LYSAGHT

Cyclonic Area Design Manual

Cyclonic Area Design Manual

Steel Roofing and Walling

Roofing & Walling Solutions

Rainwater Solutions

Fencing Solutions

Home Improvements

Structural Solutions

House Framing Solutions

Customer Support

Contents and introduction

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Please note:
The data contained in this manual was established by tests using BlueScope Lysaght roofing and walling products. It cannot be assumed to apply to seemingly similar products from other manufacturers, and BlueScope Lysaght will not be held responsible for the structural integrity of any structure designed using this data and products not of BlueScope Lysaght's manufacture.
Engineers should take note, this document is a limited edition interim reprint of our earlier design guide, and table values are 'permissible' values unless otherwise noted.

Northern Australia, as with other tropical areas, is prone to be affected by tropical cyclones. Because of the nature of cyclones and the wind speeds associated with them, the design of buildings located in cyclone prone areas and, in particular, the fixing of building components requires special consideration.

Cyclone Tracy, which destroyed Darwin on December 25, 1974, drew attention to the largely unrecognised fact that the performance of small buildings is as important, perhaps even more important, than the performance of large ones. It also demonstrated that, even when human safety was not so crucial (loss of life due to building damage was very small in relation to the total damage), the socio-economic cost of such damage justifies placing high priority on the safety aspects of small buildings as well.

One aspect of cottage building which was graphically illustrated by Cyclone Tracy was the importance of the roof fixing and the fixing of its supports. Flying debris was the cause of many broken windows which allowed a build-up of pressure inside. The resulting upward force on the roof was responsible for numerous instances of whole roof structures being blown off.

Therefore, it is not enough to simply ensure the strength of roof fixing. Rather, it is necessary that all connections of building components be adequate to withstand the expected uplift forces.

This manual, produced by BlueScope Lysaght, is a supplement to, and should be used with, the BlueScope Lysaght Roofing and Walling Installation Manual.

It was prepared to assist architects, engineers and builders in the correct specification and installation of BlueScope Lysaght roofing and walling products in cyclonic areas.

The full support of BlueScope Lysaght

At BlueScope Lysaght, we have a tradition of quality to live up to - a tradition that goes back over 130 years to when the original John Lysaght began supplying steel roofing to Australia.

Ever since we began manufacturing in Australia, we have branded our products with a symbol of quality. It's a tradition we still follow today. All our roofing products are branded with our company name, the base metal thickness of the steel, the yield stress, the applicable Australian standard and the amount of protective coating per square metre for ZINCALUME® or COLORBOND® steel.

So look for the BlueScope Lysaght edge markings when you buy - it's your assurance of quality.

Our reputation for quality, however, goes beyond just providing the best products at competitive prices. It is also based on our aim of providing a better service than you can get anywhere else.

This Cyclonic Area Design Manual is just one example of a range of technical literature that is recognised as being the most comprehensive in the business. Any of our brochures are available free, on request, at BlueScope Lysaght Sales Offices.

We provide a technical advisory service for all of our customers as well, where our engineers are always available to discuss new applications for our roofing and walling products. They will make suggestions and advise on specifications. In short, they will work with you to develop the best way to meet your design requirements.

And on top of that, there is the special Warranty, obtainable from our offices simply by asking.

At BlueScope Lysaght, we're so confident we make the best quality steel roofing and walling products in Australia, we can guarantee them, in writing, for up to 25 years on your commercial and industrial projects.

Simply by asking for it at any of our offices, you'll get a copy of our warranty, which you can examine in detail.

You'll find that it backs our products' performance with all the strength of our 130 years' expertise and experience, providing the product is installed in accordance with our specifications.


BLUESCOPE LYSAGHT

General Products Performance

Warranty

Σο λοοκ φορ τηε ΒλυεΣχοπε Λψσαγητ εδγε μαρκινγσ ωηεν ψου βυψ – ιτΠσ ψουρ ασσυρανχε οφ θυαλιτψ.
Ουρ ρεπυτατιον φορ θυαλιτψ, ηοωεβερ, γοες βεψονδ φυστ προϖιδινγ τηε βεστ προδυχτσ ατ χομπετιτιωε πριχεσ. Ιτ ισ αλσο βασεδ ον ουρ αιμ οφ προϖιδινγ α βεττερ σερϖιχε τηαν ψου χαν γετ ανψωηερε ελσε.
Τηισ Χψχλονιχ Αρεα Δεσιγν Μανυαλ ισ φυστ ονε εξαμπλε οφ α ρανγε οφ τεχηνιχαλ λιτερατυρε τηατ ισ ρεχογνισεδ ασ βεινγ τηε μοστ χομπρεηενσιωε ιν τηε βυσινεσσ. Ανψ οφ ουρ βροχηυρεσ αρε αϖαιλαβλε φρεε, ον ρεθυεστ, ατ ΒλυεΣχοπε Λψσαγητ Σαλεσ Οφφιχεσ.
Σο λοοκ φορ τηε ΒλυεΣχοπε Λψσαγητ εδγε μαρκινγσ ωηεν ψου βυψ – ιτΠσ ψουρ ασσυρανχε οφ θυαλιτψ.
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Tropical cyclones and wind forces on buildings

