

FORTRESS BUILDING PRODUCTS TEST REPORT

SCOPE OF WORK

ICC-ES AC273 TESTING ON FE26 AXIS LEVEL AND STAIR RAILING

REPORT NUMBER

P6104.01-119-19 R0

TEST DATES

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TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23

REPORT ISSUED TO

FORTRESS BUILDING PRODUCTS

1720 North First Street

Suite B

Garland, TX 75040

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 ICC-ES™ AC273 on their *Fe26 Axis* level and stair railing. This report is in conjunction with Intertek report No.'s P6104.02-119-15 which includes product sampling information and B2564.01-119-19 which includes structural performance testing of the 2 in *Fe26* post mount. Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at the Intertek Building & Construction (B&C) test facility in York, Pennsylvania where testing was completed.

Intertek B&C in York, Pennsylvania has demonstrated compliance with ISO/IEC International Standard 17025 and is accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. (IAS). Intertek B&C is accredited to perform all testing reported herein.

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.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. Intertek B&C 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.
TITLE:	Project Manager	TITLE:	Senior Staff Engineer
SIGNATURE:		SIGNATURE:	
DATE:	04/17/23	DATE:	04/17/23

AJS:vtm/aas

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SECTION 2

TEST METHODS

The specimens were evaluated in accordance with Section 4.2 of the following:

ICC-ES™ AC273 (Approved February 2008, editorially revised March 2016), *Acceptance Criteria for Handrails and Guards*

ICC-ES™ AC273 was developed by the ICC Evaluation Service, Inc. (ICC-ES™) as acceptance criteria to evaluate compliance with the following building codes:

2015 *International Building Code*®, International Code Council

2015 *International Residential Code*®, International Code Council

The specimens were also evaluated in accordance with the following:

ASTM D1761-12, *Standard Test Methods for Mechanical Fasteners in Wood*

Limitations

All tests performed were to evaluate structural performance of the railing assembly to carry and transfer imposed loads to the supports (posts). The test specimen evaluated included the pickets, rails, rail brackets, posts, and attachment to the supporting structure. Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

Testing is limited to satisfying the IRC - One- and Two-Family Dwellings requirements of ICC-ES™ AC273.

SECTION 3

MATERIAL SOURCE

The specimens were selected virtually by Intertek B&C personnel. The specimens were selected and tagged prior to shipment on 01/11/2023, (Reference Intertek B&C Test Specimen Selection Report No. P6104.02-119-15, dated 03/29/2023).

Representative samples of the test specimens will be retained by Intertek B&C for a minimum of four years from the test completion date.

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SECTION 4

LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Adam J. Schrum	Intertek B&C
Jacob A. Morningstar	Intertek B&C

SECTION 5

GENERAL DESCRIPTION

The *Fe26 Axis* guardrail system is comprised of steel rails, pickets, posts and brackets. The *Fe26 Axis* guardrail system consisted of one product color: Black. Drawings are included in Section 11 to verify the overall dimensions and other pertinent information of the tested product, its components and any constructed assemblies.

SECTION 6

TEST SPECIMEN DESCRIPTION

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

PRODUCT	<i>Fe26 Axis</i>
MATERIAL	Steel
COLOR	Black
RAIL LENGTH	- Level: 93-7/8 in (inside of post to inside of post) - Stair: 100-1/2 in (inside of post to inside of post)
RAIL HEIGHT	- Level: 40 in (top of top rail to bottom of bottom rail) - Stair: 41 in (top of top rail to bottom of bottom rail; measured parallel to the baluster) - Nominal: 42 in
TOP AND BOTTOM RAIL	1 in square by 0.06 in thick steel tube
RAIL END FRAME	C-shaped frame composed of 1 in square by 0.06 in thick steel tube
IN-FILL	- Horizontal: 5/8 in square by 0.04 in thick steel pickets - Vertical: 1 in square by 0.06 in thick steel tube intermediate picket located at midspan)
RAIL BRACKETS	- Level: 1-1/4 in high by 1-5/16 in wide by 1-3/8 in deep (1/8 in wall) steel brackets - Stair: Two piece, cast aluminum hinged bracket
POST	- 2 in square by 0.10 in thick steel tube connected to a 4 in square by 0.23 in thick steel base plate with a 1/4 in continuous fillet weld; the base plate included four 0.41 in diameter holes and one 0.91 in diameter hole - Preservative treated 4x4 Southern Yellow Pine

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Fastening Schedule

CONNECTION	FASTENER
Rail Bracket to Post Mount	Two #10-24 by 3/4" (0.190 in minor diameter) Torx drive, flat-head, thread cutting tip, coated steel screws
Rail Bracket to SYP 4x4 Post	Two #10-10 by 2-1/2" (0.150 in minor diameter) Torx drive, flat-head, coated steel wood screws
Rail Bracket to Rail End Frame	One #10-24 by 3/4" (0.190 in minor diameter) Torx drive, flat-head, thread cutting tip, coated steel screw (protected side of guardrail)
Infill Panel Top/Bottom Rail to Rail End Frame	One #10-24 by 1/2" (0.190 in minor diameter) Torx drive, pan-head, thread cutting tip, coated steel screw (protected side of guardrail)
Horizontal Picket to Rail End Frame (Level)	Compression plug
Horizontal Picket to Rail End Frame (Stair)	Compression fit on hinge pin
Horizontal Picket to Intermediate Vertical Picket (Level)	Tack weld each side
Horizontal Picket to Intermediate Vertical Picket (Stair)	Hinge pin
Hinged Bracket Connection	Two-piece fastener consisting of one, 1-1/4 in long pan head smooth outside shank female threaded pin and one, #8-32 by 1/4" pan head screw
Post Mount to Substructure	Four 3/8 in Grade 8 hex-head bolts with nut and washer

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SECTION 7**ASSEMBLY FASTENER TESTING**

Re: ICC-ES™ AC273 - Section 4.7

General

The purpose of this testing was to simulate a 90 degree bracket loading condition, which addresses a situation when the guardrail system is to be installed with the top rails in a corner condition.

Test Specimens

Short sections of the rail end frame and top rail were attached in accordance with Fortress Building Products' installation instructions to short sections of posts. Specimens were assembled by an Intertek B&C technician. Rail brackets were secured to the post and to the rail end frame and top rail as described in the Fastening Schedule.

Test Setup

The testing machine was fitted with a post section at the bottom to accommodate anchorage of the rail and bracket. The top rail had a hole drilled in it to attach to the clevis which was then attached to the test machine's crosshead. The bottom post section was attached rigidly to the base of the test machine. Reference photographs in Section 10 for test setups.

Test Procedure

Testing was performed in accordance with ASTM D 1761 and by using a computer-monitored and -controlled Instron Model 5989 Universal Testing Machine. Tests were run at a crosshead speed of 0.05 in/min, and each specimen was tested in tension to its ultimate load capacity.

