



NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17406 • TELEPHONE (717) 846-1200
FAX (717) 767-4100
www.nctlinc.com

IMPACT PERFORMANCE TEST REPORT

Report No: NCTL-110-11301-2
Test Date: 04/21/08
Report Date: 05/05/08
Expiration Date: 04/30/12

Client: Bovard Studio Inc.
2281 Highway 34 East
Fairfield, IN 52556

Test Specimen: Bovard Studio Inc.'s Series "1850" Twin Shutter Aluminum Prime Window.

Test Method: ASTM E1996-02/05, "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"; ASTM E1886-02/05, "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials".

TEST SPECIMEN DESCRIPTION

Model Designation: Series "1850"

General: The test specimen was a twin fixed "shutter" aluminum prime window measuring 2543.35 mm (100-1/4") wide by 2470.15 mm (97-1/2") high overall. The fixed lites were glazed to the frame members, providing a viewing area of 1150.94 mm (45-5/16") wide by 2366.96 mm (93-3/16") high. An extruded aluminum angle measuring 57.15 mm (2-1/4") x 57.15 mm (2-1/4") x 4.76 mm (3/16") was fastened to the buck and frame with evenly spaced #10 x 50.8 mm (2") self-tapping screws at the exterior frame perimeter. One (1) steel 69.85 mm (2-3/4") x 25.4 mm (1") mullion bar was fastened to the buck with four (4) screws and a metal mounting bracket. The fixed lites were fastened to the mullion with two (2) screws on 304.80 mm (12") centers. The frame was of butt-type corner construction. Frame members were not thermally broken.

Glazing: The fixed lites were interior glazed using 9.53 mm (3/8") laminated glass, a silicone back-bedding, an exterior glazing gasket, and a snap-in extruded aluminum glazing bead. The glass bite measured 25.4 mm (1"). The laminated glass consisted of two (2) lites of 5 mm (3/16") heat strengthened glass separated by a Dupont "Sentry Glass Plus" 2.29 mm (0.090") thick interlayer. The glazing bead was secured to the frame using #10 x 50.8 mm (2") self tapping screws on approximately 304.80 mm (12") centers.

Weatherseals: No weatherseals employed.

Weeps: Six (6) vent holes measuring 11.1125 mm x 82.55 mm (7/16" x 3-1/4") were evenly spaced at the interior and exterior jamb faces.

Interior & Exterior Surface Finish: White painted aluminum.

Sealant: The frame corners were sealed with a silicone sealant. The exterior glazing perimeter was sealed with a silicone sealant.

Installation: The test specimen was installed into a 50.8 mm (2") x 304.80 mm (12") standard grade lumber test buck. The specimen was fastened to the buck via #10 x 50.8 mm (2") self-tapping screws located on approximately 304.80 mm (12") centers through the aluminum angle, frame and glazing bead. The exterior perimeter was sealed with a silicone sealant.

IMPACT TEST PARAMETERS

The appropriate missile to be used for impact tests was selected in accordance with section 6 of ASTM E1996 based on the following criteria:

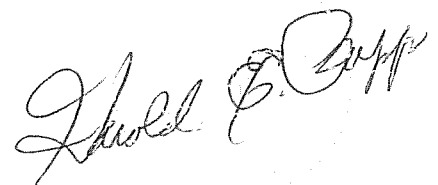
Level of Protection:	Basic Protection / Enhanced Protection
Wind Zone:	Wind Zone 4 – greater than 140 mph (63 m/s)
Assembly Height Above Ground Level:	Less than or equal to 9.1 m (30') basic protection Greater than 9.1 m (30') enhanced protection

IMPACT TEST RESULTS

Large missile impact tests were conducted using a #2 Southern Yellow Pine 2.4 m (2 x 4) measuring 92" in length and weighing 4100 g (9 lbs) (Missile D) as shown in Table 2 of ASTM E1996. Missile speeds and impact locations were in accordance with Table 2 and Section 5.3 of ASTM E1996. For pass/fail criteria, no penetration is defined as no tear longer than 130 mm (5") in length and 1 mm (1/16") wide or no opening through which a 76 mm (3") diameter solid sphere can freely pass per section 7 of ASTM E 1996. All specimens were conditioned at 70° F ± 15°F prior to testing. Missile orientation at impact complies with section 11.2.2 of ASTM E1886.

