NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17406 • TELEPHONE (717) 846-1200
FAX (717) 767-4100
www.nctlinc.com

PRODUCT APPROVAL SUPPORTING CALCULATIONS

Auraline Composite Horizontal Sliding Window

REPORT TO:

JELD-WEN WINDOWS & DOORS
3737 LAKEPORT BLVD
KLAMATH FALLS, OREGON

REPORT NUMBER: NCTL-110-24876-1
REPORT DATE: 01/13/22

JOSEPH A. REED
LICENSE
No. 58920
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Joseph A. Reed, PE
FL PE 58920
FL REG 33474
2022.01.13 10:33:06 -05'00'

Scope

National Certified Testing Laboratories was contracted by Jeld-Wen Windows & Doors to evaluate alternate installation methods for their *Auraline* Composite Horizontal Sliding windows. The evaluation is based on physical testing and product certifications. Reference standards utilized in this project include:

Florida Building Code, Building. 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 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, National Certified Testing Laboratories hereby certifies the following:

- National Certified Testing Laboratories 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.
- National Certified Testing Laboratories is not owned, operated or controlled by any company manufacturing or distributing products it tests or labels.
- Joseph A. Reed, 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.
- Joseph A. Reed, 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 *Auraline* Composite Horizontal Sliding window 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
Auraline Composite Horizontal Sliding Window (XOX) (Fin and Through Frame Install)	NCTL-310-21-053 (Rev. -, 12/13/21)	108" x 84"	+35/-40 psf

Testing documented in Table 1 was conducted by the National Certified Testing Laboratories laboratory in Everett, Washington (Florida Department of Business & Professional Regulation Test Lab No. TST9341, A2LA Certificate 3054.03).

As-Tested Installation Analysis

For air/water/structural testing the test specimen was secured to a 2x Spruce-Pine-Fir buck. The as-tested installation methods are evaluated on page 3 to page 6. These capacities will be used to prove acceptable alternate anchors and substrates for the windows.

Alternate Anchorages

Calculations on page 7 through page 22 determine the design capacity of alternate installation anchorages for the window.

Anchorage Requirements

As-tested spacing must be maintained. It must be determined the anchorages are not overloaded for the approved window size and design pressures. Calculations presented on page 23 show the anchor spacing requirements for the established limiting anchor capacities.

Anchorage requirements established by this report are accurately presented in Drawing D015651.

Attachments

Appendix A – Revision Log (1 page)

As-Tested Installation – Nail Fin to Wood

#8 x 1-1/4" Pan Head Screw

0.062" thick Nail Fin

Spruce-Pine-Fir 2x Wood Substrate Minimum (G=0.42)

Allowable Tension of #8 x 1-1/4" Pan Head Screw

W = 1.6(1.250"-0.062")(82 lb/in) (NDS, Table 12.2B)
W = 156 lb

Allowable Pull-Over of #8 x 1-1/4" Pan Head Screw

Validated by Testing
Must maintain anchor spacing and anchor head size

As-tested spacing:	8" on center
As-Tested size:	108" x 84"
As-Tested pressure:	-40 psf
As-Tested Anchor Load:	(40 psf/144)(84"/2)(8") = 93 lb
As-tested anchor head size:	0.314"

Capacity of Connection is 93 lb

As-Tested Installation – Through Frame to Wood

#8 Pan Head Screw; 1-1/2" penetration to wood

0.062" thick Window Frame

1/4" Maximum Shim Space

Spruce-Pine-Fir 2x Wood Substrate Minimum (G=0.42)

Allowable Shear of #8 Pan Head Screw

Z' = 113 lb (See Following 2 Pages)

Bending of #8 Pan Head Screw

L = 1/4" (maximum shim space)
$S = \pi d^3/32 = \pi(0.131)^3/32 = 0.000221\ in^3$
$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(90{,}000\ psi) = 70{,}200\ psi$ (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L = (2)(0.000221\ in)(70{,}200\ psi)/0.25" = 124\ lb.$

Capacity of Connection is 113 lb

As-Tested Installation – Through Frame 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	=	2.500	in.

Main Member

Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain $0^o \leq \theta \leq 90^o$)
F_e	=	3,350	psi
Thickness	=	1.500	in.

