PV-ezRACK®

# SolarTerrace II-A

## Code-Compliant Planning and Installation V 3.1
## Complying with AS/NZS1170.2:2011 AMDT 3-2012

SOLAR TERRACE

Last Updated - May 2022

# Introduction

Clenergy PV-ezRack® SolarTerrace II-A is a pre-assembled ground mount system suitable for large scale commercial and utility scale installations. PV-ezRack® SolarTerrace II-A has been developed to fit any PV module. The innovative and patented SolarTerrace II-A T-Rails simplify and improve the accuracy of the installation. SolarTerrace II-A uses high quality engineered components, saving developers and installers' time and money when delivering ground mount projects.

Please review this instruction guide thoroughly before installing PV-ezRack® SolarTerrace II-A. This manual provides the supporting documentation for building permit applications relating to PV-ezRack® SolarTerrace II-A Universal PV Mounting System.

## List of contents



The PV-ezRack® SolarTerrace II-A components, when installed in accordance with this guide, will be structurally adequate and will meet the AS/NZS1170.2:2011 Amdt. 3-2012 standard. During installation and especially when working on the ground, you will need to comply with the appropriate occupational health and safety regulations. Please also check other regulations relevant to your local region. Make sure that you are using the latest version of the installation instruction guide, which you can do by contacting Clenergy by email on tech@clenergy.com.au or contacting your local distributor.

**Product Warranty:**
Please refer PV-ezRack® Product Warranty on our website.

## The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any 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 ezRack (substitution of parts may void the warranty and invalidate the letter of certification);
- Ensuring that the ground condition are suitable;
- How to recycle: according to the local relative statute.
- How to disassemble: reverse installation process.
- Ensure that there are no less than two professionals working on the panel installation.
- Ensure the installation of the electrical equipment is performed by a professional and accredited electrician.
- Ensuring safe installation of all electrical aspects of the PV array including providing adequate earth bonding of the PV array and PV-ezRack® SolarTerraceII-A components as required in AS/NZS 5033: 2021.

# Planning

## Installation Spacing

Table 1: Max Frame Spacing and Footing Options of Panel Dimensions 1.7m x 1.4m

| Wind Region | RegionA | | RegionB | | RegionC | RegionD |
|---|---|---|---|---|---|---|
| Panels tilt angle,degrees | 20 | 30 | 20 | 30 | 20 | 20 |
| Wind speed,m/s | 41 | | 48 | | 59 | 73 |
| Panel clearance (Cp), mm,max/min | 583/446 | 600/501 | 583/446 | 600/501 | 583/446 | 583/446 |
| Max/Min post height above the ground, mm, from Clenergy | 1000/863 | 1399/1300 | 1000/863 | 1399/1300 | 1000/863 | 1000/863 |
| Spacing(S),m | 3.50 | 3.35 | 3.40 | 3.25 | 2.95 | 1.95 |
| Max Vertical Uplift Reaction,kN | 6.1 | 6.6 | 8.8 | 9.6 | 12.3 | 13.0 |
| Max Vertical Down Reaction,kN | 13.2 | 14.2 | 16.6 | 17.9 | 20.7 | 20.2 |
| Max Horizontal Reaction,kN | 3.9 | 6.5 | 5.1 | 8.6 | 6.7 | 6.8 |
| Max Moment at GL,kNm | 7.9 | 6.2 | 9.9 | 7.7 | 12.2 | 11.8 |
| Soil Class | Driven post minimum embedment depth (D), m | | | | | |
| Compact sand | 1.33 | 1.27 | 1.47 | 1.42 | 1.62 | 1.60 |
| Medium dense sand | 1.74 | N/A | N/A | N/A | N/A | N/A |
| Very Stiff to Hard Clays | 1.36 | 1.30 | 1.51 | 1.45 | 1.67 | 1.66 |
| Firm to Stiff Clays | N/A | N/A | N/A | N/A | N/A | N/A |
| Driven post maximum embedment depth based on standard 2800 mm long post (m), from Clenergy | 1.937 | 1.500 | 1.937 | 1.500 | 1.937 | 1.937 |
| Soil Class | Post embedded in concrete pier: 300 mm diameter concrete piers minimum depth (D), m | | | | | |
| Compact sand | 0.85 | 0.80 | 0.95 | 0.90 | 1.05 | 1.00 |
| Medium dense sand | 1.10 | 1.05 | 1.20 | 1.15 | 1.30 | 1.30 |
| Very Stiff to Hard Clays | 0.85 | 0.80 | 0.95 | 1.30 | 1.05 | 1.00 |
| Firm to Stiff Clays | 1.20 | 1.15 | 1.35 | 1.30 | 1.50 | 1.45 |

Notes:
- For 25 degrees tilt angle the spacing and footing options for 30 degrees can be adopted (Cp=474-585mm, post height = 1200-1085mm AG, max post depth 1.715m).
- For concrete piers foundation, we recommend to use concrete of 25MPa of minimum concrete compressive strength. For other possible pier sizes, please contact Gamcorp.The minimum post embedment depth in the pier shall be approximately 0.9 of the pier depth.
- T-Rails overhang: 0.4*S maximum.
- In the case of ø250 mm concrete piers, the pier depth will increase approx. 20% further than the ø300 mm piers.

### Table 2: Max Frame Spacing and Footing Options of Panel Dimensions 2m x 1.4m

| Wind Region | RegionA | | RegionB | | RegionC | RegionD |
|---|---|---|---|---|---|---|
| Panels tilt angle,degrees | 20 | 30 | 20 | 30 | 20 | 20 |
| Wind speed,m/s | 41 | | 48 | | 59 | 73 |
| Panel clearance (Cp), mm,max/min | 691/554 | 560/445 | 691/554 | 560/445 | 691/554 | 691/554 |
| Max/Min post height above the ground, mm, from Clenergy | 1000/863 | 1200/1085 | 1000/863 | 1200/1085 | 1000 / 863 | 1000 / 863 |
| Spacing(S),m | 3.30 | 3.20 | 3.20 | 2.95(2.85*) | 2.85 | 1.95(1.90*) |
| Max Vertical Uplift Reaction,kN | 6.7 | 7.8 | 9.7 | 10.6 | 14.0 | 15.3 |
| Max Vertical Down Reaction,kN | 14.6 | 15.6 | 18.4 | 18.7 | 23.5 | 23.7 |
| Max Horizontal Reaction,kN | 4.3 | 7.3 | 5.7 | 9.2 | 7.7 | 8.0 |
| Max Moment at GL,kNm | 8.2 | 12.3 | 10.9 | 15.4 | 14.5 | 15.2 |
| Soil Class | Driven post minimum embedment depth (D), m | | | | | |
| Compact sand | 1.34 | 1.61 | 1.51 | N/A | 1.71 | N/A |
| Medium dense sand | 1.76 | N/A | N/A | N/A | N/A | N/A |
| Very Stiff to Hard Clays | 1.38 | 1.67 | 1.56 | N/A | 1.78 | N/A |
| Firm to Stiff Clays | N/A | N/A | N/A | N/A | N/A | N/A |
| Driven post maximum embedment depth based on standard 2800 mm long post (m), from Clenergy | 1.937 | 1.715 | 1.937 | 1.715 | 1.937 | 1.715 |
| Soil Class | Post embedded in concrete pier: 300 mm diameter concrete piers minimum depth (D), m | | | | | |
| Compact sand | 0.90 | 1.05 | 1.00 | 1.10 | 1.10 | 1.10 |
| Medium dense sand | 1.10 | 1.30 | 1.25 | 1.45 | 1.40 | 1.40 |
| Very Stiff to Hard Clays | 0.85 | 1.05 | 1.00 | 1.15 | 1.10 | 1.10 |
| Firm to Stiff Clays | 1.25 | 1.50 | 1.40 | 1.65 | 1.60 | 1.60 |

Notes:
-For concrete piers foundation, we recommend to use concrete of 25MPa of minimum post embedment concrete compressive strength. For other possible pier sizes, please contact Gamcorp. The minimum depth in the pier shall be approximately 0.9 of the pier depth.
-(*): when using Clenergy East-West adaptor (if different to the spacing without adaptor).
-T-Rails overhang: 0.4*S maximum.
-In the case of ø250 mm concrete piers, the pier depth will increase approx. 20% further than the ø300 mm piers.

