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FAIRWAY ARCHITECTURAL RAILING SOLUTIONS
TEST REPORT

SCOPE OF WORK
STRUCTURAL PEFORMANCE TESTING ON THE *A210* LEVEL ALUMINUM GUARDRAIL SYSTEM

REPORT NUMBER
J3980.01-119-19 R0

TEST DATE(S)
02/14/19 - 02/15/19

ISSUE DATE
04/05/19

RECORD RETENTION END DATE
02/15/23

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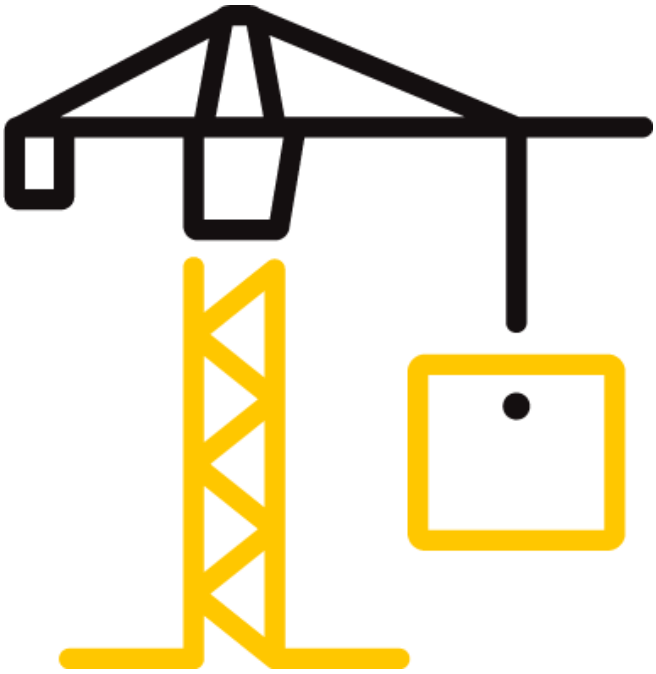

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TEST REPORT FOR FAIRWAY ARCHITECTURAL RAILING SOLUTIONS

Report No.: J3980.01-119-19 R0
Date: 04/05/19

REPORT ISSUED TO

FAIRWAY ARCHITECTURAL RAILING SOLUTIONS
53 Eby Chiques Road
P.O. Box 37
Mount Joy, Pennsylvania 17552

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Fairway Architectural Railing Solutions to perform structural performance testing in accordance with the 2018 IBC on their 72 in wide by 42 in high *A210* level aluminum 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 support posts. Posts and 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 method(s). Testing was conducted at Intertek-ATI's 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(s) met the 2018 IBC/IRC design load performance requirements for use in both IBC All Use Groups applications and IRC One- and Two-Family Dwellings.

For INTERTEK B&C:

COMPLETED BY:	Emily C. Riley	**REVIEWED BY:**	V. Thomas Mickley, Jr, P.E.
TITLE:	Project Manager	**TITLE:**	Senior Staff Engineer
SIGNATURE:	Digitally Signed by: Emily C. Riley	**SIGNATURE:**	Digitally Signed by: Virgal Thomas Mickley, Jr.
DATE:	04/05/19	**DATE:**	04/05/19

ECR/vtm:aas

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SECTION 3
TEST METHOD(S)

The specimens were evaluated in accordance with the following:

2018, *International Building Code®*, International Code Council

2018, *International Residential Code®*, International Code Council

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of IBC 2018.

SECTION 4
MATERIAL SOURCE/INSTALLATION

Test samples were provided by the client.