Side Member

Material	=	Vinyl (PVC)	
G	=	N/A	
θ	=	90	<= (Angle of load to grain $0^o \leq \theta \leq 90^o$)
F_{es}	=	13,750	psi
Thickness	=	0.125	in.

Calculations

Lateral Bearing Factors

D	=	0.131	in.
ℓ_m	=	1.500	in.
K_θ	=	1.25	
K_D	=	2.20	
R_e	=	0.244	
R_t	=	12.00	
k_1	=	1.1349	
k_2	=	0.6403	
k_3	=	6.37	

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

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

Lateral Design Values, Z

Mode I_m	=	299	lbf	
Mode I_s	=	102	lbf	
Mode II	=	116	lbf	
Mode III_m	=	129	lbf	
Mode III_s	=	71	lbf	<====== Minimum Value
Mode IV	=	99	lbf	
C_D	=	1.6		
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'	**=**	**113**	**lbf**	

Alternate Installation – Strap Anchor to Wood

Two #8 x 1-1/2" Pan Head Screws securing strap to substrate

Spruce-Pine-Fir 2x Wood Substrate Minimum (G=0.42)

Two #8 Screws securing strap to window frame

0.125" thick Window Frame

20 gauge (0.033" thick) 33 KSI Steel Strap Anchor

1/4" Maximum Shim Space

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

Z' = 122 lb (See Following 2 Pages)

Bending of #8 x 1-1/2" Pan Head Screw

L = 1/4" (maximum shim space)
$S = \pi d^3/32 = \pi(0.131)^3/32 = 0.000221\ in^3$
$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(90{,}000\ psi) = 70{,}200\ psi$ (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L = (2)(0.000221\ in)(70{,}200\ psi)/0.25" = 124$ lb.

Bearing of #8 Screw on Frame

$F_p = 10{,}000$ psi
D = 0.164"
t = 0.125"
$V_a = F_pDt = (10{,}000\ psi)(0.164")(0.125") = 205$ lb

Bearing of #8 Screw on Strap Anchor

$V_a = 2.7DtF_{tu}/3.0$
$V_a = 2.7(0.164")(0.033")(45{,}000\ psi)/3.0$
$V_a = 219$ lb.

Capacity of Connection is 122 lb

Capacity for Two Screws is 244 lb

Qualifies 8d (0.131" diameter) Nail

Alternate 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	=	2.500	in.

Main Member

Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain $0^o \leq \theta \leq 90^o$)
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 $0^o \leq \theta \leq 90^o$)
F_{es}	=	61,850	psi
Thickness	=	0.033	in.

Calculations

Lateral Bearing Factors

D	=	0.131	in.
ℓ_m	=	1.500	in.
K_θ	=	1.25	
K_D	=	2.20	
R_e	=	0.054	
R_t	=	45.45	
k_1	=	1.0041	
k_2	=	0.5032	
k_3	=	23.87	

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

Alternate Installation – Strap Anchor to Wood (Continued)

Lateral Design Values, Z

Mode I_m	=	299	lbf	
Mode I_s	=	122	lbf	
Mode II	=	122	lbf	
Mode III_m	=	136	lbf	
Mode III_s	=	77	lbf	<====== Minimum Value
Mode IV	=	108	lbf	
C_D	=	1.6		
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**	

Alternate Installation – Nail Fin to Steel Stud

#10-16 TEKS Screw

Minimum 18 gauge 33 KSI Steel Stud

Allowable Tension of #10-16 TEKS Screw

P_{ss}/Ω 885 lb (ESR-1976)

Pull-Out of #10-16 TEKS Screw

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

Pull-Over of #10-16 TEKS Screw

Head Diameter = 0.400" > 0.314" (as tested) **OK**

Capacity of Connection is 104 lb

Alternate Installation – Nail Fin to Wood with Nail

6d Nail (2" x 0.113" dia.)

