

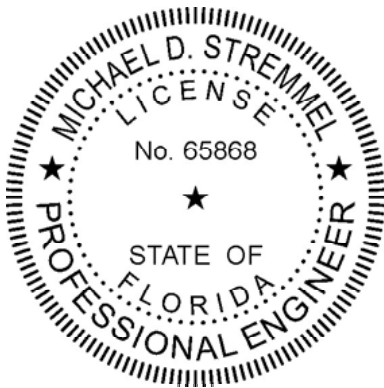
PRODUCT APPROVAL SUPPORTING CALCULATIONS

1615/1617 Sliding Glass Doors - XX

REPORT TO:

**MI WINDOWS AND DOORS, LLC
702 WEST MARKET ST
GRATZ, PENNSYLVANIA 17030**

REPORT NUMBER: 27488.15-107-16-R1
REVISION 1 DATE: 3/18/24



2024.03.18 14:15:46 -04'00'

A handwritten signature in black ink, appearing to read "Micheal D. Stremmel".

Micheal D. Stremmel, PE
FL PE 65868
FL REG 37122

This item has been digitally signed and sealed by Micheal 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 any electronic copies.

Scope

Molimo, LLC was contracted by MI Windows and Doors, LLC to evaluate alternate installation methods for their Series 1615/1617 Sliding Glass Doors - XX. The evaluation is based on physical testing and product certifications. Reference standards utilized in this project include:

Florida Building Code, Building, 8th Edition (2023). International Code Council, 2023.

ANSI/AWC NDS-2015 National Design Specification (NDS) for Wood Construction with 2015 Supplement. American Wood Council, 2015.

AISI S100-12 North American Specification for the Design of Cold-Formed Steel Structural Members, 2012. American Iron and Steel Institute, 2012.

ICC-ES Report ESR-1976 ITW Buildex TEKS Self-Drilling Fasteners. ICC Evaluation Service. 07/2022.

NOA 21-0201.06 Tapcon Concrete and Masonry Anchors with Advanced Threadform Technology. Miami-Dade County Product Control Section. 02/01/21.

AAMA TIR A9-14 Design Guide for Metal Cladding Fasteners. American Architectural Manufacturers Association, 2014.

The anchorage analyses presented herein do 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 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 is not owned, operated or controlled by any company manufacturing or distributing products it tests or labels.
- Micheal 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.
- Micheal 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

The following table summarizes the various 1615/1617 Sliding Glass 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	Product Certification	Size (W x H)	Performance
1615/1617 SGD (XX)	12006.09-106-12 (Revision -, 02/27/23)	CPD 20634	96" x 96"	LC-PG50
1615/1617 SGD (OX)	12006.09-106-12 (Revision -, 02/27/23)	CPD 21686	96" x 96"	LC-PG50
1615/1617 SGD (XX)	11713.02-106-12 (Revision 3, 02/15/23)	CPD 20591	96" x 96"	LC-PG50 Missile D Wind Zone 3
1615/1617 SGD (OX)	11713.02-106-12 (Revision 3, 02/15/23)	CPD 21660	96" x 96"	LC-PG50 Missile D Wind Zone 3

Testing documented in Table 1 was conducted by Molimo, LLC in York, Pennsylvania (Florida Department of Business & Professional Regulation Test Lab No. TST11282, IAS Certificate of Accreditation TL-678).

As-Tested Installation Analysis

For air/water/structural testing, the test specimens were secured to a pine buck as summarized in Table 2. The as-tested installation methods are evaluated on page 10 to page 15 and the established design capacities are presented in Table 2.

Table 2 As-tested Anchorage Design Capacities

Test	Connection	Capacity
1615/1617 SGD (XX) Air/Water/Structural Tests Impact/Cycle Tests	<u>Jambs</u> #10 x 2" screw through PVC frame. 5" from corners and 12" on center.	122 lb (Frame)
	<u>Head</u> #10 x 3" screw through PVC frame. 5" from corners and 12" on center.	124 lb (Clip)
	<u>Sill</u> Steel clip secured to buck with one (1) #8 x 1-1/2" screw. 5" from corners and 12" on center.	

The capacities presented in Table 2 will be used to prove acceptable alternate anchors and substrates for the doors.

Alternate Anchorages

Calculations on page 16 through page 18 determine the design capacity of alternate strap anchor installation anchorages for the door. The alternate anchorage capacities are summarized in Table 3.

