



# **NATIONAL CERTIFIED TESTING LABORATORIES**

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## **PRODUCT APPROVAL SUPPORTING CALCULATIONS**

### **Premium Vinyl Sidelite/Transom NRW Stile Impact Window**

REPORT TO:

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

REPORT NUMBER: NCTL-110-23271-1  
REPORT DATE: 04/13/20

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FL PE 58920  
FL REG 33474



### Scope

National Certified Testing Laboratories was contracted by Jeld-Wen Windows & Doors to evaluate alternate installation methods for their Premium Vinyl Sidelite/Transom NRW Stile Impact 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 16-1222.06 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.
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## **Analyses**

### **Summary of Test Results**

The following table summarizes the various Premium Vinyl Sidelite/Transom NRW Stile Impact window products and their corresponding performance levels which have been established by testing or product certification.

**Table 1** Summary of Test Results

<b>Series/Model</b>	<b>Test Report Number</b>	<b>Size (W x H)</b>	<b>Performance</b>
Premium Vinyl Sidelite/Transom (Fin Install)	NCTL-110-17-018 (Rev. 1, 12/20/18)	48" x 80"	+50/-55 psf Missile D Wind Zone 3
Premium Vinyl Sidelite/Transom (Frame Install)	NCTL-110-17-018 (Rev. 1, 12/20/18)	48" x 80"	+50/-55 psf Missile D Wind Zone 3

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 3054.01).

### **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 4 to page 7. These capacities will be used to prove acceptable alternate anchors and substrates for the windows.

### **Alternate Anchorages**

Calculations on page 8 through page 11 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 12 show the anchor spacing requirements for the established limiting anchor capacities.

Anchorage requirements established by this report are accurately presented in Drawing D014566.



## **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**

$$W = 1.6(1.250"-0.062")(82 \text{ lb/in}) \quad (\text{NDS, Table 11.2B})$$
$$W = 156 \text{ lb}$$

**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 at head: 8" on center  
Load to fastener (48x80):  $(0.42)(55 \text{ psf}/144)(48"/2)(8") = 31 \text{ lb}$   
(0.42 factor for triangular load at head)

As-tested spacing at jambs: 4" on center  
Load to fastener (48x80):  $(55 \text{ psf}/144)(48"/2)(4") = 37 \text{ lb}$

As-tested anchor head size: 0.314"

**Capacity of Connection is 37 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**

$Z' = 113 \text{ lb}$  (See Following 2 Pages)

#### **Bending of #8 Pan Head Screw**

$L = 1/4''$  (maximum shim space)

$S = \pi d^3/32 = \pi(0.131)^3/32 = 0.000221 \text{ in}^3$

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

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

$V = 2SF_b/L = (2)(0.000221 \text{ in})(70,200 \text{ psi})/0.25'' = 124 \text{ lb}$ .

**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 <sub>yb</sub>	=	90,000 psi
Fastener length	=	2.500 in.

**Main Member**

Material	=	SPF
G	=	0.42
θ	=	90 ≤ (Angle of load to grain 0° ≤ θ ≤ 90°)
F <sub>e</sub>	=	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 <sub>es</sub>	=	13,750 psi
Thickness	=	0.125 in.

**Calculations**

**Lateral Bearing Factors**

D	=	0.131 in.
ℓ <sub>m</sub>	=	1.500 in.
K <sub>θ</sub>	=	1.25
K <sub>D</sub>	=	2.20
R <sub>e</sub>	=	0.244
R <sub>t</sub>	=	12.00
k <sub>1</sub>	=	1.1349
k <sub>2</sub>	=	0.6403
k <sub>3</sub>	=	6.37

Yield Mode	R <sub>d</sub>
I <sub>m</sub> , I <sub>s</sub>	2.20
II	2.20
III <sub>m</sub> , III <sub>s</sub> , IV	2.20



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

**Lateral Design Values, Z**

Mode I <sub>m</sub>	=	299	lbf
Mode I <sub>s</sub>	=	102	lbf
Mode II	=	116	lbf
Mode III <sub>m</sub>	=	129	lbf
Mode III <sub>s</sub>	=	71	lbf
Mode IV	=	99	lbf
C <sub>D</sub>	=	1.6	

<===== Minimum Value

**Wet Service Factor**

Fabrication/In-Service	Dry/Dry
C <sub>M</sub>	= 1.0
In service temperature	T ≤ 100°F
C <sub>t</sub>	= 1.0
C <sub>g</sub>	= 1.0
C <sub>Δ</sub>	= 1.0
Is fastener installed in end grain?	No
C <sub>eg</sub>	= 1.00
Is fastener part of a diaphragm?	No
C <sub>di</sub>	= 1.0
Is fastener toe-nailed?	No
C <sub>tn</sub>	= 1.00
<b>Z'</b>	= <b><u>113</u></b> 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**

