



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

<u>Milan Bjelobrk</u>

MIEAust, CPEng, NPER 2210984,

RPEQ 12090, RBP EC-38461, NT BPB 139671ES



Gamcorp (Melbourne) Pty Ltd Consulting Structural & Civil Engineers A.C.N 141 076 904 A.B.N 73 015 060 240

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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: WTC 2

Designed: M.S

Date: Feb-13



Job: **23939** Client: **Clenergy Australia** PV-ezRack® SolarRoof Interface Spacing Table Project: Date: Feb-13

Address: Within Australia

Designed: M.S 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		Building Height – H (m)											
Region	H:	≤5	5 <h< th=""><th colspan="2">5<h≤10< th=""><th>H≤15</th><th colspan="2">15<h≤2< th=""></h≤2<></th></h≤10<></th></h<>	5 <h≤10< th=""><th>H≤15</th><th colspan="2">15<h≤2< th=""></h≤2<></th></h≤10<>		H≤15	15 <h≤2< th=""></h≤2<>						
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle					
Α	1200	1750	950	1425	850	1250	800	1175					
В	825	1225	675	975	600	875	575	825					
С	525	775	450	625	400	575	375	525					
D	350	500	275	400	250	375	250	350					

Roof Angle (Φ) – ≥ 25°

			,											
Wind		Building Height – H (m)												
Region	H	≤5	5 <h≤10< td=""><td>10<h< td=""><td>H≤15</td><td colspan="2">15<h≤20< td=""></h≤20<></td></h<></td></h≤10<>		10 <h< td=""><td>H≤15</td><td colspan="2">15<h≤20< td=""></h≤20<></td></h<>	H≤15	15 <h≤20< td=""></h≤20<>							
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle						
Α	1300	1575	1050	1275	925	1125	875	1050						
В	900	1100	725	875	650	800	625	750						
С	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 Job: 23939
Project: PV-ezRack® SolarRoof Interface Spacing Table Date: Feb-13

Address: Within Australia

Designed: M.S 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°

		9.0 (+	,											
Wind		Building Height – H (m)												
Region	H	≤5	5 <h< th=""><th>≤10</th><th>10<f< th=""><th>1≤15</th><th>15<h< th=""><th>l≤20</th></h<></th></f<></th></h<>	≤10	10 <f< th=""><th>1≤15</th><th>15<h< th=""><th>l≤20</th></h<></th></f<>	1≤15	15 <h< th=""><th>l≤20</th></h<>	l≤20						
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle						
Α	1700	1900	1600	1775	1550	1725	1525	1675						
В	1625	1850	1450	1750	1375	1650	1350	1600						
С	1300	1550	1175	1400	1050	1325	1000	1275						
D	900	1225	750	1050	675	950	625	875						

Roof Angle (Φ) – 10° - 20°

Wind				В	uilding	Height	– H (m	1)			
Region	H	H≤5		5 <h≤10< th=""><th colspan="2">10<h≤15< th=""><th colspan="2">15<h≤20< th=""><th>H≤20</th></h≤20<></th></h≤15<></th></h≤10<>		10 <h≤15< th=""><th colspan="2">15<h≤20< th=""><th>H≤20</th></h≤20<></th></h≤15<>		15 <h≤20< th=""><th>H≤20</th></h≤20<>		H≤20	
	D.W &	-		D.W &			D.W &			D.W &	
	U.W	Middle		U.W	Middle		U.W	Middle		U.W	Middle
Α	1575	1750		1475	1650		1450	1600		1400	1575
В	1425	1725		1275	1550		1225	1450		1175	1425
С	1100	1375		900	1225		825	1150		775	1100
D	700	1000		575	825		525	750		500	700

Roof Angle (Φ) – 20° - 30°

Wind				В	uilding	Height	– H (m	1)			
Region	H:	H≤5		5 <h≤10< th=""><th colspan="2">10<h≤15< th=""><th>l≤15</th><th colspan="2">15<h≤20< th=""><th>1≤20</th></h≤20<></th></h≤15<></th></h≤10<>		10 <h≤15< th=""><th>l≤15</th><th colspan="2">15<h≤20< th=""><th>1≤20</th></h≤20<></th></h≤15<>		l≤15	15 <h≤20< th=""><th>1≤20</th></h≤20<>		1≤20
	D.W & U.W	Middle		D.W & U.W	Middle		D.W & U.W	Middle		D.W & U.W	Middle
Α	1600	1700		1525	1600		1475	1550		1450	1525
	1000	1700		1323	1000		14/3	1550		1430	1323
В	1475	1625		1325	1450		1275	1375		1225	1350
С	1175	1300		975	1175		875	1050		825	1000
D	775	900		625	750		575	675		525	625

 $\ensuremath{\text{D.W}}$ & $\ensuremath{\text{U.W}}$ – Downwind and Upwind refer to note 6.



