Progressive Engineering Inc.

USA VINYL, LLC

ASTM D7032 Guardrail Test
on an 8' Aluminum Railing System Design

4/13/2020

This test report contains twenty-three (23) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2019-6414

58640 State Road 15 - Goshen, IN 46528
Phone: 574-533-0337 - Fax: 574-533-9736
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1. TITLE

ASTM D7032 Guardrail Test on an 8' Aluminum Railing System Design

2. OBJECTIVE

To evaluate an Aluminum 8' Guardrail System Design to ASTM D7032 for no end-use restrictions.

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
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. 468)
C. Linear Transducers - (PEI Nos. 1085, 1200)
D. String Pot - (PEI No. 1079)
E. 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 2.282" wide x 2.767" tall x 1.090" deep - aluminum.
D. Bottom Rail Bracket - Part No. AXAL-STRGHT-SQ 2.286" wide x 2.686" tall x 1.074" deep - aluminum.
E. Screws:
    1. Bracket to Post: #10 x 3/4" long Torx drive pan head self drilling screw. The screws had an average measured head diameter of .365", and an average thread diameter of .185".
    2. Post Base to Post: 1/4"-20 x 2" long self drilling hex washerhead screw.
    3. Foot Block to Bottom Rail: #8 x 1" long Philips drive pan head self drilling screw. The screws had an average measured head diameter of .318", and an average thread diameter of .159".

The guardrail materials were provided to PEI by the client. See attached drawings and picture pages for details. (Note: all thicknesses verified on the drawings include the finished paint coating.)

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

Each sample was tested for each condition described below in the order shown described in Section 6 of ASTM D7032. All required maximum loads were held 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. Uniform Load Test

The load was applied in two (2) separate tests. The first test used one (1) hydraulic cylinder and load cell which applied the load horizontally. The load was applied at four (4) equidistant locations across the guardrail. The load was applied at an approximate rate of 1" per minute until a force of 125 plf, 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.

The second test used one (1) hydraulic cylinder and load cell which applied the load vertically downward. The load was applied at four (4) equidistant locations across the guardrail. The load was applied at an approximate rate of 1" per minute until a force of 125 plf, plus any applicable end-use adjustment factor, was attained. Deflection readings were only taken at the midspan of the guardrail (measuring the vertical deflection of the guardrail).

C. Concentrated Load Test

A horizontal concentrated load test was conducted on one end and at the midspan of the 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 load point on 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, with new aluminum brackets, has met the IBC/IRC structural requirements of ASTM D7032 Section 6.2.4 for a span up to 96" with no end-use restrictions. The post and post connection capacity is outside the scope of this report.

A 36" guardrail height was used to calculate the allowable deflection, however a 42" height was tested as a worst-case scenario.

Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

Date: 3/18/2020
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail Assembly

Temperature: 70° F
Rel. Humidity: 33%
End-Use Adjustment Factor: 0%
Effective Guardrail Length (in): 96
Guardrail Height[5] (in): 36

Sample No.: 8' Aluminum Guardrail - 1

Load Hold Time: 1 Min.

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 lbf	N/A	0.56"	135 lbf	1.68"	No failures occurred; load was held for 60 seconds without issues.	PASS
2	In-Fill Load Test @ Bottom Rail	Flush to the bottom of the bottom rail at the midspan	50 psf	125 lbf	N/A	0.38"	136 lbf	1.48"	No failures occurred; load was held for 60 seconds without issues.	PASS
3	Horizontal Uniform Load Test	Horizontal Pull along guardrail distributed evenly at four (4) points	50 plf	125 plf or 1,000 lbf	N/A	1.67"	1,120 lbf	*N/A	No failures occurred. Some permanent set was noted in the top rail after the test was completed.	PASS
4	Vertical Uniform Load Test	Vertical Downward Pull along guardrail distributed evenly at four (4) points	50 plf	125 plf or 1,000 lbf	N/A	0.02"	1,015 lbf	0.02"	No failures occurred; load was held for 60 seconds without issues.	PASS
5	Concentrated Load Test Near Post	Near one end of the guardrail with no contact with the bracket connector	200 lbf	500 lbf	N/A	0.07"	520 lbf	0.19"	No failures occurred; load was held for 60 seconds without issues.	PASS
6	Concentrated Load Test @ Midspan	At the midspan of the guardrail	200 lbf	500 lbf	2.50"	1.83"	509 lbf	*N/A	No failures occurred. Some permanent set was noted in the top rail after the test was completed.	PASS

**Gauges were removed to prevent damaging equipment.*

See attached charts for load versus deflection

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

[2] 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

[5] A 36" guardrail height was used to calculate the allowable deflection, however a 42" high system was tested as a worst-case scenario.

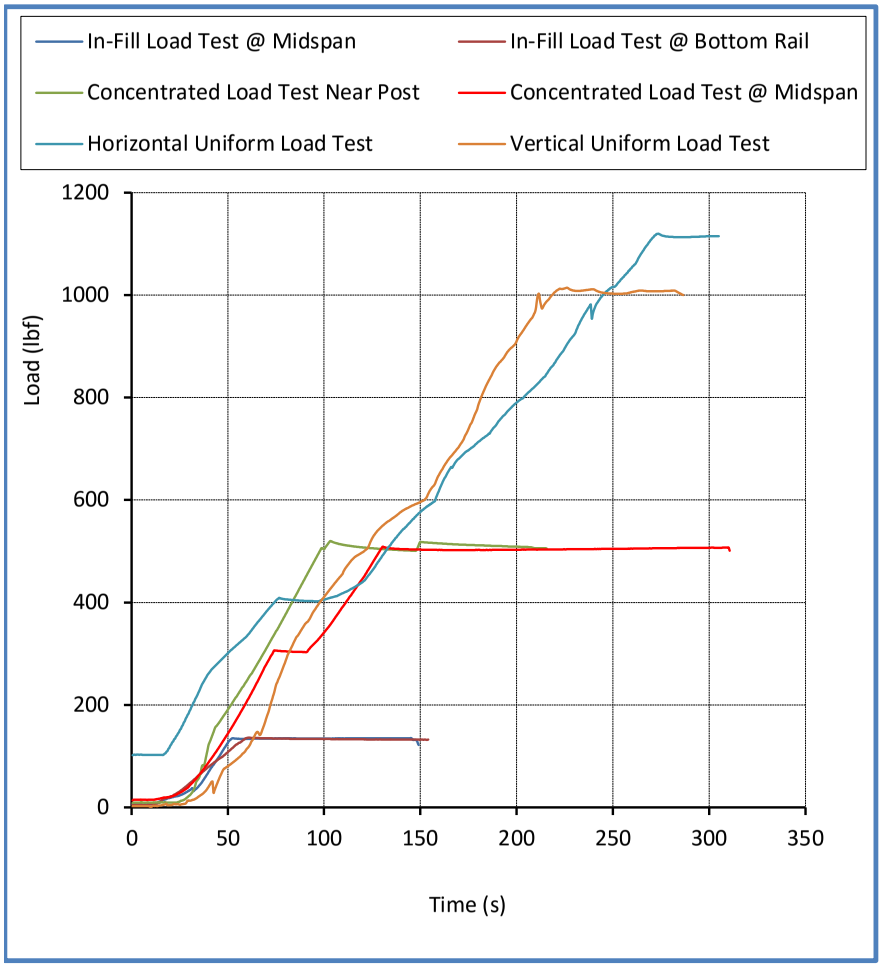
Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

