PV-ezRACK®

Penetrative Tilt Legs

Code-Compliant Planning and Installation Guide V 6.1
Complying with AS/NZS 1170.2:2021

SOLAR ROOF

Last Updated - Dec. 2023

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 Universall 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 Australia.

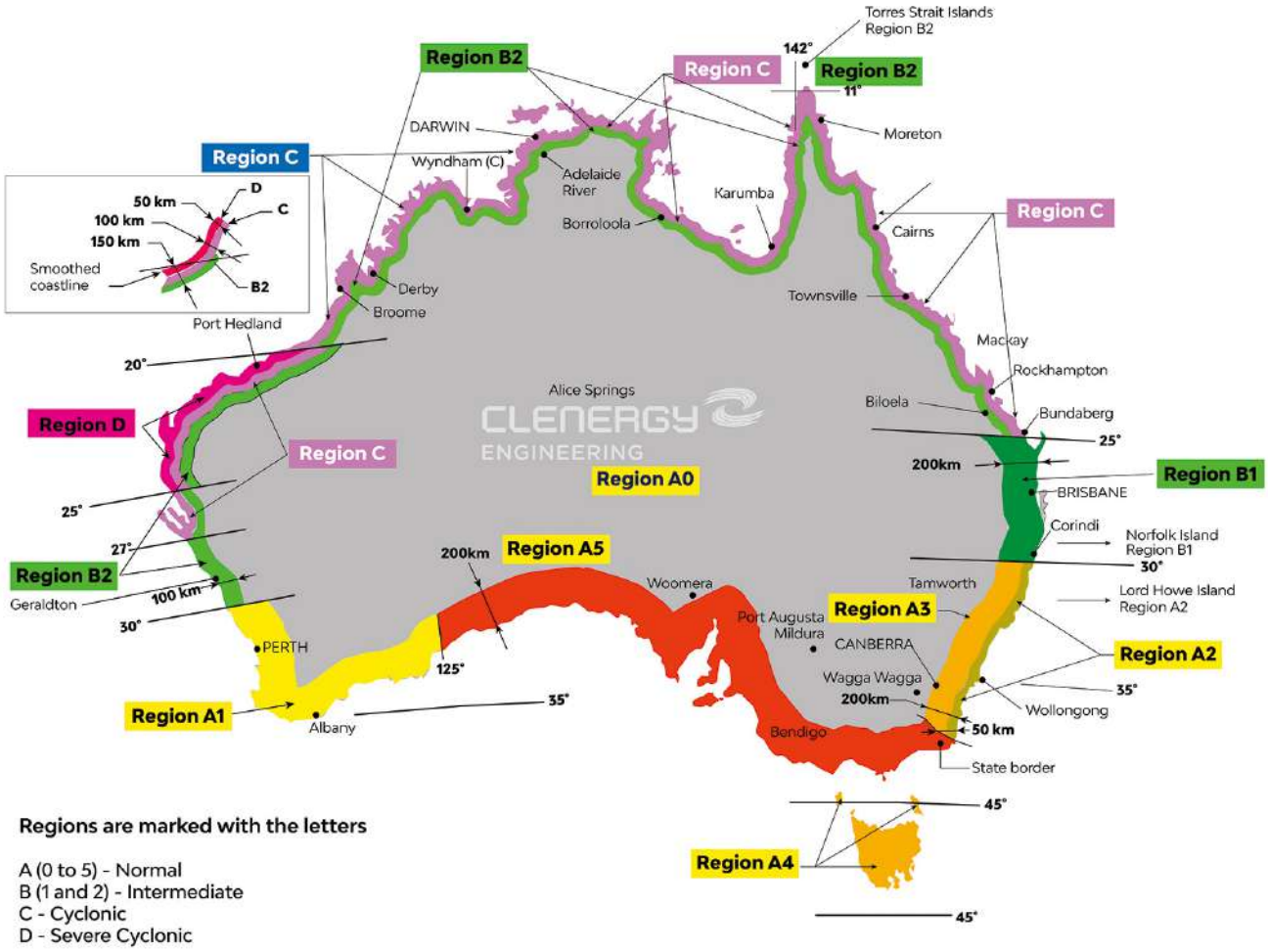
Product Warranty:
Please refer PVezRack® Product Warranty on our website.

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 PVezRack®and other products are appropriate for the particular installation and the installation environment;
- Using only PVezRack® parts and installer-supplied parts as specified by PVezRack® 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;
- Veryfying atmospheric corrosivity zone of installation site by referring to AS 4312-2008 or consulting local construction business to determine appropriate products and installations.

Planning

Determine the wind region of your installation site



Wind Regions – Australia

Wind regions are pre-defined for the whole of Australia by the Australian Standard 1170.2:2021. Comparing to 1170.2:2011, 2021 version has a lot of changes in wind regions.

- Central Australia is now classified as Wind Region A0 and Terrain Classification 2 instead of Wind Region A4.
- Region A1, previously most of the South coast of Australia, now is divided into Regions A1 and A5.
- Tasmania is now Region A4.
- Region B has been divided into regions B1 and B2. This will affect installations in Northern NSW, Gold Coast, Brisbane, Sunshine Coast, and Gladstone.
- Region B1 was increased to include more inland cities around Brisbane. This will likely mean extra structural requirements such as extra rail for installs.

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.

In 1170.2-2021, Terrain category 1.5 was removed and Terrain category 2.5 was added. See the definitions below.

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 2.5 (TC2.5) – Terrain with some trees or isolated obstructions, terrain in developing outer urban areas with scattered houses, or larger acreage developments with more than two and less then 10 buildings per hectare.

Terrain Category 3 (TC3) – Terrain with numerous closely spaced obstructions having heights generally from 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.

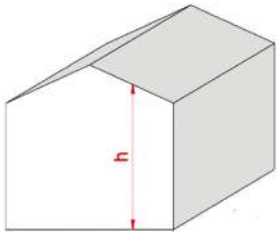
If your installation site is not at TC 2, 2.5 or 3, please contact Clenergy to obtain a project specific engineering certificate to support your installation.

Verify Atmospheric Corrosivity Zone of Installation Site

Please refer to "AS 4312-2008 Atmospheric Corrosivity Zones in Australia" or consult local construction business to verify corrosivity category of installation site to determine appropriate corrosivity class roof interface screw.

Determine the Height of the Installation Site

This document provides sufficient information for the PVezRack® SolarRoof system installation up to 30 meters building height (average roof height of structure above the ground, see the diagram below). If your building is more than 30 meters high, please contact Clenergy to obtain project specific engineering certificate to support your installation.

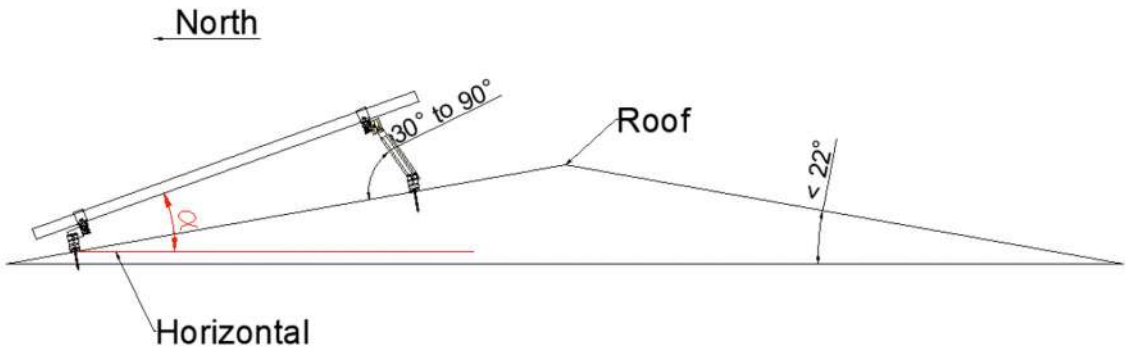


Determine Roof slope and Tilt Leg Angle

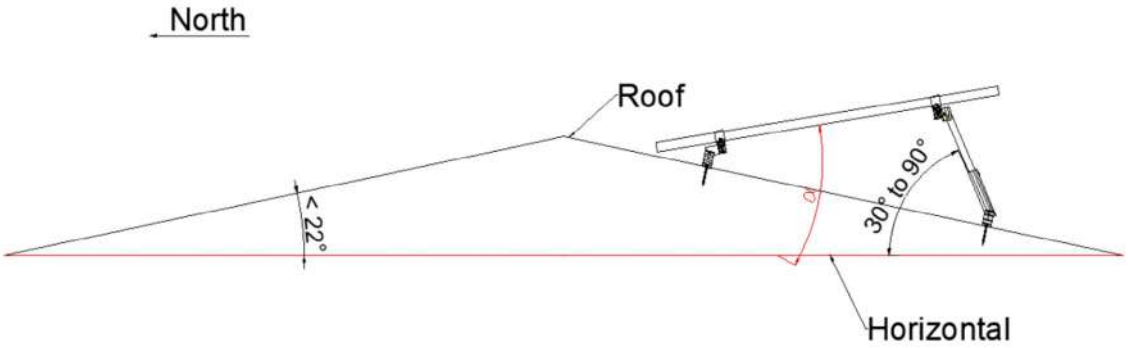
The PV-ezRack® SolarRoof Tilt Legs system is suitable for roof slope up to 22° for rails running perpendicular to the roof slope (including standard and reverse tilt), and up to 10° for rails running parallel to the roof slope. See the diagrams of 3 different scenarios below.

Please always keep back leg tilt within 30° - 90° from roof plane or horizontal depending on certain scenario.

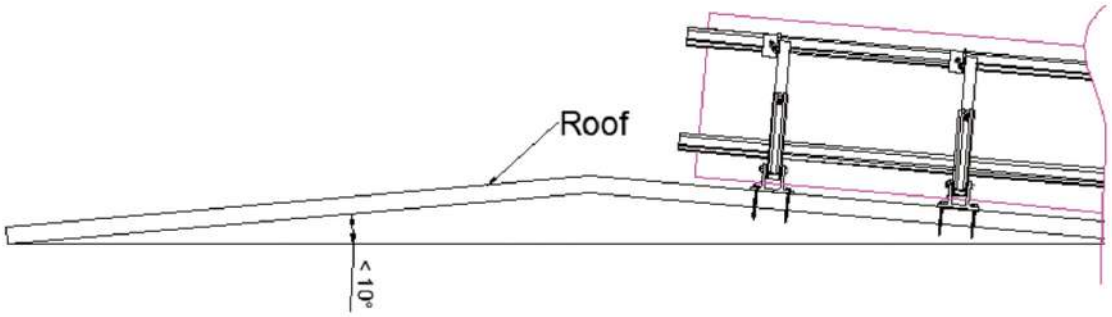
Standard Tilt – Rails perpendicular to Roof Slope

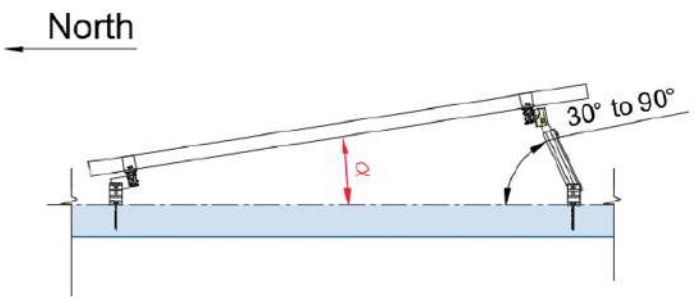


Reverse Tilt – Rails perpendicular to Roof Slope



Standard Tilt – Rails parallel to Roof Slope

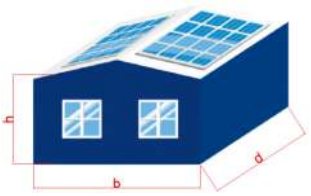




Determine the Installation Area of Roof

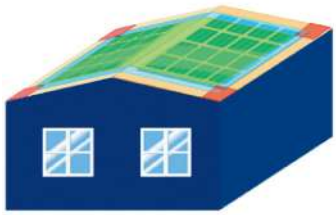
There are 4 different roof zones for tilt leg installation: Internal Zone, Intermediate Zone, Edge Zone and Corner Zone. Please see diagrams and steps below to define area of each zone.

