

Micah Swartz, P.E.	Project Number:	MS24-10012
	Project Name:	Side Hinge Impact Door w/ Sidelite
	Date:	10/31/2024

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

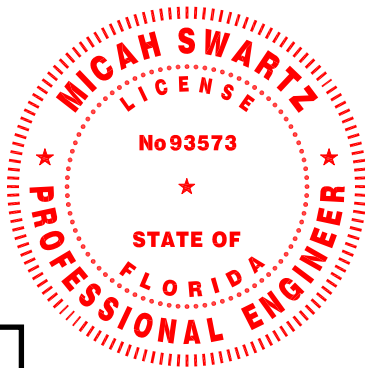
Project Number: MS24-10012

Drawing Number: HROS_FXD_LFT

Reference Test Report: 29075.01-201-12-R1

Product Name: Side Hinge Impact Door w/ Sidelite 57" x 96"

Prepared for:
VPI Quality Windows
3420 E. Ferry Avenue
Spokane, WA 99202



Prepared by:
Micah Swartz, P.E.

Micah Swartz

Micah Swartz, PE
10/31/24 Florida License No. PE 93573

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Micah Swartz, P.E.	Project Number:	MS24-10012
	Project Name:	Side Hinge Impact Door w/ Sidelite
	Date:	10/31/2024
	Page:	2 of 10

Scope:

Micah Swartz, P.E. is contracted by VPI Quality Windows to evaluate alternative anchorage for the product: Side Hinge Impact Door w/ Sidelite 57" x 96". This evaluation is based on testing performed by Molimo, LLC in York PA, test report no.: 29075.01-201-12-R1 and dated 7/31/24, revised 9/13/24.

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

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.

Micah Swartz, P.E.	Project Number:	MS24-10012
	Project Name:	Side Hinge Impact Door w/ Sidelite
	Date:	10/31/2024 Page: 3 of 10

Design Summary:

The table below summarizes the product: Side Hinge Impact Door w/ Sidelite 57" x 96" 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
Side Hinge Impact Door w/ Sidelite 57" x 96"	29075.01-201-12-R1 (7/31/24, revised 9/13/24)	57x96	+50 psf / -55 psf

As Tested Design:

Screw Information:

Screw Size: 8 Screw Embed: 1 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 131 lbs

Wood Screw Lateral: 106 lbs

Alternative Fasteners:

TEK Screw Information:

Screw Size: 10-16

TEK Withdrawal: 145 lbs

TEK Lateral: 206 lbs

Tapcon Information:

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

Tapcon Lateral (Concrete): 181 lbs

Tapcon Lateral (CMU): 135 lbs

Micah Swartz, P.E.	Project Number:	MS24-10012
	Project Name:	Side Hinge Impact Door w/ Sidelite
	Date:	10/31/2024

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 _{em} :	3,350 psi
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$W' = W * C_D * C_M^2 * C_t$ – 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:	82	lbs

W':	131	lbs
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Micah Swartz, P.E.	Project Number:	MS24-10012
	Project Name:	Side Hinge Impact Door w/ Sidelite
	Date:	10/31/2024 Page: 5 of 10

Subject: As Tested - 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 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} :	36,000 psi	Side Member dowel bearing strength
l _m :	1 in	Main Member dowel bearing length
l _s :	0.06 in	Side Member dowel bearing length
R _d :	2.2	Reduction term - Table 12.3.1B (NDS 2018)
R _e :	0.0931	= F _{em} /F _{es}
R _t :	16.7	= l _m /l _s
k ₁ :	0.629	See Table
k ₂ :	0.610	See Table

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

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

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

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:	16	GA
t:	0.060	in thickness of strap
D:	0.131	in

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

$$P_{nv}/\Omega: \boxed{233} \text{ lbs}$$

Micah Swartz, P.E.	Project Number:	MS24-10012	
	Project Name:	Side Hinge Impact Door w/ Sidelite	
	Date:	10/31/2024	Page: 7 of 10

Subject: TEK Withdrawal

Input:
Calculation:

Tensile Strength of Fastener - ESR 1976

Screw Size:

P_{nv}/Ω : lbs See ESR-1976

Tensile Pullout - ESR 1976

Screw Size:

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

t: GA

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

P_{nv}/Ω : lbs See ESR-1976

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: Tested fastener is a

Head Size: in

TEK Screw Head Size:

Screw Size:

Head Size: in

Micah Swartz, P.E.

Project Number: MS24-10012

Project Name: Side Hinge Impact Door w/ Sidelite

Date: 10/31/2024 Page: 8 of 10

Subject: TEK Lateral Design

Input:

Calculation:

Shear Strength of Fastener - ESR 1976

Screw Size: 10-16

P_{nv}/Ω : 573 lbs See ESR-1976

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

Micah Swartz, P.E.	Project Number:	MS24-10012	
	Project Name:	Side Hinge Impact Door w/ Sidelite	
	Date:	10/31/2024	Page: 9 of 10

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:	16	GA		
t:	0.0598	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: 245 lbs

Micah Swartz, P.E.

Project Number: MS24-10012

Project Name: Side Hinge Impact Door w/ Sidelite

Date: 10/31/2024 Page: 10 of 10

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 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: 239 lbs**Bearing Strength of Masonry Straps - AISI S100**

Size: 3/16 Tapcon Size

D_{sh}: 0.145 in Shank Diameter of Tapcon ScrewF_u: 33 ksi Tensile Strength of Masonry Strap

t: 16 GA

t: 0.0598 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: 258 lbs