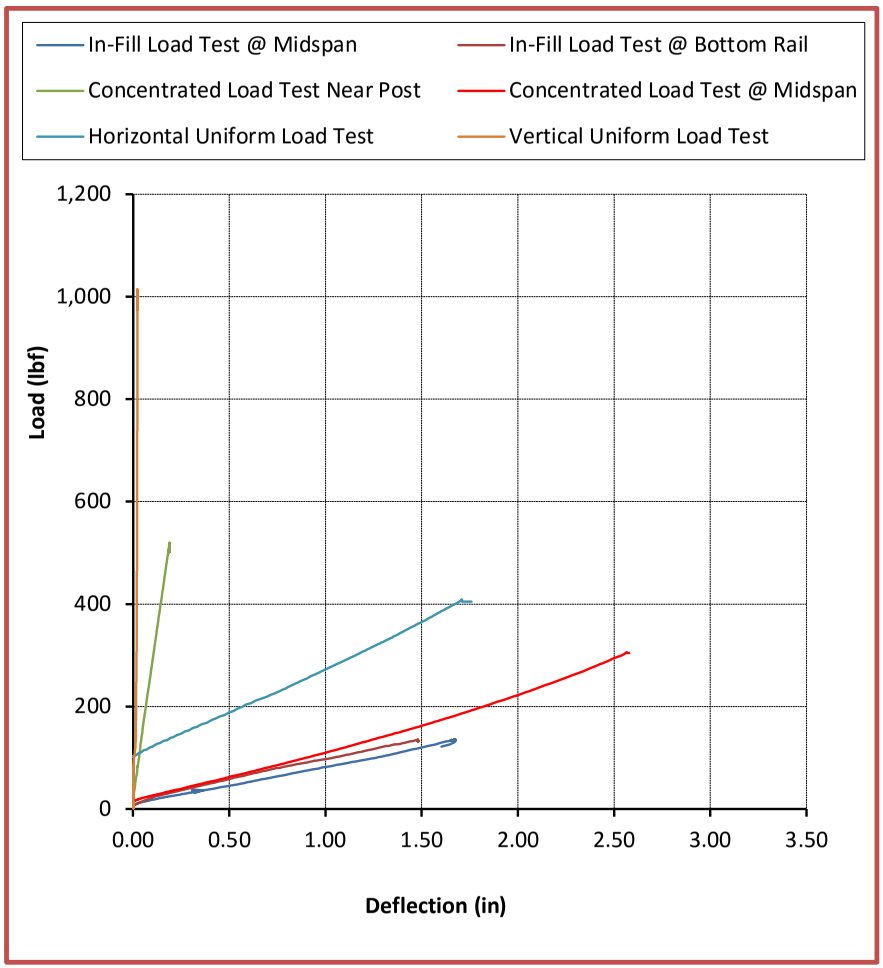
Date: 3/18/2020
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail Assembly

Sample No.: 8' Aluminum Guardrail - 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: 3/24/2020
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail Assembly

Temperature: 69
Rel. Humidity: 28%
End-Use Adjustment Factor: 0%
Effective Guardrail Length (in): 96
Guardrail Height[5] (in): 36

Sample No.: 8' Aluminum Guardrail - 2

Load Hold Time: 1 Min.

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 lbf	N/A	0.50"	145 lbf	1.82"	No failures occurred; load was held for 60 seconds without issues.	PASS
2	In-Fill Load Test @ Bottom Rail	Flush to the bottom of the bottom rail at the midspan	50 psf	125 lbf	N/A	0.28"	141 lbf	1.44"	No failures occurred; load was held for 60 seconds without issues.	PASS
3	Horizontal Uniform Load Test	Horizontal Pull along guardrail distributed evenly at four (4) points	50 plf	125 plf or 1,000 lbf	N/A	1.68"	1,009 lbf	*N/A	No failures occurred. Some permanent set was noted in the top rail after the test was completed.	PASS
4	Vertical Uniform Load Test	Vertical Downward Pull along guardrail distributed evenly at four (4) points	50 plf	125 plf or 1,000 lbf	N/A	0.02"	1,012 lbf	0.03"	No failures occurred; load was held for 60 seconds without issues.	PASS
5	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"	508 lbf	0.07"	No failures occurred; load was held for 60 seconds without issues.	PASS
6	Concentrated Load Test @ Midspan	At the midspan of the guardrail	200 lbf	500 lbf	2.50"	1.78"	515 lbf	*N/A	No failures occurred. Some permanent set was noted in the top rail after the test was completed.	PASS

**Gauges were removed to prevent damaging equipment.*

See attached charts for load versus deflection

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

[2] 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

[5] A 36" guardrail height was used to calculate the allowable deflection, however a 42" high system was tested as a worst-case scenario.

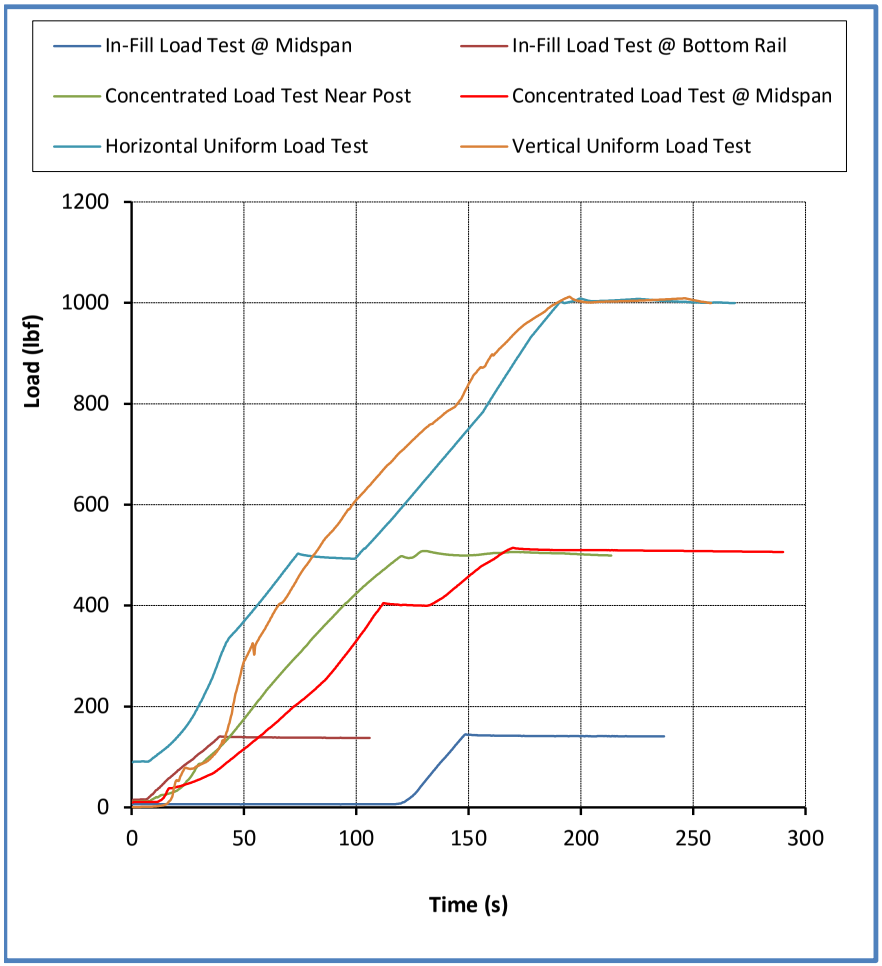
Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

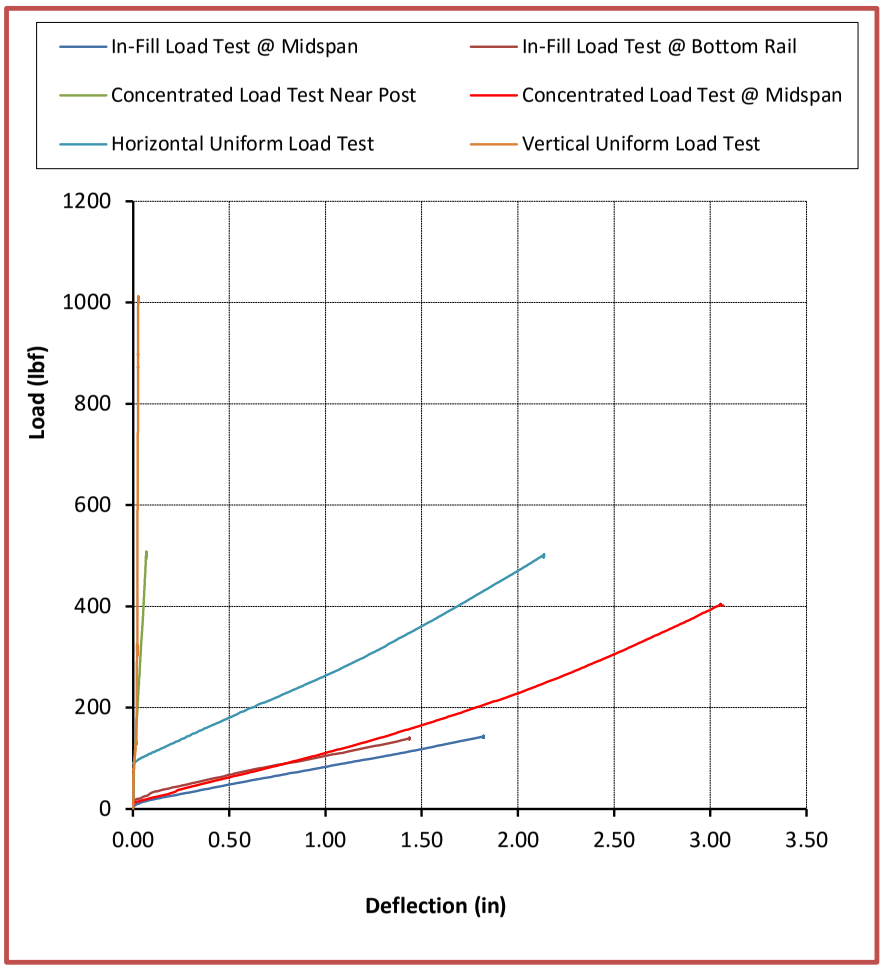
Date: 3/24/2020
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail Assembly

Sample No.: 8' Aluminum Guardrail - 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: 4/14/2020
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail Assembly

Temperature: 70
Rel. Humidity: 30%
End-Use Adjustment Factor: 0%
Effective Guardrail Length (in): 96
Guardrail Height[5] (in): 36

Sample No.: 8' Aluminum Guardrail - 3

Load Hold Time: 1 Min.

