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ENVISION OUTDOOR LIVING PRODUCTS LLC
TEST REPORT

SCOPE OF WORK
STRUCTURAL PERFORMANCE TESTING ON THE 8 FT BY 42 IN *TAM-RAIL MODERN* GUARDRAIL SYSTEM

REPORT NUMBER
S0370.01-119-19 R0

TEST DATES
11/15/24 - 11/18/24

ISSUE DATE
01/07/25

RECORD RETENTION END DATE
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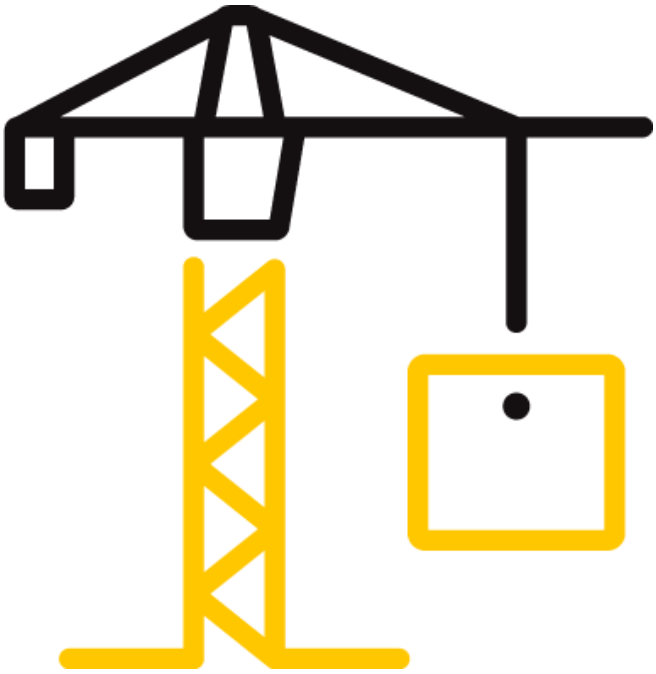

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York, Pennsylvania 17406

Telephone: 717-764-7700
Facsimile: 717-764-4129
www.intertek.com/building

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Report No.: S0370.01-119-19 R0
Date: 01/07/25

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 *TAM-RAIL Modern* guardrail system. 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 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 Intertek test facility in York, Pennsylvania. Intertek B&C 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). This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

SECTION 2

SUMMARY OF TEST RESULTS

The specimens met the 2024 IRC and IBC 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:	Digitally Signed by: Adam J. Schrum	**SIGNATURE:**	Digitally Signed by: Virgal Thomas Mickley, Jr.
DATE:	01/07/25	**DATE:**	01/07/25

AJS:vtm/lr

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York, Pennsylvania 17406

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Facsimile: 717-764-4129
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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 specimens 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
Jeffrey C. Jones	Intertek B&C
Adam J. Schrum	Intertek B&C

130 Derry Court
York, Pennsylvania 17406

Telephone: 717-764-7700
Facsimile: 717-764-4129
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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.

SECTION 8
TEST SPECIMEN DESCRIPTION

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

PRODUCT	*TAM-RAIL Modern* Guardrail System
TYPE	PVC guardrail system
OVERALL LENGTH	94-1/2 in (inside of post to inside of post); 8 ft (nominal)
OVERALL HEIGHT	- 40 in (top of top rail to bottom of bottom rail) - 42 in (nominal)
TOP/BOTTOM RAIL	2 in wide by 3-1/2 in high by 0.20 in wall, rectangular, three-layer, PVC rail
PICKETS (IN-FILL)	- 3/4 in diameter aluminum extrusion with 0.04 in/0.05 in wall - 1-1/2 in square, three-layer, PVC baluster with 0.10 in wall
RAIL BRACKETS	0.07 in thick stainless-steel U-profile brackets
SUPPORT FOOT	1-1/2 in square PVC picket cut to length and inserted into routed hole in the underside of the bottom rail
SUPPORT POST	Preservative treated southern yellow pine 4 x 4
POST SLEEVE	4 in square by 0.110 in wall, two-layer, PVC
FASTENERS	- Bracket to Post: Four, #10-8 by 2in (0.128 in minor diameter) flat head, square-drive, type 17 point, stainless steel screws - Bracket to Rail: Four, #8-8 by 1in (0.128 in minor diameter) flat head, square-drive, type 17 point, stainless steel screws

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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.

