

SWARTZ
CONSULTING ENGINEERS LLC

Project Number:	SCE 25-11008
Project Name:	im (V-4500) Vinyl Sliding Door Multi S
Date:	11/5/2025
Page:	1 of 18

Product Approval Supporting Calculations Alternative Anchorage Analysis & Design

Project Number: SCE 25-11008

Drawing Number: D014684

Reference Test Report: 210-4150-01

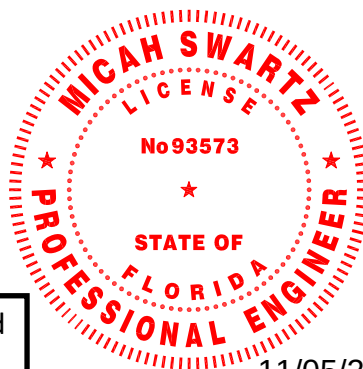
Product Name: Premium (V-4500) Vinyl Sliding Door Multi Slide XX 72 x 80

Impact: No

Design Pressure: +65 psf / -70 psf

Prepared for:

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

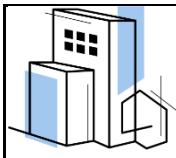


Prepared by:
Swartz Consulting Engineers LLC


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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 Sliding Door Multi Slide XX 72 x 80. This evaluation is based on testing observed by National Certified Testing Laboratories in Klamath Falls, OR, test report no's.: 210-4150-01 and dated 07/09/19.

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.
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- (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 Sliding Door Multi Slide XX 72 x 80 and their corresponding performance levels as established by testing.

Table 1: Summary of Test Results

Series/Model	Test Report Number	Size (W x H)	Performance
Premium (V-4500) Vinyl Sliding Door Multi Slide XX 72 x 80	210-4150-01 (07/09/19)	72 x 80	+65 psf / -70 psf

As Tested Design:

Screw Information:

Screw Size: 10 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 228 lbs

Wood Screw Lateral: 149 lbs * Controls Design

Alternative Fasteners:

Screw Information:

Screw Size: 10 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 228 lbs

Wood Screw Lateral: 149 lbs

Nail Information:

Nail Size: 6d Nail Type: Common Edge Distance: 3/4 in (minimum)

Nail Withdrawal: 55 lbs Spacing: 6 in Jamb Capacity: 121 plf

Nail Lateral: 113 lbs



SWARTZ
CONSULTING ENGINEERS LLC

Project Number: SCE 25-11008
Project Name: im (V-4500) Vinyl Sliding Door Multi S
Date: 11/5/2025 Page: 4 of 18

Design Summary Continued:

TEK Screw Information:

Screw Size: 10-16

TEK Withdrawal: 145 lbs

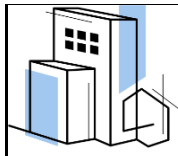
TEK Lateral: 147 lbs

Tapcon Information:

Tapcon Size: 1/4 Embedment: 1-1/4 in (minimum) Edge Distance: 2-1/2 in (minimum)

Tapcon Lateral (Concrete): 203 lbs

Tapcon Lateral (CMU): 161 lbs

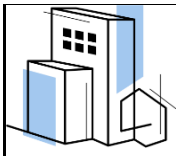


Summary of Test Results - Plastics Checklist

Table 2: Summary of Test Results - Plastics Checklist

Product	Test Report Number	Test Standard	Performance
White PVC 1476 5110	P6504.04-106-18 R0	ASTM D638 (before and after G155)	+9.5%
		ASTM D1929	824 °F (440 °C)
		ASTM D2843	71.8
		ASTM D635	Classification CC1
		ASTM 256	-3.3%
White PVC 1476 5290	P6504.04-106-18 R0	ASTM D638 (before and after G155)	+9.5%
		ASTM D1929	806 °F (430 °C)
		ASTM D2843	72.6
		ASTM D635	Classification CC1
		ASTM 256	-35.5%

The testing summarized in the table above was conducted by Intertek in York, PA dated 08/23/23 and meets the requirements listed in Miami-Dade County Checklist #0445, For the approval of: Plastic and Foam Plastic.



Subject: As Tested - Wood Screw Withdrawal

Input:
Calculation:

Screw Information:

Screw Size: Root Diameter: in
Screw Embed: in

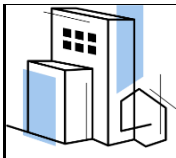
Main Member Type: G: F_{em}: psi

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

C_D: Load Duration Factor - Table 2.3.2 (NDS)
C_M: Wet Service Factor - Table 11.3.3 (NDS)
C_t: Temperature Factor - Table 11.3.4 (NDS)

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

W': lbs



Subject: As Tested - Wood Screw Lateral Design - Single Shear

Input:

Calculation:

Screw Information:

Screw Size: 10

Root Diameter: 0.152 in

Screw Embed: 1.5 in

Main Member Type: S-P-F

G: 0.42

F_{em}: 3,350 psi thickness (t_m): 1.5 in

Side Member Type: S-P-F

G: 0.42

F_{es}: 3,350 psi thickness (t_s): 1 in

Lateral Design Factors - Table 12.3.1A (NDS)

