Architectural Testing

TEST REPORT

Rendered to:

FORTRESS IRON RAILING & FENCE SYSTEMS

For:

Nylon Rail Brackets

Report No: B7404.01-119-19
Report Date: 08/27/12

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

TEST REPORT

B7404.01-119-19
August 27, 2012

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Architectural Testing

TEST REPORT

Rendered to:

FORTRESS IRON RAILING & FENCE SYSTEMS
P.O. Box 831268
Richardson, Texas 75083

Report No.: B7404.01-119-19
Test Date: 03/01/12
Report Date: 08/27/12

1.0 General Information

1.1 Product

Nylon Rail Brackets

1.2 Project Description

Architectural Testing was contracted by Fortress Iron Railing & Fence Systems to conduct structural performance tests on their nylon rail brackets in a worst-case 96 in wide by 42 in high guardrail system, comprised of 2x4 cedar rails and pre-galvanized steel balusters. The system was evaluated for the design load requirements of the following building codes:

2012 *International Building Code*®, International Code Council

2012 *International Residential Code*®, International Code Council

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of IBC 2012.

1.3 Limitations

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, and rail brackets 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.

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1.4 Qualifications

Architectural Testing has demonstrated compliance with ANS/ISO/IEC Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc.

1.5 Product Description

Fortress Iron Railing & Fence Systems provided the specimen components with the following details:

Top and Bottom Rails: Cedar 2x4's with a measured moisture content of 9%

Balusters (In-Fill): 3/4 in diameter pre-galvanized steel round baluster with 0.05 in wall

Rail Connection Condition: Nylon "drop-in" brackets

Fasteners: #9 by 1 in (0.175 in major diameter, 0.113 in minor diameter) T20 exterior screw (one per bracket/post connection)

#7 by 3 in (0.155 in major diameter, 0.110 in minor diameter, 0.125 in shank diameter) T20 wood screw (four per bracket/rail/post connection)

#10 by 2 in (0.194 in major diameter, 0.135 in minor diameter) stainless steel screw in conjunction with EZ Mount Round baluster connector (one per baluster/rail connection)

Posts: Preservative treated 4x4 wood posts (Southern Pine) provided by Architectural Testing

See drawings in Appendix A and photographs in Appendix B for additional details.

2.0 Structural Performance Testing of Assembled Railing Systems

2.1 Test 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.

2.2 Test Setup

The 96 in wide by 42 in high guardrail assembly was installed and tested as a single railing section by directly securing the posts into a rigid steel test fixture, which rigidly restrained the posts from deflecting Transducers mounted to an independent reference frame were located to record movement of reference points on the guardrail system components (ends and mid-point) to determine net component deflections. See photographs in Appendix B for individual test setups.

2.3 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.

2.4 Test Results

The following tests were performed on the guardrail assembly for the design load requirements of the codes referenced. 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.

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.

2.4 Test Results (Continued)

Test No. 1 – 03/01/12 Design Load: 50 lb / 1 Square Ft at Center of In-Fill (on Three Balusters)						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	10	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	101	00:09	0.45	0.70	0.67	0.14
Initial Load	10	02:54	0.00	0.01	0.04	-0.01
100% Recovery from 2.0 x Design Load						
2.5x Design Load	129	03:35	Achieved Load without Failure			

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

Test No. 2 – 03/01/12 Design Load: 50 lb / 1 Square Ft at Bottom of In-Fill (on Three Balusters)						
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**			
			End	**Mid**	**End**	**Net [1]**
Initial Load	10	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	101	00:15	0.07	1.06	0.07	0.99
Initial Load	10	05:37	-0.01	0.03	0.00	0.03
97% Recovery from 2.0 x Design Load						
2.5x Design Load	133	06:29	Achieved Load without Failure			

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

Test No. 3 – 03/01/12 Design Load: 200 lb 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	40	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	400	00:48	0.10	3.86	0.07	3.77
Initial Load	40	02:51	0.00	0.06	0.00	0.06
98% Recovery from 2.0 x Design Load						
2.5x Design Load	505	04:00	Achieved Load without Failure			

