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Element Materials Technology
115 South 84th Ave
Wausau, WI 54401, USA
407-505-8102

Report No.: ESP101311P-6
Report Date: July 18, 2012

STRUCTURAL PERFORMANCE TEST REPORT

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

Product Type and Series: Series 143.191CA-008 Vinyl Equal Leg Frame Impact Casement Window
C-C70 940mm x 1930mm (37" x 76")

Tests Conducted: AAMA/WDMA/CSA 101/I.S.2/A440-05 "Standard/Specification for Windows, Door and Unit Skylights".
ASTM E-1886-05/ AAMA 506-08 "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-1996-06/ AAMA 506-08 "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Windborne Debris in Hurricanes."

TEST SPECIMEN

Design Pressure: All Specimens- Vinyl Equal Leg Frame Casement Window + 70.0 psf. - 70.0 psf

Overall Size: All Specimens- 940mm x 1930mm (37" wide x 76" high)

Configuration: All Specimens- One (1) Operable Sash (X)

No. & Size of Sash: All Specimens- (1) Active Sash 895mm x 1886mm (35.250" wide x 74.250" high)

Frame and Sash Material: Extruded vinyl

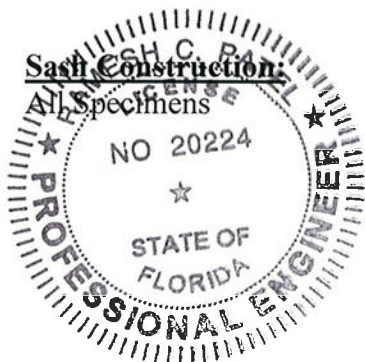
All Specimens

Frame Construction:

All Specimens

The extruded vinyl Equal Leg frame measured 940mm x 1930mm (37" wide x 76" high) buck opening overall. The equal leg frame head, sill and jambs were constructed of extruded vinyl and utilized mitered and welded corner construction. . The vinyl frame head and sill measured 83mm x 63mm (3.250" wide x 2.461") high. The vinyl frame jambs measured 83mm x 63mm (3.250" wide x 2.461" high). Reference drawing # (10008053-SH).

One (1) active sash measured 895mm x 1886mm (35.250" wide x 74.250" high) overall. The sash was constructed of extruded vinyl and utilized mitered and welded corner construction. The vinyl sash stiles and rails measured 67mm x 41mm (2.647" wide x 1.627" high) Reference drawing # (10005491-SH).



Glazing: 19mm (¾”) overall laminated glass consisting of the following: One (1) exterior piece of 3.8mm (.156”) annealed glass / one (1) 6.8mm (.270”) spacer system (as stated by manufacturer) One (1) interior piece of 3.2mm (.125”) annealed glass / 1.9mm (.075”) laminate by Solutia / One (1) interior piece of 3.2mm (.125”) annealed glass. (reference drawing #3/4” I.G, ANN, .075” LAMI, 5/32 SAC.). Exterior glazed with an adhesive back bedding compound Sikaflex-552® as stated by the manufacturer. The glazing utilized an extruded vinyl slide-in glazing bead around the exterior perimeter measuring 5mm x 14mm (.195” wide x .570” high) overall with a 16mm (.625”) glass bite. (refer to drawing #10005470-SH).

Daylight Opening: All Specimens Operable sash- 814mm x 1805mm (32.062” wide x 71.062” high)

Weather-stripping: All Specimens

<u>Description</u>	<u>Quantity</u>	<u>Location</u>
5mm(0.190”) diameter vinyl bulb	Four (4) rows	One (1) per sash stiles and rails interior perimeter
10mm(0.395”) high vinyl flap	Eight (8) rows	Two (2) per sash stiles and rails exterior perimeter

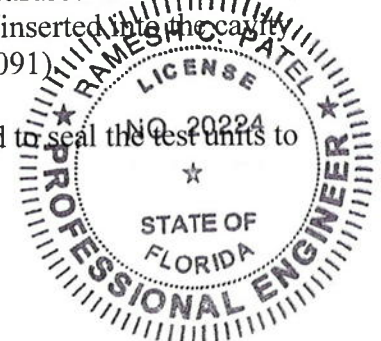
Hardware: All Specimens

<u>Description</u>	<u>Quantity</u>	<u>Location</u>
Truth Hinged Dual Arm Operator Right hand operator	One (1)	229mm(9.000”) c/l from corner of frame sill
Maxim Multi-point lock bar with four (4) Keeper locking points Lock assy. Part #24-33 Keeper part# 32687.92/LH Tie bar guide part# 32933.00.001	One (1)	229mm(9.000”) c/l from corner of frame lock jamb. Keepers located on sash lock stile at 4”, 24”, 45” and 65” measuring from sash bottom rail to sash top rail.
38mm(1.500”) long aluminum impact snubber. Sash snubber dwg.# 10300094. Frame snubber dwg. # 10300095.	Four (4)	Located at 14”, 29”, 45 and 60” on frame hinge jamb with adjacent snubbers on hinge stile.

