

12 December 2018

Project number: U117_FP1

WOCHN Green Energy Co.,Ltd

Xicen Building 349, Qingpu District, Shanghai

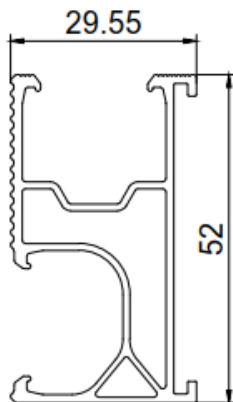
Dear Sir,

RE: WOCHN SOLAR ROOF MOUNTING FOR PORTRAIT
ORIENTATED FLUSH MOUNTED SOLAR PANELS

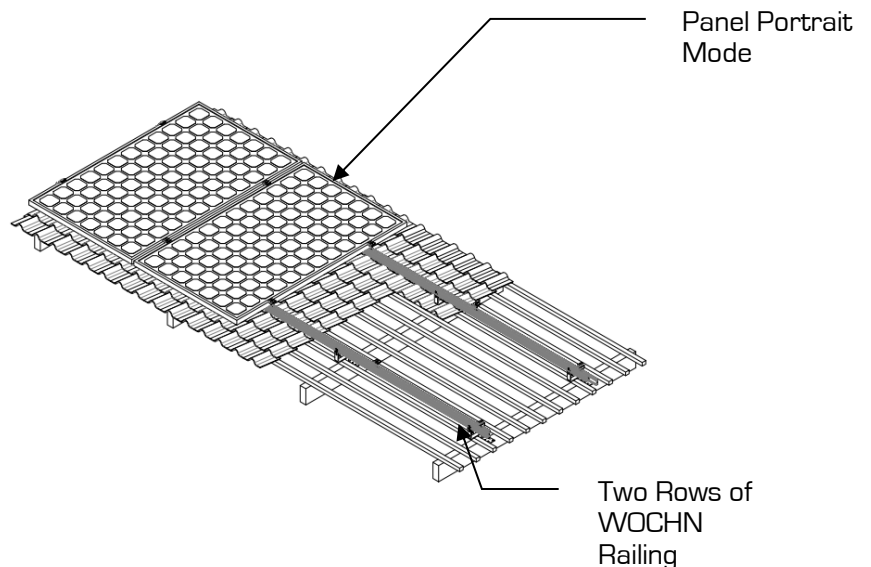
As Requested, we have reviewed the structural adequacy of the Aluminum support framing components as detailed in the drawings issued by WOCHN GREEN ENERGY CO.,LTD . We have design investigated for the Aluminum Railing as shown below. The section of the railing is shown below.

The panels are supported by two rows of railing. The railings are fixed directly to the rafters or to the purlins.

The spacing of the fixing of the Railing to the rafter/purlin shall be limited as tabulated below in tables 1.1, 1.2, 2.1, 2.2, Refer to" List of Tables" below to choose the appropriate span table. Refer to Figure A for wind regions and terrain categories as defined in AS1170.2. The Central & Edge zones referred to in the tables are depicted in figures B on the following pages



**Railing: WOCHN
52x29.55(mm)**



Panel Size	Terrain Category 2
1700x1100	1.1 & 1.2 (Page 2)
2100x1100	2.1 & 2.2 (Page 3)

Terrain Category 2 (TC2) Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.

Table 1.1 METAL ROOF.		Roof Slope: 0 to 15 deg						
Maximum spacing [mm] of the fixing of the railing to Pitched METAL roof								
	Region A		Region B		Region C		Region D	
Roof Height	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone
5m	1900	1750	1570	1320	960	780	540	480
10m	1750	1570	1330	1080	860	590	510	440
15m	1690	1460	1200	980	730	550	460	#N/A
20m	1610	1380	1130	930	570	510	#N/A	#N/A
Panel size 1700 X 1100								

Terrain Category 2

Table 1.2 METAL & TILED ROOF.		Roof Slope: 15 to 30 deg						
Maximum spacing [mm] of the fixing of the railing to Pitched METAL& TILED roof								
	Region A		Region B		Region C		Region D	
Roof Height	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone
5m	2040	1750	1730	1320	1130	780	590	480
10m	1870	1570	1540	1080	1010	590	560	440
15m	1790	1460	1410	980	880	550	520	#N/A
20m	1750	1380	1330	930	780	510	480	#N/A
Panel size 1700 X 1100								

Terrain Category 2

Terrain Category 2 (TC2) Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.

