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FORTRESS RAILING PRODUCTS
TEST REPORT

SCOPE OF WORK
ICC-ES AC273 TESTING ON THE *FE26 PLUS* GUARDRAIL SYSTEM UTILIZING *CB-05-ADJ* AND *CBS-05-ADJ* BRACKETS

REPORT NUMBER
J6881.01-119-19 R0

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06/24/19 - 07/17/19

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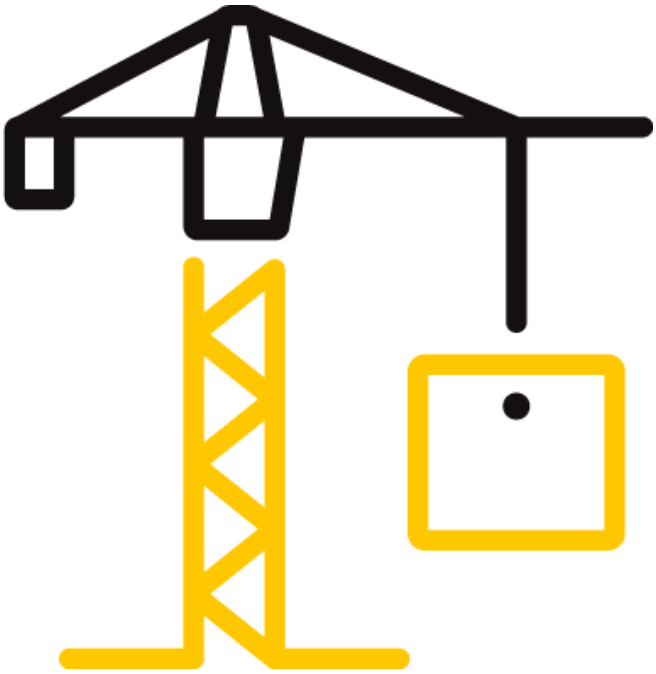

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TEST REPORT FOR FORTRESS RAILING PRODUCTS
Report No.: J6881.01-119-19 R0
Date: 04/17/20

REPORT ISSUED TO
FORTRESS RAILING PRODUCTS
1720 North 1st Street
Garland, Texas 75040

SECTION 1
SCOPE

Intertek Building & Construction (B&C) was contracted by Fortress Railing Products to perform structural performance testing in accordance with ICC-ES™ AC273 on their *Fe26 Plus* railing system utilizing *CB-05-ADJ* and *CBS-05-ADJ* brackets. This report is in conjunction with Intertek report No. J0101.02-119-19 which include structural performance testing of the 3 in *Fe26* post mount. Results obtained are tested values and were secured by using the designated test method(s). Testing was conducted at Intertek test facility in York, PA.

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.

For INTERTEK B&C:

COMPLETED BY:	Adam J. Schrum	**REVIEWED BY:**	V. Thomas Mickley, Jr., P.E.
TITLE:	Project Manager	**TITLE:**	Senior Staff Engineer
SIGNATURE:	Digitally Signed by: Adam J. Schrum	**SIGNATURE:**	Digitally Signed by: Virgal Thomas Mickley, Jr.
DATE:	04/17/20	**DATE:**	04/17/20

AJS:vtm/aas

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SECTION 2
TEST METHOD(S)

The specimens were evaluated in accordance with the following:

> **ICC-ES™ AC273 (March 1, 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, and attachment to the supporting structure. Posts (steel and wood) were included in the test specimen only to facilitate anchorage of the rail brackets.

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

Product sampling in accordance with Section 2.4 of ICC-ES™ AC273 was not completed.

Material specifications testing in accordance with Section 4.1 of ICC-ES™ AC273 was not completed.

SECTION 3
MATERIAL SOURCE

Test samples were provided by the client.

Representative samples of the test specimen(s) 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
Rob Holthaus	Fortress Railing Products
Kevin Flatt	Fortress Railing Products
Adam J. Schrum	Intertek B&C

SECTION 5
TEST PROCEDURE

Assembly Fastener Testing
Assembly fastener tests were performed per ICC-ES™ AC273, Section 4.2.7 to simulate a 90° and 45° bracket loading condition, which addresses a situation when the guardrail system is to be installed with the top rails in a corner condition.

Short sections of the top rail were attached in accordance with Fortress Railing Product's 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 as described in the Fastening Schedule.

The testing machine was pinned to the rail section at the top and the bottom post section was attached rigidly to the base of the test machine. Five specimens were tested in this manner. See photograph in Section 10 for test setup.

Testing was performed using a computer-monitored and -controlled SATEC Unidrive, Model MII 50 UD 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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Structural Performance Testing of Assembled Railing Systems

Railing assembly tests were performed per ICC-ES™ AC273, Section 4.2.1 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.

The railing assembly was installed and tested as a single railing section by directly securing the posts to a rigid steel test fixture, which rigidly restrained the post from deflecting. 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.

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.

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SECTION 6
TEST SPECIMEN DESCRIPTION

The *Fe26 Plus* Railing guardrail system is comprised of pre-galvanized formed steel top and bottom rails, pickets spaced between the rail members, and posts. 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. Photographs are provided in Section 10.

SERIES/MODEL	*Fe26 Plus* Railing
COLOR	Black
MATERIAL	Steel
RAIL LENGTH	96 in (level; inside of post to inside of post)
	95-1/2 in (stair; inside of post to inside of post)
RAIL HEIGHT	40 in (top of top rail to bottom of bottom rail)
	42 in (stair; top of top rail to bottom of bottom rail, measured parallel to the balusters)
TOP /BOTTOM RAIL	1-1/4 in square by 0.062 in thick rail
BALUSTERS	3/4 in square by 0.045 in thick steel picket
COLLAR BRACKETS	- *CBS-05-ADJ* die cast aluminum socket bracket (level application) - *CB-05-ADJ* die cast aluminum socket bracket (stair application)
POST	3 in square by 0.075 in thick steel tube connected to a 5-1/8 in square by 0.30 in thick steel base plate with a 3/16 in continuous fillet weld; the base plate included four 1/2 in diameter holes and one 15/16 in diameter hole
	Preservative treated Southern Pine 4x4 wood post

