925      | --      | --   | 540           | 825      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.35 | --                      | --   | --            | 570      | --     | --   | --            | 570      | --      | --   | --            | 495      | --      | --   | --            | 440      |
| NZ1&NZ2 with M <sub>lee</sub> of 1.20 | --                      | --   | 480           | 735      | --     | --   | 480           | 735      | --      | --   | --            | 630      | --      | --   | --            | 565      |
| NZ3                                   | --                      | --   | 515           | 790      | --     | --   | 515           | 790      | --      | --   | 445           | 680      | --      | --   | --            | 605      |
| NZ4                                   | --                      | --   | 560           | 855      | --     | --   | 560           | 855      | --      | --   | 485           | 740      | --      | --   | 430           | 660      |

Client: **CLENERGY AUSTRALIA**  
 Project: **Tilt Array Frame System Spacing Table with ECO Rail – Tin Roof (Pierced Fix Roof) within New Zealand**  
 Address:

Job: **13708**  
 Date: **Oct-23**  
 Designed: **JD**  
 Checked: **JG**

**General Notes**

Note 1 Following components are satisfied to use according to AS/NZS 1170.2:2021

| Components                                     | Part Number                           | Description                                      |
|--|---------------------------------------|--|
| ECO Rail                                       | ER-R-ECO, ER-R-ECO/BA                 | As per drawing or test report provided by client |
| ECO Rail Splice                                | ER-SP-ECO, ER-SP-ECO/BA               |  |
| Standard Inter Clamp                           | ER-IC-ST, ER-IC-ST/BA                 |  |
| Standard End Clamp                             | ER-EC-ST, ER-EC-ST/BA                 |  |
| Universal Clamp                                | C-U/30/46, C-U/30/46/BA               |  |
| Universal Clamp with Grounding Clip            | C-U/30/46-G, C-U/30/46-G/BA           |  |
| Adjustable Tilt Leg                            | ER-TL-10/15, ER-TL-15/30, ER-TL-30/60 |  |
| Adjustable Tilt Leg, pre-assembled             | ER-TL-10/15/PS, ER-TL-15/30/PS        |  |
| Adjustable Tilt Leg with L-feet, pre-assembled | TL-10/15/L/PS, TL-15/30/L/PS          |  |
| Fixed Tilt Leg, pre-assembled                  | ER-TL-5/PS, ER-TL-10/PS               |  |

Note 2 Tin roof interface spacing calculated based on 1.5mm steel purlin G450 or 35mm screw embedment into F7 (Pine) timber (JD4 seasoned timber). (2 screws per each interface)

Recommended screws

| Metal Purlins/Battens                    | Fasteners to use                             |
|--|--|
| 0.42mm to 0.75mm (G550)                  | 14g-10 TPI Tek screws or approved equivalent |
| 1.2mm to 2.4mm (G450)                    | 14g-10 TPI Tek screws or approved equivalent |
| Timber Purlins/Battens/Rafters           | Fasteners to use                             |
| Softwood F7 (Pine) (JD4 seasoned timber) | 14g-10 TPI T17 screws or approved equivalent |
| Hardwood F17 (JD3 seasoned timber)       | 14g-10 TPI T17 screws or approved equivalent |

Note 3 Maximum uplift wind pressure is limited to 5kPa.

Note 4 Deflection is limited to Minimum of L/120 and 15mm.

Note 5 Tilt angle is measured from roof surface.

Note 6 "--" states NOT SUITABLE FOR INSTALLATION.

Note 7 Terrain category definition according to section 4.2.1 of AS/NZS 1170.2:2021 as follows:  
 Terrain Category 2 (TC2) - Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare (e.g. farmland and cleared subdivisions with isolated trees and uncut grass).  
 Terrain Category 3 (TC3) - Terrain with numerous closely spaced obstructions having heights generally from 3 m to 10 m. 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).

Note 8 Wind regions are shown in Figure 3.1(B) of AS/NZS 1170.2:2021.

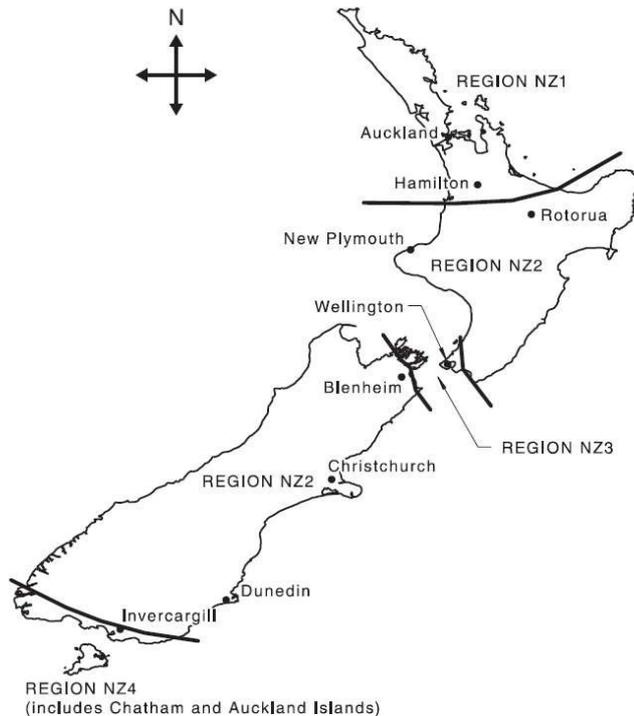


Figure 3.1(B) — Wind regions — New Zealand

Note 9 Base interface spacing to be multiplied by all applicable reduction/increase factors. Factored spacing less than one third of the panel width are not satisfied. (NOT SUITABLE FOR INSTALLATION)

