



element™

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Report No.: ESP014394P-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 143.191CA Vinyl Rep (Equal Leg) & NC (Fin) Frame Impact Glass Casement Window C-LC50 940mm x 1930mm (37" x 76") 05 Designation LC-PG 50-C 940mm x 1930mm (37" x 76") 08/11 Designation

**Tests Conducted:** AAMA/WDMA/CSA 101/IS.2/A440-05/08/11 "Standard/Specification for Windows, Door and Unit Skylights".  
ASTM E-1886-05/ AAMA 506-11 "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/ AAMA 506-11 "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 Rep (Equal Leg) + 50.0 psf. - 50.0 psf  
\*Specimen 6- ASTM E1886-05/1996-09 NC (Fin) + 50.0 psf. - 50.0 psf  
\*(With deviations only one specimen impacted and cycled (Fin).

**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 (35.375" wide x 73.125" high)

**Frame and Sash Material:** Extruded vinyl

All Specimens

**Frame Construction:**

The extruded vinyl equal leg frame measured 37" wide x 76" high buck opening overall. The extruded vinyl fin frame measured 37" wide x 76" high buck opening overall with a 1.125" integral fin. The equal leg and fin frame head, sill and jambs were constructed of extruded vinyl and utilized mitered and welded corner construction. The vinyl frame head and sill measured 3.250" wide x 2.461" high. The vinyl frame jambs measured 3.250" wide x 2.461" high. Reference drawing # (10008053 & 10008052).



**Sash Construction:** One (1) active sash measured 895mm x 1886mm (35.375” wide x 73.125” 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).  
**All Specimens**

**Glazing:** 19mm (¾”) overall laminated (Impact) glass consisting of the following: One (1) exterior piece of 3.8mm (.125”) annealed glass / one (1) 6.8mm (.300”) Quanex Duraseal spacer system (as stated by manufacturer) One (1) interior piece of 3.2mm (.125”) annealed glass / 1.9mm (.090”) PVB laminate by Solutia Saflex / One (1) interior piece of 3.2mm (.125”) annealed glass. (reference drawing #3/4” I.G, ANN .090” PVB LAMI). 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 (32.063” wide x 71.063” high)

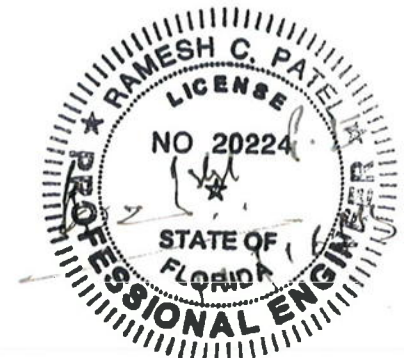
**Weather-stripping:** All Specimens

Description	Quantity	Location
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

Description	Quantity	Location
Maxim 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).

**All Specimens**

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

**All Specimens**

**Additional Description:**      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.

**All Specimens**

**Installation:**      The windows were installed in wood test buck as described above utilizing twenty-eight (28) #8 x 1.250" Phillips P.H. S.M.S. Ten (10) in each frame jamb located at 6", 13", 20", 27", 34", 41", 48", 55", 62" and 69" measuring from frame sill to frame head. Four (4) each in the frame head and sill located at 6", 14", 22" and 30" measuring from left to right.

**All Specimens**

**Performance Test Results**

<b><u>Paragraph</u></b>	<b><u>Title of Test</u></b>	<b><u>Method</u></b>	<b><u>Measured</u></b>	<b><u>Allowed</u></b>
Specimen #1(Fin)	Operating Force Operable sash	<b>ASTM E2068-00</b> Max. Force to maintain motion Max. Force to initiate motion Force to open/close locks	18 lbs. 29 lbs 7/12 lbs.	30/lbs Report only 22.5/lbs
	Air Infiltration @ 1.57psf	<b>ASTM E283-04</b>	0.03 cfm/ft <sup>2</sup>	0.34 cfm/ft <sup>2</sup>
	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 5.0 gph/ft <sup>2</sup> WTP=12.0 psf	<b>ASTM E547-00</b> Four (4) 5 min. cycles	No Entry	No Entry
		<b>ASTM E331-00</b> Fifteen (15) minute duration	No Entry	No Entry

The specimen was tested without an insect screen installed.



