

General Certification for Titanergy Tilt Mounted System on Tin (Penetrative) Roof with Titan Solar TTV2 Rail

For: JIANGYIN TITANERGY CO. LTD
No.11 Wuxiang Road
Yunting Street, Jiangyin
China 214422

Job No.: 11323-RM10
Date: 30/06/2022

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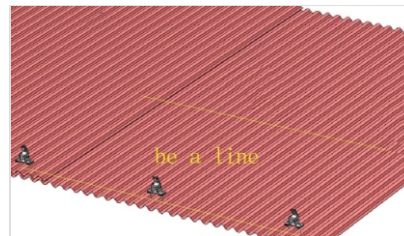
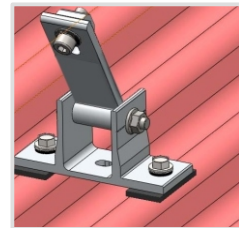
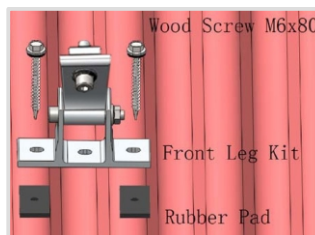
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Installation

Install on Tin Roof

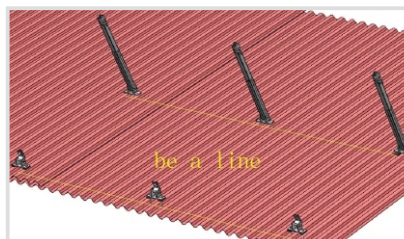
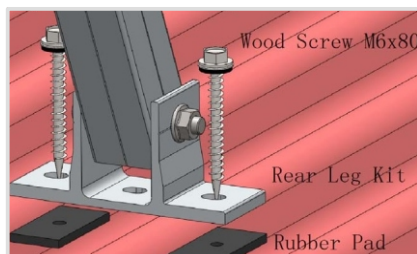
1. Fix the front leg (together with rubber pad) to the rafter using two 6*80 wood screws. Determine the positions of the front leg according to your plans.

※ Tighten the screws in the situation when the roof undamaged.



2. Fix the rear leg (together with rubber pad) to the rafter using two 6*80 wood screws. Determine the positions of the rear leg according to your plans.

※ Tighten the screws in the situation when the roof undamaged.

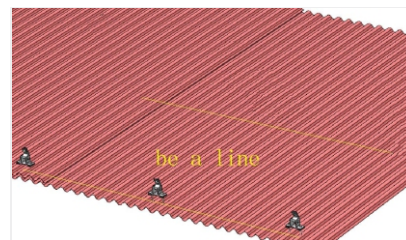
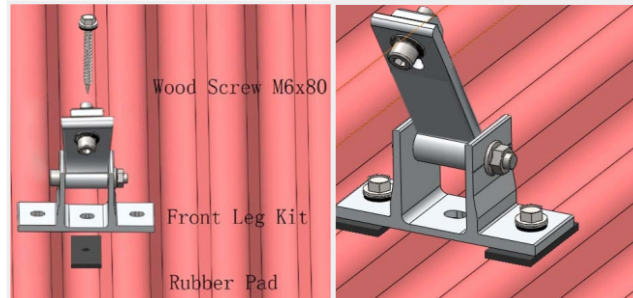


*When we fix one screw into the middle hole of the tilt leg.

Install on Tin Roof

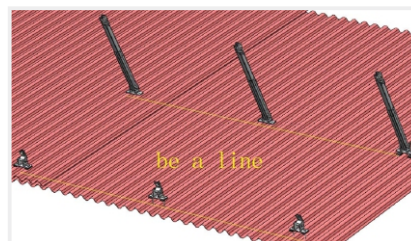
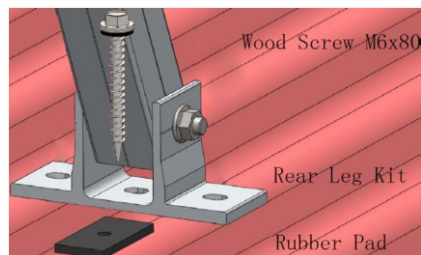
3. Fix the front leg (together with rubber pad) to the rafter using one 6*80 wood screw. Determine the positions of the front leg according to your plans.