Test Series No. 1
8 ft (94-1/2 in) by 42 in *TAM-Rail Modern* Guardrail System with 3/4 in Diameter Aluminum Balusters
Infill Load Testing Only

Test No. 1 - 11/15/24
Design Load: 50 lb / 1 Square ft at Center of In-fill

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	25	00:00	--	0.00	--	--
2.0x Design Load	101	00:14	--	1.12	--	--
Initial Load	25	02:16	--	0.17	--	--
85% Recovery from 2.0 x Design Load						
2.5x Design Load	127	02:23	Achieved Load without Failure			

Test No. 2 - 11/15/24
Design Load: 50 lb / 1 Square ft at Bottom of In-fill

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	25	00:00	--	0.00	--	--
2.0x Design Load	101	00:13	--	0.94	--	--
Initial Load	25	01:38	--	0.12	--	--
87% Recovery from 2.0 x Design Load						
2.5x Design Load	130	01:45	Achieved Load without Failure			

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Date: 01/07/25

Test Series No. 2
8 ft (94-1/2 in) by 42 in *TAM-Rail Modern* Guardrail System with 1-1/2 in Square PVC Balusters
IBC - All Use Groups

Test No. 1 - 11/18/24
Design Load: 50 lb / 1 Square ft at Center of In-fill

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	25	00:00	--	0.00	--	--
2.0x Design Load	105	00:24	--	0.98	--	--
Initial Load	26	01:49	--	0.08	--	--
92% Recovery from 2.0 x Design Load						
2.5x Design Load	131	01:57	Achieved Load without Failure			

TEST NO. 2 - 11/18/24
Design Load: 50 lb / 1 Square ft at Bottom of In-fill

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	25	00:00	--	0.00	--	--
2.0x Design Load	100	00:23	--	0.92	--	--
Initial Load	30	01:38	--	0.00	--	--
100% Recovery from 2.0 x Design Load						
2.5x Design Load	128	01:42	Achieved Load without Failure			

Test No. 3 - 11/18/24
Design Load: 50 plf x (94.5 in ÷ 12 in/ft) = 393.8 lb Horizontal Uniform Load on Top Rail [2]

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET [1]
Initial Load	80	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	793	01:06	0.13	6.79	0.22	6.62
Initial Load	80	02:48	0.01	1.00	0.00	1.00
85% Recovery from 2.0 x Design Load						
2.5x Design Load	996	03:26	Achieved Load without Failure			

[1] Net displacement was mid-rail displacement relative to the rail at the support posts.
[2] Uniform load was simulated with quarter point loading.

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Test No. 4 - 11/18/24
Design Load: 50 plf x (94.5 in ÷ 12 in/ft) = 393.8 lb Vertical Uniform Load on Top Rail [1]

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	80	00:00	--	0.00	--	--
2.0x Design Load	798	00:50	--	0.19	--	--
Initial Load	82	02:23	--	0.01	--	--
95% Recovery from 2.0 x Design Load						
2.5x Design Load	1025	02:48	Achieved Load without Failure			

[1] *Uniform load was simulated with four equal point loads.*

Test No. 5 - 11/18/24
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	49	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	406	00:30	0.04	4.52	0.12	4.44
Initial Load	49	02:00	0.00	0.05	0.00	0.05
99% Recovery from 2.0 x Design Load						
2.5x Design Load	510	02:22	Achieved Load without Failure			

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

Test No. 6 - 11/18/24
Design Load: 200 lb Vertical Concentrated Load at Midspan of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	49	00:00	--	0.00	--	--
2.0x Design Load	406	00:23	--	0.17	--	--
Initial Load	60	01:50	--	0.00	--	--
100% Recovery from 2.0 x Design Load						
2.5x Design Load	528	01:55	Achieved Load without Failure			