### Explanation of the adopted soil classes

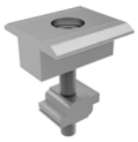
| ABC (Allowable BearingCapacity), kPa | |
|---|---|
| Compact sand | ≥ 300 |
| Medium dense sand | 150 - 300 |
| Very Stiff to Hard clays | 300 – 600 |
| Firm to Stiff Clays | 100 – 150 |

# Tools and Components

## Tools

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| **Drive Bit**<br>(M8 Hexagon Socket Screw) | **Electric Drill**<br>(ST4.8x16 self-tapping screw & M8 Hexagon Socket Screw) | **Torque Wrench** | **Socket Wrench with 19 mm socket** | **Measuring Tape** |
|  |  |  |  |  |
| **String** | **Marker Pen** | **Wrench** | **lectronic Total Station**<br>(optional) | **Hydraulic Driver** |

## Components

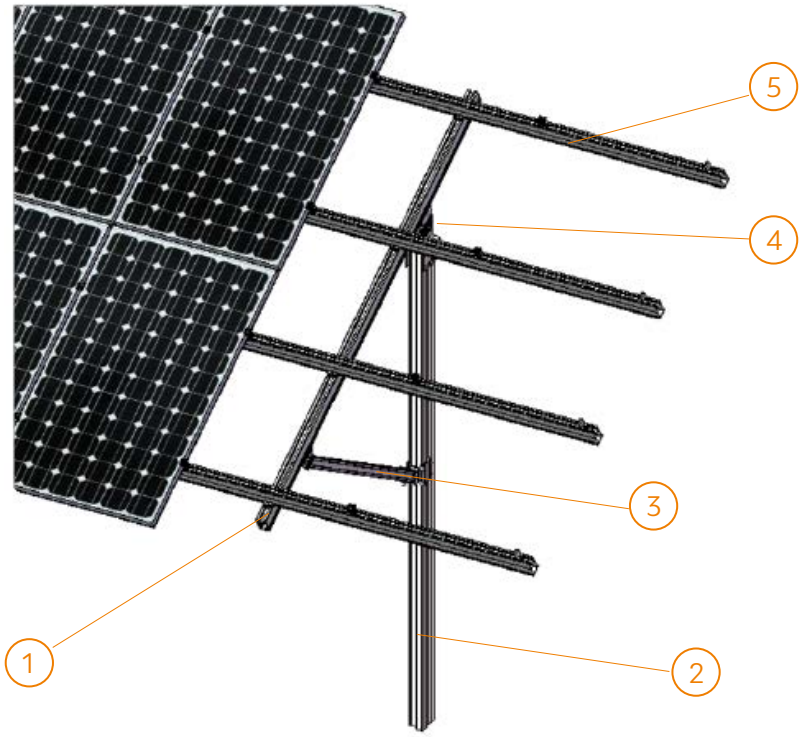
| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| **ER-EC-ST**<br>End Clamp | **ER-IC-ST**<br>Inter Clamp | **ER-R-T110**<br>T-Rail 110 | **ER-SP-T110**<br>Splice for T-110 Rail | **ER-RC-T/G**<br>Rail Clamp for T-Rail with grounding pins |
|  |  |  |  |  |
| **ER-PH-CP/A**<br>Post head for C-Post with Grounding | **ER-CP-2800/A**<br>C-Post,2800mm | **ER-PB-CP/A**<br>post brace for C-Post | **ER-PB-CP/D/A**<br>Post brace for C-Post on double support with Grounding | **ER-S-STIIA/S**<br>Support (pre-assembled) |

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| **ER-S-STIIA/D**<br>Double support (pre-assembled) | **ER-CAP-T110**<br>Cap for T-110 Rail | **ER-CAP-G/A**<br>Cap for Square Girder | **EZ-GC-ST**<br>Grounding Clip | **EZ-GL-ST**<br>Grounding Lug |
|  |  |  | | |
| **C-U/30/46-G**<br>Universal Clamp for Frame Height 30-46mm with Grounding Clip | **C-U/30/46**<br>Universal Clamp for Frame Height 30-46mm | **BR-R110/EW/G (Optional)**<br>PV-ezRack East/West Adjustable Bracket for T-Rail 110 with grounding | | |

Note:
ER-PB-CP/D/A and ER-S-STIIA/D only used on STII double support mounting system.

# System Overview

## Overview of PV-ezRack® SolarTerrace II-A




1. STII-A, Support (pre-assembled)/ Double support (pre-assembled)
2. STII-A, C-Post
3. STII-A, Post brace for C-Post/Post brace for C-Post On double support
4. STII-A, Post head for C-Post
5. T-Rail 110

## 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

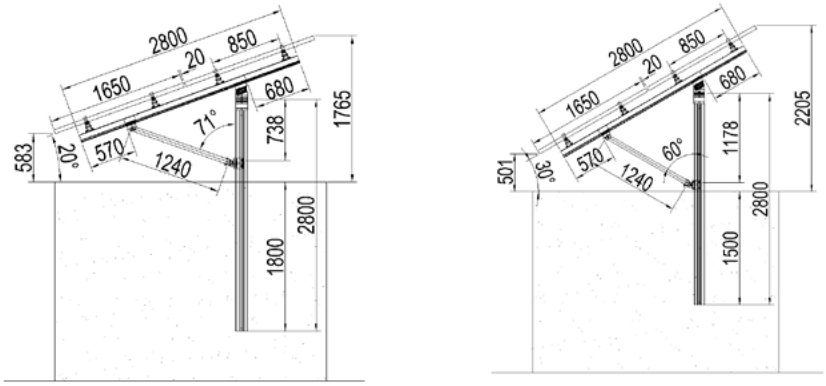
Please refer to safe torques as shown on page 13. In case power toolsare required, Clenergy recommends the use of low speed only. High speed and impact drivers increase the risk of bolt galling (deadlock). If dead lock occurs and you need to cut fasteners, please makesure that there is no load on the fastener before you cut it. Avoid damaging the anodized or galvanized surfaces.

# Installation Instructions

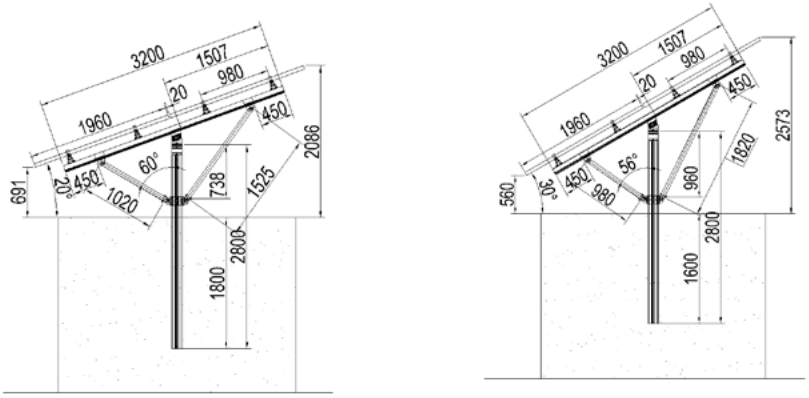
## Installation Dimensions

All drawings and dimensions in this installation guide are a generic reference only. PV-ezRack® SolarTerrace II-A is to be optimized to suit specific conditions for each project and documented in a construction drawing. As a result, major components of PV-ezRack® SolarTerrace II-A may be provided in section sizes and lengths that vary from those shown in this guide. The installation process detailed in this instruction guide remains the same regardless of the component size. In case you need to do any on-site modifications or alteration of the system in a way that would be different from the construction drawing please provide marked up drawings/sketches for Clenergy's review prior modification for comment and approval.

Below are the side view drawings of support for 60 cell panels(up to 1700 x 1400 mm)and 72 cell panels (up to 2000 x 1400 mm) at 20° and 30° tilt angles.




Side view drawings of support for 60 cell panels (up to 1700 x 1100 mm)

