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## Array Frame Engineering Certification

For: ANTAI SOLAR AUSTRALIA  
PTY LTD  
Level 1 suite 1.02/309 Pitt  
St, Sydney NSW 2000

Job No.: 10166  
Date: 24/08/2021

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Current Revision		0				

Approval			
Author Signature		Approver Signature	
Name	Yesim Kocabalkan	Name	L. Van Spaandonk
Title	Structural Engineer	Title	Principal Engineer

Our Ref: 10166-07-02 /YK  
24 August 2021

ANTAI SOLAR AUSTRALIA PTY LTD  
Level 1 suite 1.02/309 Pitt St  
Sydney NSW 2000

## PV Array Frame Engineering Certification

### **RE: AS/NZ 1170.2 Certification for Flush Mounted System on Lysaght Klip Lok 406 (Concealed 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 Lysaght Klip Lok 406 (Concealed Fix Roof) within Australia. The design check is based on the information and test reports provided by ANTAI SOLAR AUSTRALIA PTY LTD.

For the indicative location of **full rib** in the roof sheeting, please see **Figure 1**.

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

Component	Part No
Ra	ATL-TYN-355A(ATL-DR-355A); ATL-TYN-355B (ATL-DR-355B)
Rail Splice	ATL-TYN-304/54 (ATL-DR-JOINER)
Roof Clamp	ATL-TYN-19/20 (ATL-IC-406)
Inter Clamp Kit	ATL-GN-003 (ATL-IC-30/35, ATL-IC-35/40)
End Clamp Kit	ATL-CG-018 (ATL-EC-30/35, ATL-EC-35/40)

This certificate is **only valid** for Flush Mounted System on Lysaght Klip Lok 406 (Concealed 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 roof clamp fixing to the **full rib** of roof sheeting on the top of the purlins. 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.

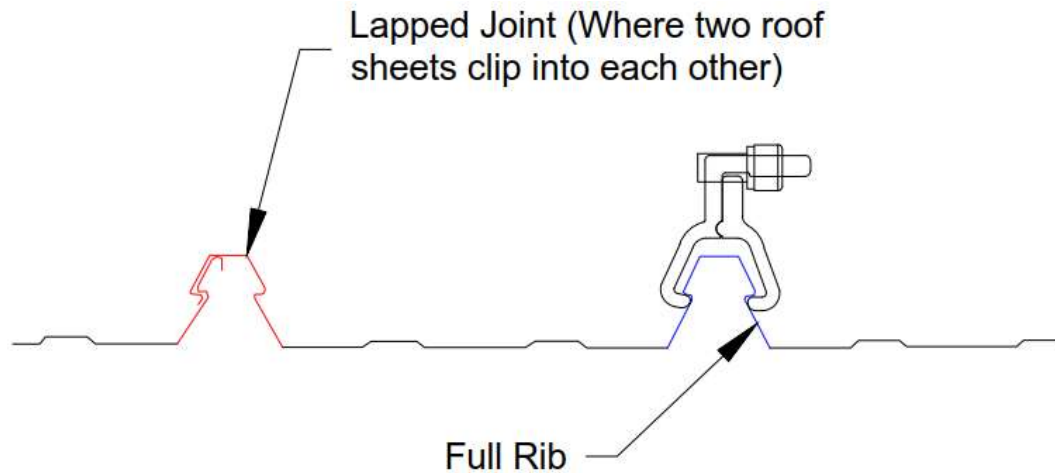
We find the Installation of Flush Mounted System on Lysaght Klip Lok 406 (Concealed Fix Roof) for Australian use to be structurally sufficient based on the following conditions:

- 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 **2300mm x 1200mm**
- Weight of the PV panel and array frame to be 15 kg/m<sup>2</sup>
- Material of Rails to be **AL6005-T6**
- Each PV panel to be installed using **2 rails** minimum in all circumstances
- Roof clamps to be fixed only to the **full rib** of roof sheeting on the top of the purlins (See **Figure 1**)
- 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
- For Corrosivity Category C4, decrease the spacing to 92%
- For Corrosivity Category C5, decrease the spacing to 84%