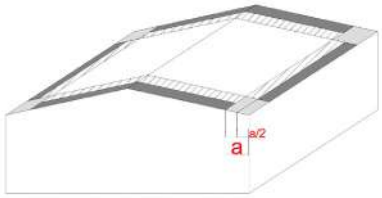
Step 1. Determine building height (h), width (b) and length (d)
Step 2. Check ratio of height to length/width (h/b and h/d)
If both h/b and h/d < 0.2, then a = 2h
Step 3. If h/b and h/d > 0.2 then a = the lowest value between 0.2b and 0.2d

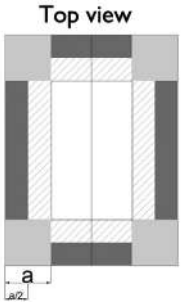


Roof zone definition

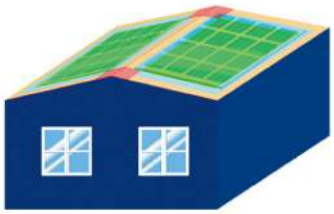
Roof Pitch < 10°

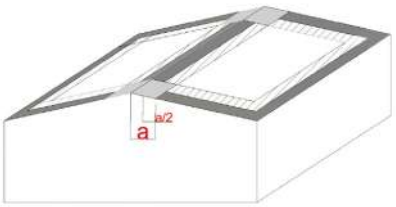


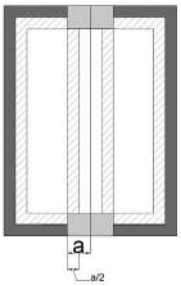




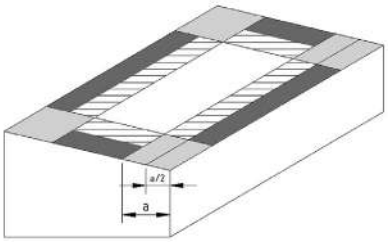
Flat/Mono – Slope Roof > 10°

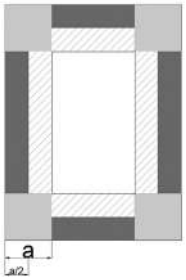




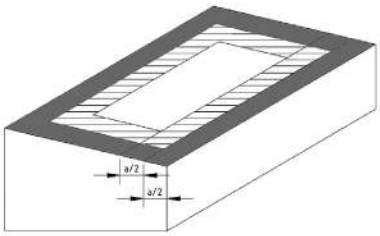


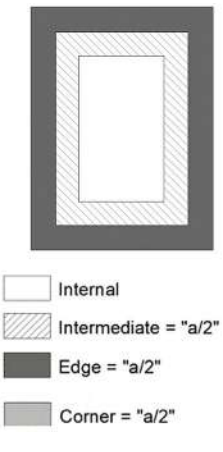
Flat/Mono – Slope Roof < 10°





Flat/Mono – Slope Roof > 10°





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 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 a note 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 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

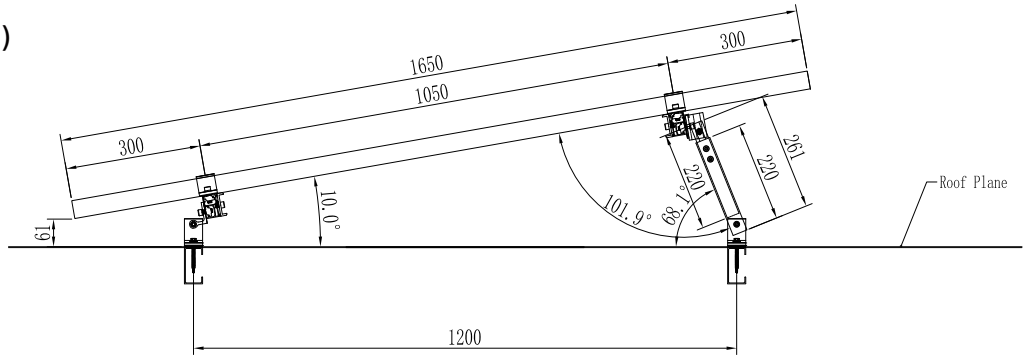
Purlin spacing		1200 mm					1400 mm					1700 mm				
	Product	10°	15°	30°	45°	60°	10°	15°	30°	45°	60°	10°	15°	30°	45°	60°
1650 mm panel in portrait	ER-TL-10/15	√ (1)	√ (2)	×	×	×	√ (6)	×	×	×	×	×	×	×	×	×
	ER-TL-15/30	×	×	×	×	×	×	√ (8)	×	×	×	×	×	×	×	×
	ER-TL-30/60	×	×	√ (3)	√ (4)	×	×	×	√ (10)	√ (12)	×	×	×	√ (14)	×	×
1960 mm panel in portrait	ER-TL-10/15	×	×	×	×	×	√ (7)	×	×	×	×	×	×	×	×	×
	ER-TL-15/30	×	×	×	×	×	×	√ (9)	×	×	×	×	×	×	×	×
	ER-TL-30/60	×	×	×	√ (5)	×	×	×	√ (11)	√ (13)	×	×	×	√ (15)	×	×

Note: √ indicates applicable; × indicates not applicable

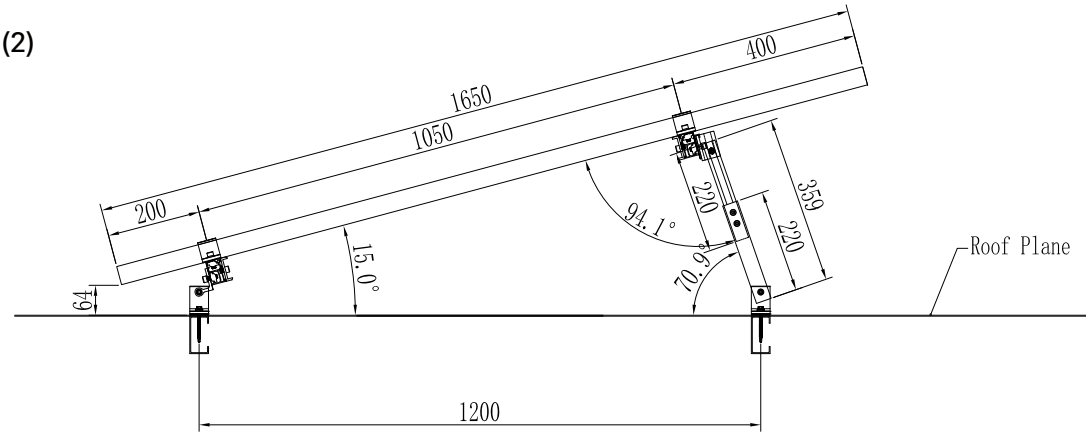
The table above is based on:

1. The panels are clamped within one quarter of panel length;
2. 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;
3. If the info. is different from the table and diagram, it could have different results. Please contact the Clenergy to confirm its applicability.

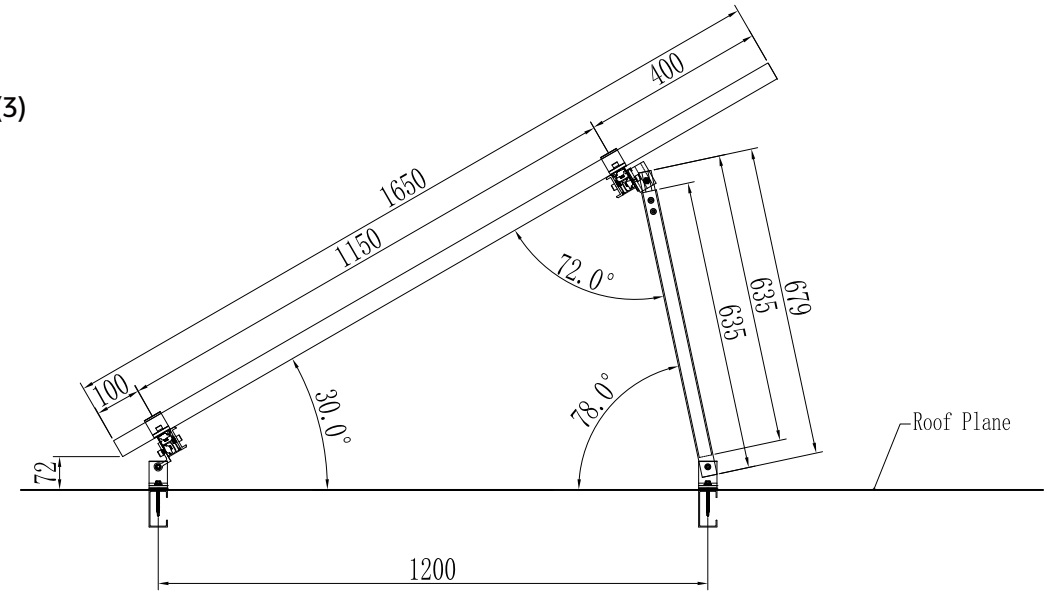
(1)


1650
1050
300
300
361
220
220
101.9°
68.1°
10.0°
61
Roof Plane
1200

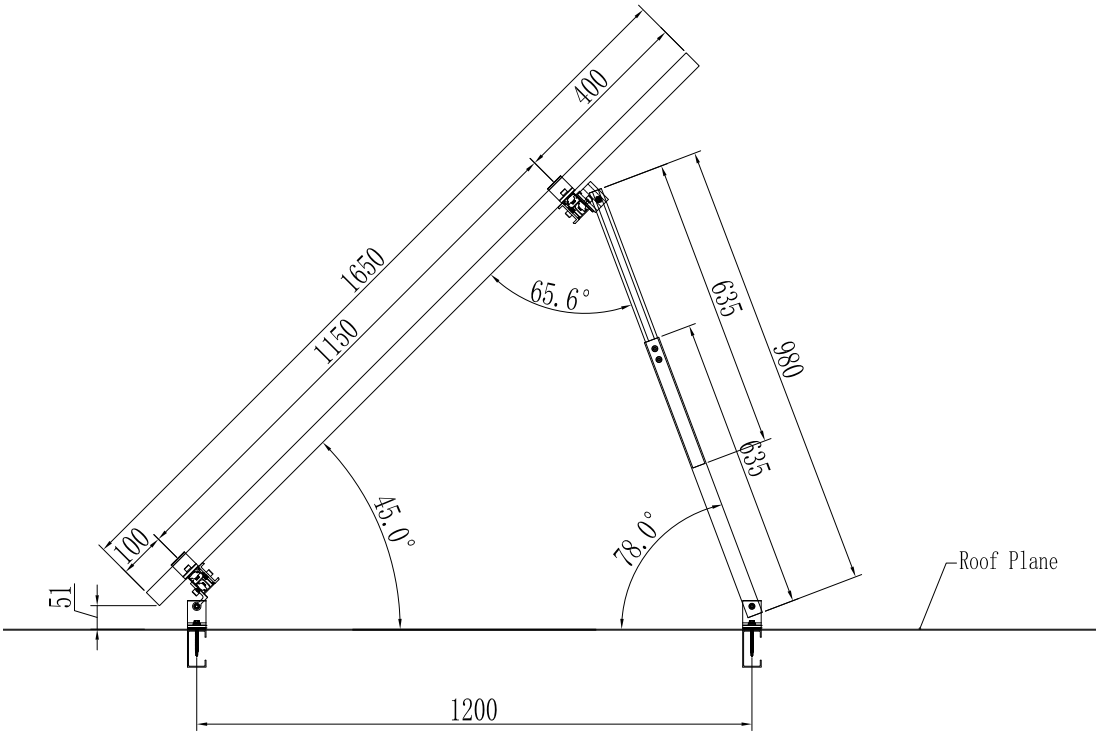
(2)


400
1650
1050
200
359
220
220
94.1°
70.9°
15.0°
64
Roof Plane
1200

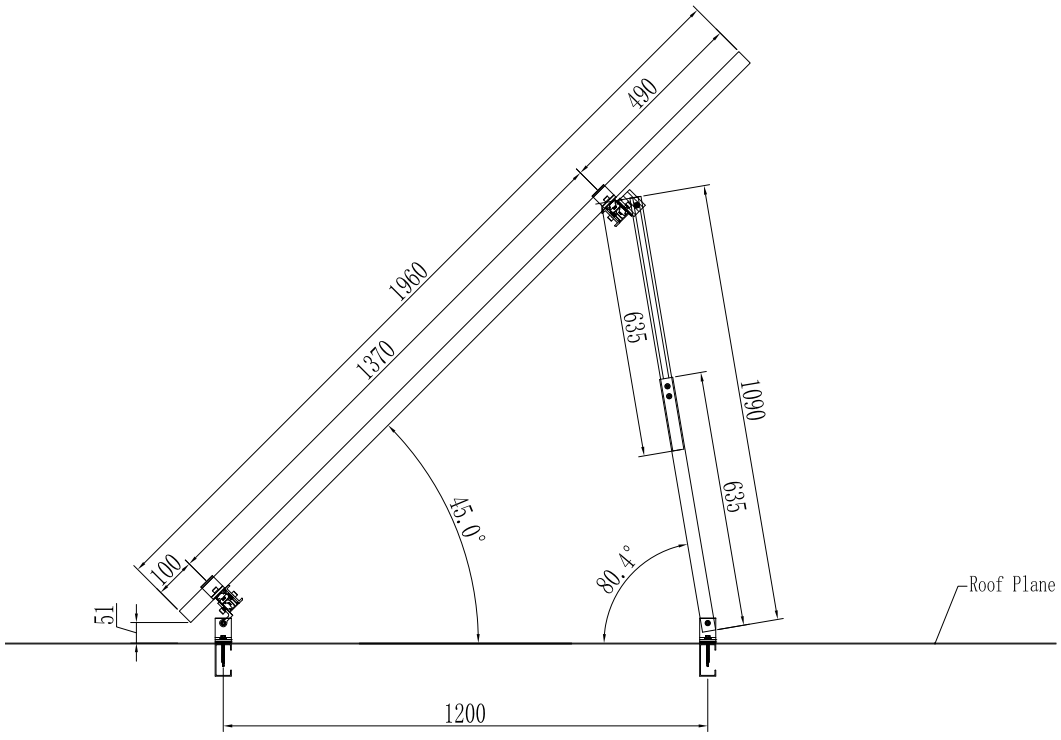
(3)