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 lbf	N/A	0.48"	151 lbf	1.78"	No failures occurred; load was held for 60 seconds without issues.	PASS
2	In-Fill Load Test @ Bottom Rail	Flush to the bottom of the bottom rail at the midspan	50 psf	125 lbf	N/A	0.25"	147 lbf	1.43"	No failures occurred; load was held for 60 seconds without issues.	PASS
3	Horizontal Uniform Load Test	Horizontal Pull along guardrail distributed evenly at four (4) points	50 plf	125 plf or 1,000 lbf	N/A	1.58"	1,005 lbf	*N/A	No failures occurred. Some permanent set was noted in the top rail after the test was completed.	PASS
4	Vertical Uniform Load Test	Vertical Downward Pull along guardrail distributed evenly at four (4) points	50 plf	125 plf or 1,000 lbf	N/A	0.02"	1,004 lbf	0.02"	No failures occurred; load was held for 60 seconds without issues.	PASS
5	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"	516 lbf	0.07"	No failures occurred; load was held for 60 seconds without issues.	PASS
6	Concentrated Load Test @ Midspan	At the midspan of the guardrail	200 lbf	500 lbf	2.50"	1.89"	527 lbf	*N/A	No failures occurred. Some permanent set was noted in the top rail after the test was completed.	PASS

**Gauges were removed to prevent damaging equipment.*

See attached charts for load versus deflection

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

[2] 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

[5] A 36" guardrail height was used to calculate the allowable deflection, however a 42" high system was tested as a worst-case scenario.

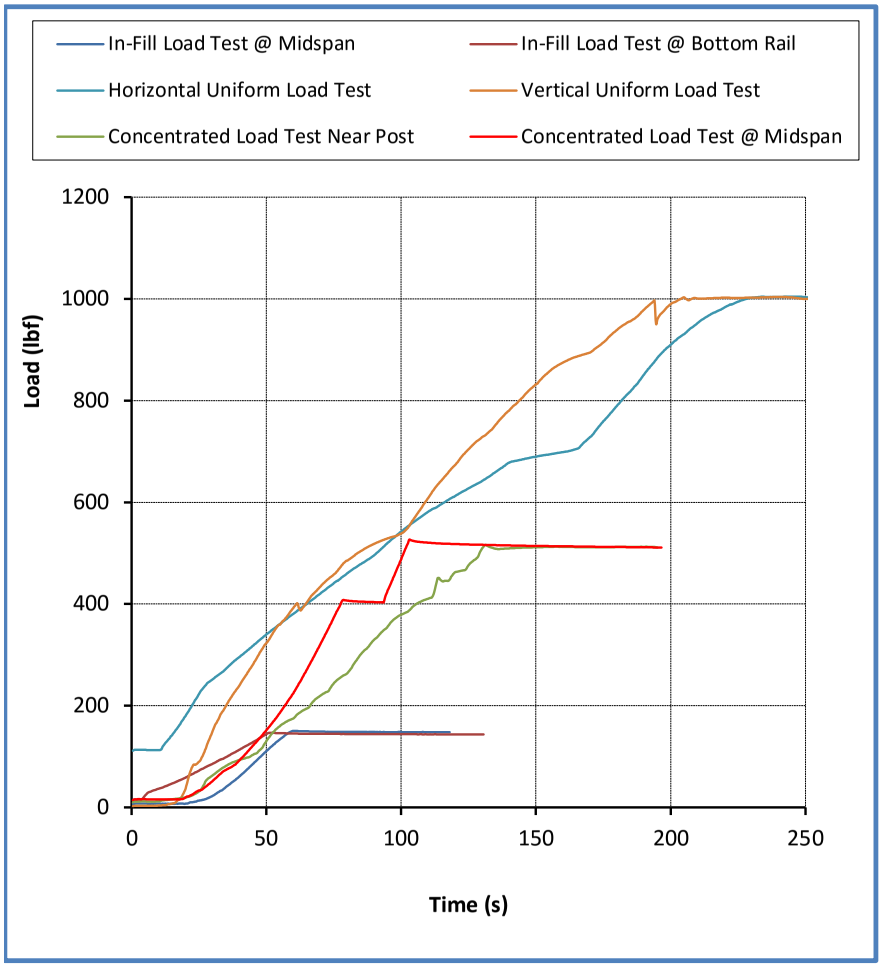
Progressive Engineering Inc.

ASTM D7032 Guardrail System Test

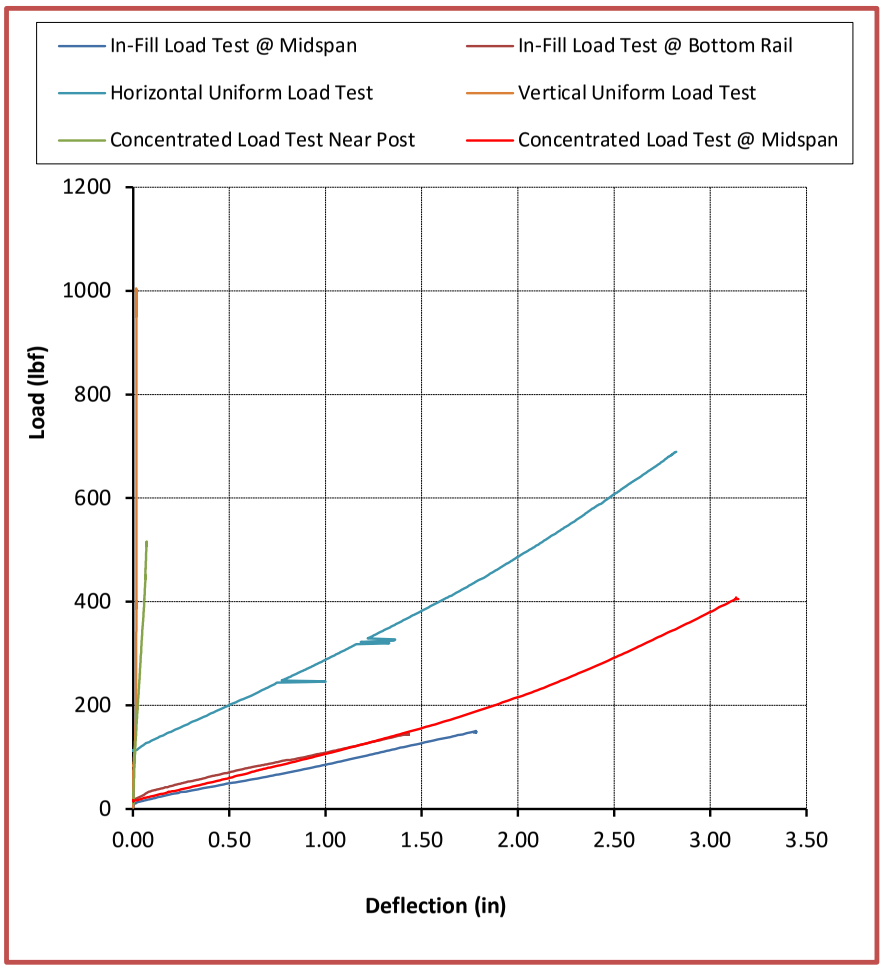
Date: 4/14/2020
Client: USA Vinyl LLC
Specimen: 8' Aluminum Guardrail Assembly

