



TEST REPORT

Rendered to:

KEY-LINK FENCING & RAILING, INC.

For:

Aluminum Guardrail Systems
American, Arabian, Keystone and Outlook Series Level Rail Systems

Report No.: F3320.01-119-19

Report Date: 07/05/16

Test Record Retention Date: 03/08/20



TEST REPORT

F3320.01-119-19

July 5, 2016

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TEST REPORT

Rendered to:

KEY-LINK FENCING & RAILING, INC.
150 Orlan Road
New Holland, Pennsylvania 17557

Report No.: F3320.01-119-19

Test Dates: 01/04/16

Through: 03/08/16

Report Date: 07/05/16

Test Record Retention Date: 03/08/20

1.0 General Information

1.1 Product

Aluminum Guardrail Systems: *American, Arabian, Keystone* and *Outlook Series* Level Rail Systems

1.2 Types

American Series:

- Horizontal Cable Rail
- Horizontal Cable Rail with Deck Board Cap
- Scranton Rail
- Scranton Rail with Deck Board Cap
- Vertical Cable Rail

Arabian Series:

- Horizontal Cable Rail
- Scranton Rail

Keystone Series:

- Horizontal Cable Rail
- Scranton Rail
- Vertical Cable Rail
- 3-Rail

Outlook Series Rail

1.3 Project Description

Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by Key-Link Fencing & Railing, Inc. to perform structural testing on various configurations of their *American*, *Arabian*, *Keystone* and *Outlook* aluminum guardrail systems. This report is in conjunction with Intertek-ATI Report No. E2610.01-119-19 which includes structural performance testing of the post mount assembly. The purpose of the testing is preliminary design load evaluation in accordance with the following criteria:

ICC-ES™ AC273 (March 1, 2008 - Editorial Revised January 2012), *Acceptance Criteria for Handrails and Guards*

ICC-ES™ AC273-08 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

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

Testing conducted and reported herein was for the purpose of preliminary (research and development) purposes only. Additional testing is required in order to specify the products as ICC-ES™ AC273 compliant.

1.5 Qualifications

Intertek-ATI in York, Pennsylvania has demonstrated compliance with ISO/IEC International Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. (IAS).

1.6 Product Sampling

All material utilized for testing reported herein was directly provided to Intertek-ATI by Key-Link Fence & Railing, Inc. and was not independently sampled and selected by a third party inspection agency.

1.7 Witnessing

Reuben Lapp and Christopher Wenger of Key-Link Fence & Railing, Inc. were present from 01/04/16 - 01/06/16 to witness the following tests and/or test setups:

- Structural performance testing of assembled railing systems

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 $68 \pm 4^{\circ}\text{F}$ and humidity in the range of $50 \pm 5\% \text{RH}$.

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 Key-Link Fence & Railing, Inc.'s 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. Three specimens were tested in this manner with each of the three specimens including two connections for a total of six 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 March 27, 2009.

3.5 Test Results

Outlook Series
Test Date: 01/29/16

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	1595	-2.4%	Bracket Failure
2	1744	6.7%	
3	1567	-4.2%	
Average	1635		
Allowable Capacity ¹	654	≥ 200 lb ∴ OK	

¹ Average ultimate load divided by a factor of safety of three (2.5)

Arabian Series
Test Date: 01/29/16

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	977	-35.0%	Bracket Failure
2	1735	15.4%	
3	1799	19.6%	
Average	1504		
Allowable Capacity ¹	602	≥ 200 lb ∴ OK	

¹ Average ultimate load divided by a factor of safety of three (2.5)

American Series with Socket Bracket
Test Date: 01/29/16

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	1600	-8.9%	Bracket Failure
2	2034	15.8%	
3	1634	-6.9%	
Average	1756		
Allowable Capacity ¹	702	≥ 200 lb ∴ OK	

¹ Average ultimate load divided by a factor of safety of three (2.5)

3.5 Test Results (Continued)

American Series with Collar Bracket (Deck Board Cap)
Test Date: 03/08/16

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	2257	10.3%	Bracket Failure
2	1773	-13.4%	
3	2112	3.2%	
Average	2047		
Allowable Capacity ¹	819	≥ 200 lb ∴ OK	

¹ Average ultimate load divided by a factor of safety of three (2.5)

Keystone Series
Test Date: 01/29/16

Sample No.	Ultimate Load (lb)	Deviation From Average	Mode of Failure
1	2048	14.6%	Bracket Failure
2	1858	4.0%	
3	1457	-18.5%	
Average	1787		
Allowable Capacity ¹	715	≥ 200 lb ∴ OK	

¹ Average ultimate load divided by a factor of safety of three (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.

4.2 Railing Assembly Description

The *Keystone*, *American*, *Arabian* and *Outlook Series* level railing consisted of aluminum top and bottom rails with spaced pickets between the rail members. Reference Section 4.8 Summary and Conclusions for overall rail length and rail height dimensions for the various railing systems reported herein. Top and bottom rails attached to an aluminum post mounts via aluminum socket or collar brackets. See Section 4.4 Fastening Schedule for connection details. Support blocks and intermediate balusters were located between the support posts. Reference Section 4.8 Summary and Conclusions for additional information regarding support blocks and intermediate balusters. See drawings in Appendix A and photographs in Appendix B for additional details.

