

23 January 2019

Project number: V002_ FP1A

POWERSTONE SOLAR MOUNTING TECHNOLOGY Pty Ltd
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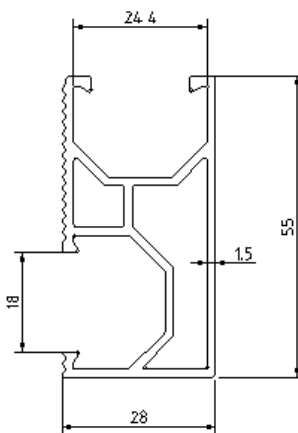
Dear Sir,

RE: POWERSTONE 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 Power Stone. We have design investigated for the section of Aluminum Railing as shown below.

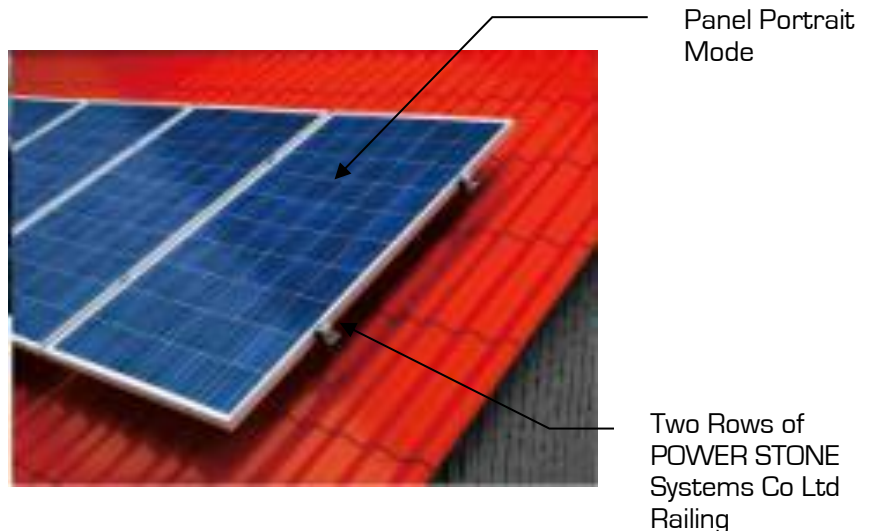
The panels are supported by two rows of railing. The railings are fixed directly to the rafters or to the purlins.

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 AS1 170.2. 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. Roof Slope: 0 to 15 deg									Terrain Category 2
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	2040	1870	1730	1530	1130	920	590	530	
10m	1870	1730	1530	1270	1020	830	560	500	
15m	1790	1630	1410	1150	880	660	520	#N/A	
20m	1750	1570	1330	1090	790	560	480	#N/A	
Panel size 1700 X 1000									

Table 1.2 METAL & TILED ROOF. Roof Slope: 15 to 30 deg									Terrain Category 2
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	2210	1870	1840	1530	1320	920	830	530	
10m	2000	1730	1710	1270	1190	830	730	500	
15m	1920	1630	1590	1150	1030	660	560	#N/A	
20m	1870	1570	1530	1090	920	560	530	#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	1910	1750	1570	1320	960	780	540	480	
10m	1760	1570	1330	1090	860	590	510	#N/A	
15m	1700	1460	1200	980	730	550	460	#N/A	
20m	1620	1380	1130	930	570	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	2050	1750	1730	1320	1130	780	590	480	
10m	1880	1570	1540	1090	1020	590	560	#N/A	
15m	1800	1460	1410	980	880	550	520	#N/A	
20m	1760	1380	1330	930	790	510	480	#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 Portrait.

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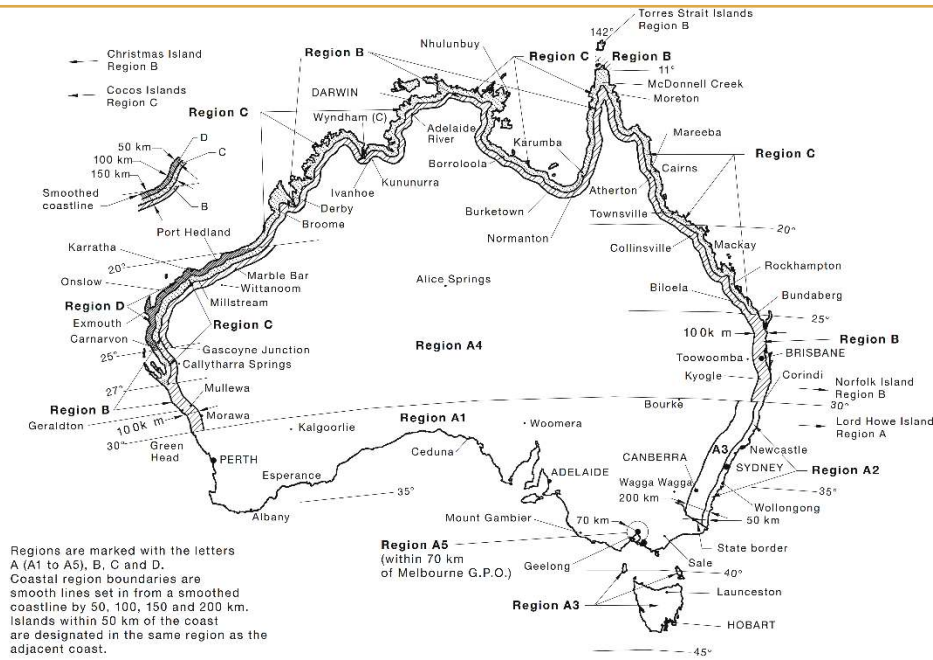


