

PERFORMANCE TEST REPORT

Rendered to:

3M COMPANY

**SERIES/MODEL: 3M™ Prestige PR-S50 Tinted Safety & Security Window Film
with 3M Impact Protection Adhesive (Black) Attachment System**

PRODUCT TYPE: Aluminum Fixed Window

Report No.: A4057.01-201-44
Test Dates: 10/05/10
Through: 10/12/10
Report Date: 10/12/10

PERFORMANCE TEST REPORT

Rendered to:

3M COMPANY
3M Renewable Energy Division
Building 235-E330-3D-02
St. Paul, Minnesota 55144

Report No.: A4057.01-201-44
Test Dates: 10/05/10
Through: 10/12/10
Report Date: 10/12/10

Project Summary: Architectural Testing, Inc. was contracted by 3M Company to conduct windstorm performance testing on a safety glazing system, comprised of tempered glass coated with **3M™ Prestige PR-S50 Tinted Safety & Security Window Film** with **3M Impact Protection Adhesive (IPA)**. The samples were provided by 3M and tested with missile impacts corresponding to Large Missile Level C, wind zone 3, and subsequently subjected to cyclic static pressure loadings at a Design Pressure of ± 2400 Pa (± 50.0 psf).

Test Procedures: The test specimens were evaluated per the following method:

ASTM E 1886-05, Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

ASTM E 1996-09, Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

TAS 202-94, Criteria for Testing Impact and Non Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.

ASTM E 330-97, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

Test specimen #4 was tested in general accordance with:

TAS 201-94, Impact Test Procedures.

TAS 202-94, Criteria for Testing Impact and Non Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading. (Structural Only)

Test Specimen Description:

Series/Model: 3M™ Prestige PR-S50 Tinted Safety & Security Window Film with 3M Impact Protection Adhesive (black) Attachment System

Product Type: Aluminum fixed window

Overall Size: 1219 mm (48") wide by 2438 mm (96") high

Daylight Opening Size: 1143 mm (45") wide by 2362 mm (93") high

Finish: All aluminum was anodized.

Glazing Details: The units were glazed with monolithic 6 mm (1/4") tempered glass coated with 3M™ Prestige PR-S50 window film applied to the interior against a vinyl gasket. The interior was secured with a vinyl wedge gasket. The film was additionally secured with a bead of **3M Impact Protection Adhesive (black)** forming a triangular wedge in the corner between the film/glass and aluminum frame members, covering approximately 3/8" of the film and the entire frame bite surface along the perimeter of the glazing.

Weatherstripping: No weatherstripping was utilized.

Frame Construction: The frames were constructed of anodized aluminum that was square-cut, butted and secured with three screws.

Hardware: No hardware was utilized.

Drainage: No drainage was utilized.

Reinforcement: No reinforcement was utilized

Installation: The units were installed within a wood test buck and secured through the frame with #8 x 3" long screws 305 mm (12") from each corner and spaced 610 mm (24") on center.

Test Results: The following results have been recorded:

ASTM E 1886, *Large Missile Impact*

Conditioning Temperature: 21°C (69°F)
Missile Weight: 2087 g. (4.6 lbs)
Missile Length: 1118 mm (44")
Muzzle Distance from Test Specimen: 1.83 m (72")

Test Unit #1

Impact #1: Missile Velocity: 12.4 m/s (40.8 fps)

Impact Area: Center of glazing
Observations: Glass did not break

Results: Pass

Test Unit #2

Impact #1: Missile Velocity: 12.6 m/s (41.1 fps)

Impact Area: Lower left glazing corner
Observations: Glass did not break

Results: Pass

Test Unit #3

Impact #1: Missile Velocity: 12.4 m/s (40.6 fps)

Impact Area: Upper right glazing corner
Observations: Glass did not break

Results: Pass

Note: Intact glass was broken with a center punch before pressure cycling.

Test Results: (Continued)

ASTM E 1886, Air Pressure Cycling

Test Unit #1, #2 and #3

Design Pressure: ± 2400 Pa (± 50.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
480 to 1200 (10.0 to 25.0)	3500	2.48	No rips, tears or penetrations
0 to 1440 (0 to 30.0)	300	3.43	No rips, tears or penetrations
1200 to 1920 (25.0 to 40.0)	600	1.91	No rips, tears or penetrations
720 to 2400 (15.0 to 50.0)	100	3.34	No rips, tears or penetrations

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
720 to 2400 (15.0 to 50.0)	50	3.13	No rips, tears or penetrations
1200 to 1920 (25.0 to 40.0)	1050	2.14	No rips, tears or penetrations
0 to 1440 (0 to 30.0)	50	3.03	No rips, tears or penetrations
480 to 1200 (10.0 to 25.0)	3350	1.66	No rips, tears or penetrations

Result: Pass

Note: Test Specimen #1, #2 and #3 were cycled in a common chamber.

