

**SWARTZ**  
CONSULTING ENGINEERS LLC

|                 |                                       |
|-----------------|---------------------------------------|
| Project Number: | SCE 26-02029                          |
| Project Name:   | V-4500) Vinyl Single Hung Side Load 3 |
| Date:           | 2/20/2026                             |
| Page:           | 1 of 15                               |

## Product Approval Supporting Calculations Alternative Anchorage Analysis & Design

**Project Number:** SCE 26-02029

**Drawing Number:** D011889

**Reference Test Report:** SJW2011-082

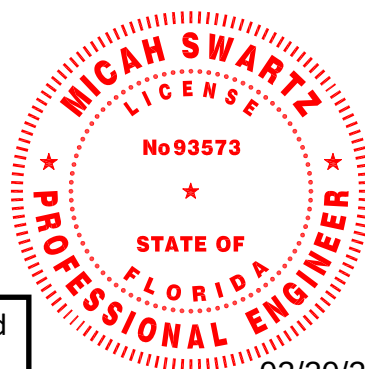
**Product Name:** Premium (V-4500) Vinyl Single Hung Side Load 3 Wide XXX 120 x 84

**Impact:** No

**Design Pressure:** +35 psf / -35 psf

**Prepared for:**

Jeld-Wen Windows & Doors  
3737 Lakeport Blvd.  
Klamath Falls, OR



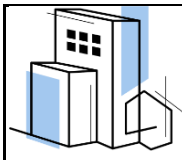
02/20/26

Prepared by:  
Swartz Consulting Engineers LLC

Micah Swartz, PE  
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Florida Registry No. 38420

This item has been digitally signed and sealed by Micah Swartz, P.E. on the date adjacent to the seal.

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**Scope:**

Swartz Consulting Engineers LLC is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Premium (V-4500) Vinyl Single Hung Side Load 3 Wide XXX 120 x 84. This evaluation is based on testing observed by National Certified Testing Laboratories in Klamath Falls, OR, test report no.: SJW2011-082 and dated 08/03/11.

This evaluation does not include the air infiltration, water resistance or water penetration of the installation method or the installed product. In addition, the design of the building substrate to resist the superimposed loads is by others.

**Reference Standards:**

*Current edition of the Florida Building Code, Building*

*ANSI/AWC NDS - National Design Specification (NDS) for Wood Construction*

*AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members*

*ICC-ES Report ESR-1976 ITW Buildex TEKS Self-Drilling Fasteners*

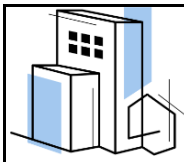
*ICC-ES Report ESR-2196 Hilti Self Drilling Screws to connect cold-formed steel*

*NOA 24-0102.06 Tapcon Concrete and Masonry Anchors with Advanced Threadform Technology*

**Certification of Independence:**

In accordance with Rule 61G20-3 Florida Administrative Code, Swartz Consulting Engineers LLC hereby certifies the following:

- (1) Swartz Consulting Engineers LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested or labeled by the agency.
- (2) Swartz Consulting Engineers LLC is not owned, operated or controlled by any company manufacturing or distributing products it tests or labels.
- (3) Micah Swartz, P.E. does not have, nor will acquire, a financial interest in any company manufacturing or distributing products for which the reports are being issued.
- (4) Micah Swartz, P.E. does not have, nor will acquire, a financial interest in any other entity involved in the approval process of the product.



**Design Summary:**

The table below summarizes the product: Premium (V-4500) Vinyl Single Hung Side Load 3 Wide XXX 120 x 84 and their corresponding performance levels as established by testing.

