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General Certification for Grace Solar Tilt Leg PV Array System for Tin Roof with GS-DR-4200 Rail

For: XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD
(BYMEA Group) Building C/D, Vanke Yunxi
Huli Dist, Xiamen, Fujian Province
China

Job No.: 11277

Date: 07/06/2022

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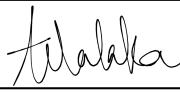

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Approval			
Author Signature		Approver Signature	
Name	Acha De Alwis	Name	L. Van Spaandonk
Title	Structural Engineer	Title	Principal Engineer

Our Ref: 11277-GS-DR-4200/AdA
01 June 2022

XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD
(BYMEA Group) Building C/D, Vanke Yunxi
Huli Dist, Xiamen, Fujian Province
China

RE: General Certification for Grace Solar Tilt Leg PV Array System on Tin Roof with GS-DR-4200 Rail

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of Grace Solar Tilt Leg PV array system installation within Australia. The design check has been based on the information, detailed drawings and the test reports provided by XIAMEN GRACE SOLAR TECHNOLOGY Co. Ltd.

Components of the system covered in this certificate shown in the table below:

Component	Part No.
GS Rail	GS-DR-4200
Tilt Leg	GS-AD-RL30/60-LD; GS-AD-RL15/30-LD; GS-AD-RL10/15-LD; GS-AD-FL-LD
Rail Splice Kit	GS-DR-SP-GW
Inter Clamp Kit	GS-IC-F35; GS-IC-F40; GS-IC-37.5
End Clamp Kit	GS-EC-F35; GS-EC-F38; GS-EC-F40; GS-EC-46 GS01-EC-F35/F40-F35; GS01-EC-F35/F40-F40;

This certificate is **only valid** for Grace Solar Tilt Leg PV array system on Tin roof with GS-DR-4200 rail. The roof structure or the building structure shall be assessed separately and accordingly.

This certificate is **only valid** when fixing into minimum 1.9mm thick steel purlin or minimum JD4 seasoned timber. If the fixing condition is different from these conditions, interface spacings shall be reviewed and validated.

This certificate is **only valid** as a whole. Any information extracted from this certificate is not valid if standing alone.

We find the Installation of Flush Mounted System on Tile Roof for Australian use to be structurally sufficient based on the following conditions:

- Wind loads to **AS/NZS1170.2:2021**
- Wind region **A, B1, B2, C & D**
- Wind terrain category **2 & 3**
- Wind average recurrence interval of **200 years**
- Maximum building height **20m**
- The PV panel dimensions to be **1700mm x 1000mm, 2300mm x 1200mm**
- Maximum weight of the PV panel and array frame to be **15 kg/m²**
- Rails to be **GS-DR-4200** rails
- Material of rails and other components to be **AL/6005-T5 UNO**
- The spacings are determined based on fixings into minimum JD4 seasoned timber and 1.9mm thick steel purlins
- Each PV panel to be installed using **2 rails** minimum in all circumstances
- Installation of PV panels to be done in accordance with the PV panels installation manual
- The certification **excludes** assessment of roof structure and PV panels

Refer to attached summary table for interface spacing (unit: mm)

NOTES:

- **The recommended spacing nominated in this certification is based on the capacity of the array frame and the fixing of array frames to the roof, not the roof structure and PV panels. It is the responsibility of the installer to adopt the most critical spacing.**
- **If any of the above conditions cannot be met, the structural engineer must be notified immediately.**
- **The capacity of tilt leg was obtained from test report No. GS19111501, GS19111502 and GS19111503 by XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD., dated 15.11.2019.**
- **The spacing shown in the interface tables shall be adjusted based on the assessment and requirement of the roof structures.**

Construction is to be carried out strictly in accordance with the manufacturer's instructions. This work was designed by **Acha De Alwis** in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles.

