Product Approval Supporting Calculations
Alternative Anchorage Analysis & Design

Project Number: SCE 25-03007

Drawing Number: D009345

Reference Test Report: NCTL 210-3899-1 A

Product Name: Premium Atlantic Vinyl 74" x 54"

Prepared for:
Jeld-Wen Windows & Doors
3737 Lakeport Blvd.
Klamath Falls, OR

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03/21/25

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This item has been digitally signed and sealed by Micah Swartz, P.E. on the date adjacent to the seal.

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Scope:

Swartz Consulting Engineers LLC is contracted by Jeld-Wen Windows & Doors to evaluate alternative anchorage for the product: Premium Atlantic Vinyl 74" x 54". This evaluation is based on testing performed by National Certified Testing Laboratories in Orlando, FL, test report no.: NCTL 210-3899-1 A and dated 7/11/13.

This evaluation does not include the air infiltration, water resistance or water penetration of the installation method or the installed product. In addition, the design of the building substrate to resist the superimposed loads is by others.

Reference Standards:

Florida Building Code, Building, 2023 Edition

ANSI/AWC NDS 2018 - National Design Specification (NDS) for Wood Construction

AISI S100-16 (2020) North American Specification for the Design of Cold-Formed Steel Structural Members

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

ICC-ES Report ESR-2196 Hilti Self Drilling Screws to connect cold-formed steel

NOA 24-0102.06 Tapcon Concrete and Masonry Anchors with Advanced Threadform Technology

Certification of Independence:

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

(1) Swartz Consulting Engineers 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

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Design Summary:

The table below summarizes the product: Premium Atlantic Vinyl 74" x 54" and their corresponding performance levels as established by testing.

Table 1: Summary of Test Results

Series/Model	Test Report Number	Size (W x H)	Performance
Premium Atlantic Vinyl 74" x 54"	NCTL 210-3899-1 A (7/11/13)	74" x 54"	+65 psf / -70 psf

As Tested Design:

Applied Load (psf): -70 psf Width: 74 in Height: 54 in Window Area: 27.8 ft^2

Total Load: -1943 lbs Number of Fasteners: 18 ft Load Per Fastener (Nailfin): -108 lbs

Load Per Fastener (Thru Frame): -108 lbs

Screw Information:

Screw Size: 10 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 228 lbs Unity: 0.47

Wood Screw Lateral: 149 lbs Unity: 0.73

Alternative Fasteners:

Screw Information:

Screw Size: 10 Screw Embed: 1.5 in Edge Distance: 3/4 in (minimum)

Wood Screw Withdrawal: 228 lbs Unity: 0.47

Wood Screw Lateral: 149 lbs Unity: 0.73

Nail Information:

Nail Size: 6d Nail Type: Box Edge Distance: 3/4 in (minimum)

Total Load: -1943 lbs Number of Nails: 44 Load Per Fastener (Nailfin): -44 lbs

Nail Withdrawal: 47 lbs Unity: 0.94

Nail Lateral: 76 lbs Unity: 0.58

Design Summary Continued:

TEK Screw Information:

Screw Size: 10-16

TEK Withdrawal:	145	lbs	Unity:	0.74
TEK Lateral:	147	lbs	Unity:	0.73

Tapcon Information:

Tapcon Size: 3/16 Embedment: 1-1/4 in (minimum) Edge Distance: 2-1/2 in (minimum)

Tapcon Lateral (Concrete):	155	lbs	Unity:	0.70
Tapcon Lateral (CMU):	135	lbs	Unity:	0.80

Summary of Test Results - Plastics Checklist

Table 2: Summary of Test Results - Plastics Checklist

Product	Test Report Number	Test Standard	Performance
White PVC 1476 5110	P6504.04-106-18 R0	ASTM D638 (before and after G155)	+9.5%
		ASTM D1929	824 °F (440 °C)
		ASTM D2843	71.8
		ASTM D635	Classification CC1
		ASTM 256	-3.3%
White PVC 1476 5290	P6504.04-106-18 R0	ASTM D638 (before and after G155)	+9.5%
		ASTM D1929	806 °F (430 °C)
		ASTM D2843	72.6
		ASTM D635	Classification CC1
		ASTM 256	-35.5%

The testing summarized in the table above was conducted by Intertek in York, PA dated 08/23/23 and meets the requirements listed in Miami-Dade County Checklist #0445, For the approval of: Plastic and Foam Plastic.