The guardrail assemblies were 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	Fairway Architectural Railing Solutions
Alva R. Baker	Intertek B&C
Adam J. Schrum	Intertek B&C
Emily C. Riley	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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SECTION 8
TEST SPECIMEN DESCRIPTION

Fairway Architectural Railing Solutions provided the fully-assembled test specimens with the following details:

PRODUCT	*A210*
TYPE	Aluminum guardrail system
OVERALL DIMENSIONS	72-1/4" wide (inside of post to inside of post) by 40-1/4" high (top of top rail to bottom of bottom rail)
TOP SUB RAIL / BOTTOM RAIL	1-1/4 in high by 1-5/16 in wide by 0.07 in wall "U" shaped aluminum (6063-T6) extrusion
TOP RAIL CAP	2 in high by 2-7/16 in wide by 0.07 in wall contoured (bread loaf) aluminum (6063-T6) extrusion
PICKETS (IN-FILL)	Mesh panel constructed from woven 1/4" diameter aluminum rod spaced 3 in on-center in both directions
	3/4 in square by 0.045 in wall aluminum (6063-T6) extrusion with 0.02 in high by 0.19 in wide internal longitudinal ribs running the length of the baluster on each face and 1/4 in diameter holes on one face for wire mesh infill attachment - located at each end of the mesh infill panel
TOP RAIL BRACKETS	1.35 in high by 1.88 in wide by 1.24 long cast zinc (Z3) collar bracket
BOTTOM RAIL BRACKETS	1.2 in high by 1.5 in wide by 1.15 in long cast zinc (Z3) collar bracket
SQUARE INFILL BALUSTER PLUG	0.65 in diameter by 0.68 in long ribbed nylon plug with countersunk hole for attachment
MESH INFILL BALUSTER PLUG	0.65 in diameter by 0.68 in long ribbed nylon plug with a 0.75 in square by 0.11 in thick back plate for attachment to rail; four plugs were spaced along each rail
POST	3 in square by 0.090 in wall aluminum (6063-T5) tube
SUPPORT FOOT	1 in wide by 1-5/16 in deep by 0.198 in wall by appropriate length T-shaped cast zinc (Z3) at mid-span bottom rail

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Report No.: J3980.01-119-19 R0
Date: 04/05/19

Fastening Schedule

CONNECTION	FASTENER
TOP AND BOTTOM RAIL BRACKET TO POST	Two #8-18 x 1-1/2 in (0.107 in minor diameter), flat head, square drive, stainless steel screws
TOP RAIL BRACKET TO RAIL	Two #8-18 x 3/4 in (0.110 in minor diameter) pan head, square drive, self-drilling, stainless steel screws
BOTTOM RAIL BRACKET TO RAIL	Two #8-18 x 3/4 in (0.110 in minor diameter) pan head, square drive, self-drilling, stainless steel screws
MESH INFILL TO TOP / BOTTOM RAILS	Slip fit into routings in rails and secured with a PVC baluster plug located 2-1/2 in and 34-1/2 in" from each end
MESH INFILL TO SQUARE INFILL	No mechanical attachment - slip fit into routings in pickets
SQUARE INFILL BALUSTER PLUGS TO TOP / BOTTOM RAILS	One #10-8 x 1-1/2 in (0.113 in minor diameter) flat-head, square drive, stainless steel screw
MESH INFILL BALUSTER PLUG TO TOP / BOTTOM RAILS	No mechanical attachment - channel fit to rails
BOTTOM RAIL SUPPORT TO BOTTOM RAIL	One #8-18 x 3/4 in (0.110 in minor diameter) pan head, square drive, self-drilling, stainless steel screws

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 No. 1 [2] - 02/14/19
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 [1]
Initial Load	25	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	101	00:24	0.75	2.75	0.70	2.03
Initial Load	25	01:53	0.07	0.53	0.10	0.45
78% Recovery from 2.0 x Design Load						
2.5x Design Load	126	02:19	Achieved Load without Failure			

[1] *Net displacement was the infill displacement relative to its top and bottom.*

[2] *Test was performed on an 8 ft by 42 in rail assembly which qualifies the infill for the 6 ft by 42 in assembly.*

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Test No. 2 [2] - 02/14/19
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 [1]
Initial Load	25	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	101	00:18	0.08	1.09	0.08	1.01
Initial Load	25	01:45	0.01	0.15	0.01	0.14
86% Recovery from 2.0 x Design Load						
2.5x Design Load	127	02:02	Achieved Load without Failure			

[1] *Net displacement was the bottom rail displacement relative to its ends.*

[2] *Test was performed on an 8 ft by 42 in rail assembly which qualifies the infill for the 6 ft by 42 in assembly.*

