

23 January 2019

Project number: V002_FL2A

POWERSTONE SOLAR MOUNTING TECHNOLOGY Pty Ltd
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Jiangsu Province China, 215400

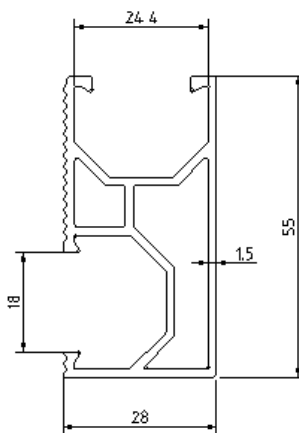
Dear Sir,

RE: POWERSTONE ROOF MOUNTING FOR LANDSCAPE
ORIENTATED FLUSH MOUNTED SOLAR PANELS

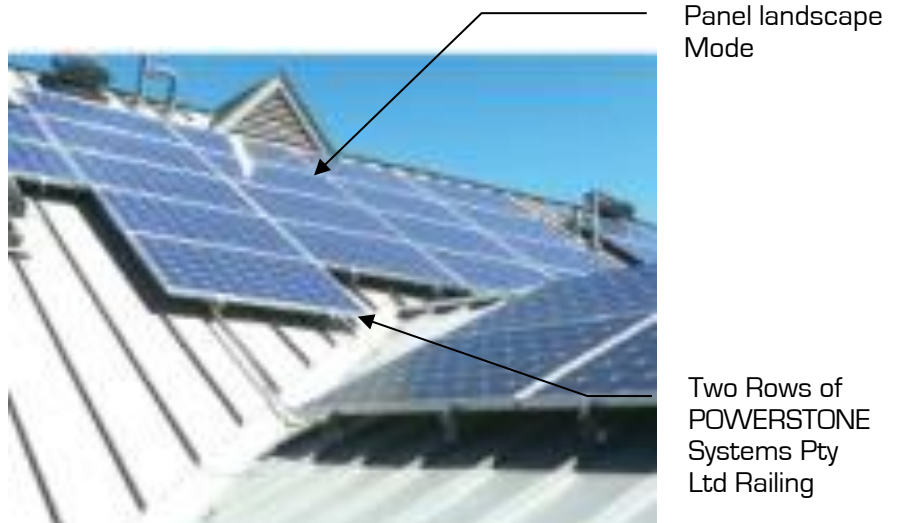
As Requested, we have reviewed the structural adequacy of the Aluminum support framing components as detailed in the drawings issued by Power Stone. We have design investigated for the section of Aluminum Railing as shown below.

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 and C on the following pages.



**Railing: PowerStone
55x28**



Panel Size	Terrain Category 2
1700x1000	1.1 & 1.2 (Page 2)
2000x1000	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.									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	2530	2270	1860	1520	970	810	680	570	
10m	2280	1860	1530	1250	860	750	620	510	
15m	2060	1680	1380	1000	780	690	540	#N/A	
20m	1940	1580	1300	920	730	630	490	#N/A	
Panel size 1700 X 1000									

Table 1.2 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	2800	2270	2190	1520	1300	810	760	570	
10m	2500	1860	1800	1250	1140	750	710	510	
15m	2400	1680	1620	1000	870	690	630	#N/A	
20m	2280	1580	1530	920	810	630	570	#N/A	
Panel size 1700 X 1000									

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	2290	1860	1520	1070	900	730	560	#N/A	
10m	1870	1520	1080	980	790	660	510	#N/A	
15m	1680	1250	1030	910	700	560	#N/A	#N/A	
20m	1590	1090	1010	860	620	510	#N/A	#N/A	
Panel size 2000 X 1000									

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	2710	1860	1800	1070	1000	730	660	#N/A	
10m	2210	1520	1450	980	940	660	580	#N/A	
15m	1990	1250	1150	910	810	560	520	#N/A	
20m	1870	1090	1080	860	730	510	#N/A	#N/A	
Panel size 2000 X 1000									

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.
 - 17 Kg panel 1700X1000
 - 20 Kg panel 2000X1000
- Panel Orientation Landscape.

