Architectural Testing

ASTM E 1886 and ASTM E 1996
TEST REPORT

Rendered to:

EAGLE WINDOW & DOOR, INC.

SERIES/MODEL: 3060 Series 02 Axiom Clad Casement Vent with Harbormaster Monolithic Glazing
PRODUCT TYPE: Aluminum Clad Casement Window with Impact Glazing

Report No.:	**90241.03-201-44**
Test Dates:	**04/27/09**
Through:	**04/29/09**
Report Date:	**05/08/09**
Test Record Retention Date:	**04/27/13**

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
fax: 651-636-3843
www.archtest.com

Architectural Testing

ASTM E 1886 and ASTM E 1996 TEST REPORT

Rendered to:

EAGLE WINDOW & DOOR, INC.
2045 Kerper Blvd., P.O. Box 1072
Dubuque, Iowa 52004-1072

Report No.:	90241.03-201-44
Test Dates:	04/27/09
Through:	04/29/09
Report Date:	05/08/09
Test Record Retention Date:	04/27/13

Project Summary: Architectural Testing, Inc. was contracted by Eagle Window and Door, Inc. to perform testing on a Series/Model 3060 Series 02 Axiom Clad Casement Vent with Harbormaster Monolithic Glazing, Aluminum Clad Casement Window with Impact Glazing at Architectural Testing, Inc. test facility in St. Paul, Minnesota. The samples tested met the performance requirements set forth in the referenced test procedures for a +3120, -3600 Pa (+65.0, -75.0 psf) Design Pressure with missile impacts corresponding to Missile Level D and Wind Zone 4. Test specimen description and results are reported herein. The samples were provided by the client.

Test Procedures: The test specimens were evaluated in accordance with the following:

ASTM E 1886-02, *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 1996-02, *Standard Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Wind Borne Debris in Hurricanes.*

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 1996-05, *Standard Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Wind Borne Debris in Hurricanes.*

Test Specimen Description:

Series/Model: 3060 Series 02 Axiom Clad Casement Vent with Harbormaster Monolithic Glazing

Product Type: Aluminum Clad Casement Window with Impact Glazing

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
fax: 651-636-3843
www.archtest.com

Test Specimen Description: (Continued)

Overall Size: 914 mm (36") wide by 1829 mm (72") high

Sash Size: 876 mm (34-1/2") wide by 1791 mm (70-1/2") high

Overall Area: 1.7 m^2 (18.0 ft^2)

Finish: Interior wood was natural and the exterior aluminum cladding was white.

Frame Construction: The wood frame was of laminated veneer lumber (LVL) with corners rabbet jointed, butted, sealed with silicone and secured with two 7/16" x 1-1/2" long staples per corner. Extruded aluminum cladding was slip-fit over the wood frame members with the corners miter cut, sealed with silicone and secured with a nylon corner key and two #8 x 7/16" screws. The head stop was secured with 3/16" x 1-1/8" long staples spaced approximately 152 mm (6") on center. The side stops were secured with glue and a vinyl spline. The sill operator cover was secured with three #8 x 2-1/8" screws.

Sash Construction: The sash members were of molded pine. The corners utilized mortise and tenon construction and were secured with glue and one #7 x 1-1/4" screw per corner. Extruded aluminum cladding was slip-fit over the wood sash members with the corners miter cut, silicone sealed and secured with a nylon corner key and one #5 x 1-1/2" screw per corner.

Weatherstripping:

Description	Quantity	Location
0.267" diameter hollow bulb	1 Row	Sash stiles and top rail
0.320" diameter foam filled bulb	1 Row	Interior frame perimeter
Vinyl spline	1 Row	Between frame jambs and stop

Glazing Details: The window utilized a nominal 10.1 mm (25/64") thick laminated glass fabricated from two sheets of nominal 3.9 mm (5/32") annealed sheets separated by a 2.3 mm (0.090") SGP innerlayer. The glass was set from the interior against hot melt silicone and backfilled with silicone. Wood glazing stops with single sided adhesive foam tape were utilized on the interior and secured with 1-1/4" brads spaced 25 mm (1") from each corner and 152 mm to 203 mm (6" to 8") on center.

Drainage: No drainage was utilized.

Test Specimen Description: (Continued)

Hardware:

Description	Quantity	Location
Roto operator	1	Frame sill/bottom rail
3-point lock system with single actuator	1	Locking jamb/stile with keepers located 64 mm (12-1/2") from head and sill; and midspan
Sash limiter	1	Sill
Full length stainless steel piano hinge	1	Frame jamb to sash stile

Installation: The window was installed within wood test buck. Masonry clips were utilized 152 mm (6") from each end of jamb and spaced 610 mm (24") on center. The masonry clips were secured to the frame with four #8 x 5/8" screws and to the wood surround with two #8 x 1-1/2" screws on each side of the buck.

Test Results: The following results have been recorded:

ASTM E 1886, *Large Missile Impact*

Conditioning Temperature: 21°C (70°F)
Missile Weight: 4082 g (9.0 lbs)
Missile Length: 2438 mm (96")
Muzzle Distance from Test Specimen: 4.9 m (16 ft.)