Test No. 3 [2] - 02/14/19
Design Load: 50 lb / 1 Square ft at Edges of In-fill

LOAD LEVEL [1]	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)	
			INFILL END #1	INFILL END #2
Initial Load	50	00:00	0.00	0.00
2.0x Design Load	204	00:33	1.28	1.29
Initial Load	50	02:14	0.12	0.12
91% Recovery from 2.0 x Design Load				
2.5x Design Load	253	02:49	Achieved Load without Failure	

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

[2] *Test was performed on an 8 ft by 42 in rail assembly which qualifies the infill for the 6 ft by 42 in assembly.*

Test No. 4 - 02/15/19
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	45	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	416	00:12	0.22	1.24	0.20	1.03
Initial Load	51	02:01	0.03	0.05	0.03	0.02
98% Recovery from 2.0 x Design Load						
2.5x Design Load	501	02:27	Achieved Load without Failure			

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

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Report No.: J3980.01-119-19 R0
Date: 04/05/19

Test No. 5 - 02/15/19
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	82	00:00	0.00	0.00
2.0x Design Load	817	00:17	0.99	0.96
Initial Load	83	02:12	0.25	0.16
75% / 83% Recovery from 2.0 x Design Load				
2.5x Design Load	1014	02:24	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. 6 - 02/15/19
Design Load: 50 plf x (72-1/4 in ÷ 12 in/ft) = 301 lb Uniform Load on Top Rail - Horizontal [2]

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)			
			END	MID	END	NET [1]
Initial Load	78	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	603	00:12	0.67	1.21	0.39	0.68
Initial Load	78	02:00	0.07	0.06	0.01	0.02
97% Recovery from 2.0 x Design Load						
2.5x Design Load	758	02:27	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 three equal point loads.*

Test No. 7 [1] - 02/15/19
Design Load: 50 plf x (72-1/4 in ÷ 12 in/ft) = 301 lb Uniform Load on Top Rail - Vertical [2]

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	81	00:00	0.00
2.0x Design Load	603	00:43	0.49
Initial Load	80	02:20	0.02
96% Recovery from 2.0 x Design Load			
2.5x Design Load	751	02:57	Achieved Load without Failure

[1] *Test was performed conservatively with the posts unrestrained.*

[2] *Uniform load was simulated with three equal point loads.*

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Test No. 5 [1] **- 02/15/19**
Design Load: **200 lb Concentrated Load at Midspan of Top Rail - Vertical**

LOAD LEVEL [1]	TEST LOAD (lb)	E.T. (min:sec)	RAIL DISPLACEMENT (in)
Initial Load	54	00:00	0.00
2.0x Design Load	403	00:10	0.68
Initial Load	56	02:01	0.02
97% Recovery from 2.0 x Design Load			
2.5x Design Load	510	02:08	Achieved Load without Failure

[1] *Test was performed conservatively with the posts unrestrained.*

SECTION 10
CONCLUSION

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 72 in wide by 42 in high railing assembly (*A210*) reported herein when limited to use in both IBC All Use Groups applications and One- and Two-Family Dwellings when attached to adequate supports of similar material reported herein. The support posts were not included in the scope the evaluation and were used only to facilitate attachment of the rail.