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

2.4 Test Results (Continued)

Test No. 4 – 03/01/12 Design Load: 200 lb 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	79	00:00	0.00	0.00
(2.0x Design Load) x 2	806	00:41	0.28	0.25
Initial Load	83	03:12	-0.05	0.04
84% Recovery from 2.0 x Design Load				
(2.5x Design Load) x 2	1015	4:26	Achieved Load without Failure	

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

2.5 Summary and Conclusions

Using performance criteria of 75% deflection recovery from 2.0 times design load and 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 96 in wide by 42 in high cedar railing assembly utilizing the nylon rail brackets as described herein. Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

3.0 Closing Statement

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report, and all other supporting evidence will be retained by Architectural Testing for a period of four years from the original test date. At the end of this retention period, said materials shall be discarded without notice, and the service life of this report by Architectural Testing shall expire. Results obtained are tested values and were secured using the designated test methods. This report neither constitutes certification of this product nor expresses an opinion or endorsement by this laboratory; it is the exclusive property of the client so named herein and relates only to the tested specimens. This report may not be reproduced, except in full, without the written approval of Architectural Testing.

For ARCHITECTURAL TESTING:

Digitally Signed by: Keith A. Gurnee

Keith A. Gurnee
Technician I
Structural Systems Testing

Digitally Signed by: Travis Hoover

Travis A. Hoover
Program Manager
Structural Systems Testing

KAG:kag/drm

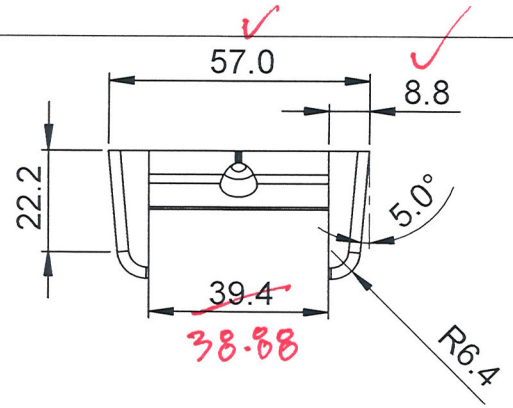
Attachments (pages): *This report is complete only when all attachments listed are included.*
Appendix A - Drawings (7)
Appendix B - Photographs (3)

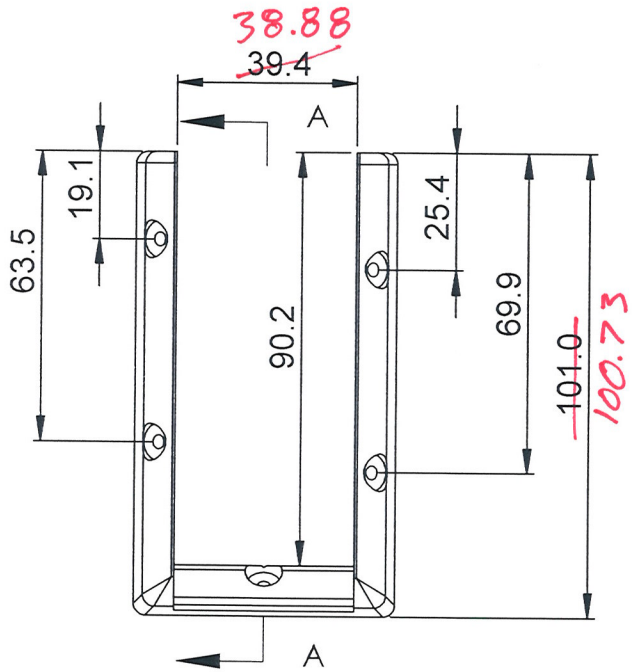
Revision Log

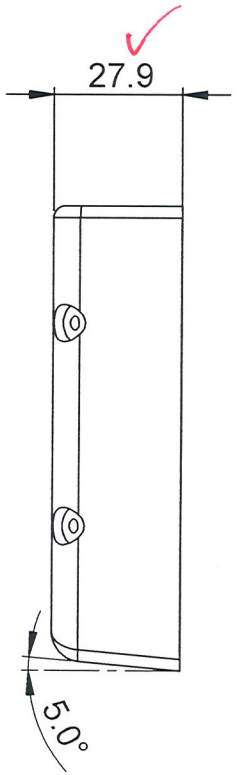
Rev. #	Date	Page(s)	Revision(s)
0	08/27/12	N/A	Original report issue