POWERSTONE ROOF MOUNTING FOR LANDSCAPE ORIENTATED FLUSH MOUNTED SOLAR PANELS

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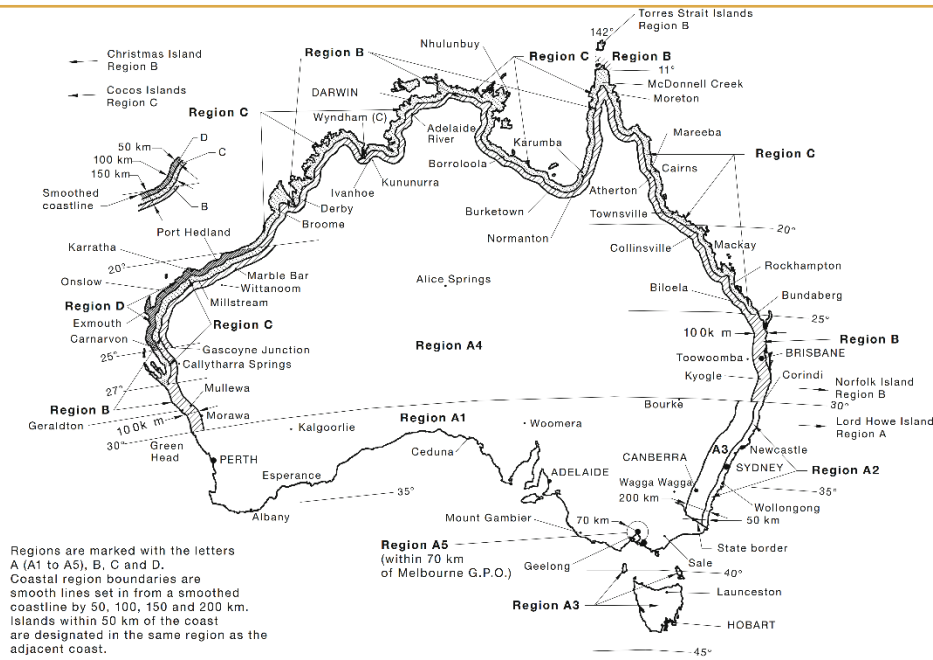


Figure A.

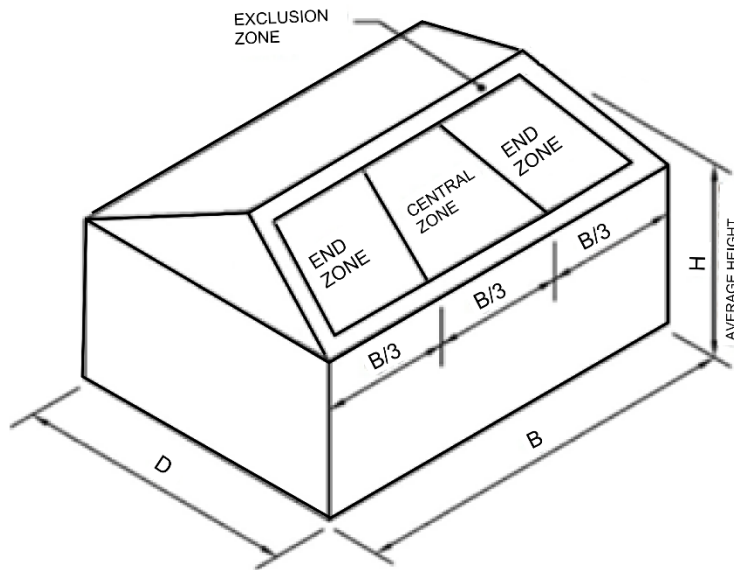
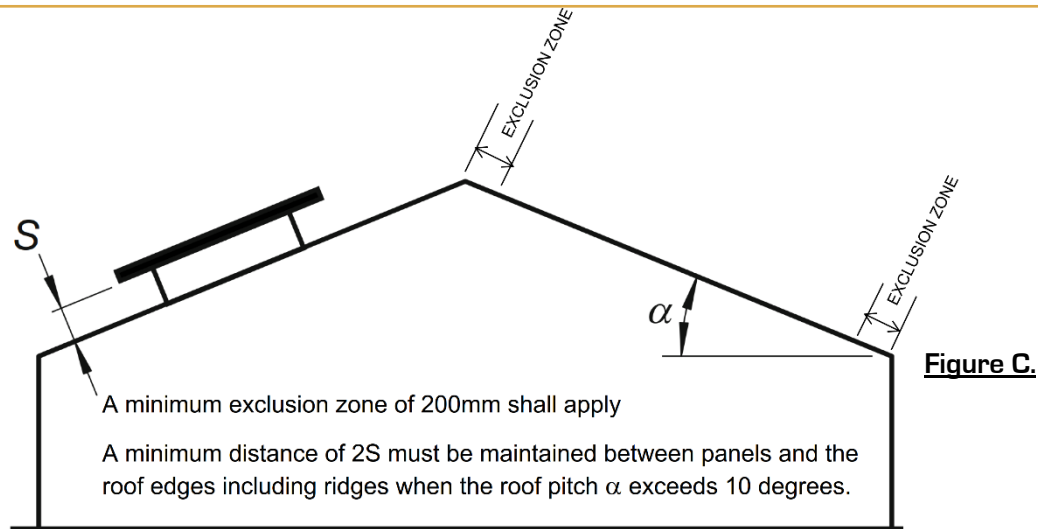


Figure B.



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 200 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 AS/NZS1170.2.
9. The installation of the framing shall conform to relevant Australian Standards, Manufacturer's specifications and good building practice.

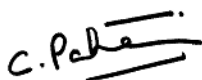
10. The spacing of the rail fixings shall not exceed the recommended spacing, and shall be reduced to match the location of the roof rafters.
11. The cantilever span of the panel shall not exceed 25% of panel length (i.e. 425mm for 1700 long).
12. The cantilever span of the railing shall not exceed 33% 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. We relied upon the material properties submitted by the manufacturer. Material Testing and or Verification of material property is excluded from our investigation.

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

Yours faithfully,
SPAD PTY LTD



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Director