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SECTION 11
PHOTOGRAPHS

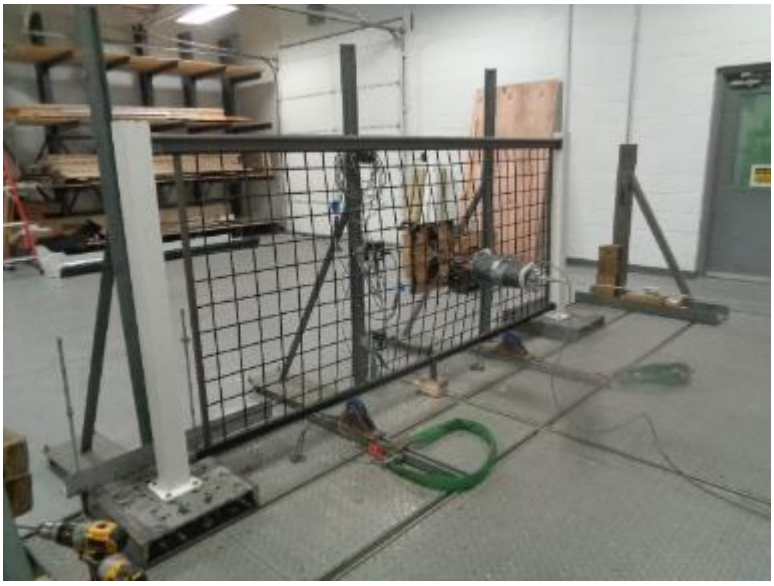

Photo No. 1
In-Fill Load Test at Center of Infill

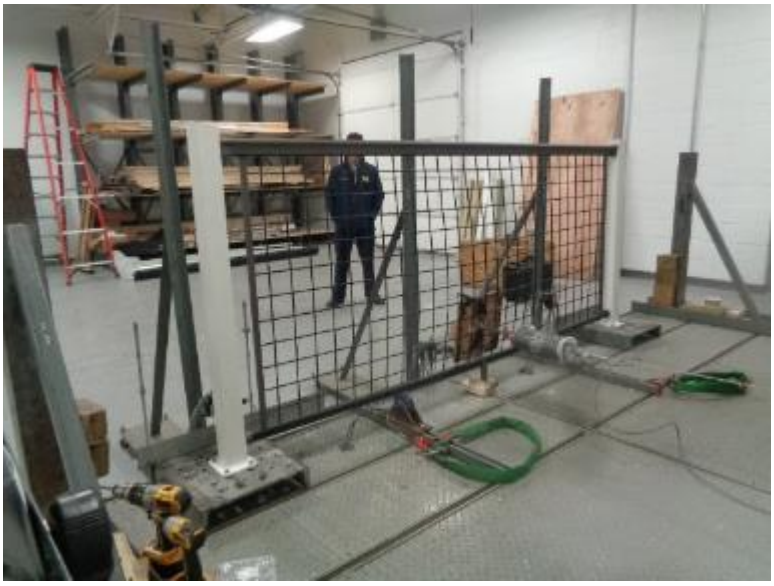

Photo No. 2
In-Fill Load Test at Bottom of Infill

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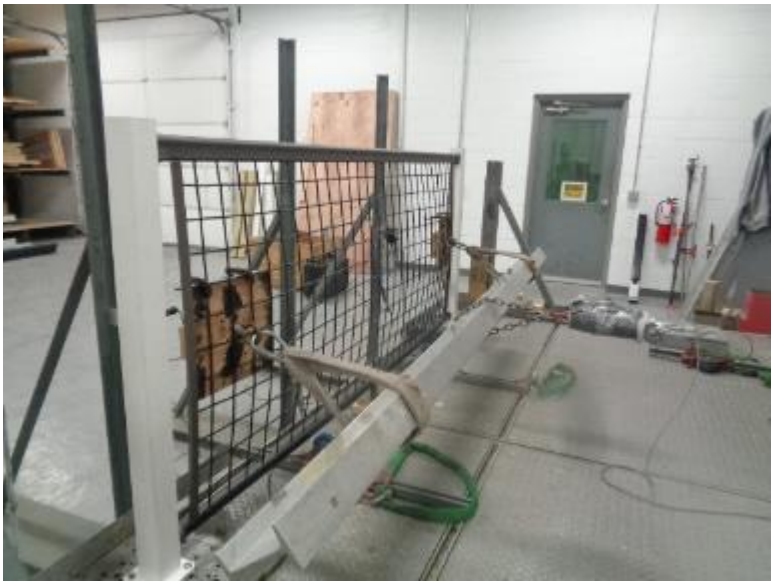

Photo No. 3
Infill Load Test at Edges of Infill

Photo No. 4
Horizontal Concentrated Load Test at Midspan of Top Rail

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Photo No. 5
Concentrated Load at Ends of Top Rail (Brackets)

Photo No. 6
Horizontal Uniform Load on Top Rail

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Photo No. 7
Vertical Uniform Load on Top Rail