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Test No. 7 - 11/18/24
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	81	00:00	0.00	0.00
(2.0x Design Load) x 2	823	00:22	0.44	0.42
Initial Load	82	02:11	0.01	0.01
98% Recovery (Rail End #1) and 98% Recovery (Rail End #2) from 2.0 x Design Load				
(2.5x Design Load) x 2	1012	02:22	Achieved Load without Failure	

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

Test No. 8 - 11/18/24
Design Load: 200 lb Vertical 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	--
(2.0x Design Load) x 2	822	00:30	0.06	--
Initial Load	81	02:09	0.01	--
83% Recovery from 2.0 x Design Load				
(2.5x Design Load) x 2	1027	02:28	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.

130 Derry Court
York, Pennsylvania 17406

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Facsimile: 717-764-4129
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SECTION 11
PHOTOGRAPHS

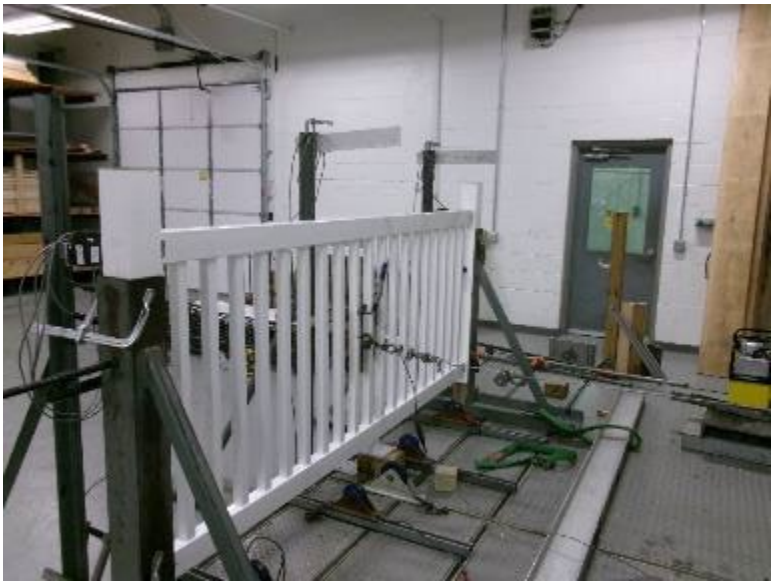

Photo No. 1
In-Fill Load Test at Center of Two Pickets

Photo No. 2
In-Fill Load Test at Bottom of Two 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 Midspan of Top Rail

Photo No. 6
Vertical Concentrated Load Test at Midspan of Top Rail

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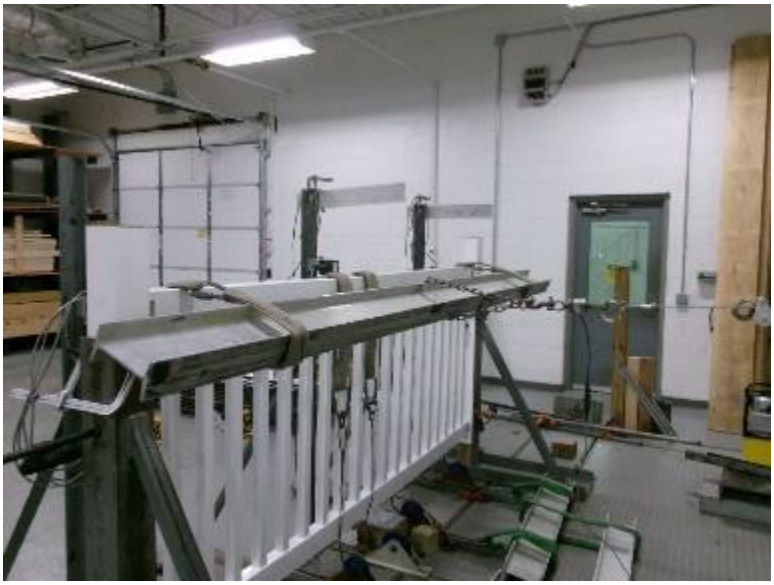