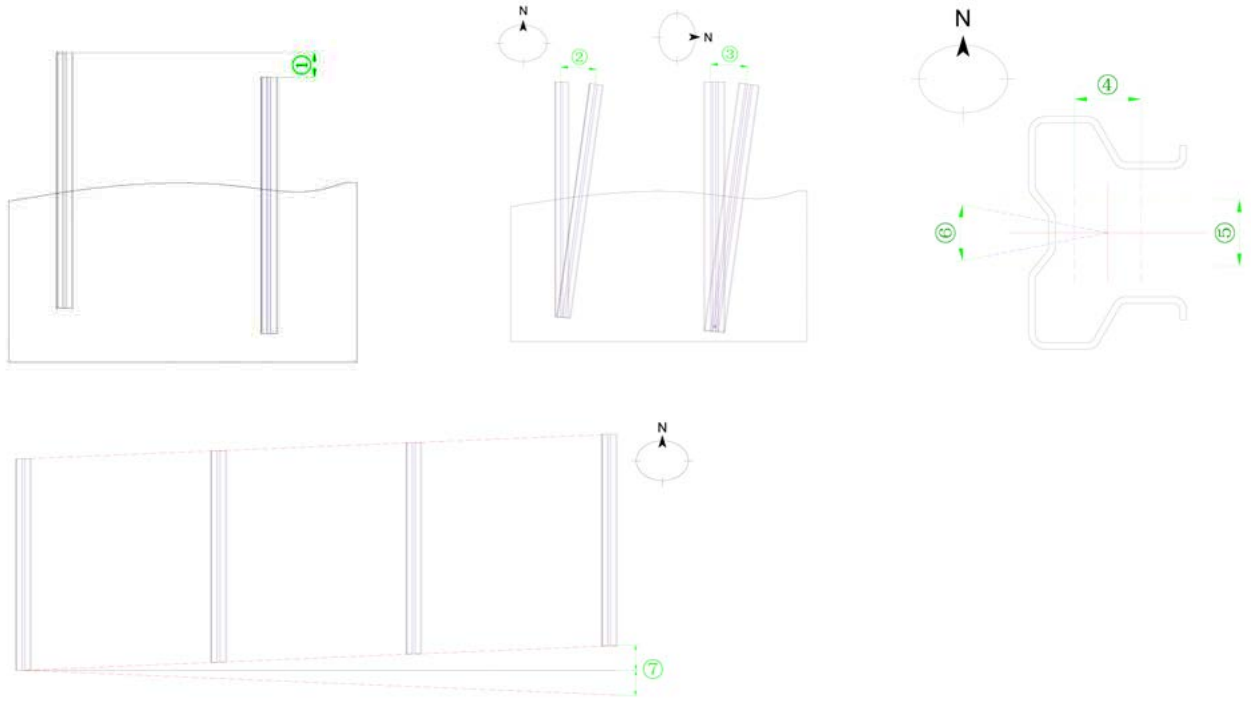



Side view drawings of support for 72 cell panels (up to 2000x1100mm)

# Range of Adjustment

The tolerances of ramming post as below,

(1) Post height max: ± 15mm (based on planned height)
(2) Inclination tolerance E-W max: ± 1°
(3) Inclination tolerance N-S max: ± 1°
(4) Position E-W max: ± 20mm
(5) Axis tolerance N-S max:± 20mm
(6) Rotation of post max: ±2°
(7) E-W slope max: ±2°



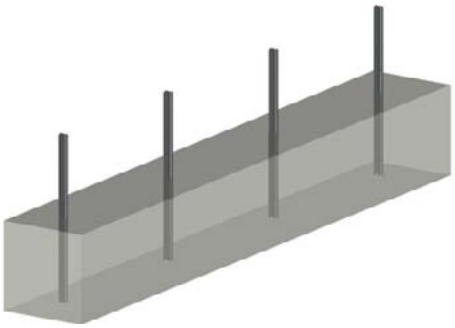

# C-Post Installation

Before starting, check you have the installation tools needed. Position the required components close to the installation location. Make sure that the hydraulic pile driver equipment is suitable for your particular installation.

Mark the line of the post array.
Obtain the maximum allowed distance between posts and the minimum embedment length from the relevant engineering certificate and/or project drawing. If you don't have this document, please contact Clenergy technical support.

Mark the positions of the posts using a string and tape measure or GPS and drive the posts into the ground. Use a sting or a laser tool to make sure all posts are in line and set to the correct height according to the drawing.

Apply Zinc Coating to upper section of C Post after ramming



**Notes:**

-Apply zinc coating to upper section (circled) of C-Post after piling to repair any damage to the galvanisation caused by ramming.

-The opening of the C-Post faces east or west if the panel faces the north. In case of slope ground installation, the opening of the C-Post is recommended to face the lower ground side to avoid catching the water.

# Post Head Installation

Install the post head and fix it with the two M12 bolts and nuts supplied. To avoid stainless steel galling/seizing apply grease or lubricant if needed.

The spring-loaded clip opening of the Post Head face the same orientation as the solar panels.

Recommended torques:
Bolt 1 with 50-55 N·m
Bolt 2 with 23-25 N·m

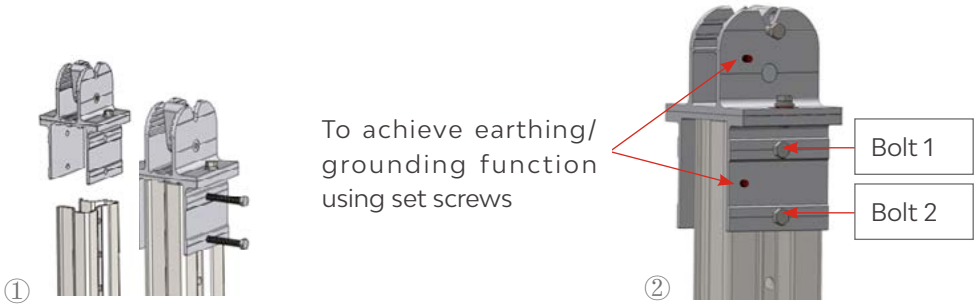



Fig. 1

# Post Brace Installation

Click the Post brace into C-Post as shown and connect with the two M12 bolts and nuts supplied.

Recommended torque:
Bolt M12 50~55N·m

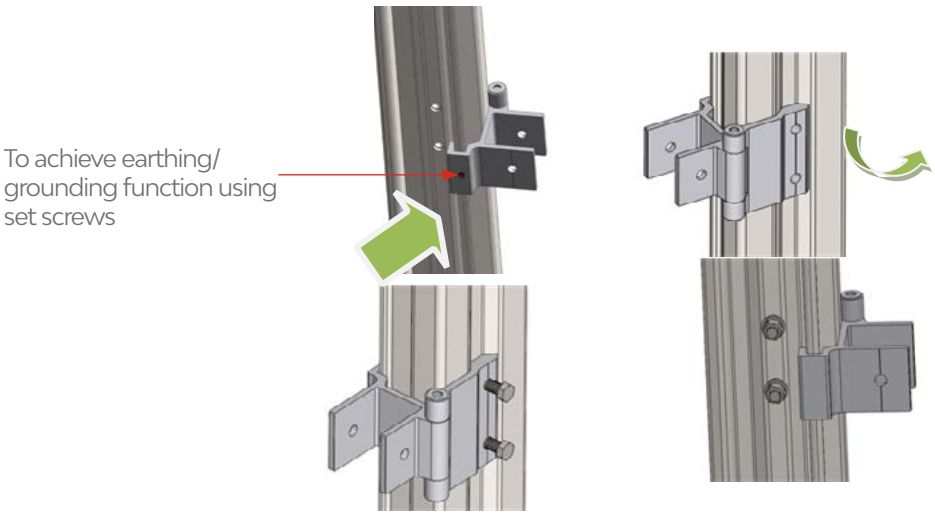



Fig. 2

Post brace on double support installation.

Click two post braces into C-Post as shown and connect with the two M12 bolts and nuts supplied.

Recommended torque:
Bolt M12 50~55N·m

Fig. 3

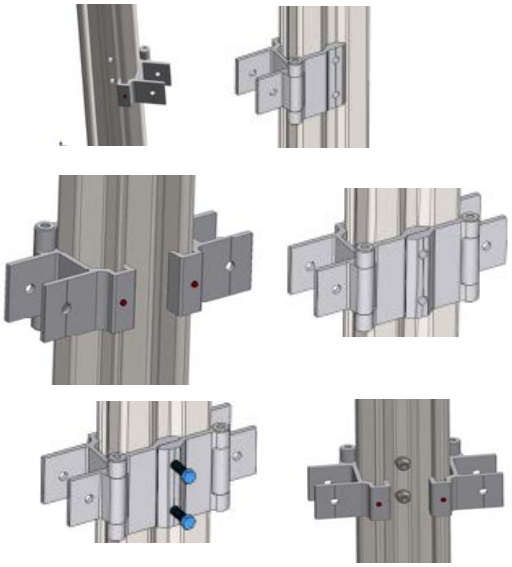


Fig. 4

# Pre-assembled Support Installation

Place the (pre-assembled) support into post head as shown in Fig.5.

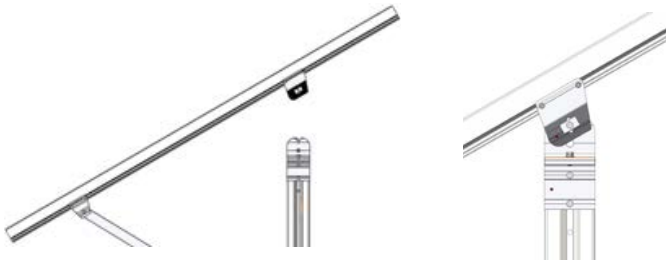


Fig. 5

Connect the brace to the post using the M12 bolt and nut supplied.