This certification is only valid till **06/06/2024**. Gamcorp should be contacted for future validation. Contact Gamcorp for a customised system or if the site conditions are not covered by this assessment.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



L. Van Spaandonk

Principal Engineer
FIEAust CPEng NER 5038980
NT Registration: 244137ES
QLD Registration: 18703
VIC Registration: PE0001956
TAS Registration: CC7366

Attachments:

- Summary table for interface spacing - tilt mount installation on tin roof with GS-DR-4200 rails

Structural Design Documentation

Tilt Array Frame System Spacing Table

According to AS/NZS 1170.2-2021

with GS-DR-4200 Rail – Tin Roof

PV Panel sizes - 1.7mx1m & 2.3mx1.2m

within Australia

Terrain Category 2 & 3

For: XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD
(BYMEA Group) Building C/D, Vanke Yunxi
Huli Dist, Xiamen, Fujian Province
China

Job Number: 11277
Date: 7 June 2022



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Relationships built on trust

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Tel: +61 3 9543 2211

Job No: 11277
Client: XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD
Project: Tilt Array Frame System Spacing Table
with GS-DR-4200 Rail – Tin Roof
Address: within Australia
Wind Terrain Category: Terrain Category 2 & 3

Australian/New Zealand Standards

AS/NZS 1170.0:2002	Structural design actions Part 0: General principles
AS/NZS 1170.1:2002 (R2016)	Structural design actions Part 1: Permanent, imposed and other actions
AS/NZS 1170.2:2021	Structural design actions Part 2: Wind actions
AS/NZS 1664.1:1997 (R2020)	Aluminium structures Part 1: Limit state design
AS/NZS 4600:2018	Cold-formed steel structures
AS 4100:2020	Steel structures

Designed: AdA
Checked: AA
Date: Jun-22

Client: **XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD**
Project: **Tilt Array Frame System Spacing Table
with GS-DR-4200 Rail – Tin Roof**
Address: **within Australia**

Job: **11277**
Date: **Jun-22**
Designed: **AdA**
Checked: **AA**

Tilt Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail: GS-DR-4200
Type of Interface: Tilt Leg
Solar Panel Dimension: 1.7m x 1m
Terrain category: 3

Tilt angle to roof surface (α), $10^\circ < \alpha \leq 15^\circ$

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal
A	555	855	1165	1835	555	855	1165	1835	480	735	1000	1565	430	655	890	1385
B1	415	635	865	1345	415	635	865	1345	360	550	740	1150	--	490	665	1025
B2	--	515	700	1080	--	515	700	1080	--	445	600	925	--	400	535	825
C	--	370	500	765	--	370	500	765	--	--	430	660	--	--	385	590
D	--	--	355	540	--	--	355	540	--	--	--	465	--	--	--	415

Tilt angle to roof surface (α), $15^\circ < \alpha \leq 30^\circ$

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal
A	--	420	570	885	--	420	570	885	--	365	495	760	--	325	440	675
B1	--	--	425	655	--	--	425	655	--	--	370	565	--	--	325	505
B2	--	--	345	530	--	--	345	530	--	--	--	455	--	--	--	410
C	--	--	--	380	--	--	--	380	--	--	--	325	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $30^\circ < \alpha \leq 60^\circ$

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal
A	--	325	445	680	--	325	445	680	--	--	380	585	--	--	340	525
B1	--	--	330	505	--	--	330	505	--	--	--	435	--	--	--	390
B2	--	--	--	410	--	--	--	410	--	--	--	355	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Client: **XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD**
Project: **Tilt Array Frame System Spacing Table
with GS-DR-4200 Rail – Tin Roof**
Address: **within Australia**

Job: **11277**
Date: **Jun-22**
Designed: **AdA**
Checked: **AA**

Tilt Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail GS-DR-4200
Type of Interface Tilt Leg
Solar Panel Dimension 1.7m x 1m
Terrain category 2

Tilt angle to roof surface (α), $10^\circ < \alpha \leq 15^\circ$

Wind Region	Building Height - h (m)															
	h \leq 5				5<h \leq 10				10<h \leq 15				15<h \leq 20			
	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal
A	460	705	955	1495	375	575	780	1210	--	520	700	1085	--	490	665	1025
B1	--	525	710	1095	--	430	580	895	--	390	525	805	--	365	495	755
B2	--	425	575	880	--	350	470	720	--	--	425	650	--	--	400	615
C	--	--	410	630	--	--	--	515	--	--	--	465	--	--	--	440
D	--	--	--	445	--	--	--	365	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $15^\circ < \alpha \leq 30^\circ$

Wind Region	Building Height - h (m)															
	h \leq 5				5<h \leq 10				10<h \leq 15				15<h \leq 20			
	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal
A	--	350	470	725	--	--	385	590	--	--	350	535	--	--	325	505
B1	--	--	350	540	--	--	--	440	--	--	--	400	--	--	--	375
B2	--	--	--	435	--	--	--	360	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $30^\circ < \alpha \leq 60^\circ$