Table 3 Alternate Anchorage Capacities for Strap Anchor Installation

Substrate	Anchor	Capacity	Comments
18 Gauge Steel Stud	#10-16 TEKS Screw	155 lb	1. 33 KSI yield strength stud. 2. Full penetration +3 threads. 3. Limited by bending capacity.
Concrete	3/16" Tapcon	186 lb	1. Minimum $f'_c = 3,000$ psi. 2. 1-1/2" Minimum Embedment. 3. 2" Min. Edge Distance. 4. Limited by shear capacity. 5. Maximum 1x buck strip.
CMU	3/16" Tapcon	135 lb	1. Minimum ASTM C90 CMU. 2. 1-1/2" Minimum Embedment. 3. 2" Min. Edge Distance. 4. Limited by shear capacity. 5. Maximum 1x buck strip.

Note: Galvanized steel strap anchor (part 9858).

Calculations on page 19 through page 21 determine the design capacity of alternate through-frame installation anchorages for the door. The alternate anchorage capacities are summarized in Table 4.

Table 4 Alternate Anchorage Capacities for Through-Frame Installation

Substrate	Anchor	Capacity	Comments
18 Gauge Steel Stud	#10-16 TEKS Screw	152 lb	1. 33 KSI yield strength stud. 2. Full penetration +3 threads. 3. Limited by bearing capacity.
Concrete	3/16" Tapcon	150 lb	1. Minimum $f'_c = 3,000$ psi. 2. 1-1/2" Minimum Embedment. 3. 2" Min. Edge Distance. 4. Limited by bearing capacity. 5. Maximum 1x buck strip.
CMU	3/16" Tapcon	135 lb	1. Minimum ASTM C90 CMU. 2. 1-1/2" Minimum Embedment. 3. 2" Min. Edge Distance. 4. Limited by shear capacity. 5. Maximum 1x buck strip.

Calculations on page 22 to page 23 determine the design capacity of alternate nail fin installation anchorages for the door. The alternate anchorage capacities are summarized in Table 5.

Table 5 Alternate Anchorage Capacities for Nail Fin Installations (non-Impact only)

Substrate	Anchor	Capacity	Comments
S-P-F	#10 x 1-1/2" Screw	123 lb	1. 1-1/4" min penetration to wood.
18 Gauge Steel Stud	#10-16 TEKS Screw	104 lb	1. 33 KSI yield strength stud. 2. Full penetration +3 threads. 3. Limited by pull-over capacity.

Anchorage Requirements

Because all alternate strap anchor anchorages and alternate through-frame anchorages evaluated by this report have higher design capacities than the tested anchorages, the alternate strap anchorages and alternate through-frame anchorages proposed by this report may be used for the doors at the as-tested spacing.

Nail fin anchorages have calculated capacities less than the as-tested anchorage. Thus, spacing specific to the nail fin anchorages are calculated on page 24. Calculations presented on page 24 validate the as-tested anchor spacing for the nail fin anchorages.

Comparative Analysis

The compared products are an alternate-size version of the tested products. Calculations are performed to establish design pressures for the compared products that would cause the same proportional deflection of spanning members (stiles), concentrated loads and member stresses as proven by the tested products as required by Florida Building Code §1709.5.1.3.i. Several potential design pressures are calculated and the proposed design pressure of the compared product shall be the least of the calculated design pressures. Compared panel areas may not exceed the panel area of the tested product. Calculations are presented on page 25 and summarized in the following tables.

Table 6 Results of Comparative Analysis

1615/1617 XX Horizontal Sliding Door (non-Impact) Doors Installed with 8055 Sill Extender						
Panel Height (in)	Design Pressure (psf) for Panel Width (inch)					
	24	30	36	42	48	54
76 (80 Door Height)	+50.0 -85.0	+50.0 -85.0	+50.0 -77.9	+50.0 -70.6	+50.0 -65.5	+50.0 -61.9
80 (84 Door Height)	+50.0 -85.0	+50.0 -83.1	+50.0 -72.8	+50.0 -65.8	+50.0 -60.8	+50.0 -57.2
86 (90 Door Height)	+50.0 -85.0	+50.0 -76.0	+50.0 -66.4	+50.0 -59.7	+50.0 -54.9	-
92 (96 Door Height)	+50.0 -83.9	+50.0 -70.1	+50.0 -61.0	+50.0 -54.6	+/-50.0	-

Notes: 1. Positive design pressure is limited by water test to 50 psf with 8055 sill extender.
 2. Structural design pressures are not limited by glass strength (see page 26 to page 27).