Fastening Schedule

CONNECTION	FASTENER
Rail Bracket to Steel Post*	Two #12-24 by 3/4 in, Torx drive, flat-head, Type F thread cutting point, steel screws
Rail Bracket to Wood Post	Two #12-10 by 2-1/2 in (0.153 in minor diameter) Torx drive, flat-head, Type A point, steel screws
Rail Bracket to Rail*	One #12-24 by 3/4 in, Torx drive, flat-head, Type F thread cutting point, steel screw
Steel Post Mount to Substructure	Four 3/8 in Grade 5 hex-head bolts with washer

* 5/32 in diameter pre-drill used

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SECTION 7
TEST RESULTS

Assembly Fastener Testing

***CBS-05-ADJ* Bracket Installed in Steel Post Mount in 90° Orientation**
Test Date: 11/13/19

SAMPLE NO.	ULTIMATE LOAD (lb)	DEVIATION FROM AVERAGE	MODE OF FAILURE
1	1228	-13.9%	Screw pulled out of post
2	1526	+6.9%	
3	1397	-2.1%	
4	1326	-7.1%	
5	1659	+16.3%	
AVERAGE	**1427**		
ALLOWABLE CAPACITY [1]	**476**	**≥ 200 lb ∴ OK**	

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

***CBS-05-ADJ* Bracket Installed in SYP 4x4 Post in 90° Orientation**
Test Date: 11/13/19

SAMPLE NO.	ULTIMATE LOAD (lb)	DEVIATION FROM AVERAGE	MODE OF FAILURE
1	2519	+6.1%	Post failure at bracket fastener
2	2229	-6.1%	
3	2152	-9.4%	
4	2362	-0.5%	
5	2606	+9.8%	
AVERAGE	**2374**		
ALLOWABLE CAPACITY [1]	**791**	**≥ 200 lb ∴ OK**	

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

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***CBS-05-ADJ* Bracket Installed in SYP 4x4 Post in 45° Orientation**
Test Date: 11/15/19

SAMPLE NO.	ULTIMATE LOAD (lb)	DEVIATION FROM AVERAGE	MODE OF FAILURE
1	1769	-6.5%	Screw pulled out of post
2	1711	-9.5%	
3	1724	-8.8%	
4	2303	+21.8%	Bracket to rail fastener sheared through rail
5	1946	+2.9%	Screw pulled out of post
AVERAGE	**1891**		
ALLOWABLE CAPACITY [1]	**630**	**≥ 283 lb ∴ OK**	

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

***CBS-05-ADJ* Bracket Installed in Steel Post Mount in 45° Orientation**
Test Date: 11/15/19

SAMPLE NO.	ULTIMATE LOAD (lb)	DEVIATION FROM AVERAGE	MODE OF FAILURE
1	1318	+8.7%	Bracket to post fastener pull-out
2	1255	+3.5%	
3	1233	+1.6%	
4	1245	+2.6%	
5	1017	-16.2%	
AVERAGE	**1213**		
ALLOWABLE CAPACITY [1]	**404**	**≥ 283 lb ∴ OK**	

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

Assembly Fastener Testing

The maximum design load rating required for guardrail systems with 90° corners 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 lb. The maximum design load rating required for guardrail systems with 45° corners 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 283 lb. The design load rating of the tested product was 404 lb. Therefore, fasteners reported herein meet the performance requirements of ICC-ES™ AC273 for use in both 45° and 90° corner conditions for both support post options.

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Structural Performance Testing of Assembled Railing Systems

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 (96 in) by 42 in *Fe26 Plus* Level Railing using *CBS-05-ADJ* Brackets (90° Bracket at One End and 45° Bracket at the Other) Installed Between SYP 4x4 Posts
IBC - All Use Groups / ICC-ES™ AC273

Specimen No. 1 of 3
Test No. 1 - Test Date: 07/16/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	128 - 130	00:16 - 01:18	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 07/16/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	127 - 133	00:15 - 01:18	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 07/16/19
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.)	1002 - 1015	00:43 - 01:47	Sustained load equal to or greater than 1000 lb for one full minute without failure

[1] *Uniform Load was simulated with quarter point loading.*

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Test No. 4 - Test Date: 07/16/19
Design Load: 200 lb 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	00:21	0.02	1.19	0.03	1.17
500 lb (2.50 x D.L.)	502 - 514	00:48 - 01:49	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.17 in on an 8 ft rail (96 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{96}{96}\right)=2.75" \ > \ 1.17" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.17" \therefore ok$$

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

Test No. 5 - Test Date: 07/16/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	979 - 1023	00:37 - 01:37	**Result**: Each end withstood 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 the target load for 4 seconds during the one minute hold period.*

Specimen No. 2 of 3
Test No. 1 - Test Date: 07/16/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	127 - 133	00:16 - 01:19	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 2 - Test Date: 07/16/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	129 - 134	00:19 - 01:23	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 07/16/19
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.)	997 - 1018	00:49 - 01:54	Sustained load equal to or greater than 1000 lb for one full minute without failure

[1] *Uniform Load was simulated with quarter point loading.*
[2] *Test load dropped below the target load for 4 seconds during the one minute hold period.*

Test No. 4 - Test Date: 07/16/19
Design Load: 200 lb 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	00:24	0.01	1.21	0.04	1.19
500 lb (2.50 x D.L.)	501 - 514	00:56 - 01:59	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.19 in on an 8 ft rail (96 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{96}{96}\right)=2.75" \ > \ 1.19" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.19" \therefore ok$$

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

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Test No. 5 - Test Date: 07/16/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	994 - 1023	00:37 - 01:40	**Result**: Each end withstood 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 the target load for 4 seconds during the one minute hold period.*

Specimen No. 3 of 3
Test No. 1 - Test Date: 07/17/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	130 - 133	00:14 - 01:17	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 07/17/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	130 - 133	00:15 - 01:22	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 07/17/19
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.)	1000 - 1017	00:47 - 01:56	Sustained load equal to or greater than 1000 lb for one full minute without failure

[1] *Uniform Load was simulated with quarter point loading.*

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Test No. 4 - Test Date: 07/17/19
Design Load: 200 lb 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	00:29	0.01	1.26	0.04	1.24
500 lb (2.50 x D.L.)	500 - 512	01:02 - 02:37	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.24 in on an 8 ft rail (96 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{96}{96}\right)=2.75" \ > \ 1.24" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.24" \therefore ok$$

