# Product Approval Supporting Calculations
# Alternative Anchorage Analysis & Design

**Project Number:** SCE 26-09019

**Drawing Number:** D014722

**Reference Test Report:** TEL 01681715

**Product Name:** Architectural Fiberglass Swinging Door ISW 2 Panel 74 x 80.75

**Impact:** WZ3 - Level D Missile

**Design Pressure:** +50 psf / -50 psf

**Prepared for:**
Jeld-Wen Windows & Doors
3737 Lakeport Blvd.
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MICAH SWARTZ
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10/05/26

This item has been digitally signed and sealed by Micah Swartz, P.E. on the date adjacent to the seal.

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Prepared by:
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**Scope:**

Swartz Consulting Engineers LLC is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Architectural Fiberglass Swinging Door ISW 2 Panel 74 x 80.75. This evaluation is based on testing observed by Testing Evaluation Laboratories in Ontario Canada, test report no.: TEL 01681715 and dated 02/10/17.
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:**

*Current edition of the Florida Building Code, Building*

*ANSI/AWC NDS - National Design Specification (NDS) for Wood Construction*

*AISI S100 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:**

In accordance with Rule 61G20-3 Florida Administrative Code, Swartz Consulting Engineers LLC hereby certifies the following:

(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 agency.

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**Design Summary:**

The table below summarizes the product: Architectural Fiberglass Swinging Door ISW 2 Panel 74 x 80.75 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 |
|---|---|---|---|
| Architectural Fiberglass Swinging Door ISW 2 Panel 74 x 80.75 | TEL 01681715 (02/10/17) | 74 x 80.75 | +50 psf / -50 psf |

***As Tested Design:***

**Screw Information:**

Screw Size: 10 Screw Embed: 1 in Edge Distance: 3/4 in (minimum)
qty: 1 Spacing: 14 in O.C. (Nail Fin)
qty: 1 Spacing: 14 in O.C. (Thru Frame)

Wood Screw Withdrawal: 152 lbs Per ft. Capacity: 130 plf
Wood Screw Lateral: 149 lbs Per ft. Capacity: 127 plf

***Alternative Fasteners:***

**Screw Information:**

Screw Size: 10 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)
qty: 1 Spacing: 14 in O.C. (Nail Fin)
qty: 1 Spacing: 14 in O.C. (Thru Frame)

Wood Screw Withdrawal: 228 lbs Per ft. Capacity: 195 plf Unity: 0.65
Wood Screw Lateral: 149 lbs Per ft. Capacity: 127 plf Unity: 1.00

**Tapcon Information:**

Tapcon Size: 1/4 Embedment: 1-1/4 in (minimum) Edge Distance: 2-1/2 in (minimum)
qty: 1 Spacing: 14 in O.C.

Tapcon Lateral (Concrete): 203 lbs Per ft. Capacity: 174 plf Unity: 0.73
Tapcon Lateral (CMU): 161 lbs Per ft. Capacity: 138 plf Unity: 0.92

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

Input:
Calculation:

**Screw Information:**

Screw Size: 10 Root Diameter: 0.152 in
Screw Embed: 1 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)**

| | | | |
|---|---|---|---|
| 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 | 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) |
| $R_e$: | 1 | | $= F_{em}/F_{es}$ |
| $R_t$: | 0.8 | | $= l_m/l_s$ |
| $k_1$: | 0.377 | | See Table |
| $k_2$: | 1.289 | | See Table |

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

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.

$Z_{Im}$: 231 lbs $$Z_{I_m} = \frac{D l_m F_{em}}{R_d} \text{ (EQ } 12.3-1)$$

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

$Z_{IIIm}$: 99 lbs $$Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1+2R_e)R_d} \text{ (EQ } 12.3-4)$$

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

$Z_{MIN}$: 99 lbs

**Subject:** As Tested - Wood Screw Lateral Design - Single Shear Cont.

**Adjusted Lateral Design Values**

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

| | | |
|---|---|---|
| $C_D$: | 1.6 | Load Duration Factor - Table 2.3.2 (NDS) |
| $C_M$: | 1.0 | Wet Service Factor - Table 11.3.3 (NDS) |
| $C_t$: | 1.0 | Temperature Factor - Table 11.3.4 (NDS) |
| $C_g$: | 1.0 | Group Action Factor - Section 11.3.6 (NDS) |
| $C_\Delta$: | 1.0 | Geometry Factor - Section 12.5.1.1 (NDS) |

$Z'$: **159** 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 |

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb}\pi D^3}{16\Omega L} \qquad Where\ M = \frac{ZL}{2}\ (Guided\ Bending)$$

$Z_n/\Omega$: **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 | |

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

$P_{nv}/\Omega$: **162** lbs

**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)**

| | | | |
|---|---|---|---|
| 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) |
| $R_e$: | 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)**

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

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

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

$Z_{IV}$: 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 $Z_{IIIs}$ are not applicable to the calculation.

**Subject:** Wood Screw Lateral Design - Single Shear Cont.

**Adjusted Lateral Design Values**

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

| | | |
|---|---|---|
| $C_D$: | 1.6 | Load Duration Factor - Table 2.3.2 (NDS) |
| $C_M$: | 1.0 | Wet Service Factor - Table 11.3.3 (NDS) |
| $C_t$: | 1.0 | Temperature Factor - Table 11.3.4 (NDS) |
| $C_g$: | 1.0 | Group Action Factor - Section 11.3.6 (NDS) |
| $C_\Delta$: | 1.0 | Geometry Factor - Section 12.5.1.1 (NDS) |

$Z'$: **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 |

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb}\pi D^3}{16\Omega L} \qquad Where\ M = \frac{ZL}{2}\ (Guided\ Bending)$$

$Z_n/\Omega$: **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 | |

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

$P_{nv}/\Omega$: **162** lbs

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**

$P_{nv}/\Omega$: 237 lbs See Table 1B of NOA 24-0102.06

**Fastener Shear Capacity - Medium-Weight CMU**

$P_{nv}/\Omega$: 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 | Ω: 3.00 |
| $D_{sh}$: | 0.19 | in | Shank Diameter of Tapcon | |
| $F_{yb}$: | 100 | ksi | Yield Strength of Tapcon | |

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

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

$P_n/\Omega$: 539 lbs

**Bearing Strength of Masonry Straps - AISI S100**

| | | | | |
|---|---|---|---|---|
| Size: | 1/4 | | Tapcon Size | Ω: 3.00 |
| $D_{sh}$: | 0.19 | in | Shank Diameter of Tapcon Screw | |
| $F_u$: | 33 | ksi | Tensile Strength of Masonry Strap | |
| t: | 20 | GA | | |
| t: | 0.0359 | in | Thickness of Masonry Strap | |

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

$P_{nv}/\Omega$: 203 lbs