



NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17406 • TELEPHONE (717) 846-1200
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ASTM E1996-2002, 2004, 2006, 2009, 2012a & 2014a
ASTM E1886-2002, 2004, 2005 & 2013a

IMPACT & CYCLING TEST REPORT SUMMARY

RENDERED TO:

GLASS FLOORING SYSTEMS INC.

10 Leslie Court
Whippany, NJ 07981

PRODUCT TYPE: Fixed Skylight

SERIES/ MODEL: "SkyFloor™ Walkable Skylight - FA-TB 4x4"

On March 23, 2017, Glass Flooring Systems, 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-110-19383-3).

Tested Size:	Overall 1216 mm (47.875") wide by 1216 mm (47.875") high
Glazing Configuration:	Interior: (3) Lites of 9.53 mm (0.375") nominal tempered glass and each lite was separated by (1) 1.52 mm (0.060") PVB interlayer Exterior: (2) Lites of 3 mm (0.125") tempered glass separated by a 0.76 mm (0.030") thick PVB interlayer
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 Missile Used:	Missile D
Positive Design Pressure:	+ 120.0 psf
Negative Design Pressure:	- 120.0 psf

Reference must be made to NCTL Report Number NCTL-110-19383-3 dated 04/06/17 for complete test sample description and data.

National Certified Testing Laboratories



DIGITAL SIGNATURE

Justin L. Bupp
Laboratory Manager



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**ASTM E1996-2002, 2004, 2006, 2009, 2012a & 2014a
ASTM E1886-2002, 2004, 2005 & 2013a**

IMPACT & CYCLING PERFORMANCE TEST REPORT

NCTL-110-19383-3

REPORT TO:

GLASS FLOORING SYSTEMS INC.
10 LESLIE COURT
WHIPPANY, NJ 07981

REPORT NUMBER: NCTL-110-19383-3
REPORT DATE: 04/06/17

PRODUCT TYPE: FIXED SKYLIGHT

SERIES/ MODEL: "SKYFLOOR™ WALKABLE SKYLIGHT - FA-TB 4X4"



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Report Number NCTL-110-19383-3

Report Date 04/06/17

Report To Glass Flooring Systems, Inc.
10 Leslie Court
Whippany, NJ 07981

Test Start Date 08/01/16
Test End Date 03/23/17

Specification ASTM E1886-02/04/05/13a, "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"

ASTM E1996-02/04/06/09/12a/14a, "Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"

Description of Sample Tested

Note: All dimensions are in the order (Width x Height x Thickness) unless otherwise noted.

Model/ Series SkyFloor™ Walkable Skylight FA-TB 4x4

Configuration Fixed Skylight

Flange Size 1365 mm x 1365 mm (53.75" x 53.75")

Frame Size 1216 mm x 1216 mm (47.875" x 47.875")

Viewing Area 1054 mm x 1054 mm (41.5" x 41.5")

Frame Type Extruded aluminum with poured urethane thermal breaks

Joint Construction Frame
Mitered, welded

Glazing Components

Overall 50.67 mm (1.995") nominal

Glass Thickness (1) Lite of 31.62 mm (1.245") nominal laminated glass to the exterior and (1) lite of 7.87 mm (0.310") laminated glass to the interior

Laminated Glass Interior
(3) Lites of 9.53 mm (0.375") nominal tempered glass and each lite was separated by (1) 1.52 mm (0.060") PVB interlayer

Laminated Glass (cont'd.) Exterior
(2) Lites of 3 mm (0.125") nominal tempered glass separated by a 0.76 mm (0.030") PVB interlayer

Spacer Type/Size 12.7 mm (0.50") Desiccant-filled aluminum spacer (Type A1-D)

