# Prime Consulting Engineers Pty. Ltd.

## Design Report:

## Heavy Duty (Octagonal Umbrella) for 80km/hr Wind Speed

## For

UltraShade

Ref: R-25-1346-2

Date: 29/04/2025

Amendment: -

Prepared by: JK

Checked by: BG

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# 1 Introduction and Scope:

The report and certification are the sole property of Prime Consulting Engineers Pty. Ltd.

Prime Consulting Engineers have been engaged by Ultra Shade to carry out a structural analysis of **6 m octagonal** Umbrella Structures for **80km/hr**. It should be noted that the outcome of our analysis is limited to the selected items as outlined in this report.

This report shall be read in conjunction with the documents listed in the references (Cl. 1.2)

## 1.1 Project Description

The report examines the effect of the peak gust wind that an equivalent moving average time of approximately 0.2S **22.23m/s (80 km/hr)** positioned for the worst effect, on **6 m octagonal** Umbrella Structures as the worst-case scenario. The relevant Australian Standards AS1170.0:2002 General principles, AS1170.1:2002 Permanent, imposed, and other actions and AS1170.2:2021 Wind actions are used. The design check is in accordance with AS1664.1 Aluminium Structures.

## 1.2 References

- The documents referred to in this report are as follows:
  - Report on results produced through SAP2000 V24 software & excel spreadsheets.
- The basic standards used in this report are as follows:
  - AS 1170.0:2002 – Structural Design Actions (Part 0: General principles)
  - AS 1170.1:2002 – Structural Design Actions (Part 1: Permanent, imposed, and other actions)
  - AS 1170.2:2021 – Structural Design Actions (Part 2: Wind Actions)
  - AS1664.1:1997 Aluminium Structures.
- Section Properties of Aluminium Section provided by the client.
- The program(s) used for this analysis are as follows:
  - SAP2000 V24
  - Microsoft Excel

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## 1.3 Notation

| | |
|---|---|
| *AS/NZS* | Australian Standard/New Zealand Standard |
| *FEM/FEA* | Finite Element Method/Finite Element Analysis |
| *SLS* | Serviceability Limit State |
| *ULS* | Ultimate Limit State |

# 2 Design Overview

## 2.1 Geometry Data

UltraShade

Octagonal Heavy Duty Umbrella Dimensions

| Size | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 3.5 m | 2300 | 2850 | 3500 | 3200 | 1350 | 3650 | 1800 | 400 |
| 4.0 m | 2300 | 2950 | 4000 | 3700 | 1500 | 3750 | 1650 | 400 |
| 4.5 m | 2300 | 3000 | 4500 | 4150 | 1750 | 3900 | 1500 | 450 |
| 5.0 m | 2400 | 3250 | 5000 | 4550 | 1900 | 4050 | 1450 | 450 |
| 5.5 m | 2350 | 3200 | 5500 | 5100 | 2100 | 4100 | 1200 | 500 |
| 6.0 m | 2400 | 3250 | 6000 | 5460 | 2300 | 4150 | 1050 | 500 |

*NB: To be used as a guide only, all measurements are approximate*

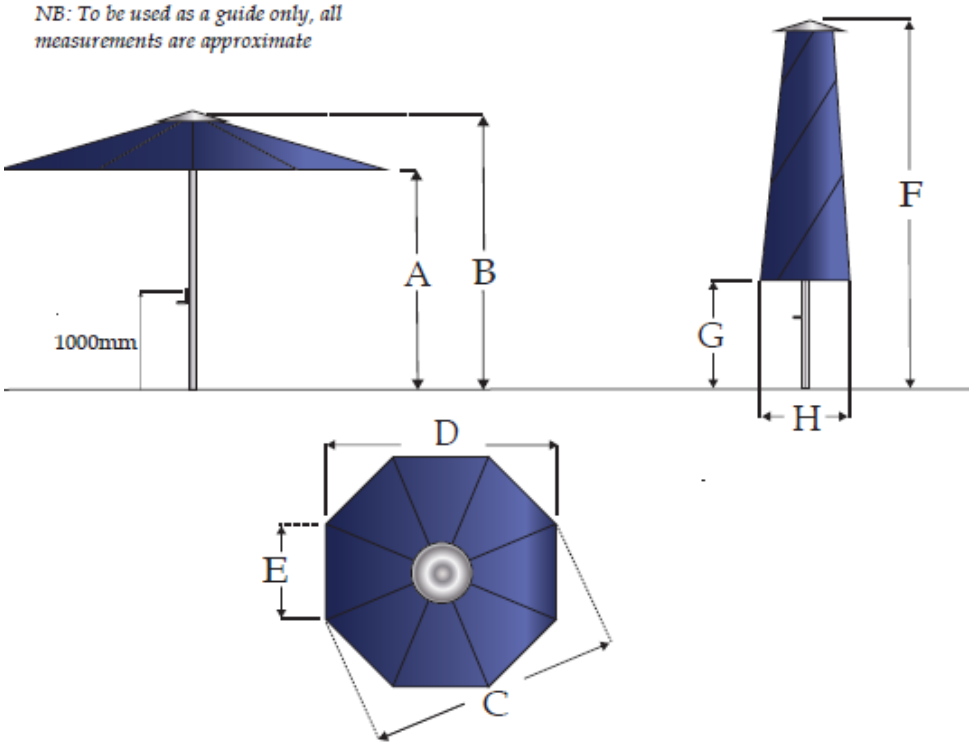


**Figure 1: Geometry of the square Umbrella**

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## 2.2 Assumptions & Limitations

- For forecast winds in excess of **80km/hr,** the umbrella structure should be closed.
- The structure is design for wind parameters as below:
    - Wind Region A
    - TC2
    - $M_s$, $M_t$ & $M_d$ = 1
- Shall the site conditions/wind parameters exceed prescribed design wind actions (refer to Cl.4), Prime Consulting Engineers Pty. Ltd. should be informed to determine appropriate wind classifications and amend computations accordingly.
- It is assumed that the fabric weighs **830gr/m²**.
- Aluminium alloy is to be **Alloy 6106-T6** for **post, and Alloy 6061-T6** for **arms** and **braces**.
- The **Post** is specified as **82.5 x 5.2 mm**, as outlined in the Heavy-Duty Umbrella Specifications.
- The **Arm** size is specified as **25 x 50 x 3.2 mm**, as per the Heavy-Duty Umbrella Specifications.
- The **Brace** size is specified as **25 x 50 x 3.2 mm**, as per the Heavy-Duty Umbrella Specifications.
- It is assumed that the umbrella is “empty under” for calculating wind loads. As per AS1170.2:2021, empty under is defined “Any goods or materials stored under the roof block less than 50% of the cross-section exposed to the wind”.

## 2.3 Exclusions

- Design of fabric.
- Wind actions due to tropical or severe tropical cyclonic areas.
- Snow and ice loads.
- Footing design.

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## 2.4 Design Parameters and Inputs

### 2.4.1 Load Cases

1. G — Permanent actions (Dead load)
2. Wu — Ultimate wind action (ULS)
3. Ws — Serviceability wind action (SLS)

### 2.4.2 Load Combinations

**Strength (ULS):**

1. 1.35G — Permanent action only
2. $0.9G+W_u$ — Permanent and wind actions
3. $1.2G+W_u$ — Permanent and wind actions

**Serviceability (SLS):**

1. $G+W_s$ — Wind service actions

# 3 Specifications

## 3.1 Material Properties

| Material Properties | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6106-T6 | $F_{tu}$ | $F_{ty}$ | $F_{cy}$ | $F_{su}$ | $F_{sy}$ | $F_{bu}$ | $F_{by}$ | E | $k_t$ | $k_c$ |
| | 235 | 210 | 210 | 144 | 120 | 480 | 337 | 70000 | 1 | 1.12 |

| Material Properties | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6061-T6 | $F_{tu}$ | $F_{ty}$ | $F_{cy}$ | $F_{su}$ | $F_{sy}$ | $F_{bu}$ | $F_{by}$ | E | $k_t$ | $k_c$ |
| | 262 | 241 | 241 | 165 | 138 | 551 | 386 | 70000 | 1 | 1.12 |

## 3.2 Buckling Constants

| TABLE 3.3(D)<br>BUCKLING CONSTANTS FOR ALLOY 6106-T6 | | | | | | |
|---|---|---|---|---|---|---|
| **Type of member and stress** | **Intercept, MPa** | | **Slope, MPa** | | **Intersection** | |
| Compression in columns and beam flanges | $B_c$ | 234.44 | $D_c$ | 1.36 | $C_c$ | 70.85 |
| Compression in flat plates | $B_p$ | 267.52 | Dp | 1.65 | $C_p$ | 66.32 |
| Compression in round tubes under axial end load | $B_t$ | 257.80 | $D_t$ | 8.85 | $C_t$ | * |
| Compressive bending stress in rectangular bars | $B_{br}$ | 395.01 | $D_{br}$ | 3.63 | $C_{br}$ | 72.46 |
| Compressive bending stress in round tubes | $B_{tb}$ | 517.50 | $D_{tb}$ | 37.34 | $C_{tb}$ | 83.09 |
| Shear stress in flat plates | $B_s$ | 153.44 | $D_s$ | 0.72 | $C_s$ | 87.57 |
| Ultimate strength of flat plates in compression | $k_1$ | 0.35 | $k_2$ | 2.27 | | |
| Ultimate strength of flat plates in bending | $k_1$ | 0.5 | $k_2$ | 2.04 | | |

** $C_t$ shall be determined using a plot of curves of limit state stress based on elastic and inelastic buckling or by trial-and-error solution*

| TABLE 3.3(D)<br>BUCKLING CONSTANTS FOR ALLOY 6061-T6 | | | | | | |
|---|---|---|---|---|---|---|
| **Type of member and stress** | **Intercept, MPa** | | **Slope, MPa** | | **Intersection** | |
| Compression in columns and beam flanges | $B_c$ | 271.04 | $D_c$ | 1.69 | $C_c$ | 65.89 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Compression in flat plates | $B_p$ | 310.11 | Dp | 2.06 | $C_p$ | 61.60 |
| Compression in round tubes under axial end load | $B_t$ | 297.39 | $D_t$ | 10.70 | $C_t$ | * |
| Compressive bending stress in rectangular bars | $B_{br}$ | 459.89 | $D_{br}$ | 4.57 | $C_{br}$ | 67.16 |
| Compressive bending stress in round tubes | $B_{tb}$ | 653.34 | $D_{tb}$ | 50.95 | $C_{tb}$ | 78.23 |
| Shear stress in flat plates | $B_s$ | 178.29 | $D_s$ | 0.90 | $C_s$ | 81.24 |
| Ultimate strength of flat plates in compression | $k_1$ | 0.35 | $k_2$ | 2.27 | | |
| Ultimate strength of flat plates in bending | $k_1$ | 0.5 | $k_2$ | 2.04 | | |

** $C_t$ shall be determined using a plot of curves of limit state stress based on elastic and inelastic buckling or by trial-and-error solution*

## 3.3 Member Sizes & Section Properties

| MEMBER(S) | Section | d | t | $y_c$ | $A_g$ | $Z_x$ | $Z_y$ | $S_x$ | $S_y$ | $I_x$ | $I_y$ | J | $r_x$ | $r_y$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *mm* | *mm* | *mm* | $mm^2$ | $mm^3$ | $mm^3$ | $mm^3$ | $mm^3$ | $mm^4$ | $mm^4$ | $mm^4$ | *mm* | *mm* |
| *Post 82.5 x 5.2* | D 82.5 x5.2 | 82.5 | 5.2 | 41.3 | 1262.8 | 22968.8 | 22968.8 | 31118.4 | 31118.4 | 947463.7 | 947464 | 1894927.5 | 27.4 | 27.4 |

| MEMBER(S) | Section | b | d | t | $y_c$ | $A_g$ | $Z_x$ | $Z_y$ | $S_x$ | $S_y$ | $I_x$ | $I_y$ | J | $r_x$ | $r_y$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *mm* | *mm* | *mm* | *mm* | $mm^2$ | $mm^3$ | $mm^3$ | $mm^3$ | $mm^3$ | $mm^4$ | $mm^4$ | $mm^4$ | *mm* | *mm* |
| *Arms* | 25x50x3.2 | 25 | 50 | 3.2 | 25.0 | 439.0 | 5278.0 | 3337.9 | 6785.5 | 4041.5 | 131949.8 | 41724.2 | 97109.2 | 17.3 | 9.7 |
| *Brace* | 25x50x3.2 | 25 | 50 | 3.2 | 25.0 | 439.0 | 5278.0 | 3337.9 | 6785.5 | 4041.5 | 131949.8 | 41724.2 | 97109.2 | 17.3 | 9.7 |