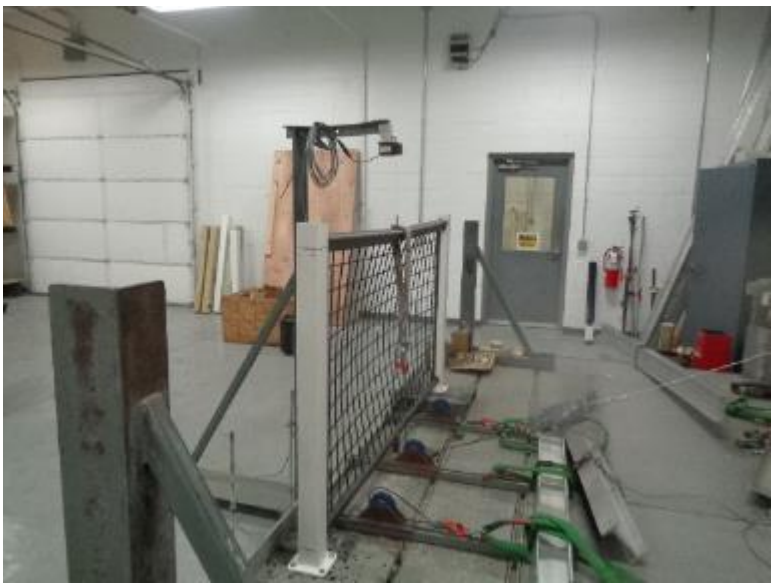

Photo No. 8
Vertical Concentrated Load on Top Rail

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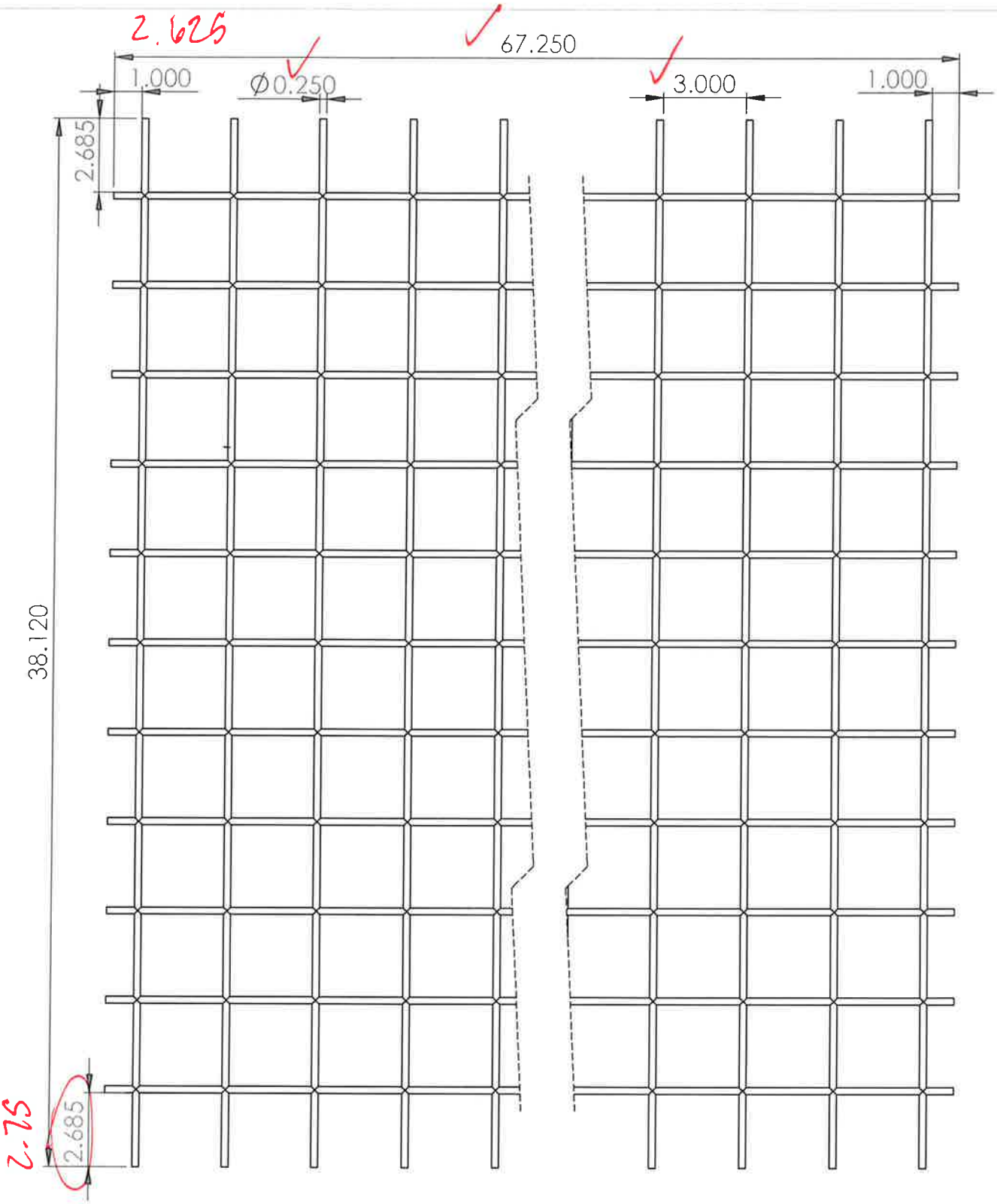
SECTION 12
DRAWINGS