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Test Results

Steel Post Mounts

TEST DATE: 01/18/23			
SPECIMEN NO.	ULTIMATE LOAD (lb)	DEVIATION FROM AVERAGE	MODE OF FAILURE
1	1328	-8.7%	Screw attaching top rail to rail end frame began to yield
2	1482	+1.9%	
3	1486	+2.1%	
4	1493	+2.6%	
5	1489	+2.3%	
AVERAGE	1455		
ALLOWABLE CAPACITY ¹	485	≥ 200 lb ∴ OK ²	

¹ Average ultimate load divided by a factor of safety of three (3.0)

² Acceptance criteria determined from the uniform load test: 50 plf x 96 in ÷ 12 in ÷ 2 brackets = 200 lb

SYP 4x4 Post

TEST DATE: 01/18/23			
SPECIMEN NO.	ULTIMATE LOAD (lb)	DEVIATION FROM AVERAGE	MODE OF FAILURE
1	1668	+13.2%	Set screw attaching top rail to rail end frame began to yield
2	1433	-2.8%	
3	1496	+1.5%	
4	1394	-5.4%	
5	1378	-6.5%	
AVERAGE	1474		
ALLOWABLE CAPACITY ¹	491	≥ 200 lb ∴ OK ²	

¹ Average ultimate load divided by a factor of safety of three (3.0)

² Acceptance criteria determined from the uniform load test: 50 plf x 96 in ÷ 12 in ÷ 2 brackets = 200 lb

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Summary and Conclusions

The maximum design load rating required for guardrail systems for use in IRC - One- and Two-Family Dwellings and for rail lengths up to and including 8 ft for use in IBC - All Use Groups is 200 lbs. Therefore, fasteners / connectors reported herein meet the performance requirements of ICC-ES™ AC273 for use in corner conditions.

SECTION 8**STRUCTURAL PERFORMANCE TESTING OF ASSEMBLED RAILING SYSTEMS**

Re: ICC-ES™ AC273 - Section 4.2.1

General

Railing assemblies were tested in a self-contained structural frame designed to accommodate anchorage of a rail assembly and application of the required test loads. The specimen was 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 specimen. Applied load was measured using an electronic load cell located in-line with the loading system. Deflections were measured to the nearest 0.01 in using electronic linear displacement transducers.

Test Procedure

The assemblies were installed and tested as a single railing section by directly securing the conventional 4x4 SYP posts to steel stanchions which rigidly restrained the rail system or by securing the base of the steel post mounts to steel channels (simulated concrete). The railing was assembled by an Intertek B&C technician. Transducers mounted to an independent reference frame were located to record movement of reference points on the railing system components (ends and mid-point) to determine net component deflections. See photographs in Section 10 for test setups.

The 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. One specimen was used for all load tests which were performed in the order reported. Each design load test was performed using the following procedure:

1. Zeroed transducers and load cell at zero load;
2. Increased load to specified test load in no less than ten seconds; and
3. Held test load for no less than one minute.

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Test Results

Unless otherwise noted, all loads and displacement measurements were normal to the rail (horizontal). The test results apply only to the railing assembly between supports and anchorage to the support.

Key to Test Results Tables:

Load Level: Target test load

Test Load: Actual applied load at the designated load level (target). Where more than one value is reported, the test load was the range (min. - max.) that was held during the time indicated in the test.

Elapsed Time (E.T.): The amount of time into the test with zero established at the beginning of the loading procedure. Where more than one value is reported, the time was the range (start-end) that the designated load level was reached and sustained.

Test Series No. 1

**8 ft (93-7/8 in) by 42 in Level/In-Line Fe26 Axis Guardrail
IRC - Residential Use Only / ICC-ES™ AC273**

Specimen 1 of 3

Test No. 1 - Test Date: 01/19/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Horizontal Pickets

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	253 - 259	00:41 - 01:45	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 2 - Test Date: 01/19/23

Design Load: 50 lb / 1 Square ft of In-Fill at Edges of Two Horizontal Pickets (Adjacent to Posts)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	253 - 260	00:40 - 01:45	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/19/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 132	00:19 - 01:26	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 4 - Test Date: 01/19/23

Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	128 - 131	00:21 - 01:24	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 5 - Test Date: 01/19/23

Design Load: 200 lb Horizontal Concentrated Load at Mid-Span of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET ¹
200 lb (D.L.)	201	00:40	0.45	2.26	0.01	2.03
500 lb (2.50 x D.L.)	501 - 510	01:10 - 02:14	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:

Maximum rail deflection at 201 lb on an 8 ft rail (93-7/8 in) = 2.03 in

Limits per AC273 ²:

$$\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{93.88}{96}\right) = 2.48 \text{ in} \geq 2.03 \text{ in} \therefore OK$$

and

$$\left(\frac{h}{12}\right) = \left(\frac{36}{12}\right) = 3.00 \text{ in} \geq 2.03 \text{ in} \therefore OK$$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

² Deflection limit calculation based on worse case 36 in railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 6 - Test Date: 01/19/23

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

LOAD LEVEL ¹	TEST LOAD ² (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.) x 2	986 - 1025	01:06 - 02:08	Each end sustained load equal to or greater than 500 lb for one full minute without failure

¹ Load was imposed on both ends of rail using a spreader beam; therefore, loads were doubled.

² Test load dropped below target load level for two seconds during the hold period.

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Specimen 2 of 3

Test No. 1 - Test Date: 01/20/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Horizontal Pickets

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	254 - 265	00:41 - 01:52	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 2 - Test Date: 01/20/23

Design Load: 50 lb / 1 Square ft of In-Fill at Edges of Two Horizontal Pickets (Adjacent to Posts)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	252 - 260	00:31 - 02:04	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/20/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	126 - 132	00:14 - 02:23	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 4 - Test Date: 01/20/23

Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	128 - 132	00:14 - 01:24	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 5 - Test Date: 01/20/23

Design Load: 200 lb Horizontal Concentrated Load at Mid-Span of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET ¹
200 lb (D.L.)	201	00:40	0.53	2.37	0.01	2.10
500 lb (2.50 x D.L.)	501 - 509	01:14 - 02:20	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:

Maximum rail deflection at 201 lb on an 8 ft rail (93-7/8 in) = 2.10 in

Limits per AC273 ²:

$$\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{93.88}{96}\right) = 2.48 \text{ in} \geq 2.10 \text{ in} \therefore OK$$

and

$$\left(\frac{h}{12}\right) = \left(\frac{36}{12}\right) = 3.00 \text{ in} \geq 2.10 \text{ in} \therefore OK$$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

² Deflection limit calculation based on worse case 36 in railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 6 - Test Date: 01/20/23

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

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.) x 2	1000 - 1045	00:54 - 02:07	Each end sustained load equal to or greater than 500 lb for one full minute without failure

¹ Load was imposed on both ends of rail using a spreader beam; therefore, loads were doubled.

