



NSEW-TS-11-A

CIR Consulting Engineers Pty Ltd

MRac L Foot
Steel Purlin
Engineering Technical Summary

NSEW Energy

CIR CONSULTING ENGINEERS PTY LTD
MRAC L FOOT - STEEL PURLIN
ENGINEERING TECHNICAL SUMMARY





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SCOPE

This publication has been prepared with a view of providing designers, specifiers, builders and erectors the relevant data to enable easy selection of maximum spacing of fixing the **MRac L Foot Hook Interface** component fixed to cold-formed steel 'Zed & Cee' Purlin Sections.

The information contained herein:

- *Defined areas of roof zones relative to the location of proposed solar panel installation positioning set out & detail of conditions of restrictions in Australia.*
- *Defined areas of wind regions extract as defined by Australian/New Zealand Standard AS/NZS 1170.2:2011 – Structural Design Actions Part 2: Wind Loads*
- *Engineered design tables with spacing capacities of the MRac component relative to the actual projects site specifics of the proposed mounting panel type & size in conjunction with wind region, roof slopes, building height and panel positioning.*
- *Engineering summary & statement relevant to the supplied engineered tables and reference documents that enabled the development of those tables.*

ENGINEERING SUMMARY & STATEMENT:

CIR Consulting Engineers Pty Ltd as professional engineers duly experienced and qualified have developed and prepared the engineered tables contained in this document in accordance with sound and widely recognized engineering principles, the relevant testing reports, product manuals (inclusive of conditions of installation) and the referenced current Australian Standards.

This document is specific to the maximum spacing of the *MRac L Foot Hook Interface* component only, it should be noted that all other panel system components and their supporting elements have not been considered and are to be assessed by others. Users of the document in conjunction with their technical specialist representative are to ensure that they refer to all the components and their support elements technical data, design tables and information associated with the assembly prior to their final selection of the fixing arrangements and spacing of the *MRac L Foot Hook Interface* element specific to the individual site application.

In particular, the design relevant to the tables for each application were developed utilizing the following Australian/New Zealand Standards & Supplement Technical Documents.



David Thomas

Managing Director

FIEAust, CPEng, NPER, RPEQ, MASEV, RBPrac

Australian/New Zealand Standards:

AS/NZS 1170.0:2002	<i>Structural design actions Part 0: General Principles (Incorporating amendment Nos 1, 2, 3, 4 & 5)</i>
AS/NZS 1170.2:2011	<i>Structural design actions Part 2: Wind Actions (Incorporating amendment Nos 1, 2, 3, 4 & 5)</i>
AS/NZS 1562.1:1992	<i>Design & Installation of Sheet Metal Roof</i>
AS/NZS 1664.1:1997	<i>Aluminum structures Part 1: Limit State Design (Incorporating amendment No 1)</i>
AS/NZS 3566:2002	<i>Self-Drilling for the Building & Construction Industry</i>
AS/NZS 4600:1996	<i>Cold-Formed Steel Structures</i>

Supplement Technical Reference Documents:

Lysaght ® Roofing & Walling Installation Manual 2017 Edition

Lysaght ® Zeds and Ceels User's Guide 2014

NSEW Energy MRac Steel Roof Installation Guide L Feet Hook

TUV Rheinland Test Report No. – 16805311 001

TUV Rheinland Test Report No. – 16805310 001

It should be noted that where any of the above noted Australian/New Zealand Standards and Supplement Technical References are superseded then the documented data as reflected in the tables will be no longer applicable.

Supplement Engineering Criteria Considerations:

The principal engineered design outcomes as reflected in the documented tables incorporate the following criteria:

- ❖ *Design working life:* 25 years
- ❖ *Importance level:* 2 (AS/NZS 1170:0 Appendix Table F1)
- ❖ *Annual probability of exceedance:*
 - *Wind:* 1/250 (AS/NZS 1170:0 Appendix Table F2)
 - *Snow:* N/A
 - *Earthquake:* N/A
- ❖ *Wind direction:* All Directions (AS/NZS 1170:2 Table 3.2)
- ❖ *Terrain category:* 3 & 2 (AS/NZS 1170:2 Clause 4.2)
- ❖ *Building Ridge Height:* 20m maximum
- ❖ *Building Height Ratio's:*
Building Height/Building Width ≤ 0.5
Building Height/Building Length ≤ 0.5
- ❖ *Panel Type:* Flush Mount
- ❖ *Minimum Roofing & BMT:* Lysaght® Roofing 0.48mm or Equivalent
- ❖ *Supporting Purlins:* 'Zed & Cee' Purlins to consist of 1.5mm BMT Min. Lysaght® Purlins or Equivalent.
- ❖ *Serviceability Deflection:* Deflection not Considered (Refer Further Notes Below)