Glazing System Exterior glazed with a structural silicone back-fill

Weatherstrip	No weatherseals employed
Operating Hardware	No operating hardware employed
Auxiliary	
Type	Extruded aluminum adjustable cap
Location	Exterior frame perimeter
Type	Aluminum block
Location	Glazing channel perimeter
Reinforcement	No reinforcement employed
Weep Description	No apparent weeps employed
Interior/ Exterior Surface Finish	Painted aluminum
Sealant	No apparent sealant applied
Insect Screen	No screen employed
Installation Method	The skylight was installed on the test chamber constructed of 19.05 mm (0.75") plywood and standard 51 mm x 152 mm (2" x 6") spruce-pine-fir studs and plates. The skylight was fastened to the top plate with (1) 9.53 mm (0.375") x 51 mm (2") lag bolt with washer at each pre-punched flange hole. The exterior perimeter was sealed with silicone sealant.

Test Results - ASTM E1886 & ASTM E1996

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	Less than or equal to 9.1 m (30') basic protection
Level:	Greater than 9.1 m (30') enhanced protection

IMPACT TEST

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 Tables 2, 3 & 4 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 E1996. 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.

Missile Type & Weight: #2 Southern Yellow Pine 2x4, Length 92" & 9 lbs.

	Location	Comments	Speed
Specimen 1			
Impact	Center of Glazing	No Penetration/ Passed	50.0 Ft./Sec.
Impact	Upper Right Corner of Glazing	No Penetration/ Passed	50.0 Ft./Sec.

Specimen 2

Impact	Lower Left Corner of Glazing	No Penetration/ Passed	50.0 Ft./Sec.
Impact	Center of Glazing	No Penetration/ Passed	50.0 Ft./Sec.

Specimen 3

Impact	Upper Right Corner of Glazing	No Penetration/ Passed	50.0 Ft./Sec.
Impact	Center of Glazing	No Penetration/ Passed	50.0 Ft./Sec.

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.

PRESSURE CYCLING TEST

Unless otherwise specified, the duration of each air pressure cycle is not less than 1 s and not more than 5 s. Dwell time between successive cycles is no more than 1 s.

Specimens 1, 2, 3

Design Pressure +120.0 psf/ -120.0 psf

Positive Loads

Range of Test	Actual			# of Cycles	Result
+0.2 to +0.5 DP	24.0	psf to	60.0 psf	3,500	Passed
+0.0 to +0.6 DP	00.0	psf to	72.0 psf	300	Passed
+0.5 to +0.8 DP	60.0	psf to	96.0 psf	600	Passed
+0.3 to +1.0 DP	36.0	psf to	120.0 psf	100	Passed

Negative Loads

Range of Test	Actual			# of Cycles	Result
-0.3 to -1.0 DP	36.0	psf to	120.0 psf	50	Passed
-0.5 to -0.8 DP	60.0	psf to	96.0 psf	1,050	Passed
-0.0 to -0.6 DP	00.0	psf to	72.0 psf	50	Passed
-0.2 to -0.5 DP	24.0	psf to	60.0 psf	3,350	Passed

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

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: + 120.0 psf

Negative Design Pressure: - 120.0 psf

Basic wind speeds stated in ASTM E1996 are as follows: Wind Zone 3 - 150 mph (58 m/s) \leq basic wind speed $<$ 170 mph (63 m/s), or 140 mph (54 m/s) \leq basic wind speed \leq 170 mph (63 m/s) and within 1.6 km (one mile) of the coastline. The coastline shall be measured from the mean high water mark. Wind Zone 4-basic wind speed $>$ 170 mph (63 m/s).

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 the particular specimen tested and do not imply the quality of similar or identical products manufactured or installed from specifications identical to the tested product. All testing was performed in compliance with the referenced test method or specification and any deviations are noted. Ambient conditions during the referenced testing are available upon request. Any film employed during testing had no effect upon test results. The test specimen was supplied to NCTL by the above named client. Foam tape is mounted to the perimeter of the test buck prior to clamping to the test wall. 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.

