



Project No.: 27206.08-107-16-R2
Project Name: Contours Steel ISW/OSW
Opaque Steel Frame Door
Revision 1 Date: 12/4/2023
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PRODUCT APPROVAL SUPPORTING CALCULATIONS

Series/Model Contours Steel ISW/OSW Opaque Steel Frame Door

REPORT NO.: 27206.08-107-16-R2

RENDERED TO: Jeld-Wen Windows & Doors
3737 Lakeport Blvd
Klamath Falls, Oregon

PREPARED BY: Michael D. Stremmel, P.E.
Molimo, LLC
1410 Eden Road
York, Pennsylvania 17402

REVISION 2 DATE: 12/4/2023

This item has been digitally signed and sealed by Michael D. Stremmel, PE on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on electronic copies.

Michael D. Stremmel, P.E.
Senior Project Engineer
FL PE 65868
FL REG 37122

It is a violation to alter this document in any way unless acting under the direction of a licensed professional engineer.



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SCOPE:

Molimo, LLC was contracted by Jeld-Wen Windows & Doors to evaluate alternate installation methods for their Contours Steel ISW/OSW Opaque Steel Frame Door. The evaluation is based on physical testing and product certifications.

Reference standards utilized in this project include:

Florida Building Code. International Code Council.

ANSI/AWC National Design Specification (NDS) for Wood Construction. American Wood Council.

AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members. American Iron and Steel Institute.

ICC-ES Report ESR-1976 ITW Buildex TEKS Self-Drilling Fasteners. ICC Evaluation Service.

NOA 21-0201.06 *Tapcon Concrete and Masonry Anchors with Advanced Threadform Technology.* Miami-Dade County Product Control Section.

The anchorage analysis presented herein does not address the water resistance, water penetration, or air infiltration performance of the installation method or the installed product. In addition, the analyses rely on the assumption that the building substrate is capable of withstanding the incurred loads.



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Certification of Independence

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

- Molimo, 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.
- Molimo LLC is not owned, operated or controlled by any company manufacturing or distributing products it tests or labels.
- Michael D. Stremmel, 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.
- Michael D. Stremmel, P.E. does not have, nor will acquire, a financial interest in any other entity involved in the approval process of the product.

ANALYSES:

Summary of Test Results

Table 1 summarizes the various Contours Steel ISW/OSW Opaque Steel Frame Door products and their corresponding performance levels which have been established by testing or product certification.

Table 1: Summary of Test Results

Series/Model	Test Report Number	Size (W x H)	Performance
Opaque Steel Edge Door (Inswing)	National Certified Testing Laboratories No. NCTL-210-3880-1A (Rev. 0, 4/26/13)	38-15/16" x 97-1/8"	+55 / -55 psf (Wind Zone 4)
Opaque Steel Edge Door (Outswing)	National Certified Testing Laboratories No. NCTL-210-3880-1A (Rev. 0, 4/26/13)	38-15/16" x 96"	+55 / -55 psf (Wind Zone 4)

Testing documented in Table 1 was conducted by National Certified Testing Laboratories of Everett, Washington (Florida Department of Business & Professional Regulation Test Lab No. TST9341, A2LA Certificate of Accreditation 3054.03). The testing documented above is certified by NAMI under certification numbers NI011574.04 (Expires 4/30/2026) and NI011574.05 (Expires 4/30/2026).

As-Tested Installation Analysis

For air/water/structural testing, the test specimen was secured to a SPF wood test buck with #8 wood screws (1-1/2" min. embedment) at the sill and jambs. The as tested installation method is evaluated on Pages 5 and 6. These capacities will be used to prove acceptable anchors and substrates for the product.

Alternate Anchorages

Calculations on Pages 7 through 9 determine the design capacity of alternate installation anchorages for the product.

Anchorages Requirements

As-tested spacing must be maintained. It must be determined that the anchorages are not overloaded for the approved product size and design pressures. Calculations presented on Page 14 show the alternate anchorages are acceptable for the established product performance.

Anchorage requirements established by this report are accurately presented in Drawing D1000347.



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As-Tested Installation – Through Frame to Wood

Anchor: #8 Wood Screw (1-1/2" Min Embedment)

Details: 16 ga (0.060") thick steel door frame
No shim space was utilized

Substrate: SPF wood test buck (G = 0.42)

Wood Screw Capacity (Shear)

$Z' = \underline{127 \text{ lb}}$

(See Following Page)

Design Capacity of the Connection = 127 lb

Lateral Design Strength of Wood Connections

Data

Fastener

Fastener	=	#8 Wood Screw
Shank Dia	=	0.164 in.
Root Dia.	=	0.131 in.
F_{yb}	=	90,000 psi
Fastener length	=	1.500 in.

Project:	Contours Steel Edge ISW/OSW Opaque Steel Frame Door
Comments:	1-1/2" min embedment

Main Member

Material	=	SPF
G	=	0.42
θ	=	90
F_e	=	3,350 psi
Thickness	=	1.500 in.