Tropical cyclones

Tropical cyclones are warm cored wind systems which affect the coastal regions of Northern Australia. They are formed over warm tropical waters, where the temperature must be >27ºC when severe barometric depressions occur. High speed winds blow spirally inward from all sides to form a roughly circular core or eye which can range in size up to about 50km in diameter. Overall, a cyclonic wind system can have a diameter as large as 650km.

The spiralling action is caused by the earth's rotation and is clockwise in the southern hemisphere, anti-clockwise in the northern hemishpere.

Air drawn into the eye of a cyclone is carried vertically by convection and a pumping action generated by high altitude winds. This core activity extends up to 12km above the sea. The air rising in the core of the cyclone carries with it substantial amounts of water vapour which condenses to form heavy cloud and rain in the area of maximum wind force around the core.

The condensing water vapour releases vast amounts of heat energy which is expended enlarging the system. As cyclones extract their energy from the warm water, they dissipate fairly quickly on reaching land, but often not before doing tremendous damage.

Cyclones ususally move at speeds of between 2 and 15 m/sec and because of their size, high wind speeds can last for many hours. These winds are of a cyclic nature, causing significant dynamic forces on building components.

These cyclic forces can induce fatigue in roofing materials, their supports and fixings; fatigue which often limits the performance of a component or system. In addition, because of the rotation of the wind system, the wind direction at a particular point can change 180º as the cyclone passes. **This requires that building designs should not take shielding into account unless it is roughly equal on all sides.**

Wind Forces on Buildings

Wind creates a number of forces on both internal and external surfaces of a building; forces which must be considered when designing or selecting cladding materials, their fasteners and supports. These forces produce both positive pressure and negative pressure (suction) and their magnitude is affected by the velocity of the wind and the building's degree of exposure and configuration. The resultant pressures are calculated using AS 1170 Part 2, 1989 SAA Loading Code - Wind Forces.

In cyclonic areas, particular note should be taken of the effects of internal pressures on roof and wall cladding and the importance of local pressure areas.

Flying debris is a significant problem in tropical cyclones and there are numerous instances of buildings appearing to stand up to the wind forces until debris broke windows or penetrated wall cladding, thus allowing pressure from the wind to build up inside. The internal pressure, acting with suction on the outside of the roof, was then sufficient to cause failure of the roof system. A sort of "explosion".

Failure of the roofing can be due to inadequate fastening of roof sheeting, in which case the fixings pull out or the sheeting cracks around the fasteners. It can be equally due to inadequate fixing of the roof framing, either the connection between the battens and rafters or the connection of the rafters to the building frame.

Irrespective of the reason for the loss of roof, the result is usually catastrophic. Water damage commonly results in the destruction of furniture and furnishings. In addition, framed buildings lose the bracing effect cause by the roof membrane, resulting in the collapse of some external walls.

Design Wind Speeds

The various conditions which affect the design wind speeds, such as geographic location, terrain category, etc., are to be taken from the AS 1170 - Part 2. The resulting four standardised wind speeds, 41, 50, 60 and 70 m/sec. (Designated as W41C, W50C, W60C and W70C respectively) are used in selection of batten spacing for each of our cladding, most of which vary in their spanning capacity.

Local pressure areas

Local pressure areas

Where external pressures are negative, buildings are subject to localised areas of increased pressure at all significant external discontinuities such as roof or wall edges including roof ridges where the roof pitch exceeds 10º. Consequently, all roof and wall claddings, their supports and fixings, must be designed to take into account these increased external pressures. The areas affected by these factors are shown in figure 1 taken from the AS1170-2. The extent of the local pressure areas is given by the dimension 'a', which should be determined as indicated in Figure 1.

When designing claddings and their supports the effect of both areas of increased pressure must be considered. But the sum of all local pressure areas is usually so great that just a small portion of total roof area remains unaffected by local pressures. Therefore, for the sake of simplicity, it is customary to only take the local pressure within 0.5'a' from the edges subject to local pressure factor 2, and to design the rest of the roof area by using the pressure factor of 1.5. whereby the roof is divided into a "high" and "low" pressure zone.

Modern roof claddings normally extend over the full length of roof slope, i.e. over several battens, thus acting as "continuous beams". The end spans of such beams are subject to a greater bending moment than interior spans, which can be compensated by making end spans shorter. Actually the reason for curtailing the end spans is twofold: one factor is the aforementioned greater bending moment. The other factor is the location of end spans of claddings within the high pressure zones. The batten spacing for end spans in Table 1 was determined in consideration of both factors.