Test Unit #1

Impact #1: Missile Velocity: 15.0 m/s (49.2 fps); orientation within ±5° of vertical

Impact Area: Center of glazing
Observations: Missile hit target area, no rips tears or penetrations
Results: Pass

Impact #2: Missile Velocity: 15.1 m/s (49.4 fps); orientation within ±5° of vertical

Impact Area: Lower right glazing corner
Observations: Missile hit target area, no rips, tears or penetrations
Results: Pass

Note: See Architectural Testing Sketch #1 for impact locations.

Test Results: (Continued)

ASTM E 1886, *Large Missile Impact*

Conditioning Temperature: 21°C (70°F)
Missile Weight: 4082 g (9.0 lbs)
Missile Length: 2438 mm (96")
Muzzle Distance from Test Specimen: 4.9 m (16 ft.)

Test Unit #2

Impact #1: Missile Velocity: 15.1 m/s (49.6 fps); orientation within ±5° of vertical

Impact Area: Center of glazing
Observations: Missile hit target area, no rips, tears or penetrations
Results: Pass

Impact #2: Missile Velocity: 15.0 m/s (49.3 fps); orientation within ±5° of vertical

Impact Area: Upper left glazing corner
Observations: Missile hit target area, no rips, tears or penetrations
Results: Pass

***Note**: See Architectural Testing Sketch #1 for impact locations.*

Test Unit #3

Impact #1: Missile Velocity: 15.0 m/s (49.1 fps); orientation within ±5° of vertical

Impact Area: Center of glazing
Observations: Missile hit target area, no rips, tears or penetrations
Results: Pass

Impact #2: Missile Velocity: 15.2 m/s (49.9 fps); orientation within ±5° of vertical

Impact Area: Lower left glazing corner
Observations: Missile hit target area, no rips, tears or penetrations
Results: Pass

***Note**: See Architectural Testing Sketch #1 for impact locations.*

Test Results: (Continued)

ASTM E 1886, *Air Pressure Cycling*

Test Unit #1

Design Pressure: +3120, -3600 Pa (+65.0, -75.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)				
			#1	#2	#3	#4	#5
625 to 1560 (13.0 to 32.5)	3500	1.03	11.4 (0.45)	7.4 (0.29)	6.6 (0.26)	5.3 (0.21)	0.5 (0.02)
0 to 1870 (0 to 39.0)	300	1.51	13.2 (0.52)	11.2 (0.44)	10.9 (0.43)	9.1 (0.36)	1.3 (0.05)
1560 to 2490 (32.5 to 52.0)	600	1.14	13.2 (0.52)	11.2 (0.44)	10.9 (0.43)	9.1 (0.36)	1.3 (0.05)
935 to 3120 (19.5 to 65.0)	100	1.93	13.5 (0.53)	11.2 (0.44)	10.9 (0.43)	9.1 (0.36)	1.3 (0.05)
			Permanent Set				
			13.0 (0.51)	10.9 (0.43)	10.2 (0.40)	8.9 (0.35)	0.5 (0.02)

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)				
			#1	#2	#3	#4	#5
1080 to 3600 (22.5 to 75.0)	50	1.44	2.5 (0.10)	8.9 (0.35)	4.8 (0.19)	3.8 (0.15)	7.9 (0.31)
1800 to 280 (37.5 to 60.0)	1050	1.53	3.0 (0.12)	8.1 (0.32)	4.6 (0.18)	3.8 (0.15)	6.9 (0.27)
0 to 2060 (0 to 45.0)	50	1.55	2.5 (0.10)	6.9 (0.27)	3.6 (0.14)	3.0 (0.12)	5.3 (0.21)
720 to 1800 (15.0 to 37.5)	3350	1.31	2.5 (0.10)	6.4 (0.25)	4.3 (0.17)	3.8 (0.15)	4.6 (0.18)
			Permanent Set				
			1.5 (0.06)	2.3 (0.09)	1.8 (0.07)	2.5 (0.10)	0.5 (0.02)

***Observations**: No additional damage or deglazing was observed.*

Result: Pass

***Note**: See Architectural Testing Sketch #2 for indicator locations*

Test Results: (Continued)

ASTM E 1886, ***Air Pressure Cycling***

Test Unit #2

Design Pressure: +3120, -3600 Pa (+65.0, -75.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)				
			#1	#2	#3	#4	#5
625 to 1560 (13.0 to 32.5)	3500	1.52	1.3 (0.05)	3.0 (0.12)	3.6 (0.14)	3.0 (0.12)	4.1 (0.16)
0 to 1870 (0 to 39.0)	300	1.31	1.5 (0.06)	3.3 (0.13)	4.1 (0.16)	3.3 (0.13)	4.3 (0.17)
1560 to 2490 (32.5 to 52.0)	600	1.30	1.5 (0.06)	3.3 (0.13)	3.8 (0.15)	3.3 (0.13)	5.1 (0.20)
935 to 3120 (19.5 to 65.0)	100	1.82	1.3 (0.05)	3.0 (0.12)	3.6 (0.14)	3.3 (0.13)	4.8 (0.19)
			Permanent Set				
			0.3 (0.01)	0.3 (0.01)	1.0 (0.04)	0.5 (0.02)	1.0 (0.04)