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

Test No. 5 - Test Date: 07/17/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	992 - 1024	00:34 - 01:38	**Result**: Each end withstood 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 the target load for 2 seconds during the one minute hold period.*

Test Series No. 2
8 ft (95-1/2 in) by 42 in by 40° *Fe26 Plus* Stair Railing using *CB-05-ADJ* Brackets Installed Between SYP 4x4 Post and 3 in *Fe26* Post Mount
IBC - All Use Groups / ICC-ES™ AC273

Specimen No. 1 of 3
Test No. 1 - Test Date: 06/24/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	126 - 130	00:29 - 01:31	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 2 - Test Date: 06/24/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 130	00:16 - 01:18	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 06/24/19
Design Load: 50 plf x (95-1/2 in ÷ 12 in/ft) = 398 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
995 lb (2.50 x D.L.)	991 - 1020	01:00 - 02:00	Sustained load equal to or greater than 995 lb for one full minute without failure

[1] Uniform Load was simulated with quarter point loading.
[2] Test load dropped below the target load for 5 seconds during the one minute hold period.

Test No. 4 - Test Date: 06/24/19
Design Load: 200 lb 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	00:19	0.02	1.14	0.13	1.07
500 lb (2.50 x D.L.)	503 - 514	00:45 - 01:48	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.07 in on an 8 ft rail (95-1/2 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{95.5}{96}\right)=2.74" \ > \ 1.07" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.07" \therefore ok$$

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

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Test No. 5 - Test Date: 06/24/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	975 - 1027	00:48 - 01:59	**Result**: Each end withstood 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 the target load for 11 seconds during the one minute hold period.*

Specimen No. 2 of 3
Test No. 1 - Test Date: 06/25/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	125 - 133	00:15 - 01:28	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 06/25/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

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

Test No. 3 - Test Date: 06/25/19
Design Load: 50 plf x (95-1/2 in ÷ 12 in/ft) = 398 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
995 lb (2.50 x D.L.)	991 - 1010	00:56 - 01:57	Sustained load equal to or greater than 995 lb for one full minute without failure

[1] *Uniform Load was simulated with quarter point loading.*
[2] *Test load dropped below the target load for 2 seconds during the one minute hold period.*

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TEST REPORT FOR FORTRESS RAILING PRODUCTS
Report No.: J6881.01-119-19 R0
Date: 04/17/20

Test No. 4 - Test Date: 06/25/19
Design Load: 200 lb 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	00:19	0.02	1.13	0.13	1.06
500 lb (2.50 x D.L.)	500 - 510	00:51 - 01:55	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.06 in on an 8 ft rail (95-1/2 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{95.5}{96}\right)=2.74" \ > \ 1.06" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.06" \therefore ok$$

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

Test No. 5 - Test Date: 06/25/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	982 - 1022	00:26 - 01:29	**Result**: Each end withstood 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 the target load for 11 seconds during the one minute hold period.*

Specimen No. 3 of 3
Test No. 1 - Test Date: 06/25/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	126 - 132	00:11 - 01:15	Sustained load equal to or greater than 125 lb for one full minute without failure

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Date: 04/17/20

Test No. 2 - Test Date: 06/25/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	127 - 133	00:22 - 01:30	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 06/25/19
Design Load: 50 plf x (95-1/2 in ÷ 12 in/ft) = 398 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
995 lb (2.50 x D.L.)	992 - 1016	00:49 - 01:51	Sustained load equal to or greater than 995 lb for one full minute without failure

[1] Uniform Load was simulated with quarter point loading.
[2] Test load dropped below the target load for 1 second during the one minute hold period.

Test No. 4 - Test Date: 06/25/19
Design Load: 200 lb 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.)	202	00:22	0.01	1.14	0.13	1.07
500 lb (2.50 x D.L.)	501 - 512	00:41 - 01:46	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 202 lb = 1.07 in on an 8 ft rail (95-1/2 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{95.5}{96}\right)=2.74" \ > \ 1.07" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.07" \therefore ok$$

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

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Report No.: J6881.01-119-19 R0
Date: 04/17/20

Test No. 5 - Test Date: 06/25/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	996 - 1031	00:25 - 01:28	**Result**: Each end withstood 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 the target load for 3 seconds during the one minute hold period.

Test Series No. 3
8 ft (96 in) by 42 in *Fe26 Plus Level Railing* Using *CBS-05-ADJ* Brackets (90° Bracket at One End and 45° Bracket at the Other) Installed Between 3 in *Fe26* Post Mounts
IBC - All Use Groups / ICC-ES™ AC273

Specimen No. 1 of 3
Test No. 1 - Test Date: 06/27/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	127 - 131	00:19 - 01:22	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 06/27/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	126 - 136	00:13 - 01:17	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 06/27/19
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.)	994 - 1018	00:56 - 01:57	Sustained load equal to or greater than 1000 lb for one full minute without failure

[1] Uniform Load was simulated with quarter point loading.
[2] Test load dropped below the target load for 3 seconds during the one minute hold period.

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Report No.: J6881.01-119-19 R0
Date: 04/17/20

Test No. 4 - Test Date: 06/27/19
Design Load: 200 lb 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.)	202	00:31	0.02	1.24	0.04	1.21
500 lb (2.50 x D.L.)	501 - 511	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 202 lb = 1.21 in on an 8 ft rail (96 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{96}{96}\right)=2.75" \ > \ 1.21" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.21" \therefore ok$$

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

Test No. 5 - Test Date: 06/27/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	992 - 1028	00:38 - 01:41	**Result**: Each end withstood 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 the target load for 5 seconds during the one minute hold period.*

Specimen No. 2 of 3
Test No. 1 - Test Date: 06/27/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	126 - 131	00:16 - 01:19	Sustained load equal to or greater than 125 lb for one full minute without failure

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Test No. 2 - Test Date: 06/27/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	127 - 134	00:14 - 01:16	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 06/27/19
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.)	994 - 1012	00:57 - 02:00	Sustained load equal to or greater than 1000 lb for one full minute without failure

[1] *Uniform Load was simulated with quarter point loading.*
[2] *Test load dropped below the target load for 3 seconds during the one minute hold period.*

