Progressive Engineering Inc.

USA Vinyl LLC

ASTM D7032 Guardrail Test
on a new Residential 8' Aluminum
Railing System Design

12/11/2017

Revised on

2/16/2018 - Updated Test Specimen Section on page 2 to add clarity.

This test report contains twenty-two (22) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2017-6122

58640 State Road 15 - Goshen, IN 46528
Phone: 574-533-0337 - Fax: 574-533-9736
www.p-e-i.com

1. TITLE

ASTM D7032 Guardrail Test on a new Residential 8' Aluminum Railing System Design

2. OBJECTIVE

To evaluate an Aluminum 8' Guardrail System Design to ASTM D7032 for One and Two Family Dwellings.

This test report pertains only to the specimens tested. It remains the sole responsibility of the manufacturer to provide a product consistent to that which was tested.

3. TESTED FOR

USA Vinyl, LLC
5795 Green Pointe Drive S
Groveport, OH 43125

4. TESTING ORGANIZATION

Progressive Engineering Inc.

58640 State Road 15
Goshen, IN 46528
www.p-e-i.com

See IAS Evaluation Report TL-178 for ISO 17025 Accreditation.

5. TESTING PERSONNEL

Director of Testing	- Jason R. Holdeman
Project Manager	- Jacob Bontrager
Technician	- Chris Stutzman

6. REFERENCE STANDARDS

ASTM D7032 - 17 - Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails

7. TEST EQUIPMENT

A. Hydraulic Cylinders
B. Load Cell - (PEI No. 465)
C. Linear Transducers - (PEI Nos. 850, 890, 1081)
D. Data Acquisition - (PEI No. 566)

8. TEST SPECIMEN

8’ Aluminum Guardrail System Part No. CXR-B42-A8 (Note: the second letter in the product code (X) refers to the railing color, i.e. B=Black, W=White…)

A. Top Rail - LXAL-BRDTOPPA-X 1.728" wide x 1.654" tall x 0.074" thick aluminum guardrail.
B. Guardrail Post - Part No. LXAL-POST-2.5-X 2.509" x 2.503" x 0.095" thick aluminum tube.
C. Top Rail Bracket - Part No. AXAL-STRGHT-BRD 2.280" wide x 2.758" tall x 1.075" deep - plastic.
D. Bottom Rail Bracket - Part No. AXAL-STRGHT-SQ 2.280" wide x 2.685" tall x 1.075" deep - plastic.
E. Screws:
    1. Bracket to Post: #10 x 3/4" long Torx drive pan head self drilling screws
    2. Post Base to Post: 1/4"-20 x 2" long self drilling hex washerhead screw.

The guardrail materials were provided to PEI by the client. See attached picture pages for details.

9. TEST SPECIMEN CONSTRUCTION

A. A section of Top rail, free from visible defects was selected.

B. Balusters were inserted into the top rail, aligned with the bottom rail and then inserted. A rubber mallet was used to seat the balusters fully into the top and bottom rails.

C. The bottom rail bracket positions were marked on the posts, and then the brackets were fastened to the posts with the four (4) provided #10 Torx Screws per bracket.

D. The top rail bracket positions were marked on the posts, and then the brackets were fastened to the posts with the four (4) provided #10 Torx Screws per bracket.

E. The section of guardrail was slid into the brackets, and fastened with the two (2) provided #10 Torx Screws per bracket, at the predrilled holes.

F. The foot block was fastened to the center of the bottom rail.

10. TEST SETUP

Guardrail Testing

The posts of the guardrail system was secured to a vertical non-yielding test fixture for all of the tests performed.

11. TEST PROCEDURE

The Guardrail system was tested for the Infill and Concentrated Load as described below. ASTM D7032 does not give a hold-time, however all required maximum loads were attempted to be applied for at least one minute.

A. In-Fill Load Test

The load was applied to the 12" x 12" plate with a hydraulic cylinder and load cell which was set in line with the test location. Load was applied at an approximate rate of 1" per minute until a force of 125 lbf, plus any applicable end-use adjustment factor, was attained. A deflection reading was taken at the center of the 12" x 12" plate. Testing was performed at two (2) locations; (1) center of the baluster height in contact with the minimum number of balusters covered by the load plate and, (2) at the bottom rail midspan.

B. Concentrated Load Test

A horizontal concentrated load test was conducted on one end and at the midspan of the top guardrail, using a hydraulic cylinder and load cell set in-line with each test location. The load was applied at an approximate rate of 1" per minute until a force of 500 lbf, plus any applicable end-use adjustment factor, was attained. Deflection readings were taken at the midspan of the guardrail and at both posts during the test.

12. TEST RESULTS

See attached data pages and charts.

13. CONCLUSION

The USA Vinyl, LLC 8' Aluminum Guardrail System Part No. CXR-B42-A8 met the IRC requirements of ASTM D7032 for Guardrail Systems for One- and Two-Family Dwellings.

Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

Date: 12/7/2017
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail

Temperature: 72° F
Rel. Humidity: 17%
End-Use Adjustment Factor: N/A
Effective Guardrail Length (in): 96
Guardrail Height (in): 42
Load Hold Time: 1 Min.

Sample No.: Aluminum 8'-1

Test Order	ASTM D7032 Section 6 - Test Information					Test Results				
	Test Type	Loading Location	[1]Design Load	[2]Required Ultimate Load	[3]Allowable Deflection @ Design Load	[4]Net Deflection @ Design Load	Maximum Load Applied	[4]Net Deflection @ Max. Load	Comments or Observations	Pass / Fail
1	In-Fill Load Test @ Midspan	Centered on baluster height and contacting the min. No. of balusters	50 psf	125 psf	N/A	0.46"	196 lbf	2.28"	No Failure. Load held for 60 seconds.	PASS
2	In-Fill Load Test @ Bottom Rail	Flush to the bottom of the bottom rail at the midspan	50 psf	125 psf	N/A	0.49"	165 lbf	1.87"	No Failure. Load held for 60 seconds.	PASS
3	Concentrated Load Test Near Post	Near one end of the guardrail with no contact with the bracket connector	200 lbf	500 lbf	N/A	0.02"	591 lbf	0.06"	No Failure. Load held for 60 seconds.	PASS
4	Concentrated Load Test @ Midspan	At the midspan of the guardrail	200 lbf	500 lbf	2.75"	1.71"	594 lbf	N/A	No Failure. Deflection gauge removed at 300 lbf. Load held for 60 seconds.	PASS

See attached charts for load versus deflection

[1] Minimum code requirements prescribed in 2009 IBC Section 1607.7.1, IRC Section R301.5 and/or ASTM D7032 Section 6.2.

[2] Infil load requirements are taken from ASTM D7032 Sectiojn 6.2.2. Concentrated Load Requirment is the Design Load times a safety factor of 2.5, plus the end-use adjustment factor as prescribed by ASTM D7032.

[3] The Allowable Deflection is based on the equation (L/96 + h/24) found in ASTM D7032.

[4] Net deflection equals the deflection at the load point minus the post deflection or average deflection of the posts for uniform load and concentrated load at midspan tests

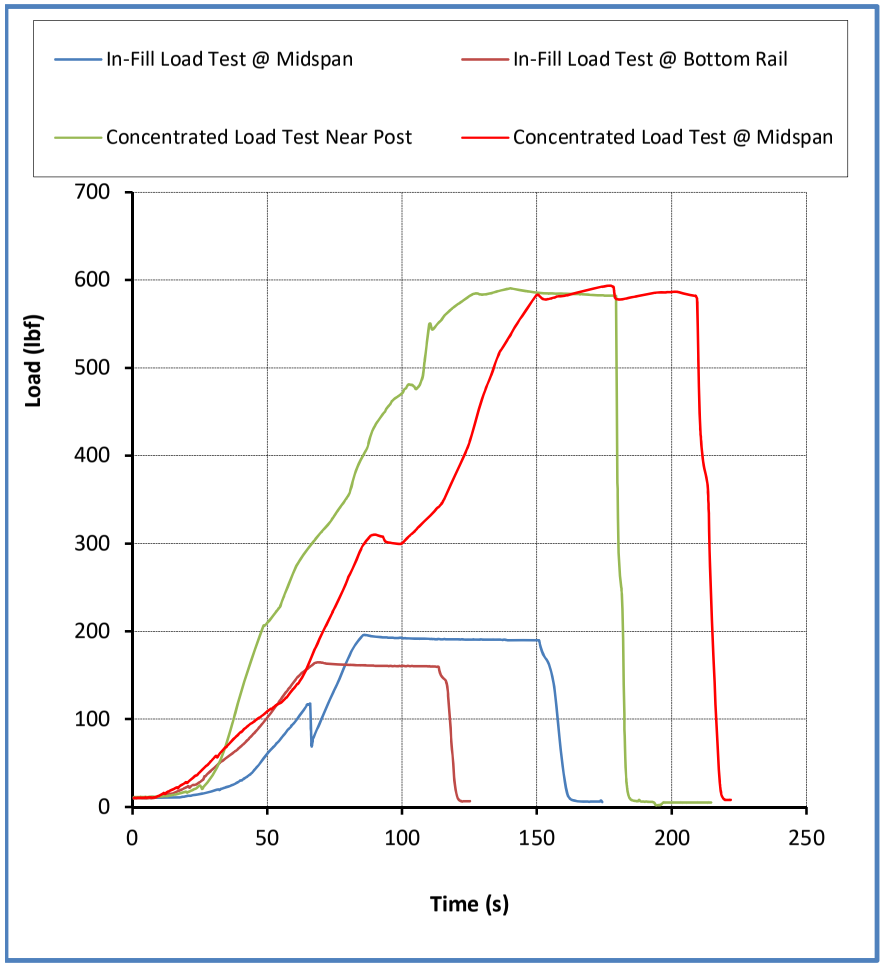
Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

