

FORTRESS BUILDING PRODUCTS TEST REPORT

SCOPE OF WORK

STRUCTURAL PERFORMANCE TESTING ON THE *AL13 PUREVIEW* GUARDRAIL SYSTEM
WITHOUT ACCENT TOP RAIL (ATR)

REPORT NUMBER

N8659.01-119-19 R0

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TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22

REPORT ISSUED TO

FORTRESS BUILDING PRODUCTS

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SECTION 1

SCOPE

Architectural Testing, Inc. (an Intertek company) dba Intertek Building & Construction (B&C) was contracted by Fortress Building Products to perform structural performance testing in accordance with the 2020 National Building Code (NBC) of Canada and 2021 International Building Code (IBC) on their *AI13 Pureview* aluminum guardrail system without accent top rails (ATR). 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 support posts. 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. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

Intertek B&C in York, Pennsylvania 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). Intertek B&C is accredited to perform all testing reported herein.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. Unless differently required, Intertek reports apply the "Simple Acceptance" rule, also called "Shared Risk approach," of ILAC-G8:09/2019, Guidelines on Decision Rules and Statements of Conformity. Intertek will service this report for the entire test record retention period. The test record retention period ends four years after the test date. Test records, such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained for the entire test record retention period.

For INTERTEK B&C:

COMPLETED BY:	Adam J. Schrum	REVIEWED BY:	V. Thomas Mickley, Jr., P.E.
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SIGNATURE:		SIGNATURE:	
DATE:	10/17/22	DATE:	10/17/22

AJS:vtm/aas

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SUMMARY OF TEST RESULTS

The specimens met the 2020 NBC and 2021 IBC design load performance requirements.

SECTION 3

TEST METHODS

The specimens were evaluated in accordance with the following:

2020, National Building Code of Canada, Canadian Commission on Building and Fire Codes

2021, International Building Code[®], International Code Council

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of the 2021 *International Building Code[®]*, International Code Council.

Limitations

Testing reported herein was performed using a safety factor of 2.5 x design load for NBC loads and IBC loads applied to the rail and 4.0 x design load for IBC loads applied to or transferred through the glass infill. Approval of the testing reported herein, and the use of the noted safety factor for the Canadian code is left up to the authority having jurisdiction.

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 guardrail assembly was installed and tested as a single railing section by surface mounting the posts to steel channels (simulated concrete). 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.

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LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Adam J. Schrum	Intertek B&C
Scott A. McMaster	Intertek B&C

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 or 4.0 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.

The test load adjustment factor was 2.5 x design load for NBC loads and horizontal IBC loads applied to the rail and 4.0 x design load for IBC loads applied to or transferred through the glass infill.

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

Test specimens were assembled by an Intertek technician. Fortress Railing Products provided the test components with the following details:

PRODUCT	<i>AL13 PureView</i>
MATERIAL	Extruded Aluminum (unspecified alloy)
COLOR	White
RAIL LENGTH	- 69-1/2 in (glass balusters) and 69 in (full glass panel) (inside of post to inside of post) (level) - 76 in (glass balusters) (inside of post to inside of post) (stair)
RAIL HEIGHT	- 42 in (nominal) - 40 in (glass balusters) and 40-1/4 in (full glass panel) (top of top rail to bottom of bottom rail) (level) - 39-1/4 in (glass balusters) (top of top rail to bottom of bottom rail; measured parallel to the baluster) (stair)
TOP AND BOTTOM RAIL	- 1-1/4 in high by 1-1/4 in wide by 0.120/0.140 in thick aluminum extrusion with slotted holes for picket grommets (glass balustrade) - 1-1/4 in high by 1-1/4 in wide by 0.080 in thick aluminum extrusion with 9/32 in wide slot for rubber gasket (full glass panel)
IN-FILL	- 39 in high by 61-1/4 in wide by 1/4 in thick tempered glass full view panel - 39 in high (level) or 39-1/2 in high (stair) by 3-3/4 in wide by 5/16 in thick tempered glass pickets
SUPPORT FOOT	5/8 in square by 2 in high cast aluminum tube with cap plate (located at midpoint of the bottom rail)
RAIL BRACKETS	- Level: 1-1/2 in high by 1-5/8 in wide by 1 in deep (0.220/0.160/0.150 in wall) cast aluminum brackets - Stair: Two piece, cast aluminum hinged bracket
POST	<i>AL13 Home</i> : 3 in square by 0.120 in thick aluminum tube connected to a 5-1/2 in square by 0.40 in thick aluminum base plate with a 1/4 in continuous fillet weld; the base plate included four 7/16 in diameter holes and one 1 in diameter hole

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Fastening Schedule

CONNECTION	FASTENER
Rail Bracket to Post	Two 1/4-14 by 1" (0.157 in minor diameter) Torx drive, flat-head, self-drilling, coated steel screws
Rail Bracket to Rail	Two #12-24 by 3/4" (0.181 in minor diameter) Torx drive, flat-head, thread cutting, coated steel screws
Hinged Bracket Connection	Two-piece fastener consisting of one, 1-1/2 in long pan head smooth outside shank female threaded pin and one, #8-32 by 1/4" pan head screw
Glass Panel or Picket to Top/Bottom Rail	Slip Fit - No mechanical connections
Support Block to Bottom Rail	Two #6-20 by 5/8" Philips drive, flat-head, coated steel screws
Post Mount to Substructure	Four 3/8 in Grade 5 hex-head bolts with nut and washer

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

6 ft (69-1/2 in) by 42 in A/13 PureView Level Guardrail with Glass Balusters

Test No. 1 - 07/28/22

IBC Design Load: 50 lb / 1 Square ft at Center of In-fill (on 2 Balusters) ¹

NBC Design Load: 112 lb / 11.81 Square in at Center of In-fill (on 2 Balusters)

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 (IBC)	103	00:17	--	0.60	--	--
Initial Load	25	01:41	--	0.01	--	--
98% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	200	02:10	Achieved Load without Failure			
2.5x Design Load (NBC)	281	02:22				

¹ Load was applied through the worst case 11.81 square in loading plate.

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Test No. 2 - 07/28/22

IBC Design Load: 50 lb / 1 Square ft at Bottom of In-fill (on 2 Balusters) ¹

NBC Design Load: 112 lb / 11.81 Square in at Bottom of In-fill (on 2 Balusters)

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 (IBC)	101	00:23	--	0.34	--	--
Initial Load	25	01:36	--	0.00	--	--
100% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	201	01:59	Achieved Load without Failure			
2.5x Design Load (NBC)	282	02:05				

¹ Load was applied through the worst case 11.81 square in loading plate.

Test No. 3 - 07/28/22

IBC Design Load: 50 plf x (69-1/2 in ÷ 12 in/ft) = 289.6 lb Horizontal Uniform Load on Top Rail

NBC-Commercial Design Load: 51.4 plf x (69-1/2 in ÷ 12 in/ft) = 297.7 lb Horizontal Uniform Load on Top Rail ¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	60	00:00	0.00	0.00	0.00	0.00
2.0x Design Load (IBC)	587	00:24	0.93	2.26	0.81	1.39
Initial Load	60	01:55	0.09	0.13	0.05	0.06
96% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	725	02:27	Achieved Load without Failure			
2.5x Design Load (NBC)	751	02:29				

¹ Uniform load was simulated with quarter-point loading.

Test No. 4 - 07/28/22

IBC Design Load: 50 plf x (69-1/2 in ÷ 12 in/ft) = 289.6 lb Vertical Uniform Load on Top Rail

NBC-Commercial Design Load: 102.78 plf x (69-1/2 in ÷ 12 in/ft) = 595.3 lb Vertical Uniform Load on Top Rail ¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	100	00:00	0.00
2.0x Design Load (IBC)	734	00:42	0.14
Initial Load	100	02:29	0.08
43% Recovery from 2.0 x Design Load (IBC)			
2.5x Design Load (IBC)	726	02:53	Achieved Load without Failure
2.5x Design Load (NBC)	1493	03:26	

¹ Uniform load was simulated with four equal point loads.

