

ENVISION OUTDOOR LIVING PRODUCTS LLC TEST REPORT

SCOPE OF WORK

STRUCTURAL PERFORMANCE TESTING ON THE 8 FT BY 42 IN PVC LEVEL GUARDRAIL SYSTEM WITH ROUND ALUMINUM BALUSTERS

REPORT NUMBER

Q9821.01-119-19 R0

TEST DATE

02/12/24

ISSUE DATE

05/07/24

RECORD RETENTION END DATE

02/14/28

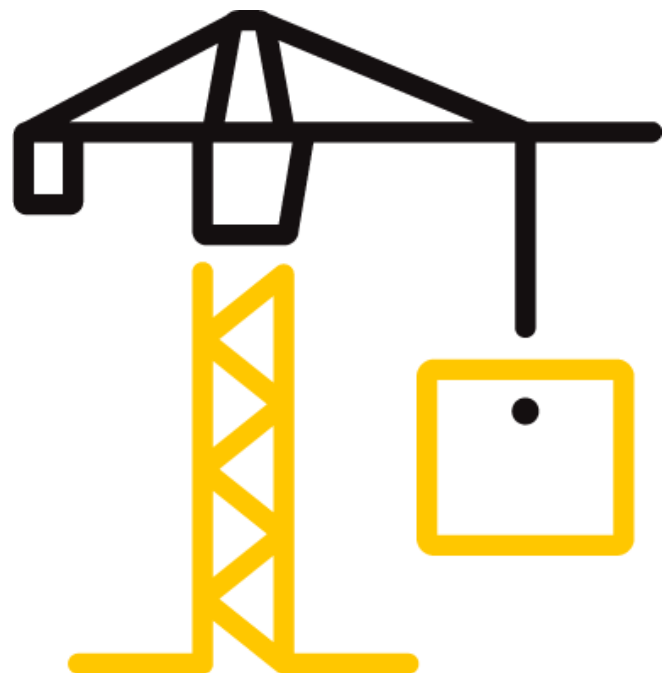
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TEST REPORT FOR ENVISION OUTDOOR LIVING PRODUCTS LLC

Report No.: Q9821.01-119-19 R0

Date: 05/07/24

REPORT ISSUED TO

ENVISION OUTDOOR LIVING PRODUCTS LLC

53 Eby Chiques Road
P.O. Box 37
Mount Joy, PA 17552

SECTION 1

SCOPE

Architectural Testing, Inc. (an Intertek company) dba Intertek Building & Construction (B&C) was contracted by Envision Outdoor Living Products LLC to perform structural performance testing in accordance with the 2024 IRC and IBC on their 8 ft wide by 42 in high level PVC guardrail system with round aluminum balusters. All tests performed were to evaluate structural performance of the guardrail assembly to carry and transfer imposed loads to the supporting structure. The test specimen evaluated included the infill, rails, rail brackets, and attachment to the support posts. The support posts were conventional construction and not within the scope of the evaluation. Posts were therefore not a tested component and were included in the test specimen only to facilitate anchorage of the rail brackets. Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at the Intertek test facility in York, Pennsylvania. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

SECTION 2

SUMMARY OF TEST RESULTS

The specimen met the 2024 IBC and IRC design load performance requirements.

For INTERTEK B&C:

COMPLETED BY:	Adam J. Schrum	REVIEWED BY:	V. Thomas Mickley, Jr., P.E.
TITLE:	Project Manager	TITLE:	Senior Staff Engineer
SIGNATURE:		SIGNATURE:	
DATE:	05/07/24	DATE:	05/07/24

AJS:vtm/aas

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SECTION 3

TEST METHODS

The specimens were evaluated in accordance with the following:

2024, *International Building Code*® (IBC), International Code Council

2024, *International Residential Code*® (IRC), International Code Council

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of IBC 2024.

SECTION 4

MATERIAL SOURCE/INSTALLATION

Test samples were provided by the client. Representative samples of the test specimen will be retained by Intertek B&C for a minimum of four years from the test completion date.

The 8 ft wide by 42 in high guardrail assembly was installed and tested as a single railing section by directly securing the posts into a rigid steel test fixture, which rigidly restrained the posts from deflecting. 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 Section 11 for individual test setups.

SECTION 5

EQUIPMENT

The guardrail 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.

