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Suite 4, 346 Ferntree Gully Rd, Notting Hill VIC 3149. Tel: 03 9543 2211

Our Ref: 9171-Pierced Fix Roof 01/AdA
25 January 2021

Innosearch Pty Ltd
22 Charlotte St
Merrylands NSW 2160

PV Array Frame Engineering Certification

RE: AS/NZ 1170.2 Certification for Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof)

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof) within Australia. The design check is based on the information and test reports provided by Innosearch Pty Ltd.

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

Component	Part No
Rail	PV001
Rail Splice	PV-NUT01&B
Tin interface	PV-LFT01&A
Tille Hook	TLB01
Inter Clamp Kit	PV-CLA01&A
End Clamp Kit	PV-CLA40&A

This certificate is **only valid** for Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof) itself. 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 1.9BMT 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.

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We find the Installation of Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof) for Australian/New Zealand 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, W**
- Wind terrain category **2 & 3**
- Wind average recurrence interval of **200 years**
- Maximum building height **20m**
- The maximum assessed PV panel dimensions are **1840mm x 998mm & 2274mm x 1134mm**
- Weight of the PV panel and array frame to be 15 kg/m²
- Material of Rails to be **AL6005-T5**
- 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 (50mm ≤ s ≤ 300mm)
- 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.**
- **Tile interface is considered reaching its serviceability limit when then unloaded (residual) displacement reach approx. 30% of loaded displacement.**
- **The capacity of roof tile hook was obtained from test report no. 50394672 001, dated 21.08.2020 and provided by TUV Rheinland.**
- **The spacing shown in the interface tables shall be adjusted based on the assessment and requirement of the roof structures.**

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Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was designed by **Acha De Alwis** in accordance with the provisions of relevant Building Regulations and in accordance with sound, widely accepted engineering principles. This certificate is only valid till 22/01/2023. 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

A handwritten signature in black ink, appearing to read 'Jianzeng Geng'.

Jianzeng Geng
Technical Director
FIEAust CPEng NER 3108316
NT Registration: 239858ES
QLD Registration: 18455
VIC Registration: EC 39483
TAS Registration: CC7263

Attachments:

- Summary table for interface spacing, Flush mount - Tin Roof (Pierced Fix Roof);
- Summary table for interface spacing, Flush mount - Tile Roof.

Structural Design Documentation

**Flush Array Frame System Spacing Table For Tin Roof
(Pierced Fix Roof)
According to AS/NZS 1170.2-2011 (R2016)
with Rail PV001
within Australia/New Zealand
Terrain Category 2 & 3**

For: Innosearch Pty Ltd
22 Charlotte St
Merrylands NSW 2160

Job Number: 9171 – 01
Date: 25 January 2021



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Job No: 9171 - 01
Client: Innosearch Pty Ltd
Project: Flush Array Frame System Spacing Table For Tin Roof
(Pierced Fix Roof)
with Rail PV001
Address: within Australia/New Zealand

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 1664.1:1997 – Aluminium structures - Limit state design
AS 4100:1998 (R2016) – Steel Structures
AS/NZS 4600:2018 – Cold-formed Steel Structures

Wind Terrain Category: WTC 2 & 3

Designed: AdA
Checked: HS

Date: Jan-21

**Flush Array Frame System Spacing Table For Tin Roof
 (Pierced Fix Roof) - mm**

Type of Rail PV001
 Type of Interface L-feet
 Solar Panel Dimension 1.840m x 0.998m
 Terrain category 2

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	965	1490	1720	1955	790	1215	1600	1840	710	1090	1485	1780	675	1030	1405	1750
B	645	990	1345	1885	530	810	1100	1705	480	730	990	1530	--	690	930	1440
C	--	510	690	1065	--	420	565	870	--	380	510	785	--	--	485	740
D	--	--	445	680	--	--	--	555	--	--	--	505	--	--	--	475
W	730	1120	1530	1775	600	920	1250	1670	540	825	1120	1605	515	780	1060	1570

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	655	1005	1365	1740	535	820	1115	1625	485	740	1000	1550	--	700	945	1465
B	--	670	910	1405	--	550	745	1145	--	500	675	1030	--	470	635	970
C	--	--	470	720	--	--	385	590	--	--	--	535	--	--	--	505
D	--	--	--	465	--	--	--	380	--	--	--	--	--	--	--	--
W	500	760	1030	1555	--	625	845	1300	--	565	760	1170	--	535	720	1105