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Test No. 5 - 07/28/22

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

NBC Design Load: 225 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 (IBC)	405	00:46	0.59	2.04	0.53	1.48
Initial Load	50	02:26	0.00	0.03	0.00	0.03
98% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	501	03:02	Achieved Load without Failure			
2.5x Design Load (NBC)	565	03:11				

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

Test No. 6 - 07/28/22

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

NBC Design Load: 225 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	50	00:00	--	0.00	--	--
2.0x Design Load (IBC)	410	00:23	--	0.06	--	--
Initial Load	50	01:44	--	0.02	--	--
66% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (NBC)	569	02:06	Achieved Load without Failure			
4.0x Design Load (IBC)	808	02:16				

Test No. 7 - 07/28/22

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

NBC Design Load: 225 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 (IBC)	802	00:49	1.25	1.12
Initial Load	80	02:32	0.06	0.02
95% Recovery (Rail End #1) and 98% Recovery (Rail End #2) from 2.0 x Design Load (IBC)				
(2.5x Design Load) x 2 (IBC)	1006	03:08	Achieved Load without Failure	
(2.5x Design Load) x 2 (NBC)	1128	03:18		

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

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Test No. 8 - 08/04/22

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

NBC Design Load: 225 lb Vertical Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	80	00:00	0.00
(2.0x Design Load) x 2 (IBC)	820	00:26	0.02
Initial Load	80	01:46	0.01
50% Recovery from 2.0 x Design Load (IBC)			
(2.5x Design Load) x 2 (NBC)	1136	02:10	Achieved Load without Failure
(4.0x Design Load) x 2 (IBC)	1613	02:27	

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

Test No. 9 - 07/28/22

IBC Design Load: 50 plf x ((69-1/2 in + 3 in) ÷ 12 in/ft) = 302 lb Concentrated Load at Top of Stand-Alone ¹ 3 in Post Mount (42 in High)

NBC Design Load: 225 lb Concentrated Load at Top of Stand-Alone ¹ 3 in Post Mount (42 in High)

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	POST DISPLACEMENT (in)
Initial Load	50	00:00	0.00
2.0x Design Load (IBC)	611	00:36	1.64
Initial Load	50	01:59	0.16
90% Recovery from 2.0 x Design Load (IBC)			
2.5x Design Load (NBC)	563	02:26	Achieved Load without Failure
2.5x Design Load (IBC)	756	02:46	
Ultimate Load	807	Mode of Failure: Weld Failure	

¹ Post was conservatively tested without a railing attached.

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Test Series No. 2

5 ft (69 in) by 42 in A113 PureView Level Guardrail with Full Glass Panel Infill

Test No. 1 - 07/29/22

IBC Design Load: 50 lb / 1 Square ft at Center of In-fill ¹

NBC Design Load: 112 lb / 11.81 Square in at Center of In-fill (on 2 Balusters)

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 (IBC)	103	00:26	--	0.30	--	--
Initial Load	25	01:41	--	0.00	--	--
100% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	204	02:07	Achieved Load without Failure			
2.5x Design Load (NBC)	282	02:16				

¹ Load was applied through the worst case 11.81 square in loading plate.

Test No. 2 - 07/29/22

IBC Design Load: 50 lb / 1 Square ft at Bottom of In-fill ¹

NBC Design Load: 112 lb / 11.81 Square in at Bottom of In-fill (on 2 Balusters)

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 (IBC)	112	00:28	--	0.28	--	--
Initial Load	25	01:50	--	0.00	--	--
100% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	203	02:11	Achieved Load without Failure			
2.5x Design Load (NBC)	281	02:17				

¹ Load was applied through the worst case 11.81 square in loading plate.

Test No. 3 - 07/29/22

IBC Design Load: 50 lb / 1 Square ft at Edge of Glass Panel In-fill ¹

NBC Design Load: 112 lb / 11.81 Square in at Edge of Glass Panel In-fill (on 2 Balusters)

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 (IBC)	102	00:19	--	0.34	--	--
Initial Load	25	01:41	--	0.00	--	--
100% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	201	02:08	Achieved Load without Failure			
2.5x Design Load (NBC)	286	02:17				

¹ Load was applied through the worst case 11.81 square in loading plate.

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Test No. 4 - 07/29/22

IBC Design Load: 50 plf x (69 in ÷ 12 in/ft) = 287.5 lb Horizontal Uniform Load on Top Rail

NBC-Commercial Design Load: 51.4 plf x (69 in ÷ 12 in/ft) = 295.6 lb Horizontal Uniform Load on Top Rail¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	60	00:00	0.00	0.00	0.00	0.00
2.0x Design Load (IBC)	575	00:50	1.14	2.40	0.75	1.46
Initial Load	60	02:28	0.13	0.16	0.02	0.09
94% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	721	03:00	Achieved Load without Failure			
2.5x Design Load (NBC)	741	03:02				

¹ Uniform load was simulated with quarter-point loading.

Test No. 5 - 07/29/22

IBC Design Load: 50 plf x (69 in ÷ 12 in/ft) = 287.5 lb Vertical Uniform Load on Top Rail

NBC-Commercial Design Load: 102.78 plf x (69 in ÷ 12 in/ft) = 591 lb Vertical Uniform Load on Top Rail¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	60	00:00	0.00			
2.0x Design Load (IBC)	583	00:24	0.13			
Initial Load	60	01:48	0.06			
54% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	720	02:26	Achieved Load without Failure			
2.5x Design Load (NBC)	1491	03:12				

¹ Uniform load was simulated with quarter-point loading.

Test No. 6 - 07/29/22

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

NBC Design Load: 225 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 (IBC)	411	00:42	0.74	2.23	0.51	1.61
Initial Load	50	02:08	0.00	0.07	0.00	0.07
96% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	500	02:49	Achieved Load without Failure			
2.5x Design Load (NBC)	563	02:56				

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

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Test No. 7 - 08/04/22

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

NBC Design Load: 225 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	50	00:00	--	0.00	--	--
2.0x Design Load (IBC)	402	00:20	--	0.07	--	--
Initial Load	50	01:52	--	0.02	--	--
71% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (NBC)	566	02:17	Achieved Load without Failure			
4.0x Design Load (IBC)	801	02:31				

Test No. 8 - 07/29/22

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

NBC Design Load: 225 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 (IBC)	805	00:51	1.51	1.16
Initial Load	80	02:28	0.07	0.03
95% Recovery (Rail End #1) and 97% Recovery (Rail End #2) from 2.0 x Design Load (IBC)				
(2.5x Design Load) x 2 (IBC)	1001	02:59	Achieved Load without Failure	
(2.5x Design Load) x 2 (NBC)	1132	03:06		

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

Test No. 9 - 08/04/22

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

NBC Design Load: 225 lb Vertical Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	80	00:00	0.00
(2.0x Design Load) x 2 (IBC)	800	00:23	0.05
Initial Load	80	01:46	0.02
60% Recovery from 2.0 x Design Load (IBC)			
(2.5x Design Load) x 2 (NBC)	1135	02:17	Achieved Load without Failure
(4.0x Design Load) x 2 (IBC)	1612	02:23	

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

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Test Series No. 3

6 ft (76 in) by 42 in by 32° A113 PureView Stair Guardrail with Glass Balusters

Test No. 1 - 08/01/22

IBC Design Load: 50 lb / 1 Square ft at Center of In-fill (on 2 Balusters) ¹

NBC Design Load: 112 lb / 11.81 Square in at Center of In-fill (on 2 Balusters)

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 (IBC)	113	00:10	--	0.60	--	--
Initial Load	25	01:37	--	0.05	--	--
92% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	201	02:18	Achieved Load without Failure			
2.5x Design Load (NBC)	280	02:42				

¹ Load was applied through the worst case 11.81 square in loading plate.

Test No. 2 - 08/01/22

IBC Design Load: 50 lb / 1 Square ft at Bottom of In-fill (on 2 Balusters) ¹

NBC Design Load: 112 lb / 11.81 Square in at Bottom of In-fill (on 2 Balusters)

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 (IBC)	103	00:14	--	0.47	--	--
Initial Load	25	01:29	--	0.00	--	--
100% Recovery from 2.0 x Design Load (IBC)						
4.0x Design Load (IBC)	202	01:52	Achieved Load without Failure			
2.5x Design Load (NBC)	283	02:10				

¹ Load was applied through the worst case 11.81 square in loading plate.

