

Micah Swartz, P.E.	Project Number:	MS24-10004
	Project Name:	Arch. F.G. Outswing Full Lite Double
	Date:	10/30/24

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

Project Number: MS24-10004

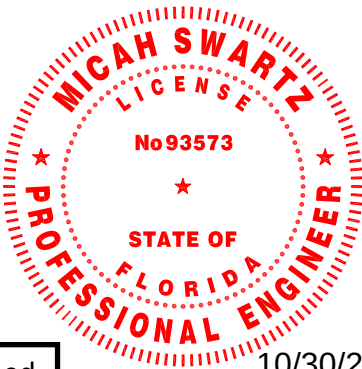
Drawing Number: D015786

Reference Test Report: M3792.01-301-47-R0

Product Name: Arch. F.G. Outswing Double 74" x 80 1/2"

Prepared for:

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



Prepared by:
Micah Swartz, P.E.

Micah Swartz

10/30/24
Micah Swartz, PE
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Micah Swartz, P.E.	Project Number:	MS24-10004
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Scope:

Micah Swartz, P.E. is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Arch. F.G. Outswing Double 74" x 80 1/2". This evaluation is based on testing observed by Intertek at Jeld-Wen's test facility in Klamath Falls, OR, test report no.: M3792.01-301-47-R0 and dated 06/03/21.

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.

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Design Summary:

The table below summarizes the product: Arch. F.G. Outswing Double 74" x 80 1/2" 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
Arch. F.G. Outswing Double 74" x 80 1/2"	M3792.01-301-47-R0 (06/03/21)	74 x 80 1/2	+60 psf / -60 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 Lateral: 106 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

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

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 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 :	1.5	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 :	2.0		$= l_m/l_s$
k_1 :	0.679		See Table
k_2 :	1.111		See Table

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

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

$$Z_{II}: 102 \text{ lbs} \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

$$Z_{III_m}: 111 \text{ lbs} \quad Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

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

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

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: 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 psi thickness (t_m): 1.5 inSide 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 :	1.5	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 :	2.0		$= l_m/l_s$
k_1 :	0.679		See Table
k_2 :	1.111		See Table

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

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

$$Z_{II}: 102 \text{ lbs} \quad Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \text{ (EQ 12.3 - 3)}$$

$$Z_{III_m}: 111 \text{ lbs} \quad Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1 + 2R_e) R_d} \text{ (EQ 12.3 - 4)}$$

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

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

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

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

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

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

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

Micah Swartz, P.E.

Project Number: MS24-10004

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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 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: 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