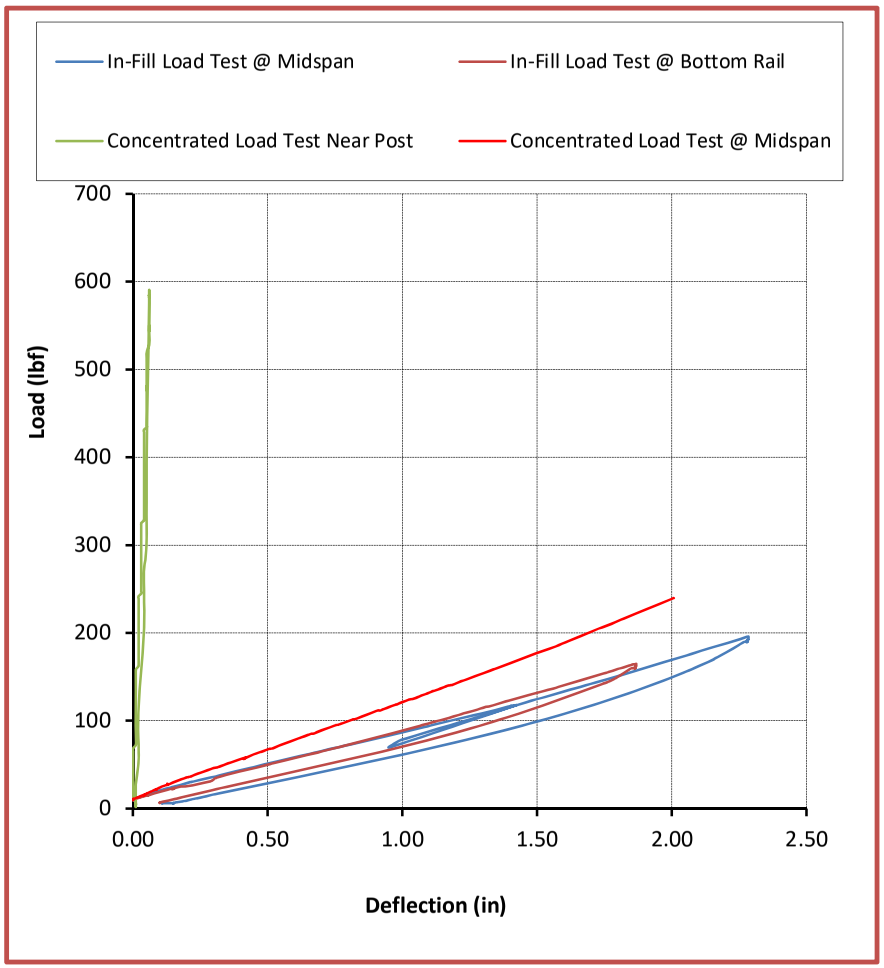
Date: 12/7/2017
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail

Sample No.: Aluminum 8'-1

Load versus Time



Load versus Deflection



Note: All deflection values are Net Deflection and do not include post deflection.

Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

Date: 12/7/2017
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail

Temperature: 68° F
Rel. Humidity: 23%
End-Use Adjustment Factor: 0%
Effective Guardrail Length (in): 96
Guardrail Height (in): 42
Load Hold Time: 1 Min.

Sample No.: Aluminum 8'-2

Test Order	ASTM D7032 Section 6 - Test Information					Test Results				
	Test Type	Loading Location	[1]Design Load	[2]Required Ultimate Load	[3]Allowable Deflection @ Design Load	[4]Net Deflection @ Design Load	Maximum Load Applied	[4]Net Deflection @ Max. Load	Comments or Observations	Pass / Fail
1	In-Fill Load Test @ Midspan	Centered on baluster height and contacting the min. No. of balusters	50 psf	125 psf	N/A	0.53"	155 lbf	1.85"	No Failure. Load held for 60 seconds.	PASS
2	In-Fill Load Test @ Bottom Rail	Flush to the bottom of the bottom rail at the midspan	50 psf	125 psf	N/A	0.54"	159 lbf	1.82"	No Failure. Load held for 60 seconds.	PASS
3	Concentrated Load Test Near Post	Near one end of the guardrail with no contact with the bracket connector	200 lbf	500 lbf	N/A	0.02"	585 lbf	0.07"	No Failure. Load held for 60 seconds.	PASS
4	Concentrated Load Test @ Midspan	At the midspan of the guardrail	200 lbf	500 lbf	2.75"	1.63"	586 lbf	N/A	Deflection gauge removed at 300 lbf. Load held for 60 seconds. Screws pulled through top post bracket.	PASS

See attached charts for load versus deflection

[1] Minimum code requirements prescribed in 2009 IBC Section 1607.7.1, IRC Section R301.5 and/or ASTM D7032 Section 6.2.

[2] Infil load requirements are taken from ASTM D7032 Sectiojn 6.2.2. Concentrated Load Requirment is the Design Load times a safety factor of 2.5, plus the end-use adjustment factor as prescribed by ASTM D7032.

[3] The Allowable Deflection is based on the equation (L/96 + h/24) found in ASTM D7032.

[4] Net deflection equals the deflection at the load point minus the post deflection or average deflection of the posts for uniform load and concentrated load at midspan tests

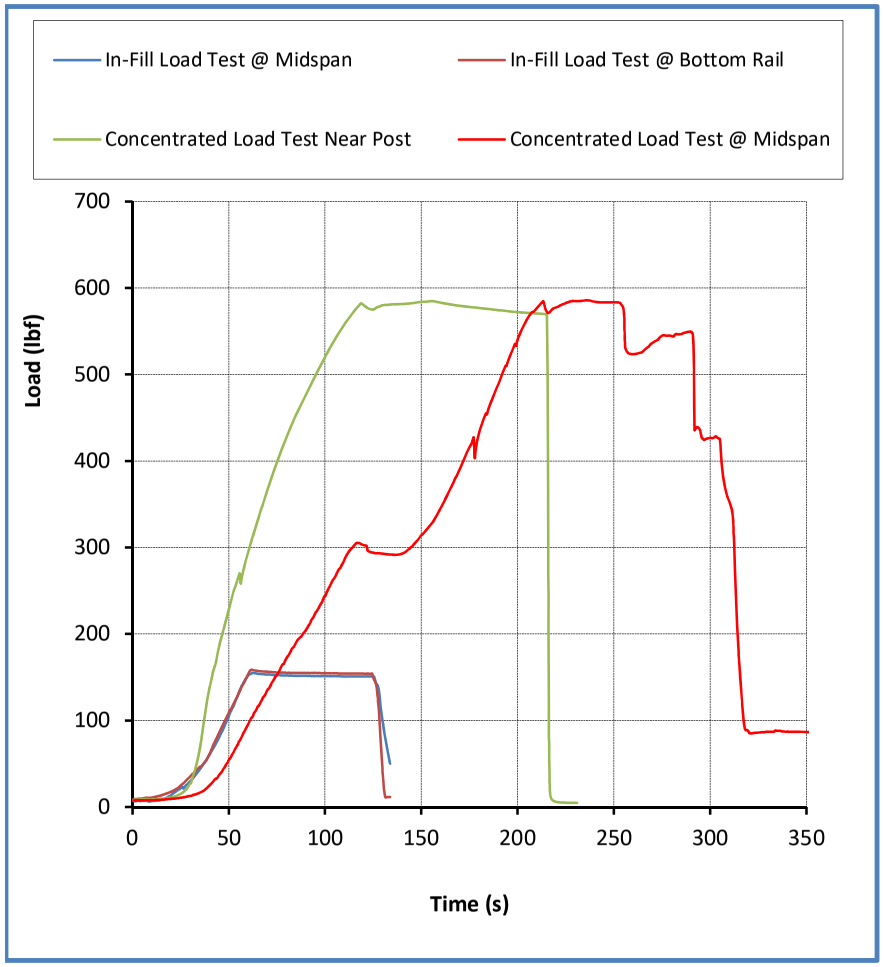
Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

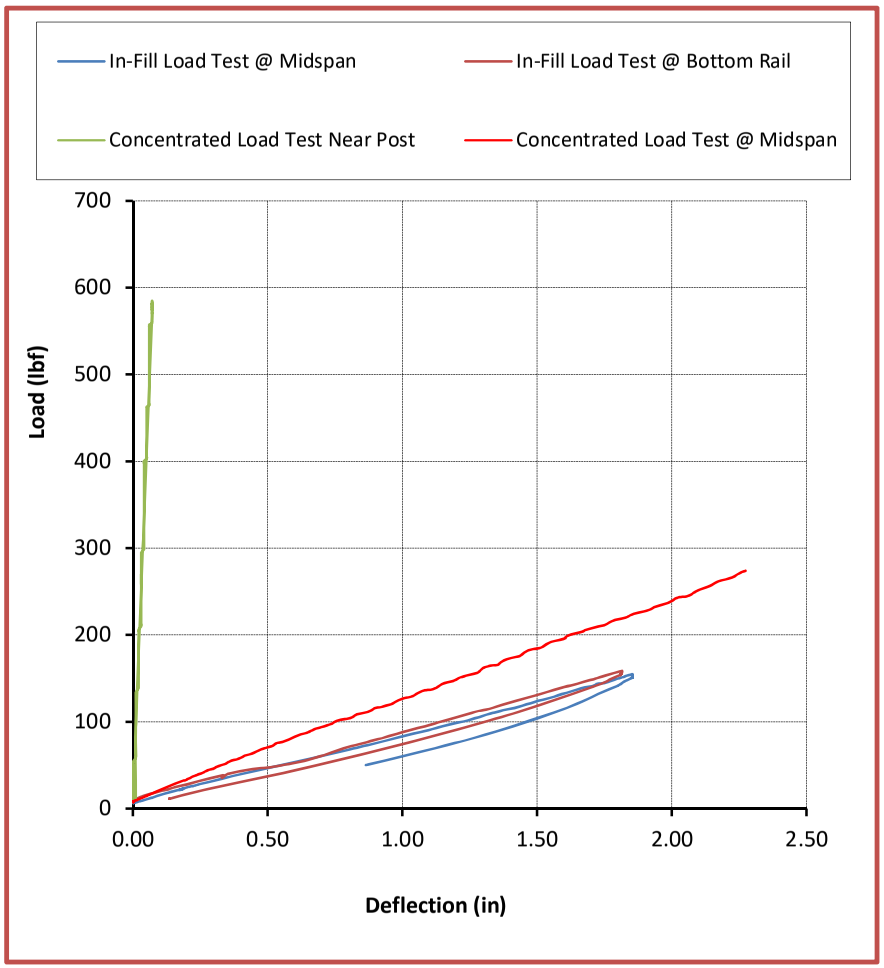
Date: 12/7/2017
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail

Sample No.: Aluminum 8'-2

Load versus Time



Load versus Deflection



Note: All deflection values are Net Deflection and do not include post deflection.

Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

Date: 12/11/2017
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail

Temperature: 68° F
Rel. Humidity: 23%
End-Use Adjustment Factor: 0%
Effective Guardrail Length (in): 96
Guardrail Height (in): 42
Load Hold Time: 1 Min.

Sample No.: Aluminum 8'-3

Test Order	ASTM D7032 Section 6 - Test Information					Test Results				
	Test Type	Loading Location	[1]Design Load	[2]Required Ultimate Load	[3]Allowable Deflection @ Design Load	[4]Net Deflection @ Design Load	Maximum Load Applied	[4]Net Deflection @ Max. Load	Comments or Observations	Pass / Fail
1	In-Fill Load Test @ Midspan	Centered on baluster height and contacting the min. No. of balusters	50 psf	125 psf	N/A	0.49"	165 lbf	1.96"	No Failure. Load held for 60 seconds.	PASS
2	In-Fill Load Test @ Bottom Rail	Flush to the bottom of the bottom rail at the midspan	50 psf	125 psf	N/A	0.24"	148 lbf	1.65"	No Failure. Load held for 60 seconds.	PASS
3	Concentrated Load Test Near Post	Near one end of the guardrail with no contact with the bracket connector	200 lbf	500 lbf	N/A	0.02"	585 lbf	0.07"	No Failure. Load held for 60 seconds.	PASS
4	Concentrated Load Test @ Midspan	At the midspan of the guardrail	200 lbf	500 lbf	2.75"	1.71"	589 lbf	N/A	Deflection gauge removed at 300 lbf. Load held for 52 seconds. Screws pulled through top post bracket.	PASS

See attached charts for load versus deflection

[1] Minimum code requirements prescribed in 2009 IBC Section 1607.7.1, IRC Section R301.5 and/or ASTM D7032 Section 6.2.

[2] Infil load requirements are taken from ASTM D7032 Sectiojn 6.2.2. Concentrated Load Requirment is the Design Load times a safety factor of 2.5, plus the end-use adjustment factor as prescribed by ASTM D7032.

[3] The Allowable Deflection is based on the equation (L/96 + h/24) found in ASTM D7032.

[4] Net deflection equals the deflection at the load point minus the post deflection or average deflection of the posts for uniform load and concentrated load at midspan tests

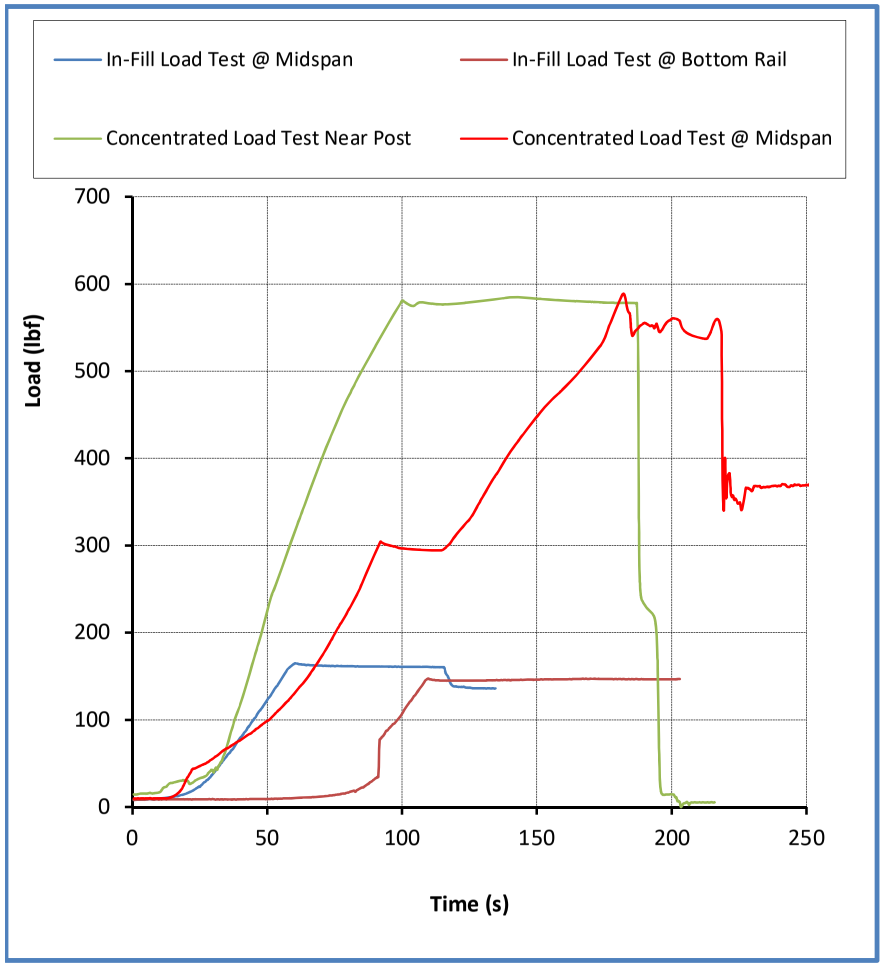
Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

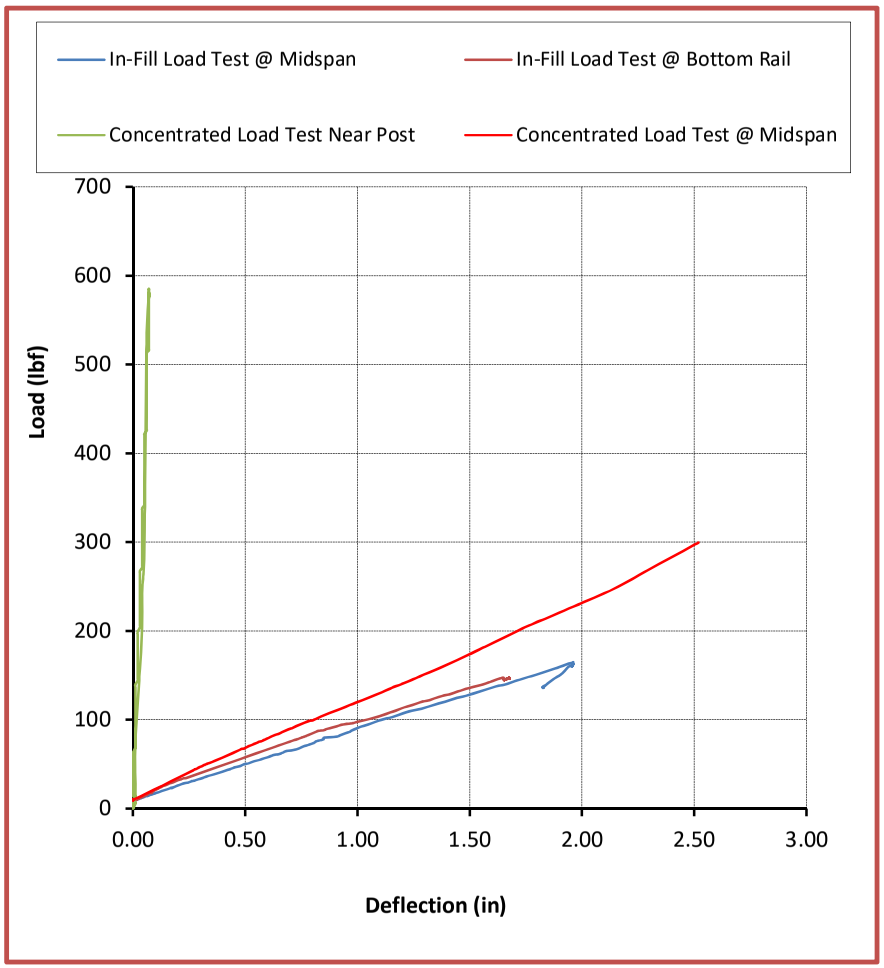
Date: 12/11/2017
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail

Sample No.: Aluminum 8'-3

Load versus Time



Load versus Deflection



Note: All deflection values are Net Deflection and do not include post deflection.

