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Our Ref: 1850

3 September 2015

Xiamen Antai New Energy Tech. Co., Ltd. Room 402, No.21 Wanghai Road, Software Park II Siming District, Xiamen, China 361008

#### Array Frame Engineering Certificate

#### Installation of flush mounted solar array frame on Tile Roof

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of the Xiamen Antai New Energy Tech. Co., Ltd. solar flush mount frame for the use within Australia. The design check has been based on the information provided by Xiamen Antai New Energy Tech. Co., Ltd.

We find the Installation of flush mounted solar array frame on tile roof to be structurally sufficient for Australian use based on the following conditions:

- Wind Loads to AS/NZ1170.2:2011 Admt 3-2012
- Wind Region A, B, C, D
- Wind Terrain Category 2 & 3
- Wind average recurrence interval of 100 years region A and B
- Wind average recurrence interval of 500 years region C and D
- Maximum Building height 20 m
- Timber with Joint Type classification J5 and J6 are excluded unless tested for Screw capacity
- PV panels to be installed flat on the roof
- Max. Solar Panel Dimensions 2000×1000
- Regional Wind speed:

Wind Zone	А	В	С	D
Wind Speed (m/s)	41	48	69	88

### 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

Page 1 of 1 ISO 9001:2008 Registered Firm Certificate No: AU1222



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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Suite 4/ 346 Ferntree Gully Rd, Notting Hill VIC 3168. Tel: 03 9543 2211 Fax: 03 9543 4046

# Structural Design Documentation

# Solar Roof Interface Spacing Table According to AS/NZS 1170.2-2011 Amdt 3-2012 Within Australia Terrain Category 2

For: Xiamen Antai New Energy Tech. Co., Ltd.



Job Number:1850Date:September 3, 2015

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ISO 9001:2008 Regist Certificate No

- Job No: 1850
- Client: Xiamen Antai New Energy Tech. Co., Ltd.

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- Project: Solar Roof 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

AS 1664.1 – Aluminium structures - Limit state design

Wind Terrain Category:

WTC 2

Designed: B.C

Date: Sep-15



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C

	Solar Array Inte	arace	spacing	Table		<u>e RUUI</u>		
	Type of Rail		Rail II					
	Type of Interface Solar Panel Dimer Terrain category		ATL-TYN 2mx1m 2		1			
	Roof Angle (Φ) –		Φ < 5°					
Wind			Buildin	g Height	t – H (I	m)		
Region		H	≤10		10<	H≤15	15<	l≤20
		D.W & U.W	Middle		D.W & U.W	Middle	D.W & U.W	Middle
A	-	794	978		716	881	674	829
В	_	569	698		514	630	485	594
С	-	266	325		241	294	228	278
	_							
D		168	204		152	185	143	175
Wind Region	Roof Angle (Φ) –	Н	5°≤Φ ≤ Buildin ≤10	30 g Height	· · ·	m) H≤15	15<+	1≤20
		D.W &	Buildin		10<		15 <f D.W &amp; U.W</f 	l≤20 Middle
		D.W &	Buildin ≤10		10<	H≤15	D.W &	
Region		D.W & U.W	Buildin ≤10 Middle		10< D.W & U.W	H≤15 Middle	D.W & U.W	Middle
<b>Region</b> A		D.W & U.W 794	Buildin ≤10 Middle 1158		10< D.W & U.W 716	H≤15 Middle 1040	D.W & U.W 674	Middle 979



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C

	Type of Rail		Rail III					
	Type of Interface		ATL-TYN-h	look01				
	Solar Panel Dimen							
	Terrain category		2					
	· · · · · · · · · · · · · · · · · · ·		-					
	Roof Angle (Φ) –		Φ < 5°					
Wind			Building H	Height – H (	m)			
Region		H	≤10	10<	:H≤15	15 <h≤20< td=""></h≤20<>		
		D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle	
	_							
A	_	794	978	716	881	674	829	
В	-	569	698	514	630	485	594	
	-							
С		266	325	241	294	228	278	
D		168	204	152	185	143	175	
	Roof Angle (Φ) –		5°≤Φ ≤ 30	h				
Wind				, Height – H (	m)			
Region		H	≤10		:H≤15	15<	1≤20	
	1	D.W & U.W		D.W & U.W		D.W & U.W	Middle	
A	-	794	1158	716	1040	674	979	
	_							
В	4	569	823	514	741	485	698	
С	-	266	381	241	344	228	325	
<u>ر</u>	-	200	501	241	577	220	525	
D	-	168	239	152	216	143	204	



