NATIONAL CERTIFIED TESTING LABORATORIES

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FAX (717) 767-4100
www.nctlinc.com

IMPACT PERFORMANCE TEST REPORT

Report No: *NCTL-110-10974-2*
Test Date: *12/20/07*
Report Date: *01/08/08*
Expiration Date: *12/31/11*

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

Test Specimen: *Bovard Studio, Inc.'s Series "Twin Shutter" Aluminum Fixed Shutter.*

Test Method: *ASTM E1996-02/06, "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

General: *The test specimen was a twin fixed "shutter" aluminum prime window measuring 100-1/4" wide by 97-1/2" high overall. The fixed lites were glazed to the frame members, providing a viewing area of 45-5/16" wide by 93-3/16" high. An extruded aluminum angle measuring 2-1/4" x 2-1/4" x 3/16" was fastened to the buck and frame with evenly spaced #10 x 2" self tapping screws at the exterior frame perimeter. One (1) steel 2-3/4" x 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 12" centers. The frame was of butt-type corner construction. Frame members were not thermally broken.*

Glazing: *The fixed lites were interior exterior glazed using 3/8" Lexan with a silicone back-bedding, an exterior glazing gasket, and a snap-in extruded aluminum glazing bead. The glazing bead was also secured to the frame using #10 x 2" self tapping screws on approximately 12" centers.*

Weatherseals: *No weatherseals employed.*

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

2/5/08

Interior & Exterior Surface Finish: *White painted aluminum..*

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

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

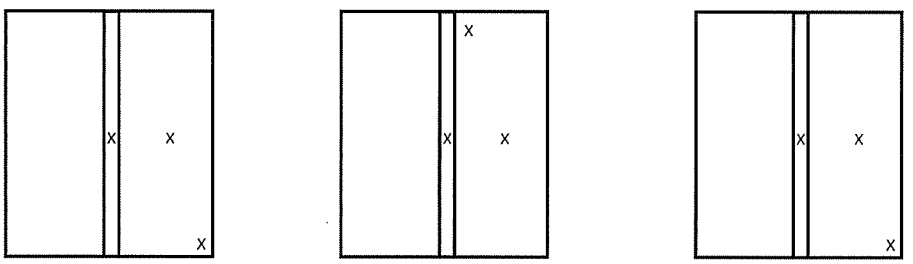
IMPACT TEST PARAMETERS

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 *Specimen 2* *Specimen 3*

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 Pressures: + 75.0 psf - 75.0 psf***

Range of Test Positive Loads	*Actual*				*# of Cycles*	*Result*
+0.2 to +0.5 DP	*15.0*	*psf to*	*37.5*	*psf*	*3500*	*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	*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*	*1050*	*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*	*3350*	*Passed*

Specimen #2 ***Design Pressures: + 75.0 psf - 75.0 psf***

Range of Test Positive Loads	*Actual*				*# of Cycles*	*Result*
+0.2 to +0.5 DP	*15.0*	*psf to*	*37.5*	*psf*	*3500*	*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*

Range of Test Negative Loads	*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*	*1050*	*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*	*3350*	*Passed*

Specimen #3 ***Design Pressures: + 75.0 psf - 75.0 psf***

Range of Test Positive Loads	*Actual*				*# of Cycles*	*Result*
+0.2 to +0.5 DP	*15.0*	*psf to*	*37.5*	*psf*	*3500*	*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	*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*	*1050*	*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*	*3350*	*Passed*

Results: *Upon completion of testing, the specimens meet the requirements of the ASTM E1996 and ASTM E1886 Test Methods.*

TEST COMPLETED 12/20/07

2/5/08

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*
Negative Design Pressure: *- 75.0 psf*

Detailed drawings were available for laboratory records and compared 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 NCTL. The results obtained apply only to the specimen tested and do not imply the quality of similar products manufactured or installed identical to the tested product. 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 ASTM specifications. This report may not be reproduced, except in full, without the written consent of NCTL.