- ☐ Tighten the screw in the situation when the roof undamaged.



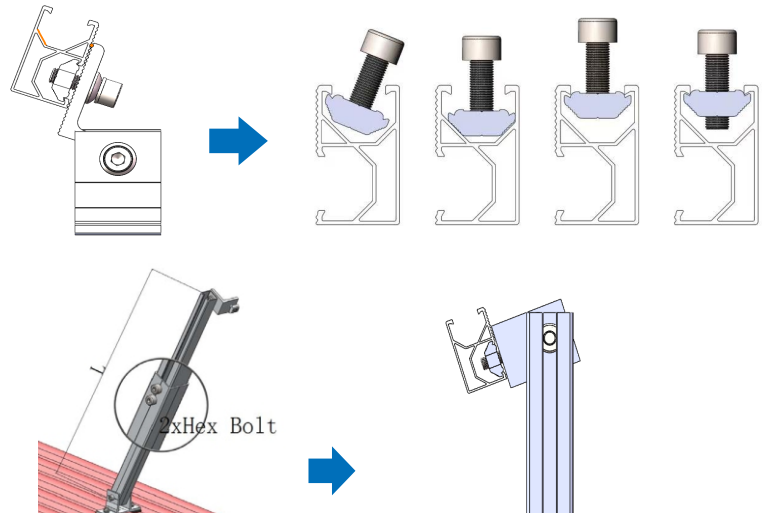
4. Fix the rear leg (together with rubber pad) to the rafter using one 6*80 wood screw. Determine the positions of the rear leg according to your plans.

- ☐ Tighten the screw in the situation when the roof undamaged.



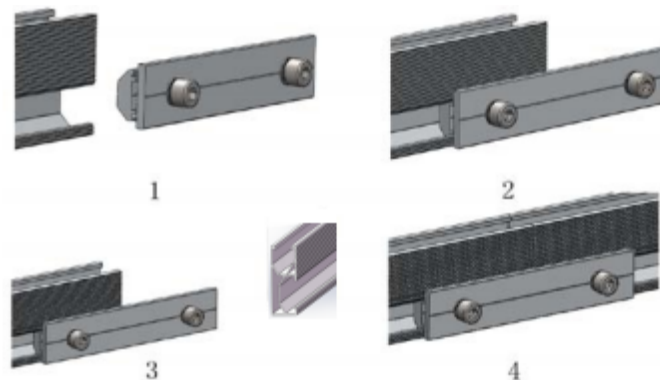
5. Use the M8*25 Hexagon screw, M8 spring washer, M8 antiskid washer and fixing nut to connect the rail with the front leg and the rear leg.

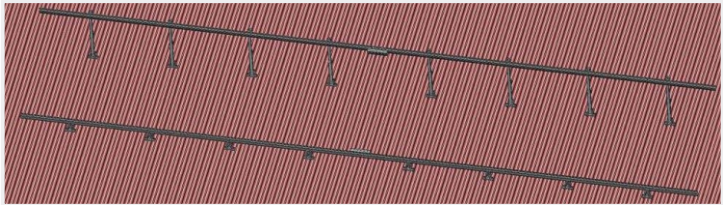
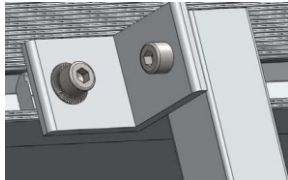
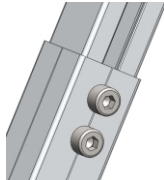
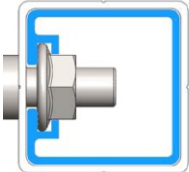
※ Torsion:23-25N.m