Flush Array Frame System Spacing Table For Tin Roof
(Pierced Fix Roof) - mm

Type of Rail PV001
 Type of Interface L-feet
 Solar Panel Dimension 1.840m x 0.998m
 Terrain category 3

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	1170	1655	1820	2000	1170	1655	1820	2000	1005	1560	1745	1985	900	1385	1680	1910
B	780	1200	1640	2000	780	1200	1640	2000	675	1035	1410	1915	605	920	1255	1850
C	405	620	840	1300	405	620	840	1300	--	535	725	1115	--	475	645	990
D	--	400	540	825	--	400	540	825	--	--	465	710	--	--	415	635
W	885	1365	1645	1880	885	1365	1645	1880	765	1175	1560	1800	680	1045	1425	1740

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	795	1220	1605	1840	795	1220	1605	1840	685	1050	1430	1765	610	935	1275	1705
B	535	815	1100	1710	535	815	1100	1710	--	705	950	1470	--	625	845	1305
C	--	425	570	875	--	425	570	875	--	--	490	755	--	--	440	670
D	--	--	--	560	--	--	--	560	--	--	--	485	--	--	--	430
W	605	920	1255	1670	605	920	1255	1670	525	795	1080	1580	465	710	960	1485

**Flush Array Frame System Spacing Table For Tin Roof
 (Pierced Fix Roof) - mm**

Type of Rail PV001
 Type of Interface L-feet
 Solar Panel Dimension 2.274m x 1.134m
 Terrain category 2

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	705	1205	1605	1850	585	980	1340	1745	465	880	1205	1685	380	800	1135	1645
B	525	800	1090	1705	320	655	890	1380	--	590	800	1240	--	555	755	1165
C	--	415	560	865	--	--	460	705	--	--	415	635	--	--	390	595
D	--	--	--	550	--	--	--	450	--	--	--	405	--	--	--	385
W	465	905	1240	1675	--	650	1010	1555	--	595	905	1410	--	570	775	1330

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	335	755	1105	1630	--	605	900	1400	--	565	755	1255	--	455	690	1185
B	--	545	735	1135	--	445	605	925	--	280	545	835	--	220	510	785
C	--	--	380	580	--	--	--	475	--	--	--	430	--	--	--	405
D	--	--	--	370	--	--	--	--	--	--	--	--	--	--	--	--
W	--	560	745	1290	--	--	600	1050	--	--	560	945	--	--	450	890

Flush Array Frame System Spacing Table For Tin Roof
(Pierced Fix Roof) - mm

Type of Rail: PV001
 Type of Interface: L-feet
 Solar Panel Dimension: 2.274m x 1.134m
 Terrain category: 3

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	945	1475	1725	1975	945	1475	1725	1975	775	1260	1635	1880	660	1125	1540	1815
B	630	970	1325	1900	630	970	1325	1900	545	835	1140	1785	485	745	1015	1580
C	--	500	680	1055	--	500	680	1055	--	430	585	905	--	385	520	800
D	--	--	435	665	--	--	435	665	--	--	375	575	--	--	--	515
W	630	1105	1515	1785	630	1105	1515	1785	560	955	1300	1705	355	765	1155	1630

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	595	985	1345	1745	595	985	1345	1745	440	845	1155	1660	--	685	1030	1590
B	320	655	890	1385	320	655	890	1385	--	570	770	1190	--	505	685	1055
C	--	--	460	705	--	--	460	705	--	--	395	610	--	--	--	540
D	--	--	--	455	--	--	--	455	--	--	--	390	--	--	--	--
W	--	650	1015	1555	--	650	1015	1555	--	575	870	1355	--	435	675	1200

General Notes

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

Components	Part Number	Description
Rail	PV001	As per drawing& test report provided by client
Splice	PV-NUT01&B	
L feet	PV-LFT01&A	

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

Note 3 Recommended screws

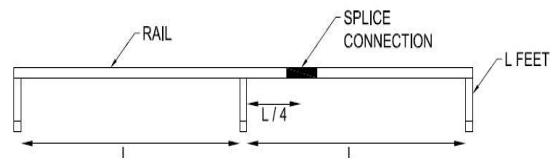
Metal Purlins/Battens	14g-10 TPI Tek screws or approved equivalent
Timber Purlins/Battens	14g-10 TPI T17 screws or approved equivalent

Note 4 Maximum uplift wind pressure is limited to 5 kPa. "--" states more uplift pressure.