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PEI Project No. 2017-6122

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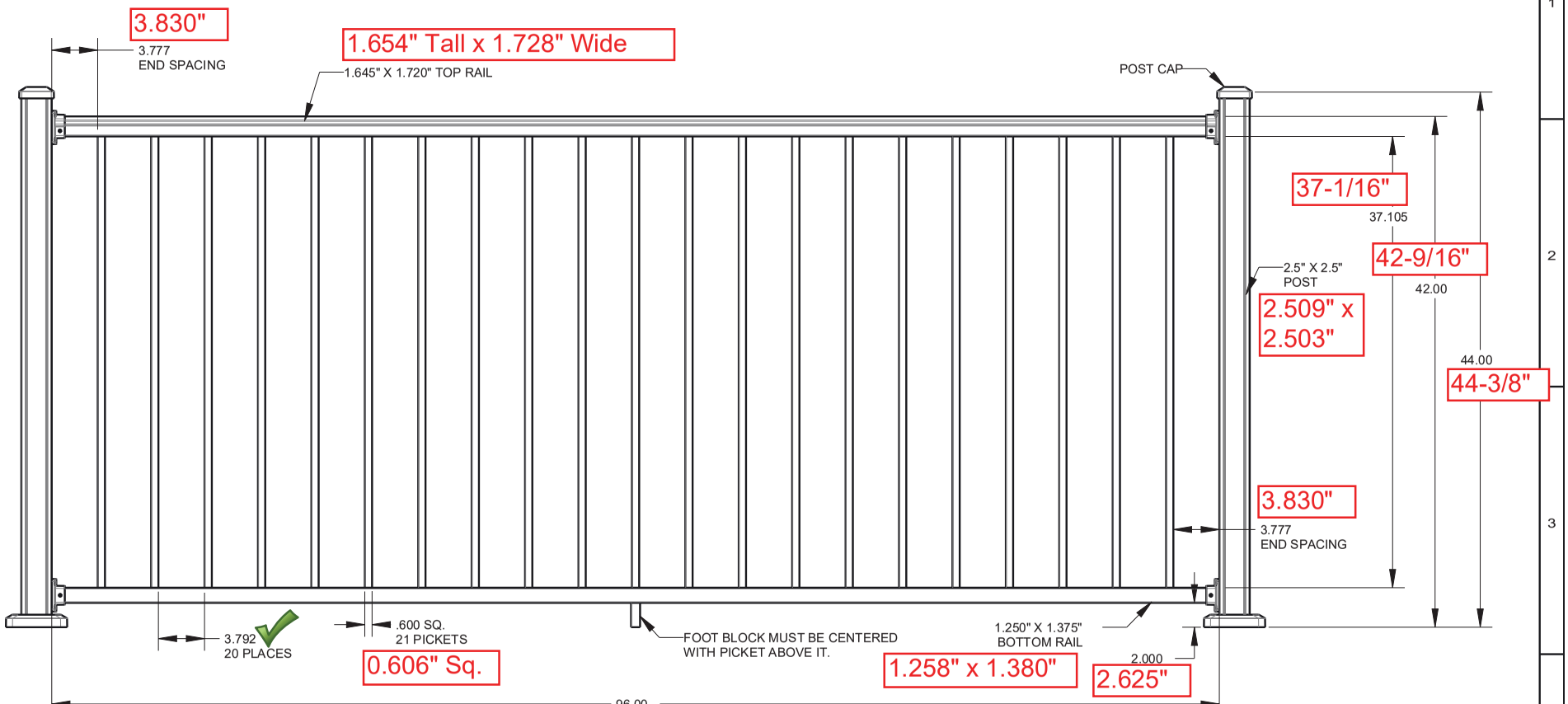

Verified dimensions in red.

✓ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

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APPRVD BY:	APPRVD DATE:		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: WXR-B42-A8	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.	

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PEI Project No. 2017-6122

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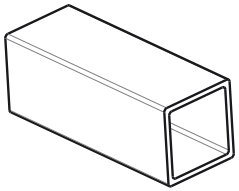

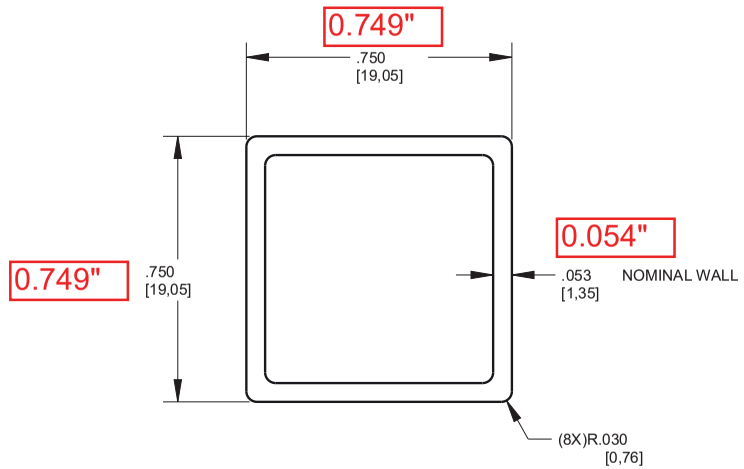

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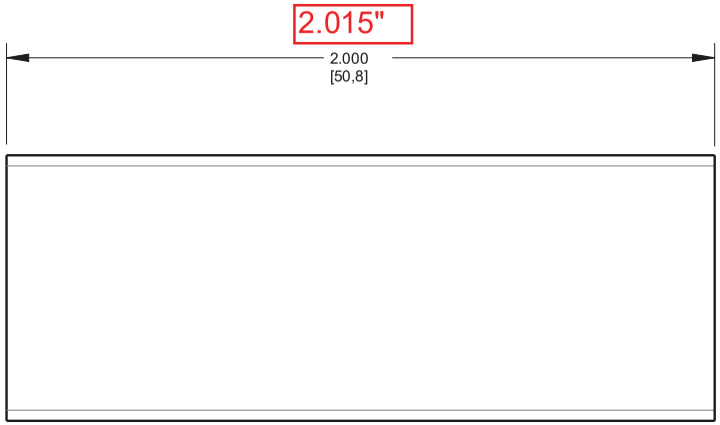

NOTES:
1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: 6005-T5 ALUMINUM
5. FINISH: POWDERCOAT
6. COLOR: TEXTURED BLACK
7. POWDERCOAT MUST ADHERE TO AAMA 2604 SPECIFICATIONS.
8. NOMINAL WALL: .053"
9. WEIGHT: .171 LBS. PER FOOT
10. CROSS SECTIONAL AREA: .147 SQ. IN.
11. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

Verified dimensions in red.

✔ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

DRAWN BY: SWW	DRAWN DATE: 171108	PART NAME: FOOT BLOCK	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE:		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LXPI-SQ-75X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.	

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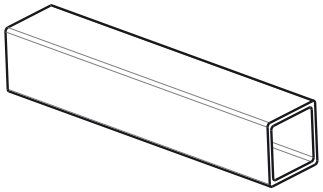

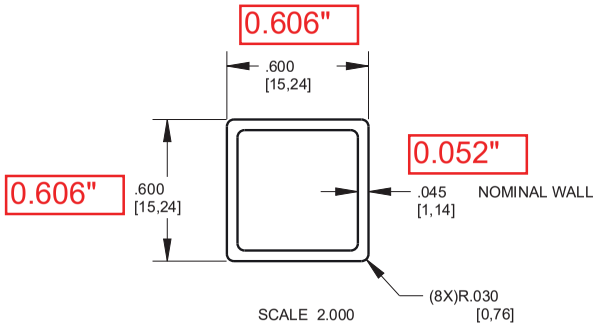

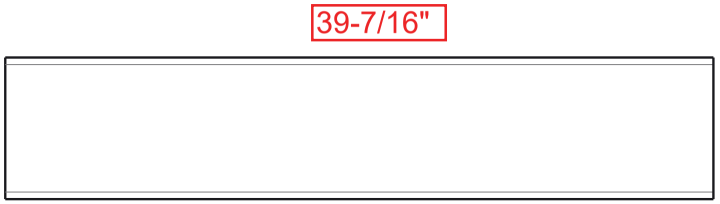

NOTES:
1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: 6005-T5 ALUMINUM
5. FINISH: POWDERCOAT
6. COLOR: TEXTURED BLACK
7. POWDERCOAT MUST MEET AAMA 2604 SPECIFICATIONS.
8. NOMINAL WALL: 0.045"
9. WEIGHT: .116 LBS. PER FOOT
10: CROSS SECTIONAL AREA: .099 SQ. IN.
11. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

Verified dimensions in red.

✔ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

DRAWN BY: SWW	DRAWN DATE: 171108	PART NAME: SQUARE PICKET	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE:		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LXPI-SQ-60-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.	

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PEI Project No. 2017-6122

REV.	DESCRIPTION	DATE	BY
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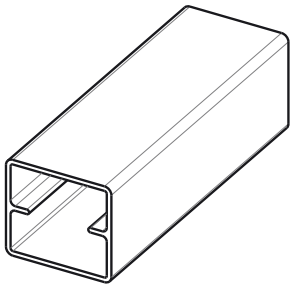
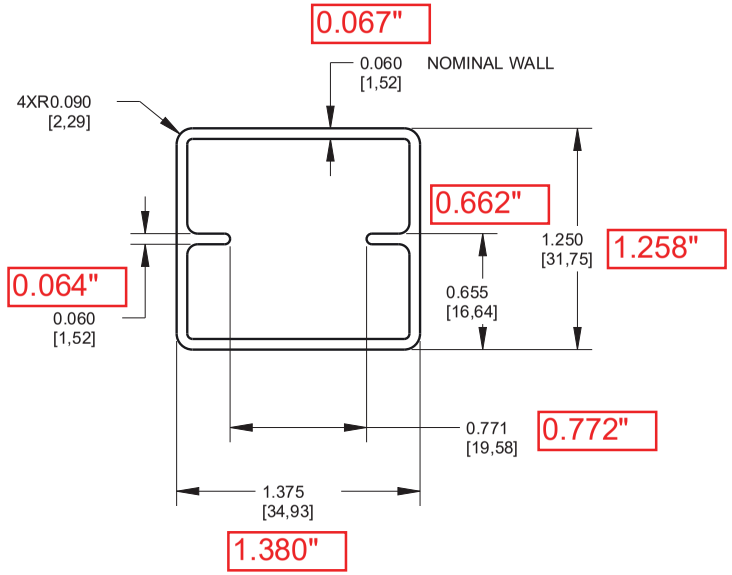
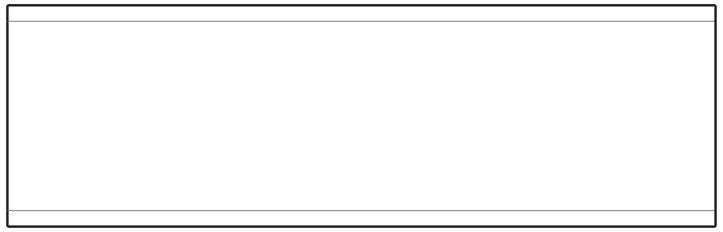






Baluster hole size:
0.629" x 0.628"

NOTES:

1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE APPROVED 3D CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: 6005-T5 ALUMINUM
5. FINISH: POWDERCOAT
6. COLOR: TEXTURED BLACK
7. POWDERCOAT MUST MEET AAMA 2604 SPECIFICATIONS.
8. CROSS SECTION AREA: 0.33 SQ.IN.
9. WEIGHT: .391 LBS. PER FOOT
10. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

Verified dimensions in red.