Client: **CLENERGY AUSTRALIA**  
 Project: **Tilt Array Frame System Spacing Table with ECO Rail – Tin Roof (Pierced Fix Roof) within New Zealand**  
 Address:

Job: **13708**  
 Date: **Oct-23**  
 Designed: **JD**  
 Checked: **JG**

- Note 10 Wind direction multiplier (Md), Shielding multiplier (Ms) and Hill shape multiplier (Mh) are taken as 1.0.
- Note 11 Refer section 4.4 of AS/NZS 1170.2:2021 for Lee multiplier (Mlee) and topographic multiplier (Mt).
- Note 12 Lee multiplier (Mlee) is taken as 1.0 except for WR NZ1&NZ2 with Mlee which is taken as 1.35 and 1.2 separately. Refer section 4.4.1 of AS/NZS 1170.2:2021 for topographic multiplier (Mt). See Note 25 for Lee zones map.
- Note 13 The assessment includes the effect of earthquake loads. See note 27 for the fixing spacing determined by earthquake loads.
- Note 14 Alpine regions are excluded for snow assessment. See note 26 for the fixing spacing determined by snow loads.
- Note 15 Refer section 2.3 and Figure 2.2 of AS/NZS 1170.3:2003 for sub-alpine regions. Probability factor (kp) and Exposure reduction coefficient (Ce) are taken as 1.0 and Shape coefficient (μi) is taken as 0.7. See Note 26 for sub-alpine regions map.
- Note 16 Maximum panel weight is limited to 15kg/m².
- Note 17 Maximum panel width is limited to 1200mm.
- Note 18 Maximum rail and panel width overhang is limited to the 40% of the allowable interface spacing.
- Note 19 PV panels clamping zone to be according to the manufacturer's specifications.
- Note 20 This certificate is applicable for the corrosion zones C1, C2, C3, C4 and C5. Correspondent roof interface must be used for each zone. Refer SNZ TS 3404:2018 for corrosion zones definitions.
- Note 21 This assessment is based on the capacity of the fixings of array frame to the structure and the array frame itself but not PV panel nor roof structures. Other building structures are deemed to be satisfactory. It is the responsibility of the installer to adopt the most critical spacing.
- Note 22 Following reduction/increase factors to be applied to the base spacing for different type of tophat, purlin or batten or if timber screw embedment is reduced by fixing to smaller timber depth. **In any case, it is not applicable for installation if the actual fixing spacing after applying spacing ratio is less than 300mm.**

| Purlin/Batten Material | Fixing Type |               | Purlin thickness (mm) | Min. Embedment (mm) | Spacing Reduction / Increase |                                  |        |        |
|------------------------|-------------|---------------|-----------------------|---------------------|------------------------------|----------------------------------|--------|--------|
|                        | Interface   | No. of screws |                       |                     | WR NZ1&NZ2                   | WR NZ1&NZ2 with M <sub>lee</sub> | WR NZ3 | WR NZ4 |
| Timber F7 (Pine)       | Tin         | 1             | -                     | 25                  | -22%                         | -22%                             | -22%   | -22%   |
| Timber F7 (Pine)       | Tin         | 2             | -                     | 25                  | 0%                           | 0%                               | 0%     | 0%     |
| Timber F7 (Pine)       | Tin         | 1             | -                     | 30                  | -6%                          | -6%                              | -6%    | -6%    |
| Timber F7 (Pine)       | Tin         | 2             | -                     | 30                  | 0%                           | 0%                               | 0%     | 0%     |
| Timber F7 (Pine)       | Tin         | 1 or 2        | -                     | 35                  | 0%                           | 0%                               | 0%     | 0%     |
| Timber F17 (HW)        | Tin         | 1 or 2        | -                     | 25                  | 0%                           | 0%                               | 0%     | 0%     |
| Timber F17 (HW)        | Tin         | 1 or 2        | -                     | 30                  | 0%                           | 0%                               | 0%     | 0%     |
| Timber F17 (HW)        | Tin         | 1 or 2        | -                     | 35                  | 0%                           | 0%                               | 0%     | 0%     |
| Metal (G550)           | Tin         | 2             | 0.42                  | -                   | -60%                         | -60%                             | -60%   | -60%   |
| Metal (G550)           | Tin         | 2             | 0.48                  | -                   | -54%                         | -54%                             | -54%   | -54%   |
| Metal (G550)           | Tin         | 2             | 0.55                  | -                   | -48%                         | -48%                             | -48%   | -48%   |
| Metal (G550)           | Tin         | 2             | 0.75                  | -                   | -29%                         | -29%                             | -29%   | -29%   |
| Metal (G450)           | Tin         | 1             | 1.2                   | -                   | -38%                         | -38%                             | -38%   | -38%   |
| Metal (G450)           | Tin         | 2             | 1.2                   | -                   | 0%                           | 0%                               | 0%     | 0%     |
| Metal (G450)           | Tin         | 1             | 1.5                   | -                   | -22%                         | -22%                             | -22%   | -22%   |
| Metal (G450)           | Tin         | 2             | 1.5                   | -                   | 0%                           | 0%                               | 0%     | 0%     |
| Metal (G450)           | Tin         | 1 or 2        | 1.9                   | -                   | 0%                           | 0%                               | 0%     | 0%     |
| Metal (G450)           | Tin         | 1 or 2        | 2.4                   | -                   | 0%                           | 0%                               | 0%     | 0%     |

