TEST REPORT

Rendered to:

FORTRESS RAILING PRODUCTS

For:

***AVANT™ Railing by Fortress®* Level Aluminum Guardrail**

Report No.: E8879.01-119-19
Report Date: 02/09/16
Revision 1: 08/24/18
Test Record Retention Date: 10/22/19

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TEST REPORT

E8879.01-119-19
Revision 1: August 24, 2018

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TEST REPORT

Rendered to:

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

Report No.:	E8879.01-119-19
Test Dates:	10/19/15
Through:	10/22/15
Report Date:	02/09/16
Revision 1:	08/24/18
Test Record Retention Date:	10/22/19

1.0 General Information

1.1 Product

8 ft by 36 in *AVANT™ Railing by Fortress®* Level Aluminum Guardrail

1.2 Project Description

Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by Fortress Railing Products to perform structural performance testing on their 8 ft by 36 in *AVANT™ Railing by Fortress®* level aluminum guardrail. The purpose of the testing is performance testing in accordance with the following criteria with the intention of not submitting for evaluation purposes:

ICC-ES™ AC273 (March 1, 2008 - Editorial Revised February 2014), *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:

2012 *International Building Code®*, International Code Council

2012 *International Residential Code®*, International Code Council

1.3 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, aluminum posts (at one end only), and attachment to the supporting structure. The support posts (at one end only) were conventional construction and not within the scope of the evaluation. Conventional posts were therefore not a tested component and 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.

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

1.4 Qualifications

Intertek-ATI 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-ATI is accredited to perform all testing reported herein.

1.5 Product Description

The *AVANT™ Railing by Fortress®* guardrail system is comprised of aluminum rails, pickets, and posts. Test specimens consisted of one product color: Black. Drawings are included in Appendix A to verify the overall dimensions and other pertinent information of the tested product, its components, and any constructed assemblies.

1.6 Product Sampling

All materials used for testing were provided by Fortress Railing Products and were not independently sampled.

1.7 Witnessing

There were no witnesses from Fortress Railing Products present for testing conducted and reported herein.

1.8 Conditions of Testing

Unless otherwise indicated, all testing reported herein was conducted in a laboratory set to maintain temperature in the range of 68 ± 4ºF and humidity in the range of 50 ± 5% RH.

2.0 Referenced Standard

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

3.0 Assembly Fastener Testing

Re: ICC-ES™ AC273 - Section 4.2.7

3.1 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.

3.2 Test Specimens

Short sections of the top rail were attached in accordance with Fortress Railing Products' installation instructions to short sections of posts. Specimens were assembled by an Intertek-ATI technician. Rail brackets were secured to the post and to the rail as described in Section 4.4 Fastening Schedule.

3.3 Test Setup

The testing machine was fitted with the post sections at the top and bottom to accommodate anchorage of the rail and brackets. The top post section was attached to the test machine's crosshead with a swivel mechanism, and the bottom post section was attached rigidly to the base of the test machine. Two specimens were tested in this manner with each of the two specimens including two connections for a total of four connections. See photograph in Appendix B for test setup.

3.4 Test Procedure

Testing was performed in accordance with ASTM D 1761 and by 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. Testing was conducted on October 22, 2015.

3.5 Test Results

***AVANT™ Railing by Fortress®* Guardrail with Straight Bracket Attached to 4x4 Treated Wood Post**

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	1442	9%	Bracket broke around rail to post fastener
2	1197	-9%	
Average	**1320**		
Allowable Capacity [1]	**528**	**≥ 200 lb ∴ OK**	

[1] *Average ultimate load divided by a factor of safety of two and one-half (2.5)*

***AVANT™ Railing by Fortress®* Guardrail with Collar Bracket Attached to Aluminum Post**

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	1609	16%	Bracket failure
2	1174	-16%	
Average	**1392**		
Allowable Capacity [1]	**557**	**≥ 200 lb ∴ OK**	

[1] *Average ultimate load divided by a factor of safety of two and one-half (2.5)*

3.6 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 lb. Therefore, fasteners / connectors reported herein meet the performance requirements of ICC-ES™ AC273 for use in corner conditions.

4.0 Structural Performance Testing of Assembled Railing Systems

Re: ICC-ES™ AC273 - Section 4.2.1

4.1 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.

4.1 Railing Assembly Description

The *AVANT™ Railing by Fortress®* guardrail system consisted of aluminum top and bottom rails with spaced pickets between the rail members. The railing systems had an overall top rail length (inside of post to inside of post) of 93-1/2 in with an overall rail height (top of top rail to bottom of bottom rail) of 32-1/2 in. Top and bottom rails attached to aluminum post mounts via metal straight brackets on one end and preservative treated 4x4 SYP wood post via metal straight brackets on the other end. One support block was utilized and was located at the midspan of the bottom rail. See Section 5.4 Fastening Schedule for connection details. See drawings in Appendix A and photographs in Appendix B for additional details.

4.2 Series / Model

The test specimen components were supplied by Fortress Railing Products and were assembled by a representative of Intertek-ATI.

Top/Bottom Rail: 1.30 in wide by 1.30 in high by 0.11 in wall "U"-shaped extruded 6063-T5 aluminum profile

Top Rail Cap: 1.45 in wide by 1.37 in high by 0.07 in wall "U"-shaped extruded 6063-T5 aluminum profile

Straight Brackets: 1.91 in wide by 1.62 in high by 1.26 in deep (0.20 in wall) cast aluminum cup bracket

Pickets: 0.63 in square by 0.05 in wall by 31 in long extruded 6063-T5 aluminum with 3.88 in clear space between pickets - pickets have welded connection points to top and bottom rails

Support Posts:

Post: 2.5 in square by 0.16 in wall, 6063-T5 aluminum tube post welded to nominal 4.25 in square by 0.40 in thick base plate with four nominal 3/8 in diameter holes located approximately 15/32 in on-center in from each edge and approximately 3-5/16 in apart on-center and one 3/4 in diameter hole located in the center of the base plate - a 1/4 in continuous fillet weld connected the tube to the base plate - the base plate was attached to the surface of a rigid steel test surface (simulated concrete) as described in Section 4.4 Fastening Schedule.

Wood Post: Nominal 4x4 preservative treated, Grade No. 2, Southern Pine wood post in rigid vertical stanchions

Support Block: 0.83 in square by 4.15 in long cast aluminum tube with integral 1.02 in by 0.83 in by 0.56 in high “U” profile at top end

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

4.3 Fastening Schedule

Connection	Fastener
Rail Bracket to Aluminum Post*	Two #12-24 by 3/4 in flat-head, star drive, Type F thread cutting tip, sheet metal screws
Rail Bracket to Wood Post	Two #12-10 by 2-1/2 in (0.157 in minor diameter) Type A point, flat-head, star drive, wood screws
Rail Bracket to Rail**	One #12-24 by 3/4 in flat-head, star drive, Type F thread cutting tip, sheet metal screws
Support Block to Bottom Rail	Slip fit - No mechanical connection
Post Mount to Substructure	Four 3/8 in Grade 5 hex-head bolts with washer

**3/16 in diameter pre-drill used*

*** 3/16 in diameter pre-drill used, fastener located on the protected side of the rail*

4.4 Test Setup

The railing assembly was installed and tested as a single railing section by directly securing (surface-mounting) the base of the aluminum post mounts to a rigid steel test frame. For the wood posts the railing assembly was installed and tested as a single railing section by directly securing the 4x4 treated wood posts (Southern Pine) to a rigid test frame, which rigidly restrained the rail system. The 4x4 treated wood posts were included only to facilitate anchorage of the test specimen and were not tested components. The railing was assembled by an Intertek-ATI 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 Appendix B for test setups.

4.5 Test Procedure

Testing and evaluation was performed in accordance with Section 4.2.1 of ICC-ES™ AC273. 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.

4.6 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.

