



**ASTM E 1886 and ASTM E 1996
TEST REPORT**

Rendered to:

EAGLE WINDOW & DOOR, INC.

**SERIES/MODEL: 5080 Series 93 Clad Auxiliary Fixed
PRODUCT TYPE: Aluminum Clad Fixed Window**

**Report No.: 87727.02-602-18
Test Date: 12/08/08
Through: 02/24/09
Report Date: 03/20/09
Expiration Date: 02/24/13**



ASTM E 1886 and ASTM E 1996 TEST REPORT

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EAGLE WINDOW & DOOR, INC.
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Report No.: 87727.02-602-18
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Through: 02/24/09
Report Date: 03/20/09
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Project Summary: Architectural Testing, Inc. was contracted by Eagle Window & Door, Inc. to perform testing on three (3), Series/Model 5080 Series 93 Clad Auxiliary Fixed, Aluminum Clad Fixed Window. The samples tested met the performance requirements set forth in the referenced test procedures for a +3360 Pa (+70.18 psf) and -3840 Pa (-80.20 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 1886-05, *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: 5080 Series 93 Clad Auxiliary Fixed

Product Type: Aluminum Clad Fixed Window

Overall Size: 1524 mm (60") wide by 2286 mm (96") high

D.L.O Size: 1422 mm (56") wide by 2337 mm (92") high

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

Test Specimen Description: (Continued)

Glazing Details: The sash utilized nominal 14.3 mm (0.562") thick laminated glass. The laminated glass was fabricated from two (2) sheets of nominal 5.7 mm (0.224") thick annealed glass by Cardinal separated by a 2.29 mm (0.090") Sentry Glass Plus Interlayer. The glass was set from the interior against 0.094" thick by 0.266" wide butyl tape sealant by PTI Inc. Dow Corning silicone sealant was employed between the glass edges and frame. Neoprene glass shims were employed at the glazing pocket perimeter. Interior wood stops employed 0.032" thick by 0.625" wide foam tape and was secured with 1-1/4" wire brads spaced 4" to 9" on center.

Weatherstripping: No weatherstrip was utilized.

Frame Construction: The wood frame members consisted of laminated veneer lumber. The frame corners were of rabbet joint construction and secured with two (2) 7/16" crown by 1-3/4" long staple per corner. Each wood frame corner employed a 1/2" wide by 1" long corrugated fastener at each interior corner. Extruded aluminum cladding at the exterior was mitered at the corners, slid onto the wood frame members, corner keyed and secured with two (2) #8 x 7/16" and one (1) #10 x 2-1/2" screws per corner. A wood secondary stop was employed at the interior and secured with three (3) rows of 1-1/4" brads spaced approximately 6" on center.

Hardware: No hardware was utilized.

Drainage: No drainage was utilized.

Installation: The specimen was installed into a nominal 2x4 wood surround which was then installed into a nominal 2x10 wood surround. The unit was set onto a continuous bed of silicone sealant and secured to the wood buck with masonry clips that were spaced 18" to 24" on center. The clips were secured to the frame with four (4) #7 x 5/8" screws per clip. The clips were secured to the wood buck with four (4) #8 x 1-1/2" screws per clips. Silicone sealant was also applied over the screw heads. The unit had a rough opening of 60-1/2" x 96-1/2".

Test Results: The following results have been recorded:

ASTM E 1886, Large Missile Impact

Conditioning Temperature: 21°C (70°F)
Missile Weight: 4332 g (9.55 lbs)
Missile Length: 2.44 m (8' 0")
Muzzle Distance from Test Specimen: 5.18 m (17 ft.)

Test Unit #1

Impact #1: Missile Velocity: 15.1 m/s (49.6 fps); orientation within $\pm 5^\circ$ of horizontal

Impact Area: Center of glass

Observations: Missile hit target area, no holes or tears

Results: Pass

Impact #2: Missile Velocity: 15.0 m/s (49.3 fps); orientation within $\pm 5^\circ$ of horizontal

Impact Area: Upper right corner of glass

Observations: Missile hit target area, no holes or tears

Results: Pass

Test Unit #2

Impact #1: Missile Velocity: 15.2 m/s (49.8 fps); orientation within $\pm 5^\circ$ of horizontal

Impact Area: Upper right corner of glass

Observations: Missile hit target area, no holes or tears

Results: Pass

Impact #2: Missile Velocity: 15.2 m/s (49.9 fps); orientation within $\pm 5^\circ$ of horizontal

Impact Area: Center of glass

Observations: Missile hit target area, 2" long by 1/16" wide tear

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: 4332 g (9.55 lbs)

Missile Length: 2.44 m (8' 0")

Muzzle Distance from Test Specimen: 5.18 m (17 ft.)