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Specimen 3 of 3

Test No. 1 - Test Date: 01/23/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Horizontal Pickets

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	250 - 256	00:32 - 01:36	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 2 - Test Date: 01/23/23

Design Load: 50 lb / 1 Square ft of In-Fill at Edges of Two Horizontal Pickets (Adjacent to Posts)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	250 - 261	00:31 - 01:35	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/23/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	127 - 131	00:17 - 01:20	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 4 - Test Date: 01/23/23

Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 131	00:19 - 01:22	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 5 - Test Date: 01/23/23

Design Load: 200 lb Horizontal Concentrated Load at Mid-Span of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET ¹
200 lb (D.L.)	201	00:30	0.66	2.49	0.00	2.16
500 lb (2.50 x D.L.)	502 - 508	01:03 - 02:05	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:

Maximum rail deflection at 201 lb on an 8 ft rail (93-7/8 in) = 2.16 in

Limits per AC273 ²:

$$\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{93.88}{96}\right) = 2.48 \text{ in} \geq 2.16 \text{ in} \therefore OK$$

and

$$\left(\frac{h}{12}\right) = \left(\frac{36}{12}\right) = 3.00 \text{ in} \geq 2.16 \text{ in} \therefore OK$$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

² Deflection limit calculation based on worse case 36 in railing height to satisfy One- and Two-Family Dwelling requirements.

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

LOAD LEVEL ¹	TEST LOAD ² (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.) x 2	999 - 1031	01:07 - 02:09	Each end sustained load equal to or greater than 500 lb for one full minute without failure

¹ Load was imposed on both ends of rail using a spreader beam; therefore, loads were doubled.

² Test load dropped below target load level for one second during the hold period.

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Test Series No. 2

8 ft (100-1/2 in) by 42 in by 32° Stair Fe26 Axis Guardrail

IRC - Residential Use Only / ICC-ES™ AC273

Specimen 1 of 2

Test No. 1 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Horizontal Pickets

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	252 - 281	00:26 - 01:33	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 2 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Edges of Two Horizontal Pickets (Adjacent to Posts)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	252 - 282	00:28 - 01:40	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	132 - 146	00:35 - 01:45	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 4 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 138	00:20 - 01:28	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 5 - Test Date: 01/24/23

Design Load: 200 lb Horizontal Concentrated Load at Mid-Span of Top Rail

LOAD LEVEL	TEST LOAD ³ (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET ¹
200 lb (D.L.)	201	00:36	0.02	2.27	0.12	2.20
500 lb (2.50 x D.L.)	498 - 510	01:04 - 02:07	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:

Maximum rail deflection at 201 lb on an 8 ft rail (100-1/2 in) = 2.20 in

Limits per AC273²:

$$\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{100.5}{96}\right) = 2.55 \text{ in} \geq 2.20 \text{ in} \therefore OK$$

and

$$\left(\frac{h}{12}\right) = \left(\frac{36}{12}\right) = 3.00 \text{ in} \geq 2.20 \text{ in} \therefore OK$$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

² Deflection limit calculation based on worse case 36 in railing height to satisfy One- and Two-Family Dwelling requirements.

³ Test load dropped below target load level for two seconds during the hold period.

Test No. 6 - Test Date: 01/24/23

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

LOAD LEVEL ¹	TEST LOAD ² (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.) x 2	991 - 1039	00:36 - 01:39	Each end sustained load equal to or greater than 500 lb for one full minute without failure

¹ Load was imposed on both ends of rail using a spreader beam; therefore, loads were doubled.

² Test load dropped below target load level for one second during the hold period.

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23

Specimen 2 of 2

Test No. 1 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Horizontal Pickets

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	250 - 254	-- ²	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

² Elapsed time was not recorded

Test No. 2 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Edges of Two Horizontal Pickets (Adjacent to Posts)

LOAD LEVEL ¹	TEST LOAD (lb)	E.T. (min:sec)	RESULT
250 lb (2.50 x D.L.) x 2	250 - 261	-- ²	Each infill section sustained load equal to or greater than 125 lb for one full minute without failure

¹ Load was imposed on both sections of infill using a spreader beam; therefore, loads were doubled.

² Elapsed time was not recorded

Test No. 3 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 131	-- ¹	Sustained load equal to or greater than 125 lb for one full minute without failure

¹ Elapsed time was not recorded

Test No. 4 - Test Date: 01/24/23

Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Vertical Picket

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 129	-- ¹	Sustained load equal to or greater than 125 lb for one full minute without failure

¹ Elapsed time was not recorded

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23

Test No. 5 - Test Date: 01/24/23

Design Load: 200 lb Horizontal Concentrated Load at Mid-Span of Top Rail

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET ¹
200 lb (D.L.)	200	00:33	0.05	2.17	0.12	2.09
500 lb (2.50 x D.L.)	504 - 512	01:02 - 02:06	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:

Maximum rail deflection at 200 lb on an 8 ft rail (100-1/2 in) = 2.09 in

Limits per AC273 ²:

$$\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{100.5}{96}\right) = 2.55 \text{ in} \geq 2.09 \text{ in} \therefore OK$$

and

$$\left(\frac{h}{12}\right) = \left(\frac{36}{12}\right) = 3.00 \text{ in} \geq 2.09 \text{ in} \therefore OK$$

¹ Each end displacement was measured at the center of the support. Net displacement was the rail displacement relative to the supports.

² Deflection limit calculation based on worse case 36 in railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 6 - Test Date: 01/24/23

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

LOAD LEVEL ¹	TEST LOAD ² (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.) x 2	997 - 1051	00:56 - 01:59	Each end sustained load equal to or greater than 500 lb for one full minute without failure

¹ Load was imposed on both ends of rail using a spreader beam; therefore, loads were doubled.

² Test load dropped below target load level for one second during the hold period.

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23

SECTION 9

CONCLUSION

When installed between adequate supports, the railing assemblies reported herein meet the structural performance requirements of Section 4.2 of ICC-ES™ AC273 for use in One- and Two-Family Dwellings (IRC).

