



Civil & Structural Engineering Design Services Pty. Ltd.

Client: Extreme Marquees Pty Ltd

Project: Design check – 5m X 5m High Pressure Inflatable EMX Series Marquee for 80km/hr Wind Speed

Reference: Extreme Marquees Technical Data

Report by: KZ
Checked by: EAB
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JOB NO: E-11-265302-2



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1 Introduction

This Certification is the sole property for copyright of Mr. Ted Bennett of Civil & Structural Engineering Design Services Pty. Ltd. and the license holder for the exclusive use of this Certification, Extreme Marquees Pty Ltd.

The following structural drawings and calculations are for the applicable transportable tents supplied by Extreme Marquees Pty Ltd.

The report examines the effect of 3s gust wind of 80 km/hr on 5m x 5m High Pressure Inflatable EMX Series Marquee as the worst case scenario. The relevant Australian Standards AS1170.0:2002 General principles, AS1170.1:2002 Permanent, imposed and other actions and AS1170.2:2011 Wind actions are used.



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2 Design Restrictions and Limitations

- 2.1 The erected structure is for temporary use only.
- 2.2 It should be noted that if high gust wind speeds are anticipated or forecast in the locality of the tent, the temporary erected structure should be dismantled.
- 2.3 For forecast winds in excess of (**refer to summary**) the structure should be completely folded.
(Please note that the locality squall or gust wind speed is affected by factors such as terrain exposure and site elevations.)
- 2.4 The structure may only be erected in regions with wind classifications no greater than the limits specified on the attached wind analysis.
- 2.5 The wind classifications are based upon category 2 in AS. Considerations have also been made to the regional wind terrain category, topographical location and site shielding from adjacent structures. Please note that in many instances topographical factors such as a location on the crest of a hill or on top of an escarpment may yield a higher wind speed classification than that derived for a higher wind terrain category in a level topographical region. For this reason, particular regard shall be paid to the topographical location of the structure. For localities which do not conform to the standard prescribed descriptions for wind classes as defined above, a qualified Structural Engineer may be employed to determine an appropriate wind class for that the particular site.
- 2.6 The structures in no circumstances shall ever be erected in tropical or severe tropical cyclonic condition.
- 2.7 The tent structure has not been designed to withstand snow and ice loadings such as when erected in alpine regions.
- 2.8 For the projects, where the site conditions approach the design limits, extra consideration should be given to pullout tests of the stakes and professional assessment of the appropriate wind classification for the site.
- 2.9 Design of fabric by others.**



3 Specifications

3.1 General

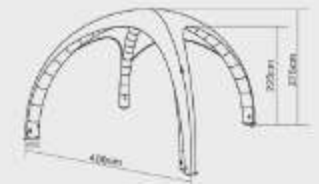
Tent category	
Material	Aluminum 6061T6

Size	Model
5m X 5m	EMX Series

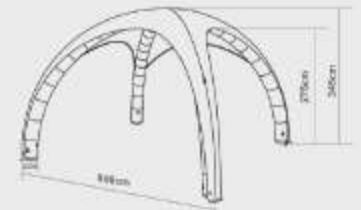


TECHNICAL DIAGRAMS

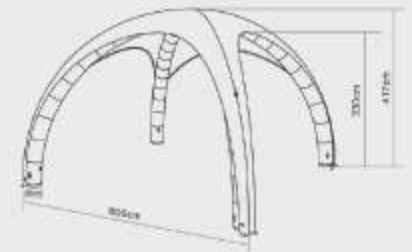
Type:
4 x 4 m



Type:
5 x 5 m



Type:
6 x 6 m



ITEM	SPECIFICATION		
Size	4m x 4m	5m x 5m	6m x 6m
Height	275cm	345cm	417cm
Clearance	225cm	275cm	330cm
Frame Weight			
Roof Canopy Weight	POLY		
Frame Box Dimensions			
Frame Profile Diameter	260mm	330mm	400mm
Framework	Thermoplastic polyurethane (TPU) with sleeve		
Fabric Plain / Printed	Commercial Grade UV50+ Waterproof PVC Coated Polyester		
Marquee Includes	Tie Down Ropes, Steel Pins & Protective Cover		



4 Design Loads

4.1 Ultimate

		Distributed load (kPa)	Design load factor (-)	Factored imposed load (kPa)
Live	Q	-	1.5	-
Self weight	G	self weight	1.35, 1.2, 0.9	1.2 self weight, 0.9 self weight
3s 80km/hr gust	W	$0.245 C_{fig}$	1.0	$0.245 C_{fig}$