Photo No. 7
Horizontal Concentrated Load Test at Ends of Top Rail (Brackets)

Photo No. 8
Vertical Concentrated Load Test at Ends of Top Rail (Brackets)

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Telephone: 717-764-7700
Facsimile: 717-764-4129
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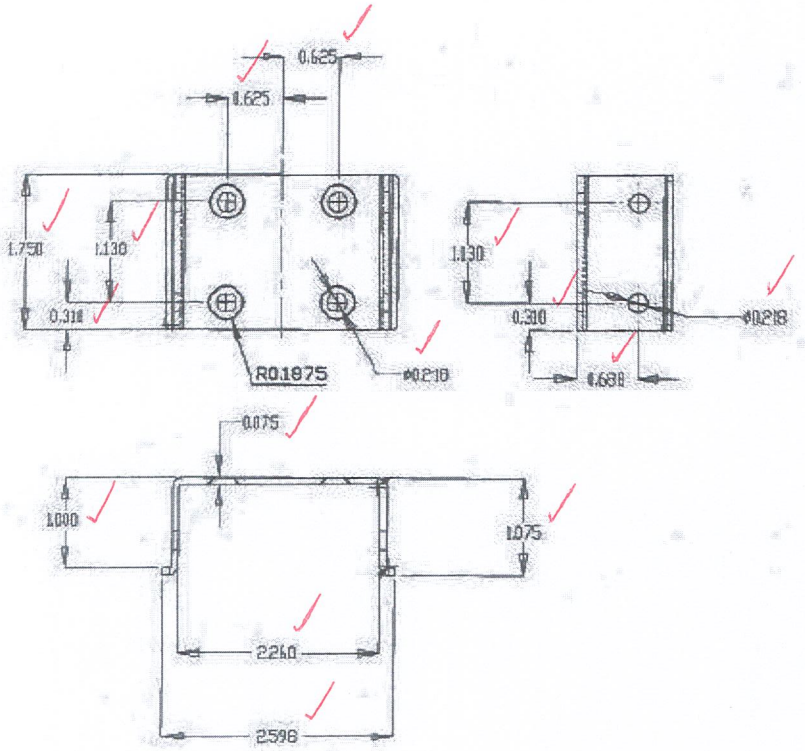
SECTION 12
DRAWINGS

The "As-Built" drawings for the 8 ft wide by 42 in high *TAM-RAIL Modern* guardrail system 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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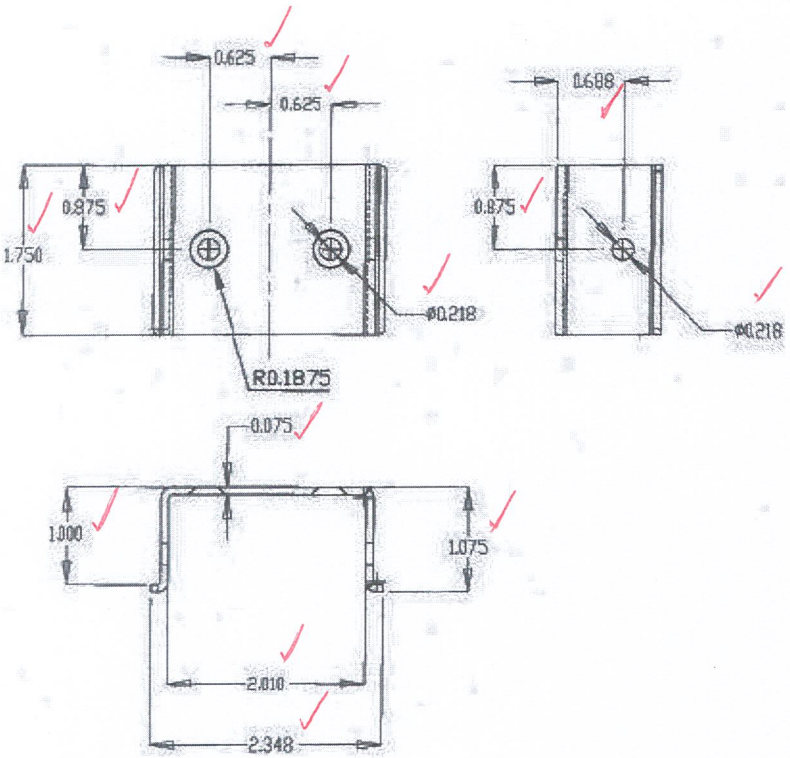
Test sample complies with these details.
Deviations are noted.