D:	<u>0.152</u>	in	Diameter
F _{yb} :	<u>90</u>	ksi	Dowel Bending Yield Strength
F _{em} :	<u>3,350</u>	psi	Main Member dowel bearing strength
F _{es} :	<u>3,350</u>	psi	Side Member dowel bearing strength
l _m :	<u>1.5</u>	in	Main Member dowel bearing length
l _s :	<u>1</u>	in	Side Member dowel bearing length
R _d :	<u>2.2</u>		Reduction term - Table 12.3.1B (NDS)
R _e :	<u>1</u>		= F _{em} /F _{es}
R _t :	<u>1.5</u>		= l _m /l _s
k ₁ :	<u>0.535</u>		See Table
k ₂ :	<u>1.133</u>		See Table

Reference Lateral Design Values - Table 12.3.1A (NDS)

$$Z_{Im}: \quad \boxed{347} \text{ lbs} \quad Z_{Im} = \frac{D l_m F_{em}}{R_d} \text{ (EQ 12.3 - 1)}$$

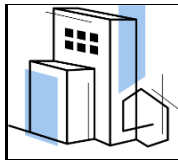
$$Z_{II}: \quad \boxed{124} \text{ lbs} \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

$$Z_{III}: \quad \boxed{131} \text{ lbs} \quad Z_{III} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

$$Z_{IV}: \quad \boxed{105} \text{ lbs} \quad Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}} \text{ (EQ 12.3 - 6)}$$

$$Z_{MIN}: \quad \boxed{105} \text{ lbs}$$

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: As Tested - 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_{Δ} :	1.0	Geometry Factor - Section 12.5.1.1 (NDS)

$$Z': \boxed{168} \text{ lbs}$$

Fastener Bending Across Shim Space

Ω :	1.67	
L:	0.25	in Maximum Shim Gap
D:	0.152	in Diameter
F_{yb} :	90	ksi Dowel Bending Yield Strength

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb} \pi D^3}{16 \Omega L} \quad \text{Where } M = \frac{ZL}{2} \text{ (Guided Bending)}$$

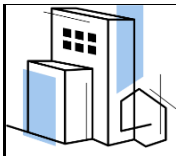
$$Z_n/\Omega: \boxed{149} \text{ lbs}$$

Bearing on Masonry Strap

Ω :	3.00	
F_u :	33	ksi Tensile Strength of strap
t:	20	GA
t:	0.036	in thickness of strap
D:	0.152	in

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

$$P_{nv}/\Omega: \boxed{162} \text{ lbs}$$



Subject: Wood Screw Withdrawal

Input:
Calculation:

Screw Information:

Screw Size: Root Diameter: in
Screw Embed: in

Main Member Type: G: F_{em}: psi

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

C_D: Load Duration Factor - Table 2.3.2 (NDS)

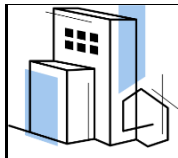
C_M: Wet Service Factor - Table 11.3.3 (NDS)

C_t: Temperature Factor - Table 11.3.4 (NDS)

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

W: lbs

W': 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:	0.152 in	Diameter
F_{yb} :	90 ksi	Dowel Bending Yield Strength
F_{em} :	3,350 psi	Main Member dowel bearing strength
F_{es} :	3,350 psi	Side Member dowel bearing strength
l_m :	1.5 in	Main Member dowel bearing length
l_s :	1 in	Side Member dowel bearing length
R_d :	2.2	Reduction term - Table 12.3.1B (NDS)
R_e :	1	$= F_{em}/F_{es}$
R_t :	1.5	$= l_m/l_s$
k_1 :	0.535	See Table
k_2 :	1.133	See Table

Reference Lateral Design Values - Table 12.3.1A (NDS)

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

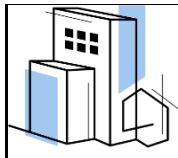
$$Z_{II}: \text{ lbs } \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

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

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

$$Z_{MIN}: \text{ lbs }$$

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_{Δ} :	1.0	Geometry Factor - Section 12.5.1.1 (NDS)

$$Z': 168 \text{ lbs}$$

Fastener Bending Across Shim Space

Ω :	1.67	
L:	0.25	in Maximum Shim Gap
D:	0.152	in Diameter
F_{yb} :	90	ksi Dowel Bending Yield Strength

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb} \pi D^3}{16 \Omega L} \quad \text{Where } M = \frac{ZL}{2} \text{ (Guided Bending)}$$

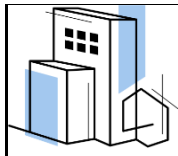
$$Z_n/\Omega: 149 \text{ lbs}$$

Bearing on Masonry Strap

Ω :	3.00	
F_u :	33	ksi Tensile Strength of strap
t:	20	GA
t:	0.036	in thickness of strap
D:	0.152	in

