



element

Element Materials Technology  
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Wausau, WI 54401, USA  
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**Report Number:** ESP014366P-2  
**Report Date:** December 16th, 2013

## STRUCTURAL PERFORMANCE TEST REPORT

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

**Product Type and Series:** Series 145.095 SS Vinyl (NC) Fin & (Rep) Equal Leg Frame Impact Glass Horizontal Sliding Window  
HS-LC 50 1880 mm x 1600 mm (73" x 62") 05 Designation  
LC-PG 50 1880 mm x 1600 mm (73" x 62")-HS 08 Designation

**Tests Conducted:** AAMA/WDMA/CSA 101/LS.2/A440-11 "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**

**Design Pressure:** Specimen 1- AAMA/A440-11 NC (Fin) + 50.0 psf. - 50.0 psf  
Specimen 2- AAMA/A440-11 (Struct. Only) Rep (Equal Leg) + 50.0 psf. - 50.0 psf  
Specimens 3, 4 & 5- ASTM E1886-05/1996-09 NC (Fin) + 50.0 psf. - 50.0 psf  
\*Specimen 6- ASTM E1886-05/1996-09 Rep (Equal Leg) + 50.0 psf. - 50.0 psf  
\*(With deviations only one specimen impacted and cycled (Equal Leg).

**Overall Size:** All Specimens- 1880 mm wide x 1600 mm high (73" wide x 62" high)

**Configuration:** All Specimens- X/O One (1) operable sash and one (1) fixed sash.

**Frame and Sash Material:** Extruded vinyl



**Frame Construction:**  
All Specimens

The extruded vinyl fin/NC & equal leg/Rep. frame measured (74" wide x 63" high) buck opening overall. The vinyl fin/NC frame included a 1.125" integral fin. Frame corners utilized mitered and welded construction. Head, Sill and Jambs measured (3.652" wide x 2.500" high) (refer to drawing #10008684-SH). Fixed meeting stile was coped and butted, secured thru frame head/sill with two (2) #8 x 3.000" PPH Truss head screws (drawing#143095SS-007Elevation meeting rail). Two (2) vinyl slider track inserts were located in the frame sill and head (refer to drawing #10008469-SH) and inserted on an aluminum slider track reinforcement in the frame sill and head and secured at each head, sill & jamb corner & c/l at fixed meeting rail with two (2) #8 x .750" PPH SMS (refer to drawing #10300189-SH).

**Sash Construction:**  
All Specimens

Sash constructed from extruded vinyl and utilized mitered and welded corner construction. One (1) fixed sash measured (36.5" wide x 60.75" high) overall. One (1) active sash measured (36.5" wide x 60.5" high) overall. The sash top and bottom rail measured (1.300" wide x 1.510" high) (refer to drawing #10008857-SH). The sash lock stile measured (1.551" wide x 1.250" high) (refer to drawing #10008845-SH). The sash pull stile measured (1.551" wide x 1.250" high) (refer to drawing #10008882-SH). The sash fixed meeting rail measured (1.524" wide x 2.118" high) (refer to drawing #10008511-SH).

**Day lite opening:**  
All Specimens

Day lite opening for fixed lite measured 864 mm x 1518 mm (34.0" wide x 59.75" high) overall Day lite opening for operable sash measured 1819 mm x 1448 mm (32.250" wide x 57.0" high) overall.

**Glazing:**  
All Specimens

¾" overall laminated (Impact) glass consisting of the following: As viewed from the exterior, operable sash was exterior glazed as follows: one(1) piece of .125" annealed glass / one (1) .300" Quanex Duraseal spacer system (as stated by manufacturer) One (1) piece of .125" annealed glass / .090" PVB laminate by Solutia Saflex / One (1) piece of .125" annealed glass. As viewed from the exterior, fixed lite was interior glazed as follows: one (1) piece of .125" annealed glass / .090" PVB laminate by Solutia Saflex / one (1) piece of .125" annealed glass / one (1) .300" Quanex Duraseal spacer system (as stated by manufacturer) / one (1) piece of annealed glass (reference drawing #3/4" I.G, ANN .090" PVB LAMI). The operable sash was exterior glazed, fixed sash was interior 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 .195" wide x .570" high overall with a .625" glass bite. (refer to drawing #10005470-SH).