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

SECTION 10

PHOTOGRAPHS

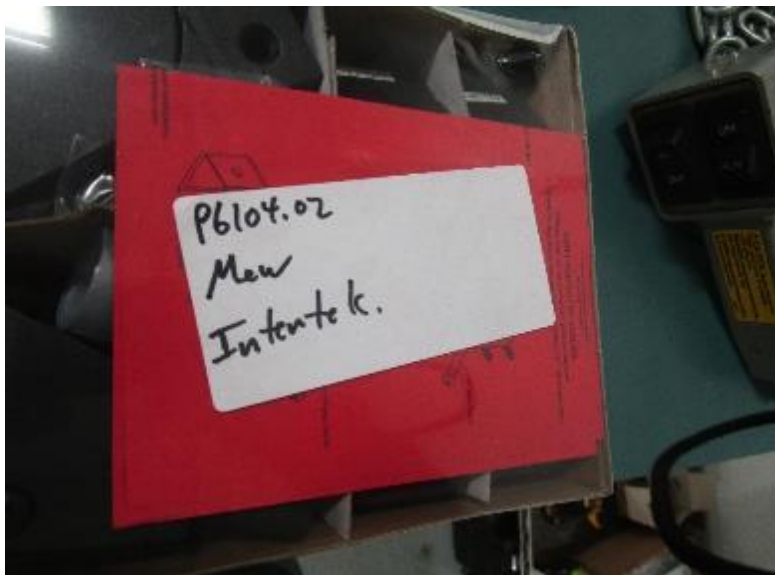


Photo No. 1
Typical Sampling Mark

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23



Photo No. 2
Assembly Fastener Test Setup



Photo No. 3
In-Fill Load Test at Center of Two Horizontal Pickets

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23



Photo No. 4

In-Fill Load Test at Edge of Two Horizontal Pickets (Adjacent to Posts)



Photo No. 5

In-Fill Load Test at the Center of Center of Intermediate Vertical Picket

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23



Photo No. 6

In-Fill Load Test at the Bottom of Intermediate Vertical Picket



Photo No. 7

Horizontal Concentrated Load Test at Mid-Span of Top Rail

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23



Photo No. 8

Horizontal Concentrated Load Test at Ends of Top Rail (Brackets)



Photo No. 9

Level Top Rail Bracket Connection

TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

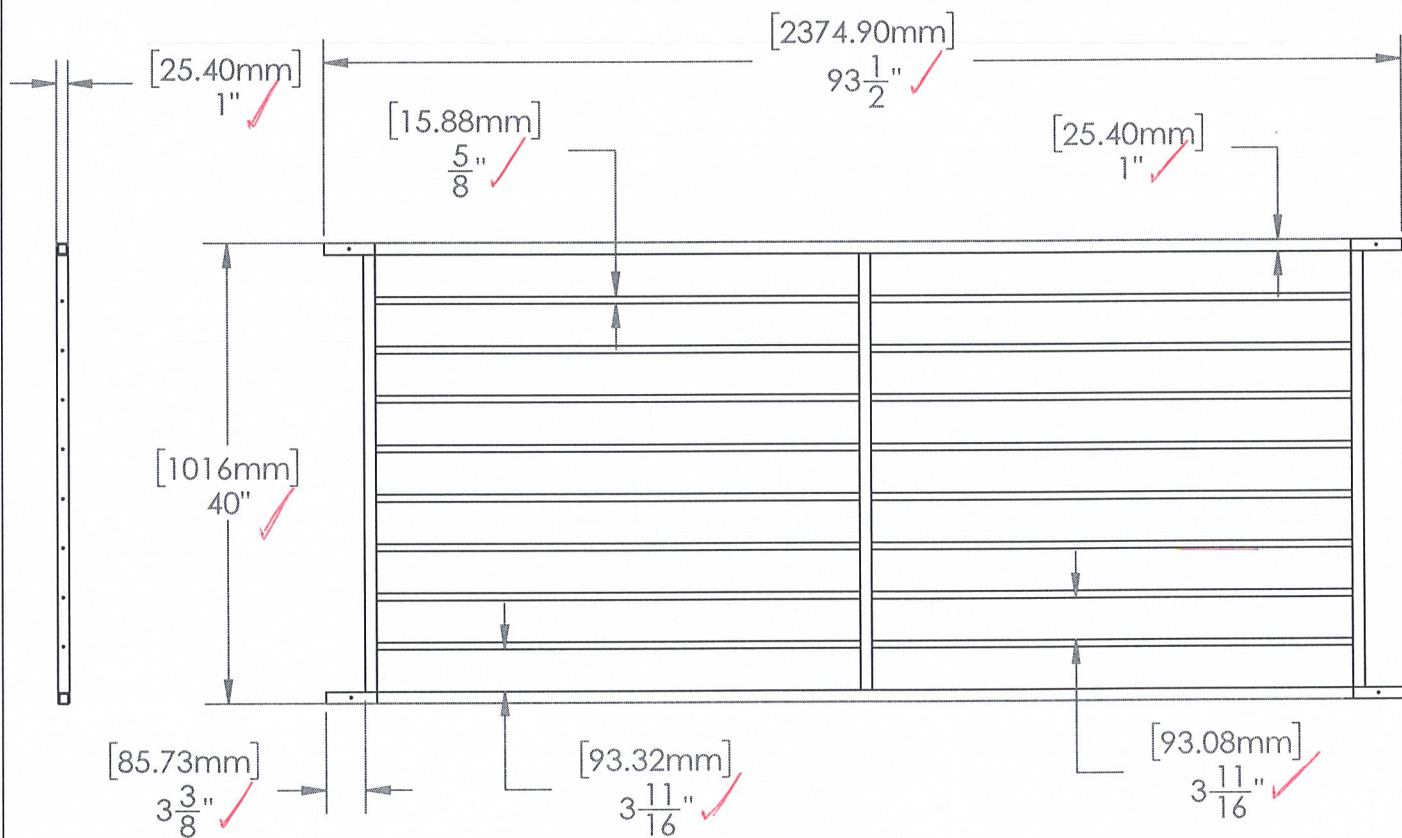
Date: 04/17/23



Photo No. 10
Stair Top Rail Bracket Connection

SECTION 11 **DRAWINGS**

The "As-Built" drawings for the *Fe26 Axis* level and stair railing 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.



12-24 PAN HEAD SCREWS
QTY: 4

intertek

Test sample complies with these details.
Deviations are noted.