In addition to the above engineering criteria the following conditions also apply:

- ❖ *Panels are to be installed in strict compliance with the minimum conditions of the MRac installations guide in conjunction with specific criteria associated with this document.*
- ❖ *Panels are not to be installed in any of the exclusion zones as reflected in Appendix C.*
- ❖ *Flush mount Panels that are to be installed such that there is a gap between 50mm & 300mm between the underside of the panel and the roof surface.*
- ❖ *All panels are to be fixed & supported by a minimum of 2 no. horizontal rails.*
- ❖ *Panels are to be centrally located about supporting rails (i.e. individual panel overhang to be equal about supporting rails)*
- ❖ *Each rail is to be fixed to roof with a minimum of two direct fixings and or supporting mount components. Connections and components are to accommodate projects specific conditions associated with dynamics, acoustics, fire, waterproofing, lightening, dissimilar metals etc to ensure that the proposed & existing elements are duly protected.*
- ❖ *Deflection of the support of the panels has not been considered in the provided tables and as such the user needs to consider this condition relative to the usage of the document in conjunction with their engineering representative prior to final selection.*
- ❖ *Primary support structure of the roof element (inclusive of roof linings & secondary elements) to which the panels are intended to be fixed, attached and or supported by is to be verified as compliant with all the appropriate Australian Standards and product suppliers minimum requirements associated with the proposed application of product.*



- ❖ *CIR Consulting Engineers Pty Ltd recommend that the user seek appropriate professional engineering advice with respect to their final selection of quantity, spacing of fixings and structural integrity of existing structural elements specific to the project site and panel expected performance criteria.*
- ❖ *Panel, fixings, attachments, panel supplement elements and existing supporting elements are to be regularly inspected and maintained to ensure that the panel system remains in a safe & stable condition at all times.*
- ❖ *The final panel installation arrangement as installed is to be verified by the appropriate approving authority as being compliant to all the elements manufactures technical manuals, Australian Standards and National Construction Code of Australia as a minimum.*
- ❖ *This document is subject to amendment as such a check that the most up to date version/s of the document in conjunction with any reference documents, manuals, Australian Standards & data as reflected in the document is to be used.*
- ❖ *All users of this document acknowledge and agree to the terms & conditions of this document.*

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TABLE SELECTION PARAMETERS

The documented tables have been developed such that a number of principal variables associated with the performance of the fixings specific to the individual installation and usage are to be duly established by a duly qualified selector to enable the *MRac L Foot Hook Interface* fixing spacing to be determined.

The selector needs to consider the following minimum tabulated conditions in conjunction with all the appropriate supplement engineering criteria considerations and the needs associated with design & installation to ensure that the application has been duly considered relative to all the site specific limitations and existing building capabilities.

- ❖ Confirm Applicable Panel Size:
 - 1700mm Maximum
 - or
 - 2000mm Maximum

- ❖ Establish the Site Specific Wind Region
(Refer Appendix A for Wind Region Map)

- ❖ Establish the Site Specific Terrain Category:
(Refer Appendix B for Terrain Category Selection Criteria)

- ❖ Establish the Panel Installation Roof Zone:
 - End Zone
 - Central Zone(Refer Appendix C for roof zone area identification)