- Note 23 This certificate can be used for the installation of tilt legs on uncracked concrete roofs using one Chemset per tilt leg/bracket. The minimum pull-out tensile capacity of the fixing anchor must be higher than 5kN with drilled hole depth of 80mm. Concrete slab thickness to be minimum 150mm because of anchor cover requirement.
- Note 24 Following reduction/increase factors to be applied to the base spacing for different panel lengths. **In any case, the actual fixing spacing after applying spacing ratio is limited to maximum 2000mm**

| Panel Length (mm) | No. of Rails | Spacing Reduction / Increase |                                  |        |        |
|-------------------|--------------|------------------------------|----------------------------------|--------|--------|
|                   |              | WR NZ1&NZ2                   | WR NZ1&NZ2 with M <sub>lee</sub> | WR NZ3 | WR NZ4 |
| 1700              | 2            | +5%                          | +17%                             | +5%    | +5%    |
| 1800              | 2            | +3%                          | +11%                             | +3%    | +3%    |
| 1900              | 2            | +2%                          | +4%                              | +2%    | +2%    |
| 2000              | 2            | 0%                           | 0%                               | 0%     | 0%     |
| 2100              | 2            | -6%                          | -6%                              | -6%    | -6%    |
| 2200              | 2            | -10%                         | -10%                             | -10%   | -10%   |
| 2300              | 2            | -14%                         | -14%                             | -14%   | -14%   |
| 2400              | 2            | -17%                         | -17%                             | -17%   | -17%   |

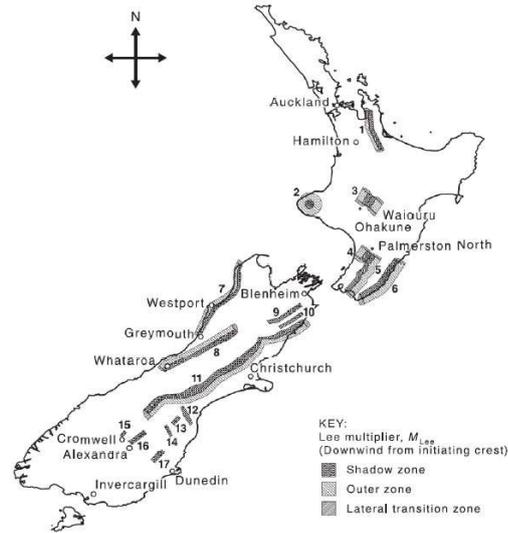
Client: **CLENERGY AUSTRALIA**  
 Project: **Tilt Array Frame System Spacing Table with ECO Rail – Tin Roof (Pierced Fix Roof) within New Zealand**  
 Address: **within New Zealand**

Job: **13708**  
 Date: **Oct-23**  
 Designed: **JD**  
 Checked: **JG**

Note 25 Interface spacing to be reduced as follows for sites in wind regions NZ1 & NZ2 with Mlee over 500m above sea level:

| Site Elevation, E (m) | Spacing Reduction |
|-----------------------|-------------------|
| E < 500               | 0%                |
| 500 ≤ E < 700         | -19%              |
| 700 ≤ E < 900         | -23%              |
| 900 ≤ E < 1200        | -30%              |
| E ≥ 1200              | N/A               |

| North Island |                         |
|--------------|-------------------------|
| 1            | Kaimai                  |
| 2            | Taranaki                |
| 3            | Ruapehu                 |
| 4            | Tararua                 |
| 5            | Tararua and Orongorongo |
| 6            | Coastal Wairarapa       |
| South Island |                         |
| 7            | West Coast North        |
| 8            | West Coast Alps         |
| 9            | Awatere                 |
| 10           | Inland Kaikoura         |
| 11           | Southern Alps           |
| 12           | Hunter                  |
| 13           | Hakataramea             |
| 14           | St Mary's               |
| 15           | Pisa                    |
| 16           | Dunstan                 |
| 17           | Rock and Pillar         |



NOTE 1 Some outer and lateral transition zones are not shown.

NOTE 2 For numbers shown, see the first column of Table 4.4.

Figure 4.6 — Locations of New Zealand lee zones

Note 26 Maximum Tin roof interface spacing in sub-alpine regions to be limited to follows for all roof zones. Lateral loading on array frame (due to accumulation snow under PV panels or exerted by drifts) has not been considered.

| Site Elevation, E (m) | No. of Rails | Maximum Interface Spacing (mm) |                   |                |                |
|-----------------------|--------------|--------------------------------|-------------------|----------------|----------------|
|                       |              | Snow Region N1                 | Snow Region N2&N3 | Snow Region N4 | Snow Region N5 |
| E ≤ 100               | 2            | N/A                            | N/A               | N/A            | 1775           |
| 100 < E ≤ 200         | 2            | N/A                            | 1775              | 1490           | 1775           |
| 200 < E ≤ 300         | 2            | N/A                            | 1775              | 1390           | 1580           |
| 300 < E ≤ 400         | 2            | N/A                            | 1775              | 1285           | 1490           |
| 400 < E ≤ 500         | 2            | 1775                           | 1500              | 1240           | 1410           |
| 500 < E ≤ 700         | 2            | 1490                           | 1320              | 1160           | 1285           |
| 700 < E ≤ 900         | 2            | 1340                           | 1200              | 1100           | 1195           |
| 900 < E ≤ 1200        | 2            | 1195                           | N/A               | N/A            | N/A            |