SECTION 6

LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Craig Barkume	Envision Outdoor Living Products LLC
Adam J. Schrum	Intertek B&C
Shawn A. Beamer	Intertek B&C

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SECTION 7**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.

An initial load, not exceeding 50% of design load, was applied and transducers were zeroed. Load was then applied at a steady uniform rate until reaching 2.0 times design load in no less than 10 seconds. After reaching 2.0 times design load, the load was released. After allowing a minimum period of one minute for stabilization, load was reapplied to the initial load level used at the start of the loading procedure, and deflections were recorded and used to analyze recovery. Load was then increased at a steady uniform rate until reaching 2.5 times design 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.

Deflection and permanent set were component deflections relative to their end-points; they were not overall system displacements. All loads and displacement measurements were horizontal, unless noted otherwise.

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TEST SPECIMEN DESCRIPTION

Envision Outdoor Living Products LLC provided the fully-assembled test specimens with the following details:

TYPE	PVC guardrail system
OVERALL LENGTH	96 in (inside of post to inside of post); 8 ft (nominal)
OVERALL HEIGHT	- 38 in (top of top rail to bottom of bottom rail) - 42 in (nominal)
TOP RAIL	3-1/2 in wide by 3-1/2 high by 0.085 in wall, T-shaped PVC (aluminum reinforced)
BOTTOM RAIL	2 in wide by 3-1/2 in high by 0.110 in wall rectangular PVC rail
ALUMINUM REINFORCEMENT	1-11/16 in wide by 3-3/16 high by 0.055 in wall, P-shaped unspecified aluminum alloy insert (long leg of 'P' must be on the protected side of railing)
PICKETS (IN-FILL)	3/4 in diameter by 0.045/0.055 in wall unspecified aluminum alloy
RAIL BRACKETS	PVC socket brackets contoured to the shape of the rail
SUPPORT BLOCK	1-3/8 in square by 0.070 in wall hollow, extruded PVC picket cut to length and secured with a fitted bracket fastened to the underside of the bottom rail (one at midspan of rail)
SUPPORT POST	Preservative treated southern yellow pine 4 x 4
POST SLEEVE	4 in square by 0.130 in wall PVC
FASTENERS	- #8-10 by 1-1/2" (0.112 in minor diameter) pan-head, square-drive, type 17 point, stainless steel screw (six in top bracket/post, four in bottom bracket/post) - #10-16 by 5/8" (0.135 in minor diameter) pan-head, square-drive, self-drilling, stainless steel screw (two in bracket/rail) - Slip-fit into routing; no mechanical connection (picket to top/bottom rail) - #10-16 by 3/4" (0.135 in minor diameter) pan-head, square-drive, self-drilling, stainless steel screw (one in support block/rail)

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SECTION 9

TEST RESULTS

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.

**8 ft (96 in) by 42 in Level Guardrail with, Round Aluminum Balusters
IBC - All Use Groups**

Test No. 1 - 02/12/24

Design Load: 50 lb / 1 Square ft at Center of In-fill (on 3 Pickets)

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)
Initial Load	25	00:00	0.00
2.0x Design Load	101	00:18	0.82
Initial Load	25	02:02	0.06
93% Recovery from 2.0 x Design Load			
2.5x Design Load	129	02:14	Achieved Load without Failure

Test No. 2 - 02/12/24

Design Load: 50 lb / 1 Square ft at Bottom of In-fill (on 3 Pickets)

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)
Initial Load	25	00:00	0.00
2.0x Design Load	100	00:20	1.38
Initial Load	25	01:52	0.03
98% Recovery from 2.0 x Design Load			
2.5x Design Load	125	02:06	Achieved Load without Failure

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Test No. 3 - 02/12/24

Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Horizontal Uniform Load on Top Rail ¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET ²
Initial Load	80	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	803	00:35	0.09	3.71	0.11	3.61
Initial Load	80	02:24	0.00	0.16	0.00	0.16
96% Recovery from 2.0 x Design Load						
2.5x Design Load	1006	02:51	Achieved Load without Failure			

¹ Uniform load was simulated with quarter point loading.

² Net displacement was mid-rail displacement relative to the rail at the support posts.

Test No. 4 - 02/12/24

Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Vertical Uniform Load on Top Rail ¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	80	00:00	0.00
2.0x Design Load	800	00:22	2.32
Initial Load	80	02:11	0.02
99% Recovery from 2.0 x Design Load			
2.5x Design Load	1021	02:33	Achieved Load without Failure

¹ Uniform load was simulated with four equal point loads.