### Performance Test Results:Cont.

#### Paragraph

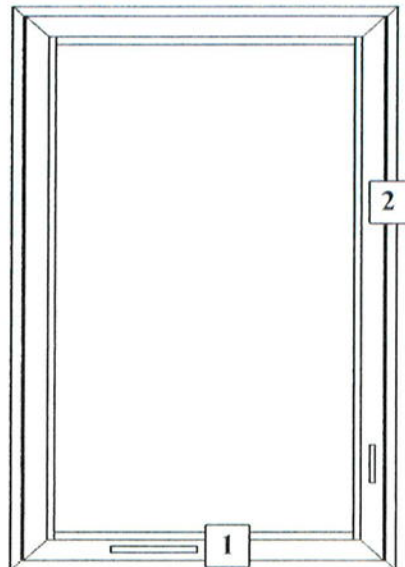
##### 5.3.4.2 Specimen #1(Fin)

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 6.1 mm (0.242") Loc. 2 7.1 mm (0.278")		
Test load	10	75.0	Loc. 1 Loc. 2	1.3mm (0.052") 1.0mm (0.034")	3.3mm (.129") 1.2mm (.048")

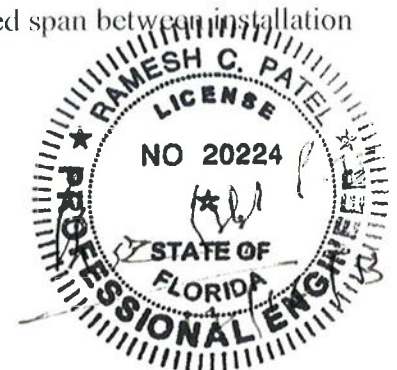
#### **Design Pressure of -50.0psf**

<b>Negative loads</b>	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 14.0 mm (0.570") Loc. 2 17.0 mm (0.682")		
Test load	10	75.0	Loc. 1 Loc. 2	1.7mm (0.068") 1.1mm (0.038")	3.3mm (.129") 1.2mm (.048")



Location (1) - Max. Allowable Perm. Set after test load at the longest unsupported span between the keepers on the sash bottom lock rail (0.4% of 819mm (32.250") span) = 3.3mm (0.129")

Location (2) - Max. Allowable Perm. Set after test load at the longest unsupported span between installation fasteners frame jamb (0.4% of 304mm (12.00") span) = 1.2mm (0.048")



**Performance Test Results:Cont.**

<u>Paragraph</u>	<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 "B" 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 D618-08**    Passed  
Note: When loaded to failure, the break did not extend along the entire weld line.

Sash Vertical Deflection Test **AAMA/A440-11**  
 Loading @ 45 lbs for 60 Seconds.    Deflection after 60 Sec. = .125"  
 Allowable Deflection= 0.707    Set after 60 Sec. = .010"  
 (Sash width = 35.375" x 0.02)    Passed

Note: At the conclusion of the test, the sash properly closed and operated. There was no glazing breakage.

Sash and Hardware Load Test **AAMA/A440-11**  
 Loading for 10 Sec.@ 300 Pa (6.27 psf). A concentrated load through the geometric center of the sash (Ref. Table 7.13 Loads for distributed load test) \* Load specified includes weight of glazed sash.  
 Passed

Note: At the conclusion of the test, the sash operated properly and fully closed. There was no failure of screws, or track, or hinge, or permanent deformation of support arms.



**Performance Test Results:Cont.**

**Paragraph**

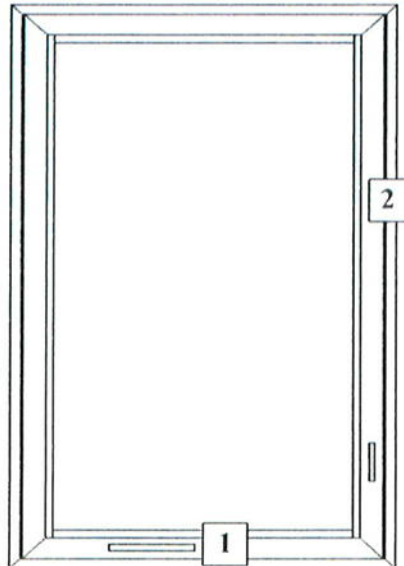
5.3.4.2 Specimen #2(Equal Leg) Structural only.