***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 rail was obtained from test report no. 20-0249- A and 20-0249- B, dated 27<sup>th</sup> May 2020 and provided by Melbourne Testing Services.**
- **The capacity of roof clamp was obtained from test report no. MT-15/317, dated 26<sup>th</sup> May 2015 and provided by Melbourne Testing Services.**
- **The spacing shown in the interface tables shall be adjusted based on the assessment and requirement of the roof structures.**



**Figure 1 – Full Rib Location For Indicative**

Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was designed by **Yesim Kocabalkan** in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles. This certificate is only valid till 24/08/2023. 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:

- Summary table for interface spacing, Flush mount - Lysaght Klip Lok 406(Concealed Fix Roof)



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[melbourne@gamcorp.com.au](mailto:melbourne@gamcorp.com.au)

## Structural Design Documentation

**Flush Array Frame System Spacing Table For Concealed Fix Roof  
– Lysaght Klip-Lok 406 roof sheeting  
According to AS/NZS 1170.2-2011 (R2016)  
with Rail ATL-TYN-355A (ATL-DR-355A)  
within Australia  
Terrain Category 2 & 3**

For: ANTAI SOLAR AUSTRALIA PTY LTD  
Level 1 suite 1.02/309 Pitt St  
Sydney NSW 2000

Job Number: 9670 – 07-02  
Date: 7 May 2021



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ISO 9001:2015 Registered Firm  
Certificate No: AU1222

**Job No:** 9670 – 07-02  
**Client:** ANTAI SOLAR AUSTRALIA PTY LTD  
**Project:** Flush Array Frame System Spacing Table For Concealed Fix Roof – Lysaght Klip-Lok  
406 roof sheeting  
with Rail ATL-TYN-355A (ATL-DR-355A)  
**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 1664.1:1997 – Aluminium structures - Limit state design  
AS 4100:2020 – Steel Structures  
AS/NZS 4600:2018 – Cold-formed Steel Structures

**Wind Terrain Category:** WTC 2 & 3

**Designed:** JD  
**Checked:** AA

**Date:** May-21

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**  
 Project: **Solar Array Interface Spacing Table**  
 Address: **within Australia**  
 Designed: **JD**

Job: **9670 – 07-02**  
 Date: **May-21**

Checked: **AA**

### Flush Array Frame System Spacing Table for LYSAGHT Klip-Lok 406 roof sheeting – mm

Type of Rail: ATL-TYN-355A (ATL-DR-355A)  
 Type of Interface: Roof Clamp  
 Solar Panel Dimension: 2.3mx1.2m  
 Terrain category: **2**

Roof Angle ( $\Phi$ ) –  $\Phi < 5^\circ$

Wind Region	Building Height – H (m)							
	H $\leq$ 5		5<H $\leq$ 10		10<H $\leq$ 15		15<H $\leq$ 20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1395</b>	<b>1505</b>	<b>1295</b>	<b>1400</b>	<b>1165</b>	<b>1345</b>	<b>635</b>	<b>1315</b>
<b>B</b>	<b>1055</b>	<b>1300</b>	<b>665</b>	<b>1060</b>	<b>605</b>	<b>725</b>	<b>520</b>	<b>690</b>
<b>C</b>	<b>500</b>	<b>665</b>	--	<b>500</b>	--	--	--	--
<b>D</b>	--	<b>355</b>	--	--	--	--	--	--