Client: Job: **23939 Clenergy Australia** PV-ezRack® SolarRoof Interface Spacing Table Project: Date: Feb-13

Address: Within Australia

Designed:	M.S				REV K						
	General Notes										
Note 1	Screws minimum	n embedr	nent le	ength in	to timber 35 r	mm					
Note 2	Recommended s	crews									
	Metal Purlins/I	Battens		Faster	ers to use						
	0.55 mm - 1.5 r	nm		M6-11	M6-11 TPI RoofZips						
	1.9 mm			M6-11 TPI RoofZips OR 12g-14 TPI Teks screws							
	2.4 mm and Abo	ve			12g-24 TPI Teks screws						
	Wood purlins a	nd Rafte	er		ers to use						
	Pine and Hardwo embedment and	od (35m		M6-11	TPI RoofZips	OR 14g-10 T	PI				
Note 3	Above Spacing c	alculated	hasad	on 1 Q	mm steel nurl	in OR F17 Ha	ardwood				
Note 5	For Wind region										
	Material	C & D Sp									
	матегіаі			egion C		Region D					
	0.55		ddle	D.W & U.W	Middle	D.W & U.W					
	0.55 mm steel B		2%	25%	30%	42%					
	0.75 mm steel B	atten)%	0%	10%	5%				
Note 4	Following compo	nents are			se according		011 cription				
	MT-base Rail	ER-R-M	1T2560)	MT-Rail 2560) mm					
A	Corrugated Adapter	ER-AD-	-C110		Adapter for corrugated iron roof						
	Tilt Legs	ER-TL-	30		Tilt Legs Kit	fixed 30° (fro	ont and back l	eg)			
ŀ	Hanger Bolt	ER-HB-	-200/W	VOMP	Hanger Bolt Fixed to timb		nting plate M1 v	0x200.			
	Roof extender	ER-RE-200			Roof Hook Ex						
Note 5	Terrain category scattered obstrutwo obstructions isolated trees an for definition of	ction hav per hect uncut gr	ing hei are. Fo ass. R	ights ge or exam efer cla	nerally from in ple farmland	1.5m to 5m, and cleared s	with no more subdivisions w	ith			
Note 6	For the definition refer attached figures										
	θ = 90		l end	Central	Downwind and						
		Pane	1111								
	θ - 0'	i end	Upwind central	Panel array							
	+	Down	nwind nd	Downwind central	Downwind end						
		,-	/3	b/3 —	b/3						
		FIGURE D	9 ROOF Z	ONES FOR PA	NEL ARRAY						



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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:

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

innovation in design and construction

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: WTC3

Designed: M.S

Date: Feb-13



Client: Clenergy Australia Job: 23939
Project: PV-ezRack® SolarRoof Interface Spacing Table Date: Feb-13

Address: Within Australia

Designed: M.S 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	Building Height – H (m)											
Region		H≤10			10 <h≤15< th=""><th>l≤20</th></h≤15<>			l≤20				
		D.W & J.W	Middle		D.W & U.W	Middle	D.W & U.W	Middle				
Α	-	1475	1875		1250	1775	1100	1650				
В	-	1025	1525		875	1275	775	1125				
С	-	650	950		575	800	500	725				
D	-	425	600		350	525	325	450				

Roof Angle (Φ) – $\geq 25^{\circ}$

Wind	Ві	uilding	Height – H (r	n)		
Region	H≤	10	10<	H≤15	15<	H≤20
	D.W & U.W	Middle	D.W & U.W	Middle	D.W 8 U.W	Middle
Α	1625	1800	1375	1675	1200	1475
В	1125	1350	950	1150	850	1025
С	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 Job: 23939
Project: PV-ezRack® SolarRoof Interface Spacing Table Date: Feb-13

