

Micah Swartz, P.E.

Project Number: MS24-05006
Project Name: Opaque Steel Edge Door(ISW&OSW)
Date: 6/6/2024 Page: _____

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

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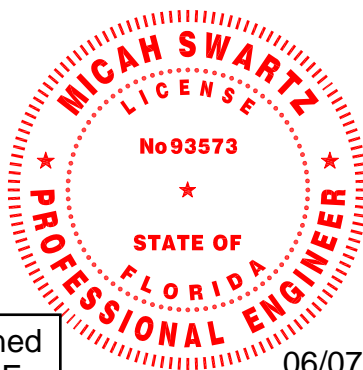
Drawing Number: D1000347

Reference Test Report: NCTL-210-3880-1A

Product Name: Opaque Steel Edge Door 3'0" x 8'0"

Prepared for:

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



Prepared by:
Micah Swartz, P.E.

06/07/24

Micah Swartz, PE
Florida License No. PE 93573

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:

Micah Swartz, P.E. is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Opaque Steel Edge Door 3'0" x 8'0" . This evaluation is based on testing performed by National Certified Testing Laboratories (NCTL) in Orlando, FL, test report no.: NCTL-210-3880-1A and dated 4/26/2013.

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.

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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.

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Design Summary:

The table below summarizes the product: Opaque Steel Edge Door 3'0" x 8'0" 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
Opaque Steel Edge Door 3'0" x 8'0"	NCTL-210-3880-1A (4/26/2013)	36 x 96	+55 psf / -55 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: 10 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)
Wood Screw Lateral: 149 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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Project Number: MS24-05006
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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:	<input type="text" value="0.131"/> in	Diameter
F_{yb} :	<input type="text" value="100"/> ksi	Dowel Bending Yield Strength
F_{em} :	<input type="text" value="3,350"/> psi	Main Member dowel bearing strength
F_{es} :	<input type="text" value="36,000"/> psi	Side Member dowel bearing strength
l_m :	<input type="text" value="1.5"/> in	Main Member dowel bearing length
l_s :	<input type="text" value="0.06"/> in	Side Member dowel bearing length
R_d :	<input type="text" value="2.2"/>	Reduction term - Table 12.3.1B (NDS 2018)
R_e :	<input type="text" value="0.0931"/>	= F_{em}/F_{es}
R_t :	<input type="text" value="25.0"/>	= l_m/l_s
k_1 :	<input type="text" value="0.939"/>	See Table
k_2 :	<input type="text" value="0.538"/>	See Table

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

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

$$Z': \quad 178 \text{ lbs}$$

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

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

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

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

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

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

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

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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 psi thickness (t_m): 1.5 in

Side Member Type: S-P-F G: 0.42 F_{es} : 3,350 psi thickness (t_s): 1.25 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} :	3,350	psi	Side Member dowel bearing strength
l_m :	1.5	in	Main Member dowel bearing length
l_s :	1.25	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 :	1.2		$= l_m/l_s$
k_1 :	0.459		See Table
k_2 :	1.133		See Table

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

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

Z_{II} : 133 lbs $Z_{II} = \frac{k_1 D l_s F_{es}}{R_d}$ (EQ 12.3 - 3)

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

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

Z_{MIN} : 105 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** $Z' = Z * C_D * C_M * C_t * C_g * C_{\Delta}$ – 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' : 168 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

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

Where $M = \frac{ZL}{2}$ (Guided Bending) Z_n/Ω : 149 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}/Ω : 162 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

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

P_{nv}/Ω: 203 lbs