

Our Ref: 23939

18 February 2013

Clenergy Australia
18/20 Duerdin Street
Clayton North VIC 3168

Array Frame Engineering Certificate

Installation of PV-ezRack[®] SolarRoof on Tin and Tile Roof

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of PV-ezRack[®] SolarRoof installation within Australia. The design check has been based on the information in the *PV-ezRack SolarRoof_Code Compliant planning and Installation_Guide AV_V2.2* 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 Australian use based on the following conditions:

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

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 Building Regulations and in accordance with sound, widely accepted engineering principles.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



Martin Gamble
Managing Director
MAICD



Milan Bjelobrk
MIEAust, CPEng, NPER 2210984,
RPEQ 12090, RBP EC-38461, NT BPB 139671ES

Structural Design Documentation

PV-ezRack® SolarRoof Interface Spacing Table **According to AS/NZS 1170.2-2011 Amdt 2-2012** **Within Australia** **Terrain Category 2**

For:

Clenergy Australia



Job Number: 23939
Date: 18 February 2013

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ISO 9001:2008 Registered Firm
Certificate No: AU1222

Job No: 23939

Client: Clenergy Australia

Project: PV-ezRack® SolarRoof Interface Spacing Table

Address: Within Australia

Australian 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: WTC2

Designed: M.S

Date: Feb-13



innovation in design and construction

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

Job: **23939**
 Date: **Feb-13**

REV K

PV-ezRack® SolarRoof Interface spacing Table for Tile Roof

Type of Rail ER-R-ST
 Type of Interface ER-I-01
 Solar Panel Dimension 2mx1m
 Terrain category 2

Roof Angle (Φ) - 20° - 25°

Wind Region	Building Height - H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle
A	1200	1750	950	1425	850	1250	800	1175		
B	825	1225	675	975	600	875	575	825		
C	525	775	450	625	400	575	375	525		
D	350	500	275	400	250	375	250	350		

Roof Angle (Φ) - ≥ 25°

Wind Region	Building Height - H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle
A	1300	1575	1050	1275	925	1125	875	1050		
B	900	1100	725	875	650	800	625	750		
C	575	700	475	575	425	500	400	475		
D	375	450	300	375	275	325	250	300		

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

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

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REV K

PV-ezRack® SolarRoof Interface spacing Table for Tin Roof

Type of Rail ER-R-ST
 Type of Interface ER-I-05
 Solar Panel Dimension 2mx1m
 Terrain category 2

Roof Angle (Φ) - 5° - 10°

Wind Region	Building Height - H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	1700	1900	1600	1775	1550	1725	1525	1675		
B	1625	1850	1450	1750	1375	1650	1350	1600		
C	1300	1550	1175	1400	1050	1325	1000	1275		
D	900	1225	750	1050	675	950	625	875		

Roof Angle (Φ) - 10° - 20°

Wind Region	Building Height - H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	1575	1750	1475	1650	1450	1600	1400	1575		
B	1425	1725	1275	1550	1225	1450	1175	1425		
C	1100	1375	900	1225	825	1150	775	1100		
D	700	1000	575	825	525	750	500	700		

Roof Angle (Φ) - 20° - 30°

Wind Region	Building Height - H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	1600	1700	1525	1600	1475	1550	1450	1525		
B	1475	1625	1325	1450	1275	1375	1225	1350		
C	1175	1300	975	1175	875	1050	825	1000		
D	775	900	625	750	575	675	525	625		

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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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 Above Spacing calculated based on 1.9mm steel purlin OR F17 Hardwood
 For Wind region C & D spacing for Tin Roof should be reduced as follows,

Material	Wind Region C		Wind Region D	
	Middle	D.W & U.W	Middle	D.W & U.W
0.55 mm steel Batten	22%	25%	30%	42%
0.75 mm steel Batten	0%	0%	10%	5%

Note 4 Following components are satisfied to use according to AS1170.2011

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 5 Terrain category 2(TC 2) refers to Open terrain, including grassland, with well-scattered obstruction having heights generally from 1.5m to 5m, with no more than two obstructions per hectare. For example farmland and cleared subdivisions with isolated trees an uncut grass. Refer clause 4.2.1 of AS/NZS 1170.2-2011 Amdt 2-2012 for definition of Terrain category 2.

