



SOLAR ROOF MOUNTING SYSTEM INSTALLATION MANUAL

>>> **MODEL NAME: TTS TIN ROOF HOOK**

JIANGYIN TITANERGY CO.,LTD.
Model Name:TTS TIN ROOF HOOK

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35 Butler Street, Richmond VIC 3121 Tel: 03 9543 2211

Our Ref: 10038-02-TT/BL
12 August 2021

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

PV Array Frame Engineering Certification

RE: AS/N Z 1170.2 Certification for Titanergy Flush Mounted System on Tin Roof (Penetrative Fix Roof) with TTS Rails

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of Titanergy Flush Mounted System on Tin Roof (Penetrative Fix Roof) with TT rails within Australia. The design check is based on the information and test reports provided by Jiangyin Titanergy Co. LTD.

This certificate is **only valid** for Titanergy Flush Mounted System themselves. The roof structure or the building structure and PV panels shall be assessed separately and accordingly.

This certificate is **only valid** when fixing into minimum 1.9mm BMT steel or minimum JD4 seasoned timber. If the fixing condition is different from those 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 Flush Mounted System on these Penetrative Fix Roof for Australian use to be structurally sufficient based on the following conditions:

- Wind loads to AS/NZ1170.2:2011(R2016) Wind actions
- Wind region **A, B, C, D**
- Wind terrain category **2 & 3**
- Wind average recurrence interval of **200 years**
- Maximum building height **20m**
- The maximum assessed PV panel dimensions are **1800mm x 1100mm, 2000mm x 1100mm, 2200mm x 1200mm, 2400mm x 1200mm**
- Weight of the PV panel and array frame to be 15 kg/m²
- Rails to be **TTS Rail**
- Material of Rails to be **AL6005-T5**
- The spacing are determined based on fixing into minimum JD4 seasoned timber with 35mm screw embedment length 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 (50mm≤s≤300mm)

ISO 9001:2015 Registered Firm
Certificate No: AU1222

10038-02-TTS General Certificate - Flush Mount Solar System on Tin Roof (Penetrative Fix Roof) with TTS rails.odt

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- 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 manufacturers 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 certificate is only valid till 15/08/2023. Gamcorp should be contacted for future validation. Contact Gamcorp for 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:

- Titanergy Flush Array Frame System Spacing Tables on Tin Roof (Penetrative Fix Roof) with TTS rail

ISO 9001:2015 Registered Firm
Certificate No: AU1222

10038-02-TTS General Certificate - Flush Mount Solar System on Tin Roof (Penetrative Fix Roof) with TTS rails.odt

Structural Design Documentation

Titanergy Flush Array Frame System Spacing Table
According to AS/NZS 1170.2-2011 (R2016)
with TTS Rail – Tin Roof
within Australia
Terrain Category 2 & 3

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



Job Number: 10038-02-TTS
Date: Aug-21

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ISO 9001:2015 Registered Firm
Certificate No: AU1222

Job No: 10038-02-TT
Client: JIANGYIN TITANERGY CO.,LTD
Project: Titanergy Flush Array Frame System Spacing Table
with TTS Rail – Tin Roof
Address: within Australia

Australian 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 1170.2:2011 (R2016) – Structural design actions, Part 2: Wind actions

AS/NZS 1252:1996 – High strength steel bolts
AS/NZS 1664.1:1997 – Aluminium structures - Limit state design
AS 4100:2020 – Steel Structures
AS/NZS 4600:2018 – Cold-Formed Steel Structures

Wind Terrain Category: WTC2 & 3

Designed: BL
Checked: AA

Date: Aug-21

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 1800x1100
Terrain category: 2

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	1080	1345	1500	1780	885	1250	1395	1640	795	1205	1345	1575	755	1155	1315	1540
B	725	1110	1440	1700	595	910	1235	1575	540	820	1110	1510	--	775	1045	1480
C	--	575	775	1195	--	--	635	975	--	--	575	880	--	--	540	830
D	--	--	500	760	--	--	--	625	--	--	--	565	--	--	--	535

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	735	1125	1305	1525	605	920	1215	1415	545	830	1125	1365	--	785	1060	1335
B	--	755	1020	1465	--	620	835	1285	--	560	755	1155	--	530	710	1085
C	--	--	530	810	--	--	--	660	--	--	--	595	--	--	--	565
D	--	--	--	520	--	--	--	--	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 1800x1100
Terrain category: 3