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22

Test No. 3 - 08/01/22

IBC Design Load: 50 plf x (76 ÷ 12 in/ft) = 316.7 lb Horizontal Uniform Load on Top Rail

NBC-Commercial Design Load: 51.4 plf x (76 ÷ 12 in/ft) = 325.5 lb Horizontal Uniform Load on Top Rail¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET
Initial Load	60	00:00	0.00	0.00	0.00	0.00
2.0x Design Load (IBC)	636	00:40	0.30	2.38	0.11	2.18
Initial Load	60	02:12	0.02	0.24	0.00	0.23
89% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	794	02:42	Achieved Load without Failure			
2.5x Design Load (NBC)	826	02:45				

¹ Uniform load was simulated with quarter-point loading.

Test No. 4 - 08/02/22

IBC Design Load: 50 plf x (76 ÷ 12 in/ft) = 316.7 lb Vertical Uniform Load on Top Rail

NBC-Commercial Design Load: 102.78 plf x (76 ÷ 12 in/ft) = 650.9 lb Vertical Uniform Load on Top Rail¹

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	60	00:00	0.00
2.0x Design Load (IBC)	647	00:26	0.46
Initial Load	60	01:50	0.16
65% Recovery from 2.0 x Design Load (IBC)			
2.5x Design Load (IBC)	794	02:14	Achieved Load without Failure
2.5x Design Load (NBC)	1645	03:01	

¹ Uniform load was simulated with four equal point loads.

Test No. 5 - 08/01/22

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

NBC Design Load: 225 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 (IBC)	403	00:29	0.21	1.84	0.07	1.70
Initial Load	50	01:58	0.03	0.11	0.02	0.09
95% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (IBC)	502	02:24	Achieved Load without Failure			
2.5x Design Load (NBC)	565	02:32				

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

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22

Test No. 6 - 08/02/22

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

NBC Design Load: 225 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	50	00:00	--	0.00	--	--
2.0x Design Load (IBC)	405	00:19	--	0.35	--	--
Initial Load	50	01:42	--	0.08	--	--
77% Recovery from 2.0 x Design Load (IBC)						
2.5x Design Load (NBC)	566	02:04	Achieved Load without Failure			
4.0x Design Load (IBC)	804	02:17				

Test No. 7 - 08/02/22

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

NBC Design Load: 225 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 (IBC)	806	00:43	0.61	0.33
Initial Load	80	02:20	0.04	0.00
93% Recovery (Rail End #1) and 100% Recovery (Rail End #2) from 2.0 x Design Load (IBC)				
(2.5x Design Load) x 2 (IBC)	1013	02:43	Achieved Load without Failure	
(2.5x Design Load) x 2 (NBC)	1136	02:48		

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

Test No. 8 - 08/02/22

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

NBC Design Load: 225 lb Vertical Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	80	00:00	0.00
(2.0x Design Load) x 2 (IBC)	809	00:43	0.36
Initial Load	80	02:23	0.13
64% Recovery from 2.0 x Design Load (IBC)			
(2.5x Design Load) x 2 (NBC)	1009	03:08	Achieved Load without Failure
(4.0x Design Load) x 2 (IBC)	1127	03:14	

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

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22

**SECTION 10
CONCLUSION**

Using performance criteria of withstanding an ultimate load of 2.5 or 4.0 times design load, the test results substantiate compliance with the design load requirements of the referenced building codes for the guardrails detailed in the following table:

AL13 PUREVIEW ALUMINUM GUARDRAIL SYSTEM	GUARDRAIL TYPE	BALUSTER	SUPPORT POST	CODE OCCUPANCY CLASSIFICATION
6 ft (69-1/2 in) by 42 in	Level / In-Line Application	Glass Balusters or Full Glass Panel	3 in Square <i>Al13 Home</i> Post Mount	2020 National Building Code of Canada and 2021 IBC
6 ft (69-1/4 in) by 42 in				
6 ft (76 in) by 42 in by 32°	Stair	Glass Balusters		

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

Reference Limitations in Section 3, Test Methods for additional information regarding installation and compliance.

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22

SECTION 11

PHOTOGRAPHS



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



Photo No. 2
In-Fill Load Test at Bottom of Two Balustrades

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22



Photo No. 3
In-Fill Load Test at Center of Glass Panel



Photo No. 4
In-Fill Load Test at Bottom of Glass Panel

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22



Photo No. 5
In-Fill Load Test at Edge of Glass Panel



Photo No. 6
Horizontal Uniform Load on Top Rail

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22



Photo No. 7
Vertical Uniform Load on Top Rail



Photo No. 8
Vertical Uniform Load on Top Rail

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22



Photo No. 9

Horizontal Concentrated Load Test at Midspan of Top Rail



Photo No. 10

Vertical Concentrated Load at Midspan of Top Rail

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22



Photo No. 11
Horizontal Concentrated Load at Ends of Rail (Brackets)

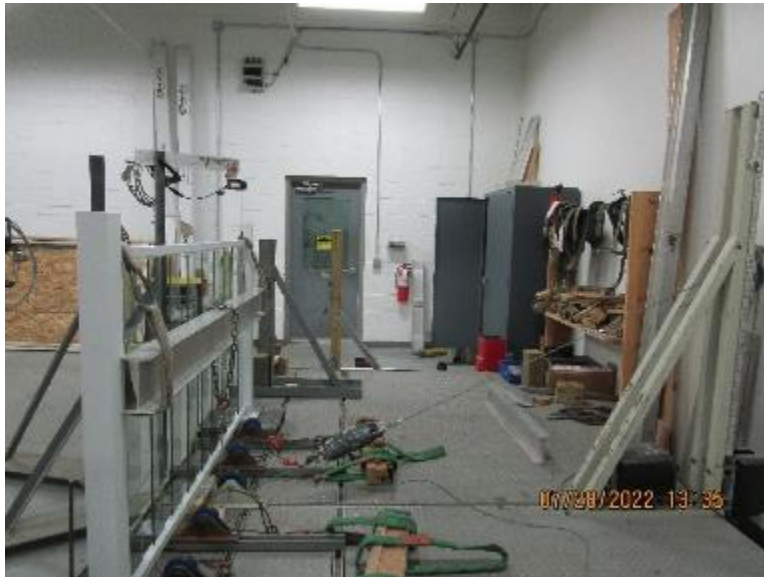


Photo No. 12
Vertical Concentrated Load at Ends of Rail (Brackets)

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

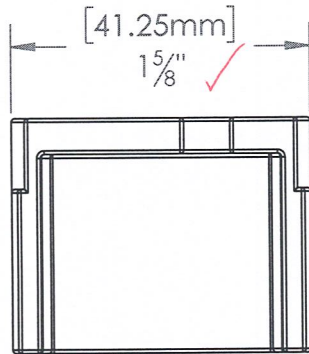
Date: 10/17/22



Photo No. 13
Concentrated Load at Top of Post Mount

SECTION 12 **DRAWINGS**

The "As-Built" drawings for the *A13 Pureview* aluminum 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.

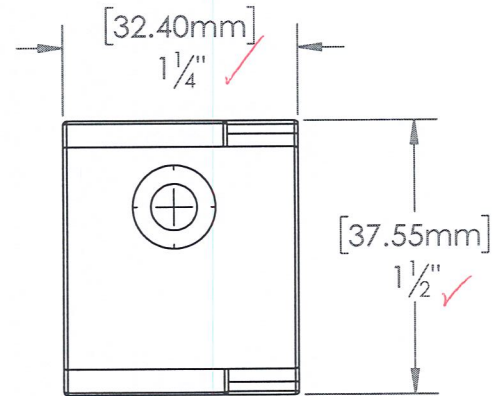
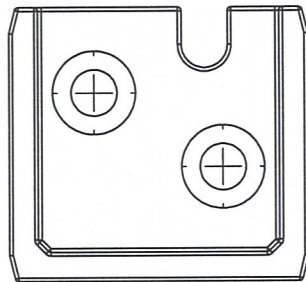
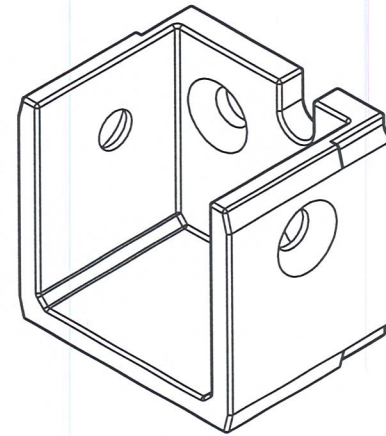


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Test sample complies with these details.
Deviations are noted.