Specimen 1	Location	Comments	Speed
Impact	Center of glass	No Penetration / Passed	15.25 m/s 50 fps
Impact	Lower right corner of glass	No Penetration / Passed	15.25 m/s 50 fps
Specimen 2	Location	Comments	Speed
Impact	Center of glass	No Penetration / Passed	15.25 m/s 50 fps
Impact	Upper left corner of glass	No Penetration / Passed	15.25 m/s 50 fps
Specimen 3	Location	Comments	Speed
Impact	Center of glass	No Penetration / Passed	15.25 m/s 50 fps
Impact	Lower right corner of glass	No Penetration / Passed	15.25 m/s 50 fps

Results: After impacts, there was no penetration or separation of glass from the frame. Upon completion of testing, all specimens meet the requirements of ASTM E1996, section 7.



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PRESSURE CYCLING TEST RESULTS

After completion of the impact tests, the specimens were pressure cycled in accordance with Table 1 of ASTM E1996. The duration of each air pressure cycle was between 1 and 5 seconds. Two-(2) mil plastic film was used to obtain cycle loads. The film did not affect the performance of the specimen or influence the results of the test. For pass/fail criteria, passing is defined as no tear longer than 130 mm (5") in length and 1 mm (1/16") wide or no opening through which a 76 mm (3") diameter solid sphere can freely pass per Section 7 of ASTM E 1996.

Specimen 1

Design Pressure +75.0/ -75.0 [+3600 Pa / -3600 Pa]

Positive Loads

Range of Test	Actual	# of Cycles	Result
+0.2 to +0.5 DP	15.0 psf to 37.5 psf	3,500	Passed
+0.0 to +0.6 DP	0 psf to 45.0 psf	300	Passed
+0.5 to +0.8 DP	37.5 psf to 60.0 psf	600	Passed
+0.3 to +1.0 DP	22.5 psf to 75.0 psf	100	Passed

Negative Loads

Range of Test	Actual	# of Cycles	Result
-0.3 to -1.0 DP	22.5 psf to 75.0 psf	50	Passed
-0.5 to -0.8 DP	37.5 psf to 60.0 psf	1,050	Passed
-0.0 to -0.6 DP	0 psf to 45.0 psf	50	Passed
-0.2 to -0.5 DP	15.0 psf to 37.5 psf	3,350	Passed

Specimen 2

Design Pressure +75.0/ -75.0 [+3600 Pa / -3600 Pa]

Positive Loads

Range of Test	Actual	# of Cycles	Result
+0.2 to +0.5 DP	15.0 psf to 37.5 psf	3,500	Passed
+0.0 to +0.6 DP	0.0 psf to 45.0 psf	300	Passed
+0.5 to +0.8 DP	37.5 psf to 60.0 psf	600	Passed
+0.3 to +1.0 DP	22.5 psf to 75.0 psf	100	Passed

Negative Loads

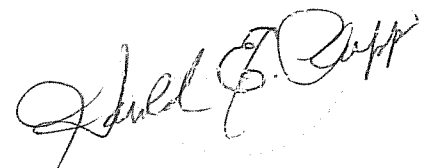
Range of Test	Actual	# of Cycles	Result
-0.3 to -1.0 DP	22.5 psf to 75.0 psf	50	Passed
-0.5 to -0.8 DP	37.5 psf to 60.0 psf	1,050	Passed
-0.0 to -0.6 DP	0.0 psf to 45.0 psf	50	Passed
-0.2 to -0.5 DP	15.0 psf to 37.5 psf	3,350	Passed