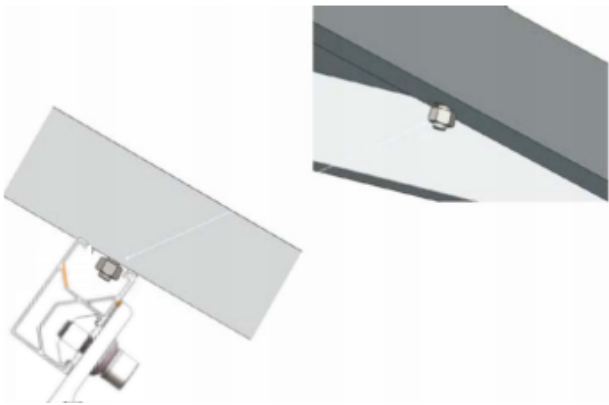


6. TTV2 Rail connect (with toothed gears)
- Put the TTV2 Rail Splice into the side channel of the TTV2 Rail about 75mm, then fasten the M8 Bolt.
 - Put the other TTV2 Rail into the other side of the TTV2 Rail Splice and fasten the other M8 bolt.

※ Torsion:23-25N.m

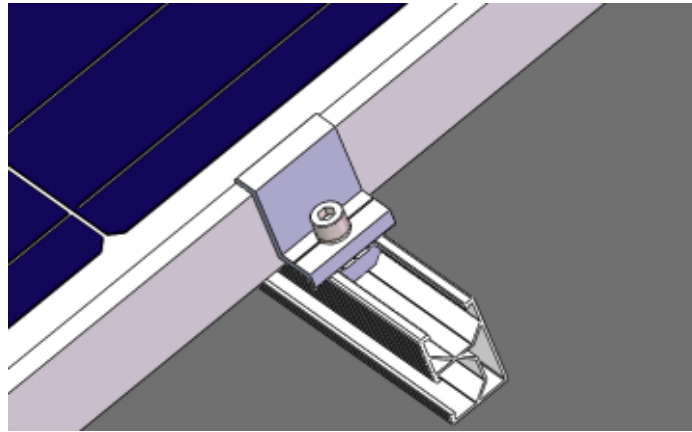


7. Repeat the above steps in accordance with the planned layout.	
8. After finishing installation of whole system, adjust the lengths of rear legs to adjust the tilt angle of panels. Slowly unlock the screw on rear leg with a wrench and then unlock two screws on rear legs and adjust.	   Telescopic Tubs
9. Calculate the suitable length of rear leg according to the required angle (for choice, 10°-15°, 15°-30° and 30°-60° rear legs are available). Then stretch or shorten the rear leg tube and lock the two screws, assuring height of rear legs keeping in the same line. Angle differences shown as the picture:	

Install the module	
10 Installing anti-slip protection The anti-slip protection is only necessary on the lowermost row of modules. At first, fit two bolts M6*20 and nuts into the lower holes of each module. Then place the first module of the bottom row so that the anti-slip protection sits in the rail channel of the lowest row of rails ※ Torsion:23-25N.m	

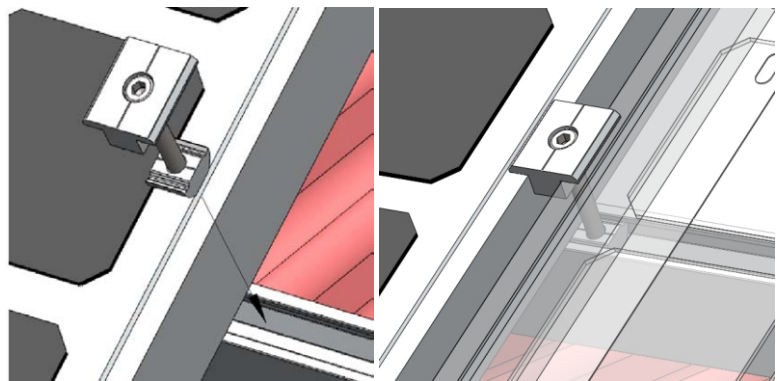
11. Fixing the outer modules by End clamp.