Test No. 4 - Test Date: 06/27/19
Design Load: 200 lb 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	00:21	0.03	1.30	0.03	1.27
500 lb (2.50 x D.L.)	500 - 514	00:45 - 01:48	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.27 in on an 8 ft rail (96 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{96}{96}\right)=2.75" \ > \ 1.27" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.27" \therefore ok$$

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

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Test No. 5 - Test Date: 06/27/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	984 - 1032	00:27 - 01:28	**Result**: Each end withstood 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 the target load for 4 seconds during the one minute hold period.*

Specimen No. 3 of 3
Test No. 1 - Test Date: 06/27/19
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets

LOAD LEVEL	TEST LOAD [1] (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	124 - 131	00:21 - 01:24	Sustained load equal to or greater than 125 lb for one full minute without failure

[1] *Test load dropped below the target load for 2 seconds during the one minute hold period.*

Test No. 2 - Test Date: 06/27/19
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	RESULT
125 lb (2.50 x D.L.)	128 - 136	00:11 - 01:13	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 06/27/19
Design Load: 50 plf x (96 in ÷ 12 in/ft) = 400 lb Uniform Load Applied on the Top Rail at 45 degrees [1]

LOAD LEVEL	TEST LOAD [2] (lb)	E.T. (min:sec)	RESULT
1000 lb (2.50 x D.L.)	998 - 1014	00:40 - 01:44	Sustained load equal to or greater than 1000 lb for one full minute without failure

[1] *Uniform Load was simulated with quarter point loading.*
[2] *Test load dropped below the target load for 1 second during the one minute hold period.*

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Test No. 4 - Test Date: 06/27/19
Design Load: 200 lb 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	00:18	0.02	1.19	0.03	1.17
500 lb (2.50 x D.L.)	502 - 516	00:41 - 01:44	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:
Maximum rail deflection at 200 lb = 1.17 in on an 8 ft rail (96 in)
Limits per AC273:

$$\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{42}{24}+\frac{96}{96}\right)=2.75" \ > \ 1.17" \ \therefore ok$$

and

$$\frac{h}{12}=\frac{42}{12}=3.50" > 1.17" \therefore ok$$

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

Test No. 5 - Test Date: 06/27/19
Design Load: 200 lb Concentrated Load at Ends of Top Rail (Brackets)

LOAD LEVEL[1]	TEST LOAD [2] (lb)	E.T. (min:sec)	DISPLACEMENT (in)
1000 lb (2.50 x D.L.) x 2	990 - 1038	00:37 - 01:40	**Result**: Each end withstood 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 the target load for 8 seconds during the one minute hold period.*

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TEST REPORT FOR FORTRESS RAILING PRODUCTS
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SECTION 8
CONCLUSION

The railing assemblies reported herein meet the structural performance requirements of Section 4.2.1 of ICC-ES™ AC273 as installed between adequate supports with guardrail details and Occupancy Classification as shown in the following table:

Fe26 PLUS **GUARDRAIL SYSTEM**	**GUARDRAIL TYPE**	**SUPPORT POSTS**	**BRACKET TYPE AND ORIENTATION**	**BALUSTER**	**CODE OCCUPANCY CLASSIFICATION**
8 ft (96 in) by 42 in	Level	3 in *Fe26* Square Steel Post Mount (Steel or Concrete Mounted) or Preservative Treated Southern Pine 4x4 Wood Post	*CBS-05-ADJ* 90° or 45°	3/4 in square steel picket	IBC - All Use Groups
8 ft (95-1/2 in) by 42 in by 40°	Stair		*CB-05-ADJ* N/A		

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

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SECTION 9
PHOTOGRAPHS

Photo No. 1
Assembly Fastener Test Setup

Photo No. 2
In-Fill Load Test at Center of Two Pickets

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

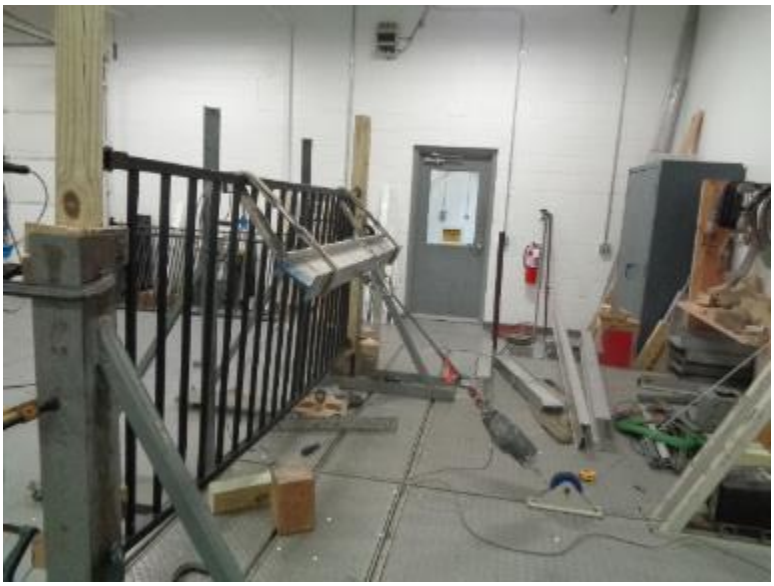

Photo No. 4
Uniform Load on Top Rail Applied at 45 degrees

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

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

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Photo No. 7
Stair Bracket Attached to Wood Post

Photo No. 8
Top Rail Bracket Oriented 45°

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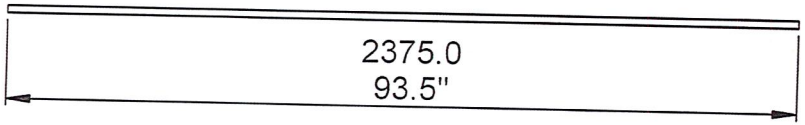
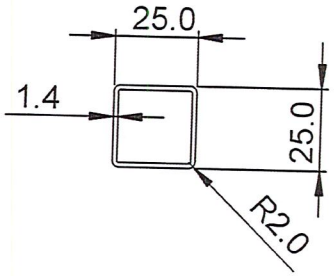
Photo No. 9
Top Rail Bracket Installed In-line

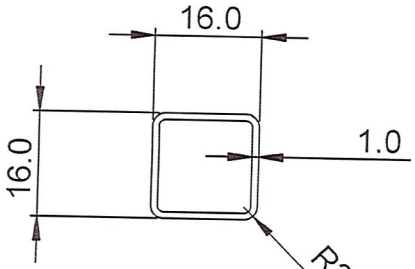
SECTION 10
DRAWINGS

The "As-Built" drawings for the *Fe26 Plus* railing system utilizing *CB-05-ADJ* and *CBS-05-ADJ* brackets 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.