Roof Angle ( $\Phi$ ) –  $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height – H (m)							
	H $\leq$ 5		5<H $\leq$ 10		10<H $\leq$ 15		15<H $\leq$ 20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1395</b>	<b>1600</b>	<b>1295</b>	<b>1485</b>	<b>1165</b>	<b>1425</b>	<b>635</b>	<b>1395</b>
<b>B</b>	<b>1055</b>	<b>1535</b>	<b>665</b>	<b>1250</b>	<b>605</b>	<b>1125</b>	<b>520</b>	<b>1060</b>
<b>C</b>	<b>500</b>	<b>860</b>	--	<b>645</b>	--	<b>595</b>	--	<b>500</b>
<b>D</b>	--	<b>615</b>	--	<b>295</b>	--	--	--	--

Roof Angle ( $\Phi$ ) –  $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height – H (m)							
	H $\leq$ 5		5<H $\leq$ 10		10<H $\leq$ 15		15<H $\leq$ 20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
<b>A</b>	<b>1525</b>	<b>1785</b>	<b>1415</b>	<b>1670</b>	<b>1365</b>	<b>1600</b>	<b>1335</b>	<b>1565</b>
<b>B</b>	<b>1350</b>	<b>1725</b>	<b>1105</b>	<b>1595</b>	<b>790</b>	<b>1535</b>	<b>715</b>	<b>1440</b>
<b>C</b>	<b>690</b>	<b>1335</b>	<b>590</b>	<b>1090</b>	--	<b>860</b>	--	<b>735</b>
<b>D</b>	<b>440</b>	<b>850</b>	--	<b>675</b>	--	<b>620</b>	--	<b>595</b>



Client: **ANTAI SOLAR AUSTRALIA PTY LTD**  
 Project: **Solar Array Interface Spacing Table**  
 Address: **within Australia**  
 Designed: **JD**

Job: **9670 – 07-02**  
 Date: **May-21**

Checked: **AA**

### Flush Array Frame System Spacing Table for LYSAGHT Klip-Lok 406 roof sheeting – mm

Type of Rail: ATL-TYN-355A (ATL-DR-355A)  
 Type of Interface: Roof Clamp  
 Solar Panel Dimension: 2.3mx1.2m  
 Terrain category: **3**

Roof Angle ( $\Phi$ ) –  $\Phi < 5^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1500</b>	<b>1620</b>	<b>1500</b>	<b>1620</b>	<b>1420</b>	<b>1530</b>	<b>1360</b>	<b>1465</b>
<b>B</b>	<b>1280</b>	<b>1550</b>	<b>1280</b>	<b>1550</b>	<b>1105</b>	<b>1360</b>	<b>780</b>	<b>1210</b>
<b>C</b>	<b>665</b>	<b>1015</b>	<b>665</b>	<b>1015</b>	<b>590</b>	<b>700</b>	<b>--</b>	<b>630</b>
<b>D</b>	<b>340</b>	<b>630</b>	<b>340</b>	<b>630</b>	<b>--</b>	<b>440</b>	<b>--</b>	<b>--</b>

Roof Angle ( $\Phi$ ) –  $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1500</b>	<b>1725</b>	<b>1500</b>	<b>1725</b>	<b>1420</b>	<b>1630</b>	<b>1360</b>	<b>1560</b>
<b>B</b>	<b>1280</b>	<b>1650</b>	<b>1280</b>	<b>1650</b>	<b>1105</b>	<b>1560</b>	<b>780</b>	<b>1430</b>
<b>C</b>	<b>665</b>	<b>1195</b>	<b>665</b>	<b>1195</b>	<b>590</b>	<b>1025</b>	<b>--</b>	<b>725</b>
<b>D</b>	<b>340</b>	<b>720</b>	<b>340</b>	<b>720</b>	<b>--</b>	<b>635</b>	<b>--</b>	<b>580</b>

