

Micah Swartz, P.E.	Project Number:	MS24-12009
	Project Name:	Premium Vinyl V-4500 - Pocket
	Date:	1/7/2025

**Product Approval Supporting Calculations
Alternative Anchorage Analysis & Design**

Project Number: MS24-12009

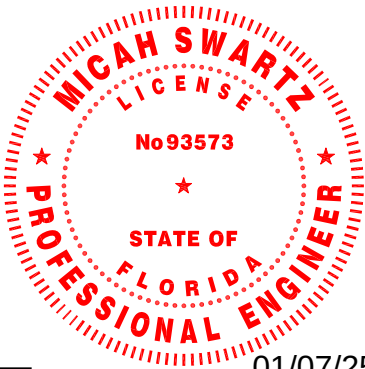
Drawing Number: D014778

Reference Test Report: NCTL-110-16-158

Product Name: V-4500 Sliding Vinyl Door 195.875" x 95.875"

Prepared for:

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



Prepared by:
Micah Swartz, P.E.

Micah Swartz

Micah Swartz, PE
Florida License No. PE 93573

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Scope:

Micah Swartz, P.E. is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: V-4500 Sliding Vinyl Door 195.875" x 95.875". This evaluation is based on testing performed by National Certified Testing Laboratories in York, PA, test report no.: NCTL-110-16-158 and dated 05/10/17.

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:

Florida Building Code, Building, 2023 Edition

ANSI/AWC NDS 2018 - National Design Specification (NDS) for Wood Construction

ANSI S100-16 (2020) 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, Micah Swartz, P.E. hereby certifies the following:

- (1) Micah Swartz, P.E. 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) Micah Swartz, P.E. 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.

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Design Summary:

The table below summarizes the product: V-4500 Sliding Vinyl Door 195.875" x 95.875" 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
V-4500 Sliding Vinyl Door 195.875" x 95.875"	NCTL-110-16-158 (05/10/17)	195.875" x 95.875"	+65 psf / -70 psf

As Tested Design:

Screw Information:

Screw Size: 8 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)

Wood Screw Lateral: 106 lbs

Alternative Fasteners:

Screw Information:

Screw Size: 8 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 197 lbs

Wood Screw Lateral: 106 lbs

TEK Screw Information:

Screw Size: 8-18

TEK Withdrawal: 125 lbs

TEK Lateral: 131 lbs

Tapcon Information:

Tapcon Size: 3/16 Embedment: 1-1/4 in (minimum) Edge Distance: 2-1/2 in (minimum)

Tapcon Lateral (Concrete): 155 lbs

Tapcon Lateral (CMU): 135 lbs

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Summary of Test Results - Plastics Checklist

Table 2: Summary of Test Results - Plastics Checklist

Product	Test Report Number	Test Standard	Performance
SMC Skin (fiberglass material)	ESP010982P	ASTM D638 (before and after G155)	-2.2% (averaged)
		ASTM D1929	770 °F (410 °C)
		ASTM D2843	62
		ASTM D635	Classification HB

The testing summarized in the table above was conducted by Element Materials Technology in St Paul, MN on 02/26/13 and meets the requirements listed in Miami-Dade County Checklist #0445, For the approval of: Plastic and Foam Plastic.

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

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_{em}: 3,350 psithickness (t_m): 1.5 in

Side Member Type: PVC

G: N/A

F_{es}: 13,750 psithickness (t_s): 0.125 in**Lateral Design Factors - Table 12.3.1A (NDS 2018)**

D:	0.131	in	Diameter
F _{yb} :	100	ksi	Dowel Bending Yield Strength
F _{em} :	3,350	psi	Main Member dowel bearing strength
F _{es} :	13,750	psi	Side Member dowel bearing strength
l _m :	1.5	in	Main Member dowel bearing length
l _s :	0.125	in	Side Member dowel bearing length
R _d :	2.2		Reduction term - Table 12.3.1B (NDS 2018)
R _e :	0.2436		= F _{em} /F _{es}
R _t :	12.0		= l _m /l _s
k ₁ :	1.135		See Table
k ₂ :	0.647		See Table

Reference Lateral Design Values - Table 12.3.1A (NDS 2018)

$$Z_{Im}: 299 \text{ lbs} \quad Z_{Im} = \frac{D l_m F_{em}}{R_d} \text{ (EQ 12.3 - 1)}$$

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

$$Z_{III_m}: 130 \text{ lbs} \quad Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

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

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

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: As Tested - Wood Screw Lateral Design - Single Shear Cont.**Adjusted Lateral Design Values**

$$Z' = Z * C_D * C_M * C_t * C_g * C_{\Delta} - \text{As per table 11.3.1 NDS 2018}$$

C_D :	1.6	Load Duration Factor - Table 2.3.2 (NDS 2018)
C_M :	1.0	Wet Service Factor - Table 11.3.3 (NDS 2018)
C_t :	1.0	Temperature Factor - Table 11.3.4 (NDS 2018)
C_g :	1.0	Group Action Factor - Section 11.3.6 (NDS 2018)
C_{Δ} :	1.0	Geometry Factor - Section 12.5.1.1 (NDS 2018)

$$Z': \boxed{167} \text{ lbs}$$

Fastener Bending Across Shim Space

Ω :	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

Ω :	3.00	
F_u :	33	ksi Tensile Strength of strap
t :	20	GA
t :	0.036	in thickness of strap
D :	0.131	in

