

11 December 2018

Project number: U117_AP1

SunRack Solar Co., Ltd.
No. 333 Qimen Road, Shushan District, Hefei,
Anhui 230071, China.

Dear Sir,

RE: SUNRACK SOLAR ROOF MOUNTING FOR PORTRAIT
ORIENTATED TILT MOUNTED SOLAR PANELS .

As requested, we have reviewed the structural adequacy of the Aluminum support framing components as detailed in the drawings issued by SunRack Solar Co. Ltd. We have design investigated for the Aluminum Railing as shown below. The section of the railing is shown below.

The panels in portrait orientation are supported by two rows of railing. The railings are supported by the legs which are fixed directly to the rafters, purlins or concrete roof.

The spacing of the back legs shall be limited as tabulated below in tables 1.1 & 1.2 for 1700 long panels and 2.1 & 2.2 for 2100 panels. Refer to Figure C on page 2 for wind regions and terrain categories as defined in AS1170.2. The spacing for the lower rail fixing can be increased by a third of the shorter legs. (Example: Spacing of longer leg-450. Spacing of lower railing-600).

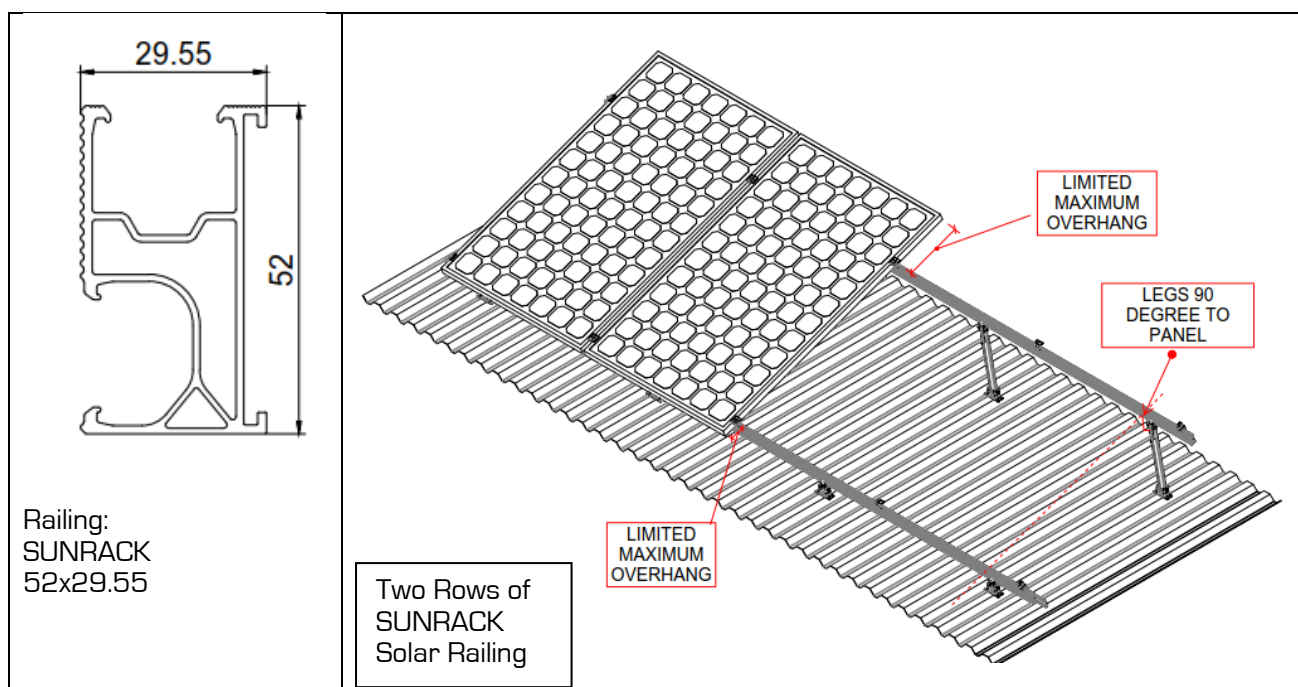


Figure A Rail Detail

Figure B Configuration.

Note: Tilt angle is measured from the surface of the roof to the PV panel.