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)				
			#1	#2	#3	#4	#5
1080 to 3600 (22.5 to 75.0)	50	1.42	4.1 (0.16)	11.2 (0.44)	6.6 (0.26)	4.6 (0.18)	7.4 (0.29)
1800 to 280 (37.5 to 60.0)	1050	1.42	3.8 (0.15)	9.4 (0.37)	5.6 (0.22)	4.1 (0.16)	6.1 (0.24)
0 to 2060 (0 to 45.0)	50	1.47	2.5 (0.10)	7.4 (0.29)	3.8 (0.15)	3.0 (0.12)	5.3 (0.21)
720 to 1800 (15.0 to 37.5)	3350	1.07	2.3 (0.09)	6.9 (0.27)	3.6 (0.14)	2.8 (0.11)	4.8 (0.19)
			Permanent Set				
			1.3 (0.05)	2.0 (0.08)	1.3 (0.05)	1.5 (0.06)	1.8 (0.07)

Observations: *No additional damage or deglazing was observed.*

Result: Pass

Note: *See Architectural Testing Sketch #2 for indicator locations*

Test Results: (Continued)

ASTM E 1886, ***Air Pressure Cycling***

Test Unit #3

Design Pressure: +3120, -3600 Pa (+65.0, -75.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)				
			#1	#2	#3	#4	#5
625 to 1560 (13.0 to 32.5)	3500	1.17	1.0 (0.04)	4.6 (0.18)	5.1 (0.20)	4.8 (0.19)	2.3 (0.09)
0 to 1870 (0 to 39.0)	300	1.23	1.3 (0.05)	4.8 (0.19)	5.3 (0.21)	5.1 (0.20)	2.5 (0.10)
1560 to 2490 (32.5 to 52.0)	600	1.35	1.3 (0.05)	5.3 (0.21)	5.7 (0.22)	5.8 (0.23)	3.0 (0.12)
935 to 3120 (19.5 to 65.0)	100	1.52	1.5 (0.06)	5.8 (0.23)	5.7 (0.22)	6.4 (0.25)	3.0 (0.12)
			Permanent Set				
			0.8 (0.03)	1.8 (0.07)	1.5 (0.06)	1.8 (0.07)	1.0 (0.04)

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Maximum Deflection at Indicator mm (inch)				
			#1	#2	#3	#4	#5
1080 to 3600 (22.5 to 75.0)	50	1.98	2.8 (0.11)	10.4 (0.41)	6.4 (0.25)	5.6 (0.22)	8.4 (0.33)
1800 to 280 (37.5 to 60.0)	1050	1.37	2.3 (0.09)	8.4 (0.33)	5.3 (0.21)	5.1 (0.20)	7.4 (0.29)
0 to 2060 (0 to 45.0)	50	1.44	2.0 (0.08)	8.1 (0.32)	5.1 (0.20)	4.8 (0.19)	6.9 (0.27)
720 to 1800 (15.0 to 37.5)	3350	1.05	1.8 (0.07)	5.6 (0.22)	3.3 (0.13)	3.6 (0.14)	5.1 (0.20)
			Permanent Set				
			0.8 (0.03)	1.3 (0.05)	0.8 (0.03)	1.0 (0.04)	1.8 (0.07)

Observations: *No additional damage or deglazing was observed.*

Result: Pass

Note: *See Architectural Testing Sketch #2 for indicator locations*

General Note: *Upon completion of testing, the specimens met the requirements of Section 7 of ASTM E 1996.*

Test Equipment:

Cannon: Constructed from steel piping utilizing compressed air to propel the missile

Missile: 2x4 Southern Pine

Timing Device: Electronic Beam Type

Cycling Mechanism: Computer controlled centrifugal blower with electronic pressure measuring device

Deflection Measuring Device: Linear transducers

Tape and film were used to seal against air leakage during structural testing. In our opinion, the tape and film did not influence the results of the test.

Drawing Reference: The test specimen drawings have been reviewed by Architectural Testing and are representative of the test specimen reported herein.

List of Official Observers:

Name	Company
Chad Cornell	Eagle Window & Door, Inc.
Jim Welter	Eagle Window & Door, Inc.
Jason A. Needham	Architectural Testing, Inc.
Tony D. Gavin	Architectural Testing, Inc.
Karl A. Lips-Eakins	Architectural Testing, Inc.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire.

Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.

Digitally Signed by: Eric Schoenthaler

Eric J. Schoenthaler
Project Manager

Digitally Signed by: Daniel A. Johnson

Daniel A. Johnson
Director - Regional Operations

Attachments (pages): This report is complete only when all attachments listed are included.

- Appendix-A: WDMA Submittal forms (2)
- Appendix-B: Sketches (2)
- Appendix-C: Drawings (19)