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# 4 Wind Analysis

## 4.1 Wind calculations

**Project:** Ultra shade-heavy duty

**Job no.** 25-1346-2 ***Designer:*** JK

**Date:** 30/04/2025 ***Amendment:***

| Name | Symbol | Value | Unit | Notes | Ref. |
|---|---|---|---|---|---|
| ***Input*** | | | | | |
| Importance level | | 2 | | | *Table 3.1 - Table 3.2 (AS1170.0)* |
| Annual probability of exceedance | | Temporary | | | *Table 3.3* |
| Regional gust wind speed | | **80.028** | Km/hr | | |
| Regional gust wind speed | $V_R$ | 22.23 | m/s | | |
| Wind Direction Multipliers | $M_d$ | 1 | | | *Table 3.2 (AS1170.2)* |
| Terrain Category | TC | 2 | | | |
| Terrain Category Multiplier | $M_{Z,Cat}$ | 0.91 | | | |
| Shield Multiplier | $M_S$ | 1 | | | *4.3 (AS1170.2)* |
| Topographic Multiplier | $M_t$ | 1 | | | *4.4 (AS1170.2)* |
| Site Wind Speed | $V_{Site,\beta}$ | **20.23** | m/s | $V_{Site,\beta}=V_R*M_d*M_{z,cat}*M_S,M_t$ | |
| Pitch | α | 22.5 | Deg | | |
| Pitch | α | - | rad | | |
| Width | B | 6 | m | | |
| Length | D | 6 | m | | |
| Height | Z | 2.65 | m | | |
| Porosity Ratio | $\delta$ | 1 | | *ratio of solid area to total area* | |
| ***Wind Pressure*** | | | | | |
| $\rho$air | $\rho$ | 1.2 | Kg/m$^3$ | | |

| | | | | | |
|---|---|---|---|---|---|
| dynamic response factor | $C_{dyn}$ | 1 | | | |
| Wind Pressure | $\rho$*$C_{fig}$ | **0.246** | Kg/m$^2$ | $\rho=0.5\rho_{air}*(V_{des,\beta})^2*C_{fig}*C_{dyn}$ | *2.4 (AS1170.2)* |
| ***WIND DIRECTION 1 (θ=0)*** | | | | | |
| ***External Pressure*** | | | | | |
| ***1. Free Roof*** | | | | $\alpha=0^o$ | |
| Area Reduction Factor | $K_a$ | 1 | | | *D7* |
| local pressure factor | $K_l$ | 1 | | | |
| porous cladding reduction factor | $K_p$ | 1.00 | | | |
| External Pressure Coefficient **MIN** | $C_{P,w}$ | -0.3 | | | |
| External Pressure Coefficient **MAX** | $C_{P,w}$ | 0.6 | | | |
| External Pressure Coefficient **MIN** | $C_{P,l}$ | -0.6 | | | |
| External Pressure Coefficient **MAX** | $C_{P,l}$ | 0 | | | |
| aerodynamic shape factor **MIN** | $C_{fig,w}$ | -0.30 | | | |
| aerodynamic shape factor **MAX** | $C_{fig,w}$ | 0.60 | | | |
| aerodynamic shape factor **MIN** | $C_{fig,l}$ | -0.60 | | | |
| aerodynamic shape factor **MAX** | $C_{fig,l}$ | 0.00 | | | |
| Pressure Windward **MIN** | P | **-0.07** | **kPa** | | |
| Pressure Windward **MAX** | P | **0.15** | **kPa** | | |
| Pressure Leeward **MIN** | P | **-0.15** | **kPa** | | |
| Pressure Leeward **MAX** | P | **0.00** | **kPa** | | |
| ***WIND DIRECTION 2 (θ=90)*** | | | | | |
| ***External Pressure*** | | | | | |
| ***4. Free Roof*** | | | | $\alpha=180^o$ | *D7* |
| Area Reduction Factor | $K_a$ | 1 | | | |
| local pressure factor | $K_l$ | 1 | | | |
| porous cladding reduction factor | $K_p$ | 1.00 | | | |
| External Pressure Coefficient **MIN** | $C_{P,w}$ | -0.3 | | | |
| External Pressure Coefficient **MAX** | $C_{P,w}$ | 0.4 | | | |
| External Pressure Coefficient **MIN** | $C_{P,l}$ | -0.4 | | | |
| External Pressure Coefficient **MAX** | $C_{P,l}$ | 0 | | | |
| aerodynamic shape factor **MIN** | $C_{fig,w}$ | -0.30 | | | |
| aerodynamic shape factor **MAX** | $C_{fig,w}$ | 0.40 | | | |
| aerodynamic shape factor **MIN** | $C_{fig,l}$ | -0.40 | | | |
| aerodynamic shape factor **MAX** | $C_{fig,l}$ | 0.00 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Pressure **MIN (Windward Side)** | P | **-0.07** | **kPa** | | |
| Pressure **MAX (Windward Side)** | P | **0.10** | **kPa** | | |
| Pressure **MIN (Leeward Side)** | P | **-0.10** | **kPa** | | |
| Pressure **MAX (Leeward Side)** | P | **0.00** | **kPa** | | |

### 4.1.1 Summary

| WIND EXTERNAL PRESSURE | Direction1 | | Direction2 | |
|---|---|---|---|---|
| | Min (Kpa) | Max (Kpa) | Min (Kpa) | Max (Kpa) |
| **Windward** | -0.074 | 0.147 | -0.074 | 0.098 |
| **Leeward** | -0.147 | 0.000 | -0.098 | 0.000 |

