



TEST REPORT

Rendered to:

PURE VISTA

For:

PRODUCT: *PosiGlaze and SpigLite*

TYPE: Glass Balustrade Systems

Report No.: G9513.04-119-19

Report Date: 10/18/17

Test Record Retention Date: 05/30/21



TEST REPORT

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October 18, 2017

TABLE OF CONTENTS

1.0 General Information	1
1.1 Product.....	1
1.2 Project Description	1
1.3 Limitations	1
1.4 Qualifications	2
1.5 Product Description	2
1.6 Component Description.....	2
1.6 Component Description (Continued)	3
1.7 Fastening Schedule	3
2.0 Structural Performance Testing of Assembled Railing Systems	4
2.1 Test Equipment.....	4
2.2 Test Setup	4
2.3 Test Procedure	4
2.3 Test Procedure (Continued).....	5
2.3 Test Procedure (Continued).....	6
2.4 Test Results	6
2.5 Summary and Conclusions.....	19
3.0 Closing Statement	20
Revision Log	21
Appendix A - Drawings	
Appendix B - Photographs	



TEST REPORT

Rendered to:

PURE VISTA
Pendewey Farm
Stoney Lane
Bodmin, Cornwall PL31 2QX
UNITED KINGDOM

Report No.: G9513.04-119-19

Test Dates: 05/02/17

Through: 05/30/17

Report Date: 10/18/17

Test Record Retention Date: 05/30/21

1.0 General Information

1.1 Product

PosiGlaze and *SpigLite* Glass Balustrade Systems

1.2 Project Description

Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by Pure Vista to conduct structural performance tests on the *PosiGlaze* and *SpigLite* glass balustrade systems. The systems were evaluated for the design load requirements of the following building codes:

2015 National Building Code of Canada, Canadian Commission on Building and Fire Codes

2012 Building Code Compendium Ontario

2012 British Columbia Building Code, Office of Housing and Construction Standards

2014 Alberta Building Code, National Research Code Council

1.3 Limitations

All tests performed were to evaluate structural performance of the guardrail assembly to carry and transfer imposed loads to the supporting structure. The test specimens evaluated included the glass panels and mounting shoes. Anchorage of the mounting shoes and the rail mounting brackets to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

1.4 Qualifications

Intertek-ATI has demonstrated compliance with ISO/IEC International Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. (IAS).

1.5 Product Description

The *PosiGlaze* and *SpigLite* guardrail systems consisted of extruded aluminum support shoes with glass panels supporting the top rail. The glass panels were 1499 mm (59 in) long with an overall rail height (deck surface to top of top rail) of 1067 mm (42 in). For configurations evaluated for use in less than 3-Panel applications, top rail ends were attached to rigid steel members via stainless steel brackets. See Section 1.7 Fastening Schedule for connection details. See drawings in Appendix A and photographs in Appendix B for additional details.

1.6 Component Description

The scope of testing performed and reported herein was intended to evaluate the *PosiGlaze* and *SpigLite* series railing systems consisting of the following components:

Top Rail:

For 19.1 mm (3/4 in) and 22.2 mm (7/8 in) thick panels: 33.3 mm (1-5/16 in) high by 31.8 mm (1-1/4 in) wide stainless steel rail profile with 3 mm (0.12 in) thick wall

For 12.7 mm (1/2 in) thick panels: 33.3 mm (1-5/16 in) high by 25.4 mm (1 in) wide stainless steel rail profile with 3 mm (0.12 in) thick wall

Glass Panels: Reference Section 2.5, Summary and Conclusions for dimensional details of glass for various tested configurations. Panels used in surface mount applications measured 1067 mm (42 in) high, and panels used in side mount applications measured 1168 mm (46 in) high. The specimens used glass options with the following construction:

- 12.7 mm (1/2 in) thick tempered monolithic
- 12.7 mm (1/2 in) thick laminated constructed from two sheets of 5.6 mm (7/32 in) thick clear tempered and a 1.5 mm (0.060 in) thick PVB interlayer
- 19.1 mm (3/4 in) thick tempered monolithic
- 22.2 mm (7/8 in) laminated constructed from two sheets of 9.5 mm (3/8 in) thick clear tempered and a 1.5 mm (0.060 in) thick PVB interlayer

SpigLite Mounting Shoe: 79.4 mm (3-1/8 in) wide by 127 mm (5 in) high by 125.4 mm (4-15/16 in) long U-Shaped aluminum bracket, two per assembly spaced 498.5 mm (19-5/8 in) on center

PosiGlaze Mounting Shoe: 73 mm (2-7/8 in) wide by 111.1 mm (4-3/8 in) high continuous U-shaped aluminum extrusion

1.6 Component Description (Continued)

Rail Brackets: 25.4 mm (1 in) wide by 33.3 mm (1-5/16 in) high by 3 mm (0.12 in) thick back plate welded to a 19.1 mm (3/4 in) wide by 30.2 mm (1-3/16 in) high by 25.4 mm (1 in) deep by 1 mm (0.04 in) thick U-shaped flange, stainless steel collar bracket. **Slip Clamps:** 85.7 mm (3-3/8 in) high by 77.8 mm (3-1/16 in) wide, two-piece molded nylon setting blocks with adjustable depth to fit each panel thickness

Glass Clamp Bar Fitting: 69.9 mm (2-3/4 in) long by 23 mm (29/32 in) wide aluminum bar with one flat surface, one contoured surface, and beveled edges

Top Seal Strip: Snap-fit extruded aluminum profile with a kerf-mounted rubber gasket, used on both sides of surface mount shoe and interior side of side mount shoe

Face Cover: Snap-fit "L" shaped aluminum extrusion with a kerf-mounted rubber gasket, used on exterior side of face mount shoe

1.7 Fastening Schedule

Connection	Fastener
Glass Panel to Support Shoe	Set onto slip clamps and secured in place with glass clamp bars, located 177.8 mm (7 in) from each end and spaced 228.6 mm (9 in) on center
	Slip clamp fit adjusted with a 10 mm (3/8")-13 hex head set screw threaded through the glass clamp bar
Rail Cap to Panel	No mechanical connection - pressure fit using rigid nylon channel
Wall Mount Bracket to Rail Cap	No mechanical connection - channel fit
Wall Mount Bracket to Steel Test Fixture	One 6 mm (1/4 in) x 38.1 mm (1-1/2") hex head bolt and nut
<i>PosiGlaze</i> Support Shoe to Steel Fixture	13 mm (1/2")-13 hex head bolt and nut, located 101.6 mm (4 in) from each end and spaced 203.2 mm (8 in) on center
<i>SpigLite</i> Mounting Bracket to Steel Fixture	13 mm (1/2")-13 hex head bolt and nut, one per bracket

2.0 Structural Performance Testing of Assembled Railing Systems

2.1 Test Equipment

The glass balustrade was tested in a self-contained structural frame designed to accommodate anchorage of the guardrail assembly and application of the required test loads. The specimens were loaded using an electric winch mounted to a rigid steel test frame. High strength steel cables, nylon straps, and load distribution beams were used to impose test loads on the specimens. Applied load was measured using an electronic load cell located in-line with the loading system. Electronic linear motion transducers were used to measure deflections.

2.2 Test Setup

The glass balustrade assemblies were installed and tested by directly securing the mounting system to a rigid steel test fixture. Transducers mounted to an independent reference frame were located to record movement of reference points on the guardrail system components (ends and mid-point) to determine net component deflections. See photographs in Appendix B for individual test setups.

2.3 Test Procedure

Each test specimen was inspected prior to testing to verify size and general condition of the materials, assembly, and installation. No potentially compromising defects were observed prior to testing. Load was applied at a steady uniform rate until reaching the test load or until failure occurred. The testing time was continually recorded from the application of initial test load until the ultimate test load was reached. Testing was performed in accordance with the following:

2015 NBC / 2012 BCBC / 2012 OBC / 2014 ABC:

Section 4.1.5.14 Loads on Guards and Handrails/ Loads on Guards

- 1) The minimum specified horizontal load applied inward or outward at the minimum required height of every guard shall be 0.75 kN/m or a concentrated load of 1.0 kN applied at any point.
- 2) Individual elements within the *guard*, including solid panels and pickets, shall be designed for a concentrated load of 0.5 kN applied over an area of 100 mm x 100 mm located at any point in the element or elements so as to produce the most critical effect.
- 3) The size of the opening between any two adjacent vertical elements within a *guard* shall not exceed 100 mm when each of these elements is subjected to a specified *live load* of 0.1 kN applied in opposite directions in the in-plane direction of the *guard* so as to produce the most critical effect. (2015 NBC only)
- 4) The minimum specified load applied vertically at the top of every required *guard* shall be 1.5 kN/m.
- 5) None of the loads specified above need be considered to act simultaneously.

Note: A safety factor of 1.67-2.5 was applied to the above loads.

2.3 Test Procedure (Continued)

2015 NBC / 2012 BCBC / 2012 OBC / 2014 ABC:

Section 9.8.8.2 Loads on Guards

- 1) The minimum specified horizontal load applied inward or outward at the minimum required height of every guard shall be 0.5 kN/m or a concentrated load of 1.0 kN applied at any point.
- 2) Individual elements within the *guard*, including solid panels and pickets, shall be designed for a concentrated load of 0.5 kN applied over an area of 300 mm x 300 mm located at any point in the element or elements so as to engage 3 balusters.
- 3) The minimum specified load applied vertically at the top of every required *guard* shall be 1.5 kN/m.
- 4) None of the loads specified above need be considered to act simultaneously.

Note: A safety factor of 1.67-2.5 was applied to the above loads.

2015 NBC / 2012 BCBC / 2012 OBC / 2014 ABC: Section 9.8.8.3 Height of Guards

- 1) All guards shall be not less than 1070 mm high.

2015 NBC / 2012 BCBC / 2012 OBC / 2014 ABC: Section 9.8.8.5 Openings in Guards

- 1) Openings through any guard shall be of a size that will prevent the passage of a spherical object having a diameter of 100 mm unless it can be shown that the location and size of openings that exceed this limit do not present a hazard.

2015 NBC / 2012 BCBC / 2012 OBC / 2014 ABC: Section 9.8.8.6 Design of Guards to Not Facilitate Climbing / Guards Designed Not to Facilitate Climbing

- 1) Guards except those in industrial occupancies and where it can be shown that the location and size of openings do not present a hazard, shall be designed so that no member, attachment or opening facilitates climbing.
- 2) Guards shall be deemed to comply with Sentence (1) where all elements protruding from the vertical and located within the area between 140 mm and 900 mm above the floor or walking surface protected by the guard conform to one of the following clauses:
 - a) they are located more than 450mm horizontally and vertically, or
 - b) they provide not more than 15 mm horizontal offset,
 - c) they do not provide a toe-space more than 45mm horizontally and 20 mm vertically, or
 - d) they present more than a 1-in-2 slope on the offset.

In-Fill Load Test

A load of 1.25 kN (281 lbs) was applied using a 100 mm x 100 mm square block on the center of the railing system normal to the in-fill. After release of the load, the system was evaluated for failure, any evidence of disengagements of any component and visible cracks in any component.

2.3 Test Procedure (Continued)

Uniform Load Test

A uniform load of 3.0 kN/m (205 plf) was applied vertically to the top of the guardrail system. A uniform load of 1.5 kN/m (103 plf) was applied horizontally to the top of the guardrail system. The loads were applied using quarter point loads. After release of the load, the system was evaluated for failure, any evidence of disengagements of any component and visible cracks in any component.

Concentrated Load Test

The top of the guardrail system was subjected to a concentrated load of 1.67 kN (375 lbs) which was applied horizontally at the midspan of the top of the guard, and at the rail end when the system evaluated included a wall mount bracket.

Height of Guards

All railings formed a protective barrier not less than 1070 mm (42 in.) high.

Openings in Guards

All railings had openings that prevented a sphere 4 in. (100 mm) in diameter to pass.

Design to Prevent Climbing

No member, attachment or opening located between 140 mm and 900 mm above the floor or walking surface protected by the guards facilitated climbing.

2015 NBC / 2012 BCBC / 2012 OBC / 2014 ABC: Section 9.6.1.3 Structural Sufficiency of Glass

Glass shall be designed in conformance with CAN/CGSB-12/20-M, "Structural Design of Glass for Buildings (Appendix A).

2.4 Test Results

The following tests were performed on the guardrail assemblies for the design load requirements of the codes referenced. Deflection and permanent set were component deflections relative to their end-points; they were not overall system displacements. Displacement reported in the data tables was recorded at applied load. All loads and displacement measurements were horizontal, unless noted otherwise.

Key to Test Results Tables:

Load Level: Target test load

Test Load: Actual applied load at the designated load level (target).

Elapsed Time (E.T.): The amount of time into the test with zero established at the beginning of the loading procedure.

2.4 Test Results (Continued)

Test Series No. 1

**PosiGlaze Surface Mount with 12.7 mm Monolithic Glass and Wall Mount Brackets
Guards within Dwelling Units / in Not More Than 2-Dwelling Units**

Test No. 1 - Test Date: 05/04/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.51	02:04	1.02

Test No. 2 - Test Date: 05/04/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.63	03:59	44.45

Test No. 3 - Test Date: 05/04/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.57	02:51	4.57

Test Series No. 2

**PosiGlaze Surface Mount with 12.7 mm Monolithic Glass
and Wall Mount Brackets (One Panel Removed)¹**

Guards within Dwelling Units / in Not More Than 2-Dwelling Units

¹ This series is intended to qualify both surface and side mount applications for evaluation of glass failure for all monolithic glass options for both models (PosiGlaze and SpigLite).

Test No. 1 - Test Date: 05/04/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Unsupported Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (in)
1.67 x 1.0 kN = 1.67 kN	2.24	01:23	49.78

2.4 Test Results (Continued)

Test Series No. 2 (Continued)

Test No. 2 - Test Date: 05/04/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Unsupported Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
1.67 x 1.0 kN = 1.67 kN	2.23	02:51	3.56

Test No. 3 - Test Date: 05/04/17 Design Load: 1.5 kN/m x 1.5 m = 2.25 kN Uniform Vertical Load Over Unsupported Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
1.67 x 2.25 kN = 3.76 kN	3.87	00:45	8.38

Test Series No. 3

PosiGlaze Surface Mount with 12.7 mm Laminated Glass and Wall Mount Brackets Guards in All-Use Locations

Test No. 1 - Test Date: 05/04/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.46	02:35	1.78

Test No. 2 - Test Date: 05/04/17 Design load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.56	03:35	69.60

Test No. 3 - Test Date: 05/04/17 Design Load: 1.5 kN/m x 3.06 m = 4.59 kN Uniform Vertical Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 4.59 kN = 11.48 kN	11.44	05:06	2.54

2.4 Test Results (Continued)

Test Series No. 3 (Continued)

Test No. 4 - Test Date: 05/04/17 Design Load: 0.75 kN/m x 3.06 m = 2.30 kN Uniform Horizontal Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.30 kN = 5.75 kN	9.01	12:26	32.26

Test Series No. 4 *PosiGlaze* Surface Mount with 12.7 mm Laminated Glass and Wall Mount Brackets (One Panel Broken) Guards in All-Use Locations

Test No. 1 - Test Date: 05/04/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.25	01:58	1.78

Test No. 2 - Test Date: 05/04/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.52	03:39	43.4

Test No. 3 - Test Date: 05/04/17 Design Load: 1.5 kN/m x 1.5 m = 2.25 kN Uniform Vertical Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.25 kN = 5.63 kN	5.73	02:53	0.51

2.4 Test Results (Continued)

Test Series No. 5
PosiGlaze Side Mount with 12.7 mm Laminated Glass and Wall Mount Brackets
Guards in All-Use Locations

Test No. 1 - Test Date: 05/18/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of Single Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.25	03:19	0.25

Test No. 2 - Test Date: 05/18/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.56	04:49	68.58

Test No. 3 - Test Date: 05/18/17 Design Load: 0.75 kN/m x 3.06 m = 2.30 kN Horizontal Uniform Load on Top Rail ¹			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.30 kN = 5.75 kN	8.85	03:28	15.49

¹ This test is intended to be used for evaluation of the Horizontal Uniform loading condition for the surface mount application.