Recommended torque:
M12 : 50-55N·m

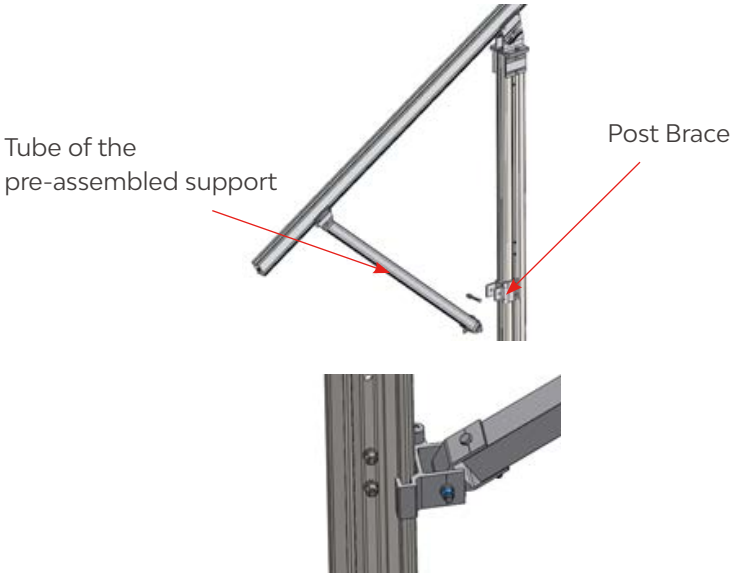
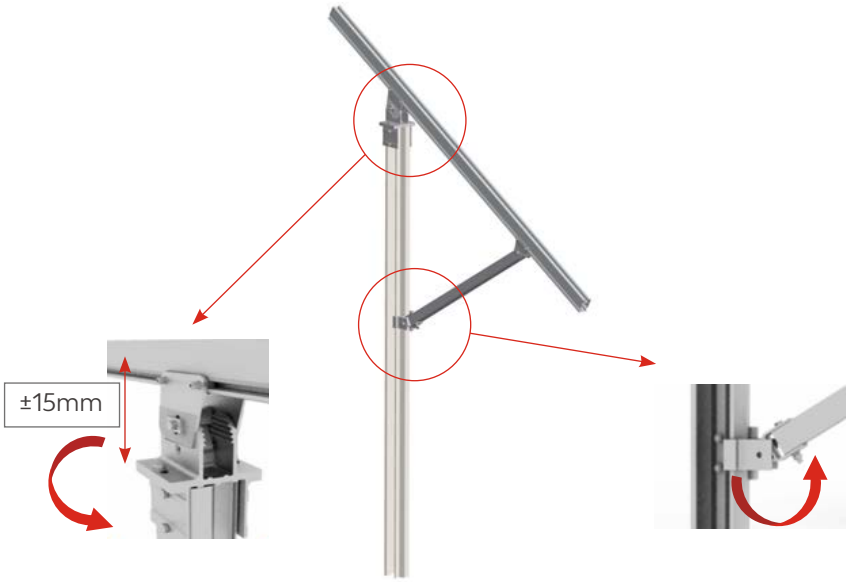



Fig. 6




Horizontal rotation is 2 degree adjustable

Horizontal rotation is 2 degree adjustable

Fig. 7

# Double Support Installation

Place the double support (pre-assembled) into post head. Connect the tubes of the support the to the post braces on the post using the M12 bolt and nut supplied.

Recommended torque:
M12 : 40-45N·m

Fig. 8

Notes:

(1) The lengths of the two tubes are different. Make sure the shorter one is positioned at the lower part of the tilt as shown.

(2) Connect the shorter Tube Support to post brace.

Fig. 9

(3) Adjust the bolt position of T head to align the post brace to the Tube Support.

Fig. 10

(4) Rotate the orientation of T head to fit the Tube Support to the post brace.

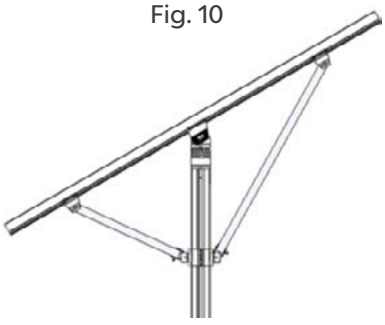


Fig. 11

# System Adjusting

Make final adjustments to Racking System.

Adjust vertically: Loosen Bolt 1 and slide along ellipse hole.

Adjust Tri-groove beam parallel: Loosen Bolt 2 and Bolt 3, turn Post Head slightly, move Al Tube left and right until being parallel. Keep all of Tri-groove beams parallel at same level.

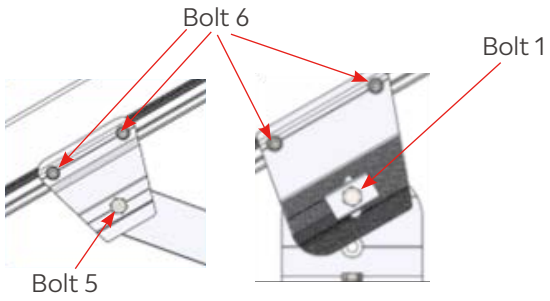



Fig. 12

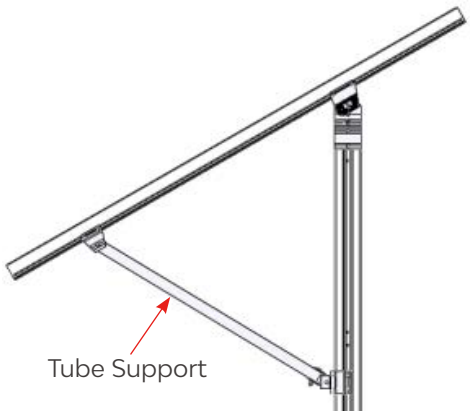



Fig. 13

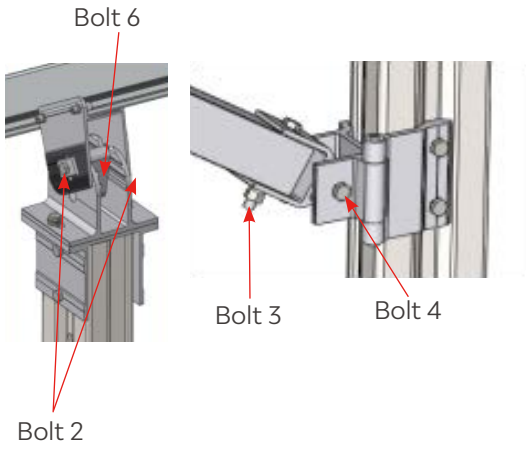



Fig. 14

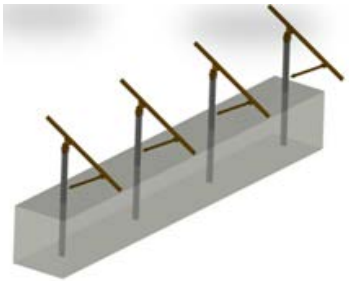


Fig. 15

**Note:**
Make sure all of Tri-groove beams are parallel prior to installation of T-Rails.

Check the torque value of bolt:

Bolt 1 with 50-55 N·m
Bolt 2 with 50-55 N·m
Bolt 3 with 40-45 N·m
Bolt 4 with 50-55 N·m
Bolt 5 with 40-45 N·m
Bolt 6 with 18-20 N·m

# T-Rail Installation

## Direct Installation

Slide T-Rails into Pre-assembled rail clamp on Tri-groove beams and use a 6mm Allen key (Hex) to fasten on another side via Rail Clamp for T-Rail.

Recommended Torque:
M8: 18N·m

**Note:**
Rail clamps can work on both sides with no pre-assembled rail clamp.

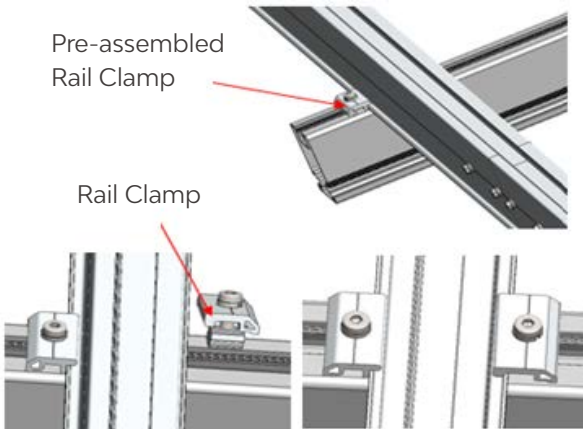



Fig. 16

Determine the necessary length of T-Rail prior to installation, if T-Rail isn't long enough; join two rails via Rail splice as shown before installing the T-Rail as directed in step 7a.

**Note:**
Connecting Rails on Structure system is not recommended.

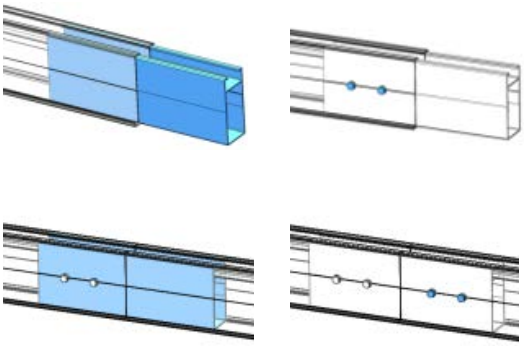


Fig. 17

Racking System installation is completed.