## 4.2 Wind Load Diagrams

### 4.2.1 Wind Load Ultimate ($W_{min}$)

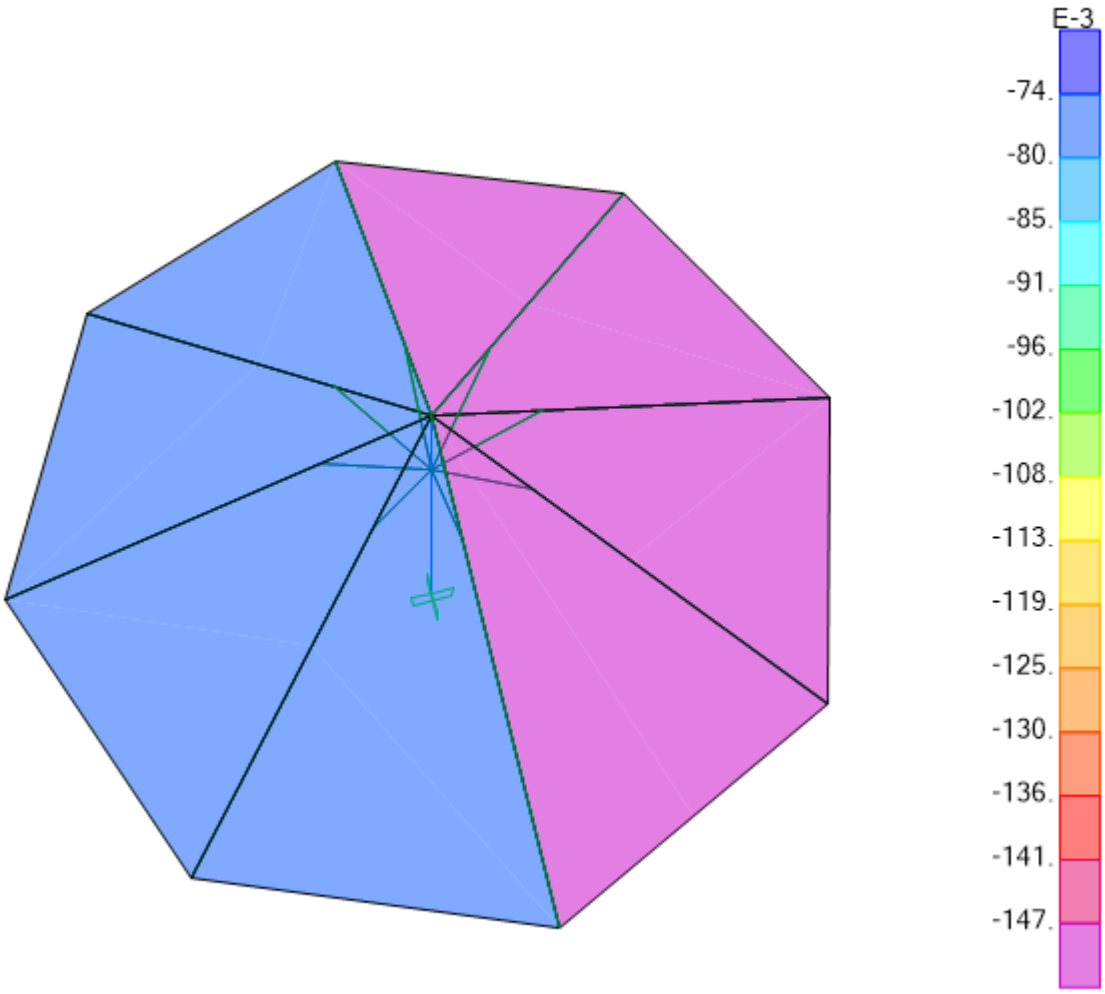


**Figure 2 Wind Min (KN, m)**

### 4.2.2 Wind Load Ultimate ($W_{max}$)

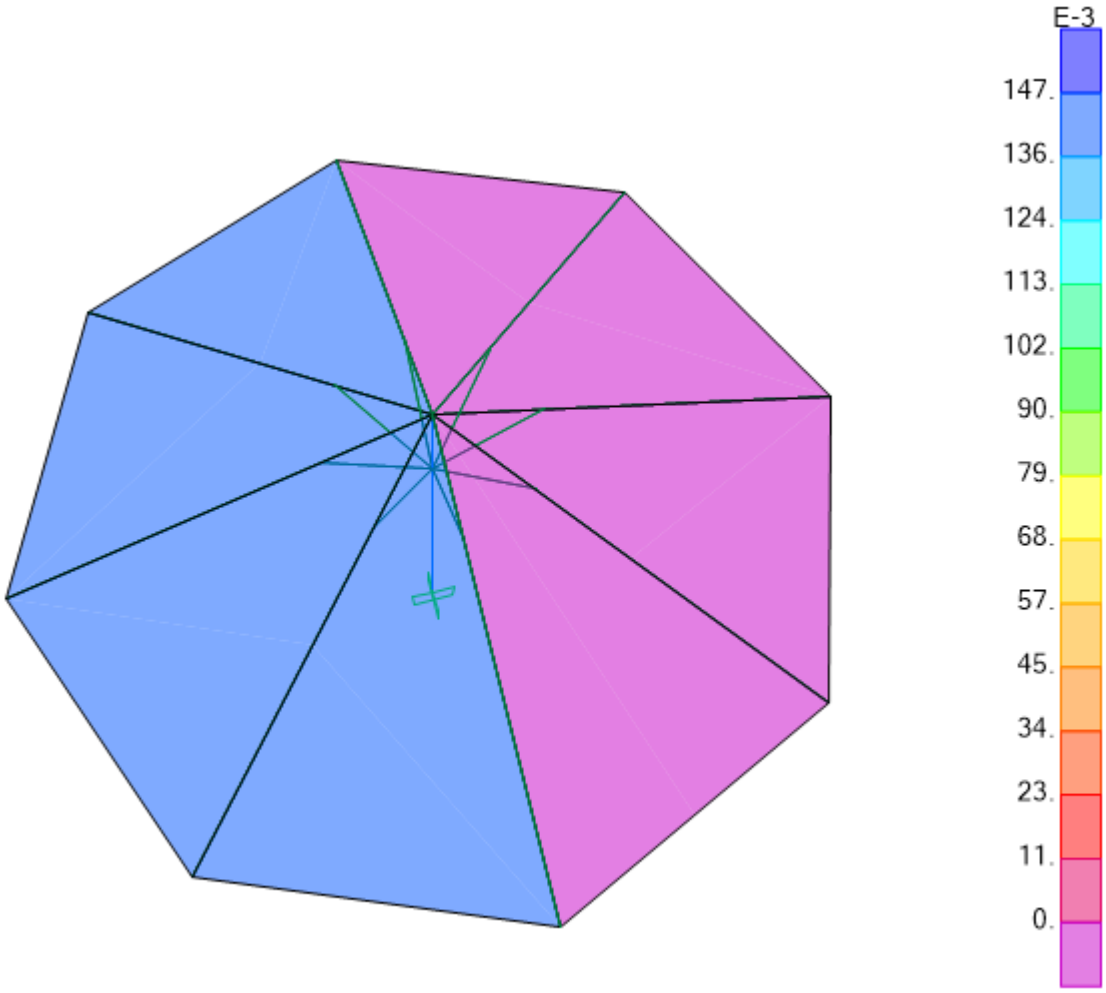


**Figure 3 Wind Max**

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# 5 Analysis

## 5.1 Results

### 5.1.1 Maximum Bending Moment in Major Axis

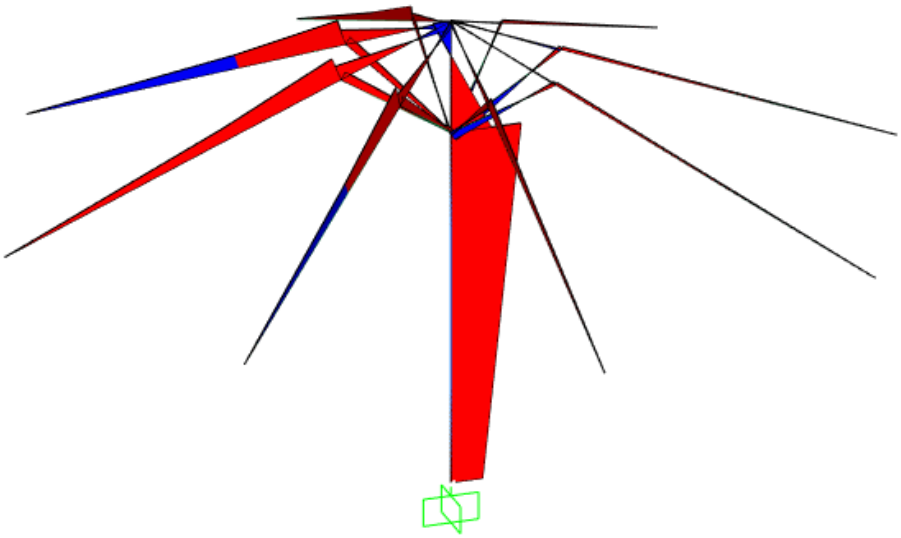

**Figure 4 Maximum Bending Moment - Major**

### 5.1.2 Maximum Bending Moment in Minor Axis

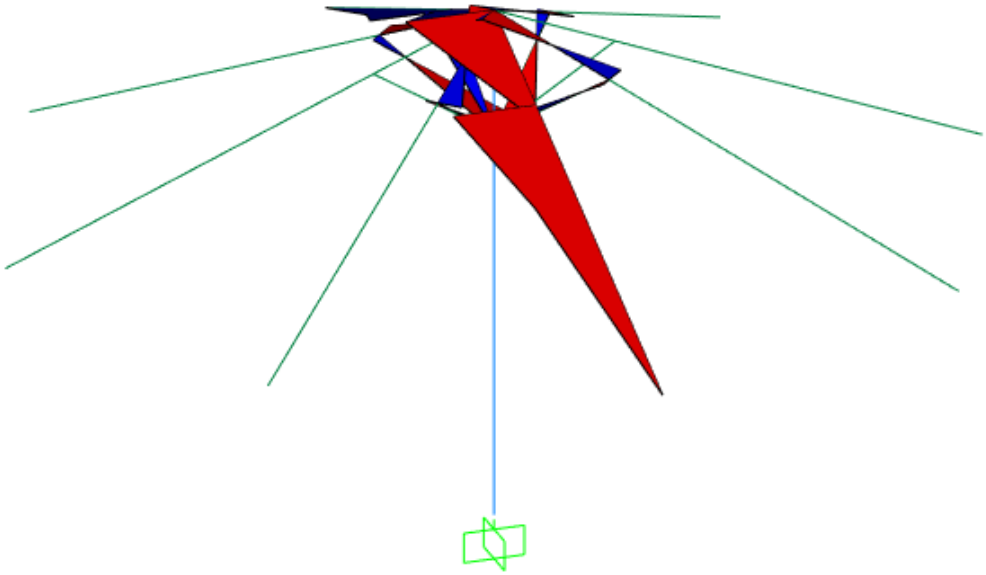

**Figure 5: Maximum Bending Moment - Minor**

### 5.1.3 Maximum Shear

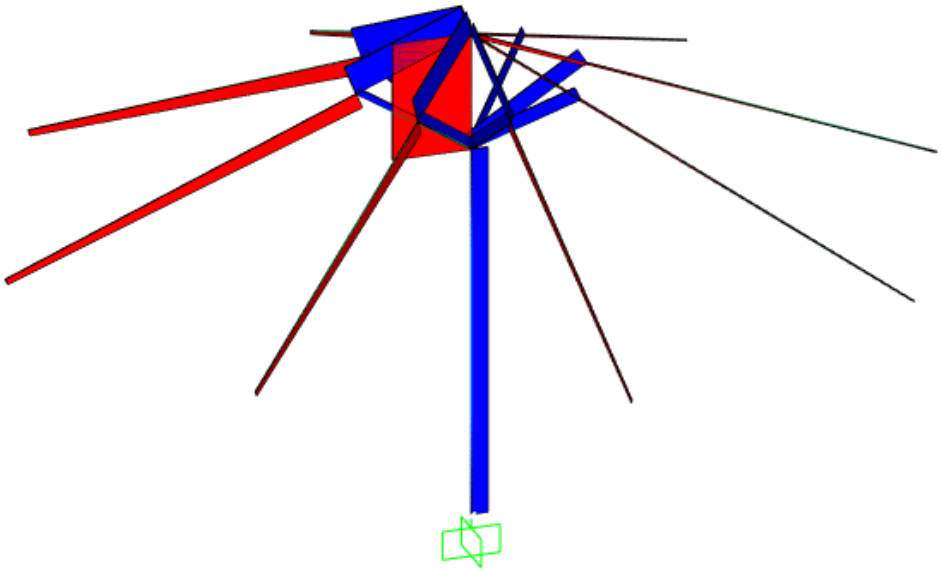

**Figure 6 Maximum Shear**

### 5.1.4 Maximum Axial Force

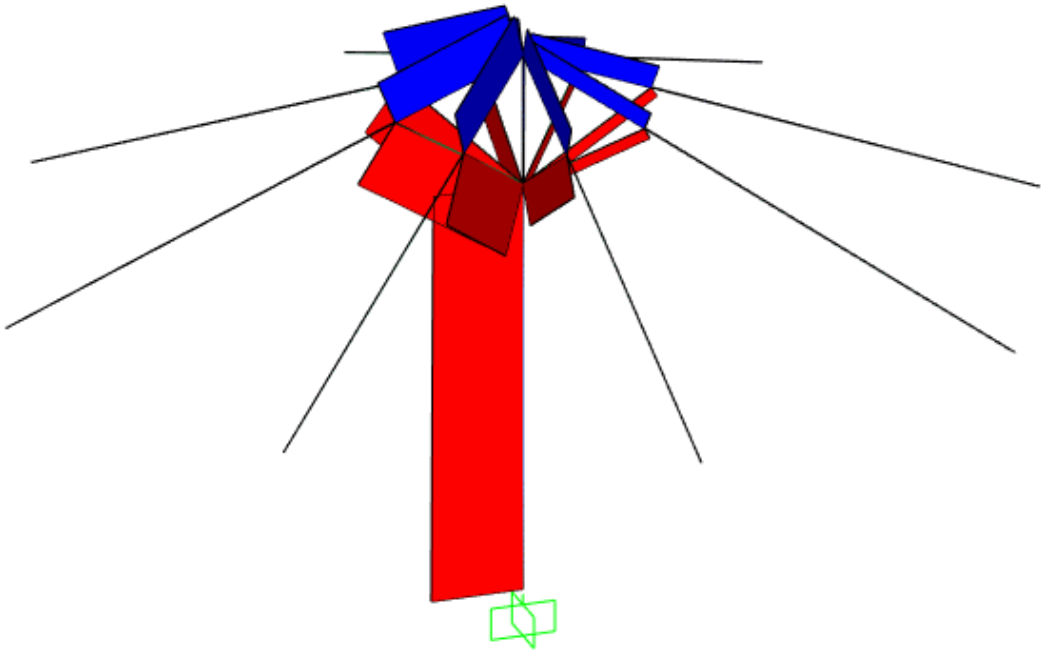

**Figure 7 Maximum Axial Force**

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### 5.1.5 Maximum Reactions

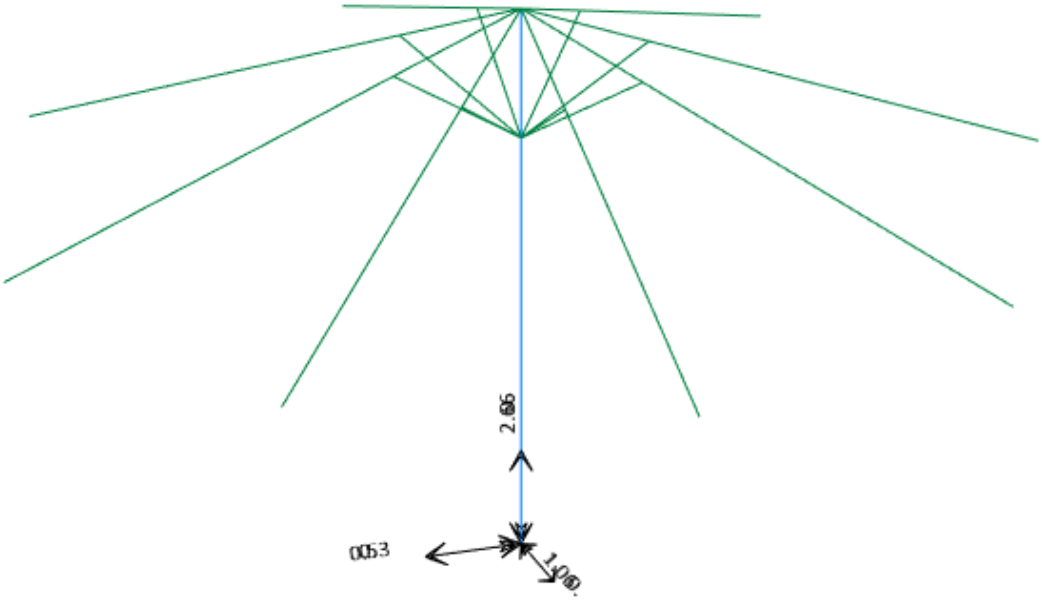


**Figure 8 Maximum Reactions (opened)**

Max $F_x$ = 0.54 kN
Max $F_y$ = 0.54 kN
Max $F_z$ = 2.66 kN
Max $M_x$ = 1.06 kN.m
Max $M_y$ = 1.06 kN.m

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# 6 Aluminium Member Design

All Aluminium members passed. The summary results are tabulated below. Refer to Appendix 'A' for details.

| MEMBER(S) | Section | d | t | $V_x$ | $V_y$ | P (Axial) Compression (-) Tension (+) | Mx | My |
|---|---|---|---|---|---|---|---|---|
| | | *mm* | *mm* | *kN* | *kN* | *kN* | *kN.m* | *kN.m* |
| *Post 82.5 x 5.2* | D 82.5 x5.2 | 82.5 | 5.2 | 0.53 | 0.00 | -2.60 | -2.35 | 0.00 |

| MEMBER(S) | Section | b | d | t | $V_x$ | $V_y$ | P (Axial) | Mx | My |
|---|---|---|---|---|---|---|---|---|---|
| | | *mm* | *mm* | *mm* | *kN* | *kN* | *kN* | *kN.m* | *kN.m* |
| *Arms* | 25x50x3.2 | 25 | 50 | 3.2 | -0.72 | -0.02 | -1.25 | 0.38 | 0.01 |
| *Brace* | 25x50x3.2 | 25 | 50 | 3.2 | 0.33 | 0.04 | -2.04 | -0.32 | -0.01 |

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# 7 Summary and Recommendations

- The 6m octagonal umbrella structure as specified has been analyzed with a conclusion that it has the capacity to withstand wind speeds up to and including **80km/hr**.
- For forecast winds in excess of **80km/hr** – the structure should be completely folded.
- For uplift due to 80km/hr, **280kg (2.8 kN)** holding down weight or **4/M12 HST3 M12 hef1, hnom = 60mm** Mechanical Anchor or alternatively HIT-HY 200-R + HIT-V-F (8.8) M12, heff = 70mm chemical anchors to concrete slab supplied by HILTI Australia is required.
- The bearing pressure of soil should be clarified prior to any construction.