Test Unit #3

Impact #1: Missile Velocity: 15.0 m/s (49.1 fps); orientation within $\pm 5^\circ$ of horizontal

Impact Area: Lower left corner of glass

Observations: Missile hit target area, no holes or tears

Results: Pass

Impact #2: Missile Velocity: 15.0 m/s (49.2 fps); orientation within $\pm 5^\circ$ of horizontal

Impact Area: Center of glass

Observations: Missile hit target area, 1-1/2" long by 1/16" wide tear

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: + 3360 Pa (+70.18 psf) and -3840 Pa (80.20 psf)

POSITIVE PRESSURE

| Pressure Range Pa (psf) | Number of Cycles | Average Cycle Time (seconds) | Maximum Deflection at Indicator mm (inch) | | |
|----------------------------------|---------------------|------------------------------------|---|-------------------|-------------------|
| | | | #1 | #2 | #3 |
| 672 to 1679 (14.04 to 35.09) | 3500 | 1.93 | 3.8 mm (0.15") | 5.1 mm (0.20") | 7.6 mm (0.30") |
| 0 to 2015 (0.00 to 42.11) | 300 | 3.02 | 5.3 mm (0.21") | 6.4 mm (0.25") | 7.6 mm (0.30") |
| 1679 to 2686 (35.09 to 56.14) | 600 | 1.95 | 5.3 mm (0.21") | 6.4 mm (0.25") | 7.6 mm (0.30") |
| 1007 to 3358 (21.05 to 70.18) | 100 | 2.98 | 5.3 mm (0.21") | 6.4 mm (0.25") | 7.6 mm (0.30") |
| | | | Permanent Set | | |
| | | | 1.5 mm (0.06") | 2.0 mm (0.08") | 3.0 mm (0.12") |

NEGATIVE PRESSURE

| Pressure Range Pa (psf) | Number of Cycles | Average Cycle Time (seconds) | Maximum Deflection at Indicator mm (inch) | | |
|----------------------------------|---------------------|------------------------------------|---|-------------------|-------------------|
| | | | #1 | #2 | #3 |
| 1151 to 3838 (24.06 to 80.20) | 50 | 2.62 | 6.6 mm (0.26") | 6.4 mm (0.25") | 4.8 mm (0.19") |
| 1919 to 3070 (40.10 to 64.16) | 1050 | 2.01 | 5.8 mm (0.23") | 5.3 mm (0.21") | 4.8 mm (0.19") |
| 0 to 2303 (0.00 to 48.12) | 50 | 2.98 | 6.1 mm (0.24") | 5.3 mm (0.21") | 4.8 mm (0.19") |
| 768 to 1919 (16.04 to 40.10) | 3350 | 1.98 | 6.1 mm (0.24") | 5.1 mm (0.20") | 4.6 mm (0.18") |
| | | | Permanent Set | | |
| | | | 2.0 mm (0.08") | 1.0 mm (0.04") | 0.5 mm (0.02") |

Result: Pass

Test Results: (Continued)

ASTM E 1886, *Air Pressure Cycling*

Test Unit #2

Design Pressure: + 3360 Pa (+70.18 psf) and -3840 Pa (80.20 psf)

POSITIVE PRESSURE

| Pressure Range Pa (psf) | Number of Cycles | Average Cycle Time (seconds) | Maximum Deflection at Indicator mm (inch) | | |
|----------------------------------|---------------------|------------------------------------|---|-------------------|-------------------|
| | | | #1 | #2 | #3 |
| 672 to 1679 (14.04 to 35.09) | 3500 | 1.86 | 2.8 mm (0.11") | 2.3 mm (0.09") | 1.8 mm (0.07") |
| 0 to 2015 (0.00 to 42.11) | 300 | 2.98 | 3.3 mm (0.13") | 2.8 mm (0.11") | 1.8 mm (0.07") |
| 1679 to 2686 (35.09 to 56.14) | 600 | 1.82 | 3.3 mm (0.13") | 2.8 mm (0.11") | 1.8 mm (0.07") |
| 1007 to 3358 (21.05 to 70.18) | 100 | 2.95 | 3.3 mm (0.13") | 2.8 mm (0.11") | 1.8 mm (0.07") |
| | | | Permanent Set | | |
| | | | 1.0 mm (0.04") | 0.7 mm (0.03") | 0.5 mm (0.02") |