Test No. 5 - 02/12/24

Design Load: 200 lb Horizontal Concentrated Load at Midspan of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET ¹
Initial Load	50	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	401	00:19	0.30	2.52	0.05	2.35
Initial Load	50	01:53	0.00	0.03	0.00	0.03
99% Recovery from 2.0 x Design Load						
2.5x Design Load	501	02:19	Achieved Load without Failure			

¹ Net displacement was mid-rail displacement relative to the rail at the support posts.

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Test No. 6 - 02/12/24

Design Load: 200 lb Vertical Concentrated Load at Midspan of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	50	00:00	0.00
2.0x Design Load	409	00:10	0.22
Initial Load	50	01:43	0.00
100% Recovery from 2.0 x Design Load			
2.5x Design Load	509	01:55	Achieved Load without Failure

Test No. 7 - 02/12/24

Design Load: 200 lb Horizontal Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)	
			RAIL END #1	RAIL END #2
Initial Load	80	00:00	0.00	0.00
(2.0x Design Load) x 2	812	00:23	0.10	0.10
Initial Load	80	02:20	0.00	0.01
100% Recovery (Rail End #1) and 90% Recovery (Rail End #2) from 2.0 x Design Load				
(2.5x Design Load) x 2	1025	02:40	Achieved Load without Failure	

¹ A spreader beam was used to impose loads on both ends of the railing system; therefore, loads were doubled.

**SECTION 10
CONCLUSION**

Using performance criteria of withstanding an ultimate load of 2.5 times design load, the test results substantiate compliance with the design load requirements of the referenced building codes for the 8 ft by 42 in railing assembly reported herein.

Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

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SECTION 11

PHOTOGRAPHS



Photo No. 1
In-Fill Load Test at Center of Three Pickets



Photo No. 2
In-Fill Load Test at Bottom of Three Pickets

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Photo No. 3
Horizontal Uniform Load Test on Top Rail



Photo No. 4
Vertical Uniform Load Test on Top Rail

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Photo No. 5
Horizontal Concentrated Load Test at Mid-Span of Top Rail



Photo No. 6
Horizontal Concentrated Load Test at Ends of Top Rail (Brackets)



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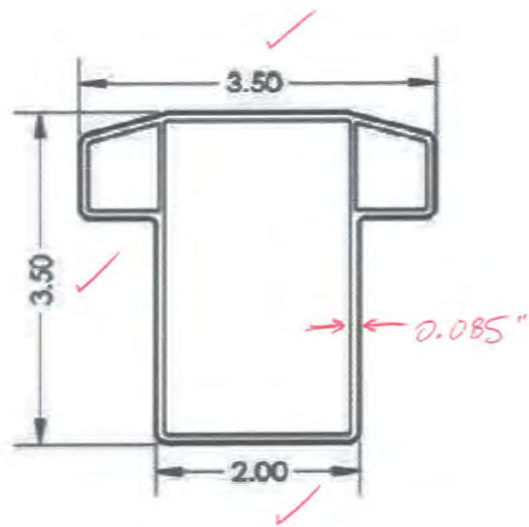
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SECTION 12

DRAWINGS

The "As-Built" drawings for the 8 ft wide by 42 in high level PVC guardrail system with round aluminum balusters which follow have been reviewed by Intertek B&C and are representative of the project reported herein. Project construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.



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Test sample complies with these details.
Deviations are noted.

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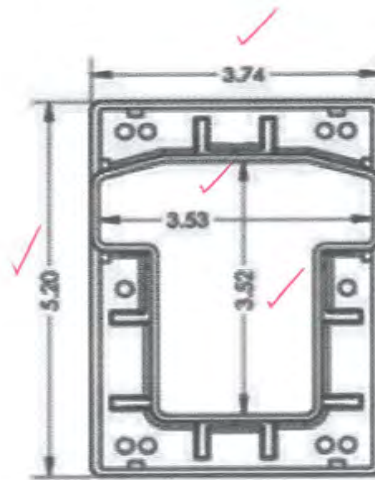
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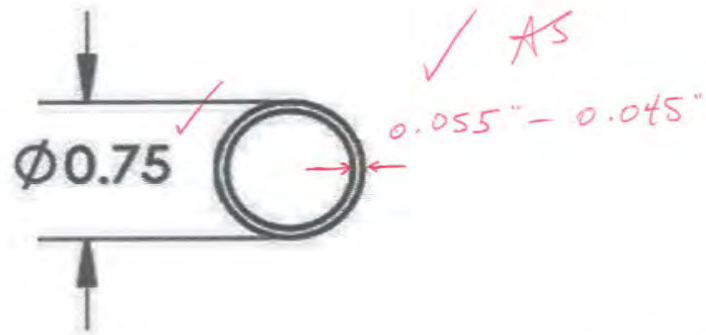
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Test sample complies with these details.
Deviations are noted.