Where, however, the high pressure zone is larger than the end span shown in Table 1, the first and possible further internal spans should be the same as end spans until the low pressure zone is reached. For the high pressure zones along the gable ends and hips, additional battens, spanning from the roof edge to the first truss (or rafter) within the low pressure zone, should be placed mid way between the main battens covering the whole roof, as shown in Figure 2 on page 5.

The batten spacing can also be limited by the strength of the batten itself. Tables 1 and 2 show the allowable spacings for suitable BlueScope Lysaght battens (TS40-0.75 and TS50-0.60 have similar strength). Both tables 1, 2 and 3 should be checked and the lesser spacings selected. It will be found that for narrow truss (or rafter) distances, the batten spacing will generally be governed by the cladding's own spanning capacity (from Tables 1 and 2, and for large truss distances by batten strength, Table 3.)

In both tables the screw pull-out strength has been accounted for. The recommended screws are given in Table 4, on Page 9.

Figure 1

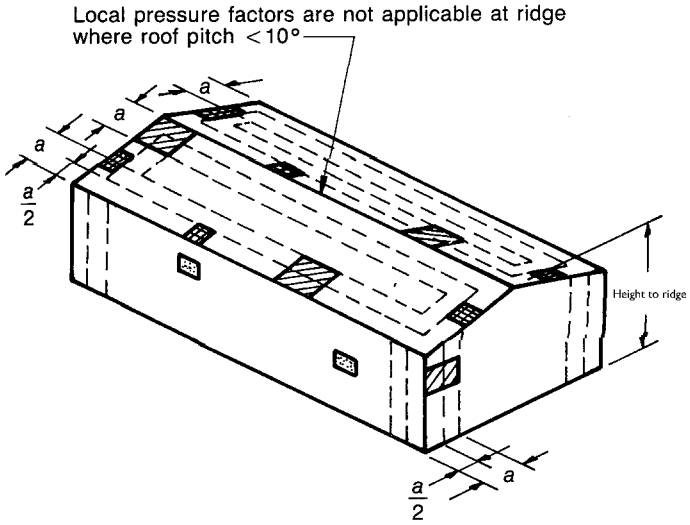
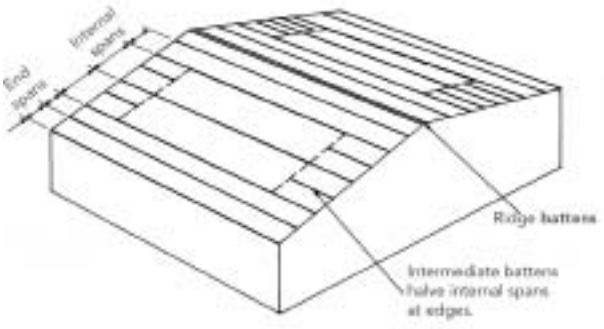


Figure 2



Notes:

1. The areas shaded with diagonal lines indicate locations for an area 'a' x 'a' subject to a local pressure factor of 1.5. Such areas lie within a zone of width 'a' from any edge.
2. The cross hatched areas indicate locations for an area 0.5 'a' x 0.5 'a' subject to a local pressure factor of 2.0. Such areas lie within a zone of width 0.5 'a' from any edge.
3. When designing claddings and their supports, the effect of both areas of increased pressure must be considered - see text.

Selection tables

Table 1: Maximum allowable batten spacing (mm) for various BlueScope Lysaght Claddings and Cyclonic winds WITHOUT cyclonic washers.

Roof Cladding	BMT (mm)	Span Type	W41C 2.017kPa	W50C 3.000kPa	W60C 4.320kPa	W70C 5.860kPa
Custom Orb	0.42	End	900	900	690	530
		Internal	1200	1200	850	620
Custom Orb	0.48	End	1200	1200	850	620
		Internal	1600	1395	1065	795
Custom Blue Orb	0.60	End	900	900	755	560
		Internal	1200	1200	905	690
Trimdek	0.42	End	1000	855	615	500
		Internal	1505	1120	795	580
Trimdek	0.48	End	1385	925	655	520
		Internal	2020	1160	825	595
Spandek	0.42	End	895	600	470	315
		Internal	1130	780	555	430
Spandek	0.48	End	1385	925	655	520
		Internal	1725	1160	825	585
Klip-Lok 700HS	0.42	End	1750	1675	1200	820
		Internal	2200	1950	1320	710
Klip-Lok 700HS	0.48	End	2350	2250	1445	1010
		Internal	2800	2570	1705	1060

Notes:

1. Fastening to comply with BlueScope Lysaght's Cyclonic Area Design Manual or Table 4.
2. Parameters for determining the cyclonic design wind pressures are:

   K = 1.5 (low pressure zone local factor); Cpi = +0.65; Cpe = - 0.90

   V_z= Design gust wind speed (e.g. W41C =41 m/sec.)

