

FRANK L. BENNARDO, P.E., INC.
4441 N DIXIE HIGHWAY
BOCA RATON, FL 33431

PH: (561)391-2888
FAX: (561) 391-2862

Calculations Provided For:

WAYNE-DALTON CORPORATION

Wayne-Dalton of Florida
3395 Addison Drive
Pensacola, FL FL 32514

Product:

Fabric-Shield™ Pulldown Shutter
Roll-Up Shutter with Fabric Curtain

Submitted for Approval to:

Florida Dept. of Community Affairs
(Florida Statewide Approval)

JUN 01 2004

Frank L. Bennardo, P.E.
#PE0046549

Work Prepared For: Wayne-Dalton Corp
 Project: Fabric-Shield Pulldown Shutter

Eccentricity Factor Calculation

| | | | |
|------------------------|------------|----------------------------------------------------|---------------------|
| Extrusion: | Side Guide | | |
| | Parallel | Direction of anchor vs. direction of loading | |
| <i>F_b</i> | 20.0 | Allowable Bending Stress in extrusion material | [ksi] |
| <i>V_{max}</i> | 257.0 | Max shear applicable to system | [lb] |
| <i>a</i> | 0.693 | Distance from anchor to lever point | [in] |
| <i>e</i> | 1.017 | Distance from anchor to shear force line of action | [in] |
| <i>t</i> | 0.08 | Leg thickness | [in] |
| <i>S</i> | 0.0128 | Section Modulus of Leg | [in ³] |
| <i>M_b</i> | 256.0 | Allowable bending moment in extrusion leg | [lb-ft] |
| <i>V_y</i> | 251.72 | Shear Load at which extrusion leg yields | [lb] |
| <i>Q</i> | 1.468 | Coefficient of Eccentricity | [1] |

| | | | |
|-------------------------------|--------------|-------------------------------------------|--------------|
| <i>WLR_t</i> | 2.468 | Windload Reaction Factor (Tension) | [1] |
| <i>WLR_v</i> | 0.000 | Windload Reaction Factor (Shear) | [1] |

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Anchor Spacing Sample Calculation

| | | | |
|------------|-------------------|---------------------------------------------------------------|---------------|
| Vmax | 194.75 | Maximum allowable shear for shutter system | [lb/ft] |
| w | 50.0 | Load | [psf] |
| L | 6.833 | Total Span | [ft] |
| WLRt | 2.468 | Wind Load Reaction factor (Tension) | [1] |
| WLRv | 0 | Wind Load Reaction factor (Shear) | [1] |
| Vy | 251.7 | Shear load at which mounting extrusion yields | [lb/ft] |
| Anchor: | 1/4" Tapcon (ITW) | | |
| Substrate: | Hollow Block | | |
| Embed: | 1.25" | | |
| Edge Dist | 2.5" | | |
| Tcap | 195 | Tensile capacity | [in] |
| Vcap | 264 | Shear capacity | [in] |
| V | 170.8 | Load applied to mounting extrusion, normal to cladding system | [lb/ft] |
| Wt | 170.8 | Tensile Reaction at Anchor | [lb/ft] |
| Wv | 0.0 | Shear Reaction at Anchor | [lb/ft] |
| s | 13.70" | Allowable Anchor Spacing (Center-To-Center) | [in] |

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Anchor Spacing Calculations

| | | | |
|--------|------|-------|-------|
| [1] | WLRt | 0 | 0 |
| [1] | WLRv | 2.468 | 2.468 |
| [lb] | Vv | 0 | 0 |
| | | 251.7 | 251.7 |

5.33' 6.83'

Max Tested Spacing 18.0 [in]

System
 Vmax 194.8 [lb]

Anchor Capacities
 Tcap Vcap
 483.0 lb 384.0 lb

| HOST STRUCT. | ANCHOR | LOAD (psf) | Spans Up To 5'-4" | Spans Up To 6'-10" |
|--------------|-------------------------------------------------------------|------------|-------------------|--------------------|
| CONCRETE | 1/4" TAPCON (ELCO OR ITW) x 1-3/4" EMBED (3192psi MIN CONC) | 35 | 18.0" | 18.0" |
| | | 40 | 18.0" | 18.0" |
| | | 45 | 18.0" | 18.0" |
| | | 50 | 18.0" | 18.0" |
| | | 57 | 18.0" | 18.0" |

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Anchor Spacing Calculations

| | | | |
|--------|------|-------|-------|
| [1] | WLRt | 0 | 0 |
| [1] | WLRv | 2.468 | 2.468 |
| [lb] | Vv | 0 | 0 |
| | | 251.7 | 251.7 |

5.33' 6.83'

Max Tested Spacing 18.0 [in]

System
 Vmax 194.8 [lb]