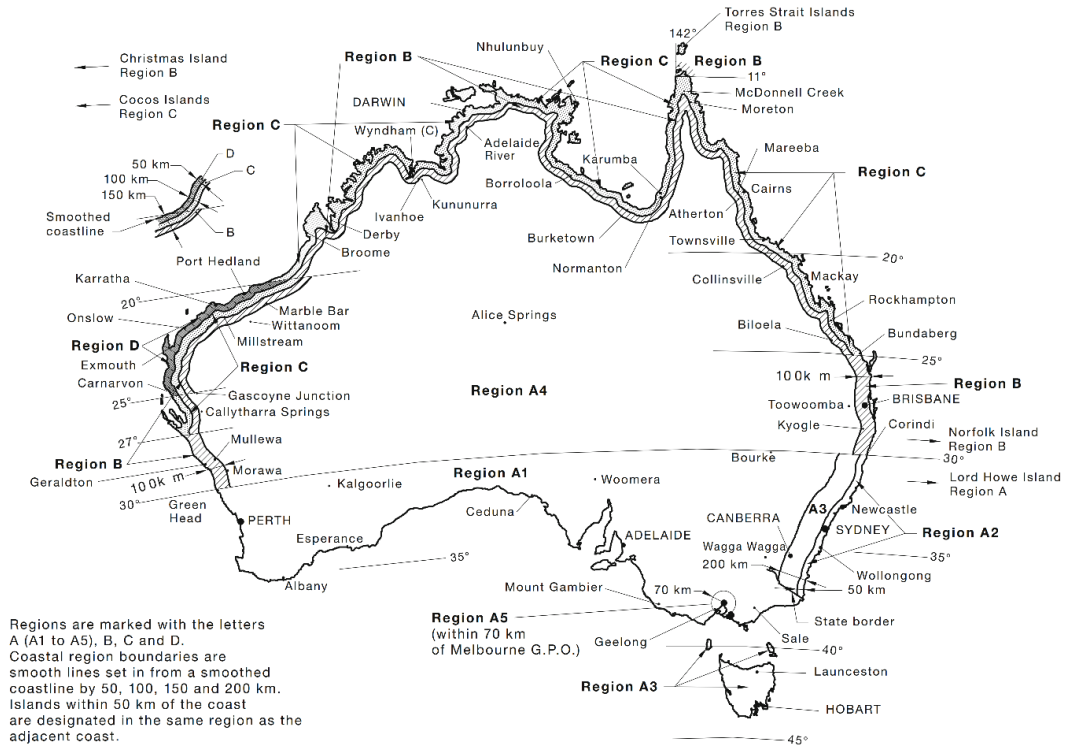


Figure C Wind Regions. AS1170.2

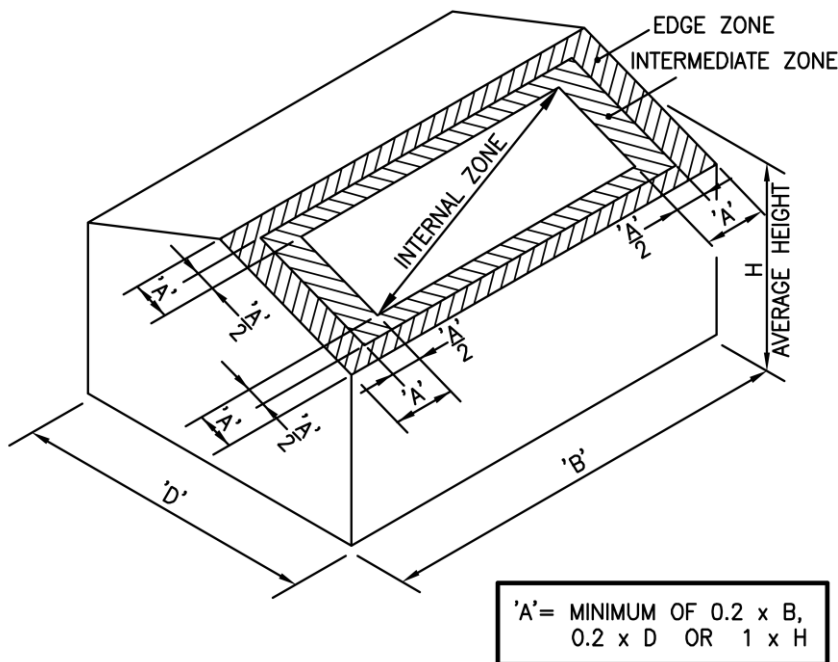


Figure D - Edge Zones. AS1170.2 (See Note 5 on Page 10)