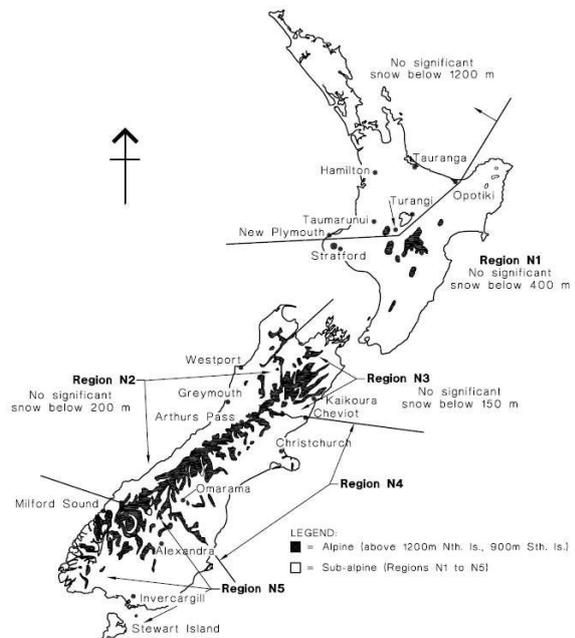
### 2.3 NEW ZEALAND

Alpine and sub-alpine regions are defined as follows:

- (a) N1 (southern portion of North Island of New Zealand, see Figure 2.2):
  - (i) Sub-alpine between 400 m and 1200 m.
  - (ii) Alpine ≥1200 m.
- (b) N2 (South Island of New Zealand):
  - (i) Sub-alpine between 200 m and 900 m.
  - (ii) Alpine ≥900 m.
- (c) N3 (South Island of New Zealand):
  - (i) Sub-alpine between 150 m and 900 m.
  - (ii) Alpine ≥900 m.
- (d) N4 and N5 (South Island of New Zealand):
  - (i) Sub-alpine <900 m.
  - (ii) Alpine ≥900 m.

NOTE: This map is approximate only and altitude above mean sea level shall be used to determine snow region. For sub-alpine regions in the South Island (N2, N3, N4 and N5) the regions coincide with the 1988 county boundaries. Where an alpine region exists between sub-alpine regions, the alpine region separates the 2 sub-alpine regions (which extend downwards from 1200 m altitude).

FIGURE 2.2 NEW ZEALAND—APPROXIMATE LOCATIONS OF ALPINE AND SUB-ALPINE REGIONS



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 Address:

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 Designed: **JD**  
 Checked: **JG**

Note 27 Refer section 3.4.1 and Figure 2 of NZS 4219:2009 for zone factor (Z). Performance factor (Cp) is taken as 0.85 and Component risk factor (Rc) coefficient (Ce) is taken as 1.0 and High coefficient (Ch) is taken as 3. Maximum Tilt mount interface spacing in Earthquake zone to be limited to follows for all roof zones.

| Earthquake Zone, Z (m) | No. of Rails | Maximum Interface Spacing (mm) |                         |                         |                         |                         |
|------------------------|--------------|--------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                        |              | Max Panel Length 2000mm        | Max Panel Length 2100mm | Max Panel Length 2200mm | Max Panel Length 2300mm | Max Panel Length 2400mm |
| Z ≤ 0.13               | 2            | 2000                           | 2000                    | 2000                    | 2000                    | 2000                    |
| 0.13 < Z ≤ 0.15        | 2            | 2000                           | 2000                    | 2000                    | 2000                    | 1980                    |
| 0.15 < Z ≤ 0.18        | 2            | 1980                           | 1960                    | 1935                    | 1915                    | 1895                    |
| 0.18 < Z ≤ 0.20        | 2            | 1930                           | 1905                    | 1885                    | 1865                    | 1845                    |
| 0.20 < Z ≤ 0.23        | 2            | 1865                           | 1845                    | 1820                    | 1800                    | 1775                    |
| 0.23 < Z ≤ 0.26        | 2            | 1805                           | 1780                    | 1755                    | 1730                    | 1705                    |
| 0.26 < Z ≤ 0.30        | 2            | 1725                           | 1700                    | 1675                    | 1650                    | 1625                    |
| 0.30 < Z ≤ 0.35        | 2            | 1640                           | 1615                    | 1590                    | 1565                    | 1545                    |
| 0.35 < Z ≤ 0.40        | 2            | 1570                           | 1545                    | 1520                    | 1500                    | 1475                    |
| 0.40 < Z ≤ 0.45        | 2            | 1510                           | 1485                    | 1460                    | 1440                    | 1385                    |
| 0.45 < Z ≤ 0.50        | 2            | 1455                           | 1425                    | 1360                    | 1300                    | 1245                    |
| 0.50 < Z ≤ 0.55        | 2            | 1360                           | 1295                    | 1235                    | 1180                    | 1130                    |
| 0.55 < Z ≤ 0.60        | 2            | 1245                           | 1185                    | 1130                    | 1080                    | 1035                    |

Note:  
 The seismic assessment is based on the rail capacity and shear capacity of fixings.