Roof Angle ( $\Phi$ ) –  $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
<b>A</b>	<b>1645</b>	<b>1900</b>	<b>1645</b>	<b>1900</b>	<b>1555</b>	<b>1810</b>	<b>1485</b>	<b>1745</b>
<b>B</b>	<b>1575</b>	<b>1830</b>	<b>1575</b>	<b>1830</b>	<b>1415</b>	<b>1750</b>	<b>1255</b>	<b>1680</b>
<b>C</b>	<b>1055</b>	<b>1595</b>	<b>1055</b>	<b>1595</b>	<b>725</b>	<b>1400</b>	<b>645</b>	<b>1245</b>
<b>D</b>	<b>650</b>	<b>1035</b>	<b>650</b>	<b>1035</b>	<b>485</b>	<b>895</b>	<b>305</b>	<b>785</b>

### General Notes

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

Components	Part Number	Description
Rail	ATL-TYN-355A	As per drawing& test report provided by client
Splice	ATL-TYN-304/54	
Roof clamp	ATL-TYN-19/20	

Note 2 Maximum uplift wind pressure is limited to 5 kPa. "--" states more uplift pressure.

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

Note 4 For definition of (End/Central) roof zones, Refer Figure D9 of AS/NZS 1170.2:2011 (R2016) or Figure A as below

For definition of intermediate and internal roof zones, Refer Figure B as below

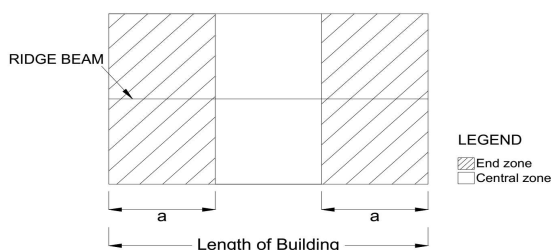


Figure A

In Figure A, the value of dimension "a" is 1/3 of the length of building

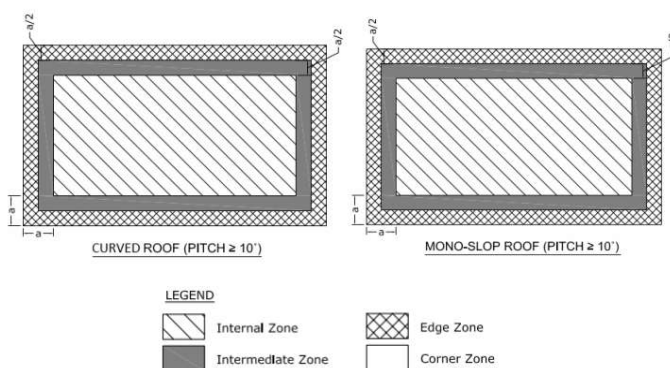


Figure B

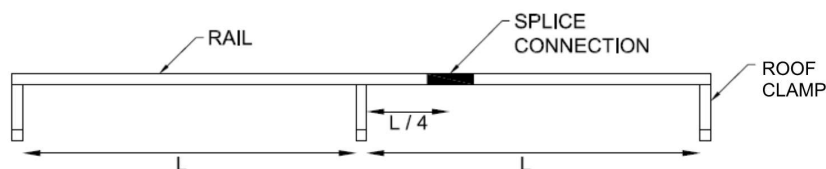
In Figure B, the value of dimension "a" is the minimum of 0.2b, 0.2d and h. (b & d are building dimensions and h is its height)

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

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.





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## Structural Design Documentation

**Flush Array Frame System Spacing Table For Concealed Fix Roof  
– Lysaght Klip-Lok 406 roof sheeting  
According to AS/NZS 1170.2-2011 (R2016)  
with Rail ATL-TYN-355B (ATL-DR-355B)  
within Australia  
Terrain Category 2 & 3**

For: ANTAI SOLAR AUSTRALIA PTY LTD  
Level 1 suite 1.02/309 Pitt St  
Sydney NSW 2000



Job Number: 9670 – 07-02  
Date: 7 May 2021

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Certificate No: AU1222

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**Client:** ANTAI SOLAR AUSTRALIA PTY LTD  
**Project:** Flush Array Frame System Spacing Table For Concealed Fix Roof – Lysaght Klip-Lok  
406 roof sheeting  
with Rail ATL-TYN-355B (ATL-DR-355B)  
**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 1664.1:1997 – Aluminium structures - Limit state design  
AS 4100:2020 – Steel Structures  
AS/NZS 4600:2018 – Cold-formed Steel Structures

