gamcorp
innovation in design and construction

QAS INTERNATIONAL
ISO 9001:2008
REGISTERED FIRM
Certificate No. AU1222

Gamcorp (Melbourne) Pty Ltd A.C.N 141 076 904 A.B.N 73 015 060 240
www.gamcorp.com.au melbourne@gamcorp.com.au
1/19 Anthony Drive, Mount Waverley VIC 3149. Tel: 03 9803 9533 Fax: 03 9802 9125

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

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

www.gamcorp.com.au
melbourne@gamcorp.com.au

1/19 Anthony Drive, Mount Waverley VIC 3149. Tel: 03 9803 9533 Fax: 03 9802 9125

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

gamcorp
innovation in design and construction

1/19 Anthony Drive
Mount Waverley VIC 3149
Tel: 03 9803 9533
Fax: 03 9802 9125
melbourne@gamcorp.com.au
www.gamcorp.com.au

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**

gamcorp
innovation in design and construction

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 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**	
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**	
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.

gamcorp
innovation in design and construction

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°

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.

gamcorp
innovation in design and construction

Client: **Clenergy Australia** Job: **23939**
Project: **PV-ezRack® SolarRoof Interface Spacing Table** Date: **Feb-13**
Address: **Within Australia**
Designed: **M.S** REV K

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.

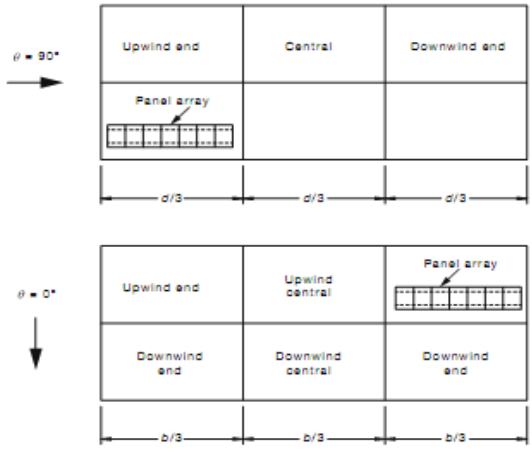

FIGURE D9 ROOF ZONES FOR PANEL ARRAY

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

www.gamcorp.com.au
melbourne@gamcorp.com.au

1/19 Anthony Drive, Mount Waverley VIC 3149. Tel: 03 9803 9533 Fax: 03 9802 9125

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

1/19 Anthony Drive
Mount Waverley VIC 3149
Tel: 03 9803 9533
Fax: 03 9802 9125
melbourne@gamcorp.com.au
www.gamcorp.com.au

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 3

Designed: **M.S**

Date: **Feb-13**

gamcorp
innovation in design and construction

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 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	**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
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.

gamcorp
innovation in design and construction

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 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.

gamcorp
innovation in design and construction

Client: **Clenergy Australia** Job: **23939**
Project: **PV-ezRack® SolarRoof Interface Spacing Table** Date: **Feb-13**
Address: **Within Australia**
Designed: **M.S** REV J

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 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.

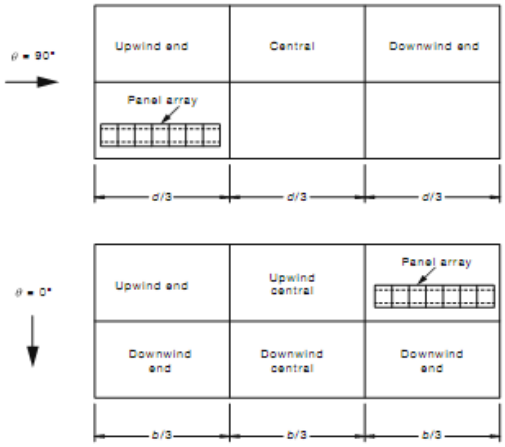

FIGURE D9 ROOF ZONES FOR PANEL ARRAY