NEGATIVE PRESSURE

| Pressure Range Pa (psf) | Number of Cycles | Average Cycle Time (seconds) | Maximum Deflection at Indicator mm (inch) | | |
|----------------------------------|---------------------|------------------------------------|---|-------------------|-------------------|
| | | | #1 | #2 | #3 |
| 1151 to 3838 (24.06 to 80.20) | 50 | 2.96 | 6.6 mm (0.19") | 3.6 mm (0.14") | 2.3 mm (0.09") |
| 1919 to 3070 (40.10 to 64.16) | 1050 | 1.95 | 4.8 mm (0.17") | 3.0 mm (0.12") | 2.3 mm (0.09") |
| 0 to 2303 (0.00 to 48.12) | 50 | 2.98 | 4.1 mm (0.16") | 2.8 mm (0.11") | 2.0 mm (0.08") |
| 768 to 1919 (16.04 to 40.10) | 3350 | 1.98 | 3.3 mm (0.13") | 2.5 mm (0.10") | 2.5 mm (0.10") |
| | | | Permanent Set | | |
| | | | 1.8 mm (0.07") | 1.0 mm (0.04") | 1.3 mm (0.05") |

Result: Pass

Test Results: (Continued)

ASTM E 1886, *Air Pressure Cycling*

Test Unit #3

Design Pressure: + 3360 Pa (+70.18 psf) and -3840 Pa (80.20 psf)

POSITIVE PRESSURE

| Pressure Range Pa (psf) | Number of Cycles | Average Cycle Time (seconds) | Maximum Deflection at Indicator mm (inch) | | |
|----------------------------------|---------------------|------------------------------------|---|-------------------|-------------------|
| | | | #1 | #2 | #3 |
| 672 to 1679 (14.04 to 35.09) | 3500 | 1.86 | 5.1 mm (0.20") | 3.8 mm (0.15") | 3.0 mm (0.12") |
| 0 to 2015 (0.00 to 42.11) | 300 | 2.98 | 5.1 mm (0.20") | 4.1 mm (0.16") | 3.0 mm (0.12") |
| 1679 to 2686 (35.09 to 56.14) | 600 | 1.82 | 5.3 mm (0.21") | 4.3 mm (0.17") | 3.3 mm (0.13") |
| 1007 to 3358 (21.05 to 70.18) | 100 | 2.95 | 5.6 mm (0.22") | 4.6 mm (0.18") | 3.3 mm (0.13") |
| | | | Permanent Set | | |
| | | | 2.8 mm (0.11") | 2.5 mm (0.10") | 2.3 mm (0.09") |

NEGATIVE PRESSURE

| Pressure Range Pa (psf) | Number of Cycles | Average Cycle Time (seconds) | Maximum Deflection at Indicator mm (inch) | | |
|----------------------------------|---------------------|------------------------------------|---|-------------------|-------------------|
| | | | #1 | #2 | #3 |
| 1151 to 3838 (24.06 to 80.20) | 50 | 2.98 | 1.5 mm (0.06") | 1.3 mm (0.05") | 0.7 mm (0.03") |
| 1919 to 3070 (40.10 to 64.16) | 1050 | 2.68 | 1.3 mm (0.05") | 1.0 mm (0.04") | 0.5 mm (0.02") |
| 0 to 2303 (0.00 to 48.12) | 50 | 2.98 | 0.5 mm (0.02") | 0.5 mm (0.02") | 0.3 mm (0.01") |
| 768 to 1919 (16.04 to 40.10) | 3350 | 2.55 | 0.5 mm (0.02") | 0.5 mm (0.02") | 0.5 mm (0.02") |
| | | | Permanent Set | | |
| | | | 1.0 mm (0.04") | 0.7 mm (0.03") | 1.0 mm (0.04") |

Result: Pass

Note: See Architectural Testing Sketch #1 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.

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


List of Official Observers:

| <u>Name</u> | <u>Company</u> |
|---------------|-----------------------------|
| Chad Cornell | Eagle Window & Door, Inc. |
| Mike Blum | Eagle Window & Door, Inc. |
| Jeff Zibton | Architectural Testing, Inc. |
| Dave Schumann | 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.

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For ARCHITECTURAL TESTING, INC.



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Jeffrey M. Zibton
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Wanda L. Matis
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Attachments (pages): This report is complete only when all attachments listed are included.

- Appendix-A: Alteration Addendum (1)
- Appendix-B: Sketch (1)
- Appendix-C: Drawings (21)