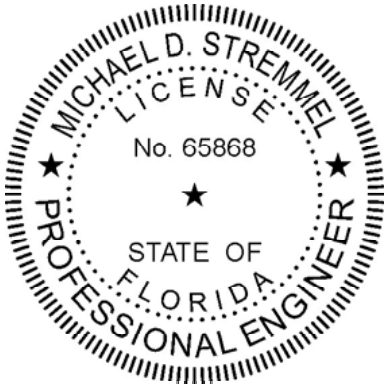
PRODUCT APPROVAL SUPPORTING CALCULATIONS

Endurance Twin Single Hung Window

REPORT TO:

VPI QUALITY WINDOWS
3420 E. FERRY AVENUE
SPOKANE, WASHINGTON 99202

REPORT NUMBER: NCTL-110-25164-1-R1
REVISION 1 DATE: 10/16/23



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Micheal D. Stremmel, PE
FL PE 65868
FL REG 47122

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

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Scope

Moliomo, LLC was contracted by VPI Quality Windows to evaluate glazing, installation methods and alternate installation methods for their *Endurance* twin single hung window. The evaluation is based on physical testing and product certifications.

The products considered in this report satisfy the requirements of the current edition of the *Florida Building Code, Building* for the overall sizes, design pressures and installation methods presented in this report.

Table 1 Summary of Product Limitations of Use

Series/Model	Overall Size (W x H)	Performance
Endurance Twin Single Hung Window	72" x 60"	+50/-50 psf Structural 7.52 psf Water Test

Reference standards utilized in this project include:

Current Edition of the *Florida Building Code, Building*. International Code Council.

ANSI/AWC NDS-2018 *National Design Specification (NDS) for Wood Construction*. American Wood Council, 2018.

AISI S100-16(2020) *North American Specification for the Design of Cold-Formed Steel Structural Members, 2020*. American Iron and Steel Institute, 2020.

ICC-ES Report ESR-1976 *ITW Buildex TEKS Self-Drilling Fasteners*. ICC Evaluation Service. 04/2021.

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

ASTM E1300-12ae1 *Standard Practice for Determining Load Resistance of Glass in Buildings*. ASTM International, 2012.

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:

- Moliomo, 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.

- Moliomo, 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 VPI Quality Windows *Endurance* twin single hung products and their corresponding performance levels which have been established by testing.

Table 2 Summary of Test Results

Series/Model	Test Report Number	Overall Size (W x H)	Performance
Endurance Twin Single Hung Window	N3979.01-901-44 (Rev. -, 03/17/22)	72" x 60"	+50/-50 psf Structural 7.52 psf Water Test

Testing documented in Table 1 was conducted by Intertek in Kent, Washington (Florida Department of Business & Professional Regulation Test Lab No. TST4310, IAS Laboratory Accreditation TL-330).

Glazing Evaluation

The glazing is evaluated with ASTM E1300-12ae1 *Standard Practice for Determining Load Resistance of Glass in Buildings* assuming four-sided support. Glazing constructions are listed in Table 3. Glazing analyses are presented on page 5 and summarized in Table 4.

Table 3 Glazing Constructions

Glass Type	Glazing Construction
Insulating Glass	1/8" Annealed Glass (Exterior) 1/8" Annealed Glass (Interior)

Table 4 Glazing Analyses

Overall Size (W x H)	Glass Type	Glass Size (W x H)	Load Resistance
72" x 60"	Insulating Glass	33" x 27-1/6"	112 psf

The glazing load resistances exceed the product design pressures thereby validating the glazing for the evaluated windows.

As-Tested Installation Analysis

For air/water/structural testing, the test specimens were secured to a Spruce-Pine-Fir buck as summarized in Table 5. The as-tested installation methods are evaluated on page 6 and the established design capacities are presented in Table 5.

Table 5 As-tested Anchorage Design Capacities

Test	Connection	Capacity
Air/Water/Structural Test	Head/Jambs/Sill Nail Fin #8 x 1" Screw	25 lb

The capacities presented in Table 5 will be used to prove acceptable alternate anchors and substrates for the window.

Alternate Anchorages

Calculations on page 7 determine the design capacity of alternate fin installation anchorages for the window. The alternate anchorage capacities are summarized in Table 6.

Table 6 Alternate Anchorage Capacities for Fin Installation

Substrate	Anchor	Capacity	Comments
Wood Framing Wood Buckstrip	6d x 2" Nail	56 lb	1. Spruce-Pine-Fir (G = 0.42). 2. Use 8d nail if non-structural sheathing covers stud.
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-out.

Calculations presented on page 8 show the as-tested and alternate anchors have sufficient design capacity for the as-tested anchor spacing and the established design pressures.

Attachments

Appendix A – Revision Log (1 page)

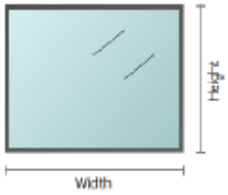
Glazing Analyses

Report

May 18, 2022

Glazing Information

Supported Edges:	Four sides simply supported
Shape:	Rectangular
Lite Width:	33.0 in.
Lite Height:	27.1 in.
Glazing Angle:	90.0 °



Glazing Construction (Double Glazed Insulating Unit)

- Exterior Lite (Monolithic 1/8 in. Annealed)

  Airspace (0.500 in.)

- Interior Lite (Monolithic 1/8 in. Annealed)

Comparisons

Short Duration	
50.0 psf 3.00 sec <= 112 psf	OK
Approximate center of glass deflection	
Exterior Lite	0.23 in.
Interior Lite	0.23 in.

Notes

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

As-Tested Installation – Nail Fin to Wood

#8 x 1" Pan Head Screw

0.062" thick Nail Fin

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

Allowable Tension of #8 x 1" Pan Head Screw

W = 1.6(1"-0.062")(82 lb/in) (NDS, Table 12.2B)
W = 123 lb

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

Validated by Testing

As-tested spacing:	4" on center
Window Width	36"
Design Pressure	50 psf
Anchor Load:	F = (50 psf/144)(4")(36"/2) = 25 lb.
As-tested anchor head size:	0.314"

Capacity of Connection is 25 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 lb/in) (NDS, Table 12.2C)
W = 56 lb

Capacity of Connection is 56 lb

Use 8d nail (2-1/2") long if must penetrate non-structural sheathing

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

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

Pull-Over of #10-16 TEKS Screw

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

Capacity of Connection is 104 lb

72x60 +50/-50 psf

Anchorage Requirements – Nail Fin

Window Overall Size: 72" x 60"
Window Overall Area: (72")(60")/144 = 30.0 ft^2
Window Overall Wind Load: (50 psf)(30.0 ft^2) = 1,500 lb
Installed Anchor Spacing: 4" head; 4" sill; 4" each jamb
Installed Anchors: 18 head +18 sill + 2(15) jambs = 66 installed anchors
Minimum Anchor Capacity: 25 lb/anchor
Total Anchor Capacity: (66 anchors)(25 lb/anchor) = 1,650 lb > 1,500 lb **OK**

Appendix A

Revision Log

Identification	Date	Page & Revision
Original Issue	05/18/22	Not Applicable
REVISION 1	10/16/23	Updated Analysis for 8th Edition of the FBC