Detailed drawings were available for laboratory records and compared to the test specimen at the time of this report. Component drawings were reviewed for product verification. The bill of materials contains details with any deviations noted. Ambient conditions during the referenced testing are available upon request. 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 full compliance with the referenced specifications and/or test methods with any deviations noted. This report may not be reproduced, except in full, without the written consent of NCTL.

National Certified Testing Laboratories

A digital signature of Justin L. Bupp, featuring a stylized cursive script and a small NCTL logo. Below the signature, the words "DIGITAL SIGNATURE" are printed in a small, sans-serif font.

Justin L. Bupp
Laboratory Manager

A digital signature of Robert H. Zeiders, featuring a stylized cursive script and a small NCTL logo. Below the signature, the words "DIGITAL SIGNATURE" are printed in a small, sans-serif font.

Robert H. Zeiders, P.E.
Vice-President Engineering & Quality

JLB/ dro

Attachments

- Appendix A - Drawing & Revision Summary
- Appendix B - Drawings

APPENDIX A

Section 1:

Component Drawings, with Applicable Part Numbers, Manufacturing and Modeling Details, were reviewed
(as submitted) for Product Verification
(Reference: NCTL-110-19383-3)

See Attached Documentation;
any deviations noted.

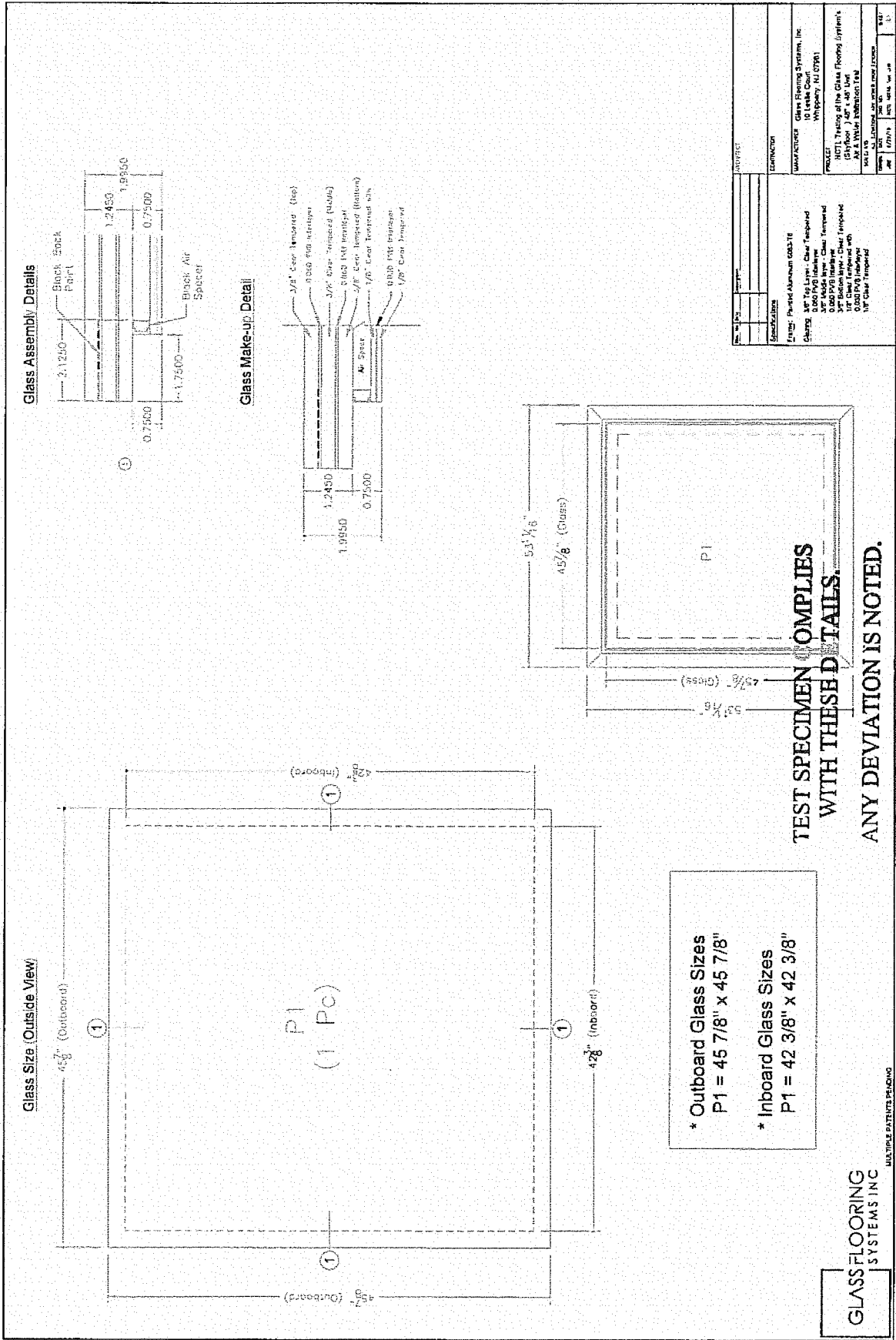
Note: The above referenced component drawings along with representative sections of the test specimen will be retained per procedure by NCTL. This testing facility assumes that all information provided by the client is accurate.