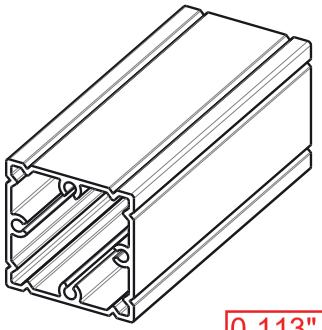
✔ Given dimension is within stated tolerance

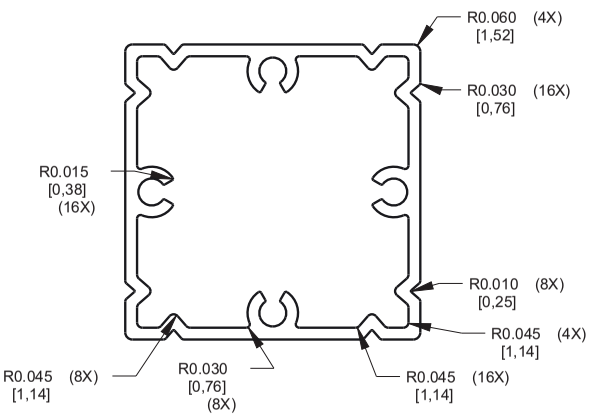
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

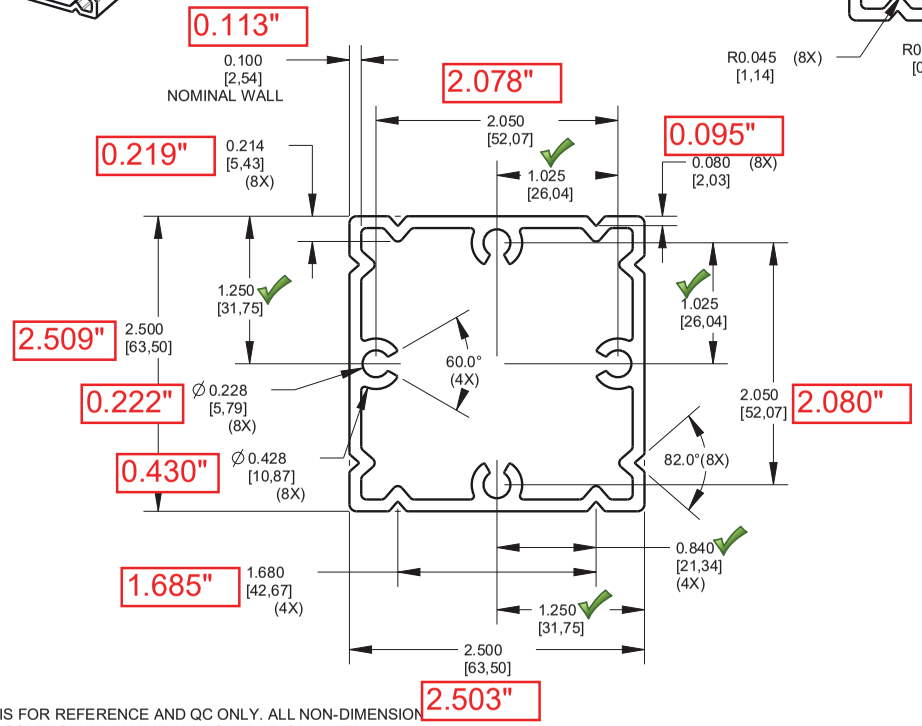
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

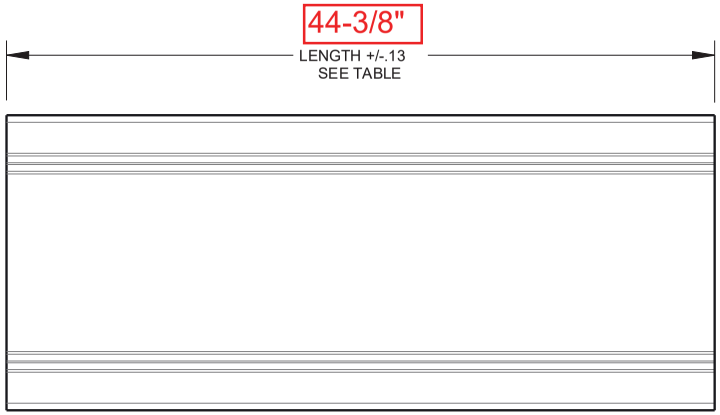
DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: BOTTOM RAIL	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LXAL-SQRA-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 0	

REV.	DESCRIPTION	DATE	BY
0	INITIAL RELEASE	04/19/17	SWW
-	-	-	-









NOTES:

1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSION ARE TO BE CONTROLLED BY THE APPROVED 3D CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: 6005-T5 ALUMINUM
5. FINISH: POWDERCOAT
6. COLOR: TEXTURED BLACK
7. POWDERCOAT MUST MEET AAMA 2604 SPECIFICATIONS.
8. CROSS SECTION AREA: 1.30 SQ.IN.
9. WEIGHT: 1.55 LBS/ FOOT
10. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

Verified dimensions in red.

✓ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: POST	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LXAL-POST-2.5-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 01	

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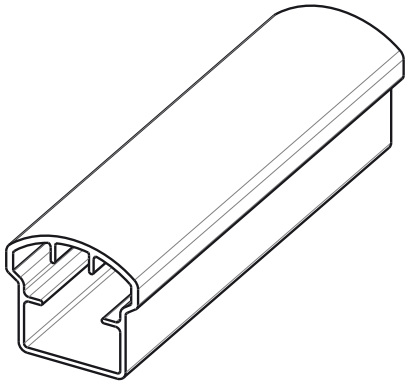
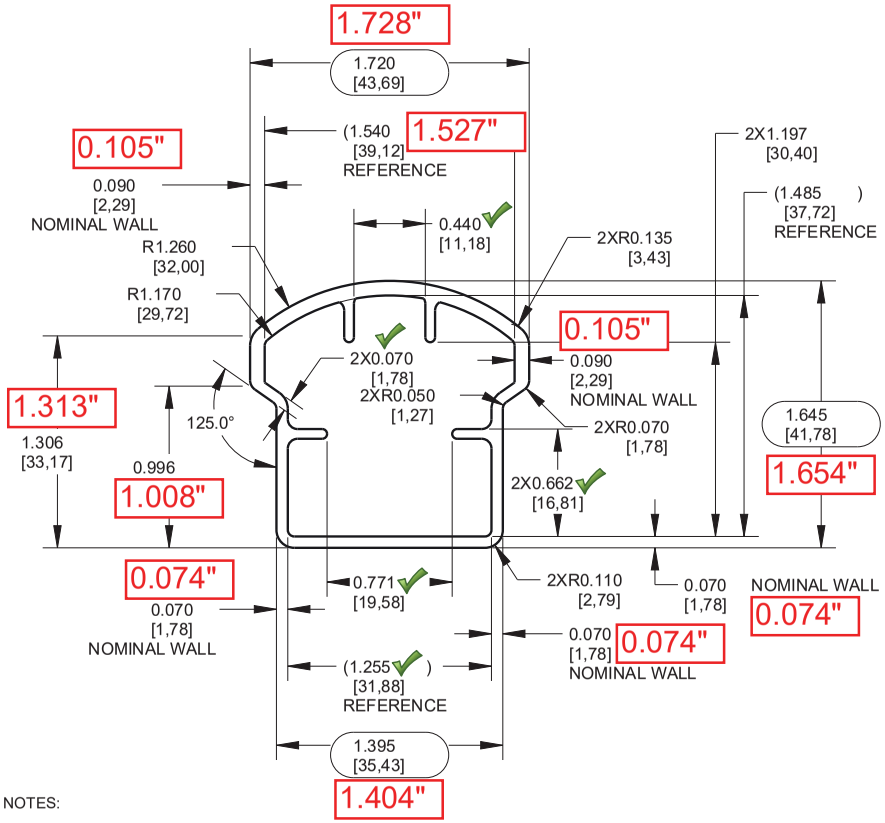
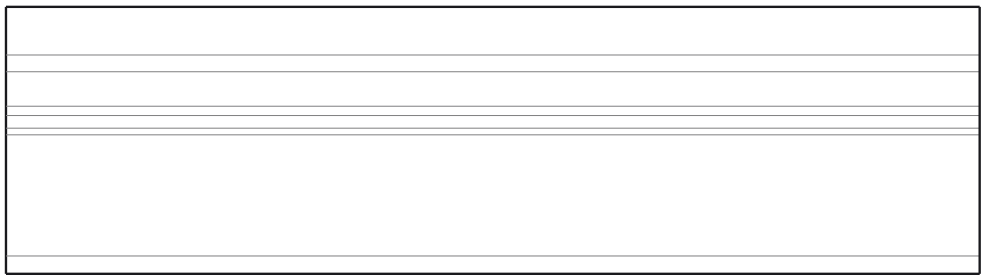
REV.	DESCRIPTION	DATE	BY
0	INITIAL RELEASE	04/19/17	SWW
1	OUTER SURFACE OFFSET BY 0.010"	09/08/17	SWW
2	ADDED .020" TO TOP INSIDE SURFACE	09/08/17	SWW







Baluster hole size:
0.631" x 0.625"

NOTES:

1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE APPROVED 3D CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: 6005-T5 ALUMINUM
5. FINISH: POWDERCOAT
6. COLOR: TEXTURED BLACK
7. POWDERCOAT MUST MEET AAMA 2604 SPECIFICATIONS.
8. CROSS SECTION AREA: 0.507 SQ.IN.
9. WEIGHT: 0.596 LBS. PER FOOT.
10. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

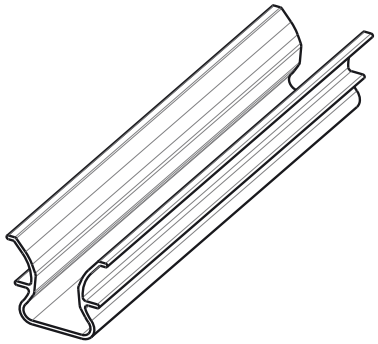
Verified dimensions in red.

