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Report Number: ESP011287P-2A
Report Date: October 22, 2012

STRUCTURAL PERFORMANCE TEST REPORT

Test Requested By: Deceuninck North America, LLC
351 North Garver Road
Monroe, Ohio 45050

Product Type and Series: Series 331.330SH-008 Vinyl Flange Frame Impact Single Hung Window
H-LC 40/70 940 mm x 1575 mm* (37" x 62"*) 05 Designation
LC-PG 40/70 940 mm x 1575 mm* (37" x 62"*) -H 08 Designation

Tests Conducted: AAMA/WDMA/CSA 101/I.S.2/A440-05/08 "Standard/Specification for Windows, Door and Unit Skylights".
AAMA 506-11 "Voluntary Specifications for Impact and Cycle Testing of Fenestration Products."
ASTM E-1886-05 "Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials."
ASTM E-1996-09 "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Windborne Debris in Hurricanes."

TEST SPECIMEN

*Note: Reference Test report # ESP011287P-1 for Initial Gateway Performance Testing

Design Pressure: Structural D/P + 130.0 - 130.0
Specimen 1 Water Resistance D/P 40 D/P 70 with Sill Riser 2.512
Specimens 2, 3 & 4 ASTM E1886/1996 + 55.0 psf. - 55.0 psf.

Overall Size: All Specimens- 940 mm wide x 1575 mm high (37" wide x 62" high)

Configuration: All Specimens- One (1) fixed top lite/ one (1) operable sash bottom $\frac{O}{X}$

Frame and Sash Material: Extruded vinyl

Frame Construction: The extruded vinyl replacement/flange frame measured 940 mm wide x 1575 mm high (37" wide x 62" high) buck opening overall. Frame corners utilized mitered and welded construction. Head, Sill and Jambs measured 68 mm x 68 mm (2.688" wide x 2.195" high) (refer to drawing #10003356). One (1) Aluminum Sill Interlock (drawing #3) clip was located in the frame sill pocket attached with six (6) #6 x .375" P.H., P.H. S.M.S. Center Mid-Span from frame corners. Fixed meeting rail was coped and butted, secured thru frame jambs with two (2) #8 x 1.5625" Truss head screws (drawing 331330 meeting rail)
For D/P 70 Water Resistance testing specimen tested with a sill riser (drawing #2) creating 2.512" overall sill ht. (drawing #2)



Sash Construction:

Sash constructed from extruded vinyl and utilized mitered and welded corner construction. One (1) fixed lite top measuring 902 mm x 940 mm (35.5" wide x 37" high) overall. One (1) active sash measuring 876 mm x 1003 mm (34.5" wide x 39.5" high) overall. The sash stiles and bottom rail measured 31mm x 45 mm (1.215" wide x 1.760" high) (*refer to drawing #10003366-C*). The sash lock/lift rail measured 43 mm x 45 mm (1.6925" wide x 1.760" high) (*refer to drawing #10003365-A*). One (1) Aluminum Sash Interlock (*drawing #3*) clips were located in the bottom rail pocket attached with four (4) #6 x .375" P.H., P.H. S.M.S. each. Center Mid-Span from frame corners.

Day lite opening:

Day lite opening for fixed lite measured 851 mm x 965 mm (33.5" wide x 38.00" high) overall. Day lite opening for operable sash measured 787 mm x 660 mm (31.00" wide x 26.00" high) overall.

Glazing:

19mm ($\frac{3}{4}$ " overall insulated laminated glass as viewed from the exterior. One (1) piece of 3mm ($\frac{1}{8}$ " annealed glass. One (1) .285" (Quanex/Truseal) Dura-seal spacer system. One (1) piece of 3mm ($\frac{1}{8}$ " annealed glass. One (1) 2.286 mm (.090") Dupont PVB interlayer (as stated by manufacturer). One (1) piece of 3mm ($\frac{1}{8}$ " annealed glass. Exterior glazed with an adhesive back bedding compound Sikaflex-552® as stated by the manufacturer (*refer to drawing #1*). Extruded vinyl snap-in glazing bead measuring 4.32 mm x 22 mm (.170" wide x .870" high) overall with a 16mm (.500") glass bite. (*refer to drawing #10003190. SH*).