**Table 1:** Summary of Test Results

| Series/Model                                                              | Test Report Number     | Size<br>(W x H) | Performance          |
|---------------------------------------------------------------------------|------------------------|-----------------|----------------------|
| Premium (V-4500)<br>Vinyl Single Hung<br>Side Load 3 Wide<br>XXX 120 x 84 | SJW2011-082 (08/03/11) | 120 x 84        | +35 psf / -35<br>psf |

**As Tested Design:**

Applied Load (psf): 35 psf Width: 120 in Height: 84 in  
Max ULD (along head): 123 plf

**Screw Information:**

Screw Size: 8 Screw Embed: 1 in Edge Distance: 3/4 in (minimum)  
qty: 1 Spacing: 8 in O.C. (Nail Fin)

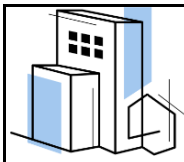
Wood Screw Withdrawal: 131 lbs Per ft. Capacity: 197 plf Unity: 0.62

**Alternative Fasteners:**

**Screw Information:**

Screw Size: 8 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)  
qty: 1 Spacing: 8 in O.C. (Nail Fin)  
qty: 1 Spacing: 9 in O.C. (Thru Frame)

Wood Screw Withdrawal: 197 lbs Per ft. Capacity: 295 plf Unity: 0.41  
Wood Screw Lateral: 106 lbs Per ft. Capacity: 141 plf Unity: 0.87



**Design Summary Continued:**

**Nail Information:**

Nail Size: 6d Nail Type: Common Edge Distance: 3/4 in (minimum)  
qty: 1 Spacing: 4 in O.C. (Nail Fin)  
qty: 2 Spacing: 9 in O.C. (Strap)

|                  |         |                   |         |        |      |
|------------------|---------|-------------------|---------|--------|------|
| Nail Withdrawal: | 55 lbs  | Per ft. Capacity: | 166 plf | Unity: | 0.74 |
| Nail Lateral:    | 113 lbs | Per ft. Capacity: | 302 plf | Unity: | 0.41 |

**TEK Screw Information:**

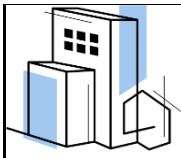
Screw Size: 10-16 qty: 1 Spacing: 9 in O.C. (Thru Frame)  
qty: 1 Spacing: 8 in O.C. (Nail Fin)

|                 |         |                   |         |        |      |
|-----------------|---------|-------------------|---------|--------|------|
| TEK Withdrawal: | 145 lbs | Per ft. Capacity: | 218 plf | Unity: | 0.56 |
| TEK Lateral:    | 147 lbs | Per ft. Capacity: | 196 plf | Unity: | 0.62 |

**Tapcon Information:**

Tapcon Size: 3/16 Embedment: 1-1/4 in (minimum) Edge Distance: 2-1/2 in (minimum)  
qty: 1 Spacing: 9 in O.C.

|                            |         |                   |         |        |      |
|----------------------------|---------|-------------------|---------|--------|------|
| Tapcon Lateral (Concrete): | 155 lbs | Per ft. Capacity: | 206 plf | Unity: | 0.59 |
| Tapcon Lateral (CMU):      | 135 lbs | Per ft. Capacity: | 180 plf | Unity: | 0.68 |



**Subject:** As Tested - Wood Screw Withdrawal

Input:

Calculation:

**Screw Information:**

Screw Size: 8

Root Diameter: 0.131 in

Screw Embed: 1 in

Main Member Type: S-P-F

G: 0.42

F<sub>em</sub>: 3,350 psi

$$W' = W * C_D * C_M^2 * C_t - \text{As per table 11.3.1 NDS}$$

C<sub>D</sub>: 1.6 Load Duration Factor - Table 2.3.2 (NDS)

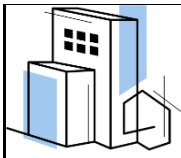
C<sub>M</sub>: 1.0 Wet Service Factor - Table 11.3.3 (NDS)

C<sub>t</sub>: 1.0 Temperature Factor - Table 11.3.4 (NDS)

W: 82 lbs/in - Table 12.2B (NDS)

W: 82 lbs

W': 131 lbs



**Subject:** Wood Screw Withdrawal

Input:

Calculation:

**Screw Information:**

Screw Size: 8

Root Diameter: 0.131 in

Screw Embed: 1.5 in

Main Member Type: S-P-F

G: 0.42

F<sub>em</sub>: 3,350 psi

$$W' = W * C_D * C_M^2 * C_t - \text{As per table 11.3.1 NDS}$$

C<sub>D</sub>: 1.6 Load Duration Factor - Table 2.3.2 (NDS)