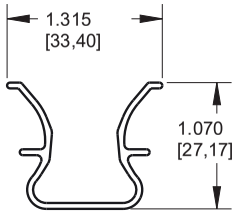
✔ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

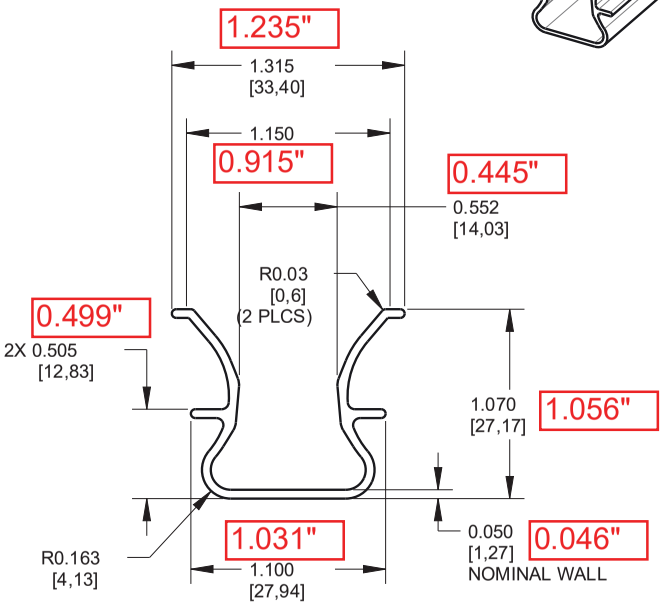
DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: TOP RAIL	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LXAL-BRDTOPRA-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 1	

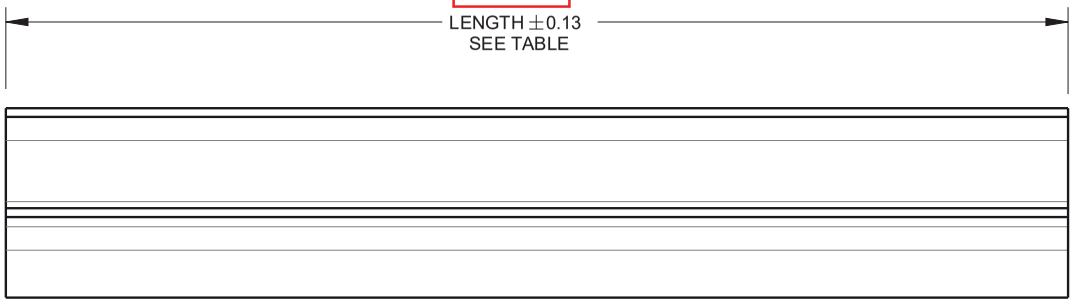
REV.	DESCRIPTION	DATE	BY
0	INITIAL RELEASE	04/19/17	SWW
1	ADDED TWO EARS FOR AN OVERALL WIDTH OF 1.315"	07/20/17	SWW
2	UPDATED CROSS SECTIONAL AREA TO .189 SQUARE INCHES	07/20/17	SWW





SCALE 1.000





SCALE 1.500

NOTES:

1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE CAD DATA.
2. STRAIGHTNESS TOLERANCE:
3. TWIST TOLERANCE:
4. MATERIAL: RPVC - EXTERIOR GRADE
5. FINISH: SMOOTH
6. COLOR: BLACK
7. CROSS SECTION AREA: 0.189 SQ.IN.
8. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.

Verified dimensions in red.

✔ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: PVC RAIL INSERT	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LBAL-PVCRAINS-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 0	

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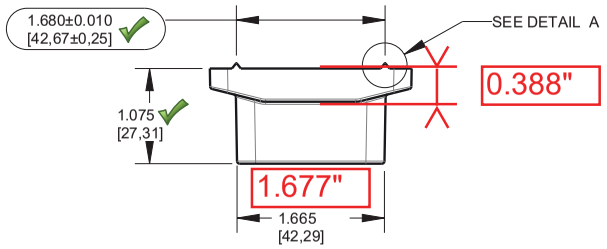
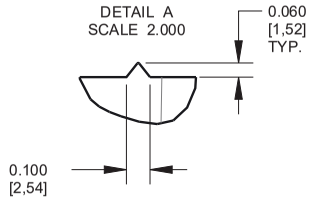
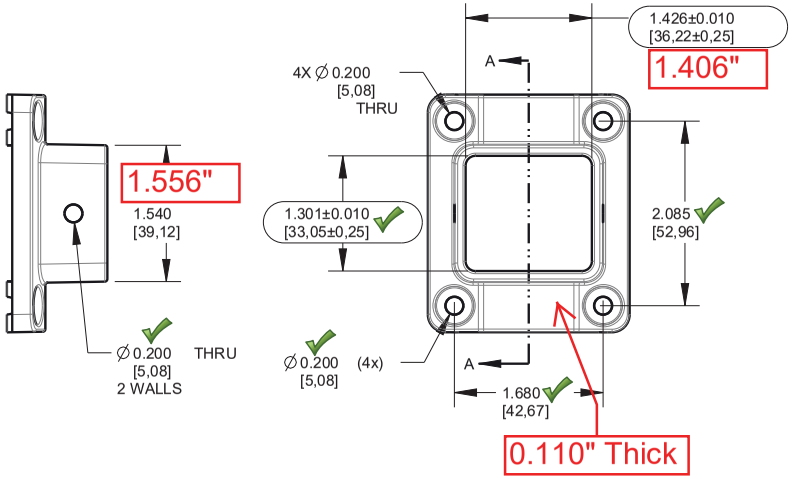
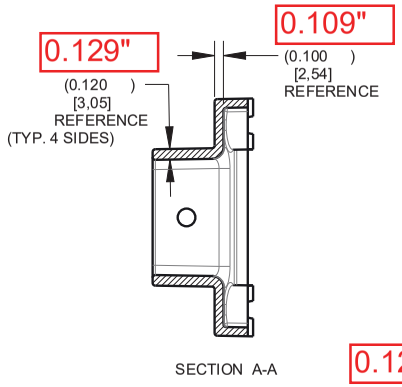
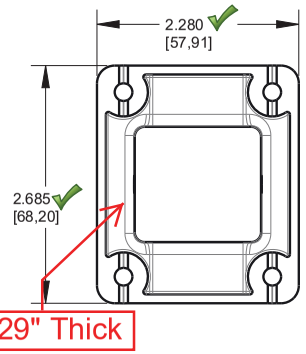
REV.	DESCRIPTION	DATE	BY
0	RELEASE FOR QUOTATION	04/25/17	SWW
1	UPDATED DIMS AND TOLERANCES	06/15/17	SWW
2	1.426" +/-.010 was 1.466" +/-.010	11/03/17	SWW
3	1.301"+/-.010 was 1.341" +/-.010	11/03/17	SWW
4	REMOVED .225"Ø THRU 1 WALL HOLE FROM BOTTOM SURFACE	11/03/17	SWW
5	.200"Ø HOLES WERE .225"Ø (6X)	11/09/17	SWW

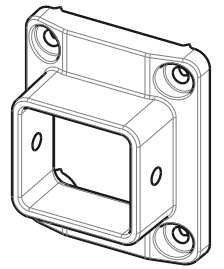


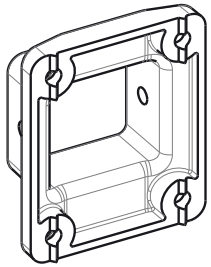


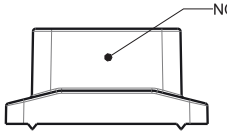












NOTES:
1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE CAD DATA.
2. DIMENSIONS ARE TO THEORETICAL INTERSECTIONS.
3. DIMENSIONS ARE "AS-MOLDED" PART DIMENSIONS.
4. MATERIAL: NYLON 66; HYLON N1000HL OR EQUIVALENT.
5. FINISH: POWDERCOAT.
6. COLOR: TEXTURED BLACK.
7. POWDERCOAT MUST ADHERE TO AAMA 2604 SPECIFICATIONS.
8. POWDER COAT THICKNESS: 0.003 TO 0.008.
9. NOMINAL WALL: 0.100.
10. DRAFT: 1.0° TYPICAL, UNLESS OTHERWISE DICTATED BY CAD DATA.
11. PART VOLUME: 1.129 CU.IN.
12. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.
13. TOOLING MUST BE APPROVED BY USA VINYL PRIOR TO BUILD.
14. DIMENSIONS IN (ARE CRITICAL TO FIT.

PART NO.	COLOR
ABAL-STRGHT-SQ	TEXTURE BLACK
AWAL-STRGHT-SQ	WHITE
AZAL-STRGHT-SQ	BRONZE

Verified dimensions in red.

✔ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.245
ANGULAR	±0.50°	±0.50°

DRAWN BY: SWW	DRAWN DATE: 02/20/17	PART NAME: BOTTOM RAIL BRACKET, STRAIGHT	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: AXAL-STRGHT-SQ	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 1	