Weather-stripping:

<u>Quantity</u>	<u>Description</u>	<u>Location</u>
One (1) strip	Center fin wool pile .187 x .290" high	Sash stile
One (1) strip	Center fin wool pile .187 x .290" high	Sash top rail
One (1) strip	Center fin wool pile .187 x .290 high	Sash bottom rail
One (1) strip	Center fin wool pile .187 x .290 high	Sill riser for D/P 70 water



Hardware & Location:

<u>Quantity</u>	<u>Description</u>	<u>Location</u>
Two (2)	Apex Block and Tackle Balance System	One (1) per each frame jamb
Two (2)	Balance take out clip	One (1) per each frame jamb
Two (2)	Keepers	Fixed Meeting Rail. Each located 12" c/l from frame jamb. Each secured with (2) #6 x .750" PFH fasteners.
Two (2)	Cast cam locks	Sash Top Rail. Each located 12" c/l from each stile locking into keepers in the fixed meeting rail. Each secured with (2) #8 x 1.000" self tapping fasteners.

Weep system:

<u>Quantity</u>	<u>Description</u>	<u>Location</u>
Two (2)	Weep Covers	Sill face 2.00" from each sill corner (<i>drawing # W646000</i>) Draining to exterior
Two (2)	Weep Slots	Sill face 2.00" from each sill corner. Draining to exterior. (<i>drawing #100003356F-07</i>)
Two (2)	Weep Slots	Sill Frame under glass (<i>drawing #100003356F-07</i>)

Reinforcement:

One (1) extruded aluminum reinforcement was located in fixed meeting rail x full length (*refer to drawing #10300221*).

One (1) extruded aluminum reinforcement was located in sash top rail x full length (*refer to drawing #10300222*).

Sealant:

Silicone caulking as needed to seal the test units to the wood bucks.

Screen:

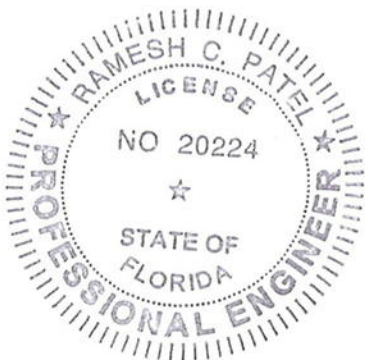
Roll formed aluminum screen with fiberglass mesh, vinyl spline and plastic corner keys. Two (2) plastic pull tabs and two (2) aluminum spring clips.

Installation:

Test specimens were tested in a 51mm x 254mm (2" x 10") main test buck. Secured to a S.P.F. 51mm x 102mm (2" x 4") buck strip utilizing sixteen (16) #8 x 32mm (1.250") Philips pan head C.S., S.M.S. fasteners located as follows:

- **Frame head and sill:**
- Three (3) located at 152mm (6.00") from each frame head, sill and jamb corner and center-mid span.
- **Frame jambs:**
- Five (5) in each frame jamb located at 152mm (6.00") from each frame head, sill and jamb corner and 330 mm nominally (13.00") O/C thereafter.

Note: Fasteners were secured thru the frame to the 51mm x 102mm (2" x 4") wood sub-buck.



Surface Finish: White vinyl

Performance Test Results

<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
Operating Force Operable sash	ASTM E2068-00		
	Max. Force to maintain motion	27 lbs.	40/lbs
	Max. Force to initiate motion	14 lbs	Report only
	Force to open/close locks	8 lbs.	22.5

Air Infiltration @ 1.57psf	ASTM E283-04	0.04 cfm/ft ²	0.34 cfm/ft ²
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The tested specimen meets the performance levels specified in AAMA/WDMA/CSA 101/I.S.2/A440-05/08.

Measured air recorded in two (2) decimals at client's request

Water Resistance 5.0 gph/ft ² WTP=6.00 psf	ASTM E547-00 Four (4) 5 min. cycles	No Entry	No Entry
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WTP=10.50 psf achieved with sill riser (*drawing #2*) 2.512" high overall
 The specimen was tested with and without an insect screen installed.

