

Our Ref: 2464

1 July 2016

Clenergy Australia
11/20 Duerdin Street
Clayton VIC 3168



Array Frame Engineering Certificate

Installation of PV-ezRack[®] SolarRoof on Tin and Tile Roof flush installation with ECO-Rails

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian and New Zealand Building Regulations, have carried out a structural design check of PV-ezRack[®] SolarRoof installation within New Zealand. The design check has been based on the information in the *PV-ezRack SolarRoof_Code Compliant planning and Installation_Guide AV_V2.5* and schematic drawings of the system components by Clenergy (Xiamen) Technology Co. Ltd., provided by Clenergy Australia.

We find the Installation of PV-ezRack[®] SolarRoof on tin and tile roof to be structurally sufficient for New Zealand use based on the following conditions:

- Wind Loads to AS/NZ1170.2:2011 Admt 2-2012
- Wind Region A and W.
- Wind Terrain Category 2 & 3
- Wind average recurrence interval of 100 years
- Maximum Building height 20 m
- Max. Solar Panel Dimensions 2000x1000 mm

Refer to attached summary table for interface spacing.

Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was designed in accordance with the provisions of Australian and New Zealand Building Regulations and in accordance with sound, widely accepted engineering principles.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd

A handwritten signature in blue ink, appearing to read 'Martin Gamble'.

Martin Gamble
Managing Director
MAICD

A handwritten signature in blue ink, appearing to read 'Mudi Ariyaratna'.

Mudi Ariyaratna
B.Eng(Civil)(Hons)Monash, M.Eng&Mgt, MIEAust,
CPEng, NPER, RBP EC-39699, RPEQ- 15899

Structural Design Documentation

PV-ezRack® SolarRoof Interface Spacing Table **According to AS/NZS 1170.2-2011 Amdt 2-2012** **with ECO-Rails** **Within New Zealand** **Terrain Category 2**

For: Clenergy Australia



Job Number: 2464
Date: 1 July 2016





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Certificate No: AU1222

Job No: 2464

Client: Clenergy Australia

Project: PV-ezRack® SolarRoof Interface Spacing Table

Address: Within New Zealand

AS/NZ Standards

AS 1170. 2011 – Structural Design Actions

Part 0 – General Principles

Part 1 – Permanent imposed and other actions

Part 2 – Wind Actions

Part 3 – Snow and Ice Actions

AS 1252 – High Strength Structural Bolting

AS 3600 – Concrete Structures

AS 4055 – Wind Loads for Housing

AS 4100 – Steel Structures

AS 4600 – Cold-Formed Steel Structures

Wind Terrain Category:

WTC 2

Designed: M.A

Date: Jul-16

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within New Zealand**
 Designed: **M.A**

Job: **2464**
 Date: **Jul-16**
 REV H

PV-ezRack® SolarRoof Interface spacing Table for Tile Roof

Type of Rail ER-R-ECO (ECO-Rail)
 Type of Interface ER-I-01 (Tile Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 2
 Roof Angle (Φ) – 5° - 10°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	1265	1635	1135	1590	1060	1535		
A (Lee Zone)	650	920	585	825	550	775		
W	930	1335	835	1195	785	1120		
W (Lee Zone)	483	680	440	615	415	580		

Roof Angle (Φ) – 10° - 20°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	965	1415	865	1265	810	1185		
A (Lee Zone)	500	720	455	650	425	610		
W	711	1035	640	925	605	869		
W (Lee Zone)	375	535	340	485	320	455		

Roof Angle (Φ) – 20° - 30°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	1045	1265	940	1135	880	1060		
A (Lee Zone)	545	650	490	585	460	550		
W	775	930	694	835	655	785		
W (Lee Zone)	405	485	370	440	345	415		

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
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 Address: **Within New Zealand**
 Designed: **M.A**

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Roof Angle (Φ) – 30° - 60°								
Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	Intermedi ate	Internal	Intermedi ate	Internal	Intermedia te	Internal		
A	1155	1575	1065	1465	1015	1405		
A (Lee Zone)	660	985	595	905	560	865		
W	920	1280	845	1185	800	1135		
W (Lee Zone)	495	765	445	690	420	650		

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within New Zealand**
 Designed: **M.A**

Job: **2464**
 Date: **Jul-16**
 REV H

PV-ezRack® SolarRoof Interface spacing Table for Tin Roof

Type of Rail ER-R-ECO (ECO-Rail)
 Type of Interface ER-I-01 (Tin Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 2
 Roof Angle (Φ) – 5° - 10°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	1490	1635	1450	1590	1425	1565		
A (Lee Zone)	1260	1375	1225	1340	1210	1315		
W	1380	1510	1340	1465	1320	1445		
W (Lee Zone)	1170	1275	1140	1240	1125	1225		