4.6 Test Results (Continued)

93-1/2 in by 36 in *AVANT™ Railing by Fortress®* Level Aluminum Guardrail
Limited to Use in IRC – One- and Two-Family Dwellings / ICC-ES™ AC273

Specimen No. 1 of 3

Test No. 1 – Test Date: 10/19/15 **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 – 129	00:22 – 01:26	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 – Test Date: 10/19/15 **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 – 127	00:23 – 01:30	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 – Test Date: 10/19/15 **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	00:39	0.03	1.36	0.22	1.24
500 lb (2.50 x D.L.)	500 – 503	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 200 lb = 1.24 in on an 8 ft rail (93.5 in) Limits per AC273: $\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{36}{24}+\frac{93.5}{96}\right)=2.47">1.24"\therefore ok$ and $\frac{h}{12}=\frac{36}{12}=3.00">1.24"\therefore ok$						

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

4.6 Test Results (Continued)

Specimen No. 1 of 3 (Continued)

Test No. 4 – Test Date: 10/19/15 **Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)**			
Load Level [1]	**Test Load (lb)**	**E.T. (min:sec)**	**Result**
1000 lb (2.5 x D.L.) x 2	1000 – 1009	00:33 – 01:41	Each end withstood a load equal to or greater than 500 lb for at least one minute without failure

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

Test No. 5 – Test Date: 10/19/15 **Design Load: 200 lb Concentrated Load at Top of Post Mount (36 in High)**			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
200 lb (D.L.)	200	00:23	0.38
500 lb (2.50 x D.L.)	501 – 509	00:38 – 01:44	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure
Deflection Evaluation: Maximum post deflection at 200 lb = 0.38 in on an 8 ft rail (93.5 in) Limits per AC273: $\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{36}{24}+\frac{93.5}{96}\right)=2.47">0.38"\therefore ok$ and $\frac{h}{12}=\frac{36}{12}=3.00">0.38"\therefore ok$			

4.6 Test Results (Continued)

Specimen No. 2 of 3

Test No. 1 – Test Date: 10/20/15 **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 – 127	00:22 – 01:27	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 – Test Date: 10/20/15 **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 – 127	00:44 – 01:50	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 – Test Date: 10/20/15 **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	00:37	0.01	1.29	0.23	1.17
500 lb (2.50 x D.L.)	500 – 502	01:02 – 02:19	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			
Deflection Evaluation: Maximum rail deflection at 202 lb = 1.17 in on an 8 ft rail (93.5 in) Limits per AC273: $\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{36}{24}+\frac{93.5}{96}\right)=2.47" > 1.17" \therefore ok$ and $\frac{h}{12}=\frac{36}{12}=3.00" > 1.17" \therefore ok$						

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

4.6 Test Results (Continued)

Specimen No. 2 of 3 (Continued)

Test No. 4 – Test Date: 10/20/15 **Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)**			
Load Level [1]	**Test Load** [2] **(lb)**	**E.T. (min:sec)**	**Result**
1000 lb (2.5 x D.L.) x 2	999 – 1011	01:02 – 02:19	Each end withstood a load equal to or greater than 500 lb for at least one minute without failure

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

500 *During the (2.5x D.L) x 2 hold, the load dropped below 1000 lb for a total of 1-1/2 seconds.*

Test No. 5 – Test Date: 10/20/15 **Design Load: 200 lb Concentrated Load at Top of Post Mount (36 in High)**			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
200 lb (D.L.)	200	00:35	0.37
500 lb (2.50 x D.L.)	500 – 503	01:05- 02:14	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure
Deflection Evaluation: Maximum post deflection at 200 lb = 0.37 in on an 8 ft rail (93.5 in) Limits per AC273: $\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{36}{24}+\frac{93.5}{96}\right)=2.47">0.37"\therefore ok$ and $\frac{h}{12}=\frac{36}{12}=3.00">0.37"\therefore ok$			

4.6 Test Results (Continued)

Specimen No. 3 of 3

Test No. 1 – Test Date: 10/20/15 **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 – 127	00:30 – 01:38	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 – Test Date: 10/20/15 **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 – 128	00:26 – 01:33	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 – Test Date: 10/20/15 **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	00:37	0.02	1.27	0.20	1.16
500 lb (2.50 x D.L.)	500 – 504	01:06 – 02:16	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure			
Deflection Evaluation: Maximum rail deflection at 200 lb = 1.16 in on an 8 ft rail (93.5 in) Limits per AC273: $\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{36}{24}+\frac{93.5}{96}\right)=2.47" > 1.16" \therefore ok$ and $\frac{h}{12}=\frac{36}{12}=3.00" > 1.16" \therefore ok$						

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

4.6 Test Results (Continued)

Specimen No. 3 of 3 (Continued)

Test No. 4 – Test Date: 10/20/15 **Design Load: 200 lb Concentrated Load at Both Ends of Top Rail (Brackets)**			
Load Level [1]	**Test Load (lb)**	**E.T. (min:sec)**	**Result**
1000 lb (2.5 x D.L.) x 2	1000 – 1014	00:50 – 01:55	Each end withstood a load equal to or greater than 500 lb for at least one minute without failure

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

Test No. 5 – Test Date: 10/20/15 **Design Load: 200 lb Concentrated Load at Top of Post Mount (36 in High)**			
Load Level	**Test Load (lb)**	**E.T. (min:sec)**	**Displacement (in)**
200 lb (D.L.)	200	00:19	0.40
500 lb (2.50 x D.L.)	500 – 505	00:31 – 01:41	**Result**: Withstood load equal to or greater than 500 lb for one full minute without failure
Deflection Evaluation: Maximum post deflection at 200 lb = 0.40 in on an 8 ft rail (93.5 in) Limits per AC273: $\left(\frac{h}{24}+\frac{l}{96}\right)=\left(\frac{36}{24}+\frac{93.5}{96}\right)=2.47">0.40"\therefore ok$ and $\frac{h}{12}=\frac{36}{12}=3.00">0.40"\therefore ok$			

4.7 Summary and Conclusions

When installed between adequate supports, the railing assemblies reported herein meet the structural performance requirements of Section 4.2.1 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.

5.0 Closing Statement

Intertek-ATI will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Intertek-ATI for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For INTERTEK-ATI:

Digitally Signed by: Emily C. Riley

Emily C. Riley
Project Manager

Digitally Signed by: Virgal Thomas Mickley, Jr.

V. Thomas Mickley, Jr., P.E.
Senior Project Engineer

ECR:vtm/jas

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A – Drawings (10)
Appendix B – Photographs (4)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	02/09/16	N/A	Original report issue
1	08/24/18	Throughout	Changed model name from *Designer's Image* to *AVANT™ Railing by Fortress®*

