

SWARTZ
CONSULTING ENGINEERS LLC

Project Number:	SCE 25-05001
Project Name:	Siteline (W-5500) Sliding Door
Date:	5/6/2025
Page:	1 of 15

Product Approval Supporting Calculations Alternative Anchorage Analysis & Design

Project Number: SCE 25-05001

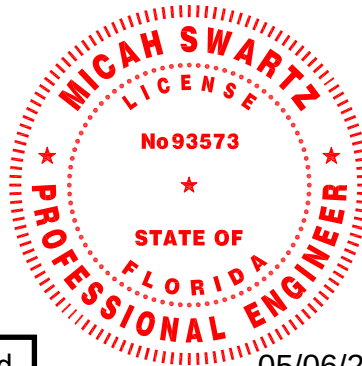
Drawing Number: D004233

Reference Test Report: 28941.01-201-12-R0

Product Name: Siteline (W-5500) Sliding Door 95.125" x 95.5"

Prepared for:

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



Prepared by:
Swartz Consulting Engineers LLC

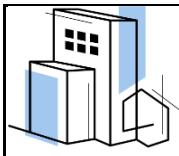
Micah Swartz

Micah Swartz, PE
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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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05/06/25



Scope:

Swartz Consulting Engineers LLC is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Siteline (W-5500) Sliding Door 95.125" x 95.5". This evaluation is based on testing performed by Molimo in Klamath Falls, OR, test report no.: 28941.01-201-12-R0 and dated 09/03/24.

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

AISI 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:

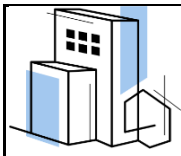
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(1) Swartz Consulting Engineers LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products tested or labeled by the

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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: Siteline (W-5500) Sliding Door 95.125" x 95.5" 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
Siteline (W-5500) Sliding Door 95.125" x 95.5"	28941.01-201-12-R0 (09/03/24)	95.125" x 95.5"	+50 psf / -50 psf

As Tested Design:

Screw Information:

Screw Size: 8 Screw Embed: 1.25 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 164 lbs

Wood Screw Lateral: 106 lbs Spacing: 17.5 in Linear Capacity: 72 lbs

Note: Wood Screw Lateral controls design

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

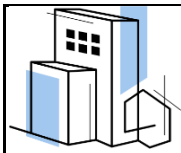
Nail Information:

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

Total Load: -3154 lbs Number of Nails: 28 Load Per Fastener (Nailfin): -113 lbs

Nail Withdrawal: 53 lbs Spacing: 6 in Linear Capacity: 107 plf

Nail Lateral: 113 lbs



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Project Number: SCE 25-05001

Project Name: Siteline (W-5500) Sliding Door

Date: 5/6/2025

Page: 4 of 15

Design Summary Continued:

TEK Screw Information:

Screw Size: 10-16

TEK Withdrawal: 145 lbs

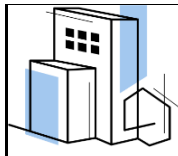
TEK Lateral: 147 lbs

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



Summary of Test Results - Plastics Checklist

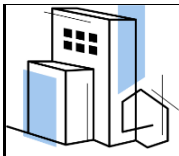
Table 2: Summary of Test Results - Plastics Checklist

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.

SMC (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 Withdrawal

Input:

Calculation:

Screw Information:

Screw Size: 8

Root Diameter: 0.131 in

Screw Embed: 1.25 in

Main Member Type: S-P-F

G: 0.42

F_{em}: 3,350 psi

Side Member Type: S-P-F

G: 0.42

F_{es}: 13,750 psi

thickness (t_s): 0.75 in

$$W' = W * C_D * C_M^2 * C_t - \text{As per table 11.3.1 NDS 2018}$$

C_D: 1.6 Load Duration Factor - Table 2.3.2 (NDS 2018)

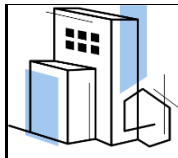
C_M: 1.0 Wet Service Factor - Table 11.3.3 (NDS 2018)