0.062" thick Nail Fin

Spruce-Pine-Fir 2x Wood Substrate Minimum (G=0.42)

Allowable Tension of 6d Nail

$W = 1.6(2.00"-0.062")(18\text{ lb/in})$ (NDS, Table 12.2C)
$W = 56\text{ lb}$

Capacity of Connection is 56 lb

Alternate Installation – Trough Frame to Steel Stud

#10-16 TEKS Screw

1/4" Maximum Shim Space

Minimum 18 gauge 33 KSI Steel Stud

Allowable Shear of #10-16 TEKS Screw

P_{ss}/Ω = 573 lb (ESR-1976)

Bearing of #10-16 TEKS Screw on Frame

F_p = 10,000 psi
D = 0.190"
t = 0.125"
$V_a = F_pDt$ = (10,000 psi)(0.190")(0.125") = 238 lb

Bearing of #10-16 TEKS Screw on Steel Stud

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.190")(0.0428")(45,000 psi)/3.0
V_a = 329 lb.

Tilting of #10-16 TEKS Screw in Steel Stud

$V_a = 4.2(t_2^3D)^{1/2}F_{tu2}/n_s$
V_a = 4.2(0.0428"^{3} x 0.190")$^{1/2}$(45,000 psi)/3.0
V_a = 243 lb.

Bending of #10-16 TEKS Screw

L = 1/4" (Maximum Shim Space)
$S = \pi d^3/32 = \pi(0.135)^3/32$ = 0.000242 in^3
$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(92,000 psi) = 71,760 psi (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L$ = (2)(0.000242 in^3)(71,760 psi)/0.25" = 139 lb.

Capacity of Connection is 139 lb.

Alternate Installation – Through Frame to Concrete

3/16" Tapcon Anchor

2-1/2" Minimum Edge Distance, 1-1/4" Minimum Embedment

1/4" Maximum Shim Space

Minimum f'_c = 3,000 psi Concrete

Allowable Shear of 3/16" Tapcon Anchor

P_{ss}/Ω = 181 lb (NOA 21-0201.06)

Bearing of 3/16" Tapcon Anchor on Frame

F_p = 10,000 psi
D = 0.170"
t = 0.125"
$V_a = F_pDt$ = (10,000 psi)(0.170")(0.125") = 213 lb

Bending of 3/16" Tapcon Anchor

L = 1/4" (Maximum Shim Space)
$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482\ in^3$
$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(137,000 psi) = 106,860 psi (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L = (2)(0.000482\ in^3)(106,860\ psi)/0.25"$ = 412 lb.

Capacity of Connection is 181 lb

Alternate Installation – Through Frame to CMU

3/16" Tapcon Anchor

2-1/2" Minimum Edge Distance, 1-1/4" Minimum Embedment

1/4" Maximum Shim Space

Minimum ASTM C90 Concrete Masonry Unit

Allowable Shear of 3/16" Tapcon Anchor

P_{ss}/Ω = 135 lb (NOA 21-0201.06)

Bearing of 3/16" Tapcon Anchor on Frame

F_p = 10,000 psi
D = 0.170"
t = 0.125"
$V_a = F_pDt$ = (10,000 psi)(0.170")(0.125") = 213 lb

Bending of 3/16" Tapcon Anchor

L = 1/4" (Maximum Shim Space)
$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482\ in^3$
$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(137,000 psi) = 106,860 psi (1.3 for weak axis bending)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L$ = (2)(0.000482 in^3)(106,860 psi)/0.25" = 412 lb.

Capacity of Connection is 135 lb

Alternate Installation – Strap Anchor to Wood with Nail

Two 6d nails (2" x 0.113" dia.) securing strap to substrate

Spruce-Pine-Fir 2x Wood Substrate Minimum (G=0.42)

Two #8 Screws securing strap to window frame

0.125" thick Window Frame

20 gauge (0.033" thick) 33 KSI Steel Strap Anchor

1/4" Maximum Shim Space

Allowable Shear of 6d Nail

$Z' = 96$ lb (See Following 2 Pages)

Bending of 6d Nail

L = 1/4" (maximum shim space)
$S = \pi d^3/32 = \pi(0.113)^3/32 = 0.000142\ in^3$
$F_b = (1.3)(0.6F_y) = (1.3)(0.6)(100{,}000\ psi) = 78{,}000\ psi$ (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L = (2)(0.000142\ in)(78{,}000\ psi)/0.25" = 88$ lb.

