ASTM E 1886 and ASTM E 1996
TEST REPORT

Report No.: B2778.02-701-18

Rendered to:

PRL ARCHITECTURAL ALUMINUM PRODUCTS

PRODUCT TYPE: Aluminum Framed Curtainwall System
SERIES/MODEL: CW-600

This report contains in its entirety:

Cover Page: 1 page
Report Body: 8 pages
Sketches: 1 pages
Drawings: 12 pages

Test Dates: 08/31/11
Through: 09/01/11
Report Date: 10/04/11
Test Record Retention End Date: 09/01/15
1.0 Report Issued To: PRL Architectural Aluminum Products
14760 Don Julian Road
City of Industry, California 91746

2.0 Test Laboratory: Architectural Testing, Inc.
4 Rancho Circle
Lake Forest, California 92630
949.460.9600

3.0 Project Summary:

3.1 Product Type: Aluminum Framed Curtainwall System

3.2 Series/Model: CW-600

3.3 Compliance Statement: Results obtained are tested values and were secured by using the designated test method(s). The samples tested met the performance requirements set forth in the referenced test procedures for a +1676/-2873 Pa (+35/-60 psf) Design Pressure with missile impacts corresponding to Missile Level D and Wind Zone 3 for a basic protection rating.

3.4 Test Dates: 08/31/2011 - 09/01/2011

3.5 Test Location: Architectural Testing, Inc. test facility in Lake Forest, California. Calibration of test equipment was performed by Architectural Testing in accordance with AAMA 205-01 "In-Plant Testing Guidelines for Manufacturers and Independent Laboratories".

3.6 Test Sample Source: The test specimen was provided by the client. Representative samples of the test specimen(s) will be retained by Architectural Testing for a minimum of four years from the test completion date.

3.7 Drawing Reference: The test specimen drawings have been reviewed by Architectural Testing and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Architectural Testing per the drawings located in Appendix B. Any deviations are documented herein or on the drawings.

3.8 List of Official Observers:

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frank Fisher</td>
<td>PRL Architectural Aluminum Products</td>
</tr>
<tr>
<td>John S. Mayfield</td>
<td>Architectural Testing, Inc.</td>
</tr>
</tbody>
</table>

www.archtest.com
4.0 Test Specification(s):

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.


5.0 Test Specimen Description:

5.1 Product Sizes:

Test Specimens #1 - #3:

<table>
<thead>
<tr>
<th>Overall Area: 12.3 m² (132.4 ft²)</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>millimeters</td>
<td>inches</td>
</tr>
<tr>
<td>Overall size</td>
<td>4636</td>
<td>182-1/2</td>
</tr>
</tbody>
</table>

5.2 Frame Construction:

<table>
<thead>
<tr>
<th>Frame Member</th>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Mullion</td>
<td>Extruded aluminum</td>
<td>Secured to each jamb and at the head and sill of each lite using one (1) #12 x 3/4&quot; &quot;B&quot; point hex head screw located 2&quot; on center from the ends and 12&quot; on center thereafter</td>
</tr>
<tr>
<td>Pressure plate closer</td>
<td>Extruded aluminum</td>
<td>Secured to each vertical mullion using one (1) #12 x 3/4&quot; &quot;B&quot; point hex head screw located 2&quot; on center from the ends and 12&quot; on center thereafter</td>
</tr>
<tr>
<td>Pressure plate</td>
<td>Extruded aluminum</td>
<td>Secured to the ends of each horizontal member using two (2) #10 x 1/2&quot; phillips pan head sheet metal screws and secured to the ends of each vertical member using two (2) phillips pan sheet metal screws</td>
</tr>
<tr>
<td>Angle bracket</td>
<td>Extruded aluminum</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Joinery Type</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>All corners</td>
<td>Butted and secured using a custom shaped aluminum angle bracket (P/N: CW-306-F01)</td>
</tr>
</tbody>
</table>

www.archtest.com
5.0 Test Specimen Description: (Continued)

5.3 Weatherstripping: No weatherstripping was utilized.

5.4 Glazing:

<table>
<thead>
<tr>
<th>Exterior Lite</th>
<th>Spacer</th>
<th>Interior Lite</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/16&quot; heat strengthened</td>
<td>3/8&quot; aluminum box</td>
<td>3/16&quot; heat strengthened</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.060&quot; DuPont SentryGlas®</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/16&quot; heat strengthened</td>
</tr>
</tbody>
</table>

Glass Type | Overall Glass Thickness | Glazing Method
--- | ------------------------ | ---------------------
Laminated | 1" I.G. | Dry glazed with compression gasket at the interior and exterior and secured full perimeter of each lite at the exterior with an aluminum pressure plate.

