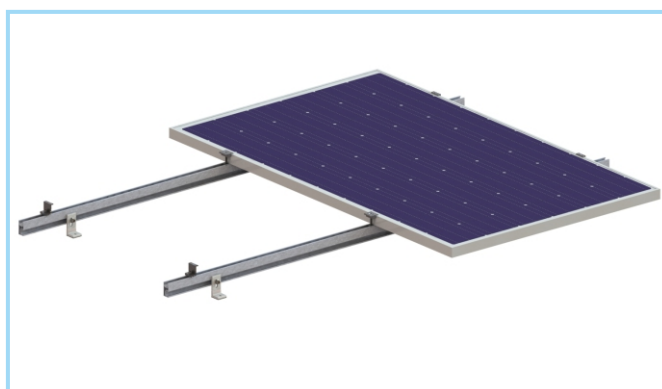


SOLAR ROOF MOUNTING SYSTEM INSTALLATION MANUAL

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

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

Phone:0086-510-86610879
Fax:0086-510-86610877

Web:www.titanergy.com
Mail:info@titanergy.com

Gamcorp (Melbourne) Pty Ltd A.C.N 141 076 904 A.B.N 73 015 060 240
www.gamcorp.com.au Email: melbourne@gamcorp.com.au
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 TT 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 **TT 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-TT General Certificate - Flush Mount Solar System on Tin Roof (Penetrative Fix Roof) with TT rails.odt

Gamcorp (Melbourne) Pty Ltd A.C.N 141 076 904 A.B.N 73 015 060 240
www.gamcorp.com.au Email: melbourne@gamcorp.com.au
35 Butler Street, Richmond VIC 3121 Tel: 03 9543 2211

- 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 TT rail

*ISO 9001:2015 Registered Firm
Certificate No: AU1222*

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

Structural Design Documentation

Titanergy Flush Array Frame System Spacing Table
According to AS/NZS 1170.2-2011 (R2016)
with TT 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-TT
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 TT 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 TT 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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	1080	1565	1750	2000	885	1360	1625	1880	795	1225	1565	1825	755	1155	1530	1795
B	725	1110	1510	1930	595	910	1235	1820	540	820	1110	1720	–	775	1045	1615
C	–	575	775	1195	–	–	635	975	–	–	575	980	–	–	540	930
D	–	–	–	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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	735	1125	1515	1775	605	920	1250	1650	545	830	1125	1585	515	785	1060	1555
B	–	755	1020	1575	–	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 TT 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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	1315	1680	1865	2000	1315	1680	1865	2000	1130	1590	1780	2000	1010	1525	1705	1960
B	875	1345	1805	2000	875	1345	1805	2000	760	1160	1585	1960	675	1035	1405	1890
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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	890	1370	1630	1885	890	1370	1630	1885	770	1175	1545	1805	685	1050	1425	1730
B	600	910	1235	1825	600	910	1235	1825	520	790	1065	1650	–	705	950	1465
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 TT 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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	905	1400	1645	1910	740	1140	1530	1800	665	1025	1395	1725	630	970	1320	1690
B	605	930	1265	1850	–	760	1030	1600	–	685	930	1435	–	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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	615	940	1280	1670	505	770	1045	1555	–	695	940	1455	–	655	890	1375
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 TT 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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	1100	1580	1775	2000	1100	1580	1775	2000	945	1465	1680	1940	845	1305	1605	1870
B	735	1125	1540	1960	735	1125	1540	1960	635	970	1325	1875	565	865	1175	1810
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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	745	1145	1535	1805	745	1145	1535	1805	640	985	1340	1705	575	880	1195	1630
B	–	765	1035	1605	–	765	1035	1605	–	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 TT Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2200x1200
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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	785	1215	1570	1845	645	990	1350	1720	580	890	1210	1650	550	840	1145	1610
B	525	805	1100	1720	–	660	895	1390	–	595	805	1250	–	560	760	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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	535	820	1115	1595	–	670	905	1410	–	600	815	1260	–	570	770	1195
B	–	550	740	1145	–	–	605	930	–	–	550	840	–	–	515	790
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 TT Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2200x1200
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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	955	1485	1695	1965	955	1485	1695	1965	820	1270	1600	1875	735	1130	1530	1805
B	635	980	1340	1895	635	980	1340	1895	550	845	1150	1800	–	750	1020	1595
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	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal	Corner	Edge	Intermedate	Internal
A	645	995	1360	1720	645	995	1360	1720	555	855	1165	1625	–	765	1035	1555
B	–	665	900	1395	–	665	900	1395	–	575	775	1200	–	510	690	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 TT Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2400x1200
Terrain category: 2