4.2 Load Combinations

4.2.1 Serviceability

$$\text{Gravity} = 1.0 \times G$$

$$\text{Wind} = 1.0 \times G + 1.0 \times W$$

4.2.2 Ultimate

$$\begin{aligned} \text{Downward} &= 1.35 \times G \\ &= 1.2 \times G + W_u \end{aligned}$$

$$\text{Upward} = 0.9 \times G + W_u$$

5 Wind Analysis

Wind towards surface (+ve), away from surface (-ve)

5.1 Parameters

Terrain category = 2

Site wind speed ($V_{sit,\beta}$) = $V_R M_d (M_{z,cat} M_s M_t)$

$V_R = 22.22$ m/s (80 km/hr)

(regional 3 s gust wind speed)

$M_d = 1$

$M_s = 1$

$M_t = 1$

$M_{z,cat} = 0.91$

(Table 4.1(B) AS1170.2)

$V_{sit,\beta} = 20.22$ m/s

Height of structure (h) = 3.45 m

(mid of peak and eave)

Width of structure (w) = 5 m

Length of structure (l) = 5 m

Pressure (P) = $0.5 \rho_{air} (V_{sit,\beta})^2 C_{fig} C_{dyn}$

= $0.245 C_{fig}$ kPa



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5.2 Pressure Coefficients (C_{fig})

Name	Symbol	Value	Unit	Notes	Ref.
Input					
Importance level		2			Table 3.1 - Table 3.2 (AS1170.0)
Annual probability of exceedance		-			Table 3.3
Regional gust wind speed		80	Km/hr		Table 3.1 (AS1170.2)
Regional gust wind speed	V_R	22.22	m/s		
Wind Direction Multipliers	M_d	1			Table 3.2 (AS1170.2)
Terrain Category Multiplier	$M_{Z,Cat}$	0.91			Table 4.1 (AS1170.2)
Shield Multiplier	M_S	1			4.3 (AS1170.2)
Topographic Multiplier	M_t	1			4.4 (AS1170.2)
Site Wind Speed	$V_{Site,\beta}$	20.22	m/s	$V_{Site,\beta} = V_R * M_d * M_{z,cats} * M_S * M_t$	
Pitch	α	-	Deg		
Pitch	α	-	rad		
Width	B	-	m		
Length	D	-	m		
Height	Z	3.45	m		
Wind Pressure					
ρ_{air}	ρ	1.2	Kg/m ³		
dynamic response factor	C_{dyn}	1			
Wind Pressure	$\rho * C_{fig}$	0.245	Kg/m ²	$\rho = 0.5 \rho_{air} * (V_{des,\beta})^2 * C_{fig} * C_{dyn}$	2.4 (AS1170.2)
WIND DIRECTION 1 ($\theta=0$)					
External Pressure					
4. Free Roof				$\alpha = 0^\circ$	
Area Reduction Factor	K_a	1			D7
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
External Pressure Coefficient	$C_{P,w}$	-0.9			



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MIN				
External Pressure Coefficient	$C_{P,w}$	0		
MAX				
External Pressure Coefficient	$C_{P,l}$	-1.1		
MIN				
External Pressure Coefficient	$C_{P,l}$	0		
MAX				
aerodynamic shape factor	$C_{fig,w}$	-0.90		
MIN				
aerodynamic shape factor	$C_{fig,w}$	0.00		
MAX				
aerodynamic shape factor	$C_{fig,l}$	-1.10		
MIN				
aerodynamic shape factor	$C_{fig,l}$	0.00		
MAX				
Pressure Windward	P	-0.22	kPa	
MIN				
Pressure Windward	P	0.00	kPa	
MAX				
Pressure Leeward	P	-0.27	kPa	
MIN				
Pressure Leeward	P	0.00	kPa	
MAX				



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5.2.1 Pressure summary

Blocked Under:

WIND EXTERNAL PRESSURE	Direction1	
	Min (Kpa)	Max (Kpa)
W	-0.22	0.00
L	-0.27	0.00

Empty Under:

WIND EXTERNAL PRESSURE	Direction1	
	Min (Kpa)	Max (Kpa)
W	-0.07	0.20
L	-0.17	0.00