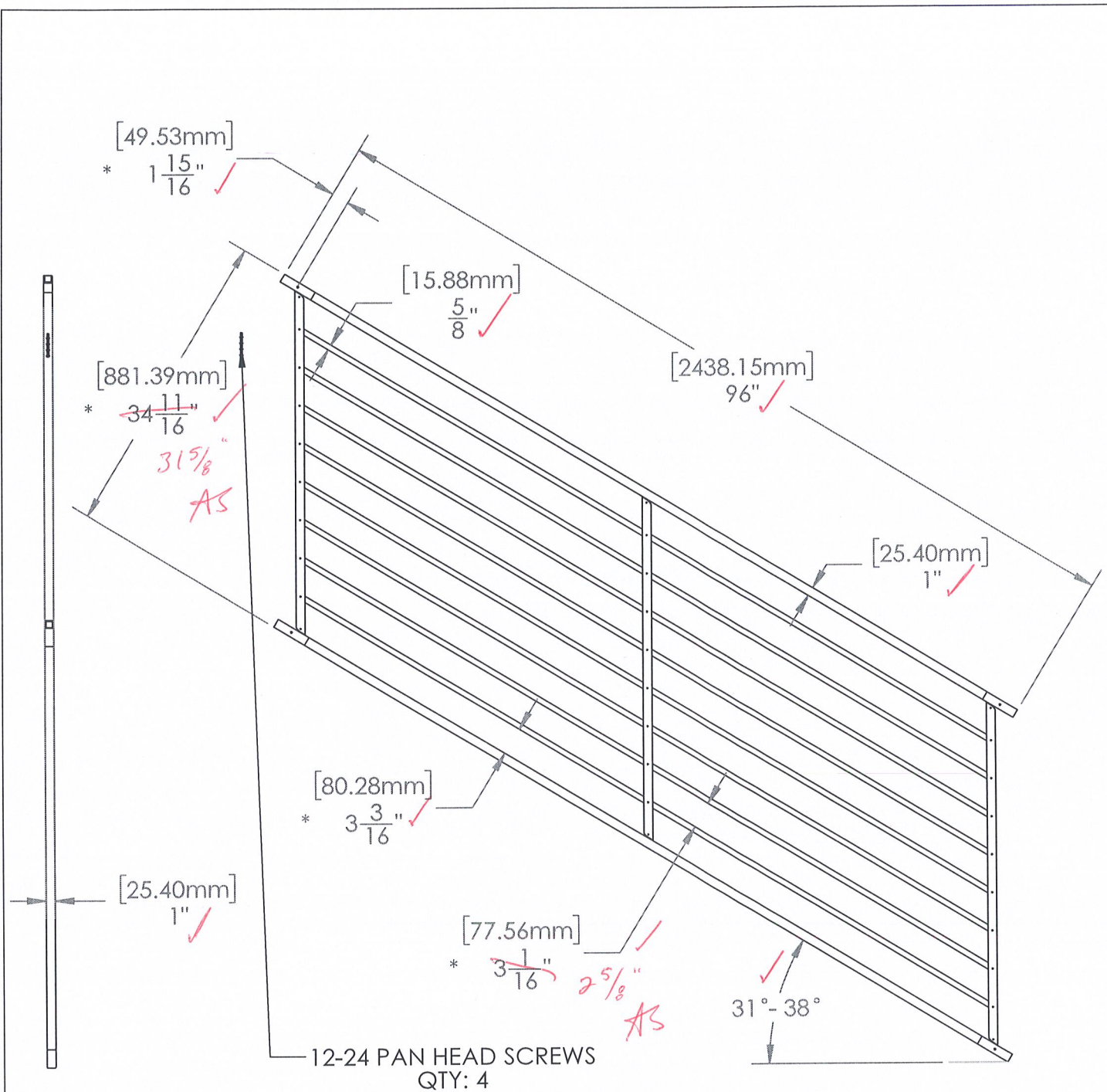
Report # P6104.01-119-19

Date 3/22/23 Tech AJS



1720 1st Street
Garland, TX 75040
www.fortressbp.com

Style: AXIS HORIZONTAL	Description: FE26 - AXIS HORIZONTAL PANEL 40" X 8'	
Height: 40"	Rev #: A	Rev Date: 9/7/22
Panel Length: 93.5"	Drawn By: ECT	
Class: FE26	Date: 9/7/22	Scale: Do Not Scale



intertek

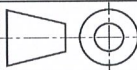
Test sample complies with these details.
 Deviations are noted.

Report # FB104.01-119-19

Date 3/22/23 Tech AJS

* THESE DIMENSIONS CAN CHANGE BASED ON THE PANEL ANGLE. 31° SHOWN




 1720 1st Street
 Garland, TX 75040
 www.fortressbp.com

Style: AXIS ADJ	Description: FE26 - AXIS HORIZONTAL PANEL (ADJ) 40" X 8'	
Height: 40"	Rev #: A	Rev Date: 9/7/22
Panel Length: 96"	Drawn By: ECT	
Class: FE26	Date: 9/7/22	Scale: Do Not Scale

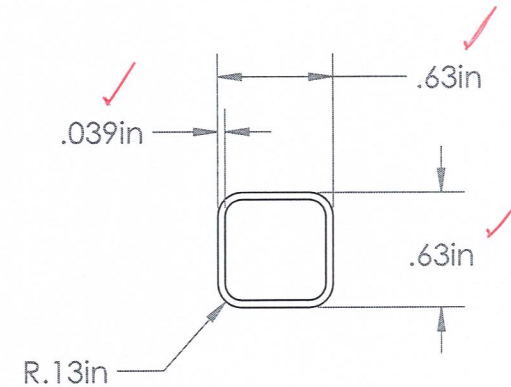
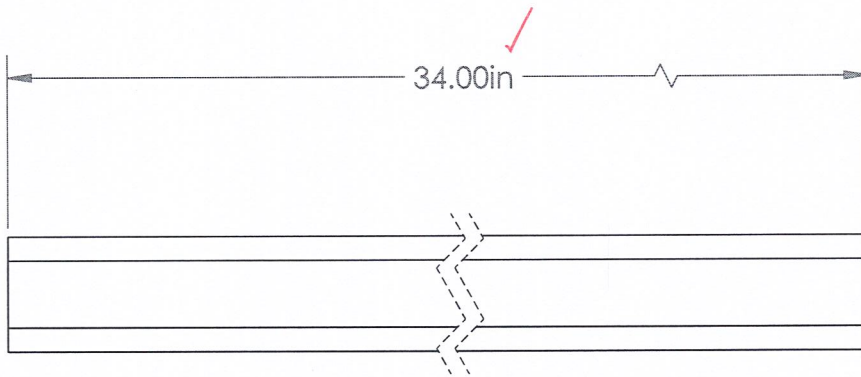
GENERAL NOTES:

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 R3100-00001
5. MATERIAL: Q195, G60, 20GA, ROLL FORMED WITH WELDED SEAM IN CORNER
6. WEIGHT: 0.802 LBM
7. WARRANTY: N/A

intertek

Test sample complies with these details.
Deviations are noted.