Table 7 Results of Comparative Analysis

1615/1617 XX Horizontal Sliding Door (non-Impact) Doors Installed Under Overhang In Accordance with FBC §1709.5.1.2						
Panel Height (in)	Design Pressure (psf) for Panel Width (inch)					
	24	30	36	42	48	54
76 (80 Door Height)	+/-85.0	+/-85.0	+/-77.9	+/-70.6	+/-65.5	+/-61.9
80 (84 Door Height)	+/-85.0	+/-83.1	+/-72.8	+/-65.8	+/-60.8	+/-57.2
86 (90 Door Height)	+/-85.0	+/-76.0	+/-66.4	+/-59.7	+/-54.9	-
92 (96 Door Height)	+/-83.9	+/-70.1	+/-61.0	+/-54.6	+/-50.0	-

Notes: 1. Doors installed where the overhang ratio ≥ 1 are not limited by water test pressure in accordance with FBC §1709.5.1.2.
 2. Structural design pressures are not limited by glass strength (see page 26 to page 27).

Attachments

Appendix A – Revision Log (1 page)

As-Tested – Through-Frame to Wood

#10 x 2" Wood Screw through-frame to wood

PVC Frame; 0.080" thickness at fastener location

1/4" Maximum Shim Space

Spruce-Pine-Fir Wood Substrate Minimum (G=0.42)

Allowable Shear of #10 x 2" Wood Screw

Z' = 122 lb (See following 2 pages)

Bending of #10 x 2" Wood Screw

L = 1/4" (maximum shim space)

$S = \pi d^3/32 = \pi(0.152)^3/32 = 0.000345 \text{ in}^3$

$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(90,000 \text{ psi}) = 70,200 \text{ psi}$ (1.3 for weak axis bending)

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

$V = 2SF_b/L = (2)(0.000345 \text{ in}^3)(70,200 \text{ psi})/0.25" = 194 \text{ lb.}$

Capacity of Connection is 122 lb

As-Tested – Through-Frame to Wood (Continued)

Lateral Design Strength of Wood Connections

Data

Fastener			
Fastener	=	#10 Wood Screw	
Shank Dia	=	0.190	in.
Root Dia.	=	0.152	in.
F _{yb}	=	80,000	psi
Fastener length	=	1.500	in.
Main Member			
Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain 0° ≤ θ ≤ 90°)
F _e	=	3,350	psi
Thickness	=	1.500	in.
Side Member			
Material	=	Vinyl (PVC)	
G	=	N/A	
θ	=	90	<= (Angle of load to grain 0° ≤ θ ≤ 90°)
F _{es}	=	13,750	psi
Thickness	=	0.080	in.

Calculations

Lateral Bearing Factors

D	=	0.152	in.
ℓ _m	=	1.040	in.
K _θ	=	1.25	
K _D	=	2.20	
R _e	=	0.244	
R _t	=	13.00	
k ₁	=	1.2303	
k ₂	=	0.7300	
k ₃	=	10.80	

As-Tested – Through-Frame to Wood (Continued)

Yield Mode	R _d
I _m , I _s	2.20
II	2.20
III _m , III _s , IV	2.20

Lateral Design Values, Z

Mode I _m	=	241	lbf
Mode I _s	=	76	lbf
Mode II	=	94	lbf
Mode III _m	=	118	lbf
Mode III _s	=	89	lbf
Mode IV	=	126	lbf
C _D	=	1.6	

<===== Minimum Value

Wet Service Factor

Fabrication/In-Service Dry/Dry

 C_M = 1.0

In service temperature T ≤ 100°F

 C_t = 1.0

 C_g = 1.0

 C_Δ = 1.0

Is fastener installed in end grain? No

 C_{eg} = 1.00

Is fastener part of a diaphragm? No

 C_{di} = 1.0

Is fastener toe-nailed? No

 C_{tn} = 1.00

Z' = 122 lbf

As-Tested Installation – Strap Anchor to Wood

#8 x 1-1/2" Wood Screw securing strap anchor to wood

(1) #8 x 5/8" screw securing strap to 0.080" thick PVC frame.