Sample No.: 8' Aluminum Guardrail - 3

Load versus Time



Load versus Deflection



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

REV.	DESCRIPTION	DATE	BY
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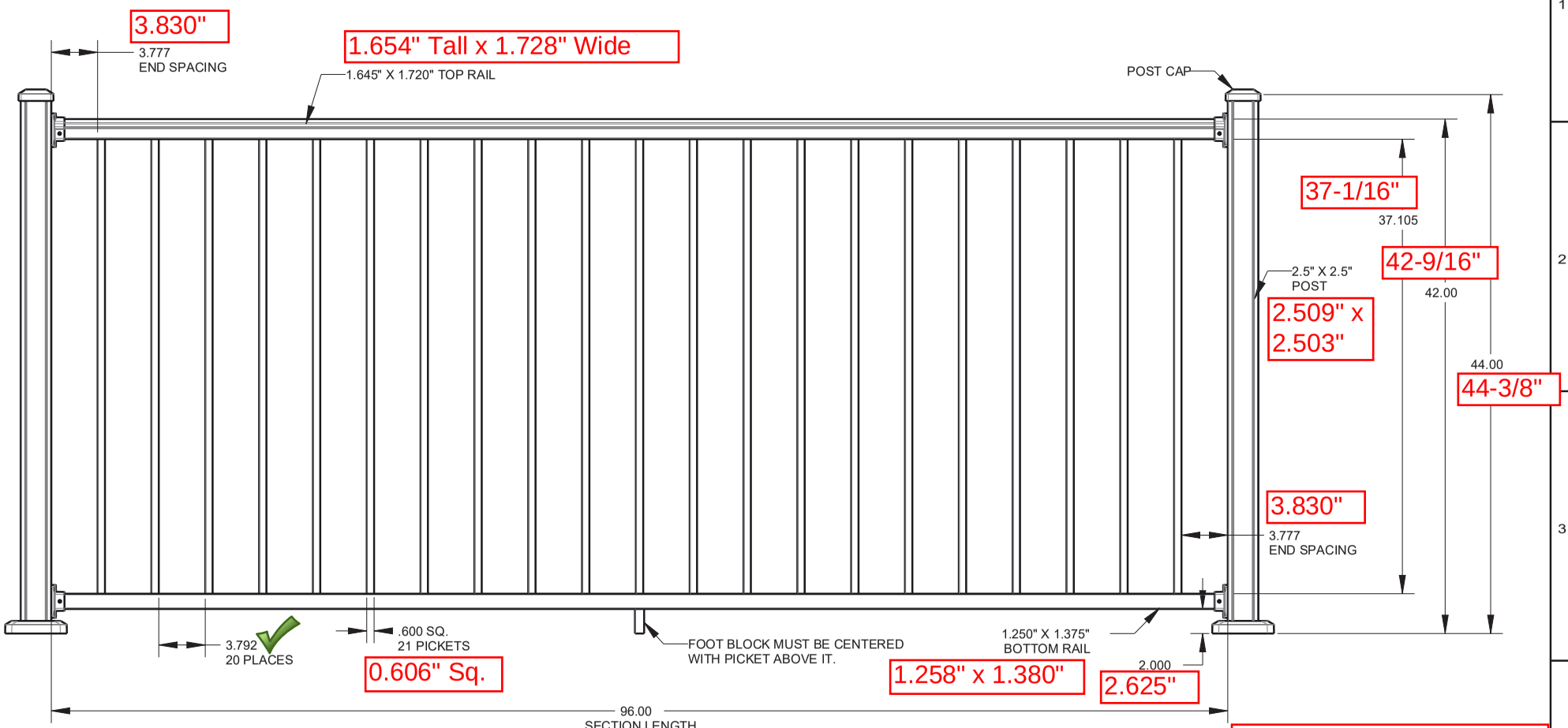
-	-	-	-



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°

DRAWN BY: SWW	DRAWN DATE: 171113	PART NAME: STRAIGHT SECTION 42" H X 8' W -	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
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.	

PEI Report No. 2019-6414

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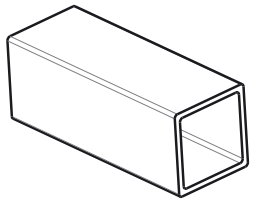
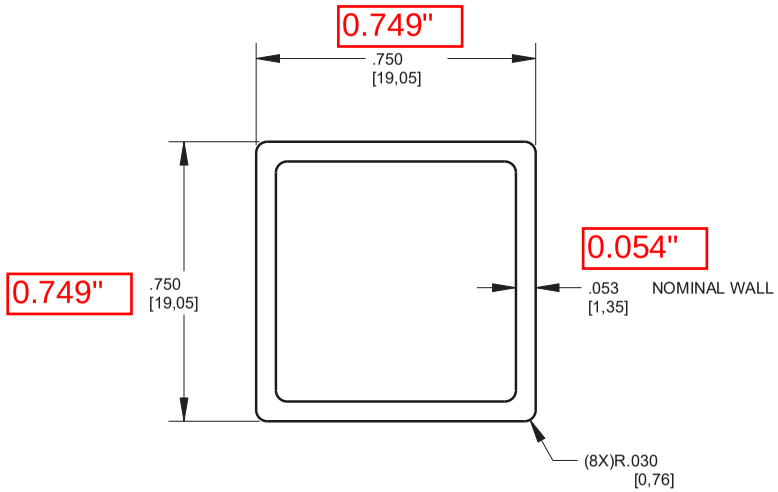
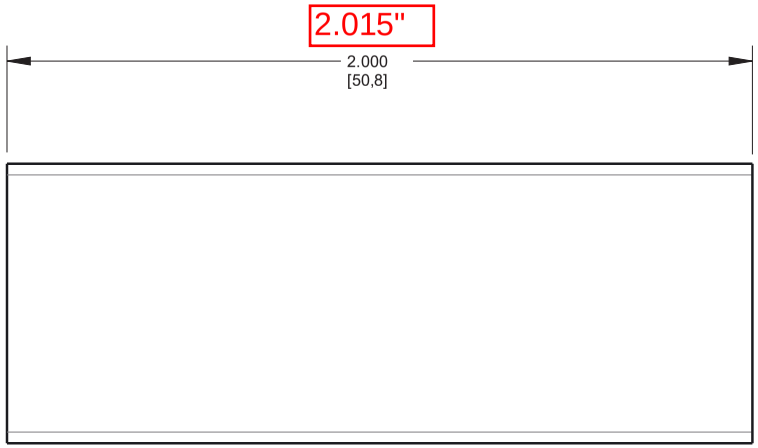
-	-	-	-





SCALE 3.000



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.	

PEI Report No. 2019-6414

REV.	DESCRIPTION	DATE	BY
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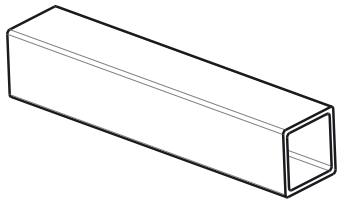
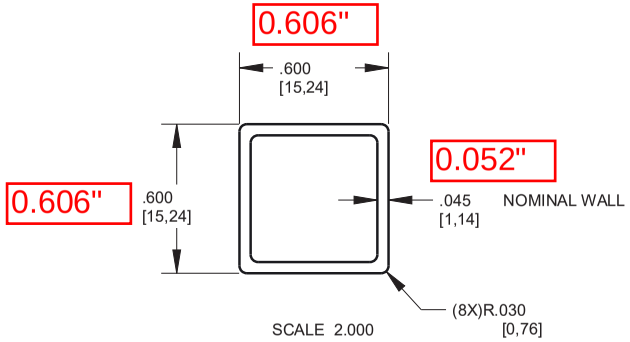
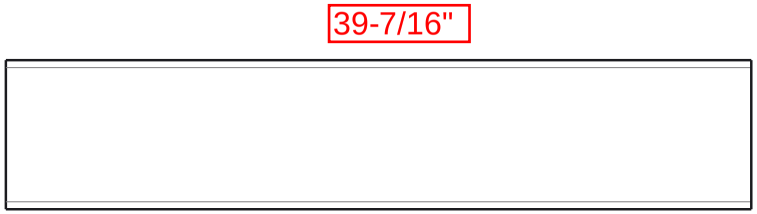
-	-	-	-







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.	