Section 2:

<u>Identification</u>	<u>Date</u>	<u>Page & Revision</u>
Original Issue	04/06/17	Not Applicable

APPENDIX B

DRAWINGS



* Outboard Glass Sizes
P1 = 45 7/8" x 45 7/8"

* Inboard Glass Sizes
P1 = 42 3/8" x 42 3/8"

TEST SPECIMEN COMPLIES
WITH THESE DETAILS.

ANY DEVIATION IS NOTED.

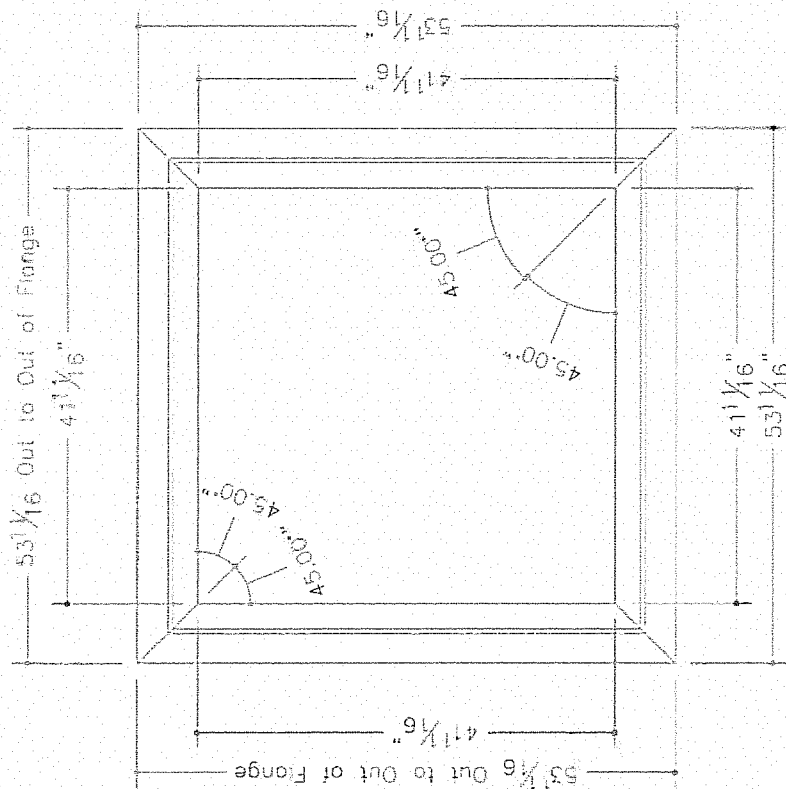
GLASS FLOORING
SYSTEMS INC

MULTIPLE PATENTS PENDING

REPORT NO. NCTL-110- 15363 3

TEST DATE: 3-23-17

SPECIFICATIONS		CONNECTION	
1. Frame: Powder Aluminum 6061-T6	2. Glass: 3/4" Thick Layer - Clear Tempered	3. Spacers: 3/8" Thick Layer - Clear Tempered	4. Sealant: 3/8" Thick Layer - Clear Tempered
5. Backing: 3/8" Thick Layer - Clear Tempered	6. Backing: 3/8" Thick Layer - Clear Tempered	7. Backing: 3/8" Thick Layer - Clear Tempered	8. Backing: 3/8" Thick Layer - Clear Tempered
9. Backing: 3/8" Thick Layer - Clear Tempered	10. Backing: 3/8" Thick Layer - Clear Tempered	11. Backing: 3/8" Thick Layer - Clear Tempered	12. Backing: 3/8" Thick Layer - Clear Tempered
13. Backing: 3/8" Thick Layer - Clear Tempered	14. Backing: 3/8" Thick Layer - Clear Tempered	15. Backing: 3/8" Thick Layer - Clear Tempered	16. Backing: 3/8" Thick Layer - Clear Tempered
17. Backing: 3/8" Thick Layer - Clear Tempered	18. Backing: 3/8" Thick Layer - Clear Tempered	19. Backing: 3/8" Thick Layer - Clear Tempered	20. Backing: 3/8" Thick Layer - Clear Tempered
21. Backing: 3/8" Thick Layer - Clear Tempered	22. Backing: 3/8" Thick Layer - Clear Tempered	23. Backing: 3/8" Thick Layer - Clear Tempered	24. Backing: 3/8" Thick Layer - Clear Tempered
25. Backing: 3/8" Thick Layer - Clear Tempered	26. Backing: 3/8" Thick Layer - Clear Tempered	27. Backing: 3/8" Thick Layer - Clear Tempered	28. Backing: 3/8" Thick Layer - Clear Tempered
29. Backing: 3/8" Thick Layer - Clear Tempered	30. Backing: 3/8" Thick Layer - Clear Tempered	31. Backing: 3/8" Thick Layer - Clear Tempered	32. Backing: 3/8" Thick Layer - Clear Tempered
33. Backing: 3/8" Thick Layer - Clear Tempered	34. Backing: 3/8" Thick Layer - Clear Tempered	35. Backing: 3/8" Thick Layer - Clear Tempered	36. Backing: 3/8" Thick Layer - Clear Tempered
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41. Backing: 3/8" Thick Layer - Clear Tempered	42. Backing: 3/8" Thick Layer - Clear Tempered	43. Backing: 3/8" Thick Layer - Clear Tempered	44. Backing: 3/8" Thick Layer - Clear Tempered
45. Backing: 3/8" Thick Layer - Clear Tempered	46. Backing: 3/8" Thick Layer - Clear Tempered	47. Backing: 3/8" Thick Layer - Clear Tempered	48. Backing: 3/8" Thick Layer - Clear Tempered