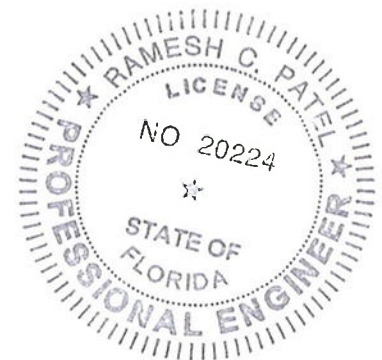
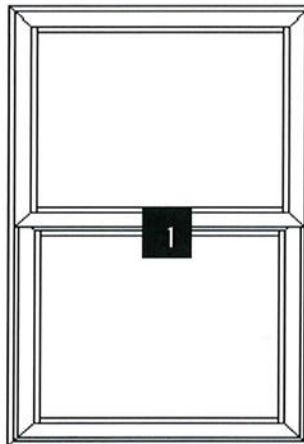
Uniform Structural Load	ASTM E330-02		
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Design Pressure of +130.0psf

Range of test	time	load	<u>Deflection</u>	<u>Perm. Set</u>	<u>Allowable</u>
Positive loads	(seconds)	psf			
½ Test load	10	97.5			
Design Load	10	130.0	Loc. 1 25.3 mm (.995") Gross		Record only
Test load	10	195.0	Loc. 1 89 mm (0.035")		3.5mm (.136")

Design Pressure of -130.0psf

Negative loads	(seconds)	psf			
½ Test load	10	97.5			
Design Load	10	130.0	Loc. 1 23.5 mm (.925") Gross		Record only
Test load	10	195.0	Loc. 1 1.7 mm (0.068")		3.5mm (.136")



Location (1) - Max. Allowable Perm. Set after test load at center mid-span of fixed meeting rail (0.4% of 1270mm (34.500") span) = 3.5mm (0.136")

Performance Test Results:Cont.

<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
Forced Entry Resistance Type "A" Window Assembly	ASTM F588-07	Passed	No Entry

The test specimen meets the performance Grade 20.

Welded Corner Test **ASTM D 618-05** Passed

Note: When loaded to failure @ 51 lbs., the break did not extend along the entire weld line.

		ASTM E 987-01	<u>Measured</u>	<u>Allowed</u>	<u>Result</u>
Deglazing					
Top Rail	70 lbs.		1.7 mm (.07") = 1.4% < 90%		Passed
Bottom Rail	70 lbs.		2.0 mm (.03") = .06% < 90%		Passed
Left Stile	50 lbs.		.50 mm (.02") = .04% < 90%		Passed
Right Stile	50 lbs.		1.0 mm (.04") = .08% < 90%		Passed