- Put the end clamp kit into the top channel of the TTV2-Rail as the step 9.
 - Push the side of module to firmly against the end clamp and then fasten the bolt.
- ※ Torsion:23-25N.m

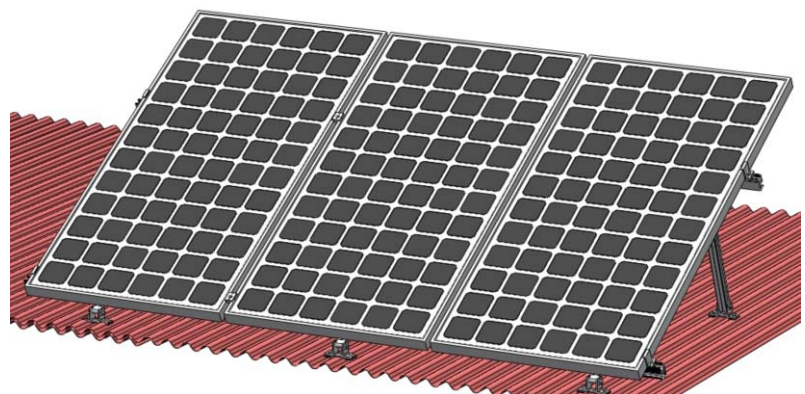


12. Fixing the inter modules by inter clamp.

- Put the inter clamp kit into the top channel of the TTV2-Rail as the step 9.
 - Push the Inter-module clamp firmly against the already fixed module.
 - Push the next module against the other side of the module-inter clamp.
 - Tighten the bolt
- ※ Torsion:23-25N.m



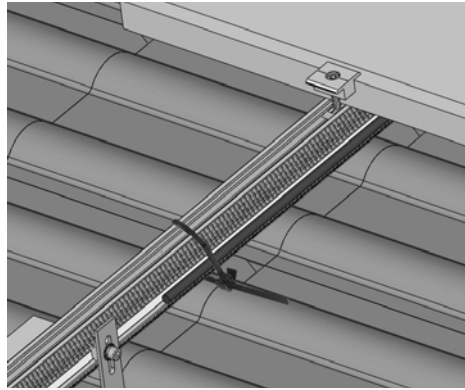
13. Installing the further rows of modules



Cable tie and Grounding

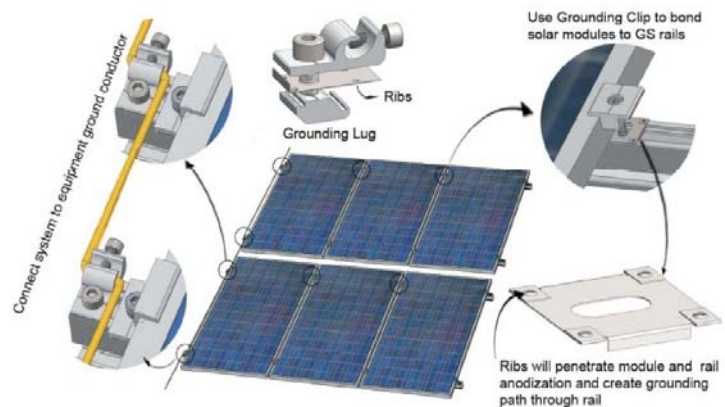
14. Tie cable with the rail

- a. Tie the cable with the rail using the zip tie



15. Grounding

Please see the Titan Solar Grounding System Installation Guide.



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0	30/06/2022	First Issue	BL	BL	AA	LvS
Current Revision		0				

Approval			
Author Signature	<i>baincaliu</i>	Approver Signature	
Name	Bianca Liu	Name	L. Van Spaandonk
Title	Structural Engineer	Title	Principal Engineer

Our Ref: 11323-RM10/BL
30 June 2022

JIANGYIN TITANERGY CO. LTD

No.11 Wuxiang Road
Yunting Street, Jiangyin
China 214422

RE: General Certification for Titanergy Tilt Mounted System on Tin (Penetrative) Roof with Titan Solar TTV2 Rail

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of Titanergy Tilt Mounted System on Tin (Penetrative) Roof with Titan Solar TTV2 rail within Australia. The design check has been based on the information and test reports provided by JIANGYIN TITANERGY CO. LTD.