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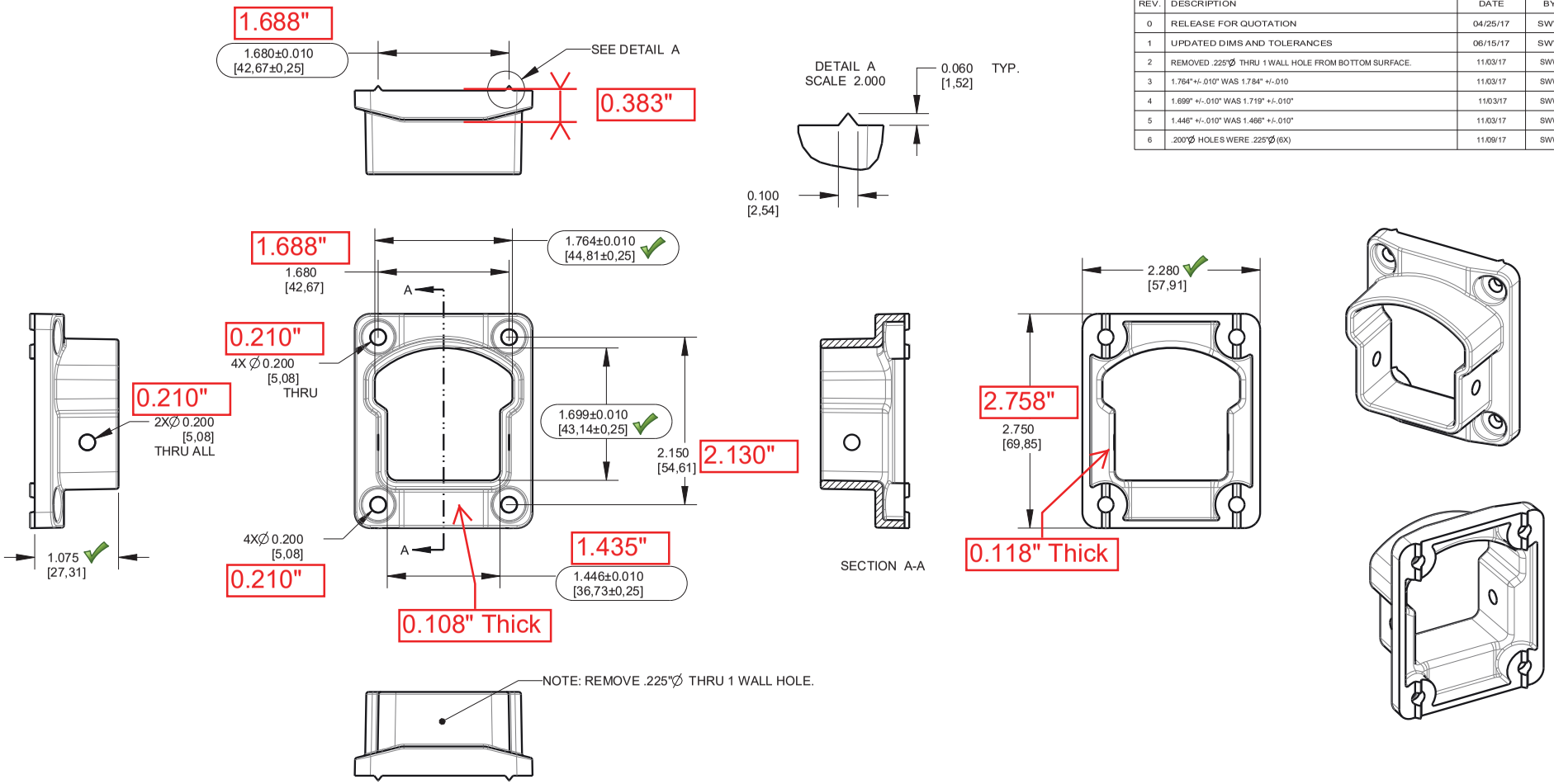
REV.	DESCRIPTION	DATE	BY
0	RELEASE FOR QUOTATION	04/25/17	SWW
1	UPDATED DIMS AND TOLERANCES	06/15/17	SWW
2	REMOVED .225"Ø THRU 1 WALL HOLE FROM BOTTOM SURFACE.	11/03/17	SWW
3	1.764"+/-.010" WAS 1.784" +/-.010	11/03/17	SWW
4	1.699" +/-.010" WAS 1.719" +/-.010"	11/03/17	SWW
5	1.446" +/-.010" WAS 1.466" +/-.010"	11/03/17	SWW
6	.200"Ø HOLES WERE .225"Ø (6X)	11/09/17	SWW



NOTES:
1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE CAD DATA.
2. DIMENSIONS ARE TO THEORETICAL INTERSECTIONS.
3. DIMENSIONS ARE "AS-MOLDED" PART DIMENSIONS BEFORE POWDER COAT.
4. MATERIAL: NYLON 66; HYLON N1000HL OR EQUIVALENT.
5. FINISH: POWDERCOAT.
6. COLOR: TEXTURED BLACK.
7. POWDERCOAT MUST ADHERE TO AAMA 2604 SPECIFICATIONS.
8. POWDER COAT THICKNESS: 0.003 TO 0.008.
9. NOMINAL WALL: 0.100.
10. DRAFT: 1.0° TYPICAL, UNLESS OTHERWISE DICTATED BY CAD DATA.
11. PART VOLUME: 1.11 CU.IN.
12. PARTS MUST BE FREE OF BLEMISHES AND COSMETIC DEFECTS.
13. TOOLING MUST BE APPROVED BY USA VINYL PRIOR TO BUILD.
14. DIMENSIONS IN (ARE CRITICAL TO FIT.

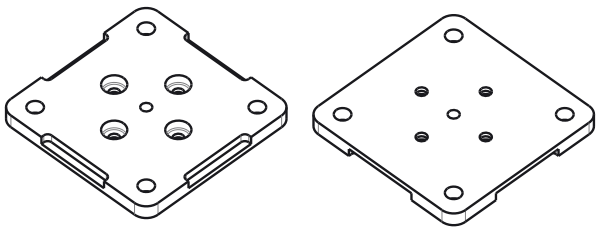
Verified dimensions in red.

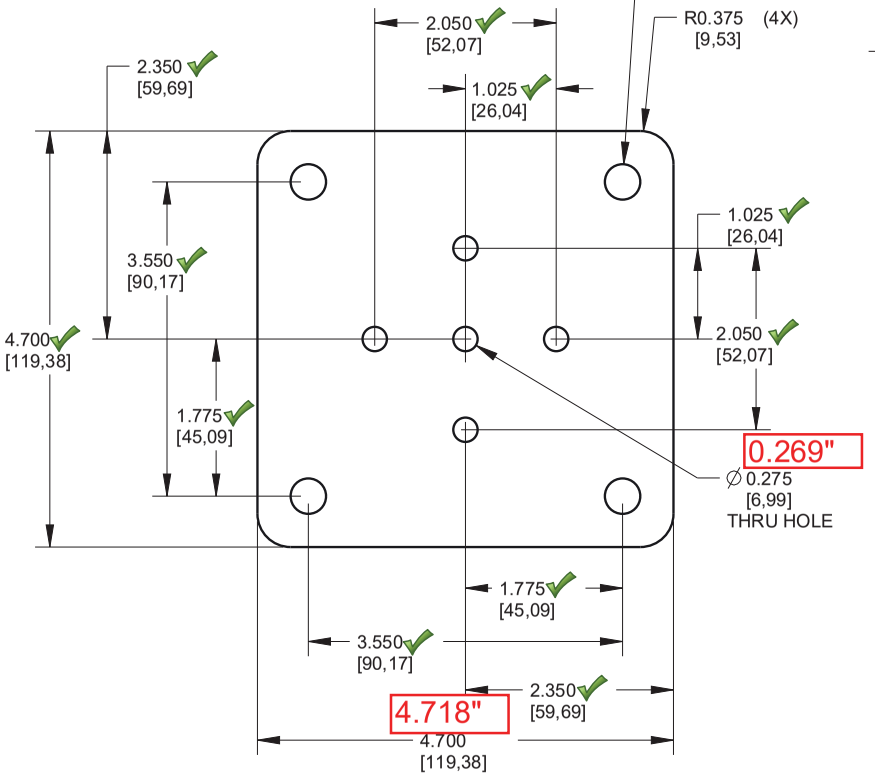
✔ Given dimension is within stated tolerance

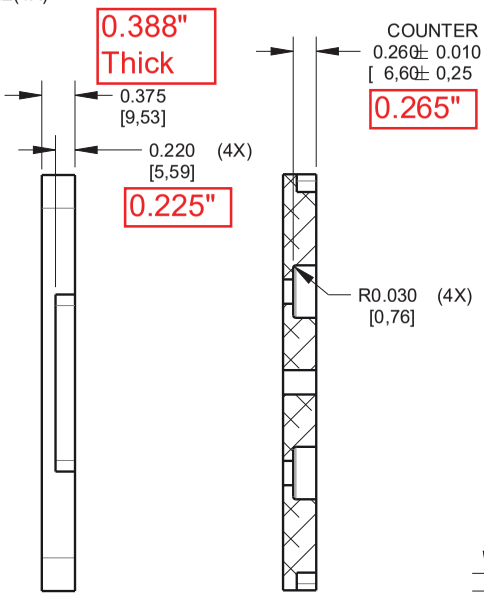
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

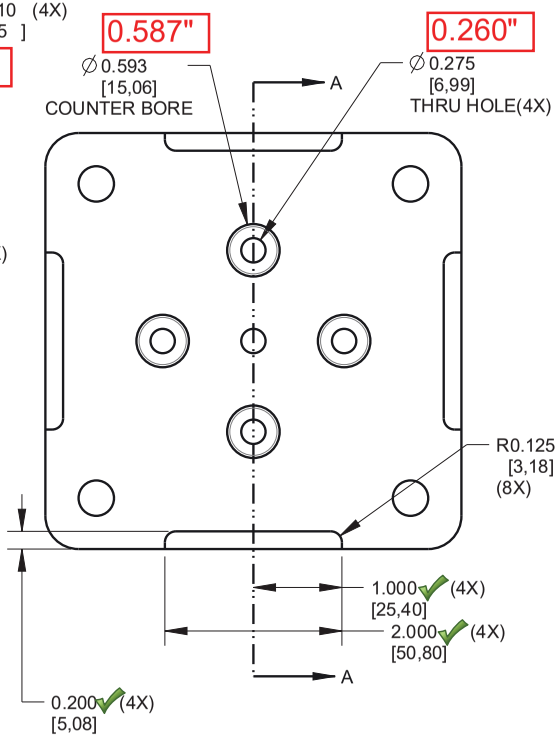
DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: TOP RAIL BRACKET, STRAIGHT	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: AXAL-STRGHT-BRD	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 1	

REV.	DESCRIPTION	DATE	BY
0	RELEASE FOR QUOTATION	04/25/17	SWW
1	ADDED (QTY. 4) 2.00" X .20" X .220" SLOTS -	07/11/17	SWW
2	DELETED 4X COUNTER SINK HOLES Ø0.275" THRU, ⌵ Ø0.615" x 82°	09/28/17	SWW
3	ADDED 4X .593"Ø x .260" DP COUNTER BORE HOLES.	09/28/17	SWW
4	ADDED 1X .275"Ø THRU HOLE	09/28/17	SWW
5	ADDED +/-.010" TOLERANCE TO 0.260" C'BORE DEPTH DIM.	10/12/17	SWW
6	RELEASED FOR PRODUCTION	10/12/17	SWW









NOTES:

1. DRAWING IS FOR REFERENCE AND QC ONLY. ALL NON-DIMENSIONED FEATURES ARE TO BE CONTROLLED BY THE APPROVED 3D CAD DATA.
2. DIMENSIONS ARE TO THEORETICAL INTERSECTIONS.
3. ALL DIMENSIONS ARE FINISHED PART DIMENSIONS.
4. MATERIAL: 6061 ALUMINUM
5. FINISH: POWDERCOAT.
6. COLOR: TEXTURED BLACK
7. POWDERCOAT MUST MEET AAMA 2604 SPECIFICATIONS.
8. PARTS MUST BE FREE OF TOOL MARKS, BLEMISHES AND COSMETIC DEFECTS.