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Date 10/17/22 Tech AJS



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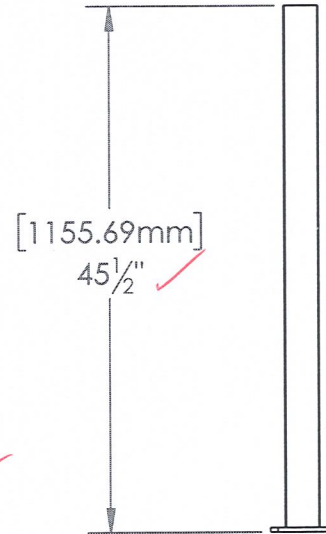
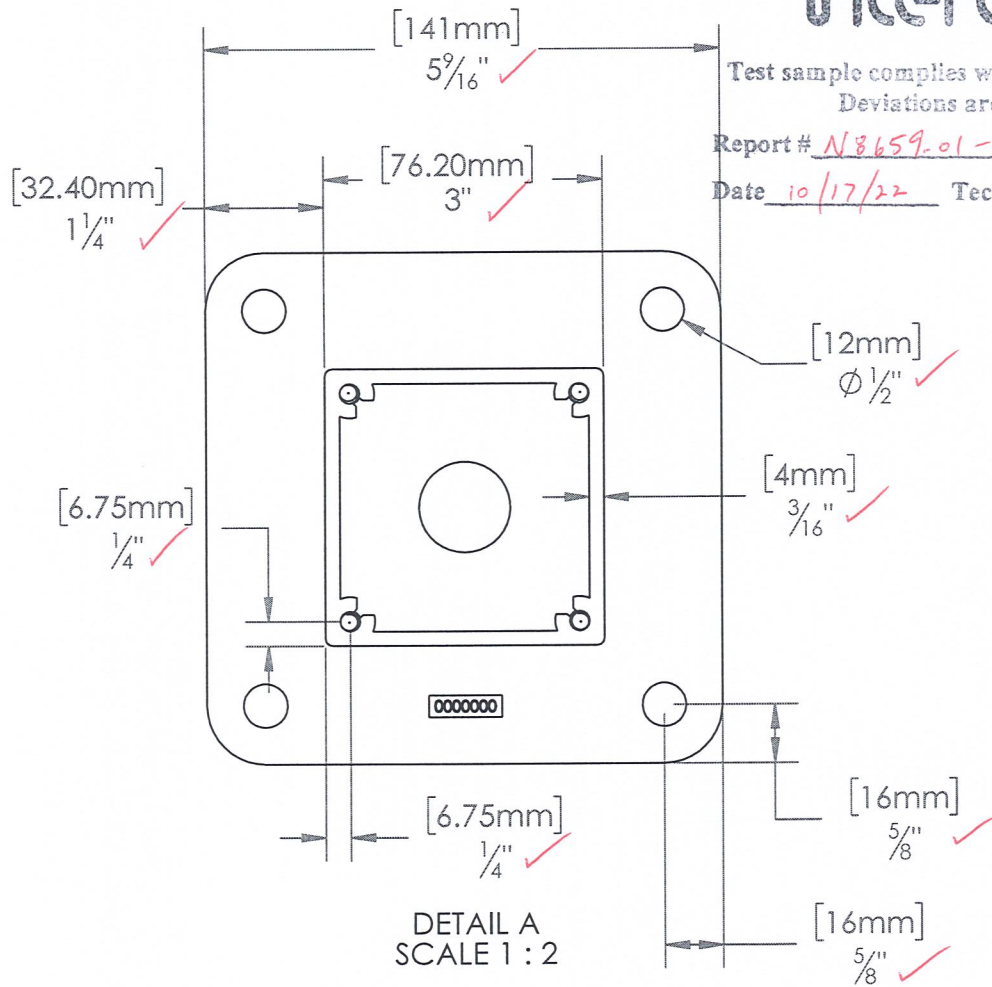
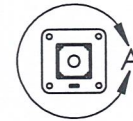
DB	1/3/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: AL13 HOME BRACKET CUP			
DRAWN BY: KevinF			SCALE: 1:1
DATE: 01/03/2019		DIVISION: RAILING	
ITEM #:	FILE NAME/PART #:		REV:
Sheet: 1 OF 1	R3934-03618A		D

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Test sample complies with these details.
Deviations are noted.

Report # N8659-01-19-19

Date 10/17/22 Tech AJS

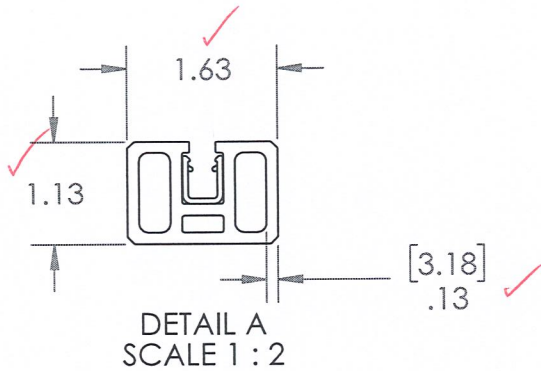


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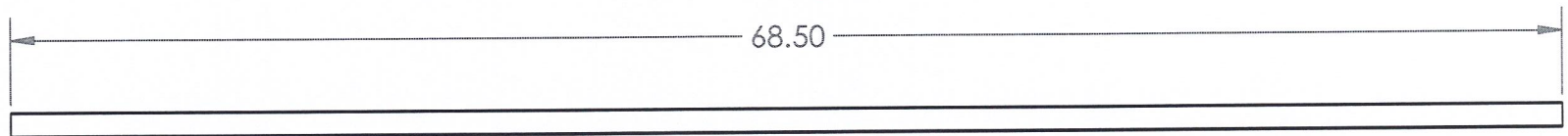
REV	DATE	BY	DESCRIPTION
A	02/05/15	KF	Initial Drawing
DESCRIPTION: AL13 PLUS-3"X45.5" SCREW BOSS POST ASSEMBLY			
DRAWN BY: KevinF			SCALE: AS SHOWN
DATE: 11/08/2019		DIVISION: Fortress Railing	
Sheet: 1 OF 1	ITEM #:	FILE NAME/PART #: R3235-08038A	REV: A



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Test sample complies with these details.
Deviations are noted.