APPENDIX A

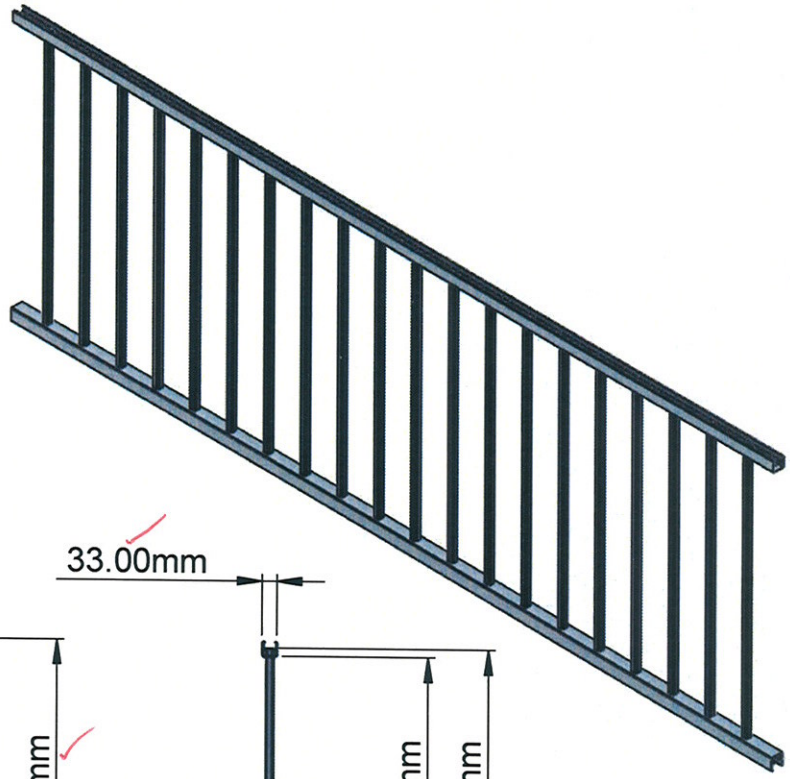
Drawings

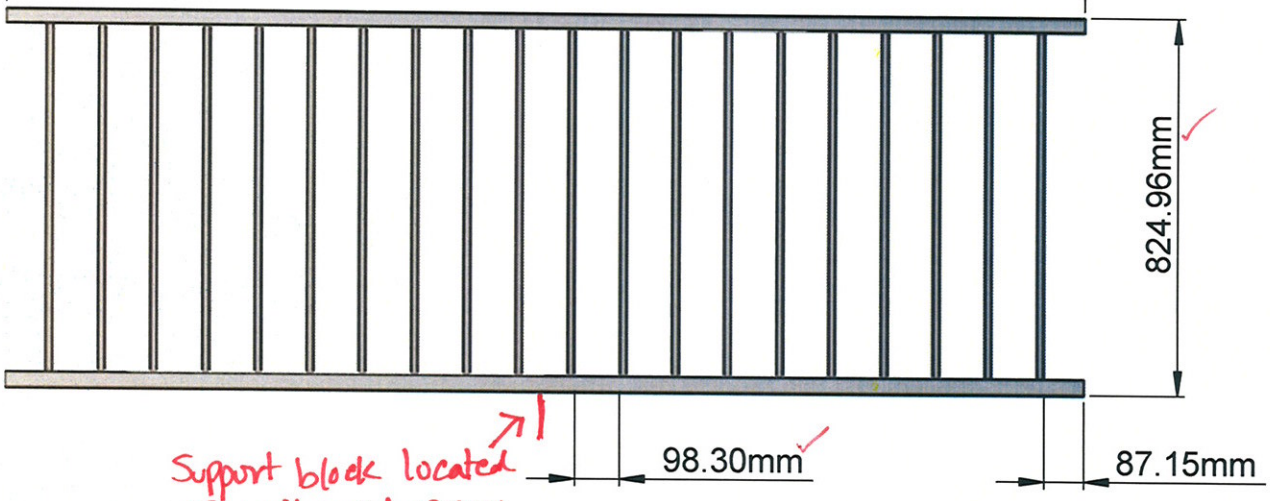
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IWG





All Dimensions are ± 0.5mm

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www.fortressrailing.com

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

REV	DATE	BY	DESCRIPTION
1	04/22/2014	DI	Revised Panel Length
0	04/14/2014	DI	Initial Drawing

TITLE: Aluminum Railing System - Menard's
Family: Railing Prod: Panel Class: RES

DRAWN BY: David Irick
DATE: 04/14/2014
SCALE: As Shown

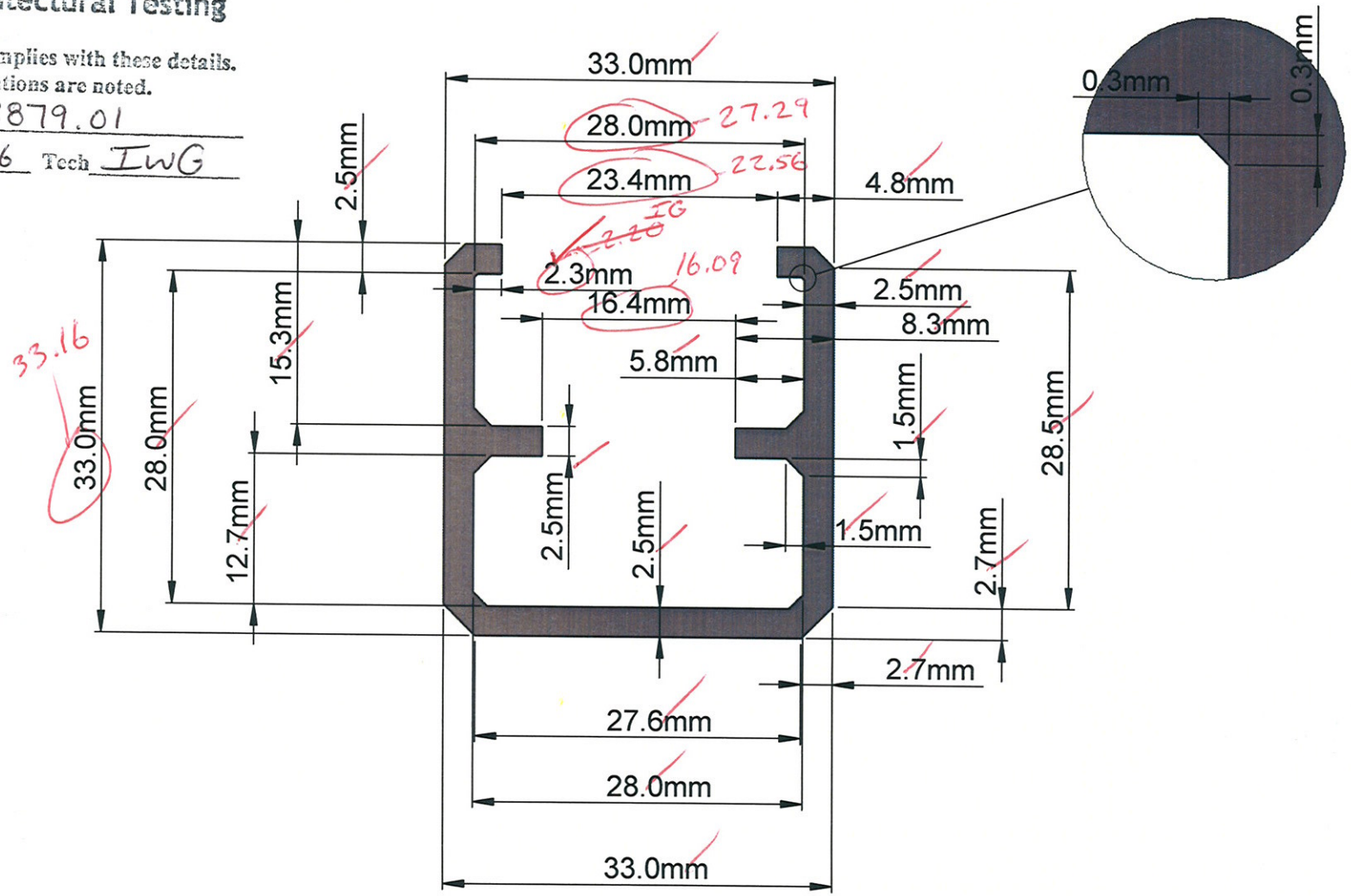
Sheet: 1 OF 2
PART #: XXXXXXX
DWG NAME: Aluminum 8' Panel - Menard's
REV: 1

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IWG



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

REV	DATE	BY	DESCRIPTION
1	04/24/2014	DI	Revised Opening For Welding Picket
0	03/09/2014	DI	Initial Drawing