NATIONAL CERTIFIED TESTING LABORATORIES

Jay Leader

JAY LEADER
Technician

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

JL/akl

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ASTM E1996 COMPLIANCE STATEMENT

On December 20, 2007, 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-110-10974-2).

Manufacturer:	*Bovard Studio, Inc.*
Product Series:	*Series "Twin Shutter"*
Product Configuration Tested:	*Aluminum Fixed Shutter*
Tested Size:	*100-1/4" x 97-1/2" overall*
Glazing Configuration:	*3/8" thick Lexan*

Level of Protection:	*Basic Protection / Enhanced Protection*
Wind Zone:	*Wind Zone 4 – greater than 140 mph*
Assembly Height Above Ground Level:	*Less than or equal to 30 feet basic protection* *Greater than 30 feet enhanced protection*

Impact Missile Used:	*Missile D*
Positive Design Pressure:	*+ 75.0 psf*
Negative Design Pressure:	*- 75.0 psf*

NATIONAL CERTIFIED TESTING LABORATORIES

Jay Leader

JAY LEADER
Technician

R. H. Zeiders

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

JL/akl

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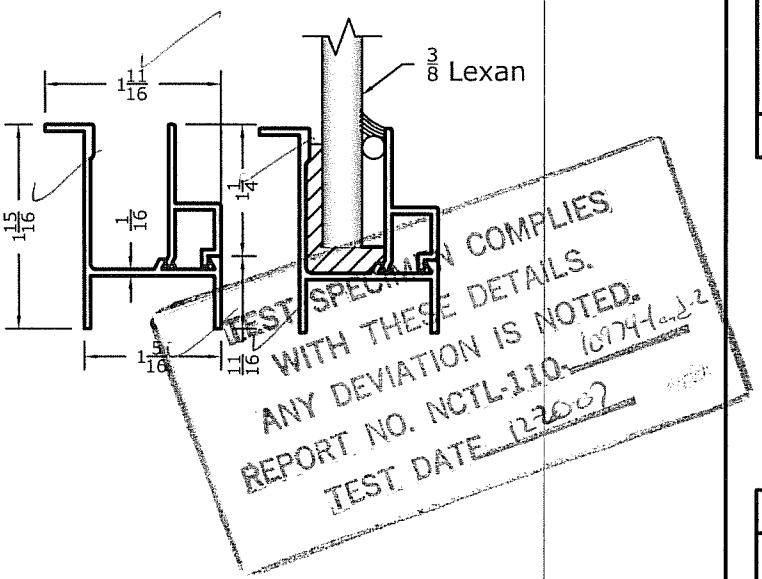
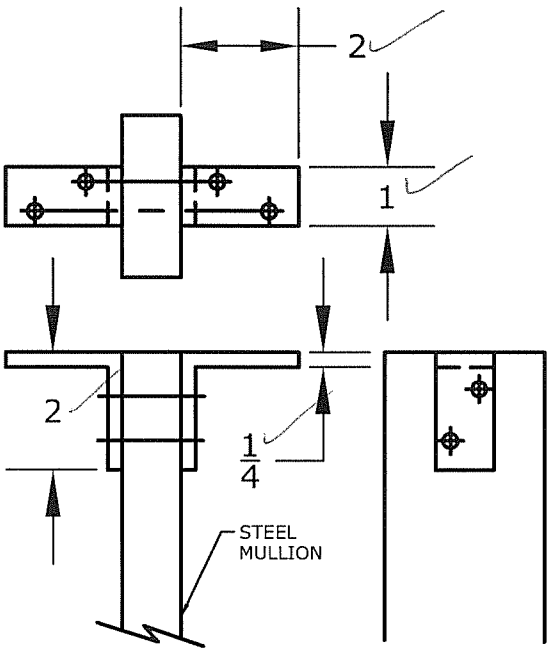
Bovard Studio Inc.
2281 Hwy. 34 E.; Fairfield, IA 52556
Phone: (641) 472-2824; Fax: (641) 472-0974