PEI Report No. 2019-6414

REV.	DESCRIPTION	DATE	BY
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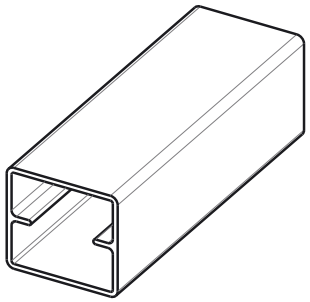
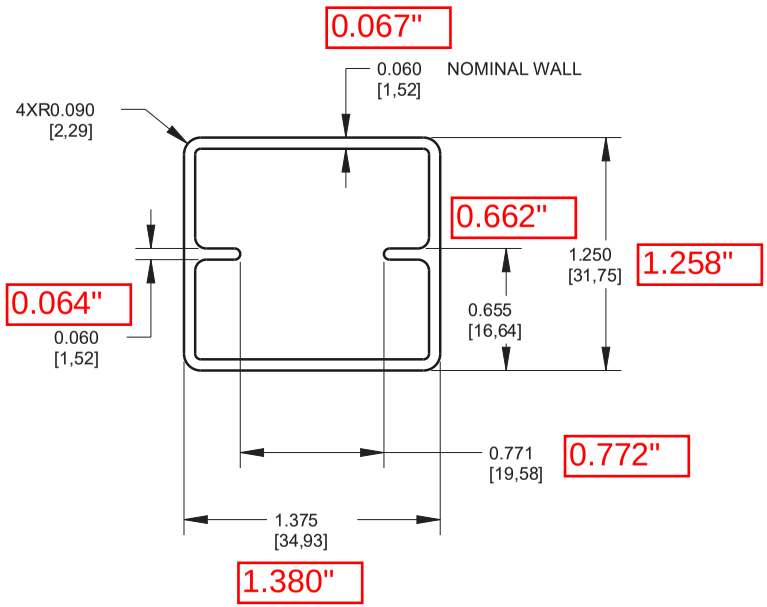
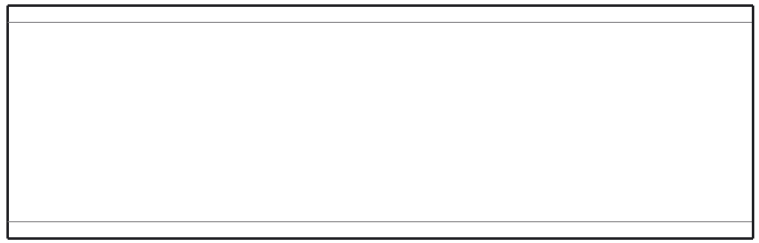
-	-	-	-







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.

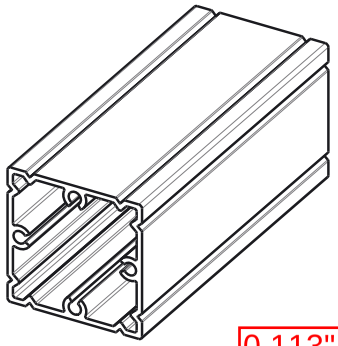
✔ Given dimension is within stated tolerance

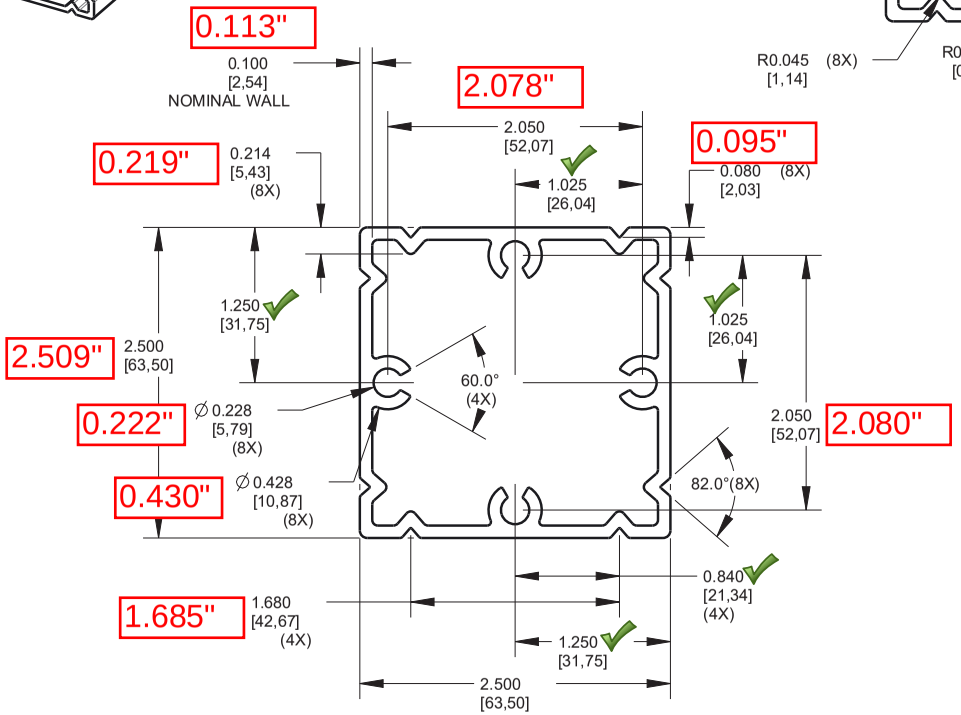
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

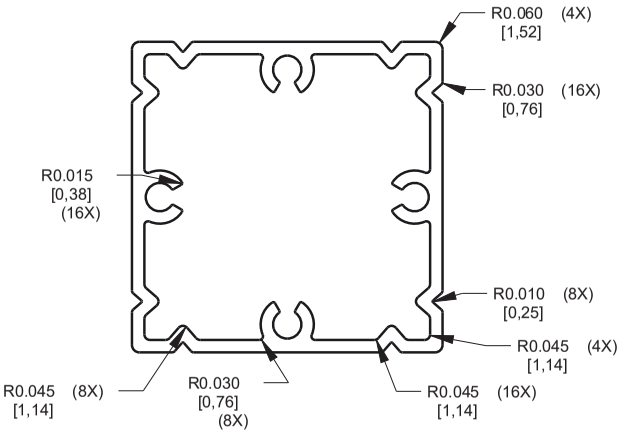
DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: BOTTOM RAIL	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LXAL-SQRA-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 0	

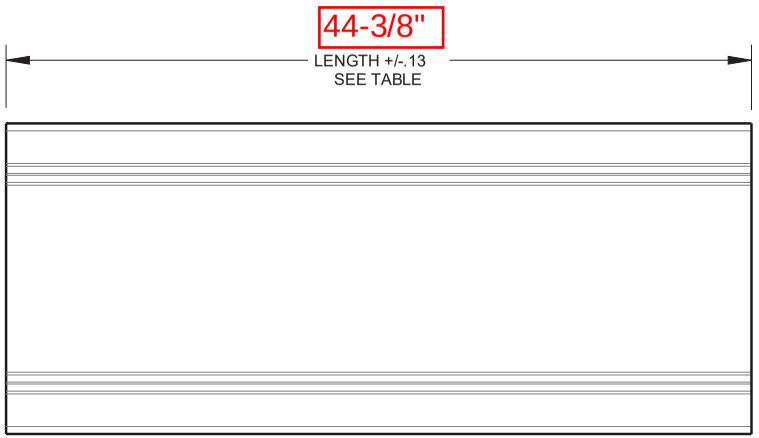
PEI Report No. 2019-6414

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.

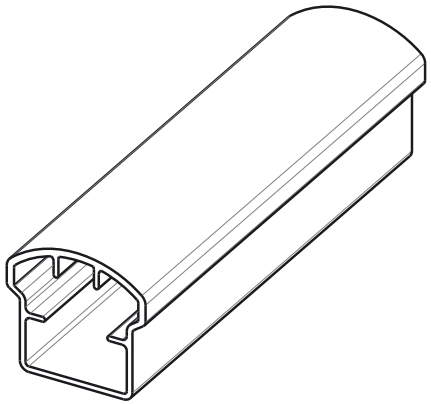
✔ Given dimension is within stated tolerance

