

Micah Swartz, P.E.	Project Number:	MS24-12008
	Project Name:	Premium Vinyl V-4500 - XX
	Date:	1/7/2025
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**Product Approval Supporting Calculations
Alternative Anchorage Analysis & Design**

Project Number: MS24-12008

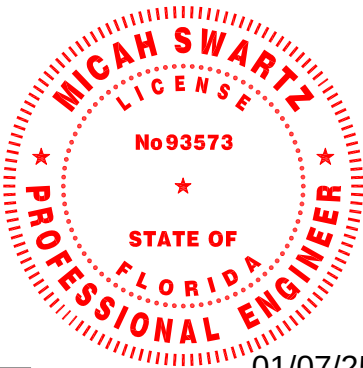
Drawing Number: D014758

Reference Test Report: NCTL-210-4150-02

Product Name: V-4500 Sliding Vinyl Door 71.75" x 79.8125"

Prepared for:

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



01/07/25

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 71.75" x 79.8125". This evaluation is based on testing performed by National Certified Testing Laboratories in Orlando, FL, test report no.: NCTL-210-4150-02 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:

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 71.75" x 79.8125" 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 71.75" x 79.8125"	NCTL-210-4150-02 (07/09/19)	71.75" x 79.8125"	+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 Lateral: 149 lbs

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

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

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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.

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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: PVC G: N/A F_{es}: 13,750 psi thickness (t_s): 0.125 in

Lateral Design Factors - Table 12.3.1A (NDS 2018)

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} :	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 :	0.662	See Table

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

Z_I: 347 lbs $Z_{Im} = \frac{D l_m F_{em}}{R_d}$ (EQ 12.3 – 1)

Z_{II}: 135 lbs $Z_{II} = \frac{k_1 D l_s F_{es}}{R_d}$ (EQ 12.3 – 3)

Z_{III}: 154 lbs $Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d}$ (EQ 12.3 – 4)

Z_{IV}: 134 lbs $Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2 F_{em} F_{yb}}{3(1 + R_e)}}$ (EQ 12.3 – 6)

Z_{MIN}: 134 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**

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

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)

$$Z': \quad 214 \text{ lbs}$$

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

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

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

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

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

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

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

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Subject:	Wood Screw Withdrawal	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

$W' = W * C_D * C_M^2 * C_t$ – 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:	95	lbs/in - Table 12.2B (NDS 2018)
W:	143	lbs

W':	228	lbs
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Subject: 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 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:	0.152	in	Diameter
F_{yb} :	90	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 :	0.662		See Table

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

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

$$Z_{II}: 135 \text{ lbs} \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

$$Z_{III_m}: 154 \text{ lbs} \quad Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

$$Z_{IV}: 134 \text{ lbs} \quad Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}} \text{ (EQ 12.3 - 6)}$$

$$Z_{MIN}: 134 \text{ lbs}$$

Note: Side member is part of the Jeld-Wen assembly and verified during testing. Modes Z_{Is} and Z_{IIs} 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)

$$Z': \quad 214 \text{ lbs}$$

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

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

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

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

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

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

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

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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

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 : 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

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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

Ω : 3.00

D: 0.138 in Root Diameter of TEK Screw

F_{yb} : 100 ksi Yield Strength of TEK Screw

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

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

P_n/Ω : 206 lbs

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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

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Subject: Tapcon Lateral Design

Input:

Calculation:

Tapcon Size:

Size: 1/4

D: 0.25 in Nominal Diameter

D_{sh}: 0.19 in Shank Diameter**Fastener Shear Capacity - 3,000 psi Concrete**P_{nv}/Ω: 237 lbs See Table 1B of NOA 24-0102.06**Fastener Shear Capacity - Medium-Weight CMU**P_{nv}/Ω: 161 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}: 0.19 in Shank Diameter of TapconF_{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: 539 lbs**Bearing Strength of Masonry Straps - AISI S100**

Size: 1/4 Tapcon Size

D_{sh}: 0.19 in Shank Diameter of Tapcon ScrewF_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: 203 lbs