Specimen 3

Design Pressure +75.0/ -75.0 [+3600 Pa / -3600 Pa]

Positive Loads

Range of Test	Actual	# of Cycles	Result
+0.2 to +0.5 DP	15.0 psf to 37.5 psf	3,500	Passed
+0.0 to +0.6 DP	0.0 psf to 45.0 psf	300	Passed
+0.5 to +0.8 DP	37.5 psf to 60.0 psf	600	Passed
+0.3 to +1.0 DP	22.5 psf to 75.0 psf	100	Passed



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PRESSURE CYCLING TEST RESULTS (Continued)**Specimen 3**

Design Pressure +75.0/ -75.0 [+3600 Pa / -3600 Pa]

Negative Loads

Range of Test	Actual		# of Cycles	Result
-0.3 to -1.0 DP	22.5 psf	to 75.0 psf	50	Passed
-0.5 to -0.8 DP	37.5 psf	to 60.0 psf	1,050	Passed
-0.0 to -0.6 DP	0.0 psf	to 45.0 psf	50	Passed
-0.2 to -0.5 DP	15.0 psf	to 37.5 psf	3,350	Passed

Specimen 4

Design Pressure +75.0/ -75.0 [+3600 Pa / -3600 Pa]

Positive Loads

Range of Test	Actual		# of Cycles	Result
+0.2 to +0.5 DP	15.0 psf	to 37.5 psf	3,500	Passed
+0.0 to +0.6 DP	0.0 psf	to 45.0 psf	300	Passed
+0.5 to +0.8 DP	37.5 psf	to 60.0 psf	600	Passed
+0.3 to +1.0 DP	22.5 psf	to 75.0 psf	100	Passed

Negative Loads

Range of Test	Actual		# of Cycles	Result
-0.3 to -1.0 DP	22.5 psf	to 75.0 psf	50	Passed
-0.5 to -0.8 DP	37.5 psf	to 60.0 psf	1,050	Passed
-0.0 to -0.6 DP	0.0 psf	to 45.0 psf	50	Passed
-0.2 to -0.5 DP	15.0 psf	to 37.5 psf	3,350	Passed

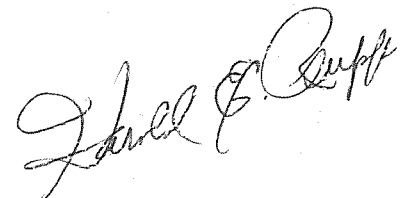
Results: Upon completion of testing, the specimens meet the requirements of ASTM E1996, Section 7.

TEST COMPLETED 04/21/08

The listed impact test results were secured by using the ASTM E1886 test method and indicate compliance with the performance requirements of ASTM E1996 for the listed test parameters at the following design pressures:

Positive Design Pressure: + 75.0 psf (3600 Pa)
 Negative Design Pressure: - 75.0 psf (3600 Pa)

This test report was prepared by National Certified Testing Laboratory (NCTL), for the exclusive use of the above named client and it does not constitute certification of this product. The results are for that particular specimen tested and does not imply the quality of similar or identical products manufactured or installed from specifications identical to the tested product. NCTL is a testing lab and assumes that all information provided by the client is accurate and does not guarantee or warranty any product tested or installed.

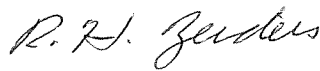


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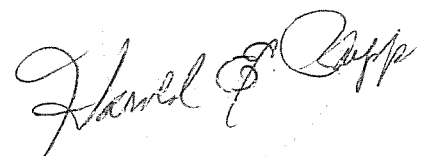
Detailed drawings were available for laboratory records and compared to the test specimen at the time of this report. A list of the component drawings reviewed for product verification is included as an appendix to this report. A copy of this report along with representative sections of the test specimen will be retained by NCTL. This report does not constitute certification or approval of the product, which may only be granted by a certification program validator or recognized approval entity. All tests were conducted in compliance with the referenced specifications. This report may not be reproduced, except in full, without the written consent of NCTL.