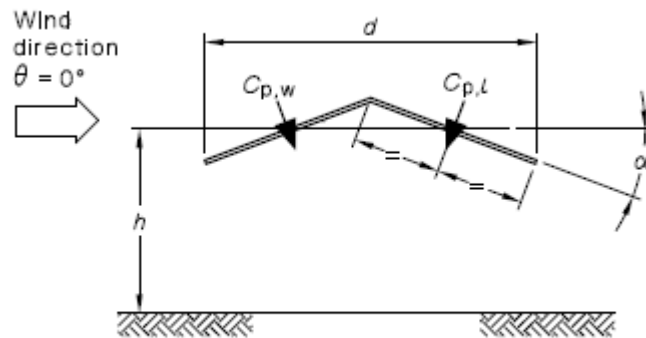
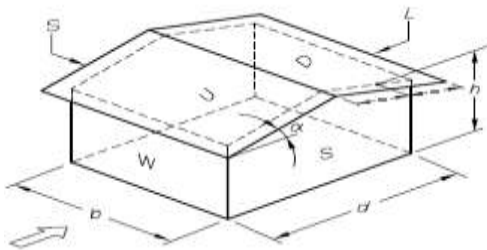
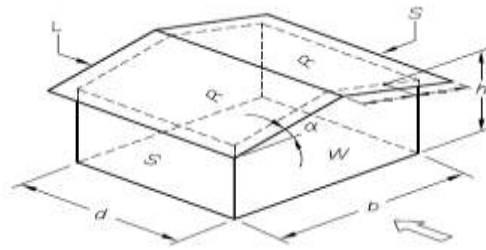


FIGURE D3 PITCHED FREE ROOFS



Direction 1



Direction 2

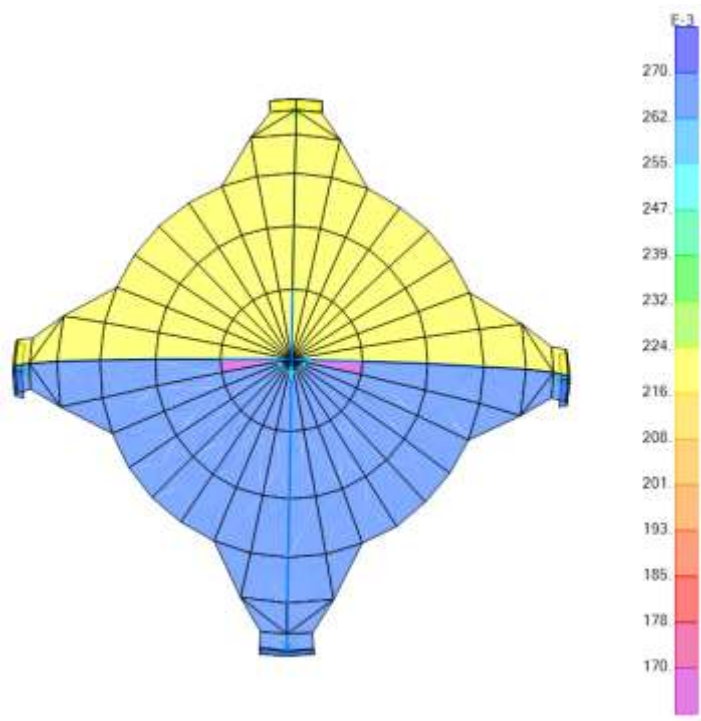
AS1170.2



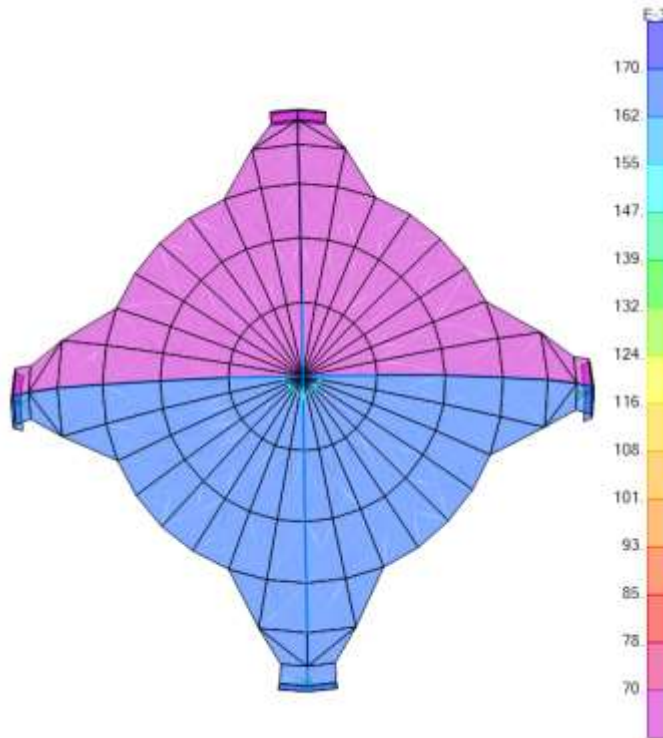
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5.3 Wind Load Diagrams