Report # P6104-01-119-19
Date 3/22/23 Tech ATJ



AA	05/18/21	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION

DESCRIPTION:
FE26 AXIS HORIZONTAL PICKET

DRAWN BY: CollinR
DATE: 03/21/2023 DIVISION: Fortress Railing SCALE: 1:20

ITEM #: FILE NAME/PART #: R3139-11527A REV: A

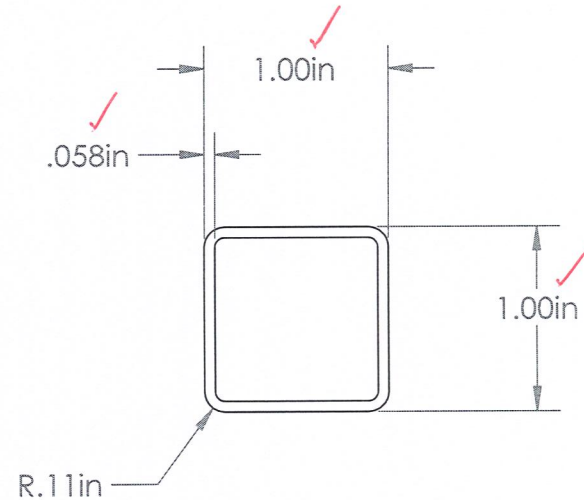
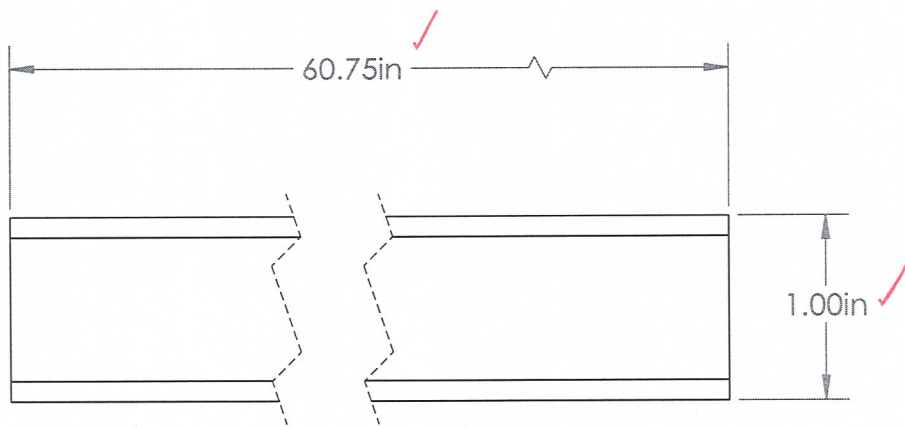


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Sheet: 1 OF 1

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 R3100-00001
5. MATERIAL: Q195, G60, 17GA ROLL FORMED TUBE WITH SEAM IN CORNER
6. WEIGHT: 3.528 LBM
7. WARRANTY: N/A



intertek

Test sample complies with these details.
Deviations are noted.

Report # P6104.01-119-19

Date 3/22/23 Tech AJS



DD	05/18/21	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: FE26 AXIS 1" X 1" RAIL			
DRAWN BY: CollinR		SCALE: 1:20	
DATE: 03/21/2023		DIVISION: Fortress Railing	
ITEM #:	FILE NAME/PART #:	REV:	
Sheet: 1 OF 1	R3131-11513A	D	

FORTRESS
BUILDING PRODUCTS

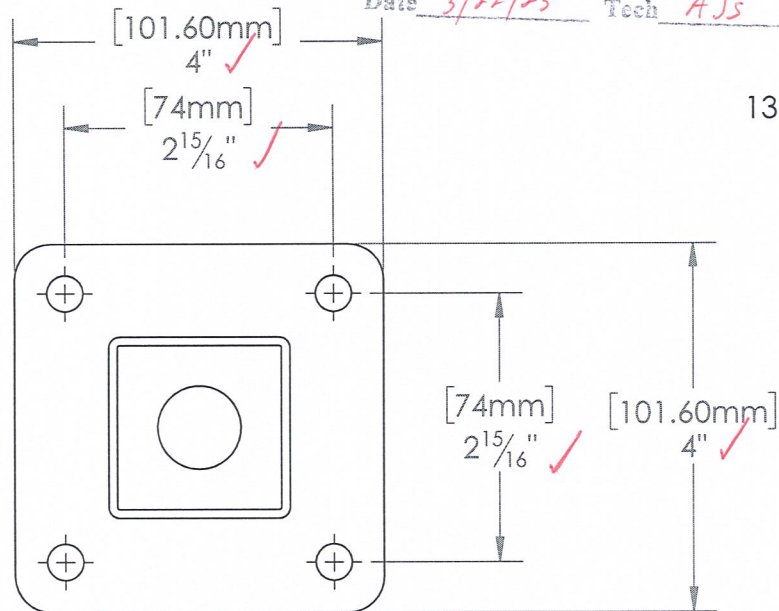
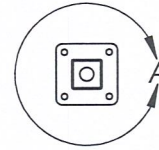
Fortress Iron, LP
1720 N 1st Street
Garland, Tx 75040

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Test sample complies with these details.
Deviations are noted.

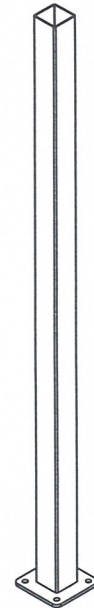
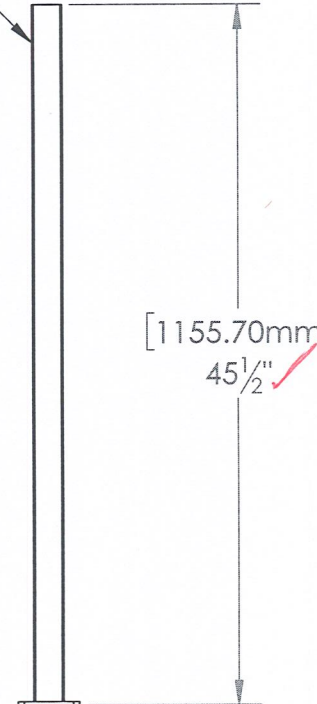
Report # P6104-01-119-19

Date 3/22/23 Tech AJS



DETAIL A
SCALE 1 : 2

13 GA



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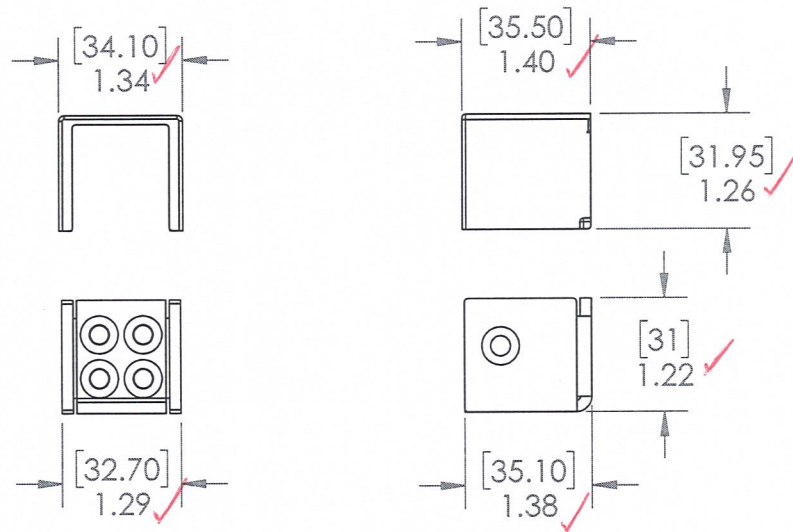


Fortress Railing
1720 N 1st Street
Garland, Tx 75040

Sheet: 1 OF 1

D	3/3/21	JH	ADD GAUGE
REV	DATE	BY	DESCRIPTION
DESCRIPTION: FE26 POST 2" X 45.5" WELDMENT			
DRAWN BY: KevinF			SCALE: 1:12
DATE: 01/14/2019		DIVISION: Fortress Railing	
ITEM #:	FILE NAME/PART #:		REV:
	R3135-00955A		D

STEEL - 11GA - BRACKET
 STEEL - 26GA - CAP



intertek

Test sample complies with these details.
 Deviations are noted.

