

Performance Test Report

Report No.: C6549.04-401-44

Rendered to:

SAINT-GOBAIN PERFORMANCE PLASTICS
SOLAR GARD®
San Diego, California

PRODUCT TYPE: 100 micron (4 mil) Polyester Film
SERIES/MODEL: Solar Gard Sentinel 4 mil

This report contains in its entirety:

Cover Page: 1 page
Report Body: 7 pages
Sketches: 1 page
Photographs: 4 pages
Drawings: 1 page

Reference must be made to Report No. C6549.02-401-44, dated 07/11/13 for complete test specimen description and detailed test results for unbroken test specimen.

Test Date: 06/19/13
Report Date: 08/12/13

1.0 Report Issued To: Saint-Gobain Performance Plastics
4540 Viewridge Avenue
San Diego, California 92123

2.0 Test Laboratory: Architectural Testing, Inc.
2250 Massaro Boulevard
Tampa, Florida 33619
813-628-4300

3.0 Project Summary:

3.1 Product Type: 100 micron (4 mil) Polyester Film

3.2 Series/Model: Solar Gard Sentinel 4 mil

3.3 Attachment Type: Pentagon Flexible Membrane

3.4 Compliance Statement: Results obtained are tested values and were secured by using a modification to the designated test method.

3.5 Test Dates: 06/19/2013

3.6 Test Record Retention End Date: All test records for this report will be retained until August 12, 2017.

3.7 Test Location: Architectural Testing, Inc. test facility in Tampa, Florida.

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

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

3.10 List of Official Observers:

<u>Name</u>	<u>Company</u>
Miguel Detres	Saint-Gobain Performance Plastics
John C. McClane	Architectural Testing, Inc.
Daniel P. White	Architectural Testing, Inc.
Shawn G. Collins, P.E.	Architectural Testing, Inc.
Scott Parker	Architectural Testing, Inc.

4.0 Test Specification(s):

A modified version of 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:

Overall Area: 10.0 m ² (107.8 ft ²)	Width		Height	
	millimeters	inches	millimeters	inches
Overall size	3829	150-3/4	2616	103
Rough opening	3861	152	2629	103-1/2

5.2 Frame Construction

Frame Member	Material	Description
Head/sill	Extruded aluminum	Extrusion drawing #15
Jambs/vertical/horizontal mullions	Extruded aluminum	Extrusion drawing #1
Shear blocks	Extruded aluminum	Extrusion drawings #8 intermediate mullions & 9 head and sill
Wind load clips	Extruded aluminum	Extrusion drawing #6 vertical intermediate mullions & 7 jambs
Pressure plate	Extruded aluminum	Extrusion drawing #4

	Joinery Type	Detail
All corners	Mechanically	Mechanically fastened to wind load clips and/or shear blocks

5.0 Test Specimen Description: (Continued)

5.3 Weatherstripping:

Description	Quantity	Location
EPDM; Glazing gasket	2 Rows	Glazing pocket; horizontal and vertical frame members. Extrusion drawing #12
EPDM; Glazing gasket	2 Rows	Each side of pressure bar. Extrusion drawing #14
EPDM; Thermal break gasket	1 Row	Center of horizontal and vertical frame members. Extrusion drawing #13

5.4 Glazing: *No conclusions of any kind regarding the adequacy or inadequacy of the glass in any glazed test specimen(s) can be made.*

Glass Type mm(inch)	Spacer Type	Interior Lite mm(inch)	Exterior Lite mm(inch)	Glazing Method
25.4 (1") IG	Aluminum	6 (1/4") tempered	6 (1/4") tempered with 100 micron (4 mil) Polyester Film at exterior side	Exterior glazed onto glazing gasket and secured with a pressure bar. All exterior lites had 100 micron (4 mil) Polyester Film applied to the exterior side.