Test No. 4 - Test Date: 05/22/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.56	03:11	6.10

Test No. 5 - Test Date: 05/22/17 Design Load: 1.5 kN/m x 3.06 m = 4.59 kN Vertical Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 4.59 kN = 11.48 kN	11.38	03:17	3.05

2.4 Test Results (Continued)

Test Series No. 6
PosiGlaze Side Mount with 12.7 mm in Laminated Glass
and Wall Mount Brackets (One Panel Broken)
Guards in All-Use Locations

Test No. 1 - Test Date: 05/22/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of Single Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.26	00:25	<0.1

Test No. 2 - Test Date: 05/18/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span Top Rail over Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.51	00:40	0.25

Test No. 3 - Test Date: 05/22/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail over Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.51	01:07	0.25

Test No. 4 - Test Date: 05/22/17 Design Load: 1.5 kN/m x 1.5 m = 2.25 kN Vertical Uniform Load on Top Rail over Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.25 kN = 5.63 kN	5.85	00:30	<0.1

2.4 Test Results (Continued)

Test Series No. 6 (Continued)

Test No. 5 - Test Date: 05/26/17 Design Load: 0.75 kN/m x 3.06 m = 2.30 kN Horizontal Uniform Load on Top Rail Across Both Panels ¹			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.30 kN = 5.75 kN	5.67	00:41	<0.1

¹ This test is intended to be used for evaluation of the Horizontal Uniform loading condition for the surface mount application.

Test No. 6 - Test Date: 05/26/17 Design Load: 0.75 kN/m x 1.5 m = 1.13 kN Horizontal Uniform Load at Top Rail Across Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.13 kN = 2.83 kN	2.80	00:51	16.76

Test Series No. 7

PosiGlaze Surface Mount with 22.2 mm Laminated Glass -
Rail Ends Unrestrained, Single Panel Assembly
Guards in All-Use Locations

Test No. 1 - Test Date: 05/02/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of Single Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.26	03:17	0.51

Test No. 2 - Test Date: 05/02/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.57	05:57	83.57

2.4 Test Results (Continued)

Test Series No. 7 (Continued)

Test No. 3 - Test Date: 05/02/17 Design Load: 1.5 kN/m x 1.5 m = 2.25 kN Vertical Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.25 kN = 5.63 kN	5.72	02:12	0.00

Test Series No. 8 *PosiGlaze* Surface Mount with 22.2 mm Laminated Glass - Rail Ends Unrestrained (One Panel Broken) Guards in All-Use Locations

Test No. 1 - Test Date: 05/03/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.26	03:41	1.27

Test No. 2 - Test Date: 05/03/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail at Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.51	05:11	80.26

Test No. 3 - Test Date: 05/03/17 Design Load: 1.5 kN/m x 1.5 m = 2.25 kN Vertical Uniform Load on Top Rail Over Broken Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.25 kN = 5.63 kN	5.97	03:20	1.78

2.4 Test Results (Continued)

Test Series No. 9
PosiGlaze Side Mount with 22.2 mm Laminated Glass -
Rail Ends Unrestrained, Single Panel Assembly
Guards in All-Use Locations

Test No. 1 - Test Date: 05/24/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.50	03:01	0.51

Test No. 2 - Test Date: 05/24/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.57	04:44	132.33

Test No. 3 - Test Date: 05/25/17 Design Load: 1.5 kN/m x 1.07 m = 1.61 kN Vertical Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.61 kN = 4.03 kN	4.01	02:26	4.57

Test No. 4 - Test Date: 05/24/17 Design Load: 0.75 kN/m x 1.07 m = 0.80 kN Inward Horizontal Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.80 kN = 2.0 kN	3.04 ¹	01:18	75.18

¹ At the reported test load, the glass broke. The test load exceeded the requirement.

2.4 Test Results (Continued)

Test Series No. 10

SpigLite with 12.7 mm Laminated Glass and Wall Mount Brackets
Guards within Dwelling Units / in Not More Than 2-Dwelling Units

Test No. 1 - Test Date: 05/05/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.27	03:30	1.52

Test No. 2 - Test Date: 05/05/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.55 ¹	05:34	73.79

¹ At the reported test load, the glass broke. The test load exceeded the requirement.

Test No. 3 - Test Date: 05/05/17 Design Load: 1.0 kN Horizontal Concentrated Load at Rail End			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.52	01:00	10.16

Test No. 4 - Test Date: 05/05/17 Design Load: 1.5 kN/m x 3.06 m = 4.59 kN Vertical Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 4.59 kN = 11.48 kN	11.41	00:59	0.25

Test Series No. 11

SpigLite with 12.7 mm Monolithic Glass and Wall Mount Brackets
Guards within Dwelling Units / in Not More Than 2-Dwelling Units

Test No. 1 - Test Date: 05/08/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.31	01:15	0.76

2.4 Test Results (Continued)

Test Series No. 11 (Continued)

Test No. 2 - Test Date: 05/08/17 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.51	01:06	36.32

Test No. 3 - Test Date: 05/08/17 1.0 kN Horizontal Concentrated Load at Rail End			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	2.52	00:51	10.41

Test No. 4 - Test Date: 05/08/17 Design Load: 1.5 kN/m x 3.06 m = 4.59 kN Vertical Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	11.47	01:01	<0.1

Test Series No. 12

PosiGlaze Side Mount with 12.7 mm Monolithic Glass and Wall Mount Brackets
Guards within Dwelling Units / in Not More Than 2-Dwelling Units

Test No. 1 - Test Date: 05/23/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.25	03:28	0.51

Test No. 2 - Test Date: 05/23/17 Design Load: 1.0 kN Horizontal Concentrated Load at Mid-Span of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.56	04:00	41.15

2.4 Test Results (Continued)

Test Series No. 12 (Continued)

Test No. 3 - Test Date: 05/23/17 1.0 kN Horizontal Concentrated Load at Rail End			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.56	03:01	5.84

Test No. 4 - Test Date: 05/23/17 Design Load: 1.5 kN/m x 3.06 m = 4.59 kN Vertical Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 4.59 kN = 11.48 kN	11.38	04:01	<0.1

Test Series No. 13 *PosiGlaze* Surface Mount with 19.1 mm Monolithic Glass - Rail Ends Unrestrained, Single Panel Assembly Guards in All-Use Locations

Test No. 1 - Test Date: 05/30/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.29	02:59	1.02

Test No. 2 - Test Date: 05/30/17 1.0 kN Horizontal Concentrated Load at End of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.57	04:16	56.39

Test No. 3 - Test Date: 05/30/17 Design Load: 1.5 kN/m x 1.5 m = 2.25 kN Uniform Vertical Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 2.25 kN = 5.63 kN	5.73	02:56	1.02

2.4 Test Results (Continued)

Test Series No. 14
PosiGlaze Side Mount with 19.1 mm Monolithic Glass -
Rail Ends Unrestrained, Single Panel Assembly
Guards in All-Use Locations

Test No. 1 - Test Date: 05/23/17 Design Load: 0.5 kN Applied Over 300 mm Square Area of Infill at Bottom of One Panel			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.5 kN = 1.25 kN	1.25	03:23	1.27

Test No. 2 - Test Date: 05/23/17 Design Load: 1.0 kN Horizontal Concentrated Load at End of Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.0 kN = 2.5 kN	3.57	04:48	116.59

Test No. 3 - Test Date: 05/23/17 Design Load: 1.5 kN/m x 1.07 m = 1.61 kN Uniform Vertical Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 1.61 kN = 4.03 kN	4.25	07:54	0.38

Test No. 4 - Test Date: 05/23/17 Design Load: 0.75 kN/m x 1.07 m = 0.80 kN Inward Horizontal Uniform Load on Top Rail			
Load Level	Applied Load (kN)	E. T. (min:sec)	Displacement (mm)
2.5 x 0.80 kN = 2.0 kN	3.11	05:51	51.56

2.5 Summary and Conclusions

Series/Model	Glass Panel Configuration ¹	Wall Mount	Code Occupancy Classification
<i>PosiGlaze</i> Side Mount	1499 mm long x 12.7 mm thick Monolithic	Yes	Within Dwelling Units / in Not More Than 2-Dwelling Units
<i>SpigLite</i>	1499 mm long x 12.7 mm thick Laminated		
	1499 mm long x 12.7 mm thick Monolithic		
<i>PosiGlaze</i> Surface Mount	1499 mm long x 12.7 mm thick Monolithic	No	All-Use Locations
	1499 mm long x 22.2 mm thick Laminated	Yes	
	1499 mm long x 12.7 mm thick Laminated		
	1499 mm long x 19.1 mm in thick Monolithic		
<i>PosiGlaze</i> Side Mount	1067 mm long x 19.1 mm thick Monolithic	No	
	1067 mm long x 22.2 mm thick Laminated		
	1499 mm long x 12.7 mm thick Laminated	Yes	

¹ All systems measured 1067 mm (42 in) high from surface of the deck to the top of the top rail.

The railing and its connections to the supporting structure (where applicable) withstood the required test loads after failure (with glass removed or broken).

The railing supports for wall mount applications were not included within the scope of this testing, and were included to facilitate anchorage of the rail brackets. These conclusions would apply only for a railing that is installed between adequate supports.

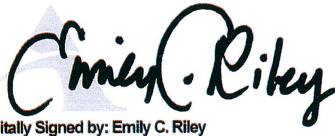
The *PosiGlaze* Side Mount system with 1067 mm long x 22.2 mm thick laminated glass, as well as both systems utilizing 19.1 mm thick monolithic glass, were not evaluated for glass failure. Additional testing would need to be performed to satisfy building code requirements for these systems for installation without wall mount brackets.

3.0 Closing Statement

Intertek-ATI 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 Intertek-ATI for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. 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 specimens tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For INTERTEK-ATI:



Digitally Signed by: Emily C. Riley

Emily C. Riley
Project Manager




Digitally Signed by: Virgal Thomas Mickley, Jr.

Virgal T. Mickley, Jr., P.E.
Senior Staff Engineer



2017.10.18 16:15:09 -04'00'



Kai Kooner, P.E.
Director, Evaluation Services



2017.10.20
11:03:15 -07'00'



Dan Lungu, P.E.
Engineer

ECR:vtm/aaa

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A - Drawings (24)
Appendix B - Photographs (5)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	10/18/17	N/A	Original report issue



G9513.04-119-19

APPENDIX A

Drawings

DO NOT SCALE DRAWING		REVISION
Purevista		
TITLE: Posiglaze with Side Cladding & Top Seal		
DWG NO.	25-10-16	A4
SCALE: 1:20	SHEET 1 OF 1	

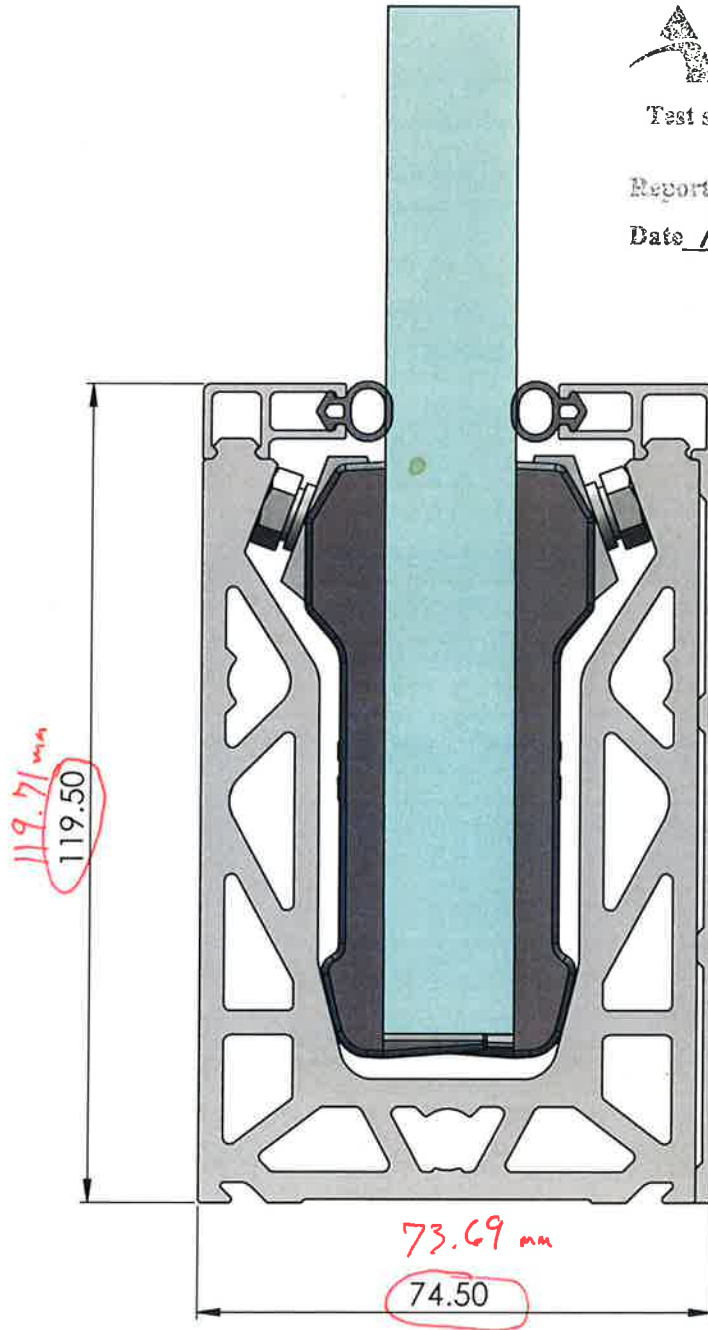


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-8-17 Tech ARB



DO NOT SCALE DRAWING

REVISION

TITLE:

Purevista

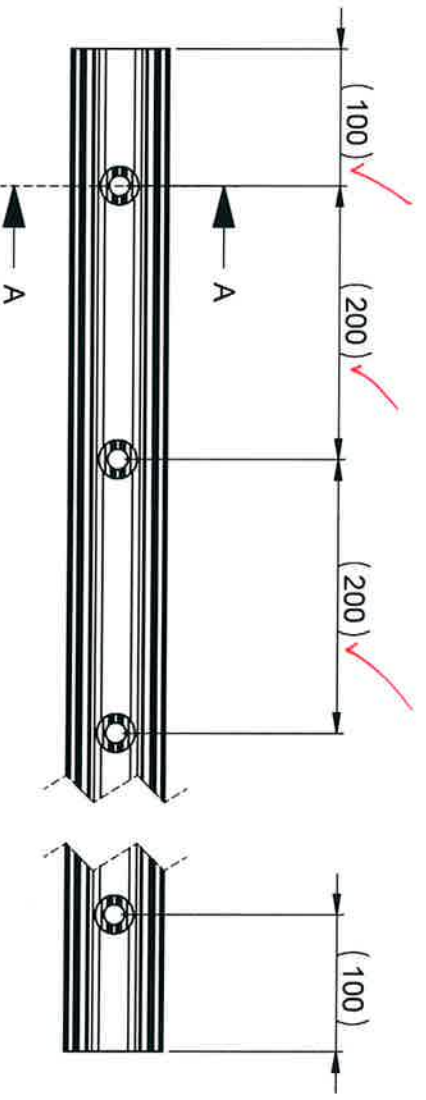
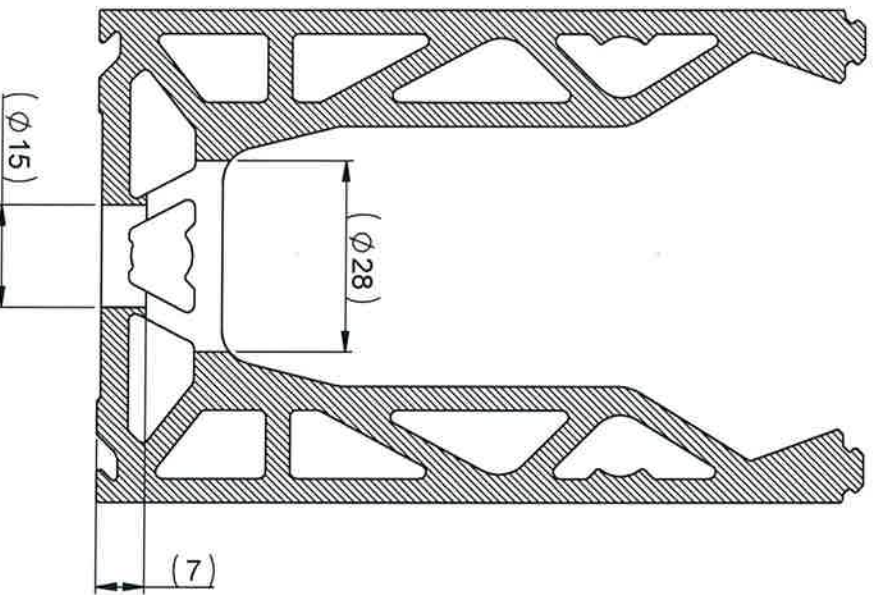
G2623 Channel Base Drilling

DWG NO.