Wind Region	Building Height - h (m)															
	h \leq 5				5<h \leq 10				10<h \leq 15				15<h \leq 20			
	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal	Corner	Edge	Intermediate	Internal
A	--	--	365	560	--	--	--	460	--	--	--	415	--	--	--	390
B1	--	--	--	415	--	--	--	345	--	--	--	--	--	--	--	--
B2	--	--	--	340	--	--	--	--	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Relationships built on trust

Client: **XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD**
Project: **Tilt Array Frame System Spacing Table
with GS-DR-4200 Rail – Tin Roof**
Address: **within Australia**

Job: **11277**
Date: **Jun-22**
Designed: **AdA**
Checked: **AA**

Tilt Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail GS-DR-4200
Type of Interface Tilt Leg
Solar Panel Dimension 2.3m x 1.2m
Terrain category 3

Tilt angle to roof surface (α), $10^\circ < \alpha \leq 15^\circ$

Wind Region	Building Height - h (m)															
	h ≤ 5				5 < h ≤ 10				10 < h ≤ 15				15 < h ≤ 20			
	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal
A	410	630	860	1355	410	630	860	1355	--	540	740	1155	--	485	660	1025
B1	--	470	640	990	--	470	640	990	--	405	550	850	--	--	490	755
B2	--	--	515	795	--	--	515	795	--	--	445	685	--	--	395	610
C	--	--	--	565	--	--	--	565	--	--	--	485	--	--	--	435
D	--	--	--	395	--	--	--	395	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $15^\circ < \alpha \leq 30^\circ$

Wind Region	Building Height - h (m)															
	h ≤ 5				5 < h ≤ 10				10 < h ≤ 15				15 < h ≤ 20			
	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal
A	--	--	420	655	--	--	420	655	--	--	--	560	--	--	--	500
B1	--	--	--	485	--	--	--	485	--	--	--	415	--	--	--	--
B2	--	--	--	390	--	--	--	390	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $30^\circ < \alpha \leq 60^\circ$

Wind Region	Building Height - h (m)															
	h ≤ 5				5 < h ≤ 10				10 < h ≤ 15				15 < h ≤ 20			
	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal
A	--	--	--	505	--	--	--	505	--	--	--	430	--	--	--	--
B1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Relationships built on trust

Client: **XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD**
Project: **Tilt Array Frame System Spacing Table
with GS-DR-4200 Rail – Tin Roof**
Address: **within Australia**

Job: **11277**
Date: **Jun-22**
Designed: **AdA**
Checked: **AA**

Tilt Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail GS-DR-4200
Type of Interface Tilt Leg
Solar Panel Dimension 2.3m x 1.2m
Terrain category 2

Tilt angle to roof surface (α), $10^\circ < \alpha \leq 15^\circ$

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal
A	--	520	705	1100	--	425	575	895	--	--	520	800	--	--	490	755
B1	--	--	525	810	--	--	430	660	--	--	--	595	--	--	--	560
B2	--	--	425	650	--	--	--	535	--	--	--	480	--	--	--	455
C	--	--	--	465	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $15^\circ < \alpha \leq 30^\circ$

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal
A	--	--	--	535	--	--	--	435	--	--	--	390	--	--	--	--
B1	--	--	--	395	--	--	--	--	--	--	--	--	--	--	--	--
B2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tilt angle to roof surface (α), $30^\circ < \alpha \leq 60^\circ$

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal	Corner	Edge	Intermed iate	Internal
A	--	--	--	415	--	--	--	--	--	--	--	--	--	--	--	--
B1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Client: **XIAMEN GRACE SOLAR TECHNOLOGY CO.LTD**
Project: **Tilt Array Frame System Spacing Table**
with GS-DR-4200 Rail – Tin Roof
Address: **within Australia**

Job: **11277**
Date: **Jun-22**
Designed: **AdA**
Checked: **AA**

General Notes

Note 1 Following components are satisfied to use according to AS/NZS 1170.2:2021

Components	Part Number	Description
GD Rail	GS-DR-4200	As per drawing or test report provided by client
Tilt Leg	GS-AD-RL30/60-LD; GS-AD-RL15/30-LD; GS-AD-RL10/15-LD; GS-AD-FL-LD	
Rail Splice Kit	GS-DR-SP-GW	
Inter Clamp Kit	GS-IC-F35; GS-IC-F40; GS-IC-37.5	
End Clamp Kit	GS-EC-F35; GS-EC-F38; GS-EC-F40; GS-EC-46 GS01-EC-F35/F40-F35; GS01-EC-F35/F40-F40;	

Note 2 Spacing calculated based on 1.9mm steel purlin or 35mm screw embedment length into timber (JD4 seasoned timber).