The for the *AL 210* 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 # J3780

Date 3/8/19 **Tech** SOC

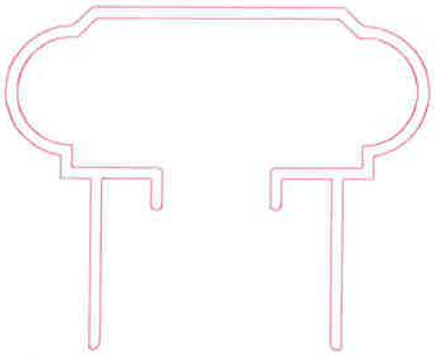
Dimensions and tolerances contained on drawings and figures are for reference only and may not encompass total allowable and approved dimensional variations.

Title: 42"x72" Wire Mesh Infill

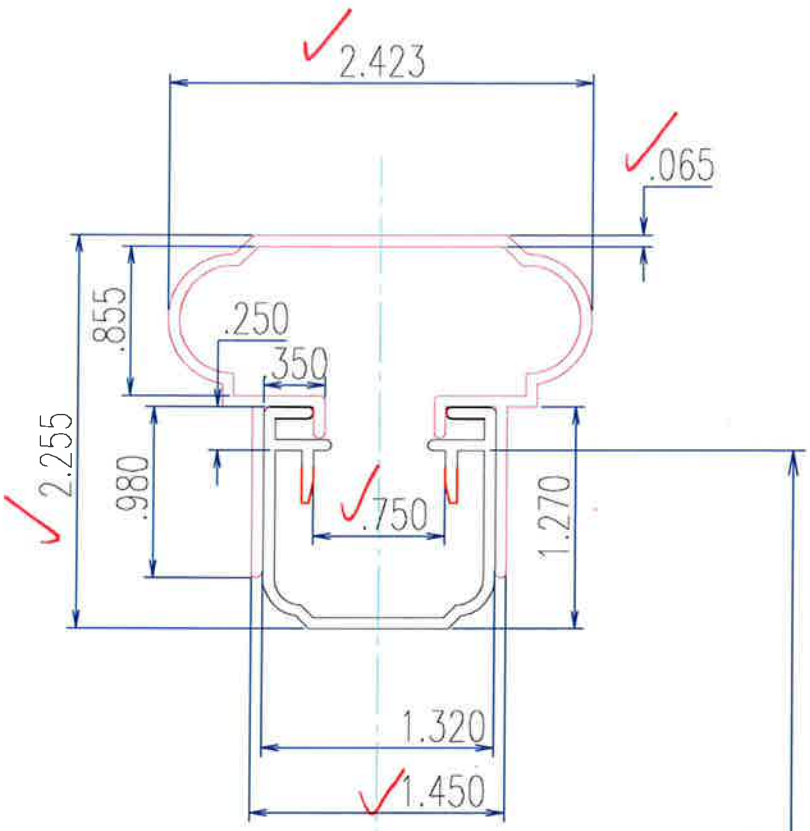
Fairway Building Products, L.P.
P.O Box 37 Mount Joy, PA 17552