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C

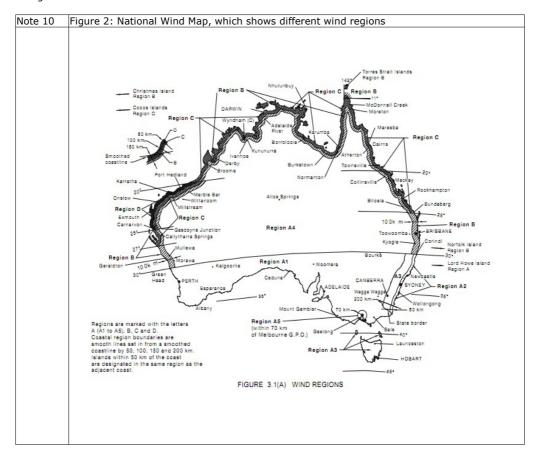
	Type of Rail Type of Interface Solar Panel Dimer	ision		N-hook01				
	Terrain category		2					
	Roof Angle (Φ) –		Φ < 5°					
Wind			Buildin	ig Height	<u>`</u>	· ·		
Region		Н	≤10		10<	:H≤15	15<	1≤20
		D.W & U.W	Middle		D.W & U.W	Middle	D.W & U.W	Middle
А	_	794	978		716	881	674	829
В	_	569	698		514	630	485	594
С	_	266	325		241	294	228	278
D	_	168	204		152	185	143	175
Wind	Roof Angle (Φ) –		5°≤Φ ≤ Buildin	30 Ig Height	– H (	m)		
Region		Н	≤10	<u>g</u>		:H≤15	15<	1≤20
		D.W & U.W	Middle		D.W & U.W	Middle	D.W & U.W	Middle
А	_	794	1158		716	1040	674	979
В	_	569	823		514	741	485	698
	-	266	381		241	344	228	325
С						1	1	1



Client: Xiamen Antai New Energy Tech. Co., Ltd. Job: 1850 Project: Solar Array Interface Spacing Table Date: Sep-15 Address: Within Australia Designed: B.C **General Notes** Note 1 All holes must be pre drilled, with minimum screw embedment of 38 mm into timber. The width of timber purlins shall not be less than 38mm. Use minimum of two screws Note 2 per tile hook Note 3 Recommended screws Wood purlins and Rafter Fasteners to use Pine and Hardwood (38mm 14g 10 TPI (6.3 x 65 mm long) embedment and above) Note 4 Roof Tile Hook must be fixed with minimum of three 14g 10 TPI Note 5 Following components are satisfied to use according to AS1170.2011 Components Part Number Description ATL-TYN-hook01 Tile Hook Roof Interface Tile hook Inter Clamp ATL-FWNY-09 Internal fixing between rail and solar panel End Clamp ALT-TYN-14 End fixing between rail and solar panel Rail Connection Splice ATL-TYN-21 Aluminium Rail (AL6005-T5) Antai Rail II ATL-TYN-28 T Module ATL-TYN-29 Rail to bolt connector Antai Rail III ATL-TYN-53 Aluminium Rail (AL6005-T5) Antai Rail IV Aluminium Rail (AL6005-T5) CG-010 Note 6 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 7 Rail Joiner connection must placed at the fifth of the length of the interface spacing. No rail joiner should be placed at the centre of spacing or over the rail support. Rail Joiner RAIL Roof Interface (Tin/Tile) Δ ~ L/5 Note 8 For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012 Note 9 Figure 1: Shows location of the Upwind/Central & Downwind end. Flush mounted arrays EXCL



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C





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# Structural Design Documentation

# Solar Roof Interface Spacing Table According to AS/NZS 1170.2-2011 Amdt 3-2012 Within Australia Terrain Category 2

For: Xiamen Antai New Energy Tech. Co., Ltd.



Job Number:1850Date:September 3, 2015

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ISO 9001:2008 Regist Certificate No

- Job No: 1850
- Client: Xiamen Antai New Energy Tech. Co., Ltd.

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- Project: Solar Roof 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

AS 1664.1 – Aluminium structures - Limit state design

Wind Terrain Category:

WTC 3

Designed: B.C

Date: Sep-15



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C

			B 11 7-						
	Type of Rail		Rail II						
	Type of Interface		ATL-TYN-ho	DOKUI					
	Terrain category	nsion 2mx1m 3							
	remain category		5						
	Roof Angle (Φ) –		Φ < 5°						
Wind			Building H	leight – H (I	m)				
Region		H	≤10	10<	H≤15	15<	l≤20		
		D.W & U.W	Middle	D.W & U.W	Middle	D.W & U.W	Middle		
A	-	1189	1476	1021	1263	907	1120		
	-	1105	1470	1021	1205		1120		
В	-	844	1041	728	895	648	796		
		-							
С		391	478	338	413	302	369		
	7								
D	_	245	299	212	259	190	232		
D Wind Region	Roof Angle (Φ) –	H	5°≤Φ ≤ 30	leight – H (1		15 <f< th=""><th></th></f<>			
Wind		H: D.W &	5°≤Φ ≤ 30 Building H	eight – H (1 10< D.W &	m)		1≤20		
Wind		H: D.W &	$5^{\circ} \le \Phi \le 30$ Building H $\le 10$	eight – H (1 10< D.W &	m) H≤15	15 <f< td=""><td></td></f<>			
Wind		H: D.W & U.W	$5^{\circ} \le \Phi \le 30$ Building H $\le 10$	eight – H (1 10< D.W &	m) H≤15 Middle	15 <f< td=""><td>1≤20</td></f<>	1≤20		
Wind Region		H: D.W & U.W 1189	5°≤Φ ≤ 30 Building H ≤10 Middle 1758	leight – H (l 10< D.W & U.W 1021	m) H≤15 Middle 1500	15 <f D.W &amp; U.W 907</f 	l≤20 Middle 1327		
Wind Region		H: D.W & U.W	5°≤Φ ≤ 30 Building H ≤10 Middle	eight – H (1 10< D.W & U.W	m) H≤15 Middle	15 <f< td=""><td>l≤20 Middle</td></f<>	l≤20 Middle		
Wind Region A B		H: D.W & U.W 1189 844	5°≤Φ ≤ 30 Building H ≤10 Middle 1758 1233	leight – H (1 10< D.W & U.W 1021 728	m) H≤15 1500 1058	15 <f D.W &amp; U.W 907 648</f 	l≤20 Middle 1327 940		
Wind Region A		H: D.W & U.W 1189	5°≤Φ ≤ 30 Building H ≤10 Middle 1758	leight – H (l 10< D.W & U.W 1021	m) H≤15 Middle 1500	15 <f D.W &amp; U.W 907</f 	l≤20 Middle 1327		