Bearing of #8 Screw on Frame

$F_p = 10{,}000$ psi
D = 0.164"
t = 0.125"
$V_a = F_pDt = (10{,}000\ psi)(0.164")(0.125") = 205$ lb

Bearing of #8 Screw on Strap Anchor

$V_a = 2.7DtF_{tu}/3.0$
$V_a = 2.7(0.164")(0.033")(45{,}000\ psi)/3.0$
$V_a = 219$ lb.

Capacity of Connection is 88 lb

Capacity for Two Nails is 176 lb

Alternate Installation – Strap Anchor to Wood with Nail (Continued)

Lateral Design Strength of Wood Connections

Data

Fastener

Fastener	=	6d Common nail	
Shank Dia	=	0.113	in.
Root Dia.	=	0.113	in.
F_{yb}	=	100,000	psi
Fastener length	=	2.000	in.

Main Member

Material	=	SPF	
G	=	0.42	
θ	=	90	<= (Angle of load to grain $0^o \leq \theta \leq 90^o$)
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 $0^o \leq \theta \leq 90^o$)
F_{es}	=	61,850	psi
Thickness	=	0.033	in.

Calculations

Lateral Bearing Factors

D	=	0.113	in.
ℓ_m	=	1.500	in.
K_θ	=	1.25	
K_D	=	2.20	
R_e	=	0.054	
R_t	=	45.45	
k_1	=	1.0041	
k_2	=	0.4945	
k_3	=	21.77	

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

Alternate Installation – Strap Anchor to Wood with Nail (Continued)

Lateral Design Values, Z

Mode I_m	=	258	lbf	
Mode I_s	=	105	lbf	
Mode II	=	105	lbf	
Mode III_m	=	115	lbf	
Mode III_s	=	60	lbf	<====== Minimum Value
Mode IV	=	84	lbf	
C_D	=	1.6		
		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'	**=**	**96**	**lbf**	

Alternate Installation – Strap Anchor to Steel Stud

#10-16 TEKS Screws Connecting Strap to Steel Stud

#8 Screws Connecting Strap to Window Frame

0.125" thick Window Frame

18 gauge (0.043" thick) 33 KSI Steel Stud

20 gauge (0.033" thick) 33 KSI Steel Strap Anchor

1/4" Maximum Shim Space

Allowable Shear of #10-16 TEKS Screw

P_{ss}/Ω = 573 lb (ESR-1976)

Bearing of #10-16 TEKS Screw on Steel Strap Anchor

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.190")(0.033")(45,000 psi)/3.0
V_a = 253 lb.

Bearing of #10-16 TEKS Screw on Steel Stud

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.190")(0.043")(45,000 psi)/3.0
V_a = 331 lb.

Tilting of #10-16 TEKS Screw in Steel Stud

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

Bending of #10-16 TEKS Screw

L = 1/4" (Maximum Shim Space)
$S = \pi d^3/32 = \pi(0.135)^3/32 = 0.000242 \text{ in}^3$
$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(92,000 psi) = 71,760 psi (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L = (2)(0.000242 \text{ in}^3)(71{,}760 \text{ psi})/0.25''$ = 139 lb.

Alternate Installation – Strap Anchor to Steel Stud (Continued)

Bearing of #8 Screw on Strap Anchor

$V_a = 2.7DtF_{tu}/3.0$
$V_a = 2.7(0.164")(0.033")(45,000 \text{ psi})/3.0$
$V_a = 219$ lb.

Bearing of #8 Screw on Frame

$F_p = 10,000$ psi
$D = 0.164"$
$t = 0.125"$
$V_a = F_pDt = (10,000 \text{ psi})(0.164")(0.125") = 205$ lb

Capacity of Connection is 139 lb

Capacity for Two Screws is 278 lb

<u>Alternate Installation – Strap Anchor to Concrete</u>

3/16" Tapcon Anchor; 2-1/2" Minimum Edge Distance, 1-1/4" Minimum Embedment

#8 Screws Connecting Strap to Window Frame

0.125" thick Window Frame

20 gauge (0.033" thick) 33 KSI Steel Strap Anchor

1/4" Maximum Shim Space

Minimum f'_c = 3,000 psi Concrete

<u>Allowable Shear of 3/16" Tapcon Anchor</u>

P_{ss}/Ω = 181 lb (NOA 21-0201.06)

<u>Bearing of 3/16" Tapcon Anchor on Strap Anchor</u>

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.170")(0.033")(45,000 psi)/3.0
V_a = 227 lb.