Item 1 - Fe26 8' Rail





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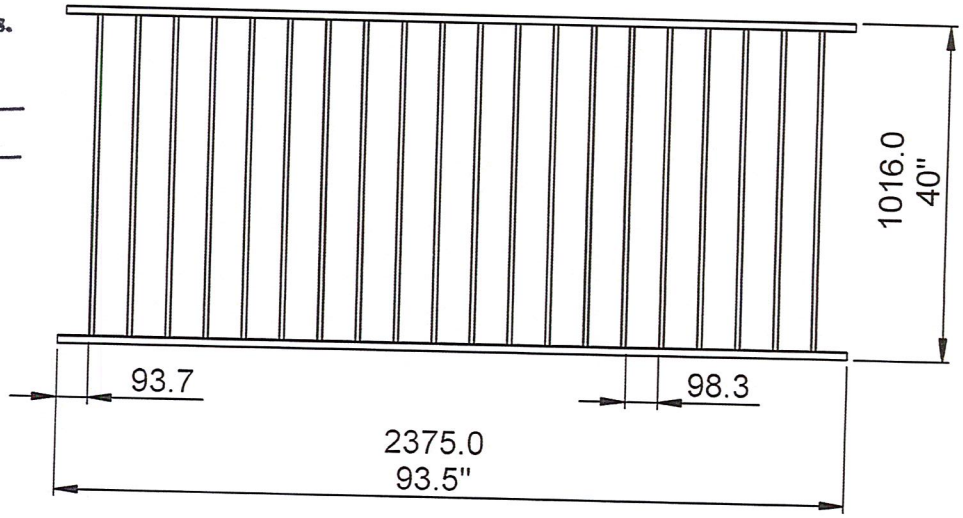
Test sample complies with these details.
Deviations are noted.

Report # J6881.01-119-19

Date 4/16/20 **Tech** STG

Test samples were not retained
Dimensions could not be verified

Item 2 - Fe26 Picket - 40" Panel



All Dimensions are Metric - mm
All Dimensions are ± 0.5mm

REV	DATE	BY	DESCRIPTION
0	09/01/12	DI	Initial Drawing

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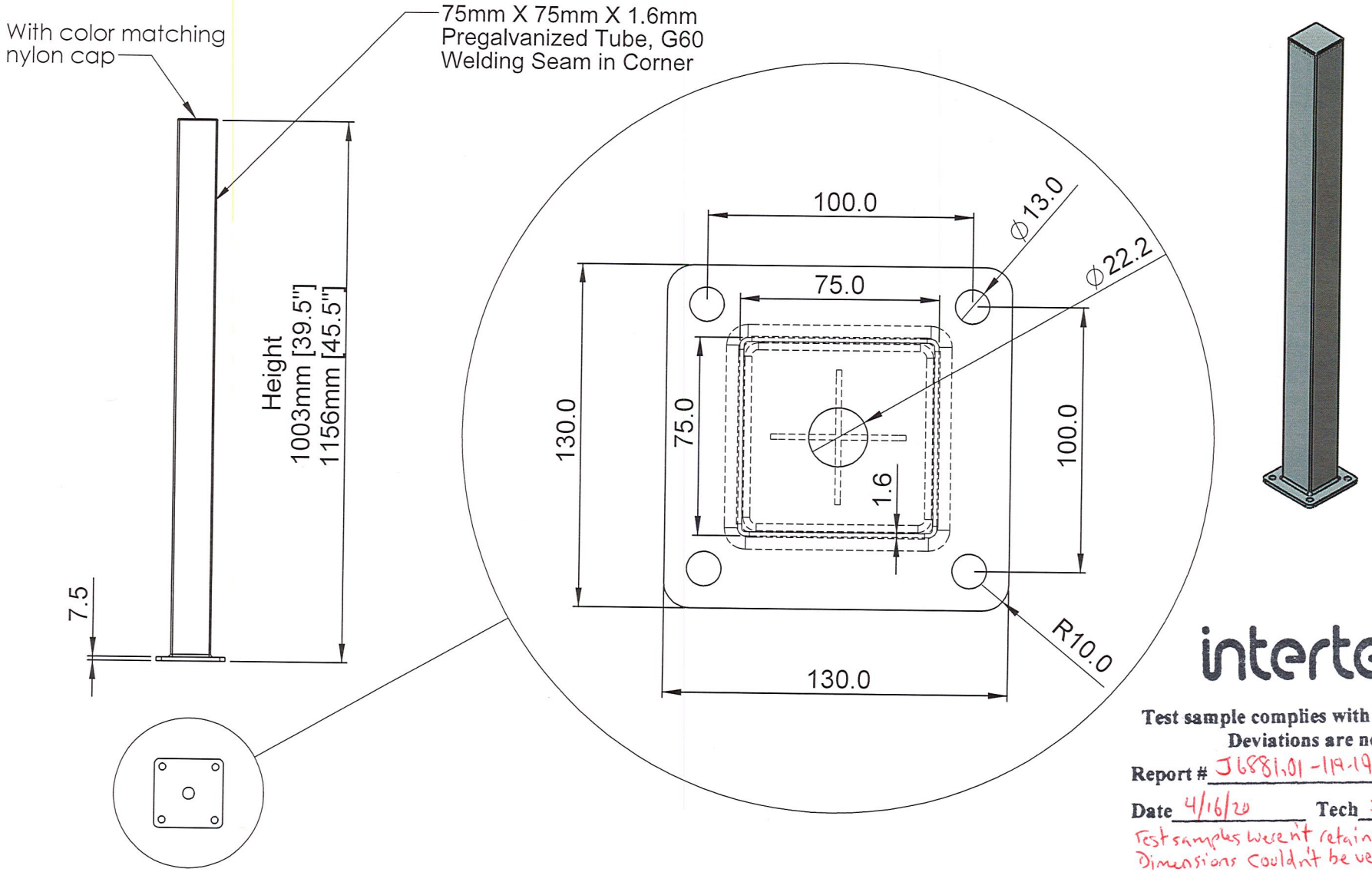
www.fortressrailing.com

Fortress Iron, LP
1800 Jay Ell, Suite 200
Richardson, TX 75081

TITLE: Fe26 Railing Family
Railing Panel Parts

DRAWN BY: David Irick
DATE: 09/01/12
SCALE: AS SHOWN

Sheet: 2 OF 2
PART #: XXXXXXX
DWG NAME: Parts for Fe26 40" RES 8'
REV: 0



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Test sample complies with these details.
Deviations are noted.