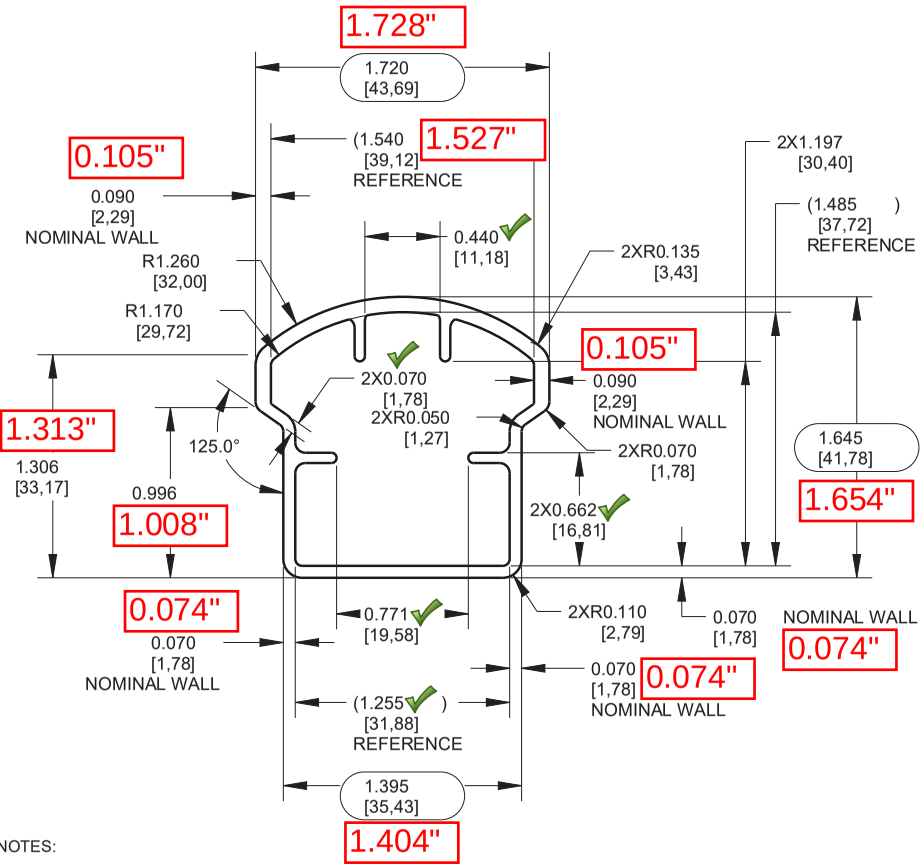
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

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	

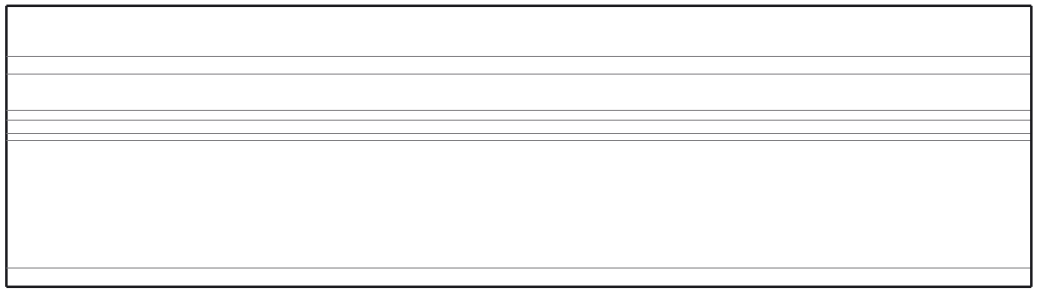
PEI Report No. 2019-6414

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





96-1/16" Long



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.

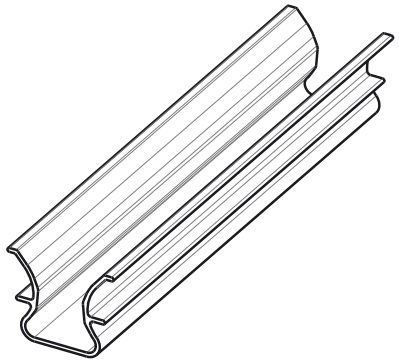
✔ Given dimension is within stated tolerance

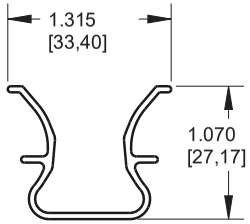
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		
DIMENSION	INCH	METRIC
2 PLACES	±0.02	±0.50
3 PLACES	±0.010	±0.250
ANGULAR	±0.50°	±0.50°

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	

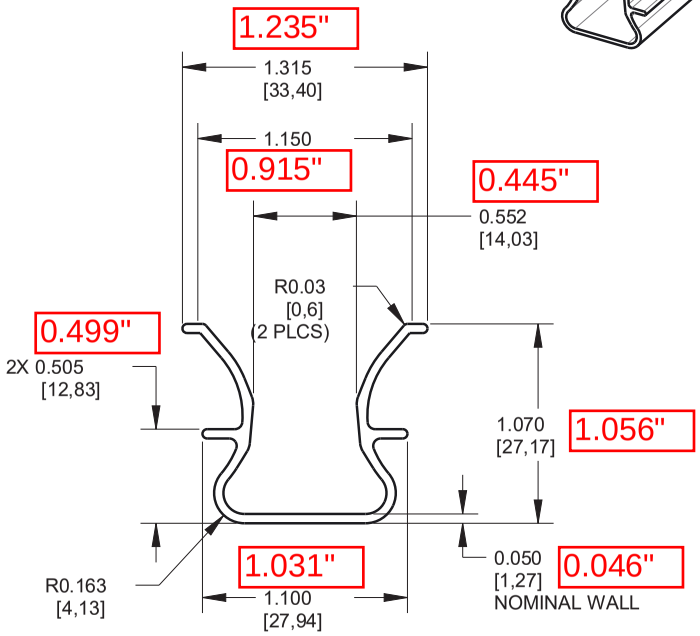
PEI Report No. 2019-6414

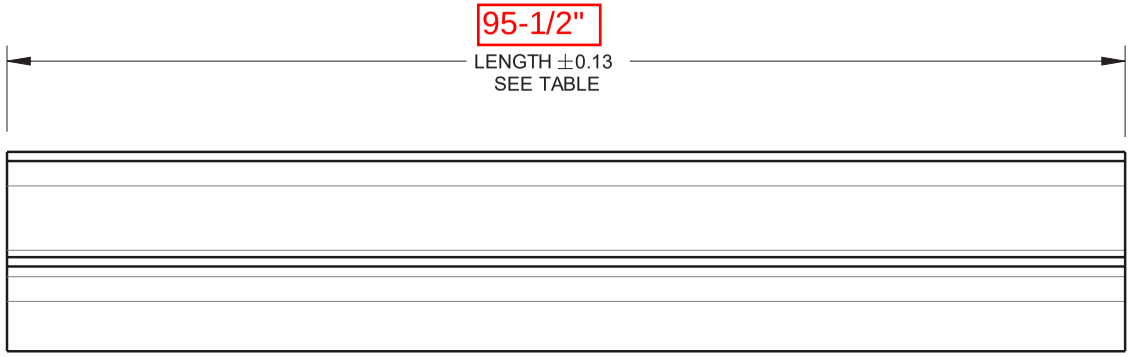
REV.	DESCRIPTION	DATE	BY
0	INITIAL RELEASE	04/19/17	SWW
1	ADDED TWO EARS FOR AN OVERALL WIDTH OF 1.315"	07/20/17	SWW
2	UPDATED CROSS SECTIONAL AREA TO .189 SQUARE INCHES	07/20/17	SWW





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.