18 gauge (0.043" thick) steel strap anchor ($F_y = 33,000$ psi, $F_u = 45,000$ psi)

1/4" Maximum Shim Space

Spruce-Pine-Fir Wood Substrate Minimum ($G=0.42$)

Allowable Shear of #8 x 1-1/2" Wood Screw

$Z' = 124$ lb (Limited by Mode III_s, See Following 2 Pages)

Allowable Shear of #8 Grade 2 Screw

$V_a = 144$ lb per screw (AAMA TIR A9-14)

Bearing of #8 Screw on Strap Anchor

$V_a = 2.7DtF_{tu}/\Omega$
 $V_a = 2.7(0.164")(0.043")(45,000 \text{ psi})/3.0$
 $V_a = 285$ lb per screw

Bearing of #8 Screw on PVC Frame

$V_a = DtF_p = (0.164")(0.080")(10,000 \text{ psi}) = 131$ lb per screw

Bending of #8 x 2" Wood Screw

$L = 1/4"$ (maximum shim space)
 $S = \pi d^3/32 = \pi(0.131")^3/32 = 0.000221 \text{ in}^3$
 $F_b = (1.3)(0.6F_y) = (1.3)(0.6)(100,000 \text{ psi}) = 78,000$ psi (1.3 for weak axis bending)
 $F_b = M/S = (VL/2)/S$ ($L/2$ for guided bending)
 $V = 2SF_b/L = (2)(0.000221 \text{ in}^3)(78,000 \text{ psi})/0.25" = 138$ lb

Capacity of Connection is 124 lb

As-Tested Installation – Strap Anchor to Wood (Continued)

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.
Main Member			
Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain 0° ≤ 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	<= (Angle of load to grain 0° ≤ θ ≤ 90°)
F _{es}	=	61,850	psi
Thickness	=	0.043	in.

Calculations

Lateral Bearing Factors

D	=	0.131	in.
ℓ _m	=	1.129	in.
K _θ	=	1.25	
K _D	=	2.20	
R _e	=	0.054	
R _t	=	26.26	
k ₁	=	0.5823	
k ₂	=	0.5413	
k ₃	=	18.50	

As-Tested Installation – Strap Anchor to Wood (Continued)

Yield Mode	R_d
I_m, I_s	2.20
II	2.20
III_m, III_s, IV	2.20

Lateral Design Values, Z

Mode I_m	=	225	lbf
Mode I_s	=	158	lbf
Mode II	=	92	lbf
Mode III_m	=	110	lbf
Mode III_s	=	77	lbf
Mode IV	=	108	lbf
C_D	=	1.6	

<===== Minimum Value

Wet Service Factor

Fabrication/In-Service Dry/Dry

 C_M = 1.0

 In service temperature $T \leq 100^\circ\text{F}$
 C_t = 1.0

 C_g = 1.0

 C_Δ = 1.0

Is fastener installed in end grain? No

 C_{eg} = 1.00

Is fastener part of a diaphragm? No

 C_{di} = 1.0

Is fastener toe-nailed? No

 C_{tn} = 1.00

 Z' = **124** lbf

Alternate Installation – Strap Anchor to Steel Stud

#10-16 TEKS Screw securing strap anchor to steel stud

18 gauge (0.0428" thick) steel stud ($F_y = 33,000$ psi, $F_u = 45,000$ psi)

18 gauge (0.043" thick) steel strap anchor ($F_y = 33,000$ psi, $F_u = 45,000$ psi)

1/4" Maximum Shim Space

Allowable Shear of #10-16 TEKS Screw

$$P_{ss}/\Omega = 573 \text{ lb (ESR-1976)}$$

Bearing of #10-16 TEKS Screw on Strap Anchor

$$\begin{aligned} V_a &= 2.7DtF_{tu}/\Omega \\ V_a &= 2.7(0.190")(0.043")(45,000 \text{ psi})/3.0 \\ V_a &= 331 \text{ lb.} \end{aligned}$$

Bearing of #10-16 TEKS Screw on Steel Stud

$$\begin{aligned} V_a &= 2.7DtF_{tu}/\Omega \\ V_a &= 2.7(0.190")(0.0428")(45,000 \text{ psi})/3.0 \\ V_a &= 329 \text{ lb.} \end{aligned}$$