Report # J6881.01-119-19

Date 4/16/20 **Tech** STG

Test samples weren't retained
Dimensions couldn't be verified

All Dimensions are Metric - mm
All Dimensions are ± 0.5mm

REV	DATE	BY	DESCRIPTION
1	03/08/11	DI	Revised for Base of 7.5mm
0	10/29/10	DI	Initial Drawing

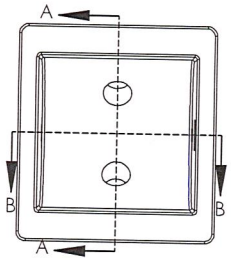
FORTRESS
Iron Railing & Fence Systems

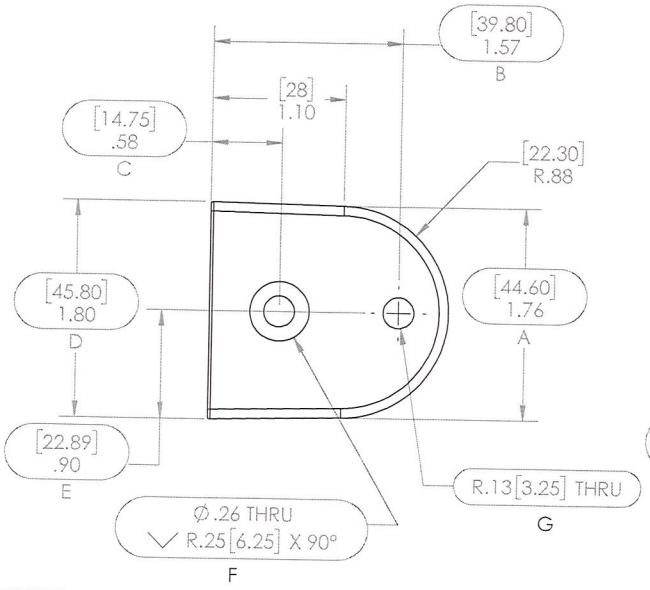
Fortress Iron, LP
1800 Jay Ell, Suite 200
Richardson, TX 75081

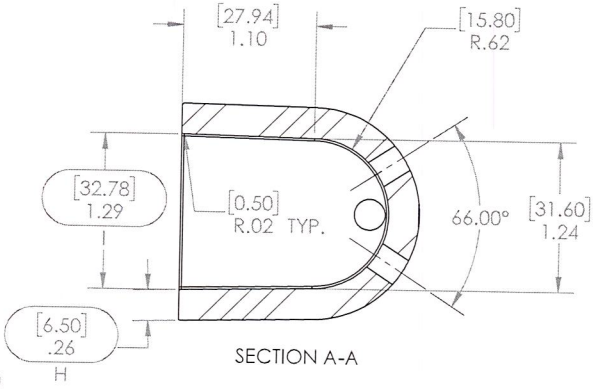
TITLE: Iron Post 3" X 39.5", 45.5" X 1.6mm Tube, 7.5mm Base		
DRAWN BY: David Irick		SCALE: AS SHOWN
DATE: 10/29/10		
PART #: XXXXXXX	DWG NAME: IP 3" X 39.5", 45.5"W/5.25 Base	REV: 1

TITLE: FE26-CB-05 ADJ CUP AL DIE CAST

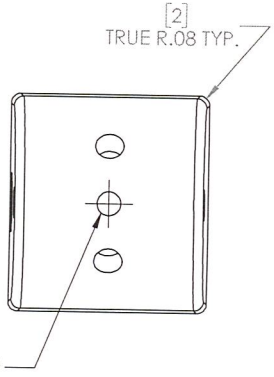
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	R5034-06836	FE26-CB-05 ADJ CUP AL DIE CAST	1

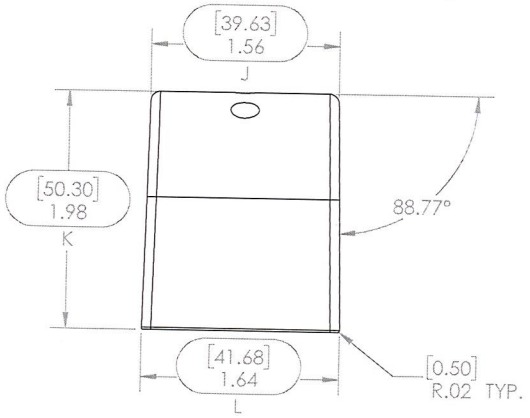


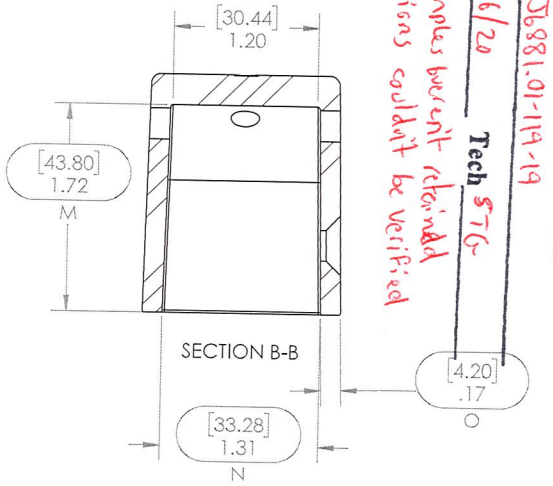




SECTION A-A







SECTION B-B

Test sample complies with these details.
Deviations are noted.