Roof Angle (Φ) – 10° - 20°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	1390	1530	1355	1490	1330	1465		
A (Lee Zone)	1180	1295	1150	1260	1135	1240		
W	1290	1415	1255	1375	1235	1354		
W (Lee Zone)	1100	1200	1070	1170	1054	1155		

Roof Angle (Φ) – 20° - 30°

Wind Region	Building Height – H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	1420	1490	1380	1450	1360	1425		
A (Lee Zone)	1210	1260	1175	1225	1155	1210		
W	1315	1380	1280	1340	1260	1320		
W (Lee Zone)	1120	1170	1090	1140	1075	1125		

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within New Zealand**
 Designed: **M.A**

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 REV H

Roof Angle (Φ) -		30° - 60°					
Wind Region	Building Height - H (m)						
	H≤10		10<H≤15		15<H≤20		
	Intermedi ate	Internal	Intermedi ate	Internal	Intermedia te	Internal	
A	1455	1575	1425	1545	1410	1530	
A (Lee Zone)	1265	1395	1235	1370	1215	1355	
W	1375	1495	1345	1465	1325	1450	
W (Lee Zone)	1175	1310	1145	1280	1130	1260	

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within New Zealand**
 Designed: **M.A**

Job: **2464**
 Date: **Jul-16**
 REV H

General Notes			
Note 1	Screws minimum embedment length into timber 35 mm		
Note 2	Recommended screws		
	Metal Purlins/Battens	Fasteners to use	
	0.55 mm – 1.5 mm	M6-11 TPI RoofZips	
	1.9 mm	M6-11 TPI RoofZips OR 12g-14 TPI Teks screws	
	2.4 mm and Above	12g-24 TPI Teks screws	
	Wood purlins and Rafter	Fasteners to use	
	Pine and Hardwood (35mm embedment and above)	M6-11 TPI RoofZips OR 14g-10 TPI	
Note 3	Following components are satisfied to use according to AS/NZS 1170.2-2011 Amdt 2-2012		
	Components	Part Number	Description
	MT-base Rail	ER-R-MT2560	MT-Rail 2560 mm
	Corrugated Adapter	ER-AD-C110	Adapter for corrugated iron roof
	Tilt Legs	ER-TL-30	Tilt Legs Kit fixed 30° (front and back leg)
	Hanger Bolt	ER-HB-200/WOMP	Hanger Bolt without mounting plate M10x200. Fixed to timber purlin only
	Roof extender	ER-RE-200	Roof Hook Extender 200mm
Note 4	Terrain category 2 (TC2) refers to open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstruction per obstructions per hectare.		
Note 5	For the definition of Downwind, Upwind end and central, refer figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.		
Note 5	For PV panels with length of 1700mm, increase the spacing by 15%.		

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within New Zealand**
 Designed: **M.A**

Job: **2464**
 Date: **Jul-16**
 REV H

Note 6 Wind Regions, based on AS 1700.2.2011 are as follows:

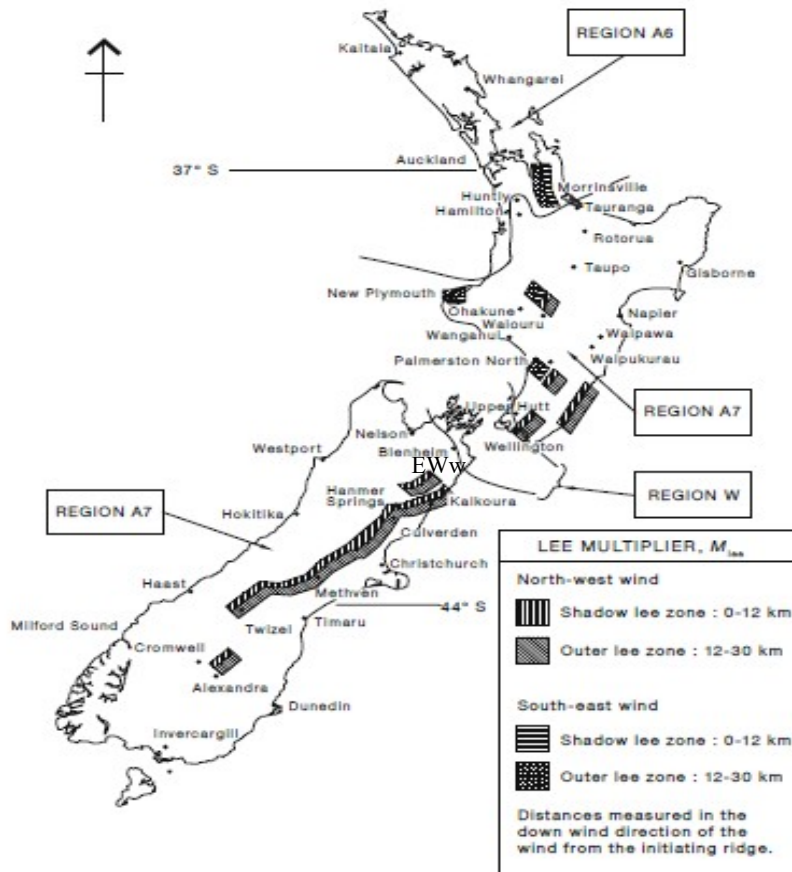


FIGURE 3.1(B) WIND REGIONS

Structural Design Documentation

PV-ezRack® SolarRoof Interface Spacing Table **According to AS/NZS 1170.2-2011 Amdt 2-2012** **with ECO-Rails** **Within New Zealand** **Terrain Category 3**

For: Clenergy Australia



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Job No: 2464

Client: Clenergy Australia

Project: PV-ezRack® SolarRoof Interface Spacing Table

Address: Within New Zealand

AS/NZ Standards

- AS 1170. 2011 – Structural Design Actions
 - Part 0 – General Principles
 - Part 1 – Permanent imposed and other actions
 - Part 2 – Wind Actions
 - Part 3 – Snow and Ice Actions
- AS 1252 – High Strength Structural Bolting
- AS 3600 – Concrete Structures
- AS 4055 – Wind Loads for Housing
- AS 4100 – Steel Structures
- AS 4600 – Cold-Formed Steel Structures

Wind Terrain Category: WTC3

Designed: M.A

Date: Jul-16

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
 Designed: **M.A**

Job: **2464**
 Date: **Jul-16**

REV H

PV-ezRack® SolarRoof Interface spacing Table for Tile Roof

Type of Rail ER-R-ECO (ECO-Rail)
 Type of Interface ER-I-01 (Tile Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 3
 Roof Angle (Φ) - 5° - 10°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central
A	1665	1850	1595	1765	1465	1700		
A (L)	980	1410	840	1200	745	1060		
W	1425	1690	1210	1615	1070	1545		
W (L)	725	1030	620	880	555	780		

Roof Angle (Φ) - 10° - 20°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central
A	1480	1715	1255	1640	1105	1590		
A (L)	750	1090	645	930	570	825		
W	1075	1575	920	1350	814	1190		
W (L)	560	805	480	690	427	615		

Roof Angle (Φ) - 20° - 30°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central
A	1580	1665	1370	1595	1205	1465		
A (L)	810	980	695	835	620	745		
W	1170	1425	1000	1210	885	1070		
W (L)	605	725	520	620	465	555		

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
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REV H

Roof Angle (Φ) - 30° - 60°								
Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
A	1540	1680	1385	1640	1270	1610		
A (L)	955	1325	850	1190	760	1090		
W	1250	1600	1115	1530	1020	1410		
W (L)	740	1065	635	950	565	870		

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 Date: **Jul-16**

REV H

PV-ezRack® SolarRoof Interface spacing Table for Tin Roof

Type of Rail ER-R-ECO (ECO-Rail)
 Type of Interface ER-I-01 (Tin Interface)
 Solar Panel Dimension 2mx1m
 Terrain category 3

Roof Angle (Φ) - 5° - 10°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1665	1850		1595	1765		1545	1700
A (L)	1395	1530		1340	1470		1305	1425
W	1535	1690		1470	1615		1425	1565
W (L)	1295	1415		1245	1360		1210	1320

Roof Angle (Φ) - 10° - 20°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1550	1715		1485	1640		1440	1590
A (L)	1305	1435		1255	1380		1220	1335
W	1430	1575		1375	1515		1335	1465
W (L)	1215	1330		1170	1280		1135	1240

Roof Angle (Φ) - 20° - 30°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	1580	1665		1520	1595		1470	1542
A (L)	1330	1395		1280	1340		1245	1305
W	1460	1531		1405	1470		1360	1425
W (L)	1235	1295		1190	1245		1160	1210

D.W & U.W – Downwind and Upwind refer to note 6.