Location	Quantity	Daylight Opening		Glass Bite mm (inch)
		millimeters	inches	
Upper and lower lites at corners	4	584 x 584	23 x 23	12.7 (1/2")
Center lites at jambs	2	584 x 1194	23 x 47	12.7 (1/2")
Top center and bottom center lites	2	2407 x 584	94-3/4 x 23	12.7 (1/2")
Center lite	1	2407 x 1194	94-3/4 x 47	12.7 (1/2")

5.5 Drainage: No drainage was utilized.

5.6 Hardware: No hardware was utilized.

5.7 Reinforcement: No reinforcement was utilized.

6.0 Installation:

Test Specimen #1: Pentagon Flexible Membrane

The nine lite specimen was installed into a C10 steel buck welded at the corners. The rough opening allowed for a 12.7 mm (1/2") shim space. The shear block clips were secured to the vertical mullions at the head, sill and intermediate locations; with #12 x 50.8 mm (2") pan head screws. The horizontal mullions were secured to the shear blocks with two #12 x 22 mm (7/8") flat head screws. The specimen was secured to the steel test buck utilizing 6 mm (1/4")-20 x 38mm (1-1/2") hex head tek screws; four each side of the "T" clip and four in the "F" clip. The Solar Gard Sentinel 4 mil film was applied to the exterior side of the insulated glass and cured for a period of 6 weeks. The perimeter of all film edges were cleaned with 91% isopropyl alcohol. The perimeter of all film edges were treated with an adhesion promoter (3M 4298) (*Reference Photo #1*). A 63.5 mm (2-1/2") wide Pentagon Flexible Membrane was applied to the film edges; bridging the two opposing glazing pockets, and secured by 14.3 mm (9/16") wide double-sided tape that was fabricated on the two outside edges of the Pentagon Flexible Membrane (*Reference Photo #2*). The Pentagon Flexible Membrane was secured in place; to the film, by applied pressure using application tools (*Reference Photo #3& 4*). The pressure bars; with EPDM weatherstripping, were secured with 6 mm (1/4")-20 x 25.4 mm (1") HWHTCS F screws located 203.2 mm (8") 33 on center.

Location	Anchor Description mm(inch)	Anchor Location mm(inch)
Shear blocks to vertical mullions	#12 x 50.8 (2") pan head screw	Two screws in shear blocks at the horizontal intermediate mullions; and three screws in shear blocks at the head and sill
Horizontal mullions to shear block	#12 x 22 (7/8") flat head screw	Two at each end of horizontal mullions
Pressure bar to mullions	6 (1/4")-20 x 25.4 (1") HWHTCS F screw	101.6 (4") from each end and 203.2 (8") on center
"T" clips and "F" clips	6 (1/4")-20 x 38 (1-1/2") hex head tek screw	Four each side of "T" clips; four in "F" clips

7.0 Test Results:

Modified ASTM E 1886, Air Pressure Cycling; 50 cycles per pressure group

Test Unit #1 Pentagon Flexible Membrane/ Broken glass

Reference must be made to Report No. C6549.02-401-44, dated 07/11/13 for complete test specimen description and detailed test results for unbroken test specimen.

Pressure		Indicator Number (Deflections) mm (inches) Broken Glass							
kPa	PSF	Cycle Time	1	2	3	4	5	6	7
0.0 to +1	0.0 to +20.9	5.93	1.27 (0.05)	2.03 (0.08)	1.27 (0.05)	1.02 (0.04)	5.59 (0.22)	2.54 (0.10)	74.42 (2.93)
0.0 to -1	0.0 to -20.9	6.11	1.27 (0.05)	4.57 (0.18)	2.29 (0.09)	4.57 (0.18)	8.89 (0.35)	3.05 (0.12)	95.25 (3.75)
0.0 to +2	0.0 to +41.8	7.35	1.52 (0.06)	4.06 (0.16)	0.76 (0.03)	2.54 (0.10)	13.97 (0.55)	8.89 (0.35)	107.70 (4.24)
0.0 to -2	0.0 to -41.8	6.97	1.52 (0.06)	6.86 (0.27)	3.30 (0.13)	7.37 (0.29)	13.72 (0.54)	1.27 (0.05)	129.03 (5.08)
0.0 to +3	0.0 to +62.7	11.90	1.78 (0.07)	6.60 (0.26)	1.27 (0.05)	3.56 (0.14)	19.56 (0.77)	11.43 (0.45)	145.03 (5.71)
0.0 to -3	0.0 to -62.7	8.60	5.59 (0.22)	10.16 (0.40)	4.32 (0.17)	11.68 (0.46)	22.61 (0.89)	4.57 (0.18)	176.28 (6.94)