Report # N8659-01-119-19
Date 10/17/22 Tech AJS

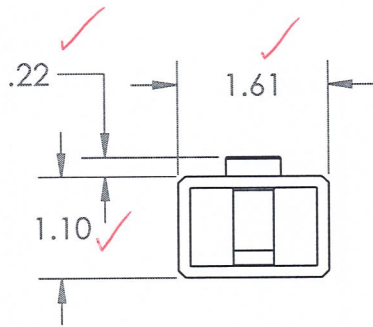
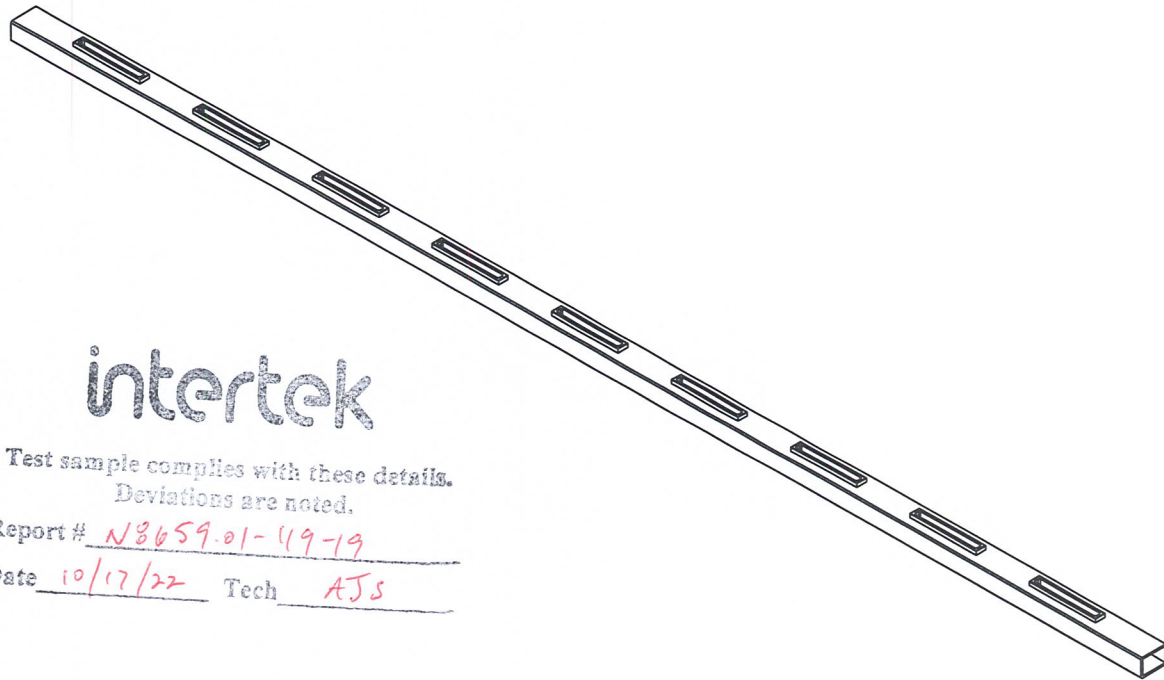


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D	12/6/17	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: PV-AL13 FGP RAILS-6'			
DRAWN BY: geoff		SCALE: 1 : 8	
DATE: 12/06/2017		DIVISION: Fortress Railing	
Sheet: 1 OF 1	ITEM #:	FILE NAME/PART #: R3531-01177A	REV: D

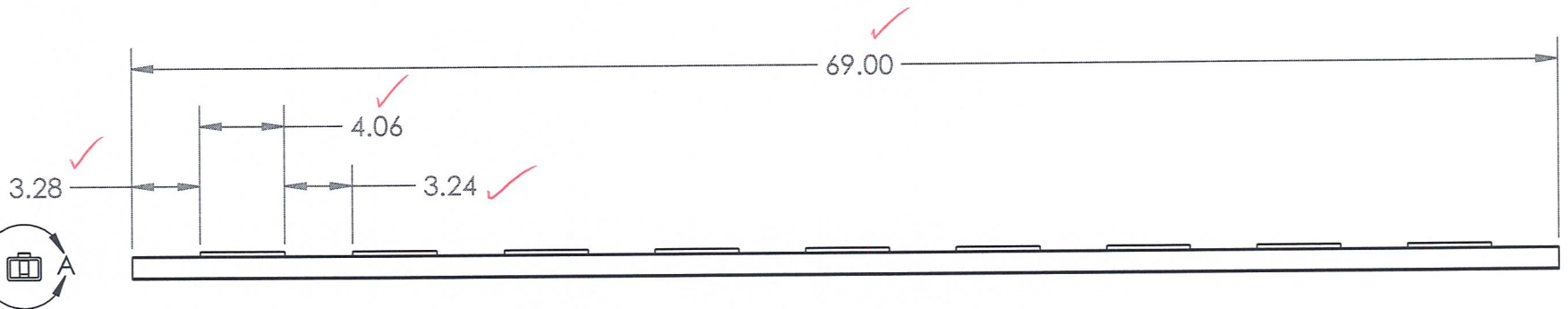


DETAIL A
SCALE 1 : 2

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Deviations are noted.

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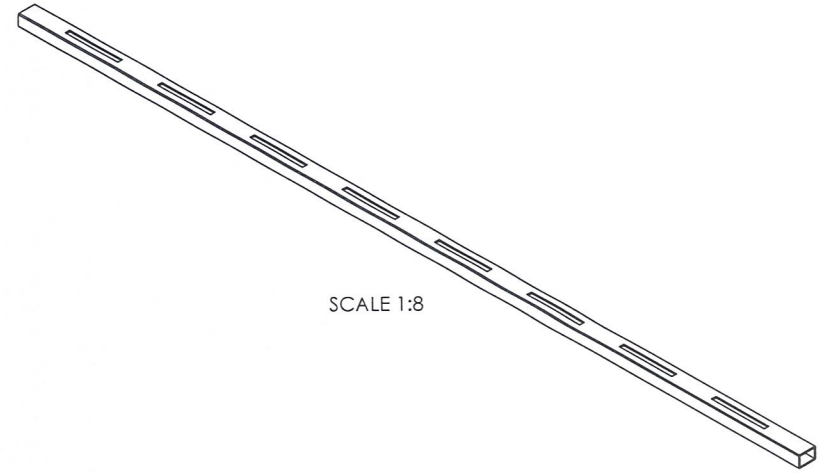


Fortress Railing
1720 N 1st Street
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A	12/6/17	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: PV-AL13 RAILS-6'			
DRAWN BY: geoff			SCALE: 1 : 8
DATE: 12/06/2017		DIVISION: Fortress Railing	
Sheet: 1 OF 1	ITEM #: 5117209X	FILE NAME/PART #: R3531-01186A	REV: A

TITLE: PV-AL13 STAIR RAIL 6'

ITEM NO.	DESCRIPTION	QTY.
1	PV-AL13 STAIR RAIL 6'	1



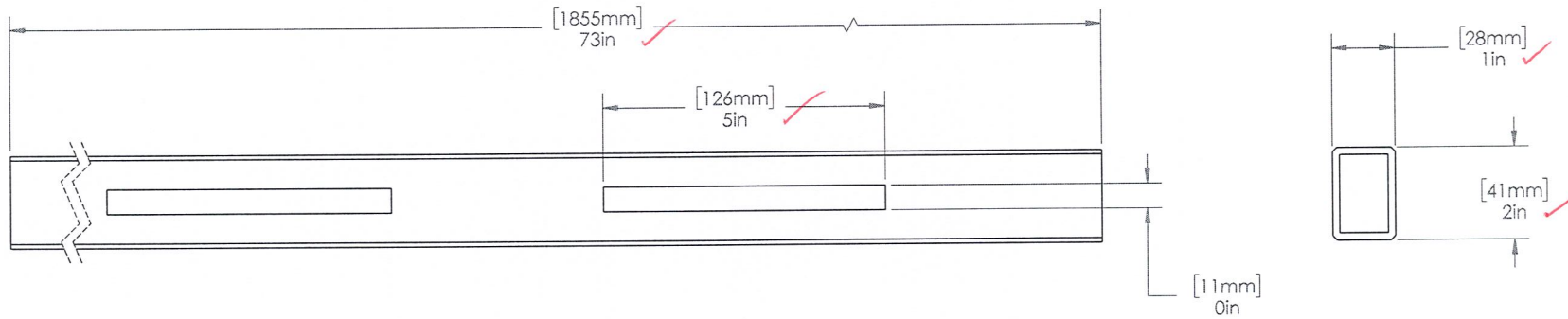
SCALE 1:8

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Test sample complies with these details.
Deviations are noted.

