

|                           |                 |                                   |
|---------------------------|-----------------|-----------------------------------|
| <b>Micah Swartz, P.E.</b> | Project Number: | MS24-10005                        |
|                           | Project Name:   | Arch. F.G. Outswing Opaque Double |
|                           | Date:           | 10/30/24                          |

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

**Project Number:** MS24-10005

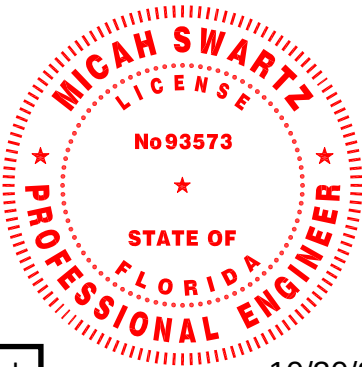
**Drawing Number:** D015785

**Reference Test Report:** M4105.01-301-47-R0

**Product Name:** Arch. F.G. Outswing Double 86" x 96 1/4"

**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  
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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|                           |                 |                                   |
|---------------------------|-----------------|-----------------------------------|
| <b>Micah Swartz, P.E.</b> | Project Number: | MS24-10005                        |
|                           | Project Name:   | Arch. F.G. Outswing Opaque Double |
|                           | Date:           | 10/30/24                          |
|                           | Page:           | 2 of 8                            |

**Scope:**

Micah Swartz, P.E. is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Arch. F.G. Outswing Double 86" x 96 1/4". This evaluation is based on testing observed by Intertek at Jeld-Wen's test facility in Klamath Falls, OR, test report no.: M4105.01-301-47-R0 and dated 06/10/21.

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.

|                           |                 |                                   |
|---------------------------|-----------------|-----------------------------------|
| <b>Micah Swartz, P.E.</b> | Project Number: | MS24-10005                        |
|                           | Project Name:   | Arch. F.G. Outswing Opaque Double |
|                           | Date:           | 10/30/24                          |
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**Design Summary:**

The table below summarizes the product: Arch. F.G. Outswing Double 86" x 96 1/4" 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<br>86" x 96 1/4" | M4105.01-301-47-R0<br>(06/10/21) | 86 x 96 1/4  | +50 psf / -50 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

# Micah Swartz, P.E.

Project Number: MS24-10005  
Project Name: Arch. F.G. Outswing Opaque Double  
Date: 10/30/24 Page: 4 of 8

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 <sub>D</sub> : | 1.6 | Load Duration Factor - Table 2.3.2 (NDS 2018)   |
| C <sub>M</sub> : | 1.0 | Wet Service Factor - Table 11.3.3 (NDS 2018)    |
| C <sub>t</sub> : | 1.0 | Temperature Factor - Table 11.3.4 (NDS 2018)    |
| C <sub>g</sub> : | 1.0 | Group Action Factor - Section 11.3.6 (NDS 2018) |
| C <sub>Δ</sub> : | 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 <sub>yb</sub> : | 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 <sub>u</sub> : | 33    | ksi Tensile Strength of strap |
| t:               | 20    | GA                            |
| t:               | 0.036 | in thickness of strap         |
| D:               | 0.131 | in                            |

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

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

|                                                |                                                 |
|------------------------------------------------|-------------------------------------------------|
| <h1 style="margin: 0;">Micah Swartz, P.E.</h1> | Project Number: MS24-10005                      |
|                                                | Project Name: Arch. F.G. Outswing Opaque Double |
|                                                | Date: 10/30/24      Page: 6 of 8                |

**Subject:** 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<sub>em</sub>: 3,350 psi

thickness (t<sub>m</sub>): 1.5 in

Side Member Type: S-P-F

G: 0.42

F<sub>es</sub>: 3,350 psi

thickness (t<sub>s</sub>): 0.75 in

**Lateral Design Factors - Table 12.3.1A (NDS 2018)**

|                   |       |     |                                           |
|-------------------|-------|-----|-------------------------------------------|
| D:                | 0.131 | in  | Diameter                                  |
| F <sub>yb</sub> : | 100   | ksi | Dowel Bending Yield Strength              |
| F <sub>em</sub> : | 3,350 | psi | Main Member dowel bearing strength        |
| F <sub>es</sub> : | 3,350 | psi | Side Member dowel bearing strength        |
| l <sub>m</sub> :  | 1.5   | in  | Main Member dowel bearing length          |
| l <sub>s</sub> :  | 0.75  | in  | Side Member dowel bearing length          |
| R <sub>d</sub> :  | 2.2   |     | Reduction term - Table 12.3.1B (NDS 2018) |
| R <sub>e</sub> :  | 1     |     | = F <sub>em</sub> /F <sub>es</sub>        |
| R <sub>t</sub> :  | 2.0   |     | = l <sub>m</sub> /l <sub>s</sub>          |
| k <sub>1</sub> :  | 0.679 |     | See Table                                 |
| k <sub>2</sub> :  | 1.111 |     | See Table                                 |

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

Z<sub>I<sub>m</sub></sub>: 299 lbs

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

Z<sub>II</sub>: 102 lbs

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

Z<sub>III<sub>m</sub></sub>: 111 lbs

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

Z<sub>IV</sub>: 82 lbs

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

Z<sub>MIN</sub>: 82 lbs

Note: Side member is part of the Jeld-Wen assembly and verified during testing. Modes Z<sub>Is</sub> and Z<sub>IIIs</sub> 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) |
| $C_{\Delta}$ : | 1.0 | Geometry Factor - Section 12.5.1.1 (NDS 2018)   |

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

**Fastener Bending Across Shim Space**

|            |       |                                  |
|------------|-------|----------------------------------|
| $\Omega$ : | 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**

|            |       |                               |
|------------|-------|-------------------------------|
| $\Omega$ : | 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: MS24-10005

Project Name: Arch. F.G. Outswing Opaque Double

Date: 10/30/24

Page: 8 of 8

Subject: Tapcon Lateral Design

Input:

Calculation:

**Tapcon Size:**

Size: 3/16

D: 0.1875 in Nominal Diameter

D<sub>sh</sub>: 0.145 in Shank Diameter**Fastener Shear Capacity - 3,000 psi Concrete**P<sub>nv</sub>/Ω: 181 lbs See Table 1B of NOA 24-0102.06**Fastener Shear Capacity - Medium-Weight CMU**P<sub>nv</sub>/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<sub>sh</sub>: 0.145 in Shank Diameter of TapconF<sub>yb</sub>: 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<sub>n</sub>/Ω: 239 lbs**Bearing Strength of Masonry Straps - AISI S100**

Size: 3/16 Tapcon Size

D<sub>sh</sub>: 0.145 in Shank Diameter of Tapcon ScrewF<sub>u</sub>: 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<sub>nv</sub>/Ω: 155 lbs