A4

SCALE: 1:10

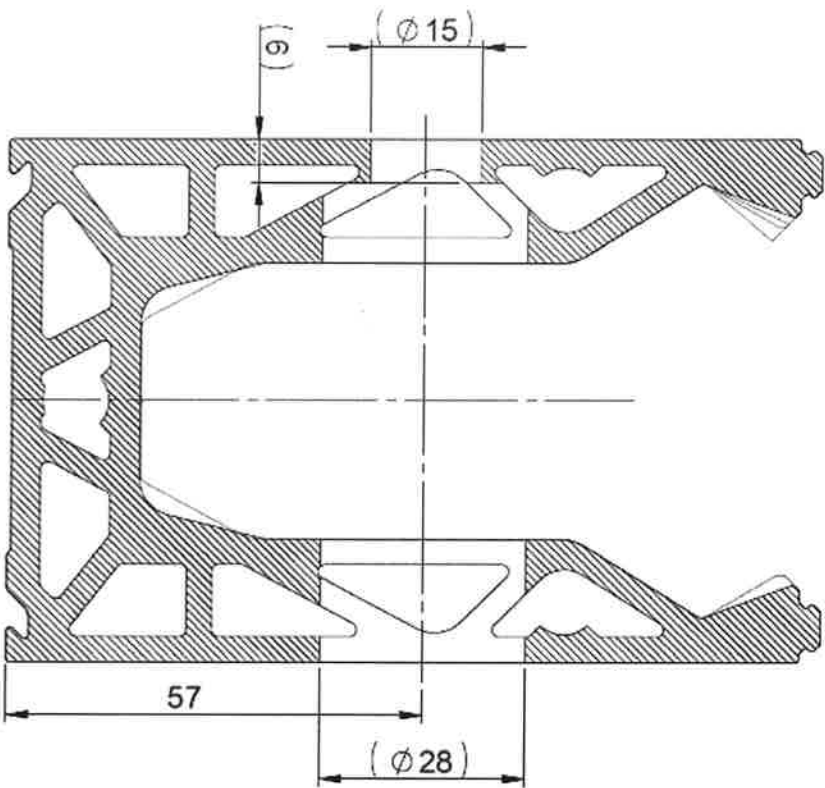
SHEET 1 OF 2



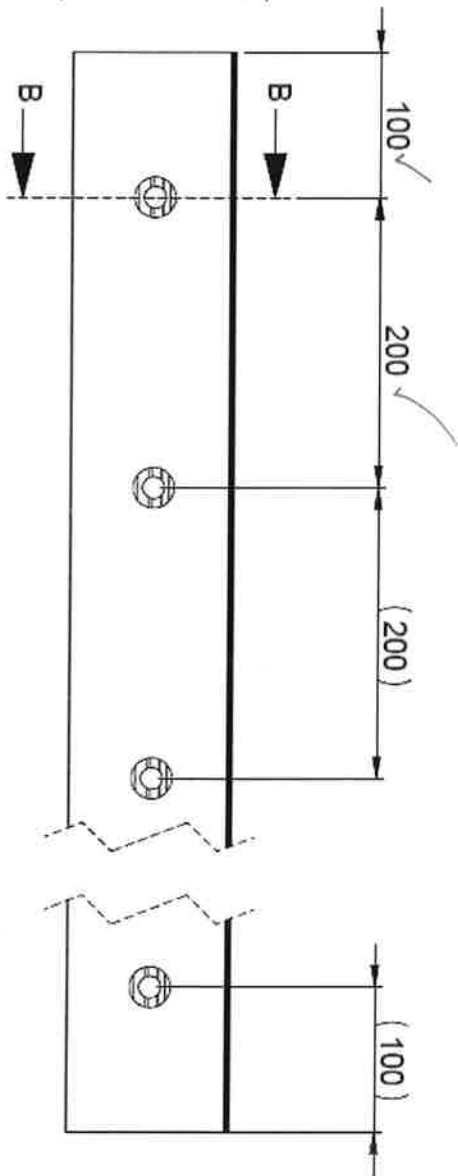
Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



SECTION B-B
SCALE 1:1



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 685/3

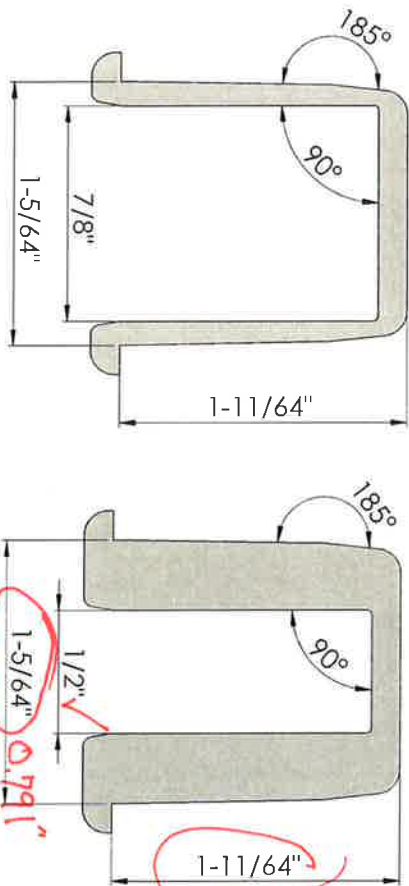
Date 10/8-17 Tech ARB



Title	
PureVista USA Testing Documentation	
Handrail Inner Liner	
DWG NO	HR_02
	A4

Handrail Plastic Liner

NOT TO SCALE
Approximate Imperial Dimensions



Profile for Plastic Handrail Liner,
7/8" Glass

Profile for Plastic Handrail Liner,
1/2" Glass



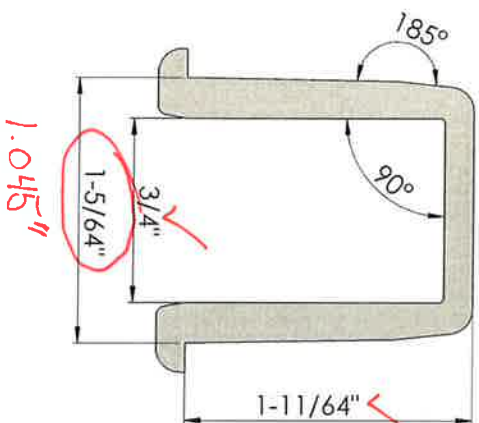
Architectural Testing

Test sample complies with these details.
Deviations are noted.

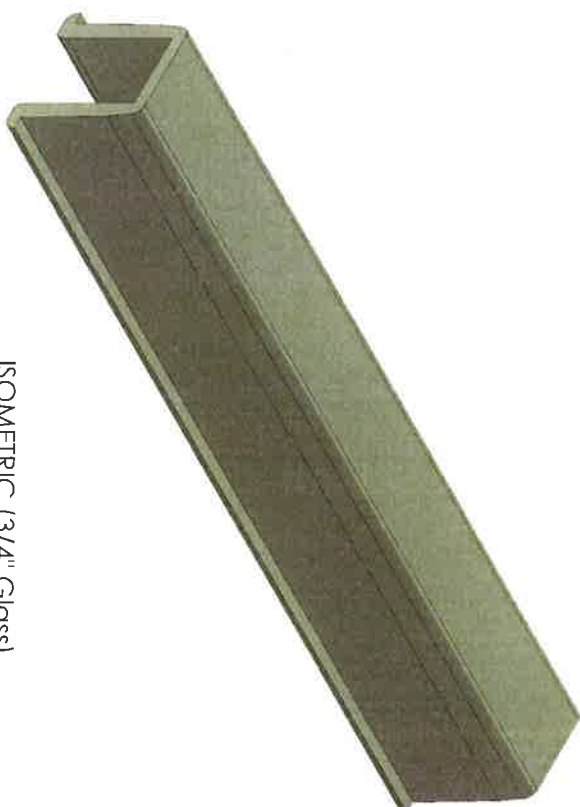
Report # 69513

Date 10-18-17 Tech ARB

Profile for Plastic Handrail Liner for
3/4" Glass



ISOMETRIC (3/4" Glass)



RIGHT VIEW (3/4" Glass)

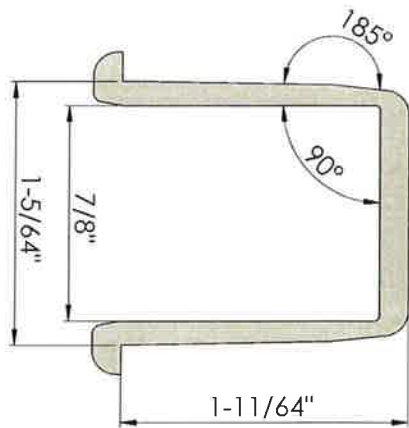




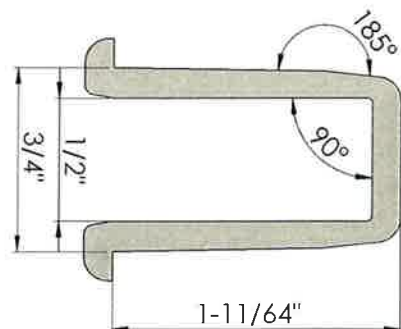
PureVista USA Testing Documentation	
Title	Handrail Inner Liner
DWG NO	HR_02
	A4

Handrail Plastic Liner

NOT TO SCALE
Approximate Imperial Dimensions



Profile for Plastic Handrail Liner,
7/8" Glass



Profile for Plastic Handrail Liner,
1/2" Glass



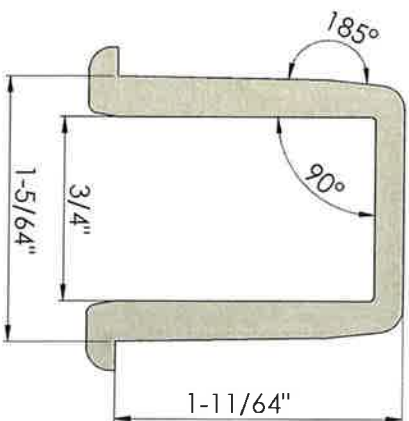
Architectural Testing

Test sample complies with these details.
Deviations are noted.

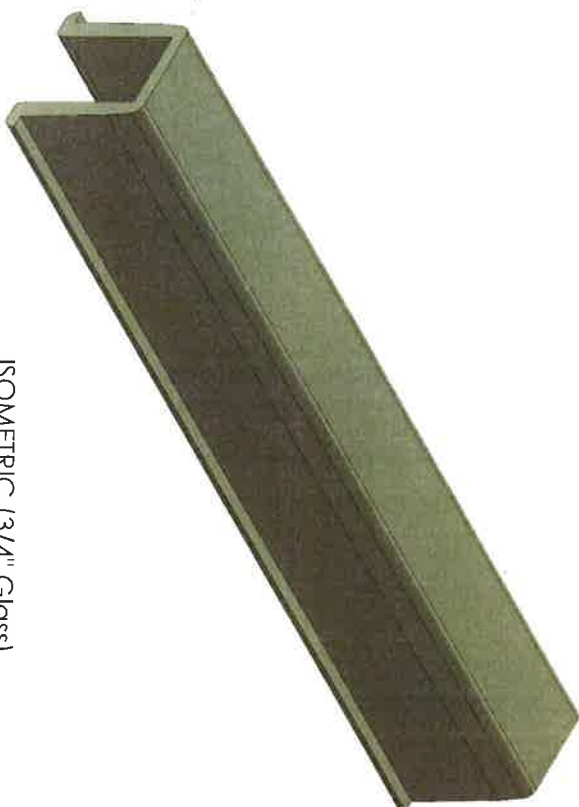
Report # 69513

Date 10-18-17 Tech ARR

Profile for Plastic Handrail Liner for
3/4" Glass



ISOMETRIC (3/4" Glass)



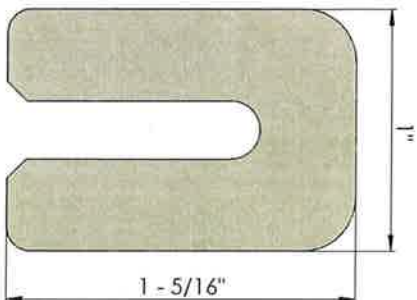
RIGHT VIEW (3/4" Glass)



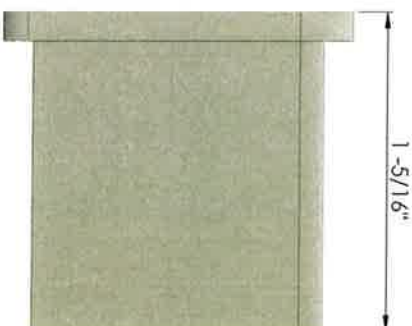
TOP VIEW



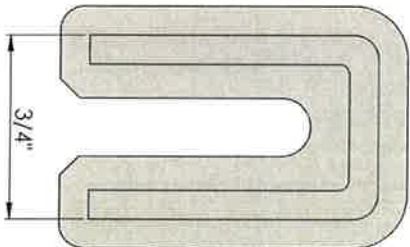
FRONT VIEW



RIGHT VIEW



BACK VIEW



PureVista USA Testing Documentation		
TITLE		
Handrail End Cap - 1/2"		
DWG NO	HR_05	A4

NOT TO SCALE

Approximate Imperial Dimensions

Stainless Steel

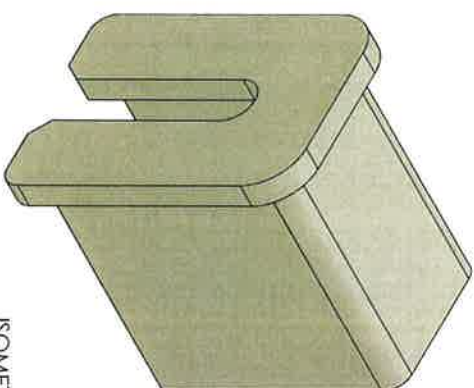


Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARL

ISOMETRIC



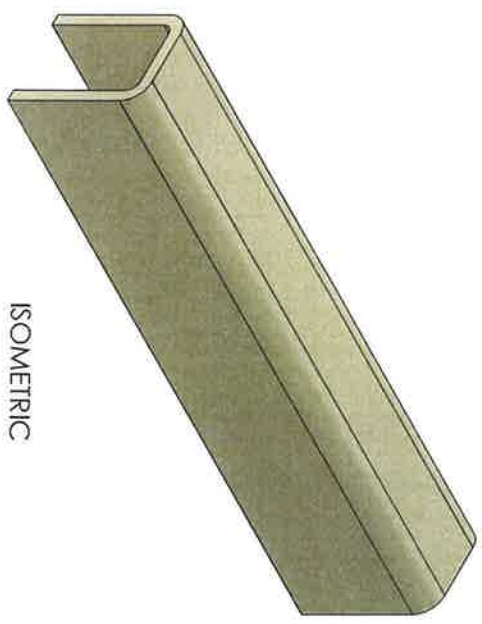


PureVista USA Testing Documentation	
TITLE	
Handrail Outer - 1/2" Glass	
DWG NO	HR_06
	A4