400
1650
1150
100
679
635
635
72.0°
78.0°
30.0°
72
Roof Plane
1200

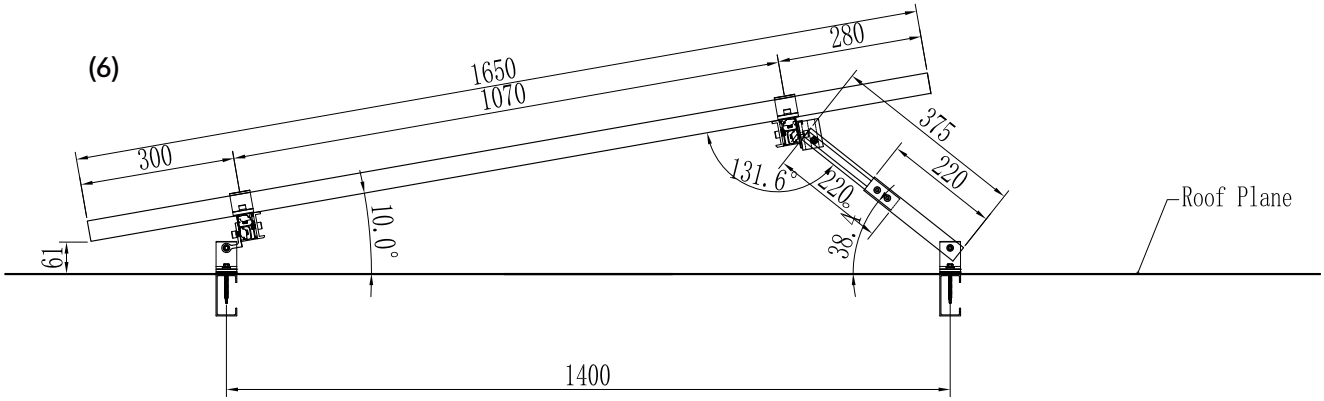
(4)


400
1650
1150
65.6°
635
980
635
45.0°
78.0°
100
51
Roof Plane
1200

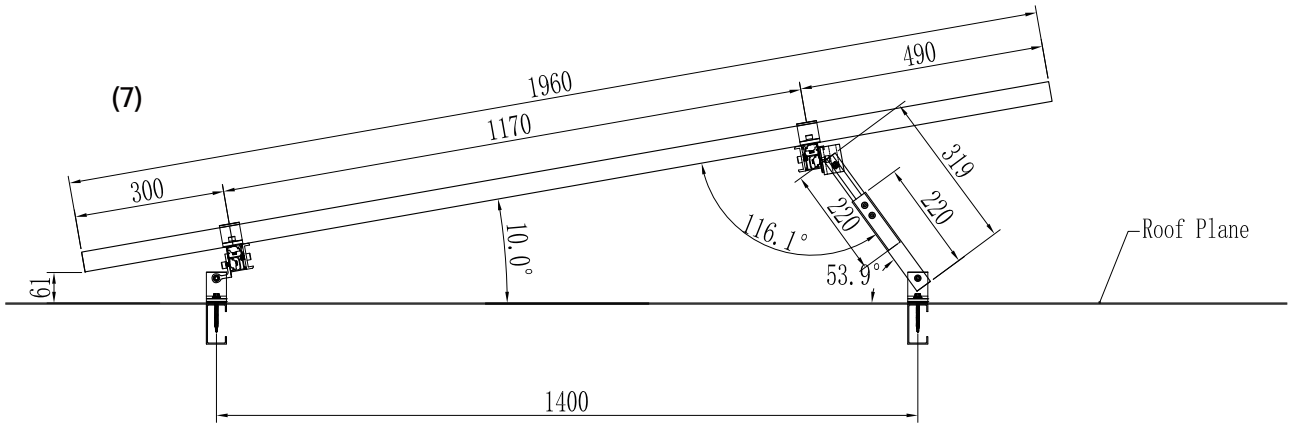
(5)


490
1960
1370
635
1090
635
45.0°
80.4°
100
51
Roof Plane
1200

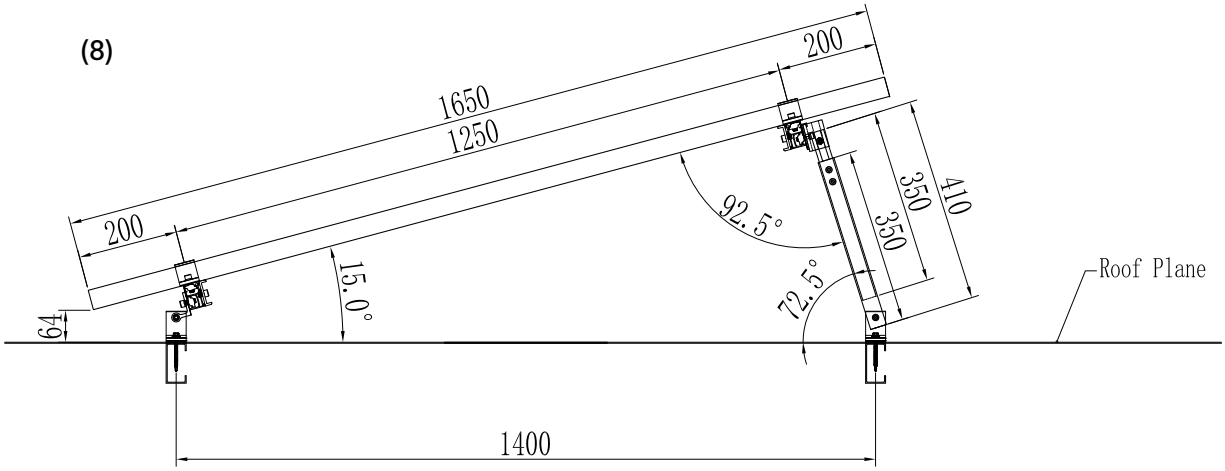
(6)


280
1650
1070
300
375
220
131.6°
220
38°
10.0°
61
Roof Plane
1400

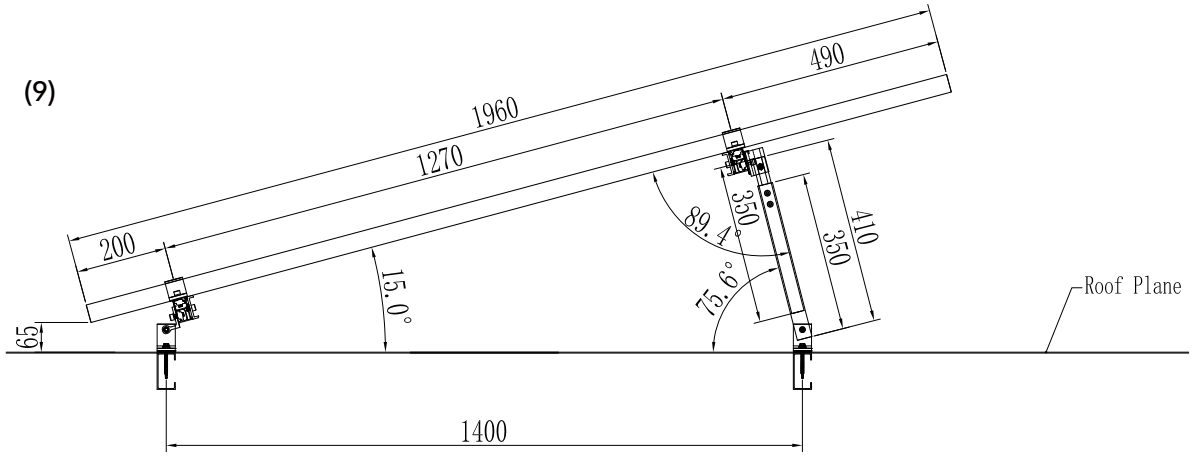
(7)


490
1960
1170
300
319
220
220
116.1°
53.9°
10.0°
61
Roof Plane
1400

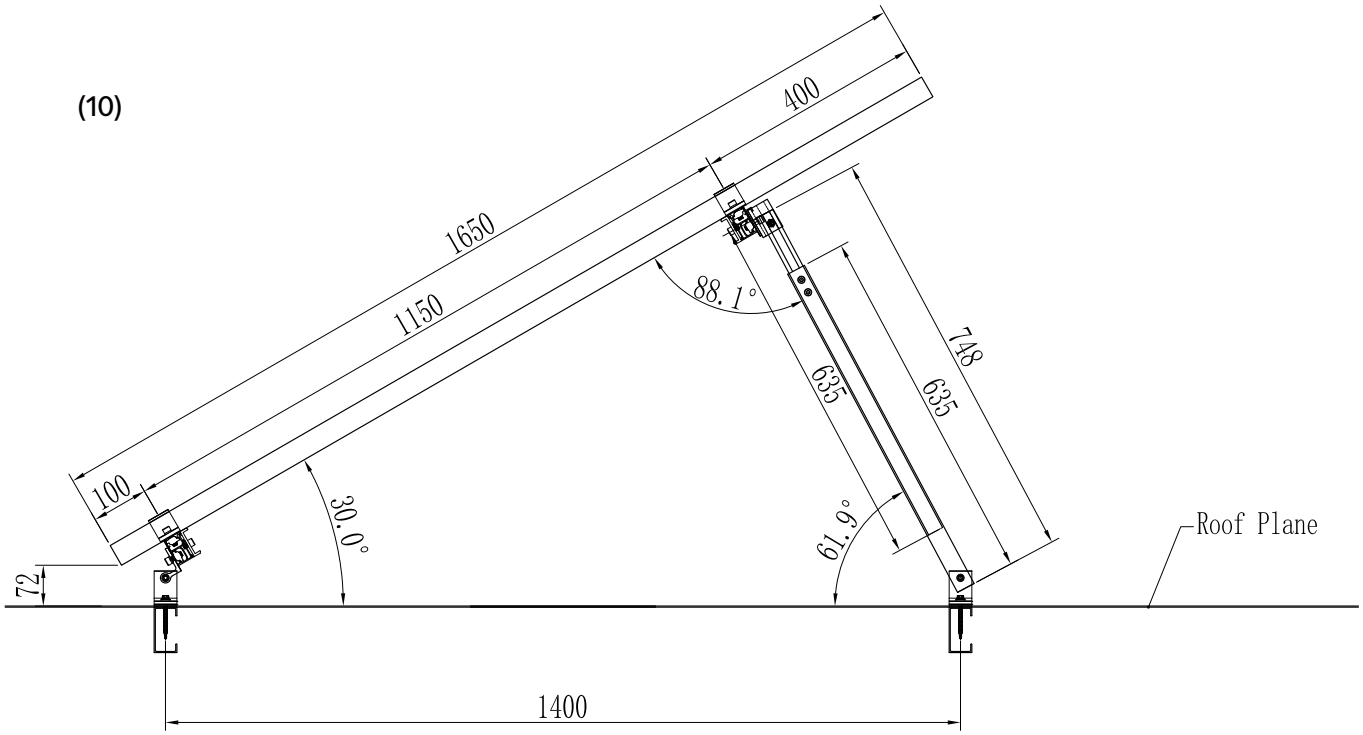
(8)


200
1650
1250
200
350
410
350
92.5°
72.5°
15.0°
64
Roof Plane
1400

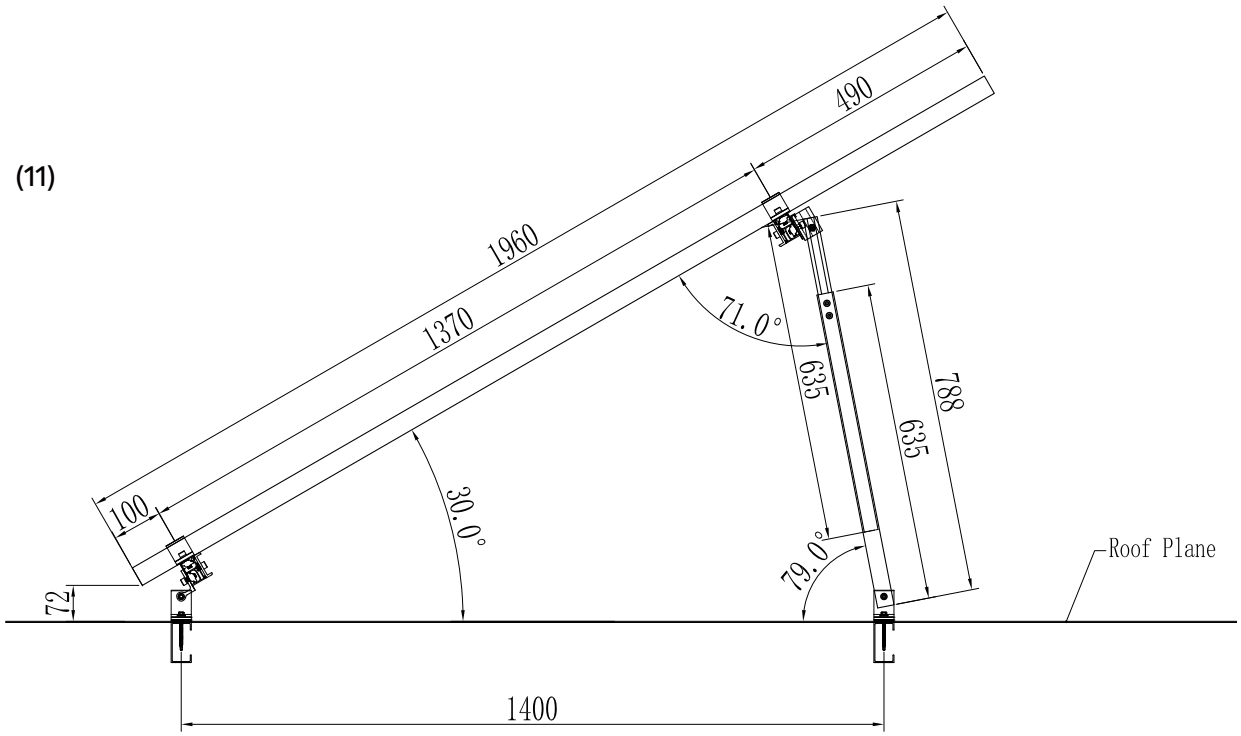
(9)