Report # N8659.01-119-19

Date 10/17/22 Tech AJS



- GENERAL NOTES:
1. ALL DIMENSIONS ARE SHOWN IN INCHES [mm]
 2. ALL DIMENSIONS ARE BEFORE ANY FINISHING OR COATING
 3. ALL DIMENSIONS ARE ± 0.5mm (UNLESS OTHERWISE NOTED)
 4. SEE PRODUCT LINE NOTES PAGE R3500-00001
 5. MATERIAL: 6063-T6
 6. WEIGHT: 4.13 LBM
 7. WARRANTY: N/A

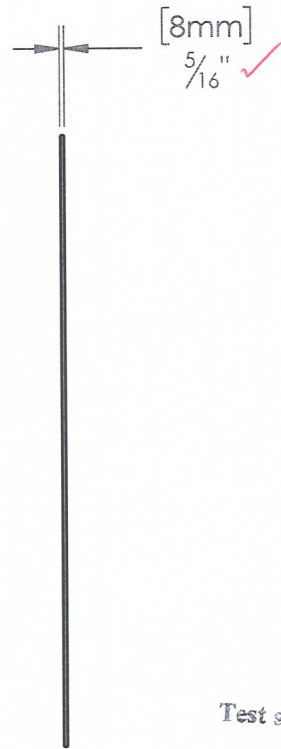
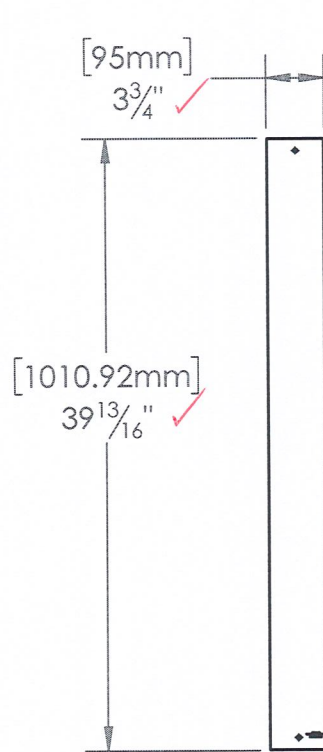
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Sheet: 1 OF 1

REV.	DATE	BY	DESCRIPTION	SCALE:
E	7/30/2020	JH	STANDARDIZED	1:2
DESCRIPTION:				REV:
PV-AL13 STAIR RAIL 6'				E
DRAWN BY: evant		DIVISION: Fortress Railing		1:2
DATE: 10/07/2022		FILE NAME/PART #:		REV:
ITEM #:		R3531-01576A		E



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Test sample complies with these details.
Deviations are noted.

Report # N 8659.01-119-19

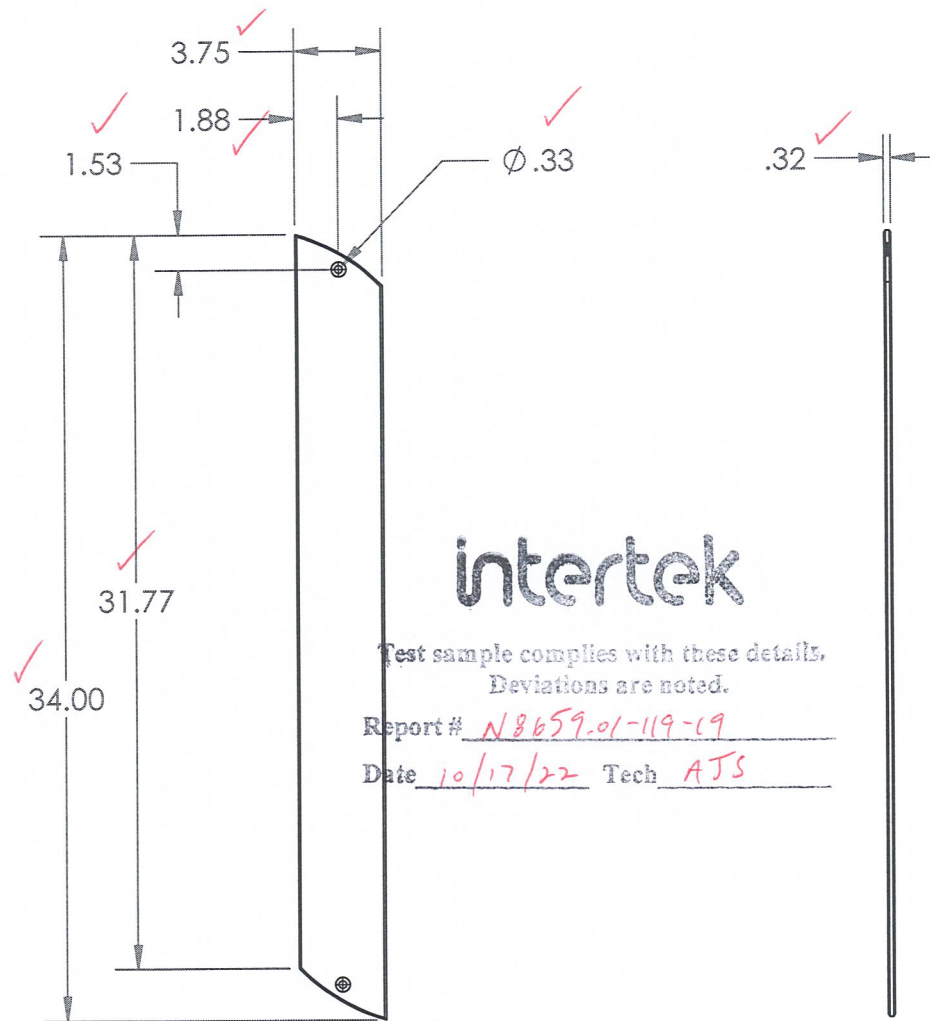
Date 10/17/22 Tech AJS

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C	12/10/20	KF	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: PV-PLA-40"			
DRAWN BY: KevinF		SCALE: 1:12	
DATE: 12/10/2020		DIVISION: Fortress Railing	
Sheet: 1 OF 1	ITEM #:	FILE NAME/PART #: R3532-01180A	REV: C



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Test sample complies with these details.
Deviations are noted.

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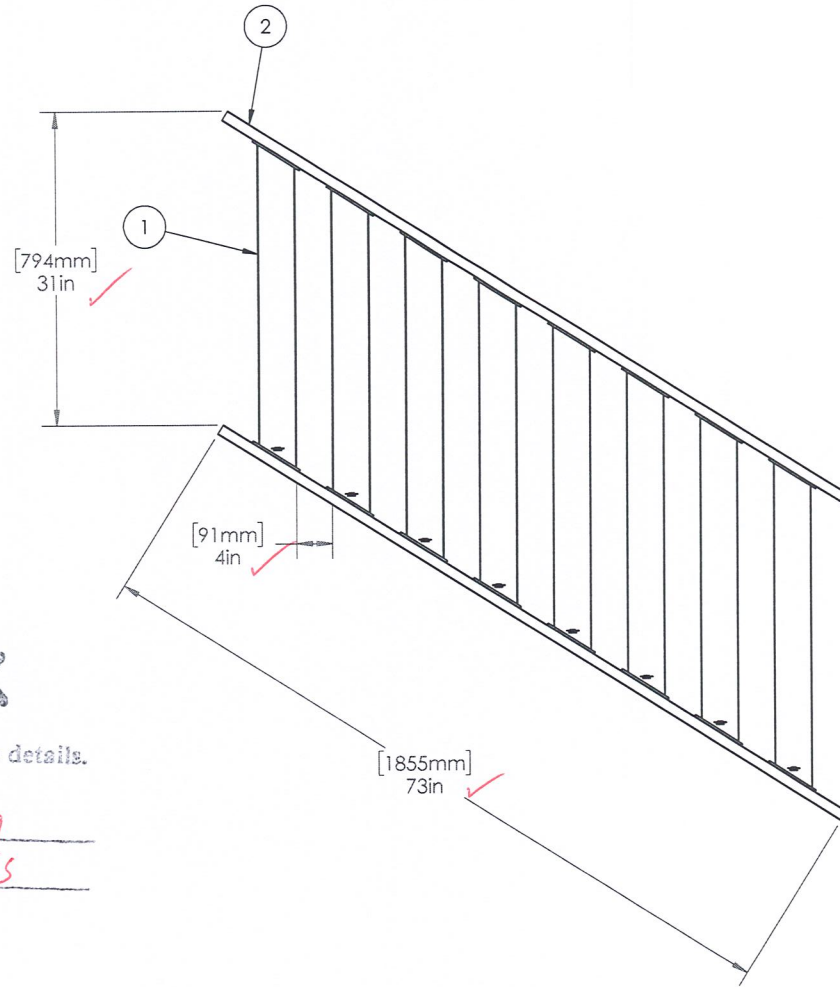


Fortress Railing
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B	12/6/17	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: PV-STR-34"			
DRAWN BY: geoff			SCALE: 1:8
DATE: 12/06/2017 DIVISION: Fortress Rail			
Sheet: 1 OF 1	ITEM #: 660530	FILE NAME/PART #: R3532-01506A	REV: B

TITLE: PV-AL13 PLA 34"X6' STAIR PANEL

ITEM NO.	DESCRIPTION	QTY.
1	PV-STR-34"	8
2	PV-AL13 STAIR RAILS-6'	2



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Test sample complies with these details.
Deviations are noted.