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Date 7/30/24 Tech AJS





intertek

Test sample complies with these details.
Deviations are noted.

Report # 29821-01-119-19

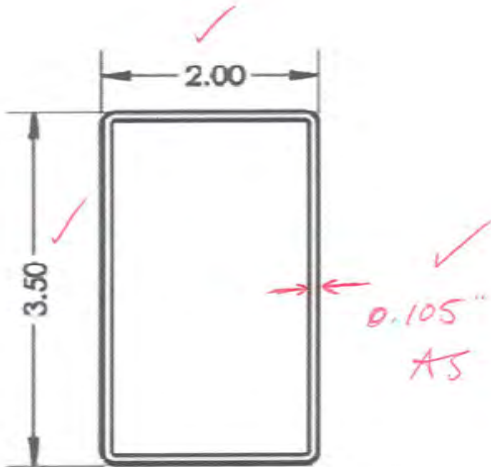
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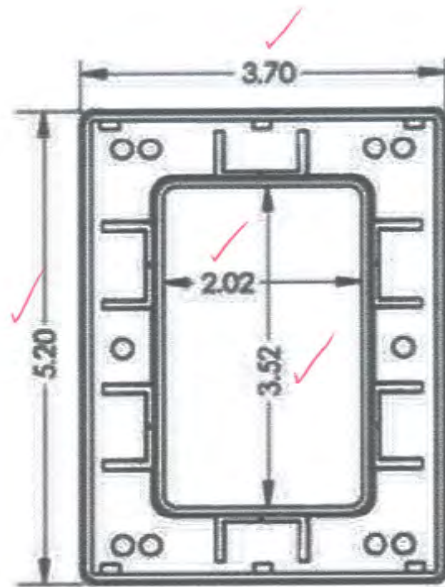
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Test sample complies with these details.
Deviations are noted.

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Date 4/30/24 Tech AJS





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Test sample complies with these details.
Deviations are noted.

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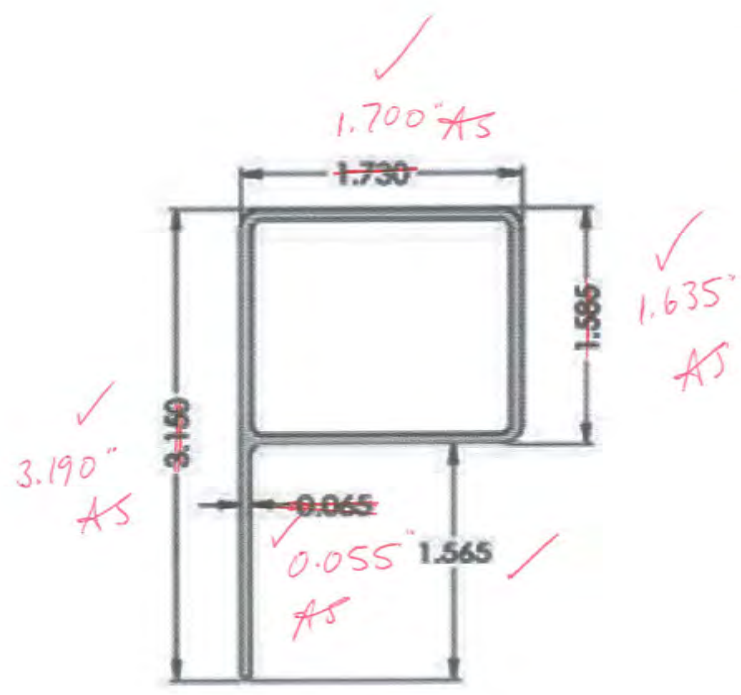
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intertek

Test sample complies with these details.
Deviations are noted.

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SECTION 13

REVISION LOG

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