5.3.1 Wind (case 1)_Blocked Under



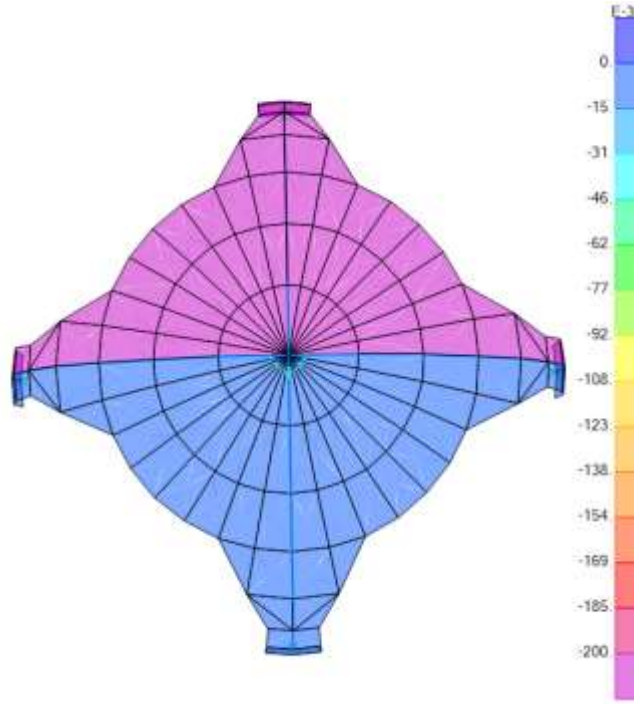
5.3.2 Wind (case 2)_Empty Under (min)





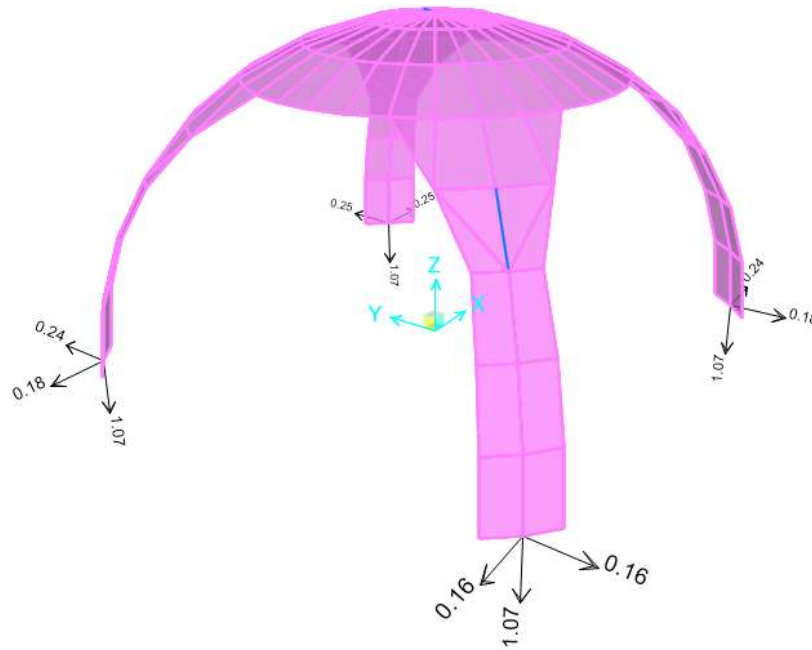
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5.3.3 Wind (case 2)_Empty Under (max)



After 3D model analysis, each member is checked based on adverse load combination. In this regard the maximum bending moment, shear and axial force due to adverse load combinations for each member are presented as below:

5.3.4 Max reactions



Max Reaction (Uplift) $N^* = 1.1 \text{ kN}$



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6 Summary

6.1 Conclusions

The 5m x 5m High Pressure Inflatable EMX Series Marquee as specified has been analyzed with a conclusion:

- a. For forecast winds in excess of **80km/hr** – the structure should be completely evacuated & deflated.
- b. For uplift due to 80km/hr, 1.5 kN (150kg) holding down weight per inflatable leg is required.
- c. The bearing pressure of soil should be clarified and checked by an engineer prior to any construction for considering foundation and base plate.
- d. **Design of fabric by others**

Yours faithfully,

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