**Wind Terrain Category:** WTC 2 & 3

**Designed:** JD  
**Checked:** AA

**Date:** May-21

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**  
Project: **Solar Array Interface Spacing Table**  
Address: **within Australia**  
Designed: **JD**

Job: **9670 – 07-02**  
Date: **May-21**

Checked: **AA**

### Flush Array Frame System Spacing Table for LYSAGHT Klip-Lok 406 roof sheeting – mm

Type of Rail: ATL-TYN-355B (ATL-DR-355B)  
Type of Interface: Roof Clamp  
Solar Panel Dimension: 2.3mx1.2m  
Terrain category: **2**

Roof Angle ( $\Phi$ ) –  $\Phi < 5^\circ$

Wind Region	Building Height – H (m)							
	H $\leq$ 5		5<H $\leq$ 10		10<H $\leq$ 15		15<H $\leq$ 20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1310</b>	<b>1415</b>	<b>1220</b>	<b>1315</b>	<b>575</b>	<b>1265</b>	<b>495</b>	<b>1240</b>
<b>B</b>	<b>675</b>	<b>1300</b>	<b>530</b>	<b>695</b>	--	<b>620</b>	--	<b>595</b>
<b>C</b>	--	<b>530</b>	--	--	--	--	--	--
<b>D</b>	--	--	--	--	--	--	--	--

Roof Angle ( $\Phi$ ) –  $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height – H (m)							
	H $\leq$ 5		5<H $\leq$ 10		10<H $\leq$ 15		15<H $\leq$ 20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1310</b>	<b>1505</b>	<b>1220</b>	<b>1395</b>	<b>575</b>	<b>1340</b>	<b>495</b>	<b>1315</b>
<b>B</b>	<b>675</b>	<b>1440</b>	<b>530</b>	<b>1250</b>	--	<b>1125</b>	--	<b>685</b>
<b>C</b>	--	<b>665</b>	--	<b>510</b>	--	--	--	--
<b>D</b>	--	--	--	--	--	--	--	--

Roof Angle ( $\Phi$ ) –  $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height – H (m)							
	H $\leq$ 5		5<H $\leq$ 10		10<H $\leq$ 15		15<H $\leq$ 20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
<b>A</b>	<b>1435</b>	<b>1700</b>	<b>1330</b>	<b>1570</b>	<b>1285</b>	<b>1505</b>	<b>1255</b>	<b>1470</b>
<b>B</b>	<b>1350</b>	<b>1625</b>	<b>1100</b>	<b>1500</b>	<b>640</b>	<b>1440</b>	<b>610</b>	<b>1410</b>
<b>C</b>	<b>595</b>	<b>1335</b>	--	<b>1090</b>	--	<b>665</b>	--	<b>630</b>
<b>D</b>	--	<b>690</b>	--	<b>580</b>	--	--	--	--

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**  
 Project: **Solar Array Interface Spacing Table**  
 Address: **within Australia**  
 Designed: **JD**

Job: **9670 – 07-02**  
 Date: **May-21**

Checked: **AA**

### Flush Array Frame System Spacing Table for LYSAGHT Klip-Lok 406 roof sheeting – mm

Type of Rail: ATL-TYN-355B (ATL-DR-355B)  
 Type of Interface: Roof Clamp  
 Solar Panel Dimension: 2.3mx1.2m  
 Terrain category: **3**