Fig. 18

## East/West Adjustable Bracket Installation (Optional)

Click the pre-assembled East/West Adjustable Bracket into the Tri-Groove Square Girder and adjust properly as shown in Fig. 19. Fasten the M8 bolt slightly with the Allen key.

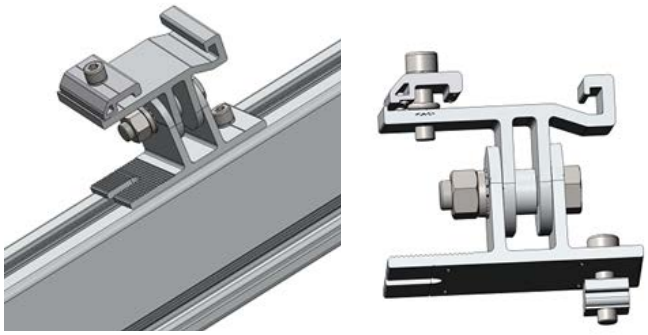


Fig. 19

Click the corrugated shim and Z Moulde/ bolt into the Tri-Groove Square Girder and move them into the opening slot hole of East/West Adjustable Bracket. After the bolt is at the end of slot hole, fasten the M8 bolts slightly as shown in Fig. 20.

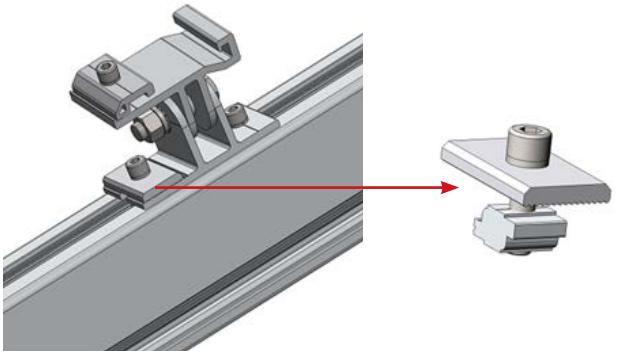


Fig. 20

Repeat above steps to install other East/ West Adjustable Brackets. Adjust all brackets and make the brackets sit at the right positions. Now fasten all M8 bolts tightly within 18~20 N·m as shown in Fig. 21.

Fig. 21

Tilt the T Rail to a certain angle and slide into the groove of East/West Adjustable Brackets of the same height on the Tri-Groove Square Girder. Then use a 6mm Allen key (Hex) to fasten on another side via Rail Clamp for T-Rail. Fasten all the M12 bolts on the East/West Adjustable Brackets.

Recommended Torque:
M8: 18~20 N·m
M12: 50~55 N·m

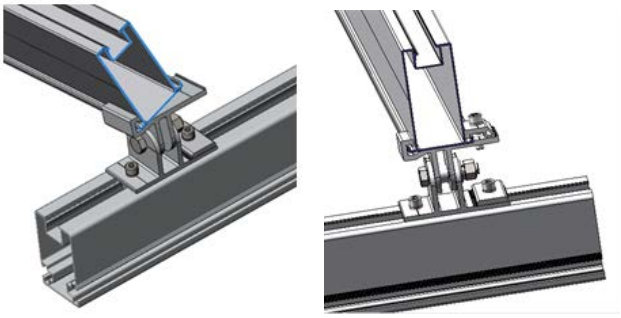


Fig. 22

Repeat the step 7b to determine the necessary length of T-Rail prior to installation.

Racking System installation is completed.

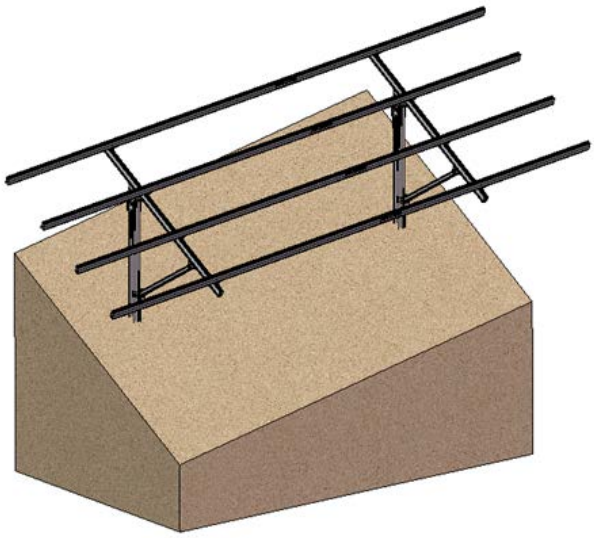
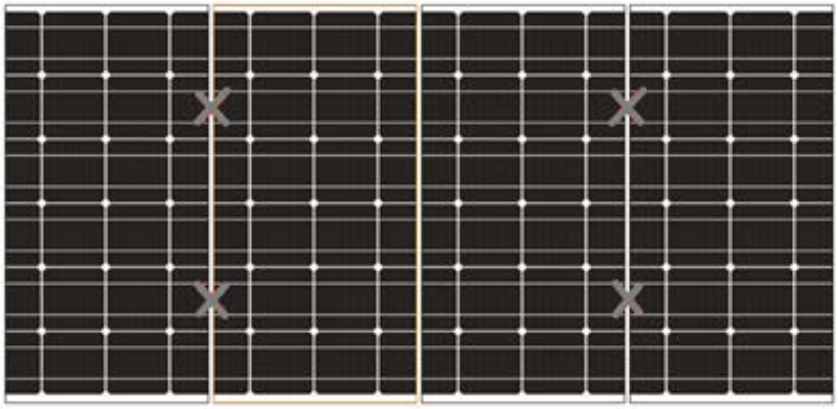


Fig.23

# PV Modules Installation

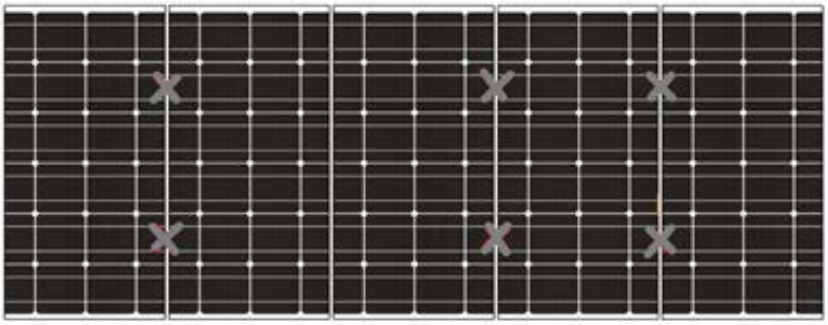
Deployment of Grounding Clip

1) Even of PV Module in each row:



Install Grounding Clips at positions marked in diagram.
Installation number of Grounding Clip = number of PV Module. Eg: 4 Grounding Clips in image shown.

2) Odd number of PV Module in each row:



Install Grounding Clips at positions marked in diagram.
Installation number of Grounding Clip = number of PV Module +1. Eg: 5+1=6 Grounding Clips image shown.

Key point:
When replacing a single defective PV Module, it's required to replace the Grounding Clip under the PV Module.

Place PV Modules on Rails, and fix them with End Clamps and Inter Clamps or Universal Clamps, then fasten them with Allen Key. Please choose below Solution 1 or 2 according to your project.

## Solution 1 (Apply End Clamps and Inter Clamps)

**Step 1:**
Place the first PV Module on T Rails according to your plan and apply the End Clamps to fix it and then fasten lightly with Allen Key as shown in figure below .

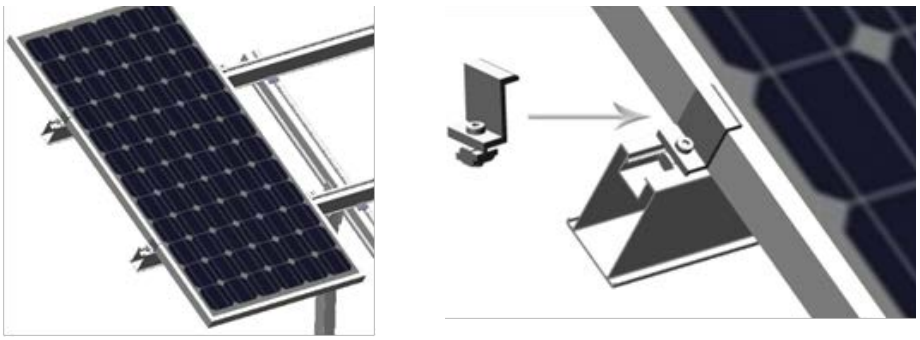


Fig. 24

**Step2:**
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 right Figure.

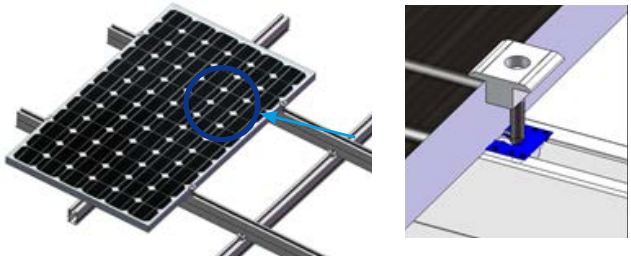


Fig. 25

**Step 3:**
Loosely place the next framed PV Module into the other side of Inter Clamp and Grounding Clip as shown in right Figure.