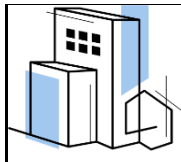
C<sub>M</sub>: 1.0 Wet Service Factor - Table 11.3.3 (NDS)

C<sub>t</sub>: 1.0 Temperature Factor - Table 11.3.4 (NDS)

W: 82 lbs/in - Table 12.2B (NDS)

W: 123 lbs

W': 197 lbs



**Subject:** Wood Screw Lateral Design - Single Shear

Input:   
Calculation:

**Screw Information:**

Screw Size:  Root Diameter:  in  
Screw Embed:  in

Main Member Type:  G:   $F_{em}$ :  psi thickness ( $t_m$ ):  in

Side Member Type:  G:   $F_{es}$ :  psi thickness ( $t_s$ ):  in

**Lateral Design Factors - Table 12.3.1A (NDS)**

|            |                                        |                                      |
|------------|----------------------------------------|--------------------------------------|
| D:         | <input type="text" value="0.131"/> in  | Diameter                             |
| $F_{yb}$ : | <input type="text" value="100"/> ksi   | Dowel Bending Yield Strength         |
| $F_{em}$ : | <input type="text" value="3,350"/> psi | Main Member dowel bearing strength   |
| $F_{es}$ : | <input type="text" value="3,350"/> psi | Side Member dowel bearing strength   |
| $l_m$ :    | <input type="text" value="1.5"/> in    | Main Member dowel bearing length     |
| $l_s$ :    | <input type="text" value="1.25"/> in   | Side Member dowel bearing length     |
| $R_d$ :    | <input type="text" value="2.2"/>       | Reduction term - Table 12.3.1B (NDS) |
| $R_e$ :    | <input type="text" value="1"/>         | $= F_{em}/F_{es}$                    |
| $R_t$ :    | <input type="text" value="1.2"/>       | $= l_m/l_s$                          |
| $k_1$ :    | <input type="text" value="0.459"/>     | See Table                            |
| $k_2$ :    | <input type="text" value="1.111"/>     | See Table                            |

**Reference Lateral Design Values - Table 12.3.1A (NDS)**

$Z_{Im}$ :  lbs  $Z_{Im} = \frac{D l_m F_{em}}{R_d}$  (EQ 12.3 - 1)

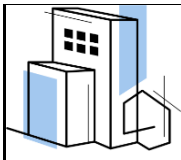
$Z_{II}$ :  lbs  $Z_{II} = \frac{k_1 D l_s F_{es}}{R_d}$  (EQ 12.3 - 3)

$Z_{III_m}$ :  lbs  $Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d}$  (EQ 12.3 - 4)

$Z_{IV}$ :  lbs  $Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}}$  (EQ 12.3 - 6)

$Z_{MIN}$ :  lbs

Note: Side member is part of the Jeld-Wen assembly and verified during testing. Modes  $Z_{Is}$  and  $Z_{IIIs}$  are not applicable to the calculation.



**Subject:** Wood Screw Lateral Design - Single Shear Cont.

### Adjusted Lateral Design Values

$$Z' = Z * C_D * C_M * C_t * C_g * C_{\Delta} - \text{As per table 11.3.1 NDS}$$

|                |     |                                            |
|----------------|-----|--------------------------------------------|
| $C_D$ :        | 1.6 | Load Duration Factor - Table 2.3.2 (NDS)   |
| $C_M$ :        | 1.0 | Wet Service Factor - Table 11.3.3 (NDS)    |
| $C_t$ :        | 1.0 | Temperature Factor - Table 11.3.4 (NDS)    |
| $C_g$ :        | 1.0 | Group Action Factor - Section 11.3.6 (NDS) |
| $C_{\Delta}$ : | 1.0 | Geometry Factor - Section 12.5.1.1 (NDS)   |

$$Z': \boxed{132} \text{ lbs}$$

### Fastener Bending Across Shim Space

|            |       |                                  |
|------------|-------|----------------------------------|
| $\Omega$ : | 1.67  |                                  |
| L:         | 0.25  | in Maximum Shim Gap              |
| D:         | 0.131 | in Diameter                      |
| $F_{yb}$ : | 100   | ksi Dowel Bending Yield Strength |