Table 3 – Zone factors for New Zealand locations (north to south)

| #  | Location        | Z    | #  | Location            | Z    |
|----|-----------------|------|----|---------------------|------|
| 1  | Kaitiaki        | 0.13 | 36 | Taupo               | 0.28 |
| 2  | Paihia/Russell  | 0.13 | 37 | Taumanunui          | 0.21 |
| 3  | Kaikohe         | 0.13 | 38 | Turangi             | 0.27 |
| 4  | Whangarei       | 0.13 | 39 | Gisborne            | 0.36 |
| 5  | Dargaville      | 0.13 | 40 | Wairoa              | 0.37 |
| 6  | Warkworth       | 0.13 | 41 | Waitara             | 0.18 |
| 7  | Auckland        | 0.13 | 42 | New Plymouth        | 0.18 |
| 8  | Manakau City    | 0.13 | 43 | Inglewood           | 0.18 |
| 9  | Waikato         | 0.13 | 44 | Stratford           | 0.18 |
| 10 | Pukekohe        | 0.13 | 45 | Opunake             | 0.18 |
| 11 | Thames          | 0.16 | 46 | Hawera              | 0.18 |
| 12 | Paeroa          | 0.18 | 47 | Patea               | 0.19 |
| 13 | Wahi            | 0.18 | 48 | Raetihi             | 0.26 |
| 14 | Hunty           | 0.15 | 49 | Ohakune             | 0.27 |
| 15 | Ngaruawahia     | 0.15 | 50 | Waikouaiti          | 0.29 |
| 16 | Morrinsville    | 0.18 | 51 | Napier              | 0.38 |
| 17 | Te Aroha        | 0.18 | 52 | Hastings            | 0.39 |
| 18 | Tauranga        | 0.20 | 53 | Wanganui            | 0.25 |
| 19 | Mount Maunganui | 0.20 | 54 | Waipawa             | 0.41 |
| 20 | Hamilton        | 0.16 | 55 | Waipukurau          | 0.41 |
| 21 | Cambridge       | 0.18 | 56 | Taihape             | 0.33 |
| 22 | Te Awamutu      | 0.17 | 57 | Marlon              | 0.30 |
| 23 | Matamata        | 0.19 | 58 | Bulls               | 0.31 |
| 24 | Te Puke         | 0.22 | 59 | Feilding            | 0.37 |
| 25 | Putaruru        | 0.21 | 60 | Palmerston North    | 0.38 |
| 26 | Tokoroa         | 0.21 | 61 | Dannevirke          | 0.42 |
| 27 | Otorohanga      | 0.17 | 62 | Woodville           | 0.41 |
| 28 | Te Kuiti        | 0.18 | 63 | Pahiatua            | 0.42 |
| 29 | Mangakino       | 0.21 | 64 | Foxton/Foxton Beach | 0.36 |
| 30 | Rotorua         | 0.24 | 65 | Levin               | 0.40 |
| 31 | Kawerau         | 0.29 | 66 | Otaki               | 0.40 |
| 32 | Whakatane       | 0.30 | 67 | Waikanae            | 0.40 |
| 33 | Opoitiki        | 0.30 | 68 | Paraparaumu         | 0.40 |
| 34 | Ruatorua        | 0.33 | 69 | Masterton           | 0.42 |
| 35 | Murupara        | 0.30 |    |                     |      |

Table 3 – Zone factors for New Zealand locations (north to south) (continued)

| #   | Location                                | Z    | #   | Location      | Z    |
|-----|---|------|-----|---------------|------|
| 70  | Ponrua                                  | 0.40 | 102 | Christchurch  | 0.22 |
| 71  | Wellington CBD (north of Basin Reserve) | 0.40 | 103 | Geraldine     | 0.19 |
| 72  | Wellington                              | 0.40 | 104 | Ashburton     | 0.20 |
| 73  | Hutt Valley – south of Taika Gorge      | 0.40 | 105 | Fairlie       | 0.24 |
| 74  | Upper Hutt                              | 0.42 | 106 | Temuka        | 0.17 |
| 75  | Eastbourne – Point Howard               | 0.40 | 107 | Timaru        | 0.15 |
| 76  | Wainuiomata                             | 0.40 | 108 | Mt Cook       | 0.38 |
| 77  | Takaka                                  | 0.23 | 109 | Twizel        | 0.27 |
| 78  | Motueka                                 | 0.26 | 110 | Waimata       | 0.14 |
| 79  | Nelson                                  | 0.27 | 111 | Cromwell      | 0.24 |
| 80  | Picton                                  | 0.30 | 112 | Wanaka        | 0.30 |
| 81  | Blenheim                                | 0.33 | 113 | Arrowtown     | 0.30 |
| 82  | St Arnaud                               | 0.36 | 114 | Alexandra     | 0.21 |
| 83  | Westport                                | 0.30 | 115 | Queenstown    | 0.32 |
| 84  | Reefton                                 | 0.37 | 116 | Milford Sound | 0.54 |
| 85  | Murchison                               | 0.34 | 117 | Palmerston    | 0.13 |
| 86  | Springs Junction                        | 0.45 | 118 | Oamaru        | 0.13 |
| 87  | Hammer Springs                          | 0.55 | 119 | Dunedin       | 0.13 |
| 88  | Seddon                                  | 0.40 | 120 | Mosgiel       | 0.13 |
| 89  | Ward                                    | 0.40 | 121 | Riverton      | 0.20 |
| 90  | Cheviot                                 | 0.40 | 122 | Te Anau       | 0.36 |
| 91  | Greymouth                               | 0.37 | 123 | Gore          | 0.18 |
| 92  | Kaikoura                                | 0.42 | 124 | Winton        | 0.20 |
| 93  | Hariton                                 | 0.46 | 125 | Balclutha     | 0.13 |
| 94  | Hokitika                                | 0.45 | 126 | Mataura       | 0.17 |
| 95  | Fox Glacier                             | 0.44 | 127 | Bluff         | 0.15 |
| 96  | Franz Josef                             | 0.44 | 128 | Invercargill  | 0.17 |
| 97  | Oira                                    | 0.60 | 129 | Oban          | 0.14 |
| 98  | Arthurs Pass                            | 0.60 |     |               |      |
| 99  | Rangiora                                | 0.33 |     |               |      |
| 100 | Darfield                                | 0.30 |     |               |      |
| 101 | Akaroa                                  | 0.16 |     |               |      |