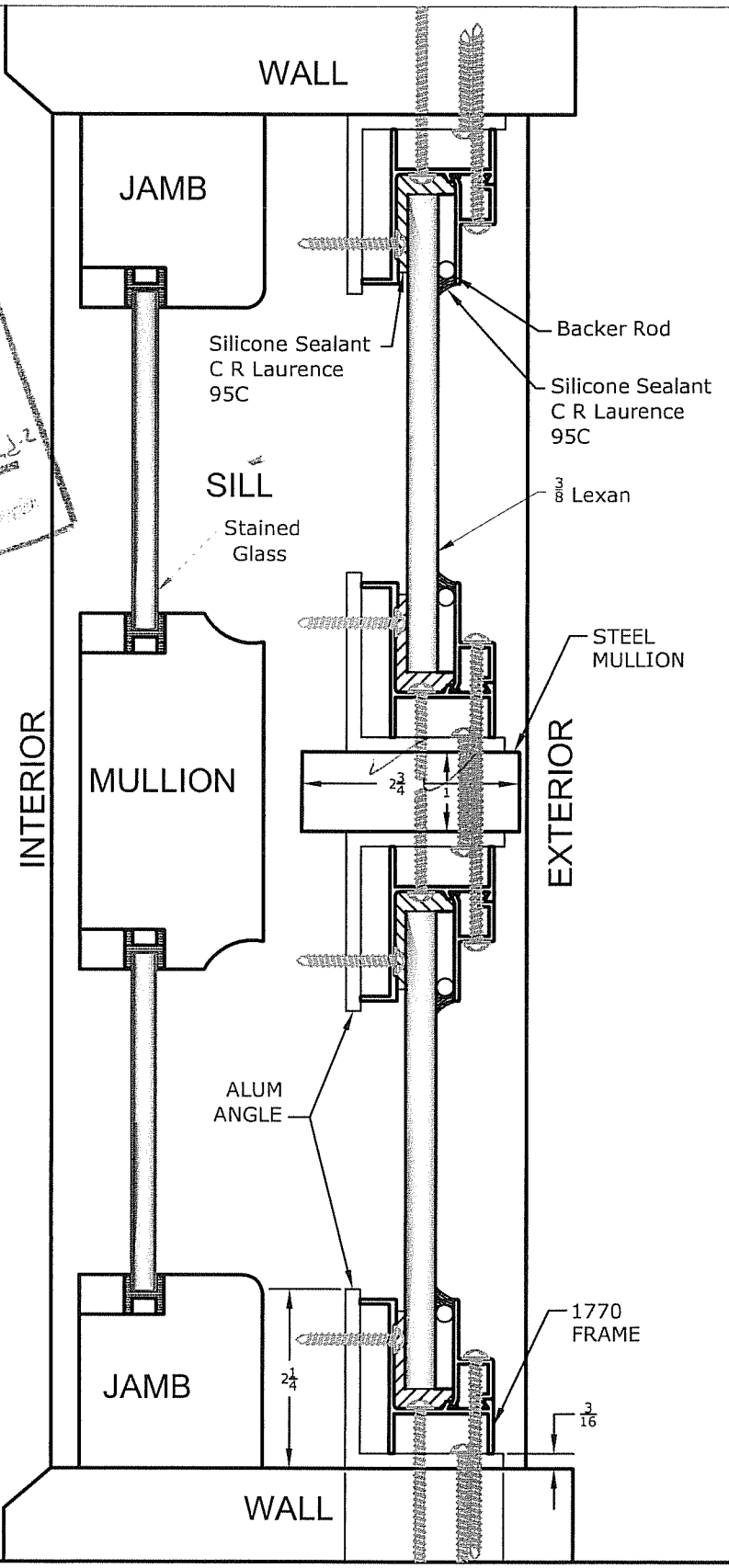
1770 SERIES
LEXAN HURRICANE MODEL

Perimeter Frame



Alum. Mullion Bracket for Steel Mullion





Bovard Studio's Precision Flow® (Patent Pending) Ventilation System