Daylight Opening

<table>
<thead>
<tr>
<th>millimeters</th>
<th>inches</th>
<th>Glass Bite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1492 x 2559</td>
<td>58-3/4 x 100-3/4</td>
<td>5/8&quot;</td>
</tr>
</tbody>
</table>

5.5 Drainage:

<table>
<thead>
<tr>
<th>Drainage Method</th>
<th>Size</th>
<th>Quantity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weep holes</td>
<td>3/8&quot;</td>
<td>2/lite</td>
<td>6&quot; on center from the ends through the pressure bar and pressure bar cap</td>
</tr>
</tbody>
</table>

5.6 Hardware: No hardware was utilized.

5.7 Reinforcement: No reinforcement was utilized.

6.0 Installation:

The specimen was installed into an aluminum test buck. The rough opening allowed for a 1/4" shim space. The exterior perimeter of the window was sealed with duct tape.
6.0 Installation: (Continued)

<table>
<thead>
<tr>
<th>Location</th>
<th>Anchor Description</th>
<th>Anchor Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ends of each jamb member</td>
<td>Custom shaped extruded aluminum angle clip (P/N: AB-1), secured to the frame and test buck, each using 4 (four) #12 x 1-1/4” hex head screws</td>
<td>Two (2) per member; located at the interior side of each jamb above the head member and below the sill member</td>
</tr>
<tr>
<td>Ends of each vertical mullion member</td>
<td>Custom shaped extruded aluminum angle clip (P/N: AB-1), secured to the frame and test buck, each using 4 (four) #12 x 1-1/4” hex head screws</td>
<td>Four (4) per member; located on each side of the vertical mullion members above the head member and below the sill member</td>
</tr>
</tbody>
</table>
7.0 Test Results: The results are tabulated as follows:

**ASTM E 1886, Large Missile Impact**

*Conditioning Temperature*: 26°C (78°F)
*Missile Weight*: 4173 g (9.20 lbs)
*Missile Length*: 2.4 m (94”)
*Muzzle Distance from Test Specimen*: 4.4 m (14'-6”)

**Test Unit #1**: Orientation within ±5° of horizontal

<table>
<thead>
<tr>
<th>Impact #1:</th>
<th>Missile Velocity: 15.4 m/s (50.5 fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Area</td>
<td>Center of left lite</td>
</tr>
<tr>
<td>Observations:</td>
<td>Missile penetrated the interior plane of the glazing causing an approximate 2” x 4&quot; rupture in the glass.</td>
</tr>
<tr>
<td>Results</td>
<td>Pass</td>
</tr>
</tbody>
</table>

**Test Unit #2**: Orientation within ±5° of horizontal

<table>
<thead>
<tr>
<th>Impact #1:</th>
<th>Missile Velocity: 15.4 m/s (50.4 fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Area</td>
<td>Bottom left corner of center lite</td>
</tr>
<tr>
<td>Observations:</td>
<td>Missile penetrated the interior plane of the glazing causing an approximate 2” x 4&quot; rupture in the glass.</td>
</tr>
<tr>
<td>Results</td>
<td>Pass</td>
</tr>
</tbody>
</table>

**Test Unit #3**: Orientation within ±5° of horizontal

<table>
<thead>
<tr>
<th>Impact #1:</th>
<th>Missile Velocity: 15.4 m/s (50.4 fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Area</td>
<td>Top right corner of right lite</td>
</tr>
<tr>
<td>Observations:</td>
<td>Missile penetrated the interior plane of the glazing causing an approximate 2” x 4&quot; rupture in the glass.</td>
</tr>
<tr>
<td>Results</td>
<td>Pass</td>
</tr>
</tbody>
</table>

*Note: See Architectural Testing Sketch #1 for impact locations.*
7.0 Test Results: (Continued)

**ASTM E 1886, Air Pressure Cycling**

Test Unit #2

Design Pressure: +1676/-2873 Pa (+35/-60 psf)

### POSITIVE PRESSURE

<table>
<thead>
<tr>
<th>Pressure Range Pa (psf)</th>
<th>Number of Cycles</th>
<th>Average Cycle Time (seconds)</th>
<th>Maximum Deflection at Indicator mm (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>335 to 838 (7.0 to 17.5)</td>
<td>3500</td>
<td>2.80</td>
<td>#1: 0.8 (0.03), #2: 4.3 (0.17), #3: 0.8 (0.03)</td>
</tr>
<tr>
<td>0 to 1005 (0 to 21.0)</td>
<td>300</td>
<td>2.92</td>
<td>#1: 1.0 (0.04), #2: 5.8 (0.23), #3: 1.0 (0.04)</td>
</tr>
<tr>
<td>838 to 1341 (17.5 to 28)</td>
<td>600</td>
<td>2.71</td>
<td>#1: 1.8 (0.07), #2: 7.6 (0.30), #3: 1.3 (0.05)</td>
</tr>
<tr>
<td>503 to 1676 (10.5 to 35)</td>
<td>100</td>
<td>3.99</td>
<td>#1: 2.0 (0.08), #2: 9.1 (0.36), #3: 1.5 (0.06)</td>
</tr>
</tbody>
</table>