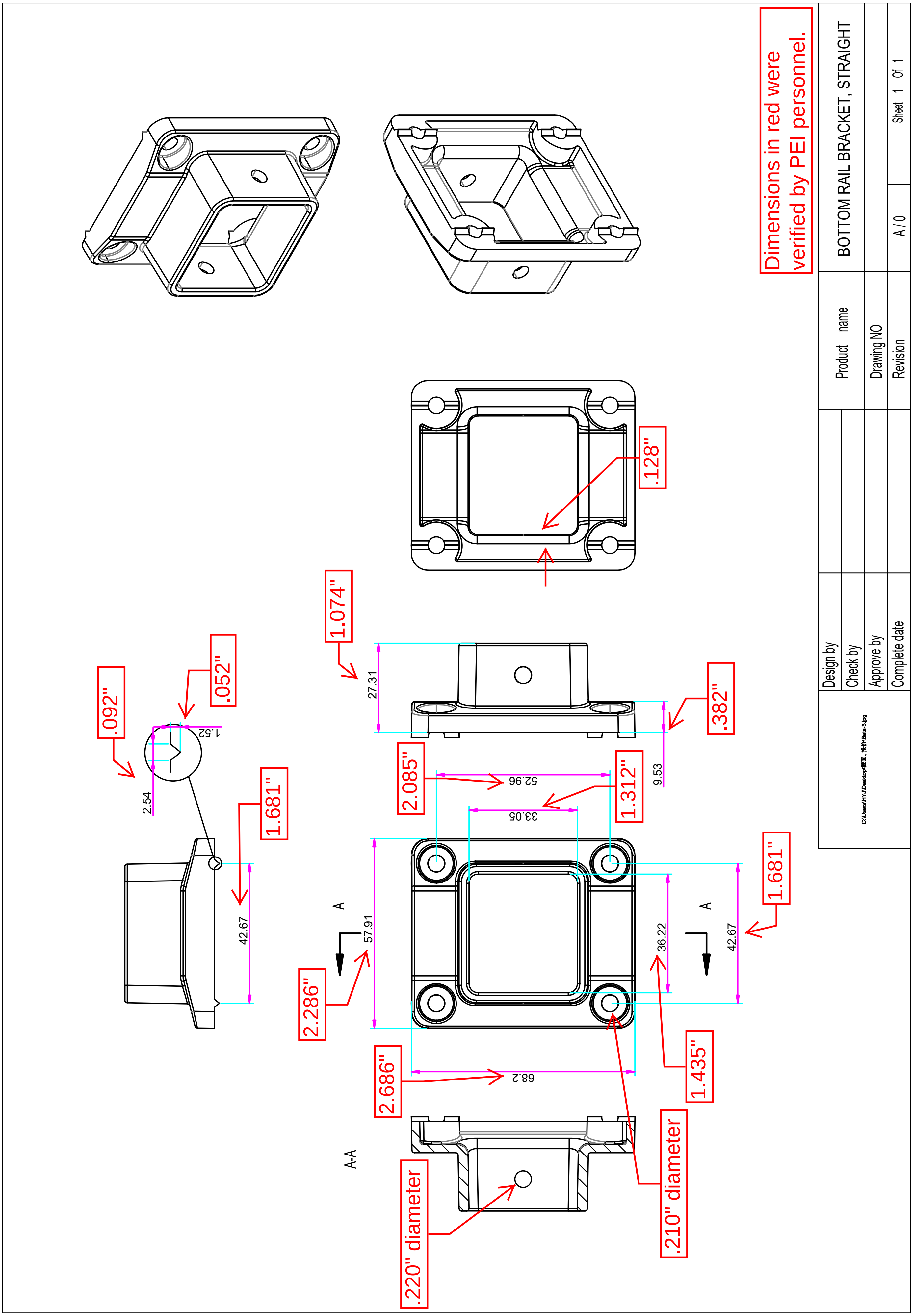
Verified dimensions in red.

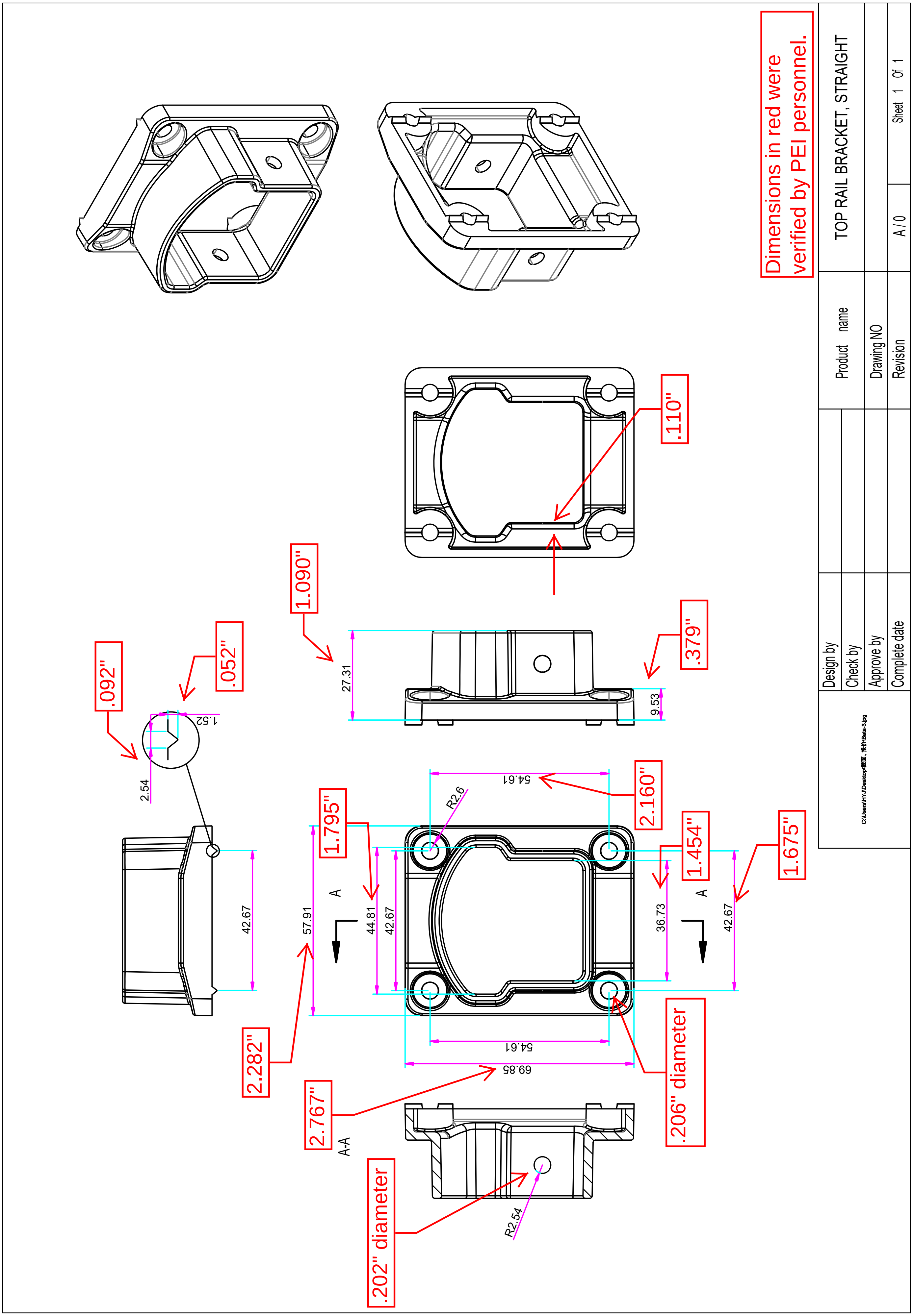
✔ Given dimension is within stated tolerance

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°

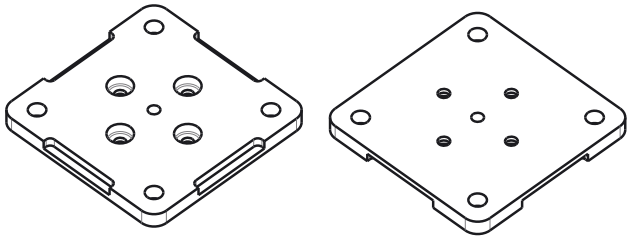
DRAWN BY: SDM	DRAWN DATE: 02/20/17	PART NAME: PVC RAIL INSERT	USA VINYL, LLC 5795 GREEN POINT DRIVE GROVEPORT, OH 43215
APPRVD BY: -	APPRVD DATE: -		
MATERIAL: AS NOTED	COLOR: AS NOTED	PART NO.: LBAL-PVCRAINS-X	
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 0	