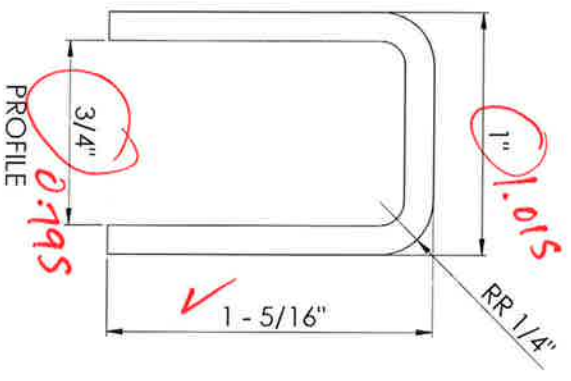
NOT TO SCALE

Brushed Stainless Steel Handrail

Approximate Imperial Dimensions



ISOMETRIC

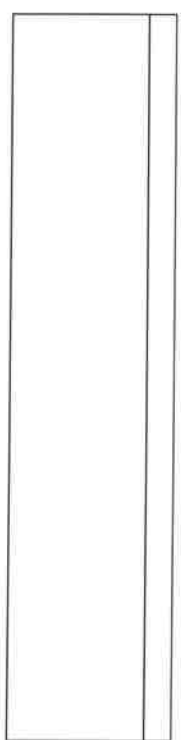


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



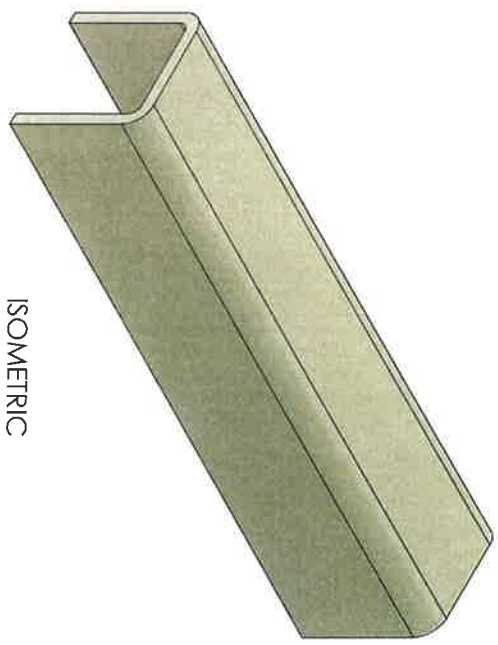
RIGHT VIEW



PureVista USA Testing Documentation	
TITLE	
Handrail Outer - Universal	
DWG NO	HR_01
	A4

Brushed Stainless Steel Handrail
Approximate Imperial Dimensions

NOT TO SCALE



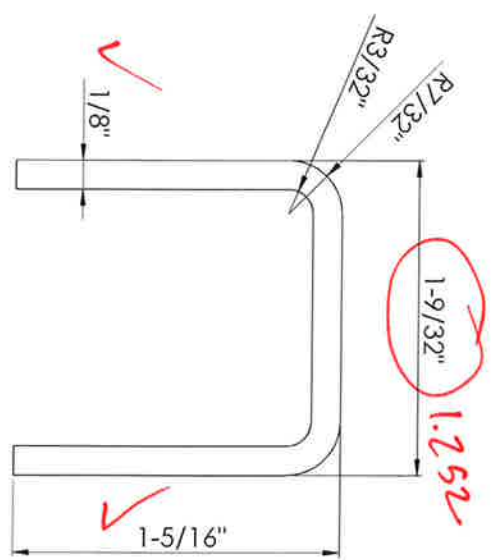
ISOMETRIC



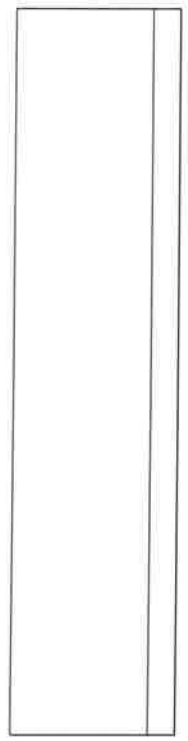
Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



PROFILE



RIGHT VIEW

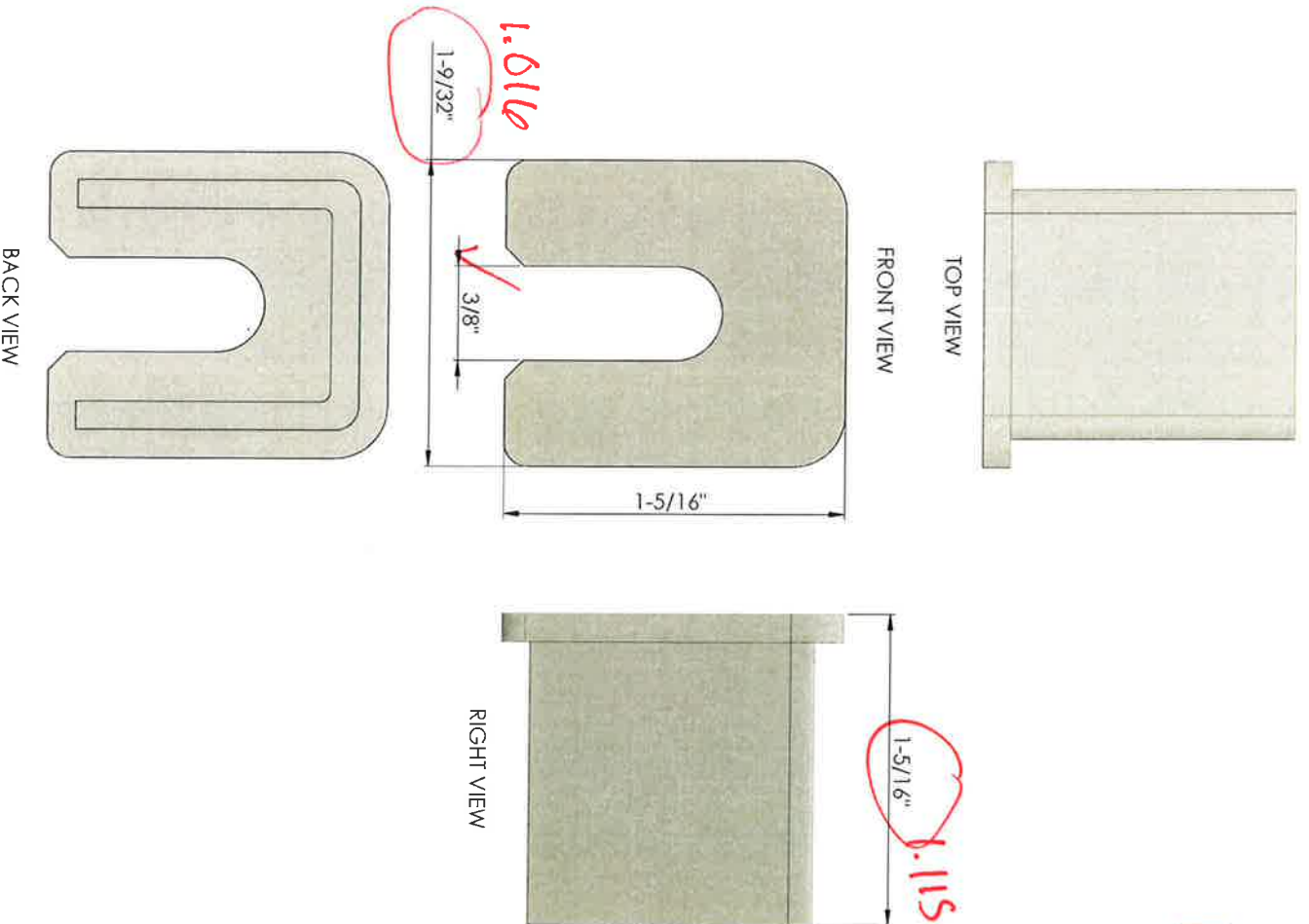


PureVista USA Testing Documentation	
Handrail End Cap	
DWG NO	HR_04
	A4

NOT TO SCALE

Approximate Imperial Dimensions

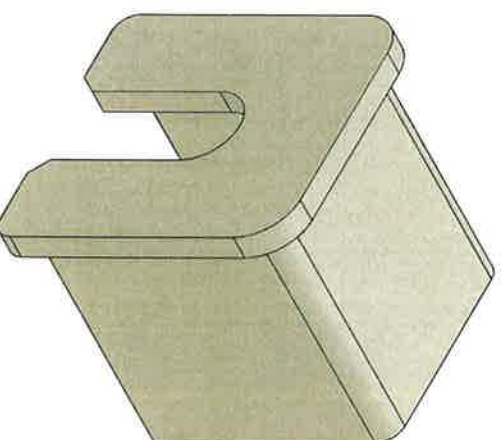
Stainless Steel



Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



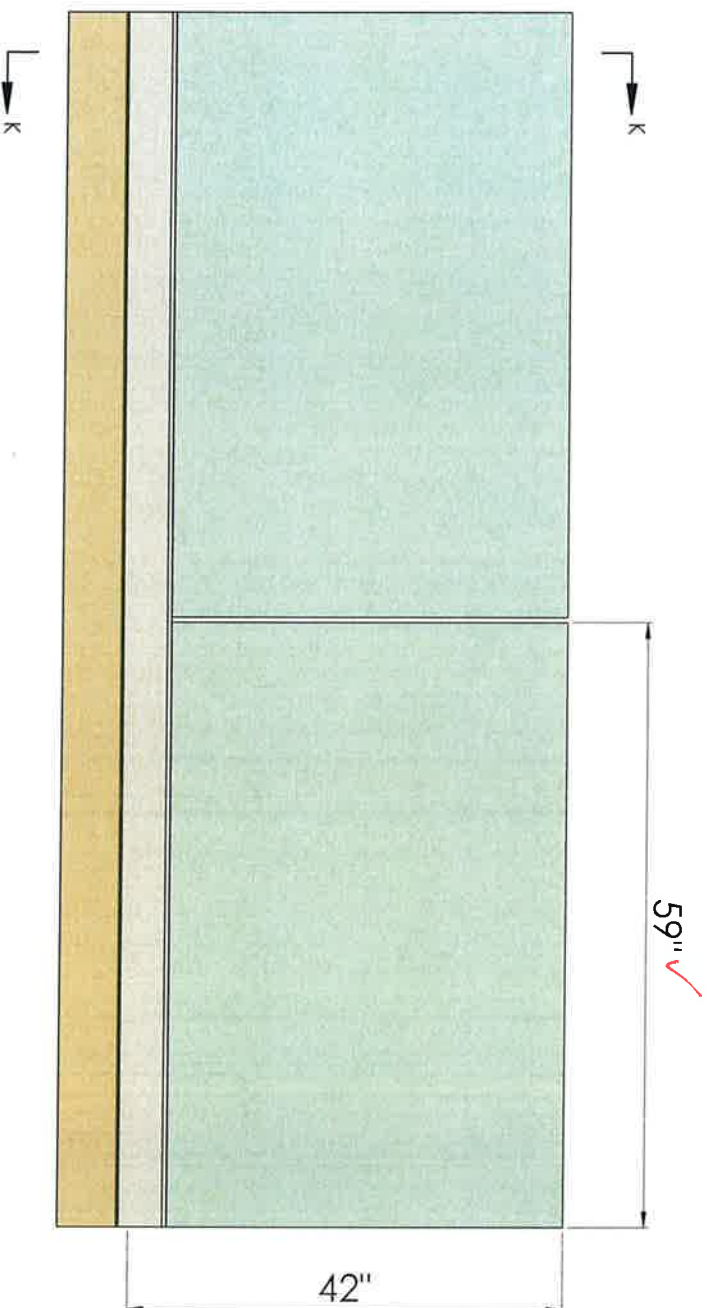
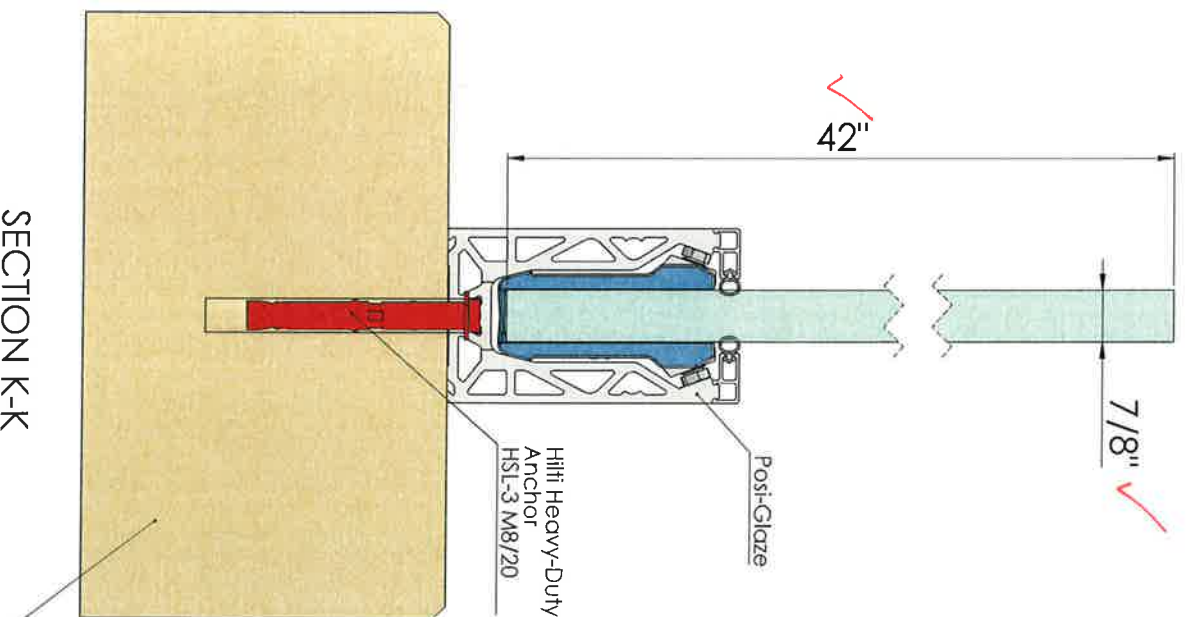
ISOMETRIC



PureVista USA Testing Documentation		
TITLE	PosiGlaze - Concrete mounted.	
DWG NO.	POS_04	A4

NOT TO SCALE

Setup 1 - 7/8" Toughened Laminated Glass, PVB Interlayer.



Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB

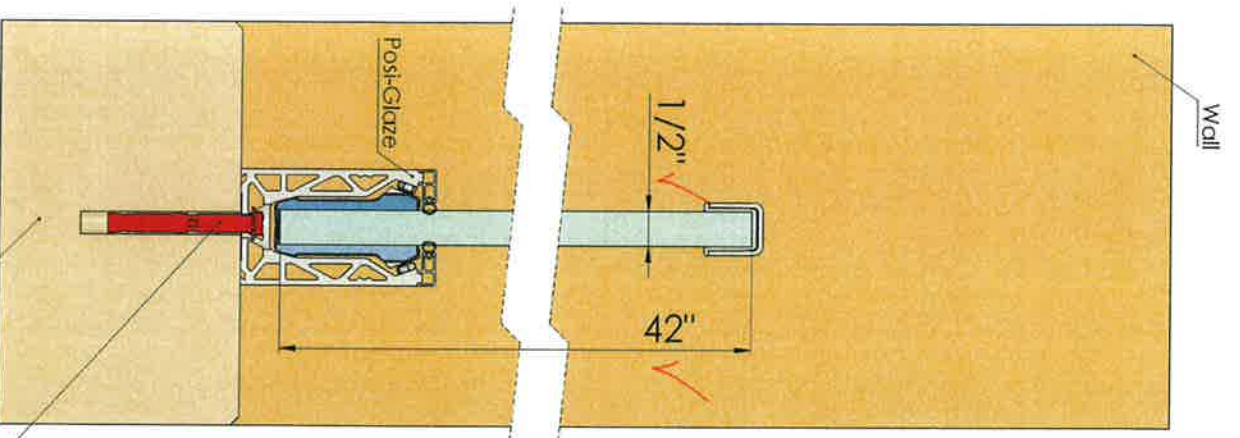


Title		PureVista USA Testing Documentation
Description		PostGlaze - Concrete mounted, fixed handrail.
DWG NO	POST_05	A4

NOT TO SCALE

Setup 1 - 1/2" Monolithic Glass.

