PRODUCT APPROVAL SUPPORTING CALCULATIONS

Series/Model Contours S.E. ISW/OSW Opaque w/Dunbarton RedI-Flex 90min Frame

REPORT NO.: 27206.10-107-16

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

DATE: 9/28/2023

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

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

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SCOPE:
Molimo, LLC was contracted by Jeld-Wen Windows & Doors to evaluate alternate installation methods for their Contours S.E. ISW/OSW Opaque w/Dunbarton RedI-Flex 90min Frame. 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.

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 s 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 S.E. ISW/OSW Opaque w/Dunbarton RedI-Flex 90min Frame 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
Contours Premium Steel Door w/steel Edge Opaque In-Swing Door (ADA Threshold)	National Certified Testing Laboratories Report No. NCTL-210-3844-1 (Rev. 0, 10/29/12) and NCTL-210-3844-1A (Rev. 0, 10/29/12)	38-15/16" x 86-5/8"	+47 / -47 psf (Wind Zone 4)
Contours Premium Steel Door w/steel Edge Opaque Out-Swing Door (Standard Threshold)		38-15/16" x 85-3/8"	+66 / -66 psf (Wind Zone 4)

Testing documented in Table 1 was conducted by National Certified Testing Laboratories of Orlando, Florida (Florida Department of Business & Professional Regulation Test Lab No. TST1589 – laboratory was approved at the time of testing). The testing documented above is certified by NAMI under certification number NI011401.01-R6 (Expires 10/31/2026) and NI011401.02-R6 (Expires 10/31/2026)

As-Tested Installation Analysis

For air/water/structural testing, the test specimen was secured to a Southern-Yellow-Pine wood test buck with #10 wood screws (1-1/2" min. embedment) at the head and jambs and a continuous bed of silicone at the sill. 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 13 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 D015882.

As-Tested Installation – Through Frame to Wood

Anchor: #6 Wood screws (1-1/2” Min Embedment) Head, Jamb

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

Substrate: Southern-Yellow-Pine wood test buck (G = 0.55)

Wood Screw Capacity (#6 Wood Screw Shear)

Z' = 126 lb (See Following Page)

Design Capacity of the Connection = 126 lb

Lateral Design Strength of Wood Connections

Data

Fastener

Project: Countours S.E. Isw Opaque w/Dunbarton Redi-Flex 90min Frame
Comments: As-Tested
1-1/2" min embedment

Fastener	=	#6 Wood Screw	
Shank Dia	=	0.138	in.
Root Dia.	=	0.113	in.
F_{yb}	=	100,000	psi
Fastener length	=	2.250	in.

Main Member

Material	=	SYP	
G	=	0.55	
θ	=	90	
F_e	=	5,550	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	=	0.113	in.	k_1	=	0.9060	
ℓ_m	=	1.500	in.	k_2	=	0.5033	
K_θ	=	1.25		k_3	=	9.65	
K_D	=	2.20		R_d	=	2.20	(Mode I_m, I_s)
R_e	=	0.090		R_d	=	2.20	(Mode II)
R_t	=	25.00		R_d	=	2.20	(Mode III_m, III_s, IV)

Lateral Design Values, Z

Mode I_m	=	428	lbf	
Mode I_s	=	191	lbf	
Mode II	=	173	lbf	
Mode III_m	=	182	lbf	
Mode III_s	=	79	lbf	<== Minimum Value
Mode IV	=	107	lbf	

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≤100°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' = 126 lbf

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)

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

Bearing Capacity (of Steel frame)

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

Bending Capacity (of 1/4" Tapcon)

L = 1/4" (maximum shim space)

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

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

$F_b = M / S = (V)\ (L/2) / S$ (L/2 for guided bending)

$V = 2\ S\ F_b / L =$ (2)(0.000673 in3)(106,860 psi) / 1/4"

V = 575 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)

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

Bearing Capacity (of Steel frame)

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

Bending Capacity (of 1/4" Tapcon)

L = 1/4" (maximum shim space)

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

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

$F_b = M / S = (V)\ (L/2) / S$ (L/2 for guided bending)

$V = 2\ S\ F_b / L = (2)(0.000673\ in3)(106{,}860\ psi) / 1/4"$

V = 575 lb

Design Capacity of the Connection = 161 lb

Anchorage Requirements

Series/Model:	Opaque Steel Edge Door (In-Swing & Out-Swing)
Test Unit Size:	38 47/50” x 86 63/100”
	38 47/50” x 85 19/50”
Design Pressure:	+47.0 / -47.0 psf
	+66.0 / -66.0 psf

Through-Frame Installation Method

Through frame installation method is validated by the test

Through Frame Anchor Capacity = 126 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

126 lb < 161 lb

Alternate Anchorages OK at tested spacing

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	9/28/2023	All	Original Report Issue