490
1960
1270
200
15.0°
89.4°
350
410
350
75.6°
Roof Plane
65
1400

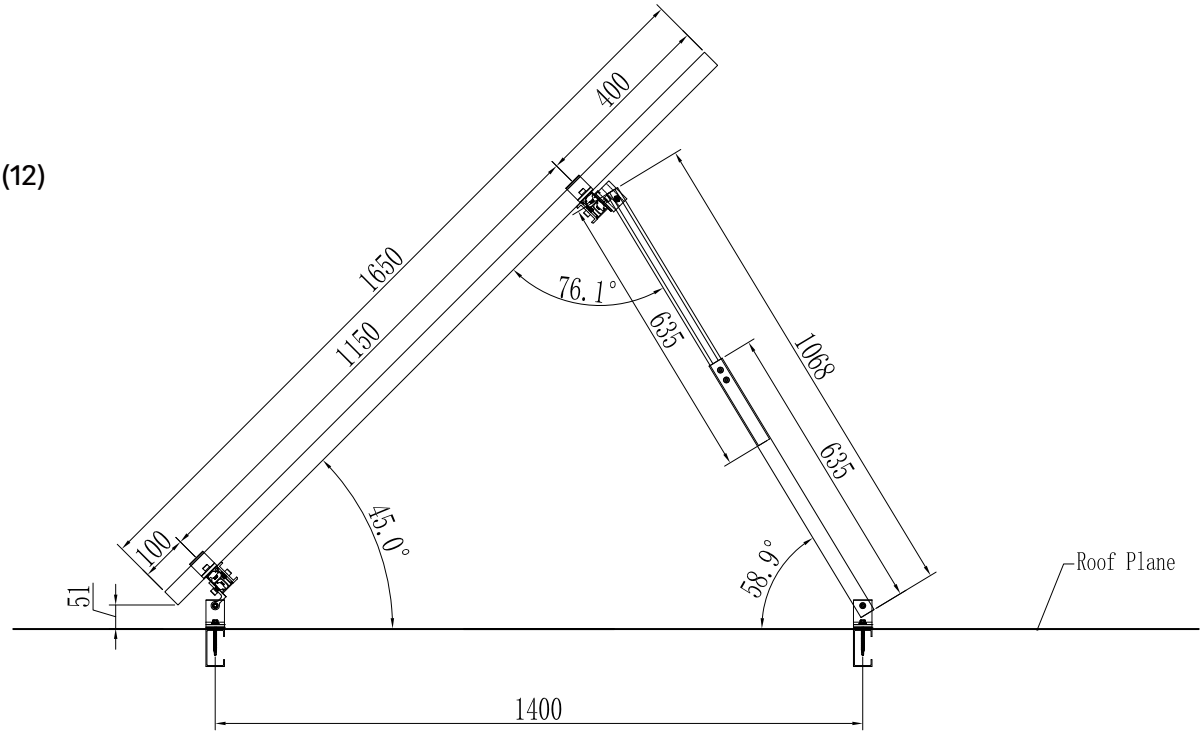
(10)


400
1650
1150
88.1°
748
635
635
100
30.0°
61.9°
Roof Plane
72
1400

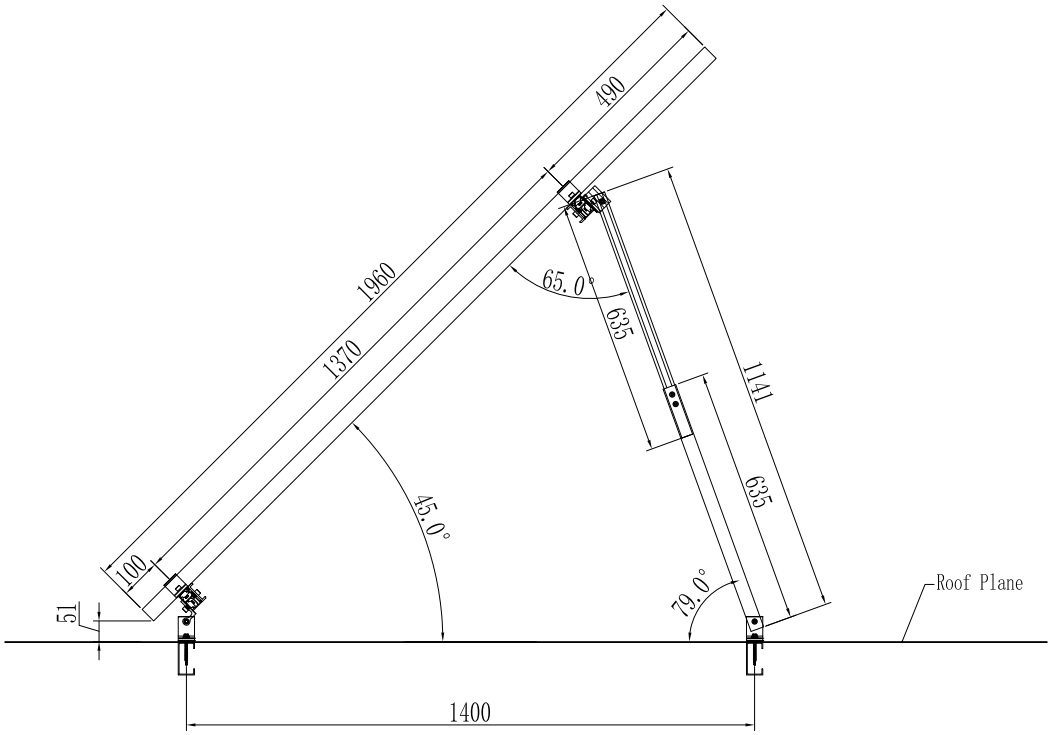
(11)


490
1960
1370
71.0°
635
788
635
100
30.0°
79.0°
Roof Plane
72
1400

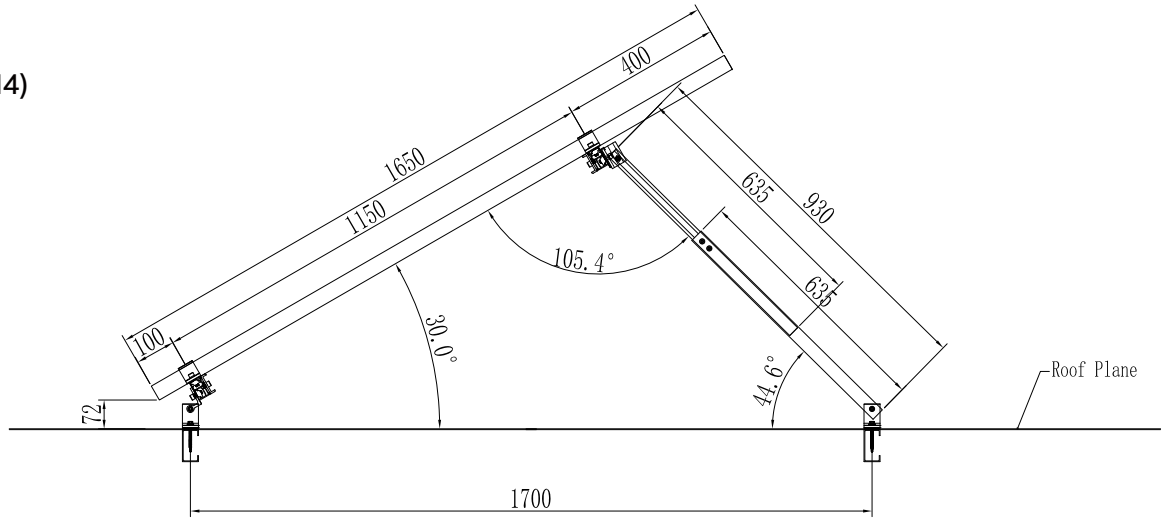
(12)


400
1650
1150
76.1°
635
1068
635
100
45.0°
58.9°
Roof Plane
51
1400

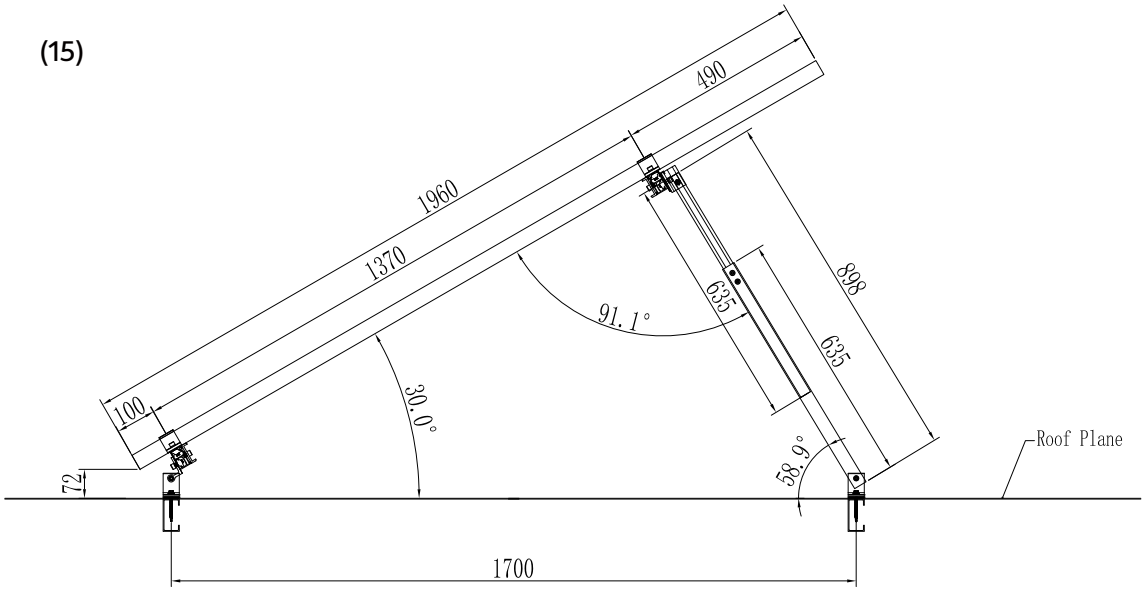
(13)


490
1960
1370
65.0°
635
1141
635
45.0°
100
51
79.0°
Roof Plane
1400

(14)


400
1650
1150
635
930
105.4°
635
100
30.0°
44.6°
Roof Plane
72
1700

(15)

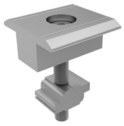


Tools and Components

Tools

Screw Driver (maximum torque≥34N·m)	Torque Spanner	Socket Wrench M8	5m Tape	String & Marker Pen

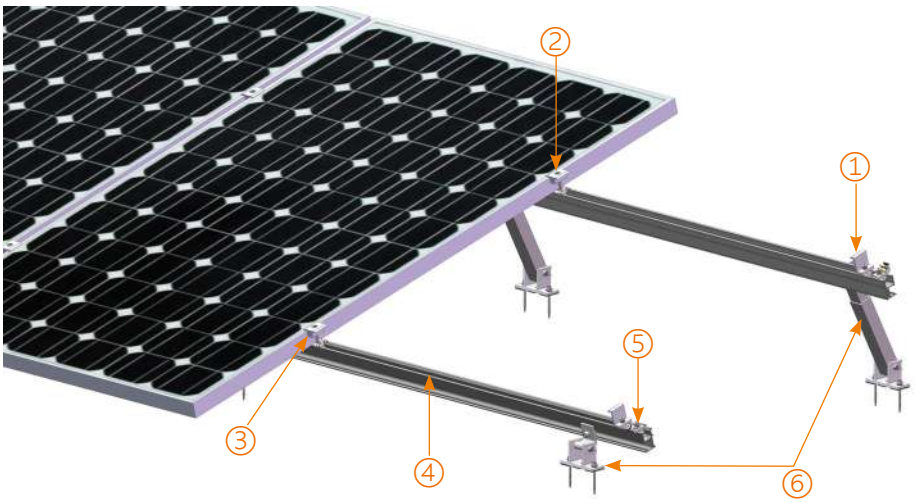
Components

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

System Overview

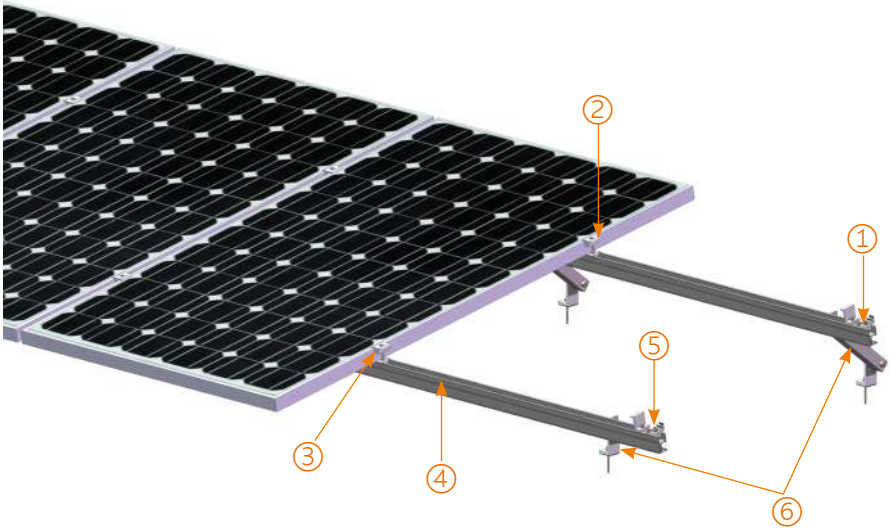
Overview of PV-ezRack® SolarRoof Adjustable Tilt Legs

Adjustable Tilt Legs



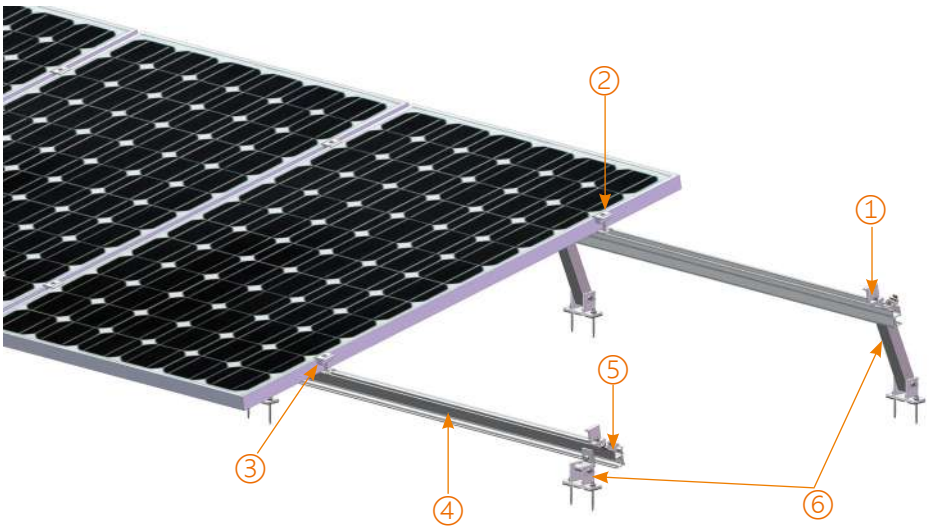
1. End Clamp 2. Inter Clamp 3. Grounding Clip 4. ECO-Rail 5. Grounding Lug 6. Adjustable Tilt Legs

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.