Note 5 Deflection is limited to Minimum of L/120 and 15mm

Note 6 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 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 1 for definition of roof zones.

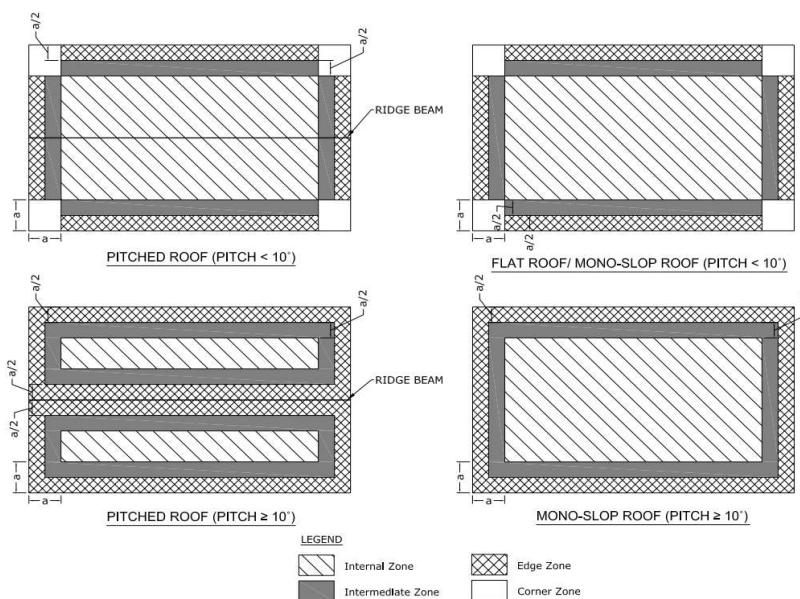


Figure 1 - Roof Zones Definition

In Figure 1, 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)

Structural Design Documentation

Flush Array Frame System Spacing Table For Tile Roof

According to AS/NZS 1170.2-2011 (R2016)

with Rail PV001

within Australia/New Zealand

Terrain Category 2 & 3

For: Innosearch Pty Ltd
22 Charlotte St
Merrylands NSW 2160

Job Number: 9171 – 01
Date: 25 January 2021



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with Rail PV001
Address: within Australia/New Zealand

Australian Standards

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and other actions
AS/NZS 1170.2:2011 (R2016) – Structural design actions, Part 2: Wind actions
AS/NZS 1664.1:1997 – Aluminium structures - Limit state design
AS 4100:1998 (R2016) – Steel Structures
AS/NZS 4600:2018 – Cold-formed Steel Structures

Wind Terrain Category: WTC 2 & 3

Designed: AdA
Checked: HS

Date: Jan-21

Flush Array Frame System Spacing Table For Tile Roof - mm

Type of Rail PV001
 Type of Interface Tile Interface TLB01
 Solar Panel Dimension 1.840m x 0.998m
 Terrain category 2

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	--	475	650	1040	--	385	525	835	--	345	475	745	--	325	445	700
B	--	--	430	670	--	--	350	545	--	--	--	485	--	--	--	455
C	--	--	--	425	--	--	--	345	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	355	485	765	--	--	395	620	--	--	355	555	--	--	335	525

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	--	220	435	680	--	--	355	550	--	--	220	495	--	--	--	465
B	--	--	--	445	--	--	--	365	--	--	--	325	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	--	325	505	--	--	--	415	--	--	--	370	--	--	--	350

Flush Array Frame System Spacing Table For Tile Roof - mm

Type of Rail: PV001
 Type of Interface: Tile Interface TLB01
 Solar Panel Dimension: 1.840m x 0.998m
 Terrain category: 3

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	370	580	805	1300	370	580	805	1300	220	495	685	1095	--	440	605	965
B	--	380	520	825	--	380	520	825	--	325	450	705	--	--	400	620
C	--	--	335	520	--	--	335	520	--	--	--	445	--	--	--	395
D	--	--	--	325	--	--	--	325	--	--	--	--	--	--	--	--
W	--	435	595	945	--	435	595	945	--	375	510	805	--	330	455	710

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	--	385	530	840	--	385	530	840	--	335	455	715	--	--	405	630
B	--	--	350	545	--	--	350	545	--	--	--	465	--	--	--	415
C	--	--	--	345	--	--	--	345	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	--	400	620	--	--	400	620	--	--	345	535	--	--	--	470