Yours faithfully,
Prime Consulting Engineers Pty. Ltd.
Bijaya Giri, MEng, MIEAust, CPEng, NER, APEC, IntPE (Aus), PE Vic

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# 8 Appendix A – Aluminium Design Based on AS1664.1

## 8.1 Post 82.5 x 5.2 mm

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**Job no.** 25-1346-2 **Date:** 30/04/2022

| NAME | SYMBOL | | VALUE | UNIT | NOTES | REF |
|---|---|---|---|---|---|---|
| **D 82.5 x5.2** | **Post 82.5 x 5.2** | | | | | |
| Alloy and temper | 6105-T5 | | | | | AS1664.1 |
| Tension | $F_{tu}$ | = | 235 | MPa | *Ultimate* | T3.3(A) |
| | $F_{ty}$ | = | 210 | MPa | *Yield* | |
| Compression | $F_{cy}$ | = | 210 | MPa | | |
| Shear | $F_{su}$ | = | 144 | MPa | *Ultimate* | |
| | $F_{sy}$ | = | 120 | MPa | *Yield* | |
| Bearing | $F_{bu}$ | = | 480 | MPa | *Ultimate* | |
| | $F_{by}$ | = | 337 | MPa | *Yield* | |
| Modulus of elasticity | E | = | 70000 | MPa | *Compressive* | |
| | $k_t$ | = | 1.0 | | | T3.4(B) |
| | $k_c$ | = | 1.1 | | | |
| *FEM ANALYSIS RESULTS* | | | | | | |
| Axial force | P | = | 2.6031715 | kN | *compression* | |
| | P | = | 0 | kN | *Tension* | |
| In plane moment | $M_x$ | = | 2.3521895 | kNm | | |
| Out of plane moment | $M_y$ | = | 3.713E-13 | kNm | | |
| *DESIGN STRESSES* | | | | | | |
| *Gross cross section area* | $A_g$ | = | 1262.7946 | $mm^2$ | | |
| In-plane elastic section modulus | $Z_x$ | = | 22968.818 | $mm^3$ | | |
| Out-of-plane elastic section mod. | $Z_y$ | = | 22968.818 | $mm^3$ | | |
| Stress from axial force | $f_a$ | = | $P/A_g$ | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | = | **2.06** | **MPa** | *compression* | |
| | | = | **0.00** | **MPa** | *Tension* | |
| Stress from in-plane bending | $f_{bx}$ | = | $M_x/Z_x$ | | | |
| | | = | **102.41** | **MPa** | *compression* | |
| Stress from out-of-plane bending | $f_{by}$ | = | $M_y/Z_y$ | | | |
| | | = | **0.00** | **MPa** | *compression* | |
| *Tension* | | | | | | |
| ***3.4.3*** *Tension in rectangular tubes* | | | | | | 3.4.3 |
| | $\phi F_L$ | = | **233.42** | **MPa** | | |
| | | **OR** | | | | |
| | $\phi F_L$ | = | **247.69** | **MPa** | | |
| *COMPRESSION* | | | | | | |
| ***3.4.8*** *Compression in columns, axial, gross section* | | | | | | |
| *1. General* | | | | | | 3.4.8.1 |
| Unsupported length of member | L | = | 3240 | mm | | |
| Effective length factor | k | = | 1.00 | | | |
| Radius of gyration about buckling axis (Y) | $r_y$ | = | 27.39 | mm | | |
| Radius of gyration about buckling axis (X) | $r_x$ | = | 27.39 | mm | | |
| Slenderness ratio | kLb/ry | = | 118.29 | | | |
| Slenderness ratio | kL/rx | = | 118.29 | | | |
| Slenderness parameter | λ | = | 2.062 | | | |
| | $D_c$* | = | 77.8 | | | |
| | $S_1$* | = | 0.60 | | | |
| | $S_2$* | = | 1.24 | | | |
| | $\phi_{cc}$ | = | 0.869 | | | |
| Factored limit state stress | $\phi F_L$ | = | **42.90** | **MPa** | | |
| *2. Sections not subject to torsional or torsional-flexural buckling* | | | | | | 3.4.8.2 |
| Largest slenderness ratio for flexural buckling | kL/r | = | 118.29 | | | |
| ***3.4.11*** *Uniform compression in components of columns, gross section - flat plates* | | | | | | |
| *Uniform compression in components of columns, gross section - curved plates with both edges, walls of round or oval tube* | | | | | | 3.4.11 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | $k_1$ | = | 0.35 | | | T3.3(D) |
| mid-thickness radius of round tubular column or maximum mid-thickness radius | $R_m$ | = | 38.65 | | | |
| | t | = | 5.2 | mm | | |
| Slenderness | $R_m/t$ | = | 7.4326923 | | | |
| Limit 1 | $S_1$ | = | 0.62 | | | |
| Limit 2 | $S_2$ | = | 672.46 | | | |
| Factored limit state stress | $\phi F_L$ | = | **210.68** | **MPa** | | |
| Most adverse compressive limit state stress | $F_a$ | = | 42.90 | MPa | | |
| Most adverse tensile limit state stress | $F_a$ | = | 233.42 | MPa | | |
| Most adverse compressive & Tensile capacity factor | $f_a/F_a$ | = | 0.05 | | PASS | |
| *BENDING - IN-PLANE* | | | | | | |
| ***3.4.13*** *Compression in beams, extreme fibre, gross section round or oval tubes* | | | | | | |
| Unbraced length for bending | $L_b$ | = | 3240 | mm | | |
| Second moment of area (weak axis) | $I_y$ | = | 9.47E+05 | $mm^4$ | | |
| Torsion modulus | J | = | 1.89E+06 | $mm^3$ | | |
| Elastic section modulus | Z | = | 22968.818 | $mm^3$ | | |
| | $R_b/t$ | = | 7.43 | | | |
| Limit 1 | $S_1$ | = | 42.32 | | | |
| Limit 2 | $S_2$ | = | 83.09 | | | |
| Factored limit state stress | $\phi F_L$ | = | **233.42** | **MPa** | | 3.4.13 |
| ***3.4.18*** *Compression in components of beams - curverd plates with both edges supported* | | | | | | |
| | $k_1$ | = | 0.5 | | | T3.3(D) |
| | $k_2$ | = | 2.04 | | | T3.3(D) |
| mid-thickness radius of round tubular column or maximum mid-thickness radius | $R_b$ | = | 38.65 | mm | | |
| | t | = | 5.2 | mm | | |
| Slenderness | $R_b/t$ | = | 7.4326923 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Limit 1 | $S_1$ | = | 3.61 | | | |
| Limit 2 | $S_2$ | = | 83.09 | | | |
| Factored limit state stress | $\phi F_L$ | = | **198.63** | **MPa** | | |
| Most adverse in-plane bending limit state stress | $F_{bx}$ | = | 198.63 | MPa | | |
| Most adverse in-plane bending capacity factor | $f_{bx}/F_{bx}$ | = | 0.52 | | PASS | |
| *BENDING - OUT-OF-PLANE* | | | | | | |
| *NOTE: Limit state stresses, $\phi F_L$ are the same for out-of-plane bending (doubly symmetric section)* | | | | | | |
| Factored limit state stress | $\phi F_L$ | = | **198.63** | **MPa** | | |
| Most adverse out-of-plane bending limit state stress | $F_{by}$ | = | 198.63 | MPa | | |
| Most adverse out-of-plane bending capacity factor | $f_{by}/F_{by}$ | = | 0.00 | | PASS | |
| COMBINED ACTIONS | | | | | | |
| ***4.1.1*** *Combined compression and bending* | | | | | | 4.1.1 |
| | $F_a$ | = | 42.90 | MPa | | 3.4.11 |
| | $F_{ao}$ | = | 210.68 | MPa | | 3.4.11 |
| | $F_{bx}$ | = | 198.63 | MPa | | 3.4.18 |
| | $F_{by}$ | = | 198.63 | MPa | | 3.4.18 |
| | $f_a/F_a$ | = | 0.048 | | | |
| Check: | $f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \le 1.0$ | | | | | 4.1.1 |
| i.e. | 0.56 | ≤ | 1.0 | | PASS | |
| SHEAR | | | | | | |
| ***3.4.24*** *Shear in webs (Major Axis)* | | | | | | 3.4.24 |
| | R | = | 41.25 | mm | | |
| | t | = | 5.2 | mm | | |
| Equivalent h/t | h/t | = | 31.50 | | | |
| Limit 1 | $S_1$ | = | 29.82 | | | |
| Limit 2 | $S_2$ | = | 59.31 | | | |
| Factored limit state stress | $\phi F_L$ | = | **112.64** | **MPa** | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Stress From Shear force | $f_{sx}$ | = | $V/A_w$ | | | |
| | | | **0.85** | **MPa** | | |
| ***3.4.25*** *Shear in webs (Minor Axis)* | | | | | | 3.4.24 |
| Clear web height | R | = | 41.25 | mm | | |
| | t | = | 5.2 | mm | | |
| Equivalent h/t | h/t | = | 31.50 | | | |
| Factored limit state stress | $\phi F_L$ | = | **112.64** | **MPa** | | |
| Stress From Shear force | $f_{sy}$ | = | $V/A_w$ | | | |
| | | | **0.00** | **MPa** | | |
| Most adverse shear capacity factor (Major Axis) | $f_{sx}/F_{sx}$ | = | 0.01 | **MPa** | | |
| Most adverse shear capacity factor (Minor Axis) | $f_{sy}/F_{sy}$ | = | 0.00 | **Mpa** | PASS | |
| COMBINED ACTIONS | | | | | | |
| ***4.4*** *Combined Shear, Compression and bending* | | | | | | 4.4 |
| Check: | $f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$ | | | | | |
| i.e. | 0.56 | ≤ | 1.0 | | PASS | |