Weep-holes: N/A

Reinforcement: Two (2) free floating extruded aluminum reinforcements were utilized in the active sash stiles and rails. One (1) located at the exterior leg of the sash stiles and rails and measured 18mm x 23mm (.718” wide x .915” high). Reference drawing # (10500006-A). One (1) located at the interior leg of the sash stiles and measured 21mm x 8mm (.820” wide x .320” high). Reference drawing # (10300091). One (1) extruded aluminum reinforcement was utilized at each frame jamb and measured 19mm x 83mm (.734” wide x .327” high). Each reinforcement was free floating/inserted into the cavity of the stiles, rails and frame jambs. Reference drawing # (10300091)

Sealant: 100% Silicone (as stated by the manufacturer) caulking was used to seal the test units to the wood bucks.



Additional Description:
All Specimens

Tested in a 51mm x 254mm (2" x 10") S.P.F. wood test buck with a 51mm x 102mm (2" x 4") wood sub frame.

Installation:
All Specimens

The windows were installed in wood test buck as described above utilizing eighteen (18) #8 x 1.500" Phillips P.H. S.M.S. Six (6) in each frame jamb located at 152mm, 457mm, 762mm, 1067mm, 1372mm & 1676mm (6", 18", 30", 42", 54", and 66") measuring from frame sill to frame head. Three (3) each in the frame head and sill located at 152mm, 457mm & 762mm (6", 18", and 30") measuring from left to right.

Performance Test Results

<u>Paragraph</u>	<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
Specimen #1 5.3.2	Air Infiltration @ 1.57psf The tested specimen meets the performance levels specified in AAMA/WDMA/CSA 101/I.S.2/A440-05. Measured air recorded in two (2) decimals at client's request	ASTM E283-99	0.08 cfm/ft ²	0.34 cfm/ft ²
5.3.3.	Water Resistance 5.0 gph/ft ² WTP=12.0 psf	ASTM E547-00 Four (4) 5 min. cycles ASTM E331-00 Fifteen (15) minute duration	No Entry No Entry	No Entry No Entry

The specimen was tested without an insect screen installed.



Performance Test Results:Cont.

Paragraph

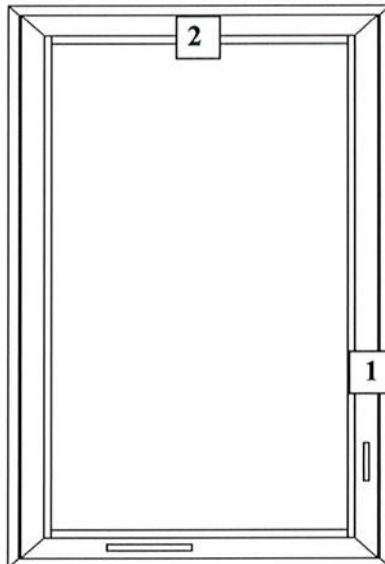
5.3.4.2 Specimen #1

Uniform Structural Load was conducted to **ASTM E330-02** with no deviations to test method. Unit was tested to a **Design Pressure of +70.0psf**

<u>Range of test</u>	<u>time</u>	<u>load</u>	<u>Deflection</u>	<u>Perm. Set</u>	<u>Allowable</u>
Positive loads	(seconds)	psf			
½ Test load	10	52.5			
Design Load	10	70.0	Loc. 1 7.3 mm (0.289") Loc. 2 7.9 mm (0.311")		
Test load	10	105.0	Loc. 1 Loc. 2	0.5mm (0.019") 1.7mm (0.066")	1.8mm (.072") 3.6mm (.141")