**Weather-stripping: All Specimens**

<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: All Specimens**

<u>Quantity</u>	<u>Description</u>	<u>Location</u>
Two (2)	Keepers	Fixed Meeting Stile. Each located 8" c/l from head/sill. Each secured with two (2) #6 x .750" PFH fasteners.
Two (2)	Locks	Sash Lock Stile. Each located 8" c/l from sash corners. Each secured with two (2) #6 x 1.0" PFH self tapping fasteners.
Two (2)	Roller Housings	Sash Bottom Rail. One at each corner. Secured with two (2) #8 x .375" PPH fasteners.

**Weep system: All Specimens**

<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-06</i> )
Two (2)	Weep Slots	Sill Frame under glass ( <i>drawing #100003356F-06</i> )

**Reinforcement:**

All Specimens  
 One (1) extruded aluminum reinforcement was located in fixed meeting stile x full length (*refer to drawing #10300084*).  
 Two (2) extruded aluminum reinforcement were located in each sash rail x full length (*refer to drawing #10300082*).  
 One (1) extruded aluminum reinforcement was located in sash pull stile x full length (*refer to drawing #10300207*).

**Sealant:**

Latex caulking as Specimen needed to seal the test units to the wood bucks.

**Screen:**

All Specimens

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



**Installation:**  
All Specimens

Test specimen was tested in a 2" x 12" S.Y.P. main test buck with a 2" x 4" pine/fur/spruce sub-buck utilizing twenty-six (26) #8 x 6mm (1.250") Phillips P.H., S.M.S. fasteners located as follows:

- **Frame head and sill:**
- Seven (7) located at 152mm (6.00") from each frame head, sill and jamb corner and 330 mm nominally (10.00") max. O/C thereafter.
- **Frame jambs:**
- Six (6) in each frame jamb located at 152 mm (6.00") from each frame head, sill and jamb corner and 330 mm nominally (10.00") max. O/C thereafter.

**Surface Finish:**      White  
All Specimens

**Performance Test Results**

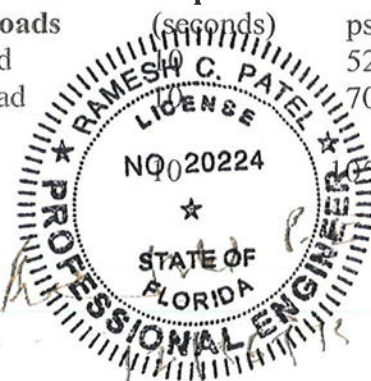
<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
Specimen: 1 (Fin)			
Operating Force	<b>ASTM E2068-00</b>		
Operable sash	Max. Force to maintain motion	19 lbs.	25/lbs
	Max. Force to initiate motion	30 lbs	Report only
	Force to open/close locks	7/19 lbs.	22.5
Air Infiltration	<b>ASTM E283-04</b>	0.09 cfm/ft <sup>2</sup>	0.34 cfm/ft <sup>2</sup>
@ 1.57psf			
The tested specimen meets the performance levels specified in AAMA/WDMA/CSA 101/I.S.2/A440-11.			
Measured air recorded in two (2) decimals at client's request			
Water Resistance	<b>ASTM E547-00</b>		
5.0 gph/ft <sup>2</sup>	Four (4) 5 min. cycles	No Entry	No Entry
WTP=12.00 psf			
The specimen was tested with and without an insect screen installed.			

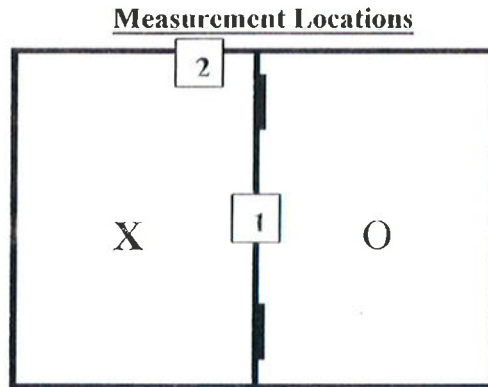
**Paragraph**

5.3.4.2 Specimen #1(Fin)

Uniform Structural Load was conducted to **ASTM E330-02** with no deviations to test method. Unit was tested to a **Design Pressure of +50.0psf**