Tilting of #10-16 TEKS Screw in Steel Stud

$$\begin{aligned} V_a &= 4.2(t_2^3 D)^{1/2} F_{tu2}/\Omega \\ V_a &= 4.2(0.0428''^3 \times 0.190'')^{1/2} (45,000 \text{ psi})/3.0 \\ V_a &= 243 \text{ lb.} \end{aligned}$$

Bending of #10-16 TEKS Screw

$$\begin{aligned} L &= 1/4" \text{ (Maximum Shim Space)} \\ S &= \pi d^3/32 = \pi(0.140)^3/32 = 0.000269 \text{ in}^3 \\ F_b &= (1.3)(0.6F_y) = (1.3)(0.6)(92,000 \text{ psi}) = 71,760 \text{ psi (1.3 for weak axis bending)} \\ F_b &= M/S = (VL/2)/S \text{ (L/2 for guided bending)} \\ V &= 2SF_b/L = (2)(0.000269 \text{ in}^3)(71,760 \text{ psi})/0.25" = 155 \text{ lb.} \end{aligned}$$

Capacity of Connection is 155 lb.

#8 Screw at Frame capacity is 131 lb

Alternate Installation – Strap Anchor to Concrete

3/16" Tapcon Anchor; 1-1/2" Minimum Embedment; 2" Minimum Edge Distance

PVC Frame, 0.080" thickness at fastener location

Minimum $f'_c = 3,000$ psi Concrete

18 gauge (0.043" thick) steel strap anchor ($F_y = 33,000$ psi, $F_u = 45,000$ psi)

1/4" Maximum Shim Space

Allowable Shear of 3/16" Tapcon Anchor

$$V_a = 186 \text{ lb} \quad (\text{NOA 21-0201.06})$$

Bearing of 3/16" Tapcon Anchor on Strap Anchor

$$\begin{aligned} V_a &= 2.7D_tF_{tu}/\Omega \\ V_a &= 2.7(0.188")(0.043")(45,000 \text{ psi})/3.0 \\ V_a &= 327 \text{ lb.} \end{aligned}$$

Bending of 3/16" Tapcon

$$\begin{aligned} L &= 1/4" \text{ (Maximum Shim Space)} \\ S &= \pi d^3/32 = \pi(0.145")^3/32 = 0.000299 \text{ in}^3 \\ F_b &= (1.3)(0.6F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \text{ (1.3 for weak axis bending)} \\ F_b &= M/S = (VL/2)/S \text{ (L/2 for guided bending)} \\ V &= 2SF_b/L = (2)(0.000299 \text{ in}^3)(106,860 \text{ psi})/0.25" = 256 \text{ lb.} \end{aligned}$$

Capacity of Connection is 186 lb

Qualifies 1/4" Tapcon if longer length anchor is required to achieve minimum embedment.

#8 Screw at Frame capacity is 131 lb

Alternate Installation – Strap Anchor to CMU

3/16" Tapcon Anchor; 1-1/2" Minimum Embedment, 2" Minimum Edge Distance

PVC Frame, 0.080" thickness at fastener location

Minimum ASTM C90 Concrete Masonry Unit

18 gauge (0.043" thick) steel strap anchor ($F_y = 33,000$ psi, $F_u = 45,000$ psi)

1/4" Maximum Shim Space

Allowable Shear of 3/16" Tapcon Anchor

$$V_a = 135 \text{ lb} \quad (\text{NOA 21-0201.06})$$

Bearing of 3/16" Tapcon Anchor on Strap Anchor

$$\begin{aligned} V_a &= 2.7D_tF_{tu}/\Omega \\ V_a &= 2.7(0.188")(0.043")(45,000 \text{ psi})/3.0 \\ V_a &= 327 \text{ lb.} \end{aligned}$$

Bending of 3/16" Tapcon

$$\begin{aligned} L &= 1/4" \text{ (Maximum Shim Space)} \\ S &= \pi d^3/32 = \pi(0.145")^3/32 = 0.000299 \text{ in}^3 \\ F_b &= (1.3)(0.6F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \text{ (1.3 for weak axis bending)} \\ F_b &= M/S = (VL/2)/S \text{ (L/2 for guided bending)} \\ V &= 2SF_b/L = (2)(0.000299 \text{ in}^3)(106,860 \text{ psi})/0.25" = 256 \text{ lb.} \end{aligned}$$

Capacity of Connection is 135 lb

Qualifies 1/4" Tapcon if longer length anchor is required to achieve minimum embedment.