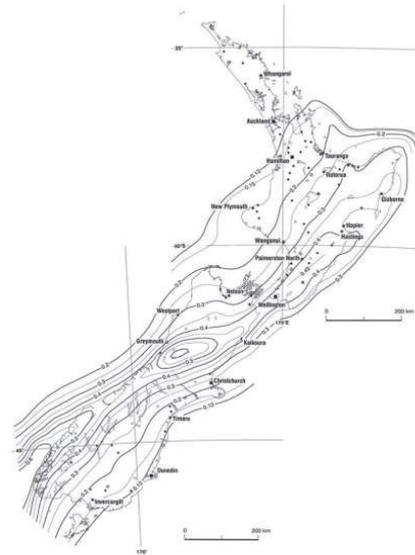


Figure 2 – Zone factor, Z

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 Date: **Oct-23**  
 Designed: **JD**  
 Checked: **JG**

Note 28 Building height is average roof height of structure above ground. Refer Figure 1 for definition of h, d and b.

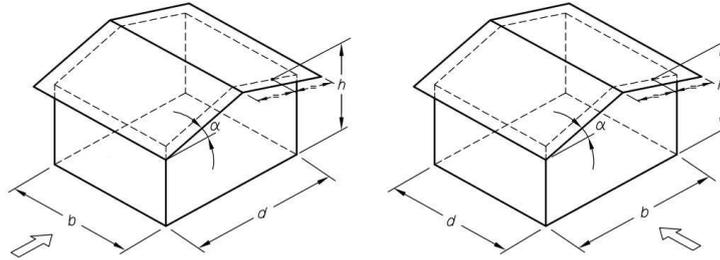
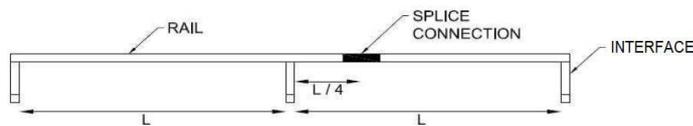


Figure 1 – h, d and b definition

Note 29 Rail splice connection must be placed at a quarter length of the spacing of interface. No Splice connection should be placed at the centre of spacing or over the interface.



Note 30 Refer Figure 2 for definition of roof zones. The smallest spacing to be used for panels fall between two (or more) roof zones.

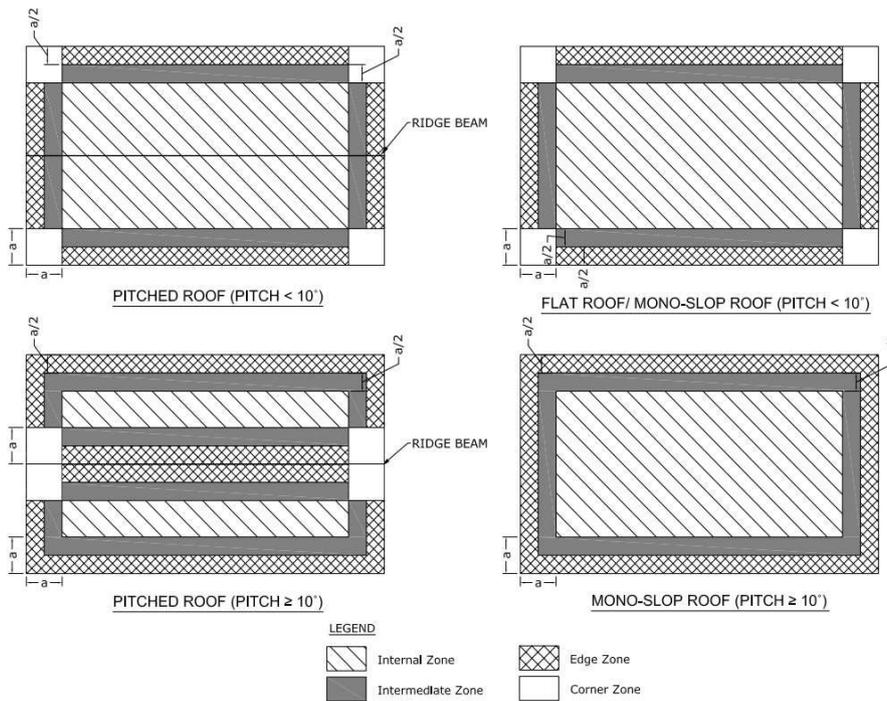


Figure 2- Roof Zones Definition

In Figure 2, the value of dimension "a" is the minimum of 0.2b or 0.2d, if (h/b) or (h/d) ≥ 0.2; or 2h if both (h/b) and (h/d) < 0.2 (b & d are building dimensions and h is average roof height, see Figure 1)

Note 31 Perpendicular installation (rails to purlins) for roofs with roof pitch greater than 10 degrees is not covered by this certification.