Subject: As Tested - Wood Screw Withdrawal

Input:
Calculation:

Screw Information:

Screw Size: 10 Root Diameter: 0.152 in
Screw Embed: 1.5 in

Main Member Type: S-P-F G: 0.42 F_{em}: 3,350 psi

$$W' = W * C_D * C_M{}^2 * C_t \ - As\ per\ table\ 11.3.1\ NDS\ 2018$$

C_D: 1.6 Load Duration Factor - Table 2.3.2 (NDS 2018)
C_M: 1.0 Wet Service Factor - Table 11.3.3 (NDS 2018)
C_t: 1.0 Temperature Factor - Table 11.3.4 (NDS 2018)

W: 95 lbs/in - Table 12.2B (NDS 2018)
W: 143 lbs

W': 228 lbs

Subject: As Tested - Wood Screw Lateral Design - Single Shear

Input:
Calculation:

Screw Information:

Screw Size: 10 Root Diameter: 0.152 in
Screw Embed: 1.5 in

Main Member Type: S-P-F G: 0.42 F_{em}: 3,350 psi thickness (t_m): 1.5 in

Side Member Type: S-P-F G: 0.42 F_{es}: 3,350 psi thickness (t_s): 1.25 in

Lateral Design Factors - Table 12.3.1A (NDS 2018)

D:	0.152	in	Diameter
F_{yb}:	90	ksi	Dowel Bending Yield Strength
F_{em}:	3,350	psi	Main Member dowel bearing strength
F_{es}:	3,350	psi	Side Member dowel bearing strength
l_m:	1.5	in	Main Member dowel bearing length
l_s:	1.25	in	Side Member dowel bearing length
R_d:	2.2		Reduction term - Table 12.3.1B (NDS 2018)
R_e:	1		$= F_{em}/F_{es}$
R_t:	1.2		$= l_m/l_s$
k_1:	0.459		See Table
k_2:	1.133		See Table

Reference Lateral Design Values - Table 12.3.1A (NDS 2018)

Note: Side member is part of the Jeld-Wen assembly and verified during testing. Modes Z_{Is} and Z_{IIIs} are not applicable to the calculation.

Z_{Im}: 347 lbs $$Z_{I_m} = \frac{D l_m F_{em}}{R_d} \text{ (EQ } 12.3-1)$$

Z_{II}: 133 lbs $$Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \ (EQ\ 12.3-3)$$

Z_{IIIm}: 131 lbs $$Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1+2R_e)R_d} \text{ (EQ } 12.3-4)$$

Z_{IV}: 105 lbs $$Z_{IV} = \frac{D^2}{R_d}\sqrt{\frac{2F_{em}F_{yb}}{3(1+R_e)}} \ (EQ\ 12.3-6)$$

Z_{MIN}: 105 lbs

Subject: As Tested - Wood Screw Lateral Design - Single Shear Cont.

Adjusted Lateral Design Values

$$Z' = Z * C_D * C_M * C_t * C_g * C_\Delta \ - As\ per\ table\ 11.3.1\ NDS\ 2018$$

C_D:	1.6	Load Duration Factor - Table 2.3.2 (NDS 2018)
C_M:	1.0	Wet Service Factor - Table 11.3.3 (NDS 2018)
C_t:	1.0	Temperature Factor - Table 11.3.4 (NDS 2018)
C_g:	1.0	Group Action Factor - Section 11.3.6 (NDS 2018)
C_Δ:	1.0	Geometry Factor - Section 12.5.1.1 (NDS 2018)

Z': **168** lbs

Fastener Bending Across Shim Space

Ω:	1.67		
L:	0.25	in	Maximum Shim Gap
D:	**0.152**	in	Diameter
F_{yb}:	**90**	ksi	Dowel Bending Yield Strength

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb}\pi D^3}{16\Omega L} \qquad Where\ M = \frac{ZL}{2}\ (Guided\ Bending)$$

Z_n/Ω: **149** lbs

Bearing on Masonry Strap

Ω:	3.00		
F_u:	33	ksi	Tensile Strength of strap
t:	20	GA	
t:	**0.036**	in	thickness of strap
D:	**0.152**	in	

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u \ - (EQ.J4.3.1 - 4, AISI\ S100)$$

P_{nv}/Ω: **162** lbs

Subject: Nail Withdrawal

Input:
Calculation:

Nail Information:

Nail Size: 6d
Nail Length: 2 in
Nail Type: Box
Nail Diameter: 0.099 in
Nail Embedment: 1.88 in

Main Member Type: S-P-F G: 0.42 F_{em}: 3,350 psi thickness (t_m): 1.5 in

Side Member Type: PVC G: N/A F_{es}: 13,750 psi thickness (t_s): 0.125 in

$$W' = W * C_D * C_M{}^2 * C_t \ - As\ per\ table\ 11.3.1\ NDS\ 2018$$

C_D: 1.6 Load Duration Factor - Table 2.3.2 (NDS 2018)
C_M: 1.0 Wet Service Factor - Table 11.3.3 (NDS 2018)
C_t: 1.0 Temperature Factor - Table 11.3.4 (NDS 2018)