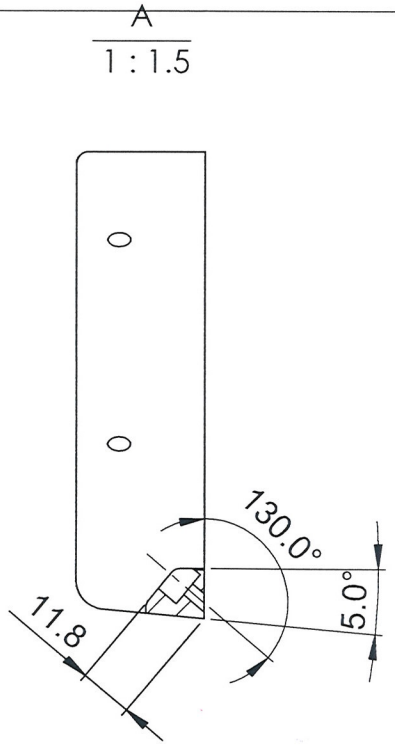
APPENDIX A

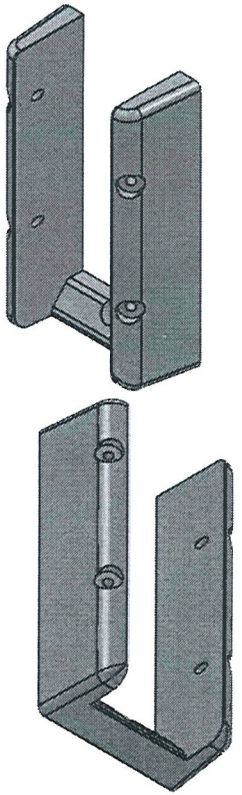
Drawings











Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# B7404.01-119-19

Date 8-9-12 Tech KAG

All Dimensions are Metric - mm
All Dimensions are ± 0.05mm

FORTRESS RAILING PRODUCTS
A Division of THE FORTRESS COMPANY
www.fortressrailing.com

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

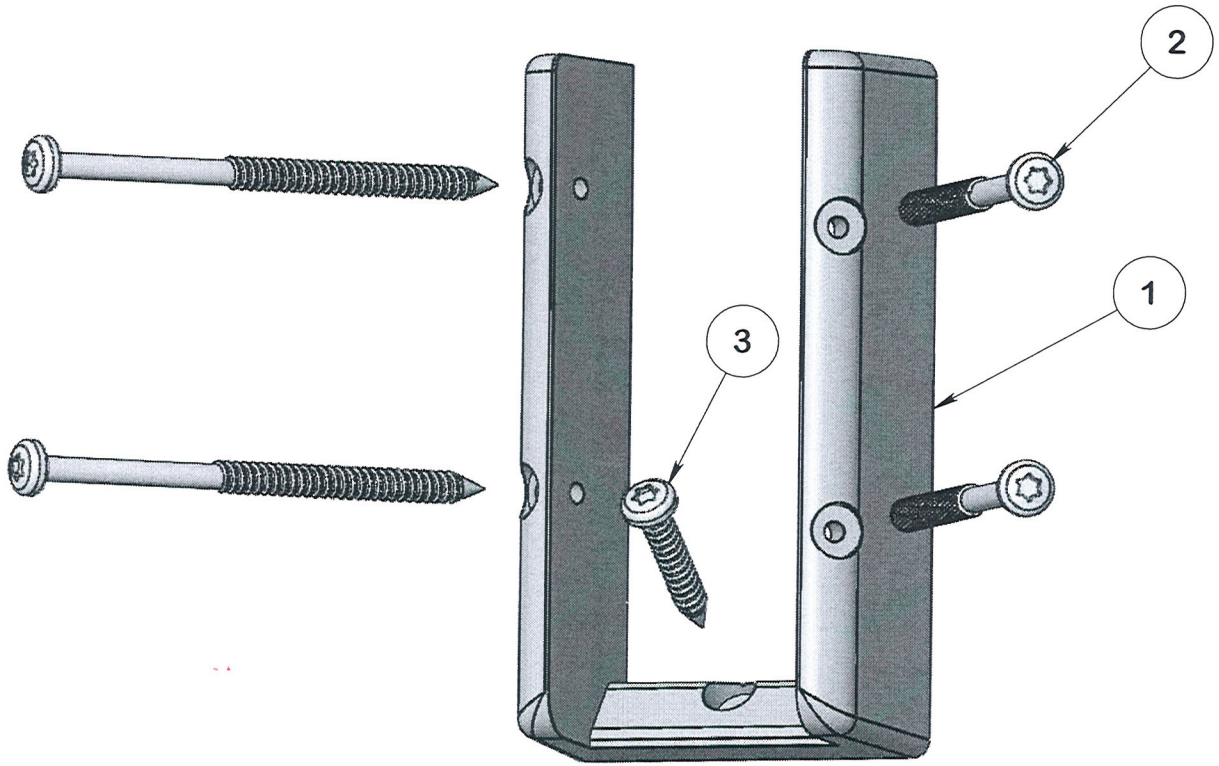
REV	DATE	BY	DESCRIPTION
0	07/29/12	DI	Initial Drawing