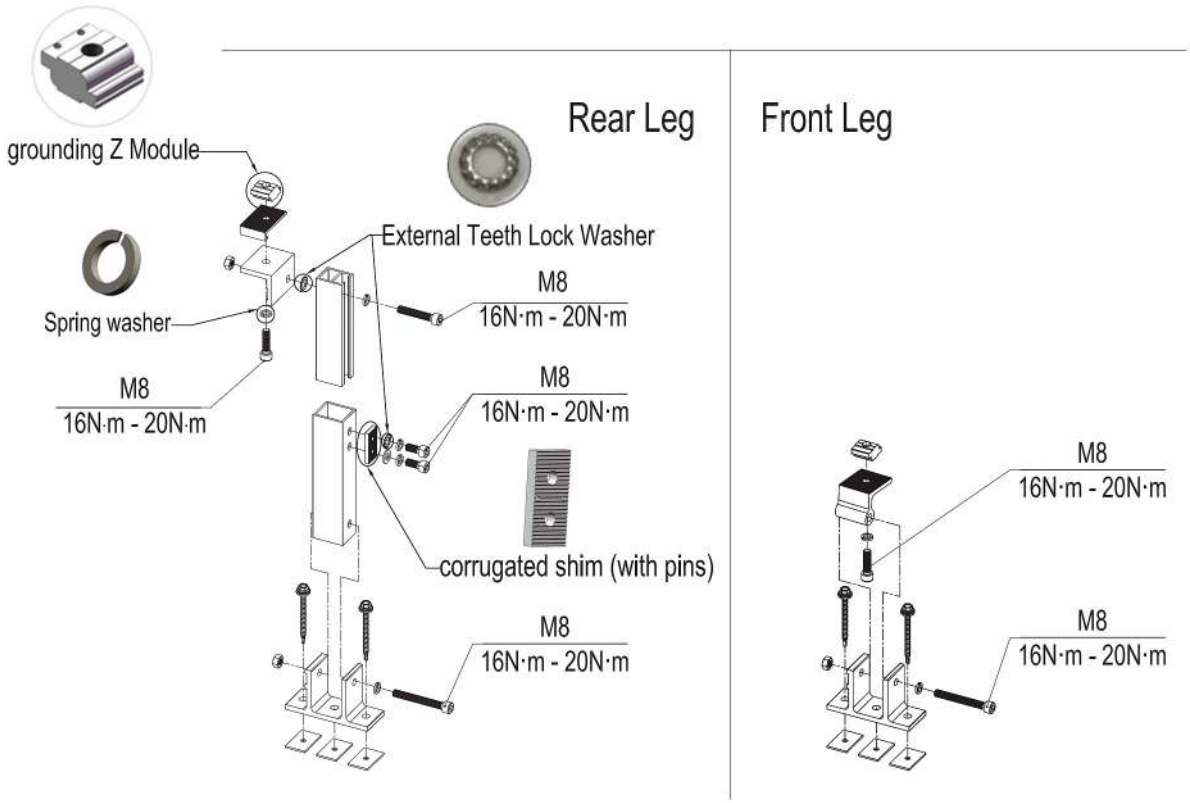
General installation instructions:

(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

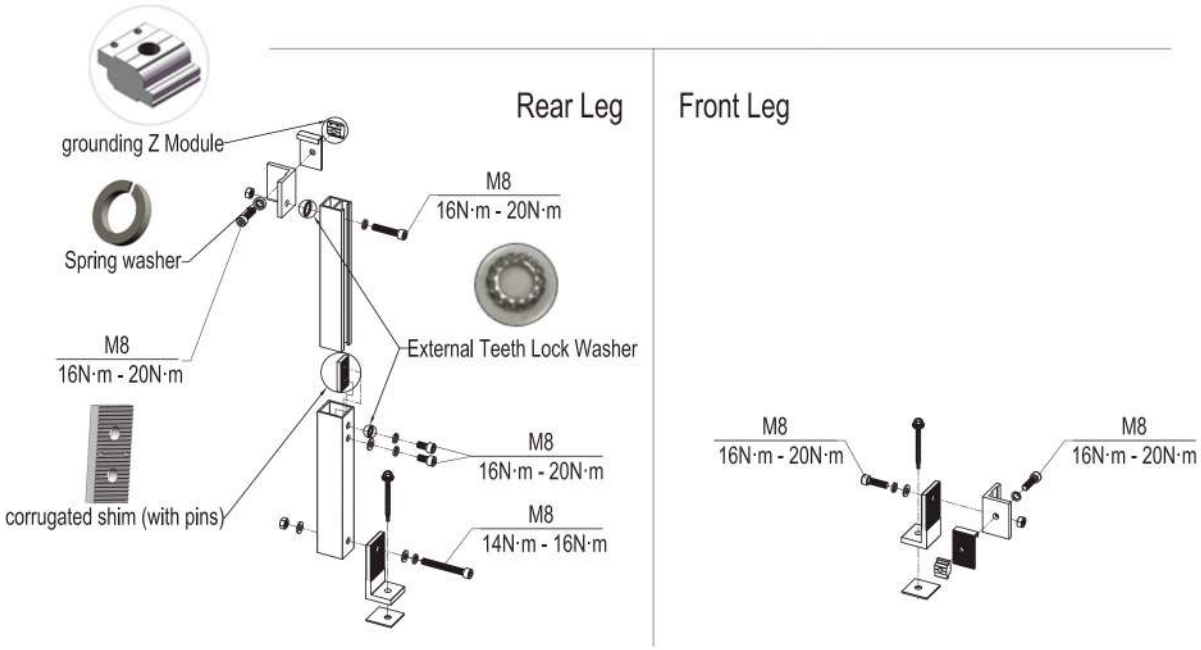
Please refer to safe torques defined in this guide as shown in the figure below. If power tools are required, Clenergy recommends the use of low speed only. High speed and impact drivers increase the risk of bolt galling (deadlock). If deadlock occurs and you need to cut fasteners, please make sure that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

1) Adjustable Tilt Legs



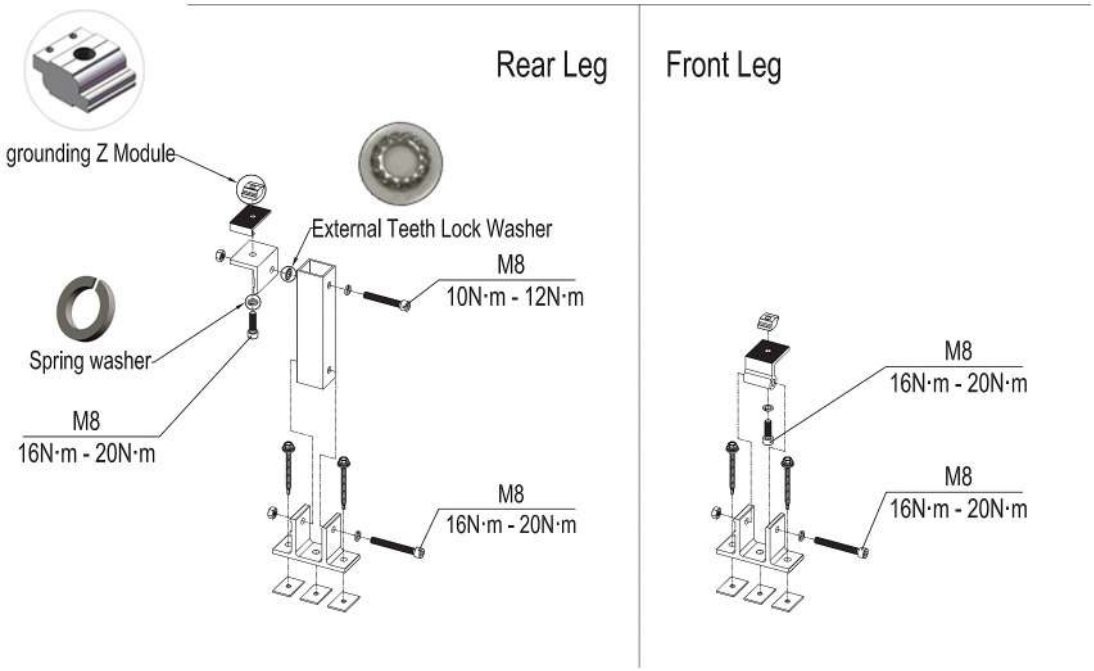
Note:
Grounding Z Module, External Teeth Lock Washers, Spring washer and corrugated shim (with pins) on the diagram above are to create the electrical continuity between rail and rear leg tubes.

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.

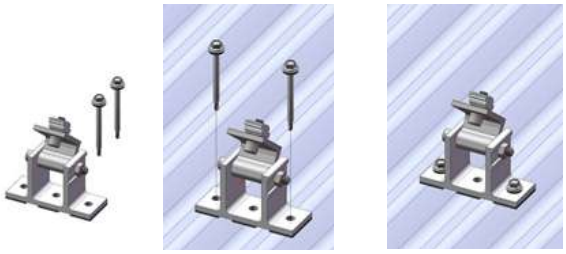


Figure 1
(Front Leg Installation with Two Screws)

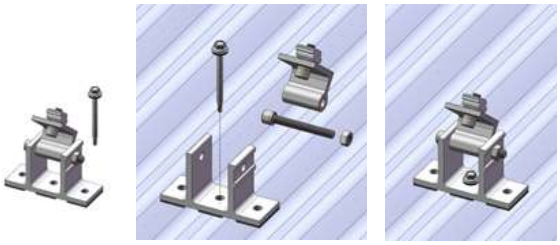


Figure 2
(Front Leg Installation with Single Screw)

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.

Under Tightened Correctly Tightened Over Tightened

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

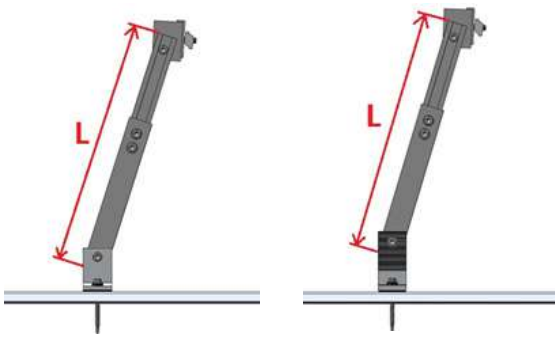


Figure 4

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.

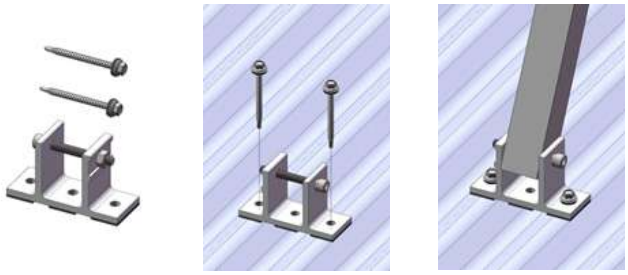


Figure 5
(Non-preassembly Rear Leg Installation with Two Screws)

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.

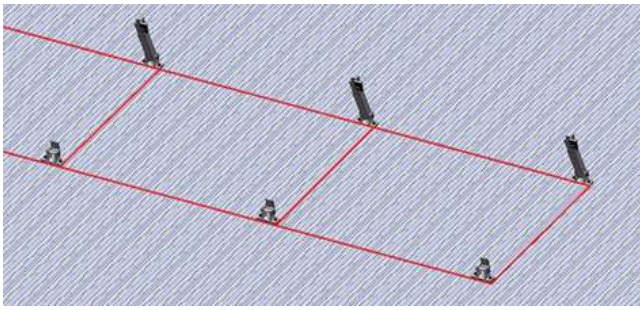


Figure 10

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.

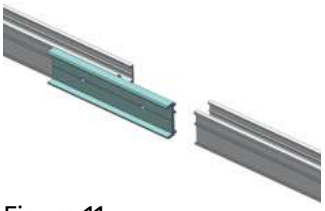


Figure 11

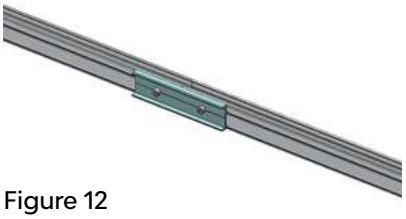


Figure 12

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.