**Permanent Set mm (inches)**

<table>
<thead>
<tr>
<th>Permanent Set mm (inches)</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 (0.02)</td>
<td>1.0 (0.04)</td>
<td>0.5 (0.02)</td>
</tr>
</tbody>
</table>

### NEGATIVE PRESSURE

<table>
<thead>
<tr>
<th>Pressure Range Pa (psf)</th>
<th>Number of Cycles</th>
<th>Average Cycle Time (seconds)</th>
<th>Maximum Deflection at Indicator mm (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>862 to 2873 (18.0 to 60.0)</td>
<td>50</td>
<td>4.00</td>
<td>#1: 10.2 (0.40), #2: 26.0 (1.02), #3: 10.2 (0.40)</td>
</tr>
<tr>
<td>1436 to 1915 (30.0 to 48.0)</td>
<td>1050</td>
<td>3.13</td>
<td>#1: 7.4 (0.29), #2: 17.0 (0.67), #3: 4.8 (0.19)</td>
</tr>
<tr>
<td>0 to 1724 (0 to 36.0)</td>
<td>50</td>
<td>3.98</td>
<td>#1: 4.3 (0.17), #2: 9.9 (0.39), #3: 2.3 (0.09)</td>
</tr>
<tr>
<td>575 to 1436 (12.0 to 30.0)</td>
<td>3350</td>
<td>2.79</td>
<td>#1: 3.8 (0.15), #2: 8.9 (0.35), #3: 2.3 (0.09)</td>
</tr>
</tbody>
</table>

**Permanent Set mm (inches)**

<table>
<thead>
<tr>
<th>Permanent Set mm (inches)</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.3 (0.01)</td>
<td>0.3 (0.01)</td>
<td>0.3 (0.01)</td>
</tr>
</tbody>
</table>

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

**Result:** Pass

**Note:** See Architectural Testing Sketch #1 for indicator locations. Test Specimens were installed and cycled as a unitized system.

www.archtest.com
General Note: Upon completion of testing, the specimens met the requirements of Section 7.1.1.1 of ASTM E 1996, for basic protection.

8.0 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.
The service life of this report will expire on the stated Test Record Retention End Date, at which time such materials as drawings, data sheets, samples of test specimens, copies of this report, and any other pertinent project documentation, shall be discarded without notice.

If test specimen contains glazing, no conclusions of any kind regarding the adequacy or inadequacy of the glass in any glazed test specimen(s) can be made. 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 specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, Inc.

John S. Mayfield
Project Manager

Shawn G. Collins, P.E.
Laboratory Support Engineer

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Sketches (1)
Appendix-B: Drawings (12)
Appendix A

Sketches
Sketch # 1: Impact and Linear Transducer Locations
Appendix B

Drawings
## PRL 2 1/2" x 6" curtain wall CW-600 series

### Bill of Material

<table>
<thead>
<tr>
<th>PRL part number</th>
<th>manufacturer</th>
<th>description</th>
<th>qty required</th>
<th>size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW-601</td>
<td>PRL proprietary</td>
<td>vertical mullion</td>
<td>4</td>
<td>H</td>
</tr>
<tr>
<td>CW-102</td>
<td>PRL proprietary</td>
<td>pressure plate closer</td>
<td>2</td>
<td>H</td>
</tr>
<tr>
<td>CW-101</td>
<td>PRL proprietary</td>
<td>pressure plate</td>
<td>2</td>
<td>H</td>
</tr>
<tr>
<td>CW-201</td>
<td>PRL proprietary</td>
<td>snap cap trim</td>
<td>4</td>
<td>H</td>
</tr>
<tr>
<td>CW-602</td>
<td>PRL proprietary</td>
<td>horizontal mullion</td>
<td>6</td>
<td>W DLO</td>
</tr>
<tr>
<td>400FF</td>
<td>PRL proprietary</td>
<td>horizontal mullion filler</td>
<td>6</td>
<td>W DLO - 1/32&quot;</td>
</tr>
<tr>
<td>CW-102</td>
<td>generic</td>
<td>pressure plate closer</td>
<td>6</td>
<td>W DLO - 1/4&quot;</td>
</tr>
<tr>
<td>CW-201</td>
<td>PRL proprietary</td>
<td>snap cap trim</td>
<td>6</td>
<td>W DLO - 1/16&quot;</td>
</tr>
<tr>
<td>AB-1</td>
<td>PRL</td>
<td>ANCHOR CLIP</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>CW-306-R01</td>
<td>PRL</td>
<td>ANGLE CLIP/CORNERS</td>
<td>12</td>
<td>AS REQ'D</td>
</tr>
<tr>
<td>WS-1</td>
<td>PRL</td>
<td>GLAZING GASKET</td>
<td>3</td>
<td>DLO + 1 1/4&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>insulated glass width</td>
<td>3</td>
<td>DLO + 1 1/4&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>insulated glass height</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

W = width
H = height
DLO = day light opening

---

**Architectural Testing**

Test sample complies with these details. Deviations are noted.

