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CONSULTING STRUCTURAL AND CIVIL ENGINEERS
think lateral

07 April 2016

Project number: R045_01A

All Star Systems Co. Ltd
No. 2 Sunjia Village
Shetou Village Zhiqian Town
Jintan, Changzhou Jiangsu China

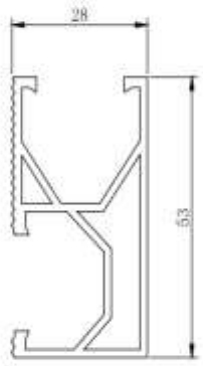
Attention : Michael Wang.

Dear Sir,

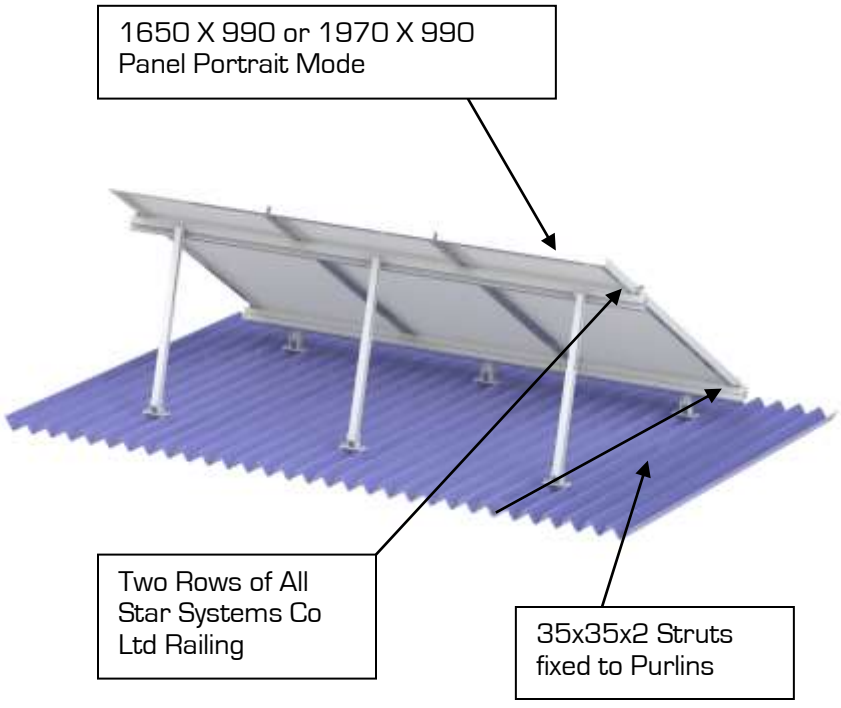
RE: ALL STAR SYSTEMS CO. LTD SOLAR PANEL SUPPORT FRAME
ADJUSTABLE TILTED MOUNT SYSTEM FOR FLAT ROOF : REPORT R045A

As requested, we have reviewed the structural adequacy of the Aluminum support framing components as detailed in the drawings issued by All Star Systems 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 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 1650 long panels and 2.1 & 2.2 for 1970 panels. The spacing for the lower rail fixing can be increased by a third of the spacing of the legs.
(Example: Spacing of longer leg-450. Spacing of lower railing-600).



Railing: All Star System
53x28



SPAD Pty Ltd ABN 47 090 039 571
Consulting Structural & Civil Engineers
114 Pyrmont Bridge Road, Annandale.
NSW 2038 AUSTRALIA

tel: +61 (2) 9565-5558
fax: +61 (2) 9565-5606
info@spadengineer.com.au
www.spadengineer.com.au

Director: Paheer C Paheerathan
BScEng, MEngSc, FIEAust, CPEng,
NPER (Civil & Structural)

Table 1.1	**Inclination**	**0-15 degrees**			**1650 LONG PANELS**
Maximum spacing of the fixing of the Back legs mm					
Roof Height	Region A	Region B	Region C	Region D	
5m	1810	1480	890	560	
10m	1640	1230	800	510	
15m	1560	1110	700	440	
20m	1510	1050	620	390	

Table 1.2	**Inclination**	**15-30 degrees**			**1650 LONG PANELS**
Maximum spacing of the fixing of the Back legs mm					
Roof Height	Region A	Region B	Region C	Region D	
5m	1260	850	510	320	
10m	1040	700	460	290	
15m	940	630	400	250	
20m	880	600	350	220	

Table 2.1	**Inclination**	**0-15 degrees**			**1970 LONG PANELS**
Maximum spacing of the fixing of the Back legs mm					
Roof Height	Region A	Region B	Region C	Region D	
5m	1660	1260	750	470	
10m	1500	1030	670	420	
15m	1390	930	580	370	
20m	1310	880	520	330	

Table 2.2	**Inclination**	**15-30 degrees**			**1970 LONG PANELS**
Minimum spacing of the fixing of the Back legs mm					
Roof Height	Region A	Region B	Region C	Region D	
5m	1060	710	420	270	
10m	870	580	380	240	
15m	780	530	330	210	
20m	740	500	300	190	

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

- AS1170.0-2002 Structural design Actions Part 0: General principles
- AS1170.2-2002 Structural design Actions Part 2: Wind actions
- AS 1664.1-1997 Aluminum structures Part 1: Limit state design
- AS 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
- 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.
  - 16 Kg panel 1650X990
  - 23 Kg panel 1970X990

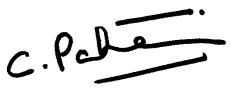
Subject to the following qualifications we certify that the above mentioned frames are structurally adequate and conform to the above Australian standards.

1. Each row of 1650/1970 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 shall be directly fixed to the purlins. The lower railing shall be fixed to the roof purlins with shorter legs of with a use of a base bracket.
2. The purlin spacing shall be in the range of 1200 to 1400 as nominated in the installation manual.
3. The connections between the solar panels shall be flexible to accommodate deflection of the railing.
4. The space under the panels shall not be blocked.
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.
6. The panel edge that is supported by the short leg shall have a clearance of 300 from the roof edge.
7. The deflection of the railing has not been controlled in the design. If defection 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.
10. The installation of the framing shall conform to relevant Australian Standards, Manufacturer's specifications and good building practice.
11. The spacing of the rail fixings shall not exceed the recommended spacing, and shall be reduced to match the location of the roof rafters.
12. The cantilever span of the panel shall not exceed 25% of panel length (ex 412mm for 1650 long).
13. The cantilever span of the railing shall not exceed 33% of the adjacent spacing of the installed fixings.
14. Each fixing shall have a minimum 2 gauge 14 screws.
15. The screws used to attach the railing to the roof framing shall conform to AS3566, ISO 3506.1.

16. 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.
17. Timber with Joint Type classification J4 to J6 are excluded unless tested for Screw capacity. i.e. minimum joint strength requirement shall be J3.
18. 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 50mm.
19. Dissimilar metals shall be separated with a suitable inert material to prevent galvanic corrosion.
20. The installation and fixings shall be periodically inspected and maintained.
21. The following are excluded from this certification.
    - Framing of the solar panel assembly.
    - Material Testing and or Verification of test certificates for the materials and components.

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

Yours faithfully,
SPAD PTY LTD



Paheer C Paheerathan
BScEng, MEngSc, FIEAust, CPEng, NPER (Civil & Structural) 142156, RPEQ-09066, NTBPB 216724ES
Director