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb} \pi D^3}{16 \Omega L}$$

$$\text{Where } M = \frac{ZL}{2} \text{ (Guided Bending)}$$

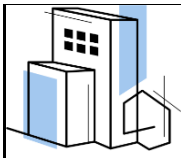
$$Z_n/\Omega: \boxed{106} \text{ lbs}$$

### Bearing on Masonry Strap

|            |       |                               |
|------------|-------|-------------------------------|
| $\Omega$ : | 3.00  |                               |
| $F_u$ :    | 33    | ksi Tensile Strength of strap |
| t:         | 20    | GA                            |
| t:         | 0.036 | in thickness of strap         |
| D:         | 0.131 | in                            |

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u - (EQ. J4.3.1 - 4, AISI S100)$$

$$P_{nv}/\Omega: \boxed{140} \text{ lbs}$$



Subject: Nail Withdrawal

Input:   
Calculation:

**Nail Information:**

Nail Size: 6d Nail Length: 2 in  
Nail Type: Common Nail Diameter: 0.113 in Nail Embedment: 1.94 in

Main Member Type: S-P-F G: 0.42  $F_{em}$ : 3,350 psi thickness ( $t_m$ ): 1.5 in

Side Member Type: Alum G: N/A  $F_{es}$ : 13,750 psi thickness ( $t_s$ ): 0.0625 in

$$W' = W * C_D * C_M^2 * C_t - \text{As per table 11.3.1 NDS}$$

$C_D$ : 1.6 Load Duration Factor - Table 2.3.2 (NDS)

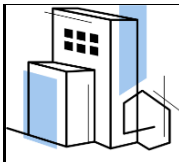
$C_M$ : 1.0 Wet Service Factor - Table 11.3.3 (NDS)

$C_t$ : 1.0 Temperature Factor - Table 11.3.4 (NDS)

$W$ : 18 lbs/in  $W = 1380G^{5/2}D$  - Carbon Steel Nails (EQ. 12.2 - 3, NDS)

$W$ : 35 lbs

$W'$ : 55 lbs



**Subject:** Nail Lateral Design - Single Shear

Input:   
Calculation:

**Nail Information:**

Nail Size:  Nail Length:  in  
Nail Type:  Nail Diameter:  in Nail Embedment:  in

Main Member Type:  G:   $F_{em}$ :  psi thickness ( $t_m$ ):  in

Side Member Type:  G:   $F_{es}$ :  psi thickness ( $t_s$ ):  in

**Lateral Design Factors - Table 12.3.1A (NDS)**

|            |                                         |                                      |
|------------|-----------------------------------------|--------------------------------------|
| D:         | <input type="text" value="0.113"/> in   | Diameter                             |
| $F_{yb}$ : | <input type="text" value="100"/> ksi    | Dowel Bending Yield Strength         |
| $F_{em}$ : | <input type="text" value="3,350"/> psi  | Main Member dowel bearing strength   |
| $F_{es}$ : | <input type="text" value="21,000"/> psi | Side Member dowel bearing strength   |
| $l_m$ :    | <input type="text" value="1.6875"/> in  | Main Member dowel bearing length     |
| $l_s$ :    | <input type="text" value="0.0625"/> in  | Side Member dowel bearing length     |
| $R_d$ :    | <input type="text" value="2.2"/>        | Reduction term - Table 12.3.1B (NDS) |
| $R_e$ :    | <input type="text" value="0.1595"/>     | $= F_{em}/F_{es}$                    |
| $R_t$ :    | <input type="text" value="27.0"/>       | $= l_m/l_s$                          |
| $k_1$ :    | <input type="text" value="1.713"/>      | See Table                            |
| $k_2$ :    | <input type="text" value="0.561"/>      | See Table                            |

**Reference Lateral Design Values - Table 12.3.1A (NDS)**

$Z_{Im}$ :  lbs  $Z_{Im} = \frac{D l_m F_{em}}{R_d}$  (EQ 12.3 - 1)