TITLE: Menard's Aluminum Railing System Extrusions

DRAWN BY: David Irick

DATE: 03/09/2014

SCALE: As Shown

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Richardson, TX 75081

Sheet: 4 OF 5

PART #: XXXXXXX

DWG NAME: Menard's Top Rail Extrusion

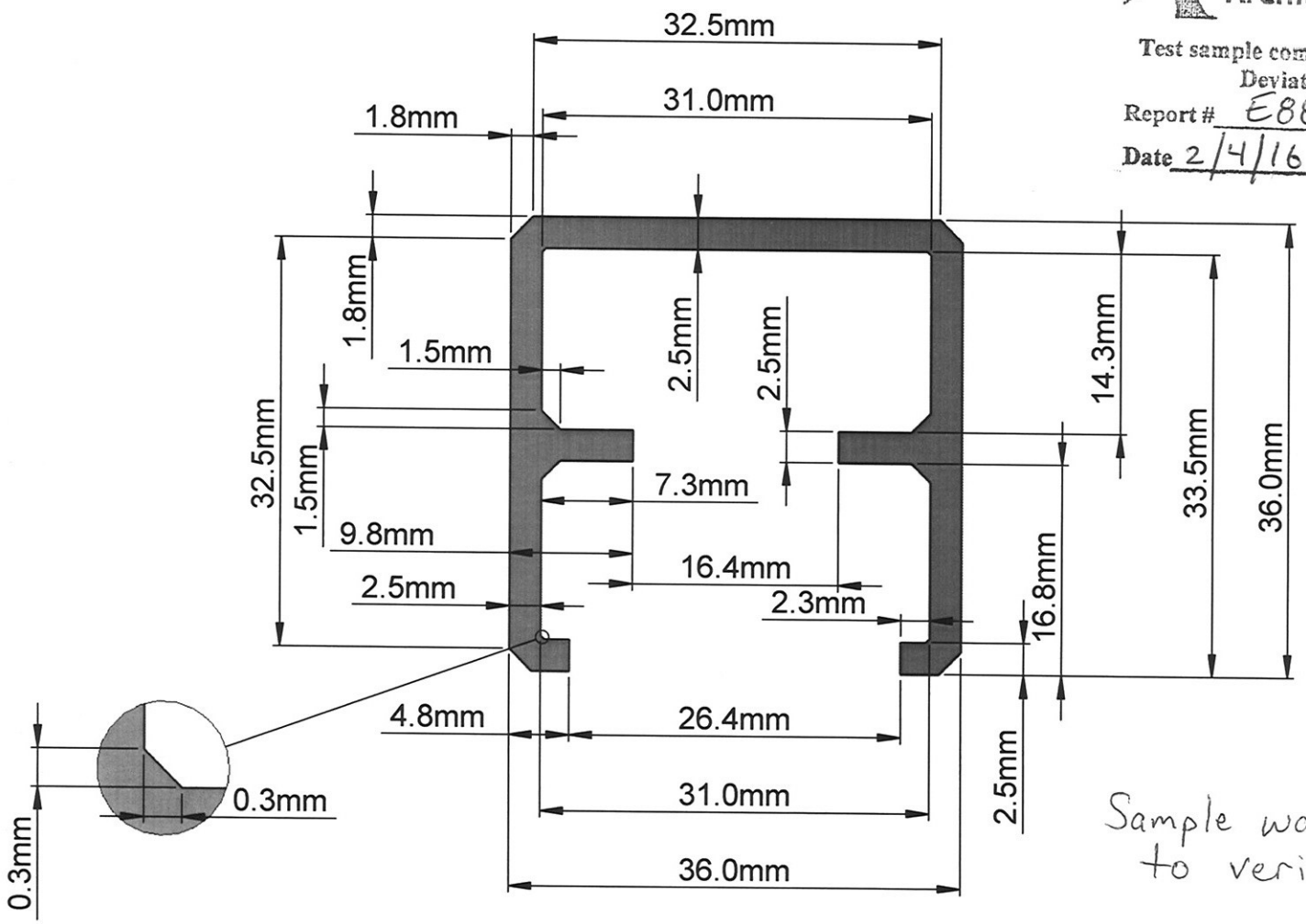
REV: 1

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IWG



Sample was not available to verify dimensions.

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

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1800 Jay Ell, Suite 200
Richardson, TX 75081

REV	DATE	BY	DESCRIPTION
1	04/24/2014	DI	Revised Opening For Welding Picket
0	03/09/2014	DI	Initial Drawing

TITLE: Menard's Aluminum Railing System Extrusions

DRAWN BY: David Irick

DATE: 03/09/2014

SCALE: As Shown

Sheet: 3 OF 5

PART #: XXXXXXX

DWG NAME: Menard's Bottom Rail Extrusion

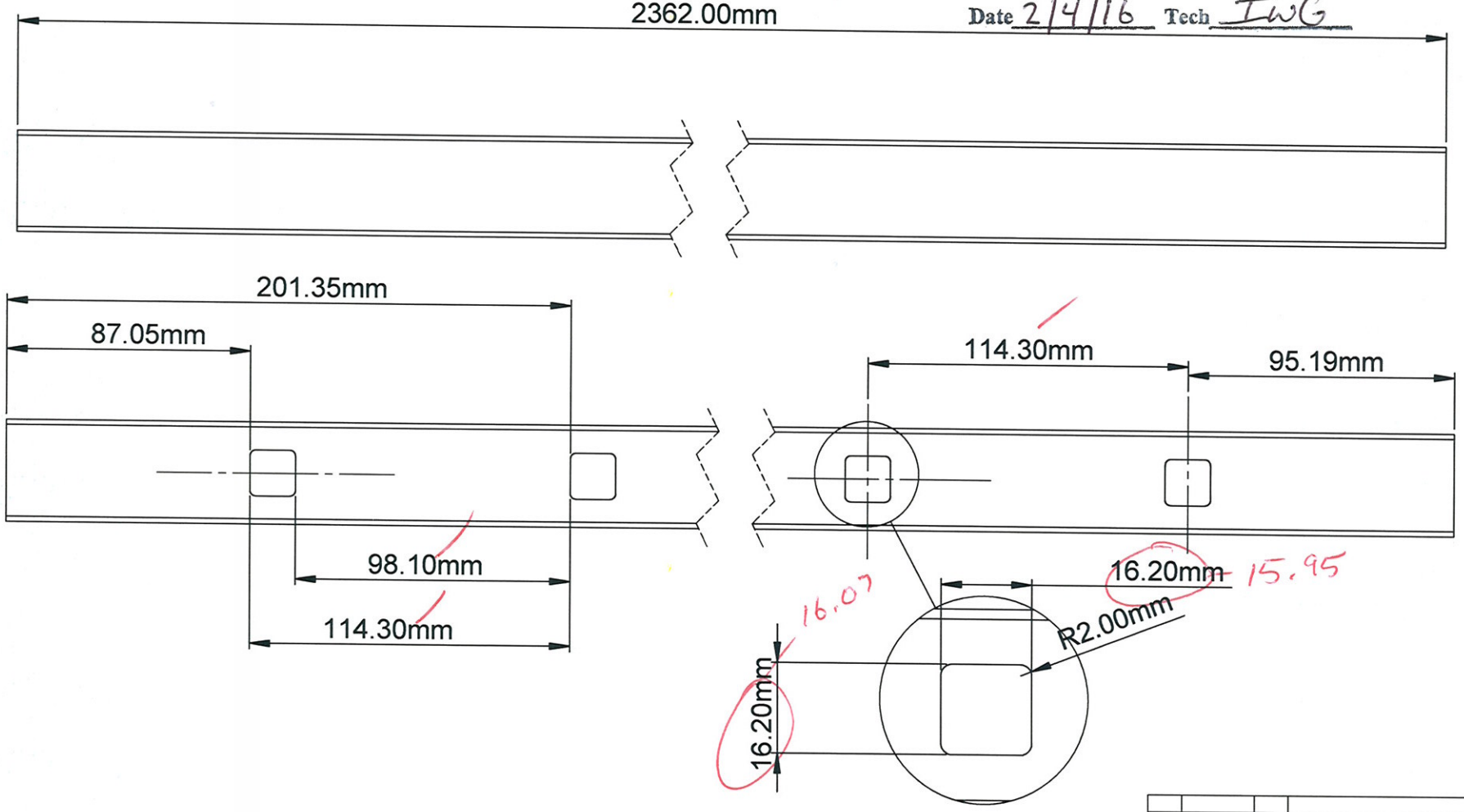
REV: 1

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IWG



All Dimensions are ± 0.5mm

REV	DATE	BY	DESCRIPTION
1	04/22/2014	DI	Revised Panel Length
0	04/14/2014	DI	Initial Drawing