49. Backing: 3/8" Thick Layer - Clear Tempered	50. Backing: 3/8" Thick Layer - Clear Tempered	51. Backing: 3/8" Thick Layer - Clear Tempered	52. Backing: 3/8" Thick Layer - Clear Tempered
53. Backing: 3/8" Thick Layer - Clear Tempered	54. Backing: 3/8" Thick Layer - Clear Tempered	55. Backing: 3/8" Thick Layer - Clear Tempered	56. Backing: 3/8" Thick Layer - Clear Tempered
57. Backing: 3/8" Thick Layer - Clear Tempered	58. Backing: 3/8" Thick Layer - Clear Tempered	59. Backing: 3/8" Thick Layer - Clear Tempered	60. Backing: 3/8" Thick Layer - Clear Tempered
61. Backing: 3/8" Thick Layer - Clear Tempered	62. Backing: 3/8" Thick Layer - Clear Tempered	63. Backing: 3/8" Thick Layer - Clear Tempered	64. Backing: 3/8" Thick Layer - Clear Tempered
65. Backing: 3/8" Thick Layer - Clear Tempered	66. Backing: 3/8" Thick Layer - Clear Tempered	67. Backing: 3/8" Thick Layer - Clear Tempered	68. Backing: 3/8" Thick Layer - Clear Tempered
69. Backing: 3/8" Thick Layer - Clear Tempered	70. Backing: 3/8" Thick Layer - Clear Tempered	71. Backing: 3/8" Thick Layer - Clear Tempered	72. Backing: 3/8" Thick Layer - Clear Tempered
73. Backing: 3/8" Thick Layer - Clear Tempered	74. Backing: 3/8" Thick Layer - Clear Tempered	75. Backing: 3/8" Thick Layer - Clear Tempered	76. Backing: 3/8" Thick Layer - Clear Tempered
77. Backing: 3/8" Thick Layer - Clear Tempered	78. Backing: 3/8" Thick Layer - Clear Tempered	79. Backing: 3/8" Thick Layer - Clear Tempered	80. Backing: 3/8" Thick Layer - Clear Tempered
81. Backing: 3/8" Thick Layer - Clear Tempered	82. Backing: 3/8" Thick Layer - Clear Tempered	83. Backing: 3/8" Thick Layer - Clear Tempered	84. Backing: 3/8" Thick Layer - Clear Tempered
85. Backing: 3/8" Thick Layer - Clear Tempered	86. Backing: 3/8" Thick Layer - Clear Tempered	87. Backing: 3/8" Thick Layer - Clear Tempered	88. Backing: 3/8" Thick Layer - Clear Tempered
89. Backing: 3/8" Thick Layer - Clear Tempered	90. Backing: 3/8" Thick Layer - Clear Tempered	91. Backing: 3/8" Thick Layer - Clear Tempered	92. Backing: 3/8" Thick Layer - Clear Tempered
93. Backing: 3/8" Thick Layer - Clear Tempered	94. Backing: 3/8" Thick Layer - Clear Tempered	95. Backing: 3/8" Thick Layer - Clear Tempered	96. Backing: 3/8" Thick Layer - Clear Tempered
97. Backing: 3/8" Thick Layer - Clear Tempered	98. Backing: 3/8" Thick Layer - Clear Tempered	99. Backing: 3/8" Thick Layer - Clear Tempered	100. Backing: 3/8" Thick Layer - Clear Tempered