- ❖ Establish the Roof Parameters:
 - Roof Pitch (*ie Angle*)
 - Roof Height

ENGINEERED TABLES – MRAC L FOOT – STEEL PURLINS– 1700 MAX. PANEL LENGTH

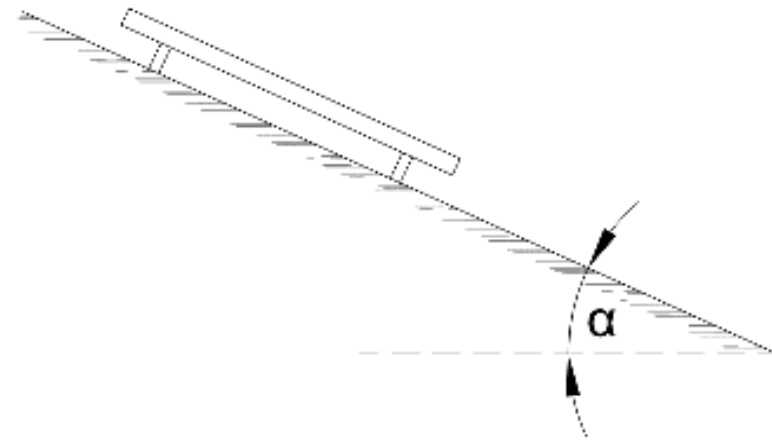
WIND REGION A	Terrain Category 3							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	1520	1230	1610	1230	1700	1230	1790	1230
5	1520	1230	1610	1230	1700	1230	1790	1230
10	1520	1230	1610	1230	1700	1230	1790	1230
15	1410	1140	1490	1140	1580	1140	1660	1140
20	1330	1080	1410	1080	1480	1080	1560	1080

WIND REGION A	Terrain Category 2							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	1370	1120	1450	1120	1540	1120	1620	1120
5	1370	1120	1450	1120	1540	1120	1620	1120
10	1240	1010	1310	1010	1390	1010	1460	1010
15	1180	960	1250	960	1320	960	1390	960
20	1140	930	1210	930	1280	930	1350	930

WIND REGION B	Terrain Category 3							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	1150	930	1220	930	1280	930	1350	930
5	1150	930	1220	930	1280	930	1350	930
10	1150	930	1220	930	1280	930	1350	930
15	1060	870	1120	870	1190	870	1250	870
20	1010	820	1070	820	1120	820	1180	820

WIND REGION B	Terrain Category 2							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	1040	850	1100	850	1160	850	1220	850
5	1040	850	1100	850	1160	850	1220	850
10	940	770	1000	770	1050	770	1110	770
15	890	730	940	730	1000	730	1050	730
20	870	710	920	710	970	710	1020	710

FLUSH MOUNT ARRANGEMENT



ENGINEERED TABLES – MRAC L FOOT – STEEL PURLINS – 2000 MAX. PANEL LENGTH

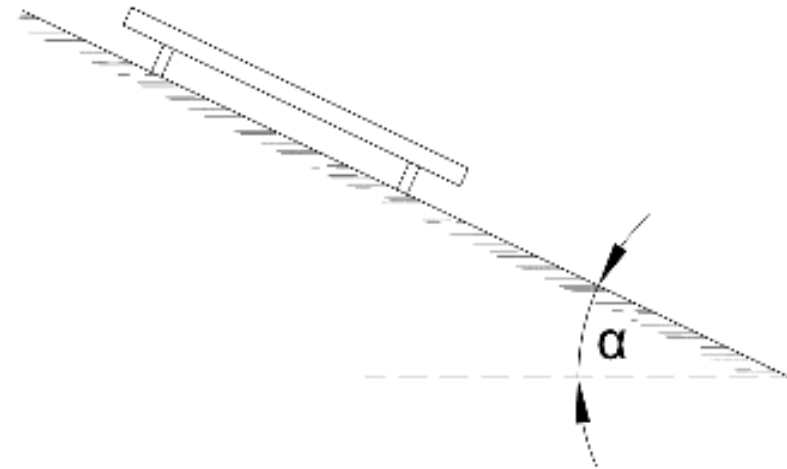
WIND REGION A	Terrain Category 3							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	1310	1060	1390	1060	1470	1060	1550	1060
5	1310	1060	1390	1060	1470	1060	1550	1060
10	1310	1060	1390	1060	1470	1060	1550	1060
15	1210	980	1290	980	1360	980	1440	980
20	1140	930	1210	930	1280	930	1350	930

WIND REGION A	Terrain Category 2							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	1190	960	1260	960	1330	960	1400	960
5	1190	960	1260	960	1330	960	1400	960
10	1070	870	1140	870	1200	870	1270	870
15	1020	830	1080	830	1140	830	1200	830
20	980	800	1040	800	1100	800	1160	800

WIND REGION B	Terrain Category 3							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	990	800	1050	800	1110	800	1170	800
5	990	800	1050	800	1110	800	1170	800
10	990	800	1050	800	1110	800	1170	800
15	920	750	970	750	1030	750	1080	750
20	860	700	910	700	970	700	1020	700