Test Results: (Continued)

ASTM E 1886, Air Pressure Cycling

Test Unit #1

Design Pressure: ± 3840 Pa (± 80.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
770 to 1920 (16.0 to 40.0)	3500	2.27	No rips, tears or penetrations
0 to 2300 (0 to 48.0)	300	4.21	No rips, tears or penetrations
1920 to 3065 (40.0 to 64.0)	600	2.53	No rips, tears or penetrations
1150 to 3840 (24.0 to 80.0)	100	3.08	No rips, tears or penetrations

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
1150 to 3840 (24.0 to 80.0)	50	3.05	No rips, tears or penetrations
1920 to 3065 (40.0 to 64.0)	1050	2.40	No rips, tears or penetrations
0 to 2300 (0 to 48.0)	50	2.58	No rips, tears or penetrations
770 to 1920 (16.0 to 40.0)	3350	Fail	The unit deglazed in the lower right corner

Result: Fail

Note: Test Specimen #1, #2 and #3 were cycled in a common chamber.

Test Results: (Continued)

ASTM E 1886, Air Pressure Cycling

Test Unit #2

Design Pressure: ± 3840 Pa (± 80.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
770 to 1920 (16.0 to 40.0)	3500	2.27	No rips, tears or penetrations
0 to 2300 (0 to 48.0)	300	4.21	No rips, tears or penetrations
1920 to 3065 (40.0 to 64.0)	600	2.53	No rips, tears or penetrations
1150 to 3840 (24.0 to 80.0)	100	3.08	No rips, tears or penetrations

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
1150 to 3840 (24.0 to 80.0)	50	3.05	No rips, tears or penetrations
1920 to 3065 (40.0 to 64.0)	1050	Fail	The unit deglazed in the lower right corner
0 to 2300 (0 to 48.0)	50	--	--
770 to 1920 (16.0 to 40.0)	3350	--	--

Result: Fail

Note: Test Specimen #1, #2 and #3 were cycled in a common chamber.

Test Results: (Continued)

ASTM E 1886, Air Pressure Cycling

Test Unit #3

Design Pressure: ± 3840 Pa (± 80.0 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
770 to 1920 (16.0 to 40.0)	3500	2.27	No rips, tears or penetrations
0 to 2300 (0 to 48.0)	300	4.21	No rips, tears or penetrations
1920 to 3065 (40.0 to 64.0)	600	2.53	No rips, tears or penetrations
1150 to 3840 (24.0 to 80.0)	100	3.08	No rips, tears or penetrations

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
1150 to 3840 (24.0 to 80.0)	50	3.05	No rips, tears or penetrations
1920 to 3065 (40.0 to 64.0)	1050	2.40	No rips, tears or penetrations
0 to 2300 (0 to 48.0)	50	2.58	No rips, tears or penetrations
770 to 1920 (16.0 to 40.0)	3350	Fail	The unit deglazed along the right stile

Result: Fail

Note: Test Specimen #1, #2 and #3 were cycled in a common chamber.

Test Results: (Continued)

Protocol TAS 202-94, ASTM E 330, *Static Air Pressure Tests*

Test Unit #4

Design Pressure: ±50.0 psf

Title of Test	Results		
	Indicator Readings (inch)		
	#1	#2	#3
Structural Loads			
50% of Test Pressure (+37.5 psf)			
Maximum Deflection	0.04	0.03	0.03
Permanent Set	0.01	0.01	0.01
Design Pressure (+50.0 psf)			
Maximum Deflection	0.06	0.05	0.05
Permanent Set	0.01	0.01	0.01
50% of Test Pressure (-37.5 psf)			
Maximum Deflection	0.07	0.08	0.08
Permanent Set	0.02	0.02	0.02
Design Pressure (-50.0 psf)			
Maximum Deflection	0.12	0.14	0.14
Permanent Set	0.03	0.04	0.03
Test Pressure (+75.0 psf)			
Maximum Deflection	0.08	0.06	0.06
Permanent Set	0.05	0.04	0.04
Test Pressure (-75.0 psf)			
Maximum Deflection	0.12	0.08	0.07
Permanent Set	0.04	0.04	0.03

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

Test Results: (Continued)

Protocol TAS 202-94, ASTM E 330, *Static Air Pressure Tests*

Test Unit #4

Design Pressure: ± 100.0 psf

Title of Test	Results		
	Indicator Readings (inch)		
	#1	#2	#3
Structural Loads			
50% of Test Pressure (+75.0 psf)			
Maximum Deflection	0.10	0.08	0.08
Permanent Set	0.07	0.06	0.06
Design Pressure (+100.0 psf)			
Maximum Deflection	0.15	0.13	0.12
Permanent Set	0.08	0.07	0.06
50% of Test Pressure (-75.0 psf)			
Maximum Deflection	0.09	0.06	0.04
Permanent Set	0.05	0.03	0.02
Design Pressure (-100.0 psf)			
Maximum Deflection	0.09	0.07	0.06
Permanent Set	0.03	0.03	0.03
Test Pressure (+150.0 psf)			
Maximum Deflection	0.21	0.20	0.18
Permanent Set	0.15	0.14	0.14
Test Pressure (-150.0 psf)			
Maximum Deflection	0.17	0.14	0.13
Permanent Set	0.07	0.06	0.06

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

Test Results: (Continued)

Protocol TAS 201-94, *Impact Test Procedures*

Conditioning Temperature: 74°F

Missile Weight: 2 grams each

Muzzle Distance from Test Specimen: 6 ft.