TITLE: Railing Family
Rail Bracket 2" X 4"

DRAWN BY: David Irick
DATE: 07/29/12
SCALE: AS SHOWN

Sheet: 2 OF 2
PART #: XXXXXXX
DWG NAME: RB 2" X 4" (Nylon)
REV: 0

ITEM NO.	DESCRIPTION	MATERIAL	QTY.
1	RB 2" X 4" Nylon	NYLON TYPE 6	1
2	925016	SS304	4
3	925015	SS304	1



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# B7404.01-119-19

Date 8/9/12 Tech ICAG

All Dimensions are Metric - mm
All Dimensions are ± 0.05mm

REV	DATE	BY	DESCRIPTION
0	07/29/12	DI	Initial Drawing

FORTRESS RAILING PRODUCTS
www.fortressrailing.com

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

TITLE: Railing Family
Rail Bracket 2 X 4 Rail

DRAWN BY: David Irick
DATE: 07/29/12
SCALE: AS SHOWN

Sheet: 1 OF 2
PART #: 54500020
DWG NAME: RB 2" X 4" (Nylon)
REV: 0

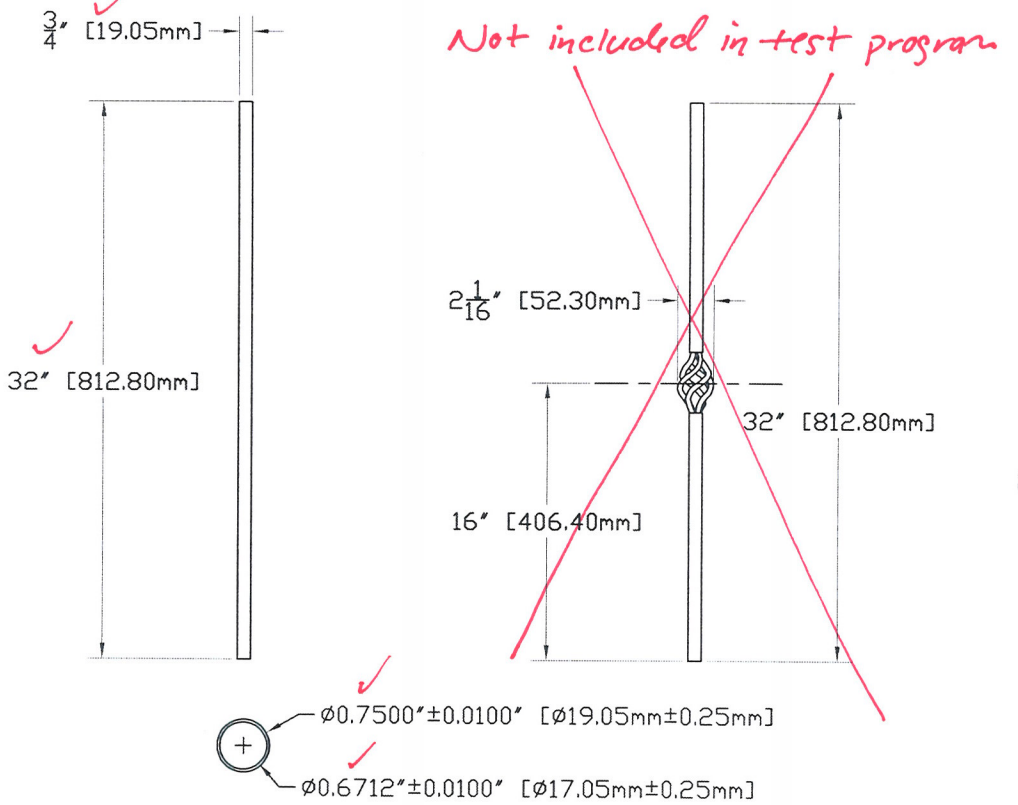
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # B7404.01