W: 16 lbs/in
W: 29 lbs

$$W = 1380G^{5/2}D \ - Carbon\ Steel\ Nails\ (EQ.12.2-3, NDS\ 2018)$$

W': 47 lbs

Subject: Nail Lateral Design - Single Shear

Input:
Calculation:

Nail Information:

Nail Size: 6d
Nail Length: 2 in
Nail Type: Box
Nail Diameter: 0.099 in
Nail Embedment: 1.63 in

Main Member Type: S-P-F G: 0.42 F_{em}: 3,350 psi thickness (t_m): 1.5 in

Side Member Type: PVC G: N/A F_{es}: 13,750 psi thickness (t_s): 0.125 in

Lateral Design Factors - Table 12.3.1A (NDS 2018)

D:	0.099	in	Diameter
F_{yb}:	100	ksi	Dowel Bending Yield Strength
F_{em}:	3,350	psi	Main Member dowel bearing strength
F_{es}:	13,750	psi	Side Member dowel bearing strength
l_m:	1.625	in	Main Member dowel bearing length
l_s:	0.125	in	Side Member dowel bearing length
R_d:	2.2		Reduction term - Table 12.3.1B (NDS 2018)
R_e:	0.2436		$= F_{em}/F_{es}$
R_t:	13.0		$= l_m/l_s$
k_1:	1.230		See Table
k_2:	0.612		See Table

Reference Lateral Design Values - Table 12.3.1A (NDS 2018)

Note: Side member is part of the Jeld-Wen assembly and verified during testing. Modes Z_{Is} and Z_{IIIs} are not applicable to the calculation.

Z_{Im}: 245 lbs $$Z_{I_m} = \frac{D l_m F_{em}}{R_d} \text{ (EQ } 12.3-1)$$

Z_{II}: 95 lbs $$Z_{II} = \frac{k_1 D l_s F_{es}}{R_d} \ (EQ\ 12.3-3)$$

Z_{IIIm}: 101 lbs $$Z_{III_m} = \frac{k_2 D l_m F_{em}}{(1+2R_e)R_d} \text{ (EQ } 12.3-4)$$

Z_{IV}: 60 lbs $$Z_{IV} = \frac{D^2}{R_d}\sqrt{\frac{2F_{em}F_{yb}}{3(1+R_e)}} \ (EQ\ 12.3-6)$$

Z_{MIN}: 60 lbs

Subject: Nail Lateral Design - Single Shear Cont.

Adjusted Lateral Design Values

$$Z' = Z * C_D * C_M * C_t * C_g * C_\Delta \ - As\ per\ table\ 11.3.1\ NDS\ 2018$$

C_D:	1.6	Load Duration Factor - Table 2.3.2 (NDS 2018)
C_M:	1.0	Wet Service Factor - Table 11.3.3 (NDS 2018)
C_t:	1.0	Temperature Factor - Table 11.3.4 (NDS 2018)
C_g:	1.0	Group Action Factor - Section 11.3.6 (NDS 2018)
C_Δ:	1.0	Geometry Factor - Section 12.5.1.1 (NDS 2018)

Z': **96** lbs

Fastener Bending Across Shim Space

Ω:	1.67		
L:	0.25	in	Maximum Shim Gap
D:	**0.099**	in	Diameter
F_{yb}:	**100**	ksi	Dowel Bending Yield Strength

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16ZL}{\pi D^3} \Leftrightarrow Z = \frac{F_{yb}\pi D^3}{16\Omega L} \qquad Where\ M = \frac{ZL}{2}\ (Guided\ Bending)$$

Z_n/Ω: **76** lbs

Bearing on Masonry Strap

Ω:	3.00		
F_u:	33	ksi	Tensile Strength of strap
t:	20	GA	
t:	**0.036**	in	thickness of strap
D:	**0.099**	in	

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u \ - (EQ.J4.3.1 - 4, AISI\ S100)$$

P_{nv}/Ω: **106** lbs

Subject: TEK Withdrawal

Input:
Calculation:

Shear Strength of Fastener - ESR 1976

Screw Size: **10-16**

P_{nv}/Ω: **885** lbs See ESR 2196

Tensile Pullout - ESR 1976

Screw Size: **10-16**

F_u: 45 ksi Tensile Strength of material NOT in contact with screw head

t: 16 GA

t: **0.0598** in Thickness of material NOT in contact with screw head

P_{nv}/Ω: **145** lbs See ESR 2196

Tensile Pullover

Note: The tensile pullover analysis checks the material IN contact with the screw head. This material is part of the Jeld-Wen assembly and has been verified by testing. Below is a check to ensure the head size of the TEK screw is equal to or larger than the head of the tested fastener, ensuring compliance.