Report # P6104.01-119-19
 Date 3/22/23 Tech AJS

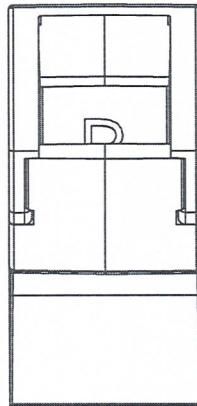
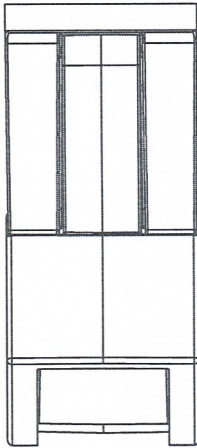
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 Garland, Tx 75040

BB	02/05/15	KF	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: FE26-UB-04-1" (BAG 4)			
DRAWN BY: kevin		SCALE: AS SHOWN	
DATE: 05/17/2021		DIVISION: Fortress Railing	
ITEM #:	FILE NAME/PART #:	REV:	
650036	R3134-00890A	B	
5350400A			

Sheet: 1 OF 1

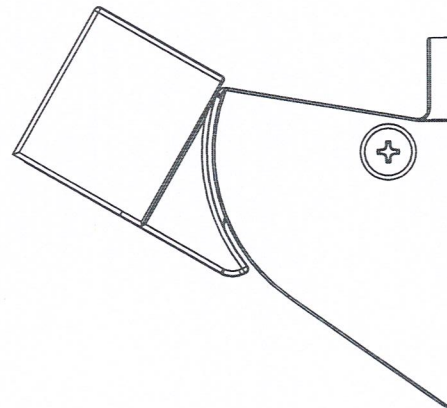
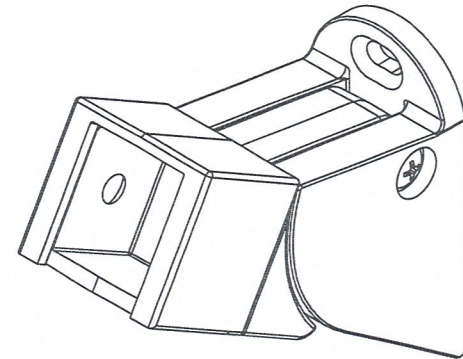


intertek

Test sample complies with these details.
Deviations are noted.

Report # PL104.01-119-19

Date 3/22/23 Tech AJS



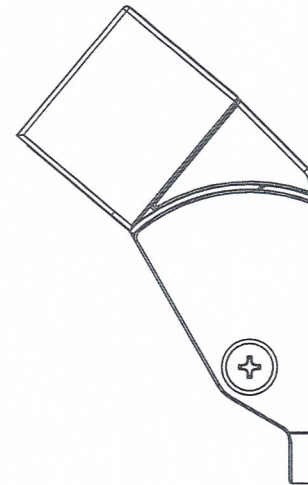
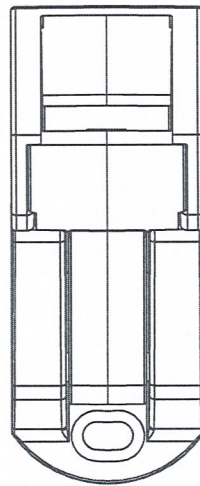
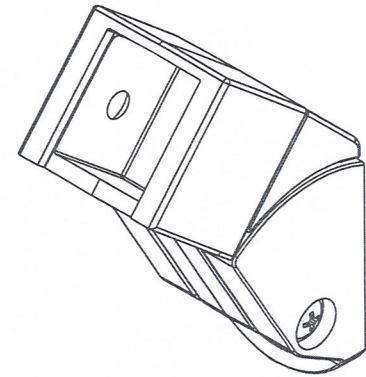
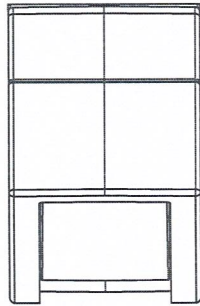
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Sheet: 1 OF 4

51	1/14/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION:			
FE26 SIMPLIFIED STAIR BRACKET			
858-04 (BAG)			
DATE:	01/14/2019	DIVISION:	Fortress Railing
SCALE:	2:3		
ITEM #:	5350406X	FILE NAME/PART #:	R3134-05892A
REV:	5		



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Test sample complies with these details.
Deviations are noted.

Report # P6104.01-119-19

Date 3/22/23 Tech AJS

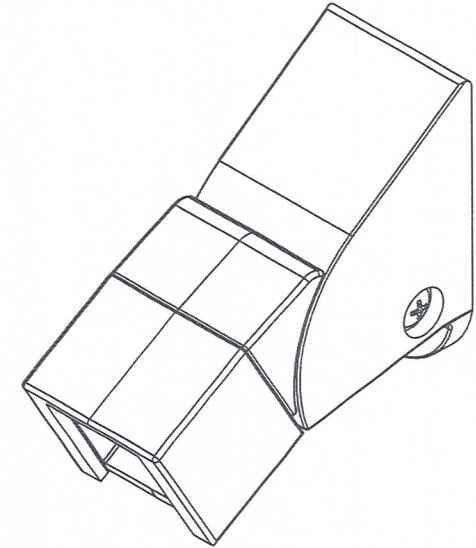
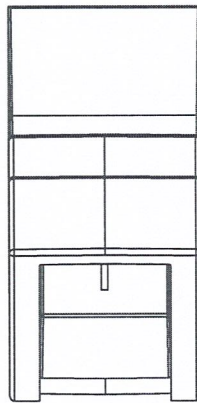
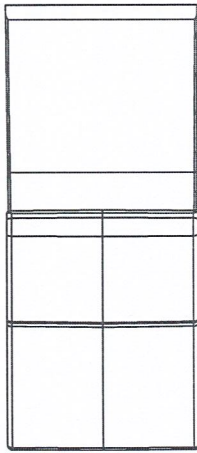
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Fortress Railing
1720 N 1st Street
Garland, Tx 75040

Sheet: 2 OF 4

51	1/14/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION:			
FE26 SIMPLIFIED STAIR BRACKET			
53504 (BAG#)			
DATE:	01/14/2019	DIVISION: Fortress Railing	
ITEM #:	5350406X	FILE NAME/PART #:	R3134-05892A
SCALE:			2:3
REV:			5

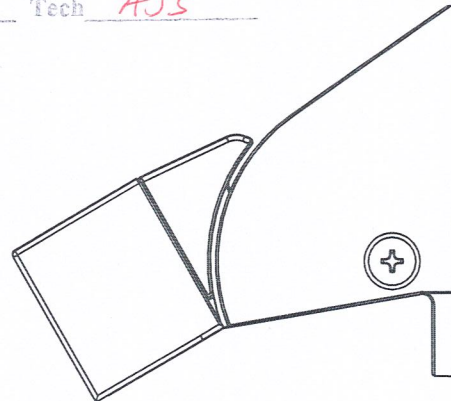


intertek

Test sample complies with these details.
Deviations are noted.