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

**Pull-Out of #10-16 TEKS Screw**

$$P_{\text{not}} = 0.85t_c d F_{u2} / \Omega$$

$$P_{\text{not}} = 0.85(0.0428")(0.190")(45,000 \text{ psi}) / 3.0$$

$$P_{\text{not}} = 104 \text{ lb}$$

**Pull-Over of #10-16 TEKS Screw**

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

**Capacity of Connection is 104 lb**

**Limit Spacing to As-Tested**



## 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

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

### Bearing of #10-16 TEKS Screw on Frame

$$F_p = 10,000 \text{ psi}$$

$$D = 0.190''$$

$$t = (2)(0.080'') = 0.160''$$

$$V_a = F_p D t = (10,000 \text{ psi})(0.190'')(0.160'') = 304 \text{ lb}$$

### Bearing of #10-16 TEKS Screw on Steel Stud

$$V_a = 2.7 D t F_{tu} / 3.0$$

$$V_a = 2.7(0.190'')(0.0428'')(45,000 \text{ psi}) / 3.0$$

$$V_a = 329 \text{ lb.}$$

### Tilting of #10-16 TEKS Screw in Steel Stud

$$V_a = 4.2(t_2^3 D)^{1/2} F_{tu2} / n_s$$

$$V_a = 4.2(0.0428''^3 \times 0.190'')^{1/2} (45,000 \text{ psi}) / 3.0$$

$$V_a = 243 \text{ lb.}$$

### Bending of #10-16 TEKS Screw

$$L = 1/4'' \text{ (Maximum Shim Space)}$$

$$S = \pi d^3 / 32 = \pi(0.135)^3 / 32 = 0.000242 \text{ in}^3$$

$$F_b = (1.3)(0.6 F_y) = (1.3)(0.6)(92,000 \text{ psi}) = 71,760 \text{ psi (1.3 weak axis factor)}$$

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

$$V = 2 S F_b / L = (2)(0.000242 \text{ in}^3)(71,760 \text{ psi}) / 0.25'' = 139 \text{ lb.}$$

**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**

$$P_{ss}/\Omega = 181 \text{ lb} \quad (\text{NOA-No. 16-1222.06})$$

#### **Bearing of 3/16" Tapcon Anchor on Frame**

$$F_p = 10,000 \text{ psi}$$

$$D = 0.170"$$

$$t = (2)(0.080") = 0.160"$$

$$V_a = F_p D t = (10,000 \text{ psi})(0.170")(0.160") = 272 \text{ lb}$$

#### **Bending of 3/16" Tapcon Anchor**

$$L = 1/4" \text{ (Maximum Shim Space)}$$

$$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482 \text{ in}^3$$

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

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

$$V = 2SF_b/L = (2)(0.000482 \text{ in}^3)(106,860 \text{ psi})/0.25" = 412 \text{ lb.}$$

**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**

$$P_{ss}/\Omega = 135 \text{ lb} \quad (\text{NOA-No. 16-1222.06})$$

### **Bearing of 3/16" Tapcon Anchor on Frame**

$$F_p = 10,000 \text{ psi}$$

$$D = 0.170"$$

$$t = (2)(0.080") = 0.160"$$

$$V_a = F_p D t = (10,000 \text{ psi})(0.170")(0.160") = 272 \text{ lb}$$

### **Bending of 3/16" Tapcon Anchor**

$$L = 1/4" \text{ (Maximum Shim Space)}$$

$$S = \pi d^3/32 = \pi(0.170")^3/32 = 0.000482 \text{ in}^3$$

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

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

$$V = 2SF_b/L = (2)(0.000482 \text{ in}^3)(106,860 \text{ psi})/0.25" = 412 \text{ lb.}$$

**Capacity of Connection is 135 lb**



**48x80 +50/-55 psf**

**Anchorage Requirements – Nail Fin**

Window Overall Size: 48" x 80"

Window Overall Area:  $(48")(80")/144 = 26.7 \text{ ft}^2$

Window Overall Wind Load:  $(55 \text{ psf})(26.7 \text{ ft}^2) = 1,469 \text{ lb}$

Installed Anchor Spacing: 8" head; 8" sill; 4" each jamb

Installed Anchors: 6 head + 6 sill + 2(19) jambs = 50 installed anchors

Minimum Anchor Capacity: 37 lb/anchor

Total Anchor Capacity:  $(50 \text{ anchors})(37 \text{ lb/anchor}) = 1,850 \text{ lb} > 1,469 \text{ lb}$  **OK**

**Anchorage Requirements – Through Frame**

Window Overall Size: 48" x 80"

Window Overall Area:  $(48")(80")/144 = 26.7 \text{ ft}^2$

Window Overall Wind Load:  $(55 \text{ psf})(26.7 \text{ ft}^2) = 1,469 \text{ lb}$

Installed Anchor Spacing: 16" head; 16" sill; 16" each jamb

Installed Anchors: 4 head + 4 sill + 2(6) jambs = 20 installed anchors

Minimum Anchor Capacity: 113 lb/anchor

Total Anchor Capacity:  $(20 \text{ anchors})(113 \text{ lb/anchor}) = 2,260 \text{ lb} > 1,469 \text{ lb}$  **OK**



## Appendix A

### Revision Log

<u>Identification</u>	<u>Date</u>	<u>Page &amp; Revision</u>
Original Issue	04/13/20	Not Applicable