#8 Screw at Frame capacity is 131 lb

Alternate Installation – Trough-Frame to Steel Stud

#10-16 TEKS Screw

PVC Frame; 0.080" thickness at fastener location

1/4" Maximum Shim Space

Minimum 18 gauge 33 KSI Steel Stud

Allowable Shear of #10-16 TEKS Screw

$$P_{ss}/\Omega = 573 \text{ lb (ESR-1976)}$$

Bearing of #10-16 TEKS Screw on Frame

$$\begin{aligned} V_a &= DtF_p \\ V_a &= (0.190")(0.080")(10,000 \text{ psi}) \\ V_a &= 152 \text{ lb} \end{aligned}$$

Bearing of #10-16 TEKS Screw on Steel Stud

$$\begin{aligned} V_a &= 2.7DtF_{tu}/\Omega \\ V_a &= 2.7(0.190")(0.0428")(45,000 \text{ psi})/3.0 \\ V_a &= 329 \text{ lb.} \end{aligned}$$

Tilting of #10-16 TEKS Screw in Steel Stud

$$\begin{aligned} V_a &= 4.2(t_2^3 D)^{1/2} F_{tu2}/\Omega \\ V_a &= 4.2(0.0428''^3 \times 0.190'')^{1/2} (45,000 \text{ psi})/3.0 \\ V_a &= 243 \text{ lb.} \end{aligned}$$

Bending of #10-16 TEKS Screw

$$\begin{aligned} L &= 1/4" \text{ (Maximum Shim Space)} \\ S &= \pi d^3/32 = \pi(0.140)^3/32 = 0.000269 \text{ in}^3 \\ F_b &= (1.3)(0.6F_y) = (1.3)(0.6)(92,000 \text{ psi}) = 71,760 \text{ psi (1.3 for weak axis bending)} \\ F_b &= M/S = (VL/2)/S \text{ (L/2 for guided bending)} \\ V &= 2SF_b/L = (2)(0.000269 \text{ in}^3)(71,760 \text{ psi})/0.25" = 155 \text{ lb.} \end{aligned}$$

Capacity of Connection is 152 lb.

Alternate Installation – Through-Frame to Concrete

3/16" Tapcon Anchor

1-1/2" Minimum Embedment; 2" Minimum Edge Distance

1/4" Maximum Shim Space

PVC Frame, 0.080" thickness at fastener location

Minimum $f'_c = 3,000$ psi Concrete

Allowable Shear of 3/16" Tapcon Anchor

$$V_a = 186 \text{ lb} \quad (\text{NOA 21-0201.06})$$

Bearing of 3/16" Tapcon Anchor on Frame

$$\begin{aligned} V_a &= DtF_p \\ V_a &= (0.188")(0.080")(10,000 \text{ psi}) \\ V_a &= 150 \text{ lb} \end{aligned}$$

Bending of 3/16" Tapcon

$$\begin{aligned} L &= 1/4" \text{ (Maximum Shim Space)} \\ S &= \pi d^3/32 = \pi(0.145")^3/32 = 0.000299 \text{ in}^3 \\ F_b &= (1.3)(0.6F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \text{ (1.3 for weak axis bending)} \\ F_b &= M/S = (VL/2)/S \text{ (L/2 for guided bending)} \\ V &= 2SF_b/L = (2)(0.000299 \text{ in}^3)(106,860 \text{ psi})/0.25" = 256 \text{ lb.} \end{aligned}$$

Capacity of Connection is 150 lb

Qualifies 1/4" Tapcon if longer length anchor is required to achieve minimum embedment.