Table 2.1 METAL ROOF.									Terrain Category 2
Roof Slope: 0 to 15 deg									
Maximum spacing (mm) of the fixing of the railing to Pitched METAL roof									
	Region A		Region B		Region C		Region D		
Roof Height	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone	
5m	1750	1560	1320	1070	770	560	470	#N/A	
10m	1570	1310	1080	880	590	520	430	#N/A	
15m	1460	1190	980	800	540	480	#N/A	#N/A	
20m	1370	1120	920	730	510	430	#N/A	#N/A	
Panel size 2100 X 1100									

Table 2.2 METAL & TILED ROOF.									Terrain Category 2
Roof Slope: 15 to 30 deg									
Maximum spacing (mm) of the fixing of the railing to Pitched METAL& TILED roof									
	Region A		Region B		Region C		Region D		
Roof Height	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone	Central Zone	Edge Zone	
5m	1880	1560	1530	1070	910	560	530	#N/A	
10m	1730	1310	1270	880	820	520	500	#N/A	
15m	1640	1190	1150	800	590	480	440	#N/A	
20m	1570	1120	1080	730	560	430	#N/A	#N/A	
Panel size 2100 X 1100									

Our design investigation is based on the following Australian Standards and sections of Building Code of Australia relevant to structural issues.

- AS/NZS 1170.0-2002 Structural design Actions Part 0: General principles.
- AS/NZS 1170.2-2011(R2016) Structural design Actions Part 2: Wind actions.
- AS 1664.1-1997 Aluminum structures Part 1: Limit state design.
- AS/NZS 4673-2001 Cold Formed Stainless Steel.
- AS 1684.1-1999 Residential timber-framed construction - Design criteria.
- AS 1684.2-2010 Residential timber-framed construction - Non-cyclonic areas.
- AS 1684.3-2010 Residential timber-framed construction - Cyclonic areas.
- AS 1720.1-2010 Timber structures - Design methods.pdf.
- AS 3566.1-2002 Self-drilling screws for the building and construction industries.
- AS3566.2-2002 Part 2: Corrosion resistance requirements.
- ISO3506:1-2009 Mechanical Properties of Corrosion-Resistance Stainless Steel Fasteners.

Following design criteria has been used for the structural verification.

- Design Life 25 years
- Importance Level Type 2: Ordinary
- Annual Probability of exceedance 1/200
- Terrain Category to AS1170.2 2
- Service Deflection Not limited
- Snow loading Not considered
- Earthquake Loading Not considered
- Maximum Roof Pitch 30 degrees
- Minimum pitch for Tiled Roof 15 degrees
- Aluminum Rails 6005 - T5
- Maximum dimensions & Minimum weight of Solar panels.
 - 18 Kg panel 1700X1100
 - 25 Kg panel 2100X1100
- Panel Orientation Portrait.

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Figure A: Wind Regions. AS1170.2