## 8.2 Arms (25 x 50 x 3.2 mm)

PRIME CONSULTING ENGINEERS PTY. LTD

**Job no.** 25-1346-2 **Date:** 30/04/2025

| NAME | SYMBOL | | VALUE | UNIT | NOTES | REF |
|---|---|---|---|---|---|---|
| **25x50x3.2** | **Arms** | | | | | |
| Alloy and temper | 6061-T6 | | | | | AS1664.1 |
| Tension | $F_{tu}$ | = | 262 | MPa | *Ultimate* | T3.3(A) |
| | $F_{ty}$ | = | 241 | MPa | *Yield* | |
| Compression | $F_{cy}$ | = | 241 | MPa | | |
| Shear | $F_{su}$ | = | 165 | MPa | *Ultimate* | |
| | $F_{sy}$ | = | 138 | MPa | *Yield* | |
| Bearing | $F_{bu}$ | = | 551 | MPa | *Ultimate* | |
| | $F_{by}$ | = | 386 | MPa | *Yield* | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Modulus of elasticity | E | = | 70000 | MPa | *Compressive* | |
| | $k_t$ | = | 1 | | | T3.4(B) |
| | $k_c$ | = | 1 | | | |
| *FEM ANALYSIS RESULTS* | | | | | | |
| Axial force | P | = | 1.2549444 | kN | *compression* | |
| | P | = | 0 | kN | *Tension* | |
| In plane moment | $M_x$ | = | 0.3773368 | kNm | | |
| Out of plane moment | $M_y$ | = | 0.008551 | kNm | | |
| *DESIGN STRESSES* | | | | | | |
| *Gross cross section area* | $A_g$ | = | 439.04 | $mm^2$ | | |
| In-plane elastic section modulus | $Z_x$ | = | 5277.9916 | $mm^3$ | | |
| Out-of-plane elastic section mod. | $Z_y$ | = | 3337.9352 | $mm^3$ | | |
| Stress from axial force | $f_a$ | = | $P/A_g$ | | | |
| | | = | **2.86** | **MPa** | *compression* | |
| | | = | **0.00** | **MPa** | *Tension* | |
| Stress from in-plane bending | $f_{bx}$ | = | $M_x/Z_x$ | | | |
| | | = | **71.49** | **MPa** | *compression* | |
| Stress from out-of-plane bending | $f_{by}$ | = | $M_y/Z_y$ | | | |
| | | = | **2.56** | **MPa** | *compression* | |
| *Tension* | | | | | | |
| ***3.4.3*** *Tension in rectangular tubes* | | | | | | |
| | $\phi F_L$ | = | **228.95** | **MPa** | | |
| | | **OR** | | | | |
| | $\phi F_L$ | = | **222.70** | **MPa** | | |
| *COMPRESSION* | | | | | | |
| ***3.4.8*** *Compression in columns, axial, gross section* | | | | | | |
| *1. General* | | | | | | … 3.4.8.1 |
| Unsupported length of member | L | = | 3230 | mm | | |
| Effective length factor | k | = | 1.00 | | | |
| Radius of gyration about buckling axis (Y) | $r_y$ | = | 9.75 | mm | | |
| Radius of gyration about buckling axis (X) | $r_x$ | = | 17.34 | mm | | |
| Slenderness ratio | kLb/ry | = | 331.33 | | | |
| Slenderness ratio | kL/rx | = | 186.32 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Slenderness parameter | $\lambda$ | = | 6.188 | | | |
| | $D_c$* | = | 90.3 | | | |
| | $S_1$* | = | 0.33 | | | |
| | $S_2$* | = | 1.23 | | | |
| | $\phi_{cc}$ | = | 0.950 | | | |
| Factored limit state stress | **$\phi F_L$** | **=** | **5.98** | **MPa** | | |
| *2. Sections not subject to torsional or torsional-flexural buckling* | | | | | | … 3.4.8.2 |
| Largest slenderness ratio for flexural buckling | kL/r | **=** | 331.33 | | | |
| ***3.4.10** Uniform compression in components of columns, gross section - flat plates* | | | | | | |
| *1. Uniform compression in components of columns, gross section - flat plates with both edges supported* | | | | | | … 3.4.10.1 |
| | $k_1$ | **=** | 0.35 | | | T3.3(D) |
| Max. distance between toes of fillets of supporting elements for plate | b' | **=** | 18.6 | | | |
| | t | **=** | 3.2 | mm | | |
| Slenderness | b/t | **=** | 5.8125 | | | |
| Limit 1 | $S_1$ | **=** | 12.34 | | | |
| Limit 2 | $S_2$ | **=** | 32.87 | | | |
| Factored limit state stress | **$\phi F_L$** | **=** | **228.95** | **MPa** | | |
| Most adverse compressive limit state stress | $F_a$ | **=** | 5.98 | MPa | | |
| Most adverse tensile limit state stress | $F_a$ | **=** | 222.70 | MPa | | |
| Most adverse compressive & Tensile capacity factor | $f_a/F_a$ | **=** | 0.48 | | PASS | |
| *BENDING - IN-PLANE* | | | | | | |
| ***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections* | | | | | | |
| Unbraced length for bending | $L_b$ | = | 3230 | mm | | |
| Second moment of area (weak axis) | $I_y$ | = | 4.17E+04 | $mm^4$ | | |
| Torsion modulus | J | = | 9.71E+04 | $mm^3$ | | |
| Elastic section modulus | Z | = | 5277.9916 | $mm^3$ | | |
| Slenderness | S | = | 535.64 | | | |
| Limit 1 | $S_1$ | = | 0.39 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Limit 2 | $S_2$ | = | 1695.86 | | | |
| Factored limit state stress | $\phi F_L$ | = | **177.30** | **MPa** | | … 3.4.15(2) |
| ***3.4.17*** *Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported* | | | | | | |
| | $k_1$ | = | 0.5 | | | T3.3(D) |
| | $k_2$ | = | 2.04 | | | T3.3(D) |
| Max. distance between toes of fillets of supporting elements for plate | b' | = | 18.6 | mm | | |
| | t | = | 3.2 | mm | | |
| Slenderness | b/t | = | 5.8125 | | | |
| Limit 1 | $S_1$ | = | 12.34 | | | |
| Limit 2 | $S_2$ | = | 46.95 | | | |
| Factored limit state stress | $\phi F_L$ | = | **228.95** | **MPa** | | |
| Most adverse in-plane bending limit state stress | $F_{bx}$ | = | 177.30 | MPa | | |
| Most adverse in-plane bending capacity factor | $f_{bx}/F_{bx}$ | = | 0.40 | | PASS | |
| *BENDING - OUT-OF-PLANE* | | | | | | |
| *NOTE: Limit state stresses, $\phi F_L$ are the same for out-of-plane bending (doubly symmetric section)* | | | | | | |
| Factored limit state stress | $\phi F_L$ | = | **177.30** | **MPa** | | |
| Most adverse out-of-plane bending limit state stress | $F_{by}$ | = | 177.30 | MPa | | |
| Most adverse out-of-plane bending capacity factor | $f_{by}/F_{by}$ | = | 0.01 | | PASS | |
| COMBINED ACTIONS | | | | | | |
| ***4.1.1*** *Combined compression and bending* | | | | | | … 4.1.1(2) |
| | $F_a$ | = | 5.98 | MPa | | … 3.4.8 |
| | $F_{ao}$ | = | 228.95 | MPa | | … 3.4.10 |
| | $F_{bx}$ | = | 177.30 | MPa | | … 3.4.17 |
| | $F_{by}$ | = | 177.30 | MPa | | … 3.4.17 |
| | $f_a/F_a$ | = | 0.478 | | | |
| Check: | $f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$ | | | | | … 4.1.1 (3) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | i.e. 0.90 | ≤ | 1.0 | | PASS | |
| SHEAR | | | | | | |
| ***3.4.24*** *Shear in webs (Major Axis)* | | | | | | … 4.1.1(2) |
| Clear web height | h | = | 43.6 | mm | | |
| | t | = | 3.2 | mm | | |
| Slenderness | h/t | = | 13.625 | | | |
| Limit 1 | $S_1$ | = | 29.01 | | | |
| Limit 2 | $S_2$ | = | 59.31 | | | |
| Factored limit state stress | $\phi F_L$ | = | **131.10** | **MPa** | | |
| Stress From Shear force | $f_{sx}$ | = | $V/A_w$ | | | |
| | | | **1.97** | **MPa** | | |
| ***3.4.25*** *Shear in webs (Minor Axis)* | | | | | | |
| Clear web height | b | = | 18.6 | mm | | |
| | t | = | 3.2 | mm | | |
| Slenderness | b/t | = | 5.8125 | | | |
| Factored limit state stress | $\phi F_L$ | = | **131.10** | **MPa** | | |
| Stress From Shear force | $f_{sy}$ | = | $V/A_w$ | | | |
| | | | **0.06** | **MPa** | | |
| Most adverse shear capacity factor (Major Axis) | $f_{sx}/F_{sx}$ | = | 0.02 | **MPa** | | |
| Most adverse shear capacity factor (Minor Axis) | $f_{sy}/F_{sy}$ | = | 0.00 | **Mpa** | PASS | |
| COMBINED ACTIONS | | | | | | |
| ***4.4*** *Combined Shear, Compression and bending* | | | | | | |
| Check: | $f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$ | | | | | |
| | i.e. 0.88 | ≤ | 1.0 | | PASS | |

## 8.3 Brace (25 x 50 x 3.2 mm)

| NAME | SYMBOL | | VALUE | UNIT | NOTES | REF |
|---|---|---|---|---|---|---|
| **25x50x3.2** | **Brace** | | | | | |
| Alloy and temper | 6061-T6 | | | | | AS1664.1 |
| Tension | $F_{tu}$ | = | 262 | MPa | *Ultimate* | T3.3(A) |
| | $F_{ty}$ | = | 241 | MPa | *Yield* | |
| Compression | $F_{cy}$ | = | 241 | MPa | | |
| Shear | $F_{su}$ | = | 165 | MPa | *Ultimate* | |
| | $F_{sy}$ | = | 138 | MPa | *Yield* | |
| Bearing | $F_{bu}$ | = | 551 | MPa | *Ultimate* | |
| | $F_{by}$ | = | 386 | MPa | *Yield* | |
| Modulus of elasticity | E | = | 70000 | MPa | *Compressive* | |
| | $k_t$ | = | 1 | | | T3.4(B) |
| | $k_c$ | = | 1 | | | |
| *FEM ANALYSIS RESULTS* | | | | | | |
| Axial force | P | = | 2.0359656 | kN | *compression* | |
| | P | = | 0 | kN | *Tension* | |
| In plane moment | $M_x$ | = | 0.3201432 | kNm | | |
| Out of plane moment | $M_y$ | = | 0.0089452 | kNm | | |
| *DESIGN STRESSES* | | | | | | |
| *Gross cross section area* | $A_g$ | = | 439.04 | $mm^2$ | | |
| In-plane elastic section modulus | $Z_x$ | = | 5277.9916 | $mm^3$ | | |
| Out-of-plane elastic section mod. | $Z_y$ | = | 3337.9352 | $mm^3$ | | |
| Stress from axial force | $\mathbf{f_a}$ | = | $P/A_g$ | | | |
| | | = | **4.64** | **MPa** | *compression* | |
| | | = | **0.00** | **MPa** | *Tension* | |
| Stress from in-plane bending | $\mathbf{f_{bx}}$ | = | $M_x/Z_x$ | | | |
| | | = | **60.66** | **MPa** | *compression* | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Stress from out-of-plane bending | $f_{by}$ | = | $M_y/Z_y$ | | | |
| | | = | **2.68** | **MPa** | *compression* | |
| *Tension* | | | | | | |
| ***3.4.3*** *Tension in rectangular tubes* | | | | | | |
| | **$\phi F_L$** | = | **228.95** | **MPa** | | |
| | | **OR** | | | | |
| | **$\phi F_L$** | = | **222.70** | **MPa** | | |
| *COMPRESSION* | | | | | | |
| ***3.4.8*** *Compression in columns, axial, gross section* | | | | | | |
| *1. General* | | | | | | … 3.4.8.1 |
| Unsupported length of member | L | = | 1000 | mm | | |
| Effective length factor | k | = | 1.00 | | | |
| Radius of gyration about buckling axis (Y) | $r_y$ | = | 9.75 | mm | | |
| Radius of gyration about buckling axis (X) | $r_x$ | = | 17.34 | mm | | |
| Slenderness ratio | kLb/ry | = | 102.58 | | | |
| Slenderness ratio | kL/rx | = | 57.68 | | | |
| Slenderness parameter | λ | = | 1.92 | | | |
| | $D_c$* | = | 90.3 | | | |
| | $S_1$* | = | 0.33 | | | |
| | $S_2$* | = | 1.23 | | | |
| | $\phi_{cc}$ | = | 0.848 | | | |
| Factored limit state stress | **$\phi F_L$** | = | **55.69** | **MPa** | | |
| *2. Sections not subject to torsional or torsional-flexural buckling* | | | | | | … 3.4.8.2 |
| Largest slenderness ratio for flexural buckling | kL/r | = | 102.58 | | | |
| ***3.4.10*** *Uniform compression in components of columns, gross section - flat plates* | | | | | | |
| *1. Uniform compression in components of columns, gross section - flat plates with both edges supported* | | | | | | … 3.4.10.1 |
| | $k_1$ | = | 0.35 | | | T3.3(D) |
| Max. distance between toes of fillets of supporting elements for plate | b' | = | 18.6 | | | |
| | t | = | 3.2 | mm | | |
| Slenderness | b/t | = | 5.8125 | | | |
| Limit 1 | $S_1$ | = | 12.34 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Limit 2 | $S_2$ | = | 32.87 | | | |
| Factored limit state stress | $\phi F_L$ | = | **228.95** | **MPa** | | |
| Most adverse compressive limit state stress | $F_a$ | = | 55.69 | MPa | | |
| Most adverse tensile limit state stress | $F_a$ | = | 222.70 | MPa | | |
| Most adverse compressive & Tensile capacity factor | $f_a/F_a$ | = | 0.08 | | PASS | |
| *BENDING - IN-PLANE* | | | | | | |
| ***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections* | | | | | | |
| Unbraced length for bending | $L_b$ | = | 1000 | mm | | |
| Second moment of area (weak axis) | $I_y$ | = | 4.17E+04 | $mm^4$ | | |
| Torsion modulus | J | = | 9.71E+04 | $mm^3$ | | |
| Elastic section modulus | Z | = | 5277.9916 | $mm^3$ | | |
| Slenderness | S | = | 165.83 | | | |
| Limit 1 | $S_1$ | = | 0.39 | | | |
| Limit 2 | $S_2$ | = | 1695.86 | | | |
| Factored limit state stress | $\phi F_L$ | = | **200.85** | **MPa** | | … 3.4.15(2) |
| ***3.4.17** Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported* | | | | | | |
| | $k_1$ | = | 0.5 | | | T3.3(D) |
| | $k_2$ | = | 2.04 | | | T3.3(D) |
| Max. distance between toes of fillets of supporting elements for plate | b' | = | 18.6 | mm | | |
| | t | = | 3.2 | mm | | |
| Slenderness | b/t | = | 5.8125 | | | |
| Limit 1 | $S_1$ | = | 12.34 | | | |
| Limit 2 | $S_2$ | = | 46.95 | | | |
| Factored limit state stress | $\phi F_L$ | = | **228.95** | **MPa** | | |
| Most adverse in-plane bending limit state stress | $F_{bx}$ | = | 200.85 | MPa | | |
| Most adverse in-plane bending capacity factor | $f_{bx}/F_{bx}$ | = | 0.30 | | PASS | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *BENDING - OUT-OF-PLANE* | | | | | | |
| *NOTE: Limit state stresses, $\phi F_L$ are the same for out-of-plane bending (doubly symmetric section)* | | | | | | |
| Factored limit state stress | $\phi F_L$ | = | **200.85** | **MPa** | | |
| Most adverse out-of-plane bending limit state stress | $F_{by}$ | = | 200.85 | MPa | | |
| Most adverse out-of-plane bending capacity factor | $f_{by}/F_{by}$ | = | 0.01 | | PASS | |
| COMBINED ACTIONS | | | | | | |
| ***4.1.1** Combined compression and bending* | | | | | | … 4.1.1(2) |
| | $F_a$ | = | 55.69 | MPa | | … 3.4.8 |
| | $F_{ao}$ | = | 228.95 | MPa | | … 3.4.10 |
| | $F_{bx}$ | = | 200.85 | MPa | | … 3.4.17 |
| | $F_{by}$ | = | 200.85 | MPa | | … 3.4.17 |
| | $f_a/F_a$ | = | 0.083 | | | |
| Check: | $f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$ | | | | | … 4.1.1 (3) |
| i.e. | 0.40 | ≤ | 1.0 | | PASS | |
| SHEAR | | | | | | |
| ***3.4.24** Shear in webs (Major Axis)* | | | | | | … 4.1.1(2) |
| Clear web height | h | = | 43.6 | mm | | |
| | t | = | 3.2 | mm | | |
| Slenderness | h/t | = | 13.625 | | | |
| Limit 1 | $S_1$ | = | 29.01 | | | |
| Limit 2 | $S_2$ | = | 59.31 | | | |
| Factored limit state stress | $\phi F_L$ | = | **131.10** | **MPa** | | |
| Stress From Shear force | $f_{sx}$ | = | $V/A_w$ | | | |
| | | | **0.89** | **MPa** | | |
| ***3.4.25** Shear in webs (Minor Axis)* | | | | | | |
| Clear web height | b | = | 18.6 | mm | | |
| | t | = | 3.2 | mm | | |
| Slenderness | b/t | = | 5.8125 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Factored limit state stress | $\phi F_L$ | = | **131.10** | **MPa** | | |
| Stress From Shear force | $f_{sy}$ | = | $V/A_w$ | | | |
| | | | **0.12** | **MPa** | | |
| Most adverse shear capacity factor (Major Axis) | $f_{sx}/F_{sx}$ | = | 0.01 | **MPa** | | |
| Most adverse shear capacity factor (Minor Axis) | $f_{sy}/F_{sy}$ | = | 0.00 | **Mpa** | PASS | |
| COMBINED ACTIONS | | | | | | |
| ***4.4*** *Combined Shear, Compression and bending* | | | | | | |
| Check: | $f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$ | | | | | |
| i.e. | 0.39 | ≤ | 1.0 | | PASS | |