Design Pressure of -70.0psf

Negative loads	(seconds)	psf			
½ Test load	10	52.5			
Design Load	10	70.0	Loc. 1 15.2 mm (0.600") Loc. 2 18.4 mm (0.723")		
Test load	10	105.0	Loc. 1 Loc. 2	1.8mm (0.069") 1.1mm (0.044")	1.8mm (.072") 3.6mm (.141")



Location (1) - Max. Allowable Perm. Set after test load at the longest unsupported span between the keepers on the sash side lock stile (0.4% of 457mm (18.000") span) = 1.8mm (0.072")

Location (2) - Max. Allowable Perm. Set after test load at the longest unsupported span between the keepers on the sash top lock rail (0.4% of 895mm (35.250") span) = 3.6mm (0.141")



Performance Test Results:Cont.

<u>Paragraph</u> Specimen #1	<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
5.3.5	Forced Entry Resistance Type "C" Window Assembly T ₁ = 10 minutes Tools used: a spatula (10.1.1.1) and a piece of stiff wire (10.1.1.2). The test specimen meets the performance Grade 40.	ASTM F588-97	Passed	
5.3.6.2	Welded Corner Test Note: When loaded to failure, the break did not extend along the entire weld line.	ASTM D618-00	Passed	
5.3.6.4.4	Sash Concentrated Load Test on Latch Rail Load direction-Vertical/ Load @ 50 lbs up Load direction-Vertical/ Load @ 50 lbs down Load direction-Horizontal/ Load @ 30 lbs up Load direction-Horizontal/ Load @ 30 lbs down	AAMA/A440-05	1.7mm(0.067") 1.8mm(0.072") Passed 0.7mm(0.030") 1.9mm(0.038") Passed	3.3mm(0.130") 3.3mm (0.130")
	Note: At the conclusion of the test, the sash properly closed and operated and there was no failure of screws, track, keepers or permanent deformation of support arms. There was no glazing breakage.			
5.3.6.6.3	Stabilizing arm load Test Sash top rail at center = Load- 1780 (400) N (200) (lbf) 10 second duration concentrated load acting vertically downward at the sash corner and sash top rail at center	AAMA/A440-05	Passed	
	Note: At the conclusion of the test, the sash properly and fully functioned normally and there was no failure of sash, components, glass, stabilizing arm or hardware components			



PERFORMANCE TEST RESULTS-Large Missile Test

Specimens 2, 3 & 4: ASTM E1996-06/ AAMA 506-08

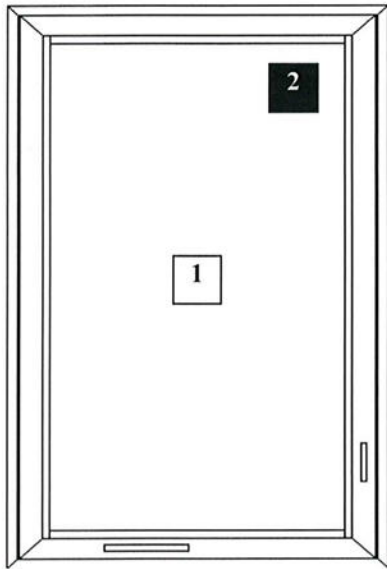
Specimens were tested to **ASTM E1886-05 and 1996-06** with no deviation to the test specifications. All specimens were tested to the Wind Zone 4 requirements stated in section 5 of **ASTM E1996-06**. Missile level D. The missile orientation was perpendicular to the glass surface at impact. Each specimen was impacted with a 96", 9 lb. #2 southern yellow pine 2" x 4" at the following locations.

Note:

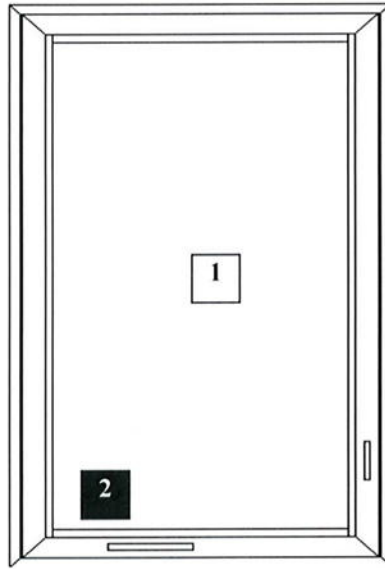
X- measurement from left edge of test specimen.

Y- measurement from top edge of test specimen.