<u>Range of test</u>	<u>time</u>	<u>load</u>	<u>Deflection</u>	<u>Perm. Set</u>	<u>Allowable</u>
<b>Positive loads</b>	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 7.4 mm (0.342") Loc. 2 6.1 mm (0.265")		
Test load	10	75.0	Loc. 1 Loc. 2	1.1mm (0.087") 0.7mm (0.042")	1.2mm (.228") 5.4mm (.048")
<b>Design Pressure of -70.0psf</b>					
<b>Negative loads</b>	(seconds)	psf			
½ Test load	10	52.5			
Design Load	10	70.0	Loc. 1 7.0 mm (0.782") Loc. 2 5.2 mm (0.450")		
Test load	10	105.0	Loc. 1 Loc. 2	0.8mm (0.105") 0.5mm (0.045")	1.2mm (.228") 5.4mm (.048")





**Performance Test Results: Cont.**

5.3.4.2 Specimen #1(Fin)

Uniform Structural Load was conducted to ASTM E330-02 with no deviations to test method. Unit was tested to a **Design Pressure of +/-50.0psf**

Location (1) - Max. Allowable Perm. Set after test load at center mid-span of the fixed meeting stile.(0.4% of 1556 mm (57.00”) span) = 6.2 mm (0.228”)

Location (1) - Max. Allowable Perm. Set after test load at longest unsupported span between installation fasteners frame head.(0.4% of 1556 mm (12.00”) span) = 6.2 mm (0.048”)

<u>Title of Test</u>	<u>Method</u>	<u>Measured</u>	<u>Allowed</u>
Specimen: 1 (Fin)			
Forced Entry Resistance	ASTM F588-07	Passed	
Type “A” Window Assembly	T <sub>1</sub> = 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.			

Welded Corner Test      ASTM D 618-08      Passed

**Note:** When loaded to failure @ 39 lbs., the break did not extend along the entire weld line.

<u>Allowed</u>		<u>Measured</u>	<u>Results</u>
Deglazing	ASTM E 987-09		
Lock Stile	70 lbs.	0.23mm (.009”) = 1.8% < 90%	Passed
Lead Stile	70 lbs.	0.05mm (.002”) = 0.4% < 90%	Passed
Bottom Rail	50 lbs.	0.05mm (.002”) = 0.4% < 90%	Passed
Top Rail	50 lbs.	0.02mm (.001”) = 0.2% < 90%	Passed



**Paragraph**

**5.3.4.2 Specimen #2(Equal Leg) Structural only**

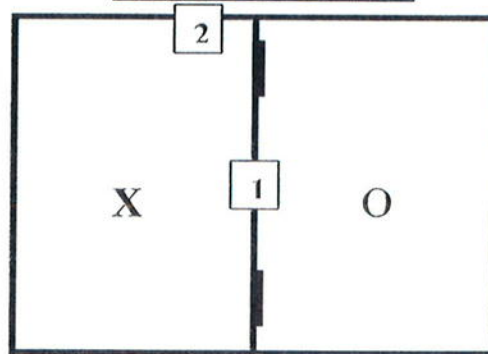
Uniform Structural Load was conducted to **ASTM E330-02** with no deviations to test method. Unit was tested to a **Design Pressure of +50.0psf**

<u>Range of test</u>	<u>time</u>	<u>load</u>	<u>Deflection</u>	<u>Perm. Set</u>	<u>Allowable</u>
<b>Positive loads</b>	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 7.4 mm (0.342") Loc. 2 6.1 mm (0.265")		
Test load	10	75.0	Loc. 1 Loc. 2	1.1mm (0.094") 0.7mm (0.044")	5.8mm (.228") 1.2mm (.048")

**Design Pressure of -50.0psf**

<b>Negative loads</b>	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 7.0 mm (0.782") Loc. 2 5.2 mm (0.450")		
Test load	10	75.0	Loc. 1 Loc. 2	0.8mm (0.112") 0.5mm (0.041")	5.8mm (.228") 1.2mm (.048")

Measurement Locations



Location (1) - Max. Allowable Perm. Set after test load at center mid-span of the fixed meeting stile.(0.4% of 1556 mm (57.00") span) = 5.8 mm (0.228")

Location (1) - Max. Allowable Perm. Set after test load at longest unsupported span between installation fasteners frame head.(0.4% of 1556 mm (12.00") span) = 1.2 mm (0.048")



**Large Missile Impact**

Specimens 3, 4 & 5: 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:

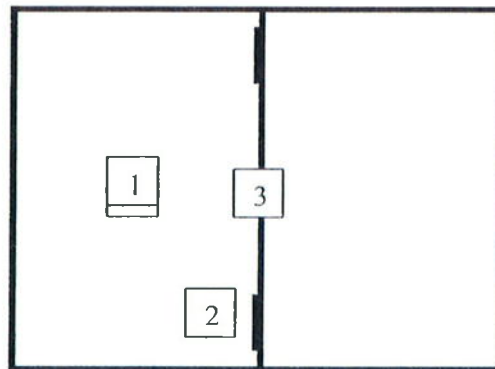
**Note:**

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.