**Address:** Level M 394 Lane Cove Rd
Macquarie Park NSW 2113
**Phone:** (02) 8964 1818

# 9 Appendix B – Technical Data Sheet

A.B.N. 77 010 472 563
56 Zillmere Road, Boondall QLD
4034 P.O. Box 856, Virginia QLD
4014 Tel: (07) 3265 7288
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# Heavy Duty Umbrella Specifications

## Frame Specifications:

Post Specifications: 82.5mm x 5.2mm Round Tube 6106 T6 Aluminium

Arm Specification: 25mm x 50mm x 3.2mm 6106 T5 Aluminium

Winding Mechanism: Anti-tamper Rack and Pinion Gearbox

Materials: Aluminum Frame Components, Nylon Arm ends and Bushes, Stainless Steel Fittings

Finish: Dulux Powder Coat Range

Standard Frame Colours: White, Beige, Primrose, Green, Black Charcoal, Silver, White Birch, Claret, Navy **Custom Colours Available on Request**

Available Base Types: Stainless Steel Bolt down or In-ground (Heavy Duty Umbrellas must be fixed to the ground)

## Fabric Types:

**100% Solution Dyed Acrylic Outdoor Awning Fabric**

Large Colour Selection
UV Blockout UV Reflective
Water Resistant
Mould & Mildew Resistant
Fade Resistant Guarantee

**Serge Ferrari Soltis Proof 502V2 Satin**

***Only available up to 5.0m Octagonal and 4.0m Square***

Satin finish
Reinforced dirt resistance and easy clean-ability
Heat and weather protection
High UV resistance
High dimensional stability due to Precontraint® technology

All UltraShade Heavy Duty Umbrellas are wind rated to 80km/h whilst erected based on the engineering of the 6.0m Octagonal and the 4.8m Square

UltraShade
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# Heavy Duty Umbrella

## UltraShade Price List

*Effective 1st July 2023*

| OCTAGONAL | Size | Coverage | Price Excluding GST | Price Including GST |
|---|---|---|---|---|
| **CE 3.0m** | 3.0m Diameter | 6.3 $m^2$ | $4,616.36 | **$5,078.00** |
| **CE 3.5m** | 3.5m Diameter | 8.7 $m^2$ | $4,657.27 | **$5,123.00** |
| **CE 4.0m** | 4.0m Diameter | 11.3 $m^2$ | $4,970.91 | **$5,468.00** |
| **CE 4.5m** | 4.5m Diameter | 14.4 $m^2$ | $5,291.82 | **$5,821.00** |
| **CE 5.0m** | 5.0m Diameter | 17.6 $m^2$ | $5,635.45 | **$6,199.00** |
| **CE 5.5m** | 5.5m Diameter | 21.4 $m^2$ | $6,055.45 | **$6,661.00** |
| **CE 6.0m** | 6.0m Diameter | 25.5 $m^2$ | $6,404.64 | **$7,044.00** |

| SQUARE | Size | Coverage | Price Excluding GST | Price Including GST |
|---|---|---|---|---|
| **CE 3.0m** | 3.0m x 3.0m | 9.0 $m^2$ | $4,825.45 | **$5,308.00** |
| **CE 3.6m** | 3.6m x 3.6m | 12.9 $m^2$ | $5,140.00 | **$5,654.00** |
| **CE 4.0m** | 4.0m x 4.0m | 16.0 $m^2$ | $5,455.45 | **$6,001.00** |
| **CE 4.5m** | 4.5m x 4.5m | 20.2 $m^2$ | $5,770.00 | **$6,347.00** |
| **CE 4.8m** | 4.8m x 4.8m | 23.0 $m^2$ | $6,085.45 | **$6,694.00** |

All umbrellas include an **Acrylic Fabric Canopy** with **No Valance**.
All above prices includes the choice of either a;
Stainless Steel **Bolt Down Base** or Stainless Steel **In-ground Base**

### Optional Extras

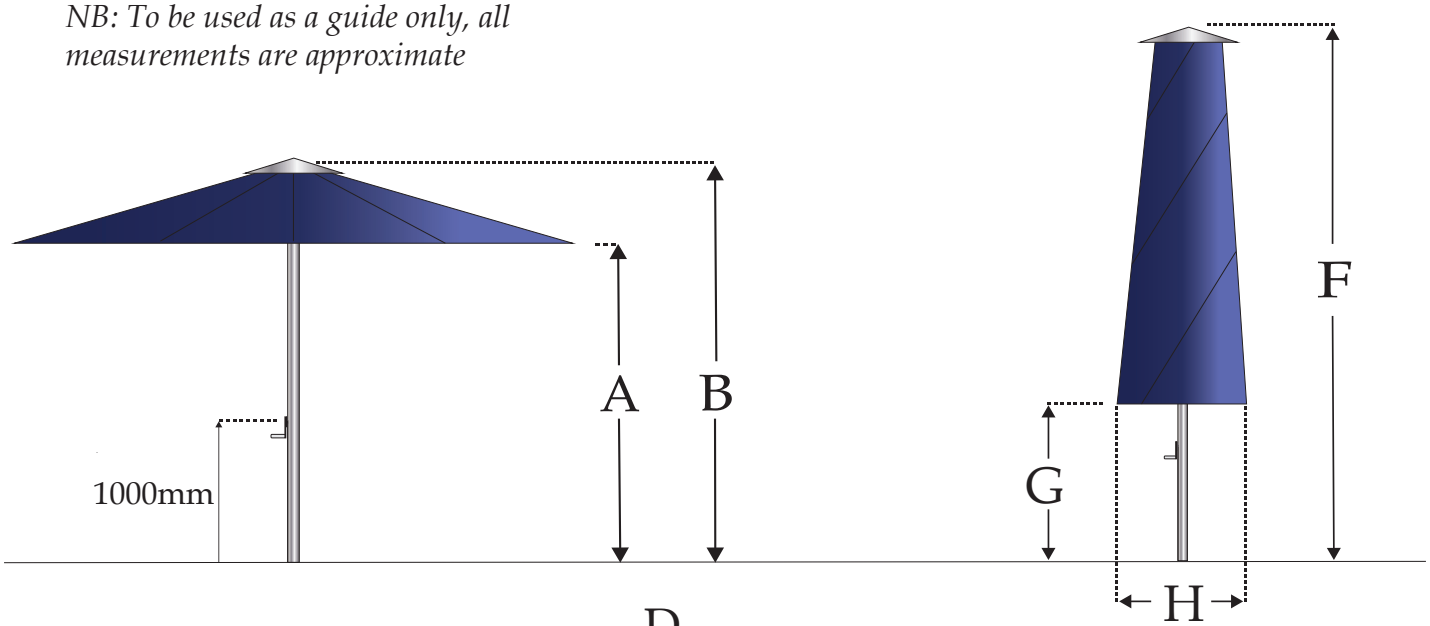
| | | |
|---|---|---|
| **Valance** (Straight or Scalloped) | $357.27 | **$393.00** |
| **Serge Ferrari 502V2 Satin Surcharge** | $283.64 | **$312.00** |
| Extra Spigot Only | $215.45 | **$237.00** |
| Extra Bolt Down Base Only | $215.45 | **$237.00** |
| Extra In Ground Base Only | $215.45 | **$237.00** |
| Velcro 4 sides - **8 x panels (Square only)** | $330.91 | **$364.00** |
| Velcro per panel **(Square only)** | $47.27 | **$52.00** |
| Gutter | $330.91 | **$364.00** |
| Acrylic Dust Cover with Zip Replacement | $610.91 | **$672.00** |
| Handle | $70.00 | **$77.00** |
| Installation | **P.O.A.** | **P.O.A.** |

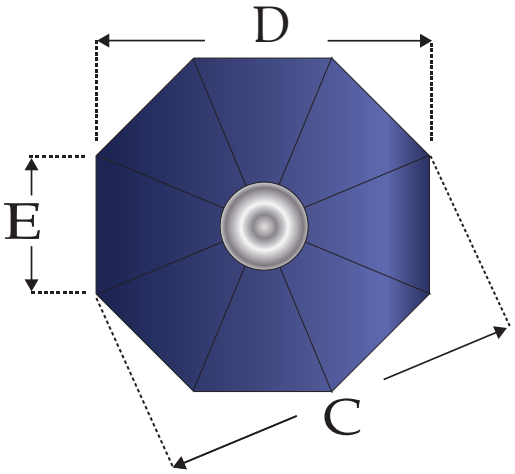
UltraShade

# Octagonal Heavy Duty Umbrella Dimensions

| Size | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 3.5 m | 2300 | 2850 | 3500 | 3200 | 1350 | 3650 | 1800 | 400 |
| 4.0 m | 2300 | 2950 | 4000 | 3700 | 1500 | 3750 | 1650 | 400 |
| 4.5 m | 2300 | 3000 | 4500 | 4150 | 1750 | 3900 | 1500 | 450 |
| 5.0 m | 2400 | 3250 | 5000 | 4550 | 1900 | 4050 | 1450 | 450 |
| 5.5 m | 2350 | 3200 | 5500 | 5100 | 2100 | 4100 | 1200 | 500 |
| 6.0 m | 2400 | 3250 | 6000 | 5460 | 2300 | 4150 | 1050 | 500 |