Figure A.

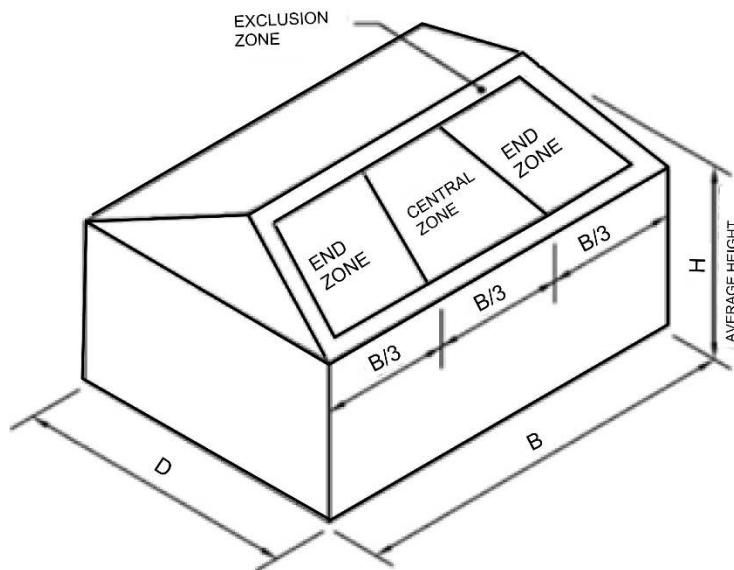
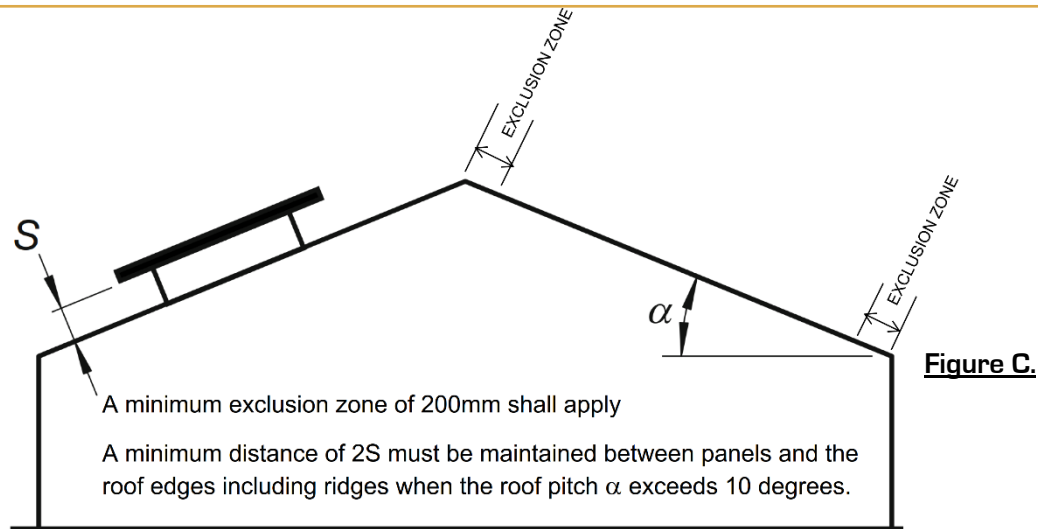


Figure B.



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, AS/NZS1720, 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.

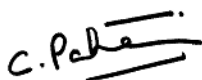
10. The spacing of the rail fixings shall not exceed the recommended spacing, and shall be reduced to match the location of the roof rafters.
11. The cantilever span of the panel shall not exceed 25% of panel length (i.e. 425mm for 1700 long).
12. The cantilever span of the railing shall not exceed 33% 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