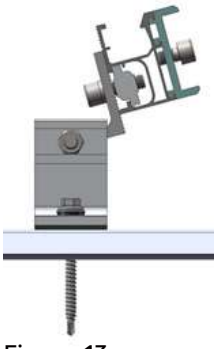


Figure 13

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

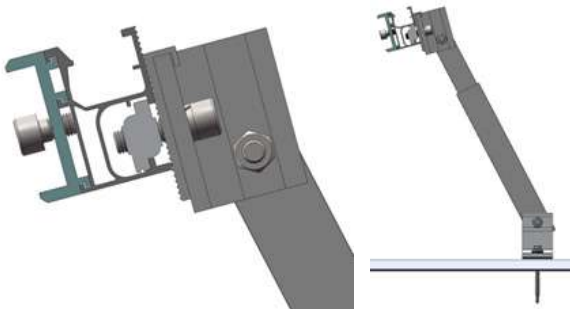


Figure 14

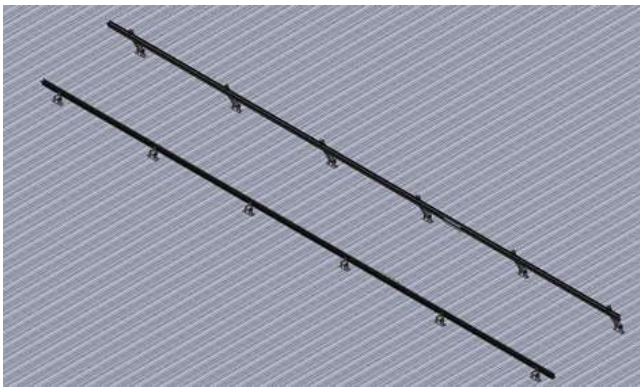


Figure 15

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 (P17)**".

Certification

MW Engineering Melbourne

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ABN 37 605 815 585

28 August 2023

Clenergy Australia
1/10 Duerdin Street
Clayton, VIC 3168

CERTIFICATION LETTER

Clenergy PV ez-Rack penetrative tilt Certification – TC2, 2.5, 3 – Wind Region A, B1, B2 C, D. Project No.: **CL-530-S-REV 3**. Internal REF: **00631.**

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

- **Wind Loads to AS 1170.2-2011 AMDT 4-2016**
  - **Wind Terrain Category 2, 2.5 and 3**
  - **Wind average recurrence of 200 years**
  - **Wind Region A, B1,B2, C and D**
- **Solar panel length up to 2.4 m**
- **Solar panel width up to 1.2m**

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

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

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

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

Best Regards,

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August 2023

STRUCTURAL DESIGN CERTIFICATION

PV-ezRACK®

SOLAR ROOF

Penetrative tilt interface spacing tables

Standard: AS/NZS 1170.2:2021

Terrain Category: 2, 2.5 & 3

Client: Clenergy Australia

REF: 00631

Date: AUGUST 2023

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Client reference: CL-530-S-REV3

Project: PV ez-Rack SolarRoof penetrative tilt interface spacing tables

Australian Standards

AS/NZS 1170.0:2002 (R2016)	**General Principles**
AS/NZS 1170.1:2002 (R2016)	**Imposed loadings**
AS/NZS 1170.2:2021	**Wind Loadings**
AS/NZS 1664.1:1997-Amdt 1:1999	**Aluminium**

Rail type: ECO-RAIL

Wind Terrain Category: 2, 2.5 & 3

Wind average recurrence: 200 years

This engineering document was designed to cater for most common installation scenarios defined with an importance level 2 (200 years wind average recurrence) such as residential shed or garage, small - isolated warehouses and farm sheds, residential carports, and one or double storey dwelling. If the project conditions do not fit on the above criteria, please contact Clenergy for an assessment.

From 1 May 2023 installers must follow AS/NZS1170.2:2021 only.

Designed: AE

Date: AUGUST 2023

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

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

0° < α < 10°

Type of Rail ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	0° ≤ α < 10°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	2095	1676	1270	838	1907	1525	1156	763	1844	1475	1117	738	1540	1232	933	616	1485	990	743	495
B1	1812	1246	944	623	1464	1171	887	585	1432	1146	868	573	1214	972	736	486	1093	729	546	364
B2	1746	1202	911	563	1411	1130	856	529	1382	1107	784	518	1172	939	664	439	1055	697	494	330
C	1354	1083	821	542	1115	892	676	446	1068	854	647	427	783	627	475	313	686	458	343	229
D	1041	833	631	417	937	750	568	375	664	531	402	266	625	500	379	250	547	364	273	182

ANGLE TO THE HORIZONTAL	0° ≤ α < 10°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	2011	1609	1219	805	1830	1464	1109	732	1770	1416	1073	708	1478	1183	896	591	1426	950	713	475
B1	1739	1196	906	598	1405	1124	851	562	1375	1100	833	550	1166	933	707	466	1049	699	525	350
B2	1677	1155	839	540	1355	1085	768	508	1327	1063	753	497	1126	879	639	422	1013	631	474	317
C	1300	1040	788	520	1070	856	649	428	1025	820	621	410	752	601	456	301	659	439	329	220
D	1000	800	606	400	900	720	545	360	637	510	386	255	600	480	364	240	525	350	262	175

ANGLE TO THE HORIZONTAL	0° ≤ α < 10°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1959	1567	1187	784	1783	1426	1080	713	1724	1379	1045	690	1440	1152	873	576	1388	926	694	463
B1	1694	1165	882	582	1368	1095	829	547	1339	1071	812	536	1135	908	688	454	1022	681	511	341
B2	1634	1125	797	526	1320	1047	749	495	1294	967	734	484	1097	820	622	411	987	616	462	308
C	1266	1013	767	506	1042	834	632	417	998	799	605	399	732	586	444	293	642	428	321	214
D	974	779	590	389	876	701	507	335	621	497	376	248	584	467	354	234	511	341	256	170

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

10° ≤ α < 15°

Type of Rail — ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension — 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	10° ≤ α < 15°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1869	1525	1156	763	1716	1373	1040	686	1602	1281	971	641	1351	1081	819	541	1251	834	626	417
B1	1355	1084	821	542	1152	922	698	461	976	781	591	390	951	761	577	381	799	532	399	266
B2	1308	1013	742	490	1112	861	631	417	942	705	534	353	919	688	521	344	764	481	362	241
C	1201	961	695	459	854	683	517	341	645	516	391	258	554	443	336	222	429	286	215	143
D	974	709	537	354	663	530	402	265	380	304	230	152	438	351	266	175	351	234	176	117

ANGLE TO THE HORIZONTAL	10° ≤ α < 15°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1794	1464	1109	732	1647	1318	998	659	1538	1230	932	615	1297	1038	786	519	1201	801	601	400
B1	1301	1041	788	520	1106	885	670	442	937	749	568	375	913	731	554	365	767	511	383	256
B2	1256	940	712	471	1068	799	606	400	905	677	513	339	861	660	501	330	692	462	347	232
C	1153	881	635	419	820	656	497	328	620	496	376	248	532	426	323	213	412	275	206	137
D	935	663	494	327	636	509	385	254	365	292	221	146	421	337	255	168	337	225	169	112

ANGLE TO THE HORIZONTAL	10° ≤ α < 15°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1747	1426	1080	713	1604	1284	972	642	1497	1198	908	599	1264	1011	766	505	1170	780	585	390
B1	1267	1014	768	507	1077	862	653	431	912	730	553	365	890	712	539	356	747	498	373	249
B2	1224	915	694	459	1030	778	591	390	824	660	500	330	803	643	488	323	675	450	338	226
C	1123	817	619	408	798	639	484	319	603	483	366	241	518	415	314	207	402	268	201	134
D	870	604	450	298	619	451	341	225	355	284	215	142	410	328	248	164	329	219	164	110

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

15° ≤ α < 20°

Type of Rail ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	15° ≤ α < 20°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1686	1442	1092	721	1478	1182	895	591	1442	1153	874	577	1277	1022	774	511	1183	788	591	394
B1	1223	978	741	489	917	734	556	367	856	685	519	342	720	576	437	288	636	424	318	212
B2	1181	884	670	442	886	663	502	332	816	619	469	310	650	521	395	261	574	383	288	192
C	1121	804	599	396	728	583	441	291	641	513	388	256	473	379	287	189	364	243	182	121
D	826	572	427	284	681	520	394	260	477	381	289	191	409	327	248	163	320	213	160	107

ANGLE TO THE HORIZONTAL	15° ≤ α < 20°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1695	1384	1048	692	1418	1135	860	567	1384	1107	839	554	1226	981	743	490	1135	757	568	378
B1	1174	939	711	469	880	704	533	352	822	657	498	329	692	553	419	277	610	407	305	203
B2	1134	848	643	425	808	637	483	319	742	594	451	297	625	500	380	250	552	368	276	184
C	1027	730	544	360	699	559	424	280	615	492	373	246	455	364	275	182	350	233	175	117
D	788	520	389	257	654	469	351	232	458	366	277	183	392	314	238	157	307	205	154	102

ANGLE TO THE HORIZONTAL	15° ≤ α < 20°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1576	1348	1021	674	1382	1105	837	553	1348	1029	780	515	1194	955	724	478	1106	737	553	369
B1	1143	914	693	457	857	686	520	343	800	640	485	320	674	539	408	269	594	396	297	198
B2	1057	826	627	414	774	620	470	310	723	579	439	290	609	488	369	245	538	359	270	180
C	953	666	497	329	681	520	375	248	599	458	347	229	443	354	268	177	341	227	170	114
D	718	475	354	235	579	392	293	194	446	324	246	162	382	306	232	153	299	200	150	100

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

20° ≤ α < 25°

Type of Rail ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	20° ≤ α < 25°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1570	1265	968	633	1349	1037	793	519	1316	1012	774	506	1108	852	652	426	1022	681	511	341
B1	1103	848	649	424	827	636	486	318	772	594	454	297	621	478	365	239	526	350	263	175
B2	1014	767	586	384	761	575	440	288	697	537	411	269	561	432	331	217	475	317	238	158
C	930	660	492	327	665	511	391	256	621	477	365	239	412	317	242	159	332	222	166	111
D	713	471	352	233	622	435	332	217	435	335	256	167	404	311	238	155	280	187	140	93

ANGLE TO THE HORIZONTAL	20° ≤ α < 25°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1579	1215	929	607	1295	996	762	498	1263	972	743	486	1064	818	626	409	981	654	490	327
B1	1059	814	623	407	794	611	467	305	741	570	436	285	596	459	351	229	505	336	252	168
B2	956	736	563	369	717	552	423	277	669	515	395	258	539	415	317	208	456	305	229	152
C	893	601	447	297	638	491	375	245	596	437	335	219	396	304	233	152	319	213	160	106
D	647	428	319	212	543	386	289	191	418	321	235	153	388	285	218	142	269	179	134	90

ANGLE TO THE HORIZONTAL	20° ≤ α < 25°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1468	1129	864	565	1261	926	708	463	1230	860	658	430	1036	797	609	399	955	637	478	318
B1	1031	757	579	378	773	595	455	297	722	555	425	278	581	447	342	223	491	328	246	164
B2	931	684	524	342	698	538	411	269	653	502	384	252	525	404	309	202	445	297	222	149
C	830	547	408	271	622	435	332	217	580	406	306	203	385	296	227	148	311	207	155	104
D	590	391	292	194	487	322	242	161	407	285	218	142	378	264	202	132	262	174	131	87

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

25° ≤ α < 30°

Type of Rail ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	25° ≤ α < 30°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1530	1177	900	588	1254	965	738	482	1224	941	720	471	1017	782	598	391	950	633	475	317
B1	1001	770	589	385	700	539	412	269	700	539	412	269	564	434	332	217	520	347	260	173
B2	921	696	532	348	644	487	372	244	632	487	373	244	509	392	300	197	470	314	235	157
C	927	648	492	324	602	463	354	232	562	432	331	216	373	287	220	144	325	217	163	108
D	662	471	352	233	546	420	321	210	382	294	225	147	328	252	193	126	268	178	134	89

ANGLE TO THE HORIZONTAL	25° ≤ α < 30°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1468	1129	864	565	1204	926	708	463	1175	904	691	452	976	751	574	376	912	608	456	304
B1	961	739	565	369	672	517	396	259	672	517	396	259	541	416	318	208	500	333	250	167
B2	867	668	511	335	607	468	359	235	607	468	358	234	489	377	288	189	452	302	226	151
C	849	601	447	297	578	445	340	222	540	415	317	208	358	276	211	138	312	208	156	104
D	635	428	319	212	524	367	280	183	367	282	216	141	315	242	185	121	257	171	128	86

ANGLE TO THE HORIZONTAL	25° ≤ α < 30°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1430	1100	841	550	1173	902	690	451	1144	840	642	420	951	732	559	366	888	592	444	296
B1	936	720	550	360	655	504	385	252	655	504	385	252	527	405	310	203	487	324	243	162
B2	845	650	499	325	591	456	348	228	593	456	349	229	476	367	281	184	440	294	220	147
C	788	547	408	271	563	413	316	207	526	386	281	184	349	269	205	134	304	203	152	101
D	590	391	292	194	464	322	242	161	357	275	201	131	306	236	180	118	250	167	125	83

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

α = 30°

Type of Rail ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	α = 30°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1372	1056	807	528	1125	866	662	433	1098	845	646	422	865	665	509	333	793	528	396	264
B1	898	691	528	345	628	483	370	242	611	470	359	235	506	389	298	195	412	275	206	137
B2	811	625	478	313	568	437	335	219	552	425	325	213	457	352	269	177	373	249	186	125
C	794	561	419	277	512	394	301	197	504	388	297	194	357	274	210	137	259	173	130	86
D	585	400	299	198	489	376	275	180	352	271	207	136	314	241	185	121	208	138	104	69