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	1235	1445	1620	1900	1235	1445	1620	1900	1130	1365	1530	1810	1010	1310	1465	1730
B	875	1345	1550	1830	875	1345	1550	1830	760	1160	1465	1735	675	1035	1405	1655
C	--	695	945	1460	--	695	945	1460	--	600	810	1250	--	535	725	1110
D	--	--	605	925	--	--	605	925	--	--	525	800	--	--	--	710

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	890	1255	1400	1645	890	1255	1400	1645	770	1175	1325	1555	685	1050	1270	1485
B	600	910	1235	1575	600	910	1235	1575	--	790	1065	1490	--	705	950	1425
C	--	--	640	980	--	--	640	980	--	--	550	845	--	--	--	750
D	--	--	--	630	--	--	--	630	--	--	--	545	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2000x1100
Terrain category: 2

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	905	1265	1415	1675	740	1140	1315	1550	665	1025	1265	1485	630	970	1240	1450
B	605	930	1265	1600	--	760	1030	1480	--	685	930	1420	--	645	875	1350
C	--	--	650	1000	--	--	530	815	--	--	--	735	--	--	--	695
D	--	--	--	635	--	--	--	525	--	--	--	--	--	--	--	--

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	615	940	1230	1435	505	770	1045	1335	--	695	940	1285	--	655	890	1255
B	--	630	855	1315	--	520	700	1075	--	--	630	970	--	--	595	910
C	--	--	--	675	--	--	--	555	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2000x1100
Terrain category: 3

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	1100	1360	1525	1820	1100	1360	1525	1820	945	1290	1445	1710	845	1235	1380	1630
B	735	1125	1460	1735	735	1125	1460	1735	635	970	1325	1635	565	865	1175	1560
C	--	580	790	1220	--	580	790	1220	--	--	680	1045	--	--	605	930
D	--	--	505	775	--	--	505	775	--	--	--	670	--	--	--	595

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	745	1145	1320	1550	745	1145	1320	1550	640	985	1250	1465	575	880	1195	1400
B	--	765	1035	1485	--	765	1035	1485	--	660	895	1380	--	590	795	1225
C	--	--	535	820	--	--	535	820	--	--	--	705	--	--	--	630
D	--	--	--	525	--	--	--	525	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2200x1100
Terrain category: 2

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	755	1205	1350	1600	630	990	1255	1475	580	890	1205	1415	550	820	1145	1385
B	525	775	1100	1530	--	645	895	1390	--	595	775	1250	--	560	730	1170
C	--	--	565	870	--	--	--	710	--	--	--	640	--	--	--	600
D	--	--	--	555	--	--	--	--	--	--	--	--	--	--	--	--

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	535	790	1115	1370	--	650	905	1275	--	600	790	1225	--	570	740	1195
B	--	550	710	1145	--	--	605	930	--	--	550	820	--	--	515	755
C	--	--	--	585	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2200x1100
Terrain category: 3

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	955	1295	1455	1740	955	1295	1455	1740	795	1230	1375	1635	705	1130	1315	1555
B	625	980	1340	1655	625	980	1340	1655	550	830	1150	1560	--	720	1020	1485
C	--	505	685	1060	--	505	685	1060	--	--	590	910	--	--	525	810
D	--	--	--	670	--	--	--	670	--	--	--	580	--	--	--	515

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	630	995	1255	1480	630	995	1255	1480	555	835	1165	1400	--	730	1035	1335
B	--	645	895	1395	--	645	895	1395	--	575	745	1200	--	510	665	1065
C	--	--	--	715	--	--	--	715	--	--	--	615	--	--	--	545
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2400x1100
Terrain category: 2

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	650	980	1325	1570	540	780	1155	1450	--	710	970	1390	--	685	905	1360
B	--	665	855	1500	--	555	715	1315	--	--	665	1180	--	--	635	930
C	--	--	535	820	--	--	--	670	--	--	--	605	--	--	--	570
D	--	--	--	525	--	--	--	--	--	--	--	--	--	--	--	--

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	--	670	870	1345	--	565	725	1180	--	505	670	1090	--	--	645	955
B	--	--	620	905	--	--	515	740	--	--	--	685	--	--	--	655
C	--	--	--	555	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