| Table A-1 Calculation of Edge Zones. | | | |
|-------------------------------------------------------------------------------------|---------|--------------------|-------|
| 1. Building Height H: | ___ m. | Use Value of H | ___ m |
| 2. Building Width B: | ___ m. | Calculate 0.2 X B. | ___ m |
| 3. Building Depth D: | ___ m. | Calculate 0.2 X D. | ___ m |
| Select the minimum Value of the three (3) results above. | | | |
| A = ___ m. (The above calculated minimum value) | | | |
| Edge zones need NOT be considered for small buildings for the following conditions. | | | |
| 1. 1700x1100 PV panels: Minimum building width < 6800mm. | | | |
| 2. 2100x1100 PV panels: Minimum building width < 7600mm. | | | |
| Example: | | | |
| Building Height H: | 5.0 m. | Use Value of H | 5.0 m |
| Building Width B: | 8.0 m. | Calculate 0.2 X B. | 1.6 m |
| Building Depth D: | 10.0 m. | Calculate 0.2 X D. | 2.0 m |
| A= minimum {0.2b,0.2d H} = 1.6m | | | |

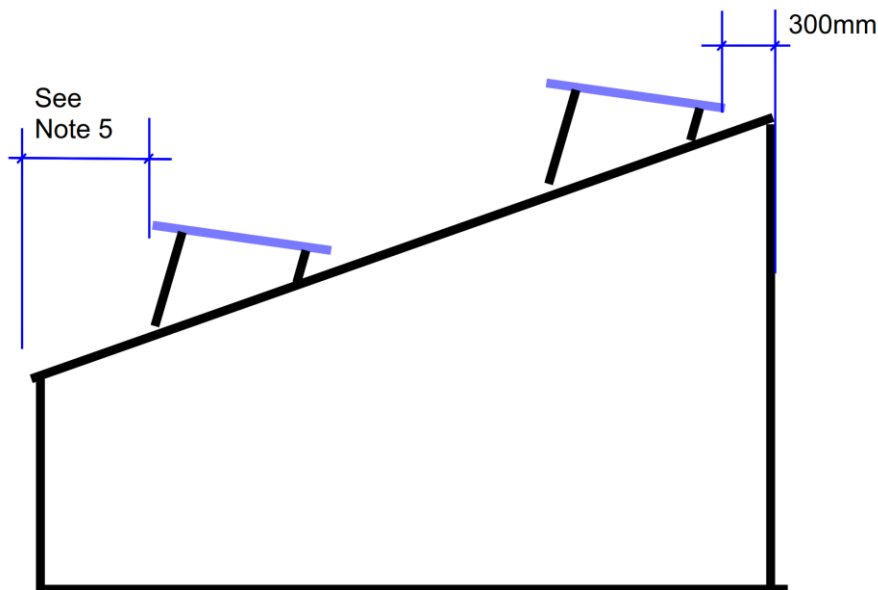


Figure E - Edge Clearance .(See Notes 5 &6 on Page 9)

| | |
|------------------|---------------------------|
| Panel Size | Terrain Category 2 |
| 1700x1100 | 1.1 & 1.2 (Page 4) |
| 2100x1100 | 2.1 & 2.2 (Page 5) |

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 | | | | | Terrain Category 2 |
|---------------------------------------------------|----------|----------|----------|----------|---------------------------|
| Inclination 0 - 15 degrees | | | | | |
| Maximum spacing of the fixing of the Back legs mm | | | | | |
| Roof Height | Region A | Region B | Region C | Region D | |
| 5m | 1700 | 1210 | 590 | 440 | |
| 10m | 1470 | 990 | 560 | #N/A | |
| 15m | 1330 | 890 | 520 | #N/A | |
| 20m | 1250 | 840 | 480 | #N/A | |
| Panel size 1700 X 1100 | | | | | |

| Table 1.2 | | | | | Terrain Category 2 |
|---------------------------------------------------|----------|----------|----------|----------|---------------------------|
| Inclination 15-30 degrees | | | | | |
| Maximum spacing of the fixing of the Back legs mm | | | | | |
| Roof Height | Region A | Region B | Region C | Region D | |
| 5m | 970 | 560 | 390 | #N/A | |
| 10m | 800 | #N/A | #N/A | #N/A | |
| 15m | 630 | #N/A | #N/A | #N/A | |
| 20m | 580 | #N/A | #N/A | #N/A | |
| Panel size 1700 X 1100 | | | | | |

#N/A : Failure of screw fixing to purlins.