$h/d \leq 0.5^*$ - Refer to Note 6 for definition of h and d

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	745	1150	1545	1820	610	935	1280	1685	550	840	1145	1620	520	795	1085	1580
B	–	765	1040	1625	–	625	845	1315	–	565	765	1180	–	530	720	1110
C	–	–	535	820	–	–	–	670	–	–	–	605	–	–	–	570
D	–	–	–	525	–	–	–	–	–	–	–	–	–	–	–	–

$h/d \geq 1^*$ - Refer to Note 6 for definition of h and d

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	505	775	1055	1565	–	635	860	1335	–	570	770	1195	–	540	730	1130
B	–	520	700	1080	–	–	575	880	–	–	520	795	–	–	–	750
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 TT Rail
Type of Interface: Tin Roof Hook
Solar Panel Dimension: 2400x1200
Terrain category: 3

$h/d \leq 0.5^*$ - Refer to Note 6 for definition of h and d

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	900	1405	1665	1940	900	1405	1665	1940	775	1205	1570	1850	695	1070	1470	1775
B	605	925	1265	1870	605	925	1265	1870	520	800	1090	1705	–	710	965	1510
C	–	–	650	1005	–	–	650	1005	–	–	555	860	–	–	–	765
D	–	–	–	635	–	–	–	635	–	–	–	550	–	–	–	–

$h/d \geq 1^*$ - Refer to Note 6 for definition of h and d

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	610	940	1285	1690	610	940	1285	1690	525	810	1100	1595	–	720	980	1525
B	–	625	850	1320	–	625	850	1320	–	540	735	1135	–	–	655	1005
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
TT Rail	TT 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.

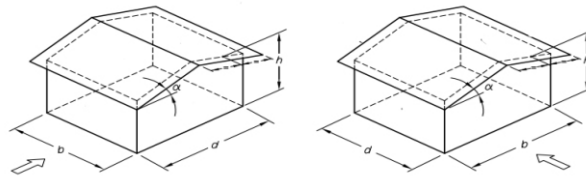
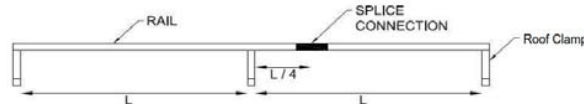


Figure 1 – h and d definition

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.

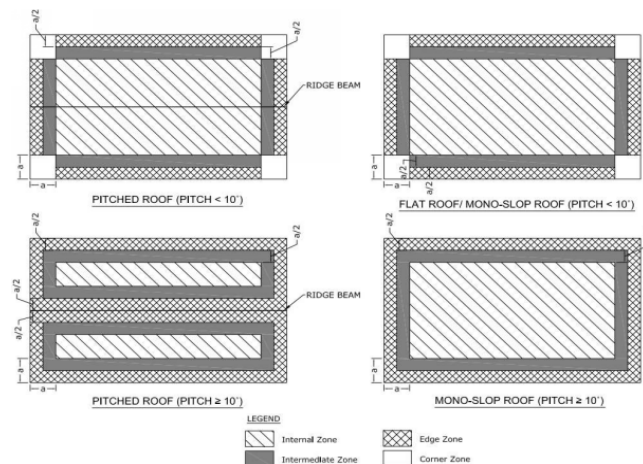


Figure 2 - Roof Zones Definition

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)