NATIONAL CERTIFIED TESTING LABORATORIES


JUSTIN L. BUPP
Technician


ROBERT H. ZEIDERS, P.E.
Vice-President Engineering & Quality

JLB/amb



7/31/08



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FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17406 • TELEPHONE (717) 846-1200
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ASTM E1996 COMPLIANCE STATEMENT

On April 21, 2008, Bovard Studio Inc. completed impact testing at National Certified Testing Laboratories in York, PA. All tests were performed in full accordance with ASTM E1886 and ASTM E1996 with no deviations (Ref: NCTL-110-11301-2).

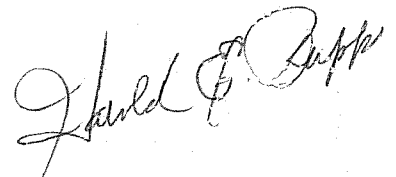
<i>Manufacturer:</i>	<i>Bovard Studio Inc.</i>
<i>Product Series:</i>	<i>Series "1850"</i>
<i>Product Configuration Tested:</i>	<i>Twin Fixed</i>
<i>Tested Size:</i>	<i>2546.35 mm x 2470.15 mm (100-1/4" x 97-1/4") overall</i>
<i>Glazing Configuration:</i>	<i>Interior: (2) lites 5 mm (3/16") glass separated by a DuPont "Sentry Glass Plus" 2.286 mm (0.090") thick interlayer</i>
<i>Level of Protection:</i>	<i>Basic Protection / Enhanced Protection</i>
<i>Wind Zone:</i>	<i>Wind Zone 4 – greater than 140 mph (63 m/s)</i>
<i>Assembly Height Above Ground Level:</i>	<i>Less than or equal to 9.1 m (30') basic protection Greater than 9.1 m (30') enhanced protection</i>
<i>Impact Missile Used:</i>	<i>Missile D</i>
<i>Positive Design Pressure:</i>	<i>+ 75.0 psf (3600 Pa)</i>
<i>Negative Design Pressure:</i>	<i>- 75.0 psf (3600 Pa)</i>

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JUSTIN L. BUPP
Technician


ROBERT H. ZEIDERS, P.E.
Vice-President Engineering & Quality

JLB/amb



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APPENDIX A

*List of Component Drawings Reviewed for Product Verification
(Reference: NCTL-110-11301-2)*

*See Attached Bill of Materials
Any deviations are noted.*

Note: The above referenced component drawings along with representative sections of the test specimen will be retained per procedure by NCTL.

David E. Cuffe

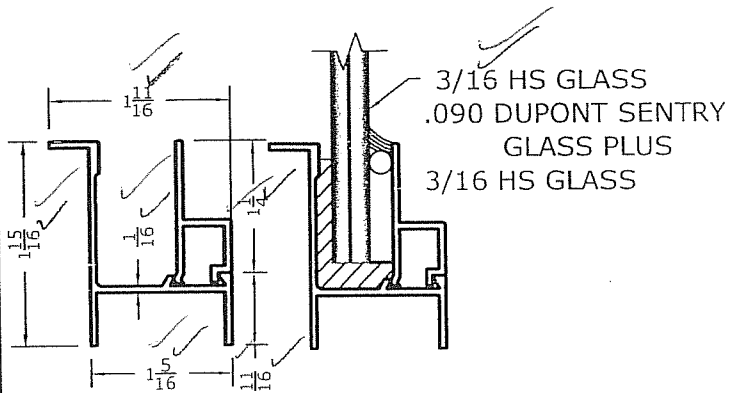
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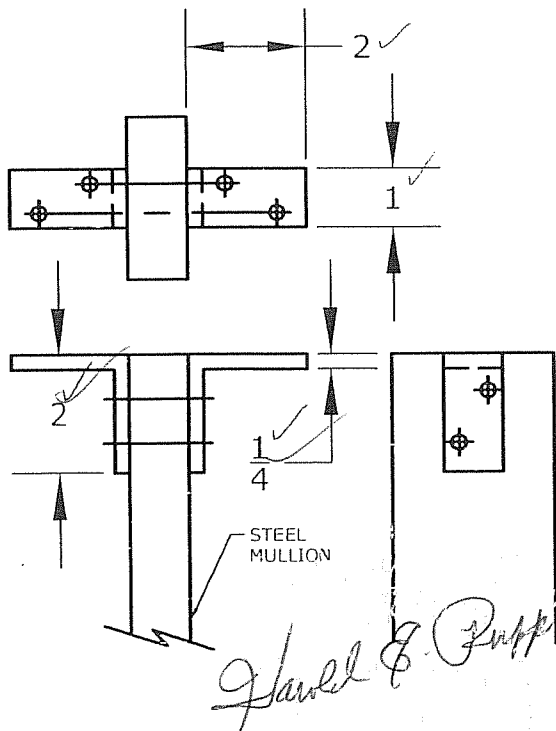
Bovard Studio Inc.
 2281 Hwy. 34 E.; Fairfield, IA 52556
 Phone: (641) 472-2824; Fax: (641) 472-0974