Roof Angle ( $\Phi$ ) –  $\Phi < 5^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1410</b>	<b>1525</b>	<b>1410</b>	<b>1525</b>	<b>1335</b>	<b>1440</b>	<b>1280</b>	<b>1380</b>
<b>B</b>	<b>1280</b>	<b>1460</b>	<b>1280</b>	<b>1460</b>	<b>1105</b>	<b>1360</b>	<b>630</b>	<b>1210</b>
<b>C</b>	<b>530</b>	<b>680</b>	<b>530</b>	<b>680</b>	--	<b>605</b>	--	<b>435</b>
<b>D</b>	--	<b>440</b>	--	<b>440</b>	--	--	--	--

Roof Angle ( $\Phi$ ) –  $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
<b>A</b>	<b>1410</b>	<b>1625</b>	<b>1410</b>	<b>1625</b>	<b>1335</b>	<b>1535</b>	<b>1280</b>	<b>1465</b>
<b>B</b>	<b>1280</b>	<b>1555</b>	<b>1280</b>	<b>1555</b>	<b>1105</b>	<b>1470</b>	<b>630</b>	<b>1405</b>
<b>C</b>	<b>530</b>	<b>1195</b>	<b>530</b>	<b>1195</b>	--	<b>695</b>	--	<b>620</b>
<b>D</b>	--	<b>630</b>	--	<b>630</b>	--	<b>475</b>	--	--

Roof Angle ( $\Phi$ ) –  $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
<b>A</b>	<b>1550</b>	<b>1815</b>	<b>1550</b>	<b>1815</b>	<b>1460</b>	<b>1730</b>	<b>1400</b>	<b>1650</b>
<b>B</b>	<b>1480</b>	<b>1750</b>	<b>1480</b>	<b>1750</b>	<b>1400</b>	<b>1655</b>	<b>1255</b>	<b>1580</b>
<b>C</b>	<b>725</b>	<b>1500</b>	<b>725</b>	<b>1500</b>	<b>620</b>	<b>1400</b>	<b>510</b>	<b>1245</b>
<b>D</b>	<b>500</b>	<b>1035</b>	<b>500</b>	<b>1035</b>	--	<b>725</b>	--	<b>645</b>

### General Notes

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

Components	Part Number	Description
Rail	ATL-TYN-355B	As per drawing& test report provided by client
Splice	ATL-TYN-304/54	
Roof clamp	ATL-TYN-19/20	

Note 2 Maximum uplift wind pressure is limited to 5 kPa. “--” states more uplift pressure.

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

Note 4 For definition of (End/Central) roof zones, Refer Figure D9 of AS/NZS 1170.2:2011 (R2016) or Figure A as below

For definition of intermediate and internal roof zones, Refer Figure B as below

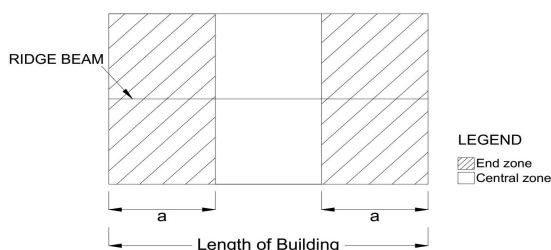


Figure A

In Figure A, the value of dimension “a” is 1/3 of the length of building

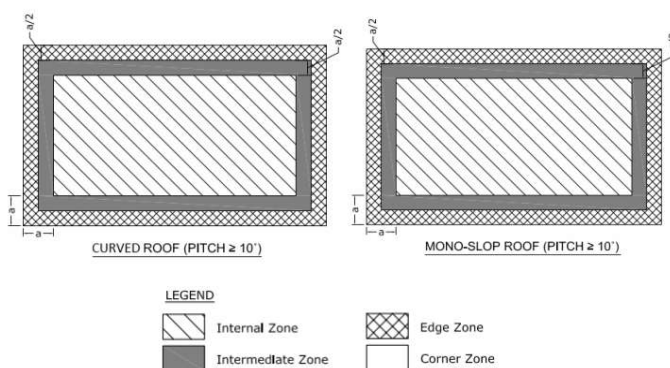


Figure B

In Figure B, 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)

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

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.