   The design wind pressure is obtained from: $P_d = (Cpi - KCpe) V_z^2 \times 0.6 \times 10^{-3}$ [kPa]
3. Some batten spacings are governed by walk-on requirements.

Table 2: Maximum allowable batten spacing (mm) for various BlueScope Lysaght Claddings and Cyclonic winds WITH cyclonic washers.

Roof Cladding	BMT (mm)	Span Type	W41C 2.017kPa	W50C 3.000kPa	W60C 4.320kPa	W70C 5.860kPa
Custom Orb	0.42	End	900	900	850	620
		Internal	1200	1200	1060	795
Custom Orb	0.48	End	1200	1200	1090	965
		Internal	1600	1600	1415	1240
Custom Blue Orb	0.60	End	900	900	900	765
		Internal	1200	1200	1200	925
Trimdek	0.42	End	1000	1000	1000	840
		Internal	1700	1475	1290	1045
Trimdek	0.48	End	1620	1340	1090	900
		Internal	2060	1690	1395	1135
Spandek	0.42	End	1500	1180	1045	885
		Internal	2000	1650	1370	1115
Spandek	0.48	End	1655	1385	1125	950
		Internal	2110	1865	1440	1210
Klip-Lok 700HS	0.42	End	1750	1675	1200	820
		Internal	2200	1950	1320	710
Klip-Lok 700HS	0.48	End	2350	2250	1445	1010
		Internal	2800	2570	1705	1080

Notes:

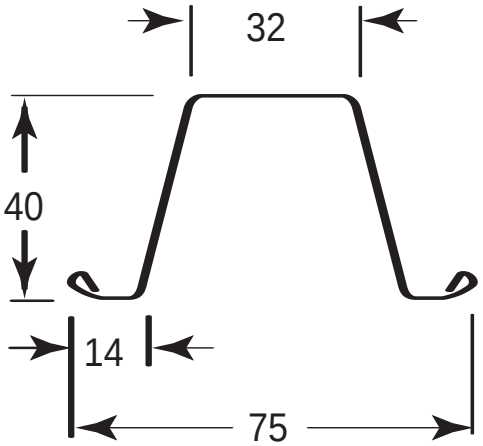
1. Fastening to comply with BlueScope Lysaght's Cyclonic Area Design Manual or Table 4.
2. Parameters for determining the cyclonic design wind pressures are:

   K = 1.5 (low pressure zone local factor); Cpi = +0.65; Cpe = - 0.90

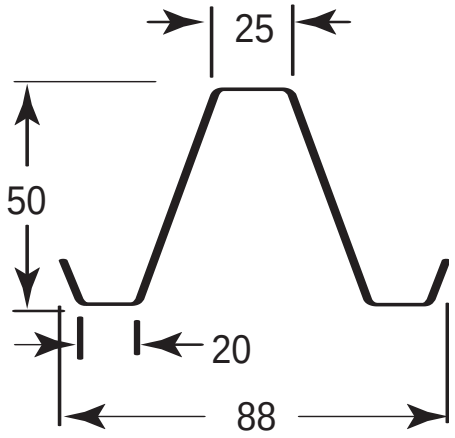
   V_z= Design gust wind speed (e.g. W41C =41 m/sec.)

   The design wind pressure is obtained from: $P_d = (Cpi - KCpe) V_z^2 \times 0.6 \times 10^{-3}$ [kPa]
3. Some batten spacings are governed by walk-on requirements.

Cyclonic roof battens



TOPSPAN® 40 - 0.75



TOPSPAN® 50 - 0.75

Table 3: Maximum allowable batten spacing(mm) for Cyclonic conditions
TOPSPAN 40-75 and TOPSPAN 50-75

Wind Classification	Roof Location	Pressure (kPa)	Maximum Allowable Batten Spacings (mm) Batten Span (mm) (Rafter/Truss Spacing) 450	600	900	1200
W41C	Roof Edges	2.01	2200	1650	1100	820
	Internal Areas	1.56	2860	2150	1420	1050
W50C	Roof Edges	3.00	1480	1110	740	550
	Internal Areas	2.33	1900	1420	950	710
W60C	Roof Edges	4.32	1020	770	510	380
	Internal Areas	3.35	1320	990	660	490
W70C	Roof Edges	5.86	750	560	370	280
	Internal Areas	4.56	970	730	480	360

Notes:

1. Batten designation is as follows: TS40 - 75 = Topspan 40 - 0.75mm BMT G550
   TS50 - 75 = Topspan 50 - 0.75mm BMT G550
2. Performance of Topspan 40 - .75 and Topspan 50 - .75 is considered similar for cyclonic areas.
3. Batten spacings are based on continuous battens over at least 2 spans with battens lapped a minimum of 40mm at the support (truss and rafter) locations.
4. Wind loading has been based on: Cpe=0.90, Cpi=0.65 & Kl=1.5 for roof edges and Kl =1.0 for Internal Roof Areas.
5. Roof Edge and Internal areas are in accordance with AS 1170.2-1989 and AS 4055-1992.
6. Batten spacings may also be limited by the cladding spanning capacity. Refer to BlueScope Lysaght's publication Cyclonic Area Design Manual for further information.
7. Fastener requirements to supports:
   Steel Supports (1.0mm min.) = 2 - No.12 -14x20 Hex head self drilling TEKS
   Timber Supports: Hardwood = 2 - No.12 -11x25 Hex head Type 17 self drilling screws
   Timber Supports: Softwood = 2 - No.12 -11x40 Hex head Type 17 self drilling screws
8. For steel supports less than 1.0mm thick, please contact your local BlueScope Lysaght Service Centre.

Fastener selection

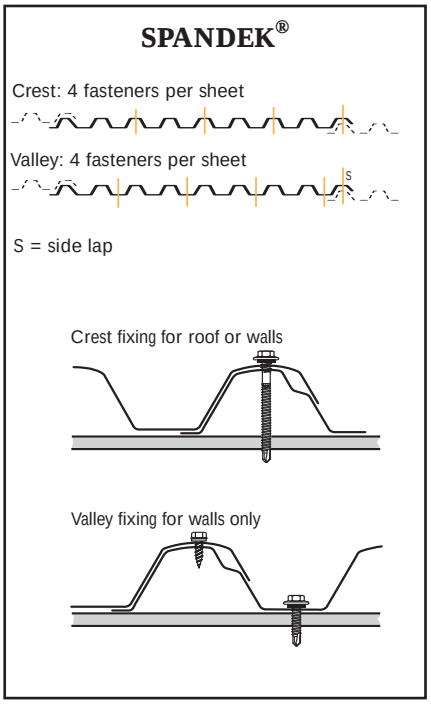
Table 4: Fastener Selection - Cladding to Batten - Cyclonic Areas

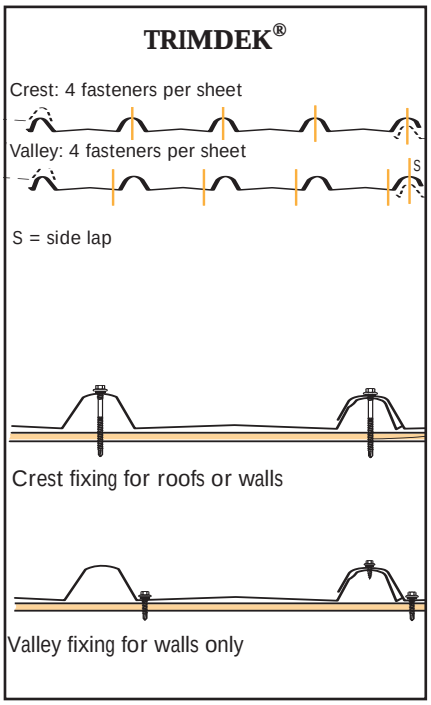
Profile		FIXING TO STEEL 1.0 - 2.5 mm THICK	FIXING TO STEEL 2.5 - 5.0 mm THICK	FIXING TO TIMBER Hardwood J1 - J3	FIXING TO TIMBER Softwood J4
CUSTOM ORB/ CUSTOM BLUE ORB	Crest fixed	No.14 - 10 x 42 mm Hex Head self drilling tapping screw	No.14 - 20 x 45 mm Hex Head self drilling tapping screw	No.14 - 10 x 50 mm Hex Head Type 17 self drilling screw	No.14 - 10 x 65 mm Hex Head Type 17 self drilling screw
TRIMDEK SPANDEK	Crest fixed	No.14 - 10 x 50 mm Hex Head self drilling tapping screw	No.14 - 20 x 50 mm Hex Head self drilling tapping screw	No.14 - 10 x 65 mm Hex Head Type 17 self drilling screw	No.14 - 10 x 75 mm Hex Head Type 17 self drilling screw
KLIP-LOK 700HS	Clip fixed	No.12 - 14 x 20 mm Wafer Head self drilling tapping screw	No.12 - 14 x 20 mm Wafer Head self drilling tapping screw	Type 17 self drilling wood screw Washer Head Softwood 12 - 11 x 40 Hardwood 12 - 11 x 25	
CUSTOM ORB CUSTOM BLUE ORB TRIMDEK SPANDEK	Valley fixed on wall	No.14 - 10 x 20 mm Hex Head self drilling tapping screw	No.14 - 20 x 22 mm Hex Head self drilling tapping screw	No.14 - 10 x 25 mm Hex Head Type 17 self drilling screw	No.14 - 10 x 50 mm Hex Head Type 17 self drilling screw