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C

	Type of Rail	Rail III									
	Type of Interface	ATL-TYN-hook01									
	Solar Panel Dimensi										
	Terrain category		3								
	Roof Angle (Φ) –		Φ < 5°								
Wind			Buildina H	leight – H (	m)						
Region		H≤10			H≤15	15<	1≤20				
		.w & .w	Middle	D.W & U.W	Middle	D.W & U.W	Middle				
A		189	1476	1021	1263	907	1120				
В		844	1041	728	895	648	796				
С		391	478	338	413	302	369				
-											
D	1	245	299	212	259	190	232				
Wind Region	Roof Angle (Φ) –		$\frac{5^{\circ} \le \Phi \le 30}{\text{Building F}}$	leight – H (	n) H≤15	15<	1≤20				
		.W & .W	Middle	D.W & U.W	Middle	D.W & U.W	Middle				
			1750	1021	1500	907	1327				
A	1	189	1758	1021							
AB		189 844	1233	728	1058	648	940				
					1058 485	648 302	940 433				



Client:Xiamen Antai New Energy Tech. Co., Ltd.Project:Solar Array Interface Spacing TableAddress:Within AustraliaDesigned:B.C

	Type of Rail		Rail IV					
	Type of Interface Solar Panel Dimer		ATL-TYN- 2mx1m	hook01				
	Terrain category		3					
	Roof Angle (Φ) –		Φ < 5°					
Wind				Height – H				
Region		H:	≤10	1	)<	H≤15	15<+	1≤20
		D.W & U.W	Middle	D.W U.W		Middle	D.W & U.W	Middle
	_							
A	_	1189	1476	102	21	1263	907	1120
В	_	844	1041	72	8	895	648	796
С	_	391	478	33	8	413	302	369
D	_	245	299	21	2	259	190	232
	Roof Angle (Φ) –		5°≤Φ ≤ 3	I				_
Wind	Roof Aligie $(\Psi)$ –			Height – H	( r	m)		
Region		H	≤10			H≤15	15<	1≤20
		D.W & U.W	Middle	D.W U.W		Middle	D.W & U.W	Middle
A	-	1189	1596	102	01	1500	907	1327
A	-	1199	1230	102		1200	907	132/
В	-	844	1233	72	8	1058	648	940
С	_	391	561	33	8	485	302	433
		245	350	21	_	303	190	271



Xiamen Antai New Energy Tech. Co., Ltd. Job: 1850 Client: Project: Solar Array Interface Spacing Table Date: Sep-15 Address: Within Australia Designed: B.C **General Notes** All holes must be pre drilled, with minimum screw embedment of 38 mm into timber. Note 1 The width of Timber purlins shall not be less than 38mm. Use minimum of two screws Note 2 per tile hook Note 3 Recommended screws Wood purlins and Rafter Fasteners to use Pine and Hardwood (38mm 14g 10 TPI (6.3 x 65 mm long) embedment and above) Note 4 Roof Tile Hook must be fixed with minimum of three 14g 10 TPI . Note 5 Following components are satisfied to use according to AS1170.2011 Components Part Number Description Tile hook ATL-TYN-hook01 Tile hook Roof interface Inter Clamp ATL-FWNY-09 Internal fixing between rail and solar panel End Clamp End fixing between rail and solar Panel ALT-TYN-14 ATL-TYN-21 Rail Connection Splice Antai Rail II ATL-TYN-28 Aluminium Rail (AL6005-T5) ATL-TYN-29 Rail to bolt connector T Module Aluminium Rail (AL6005-T5) Antai Rail III ATL-TYN-53 Aluminium Rail (AL6005-T5) Antai Rail IV CG-010 Note 6 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. Rail Joiner connection must placed at the fifth of the length of the interface spacing. Note 7 No rail joiner should be placed at the centre of spacing or over the rail support. Rail Joine RAIL of Interface (Tin/Tile) Δ L/5 ī Note 8 For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012. Figure 1: Shows location of the Upwind/Central & Downwind end. Note 9 Flush mounted arrays: EXCLUSIO Panel Must be installed flat to the roof



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