**TEST SPECIMEN COMPLIES
WITH THESE DETAILS.**

ANY DEVIATION IS NOTED.

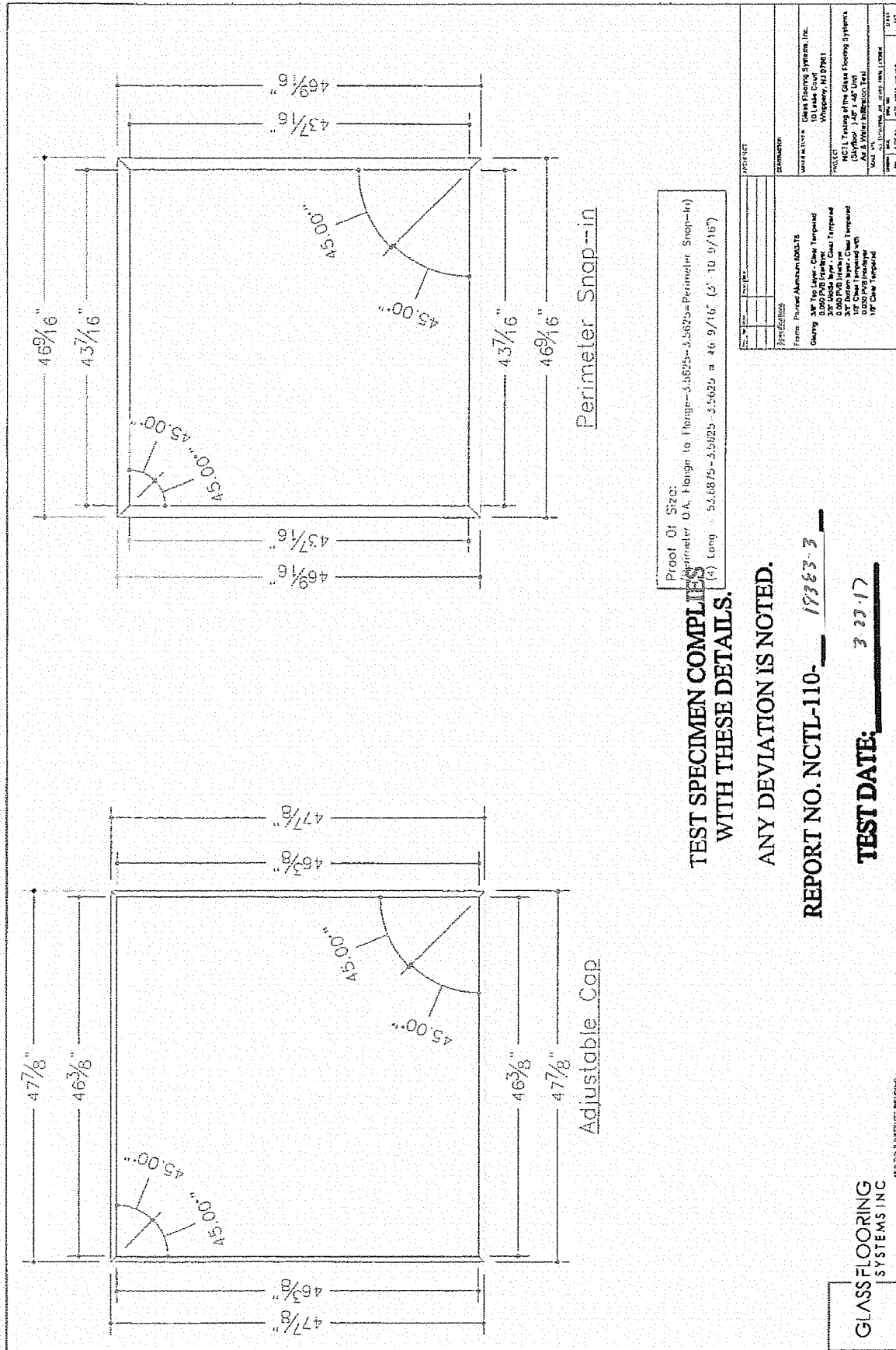
REPORT NO. NCTL-110- 15368-3

TEST DATE: 3-23-17

GLASS FLOORING
SYSTEMS INC.

MULTIPLE CHOICE QUESTIONS

11 of 12



Proof Of Size:
 Perimeter O.A. Flange to Flange = 3.5625 = Perimeter Snap-in
 (-) Long 5.56875 = 3.5625 = 46 9/16" (3' 10 9/16")

TEST SPECIMEN COMPLIES WITH THESE DETAILS.

ANY DEVIATION IS NOTED.

REPORT NO. NCTL-110- 19363-3

TEST DATE: 3-23-17

GLASS FLOORING SYSTEMS INC.

MULTIPLE PATENTS PENDING

SPECIFICATIONS	
Material	Tempered Glass
Thickness	1/2"
Finish	Clear
Edge Treatment	45° Bevel
Installation	See Details
Manufacturer	Glass Flooring Systems, Inc.
Address	10000 Whittier Blvd., Whittier, CA 90601
Phone	(562) 895-1111
Fax	(562) 895-1112
Website	www.glassflooring.com
Notes	1. All dimensions are in inches unless otherwise noted. 2. All glass is tempered.