Note 32 Installation of solar array to be done in accordance with the relevant Clenergy PV installation manual. Contact Clenergy if you are unable to comply with any of the above installation specifications.

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**Examples**

|                  |                   |                        |        |  |  |
|------------------|-------------------|------------------------|--------|--|--|
| <b>Example 1</b> | Tin Roof          |                        | factor |  |  |
|                  | Wind Region       | NZ1                    | -      |  | Final factor   |
|                  | Terrain Category  | 2                      | -      |  | 1  |
|                  | Building Height   | 6.5m                   | -      |  |  |
|                  | Tilt angle        | 20°                    | -      |  | Roof Zone  |
|                  | Panel Dimension   | 2m x 1m                | 1      |  | Final Spacing  |
|                  | Purlin Thickness  | 1.5mm                  | 1      |  | Internal Zone  |
|                  | No. of screws     | 2                      |        |  | 990mm  |
|                  |                   |                        |        |  | Intermediate Zone  |
|                  |                   |                        |        |  | 645mm  |
|                  |                   |                        |        |  | Edge Zone  |
|                  |                   |                        |        |  | 480mm  |
|                  |                   |                        |        |  | Corner Zone  |
|                  |                   |                        |        |  | --   |
| <b>Example 2</b> | Tin Roof          |                        | factor |  |  |
|                  | Wind Region       | NZ2, with Mlee of 1.35 | -      |  | Final factor   |
|                  | Terrain Category  | 3                      | -      |  | 0.89   |
|                  | Building Height   | 12m                    | -      |  |  |
|                  | Tilt angle        | 22°                    | -      |  | Roof Zone  |
|                  | Panel Dimension   | 1.75m x 1m             | 1.11   |  | Final Spacing  |
|                  | Purlin Thickness  | 1.9mm                  | 1      |  | Internal Zone  |
|                  | No. of screws     | 2                      |        |  | 590mm  |
|                  | Site Elevation    | 600m                   | 0.80   |  | Intermediate Zone  |
|                  | Sub-alpine Region | N2 (E=600m)            | -      |  | 390mm  |
|                  |                   |                        |        |  | Edge Zone  |
|                  |                   |                        |        |  | --   |
|                  |                   |                        |        |  | Corner Zone  |
|                  |                   |                        |        |  | --   |
| <b>Example 3</b> | Tin Roof          |                        | factor |  |  |
|                  | Wind Region       | NZ3                    | -      |  | Final factor   |
|                  | Terrain Category  | 3                      | -      |  | 1  |
|                  | Building Height   | 5m                     | -      |  |  |
|                  | Tilt angle        | 10°                    | -      |  | Roof Zone  |
|                  | Panel Dimension   | 2m x 1.1m              | 1      |  | Final Spacing  |
|                  | Purlin Thickness  | 2.4mm                  | 1      |  | Internal Zone  |
|                  | No. of screws     | 1                      |        |  | 1490mm*  |
|                  | Sub-alpine Region | N1 (E=600m)            | *      |  | Intermediate Zone  |
|                  |                   |                        |        |  | 1000mm   |
|                  |                   |                        |        |  | Edge Zone  |
|                  |                   |                        |        |  | 735mm  |
|                  |                   |                        |        |  | Corner Zone  |
|                  |                   |                        |        |  | 485mm  |
|                  |                   |                        |        |  |  |
|                  |                   |                        |        |  | (From Note 26, the maximum spacing is 1490mm, which is determined by snow)   |
| <b>Example 4</b> | Tile Roof         |                        | factor |  |  |
|                  | Wind Region       | NZ4                    | -      |  | Final factor   |
|                  | Terrain Category  | 2                      | -      |  | 1.05   |
|                  | Building Height   | 5m                     | -      |  |  |
|                  | Tilt angle        | 25°                    | -      |  | Roof Zone  |
|                  | Panel Dimension   | 1.65m x 1.1m           | 1.05   |  | Final Spacing  |
|                  | Embedment F17     | 30mm                   | 1      |  | Internal Zone  |
|                  | No. of screws     | 2                      |        |  | 1005mm   |
|                  | Sub-alpine Region | N5 (E=200m)            | -      |  | Intermediate Zone  |
|                  |                   |                        |        |  | 660mm  |
|                  |                   |                        |        |  | Edge Zone  |
|                  |                   |                        |        |  | 485mm  |
|                  |                   |                        |        |  | Corner Zone  |
|                  |                   |                        |        |  | --   |
|                  |                   |                        |        |  | (From Note 26, the maximum spacing is 1775mm, which is determined by snow)   |
| <b>Example 5</b> | Tin Roof          |                        | factor |  |  |
|                  | Wind Region       | NZ2, with Mlee of 1.20 | -      |  | Final factor   |
|                  | Terrain Category  | 3                      | -      |  | 0.63   |
|                  | Building Height   | 10m                    | -      |  |  |
|                  | Tilt angle        | 15°                    | -      |  | Roof Zone  |
|                  | Panel Dimension   | 2.40m x 1.1m           | 0.83   |  | Final Spacing  |
|                  | Purlin Thickness  | 1.9mm                  | 1      |  | Internal Zone  |
|                  | No. of screws     | 2                      |        |  | 900mm  |
|                  | Site Elevation    | 700mm                  | 0.76   |  | Intermediate Zone  |
|                  | Sub-alpine Region | N5 (E=700m)            | -      |  | 585mm  |
|                  |                   |                        |        |  | Edge Zone  |
|                  |                   |                        |        |  | 430mm  |
|                  |                   |                        |        |  | Corner Zone  |
|                  |                   |                        |        |  | --*  |
|                  |                   |                        |        |  | (From Note 26, the maximum spacing is 1285mm, which is determined by snow)   |
|                  |                   |                        |        |  | (From Note 27, the maximum spacing is 1035mm, which is determined by earthquake)   |
|                  |                   |                        |        |  | *From Note 22, In any case, it is not applicable for installation if the actual fixing spacing by applying spacing ratio is less than 300mm. |