Tested Fastener Head Size:

Screw Size: 8 Tested fastener is a

Head Size: **0.312** in

TEK Screw Head Size:

Screw Size: **10-16**

Head Size: **0.365** in

Subject: TEK Lateral Design

Input:
Calculation:

Shear Strength of Fastener - ESR 1976

Screw Size: **10-16**

P_{nv}/Ω: **573** lbs See ESR 2196

Bearing Strength of Material NOT in Contact with Screw Head - AISI S100

Screw Size: **10-16** Ω: 3.00

D:	**0.138**	in	Root Diameter of TEK Screw
F_u:	45	ksi	Tensile Strength of material NOT in contact with screw head
t:	18	GA	
t:	**0.0478**	in	Thickness of material NOT in contact with screw head

$$\frac{P_{nv1}}{\Omega} = 2.7 * t * D * F_u \ - (EQ.J4.3.1-3, AISI\ S100)$$

$$\frac{P_{nv2}}{\Omega} = 4.2\sqrt{t^3 * D} * F_u \ - (EQ.J4.3.1-1, AISI\ S100)$$

P_{nv1}/Ω: **267** lbs

P_{nv2}/Ω: **245** lbs

P_{nv}/Ω: **245** lbs $\frac{P_{nv}}{\Omega} = smallest\ of\ \frac{P_{nv1}}{\Omega}\ and\ \frac{P_{nv2}}{\Omega}$

Bearing Strength of Material IN in Contact with Screw Head

Note: Material IN contact with the screw head is part of the Jeld-Wen assembly and has been verified by testing.

Fastener Bending Across Shim Space

L:	0.25	in	Maximum Shim Gap	Ω: 3.00
D:	**0.138**	in	Root Diameter of TEK Screw	
F_{yb}:	100	ksi	Yield Strength of TEK Screw	

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16P_nL}{\pi D^3} \Leftrightarrow P_n = \frac{F_{yb}\pi D^3}{16\Omega L} \qquad Where\ M = \frac{P_nL}{2}\ (Guided\ Bending)$$

P_n/Ω: **206** lbs

Bearing Strength of Masonry Straps - AISI S100

Screw Size:	10-16		TEK Screw	Ω: 3.00
D:	0.138	in	Root Diameter of TEK Screw	
F_u:	33	ksi	Tensile Strength of Masonry Strap	
t:	20	GA		
t:	0.0359	in	Thickness of Masonry Strap	

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u \ - (EQ.J4.3.1 - 3, AISI\ S100)$$

P_{nv}/Ω: **147** lbs

Subject: Tapcon Lateral Design

Input:
Calculation:

Tapcon Size:

Size:	3/16		
D:	0.1875	in	Nominal Diameter
D_{sh}:	0.145	in	Shank Diameter

Fastener Shear Capacity - 3,000 psi Concrete

P_{nv}/Ω: 181 lbs See Table 1B of NOA 24-0102.06

Fastener Shear Capacity - Medium-Weight CMU

P_{nv}/Ω: 135 lbs See Table 3 of NOA 24-0102.06

Note:
- Critical anchor spacing is 16D
- Minimum Anchor Embedment is 1-1/4"
- Minimum Edge Distance is 2-1/4"

Fastener Bending Across Shim Space

L:	0.25	in	Maximum Shim Gap	Ω: 3.00
D_{sh}:	0.145	in	Shank Diameter of Tapcon	
F_{yb}:	100	ksi	Yield Strength of Tapcon	

$$\frac{F_{yb}}{\Omega} = \frac{M}{S} = \frac{16P_nL}{\pi D^3} \Leftrightarrow P_n = \frac{F_{yb}\pi D^3}{16\Omega L}$$

$$Where\ M = \frac{P_nL}{2}\ (Guided\ Bending)$$

P_n/Ω: 239 lbs

Bearing Strength of Masonry Straps - AISI S100

Size:	3/16		Tapcon Size	Ω: 3.00
D_{sh}:	0.145	in	Shank Diameter of Tapcon Screw	
F_u:	33	ksi	Tensile Strength of Masonry Strap	
t:	20	GA		
t:	0.0359	in	Thickness of Masonry Strap	

$$\frac{P_{nv}}{\Omega} = 2.7 * t * D * F_u \ - (EQ.J4.3.1 - 3, AISI\ S100)$$

P_{nv}/Ω: 155 lbs