Large Missile Impact

Specimens 2, 3 &4: **AAMA 506-11/ASTM E-1996-09**

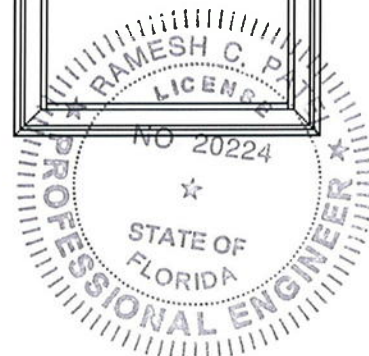
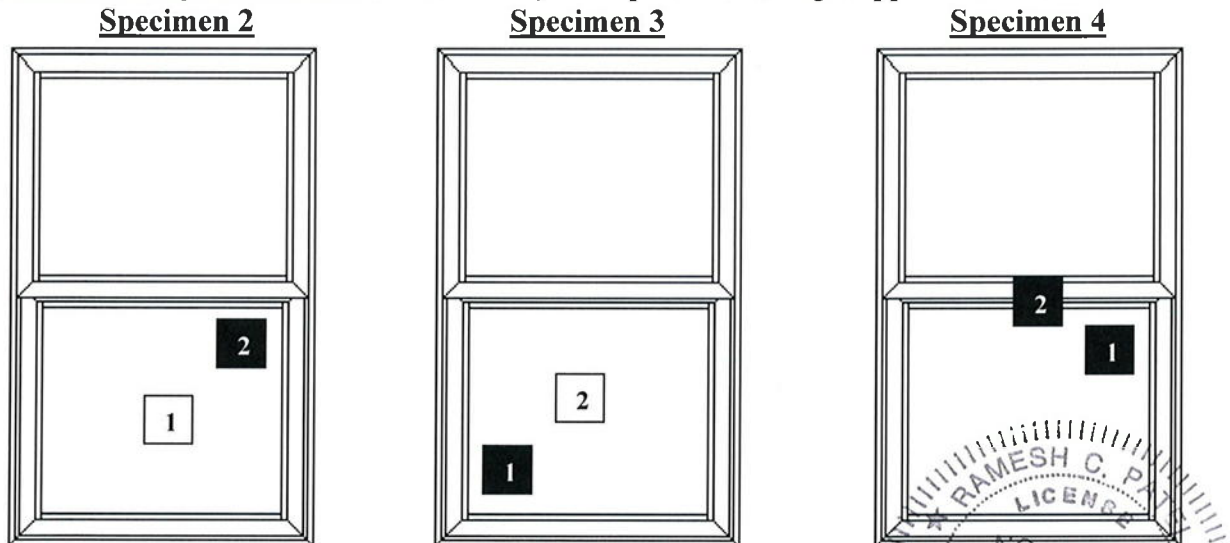
Specimens were tested to **ASTM E-1886-05 and 1996-09** with no deviation to the test specifications. All specimens were tested to the Wind Zone 4 requirements stated in section 5 of **ASTM E-1996-09**. Missile level D. The missile orientation was perpendicular to the glass surface at impact. Each specimen was impacted with an 8 ft., 9 lb. Southern yellow pine 2" x 4" at the following locations:

Note:

X- measurement from left edge of test specimen.

Y- measurement from top edge of test specimen.

Type and weight of missile: #2 Southern yellow pine 2 x 4, length approx. 96" & 9 lb.



Performance Test Results:Cont.

Specimens 2, 3 and 4: ASTM E-1996-06.

Specimen	Impact Loc.	Speed Ft/Sec	X Meas.	Y Meas.
No. 2	Loc: 1.	50.1	20.00"	46.000"
	Loc: 2.	49.9	28.00"	41.000"

Specimen	Impact Loc.	Speed Ft/Sec	X Meas.	Y Meas.
No. 3	Loc: 1.	50.1	11.000"	55.000"
	Loc: 2.	50.1	18.500"	48.000"

Specimen	Impact Loc.	Speed Ft/Sec	X Meas.	Y Meas.
No. 4	Loc: 1.	50.0	28.500"	49.500"
	Loc: 2.	50.1	20.000"	33.500"

Results: All specimens tested resisted the large missile impact, without penetration of the inner plane of the glazing. With no tear forming longer than 5" and wider than 1/16" thru which air can pass, or no opening through which a 3" diameter solid sphere could freely pass.

Air Pressure Cycling

All Specimens: **AAMA 506-11/ASTM E-1996-09**

Specimens were tested to **AAMA 506-11/ASTM E-1996-09** with no deviation to the test specifications.

All specimens were tested to the requirements of section 5.4 table 1 in **ASTM E-1996-09**.

Specimen 2

Design Load + 55.0 psf, -55.0 psf

+ Positive loads

Range of test	Actual load PSF		# of cycles	Cycles/min
+ .2 - .5	11.0	27.5	3500	55
+ .0 - .6	0.00	33.0	300	55
+ .5 - .8	27.5	44.0	600	55
+ .3 - 1.0	16.5	55.0	100	55

4500 cycles complete

-Negative Loads

Deflection/ Set

1.500" 0.125"

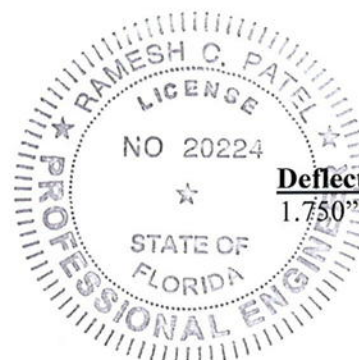
Range of test	Actual load PSF		# of cycles	Cycles/min
+ .3 - 1.0	16.5	55.0	50	55
+ .5 - .8	27.5	44.0	1050	55
+ .0 - .6	0.00	33.0	50	55
+ .2 - .5	11.0	27.5	3350	55