association of  
consulting and  
engineering

Building Code Clause(s) **B1**

**PRODUCER STATEMENT – PS1 – DESIGN**

**ISSUED BY:** Gamcorp Pty Ltd  
(Design Firm)

**TO:** Clenergy Australia  
(Owner/Developer)

**TO BE SUPPLIED TO:**  
(Building Consent Authority)

**IN RESPECT OF:** Clenergy PV-ezRack SolarRoof Flush and Tilt Roof Mount systems with ER-R-ECO & ER-R-ELT Penetrative fixing

**AT:** Within New Zealand  
(Address)

Town/City: ..... **LOT** ..... **DP** ..... **SO** .....  
(Address)

We have been engaged by the owner/developer referred to above to provide:

The assessment according to the capacity of the fixing of the array frame to the roof structure and the array frame itself for roof top solar panel installation.

PV panel and building structure including roof structure are excluded.

(Extent of Engagement)

services in respect of the requirements of Clause(s) **B1** ..... of the Building Code for:

All or  Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

Compliance Documents issued by the Ministry of Business, Innovation & Employment ..... or  
(verification method/acceptable solution)

Alternative solution as per the attached schedule. refer Certification Letter 13708-01(Eco Rail) & 13924-01(Elite Rail) for Flush Mount system & 13708-02 (Eco Rail) & 13924-02(Elite Rail) for Tilt Mount system

The proposed building work covered by this producer statement is described on the drawings titled:

..... and numbered ..... ;  
together with the specification, and other documents set out in the schedule attached to this statement.

**On behalf of the Design Firm**, and subject to: refer Certification Letter 13708-01(Eco Rail) & 13924-01(Elite Rail) for Flush Mount system & 13708-02 (Eco Rail) & 13924-02(Elite Rail) for Tilt Mount system  
(i) Site verification of the following design assumptions  
(ii) All proprietary products meeting their performance specification requirements;

**I believe on reasonable grounds** that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

CM1  CM2  CM3  CM4  CM5 (Engineering Categories)

I, L. Van Spaandonk ..... am:  CPEng # **CMEngNZ 2003796**  
(Name of Design Professional)

I am a member of:  Engineering New Zealand and hold the following qualifications: ..... FIEAust CPEng NER APEC Engineer IntPE(Aus) CMEngNZ

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than \$200,000\*.

The Design Firm is a member of ACE New Zealand:

**SIGNED BY** L. Van Spaandonk ..... (Signature)

**ON BEHALF OF** Gamcorp Pty Ltd ..... **08/05/2024**  
(Design Firm) ..... Date.

*Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of \$200,000\*.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.  
**THIS FORM AND ITS CONDITIONS ARE COPYRIGHT TO ACE NEW ZEALAND AND ENGINEERING NEW ZEALAND**

# GUIDANCE ON USE OF PRODUCER STATEMENTS

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects, Institution of Professional engineers New Zealand (now Engineering New Zealand), ACE New Zealand in consultation with the Building Officials Institute of New Zealand. The original suit of producer statements has been revised at the date of this form as a result of enactment of the Building Act (2004) by these organisations to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate, without having to duplicate design or construction checking undertaken by others.

**PS1 Design** Intended for use by a suitably qualified independent design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

**PS2 Design Review** Intended for use by a suitably qualified independent design professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

**PS3 Construction** Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011<sup>2</sup>

**PS4 Construction Review** Intended for use by a suitably qualified independent design professional who undertakes construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

## Competence of Design Professional

This statement is made by a Design Firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its designers.

A competent design professional will have a professional qualification and proven current competence through registration on a national competence based register as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand (formerly IPENZ) provides additional assurance of the designer's standing within the profession. If the design firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent design professional".

## \*Professional Indemnity Insurance

As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard, small projects. If the parties deem this inappropriate for large projects the minimum may be up to \$500,000.

## Professional Services during Construction Phase

There are several levels of service which a Design Firm may provide during the construction phase of a project (CM1-CM5 for Engineers<sup>3</sup>). The Building Consent Authority is encouraged to require that the service to be provided by the Design Firm is appropriate for the project concerned.

## Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design firm's engagement.

## Attached Particulars

Attached particulars referred to in this producer statement refer to supplementary information appended to the producer statement.

## Refer Also:

- 1 Conditions of Contract for Building & Civil Engineering Construction  
NZS 3910: 2013
- 2 NZIA Standard Conditions of Contract SCC 2011  
  
Guideline on the Briefing & Engagement for Consulting Engineering Services  
(ACE New Zealand/Engineering New Zealand 2004)
- 4 PN Guidelines on Producer Statements

[www.acenz.org.nz](http://www.acenz.org.nz)  
[www.engineeringnz.org](http://www.engineeringnz.org)



association of  
consulting and  
engineering



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