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

$$P_{nv}/\Omega: 162 \text{ lbs}$$



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)

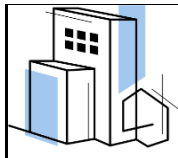
C_t: 1.0 Temperature Factor - Table 11.3.4 (NDS)

W: 18 lbs/in

W: 35 lbs

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

W': 55 lbs



Subject: Nail Lateral Design - Single Shear

Input:

Calculation:

Nail Information:

Nail Size: 6d

Nail Length: 2 in

Nail Type: Common

Nail Diameter: 0.113 in

Nail Embedment: 1.69 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}: 21,000 psi thickness (t_s): 0.0625 in

Lateral Design Factors - Table 12.3.1A (NDS)

D:	0.113	in	Diameter
F _{yb} :	100	ksi	Dowel Bending Yield Strength
F _{em} :	3,350	psi	Main Member dowel bearing strength
F _{es} :	21,000	psi	Side Member dowel bearing strength
l _m :	1.6875	in	Main Member dowel bearing length
l _s :	0.0625	in	Side Member dowel bearing length
R _d :	2.2		Reduction term - Table 12.3.1B (NDS)
R _e :	0.1595		= F _{em} /F _{es}
R _t :	27.0		= l _m /l _s
k ₁ :	1.713		See Table
k ₂ :	0.561		See Table

Reference Lateral Design Values - Table 12.3.1A (NDS)

$$Z_{Im}: 290 \text{ lbs} \quad Z_{Im} = \frac{D l_m F_{em}}{R_d} \text{ (EQ 12.3 - 1)}$$

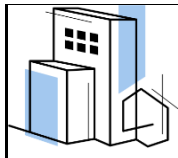
$$Z_{II}: 116 \text{ lbs} \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

$$Z_{III}: 123 \text{ lbs} \quad Z_{III} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

$$Z_{IV}: 81 \text{ lbs} \quad Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}} \text{ (EQ 12.3 - 6)}$$

$$Z_{MIN}: 81 \text{ lbs}$$

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: 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_{Δ} :	1.0	Geometry Factor - Section 12.5.1.1 (NDS)

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

Fastener Bending Across Shim Space

Ω :	1.67	
L:	0.25	in Maximum Shim Gap
D:	0.113	in Diameter
F_{yb} :	100	ksi Dowel Bending Yield Strength

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

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

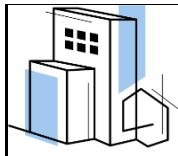
$$Z_n/\Omega: 113 \text{ lbs}$$

Bearing on Masonry Strap

Ω :	3.00	
F_u :	33	ksi Tensile Strength of strap
t:	20	GA
t:	0.036	in thickness of strap
D:	0.113	in

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

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



Subject: TEK Withdrawal

Input:
Calculation:

Shear Strength of Fastener - ESR 1976

Screw Size: 10-16

P_{nv}/Ω : 885 lbs See ESR 2196

Tensile Pullout - ESR 1976

Screw Size: 10-16

F_u : 45 ksi Tensile Strength of material NOT in contact with screw head

t: 16 GA

t: 0.0598 in Thickness of material NOT in contact with screw head

P_{nv}/Ω : 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

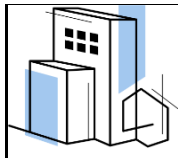
Head Size: 0.312 in

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}/Ω : 573 lbs See ESR 2196

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

Screw Size: 10-16

Ω : 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}/Ω : 267 lbs

P_{nv2}/Ω : 245 lbs

P_{nv}/Ω : 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

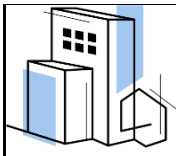
L: 0.25 in Maximum Shim Gap
D: 0.138 in Root Diameter of TEK Screw
 F_{yb} : 100 ksi Yield Strength of TEK Screw

Ω : 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/Ω : 206 lbs



Bearing Strength of Masonry Straps - AISI S100

Screw Size: 10-16

TEK Screw

Ω : 3.00

D: 0.138 in

Root Diameter of TEK Screw

F_u : 33 ksi

Tensile Strength of Masonry Strap

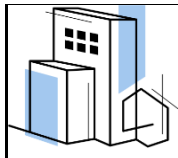
t: 20 GA

t: 0.0359 in

Thickness of Masonry Strap

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

P_{nv}/Ω : 147 lbs



Subject: Tapcon Lateral Design

Input:
Calculation:

Tapcon Size:

Size:
D: in Nominal Diameter
D_{sh}: in Shank Diameter

Fastener Shear Capacity - 3,000 psi Concrete

P_{nv}/Ω: lbs See Table 1B of NOA 24-0102.06

Fastener Shear Capacity - Medium-Weight CMU

P_{nv}/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_{sh}: in Shank Diameter of Tapcon
F_{yb}: 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_n/Ω: lbs

Bearing Strength of Masonry Straps - AISI S100

Size: Tapcon Size
D_{sh}: in Shank Diameter of Tapcon Screw
F_u: 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_{nv}/Ω: lbs