Anchor Capacities
 Tcap Vcap
 195.0 lb 264.0 lb

| HOST STRUCT. | ANCHOR | LOAD (psf) | Spans Up To 5'-4" | Spans Up To 6'-10" |
|--------------|-------------------------------------------------------------|------------|-------------------|--------------------|
| HOLLOW BLOCK | 1/4" TAPCON (ELCO OR ITW) x 1-3/4" EMBED (3192psi MIN CONC) | 35 | 18.0" | 18.0" |
| | | 40 | 18.0" | 17.1" |
| | | 45 | 18.0" | 15.2" |
| | | 50 | 17.6" | 13.7" |
| | | 57 | 15.4" | 12.0" |

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Anchor Spacing Calculations

| | | | |
|--------|------|-------|-------|
| [1] | WLRt | 2.468 | 0 |
| [1] | WLRv | 0 | 2.468 |
| [lb] | Vv | 251.7 | 251.7 |

5.33' 6.83'

Max Tested Spacing 18.0 [in]

| HOST STRUCT. | ANCHOR | LOAD (psf) | Spans Up To 5'-4" | Spans Up To 6'-10" |
|--------------|-------------------------------------------------------------|------------|-------------------|--------------------|
| WOOD | 1/4" TAPCON (ELCO OR ITW) x 1-3/4" EMBED (3192psi MIN CONC) | 35 | 18.0" | 15.7" |
| | | 40 | 17.6" | 13.7" |
| | | 45 | 15.6" | 12.2" |
| | | 50 | 14.0" | 11.0" |
| | | 57 | 12.3" | 9.6" |

System
 Vmax 194.8 [lb]

Anchor Capacities
 Tcap Vcap
 156.0 lb 130.01 lb

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CUT-THREAD / ROLLED-THREAD WOOD SCREW CAPACITY PER 1991 NDS

(Same Equations Specified in 1997 NDS)

Anchor: 1/4" Tapcon to Southern Pine

$D = 0.25"$ Anchor Diameter (Nominal)
 $P = 1.75"$ Thread Penetration (See Appendix L if Lag Screw used)

$G = 0.55$ Main Member Specific Gravity (0.55 for Southern Pine)
 $F_{em} = 5550$ psi Main Member Dowel Bearing Strength (Per NDS Table 11a)
 $F_{es} = 45.0$ ksi Side Member Bearing Stress (Grade 33 Sheet Steel, per ASTM A653)
 $R_e = 0.123 = F_{em}/F_{es}$
 $F_{yb} = 92.0$ ksi SAE Grade 5 Steel Screw Bending Yield Stress (Per AAMA Table 24)
 $t_s = 0.1345"$ Side Member Thickness (Metal Plate Fastened to Wood)

$W = 208$ lb Withdrawal Design Value (NDS Table 11.2A)

$k = 7.889$ $k = -1 + \sqrt{\frac{2 \cdot (1 + R_e)}{R_e} + \frac{F_{yb} \cdot (2 + R_e) \cdot D^2}{2 \cdot F_{em} \cdot t_s^2}}$

$kd = 3$ $kd = \begin{cases} 2.2 & (D \leq 0.17") \\ 10 \cdot D + 0.5 & (0.17 < D < 0.25") \\ 3.0 & (D \geq 0.25") \end{cases}$ (NDS Sec 11.3.1)

$Z_{III} = 231.1$ lb $Z_{III} = \frac{k \cdot D \cdot t_s \cdot F_{em}}{k_d \cdot (2 + R_e)}$ Yield Mode III (NDS Eq. 11.3-2)

$Z_{IV} = 339.2$ lb $Z_{IV} = \frac{D^2}{k_d} \cdot \sqrt{\frac{1.75 \cdot F_{em} \cdot F_{yb}}{3 \cdot (1 + R_e)}}$ Yield Mode IV (NDS Eq. 11.3-3)

Adjustment Factors:

$CD = 1.0$ Short Duration Load Factor (May use 1.333 for Wind Loads)
 $CM = 0.75$ Wet Service Factor, = 1.0 (Dry in Service), = 0.75 (Exposed to Weather)
 $Ct = 1.0$ Temperature Factor, = 1.0 ($T \leq 100$ degF), = 0.8 (100-125), = 0.7 (125-150)
 $Cd = 1.0$ $C_d = P/7D$ Penetration Depth Factor (NDS Eq. 11.3.4)
 $ED = 0.75"$ Edge Distance
 $ED_{min} = 1.0"$ $ED_{min} = 4 \cdot D$ Minimum Edge Distance
 $C_e = 0.75$ $C_e = ED/ED_{min}$ Edge Distance Factor

| | |
|-----------------------|---------------------------------------------------------------------------------------------------------|
| Z* = 130.01 lb | Lateral (Shear) Design Capacity (= min of Z _{III} or Z _{IV} times adjustment factors) |
| W* = 156.0 lb | Withdrawal (Tensile) Design Capacity (= W times adjustment factors) |