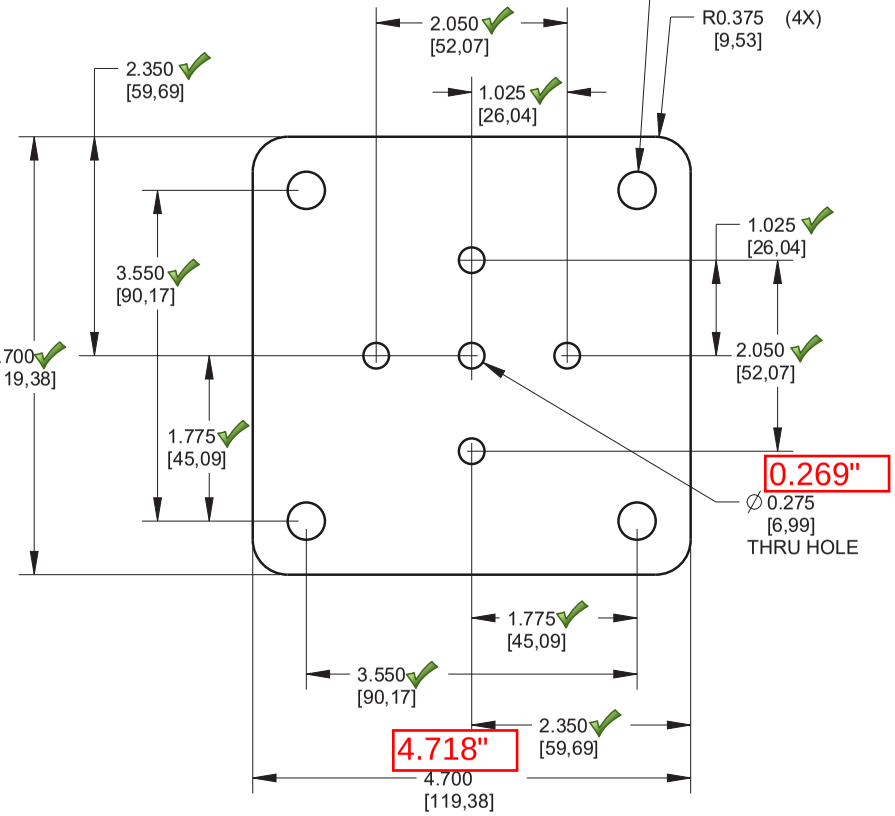
PEI Report No. 2019-6414

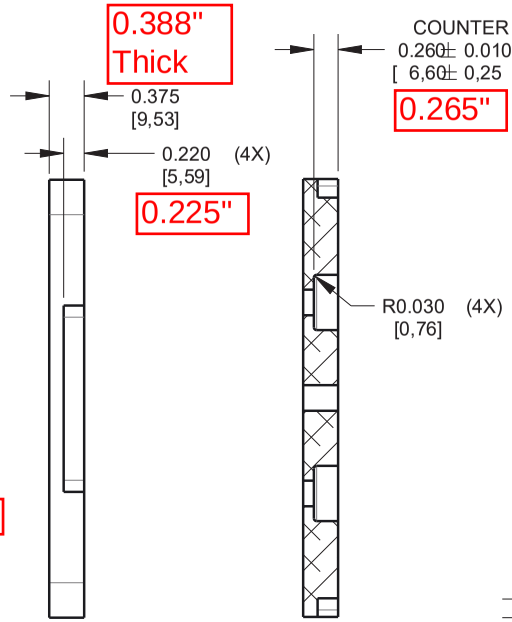

Dimensions in red were verified by PEI personnel.
BOTTOM RAIL BRACKET, STRAIGHT
Product name
Drawing NO
Revision
A / 0
Sheet 1 Of 1
Design by
Check by
Approve by
Complete date
A-A
A
A
.092"
.052"
1.52
2.54
1.681"
42.67
1.074"
27.31
.382"
9.53
2.085"
52.96
1.312"
33.05
2.286"
57.91
36.22
1.681"
42.67
1.435"
2.686"
68.2
.220" diameter
.210" diameter
.128"

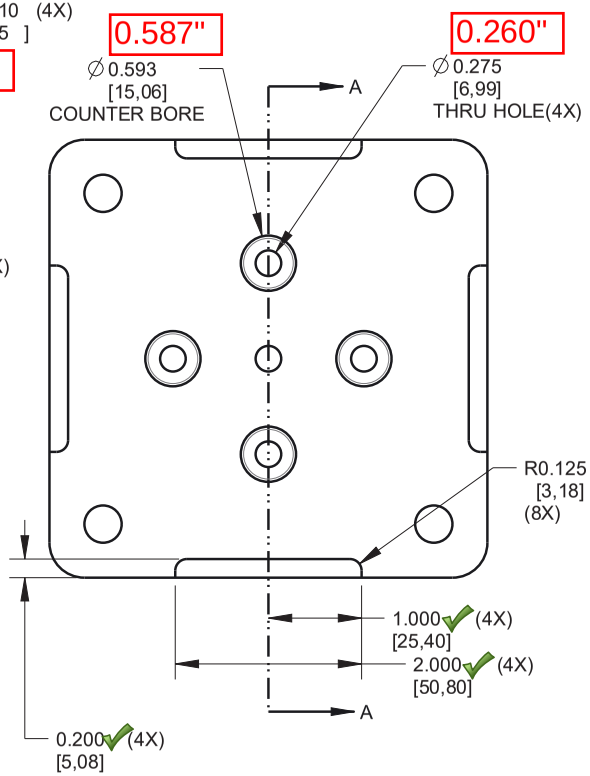

Dimensions in red were verified by PEI personnel.
TOP RAIL BRACKET, STRAIGHT
Product name
Drawing NO
Revision
A / 0
Sheet 1 Of 1
Design by
Check by
Approve by
Complete date
.110"
1.090"
27.31
.379"
9.53
.092"
.052"
1.52
2.54
42.67
2.160"
54.61
R2.6
1.795"
1.454"
1.675"
57.91
44.81
42.67
36.73
42.67
A
A
2.282"
54.61
69.85
2.767"
.206" diameter
A-A
.202" diameter
R2.54

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 Ø 0.275" THRU, ⌵ Ø 0.615" 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	THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO USA VINYL, LLC. THIS INFORMATION SHOULD NOT BE REPRODUCED, USED, OR DISCLOSED TO OTHERS WITHOUT WRITTEN PERMISSION FROM USA VINYL, LLC.
FINISH: AS NOTED	TEXTURE: AS NOTED	SCALE: N/A / SHEET: 1 OF 1 / REV.: 0	

PEI Report No. 2019-6414

Typical Infill Load Test Setup (Near Center of Balusters)

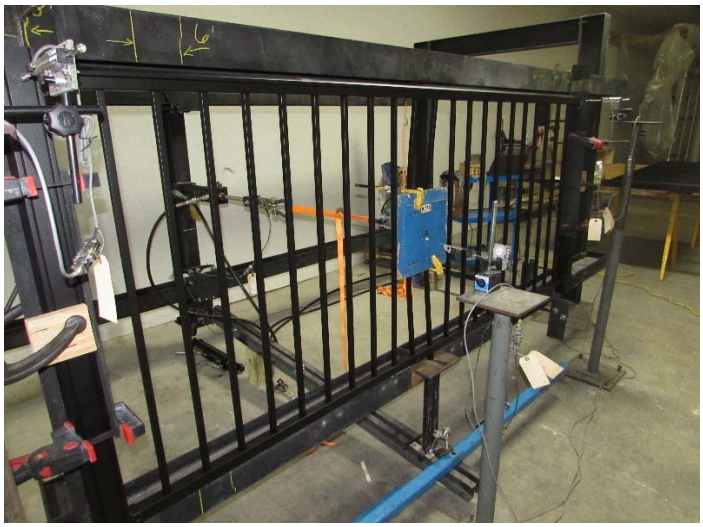
Typical Infill Load Test Setup (Near Bottom Rail)

Typical Horizontal Uniform Load Test Setup

Typical Vertical Uniform Load Test Setup

Typical Concentrated Load at Post Test Setup

Typical Concentrated Load at Midspan Test Setup

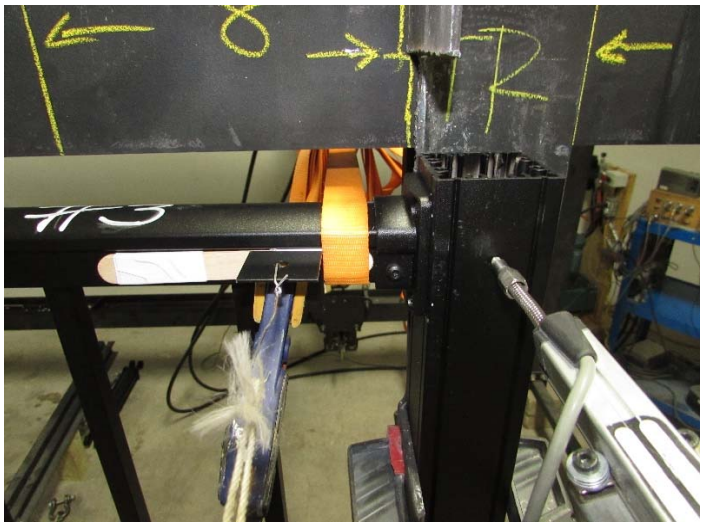


Typical Infill Load (Center) w/ Full Load Applied

Typical Infill Load (Bottom Rail) w/ Full Load Applied

Typical Horizontal Uniform Load w/ Full Load Applied

Typical Vertical Uniform Load w/ Full Load Applied



Typical Concentrated Load (Post) w/ Full Load Applied

Typical Concentrated Load (Midspan) w/ Full Load Applied

Top Rail Profile Detail

Top Bracket Profile Detail

Bottom Rail Profile Detail

Bottom Bracket Profile Detail

Aluminum Post Profile Detail

Post & Foot Block Screws