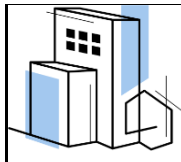
$Z_{II}$ :  lbs  $Z_{II} = \frac{k_1 D l_s F_{es}}{R_d}$  (EQ 12.3 - 3)

$Z_{III_m}$ :  lbs  $Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d}$  (EQ 12.3 - 4)

$Z_{IV}$ :  lbs  $Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}}$  (EQ 12.3 - 6)

$Z_{MIN}$ :  lbs

Note: Side member is part of the Jeld-Wen assembly and verified during testing. Modes  $Z_{Is}$  and  $Z_{III_s}$  are not applicable to the calculation.



**Subject:** Nail Lateral Design - Single Shear Cont.

### Adjusted Lateral Design Values

$$Z' = Z * C_D * C_M * C_t * C_g * C_{\Delta} - \text{As per table 11.3.1 NDS}$$

|                |     |                                            |
|----------------|-----|--------------------------------------------|
| $C_D$ :        | 1.6 | Load Duration Factor - Table 2.3.2 (NDS)   |
| $C_M$ :        | 1.0 | Wet Service Factor - Table 11.3.3 (NDS)    |
| $C_t$ :        | 1.0 | Temperature Factor - Table 11.3.4 (NDS)    |
| $C_g$ :        | 1.0 | Group Action Factor - Section 11.3.6 (NDS) |
| $C_{\Delta}$ : | 1.0 | Geometry Factor - Section 12.5.1.1 (NDS)   |

$$Z': \boxed{129} \text{ lbs}$$

### Fastener Bending Across Shim Space

|            |       |                                  |
|------------|-------|----------------------------------|
| $\Omega$ : | 1.67  |                                  |
| L:         | 0.25  | in Maximum Shim Gap              |
| D:         | 0.113 | in Diameter                      |
| $F_{yb}$ : | 100   | ksi Dowel Bending Yield Strength |

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb} \pi D^3}{16 \Omega L}$$

$$\text{Where } M = \frac{ZL}{2} \text{ (Guided Bending)}$$

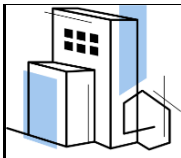
$$Z_n/\Omega: \boxed{113} \text{ lbs}$$

### Bearing on Masonry Strap

|            |       |                               |
|------------|-------|-------------------------------|
| $\Omega$ : | 3.00  |                               |
| $F_u$ :    | 33    | ksi Tensile Strength of strap |
| t:         | 20    | GA                            |
| t:         | 0.036 | in thickness of strap         |
| D:         | 0.113 | in                            |

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u - (EQ. J4.3.1 - 4, AISI S100)$$

$$P_{nv}/\Omega: \boxed{120} \text{ lbs}$$



Subject: TEK Withdrawal

Input:   
Calculation:

**Shear Strength of Fastener - ESR 1976**

Screw Size: 10-16

$P_{nv}/\Omega$ : 885 lbs See ESR 2196

**Tensile Pullout - ESR 1976**

Screw Size: 10-16

$F_u$ : 45 ksi

t: 16 GA

t: 0.0598 in

Tensile Strength of material NOT in contact with screw head

Thickness of material NOT in contact with screw head

$P_{nv}/\Omega$ : 145 lbs See ESR 2196

**Tensile Pullover**

Note: The tensile pullover analysis checks the material IN contact with the screw head. This material is part of the Jeld-Wen assembly and has been verified by testing. Below is a check to ensure the head size of the TEK screw is equal to or larger than the head of the tested fastener, ensuring compliance.