Pressure		Indicator Number (Permanent Set) mm (inches) Broken Glass							
kPa	PSF	Cycle Time	1	2	3	4	5	6	7
0.0 to +1	0.0 to +20.9	5.93	1.27 (0.05)	0.76 (0.03)	0.51 (0.02)	1.02 (0.04)	0.25 (0.01)	0.51 (0.02)	32.00 (1.26)
0.0 to -1	0.0 to -20.9	6.11	3.05 (0.12)	2.54 (0.10)	2.03 (0.08)	3.05 (0.12)	3.81 (0.15)	1.52 (0.06)	55.88 (2.20)
0.0 to +2	0.0 to +41.8	7.35	7.87 (0.31)	<0.25 (<0.01)	0.76 (0.03)	1.02 (0.04)	3.05 (0.12)	5.08 (0.20)	55.88 (2.20)
0.0 to -2	0.0 to -41.8	6.97	10.92 (0.43)	3.05 (0.12)	2.79 (0.11)	4.32 (0.17)	3.30 (0.13)	2.03 (0.08)	80.52 (3.17)
0.0 to +3	0.0 to +62.7	11.90	1.52 (0.06)	0.25 (0.01)	1.02 (0.04)	2.54 (0.10)	2.29 (0.09)	4.57 (0.18)	73.15 (2.88)
0.0 to -3	0.0 to -62.7	8.60	5.08 (0.20)	3.81 (0.15)	3.30 (0.13)	6.10 (0.24)	6.35 (0.25)	1.27 (0.05)	108.20 (4.26)

Observations: No additional damage or deglazing was observed.

Result: Glass remained in opening through +/- 3 kPa (+/- 62.7 psf) pressure groups.

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

8.0 Test Equipment:

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.

Architectural Testing will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period.

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.

Scott Parker
Technician

Shawn G. Collins, P.E.
Manager- Regional Operations

SP:jah

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

- Appendix-A: Sketches (1)
- Appendix B: Photographs (4)
- Appendix-C: Drawings (1)



Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	8/12/13	N/A	Original report issue
1	08/14/13	1	Removed Specimen #1 attachment type in 3.3
1	08/14/13	4	Removed Test Speciment #1 installation details
1	08/14/13	6	Removed Test Speciment #1 test results table
1	08/14/13	Appendix A	Removed Appendix A Photographs
2	08/26/13	Appendix B	Added Appendix B Photographs (4pages)
2	08/26/13	4	Installation measurement
2	08/26/13	5	Added Reference ATI Job # note
2	08/26/13	Cover	Reference ATI Job # note / Table of Contents



Architectural Testing

Test Report No.: C6549.04-401-44

Revision 2: 08/26/13

Report Date: 08/12/13

Appendix A

Sketches

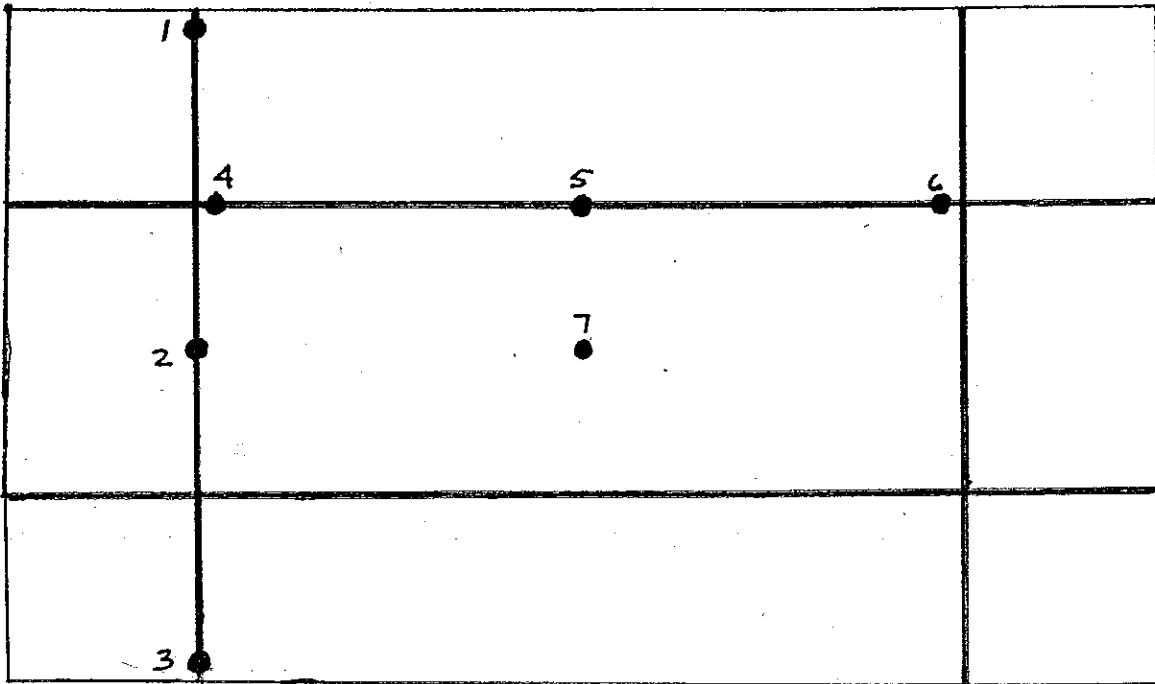
Architectural Testing, Inc.