4500 cycles complete

9000 cycles completed

Deflection/ Set

1.750" 0.250"



Air Pressure Cycling: Cont.
Specimen 3
Design Load + 55.0 psf, -55.0 psf
 + Positive loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .2 - .5	11.0	27.5	3500	55
+ .0 - .6	0.00	33.0	300	55
+ .5 - .8	27.5	44.0	600	55
+ .3 - 1.0	16.5	55.0	100	55

4500 cycles complete

Deflection/ Set
 1.250" 0.125"

-Negative Loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .3 - 1.0	16.5	55.0	50	55
+ .5 - .8	27.5	44.0	1050	55
+ .0 - .6	0.00	33.0	50	55
+ .2 - .5	11.0	27.5	3350	55

4500 cycles complete

Deflection/ Set
 1.625" 0.250"

9000 cycles completed

Air Pressure Cycling: Cont.
Specimen 4
Design Load + 55.0 psf, -55.0 psf
 + Positive loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .2 - .5	11.0	27.5	3500	55
+ .0 - .6	0.00	33.0	300	55
+ .5 - .8	27.5	44.0	600	55
+ .3 - 1.0	16.5	55.0	100	55

4500 cycles complete

Deflection/ Set
 1.375" 0.420"

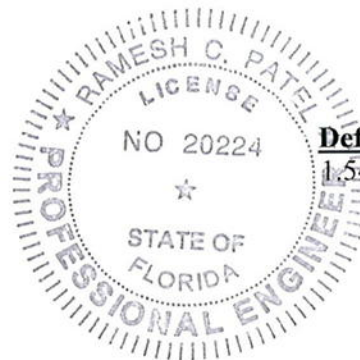
-Negative Loads

<u>Range of test</u>	<u>Actual load PSF</u>		<u># of cycles</u>	<u>Cycles/min</u>
+ .3 - 1.0	16.5	55.0	50	55
+ .5 - .8	27.5	44.0	1050	55
+ .0 - .6	0.00	33.0	50	55
+ .2 - .5	11.0	27.5	3350	55

4500 cycles complete

Deflection/ Set
 1.540" 0.500"

9000 cycles completed



Note: The windows were operable at the end of cycle test.

Results: All specimens tested resisted the large missile impact, without penetration of the inner plane of the glazing and resisted the cycle pressure loading specified in Table 1. With no tear forming longer than 5" and wider than 1/16" thru which air can pass, or no opening through which a 3" diameter solid sphere could freely pass.

Comment:

1. At the conclusion of testing it was determined that the tested specimens passed the criteria of Wind Zone 4 set forth in ASTM E 1886-05 and ASTM E 1996-09.
2. The tested specimens were separated and conditioned for 4 hrs. between 59 and 95 degrees Fahrenheit.
3. Nominal 2-mil polyethylene film was used to seal against air leakage during structural loads. The film was used in a manner that did not influence the test results.

Test Dates: October 11, 2012 thru October 13, 2012

Remarks: Detail drawings were available for laboratory records and comparison to the test specimen at the time of this report. A copy of this report along with representative sections of the test specimen will be retained by Element Materials Technology for a period of four (4) years. The results obtained apply only to the specimen tested. This test report does not constitute certification of this product, but only the above test results were obtained using the designated test methods and they indicate compliance with the performance requirements (paragraphs as listed) of the above referenced specifications. Element Materials Technology assumed that all information provided by the client is accurate and that the physical and chemical properties of the components are as stated by the manufacturer.

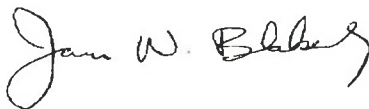
Element Materials Technology

Testing Performed By:

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Washington Romero Element Materials Technology

Client Present:

Dennis Cox Deceuninck NA



James Blakely
Operations Manager
Element Materials Technology

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 Ramesh Patel P.E. (1)
 File (1)