*Tested Fastener Head Size:*

Screw Size: 8

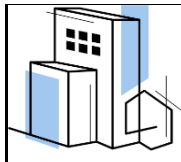
Head Size: 0.312 in

Tested fastener is a

*TEK Screw Head Size:*

Screw Size: 10-16

Head Size: 0.365 in



Subject: TEK Lateral Design

Input:   
Calculation:

### Shear Strength of Fastener - ESR 1976

Screw Size: 10-16

$P_{nv}/\Omega$ : 573 lbs See ESR 2196

### Bearing Strength of Material NOT in Contact with Screw Head - AISI S100

Screw Size: 10-16

$\Omega$ : 3.00

D: 0.138 in Root Diameter of TEK Screw  
 $F_u$ : 45 ksi Tensile Strength of material NOT in contact with screw head  
t: 18 GA  
t: 0.0478 in Thickness of material NOT in contact with screw head

$$\frac{P_{nv1}}{\Omega} = 2.7 * t * D * F_u - (EQ.J4.3.1 - 3, AISI S100)$$

$$\frac{P_{nv2}}{\Omega} = 4.2 \sqrt{t^3 * D * F_u} - (EQ.J4.3.1 - 1, AISI S100)$$

$P_{nv1}/\Omega$ : 267 lbs

$P_{nv2}/\Omega$ : 245 lbs

$P_{nv}/\Omega$ : 245 lbs  $\frac{P_{nv}}{\Omega} = \text{smallest of } \frac{P_{nv1}}{\Omega} \text{ and } \frac{P_{nv2}}{\Omega}$

### Bearing Strength of Material IN in Contact with Screw Head

Note: Material IN contact with the screw head is part of the Jeld-Wen assembly and has been verified by testing.

### Fastener Bending Across Shim Space

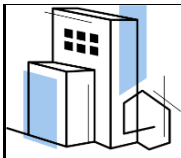
L: 0.25 in Maximum Shim Gap  
D: 0.138 in Root Diameter of TEK Screw  
 $F_{yb}$ : 100 ksi Yield Strength of TEK Screw

$\Omega$ : 3.00

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16P_n L}{\pi D^3} \Leftrightarrow P_n = \frac{F_{yb} \pi D^3}{16 \Omega L}$$

Where  $M = \frac{P_n L}{2}$  (Guided Bending)

$P_n/\Omega$ : 206 lbs



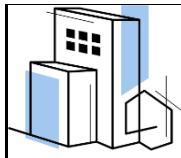
### Bearing Strength of Masonry Straps - AISI S100

Screw Size: **10-16** TEK Screw  
D: **0.138** in Root Diameter of TEK Screw  
F<sub>u</sub>: **33** ksi Tensile Strength of Masonry Strap  
t: **20** GA  
t: **0.0359** in Thickness of Masonry Strap

Ω: **3.00**

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u - (EQ.J4.3.1 - 3, AISI S100)$$

P<sub>nv</sub>/Ω: **147** lbs



Subject: Tapcon Lateral Design

Input:   
Calculation:

**Tapcon Size:**

Size:   
D:  in Nominal Diameter  
D<sub>sh</sub>:  in Shank Diameter

**Fastener Shear Capacity - 3,000 psi Concrete**

P<sub>nv</sub>/Ω:  lbs See Table 1B of NOA 24-0102.06

**Fastener Shear Capacity - Medium-Weight CMU**

P<sub>nv</sub>/Ω:  lbs See Table 3 of NOA 24-0102.06

**Note:**

- Critical anchor spacing is 16D
- Minimum Anchor Embedment is 1-1/4"
- Minimum Edge Distance is 2-1/4"

**Fastener Bending Across Shim Space**

L:  in Maximum Shim Gap  
D<sub>sh</sub>:  in Shank Diameter of Tapcon  
F<sub>yb</sub>:  ksi Yield Strength of Tapcon

Ω:

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16P_n L}{\pi D^3} \Leftrightarrow P_n = \frac{F_{yb} \pi D^3}{16 \Omega L}$$

Where  $M = \frac{P_n L}{2}$  (Guided Bending)

P<sub>n</sub>/Ω:  lbs

**Bearing Strength of Masonry Straps - AISI S100**

Size:  Tapcon Size  
D<sub>sh</sub>:  in Shank Diameter of Tapcon Screw  
F<sub>u</sub>:  ksi Tensile Strength of Masonry Strap  
t:  GA  
t:  in Thickness of Masonry Strap

Ω:

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u - (EQ.J4.3.1 - 3, AISI S100)$$

P<sub>nv</sub>/Ω:  lbs