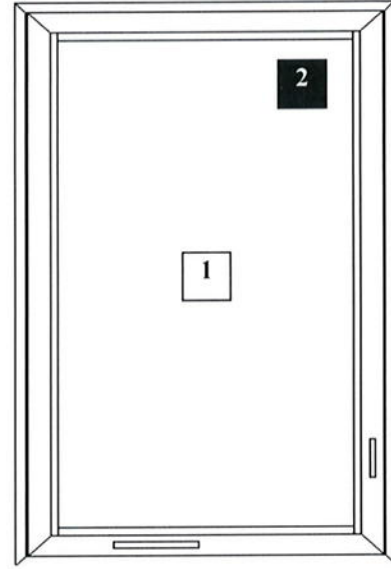
Specimen 2



Specimen 3



Specimen 4



Specimen 2

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	50.0	17.000"	38.500"
2.	2	50.3	26.000"	10.500"

Specimen 3

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	50.1	18.500"	37.000"
2.	2	50.2	10.000"	63.000"

Specimen 4

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	49.9	18.000"	36.500"
2.	2	50.1	25.500"	9.500"

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", or no opening through which a 3" diameter solid sphere could freely pass.



PERFORMANCE TEST RESULTS- Cyclic Static Air Pressure Loading

All Specimens: ASTM E1886-05/ AAMA 506-08

Specimens were tested to **ASTM E1886-05 and 1996-06** with no deviation to the test specifications. All specimens were tested to the requirements of section 5.4 table 1 in **ASTM E1996-06**.

Specimen 2

Design Load +70.0 psf, -70.0 psf

Positive loads

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	14.0	35.0	3500	55
0.0 - .6	0.00	42.0	300	55
0.5 - .8	35.0	56.0	600	55
0.3 - 1.0	21.0	70.0	100	55

4500 cycles complete

Deflection/ Set

1.500" .000"

Negative Loads

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
-.3 - 1.0	21.0	70.0	50	55
-.5 - .8	35.0	56.0	1050	55
-.0 - .6	0.00	42.0	50	55
-.2 - .5	14.0	35.0	3350	55

4500 cycles complete

Deflection/ Set

1.750" .375"

9000 cycles completed

Specimen 3

Design Load + 70.0 psf, -70.0 psf

Positive loads

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	14.0	35.0	3500	55
0.0 - .6	0.00	42.0	300	55
0.5 - .8	35.0	56.0	600	55
0.3 - 1.0	21.0	70.0	100	55

4500 cycles complete

Deflection/ Set

1.250" .1875"

Negative Loads

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
-.3 - 1.0	21.0	70.0	50	55
-.5 - .8	35.0	56.0	1050	55
-.0 - .6	0.00	42.0	50	55
-.2 - .5	14.0	35.0	3350	55

4500 cycles complete

Deflection/ Set

1.625" .375"

9000 cycles completed



PERFORMANCE TEST RESULTS- Cyclic Static Air Pressure Loading: Continued
ASTM E1886-05/ AAMA 506-08

Specimen 4

Design Load + 70.0 psf, -70.0 psf

Positive loads

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	14.0	35.0	3500	55
0.0 - .6	0.00	42.0	300	55
0.5 - .8	35.0	56.0	600	55
0.3 - 1.0	21.0	70.0	100	55

4500 cycles complete

Deflection/ Set
 1.500" .125"

Negative Loads

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
-.3 - 1.0	21.0	70.0	50	55
-.5 - .8	35.0	56.0	1050	55
-.0 - .6	0.00	42.0	50	55
-.2 - .5	14.0	35.0	3350	55

4500 cycles complete

Deflection/ Set
 1.750" .375"

9000 cycles completed

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" or no opening through which a 3" diameter solid sphere could freely pass.

Comment: 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.

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 1996-06.

The tested specimens were separated and conditioned for 4 hrs. between 59 to 95 degree Fahrenheit.

Test Date: June 18th 2012 thru June 22nd 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.

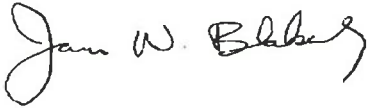
Element Materials Technology

Testing Performed By:

Steve Gibbs Element Materials Technology
Washington Romero Element Materials Technology

Client Present:

Dennis Cox Deceuninck NA



James Blakely
Operations Manager
Element Materials Technology

cc: Deceuninck NA (2)
NAMI (2)
Ramesh Patel P.E. (1)
File (1)