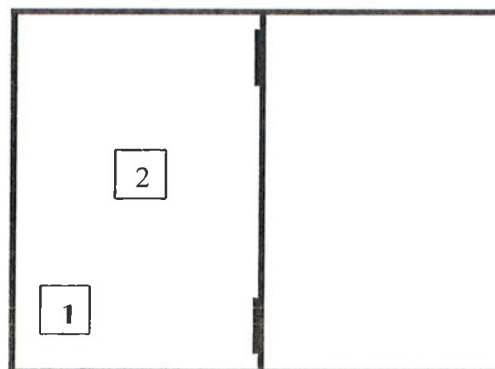
**Specimen 3**



X O

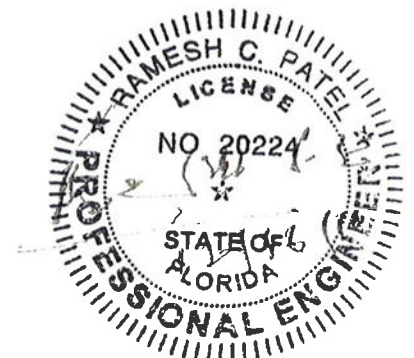
Specimen	Impact Loc.	Speed Ft/Sec	X Meas.	Y Meas.
No. 3	Loc: 1.	50.2	17.500"	30.250"
	Loc: 2.	50.0	26.000"	52.000"
	Loc: 3.	50.1	36.500"	30.500"

**Specimen 4**



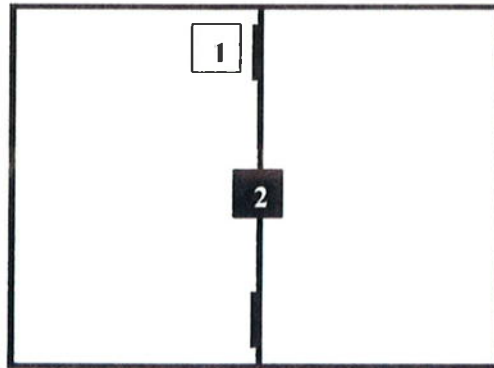
X O

Specimen	Impact Loc.	Speed Ft/Sec	X Meas.	Y Meas.
No. 4	Loc: 1.	49.9	17.000"	30.500"
	Loc: 2.	50.1	10.000"	51.750"



### Performance Test Results Continued

#### Specimen 5



<u>Specimen</u>	<u>X</u> <u>Impact Loc.</u>	<u>O</u> <u>Speed Ft/Sec</u>	<u>X Meas.</u>	<u>Y Meas.</u>
No. 5	Loc: 1.	50.1	27.000"	9.500"
	Loc: 2.	50.0	36.250"	31.000"

**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: Specimens: 3, 4 & 5 (Fin)

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 3

**Design Load** + 50.0 psf, -50.0 psf

##### + Positive loads

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .2 - .5	10.0 25.0	3500	55
+ .0 - .6	0.00 30.0	300	55
+ .5 - .8	25.0 40.0	600	55
+ .3 - 1.0	15.0 50.0	100	55

4500 cycles complete

##### -Negative Loads

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .3 - 1.0	15.0 50.0	50	55
+ .5 - .8	25.0 40.0	1050	55
+ .0 - .6	0.00 30.0	50	55
+ .2 - .5	10.0 25.0	3350	55

4500 cycles complete

9000 cycles completed

#### Deflection/ Set

1.500" 0.250"

#### Deflection/ Set

1.750" 0.430"





**Air Pressure Cycling: Cont.** Specimens: 3, 4 & 5 (Fin)

**Specimen 4**

**Design Load** + 50.0 psf, -50.0 psf

**+ Positive loads**

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .2 - .5	10.0 25.0	3500	55
+ .0 - .6	0.00 30.0	300	55
+ .5 - .8	25.0 40.0	600	55
+ .3 - 1.0	15.0 50.0	100	55

4500 cycles complete

**-Negative Loads**

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .3 - 1.0	15.0 50.0	50	55
+ .5 - .8	25.0 40.0	1050	55
+ .0 - .6	0.00 30.0	50	55
+ .2 - .5	10.0 25.0	3350	55

4500 cycles complete

**Deflection/ Set**

1.375" 0.375"