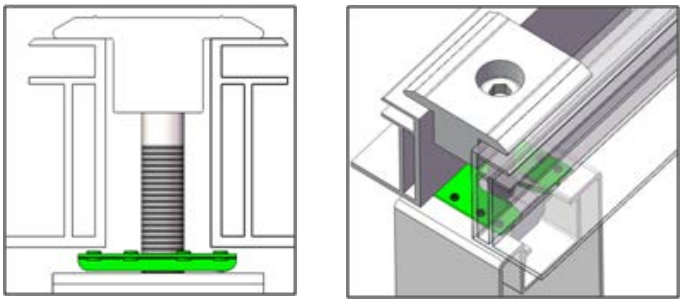


Fig. 26

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

-Grounding Clips are intended for SINGLE USE ONLY! Do not fasten the bolts down if the position of PV Module is not finalized. Only slightly tighten bolts to keep PV Modules in place.

**Step 4:**
Maintain 18mm vertical gap and 18mm horizontal gap between the two adjacent rows of PV Modules. You can use two Inter Clamps as separation between two PV Modules, and remove them after installation finished as shown in right Figure.

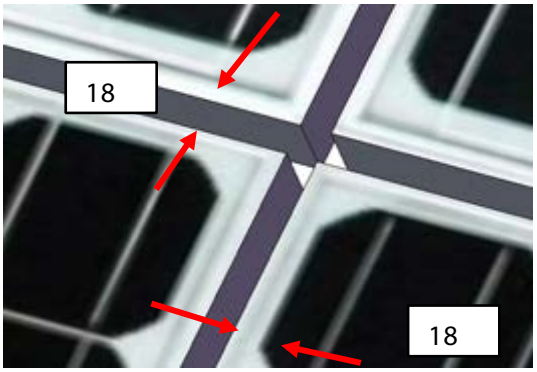


Fig. 27

**Step 5:**
Repeat above steps to install all PV Modules. Fasten all End Clamps and Inter Clamps tightly with18~20N.muntil all PV Modules are properly installed.

## Solution 2 (Apply Universal Clamps)

**Step 1:**
Twist the head of Universal Clamp to change functionality from end to inter clamp as shown in right figure.

**Note:**
Properly apply the Universal Clamp C-U/30/46 or Universal Clamp with Grounding Clip C-U/30/46-G according to 5.8.1. Deployment of Grounding Clip.

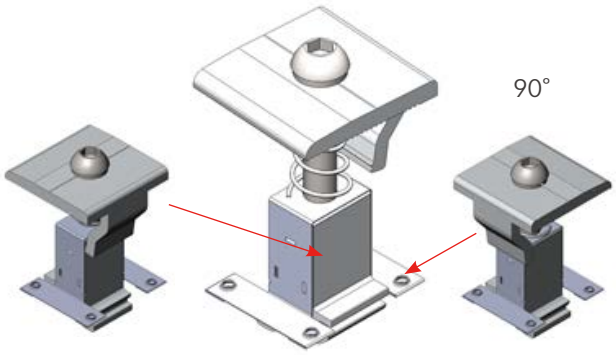


Fig. 28

**Step 2:**
Incline the Universal Clamp to fit the channel on its lower part against the lower channel of T Rail, and press down the Universal Clamp towards the other side to fit the channel on its upper part against the upper channel of T Rail as shown in figure below .

**Note:**
before installation, make sure there will be enough clearance between screw and module of Universal Clamp as shown in figure below .

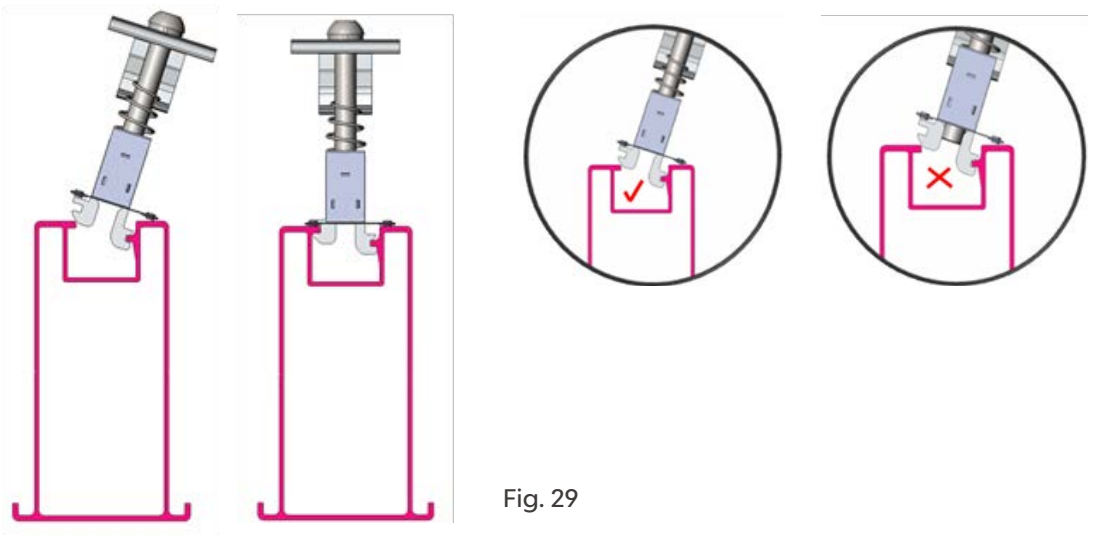


Fig. 29

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

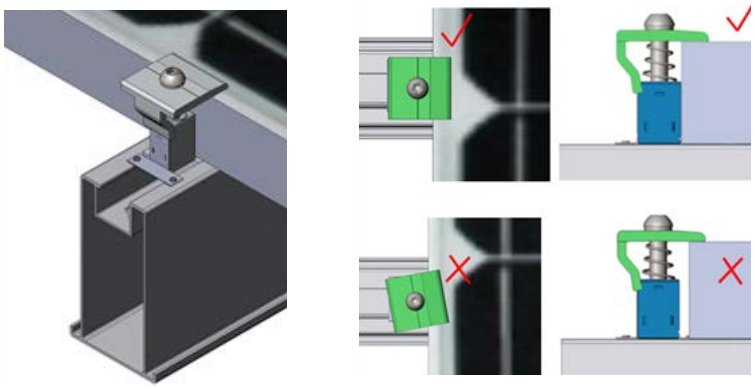


Fig. 30

Step 4:
When using as Inter Clamp, click Universal Clamp into the channel of T Rail and then slightly lift the framed PV Module to make sure the Grounding Clip of Universal Clamp will be fully covered as shown in right Figure.

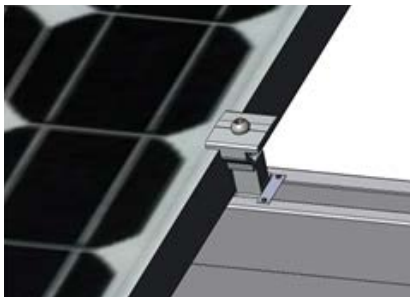


Fig. 31

Step 5:
Slightly place the next framed PV Module into the other side of Universal Clamp, Making sure the Grounding Clip of Universal Clamp will be fully covered and the frame of PV Module is closely in contact with Universal Clamp as shown in right Figure.

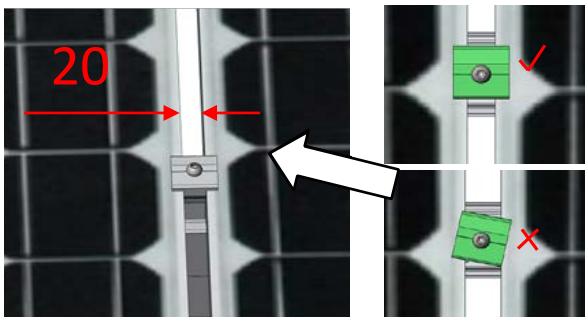



Fig. 32

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

The recommended torque for Universal Clamps in End Clamp position is 13~14N·m.
The recommended torque for Universal Clamps in Inter Clamp position is 18~20N·m.

Apply one pre-assembled Grounding Lug per T Rail. Click the Grounding Lug into to the channel of T Rail, insert the Copper Wire (the maximum size is 6AWG or similar) and fasten the bolt M6*10 with 10N·m and fasten the bolt M8*25 with 13.5N·m as shown in figure below .