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 | | | | | Terrain Category 2 |
|---------------------------------------------------|----------|----------|----------|----------|---------------------------|
| Inclination 0 - 15 degrees | | | | | |
| Maximum spacing of the fixing of the Back legs mm | | | | | |
| Roof Height | Region A | Region B | Region C | Region D | |
| 5m | 1470 | 980 | 530 | #N/A | |
| 10m | 1200 | 800 | 500 | #N/A | |
| 15m | 1080 | 670 | 440 | #N/A | |
| 20m | 1020 | 580 | #N/A | #N/A | |
| Panel size 2100 X 1100 | | | | | |

| Table 2.2 | | | | | Terrain Category 2 |
|---------------------------------------------------|----------|----------|----------|----------|---------------------------|
| Inclination 15 - 30 degrees | | | | | |
| Maximum spacing of the fixing of the Back legs mm | | | | | |
| Roof Height | Region A | Region B | Region C | Region D | |
| 5m | 780 | #N/A | #N/A | #N/A | |
| 10m | 560 | #N/A | #N/A | #N/A | |
| 15m | 530 | #N/A | #N/A | #N/A | |
| 20m | #N/A | #N/A | #N/A | #N/A | |
| Panel size 2100 X 1100 | | | | | |

#N/A : Failure of screw fixing to purlins.

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 7 degrees
- Aluminum Rails 6005 - T5
- Maximum dimensions of Solar panels.
 - 18 Kg panel 1700X1100
 - 25 Kg panel 2100X1100
- Panel Orientation Portrait

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

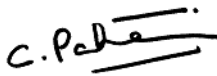
1. Each row of 1700/2100 long solar panels shall have a minimum of two rows of railing to support the panels. The upper railing is supported with back legs (struts). The struts are perpendicular to the panels (See figure C). The struts shall be directly fixed to the purlins or Rafters. The lower railing shall be fixed to the roof purlins with shorter legs of with a use of a base bracket.
2. The cantilever span of the panel shall not exceed 25% of panel length (ex 425mm for 1700 long). (See Figure C)
3. The cantilever span of the railing shall not exceed 33% of the adjacent spacing of the installed fixings.
4. The spacing of the rail fixings shall not exceed the recommended spacing and shall be reduced to match the location of the roof rafters or purlins.
5. The panel edge that is supported by the longer leg shall not be located within the edge zone, minimum of 0.2b, or 0.2d, or h, as defined in Clause 5.4.4 of AS1170.2. Refer to Table A-1 above.
6. PV panels shall have a minimum clearance of 300mm or the roof edge. For the edges adjacent to the longer legs shall have an edge clearance as defined in note 5 above.
7. 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.
8. The roofing to which the panels are to be installed shall conform to the relevant Australian Standards including AS1684, AS4440, AS1720, AS4100 and AS4600.
9. 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. For commercial buildings the roof framing shall be verified by a practicing Structural engineer.
10. The installation of the framing shall conform to relevant Australian Standards, Manufacturer's specifications and good building practice.
11. Each fixing shall have a minimum 2 gauge 14 screws.
12. The screws used to attach the railing to the roof framing shall conform to AS3566, ISO 3506.1.
13. 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.
14. 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 | |

15. Predrilled holes shall be used for all screw fixings into timber. The width of Timber purlins shall not be less than 35mm. The minimum embedment for each screw shall be 35 mm.
16. Dissimilar metals shall be separated with a suitable inert material to prevent galvanic corrosion.
17. The installation and fixings shall be periodically inspected and maintained.
18. 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.
19. We relied upon the material properties provided by SunRack Solar 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