Recommended screws

Metal Purlins/Battens	Fasteners to use
1.9mm and above	14g-10 TPI Teks screws or approved equivalent
Timber Purlins/Battens/Rafters	Fasteners to use
Softwood / Hardwood (35mm embedment and above)	14g-10 TPI T17 screws or approved equivalent

Note 3 Maximum uplift wind pressure is limited to 5kPa.

Note 4 Deflection is limited to Minimum of L/120 and 15mm.

Note 5 Tilt angle is measured from roof surface.

Note 6 "--" states NOT SUITABLE FOR INSTALLATION.

Note 7 Refer section 4.2.1 of AS/NZS 1170.2:2021 for terrain category definition.

Note 8 Wind regions are shown in Figure 3.1(A) of AS/NZS 1170.2:2021.

Note 9 Building height is average roof height of structure above ground. Refer Figure 1 for definition of h, d and b.

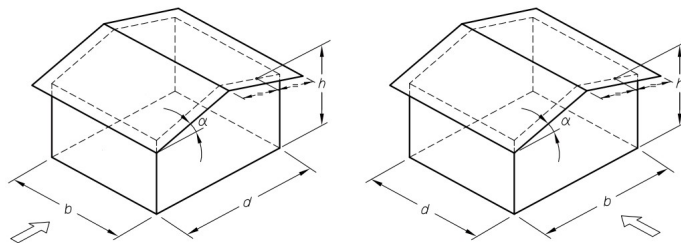
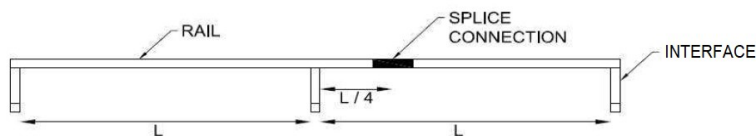


Figure 1 – h, d and b definition

Note 10 Rail splice connection must be placed a quarter length of the spacing of interface. No Splice connection should be placed at the centre of spacing or over the interface.



Relationships built on trust

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Project: **Tilt Array Frame System Spacing Table with GS-DR-4200 Rail – Tin Roof**
Address: **within Australia**

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Note 11 Refer Figure 2 for definition of roof zones.

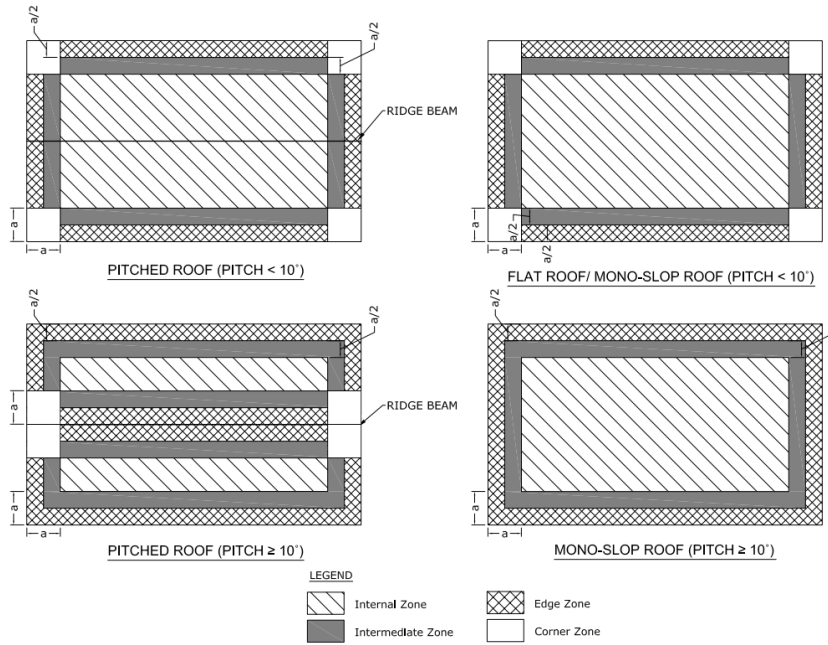


Figure2- Roof Zones Definition

In Figure 2, the value of dimension "a" is the minimum of 0.2b or 0.2d, if (h/b) or (h/d) ≥ 0.2; or 2h if both (h/b) and (h/d) < 0.2 (b & d are building dimensions and h is average roof height, see Figure 1)