1770 SERIES LAMINATED HURRICANE MODEL

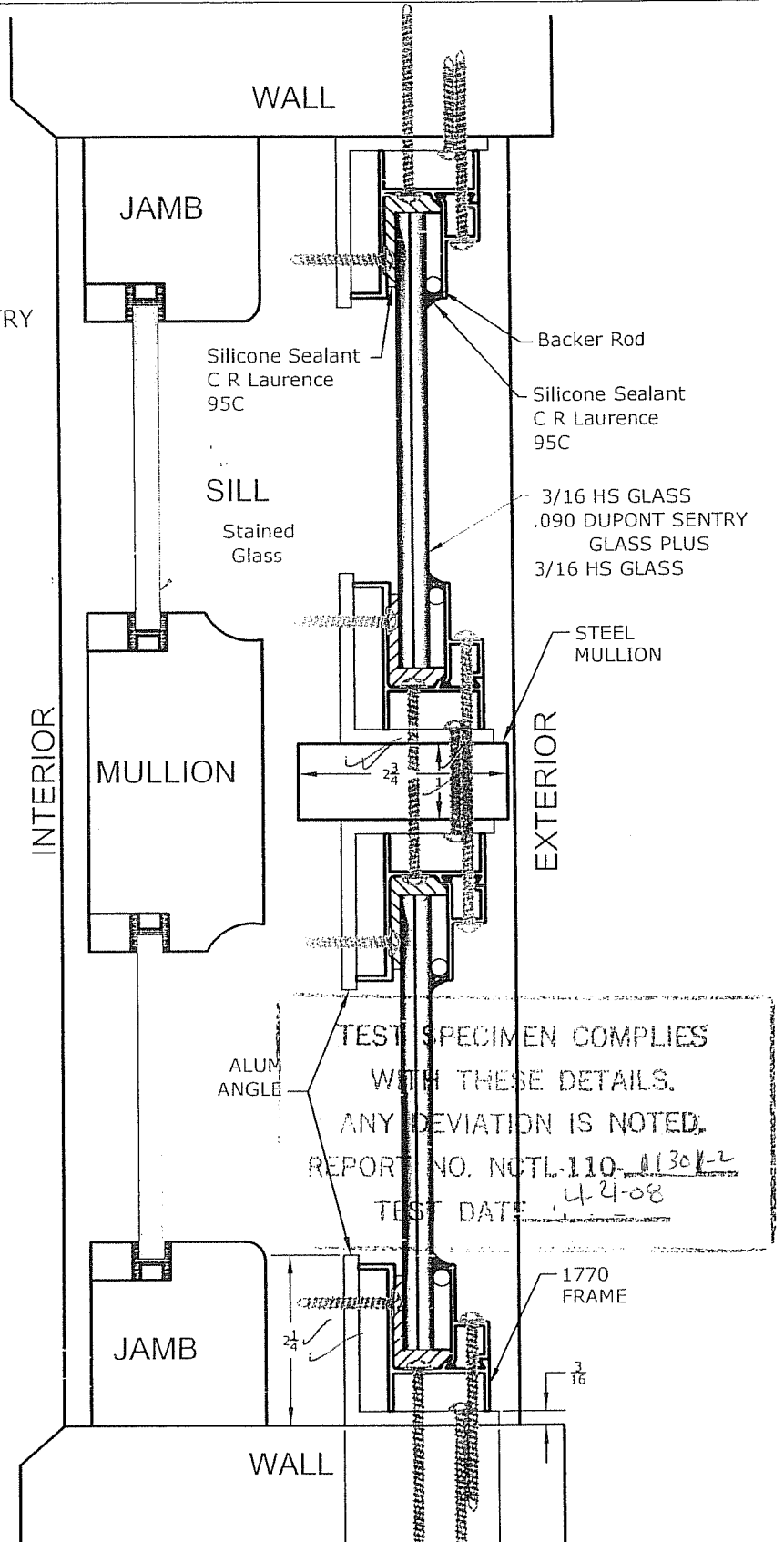
Perimeter Frame



Alum. Mullion Bracket for Steel Mullion



7/31/08

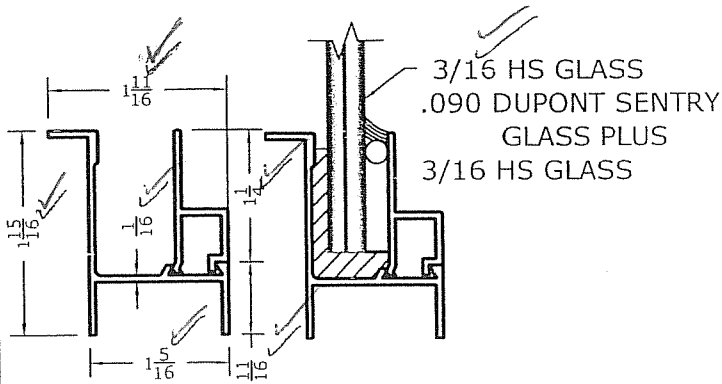




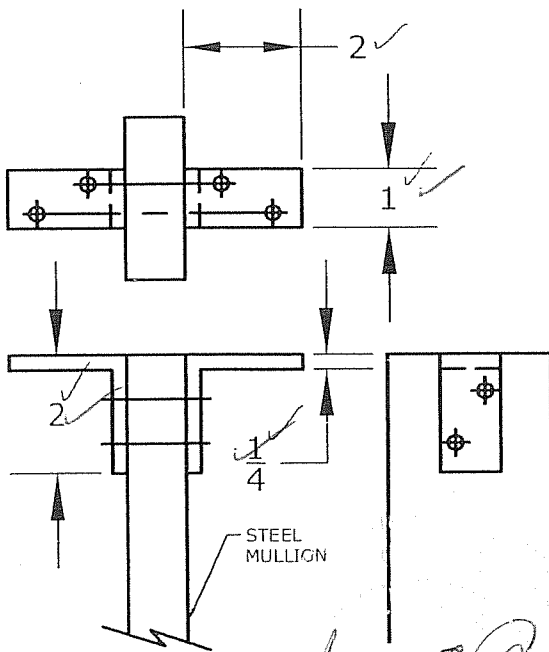
Bovard Studio Inc.
 2281 Hwy. 34 E.; Fairfield, IA 52556
 Phone: (641) 472-2824; Fax: (641) 472-0974

**1770 SERIES
 LAMINATED HURRICANE MODEL**

Perimeter Frame



**Alum. Mullion Bracket
 for Steel Mullion**



Handwritten signature: David B. Buff

Handwritten date: 7/31/08