Alternate Installation – Through-Frame to CMU

3/16" Tapcon Anchor

1-1/2" Minimum Embedment, 2" Minimum Edge Distance

1/4" Maximum Shim Space

PVC Frame, 0.080" thickness at fastener location

Minimum ASTM C90 Concrete Masonry Unit

Allowable Shear of 3/16" Tapcon Anchor

$$V_a = 135 \text{ lb} \quad (\text{NOA 21-0201.06})$$

Bearing of 3/16" Tapcon Anchor on Frame

$$\begin{aligned} V_a &= DtF_p \\ V_a &= (0.188")(0.080")(10,000 \text{ psi}) \\ V_a &= 150 \text{ lb} \end{aligned}$$

Bending of 3/16" Tapcon

$$\begin{aligned} L &= 1/4" \text{ (Maximum Shim Space)} \\ S &= \pi d^3/32 = \pi(0.145")^3/32 = 0.000299 \text{ in}^3 \\ F_b &= (1.3)(0.6F_y) = (1.3)(0.6)(137,000 \text{ psi}) = 106,860 \text{ psi} \text{ (1.3 for weak axis bending)} \\ F_b &= M/S = (VL/2)/S \text{ (L/2 for guided bending)} \\ V &= 2SF_b/L = (2)(0.000299 \text{ in}^3)(106,860 \text{ psi})/0.25" = 256 \text{ lb.} \end{aligned}$$

Capacity of Connection is 135 lb

Qualifies 1/4" Tapcon if longer length anchor is required to achieve minimum embedment.

Alternate Installation – Nail Fin to Wood

#10 x 1-1/2" Wood Screw

PVC Nailing Fin

Spruce-Pine-Fir Wood Substrate Minimum (G=0.42)

Allowable Tension of #10 x 1-1/2" Wood Screw

$$W = 1.6(1.500'' - 0.062'')(95 \text{ lb/in})(2/3) \quad (\text{NDS, Table 12.2B})$$
$$W = 145 \text{ lb}$$

Pull-Over of #10 x 1-1/2" Wood Screw

Validated by Testing (Test Report AI-04969-C1, see NCTL 22096-1)

Anchor Placement:	8" from corner; 16" on center
Anchor Quantities:	6 each jamb; 9 head; 9 sill; 30 total
Load to Anchors:	$(144'')(82'')(45 \text{ psf}/144) = 3,690 \text{ lb}$
Individual Anchor Load:	$(3,690 \text{ lb})/(30 \text{ anchors}) = 123 \text{ lb}$

Must maintain as-tested anchor head size: 0.370" diameter

Capacity of Connection is 123 lb

Alternate Installation – Nail Fin to Steel Stud

#10-16 TEKS Screw

PVC Nailing Fin

Minimum 18 gauge 33 KSI Steel Stud

Allowable Tension of #10-16 TEKS Screw

$$P_{ts}/\Omega = 885 \text{ lb} \quad (\text{ESR-1976})$$

Pull-Over of #10-16 TEKS Screw

Anchor head size: 0.365" $\approx$ 0.370" Maintain as-tested spacing.
Do not exceed 123 lb

Pull-Out of #10-16 TEKS Screw

$$\begin{aligned} P_{\text{not}} &= 0.85t_c d F_{u2} / \Omega \\ P_{\text{not}} &= 0.85(0.0428")(0.190")(45,000 \text{ psi}) / 3.0 \\ P_{\text{not}} &= 104 \text{ lb} \end{aligned}$$

Capacity of Connection is 104 lb

Nail Fin Anchorage Requirements (non-Impact only)

Door Size:	96" wide by 96" tall
Design Pressure:	50 psf
Load to Anchors:	$(96")(96")(50 \text{ psf}/144) = 3,200 \text{ lb}$
As-Tested Anchors:	$(2)(8 \text{ head} + 8 \text{ jamb}) = 32 \text{ anchors}$
Minimum Nail Fin Capacity:	104 lb
Total Anchor Capacity:	$(104 \text{ lb})(32 \text{ anchors}) = 3,328 \text{ lb} > 3,200 \text{ lb}$

As-tested anchor placement OK for nail fin anchorage.

Comparative Analyses

Sliding Door Comparative Analysis

AAMA 2502-19
 Florida Building Code 1709.5.1
 International Building Code 1709.5
 International Residential Building Code R609.3.1