Client: **Clenergy Australia**
 Project: **PV-ezRack® SolarRoof Interface Spacing Table**
 Address: **Within Australia**
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REV H

Roof Angle (Φ) - 30° - 60°								
Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
A	1570	1650	1520	1615	1490	1610		
A (L)	1395	1505	1350	1465	1310	1435		
W	1490	1600	1445	1560	1410	1400		
W (L)	1310	1425	1250	1385	1215	1355		

Client: **Clenergy Australia**
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 Address: **Within Australia**
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REV H

General Notes			
Note 1	Screws minimum embedment length into timber 35 mm. Holes must be pre drilled.		
Note 2	Recommended screws		
	Metal Purlins/Battens		Fasteners to use
	0.55 mm – 1.5 mm		M6-11 TPI RoofZips
	1.9 mm		M6-11 TPI RoofZips OR 12g-14 TPI Teks screws
	2.4 mm and Above		12g-24 TPI Teks screws
	Wood purlins and Rafter		Fasteners to use
Pine and Hardwood (35mm embedment and above)		M6-11 TPI RoofZips OR 14g-10 TPI	
Note 3	Following components are satisfied to use according to AS/NZS 1170.2-2011 Amdt 2-2012		
	Components	Part Number	Description
	MT-base Rail	ER-R-MT2560	MT-Rail 2560 mm
	Corrugated Adapter	ER-AD-C110	Adapter for corrugated iron roof
	Tilt Legs	ER-TL-30	Tilt Legs Kit fixed 30° (front and back leg)
	Hanger Bolt	ER-HB-200/WOMP	Hanger Bolt without mounting plate M10x200. Fixed to timber purlin only
	Roof extender	ER-RE-200	Roof Hook Extender 200mm
Note 4	Terrain category 3(TC3) refers to numerous closely spaced obstructions having heights generally from 3 m to 10 m. For example suburban housing or light industrial estates. Refer clause 4.2.1 of AS/NZS 1170.2-2011 Amdt 2-2012 for definition of Terrain category 3.		
Note 5	For the definition of Downwind, Upwind end and central, refer to figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.		
Note 6	For PV panels with length of 1700mm, increase the spacing by 15%.		

Client: **Clenergy Australia**
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Note 7 Wind Regions, based on AS 1700.2.2011 are as follows:

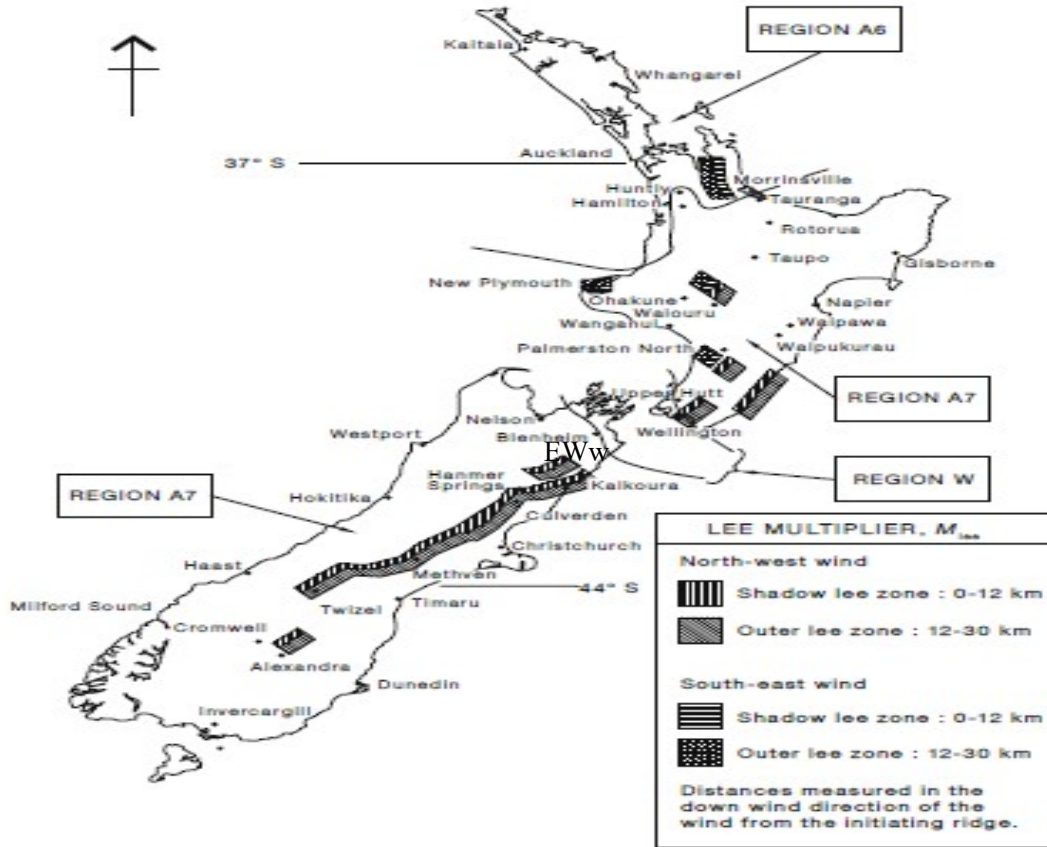


FIGURE 3.1(B) WIND REGIONS