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

Component	Part No.
Rail	Titan Solar TTV2 Rail
Mid Clamp	Titan Solar Mid Clamp Kit 40mm
End Clamp	Titan Solar End Clamp Kit 40mm
Tilt Roof System	Titan Solar Tilt Roof System

This certificate is **only valid** for Titanergy Tilt Mounted System on the Tin (Penetrative) Roof with Titan Solar TTV2 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 JD4 seasoned timber. If the fixing condition is different from this conditions, interface spacing 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 Tilt Mounted System on Tin (Penetrative) 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 **1800mm x 1100mm, 2000mm x 1100mm, 2200mm x 1200mm, 2400mm x 1200mm**
- Maximum weight of the PV panel and array frame to be **15 kg/m²**
- Rails to be **Titan Solar TTV2** 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

- No PV panel to be installed within 2xs from edges and ridge. "s" is the maximum gap between the underside of the panel and the roof surface when installed on the roof ($50\text{mm} \leq s \leq 300\text{mm}$)
- 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 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 **Bianca Liu** in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles.

This certification is only valid till **30/06/2024**. 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 (penetrative) roof with Titan Solar TTV2 rail

Structural Design Documentation

Tilt Array Frame System Spacing Table

According to AS/NZS 1170.2-2021
with Titan Solar TTV2 Rail – Tin (Penetrative) Roof
within Australia
Terrain Category 2 & 3

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Tel: +61 3 9543 2211



Job No: 11323-RM10
Client: Jiangyin Titanergy Co. Ltd
Project: Tilt Array Frame System Spacing Table
with Titan Solar TTV2 Rail – Tin (Penetrative) 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: BL
Checked: AA
Date: Jun-22

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Client: **Jiangyin Titanergy Co. Ltd**
Project: **Tilt Array Frame System Spacing Table**
with Titan Solar TTV2 Rail – Tin (Penetrative) Roof
Address: **within Australia**

Job: **11323-RM10**
Date: **Jun-22**
Designed: **BL**
Checked: **AA**

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

Type of Rail	Titan Solar TTV2 Rail
Type of Interface	Tilt Roof Set
Solar Panel Dimension	1.8mx1.1m
Terrain category	3

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

Wind Region	Building Height - h (m)															
	h≤5				5<h≤10				10<h≤15				15<h≤20			
	Corner	Edge	Intermed late	Internal	Corner	Edge	Intermed late	Internal	Corner	Edge	Intermed late	Internal	Corner	Edge	Intermed late	Internal
A	675	1035	1325	1555	675	1035	1325	1555	580	890	1215	1470	520	795	1080	1405
B1	505	770	1050	1550	505	770	1050	1550	435	665	900	1395	--	595	805	1240
B2	--	625	845	1310	--	625	845	1310	--	540	730	1125	--	485	650	1000
C	--	405	545	835	--	405	545	835	--	--	470	720	--	--	420	645
D	--	--	390	590	--	--	390	590	--	--	--	510	--	--	--	455

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

[illegible]

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

[illegible]

Relationships built on trust

Client: **Jiangyin Titanergy Co. Ltd**
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with Titan Solar TTV2 Rail – Tin (Penetrative) Roof
Address: **within Australia**

Job: **11323-RM10**
Date: **Jun-22**
Designed: **BL**
Checked: **AA**

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

Type of Rail	Titan Solar TTV2 Rail
Type of Interface	Tilt Roof Set
Solar Panel Dimension	1.8mx1.1m
Terrain category	2

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

[illegible]

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

[illegible]

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

[illegible]

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

Type of Rail
Type of Interface
Solar Panel Dimension
Terrain category

Titan Solar TTV2 Rail
Tilt Roof Set
2mx1.1m
3

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

Wind Region	The angle to roof surface (α), $\alpha \leq 45^\circ$															
	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	605	930	1270	1505	605	930	1270	1505	525	800	1090	1420	470	715	975	1360
B1	455	695	945	1465	455	695	945	1465	395	600	810	1255	--	535	725	1120
B2	--	565	760	1180	--	565	760	1180	--	485	655	1010	--	435	585	900
C	--	360	490	750	--	360	490	750	--	--	425	650	--	--	380	580
D	--	--	--	530	--	--	--	530	--	--	--	460	--	--	--	410