ANGLE TO THE HORIZONTAL	α = 30°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1317	1013	775	507	1080	831	635	416	1054	811	620	405	830	638	488	319	761	507	380	254
B1	862	663	507	332	603	464	355	232	586	451	345	225	486	374	286	187	396	264	198	132
B2	779	600	459	301	545	420	321	210	530	408	312	204	439	338	258	169	358	239	179	119
C	726	509	380	252	491	378	289	189	484	372	285	186	342	263	201	132	249	166	125	83
D	549	363	272	181	448	328	246	163	338	260	199	130	301	232	177	116	199	133	100	66

ANGLE TO THE HORIZONTAL	α = 30°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1283	987	721	471	1052	809	591	386	1027	718	549	359	808	622	476	311	741	494	371	247
B1	839	646	494	323	588	452	346	226	571	439	336	220	473	364	278	182	386	257	193	129
B2	759	584	447	293	531	409	313	205	516	397	305	199	428	329	252	165	349	233	175	116
C	704	465	348	230	478	351	269	176	472	330	252	165	333	257	196	128	243	162	121	81
D	501	332	248	165	414	274	205	137	329	230	176	115	293	215	165	108	194	129	97	65

PV ez-Rack SolarRoof Interface spacing table for penetrative tilt legs

30° < α ≤ 60°

Type of Rail ER-R-ECO (see Note 12 for other compatible rails)

Solar Panel Dimension 2 m x 1 m (see Note 25 for other panel sizes)

ANGLE TO THE HORIZONTAL	30° < α ≤ 60°																			
TC	3																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1557	1277	946	624	1527	1239	946	624	1417	1104	819	541	1410	985	732	484	1169	779	584	390
B1	1191	860	641	423	1192	860	641	423	1133	746	555	368	962	641	481	321	784	522	392	261
B2	1076	778	580	383	1076	778	580	383	1024	674	502	333	870	581	435	291	709	473	354	237
C	851	561	419	277	851	561	419	277	736	486	363	240	645	430	322	215	420	280	210	140
D	605	400	299	198	605	400	299	198	525	348	259	172	469	311	232	154	336	224	168	112

ANGLE TO THE HORIZONTAL	30° < α ≤ 60°																			
TC	2.5																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1489	1157	859	567	1394	1042	774	511	1291	923	687	454	1226	849	632	418	1065	710	532	355
B1	1140	781	582	384	1070	704	525	348	948	625	466	309	872	575	429	285	725	483	362	242
B2	1030	707	526	349	967	637	475	315	857	565	422	279	789	521	389	257	655	437	328	218
C	772	509	380	252	696	460	343	228	617	408	306	203	568	376	281	187	388	258	194	129
D	549	363	272	181	496	329	246	163	440	292	218	145	405	269	201	133	310	207	155	103

ANGLE TO THE HORIZONTAL	30° < α ≤ 60°																			
TC	2																			
BUILDING HEIGHT (m)	≤ 5				5<H≤10				10<H≤15				15<H≤20				20<H≤30			
	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner	Internal	Intermediate	Edge	Corner
A	1422	1054	782	517	1267	867	645	426	1193	784	584	386	1125	740	551	364	954	636	477	318
B1	1082	712	530	351	889	587	438	290	804	531	396	263	759	502	375	248	660	440	330	210
B2	978	644	480	318	804	531	396	263	728	481	359	238	687	454	339	225	597	399	299	190
C	704	465	348	230	580	384	287	190	525	348	259	172	496	329	246	163	370	247	185	123
D	501	332	248	165	414	274	205	137	375	249	186	124	354	235	175	117	296	198	148	99

General Notes

Note 1. This engineering document was designed to cater for most common installation scenarios however, it does not cater for all of them. Contact Clenergy if you are unable to comply with any of the installation specifications listed on this document.

Note 2. The spacing information in this document has been designed to be compliant with the capacity of the below items:

- Mounting system components, including the fixings, capacity and rail deflection.
- Buildex- 14 - 11 x 70 Hex Head Zips with 16 mm Aluminium Bonded Washer.

Note 3. This certificate only covers the assessment of the Clenergy PV mounting system, including the components listed on note 2 and 12. Assessment of the roof structure, PV panels and other fixings are to be checked by the installer/contractor, if necessary.

Note 4. Roof pitch between 0° and < 10° when rails run parallel to the roof pitch (Figure 1) and 0° and < 22° when rails run perpendicular to the roof pitch (Figure 2).

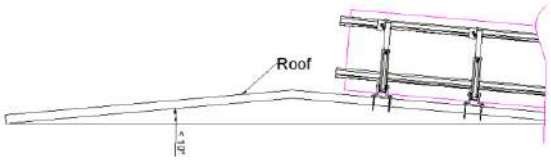


Figure 1. Rails running parallel to roof pitch

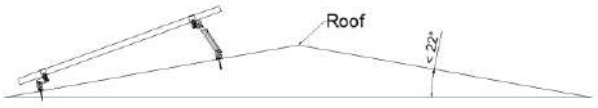


Figure 2. Rails running perpendicular to roof pitch

Note 5. Fixing spacings were calculated using **two screws** per tilt leg on Steel Purlins G450 1.5mm and 35 mm Timber F7 (Pine).

Note 6. Reduction factors using **one screw** per tilt leg and depending on the type of tophat, purlin or batten as per the below table. Screw must be located on central hole.

Purlin Material	Purlin thickness (mm)	Min. embedment (mm)	Spacing +/- (WR A)	Spacing +/- (WR B1)	Spacing +/- (WR B2)	Spacing +/- (WR C)	Spacing +/- (WR D)
Timber (Pine F7)	-	25	-65%	-65%	-85%	**Contact Clenergy**	**Contact Clenergy**
Timber (Pine F7)	-	30	-40%	-40%	-75%	-75%	**Contact Clenergy**
Timber (Pine F7)	-	35	-20%	-25%	-50%	-50%	-85%
Timber (Hardwood F17)	-	25	-5%	-5%	-15%	-15%	-40%
Timber (Hardwood F17)	-	30	-	-	-5%	-5%	-20%
Timber (Hardwood F17)	-	35	-	-	-5%	-5%	-20%
Metal (G550)	0.42		**Contact Clenergy**	**Contact Clenergy**	**Contact Clenergy**	**Contact Clenergy**	**Contact Clenergy**
Metal (G550)	0.48		**Contact Clenergy**	**Contact Clenergy**	**Contact Clenergy**	**Contact Clenergy**	**Contact Clenergy**

Metal (G550)	0.55		Contact Clenergy	Contact Clenergy	Contact Clenergy	Contact Clenergy	Contact Clenergy
Metal (G550)	0.75		-90%	Contact Clenergy	Contact Clenergy	Contact Clenergy	Contact Clenergy
Metal (G450)	1.2		-75%	-80%	-90%	Contact Clenergy	Contact Clenergy
Metal (G450)	1.5		-45%	-50%	-50%	-50%	-65%
Metal (G450)	1.9		-	-	-5%	-5%	-20%
Metal (G450)	2.4		-	-	-5%	-5%	-10%

Note 7. Increase or reduction factors using **two screws** per tilt leg and depending on the type of tophat, purlin or batten as per the below table

Purlin Material	Purlin thickness (mm)	Min. embedment (mm)	Spacing +/- (WR A)	Spacing +/- (WR B1)	Spacing +/- (WR B2)	Spacing +/- (WR C)	Spacing +/- (WR D)
Timber (Pine F7)	-	25	-	-5%	-9%	-10%	-10%
Timber (Pine F7)	-	30	-	-5%	-9%	-10%	-10%
Timber (Pine F7)	-	35	-	-	-	-	-
Timber (Hardwood F17)	-	25	-	-	+10%	+5%	+4%
Timber (Hardwood F17)	-	30	-	-	+10%	+5%	+4%
Timber (Hardwood F17)	-	35	-	-	+20%	+10%	+5%
Metal (G550)	0.42	-	-80%	-80%	Contact Clenergy	Contact Clenergy	Contact Clenergy
Metal (G550)	0.48	-	-40%	-60%	-60%	-70%	-85%
Metal (G550)	0.55	-	-25%	-30%	-50%	-55%	-70%
Metal (G550)	0.75	-	-12%	-15%	-20%	-25%	-45%
Metal (G450)	1.2	-	-5%	-10%	-10%	-15%	-20%
Metal (G450)	1.5	-	-	-	-	-	-
Metal (G450)	1.9	-	-	-	+10%	+5%	+5%
Metal (G450)	2.4	-	-	-	+10%	+5%	+5%

Note 8. If any of the screws of the interfaces go into pre-existing holes, they will have to be one size up compared to the screws that were previously installed. This is to ensure that the pullout capacity remains the same or higher.

Note 9. The most conservative spacing has to be used if one panel or panel row fall between two roof zones.

Note 10. Minimum purlin steel grade to be G450 and timber grade members: F7 (Pine) and F17 (Hardwood).

Note 11. In case the installation is done with one screw and the purlin thickness differs from Note 6, a site-specific certificate shall be issued. Contact Clenergy for more information.

Note 12. The following components are satisfied for use according to AS/NZS 1664.1:1997-Amdt 1:1999 and AS/NZS 1170.2:2021.

Components	Part No.	Description
ECO-Rail	ER-R-ECO/XXXX	ECO Rail
Splice	ER-SP-ECO	PV-ezRack Splice for ECO rail
Australian Made Mill	R-ECO/XXXX/AUMF	PV-ezRack Australian Made Mill Finish ECO Rail
Black ECO-Rail	ER-R-ECO/XXXX/BA	Black ECO Rail
Black Splice ECO Rail	ER-SP-ECO/BA	Splice ECO Rail Black
Inter Clamp	ER-IC-STXX	Inter Clamp = Clamp + Z-Module + Bolt
End Clamp	ER-EC-STXX	End Clamp = Clamp + Z-Module + Bolt
Clamp	C-U/30/46-G	Universal Clamp for Frame Height 30-46mm with Grounding Clip
Clamp	C-U/30/46	Universal Clamp for Frame Height 30-46mm
End Clamp	ER-EC-DU35/40	End Clamp dual 35 or 40mm
End Clamp	ER-EC-DU40/46	End Clamp dual 40 or 46mm
Inter Security Clamp	ER-IC-STXX/S	Inter Clamp = Clamp + Z-Module + Security Bolt
End Security Clamp	ER-EC-STXX/S	End Clamp = Clamp + Z-Module + Security Bolt
Tilt Legs	ER-TL-10/15	10°/15° Adjustable Tilt Legs
Tilt Legs	ER-TL-15/30	15°/30° Adjustable Tilt Legs
Tilt Legs	ER-TL-30/60	30°/60° Adjustable Tilt Legs
Tilt Legs	ER-TL-10/15/PS	10°/15° Adjustable Tilt Legs, Preassembly
Tilt Legs	ER-TL-15/30/PS	15°/30° Adjustable Tilt Legs, Preassembly
Tilt Legs	TL-10/15/L/PS	10°/15° L Feet Adjustable Tilt Legs, Preassembly
Tilt Legs	TL-15/30/L/PS	15°/30° L Feet Adjustable Tilt Legs, Preassembly

Tilt Legs	ER-TL-5/PS	5° Fixed Tilt Legs, Preassembly
Tilt Legs	ER-TL-10/PS	10° Fixed Tilt Legs, Preassembly
Tilt Legs	ER-TL-FF	Front Foot of Tilt Legs
Black Tilt Legs	ER-TL-10/15/BA	Black 10°/15° Adjustable Tilt Legs
Black Tilt Legs	ER-TL-15/30/BA	Black 15°/30° Adjustable Tilt Legs
End Clamp (*)	EC-FL/GE/XX/XX	End Clamp for Frameless Module (glued EPDM)
Inter Clamp (*)	IC-FL/GE/XX/XX	Inter Clamp for Frameless Module (glued EPDM)
End Clamp (*)	ER-EC-FL/XX/XX	End Clamp for Frameless Module
Inter Clamp (*)	ER-IC-FL/XX/XX	Inter Clamp for Frameless Module
Black End Clamp (*)	EC-FL/GE/XX/XX/B	Black End Clamp for Frameless Module (glued EPDM)
Black Inter Clamp (*)	IC-FL/GE/XX/XX/B	Black Inter Clamp for Frameless Module (glued EPDM)
Mid Clamp XX Black	ER-IC-STXXB	Inter Clamp XX Black
End Clamp XX Black	ER-EC-STXXB	End Clamp XX Black
Adapter for tilt leg	EZ-AD-C110	Adapter for tilt leg on corrugated roofs
Black Universal Clamp	C-U/30/46/BA	Black Universal Clamp
Black Universal Clamp	C-U/30/46-G/BA	Black Universal Clamp with grounding clip

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

Note 13. For Terrain Category (TC) definition. Refer to clause 4.2.1 of AS/NZS 1170.2:2021 for more information.

Note 14. Topographic Multiplier (Mt) taken as 1.0. Refer to clause 4.4 of AS/NZS 1170.2:2021 for more information.

For topographic Multiplier (Mt) more than 1.0 (installations on a mountain, hilly or sloped terrain) please refer to clause 4.4 of AS/NZS 1170.2:2021 to define appropriate Topographic multiplier value.

The below table provides a reduction factor applied for topographic multipliers greater than 1 (installation on a slope, hill on mountain). To achieve a more accurate and cost-effective design or installations in wind region C and D, please contact Clenergy Engineering department.