*NB: To be used as a guide only, all measurements are approximate*



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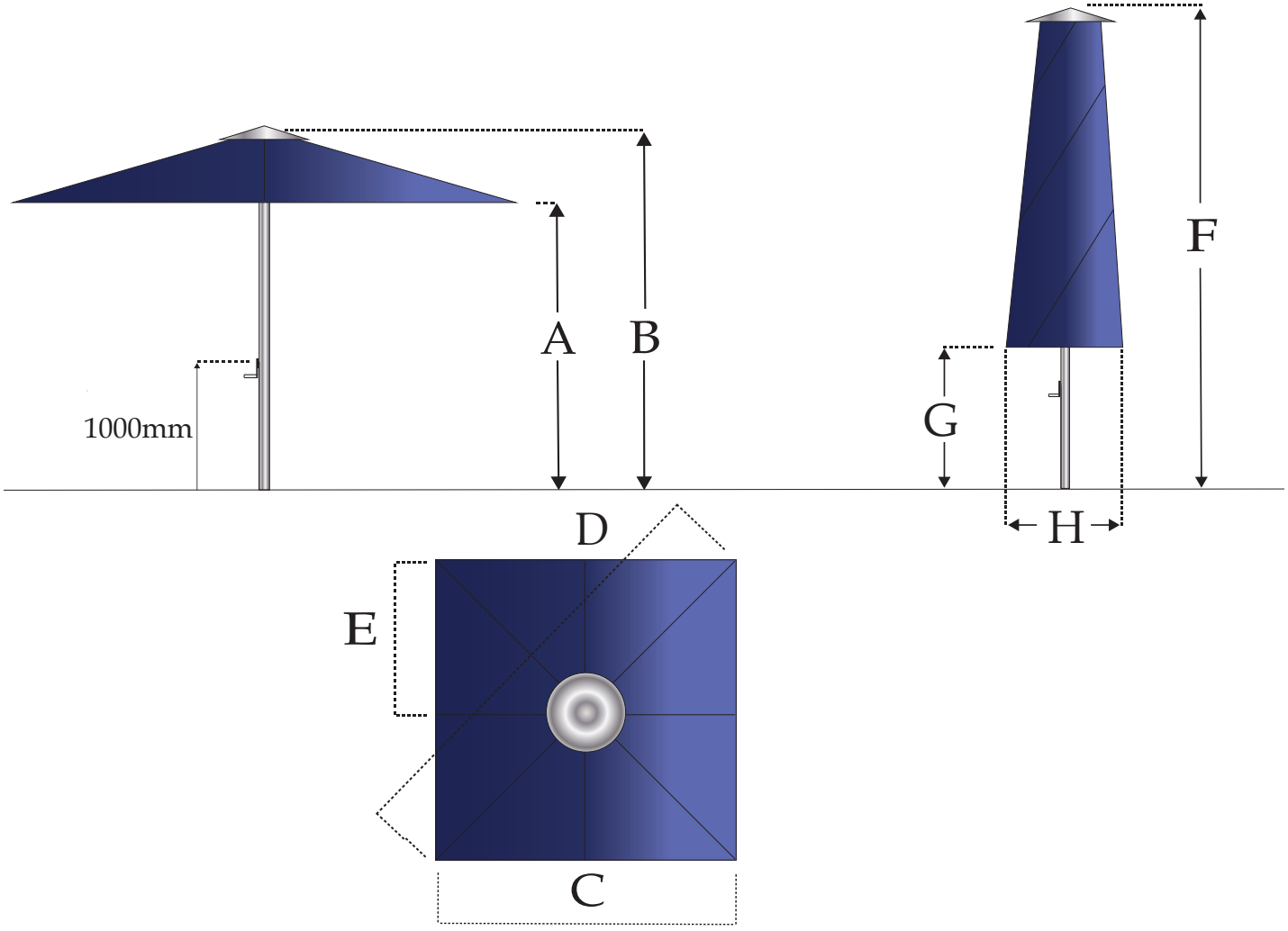
# Square Heavy Duty Umbrella Dimensions

| Size | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 2.5 m | 2350 | 2850 | 2500 | 3550 | 1250 | 3600 | 1750 | 400 |
| 2.8 m | 2300 | 2850 | 2830 | 4050 | 1415 | 3600 | 1550 | 400 |
| 2.9 m | 2250 | 2850 | 2960 | 4200 | 1480 | 3600 | 1450 | 400 |
| 3.0 m | 2250 | 2900 | 3060 | 4350 | 1530 | 3600 | 1350 | 400 |
| 3.6m | 2300 | 2950 | 3670 | 5100 | 1835 | 3700 | 1050 | 450 |
| 4.0m | 2300 | 3100 | 4000 | 5600 | 2000 | 4000 | 1100 | 450 |
| 4.5 m | 2350 | 3250 | 4400 | 6200 | 2200 | 4150 | 900 | 450 |
| 4.8 m | 2300 | 3300 | 4700 | 6600 | 2350 | 4150 | 700 | 450 |



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# Heavy Duty Umbrella Installation Instructions

## Bolt Down Installations - Fixing to Concrete:

| Supplied Parts: | Recommended Fixings: | Tools Required: |
|---|---|---|
| a) The Base Plate (250mm x 250 mm x 12mm)<br>b) Umbrella Spigot<br>c) Five 3/8" x 1" Bolts<br>d) Five 3/8" Spring Washers<br>e) Two ½" Grub Screws<br>f) One ¼ "Allen Key<br>g) One M8 x 90 mm Stainless Bolt & Nylock Nut<br>h) Umbrella Hat<br>i) Umbrella Handle | M12 x 100mm Dyna Bolts - Stainless Steel<br>M12 Chem Set – Stainless Steel<br>M12 Screw Bolt – Galvanized<br><br>**Minimum Concrete Thickness:**<br>Reinforced concrete slab 100mm thick.<br><br>**PPE Required:**<br>Dust mask, Safety Glasses, Hearing Protection, Gloves | 1. M12 Concrete SDS Drill Bit<br>2. SDS Drill<br>3. Post Level<br>4. Dust Extraction<br>5. Spanner/Socket Set<br>6. Cordless Drill<br>7. Tape Measure<br>8. 8mm Cobalt Drill Bit<br>9. 9/16" Spanner<br>10. 1 box M12 Flat Washer |

1. Bolt the spigot to the base plate using the 3/8" x 1" bolts and spring washers supplied using the 9/16" spanner.
2. Slide the spigot and the attached base up inside the umbrella post and lock in place using the Allen Key with the two supplied ½" Grub Screws
3. Attach the Hat to the umbrella using the threaded hole at the top of the umbrella with the 9/16" Spanner. Once the Hat is attached, do not lay umbrella down as to not damage the hat.
4. Stand the umbrella in approximate location using 3 people. Have one person on the base end and two people on the canopy end, carry the umbrella to the approximate position and rest the base on the ground while two people hold the umbrella up. Have someone hold the base so it does not slip whilst two people push the umbrella vertical. Open the umbrella by removing the strap, attaching the handle and pushing all 8 arms out. Tighten the umbrella and lock in place. Have a few people hold the umbrella and measure to final position.
5. Using the post level, ensure the umbrella is plumb. Use M12 Stainless Steel Flat Washers under the fixing holes to level the base plate if required. The fixing bolts will be able to pass through the washers and hold the packing in place.
6. Use the base plate as a template and drill through the base fixing holes to the required depth of your concrete fixings. Ensure to use correct dust extraction techniques.
7. Fix the umbrella down using Dyna bolts or similar and cap with dome nuts.
8. Loosen the ½" grub screws and rotate umbrella to desired orientation. Lock grub screws again with Allen Key.
9. Locate the 8mm hole in the umbrella post 50mm up from the bottom of the post.
10. Using the 8mm cobalt drill bit, drill through the spigot from one side of the umbrella, then drill through the other side of the umbrella then run the drill through both holes.
11. Secure the umbrella to the spigot with the M8 x 90 mm bolt and Nylock nut.
12. Check Spigot bolts are tight.
13. Tighten the umbrella and remove the handle. Enjoy your UltraShade Heavy Duty Umbrella!

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# Heavy Duty Umbrella Installation Instructions

## Bolt Down Installation – Fixing to Timber Deck:

| Supplied Parts: | Recommended Fixings: | Tools and Hardware Required: |
|---|---|---|
| a) The Base Plate<br>b) Umbrella Spigot<br>c) Five 3/8" x 1" Bolts<br>d) Five 3/8" Spring Washers<br>e) Two ½" Grub Screws<br>f) One ¼ "Allen Key<br>g) One M8 x 90 mm Stainless Bolt & Nylock Nut<br>h) Umbrella Hat<br>i) Umbrella Handle | M12 x 130mm Hex Head Bolts - Stainless Steel<br>M12 x 150mm Head Bolts - Stainless Steel<br>M12 Stainless Steel Nuts<br><br>**PPE Required:**<br>Dust mask, Safety Glasses, Hearing Protection, Gloves | 1. M12 Long Series Drill Bit<br>2. M5 Long Series Drill Bit,<br>3. Cordless Drill<br>4. Impact Driver<br>5. Post Level<br>6. Dust Extraction<br>7. Spanner/Socket Set<br>8. Tape Measure<br>9. 8mm Cobalt Drill Bit<br>10. 9/16" Spanner<br>11. 1 box M12 S/S Flat Washer<br>12. 75mm or 100mm Batton Screws<br>13. Length of 75mm x 100mm hardwood. |

1. Bolt the spigot to the base plate using the 3/8" x 1" bolts and spring washers supplied using the 9/16" spanner.
2. Locate the final position of the umbrella. It is ideal to have the base fit between two joists rather than sitting over the top of a joist.
3. With the base in its final position and orientation, use the base a template and drill through your decking boards through the base fixing holes with a M12 drill. This marks where you will need to reinforce the deck.
4. Get under the deck and measure the distance between you joists and cut two lengths of 75 x 100mm hardwood to those lengths.
5. Ensure the centre of the hardwood aligns with the holes drilled through the decking boards and pre-drill the joists and hardwood with a 5mm drill and fix to the joists using 75mm or 100mm batten screws.
6. From the top of the deck, drill through the hardwood reinforcing with the M12 drill bit.
7. Slide the spigot and the attached base up inside the umbrella post and lock in place using the Allen Key with the two supplied ½" Grub Screws.
8. Stand the umbrella in approximate location using 3 people. Have one person on the base end and two people on the canopy end, carry the umbrella to the approximate position and rest the base on the ground while two people hold the umbrella up. Have someone hold the base so it does not slip whilst two people push the umbrella vertical. Open the umbrella by removing the strap, attaching the handle and pushing all 8 arms out. Tighten the umbrella and lock open. Have a few people hold the umbrella and align the base to 12mm holes in the deck.
9. Using the post level, ensure the umbrella is plumb. Use M12 Stainless Steel Flat Washers under the fixing holes to level the base plate if required. The fixing bolts will be able to pass through the washers and hold the packing in place.
10. Insert the M12 Bolts into the base and through the holes in the deck and reinforcing hardwood.
11. From underneath the deck, fix the bolts down with a M12 washer and nut.
12. Loosen the ½" grub screws and rotate umbrella to desired orientation. Lock grub screws again with Allen Key.
13. Locate the 8mm hole in the umbrella post 50mm up from the bottom of the post.
14. Using the 8mm cobalt drill bit, drill through the spigot from one side of the umbrella, then drill through the other side of the umbrella then run the drill through both holes.
15. Secure the umbrella to the spigot with the M8 x 90 mm bolt and Nylock nut.
16. Check Spigot bolts are tight.
17. Tighten the umbrella and remove the handle. Enjoy your UltraShade Heavy Duty Umbrella!

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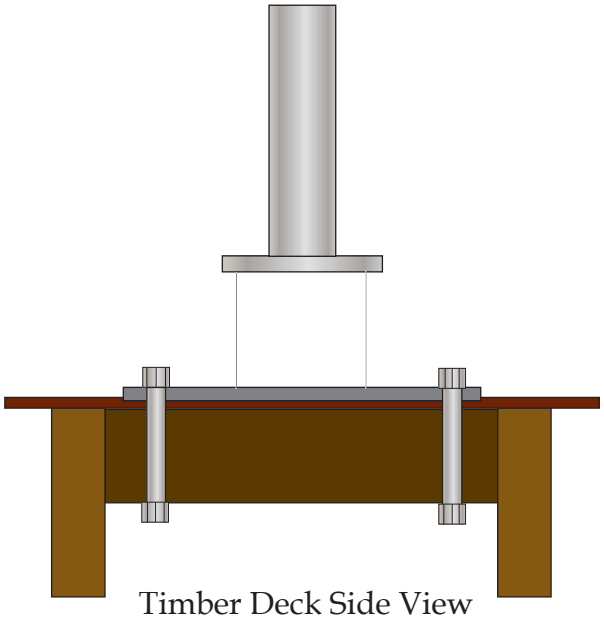
# Heavy Duty Umbrella Installation Instructions

## In-ground Installations – Paving, soil or loose-ground

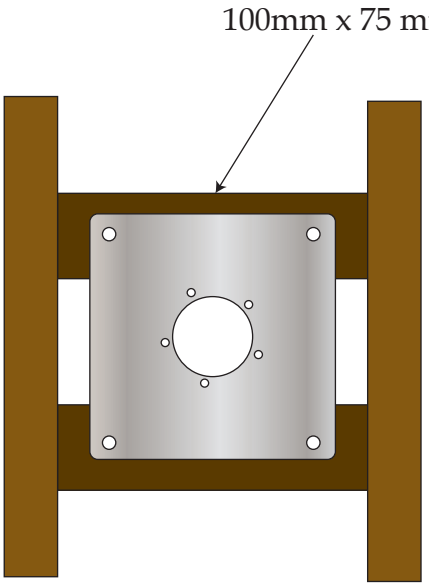
| **Supplied Parts:** | **Recommended Fixings:** | **Tools and Hardware Required:** |
|---|---|---|
| a) The In-ground Base<br>b) Umbrella Spigot<br>c) Five 3/8" x 1" Bolts<br>d) Five 3/8" Spring Washers<br>e) Two ½" Grub Screws<br>f) One ¼ "Allen Key<br>g) One M8 x 90 mm Stainless Bolt & Nylock Nut<br>h) Umbrella Hat<br>i) Umbrella Handle | 4 x 20 KG Bag Structural Concrete Premix (Rapid set is strongly discouraged)<br><br>**PPE Required:**<br>Dust mask, Safety Glasses, Hearing Protection, Gloves | 1. Post Hole Shovel<br>2. Spade<br>3. Crowbar or Jackhammer<br>4. Wheelbarrow<br>5. Cordless Drill<br>6. Post Level<br>7. Hose<br>8. Spanner/Socket Set<br>9. Tape Measure<br>10. 8mm Cobalt Drill Bit<br>11. 9/16" Spanner |