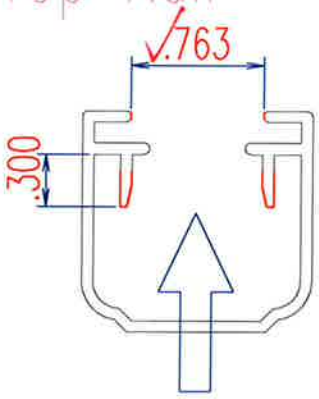
UOM inch | REF# | REV.

SCALE | SHEET# 1 of 1 | DRAWN BY FBP | Date 9/5/18



Top Rail





Sub Rail

Punch

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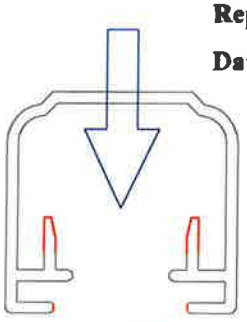
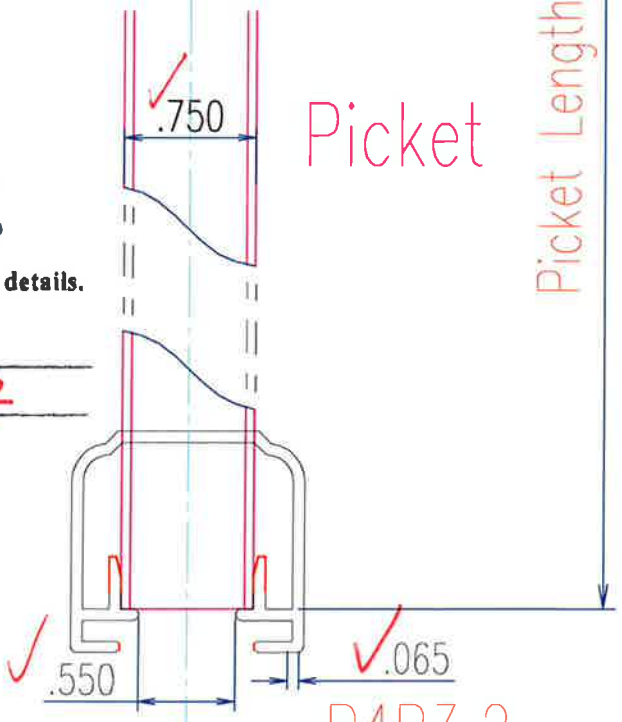