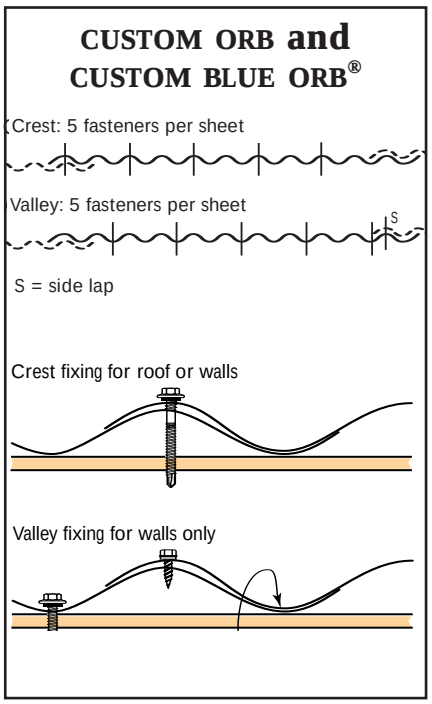
Notes:

Fixing to supports thinner than 1.0mm may be with the screws listed for 1.0-2.5 mm steel or with Type 17 screws of the same size. All fasteners exposed directly to the weather should be fitted with sealing washers.

Fastening to Supports: Cyclonic Areas







Wind Classification

Table 5: Wind Classification System for Cyclonic Conditions Indicating Directly Design Wind Speed

Region	Terrain Category	Topographic Classification									
		T1		T2		T3		T4		T5	
		FS	NS	FS	NS	FS	NS	FS	NS	FS	NS
C	TC3	W41C	W50C	W50C	W50C	W50C	W60C	W60C	W60C	W60C	W70C
	TC2.5 (Note 1)	W41C	W50C	W50C	W60C	W50C	W60C	W60C	W70C	W60C	W70C
	TC1, TC2	W50C	W50C	W50C	W60C	W60C	W70C	W60C	W70C	W70C	N/A
D	TC3	W50C	W60C	W50C	W60C	W60C	W70C	W70C	N/A	W70C	N/A
	TC2.5 (Note 1)	W50C	W60C	W60C	W70C	W60C	W70C	W70C	N/A	N/A	N/A
	TC1, TC2	W60C	W60C	W60C	W70C	W70C	N/A	N/A	N/A	N/A	N/A

Legend:
FS = Full Shielding
NS = No Shielding (Partial shielding does not apply to cyclonic winds)
N/A = Not applicable, see note 2.

Notes:
1. Terrain category 2.5 is not specified in current AS1170.2 It is retained in the table for those who prefer to use the old edition of the standard.
2. Above table is an excerpt from Table 1 of AS 4055 - 1992. In lieu of classification C1, C2, C3 and C4, the design gust wind speeds are indicated directly, condensing Tables 1 and 2 of the same standard. Where N/A appears, conditions are beyond the scope of AS 4055 - 1992.
3. For topographic classification see Table 6, taken from the same standard.

Geographic classification

Table 6: Topographic Classification for hills, ridges or escarpments.

Average Slope (ϕa)	Site Location			
	Lower-third (L)	Mid-third (L)	Top-third (L)	Over the top (O) (for escarpment only)
<1:10	T1	T1	T1	T1
1:10 <1:7.5	T1	T1	T2	T1
1:7.5 < 1:5	T1	T1	T3	T1
1:5 < 1:3	T1	T2	T4	T2
1:3	T1	T3	T5	T3

Notes:

1. An escarpment has one average slope less and 1 in 20 and another average slope greater than 1 in 10.
2. The location of a site on a hill, ridge or escarpment is shown in Figure 3a and 3b.
3. The average slope (ϕa) is the slope measured by averaging the steepest slope and the least slope through the top half of the hill, ridge or escarpment.
The average slope will not often occur at the actual proposed building site and should be appraised by considering the adjacent topography (see appendix D for the calculation of topography).
4. The top-third zone extends for an equal distance, d, either side of the crest of an escarpment as shown in Figures 3a and 3b.
The distance 'd' is the average horizontal distance measured from the crest of the escarpment to the near top-third zone.
5. The over-top zone of an escarpment is considered to extend to a distance of 5H past the crest of an escarpment.
6. The bottom of a hill, ridge or escarpment is that area at the base of a hill, ridge or escarpment where the average slope is less than 1 in 20, e.g. creek, river valley or flat area.