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

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

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Subject:	Wood Screw Withdrawal	Input:	
		Calculation:	

Screw Information:	
Screw Size:	8
Screw Embed:	1.5 in
Root Diameter:	0.131 in
Main Member Type:	S-P-F
G:	0.42
F _{em} :	3,350 psi

$W' = W * C_D * C_M^2 * C_t$ – As per table 11.3.1 NDS 2018

C _D :	1.6	Load Duration Factor - Table 2.3.2 (NDS 2018)
C _M :	1.0	Wet Service Factor - Table 11.3.3 (NDS 2018)
C _t :	1.0	Temperature Factor - Table 11.3.4 (NDS 2018)

W:	82	lbs/in - Table 12.2B (NDS 2018)
W:	123	lbs

W':	197	lbs
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Subject: Wood Screw Lateral Design - Single Shear

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_{em} : 3,350 psithickness (t_m): 1.5 in

Side Member Type: PVC

G: N/A

 F_{es} : 13,750 psithickness (t_s): 0.125 in**Lateral Design Factors - Table 12.3.1A (NDS 2018)**

D:	0.131	in	Diameter
F_{yb} :	100	ksi	Dowel Bending Yield Strength
F_{em} :	3,350	psi	Main Member dowel bearing strength
F_{es} :	13,750	psi	Side Member dowel bearing strength
l_m :	1.5	in	Main Member dowel bearing length
l_s :	0.125	in	Side Member dowel bearing length
R_d :	2.2		Reduction term - Table 12.3.1B (NDS 2018)
R_e :	0.2436		$= F_{em}/F_{es}$
R_t :	12.0		$= l_m/l_s$
k_1 :	1.135		See Table
k_2 :	0.647		See Table

Reference Lateral Design Values - Table 12.3.1A (NDS 2018)

$$Z_{Im}: 299 \text{ lbs} \quad Z_{Im} = \frac{D l_m F_{em}}{R_d} \text{ (EQ 12.3 - 1)}$$

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

$$Z_{III_m}: 130 \text{ lbs} \quad Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

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

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

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: Wood Screw Lateral Design - Single Shear Cont.**Adjusted Lateral Design Values**

$$Z' = Z * C_D * C_M * C_t * C_g * C_{\Delta} - \text{As per table 11.3.1 NDS 2018}$$

C_D :	1.6	Load Duration Factor - Table 2.3.2 (NDS 2018)
C_M :	1.0	Wet Service Factor - Table 11.3.3 (NDS 2018)
C_t :	1.0	Temperature Factor - Table 11.3.4 (NDS 2018)
C_g :	1.0	Group Action Factor - Section 11.3.6 (NDS 2018)
C_{Δ} :	1.0	Geometry Factor - Section 12.5.1.1 (NDS 2018)

$$Z': \boxed{167} \text{ lbs}$$

Fastener Bending Across Shim Space

Ω :	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

Ω :	3.00	
F_u :	33	ksi Tensile Strength of strap
t :	20	GA
t :	0.036	in thickness of strap
D :	0.131	in

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

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

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Subject: TEK Withdrawal

Input:

Calculation:

Shear Strength of Fastener - ESR 2196

Screw Size: 8-18

P_{nv}/Ω : 335 lbs See ESR 2196

Tensile Pullout - ESR 2196

Screw Size: 8-18

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}/Ω : 125 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: 8-18

Head Size: 0.335 in

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Subject:

TEK Lateral Design

Input:

Calculation:

Shear Strength of Fastener - ESR 2196

Screw Size:

8-18

P_{nv}/Ω :

390

 lbs See ESR 2196

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

Screw Size:

8-18

Ω :

3.00

D:

0.123

 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 :

238

 lbs

P_{nv2}/Ω :

231

 lbs

P_{nv}/Ω :

231

 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:

0.123

 in Root Diameter of TEK Screw

F_{yb} :

100

 ksi Yield Strength of TEK Screw

Ω :

3.00

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

P_n/Ω :

146

 lbs

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Bearing Strength of Masonry Straps - AISI S100

Screw Size:	8-18	TEK Screw	Ω:	3.00
D:	0.123	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: 131 lbs

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Subject: Tapcon Lateral Design

Input:

Calculation:

Tapcon Size:

Size: 3/16

D: 0.1875 in

Nominal Diameter

D_{sh}: 0.145 in

Shank Diameter

Fastener Shear Capacity - 3,000 psi Concrete

P_{nv}/Ω: 181 lbs

See Table 1B of NOA 24-0102.06

Fastener Shear Capacity - Medium-Weight CMU

P_{nv}/Ω: 135 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: 0.25 in

Maximum Shim Gap

D_{sh}: 0.145 in

Shank Diameter of Tapcon

F_{yb}: 100 ksi

Yield Strength of Tapcon

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: 239 lbs

Bearing Strength of Masonry Straps - AISI S100

Size: 3/16

Tapcon Size

D_{sh}: 0.145 in

Shank Diameter of Tapcon Screw

F_u: 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_{nv}/Ω: 155 lbs