Flush Array Frame System Spacing Table For Tile Roof - mm

Type of Rail PV001
 Type of Interface Tile Interface TLB01
 Solar Panel Dimension 2.274m x 1.134m
 Terrain category 2

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	--	385	525	845	--	--	425	675	--	--	380	600	--	--	250	565
B	--	--	--	540	--	--	--	440	--	--	--	395	--	--	--	345
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	--	395	620	--	--	--	500	--	--	--	450	--	--	--	420

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	--	--	--	550	--	--	--	445	--	--	--	400	--	--	--	375
B	--	--	--	250	--	--	--	--	--	--	--	--	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	--	--	410	--	--	--	--	--	--	--	--	--	--	--	--

Flush Array Frame System Spacing Table For Tile Roof - mm

Type of Rail PV001
 Type of Interface Tile Interface TLB01
 Solar Panel Dimension 2.274m x 1.134m
 Terrain category 3

Wind Region	Building Height – H (m); Aspect ratio H/d ≤ 0.5 & H/b ≤ 0.5															
	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	--	470	650	1055	--	470	650	1055	--	400	555	885	--	225	490	780
B	--	--	420	665	--	--	420	665	--	--	250	570	--	--	--	505
C	--	--	--	420	--	--	--	420	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	--	480	765	--	--	480	765	--	--	415	655	--	--	255	575

Wind Region	Building Height – H (m); Aspect ratio H/d > 0.5 or H/b > 0.5															
	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	--	--	430	675	--	--	430	675	--	--	265	575	--	--	--	510
B	--	--	--	440	--	--	--	440	--	--	--	380	--	--	--	--
C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
W	--	--	--	505	--	--	--	505	--	--	--	430	--	--	--	380

General Notes

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

Components	Part Number	Description
Rail	PV001	As per drawing& test report provided by client
Splice	PV-NUT01&B	
Tile Hook	TLB01	

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

Note 3 Recommended screws

Metal Purlins/Battens	14g-10 TPI Tek screws or approved equivalent
Timber Purlins/Battens	14g-10 TPI T17 screws or approved equivalent

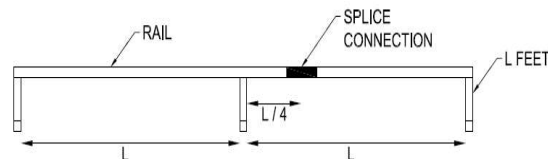
Note 4 Maximum uplift wind pressure is limited to 5 kPa. "--" states more uplift pressure.

Note 5 Tile interface is considered reaching its serviceability limit when then unloaded (residual) displacement reach approx. 30% of the loaded displacement

Note 6 Deflection is limited to Minimum of L/120 and 15mm

Note 7 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 8 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 9 Refer Figure 1 for definition of roof zones.

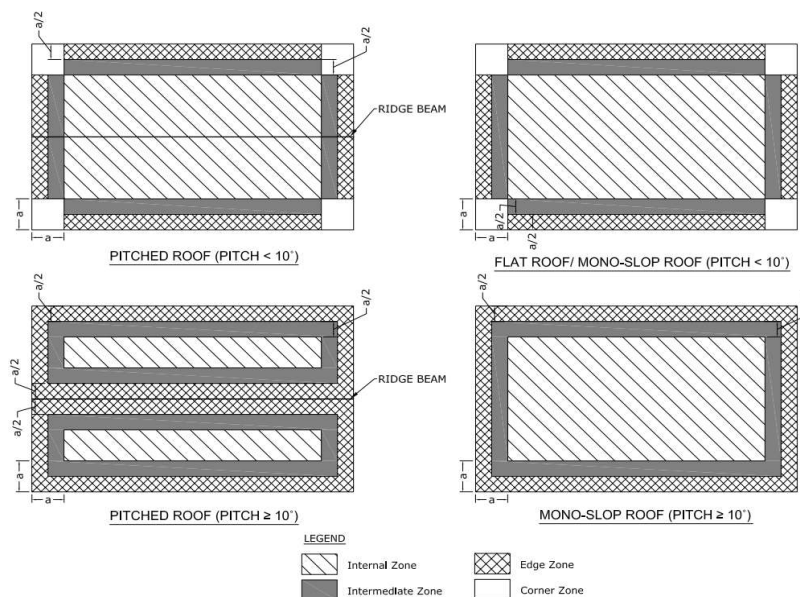


Figure 1 - Roof Zones Definition

In Figure 1, 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)