TITLE: Aluminum Railing System - Menard's
Family: Railing Prod: Panel Class: RES

DRAWN BY: David Irick SCALE: As Shown

DATE: 04/22/2014

Sheet: 2 OF 2 PART #: XXXXXXX DWG NAME: Aluminum 8' Panel - Top/Bottom Rails REV: 1

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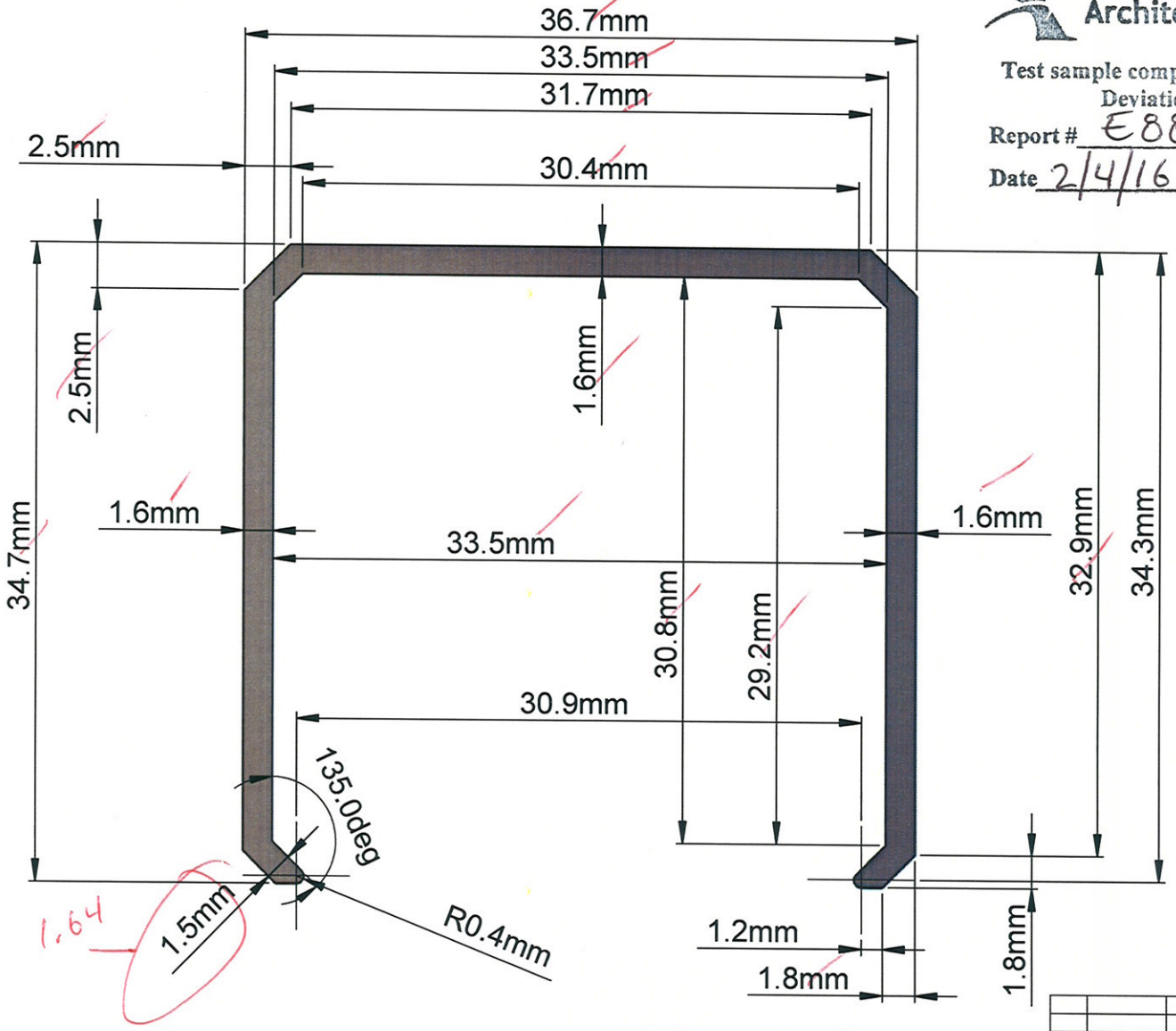

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IWG

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

REV	DATE	BY	DESCRIPTION
0	03/09/2014	DI	Initial Drawing

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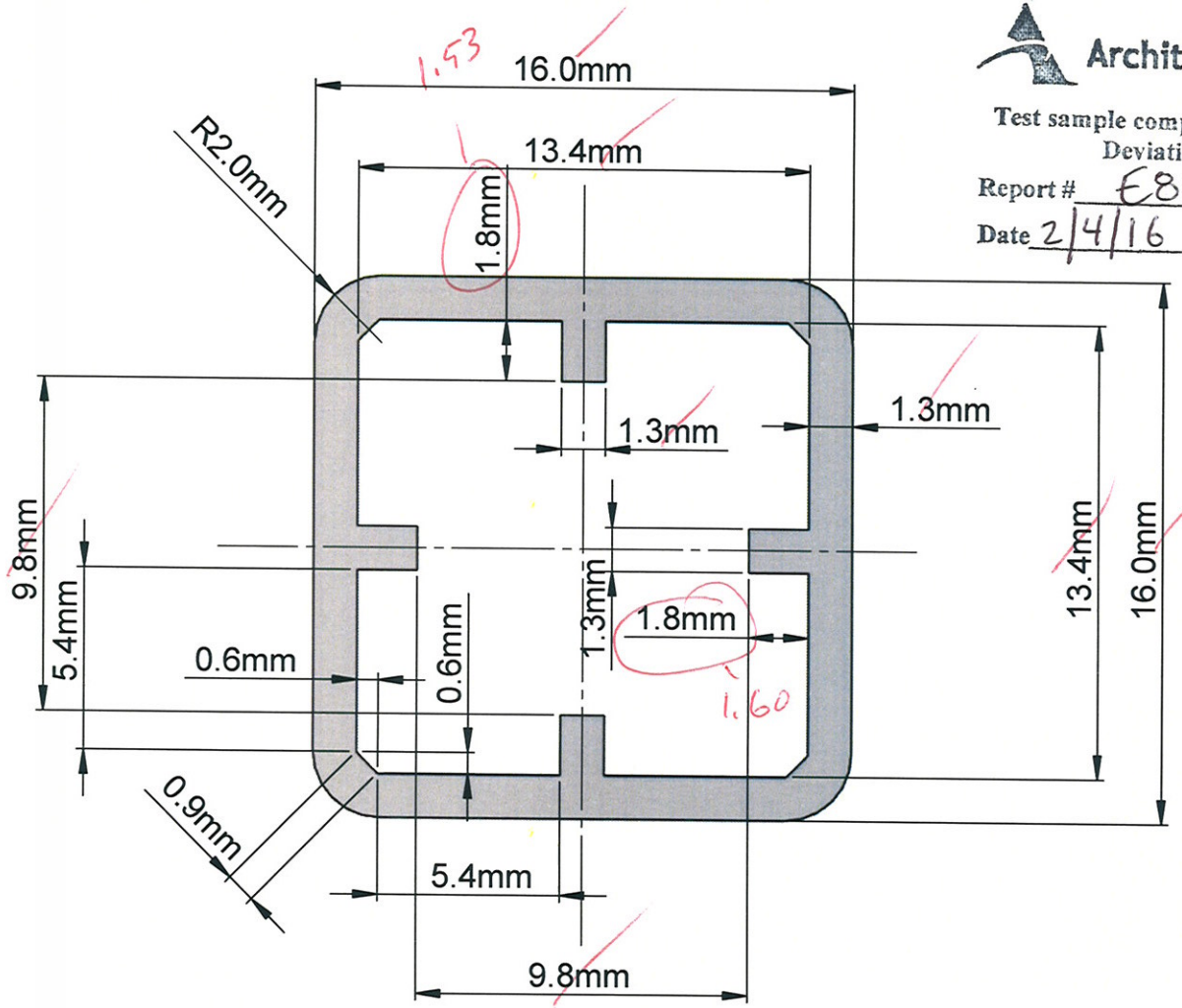
Fortress Iron, LP
1800 Jay Ell, Suite 200
Richardson, TX 75081