Date 8/27/12 Tech TG

Notes:
1. All material to be Q195, pregalvanized, to meet GB 2518-88 Standard.
2. All tubes to be formed and welded full length.
3. All tube welds to be scrapped smooth with no sharp edges or points then zinc thermal sprayed.
4. After manufacturing Plain Balusters to be cleaned including a zinc phosphate pretreatment. One and Two Basket Balusters to receive e-coating treatment after pretreatment.
5. After pretreatment and or e-coating products to be powder coated per DuPont Approved applicator process.



Picket End View - Scale 4X
Note: Picket OD varies based on powder coating type and with manufacturing runs.
Picket ID varies based on manufacturing runs and based on amount of powder coating inside picket.

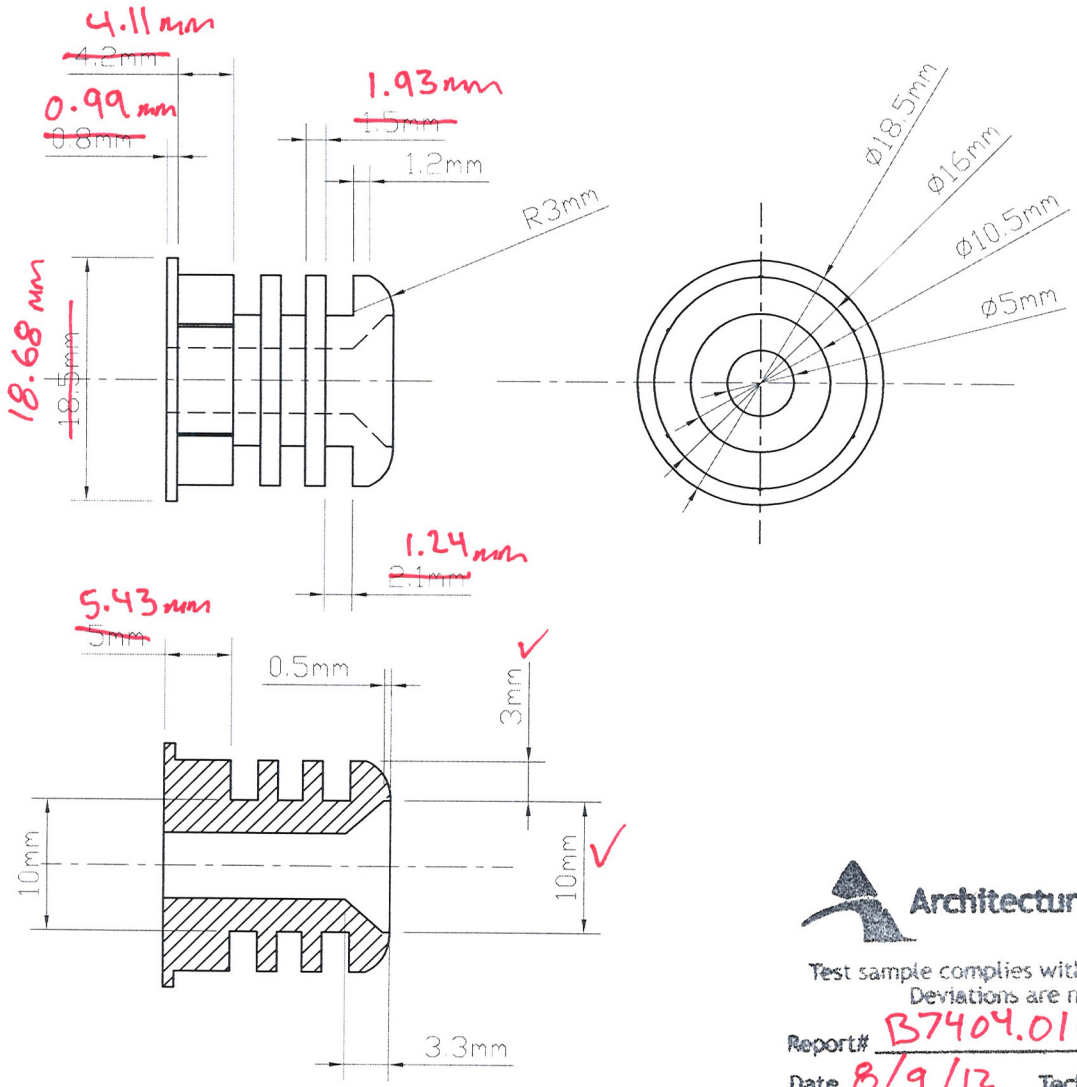
REV	DATE	BY	DESCRIPTION
1	07/29/12	DI	Added Material Specs
0	07/13/06	DI	Initial Drawing Generation