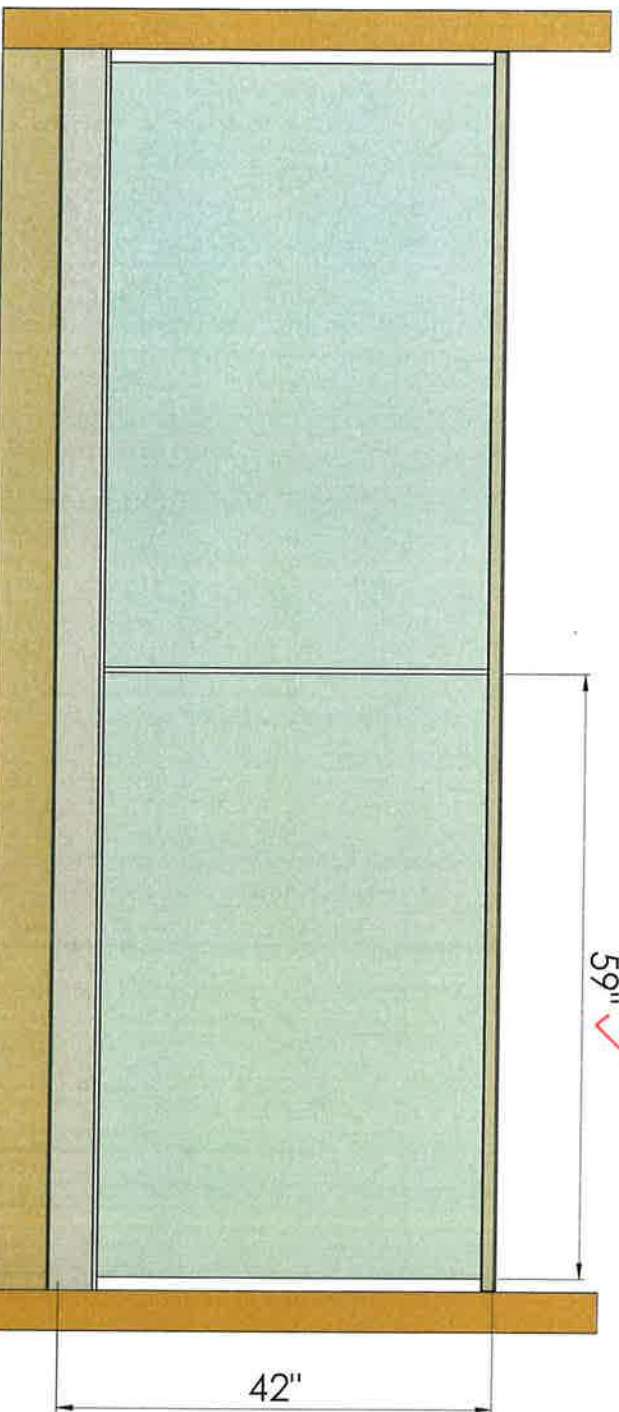
Setup 2 - 1/2" Toughened Laminated Glass, PVB interlayer.



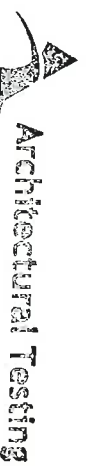
SECTION L-L

Concrete

Hilti Heavy-Duty Anchor
HSL-3 M8/20



FRONT VIEW



Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB

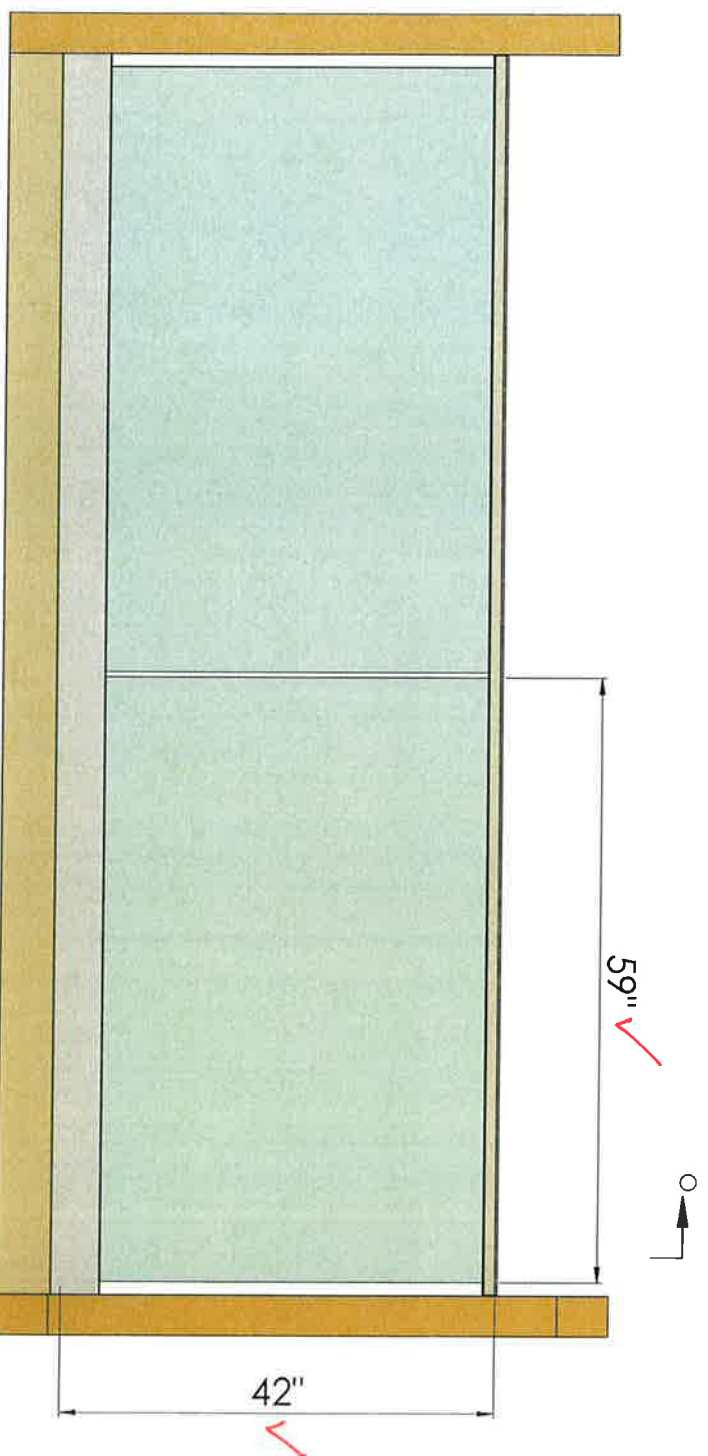
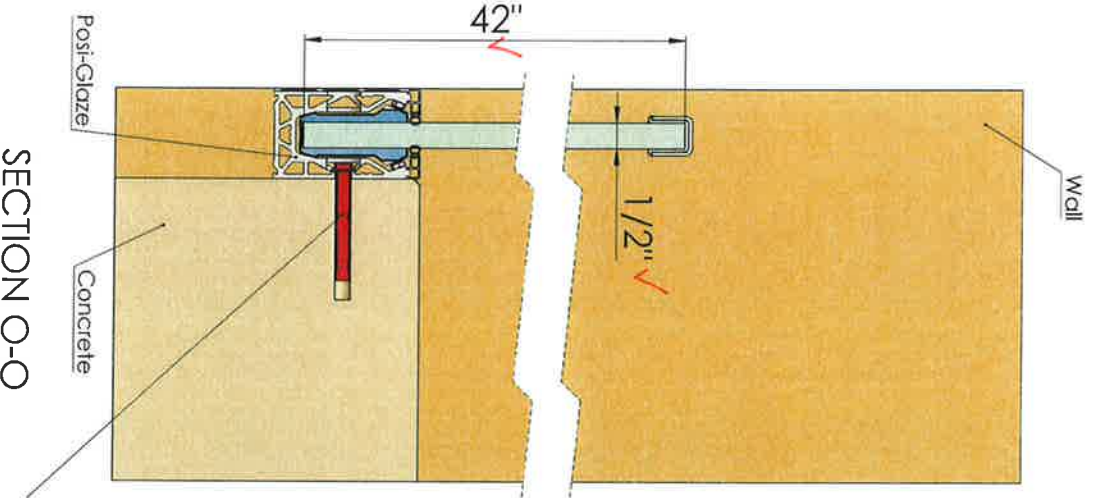


PureVista USA Testing Documentation	
TITLE	PosiGlaze - Concrete side-mounted, fixed handrail.
DWG NO	POS_06
	A4

NOT TO SCALE

Setup 1 - 1/2" Monolithic Glass.

Setup 2 - 1/2" Toughened Laminated Glass, PVB interlayer.



FRONT VIEW



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



Architectural Testing

Test sample complies with these details.

Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



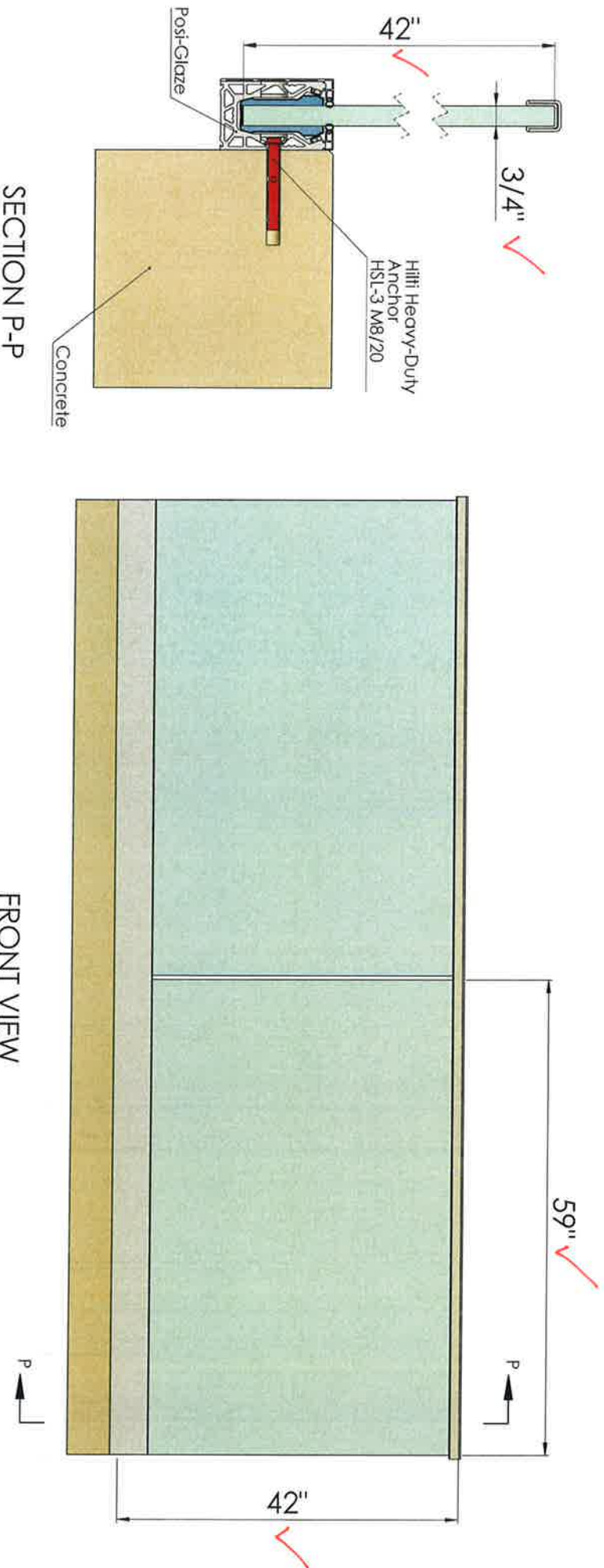
PUREVISTA

SHEET 8 OF 12

Title		PureVista USA Testing Documentation
Description		PosiGlaze - Concrete, side-mounted, handrail.
Drawn by	POSL07	A4

NOT TO SCALE

Setup 1 - 3/4" Monolithic Glass.





Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 69513

Date 10-18-17 Tech ARB



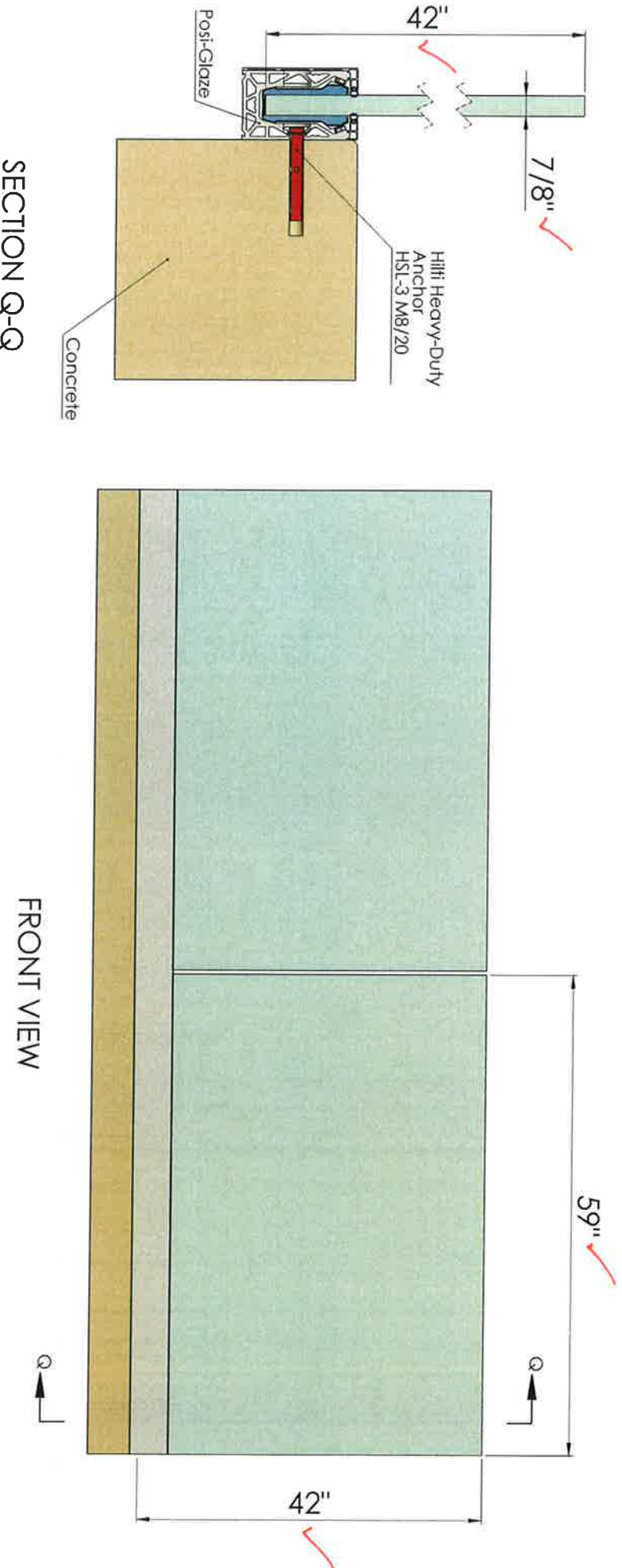
PUREVISTA

SHEET 9 OF 12

Title		PureVista USA Testing Documentation
Description		PosiGlaze - Concrete side-mounted.
Drawn By	POSL08	A4

NOT TO SCALE

Setup 1 - 7/8" Toughened Laminated Glass, PVB Interlayer.