7/3/2013 SP

Sketch #1

TEST SPECIMEN # 3

● - Indicator Locations



Appendix B

Photographs



Photo#1
Specimen #1
Pentagon Flexible Membrane Specimen
Perimeter of All Film Edges Treated with an
Adhesion Promoter (3M 4298)



Photo#2

Specimen #1

Pentagon Flexible Membrane Specimen

**Pentagon Flexible Membrane Applied to the Film Edges;
Bridging the Two Opposing Glazing Pockets and Secured by
14.3 mm (9/16") wide Double-sided Tape that was Fabricated
on the Two Outside Edges of the Pentagon Flexible Membrane**



Photo#3
Specimen #1
Pentagon Flexible Membrane Specimen
Pentagon Flexible Membrane Secured in Place to the Film,
by Applied Pressure Using Application Tools.
Application Tool #1



Photo#4
Specimen #1
Pentagon Flexible Membrane Specimen
The Pentagon Flexible Membrane Secured in Place
to the Film by Applied Pressure Using Application Tools.
Application Tool #2



Architectural Testing

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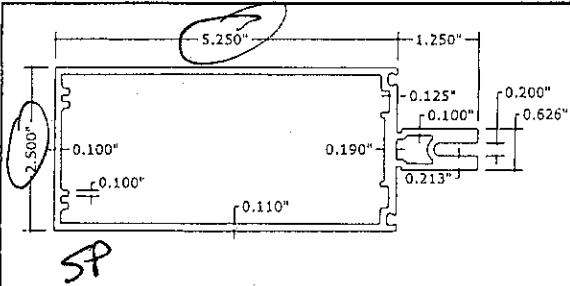
Appendix C

Drawings

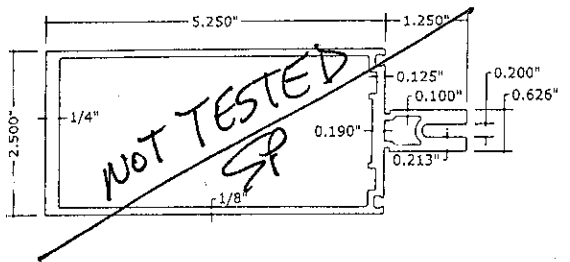
Test sample complies with these details.
 Deviations are noted.

Report# C6549.0A-401-44

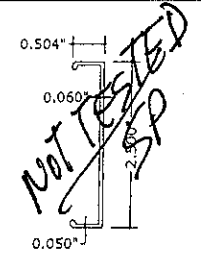
Date 7/19/2013 Tech SP



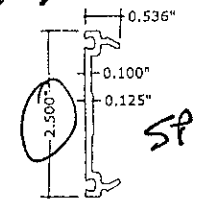
1 LIGHT MULLION
 6" = 1'-0" 6063-T6 ALUM



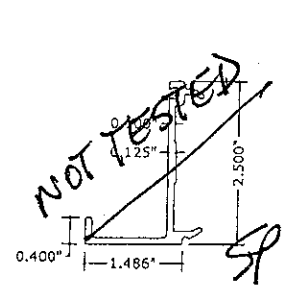
2 HEAVY MULLION
 6" = 1'-0" 6063-T6 ALUM