Report # N8659.01-119-19
Date 10/17/22 Tech AJS

- GENERAL NOTES:
1. ALL DIMENSIONS ARE SHOWN IN INCHES (MM)
 2. ALL DIMENSIONS ARE ± 0.5mm (UNLESS OTHERWISE NOTED)
 3. MATERIAL: NOTED IN INDIVIDUAL DRAWINGS
 4. WEIGHT: 36.17 LBM
 5. WARRANTY:

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Sheet: 1 OF 1

0	9/17/15	ET	Initial Drawing
REV:	DATE	BY	DESCRIPTION
DESCRIPTION: PV-AL13 PLA 34"X6' STAIR PANEL			
DRAWN BY: evant			SCALE: 1 : 12
DATE: 10/07/2022 DIVISION: Fortress Railing			REV: 0
ITEM #:	FILE NAME/PART #: R3536-01579A		

TITLE: PV AL13 HOME GROMMET ANGLE

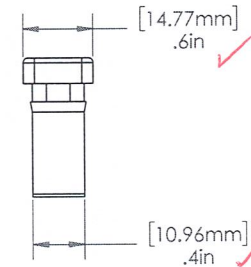
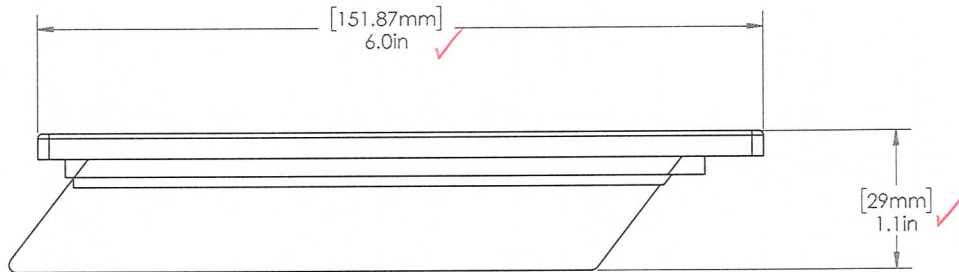
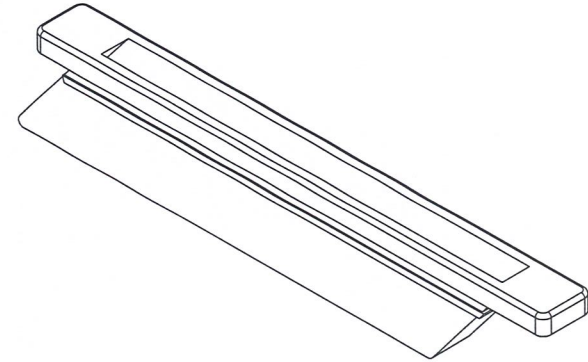
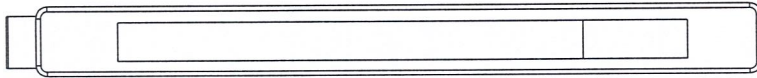
ITEM NO.	DESCRIPTION	QTY.
1	PV AL13 HOME GROMMET ANGLE	1

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Test sample complies with these details.
Deviations are noted.

Report # N8659-01-119-19

Date 10/17/22 Tech AJS



GENERAL NOTES:
 1. ALL DIMENSIONS ARE SHOWN IN INCHES [mm]
 2. ALL DIMENSIONS ARE BEFORE ANY FINISHING OR COATING
 3. ALL DIMENSIONS ARE ± 0.5mm [UNLESS OTHERWISE NOTED]
 4. SEE PRODUCT LINE NOTES PAGE R3500-00001
 5. MATERIAL: PA 66 (NYLON 66) 15% Glass
 6. WEIGHT: 0.05 LBM
 7. WARRANTY: N/A

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FORTRESS
 BUILDING PRODUCTS

Sheet: 1 OF 1

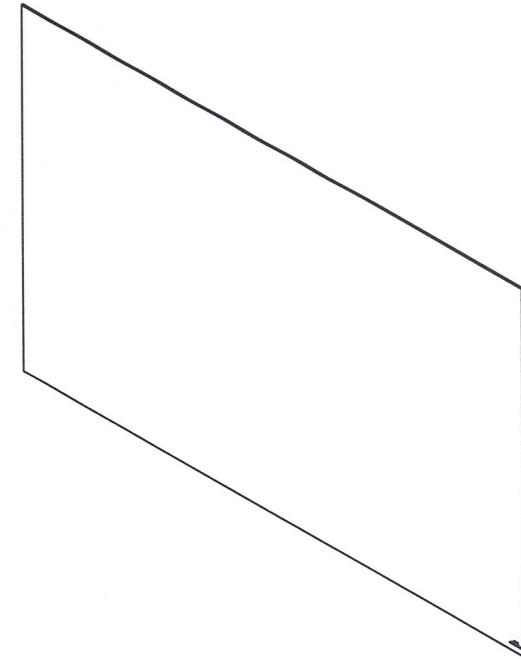
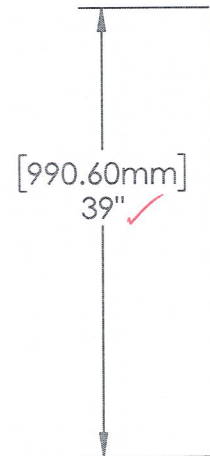
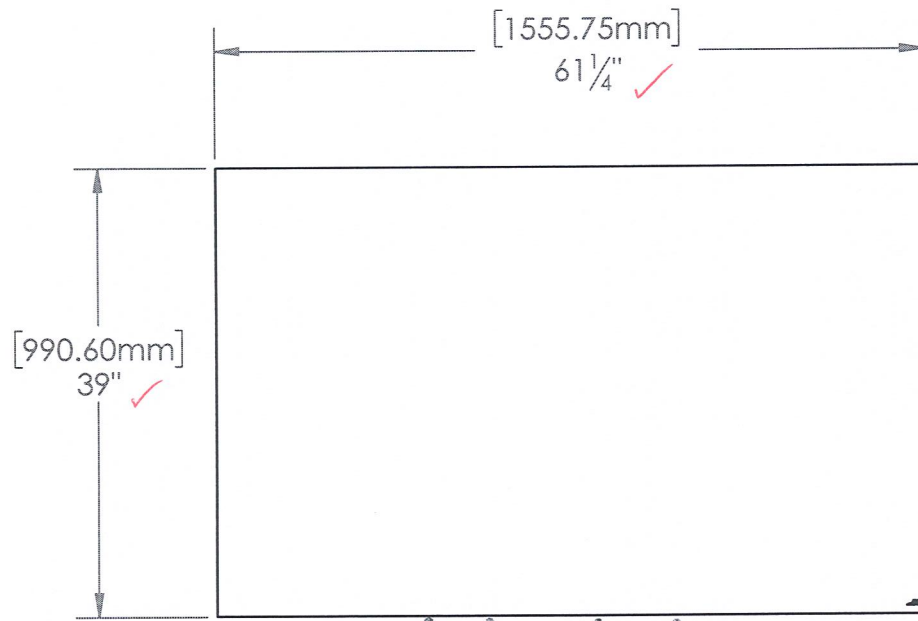
REV	DATE	BY	DESCRIPTION
2	6/15/21	JH	FIX DIMENSIONS, FIX VIEWS

DESCRIPTION:
 PV AL13 HOME GROMMET ANGLE

DRAWN BY: geoffi
 DATE: 10/07/2022 DIVISION: Fortress Railing

ITEM #: R3539-10317A

SCALE: 1:1
 REV: 2



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Report # N8059-01-119-19

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Sheet 1 OF 1

C	12/10/20	KF	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: PV -FGP 39" X 61.25"			
DRAWN BY: KevinF		SCALE: 1:16	
DATE: 12/10/2020		DIVISION:	
ITEM #:	FILE NAME/PART #:	REV:	
	R3540-01171A	C	