C_t: 1.0 Temperature Factor - Table 11.3.4 (NDS 2018)

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

W: 103 lbs

W': 164 lbs



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

Input:

Calculation:

Screw Information:

Screw Size: 8

Root Diameter: 0.131 in

Screw Embed: 1.25 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): 0.75 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} :	3,350	psi	Side Member dowel bearing strength
l_m :	1.25	in	Main Member dowel bearing length
l_s :	0.75	in	Side Member dowel bearing length
R_d :	2.2		Reduction term - Table 12.3.1B (NDS 2018)
R_e :	1		$= F_{em}/F_{es}$
R_t :	1.7		$= l_m/l_s$
k_1 :	0.582		See Table
k_2 :	1.158		See Table

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

$$Z_{Im}: 249 \text{ lbs} \quad Z_{Im} = \frac{D l_m F_{em}}{R_d} \text{ (EQ 12.3 - 1)}$$

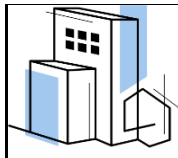
$$Z_{II}: 87 \text{ lbs} \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

$$Z_{III_m}: 96 \text{ lbs} \quad Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

$$Z_{IV}: 82 \text{ lbs} \quad Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}} \text{ (EQ 12.3 - 6)}$$

$$Z_{MIN}: 82 \text{ lbs}$$

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: 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)

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

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

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

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

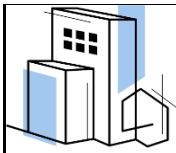
$$Z_n/\Omega: \boxed{106} \text{ lbs}$$

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

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

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



Subject: Nail Withdrawal

Input:

Calculation:

Nail Information:

Nail Size: 6d

Nail Length: 2 in

Nail Type: Common

Nail Diameter: 0.113 in

Nail Embedment: 1.88 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

$$W' = W * C_D * C_M^2 * C_t - \text{As per table 11.3.1 NDS 2018}$$

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)

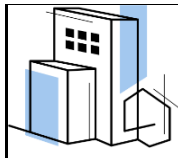
C_t: 1.0 Temperature Factor - Table 11.3.4 (NDS 2018)

W: 18 lbs/in

W: 33 lbs

$$W = 1380G^{5/2}D - \text{Carbon Steel Nails (EQ. 12.2 - 3, NDS 2018)}$$

W': 53 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: **1.63** 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:	0.113 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 :	1.625 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 :	13.0	$= l_m/l_s$
k_1 :	1.230	See Table
k_2 :	0.622	See Table

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

Z_{Im} : **280** lbs $Z_{Im} = \frac{D l_m F_{em}}{R_d}$ (EQ 12.3 - 1)

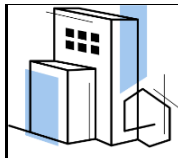
Z_{II} : **109** lbs $Z_{II} = \frac{k_1 D l_s F_{es}}{R_d}$ (EQ 12.3 - 3)

Z_{III_m} : **117** lbs $Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d}$ (EQ 12.3 - 4)

Z_{IV} : **78** lbs $Z_{IV} = \frac{D^2}{R_d} \sqrt{\frac{2F_{em}F_{yb}}{3(1 + R_e)}}$ (EQ 12.3 - 6)

Z_{MIN} : **78** 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

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

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)

$$Z': 124 \text{ lbs}$$

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

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

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

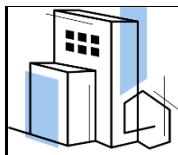
$$Z_n/\Omega: 113 \text{ lbs}$$

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

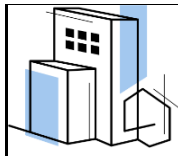
Tested fastener is a

Head Size: 0.312 in

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

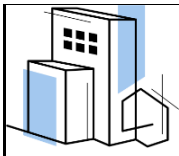
L: 0.25 in Maximum Shim Gap
D: 0.138 in Root Diameter of TEK Screw
 F_{yb} : 100 ksi Yield Strength of TEK Screw

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

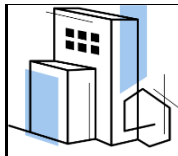
t: 20 GA

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