Flush Array Frame System Spacing Table for Tin Roof – mm

Type of Roof: Tin Roof
Type of Rail: Titanergy TTS Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2400x1100
Terrain category: 3

h/d≤0.5* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	755	1245	1430	1710	755	1245	1430	1710	675	1115	1350	1605	610	890	1285	1525
B	540	775	1265	1625	540	775	1265	1625	--	685	905	1530	--	630	800	1460
C	--	--	650	1005	--	--	650	1005	--	--	555	860	--	--	--	765
D	--	--	--	635	--	--	--	635	--	--	--	550	--	--	--	--

h/d≥1* - Refer to Note 6 for definition of h and d

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal	Corner	Edge	Interme diate	Internal
A	545	785	1155	1455	545	785	1155	1455	--	695	920	1370	--	635	815	1310
B	--	555	720	1320	--	555	720	1320	--	--	645	960	--	--	580	830
C	--	--	--	675	--	--	--	675	--	--	--	580	--	--	--	515
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*For intermediate values of h/d ratios, linear interpolation shall be used.
*Refer to Note 8- Figure 2 for roof zone definition.

General Notes

Note 1 Following components are satisfied to use according to AS/NZS 1170.2-2011(R2016)

Components	Part number	Comments
Inter Clamp Kit	Inter Clamp Kit 25-50mm	as per drawing provided by client
End Clamp Kit	End Clamp Kit 25-50mm	as per drawing provided by client
Tin Hook	Tin Hook (L-Foot)	as per drawing provided by client
TTS Rail	TTS Rail	as per drawing provided by client

Note 2 Maximum uplift wind pressure is limited to 5.0 KPa for panels of 1800x1100mm and 2000x1100mm
Maximum uplift wind pressure is limited to 4.37KPa for panel of 2200x1200mm
Maximum uplift wind pressure is limited to 3.6KPa for panel of 2400x1200mm

Note 3 Deflection is limited to minimum of L/120 and 15mm

Note 4 Spacing calculated based on at least 1.5mm thick steel purlin or 35mm screw embedment length into timber.

Note 5 Terrain Category 2 (TC2) refers to 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.
Terrain Category 3 (TC3) refers to terrain with numerous closely spaced obstructions having heights generally from 3 m to 10 m. The minimum density of obstructions shall be at least the equivalent of 10 house-size obstructions per hectare, e.g. suburban housing, light industrial estates or dense forests.

Note 6 Refer to Figure 1 for definition of h and d.

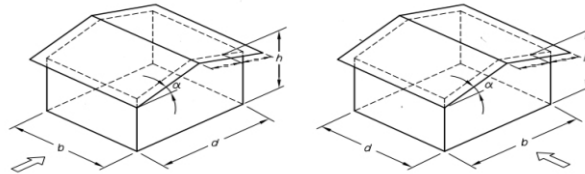
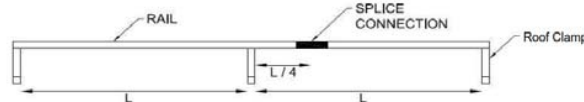


Figure 1 – h and d definition

Note 7 The optimised location of rail splice connection is at quarter length of the spacing of the interface. No Splice connection should be placed at the centre of spacing or over the interface.



Note 8 Refer Figure 2 for definition of roof zones.

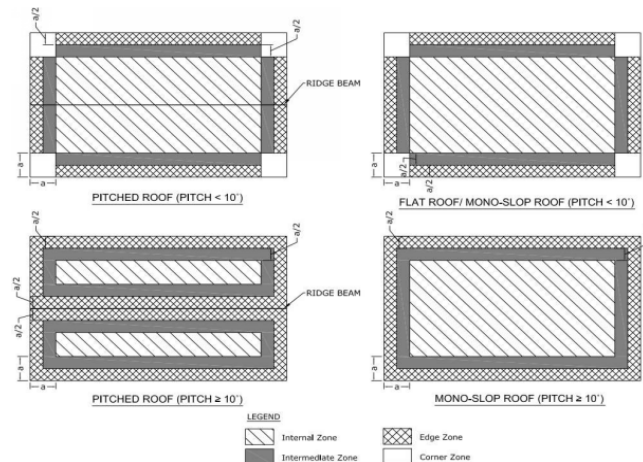


Figure 2 - Roof Zones Definition

In Figure 2, the value of dimension "a" is the minimum of 0.2b, 0.2d and h. (b & d are building dimensions and h is its height)