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 6.1 mm (0.242") Loc. 2 7.1 mm (0.278")		
Test load	10	75.0	Loc. 1 Loc. 2	1.3mm (0.052") 1.0mm (0.034")	3.3mm (.129") 1.2mm (.048")

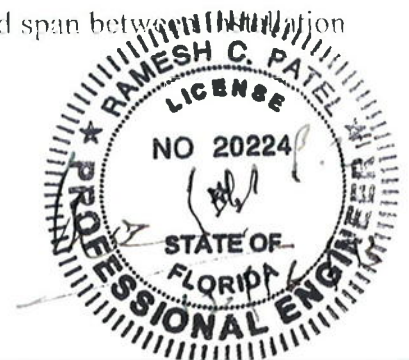
**Design Pressure of -50.0psf**

<b>Negative loads</b>	(seconds)	psf			
½ Test load	10	37.5			
Design Load	10	50.0	Loc. 1 14.0 mm (0.570") Loc. 2 17.0 mm (0.682")		
Test load	10	75.0	Loc. 1 Loc. 2	1.7mm (0.068") 1.1mm (0.040")	3.3mm (.129") 1.2mm (.048")



Location (1) - Max. Allowable Perm. Set after test load at the longest unsupported span between the keepers on the sash bottom lock rail (0.4% of 819mm (32.250") span) = 3.3mm (0.129")

Location (2) - Max. Allowable Perm. Set after test load at the longest unsupported span between the fasteners frame jamb (0.4% of 304mm (12.00") span) = 1.2mm (0.048")



**PERFORMANCE TEST RESULTS-Large Missile Test**

**Specimens 3, 4 & 5 (Equal Leg): ASTM E1996-09/ AAMA 506-11**

Specimens were tested to **ASTM E1886-05 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 E1996-09**. 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:**

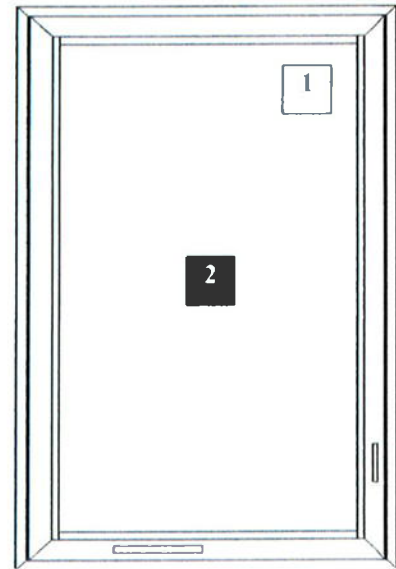
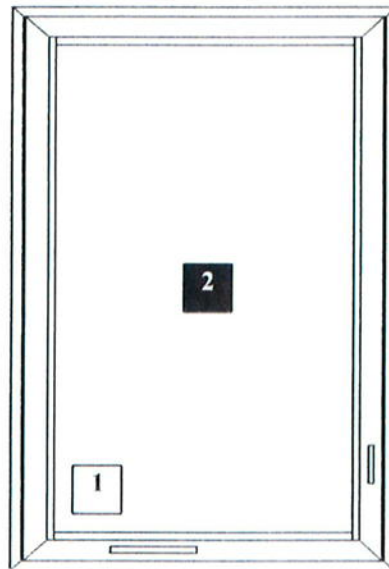
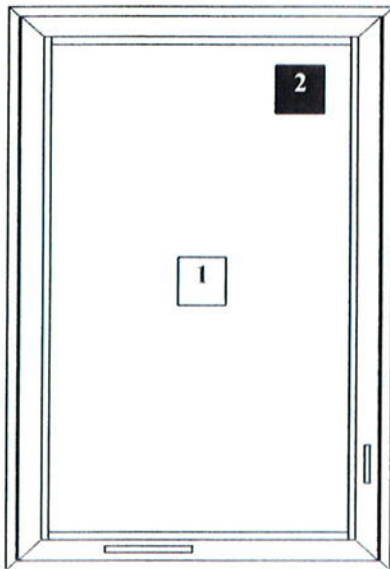
X- measurement from left edge of test specimen.

Y- measurement from top edge of test specimen.

**Specimen 3**

**Specimen 4**

**Specimen 5**



**Specimen 3**

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	50.0	17.500"	37.500"
2.	2	50.3	29.000"	10.000"

**Specimen 4**

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	50.1	18.000"	37.000"
2.	2	50.2	9.500"	65.500"

**Specimen 5**

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	49.9	28.000"	9.000"
2.	2	50.1	18.500"	36.500"

**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



**PERFORMANCE TEST RESULTS- Cyclic Static Air Pressure Loading**

**Specimens 3, 4 & 5: (Equal Leg) ASTM E1886-05/ AAMA 506-11**

Specimens were tested to **ASTM E1886-05 and 1996-09** with no deviation to the test specifications. All specimens were tested to the requirements of section 5.4 table 1 in **ASTM E1996-09**.