TITLE: Menard's Aluminum Railing System Extrusions			
DRAWN BY: David Irick			SCALE: As Shown
DATE: 03/09/2014			
Sheet: 5 OF 5	PART #: XXXXXXX	DWG NAME: Menard's Top Rail Cover Extrusion	REV: 0



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IWG

All Dimensions are ± 0.05mm

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REV	DATE	BY	DESCRIPTION
0	03/09/2014	DI	Initial Drawing

TITLE: Menard's Aluminum Railing System Extrusions

DRAWN BY: David Irick

DATE: 03/09/2014

SCALE: As Shown

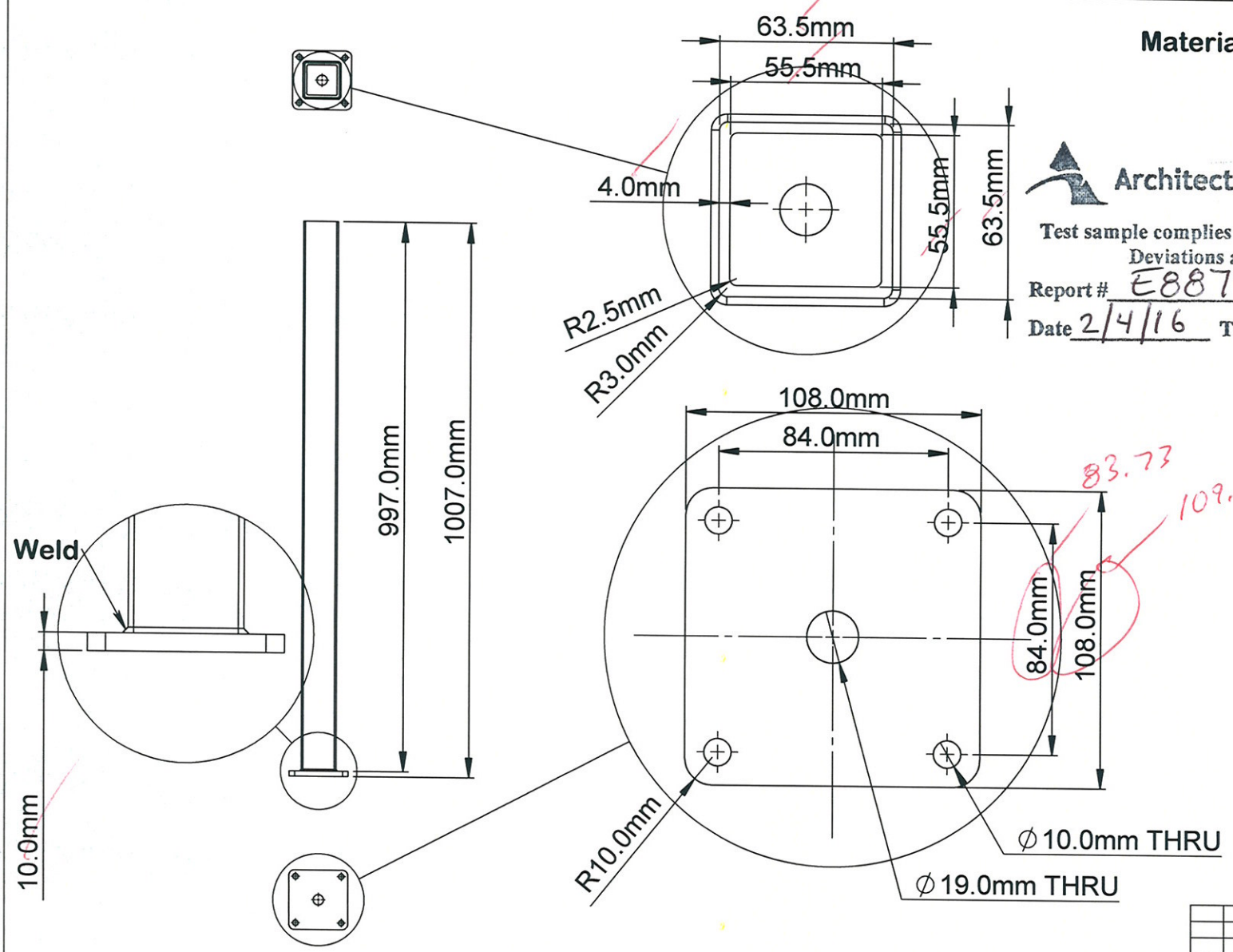
Sheet: 2 OF 5

PART #: XXXXXXX

DWG NAME: Menard's Picket Extrusion

REV: 0

Material: 6063-T5



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/4/16 Tech IwG

All Dimensions are ± 0.5mm

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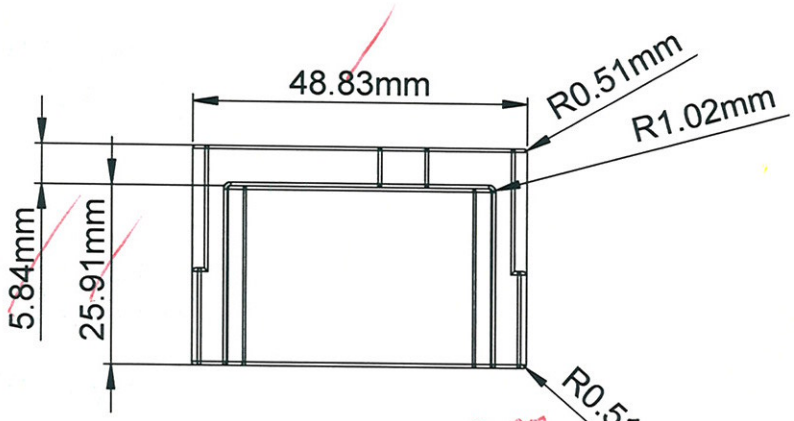
REV	DATE	BY	DESCRIPTION
0	04/18/2014	DI	Initial Drawing