Report # 50370.01-119-19

Date 12/18/24 Tech AJS

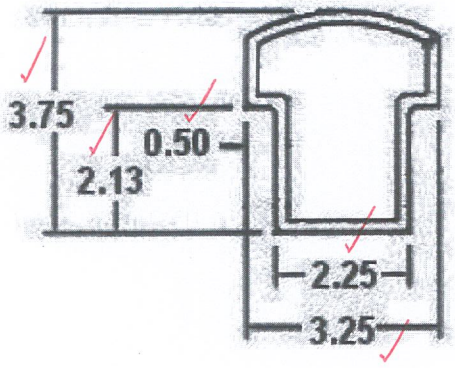


intertek

Test sample complies with these details.
Deviations are noted.

Report # 50370.01-119-19

Date 12/18/24 Tech AJS



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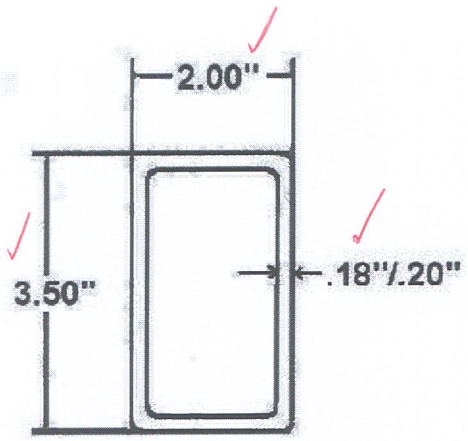
Test sample complies with these details.
Deviations are noted.

Report # 50370.01-119-19

Date 12/18/24 Tech AJS



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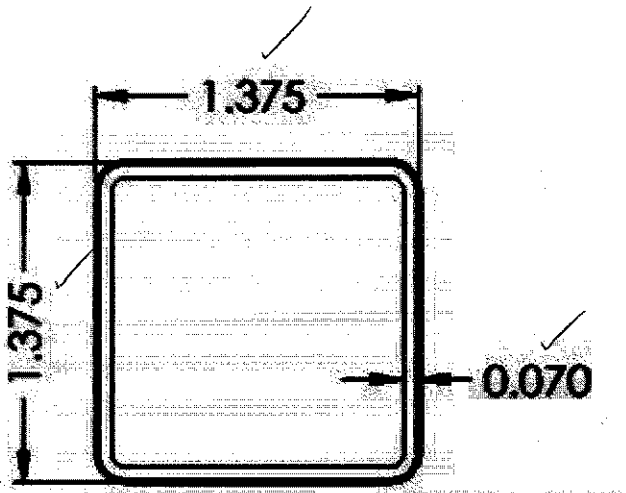
Test sample complies with these details.
Deviations are noted.

Report # 50370.01-119-19

Date 12/18/24 Tech AJS



1-3/8" Square Baluster

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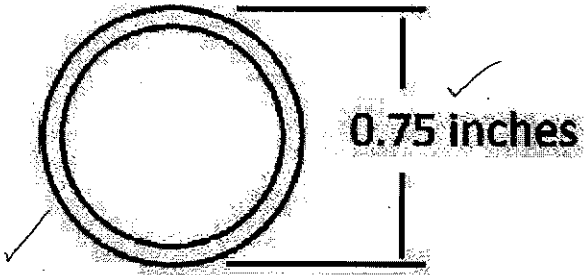
Test sample complies with these details.
Deviations are noted.

Report # 50370-01-119-19

Date 12/18/24 Tech AJS



3/4" dia. (0.05" wall) Aluminum Baluster

intertek

Test sample complies with these details.
Deviations are noted.

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Facsimile: 717-764-4129
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SECTION 13
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	01/07/25	N/A	Original Report Issue