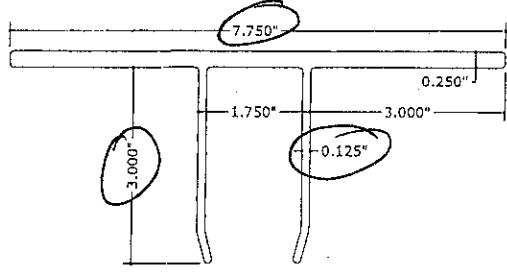
3 SNAP ON CAP
 6" = 1'-0" 6063-T6 ALUM



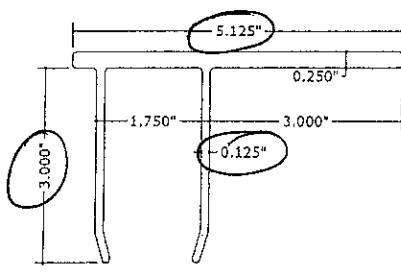
4 PRESSURE PLATE
 6" = 1'-0" 6063-T6 ALUM



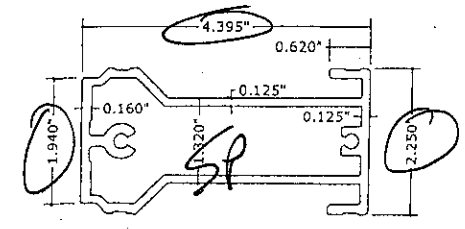
5 PERIMETER PRESSURE PLATE
 6" = 1'-0" 6063-T6 ALUM



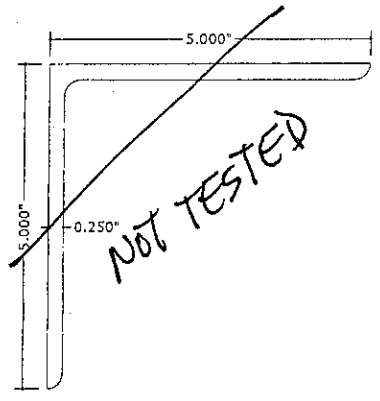
6 "I" CLIP SP
 6" = 1'-0" 6063-T6 ALUM



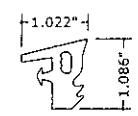
7 "F" CLIP SP
 6" = 1'-0" 6063-T6 ALUM



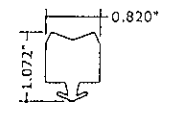
8 SHEAR BLOCK
 6" = 1'-0" 6063-T6 ALUM



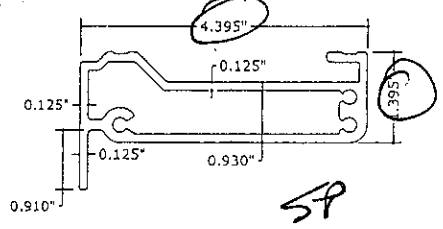
10 WIND LOAD CLIP
 6" = 1'-0" A36 STEEL



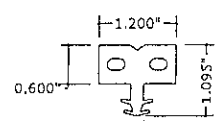
12 GLAZING GASKET SP
 1'-0" = 1'-0" EPDM



14 PERIMETER GASKET SP
 1'-0" = 1'-0" EPDM



9 HEAD/SILL SHEAR BLOCK
 6" = 1'-0" 6063-T6 ALUM



13 THERMAL BREAK SP
 1'-0" = 1'-0" EPDM

BILL OF MATERIALS

NO.	DESCRIPTION	MATERIAL
1	2-1/2"x5-1/4" LIGHT MULLION FOR 1" GLASS	6063-T6 ALUMINUM
2	2-1/2"x5-1/4" HEAVY MULLION FOR 1" GLASS	6063-T6 ALUMINUM
3	SNAP ON CAP	6063-T6 ALUMINUM
4	PRESSURE PLATE	6063-T6 ALUMINUM
5	PERIMETER PRESSURE PLATE	6063-T6 ALUMINUM
6	"I" CLIP	6063-T6 ALUMINUM
7	"F" CLIP	6063-T6 ALUMINUM
8	SHEAR BLOCK	6063-T6 ALUMINUM
9	HEAD/SILL SHEAR BLOCK	6063-T6 ALUMINUM
10	WIND LOAD CLIP	A36 STEEL
11	JOINT CLIP	A36 STEEL
12	GLAZING GASKET - 70 DUROMETER	EPDM
13	THERMAL BREAK - 70 DUROMETER	EPDM
14	PERIMETER GASKET - 70 DUROMETER	EPDM
15	"I" SETTING BLOCK	A36 STEEL