Figure 3a and 3b: Topographic zones for average slope

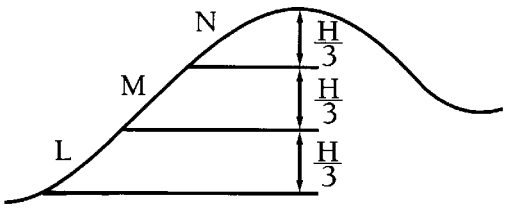


Figure 3(a) Hill or Ridge

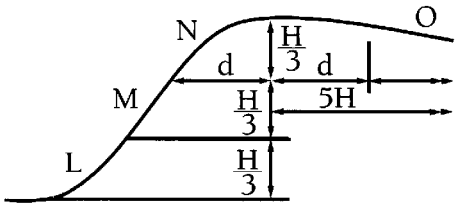


Figure 3(b) Escarpment

Cladding design tables

Table 7: CUSTOM ORB 0.42 BMT - Allowable Wind Pressure (kPa)

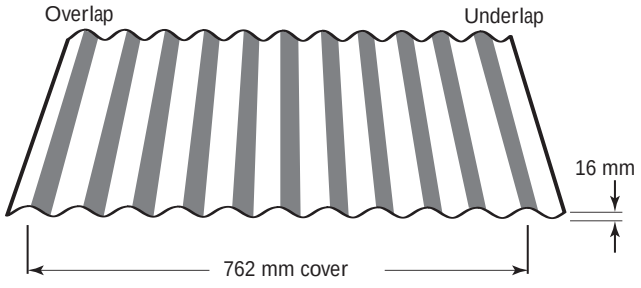
Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	9.98	4.79	5.99	10.31	6.00	7.50	9.98	4.79	5.99
900	4.44	3.19	3.99	5.33	4.00	5.00	4.44	3.19	3.99
1200	2.50	1.79	2.99	3.00	2.17	3.75	2.50	1.79	2.99
1500	1.11	1.17	2.31	1.23	1.17	2.42	1.11	1.17	2.31
1800	0.53	0.67	1.47	0.59	0.67	1.47	0.53	0.67	1.47

Table 8: CUSTOM ORB 0.48 BMT - Allowable Wind Pressure (kPa)

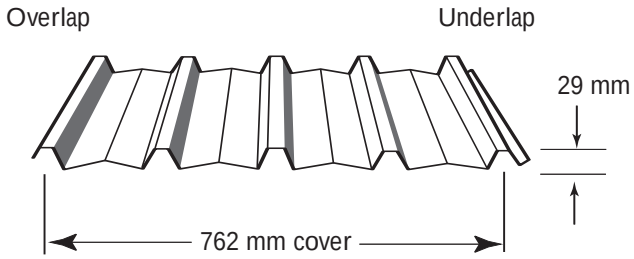
Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	11.25	6.00	7.50	11.25	10.00	12.50	11.25	6.00	7.50
900	5.33	4.00	5.00	6.94	6.67	8.33	5.33	4.00	5.00
1200	3.00	3.00	3.75	3.91	3.00	6.25	3.00	3.00	3.75
1500	0.94	1,57	2.60	0.94	1.57	3.61	0.94	1,57	2.60
1800	0.65	1.01	1.81	0.65	1.01	1.81	0.65	1.01	1.81
2100	0.41	0.63	1.33	0.41	0.63	1.33	0.48	0.63	1.33

Table 9: CUSTOM BLUE ORB 0.60 BMT - Allowable Wind Pressure (kPa)

Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	9.56	5.20	6.50	11.25	7.20	9.00	9.56	5.20	6.50
900	4.25	3.47	4.33	5.00	4.80	6.00	4.25	3.47	4.33
1200	1.34	2.22	3.25	1.58	2.74	4.50	1.34	2.22	3.25
1500	0.55	1.40	2.40	0.65	1.40	3.05	0.55	1.40	2.40
1800	0.27	0.81	1.67	0.31	0.81	1.77	0.27	0.81	1.67
2100	0.14	0.51	1.11	0.17	0.51	1.11	0.14	0.51	1.11



CUSTOM ORB & CUSTOM BLUE ORB



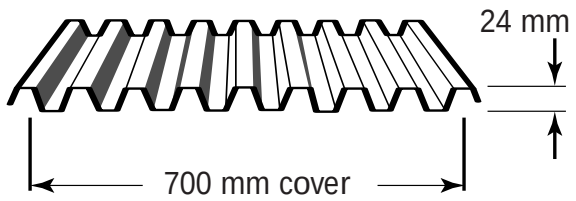
TRIMDEK

Table 10: TRIMDEK 0.42 BMT - Allowable Wind Pressure (kPa)

Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	8.55	4.40	5.50	8.55	8.00	10.00	8.55	4.40	5.50
900	3.91	2.93	3.67	5.45	5.33	6.67	3.91	2.93	3.67
1200	2.20	2.20	2.75	3.07	3.47	5.00	2.20	2.20	2.75
1500	1.41	1.41	2.03	1.84	1.78	2.84	1.41	1.41	2.03
1800	0.89	0.80	1.37	0.89	0.80	1.75	0.89	0.80	1.37
2100	0.48	0.50	1.01	0.48	0.50	1.10	0.48	0.50	1.01