WIND REGION B	Terrain Category 2							
	Roof Pitch							
	$\alpha < 5^\circ$		$5^\circ \leq \alpha < 10^\circ$		$10^\circ \leq \alpha < 20^\circ$		$20^\circ \leq \alpha < 30^\circ$	
Roof Zone	Central	End	Central	End	Central	End	Central	End
Height	Maximum Spacing (mm)							
3	890	730	950	730	1000	730	1060	730
5	890	730	950	730	1000	730	1060	730
10	810	660	860	660	900	660	950	660
15	770	630	820	630	860	630	910	630
20	750	610	790	610	840	610	880	610

FLUSH MOUNT ARRANGEMENT



APPENDIX

Appendix A: WIND REGION

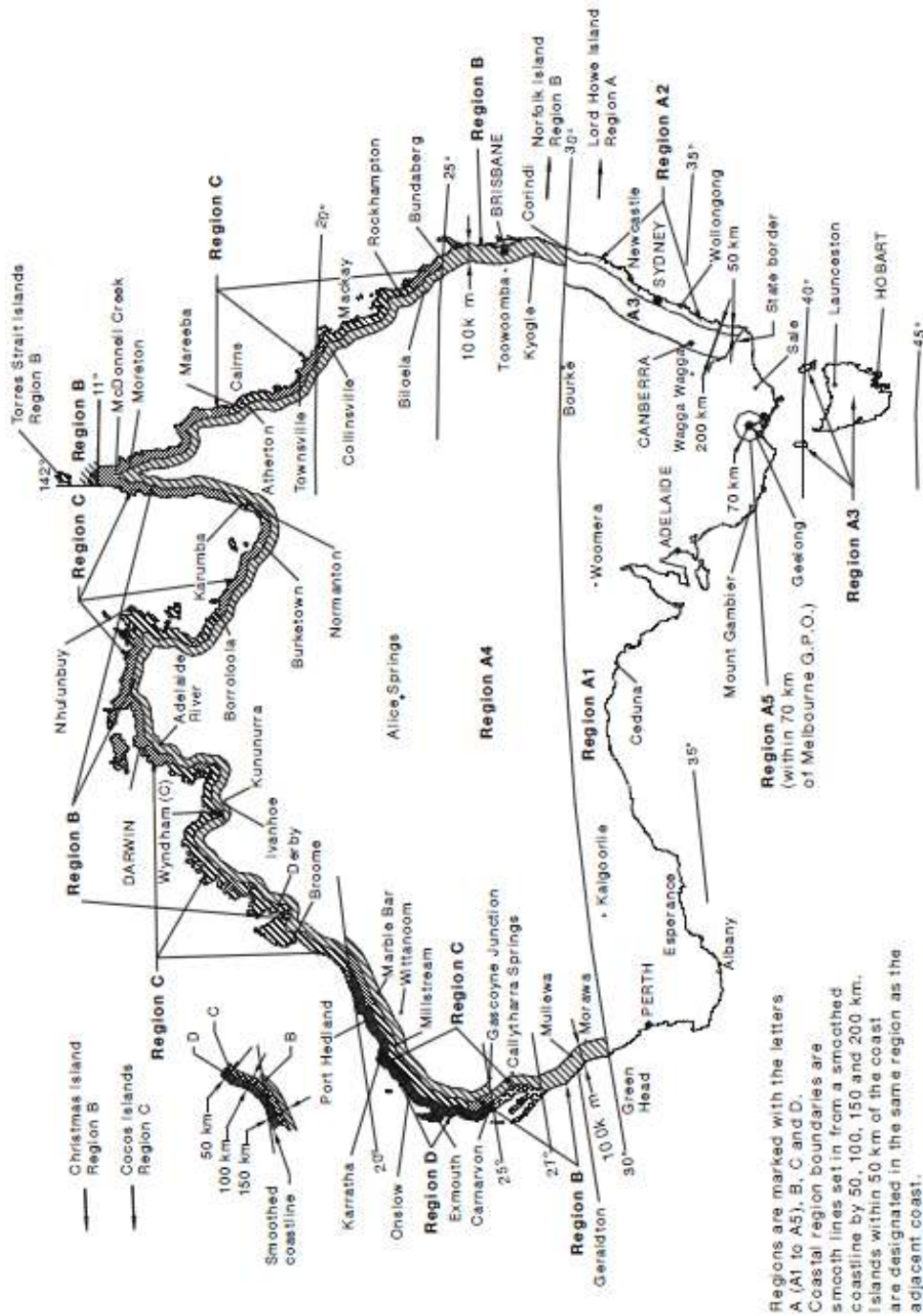


FIGURE 3.1(A) WIND REGIONS

Excerpt from AS/NZS 1170.2:2011 Clause 3.