**Specimen 3**

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

**Positive loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	10.0	25.0	3500	55
0.0 - .6	0.00	30.0	300	55
0.5 - .8	25.0	40.0	600	55
0.3 - 1.0	15.0	50.0	100	55

4500 cycles complete

**Deflection/ Set**

1.375" .125"

**Negative Loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
-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" .250"

9000 cycles completed

**Specimen 4**

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

**Positive loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	10.0	25.0	3500	55
0.0 - .6	0.00	30.0	300	55
0.5 - .8	25.0	40.0	600	55
0.3 - 1.0	15.0	50.0	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	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**

1.750" .250"

9000 cycles completed





**PERFORMANCE TEST RESULTS- Cyclic Static Air Pressure Loading: Continued**  
**ASTM E1886-05/ AAMA 506-11**

**Specimen 5**

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

**Positive loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	10.0	25.0	3500	55
0.0 - .6	0.00	30.0	300	55
0.5 - .8	25.0	40.0	600	55
0.3 - 1.0	15.0	50.0	100	55

4500 cycles complete

**Deflection/ Set**

1.437" .1875"

**Negative Loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
-.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**

1.625" .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.



**PERFORMANCE TEST RESULTS-Large Missile Test**

**Specimen 6 (Fin): ASTM E1996-09/ AAMA 506-11**

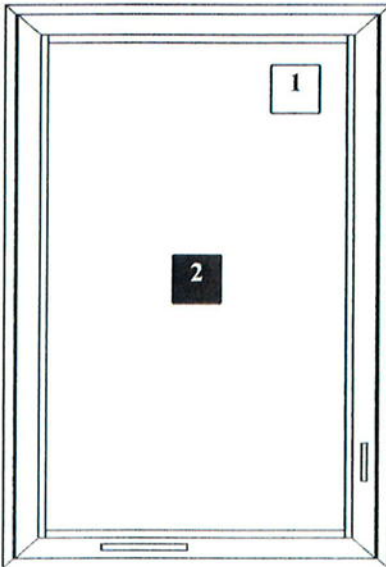
Specimens were tested to **ASTM E1886-05 and 1996-09** with no deviation to the test specifications. All specimens were tested to the Wind Zone 4 requirements stated in section 5 of **ASTM E1996-09**. Missile level D. The missile orientation was perpendicular to the glass surface at impact. Each specimen 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.

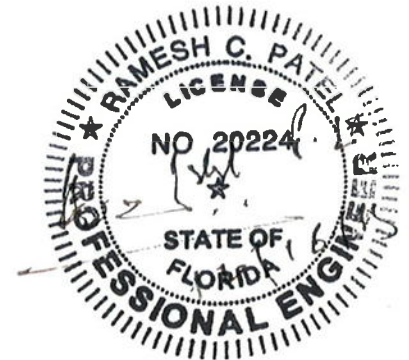
**Specimen 6**



**Specimen 6**

Impact No.	Impact Loc.	Speed Ft/Sec.	X Meas.	Y Meas.
1.	1	50.0	17.500"	37.500"
2.	2	50.3	29.000"	10.000"

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



**PERFORMANCE TEST RESULTS- Cyclic Static Air Pressure Loading**

**Specimen 6: (Fin) ASTM E1886-05/ AAMA 506-11**

Specimens were tested to **ASTM E1886-05 and 1996-09** with no deviation to the test specifications. All specimens were tested to the requirements of section 5.4 table 1 in **ASTM E1996-09**.

**Specimen 6**

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

**Positive loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
0.2 - .5	10.0	25.0	3500	55
0.0 - .6	0.00	30.0	300	55
0.5 - .8	25.0	40.0	600	55
0.3 - 1.0	15.0	50.0	100	55

4500 cycles complete

**Deflection/ Set**  
 1.375" .125"

**Negative Loads**

<u>Range of test</u>	<u>actual load psf</u>		<u># of cycles</u>	<u>cycles/min</u>
-.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**  
 1.625" .250"

**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 1996-09.

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

**Test Date:** November 14<sup>th</sup> 2013 thru November 18<sup>th</sup> 2013



**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:**

Michael 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                                      (2)  
          Ramesh Patel P.E.                    (1)  
          File                                        (1)