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

[illegible]

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

[illegible]

[illegible]

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Checked: **AA**

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

Type of Rail	Titan Solar TTV2 Rail
Type of Interface	Tilt Roof Set
Solar Panel Dimension	2.2mx1.2m
Terrain category	3

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

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	550	845	1155	1455	550	845	1155	1455	475	730	990	1375	425	650	885	1315
B1	415	630	855	1330	415	630	855	1330	--	545	735	1140	--	485	660	1015
B2	--	510	695	1070	--	510	695	1070	--	440	595	920	--	390	535	820
C	--	--	445	685	--	--	445	685	--	--	--	590	--	--	--	525
D	--	--	--	485	--	--	--	485	--	--	--	415	--	--	--	--

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

[illegible]

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

[illegible]

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

Type of Rail	Titan Solar TTV2 Rail
Type of Interface	Tilt Roof Set
Solar Panel Dimension	2.2mx1.2m
Terrain category	2

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

[illegible]

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

[illegible]

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

[illegible]

Relationships built on trust

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

Type of Rail	Titan Solar TTV2 Rail
Type of Interface	Tilt Roof Set
Solar Panel Dimension	2.4mx1.2m
Terrain category	3

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

[illegible]

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

[illegible]

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

[illegible]

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

Type of Rail	Titan Solar TTV2 Rail
Type of Interface	Tilt Roof Set
Solar Panel Dimension	2.4mx1.2m
Terrain category	2

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

[illegible]

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

[illegible]

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

[illegible]

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General Notes

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

Components	Part Number	Description
Rail	Titan Solar TTV2 Rail	As per drawing or test report provided by client
Mid Clamp	Mid Clamp Kit 40mm	
End Clamp	End Clamp Kit 40mm	
Tilt Roof System	Titan Solar Tilt Roof System	

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 Tek 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.

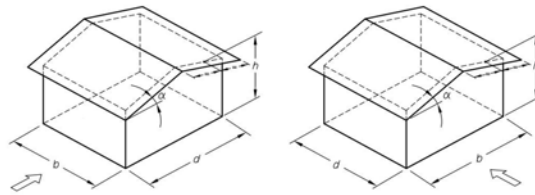
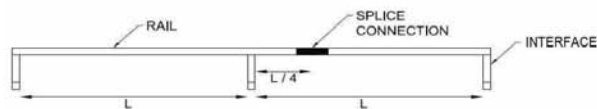


Figure 1 – h, d and b definition

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.



Note 11 Refer Figure 2 for definition of roof zones.

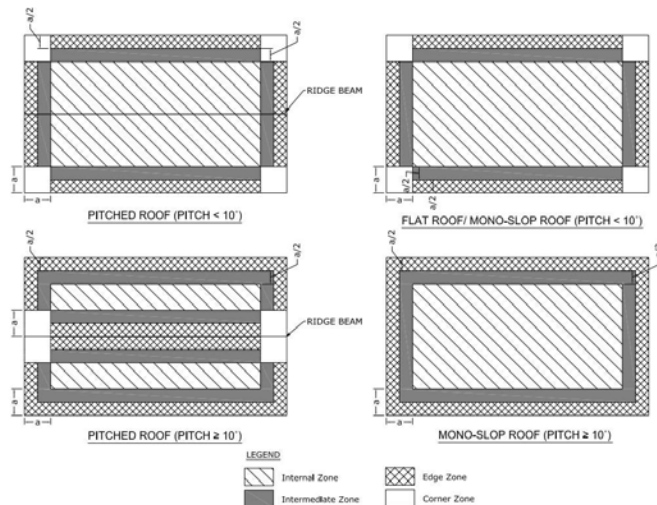


Figure2- Roof Zones Definition

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)