Address: Within Australia

Designed: M.S 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	Building Height – H (m)											
Region		H≤	10		10<	1≤15	15 <h≤20< th=""></h≤20<>					
		.W & .W	Middle		D.W & U.W	Middle		D.W & U.W	Middle			
Α	1	800	2025		1725	1925		1650	1850			
В	1	775	1975		1675	1875		1575	1825			
С	1	425	1725		1325	1575		1250	1500			
D	1	150	1350		1050	1250		1000	1175			

Roof Angle (Φ) – 10° - 20°

Wind	В	Building Height – H (m)									
Region	H≤	≤10	10<	H≤15	15<	15 <h≤20< th=""></h≤20<>					
	D.W & U.W	Middle	D.W 8 U.W	Middle	D.W & U.W	Middle					
А	1675	1875	1600	1775	1550	1700					
В	1575	1825	1450	1750	1375	1650					
С	1250	1525	1175	1400	1325	1100					
D	1000	1200	925	1125	875	1050					

Roof Angle (Φ) – 20° - 30°

Wind	Ві	uilding	Height – H (n	n)		
Region	H≤	10 10 <h< th=""><th>1≤15</th><th>15<h< th=""><th>1≤20</th></h<></th></h<>		1≤15	15 <h< th=""><th>1≤20</th></h<>	1≤20
	D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle
Α	1700	1800	1625	1725	1575	1650
В	1650	1775	1525	1675	1425	1575
С	1300	1425	1225	1325	1150	1250
D	1050	1150	975	1050	925	1000

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



Client: Job: **23939 Clenergy Australia** PV-ezRack® SolarRoof Interface Spacing Table Within Australia Project: Date: Feb-13

Address:

Designed		a			REV J							
2 00.500	General Notes				112.00							
Note 1	Screws minimum	n embed	lment	length i	nto timber 3	5 mm						
Nata 2	D											
Note 2	Recommended s			Eactor	Fasteners to use							
	Metal Purlins/I 0.55 mm - 1.5 r		•	M6-11 TPI RoofZips								
	1.9 mm	11111		M6-11 TPI RoofZips OR 12g-14 TPI Teks screws								
	2.4 mm and Abo	VA			TPI Teks sc		4 IFI TEKS SCIE	2005				
	Wood purlins a		tor		ers to use	16443						
i	Pine and Hardwo											
	embedment and			M6-11	TPI RoofZips	OR 14g-1	0 TPI					
	consederate and	asovej		l								
Note 3	Above Spacing c	alculate	d base	d on 1.	9mm steel p	urlin OR F1	17 Hardwood					
	For Wind region											
	Material				egion C		l Region D					
			Mi	ddle	D.W & U.W	Middle	D.W & U.W					
	0.55 mm steel B	atten	2	2%	25%	30%	42%					
	0.75 mm steel B	nm steel Batten)%	0%	10%	5%					
Note 4	Following compo				use according							
	Components		Numb		Description							
	MT-base Rail	ER-R-	MT256	50	MT-Rail 2560 mm							
	Corrugated	ER-A	D-C110)	Adapter for	corrugated	d iron roof					
	Adapter	ED TI	20		_	_		(log)				
	Tilt Legs	ER-TL	30				(front and back					
	Hanger Bolt	ER-H	3-200/	WOMP	Fixed to tim		nounting plate N	110x200.				
	Roof extender	ER-RE	-200									
	1001 CACCITACI	LIX IXL	_ 200	Roof Hook Extender 200mm								
Note 5	Terrain category	3(TC3)	3(TC3) refers to numerous closely spaced obstructions having heigh									
			to 10 m. For example suburban housing									
	or light industria	l estate:	s. Refe	r clause	4.2.1 of AS	/NZS 1170).2-2011 Amdt	2-2012 for				
	definition of Terr	ain cate	egory 3	3.								
Note 6	For the definition					•						
	refer attached fig	gure D9	from /	AS/NZS	1170.2-201	1 Amdt 2-	2012.					
	θ •	. 90• U	pwind end	Centre	zi Downwind e	nd						
	_	- ⊢	Panel array			\dashv						
		F										
		<u> </u>				!						
		_	d/3	d/3								
					,							
					Panel arra	y]						
	θ	_ o. U	pwind end	Upwin								
		♦	Downwind end	Downwi								
			end	centra	end end							
		L	b/3	b/3	b/3							
		-	-,-			-						
	FIGURE D9 ROOF ZONES FOR PANEL ARRAY											