Table 11: TRIMDEK 0.48 BMT - Allowable Wind Pressure (kPa)

Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	9.20	4.60	5.75	9.37	8.76	10.95	9.37	5.00	6.25
900	5.00	3.07	3.83	6.25	5.84	7.30	5.00	3.33	4.17
1200	2.81	2.30	2.87	4.05	3.51	5.47	2.81	2.50	3.12
1500	1.80	1.84	2.50	2.59	2.44	3.74	1.80	2.00	2.60
1800	1.25	1.41	2.25	1.25	1.41	2.60	1.25	1.41	2.25
2100	0.79	0.89	1.93	0.79	0.89	1.93	0.79	0.89	1.93
2400	0.53	0.60	1.30	0.53	0.60	1.30	0.53	0.60	1.30



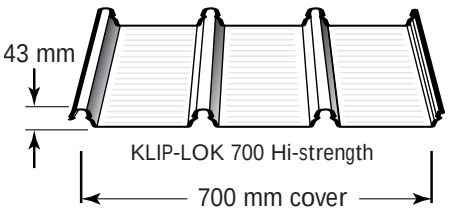
SPANDEK

Table 12: SPANDEK 0.42 BMT - Allowable Wind Pressure (kPa)

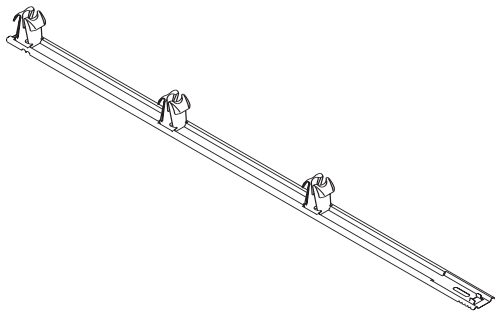
Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	6.00	3.00	3.75	12.75	8.60	10.75	6.00	3.00	3.75
900	2.67	2.00	2.50	7.64	5.73	7.17	2.67	2.00	2.50
1200	1.50	1.50	1.87	3.60	2.83	5.37	1.50	1.50	1.87
1500	0.96	1.20	1.50	2.50	2.32	3.54	0.96	1.20	1.50
1800	0.67	1.00	1.25	1.70	1.34	2.46	0.67	1.00	1.25
2100	0.49	0.84	1.07	0.92	0.84	1.80	0.49	0.84	1.07
2400	0.37	0.57	0.94	0.54	0.57	1.23	0.37	0.57	0.94

Table 13: SPANDEK 0.48 BMT - Allowable Wind Pressure (kPa)

Span (mm)	Roofing or Walling						Walling only		
	Crest fastened without cyclone washers			Crest fastened with cyclone washers			Valley fastened		
	Single	End	Internal	Single	End	Internal	Single	End	Internal
600	9.20	4.60	5.75	14.25	9.52	11.90	9.60	4.80	6.00
900	4.09	3.07	3.83	7.60	6.35	7.93	4.27	3.20	4.00
1200	2.30	2.30	2.87	4.27	3.67	5.95	2.40	2.40	3.00
1500	1.47	1.84	2.30	2.46	2.59	3.95	1.54	1.92	2.40
1800	1.02	1.50	1.92	1.42	1.50	3.27	1.07	1.50	2.00
2100	0.75	0.94	1.64	0.90	0.94	2.06	0.78	0.94	1.71
2400	0.57	0.63	1.38	0.60	0.63	1.38	0.60	0.63	1.38



KLIP-LOK 700 High Strength



KLIP-LOK 700 High Strength 3 tower clip

Table 14: KLIP-LOK 700HS 0.42 BMT - LIMIT STATES Pressure (kPa)

Span mm	Roofing or Walling		
	Clip fastened		
	Single	End	Internal
600	-	6.75	6.15
900	4.95	5.55	5.40
1200	4.15	4.30	4.60
1500	3.50	3.35	3.90
1800	2.85	2.75	3.25
2100	2.30	2.55	2.75
2400	1.85	2.40	2.40
2700	1.55	2.20	2.20

Table 15: KLIP-LOK 700HS 0.48 BMT - LIMIT STATES Pressure (kPa)

Span mm	Roofing or Walling		
	Clip fastened		
	Single	End	Internal
600	-	7.45	7.15
900	6.30	6.30	6.35
1200	5.20	5.10	5.55
1500	4.25	4.15	4.80
1800	3.35	3.55	4.10
2100	2.70	3.15	3.60
2400	2.15	2.85	3.20
2700	1.80	2.50	2.85

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