TITLE: Aluminum Railing System - Menard's
Family: Railing Prod: Post Class: RES

DRAWN BY: David Irick
DATE: 04/18/2014
SCALE: As Shown

Sheet: 1 OF 1
PART #: XXXXXXX
DWG NAME: Aluminum Post - 2 1/2" X 39 1/2"
REV: 0

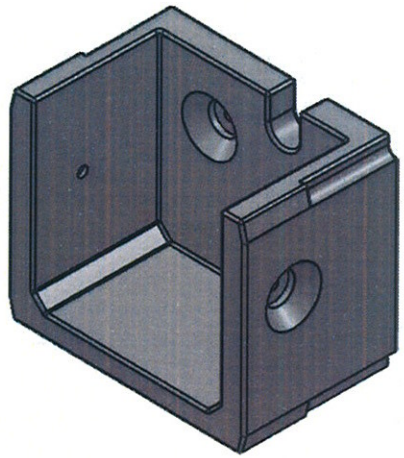


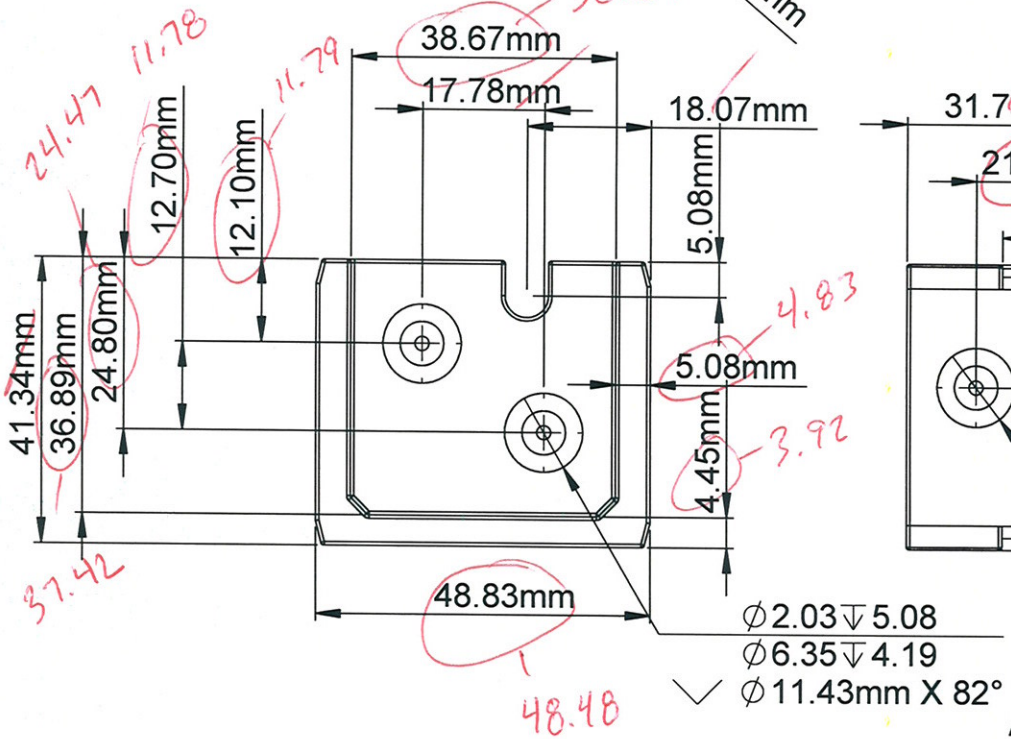
Architectural Testing

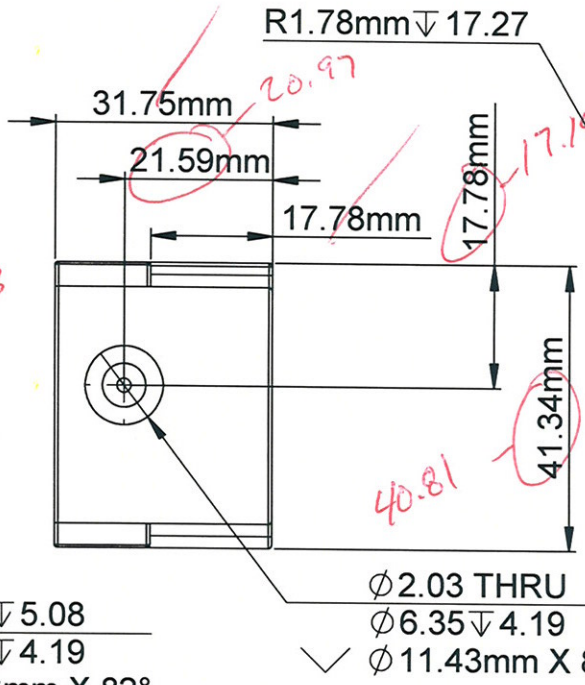
Test sample complies with these details.
Deviations are noted.

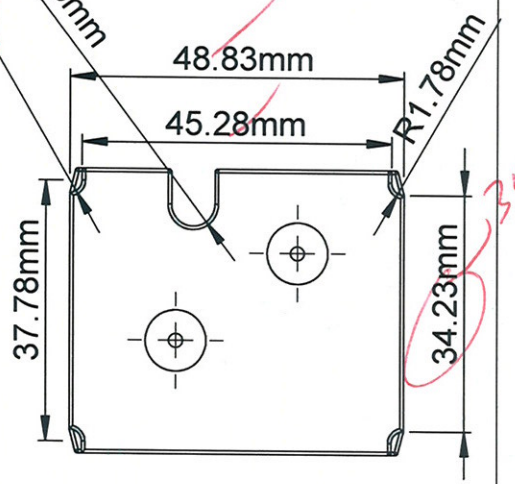
Report # E8879.01

Date 2/4/16 Tech IWG









All Dimensions are ± 0.05mm

REV	DATE	BY	DESCRIPTION
0	05/02/2014	DI	Initial Drawing

TITLE: Menard's Aluminum Railing System
Family: Railing Prod: Bracket Class: RES

DRAWN BY: David Irick
DATE: 05/02/2014
SCALE: As Shown

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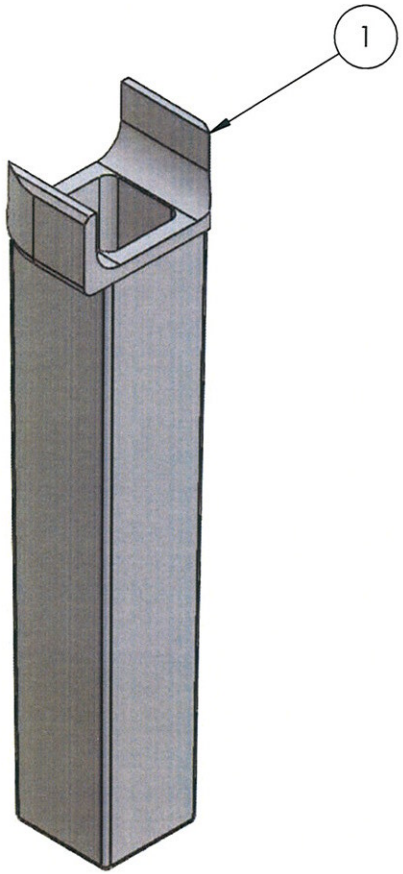
Sheet: 2 OF 3
PART #: XXXXXXX
DWG NAME: External Bracket for Menard's Panels
REV: 0

ITEM NO.	DESCRIPTION	PARTor SHEET NUMBER	QTY.
1	I SUPPORT	Sheet 2	1



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # E8879.01

Date 2/8/16 Tech EOR

All Dimensions are ± 0.05mm

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REV	DATE	BY	DESCRIPTION
0	05/03/2014	DI	Initial Drawing

TITLE: Menard's Aluminum Railing System
Family: Railing Prod: Bracket Class: RES

DRAWN BY: David Irick
DATE: **05/03/2014**
SCALE: As Shown

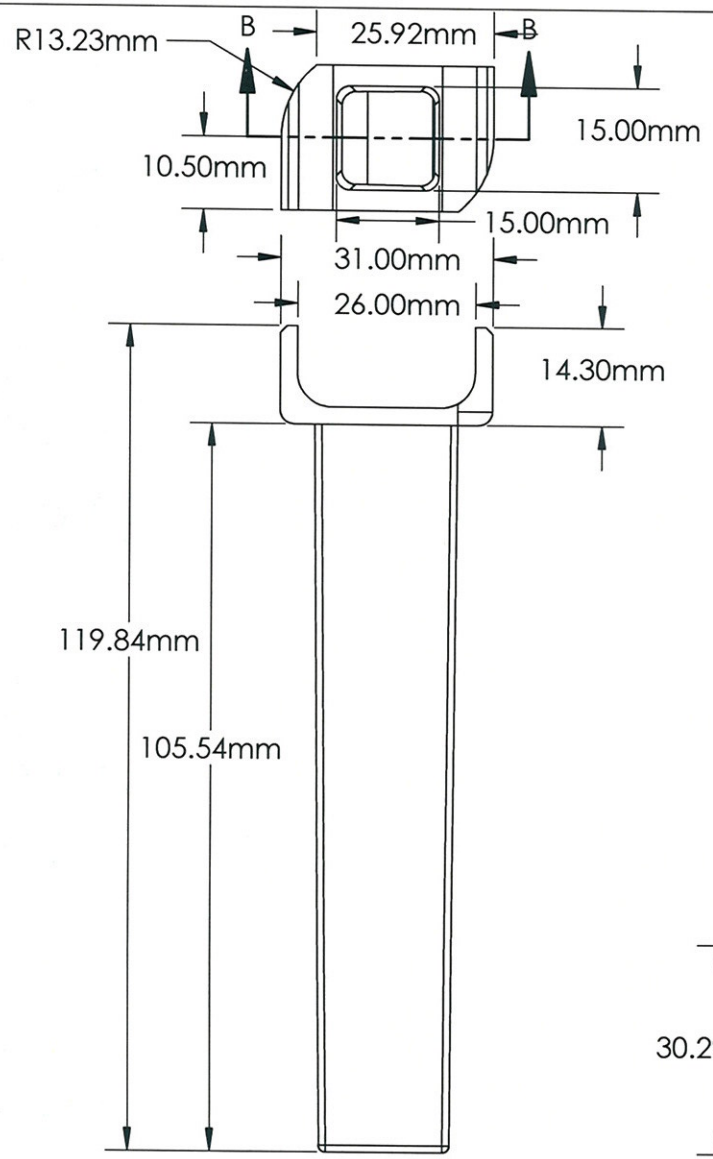
Sheet: 1 OF 2
PART #: XXXXXXX
DWG NAME: **I Support for Menard's Panels**
REV: 0