Mt	A, B1 & B2			
	Internal	Intermediate	Edge	Corner
1	1	1	1	1
1.01	0.93	1	0.86	1
1.02	0.93	1	0.86	1
1.03	0.93	0.89	0.86	1
1.04	0.93	0.89	0.86	1
1.06	0.86	0.89	0.86	1
1.08	0.86	0.89	0.86	1
1.09	0.79	0.78	0.71	0.75
1.1	0.79	0.78	0.71	0.75
1.2	0.64	0.67	0.57	0.75
1.3	0.57	0.56	0.57	0.50
1.4	0.50	0.44	0.43	0.50
1.5	0.43	0.44	0.43	0.50

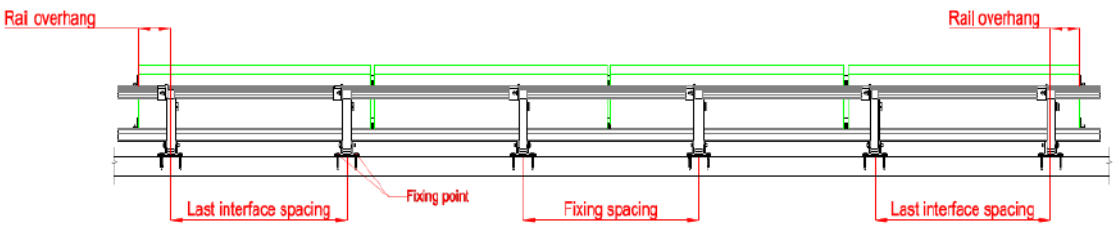
Note 15. Shielding Multiplier (Ms) taken as 1.0. Refer to clause 4.3 of AS/NZS 1170.2:2021 for more information.

Note 16. Wind Direction Multiplier (Md) taken as 1.0. Refer to clause 3.3 of AS/NZS 1170.2:2021 for more information.

Note 17. Clamping zone of the PV panels should be according to the manufacturer's specifications.

Note 18. Capacities checked and compared against testing data from Clenergy Australia and NATA certified testing.

Note 19. Rail overhang ends where the panel finishes and this should be less than 40% of the last installed interface spacing.



Note 20. From the date of publication onwards, any amendment made to any of the above-mentioned Standards will make this report outdated and a new one will have to be released, unless the amendment has no implications on this certificate.

Note 21. All components from Clenergy must be installed according to manufacturer's specification and the instructions shown in the relevant installation manual. Please check the Clenergy Australia website or contact them for access to the most recent installation manuals.

Note 22. Only hip and gable roofs installations are covered on this certificate. Contact Clenergy if you are planning to install on a different roof type such as curved, multi-span (pitched and saw-tooth), mansard, circular bin, silo, tank, pitched free, troughed free, hypar free, canopy, awning and cantilivered roof.

Note 23. No consideration has been taken on the effect of snow loads. In case the roof is located in a snow prone area, a project specific design must be completed.

Note 24. No consideration has been taken on the effect of earthquake loads.

Note 25. This Engineering report is based on 2 m x 1 m panels and two rails per panel. However, a percentage increase could be applied on all interface spacings as shown on the following table.

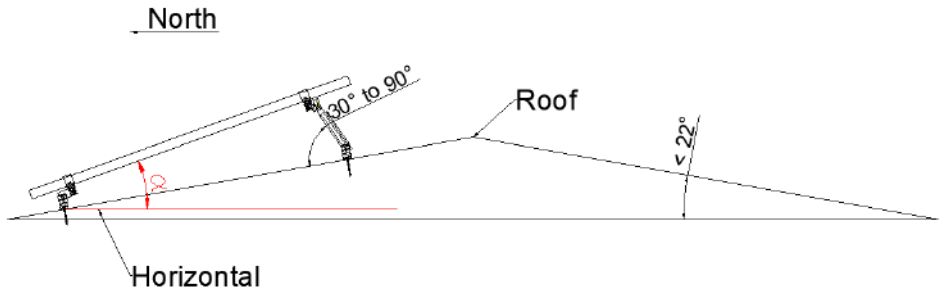
Number of rails per panel	Panel length (mm)	Spacing +/- W.R – A & B1	Spacing +/- W.R – B2, C & D
2 rails	≤ 1700	+ 6 %	+ 10 %
2 rails	≤ 1800	+ 4 %	+ 7 %
2 rails	≤ 1900	0 %	+ 5 %
2 rails	≤ 2000	0 %	0 %
2 rails	≤ 2100	- 10 %	- 6 %
2 rails	≤ 2200	- 18 %	- 12 %
2 rails	≤ 2300	- 20 %	- 12 %
2 rails	≤ 2400	- 25 %	- 15 %

Note 26. Panel width cannot exceed 1.20 m for any of the above panel length dimensions and panel weight cannot exceed 15 kg/m^2.

Note 27. Please refer to AS 4312 to find out about corrosion categories.

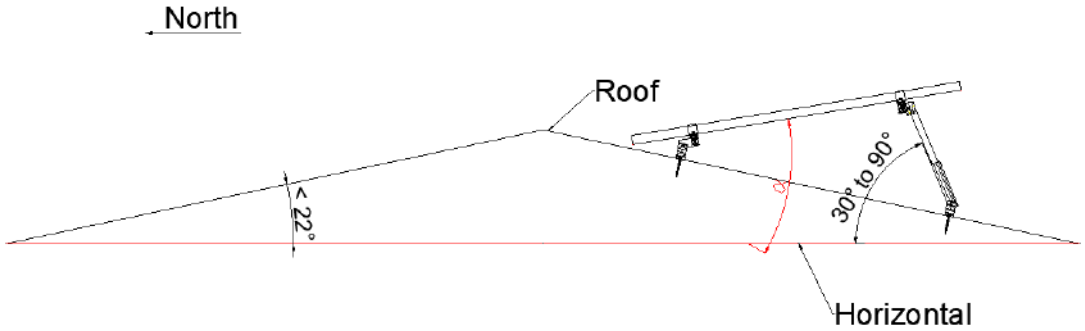
Note 28. Final tilt "α" identification as per below

Standard tilt



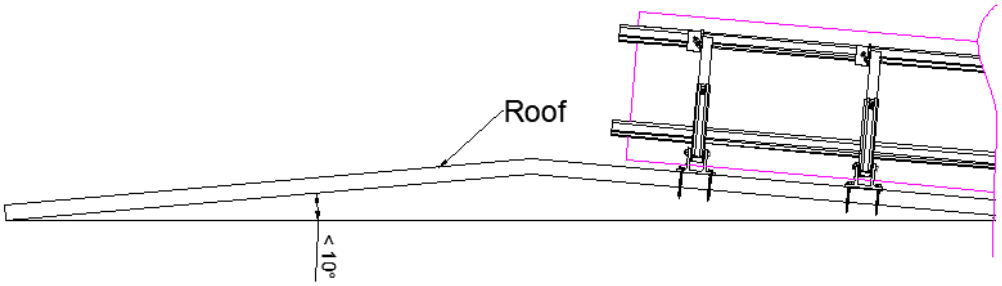
Back leg angle between 30° and 90°

Reverse tilt

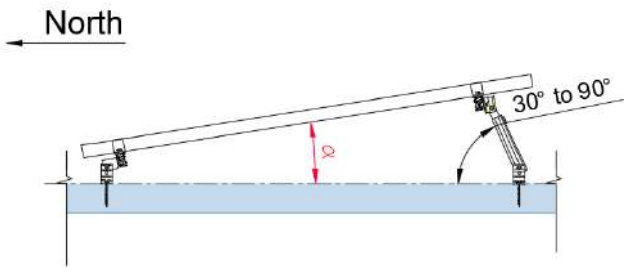


Back leg angle between 30° and 90°

ECO – Rail parallel to ribs



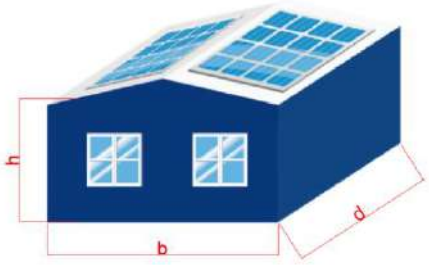
Back leg angle between 30° and 90°

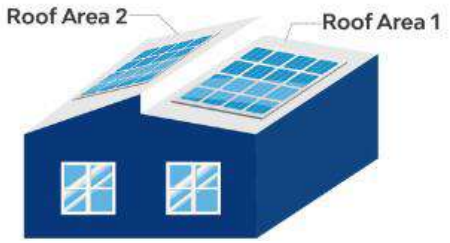


Note 29. This certificate can be used for the installation of tilt legs on uncracked concrete roofs using one Chemset per tilt leg. The minimum Chemset tensile capacity should be 6.1 kN and this should be confirmed by the manufacturer. As an example, installers can use M8 Chemset 101Plus by Ramset assuming a 20 MPa concrete strength and a depth of 80 mm. Please check that during the installation any reinforcement is not damaged.

Note 30. Roof Zone definition to be calculated as per below:

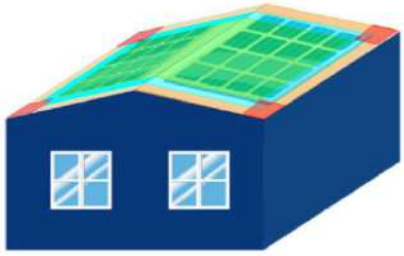
Step 1. Determine building height (h), width (b) and length (d).
Step 2. Check ratio of height to length/width (h/b and h/d)
If both h/b and h/d < 0.2, then a = 2h
Step 3. If h/b and h/d > 0.2 then a = the lowest value between 0.2b and 0.2d

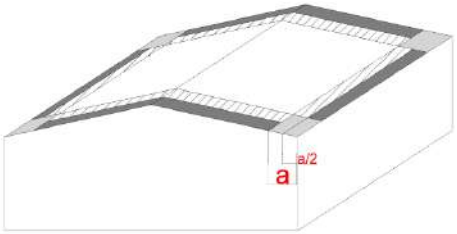




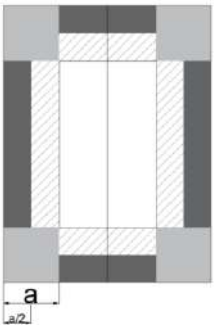
Roof zone definition

Roof Pitch < 10°

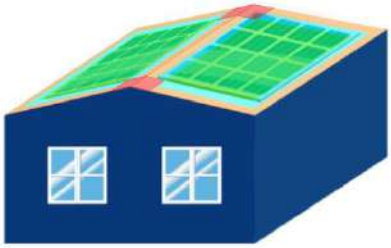


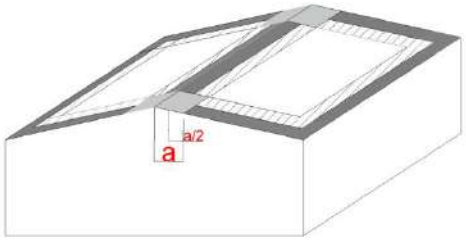


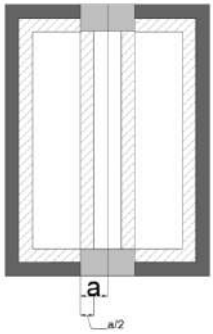
Top view



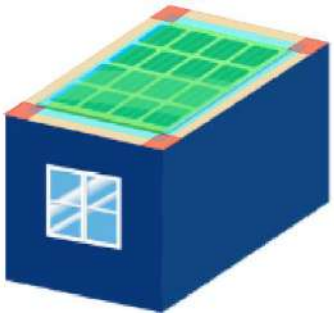
Flat/Mono – Slope Roof > 10°

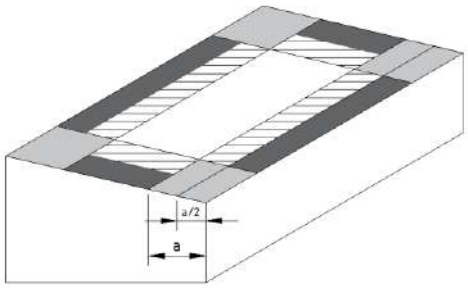


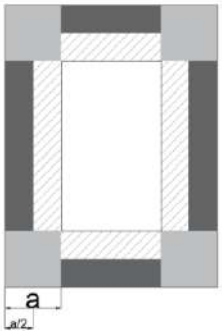




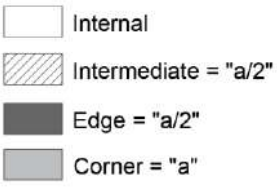
Flat/Mono – Slope Roof







Legend:



Example 1:

- Wind Region: A
- Terrain Category: 3
- Building Height: 6 m
- Roof Pitch: 3°
- Panel Tilt Angle: 5°
- Tilt Condition (Standard or Reverse): Standard
- No. of screws per tilt leg: 2 (refer to Note 11)
- Purlin type and thickness: 1.5 mm
- Panel Dimension: 2000mm x 1000mm

Fixing Spacing as per below (α=3°+5°=8°, see Note 28):

- Internal: 1907 mm
- Intermediate: 1525 mm
- Edge: 1156 mm
- Corner: 763 mm

Example 2:

- Wind Region: B1
- Terrain Category: 2
  Building Height: 12 m
- Roof Pitch: 5°
- Panel Tilt Angle: 20°
- Tilt Condition (Standard or Reverse): Reverse
- No. of screws per tilt leg: 2 (refer to Note 11)
- Purlin type and thickness: F7 Pine 30mm (Spacing -5%, refer to Note 7)
- Panel Dimension: 1750 mm x 1000 mm (Spacing +4%, refer to Note 25)

Fixing Spacing as per below (α=20°-5°= 15°, refer to Note 28):

- Internal: 790 mm
- Intermediate: 632 mm
- Edge: 479 mm
- Corner: 316 mm

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