Test Unit #4

Impact #1: Missile Velocity: 130.8 fps

Impact Area: Upper left glazing corner

Observations: No rips, tears or penetrations. Glass shattered but remained adhered to film

Results: Pass

Impact #2: Missile Velocity: 131.0 fps

Impact Area: Center of glazing

Observations: No rips, tears or penetrations. Glass remained adhered to film

Results: Pass

Impact #3: Missile Velocity: 130.7 fps

Impact Area: Lower right glazing corner

Observations: No rips, tears or penetrations. Glass remained adhered to film

Results: Pass

Test Results: (Continued)

Protocol TAS 202-94, ASTM E 330, *Static Air Pressure Tests*

Test Unit #4

Design Pressure: ±100.0 psf

Note: Testing was performed after small missile impacts.

Title of Test	Results		
	Indicator Readings (inch)		
	#1	#2	#3
Structural Loads			
50% of Test Pressure (+75.0 psf)			
Maximum Deflection	0.13	0.09	0.07
Permanent Set	0.10	0.06	0.06
Design Pressure (+100.0 psf)			
Maximum Deflection	0.17	0.13	0.10
Permanent Set	0.14	0.10	0.09
50% of Test Pressure (-75.0 psf)			
Maximum Deflection	0.08	0.07	0.05
Permanent Set	0.05	0.04	0.03
Design Pressure (-100.0 psf)			
Maximum Deflection	0.15	0.12	0.10
Permanent Set	0.09	0.06	0.06
Test Pressure (+150.0 psf)			
Maximum Deflection	0.22	0.17	0.14
Permanent Set	0.17	0.12	0.11
Test Pressure (-150.0 psf)			
Maximum Deflection	Fail - The unit failed at pressure when the installation screws sheared along the jamb		
Permanent Set	Fail - The unit failed at pressure when the installation screws sheared along the jamb		

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

Test Equipment:

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

Missile: Missile C; Douglas Fir 2" x 4" lumber and 8 mm (5/16") diameter ball bearings

Timing Device: Electronic Beam Type

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

Tape and film were not 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>
Tony D. Gavin	Architectural Testing, Inc.
Eric J. Schoenthaler	Architectural Testing, Inc.

Detailed drawings, data sheets, 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.

Eric J. Schoenthaler
Project Manager

Daniel A. Johnson
Director - Regional Operations

EJS/jb

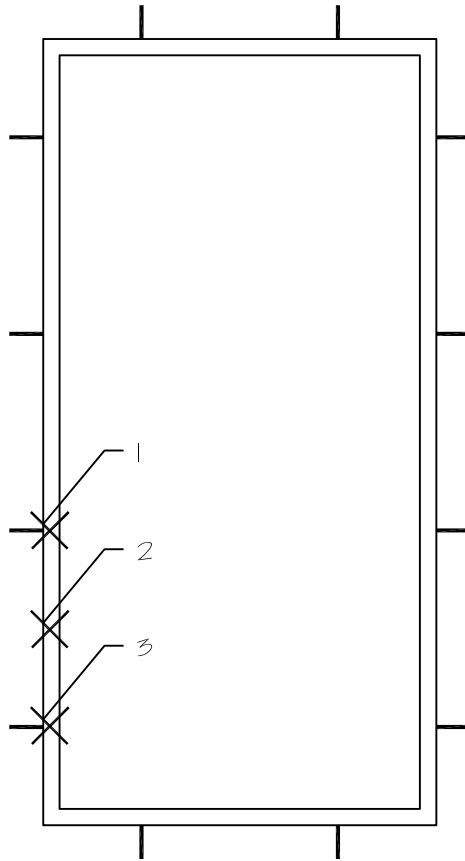
Attachments (0): This report is complete only when all attachments listed are included.

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	10/12/10	NA	Original report issue.

APPENDIX A

Sketch



X = INDICATOR LOCATION

- = #8 x 3" SCREWS

PROJECT NO.
A4057.01-201-44

CLIENT:
3M COMPANY
PROJECT NAME:
Ultra Prestige PR-S50 + IPA (black)



DRAWING
INDICATOR LOCATIONS

DWG. BY:
HMD
DATE:
11/1/10

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