FORTRESS Iron Railing & Fence Systems

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

TITLE: Vintage Round Picket
32 Inch Round Picket, Plain, 1 Basket, 2 Basket

DRAWN BY: David Irick
DATE: 07/13/06
SCALE: As Shown
DWG NAME: 32" Round Pickets
REV: 1



Notes:

1. All materials to be Nylon Type-6
2. After molding pieces are to be cleaned of all sprew marks and rough spots.
3. M4.8X50.8 T-20 FH SS304 DACO coated Wood Screws to be included

PACKAGING:

- Pieces in Butterfly Cardboard Top bag
- Connector-6:
  - 30 Pieces/Bag w/30 ea T-20, DACO Coated Ø4.7mm-2" Wood Screws
  - 50 Bags/Carton
  - Total Pieces/Carton = 1500
  - Carton Size: 21 5/8"L x 6 3/8"W x 11 7/8"H
- Connector-8:
  - 40 Pieces/Bag w/40 ea T-20, DACO Coated Ø4.7mm-2" Wood Screws
  - 50 Bags/Carton
  - Total Pieces/Carton = 2000
  - Carton Size: 15 3/4"L X 6 3/8"W X 11 7/8"H

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# B7409.01-119-19

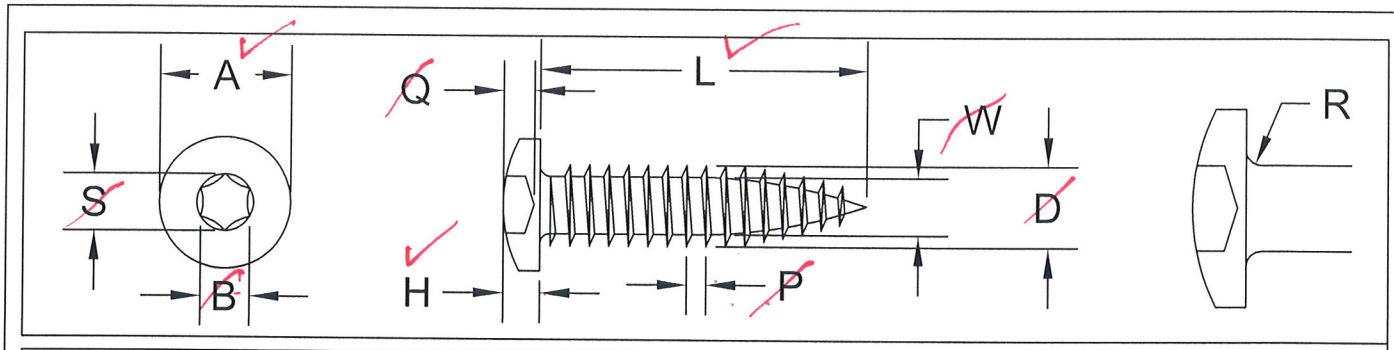
Date 8/9/12 Tech KAG

REV	DATE	BY	DESCRIPTION
0	07/15/07	DI	Initial Drawing Generation