Manufacturer: MI Windows and Doors

Product: 1615/1617 SGD

Test Report: 12006.09-106-12

Panel Height: 92 inch

Panel Width: 48.625 inch

Design Pressure: 50 psf

Test Door	DP (psf)	Panel Height (inch)	Panel Width (inch)	Load Area (ft ²)	K	B	C	DP Stress (psf)	DP Defl (psf)	DP Point Load (psf)	DP (psf)	Panel Area OK?
	50	92	48.625	11.43	0.26	6.483	63.33	136.1	163.3	104.9	104.9	YES
		76	24.625	5.45	0.16	6.948	67.27	111.6	134.3	88.5	88.5	YES
		76	30.625	6.45	0.20	6.750	65.57	95.6	115.5	77.9	77.9	YES
		76	36.625	7.34	0.24	6.576	64.09	84.7	102.7	70.6	70.6	YES
		76	42.625	8.09	0.28	6.424	62.85	77.0	93.7	65.5	65.5	YES
		76	48.625	8.73	0.32	6.295	61.83	71.5	87.4	61.9	61.9	YES
		80	24.625	5.79	0.15	6.189	61.04	122.4	139.5	98.7	98.7	YES
		80	30.625	6.88	0.19	6.798	65.98	100.2	114.5	83.1	83.1	YES
		80	36.625	7.84	0.23	6.626	64.52	85.6	98.1	72.8	72.8	YES
		80	42.625	8.69	0.27	6.475	63.26	75.6	86.9	65.8	65.8	YES
		80	48.625	9.40	0.30	6.345	62.21	68.4	79.0	60.8	60.8	YES
		80	54.625	9.99	0.34	6.235	61.37	63.2	73.3	57.2	57.2	YES
		86	24.625	6.30	0.14	7.050	68.17	105.5	111.7	90.7	90.7	YES
		86	30.625	7.52	0.18	6.865	66.55	86.1	91.4	76.0	76.0	YES
		86	36.625	8.61	0.21	6.697	65.12	73.4	78.1	66.4	66.4	YES
		86	42.625	9.57	0.25	6.548	63.86	64.5	68.9	59.7	59.7	YES
		86	48.625	10.42	0.28	6.416	62.78	58.1	62.2	54.9	54.9	YES
		86	54.625	11.13	0.32	6.302	61.88	53.4	57.4	51.3	51.3	NO
		92	24.625	6.81	0.13	7.103	68.63	91.9	90.9	83.9	83.9	YES
		92	30.625	8.15	0.17	6.924	67.07	74.8	74.2	70.1	70.1	YES
		92	36.625	9.37	0.20	6.762	65.67	63.6	63.2	61.0	61.0	YES
		92	42.625	10.46	0.23	6.615	64.42	55.7	55.6	54.6	54.6	YES
		92	48.625	11.43	0.26	6.483	63.33	50.0	50.0	50.0	50.0	YES
		92	54.625	12.27	0.30	6.367	62.39	45.7	45.9	46.6	45.7	NO

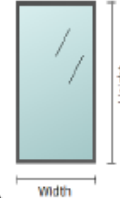
Glazing Analyses

non- Impact Glass

February 02, 2023

Glazing Information

Supported Edges:	Four sides simply supported
Shape:	Rectangular
Lite Width:	42.2 in.
Lite Height:	85.0 in.
Glazing Angle:	90.0 °



Glazing Construction (Double Glazed Insulating Unit)

- Exterior Lite (Monolithic 3/16 in. Fully Tempered)
Airspace (0.500 in.)
- Interior Lite (Monolithic 3/16 in. Fully Tempered)

Comparisons

Short Duration	
50.0 psf 3.00 sec $\leq$ 210 psf	OK
Approximate center of glass deflection	
Exterior Lite	0.58 in.
Interior Lite	0.58 in.

Notes

Load resistance values are computed in accordance with ASTM E1300-12 Section 6

Product Line Glazing Analysis

Glazing Strength – 7/8" IG						
Door Height (in)	Glazing Strength (psf) for Panel Width (inch)					
	24	30	36	42	48	54
80	659	386	294	281	278	266
84	647	374	279	262	261	251
90	631	362	261	232	232	-
96	618	352	246	211	210	-
102	606	344	233	192	-	-
108	597	337	223	181	-	-
114	590	331	217	-	-	-
118	586	327	213	-	-	-
120	584	325	212	-	-	-
126	578	320	-	-	-	-
132	573	316	-	-	-	-
138	568	312	-	-	-	-
144	563	308	-	-	-	-

Notes: 1. DLO is Door Height – 11" x Panel Width – 6"

Appendix A

Revision Log

<u>Identification</u>	<u>Date</u>	<u>Page & Revision</u>
Original Issue	12/12/23	Not Applicable
Revision 1	3/18/2024	Page 3 – Added test results and certification information for OX products