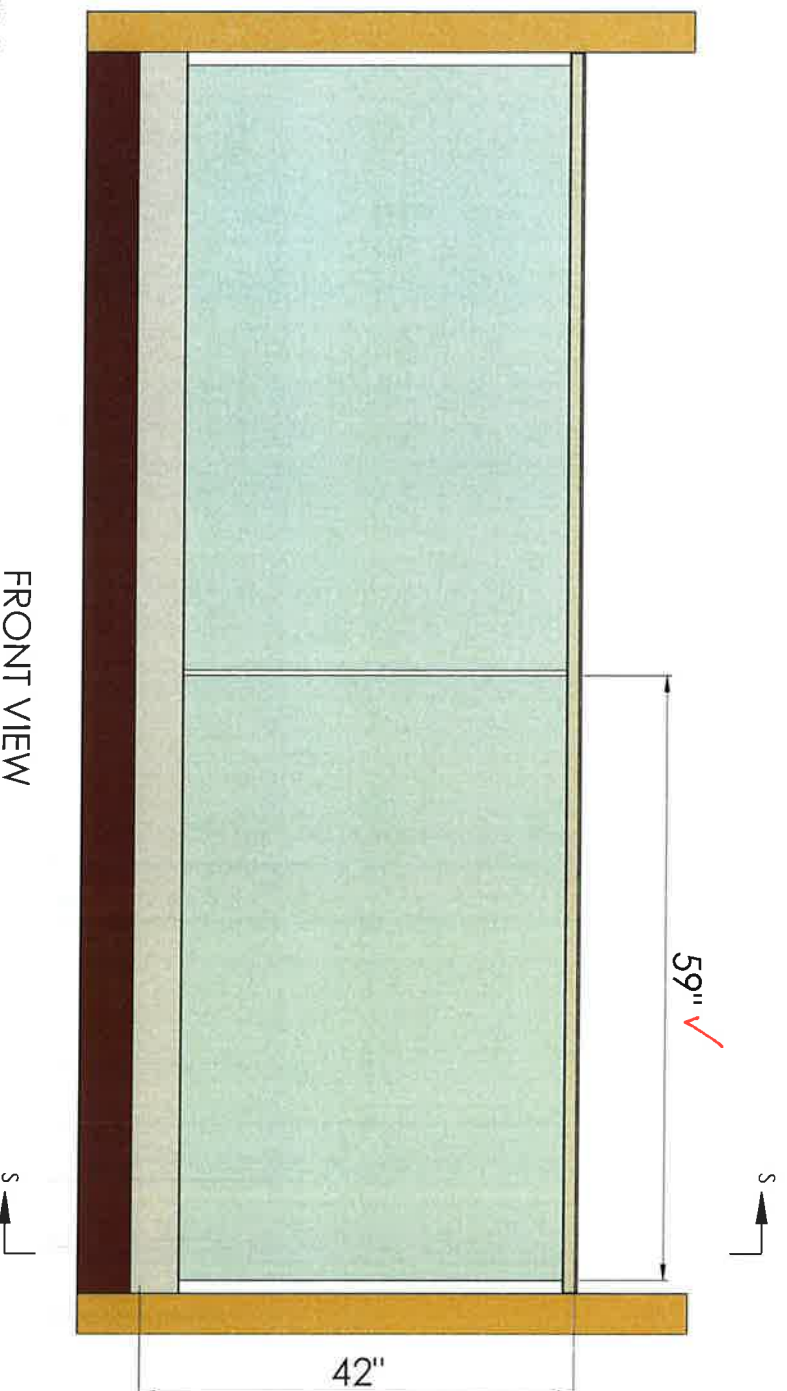
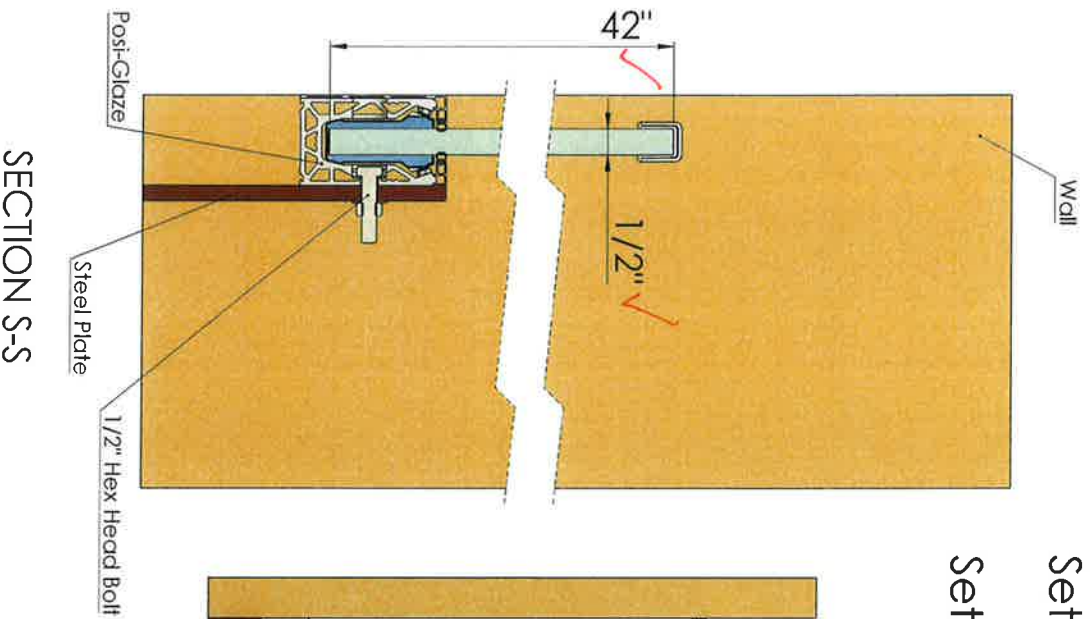


PureVista USA Testing Documentation	
TITLE	
PosiGlaze - Steel side-mounted, fixed handrail.	
DWG NO	POS1_09
	A4

NOT TO SCALE

Setup 1 - 1/2" Monolithic Glass.

Setup 2 - 1/2" Toughened Laminated Glass, PVB interlayer.

**Architectural Testing**

Test sample complies with these details.
Deviations are noted.

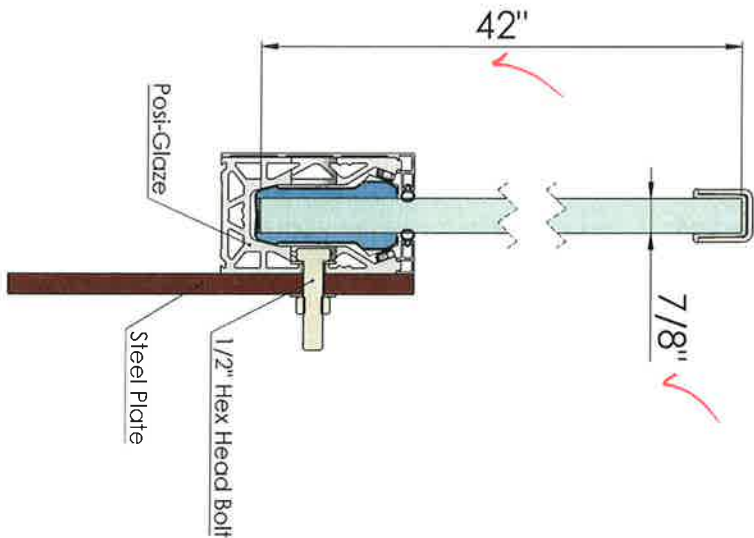
Report # 69513Date 10-18-17 Tech ARB



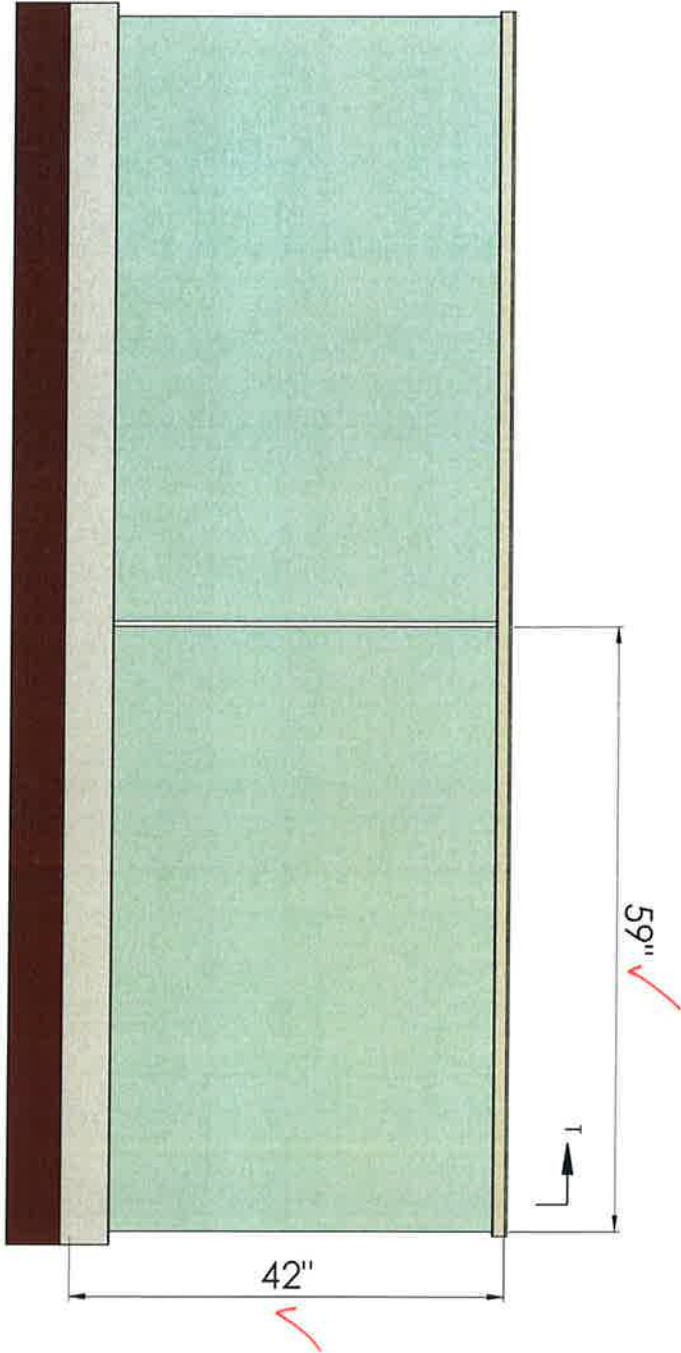
PureVista USA Testing Documentation		
TITLE		
PosiGlaze - Steel side-mounted, handrail.		
DRAWING NO.	POS_10	A4

NOT TO SCALE

Set up 1 - 7/8" Toughened Laminated Glass, PVB Interlayer.



SECTION T-T



FRONT VIEW



Test sample complies with these details.
Deviations are noted.

Report # 69513

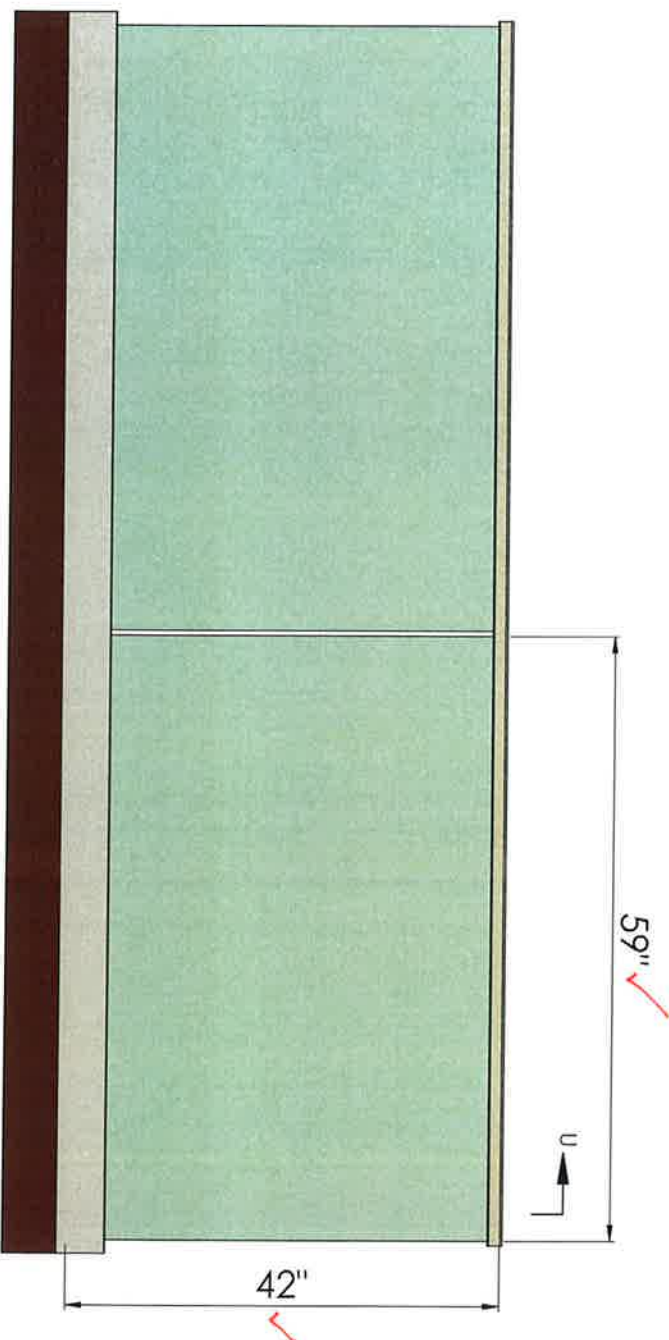
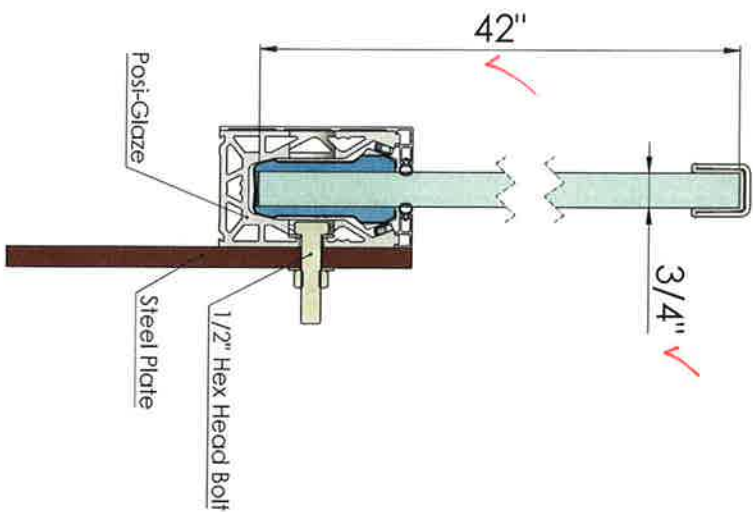
Date 10-18-17 Tech ARB



PureVista USA Testing Documentation	
TITLE	PosiGlaze - Steel side-mounted, handroll.
DWG NO.	POSL_11
	A4

NOT TO SCALE

Setup 1 - 3/4" Monolithic Glass



FRONT VIEW

SECTION U-U



Test sample complies with these details.
Deviations are noted.

Report # 68513

Date 10-18-17 Tech ARR

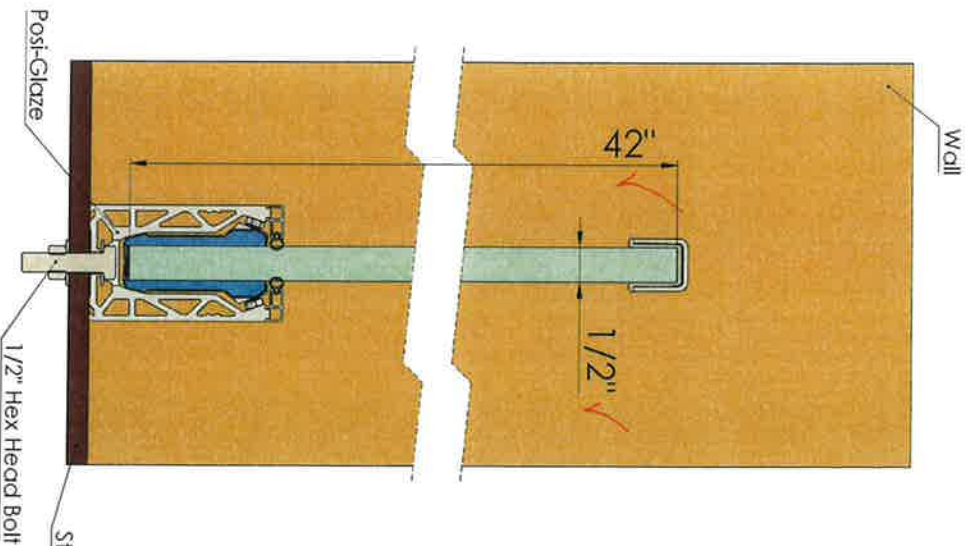


Title PureVista USA Testing Documentation	
PosiGlaze - Steel mounted, fixed handrail.	
DWG NO POSL_01	A4