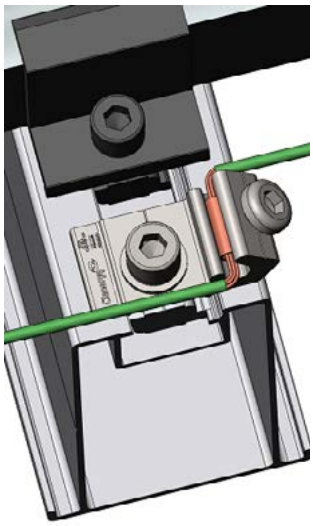


Fig. 33

Now the installation is completed as shown in figure below. Please recheck all Bolts and fasten them tightly using the recommended torque.

Fig. 34

# Certification

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Tel: 03 9543 2211

Our Ref: **6396-1** / LvS+AdA+NK
4 May 2022

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

## Array Frame Engineering Certificate

**RE: SolarTerrace II-A (single support) Installation in Australia and New Zealand**

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian and NZ Building Regulations, have carried out a structural design check of the PV-ezRack SolarTerrace II-A within Australia and New Zealand. The design check has been based on the information in the *PV-ezRack SolarTerrace II-A Planning and Installation Guide* and schematic drawings of the system components, provided by Clenergy Australia.

| Component Description | Part No |
|---|---|
| T-Rail 110 | ER-R-T110/XXXX |
| PV-ezRack SolarTerrace II-A, Single Support (Pre-assembled) adjustable 20°/25°/30°, with 2800mm Girder | ER-S-STIIA/S30 |
| PV-ezRack SolarTerrace II-A, C-Post | ER-CP-XXXX/A |
| Splice for T-Rail 110 | ER-SP-T110 |
| PV-ezRack SolarTerrace II-A, Post Head for C-post | ER-PH-CP/A, ER-PH-CP/A/G |
| PV-ezRack SolarTerrace II-A, Post Brace for C-Post | ER-PB-CP/A, ER-PB-CP/A/G |
| PV-ezRack Inter Clamp | ER-IC-STXX |
| PV-ezRack End Clamp | ER-EC-STXX |
| PV-ezRack Universal Clamp for Frame Height 30-46mm with Grounding Clip | C-U/30/46-G |
| PV-ezRack Universal Clamp for Frame Height 30-46mm | C-U/30/46 |
| PV-ezRack T-Rail Clamp with Grounding | ER-RC-T/G |
| East/West Adjustable - Bracket for T-Rail 110 | BR-R110/EW, BR-R110/EW/G |

We find the SolarTerrace II-A to be structurally sufficient for Australian and New Zealand use, based on the following conditions:

- Wind Loads to AS/NZ1170.2:2011(R2016);
  - Wind Terrain Category 2;
  - Wind average recurrence interval of **100 years** (ultimate);
  - Wind region A, B, C & D;
  - Wind pressure coefficients according Wind Tunnel Test Report RWDI #1101970, by Rowan Williams Davies & Irwin Inc. (Canada), dated 7/6/2012;
- Solar Panel up to the **length (Lp) 1.7m, width 1.4m**, mass approx. **15kg/m2**;
- Materials Yield strength:
  - steel 400MPa,
  - aluminium 240MPa;
- Maximum frame spacing (S) and footing options: [refer table(s) on page 2].

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Table 1. Maximum Frame Spacing (S) and Footing Options

| Wind Region | Region A | | Region B | | Region C | Region D |
|---|---|---|---|---|---|---|
| Panels tilt angle, degrees | **20** | **30** | **20** | **30** | **20** | **20** |
| Wind speed, m/s | 41 | | 48 | | 59 | 73 |
| Panel clearance (Cp), mm, max/min | **583** / 446 | **600** / 501 | 583 / 446 | 600 / 501 | 583 / 446 | 583 / 446 |
| Max/Min post height above the ground, mm, from Clenergy | 1000 / 863 | 1399 / 1300 | 1000 / 863 | 1399 / 1300 | 1000 / 863 | 1000 / 863 |
| Spacing (S), m | **3.50** | **3.35** | **3.40** | **3.25** | **2.95** | **1.95** |
| Max Vertical Uplift Reaction, kN | 6.1 | 6.6 | 8.8 | 9.6 | 12.3 | 13.0 |
| Max Vertical Down Reaction, kN | 13.2 | 14.2 | 16.6 | 17.9 | 20.7 | 20.2 |
| Max Horizontal Reaction, kN | 3.9 | 6.5 | 5.1 | 8.6 | 6.7 | 6.8 |
| Max Moment at GL, kNm | 7.9 | 6.2 | 9.9 | 7.7 | 12.2 | 11.8 |
| **Soil Class** | **Driven post minimum embedment depth (D), m** | | | | | |
| Compact sand | 1.33 | 1.27 | 1.47 | 1.42 | 1.62 | 1.60 |
| Medium dense sand | 1.74 | N/A | N/A | N/A | N/A | N/A |
| Very Stiff to Hard clays | 1.36 | 1.30 | 1.51 | 1.45 | 1.67 | 1.66 |
| Firm to Stiff Clays | N/A | N/A | N/A | N/A | N/A | N/A |
| Driven post maximum embedment depth based on standard 2800 mm long post (m), from Clenergy | 1.937 | 1.500 | 1.937 | 1.500 | 1.937 | 1.937 |
| **Soil Class** | **Post embedded in concrete pier: 300 mm diameter concrete piers minimum depth (D), m** | | | | | |
| Compact sand | 0.85 | 0.80 | 0.95 | 0.90 | 1.05 | 1.00 |
| Medium dense sand | 1.10 | 1.05 | 1.20 | 1.15 | 1.30 | 1.30 |
| Very Stiff to Hard clays | 0.85 | 0.80 | 0.95 | 0.90 | 1.05 | 1.00 |
| Firm to Stiff Clays | 1.20 | 1.15 | 1.35 | 1.30 | 1.50 | 1.45 |

Notes.
- This certification is applicable only for Standard STII-A (single support) with dimensions as shown in the Figures 1-4 and the panel clearance above the ground (Cp) as mentioned in the Table 1. Contact Gamcorp for customised STII-A or if the site conditions are not covered by the soil classes considered in this assessment.
- For 25 degrees tilt angle the spacing and footing options for 30 degrees can be adopted (Cp=474-585mm, post hight = 1200-1085mm AG, max post depth 1.715m).
- For concrete piers foundation we recommend to use 25 MPa strength concrete. Other pier sizes possible, contact Gamcorp. The minimum post embedment depth in the pier shall be approximately 0.9 of the pier depth.
- T-Rails overhang: 0.4*S maximum.
- Other pier sizes are possible. In the case of ø250mm concrete pier, the pier depth will increase approx. 20% comparing with the ø300mm pier. Contact Gamcorp for the pier depths of other pier diameters.

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Table 2. Explanation of the adopted soil classes

| | ABC (Allowable Bearing Capacity), kPa |
|---|---|
| Compact sand | ≥300 |
| Medium dense sand | 150 – 300 |
| Very Stiff to Hard clays | 300 – 600 |
| Firm to Stiff Clays | 100 – 150 |

The maximum frame spacing is based on the structural capacity of the frame in the perimeter zone of an array. We recommend to perform tests on site for the geotechnical capacity of the driven post. The spacing may need to be decreased to achieve the available geotechnical capacity of the driven post following from the test results.

Construction is to be carried out strictly in accordance with the instruction manual. This work was designed in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles. This assessment excludes solar panels themselves. This certification is valid till **31 August 2022**, unless any of the relevant Australian Standards becomes updated before the due date.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd

L. van Spaandonk
Principal Engineer
FIEAust CPEng NER

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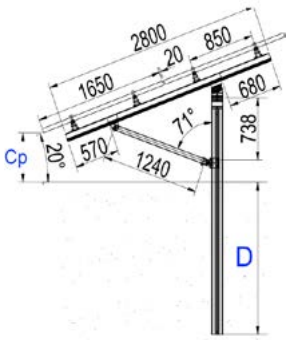


Fig. 1

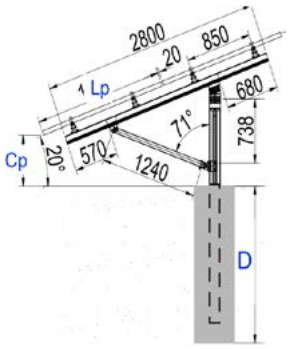


Fig. 2

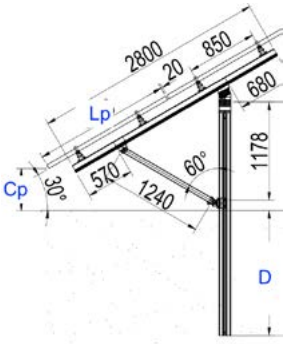


Fig. 3

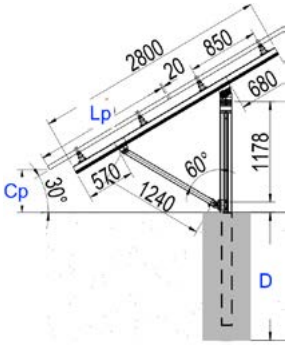


Fig. 4

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Our Ref: **6396-2** / LvS+NK
4 May 2022