Report # J6881.01-119-19

Date 4/16/20 **Tech** STG

Test samples weren't retained
Dimensions couldn't be verified

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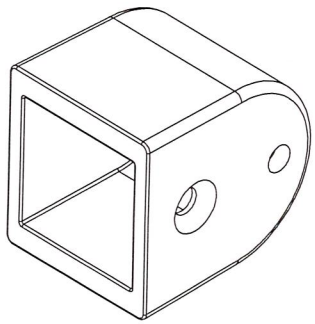


GENERAL NOTES:
1. ALL DIMENSIONS ARE SHOWN IN INCHES [mm]
2. ALL DIMENSIONS ARE BEFORE ANY FINISHING OR COATING
3. ALL DIMENSIONS ARE ± 0.5mm (UNLESS OTHERWISE NOTED)
4. SEE PRODUCT LINE NOTES PAGE R5000-00001
5. MATERIAL: ADC12
6. WEIGHT: 0.25 LBM
7. WARRANTY: N/A

FORTRESS BUILDING PRODUCTS

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

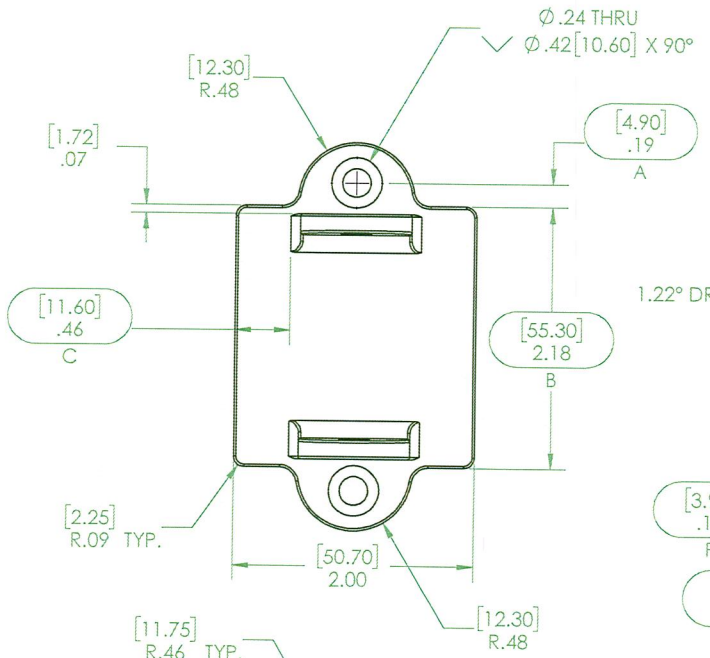
Sheet: 1 OF 1

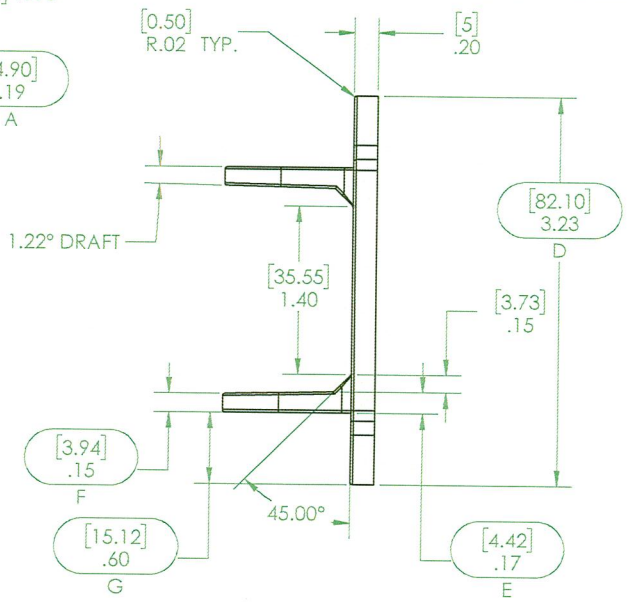
REV	DATE	BY	DESCRIPTION
B	8/28/19	KB	UPDATED CRITICAL DIMENSIONS

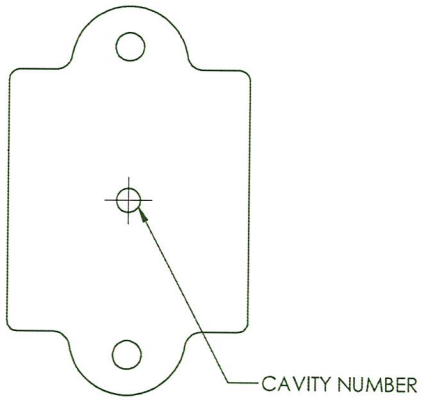
DESCRIPTION: FE26-CB-05 ADJ CUP AL DIE CAST
DRAWN BY: KevinF
DATE: 11/28/2017 DIVISION: Fortress Railing
SCALE: 1:1
ITEM #:
FILE NAME/PART #: R5034-06836
REV: B

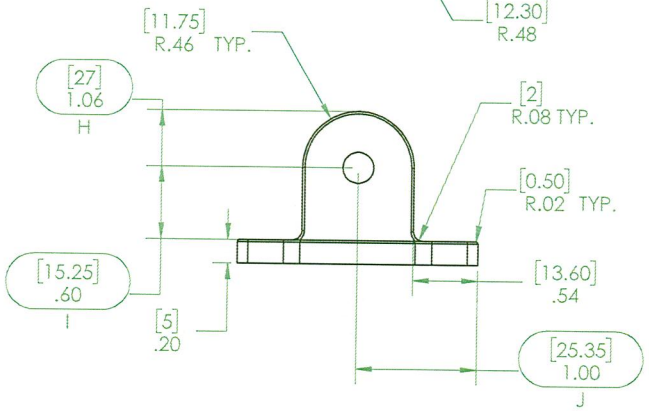
TITLE: FE26-CBS-05 ADJ BASE PLATE AL DIE CAST

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	R5034-06866	FE26-CBS-05 ADJ BASE PLATE AL DIE CAST	1









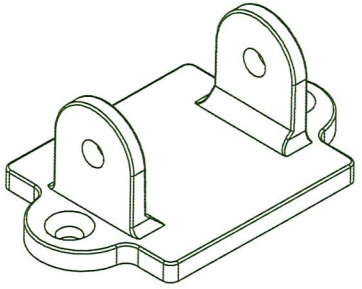
intertek

Test sample complies with these details.
Deviations are noted.