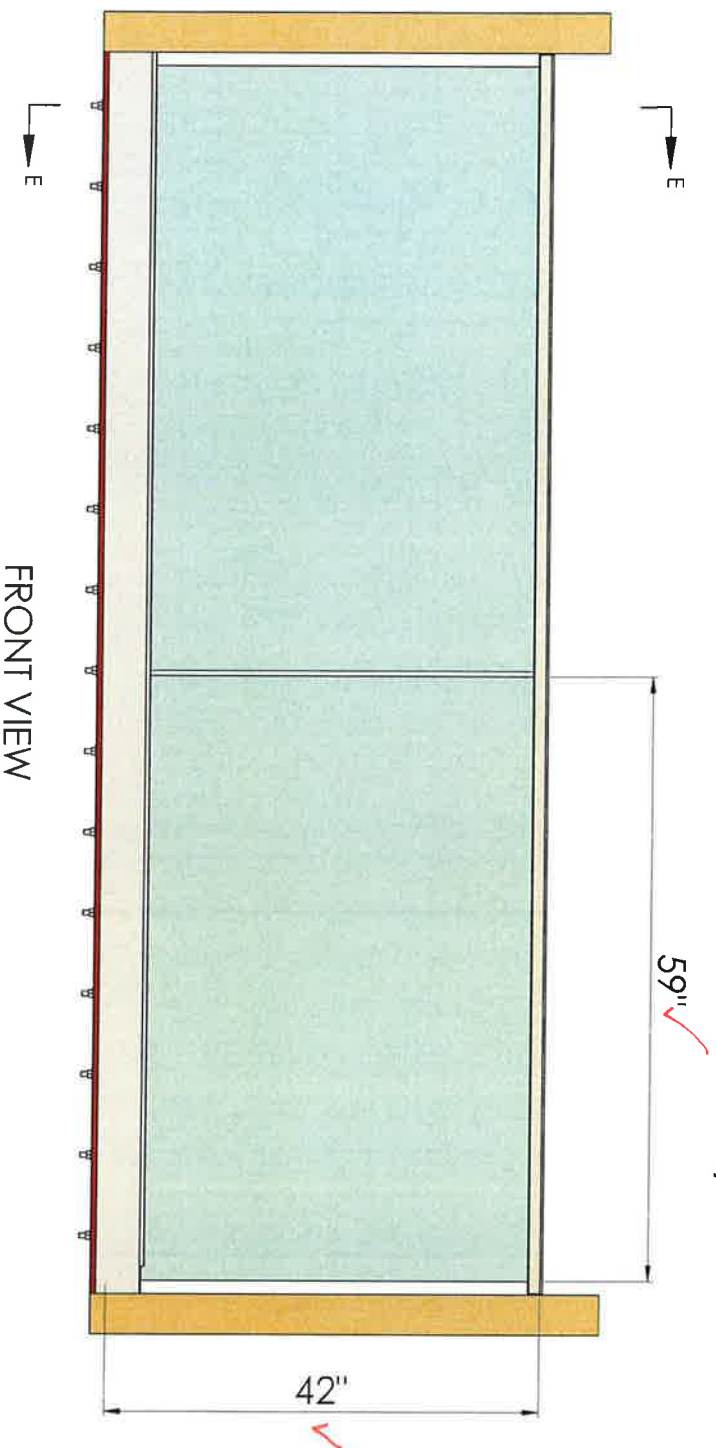
NOT TO SCALE

Setup 1 - 1/2" Monolithic Glass.

Setup 2 - 1/2" Toughened Laminated Glass, PVB interlayer.



SECTION E-E



FRONT VIEW



Architectural Testing

Test sample complies with these details.
Deviations are noted.Report # 69513Date 10-18-17 Tech ARB



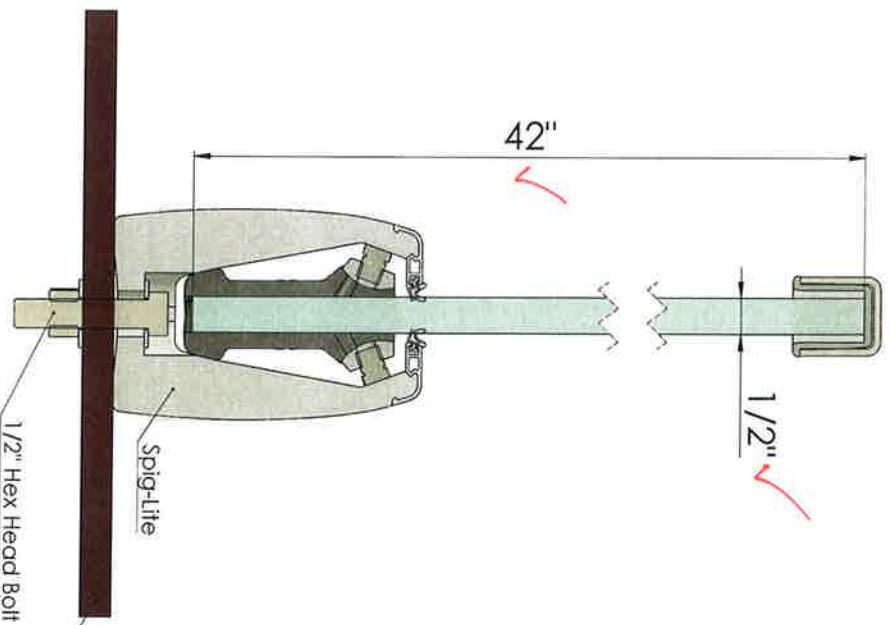
PureVista USA Testing Documentation		
FILE	Spig-Lite Pro - Steel Mounted, handrail.	
DWG NO	SPIG_01	A4

NOT TO SCALE

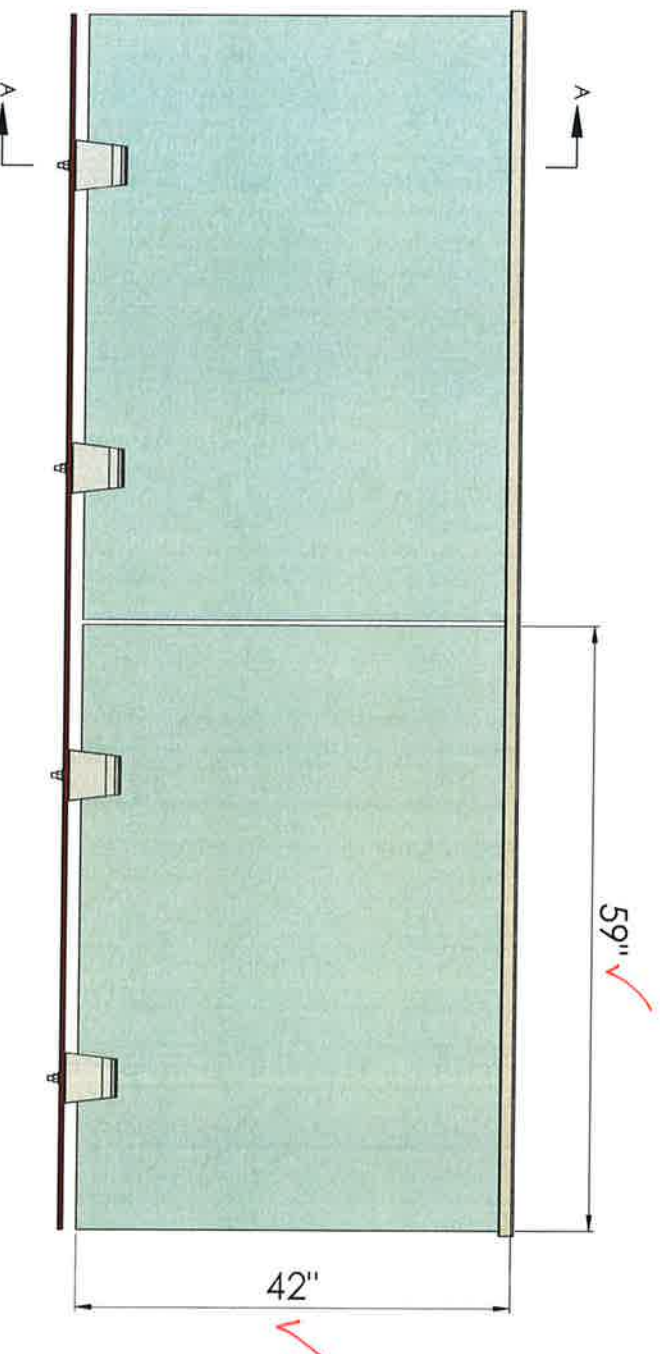
Setup 1 - 1/2" Monolithic Glass.

Setup 2 - 1/2" Toughened Laminated Glass, PVB interlayer.

SECTION A-A



FRONT VIEW



Test sample complies with these details.
Deviations are noted.

Report # 69513.

Date 10-16-17 Tech ARB

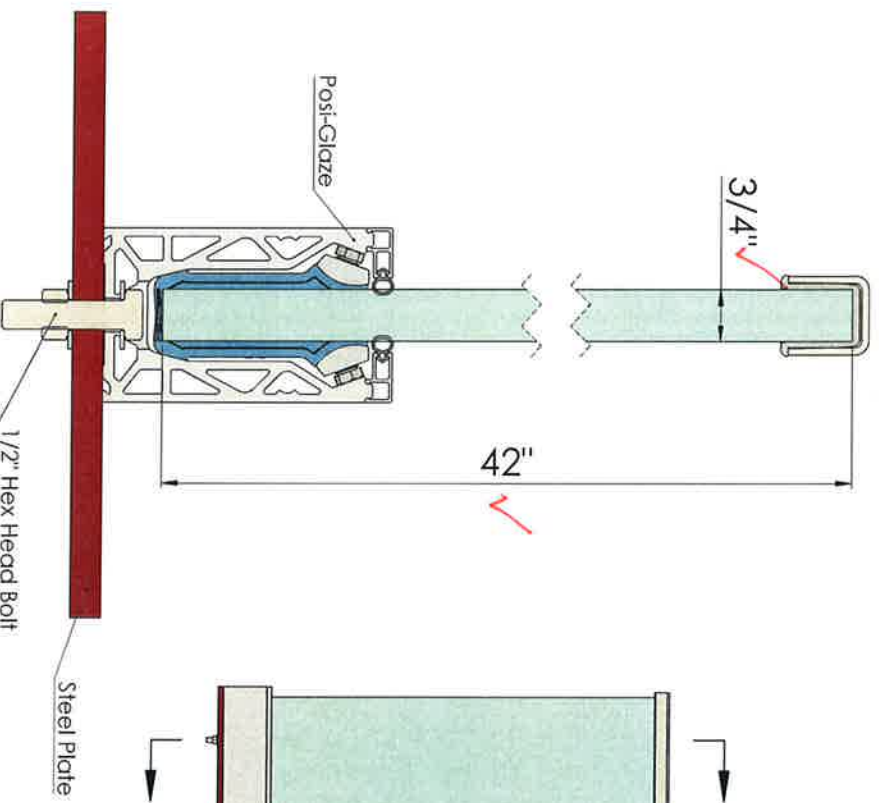


PureVista USA Testing Documentation		
TITLE		
PostGlaze - Steel mounted, Handrail.		
DWG NO	POST_02	A4

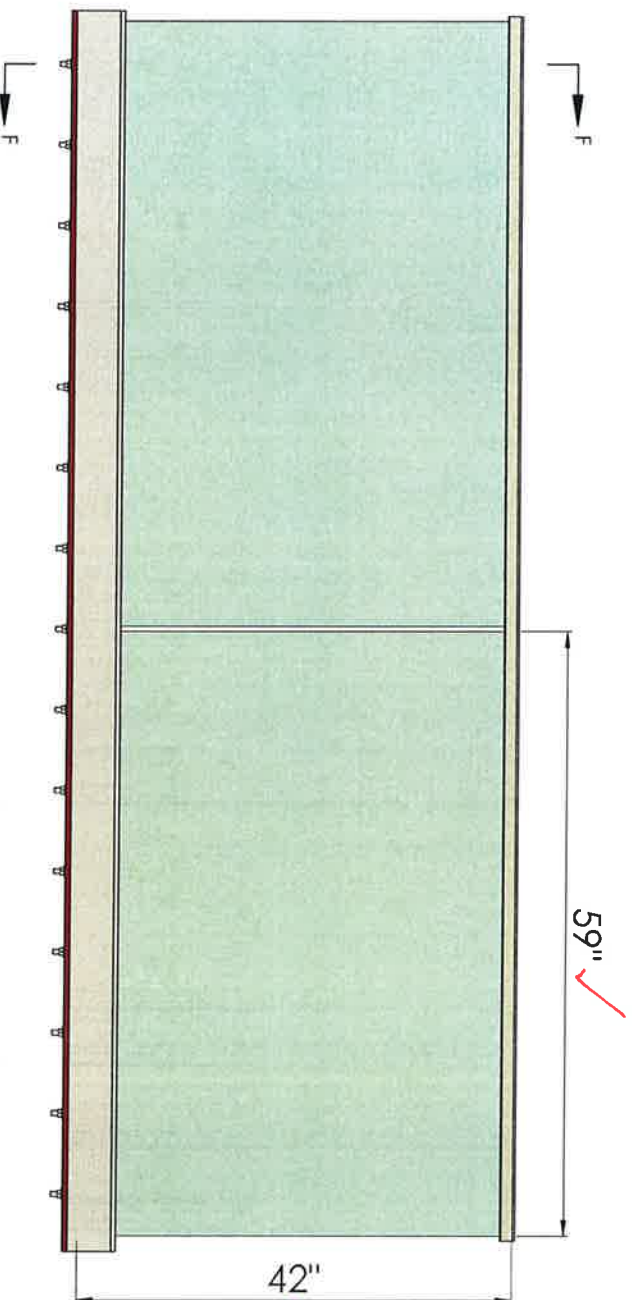
NOT TO SCALE

Setup 1 - 3/4" Monolithic Glass.

SECTION F-F



FRONT VIEW



Test sample complies with these details.
Deviations are noted.

Report # 69513

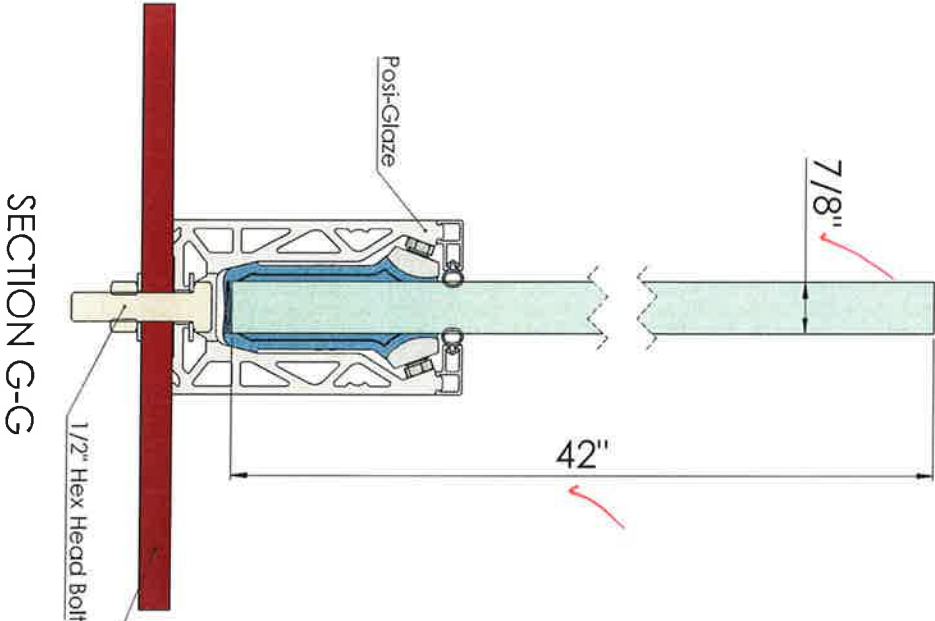
Date 10-18-17 Tech ARB



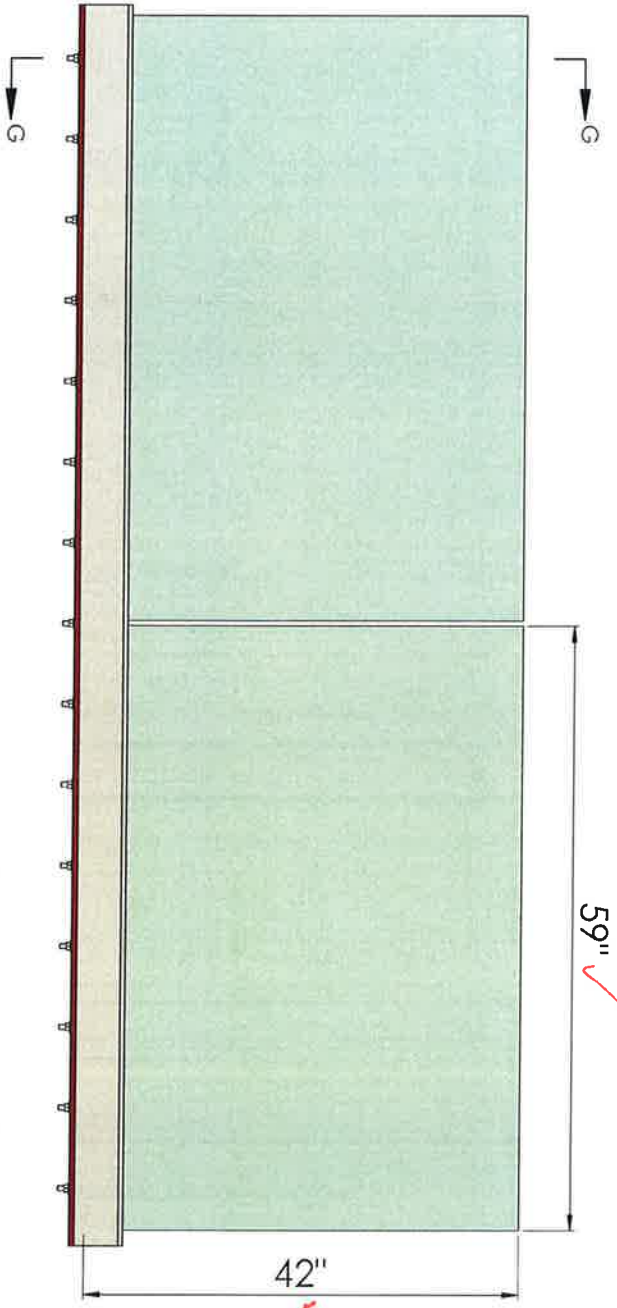
PureVista USA Testing Documentation		
Title		
PosiGlaze - Steel mounted.		
DWG NO.	POSL_03	A4

NOT TO SCALE

Setup 1 - 7/8" Toughened Laminated Glass, PVB Interlayer.