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

## Array Frame Engineering Certificate

**RE: SolarTerrace II-A (double support) Installation in Australia and New Zealand**

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian and NZ Building Regulations, have carried out a structural design check of the PV-ezRack SolarTerrace II-A within Australia and New Zealand. The design check has been based on the information in the *PV-ezRack SolarTerrace II-A Planning and Installation Guide* and schematic drawings of the system components, provided by Clenergy Australia.

| Component Description | Part No |
|---|---|
| T-Rail 110 | ER-R-T110/XXXX |
| PV-ezRack SolarTerrace II-A, Double Support (Pre-assembled) adjustable 20°, with 3200mm Girder | ER-S-STIIA/D20 |
| PV-ezRack SolarTerrace II-A, Double Support (Pre-assembled) adjustable 30°, with 3200mm Girder | ER-S-STIIA/D30 |
| PV-ezRack SolarTerrace II-A, C-Post | ER-CP-XXXX/A |
| Splice for T-Rail 110 | ER-SP-T110 |
| PV-ezRack SolarTerrace II-A, Post Head for C-post | ER-PH-CP/A, ER-PH-CP/A/G |
| PV-ezRack SolarTerrace II-A, Post Brace for C-Post on Double Support | ER-PB-CP/D/A, ER-PB-CP/D/A/G |
| PV-ezRack Inter Clamp | ER-IC-STXX |
| PV-ezRack End Clamp | ER-EC-STXX |
| PV-ezRack Universal Clamp for Frame Height 30-46mm with Grounding Clip | C-U/30/46-G |
| PV-ezRack Universal Clamp for Frame Height 30-46mm | C-U/30/46 |
| PV-ezRack T-Rail Clamp with Grounding | ER-RC-T/G |
| East/West Adjustable - Bracket for T-Rail 110 | BR-R110/EW, BR-R110/EW/G |

We find the SolarTerrace II-A to be structurally sufficient for Australian and New Zealand use, based on the following conditions:

- Wind Loads to AS/NZ1170.2-2011(R2016);
  - Wind Terrain Category 2;
  - Wind average recurrence interval of **100 years** (ultimate);
  - Wind region A, B, C & D;
  - Wind pressure coefficients according Wind Tunnel Test Report RWDI #1101970, by Rowan Williams Davies & Irwin Inc. (Canada), dated 7/6/2012;
- Solar Panel up to the **length (Lp) 2.0m, width 1.4m**, mass approx. **15kg/m²**;
- Materials Yield strength:
  - steel 400MPa,
  - aluminium 240MPa;
- Maximum frame spacing (S) and footing options: [refer table(s) on page 2].

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Tel: 03 9543 2211

Table 1. Maximum Frame Spacing (S) and Footing Options

| Wind Region | Region A | | Region B | | Region C | Region D |
|---|---|---|---|---|---|---|
| Panels tilt angle, degrees | **20** | **30** | **20** | **30** | **20** | **20** |
| Wind speed, m/s | 41 | | 48 | | 59 | 73 |
| Panel clearance (Cp), mm, max/min | **691** / 554 | **560** / 445 | **691** / 554 | **560** / 445 | **691** / 554 | **691** / 554 |
| Max/Min post height above the ground, mm, from Clenergy | 1000 / 863 | 1200 / 1085 | 1000 / 863 | 1200 / 1085 | 1000 / 863 | 1000 / 863 |
| Spacing (S), m | **3.30** | **3.20** | **3.20** | **2.95 (2.85*)** | **2.85** | **1.95 (1.90*)** |
| Max Vertical Uplift Reaction, kN | 6.7 | 7.8 | 9.7 | 10.6 | 14.0 | 15.3 |
| Max Vertical Down Reaction, kN | 14.6 | 15.6 | 18.4 | 18.7 | 23.5 | 23.7 |
| Max Horizontal Reaction, kN | 4.3 | 7.3 | 5.7 | 9.2 | 7.7 | 8.0 |
| Max Moment at GL, kNm | 8.2 | 12.3 | 10.9 | 15.4 | 14.5 | 15.2 |
| **Soil Class** | **Driven post minimum embedment depth (D), m** | | | | | |
| Compact sand | 1.34 | 1.61 | 1.51 | N/A | 1.71 | N/A |
| Medium dense sand | 1.76 | N/A | N/A | N/A | N/A | N/A |
| Very Stiff to Hard clays | 1.38 | 1.67 | 1.56 | N/A | 1.78 | N/A |
| Firm to Stiff Clays | N/A | N/A | N/A | N/A | N/A | N/A |
| Driven post maximum embedment depth based on standard 2800 mm long post (m), from Clenergy | 1.937 | 1.715 | 1.937 | 1.715 | 1.937 | 1.715 |
| **Soil Class** | **Post embedded in concrete pier: 300 mm diameter concrete piers minimum depth (D), m** | | | | | |
| Compact sand | 0.90 | 1.05 | 1.00 | 1.10 | 1.10 | 1.10 |
| Medium dense sand | 1.10 | 1.30 | 1.25 | 1.45 | 1.40 | 1.40 |
| Very Stiff to Hard clays | 0.85 | 1.05 | 1.00 | 1.15 | 1.10 | 1.10 |
| Firm to Stiff Clays | 1.25 | 1.50 | 1.40 | 1.65 | 1.60 | 1.60 |

Notes.
- This certification is applicable only for Standard STII-A (double support) with dimensions as shown in the Figures 1-4 and the panel clearance above the ground (Cp) as mentioned in the Table 1. Contact Gamcorp for customised STII-A or if the site conditions are not covered by the soil classes considered in this assessment.
- For concrete piers foundation we recommend to use 25 MPa strength concrete. Other pier sizes possible, contact Gamcorp. The minimum post embedment depth in the pier shall be approximately 0.9 of the pier depth.
- (*): when using Clenergy East-West adaptor (if different to the spacing without adaptor);
- T-Rails overhang: 0.4*S maximum.
- Other pier sizes are possible. In the case of ø250mm concrete pier, the pier depth will increase approx. 20% comparing with the ø300mm pier depth. Contact Gamcorp for the pier depth of other pier diameters.

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Table 2. Assumed capacity for adopted soil classes

| | ABC (Allowable Bearing Capacity), kPa |
|---|---|
| Compact sand | ≥300 |
| Medium dense sand | 150 - 300 |
| Very Stiff to Hard clays | 300 - 600 |
| Firm to Stiff Clays | 100 - 150 |

The maximum frame spacing is based on the structural capacity of the frame in the perimeter zone of an array. We recommend to perform tests on site for the geotechnical capacity of the driven post. The spacing may need to be decreased to achieve the available geotechnical capacity of the driven post following from the test results.

Construction is to be carried out strictly in accordance with the instruction manual. This work was designed in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles. This assessment excludes solar panels themselves. This certification is valid till **31 August 2022**, unless any of the relevant Australian Standards becomes updated before the due date.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd

L. van Spaandonk
Principal Engineer
FIEAust CPEng NER

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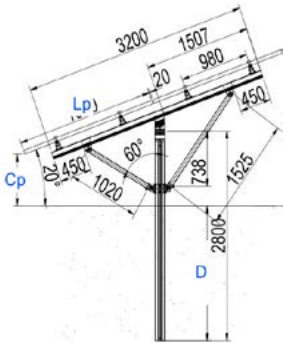


Fig. 1

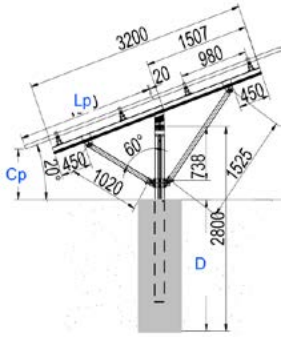


Fig. 2

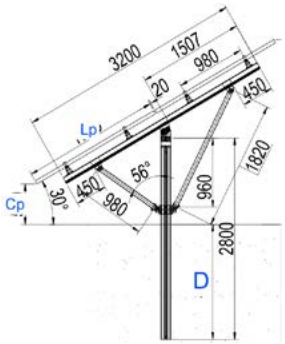


Fig. 3

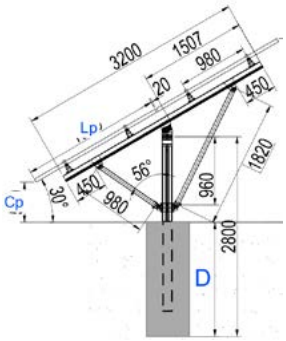


Fig. 4

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