Report # PK104.01-119-19

Date 3/22/23 Tech AJS



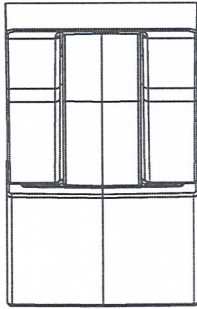
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Garland, Tx 75040

Sheet: 3 OF 4

51	1/14/19	GL	Initial Drawing
REV:	DATE	BY	DESCRIPTION
DESCRIPTION: FE26 SIMPLIFIED STAIR BRACKET			
888-84 (BAG #)			
DATE:	01/14/2019	DIVISION: Fortress Railing	
SCALE:	2:3		
ITEM #:	FILE NAME/PART #:	REV:	
5350406X	R3134-05892A	5	

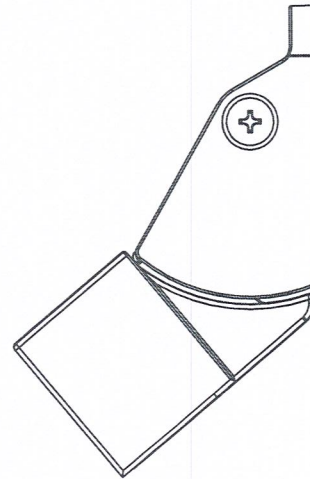
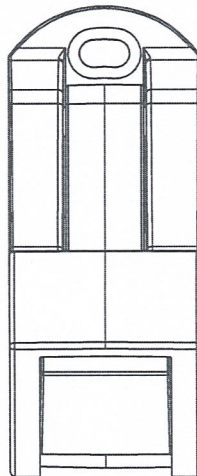
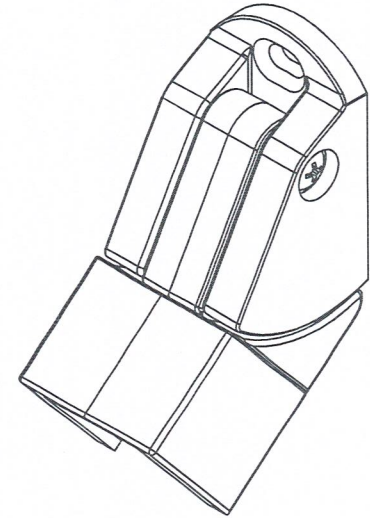


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Test sample complies with these details.
Deviations are noted.

Report # PG104-01-119-19

Date 3/22/23 Tech AJS



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51	1/14/19	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION:			
FE26 SIMPLIFIED STAIR BRACKET			
688-04 (BAG #)			
DATE:	01/14/2019	DIVISION:	Fortress Railing
SCALE:			2:3
SHEET:	4 OF 4	ITEM #:	5350406X
FILE NAME/PART #:		R3134-05892A	
REV:			5



Fortress Railing
1720 N 1st Street
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Sheet: 4 OF 4

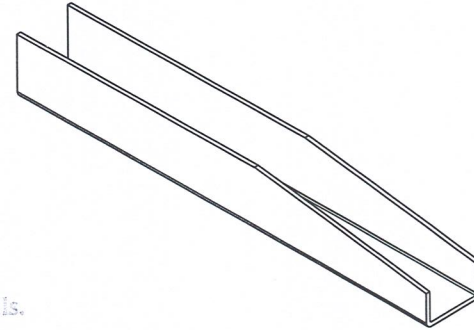
ITEM #:
5350406X

FILE NAME/PART #:
R3134-05892A

REV:
5

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 R3100-00001
5. MATERIAL: Q195, G60, ROLL FORM
6. WEIGHT: 0.222 LBM
7. WARRANTY: N/A



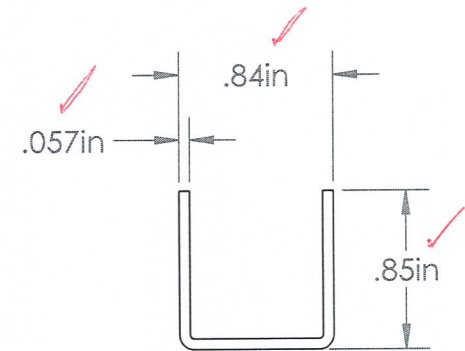
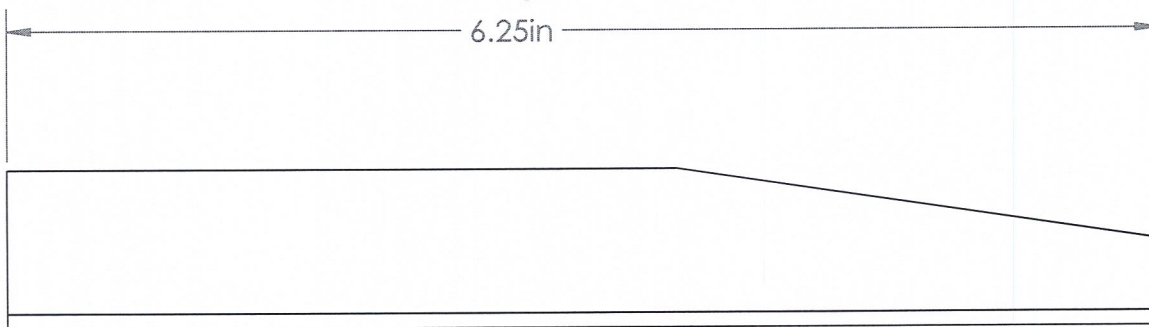
intertek

Test sample complies with these details.

Deviations are noted.

Report # P6104.01-119-19

Date 3/22/23 Tech AJS



C	05/18/21	GL	Initial Drawing
REV	DATE	BY	DESCRIPTION
DESCRIPTION: FE26 AXIS LENGTH ADJUSTER RAIL			
DATE	3/21/2023	DIVISION:	Fortress Rail
SCALE:	1:20	ITEM #:	FILE NAME/PART #: R3152-13079A
Sheet:	1 OF 1	REV:	

Fortress Iron, LP
 1720 N 1st Street
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TEST REPORT FOR FORTRESS BUILDING PRODUCTS

Report No.: P6104.01-119-19 R0

Date: 04/17/23

SECTION 12

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	04/17/23	N/A	Original Report Issue