SECTION G-G



FRONT VIEW



Test sample complies with these details.
Deviations are noted.

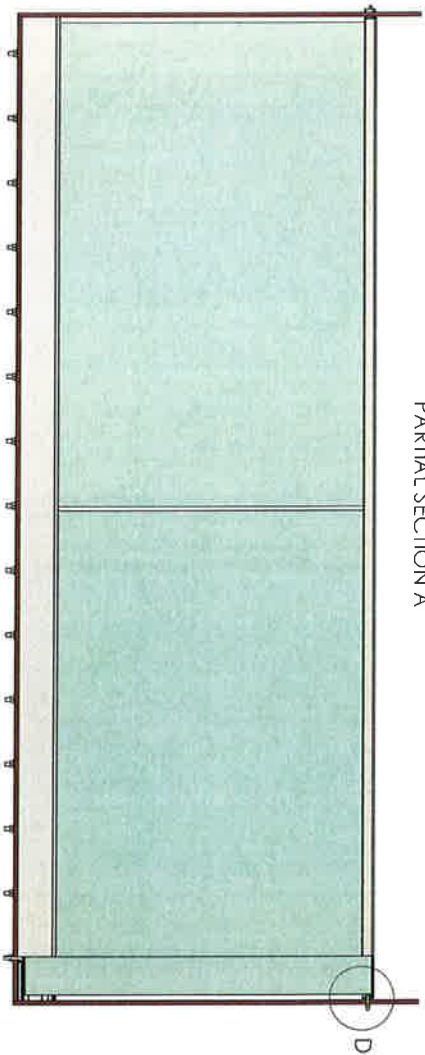
Report # 69513

Date 10-18-17 Tech ARB



PureVista USA Testing Documentation		
Handrail Wall Fixture - Page 1		
DWG NO.	HR_03	A4

RIGHT VIEW
PARTIAL SECTION A



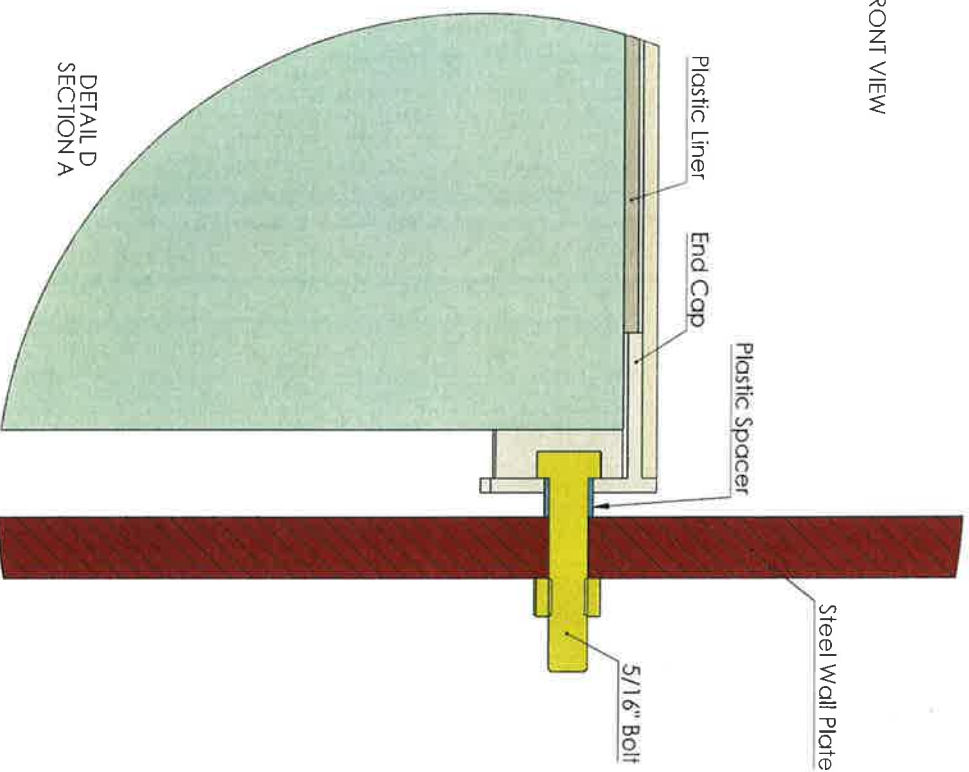
SECTION VIEW A



FRONT VIEW

NOT TO SCALE

Approximate Imperial Dimensions



DETAIL D
SECTION A



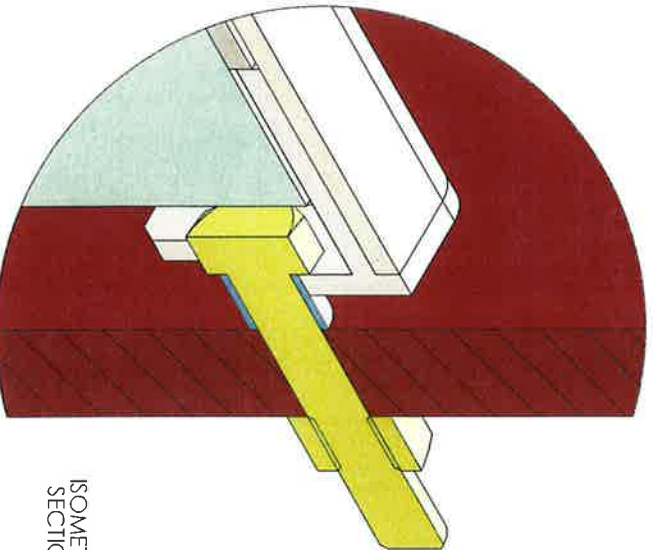
Architectural Testing

Test sample complies with these details.
Deviations are noted.

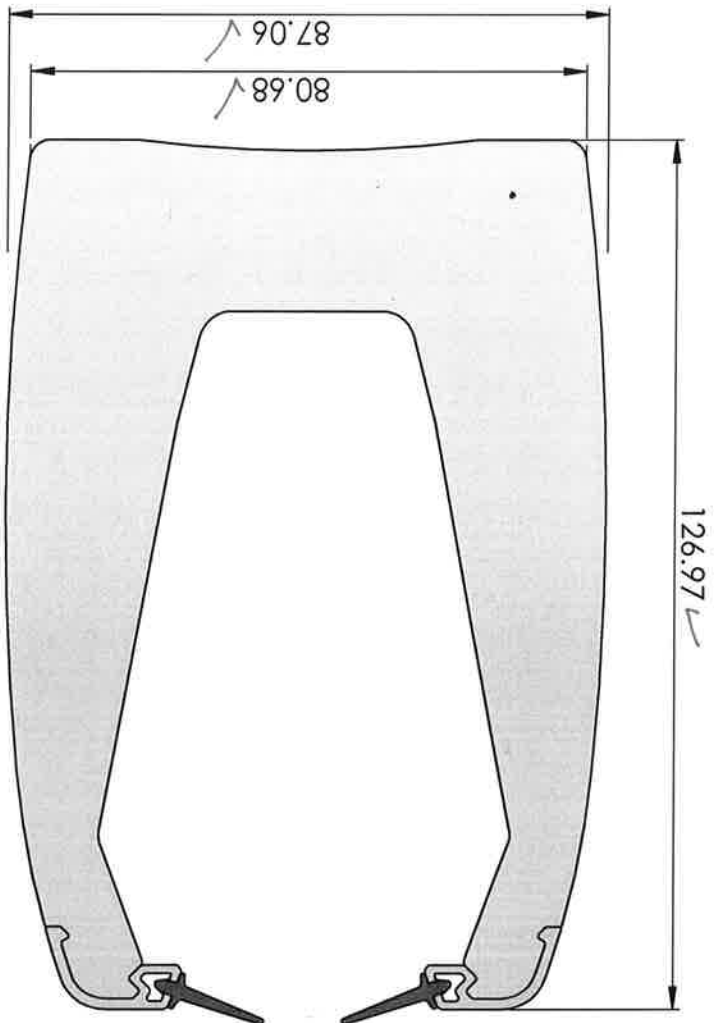
Report # 69513

Date 10/18-17

Tech APB



ISOMETRIC DETAIL
SECTION A VIEW



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 68513.04

Date 10-18-17 Tech ARB



Architectural Testing

Test sample complies with base details.
Deviations are noted.

Report # 69513.04

Date 10-18-17 Tech ARRD

DO NOT SCALE DRAWING

REVISION

Purevista

Small Spigot

TITLE:

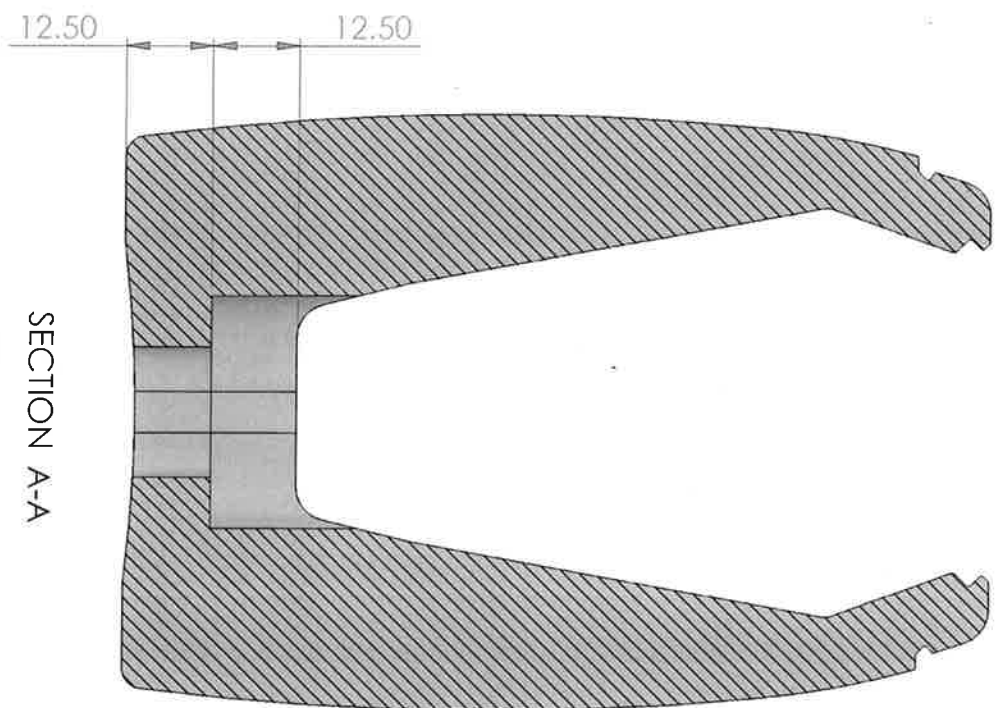
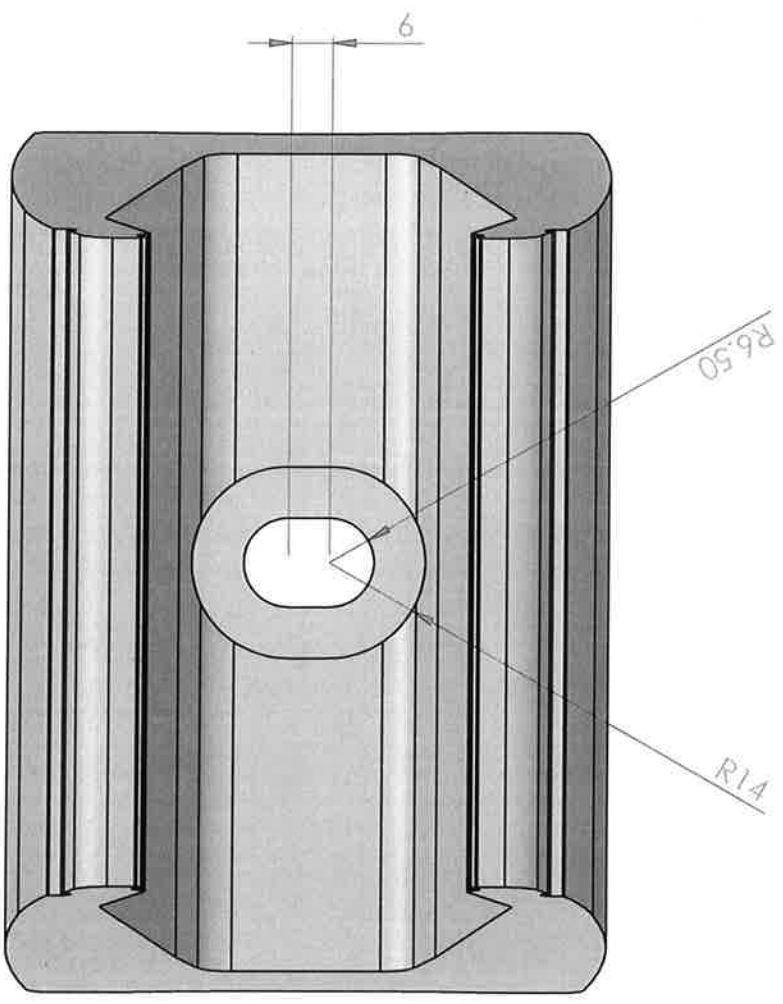
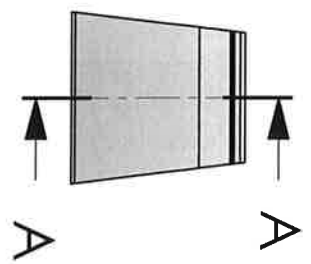
DWG. NO.

14-01-15

SCALE 1:5

SHEET 3 OF 4

A4



SECTION A-A

SCALE 1:1



G9513.04-119-19

APPENDIX B

Photographs



Photo No. 1
In-Fill Load Test at Bottom of One Glass Panel



Photo No. 2
In-Fill Load Test at Bottom of Broken Panel



Photo No. 3
Concentrated Load Test at End of Top Rail (No Wall Mount)



Photo No. 4
Concentrated Load Test at End of Top Rail (Brackets)



Photo No. 5
Concentrated Load Test at End of Top Rail (Glass Removed)



Photo No. 6
Concentrated Load at Mid-Span of Top Rail



Photo No. 7
Vertical Uniform Load on Top Rail



Photo No. 8
Horizontal Uniform Load on Top Rail



Photo No. 9
Horizontal Inward Uniform Load at 42 in (Top Rail)