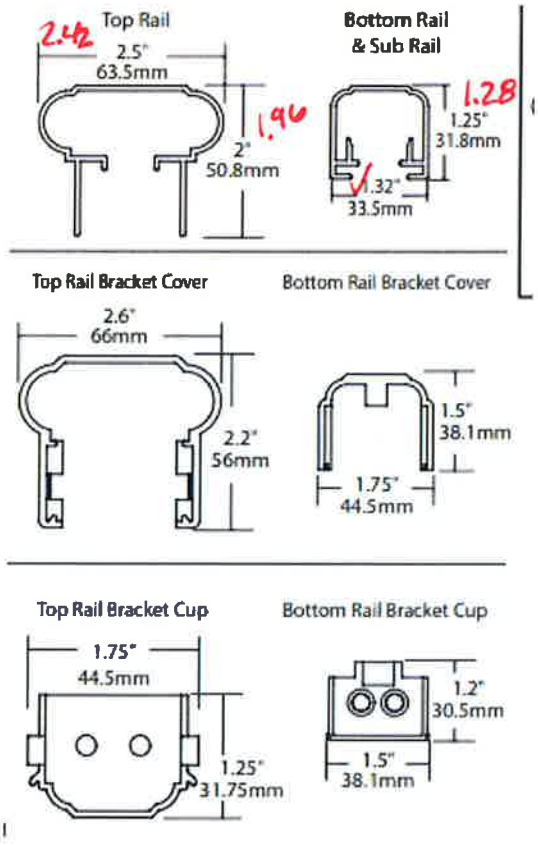
Bottom Rail



P4R3.2

12-212 Thailand Rail

20141015



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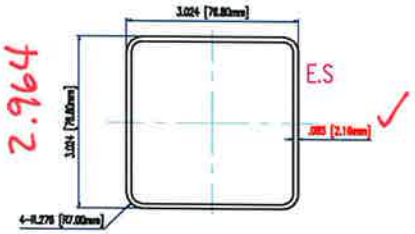
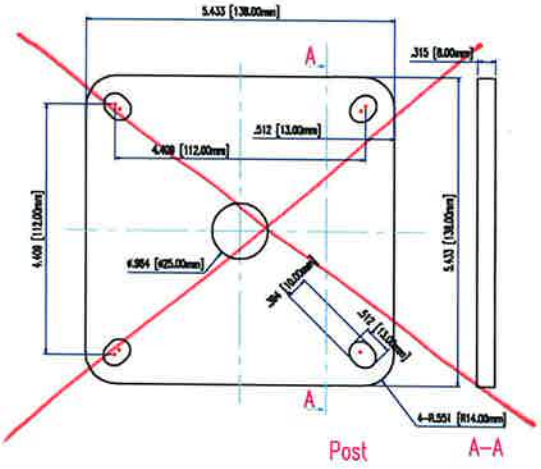
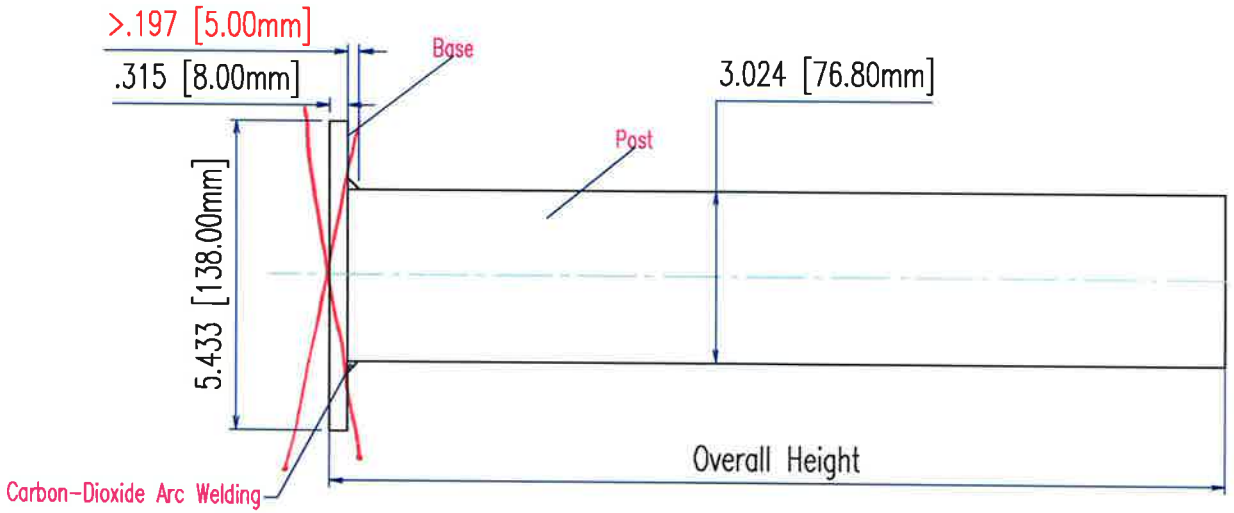
2.964







13-157B1P2 (14-009) R0.2
3in Weld Post and Base
Al. 6063-5 Powder Coating

sizes:
3"x3"x39" Flange Mounting Post
3"x3"x44" Flange Mounting Post
3"x3"x54" Flange Mounting Post

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SECTION 13
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	04/05/19	N/A	Original Report Issue