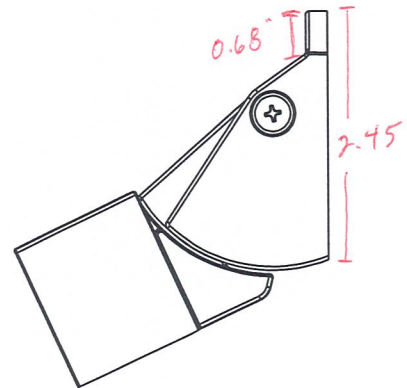
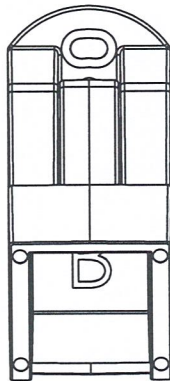
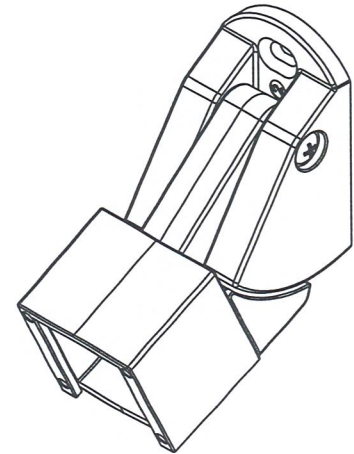


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Test sample complies with these details.
Deviations are noted.

Report # N8659-01-119-19

Date 10/17/22 Tech AJS

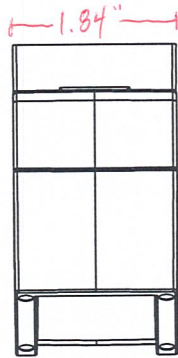


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Fortress Railing
1720 N 1st Street
Garland, Tx 75040

6	1/14/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: SIMPLIFIED STAIR BRACKET SSB-05			
DRAWN BY: KevinF			SCALE: 1:2
DATE: 01/14/2019			DIVISION: Fortress Railing
Sheet: 4 OF 4	ITEM #: 5350506X	FILE NAME/PART #: R3734-05746A	REV: 6

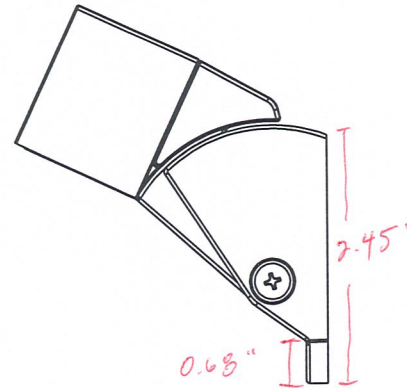
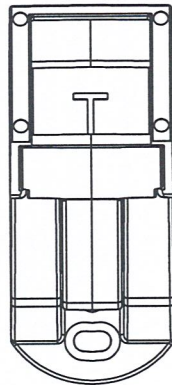
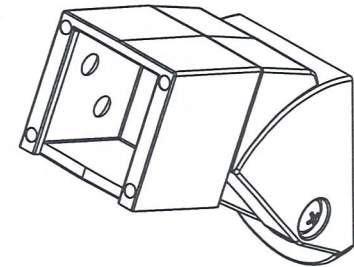


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Test sample complies with these details.
Deviations are noted.

Report # N8659.01-119-19

Date 10/17/22 Tech AJS

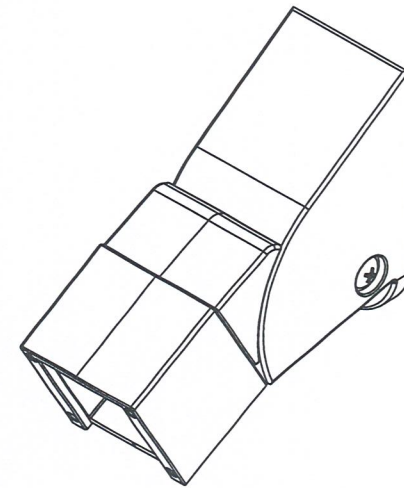
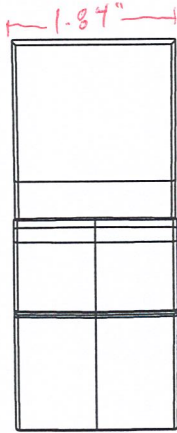


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Fortress Railing
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Garland, Tx 75040

6	1/14/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: SIMPLIFIED STAIR BRACKET SSB-05			
DRAWN BY: KevinF			SCALE: 1:2
DATE: 01/14/2019		DIVISION: Fortress Railing	
Sheet: 2 OF 4	ITEM #: 5350506X	FILE NAME/PART #: R3734-05746A	REV: 6

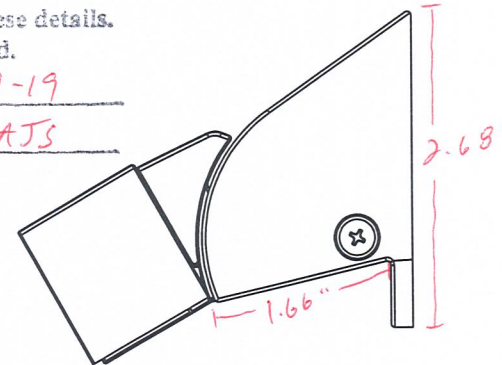
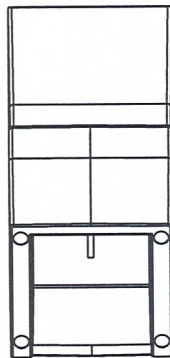


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Deviations are noted.

Report # N8659-01-119-19

Date 10/17/22 Tech AJS

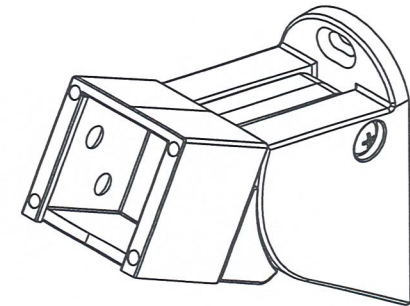
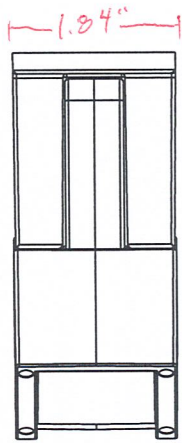


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Fortress Railing
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Garland, Tx 75040

6	1/14/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: SIMPLIFIED STAIR BRACKET SSB-05			
DRAWN BY: KevinF		SCALE: 1:2	
DATE: 01/14/2019		DIVISION: Fortress Railing	
SHEET: 1 OF 4	ITEM #: 5350506X	FILE NAME/PART #: R3734-05746A	REV: 6

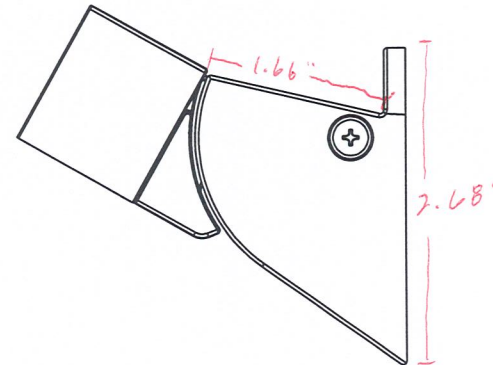
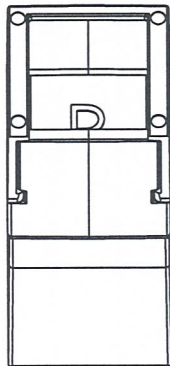


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Deviations are noted.

Report # NB659.01-119-19

Date 10/17/22 Tech AJS



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Fortress Railing
1720 N 1st Street
Garland, Tx 75040

6	1/14/19	GL	Initial Drawing	
REV	DATE	BY	DESCRIPTION	
DESCRIPTION:				
SIMPLIFIED STAIR BRACKET SSB-05				
DRAWN BY: KevinF			SCALE: 1:2	
DATE: 01/14/2019		DIVISION: Fortress Railing		
Sheet: 3 OF 4	ITEM #: 5350506X	FILE NAME/PART #: R3734-05746A		REV: 6



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TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: N8659.01-119-19 R0

Date: 10/17/22

SECTION 13

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	10/17/22	N/A	Original Report Issue