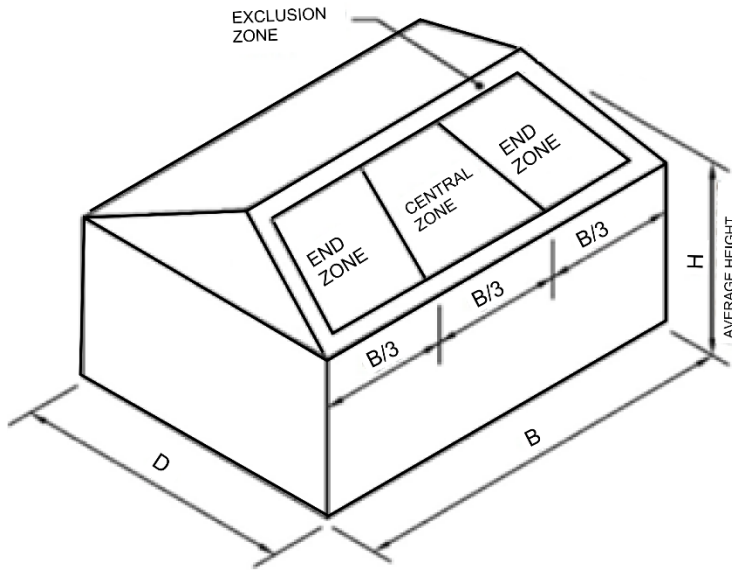


Figure B: Central & End Zones Plan/Elevation. AS1170.2

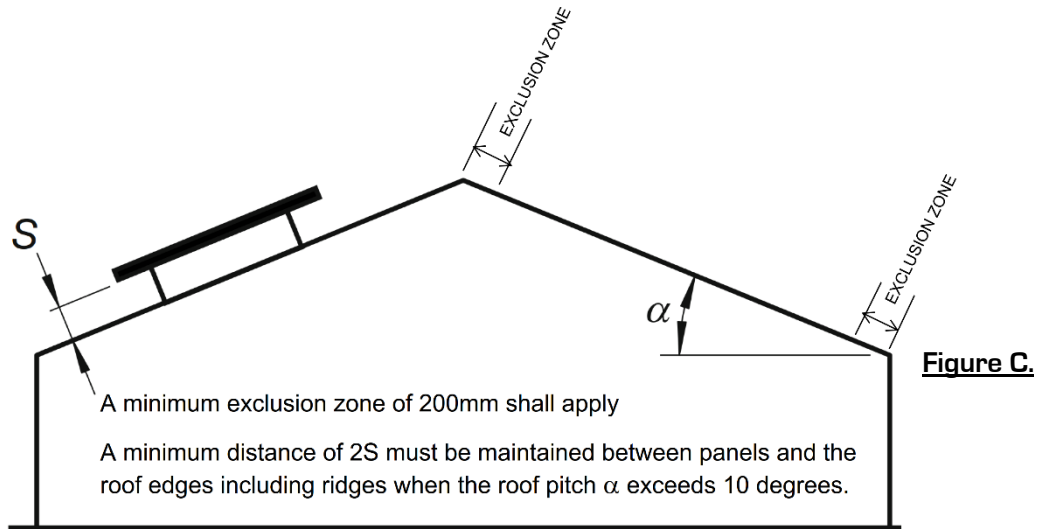


Figure C: Exclusion Zones. AS1170.2

Subject to the following qualifications we certify that the above mentioned frames are structurally adequate and conform to the above Australian standards.

1. The gap between the underside of the solar panels and the roof shall be between 50mm minimum and 300mm maximum. Nominate the actual gap as "S" mm.
2. The solar panels shall be installed 2xS mm or 300 mm (whichever is greater) away from the roof edges and the ridge. Example: If the gap below the panel is 150mm then the panels shall be located 300mm away from the roof edge and the ridge. See Figure C above.
3. Each row of solar panels shall have a minimum of two rows of railing fixed to the roof framing.
4. The connections between the solar panels shall be flexible to accommodate deflection of the railing.
5. The deflection of the railing has not been controlled in the design. If deflection has to be limited then spacing shall be reduced as advised by a practicing structural engineer.
6. The roofing to which the panels are to be installed shall conform to the relevant Australian Standards including AS1684, AS4440, AS1720, AS4100 and AS4600.
7. The buildings to which the panels are to be installed shall be of approved construction and conform to BCA and the relevant Australian Standards. The roof framing and the building shall be regularly maintained as required.
8. The existing roof framing shall be verified for compliance to Clause D6, of AS1170.2.
9. The installation of the framing shall conform to relevant Australian Standards, Manufacturer's specifications and good building practice.
10. The spacing of the rail fixings shall not exceed the recommended spacing, and shall be reduced to match the location of the roof rafters.
11. The cantilever span of the panel shall not exceed 25% of panel length (i.e. 425mm for 1700 long).
12. The cantilever span of the railing shall not exceed 33% of the adjacent spacing of the installed fixings.
13. Each fixing shall have a minimum of two gauge 14 screws.
14. The screws used to attach the railing to the roof framing shall conform to AS3566, ISO 3506.1.
15. The cold formed steel purlins shall have a minimum base material thickness of 1.2mm in Regions A & B and 1.9mm in Regions C & D.

16. The Minimum Timber Joint Type classification shall be as follows:

Wind Regions	Seasoned	Unseasoned	Joint Classification as in Tables H2.3 & H3.1 of AS1720.1.
A & B	JD1 to JD5	J1 to J4	
C & D	JD1 to JD4	J1 to J3	

17. Predrilled holes shall be used for all screw fixings into timber. The width of Timber purlins shall not be less than 35mm. Minimum edge distance for screws shall be 17mm. The minimum embedment for each screw shall be 35mm.

18. Dissimilar metals shall be separated with a suitable inert material to prevent galvanic corrosion.

19. The installation and fixings shall be periodically inspected and maintained.

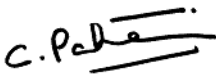
20. The following are excluded from this certification.

- x Framing of the solar panel assembly.
- x Material Testing and or Verification of test certificates for the materials and components.

21. We relied upon the material properties and a test certificate for tile hook provided by Xiamen Enerack Technology Co. Ltd.

Should you have any queries, please feel free to call Paheer on 9565-5558.

Yours faithfully,
SPAD PTY LTD



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Director