1. Bolt the Spigot to the In-ground base using the 3/8" x 1" Bolts and 3/8" Spring Washers and the 9/16" spanner.
2. Dig a hole for the concrete measuring approximately 400mm wide x 500mm deep. **Note:** The size of the hole depends on the soil type, (e.g., sandy soil = 500mm x 700mm). For taller umbrellas (custom height) = 500mm x 700mm.
3. Mix the required concrete and fill the hole until the level of the concrete is approximately 50mm below the ground level.
4. Insert the in-ground base into the concrete. The underside of the base flange should be **at least 12mm above.** ground level.
5. Using a post level, ensure the spigot is plumb while the concrete goes off.
6. UltraShade recommend leaving the concrete for 5 – 7 days to cure.
7. Remove the spigot from the in-ground base and insert into umbrella pole and lock in place with the two ½" grub screws and Allen key.
8. Attach the Hat to the umbrella using the threaded hole at the top of the umbrella with the 9/16" Spanner. Once the Hat is attached, do not lay umbrella down as to not damage the hat.
9. Stand the umbrella using 3 people. Have one person on the base/spigot end and two people on the canopy end, carry the umbrella to the in-ground base and rest the flange of the spigot on the in-ground base. Have someone hold the spigot down so it does not slip whilst two people push the umbrella vertical. Align the spigot holes with the base holes and secure the umbrella with the 3/8" x 1" Bolts and spring washers. Open the umbrella by removing the strap, attaching the handle and pushing all 8 arms out. Tighten the umbrella and lock open.
10. Loosen the ½" grub screws and rotate umbrella to desired orientation. Lock grub screws again with Allen Key.
11. Locate the 8mm hole in the umbrella post 50mm up from the bottom of the post.
12. Using the 8mm cobalt drill bit, drill through the spigot from one side of the umbrella, then drill through the other side of the umbrella then run the drill through both holes.
13. Secure the umbrella to the spigot with the M8 x 90 mm bolt and Nylock nut.
14. Check the spigot bolts are tight.
15. Tighten the umbrella and remove the handle. Enjoy your UltraShade Heavy Duty Umbrella!

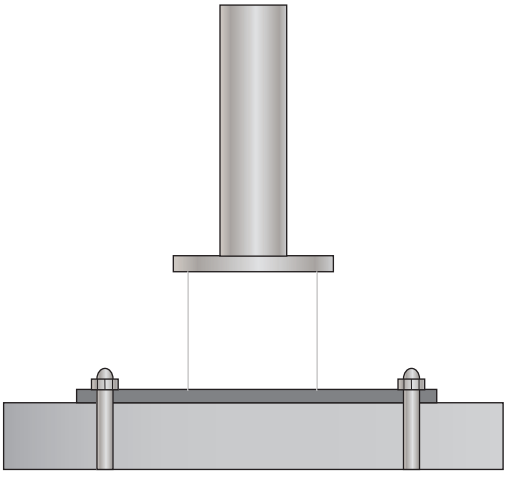
# UltraShade



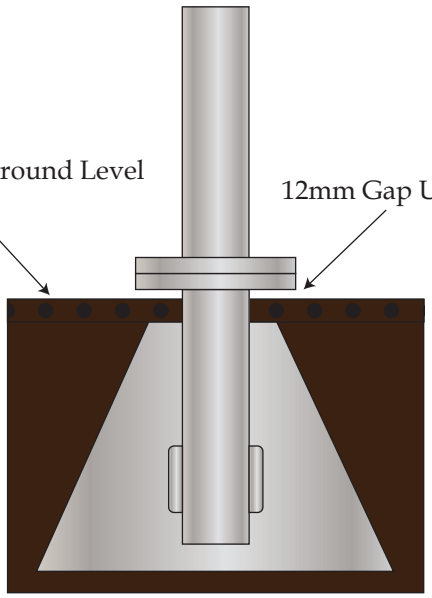
Timber Deck Side View




Timber Deck Plan View



Bolt Down Base on Concrete or Tiles




In-ground Base

Footing Size:
Approximately 400mm x 600 mm

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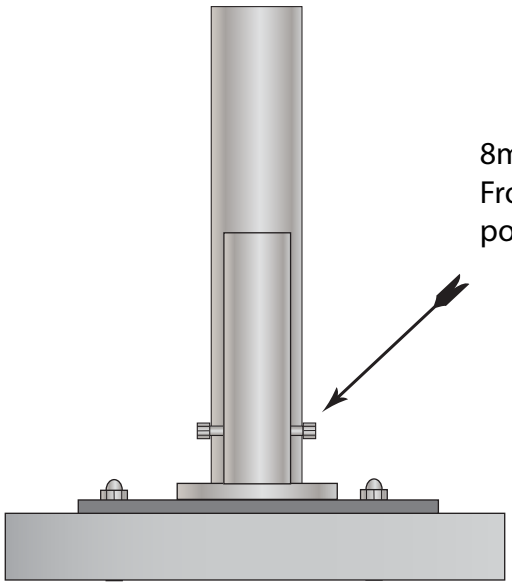
# LOCKING BOLT INSTALLATION INFORMATION

To ensure the umbrella remains secure and does not turn or lift off the spigot,  locate the 8mm holes in the umbrella post, 50mm from the bottom. Then use an 8mm drill bit to drill through the umbrella post then through the spigot. Drill through one side of the post, then drill through the opposite side, then pass the drill bit through both holes to ensure a bolt can pass through.

Once the holes have been drilled, secure the umbrella to the spigot by passing the supplied M8 x 90mm Bolt through the drilled holes and secure it with the provided M8 Nut using two 13mm Spanners.

**NB:** If this precaution is not taken when first installing the umbrella it could cause damage or injury due to turning or lifting off the spigot.



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# How to Open and Close Your UltraShade Heavy Duty Umbrella

## To Open:

1. While lightly holding one arm out as far as possible, gently push all of the remaining 7 umbrella arms out from the main post.
2. The umbrella should unfold mostly by itself. If it fails to open, at least one of the arms will be in the over locked position.
3. Bolt the handle to the round stainless-steel axle and wind it up.
4. Open the umbrella until the canopy is taut.
5. Secure the umbrella by placing the locking pin into the round stainless-steel axle and into the post.
6. Store the handle in a safe place.
7. Ensure that the canopy is taut to prevent damage from stress fracturing due to flapping.

## To Close:

1. Attach the handle to the round stainless-steel axle.
2. Release the pressure on the locking pin by using your body weight to turn the umbrella in a clock-wise direction.
3. Remove the locking pin from the axle and main post.
4. Wind the umbrella down with the handle in an anti-clockwise direction.
5. Ensure that all the canopy material is not jammed between the arms and arm brackets or between the arms and the bottom bracket system, and push the arms toward the main post. Failure to remove the fabric from the pinch points will result in damage to the canopy and will not be covered under warranty.
6. Wrap all the canopy material around the umbrella in the same way you would for a handheld rain umbrella.
7. Secure it with the provided strap.
8. Remove and store the handle in a safe place.

Note: It's important to secure the panels with the strap provided to prevent damage to the canopy, which is not covered by our warranty. If the umbrella is left in the down position for more than 24 hours, wind may cause flapping of the panels, which could result in fabric stress fracturing. This damage is not covered by warranty.

You can find an instructional video at:
www.youtube.com/ultrashadeumbrellas

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# FABRIC CARE INSTRUCTIONS

Congratulations on your new umbrella! To prolong the life of your umbrella canopy, it is important to care for it properly. Regular cleaning and re treatment of the fabric will keep it looking great and extend its life. Here are some tips for caring for canvas and acrylic fabrics:

For new canvas installations, erect the umbrella fully and leave it erected for at least 2 to 4 days to allow the canvas to condition.

Ensure the canopy is thoroughly dry before closing it away to avoid encouraging algae, mildew, or other fungal growth.

Brush the fabric regularly with a soft brush and hose it down occasionally with clear, cold water to remove dust and grime. Do not let dirt, dust, grime, leaf litter, or bird matter remain on the fabric.

Cleaning Acrylic Fabrics:

Brush off any loose dirt and hose down the fabric.

Clean the fabric with a mild soap in lukewarm water (37°C). Rinse thoroughly and do not use detergents.

For more stubborn stains, soak the fabric for approximately 20 minutes in a solution of no more than 1/2 cup of non-chlorine bleach and 1/4 cup natural soap per 4 liters of water at approximately 30-35°C. Rinse thoroughly in cold water to remove all the soap.

Allow the fabric to air dry and apply an air-curing re-treatment to restore water repellent.

To aid in the care of your fabric awnings and blinds, we recommend using Brellaguard 303 Fabric Cleaner for acrylic fabrics. For restoring water repellent to acrylic fabric products, use 303 Fabric Guard Water Repellent for all woven fabrics.

To clean PVC fabrics, used in some outdoor umbrellas, follow these steps:

Remove any loose dirt or debris from the fabric surface using a soft brush or a dry cloth.

Prepare a cleaning solution by mixing warm water with a mild detergent. Use a non-abrasive and non-solvent cleaner.

Apply the cleaning solution to the fabric surface using a soft brush or sponge, working in a circular motion. Avoid using abrasive brushes or pads, as these can damage the fabric.

Rinse the fabric thoroughly with clean water, using a garden hose or a bucket of clean water.

Wipe off excess water from the fabric using a dry cloth, and allow the fabric to air dry completely before storing or using again.

For stubborn stains or marks, you may need to use a specialized cleaner recommended by the manufacturer. Be sure to follow the instructions carefully and test the cleaner on a small, inconspicuous area of the fabric first to ensure that it doesn't cause damage or discoloration.

If you have any questions about caring for your umbrella canopy, speak with one of our friendly customer service staff.

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# HEAVY DUTY UMBRELLA WARRANTY

Aluminum Frames are covered by a 5 Year structural warranty. Warranty specifically excludes damage to the powder coat finish caused by corrosion, scratching, pitting, fading or peeling.

Canopy Fabrics are covered by a 3 Year manufactures and workmanship warranty. Warranty specifically excludes; stains, mildew and fading.

## Conditions of Warranty:

1. This warranty does not cover any repairs consequent upon accident, alterations or repairs by any other than an authorised dealer/agent of UltraShade, misuse, fire, floods, earthquakes or excessively high wind conditions.
2. This warranty applies to the original purchaser from the purchase date and covers manufacturing faults and defects.
3. This warranty is valid only for installation made by UltraShade/ Agent/ Dealer/Yourself/ Tradesman: The installation must be carried out exactly as shown in the Ultrashade Installation Instructions and Technical Information.
4. Owner to ascertain position of all underground pipes and electrical wires and notify installer of any obstacles. Although all care will be taken, no responsibility can be accepted for any underground breakages.
5. This warranty is only valid if the Locking pin is installed correctly and both pin and strap are used correctly at all times whilst the umbrella is erected and collapsed. Umbrella should not be closed for more than a 24 hour period.
6. This warranty is valid only if the canopy has been kept clean and free of dust/debris with regular hosing as this will help prolong the life of the canopy.
7. This warranty is only valid if the umbrella is put up and collapsed as detailed in the Technical information.
8. The cost of transportation and insurance both ways for any repair to the UltraShade Umbrella is to be paid by the claimant.
9. Warranty specifically excludes general wear and tear, rusting of steel components and parts, corrosion and damage caused as a result of failure to observe reasonable care, maintenance and assembly instructions.
10. UltraShade reserves the right to determine whether or not fault is caused by faulty workmanship or material or any other part is defective.
11. UltraShade may offer advice but accepts no responsibility to the suitability of the ultimate position of the UltraShade Umbrellas.

The benefits conferred by this manufacturer's warranty are in addition to all rights and remedies conveyed by the Competition and Consumer Act 2010 (Commonwealth), and any other statutory rights to which you may already be entitled, and this warranty does not exclude, restrict or modify any such rights or remedies that are implied by law.