Report# B271801
Date 9/27
Tech [Signature]
Architectural Testing

Test sample complies with these details. Deviations are noted.

Report# B278.02
Date 9/27
Tech

4x scale

PRL ALUMINUM INC.
14760 DON JULIAN RD.
INDUSTRY, CA. 91746

CUSTOMER: ALUMINUM STOREFRONTS

HIDES 6/06-16
ALUM. 5/36-5
BALKER 16-38
HOLZGR. 2/7-46
PRL-ALUM

775-2586
877-274-8800

DATE: 12-14-10
PART NAME: mullion
PART # CW-602
UNLESS OTHERWISE SPECIFIED STANDARD ALUMINUM ASSOCIATION TOLERANCES APPLY

ARCHITECTURAL TESTING

Test sample complies with these details.
Deviations are noted.

Report # B2178.02
Date 9/27 Tech

ARCHITECTURAL TESTING

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # B2178.02
Date 9/27 Tech

ARCHITECTURAL TESTING

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # B2178.02
Date 9/27 Tech

UNMARKED CORNERS .020 R.
UNLESS OTHERWISE NOTED TYP. WALL

CUSTOMER: ALUMINUM STOREFRONTS

MAT'L 6063-T6 HONES
AREA 0.513 BACKER
WT. / FT 0.616 BULSTER
PERI. 10.578 W/P
FACTOR 20 EXT. RATIO
C.C.D. 2.906 CLASS solid

PRL ALUMINUM INC.
14760 DOD JULIAN RD.
INDUSTRY CA. 91746

TEL. (877) 775-2586
FAX (877) 274-8800

PRL-ALUM

DRAWN: E D
DATE: 12-14-10 PART NAME: PRESSURE PLATE
PART # CW-102
UNLESS OTHERWISE SPECIFIED STANDAR ALUMINUM ASSOCIATION TOLERANCES APPLY

no exposed surface
snaps with CW-201

4x scale

Architectural Testing
Test sample complies with these details.
Deviations are noted.

Report# B2778.02
Date 9/27
Tech

UNMARKED CORNERS .020 R.
UNLESS OTHER WISE NOTED

TYP. WALL

CUSTOMER: ALUMINUM STOREFRONTS

REV.

ALUMINUM INC.
14760 DON JULIAN RD.
INDUSTRY CA. 91746

* CRITICAL DIM
© SPECIAL TOOL

PERI. 7.631 W/P
FACTOR 21 EXT. RATIO
C.C.D. 2.486 CLASS solid

DRAWN: 
DATE: 12-14-10 PART NAME: PRESSURE PLATE
SCALE PART # CW-101
snaps with CW-101

Architectural Testing
Test sample complies with these details. Deviations are noted.

Report# 32778.0r
Date 09/27 Tech

8x scale

UNMARKED CORNERS .020 R.
UNLESS OTHERWISE NOTED TYP. WALL

CUSTOMER: ALUMINUM STOREFRONTS

<table>
<thead>
<tr>
<th>REV</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MATERIAL</td>
<td>6063-16</td>
</tr>
<tr>
<td></td>
<td>AREA</td>
<td>0.205</td>
</tr>
<tr>
<td></td>
<td>WT./FT</td>
<td>0.250</td>
</tr>
<tr>
<td></td>
<td>P.E.R.</td>
<td>18.831</td>
</tr>
<tr>
<td></td>
<td>FACTOR</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>C.C.D.</td>
<td>2.550</td>
</tr>
</tbody>
</table>

ALUMINUM ASSOCIATION TOLERANCES APPLY

DIE NO. X

PRL ALUMINUM INC.
14760 DON JULIAN RD.
INDUSTRY, CA. 91746
TEL. (877) 775-2586
FAX (877) 274-8800

PR-L-ALUM

12-14-10

PART NAME: snap cap

PART # CW-201
part number: CW-306-F01

use with CW-602 & CW-702
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# B2778.02.201-18
Date 10/1/11  Tech

P/N: AB-9
CURTAIN WALL
ANCHOR

ARCHITECTURAL TESTING

ARCHITECTURAL TESTING

ARCHITECTURAL TESTING
The design of the gasket shown herein is the product of Tremco Incorporated. No reproduction or use of this design is authorized without the consent of Tremco Incorporated.