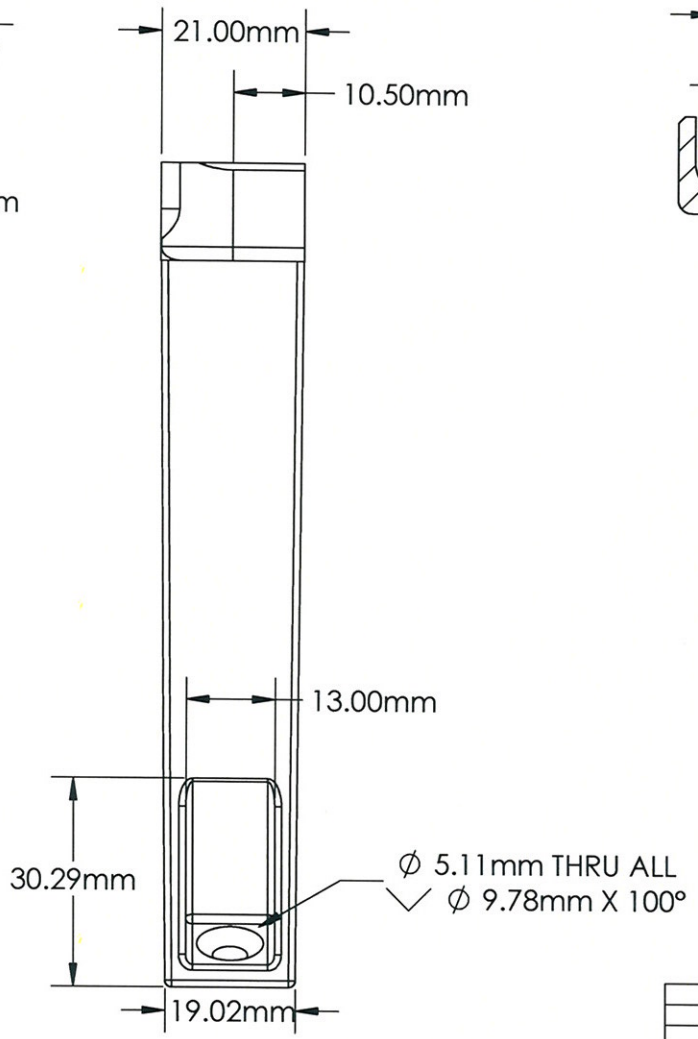
Architectural Testing

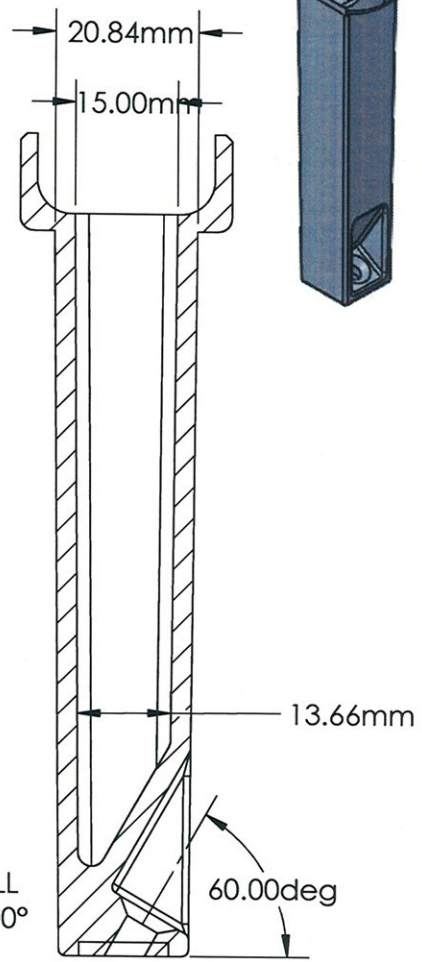
Test sample complies with these details.
Deviations are noted.

Report # ES879-01

Date 2/8/16 Tech EOR







All Dimensions are ± 0.05mm

REV	DATE	BY	DESCRIPTION
0	05/03/2014	DI	Initial Drawing

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

Division: Railing - Menard's
Family: AI Railing Prod: Part Class: RES
DRAWN BY: David Irick
DATE: 05/03/2014
Quotation XX
Production XX
SCALE: As Shown

Sheet: 2 OF 2
PART #: XXXXXXXXX
DWG NAME: I Support for Menard's Panels
REV: 0

APPENDIX B

Photographs

Photo No. 1
Assembly Fastener Test Setup (Aluminum Post)

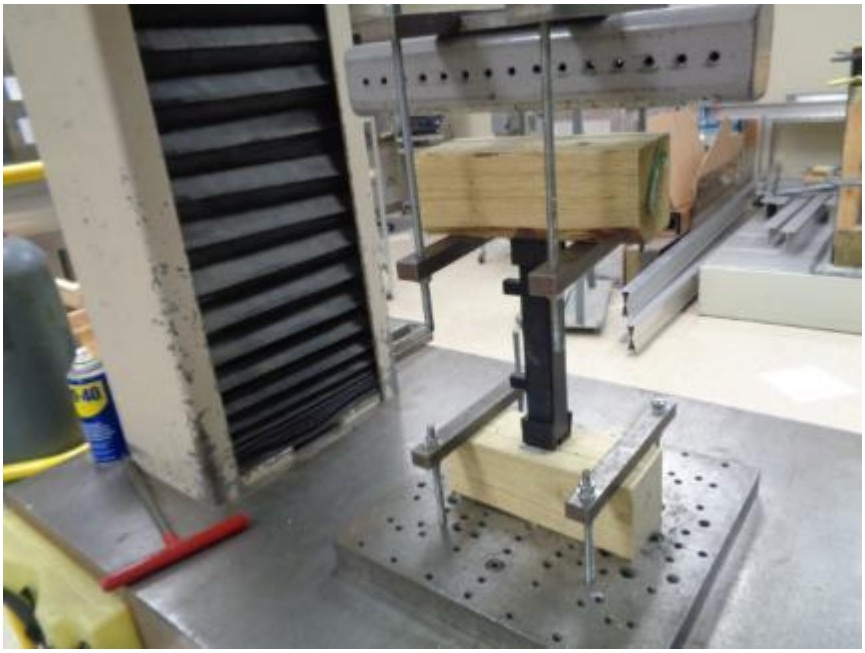

Photo No. 2
Assembly Fastener Test Setup (Wood Post)

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

Photo No. 4
In-Fill Load Test at Bottom of Two Pickets

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

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

Photo No. 7
Concentrated Load Test at Top of Post Mount