Side Member

Material	=	ASTM A 653, Grade 33 Steel
G	=	N/A
θ	=	90
F_{es}	=	61,850 psi
Thickness	=	0.060 in.

Calculations

Lateral Bearing Factors

D	=	0.131 in.	k_1	=	0.4742
ℓ_m	=	1.276 in.	k_2	=	0.5224
K_θ	=	1.25	k_3	=	13.64
K_D	=	2.20	R_d	=	2.20 (Mode I _m , I _s)
R_e	=	0.054	R_d	=	2.20 (Mode II)
R_t	=	21.27	R_d	=	2.20 (Mode III _m , III _s , IV)

Lateral Design Values, Z

Mode I _m	=	255 lbf
Mode I _s	=	221 lbf
Mode II	=	105 lbf
Mode III _m	=	120 lbf
Mode III _s	=	79 lbf
Mode IV	=	108 lbf

<== Minimum Value

Adjustment Factors

C_D	=	1.6	C_Δ	=	1.0
Wet Service Factor			Is fastener installed in end grain?		No
Fabrication/In-Service		Dry/Dry	C_{eg}	=	1.00
C_M	=	1.0	Is fastener part of a diaphragm?		No
In service temperature		$T \leq 100^\circ\text{F}$	C_{di}	=	1.0
C_t	=	1.0	Is fastener toe-nailed?		No
C_g	=	1.0	C_{tn}	=	1.00

Adjusted Design Value, Z'

Z'	=	127 lbf
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Alternate Installation – Through-Frame to Concrete

Anchor: 1/4" Tapcon Anchor
- 1-1/4" min embedment
- 2-1/2" min edge distance
- 3" min anchor spacing
- 1/4" max shim space

Details: 16 ga (0.060") thick steel door frame

Substrate: 3,000 psi Concrete

Anchor Capacity (Shear of 1/4" Tapcon)

$$P_{ss} / \Omega = \underline{223 \text{ lb}} \quad (\text{NOA-No. 21-0201.06})$$

Bearing Capacity (of Steel frame)

$$P_b = 0.85 F_e D t / K_D = 0.85 (45,000 \text{ psi})(0.250")(0.060") / (3.0) = \underline{191 \text{ lb}}$$

Bending Capacity (of 1/4" Tapcon)

$$L = 1/4" \text{ (maximum shim space)}$$

$$S = \pi d^3 / 32 = \pi (0.190")^3 / 32 = 0.000673 \text{ in}^3$$

$$F_b = (1.3)(0.6 F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \quad (1.3 \text{ for weak axis bending})$$

$$F_b = M / S = (V) (L/2) / S \quad (L/2 \text{ for guided bending})$$

$$V = 2 S F_b / L = (2)(0.000673 \text{ in}^3)(106,860 \text{ psi}) / 1/4"$$

$$V = \underline{575 \text{ lb}}$$

Design Capacity of the Connection = 191 lb

Alternate Installation – Through-Frame to CMU Block

Anchor: 3/16" Tapcon Anchor
- 1-1/4" min embedment
- 2-1/2" min edge distance
- 3" min anchor spacing
- 1/4" max shim space

Details: 16 ga (0.060") thick steel door frame

Substrate: CMU Block

Anchor Capacity (Shear of 1/4" Tapcon)

$$P_{ss} / \Omega = \underline{161 \text{ lb}} \quad (\text{NOA-No. 21-0201.06})$$

Bearing Capacity (of Steel frame)

$$P_b = 0.85 F_e D t / K_D = 0.85 (45,000 \text{ psi})(0.250")(0.060") / (3.0) = \underline{191 \text{ lb}}$$

Bending Capacity (of 1/4" Tapcon)

$$L = 1/4" \text{ (maximum shim space)}$$

$$S = \pi d^3 / 32 = \pi (0.190")^3 / 32 = 0.000673 \text{ in}^3$$

$$F_b = (1.3)(0.6 F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \quad (1.3 \text{ for weak axis bending})$$

$$F_b = M / S = (V) (L/2) / S \quad (L/2 \text{ for guided bending})$$

$$V = 2 S F_b / L = (2)(0.000673 \text{ in}^3)(106,860 \text{ psi}) / 1/4"$$

$$V = \underline{575 \text{ lb}}$$

Design Capacity of the Connection = 161 lb



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Anchorage Requirements

Series/Model: Opaque Steel Edge Door (In-Swing & Out-Swing)
Test Unit Size: 35 3/4" x 95 1/4"
Design Pressure: +55.0 / -55.0 psf

Through-Frame Installation Method

Through frame installation method is validated by the test

Through Frame Anchor Capacity = 127 lb / anchor

Alternate Installation Methods

Through-Frame to Concrete = 191 lb / anchor

Through-Frame to CMU Block = 161 lb / anchor

Minimum Alternate Installation Capacity = 161 lb / anchor

127 lb < 161 lb

Alternate Anchorages OK at tested spacing



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Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	9/28/2023	All	Original Report Issue
1	11/14/2023	Page 4	Updated Certification Numbers
2	12/4/2023	Page 4	Updated the product information and sizes in Table 1