Note 6 For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.

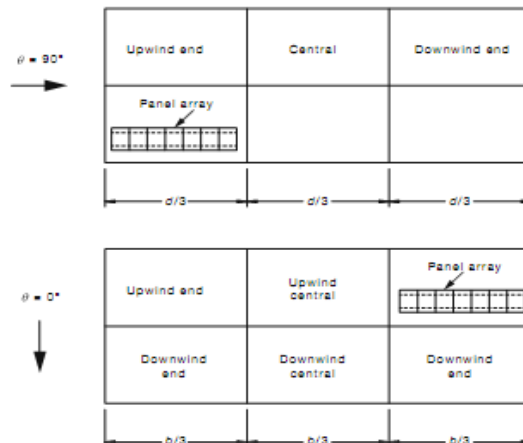


FIGURE D9 ROOF ZONES FOR PANEL ARRAY

Structural Design Documentation

PV-ezRack® SolarRoof Interface Spacing Table **According to AS/NZS 1170.2-2011 Amdt 2-2012** **Within Australia** **Terrain Category 3**

For:

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Address: Within Australia

Australian Standards

- AS 1170. 2011 – Structural Design Actions
 - Part 0 – General Principles
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- 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.S

Date: Feb-13

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

Job: **23939**
 Date: **Feb-13**

REV J

PV-ezRack® SolarRoof Interface spacing Table for Tile Roof

Type of Rail ER-R-ST
 Type of Interface ER-I-01
 Solar Panel Dimension 2mx1m
 Terrain category 3

Roof Angle (Φ) - 20° - 25°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle
A	1475	1875	1250	1775	1100	1650		
B	1025	1525	875	1275	775	1125		
C	650	950	575	800	500	725		
D	425	600	350	525	325	450		

Roof Angle (Φ) - ≥ 25°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle
A	1625	1800	1375	1675	1200	1475		
B	1125	1350	950	1150	850	1025		
C	700	850	600	725	550	650		
D	450	550	475	400	350	425		

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

Client: **Clenergy Australia**
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REV J

PV-ezRack® SolarRoof Interface spacing Table for Tin Roof

Type of Rail ER-R-ST
 Type of Interface ER-I-05
 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	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	1800	2025	1725	1925	1650	1850		
B	1775	1975	1675	1875	1575	1825		
C	1425	1725	1325	1575	1250	1500		
D	1150	1350	1050	1250	1000	1175		

Roof Angle (Φ) - 10° - 20°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	1675	1875	1600	1775	1550	1700		
B	1575	1825	1450	1750	1375	1650		
C	1250	1525	1175	1400	1325	1100		
D	1000	1200	925	1125	875	1050		

Roof Angle (Φ) - 20° - 30°

Wind Region	Building Height - H (m)							
	H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	1700	1800	1625	1725	1575	1650		
B	1650	1775	1525	1675	1425	1575		
C	1300	1425	1225	1325	1150	1250		
D	1050	1150	975	1050	925	1000		

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

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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 5 | 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 6 | For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.

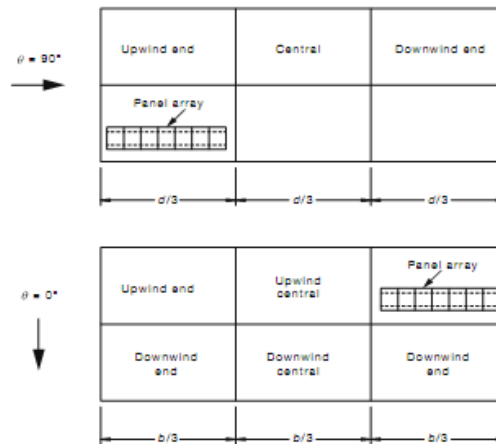


FIGURE D9 ROOF ZONES FOR PANEL ARRAY