**9000 cycles completed**

**Deflection/ Set**

1.875" 0.500"

**Specimen 5**

**Design Load** + 50.0 psf, -50.0 psf

**+ Positive loads**

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .2 - .5	10.0 25.0	3500	55
+ .0 - .6	0.00 30.0	300	55
+ .5 - .8	25.0 40.0	600	55
+ .3 - 1.0	15.0 50.0	100	55

4500 cycles complete

**-Negative Loads**

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .3 - 1.0	15.0 50.0	50	55
+ .5 - .8	25.0 40.0	1050	55
+ .0 - .6	0.00 30.0	50	55
+ .2 - .5	10.0 25.0	3350	55

4500 cycles complete

**Deflection/ Set**

1.500" 0.125"

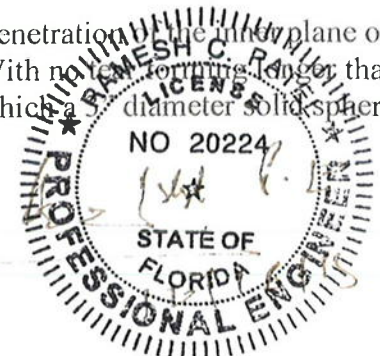
**9000 cycles completed**

**Deflection/ Set**

1.750" 0.437"

**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 opening larger than 5" and wider than 1/16" thru which air can pass, or no opening through which a diameter solid sphere could freely pass.



### Large Missile Impact

Specimen 6 (Equal Leg): 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:

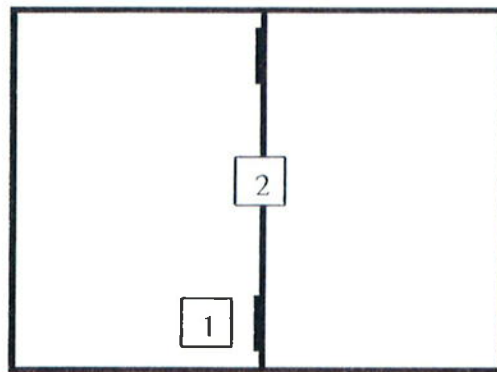
#### Note:

X- measurement from left edge of test specimen.

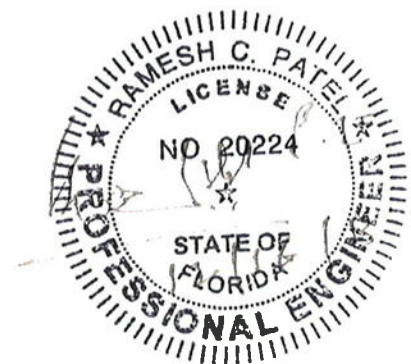
Y- measurement from top edge of test specimen.

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

### Specimen 6



Specimen	X Impact Loc.	O Speed Ft/Sec	X Meas.	Y Meas.
No. 6	Loc: 1.	50.2	26.500"	51.000"
	Loc: 2.	50.0	36.000"	31.500"



**Air Pressure Cycling:** Specimen: 6 (Equal Leg)

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 6 (Equal Leg)**

**Design Load** + 50.0 psf, -50.0 psf

**+ Positive loads**

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .2 - .5	10.0 25.0	3500	55
+ .0 - .6	0.00 30.0	300	55
+ .5 - .8	25.0 40.0	600	55
+ .3 - 1.0	15.0 50.0	100	55

4500 cycles complete

**Deflection/ Set**

1.375" 0.375"

**-Negative Loads**

Range of test	Actual load PSF	# of cycles	Cycles/min
+ .3 - 1.0	15.0 50.0	50	55
+ .5 - .8	25.0 40.0	1050	55
+ .0 - .6	0.00 30.0	50	55
+ .2 - .5	10.0 25.0	3350	55

4500 cycles complete

**Deflection/ Set**

1.430" 0.375"

**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 Date:** November 11, 2013**Test Completion Date:** November 13, 2013

**Remarks:** Detailed 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 that 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 assumes 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.

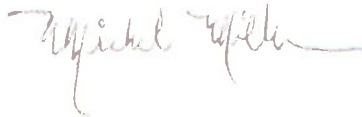
Element Materials Technology

**Testing Performed/Witnessed By:**

Mike Miller                    Element Materials Technology  
Washington Romero        Element Materials Technology

**Client Present:**

Dennis Cox                    Deceuninck NA



Michael Miller  
Documentation Manager  
Element Materials Technology

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