Report # J6881.01-119-19

Date 4/16/20 **Tech** SG

Test samples weren't retained
Dimensions couldn't be verified



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 R5000-00001
5. MATERIAL: ADC12
6. WEIGHT: 0.13 LBM
7. WARRANTY: N/A

FORTRESS BUILDING PRODUCTS

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

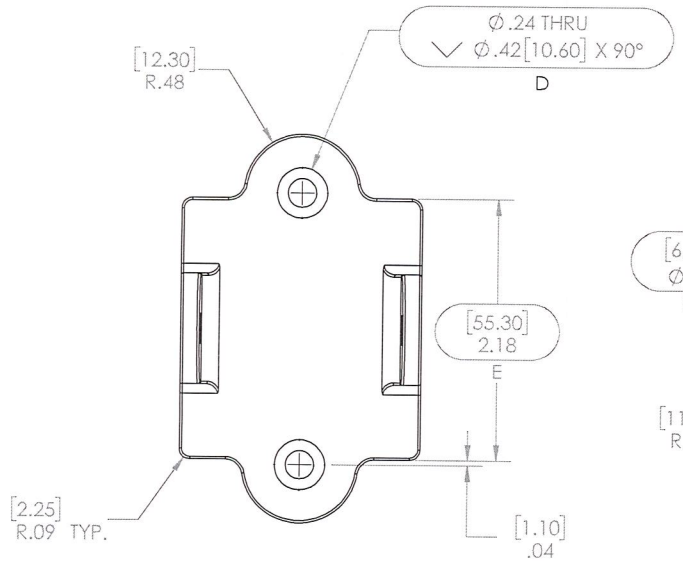
Sheet: 1 OF 1

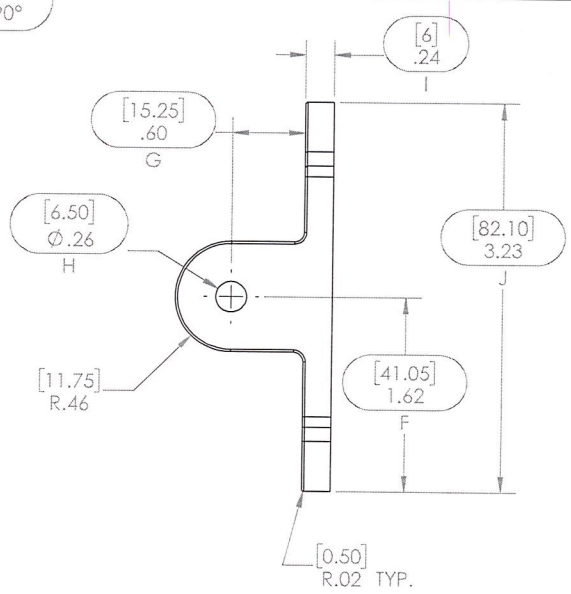
REV	DATE	BY	DESCRIPTION
A	12/05/18	KF	CHANGED TO MATCH FAI

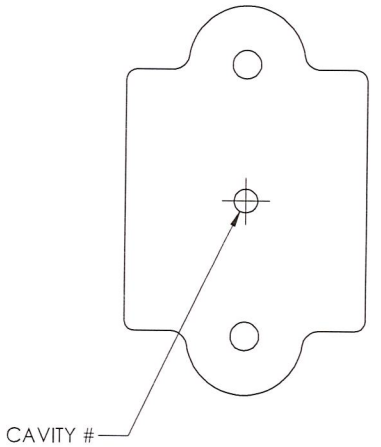
DESCRIPTION: FE26-CBS-05 ADJ BASE PLATE AL DIE CAST
DRAWN BY: KevinF
SCALE: 1 : 1
DATE: 12/01/2017
DIVISION: Fortress Railing
ITEM #:
FILE NAME/PART #: R5034-06866
REV: A

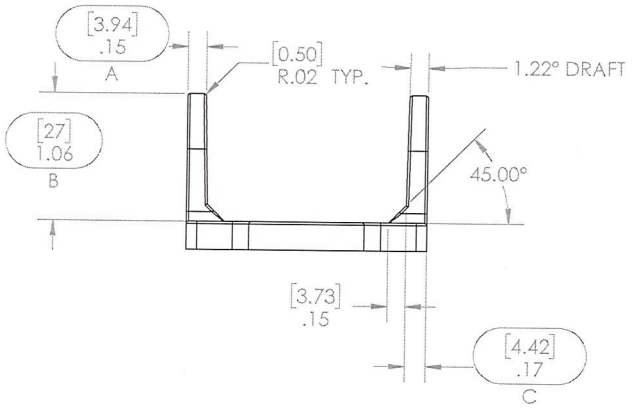
TITLE: FE26-CB-05 ADJ BASE PLATE AL DIE CAST

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	R5034-06835	FE26-CB-05 ADJ BASE PLATE AL DIE CAST	1









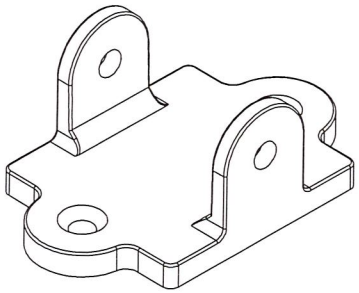
intertek

Test sample complies with these details.
Deviations are noted.

Report # J6881.01-119-19

Date 4/16/20 **Tech** STG

Test samples weren't retained
Dimensions couldn't be verified



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 R5000-00001
5. MATERIAL: ADC12
6. WEIGHT: 0.15 LBM
7. WARRANTY: N/A

FORTRESS BUILDING PRODUCTS

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

Sheet: 1 OF 1

REV	DATE	BY	DESCRIPTION
B	8/29/19	KB	UPDATED PER FAI

DESCRIPTION: FE26-CB-05 ADJ BASE PLATE AL DIE CAST
DRAWN BY: KevinF
DATE: 11/28/2017 DIVISION: Fortress Railing
SCALE: 1:1
ITEM #:
FILE NAME/PART #: R5034-06835
REV: B

130 Derry Court
York, Pennsylvania 17406

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

TEST REPORT FOR FORTRESS RAILING PRODUCTS
Report No.: J6881.01-119-19 R0
Date: 04/17/20

SECTION 11
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	04/17/20	N/A	Original Report Issue