FORTRESS Iron Railing & Fence Systems

Fortress Iron, LP
216 N. Interurban
Richardson, TX 75081

TITLE	EZ-Mount Standard
DRAWN BY	David Irick
DATE	07/15/07
SCALE	As Shown
ITEM NUMBER	
DRAWING NO.	EZ-Mounts-Standard
REV.	0



Size		M4.6 x 25mm
A	Min	7.77mm
	Max	8.18mm
~~B~~		~~2.83mm~~ 3.03mm
~~S~~		~~3.94mm~~ 3.81mm
~~Q~~	Min	~~1.15mm~~ 2.12mm
	Max	~~1.27mm~~
H	Min	3.35mm
	Max	3.75mm
~~D~~	Min	~~4.52mm~~ 4.42mm
	Max	~~4.75mm~~
~~P~~		~~2.8mm~~ 2.68mm
L	Min	24.9mm
	Max	25.1mm
~~W~~	Min	~~3.45mm~~ 2.92mm
	Max	~~3.55mm~~
R	Min	1.20mm
	Max	1.25mm

T-20

Material	SS304
Usage	Wood

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# B7404.01-119-19

Date 8/9/12 Tech ICAG

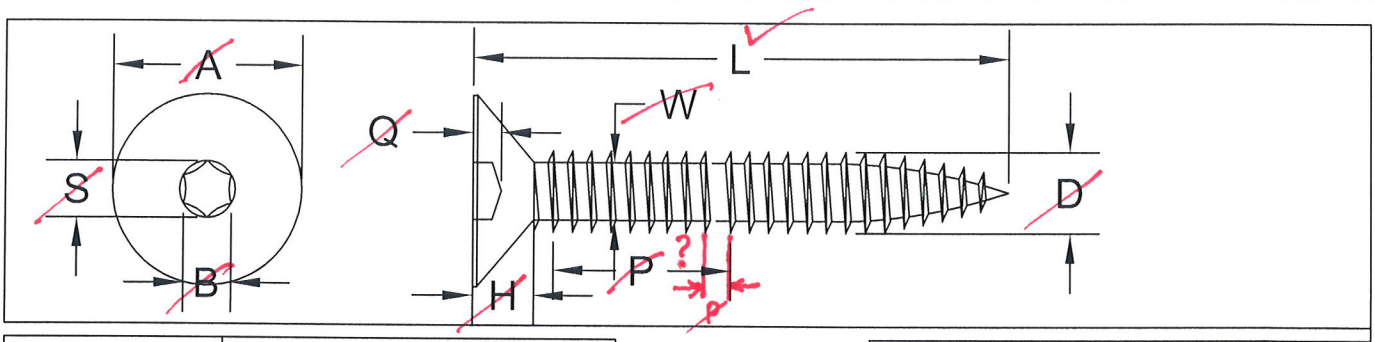
REV	DATE	BY	DESCRIPTION
0	07/30/12	DI	Initial Drawing Generation

FORTRESS Iron Railing & Fence Systems

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

TITLE: Wood Screw
Pan Head, 6-Lobe, Sharp End

DRAWN BY: David Irick
DATE: 07/30/12
SCALE: As Shown
ITEM #: 925015
DRAWING NO.: Pan Head, 6-Lobe, Sharp End
REV.: 0