Appendix B: TERRAIN CATEGORIES

The tables in this document provide maximum allowable spacing's between the MRac Klip-Lok interface kit for systems mounted on roof terrain categories 2 & 3. The following examples are descriptions of these terrain categories as defined in AS/NZS 1170.2:2011.

Terrain Category 2 (TC2): Open terrain, including grassland, with well-scattered obstructions having heights general from 1.5m to 5m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.

Terrain Category 3 (TC3): 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 sized obstructions per hectare, e.g. suburban housing or light industrial estates

The following excerpts from AS/NZS 1170.2: Supplement 1:2002 provide examples of these terrain categories and are to be used as a guide only.

Typical examples of terrain category 2



FIGURE C4.2.1(B) TYPICAL EXAMPLE OF TERRAIN CATEGORY 2
Excerpt from AS/NZS 1170.2 Supplement 1:2002



FIGURE C4.2.1(C) TYPICAL EXAMPLE OF TERRAIN CATEGORY 2
Excerpt from AS/NZS 1170.2 Supplement 1:2002

Typical examples of terrain category 3

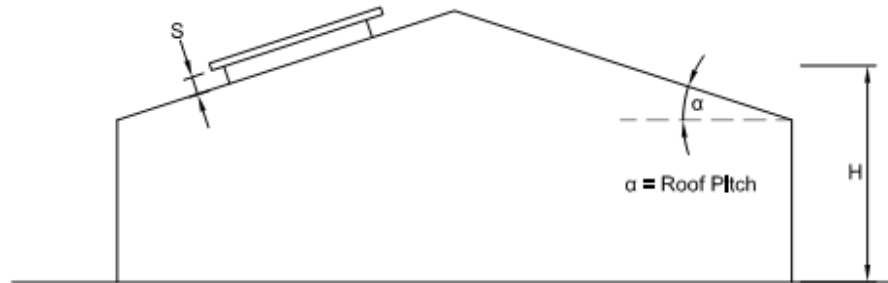


FIGURE C4.2.1(D) TYPICAL EXAMPLE OF TERRAIN CATEGORY 3
Excerpt from AS/NZS 1170.2 Supplement 1:2002



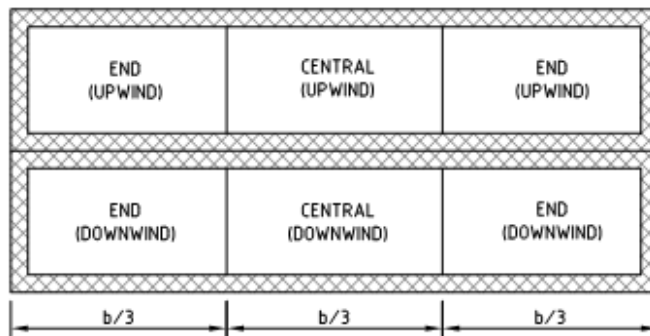
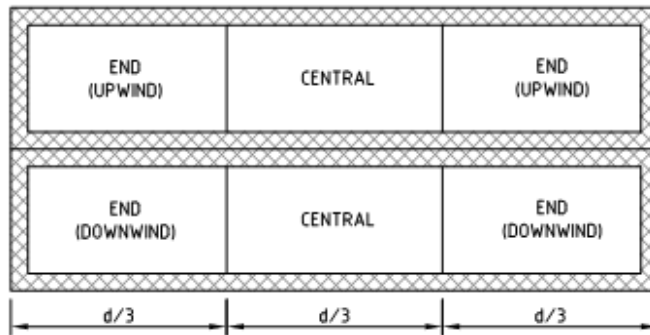
FIGURE C4.2.1(E) TYPICAL EXAMPLE OF TERRAIN CATEGORY 3
Excerpt from AS/NZS 1170.2 Supplement 1:2002

Appendix C: FLUSH MOUNT ROOF HEIGHT, PITCH & ZONE



PANEL MOUNTED PARALLEL TO ROOF PLANE

WIND DIRECTION $\theta = 90^\circ$



WIND DIRECTION $\theta = 0^\circ$



LEGEND:



- Exclusion zone is equal to $2 \times S$ where S is the gap between the underside of the panel and roof surface