<u>Bending of 3/16" Tapcon Anchor</u>

L = 1/4" (Maximum Shim Space)
$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482\ in^3$
$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(137,000 psi) = 106,860 psi (1.3 weak axis factor)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L$ = (2)(0.000482 in^3)(106,860 psi)/0.25" = 412 lb.

<u>Bearing of #8 Screw on Strap Anchor</u>

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.164")(0.033")(45,000 psi)/3.0
V_a = 219 lb.

Alternate Installation – Strap Anchor to Concrete (Continued)

Bearing of #8 Screw on Frame

F_p = 10,000 psi
D = 0.164"
t = 0.125"
$V_a = F_p D t$ = (10,000 psi)(0.164")(0.125") = 205 lb

Capacity of Connection is 181 lb

Alternate Installation – Strap Anchor to CMU

3/16" Tapcon Anchor; 2-1/2" Minimum Edge Distance, 1-1/4" Minimum Embedment

#8 Screws Connecting Strap to Window Frame

0.125" thick Window Frame

20 gauge (0.033" thick) 33 KSI Steel Strap Anchor

1/4" Maximum Shim Space

Minimum ASTM C90 Concrete Masonry Unit

Allowable Shear of 3/16" Tapcon Anchor

P_{ss}/Ω = 135 lb (NOA 21-0201.06)

Bearing of 3/16" Tapcon Anchor on Strap Anchor

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.170")(0.033")(45,000 psi)/3.0
V_a = 227 lb.

Bending of 3/16" Tapcon Anchor

L = 1/4" (Maximum Shim Space)
S = $\pi d^3/32 = \pi(0.170")^3/32 = 0.000482$ in^3
$F_b = (1.3)(0.6F_y)$ = (1.3)(0.6)(137,000 psi) = 106,860 psi (1.3 for weak axis bending)
$F_b = M/S = (VL/2)/S$ (L/2 for guided bending)
$V = 2SF_b/L$ = (2)(0.000482 in^3)(106,860 psi)/0.25" = 412 lb.

Bearing of #8 Screw on Strap Anchor

$V_a = 2.7DtF_{tu}/3.0$
V_a = 2.7(0.164")(0.033")(45,000 psi)/3.0
V_a = 219 lb.

<u>Alternate Installation – Strap Anchor to CMU</u> (Continued)

<u>Bearing of #8 Screw on Frame</u>

F_p = 10,000 psi
D = 0.164"
t = 0.125"
$V_a = F_pDt$ = (10,000 psi)(0.164")(0.125") = 205 lb

Capacity of Connection is 135 lb

<u>108x84 +35/-40 psf</u>

Anchorage Requirements – Nail Fin

Window Overall Size: 108" x 84"
Window Overall Area: (108")(84")/144 = 63 ft^2
Window Overall Wind Load: (40 psf)(63 ft^2) = 2,520 lb
Installed Anchors: 12 head + 12 sill + 2(9) jambs = 42 installed anchors
Minimum Anchor Capacity: 56 lb/anchor
Total Anchor Capacity: (42 anchors)(56 lb/anchor) = 2,352 lb ≈ 2,520 lb **OK**

Anchorage Requirements – Through Frame and Strap Anchor

Window Overall Size: 108" x 84"
Window Overall Area: (108")(84")/144 = 63 ft^2
Window Overall Wind Load: (40 psf)(63 ft^2) = 2,520 lb
Installed Anchors: 6 head + 6 sill + 2(5) jambs = 22 installed anchors
Minimum Anchor Capacity: 113 lb/anchor
Total Anchor Capacity: (22 anchors)(113 lb/anchor) = 2,486 lb ≈ 2,520 lb **OK**

Appendix A

Revision Log

Identification	Date	Page & Revision
Original Issue	01/13/22	Not Applicable