Size		M5 x 50mm	
A	Min	~~10.0mm~~	9.56mm
	Max	~~10.20mm~~	
B		~~3.93mm~~ 3.26mm	T25
S		~~4.50mm~~ 4.56mm	
Q	Min	~~1.75mm~~	2.63mm
	Max	~~1.87mm~~	
H	Min	~~2.50mm~~	3.69mm
	Max	~~2.80mm~~	
D	Min	~~4.95mm~~	4.94mm
	Max	~~5.00mm~~	
P		~~~1.7mm~~	2.33mm
L	Min	49.50mm	
	Max	50.50mm	
W	Min	~~3.45mm~~	3.41mm
	Max	~~3.55mm~~	

Material	SS304
Usage	Wood

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# B7404.01-119-19

Date 8/9/12 Tech KAG

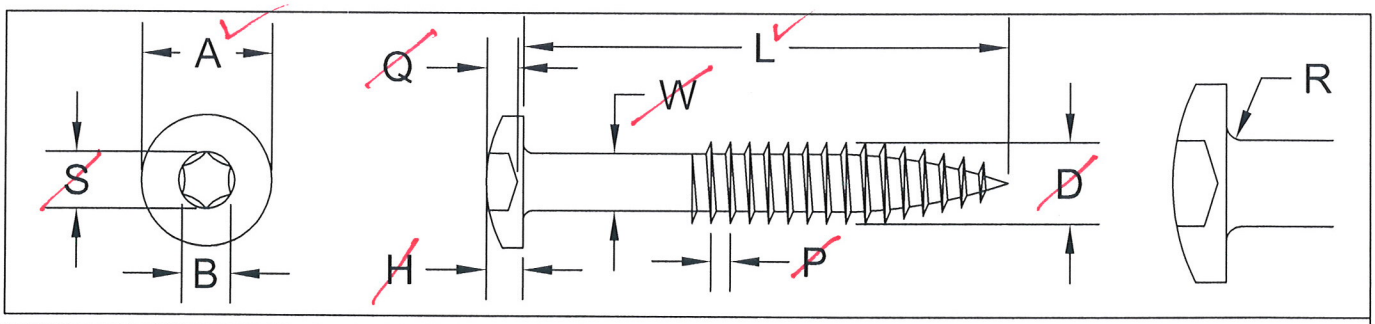
REV	DATE	BY	DESCRIPTION
0	08/02/12	DI	Initial Drawing Generation

FORTRESS Iron Railing & Fence Systems

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

TITLE: Wood Screw
Flat Head, T-25 Drive, Sharp End

DRAWN BY: David Irick
DATE: 08/02/12
SCALE: As Shown
ITEM #: 925018
DRAWING NO.: FH - T-25- M5 X 50 Wood Screw
REV.: 0



Size		M4.6 x 76mm
A	Min	7.77mm
	Max	8.18mm
B		~~2.83mm~~ 2.88 mm
S		~~3.94mm~~ 3.82 mm
Q	Min	~~1.15mm~~
	Max	~~1.27mm~~ 2.00 mm
H	Min	~~3.35mm~~
	Max	~~3.75mm~~ 3.01 mm
D	Min	~~4.52mm~~
	Max	~~4.75mm~~ 4.01 mm
P		~~2.8mm~~ 1.56 mm
L	Min	75.8mm
	Max	76.2mm
W	Min	~~3.45mm~~
	Max	~~3.55mm~~ 3.13 mm
R	Min	1.20mm
	Max	1.25mm

T-20

Material	SS304
Usage	Wood

Architectural Testing

Test sample complies with these details.
Deviations are noted.

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REV	DATE	BY	DESCRIPTION
0	07/30/12	DI	Initial Drawing Generation

FORTRESS Iron Railing & Fence Systems

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

TITLE: Wood Screw
Pan Head, 6-Lobe, Sharp End

DRAWN BY: David Irick
DATE: 07/30/12
SCALE: As Shown
ITEM #: 925016
DRAWING NO.: Pan Head, 6-Lobe, Sharp End
REV.: 0

APPENDIX B

Photographs

Photo No. 1
In-Fill Load at Center of Three Balusters

Photo No. 2
In-Fill Load at Bottom of Three Balusters

Photo No. 3
Concentrated Load at Midspan of Top Rail

Photo No. 4
Concentrated Load at Both Ends of Top Rail (Brackets)

Photo No. 5
Nylon Rail Bracket Installed