Verified dimensions in red.

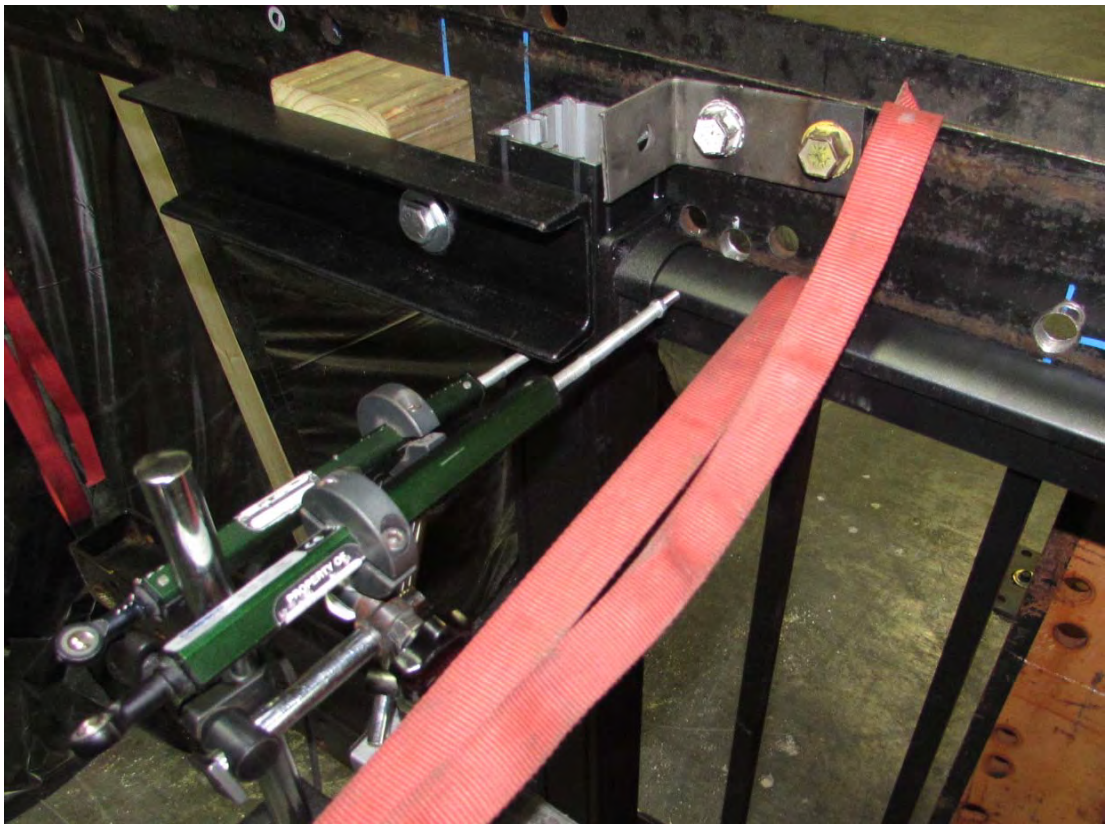
✓ Given dimension is within stated tolerance

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.01	±0.25
3 PLACES	±0.005	±0.125
ANGULAR	±0.50°	±0.50°

DRAWN BY: SDM	DRAWN DATE: 04/23/17	PART NAME: POST BASE	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: AXAL-POSTBASE-2.5	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A	SHEET: 1 OF 1 REV.: 0

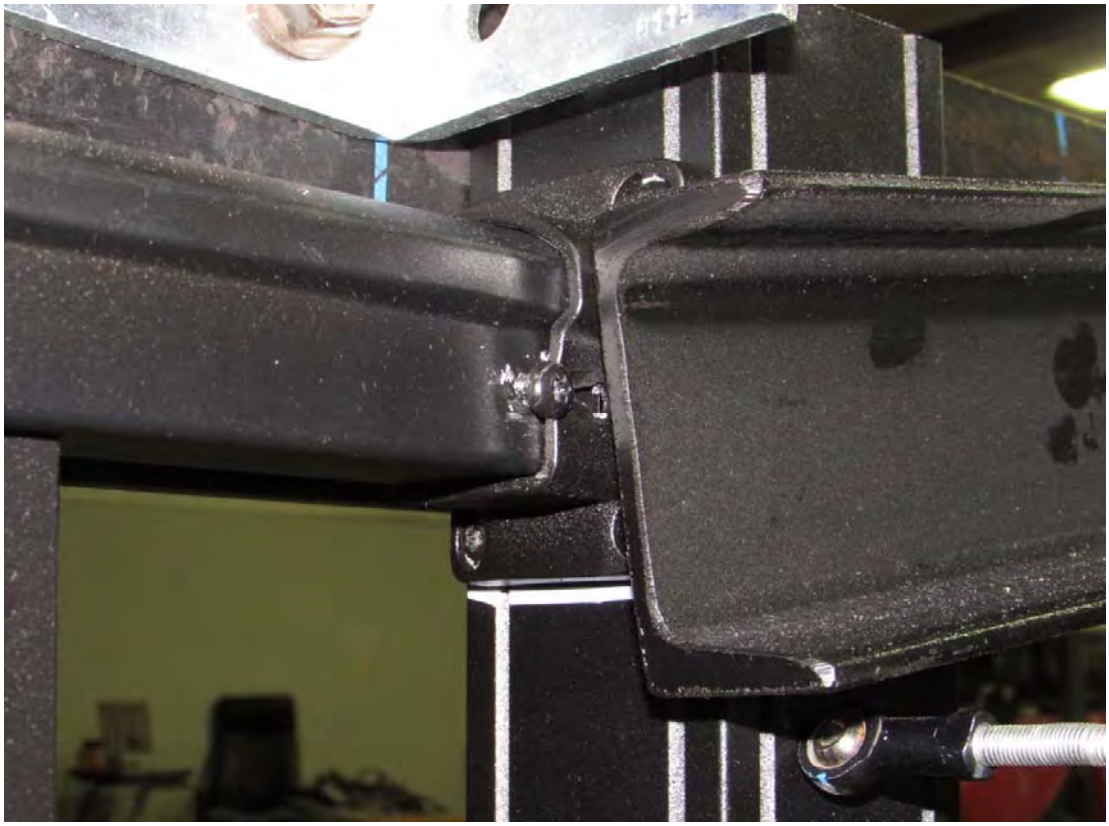
Typical In-fill Load Test Setup

Typical In-fill Load at Bottom Rail Test Setup

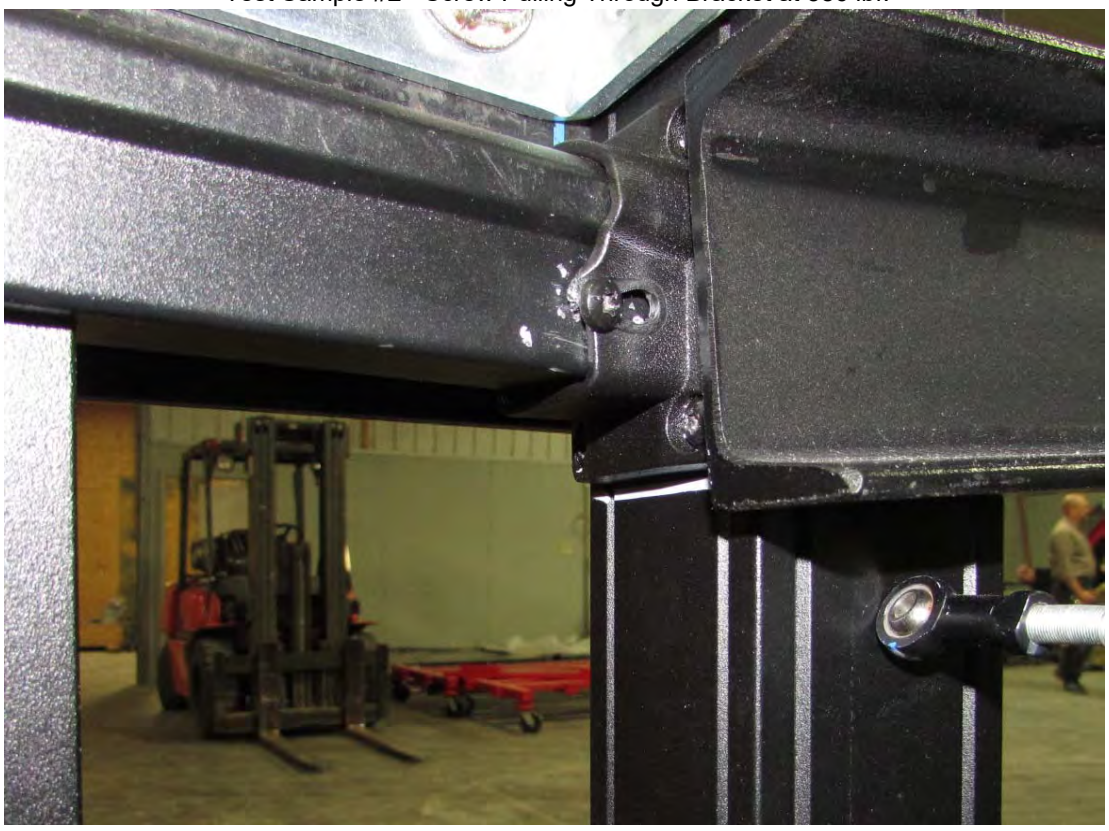


Typical Concentrated Load Near Post Test Setup

Typical Concentrated Load at Midspan Test Setup



Test Sample #2 - Screw Pulling Through Bracket at 586 lbf.



Test Sample #3 - Screw Pulling Through Bracket at 589 lbf.