4.3 Series / Model

The test specimen components were supplied by Key-Link Fencing and Railing, Inc. and were assembled by a representative of Intertek-ATI.

Top Rails:

Keystone Series: Three piece, 1-7/8 in high by 1-3/4 in wide overall dimensions; 15/16 in high by 1-3/4 in wide by 0.09 in wall, flat top profile, 6105-T6 aluminum extrusion top rail cap upper section, 1-1/2 in high by 1-1/4 in wide by 0.10 in wall "U"-shaped, 6105-T6 aluminum extrusion top rail subassembly lower section and a 1-3/8 in high by 1 in wide by 0.05 in wall inverted "U"-shaped PVC baluster retainer strip (where applicable) installed in lower section

American Series: Three piece, 1-7/8 in high by 1-3/4 in wide overall dimensions; 15/16 in high by 1-3/4 in wide by 0.09 in wall, flat top profile, 6005-T5 aluminum extrusion top rail cap upper section, 1-1/2 in high by 1-1/4 in wide by 0.10 in wall "U"-shaped, 6063-T6 aluminum extrusion top rail subassembly lower section and a 1-3/8 in high by 1 in wide by 0.05 in wall inverted "U"-shaped PVC baluster retainer strip (where applicable) installed in lower section

4.3 Series / Model (Continued)

Top Rails: (Continued)

Arabian Series: Three piece, 1-15/16 in high by 1-3/4 in wide overall dimensions; 1-1/16 in high by 1-3/4 in wide by 1.10 / 0.09 in wall, sloped top profile, 6005-T5 aluminum extrusion top rail cap upper section, 1-1/2 in high by 1-1/4 in wide by 0.10 in wall "U"-shaped, 6063-T6 aluminum extrusion top rail subassembly lower section and a 1-3/8 in high by 1 in wide by 0.05 in wall inverted "U"-shaped PVC baluster retainer strip (where applicable) installed in lower section

Outlook Series: Three piece, 1-9/16 in high by 1-1/2 in wide overall dimensions; 15/16 in high by 1-1/2 in wide by 0.07 / 0.08 / 0.12 in wall, flat top profile, 6105-T6 aluminum extrusion top rail cap upper section, 1 in high by 1-1/8 in wide by 0.08 in wall "U"-shaped, 6105-T6 aluminum extrusion top rail subassembly lower section and 13/16 in high by 15/16 in wide by 0.04 in wall inverted "U"-shaped PVC baluster retainer strip installed in lower section

Intermediate Rail:

Keystone Series: Two piece, 1-1/2 in high by 1-1/4 in wide overall dimensions; 1-1/2 in high by 1-1/4 in wide by 0.10 in wall inverted "U"-shaped 6105-T6 aluminum extrusion and 1-3/8 in high by 1 in wide by 0.05 in wall "U"-shaped PVC baluster retainer strip (where applicable)

Bottom Rails:

Keystone Series: Two piece, 1-1/2 in high by 1-1/4 in wide overall dimensions; 1-1/2 in high by 1-1/4 in wide by 0.10 in wall inverted "U"-shaped 6105-T6 aluminum extrusion and 1-3/8 in high by 1 in wide by 0.05 in wall "U"-shaped PVC baluster retainer strip (where applicable)

American Series: Two piece, 1-1/2 in high by 1-1/4 in wide overall dimensions; 1-1/2 in high by 1-1/4 in wide by 0.10 in wall inverted "U"-shaped 6063-T6 aluminum extrusion and 1-3/8 in high by 1 in wide by 0.05 in wall "U"-shaped PVC baluster retainer strip (where applicable)

Arabian Series: Two piece, 1-1/2 in high by 1-1/4 in wide overall dimensions; 1-1/2 in high by 1-1/4 in wide by 0.10 in wall inverted "U"-shaped 6063-T6 aluminum extrusion and 1-3/8 in high by 1 in wide by 0.05 in wall "U"-shaped PVC baluster retainer strip (where applicable)

Outlook Series: Two piece, 1 in high by 1-1/8 in wide overall dimensions; 1 in high by 1-1/8 in wide by 0.08 in wall inverted "U"-shaped 6105-T6 aluminum extrusion and 13/16 in high by 15/16 in wide by 0.04 in wall "U"-shaped PVC baluster retainer strip

4.3 Series / Model (Continued)

Brackets: A360 cast aluminum socket and collar (*American Series* rails with deck board cap) brackets contoured to shape of rails

Infill: *Outlook Series* - 5/8 in square by 0.05 in wall 6063-T52 aluminum extrusion picket

Keystone, American and Arabian Series - 3/4 in square by 0.05 in wall 6063-T6 aluminum extrusion picket

Keystone, American and Arabian Series - 1/8 in, 1x19 strand, Type AISI, 316 stainless steel aircraft cable

Intermediate Support Balusters for Cable Rail Systems used in *Keystone, American and Arabian Series*:

- 3/4 in square by 0.05 in wall 6063-T6 aluminum extrusion with grooves located on all four sides and 3/16 in diameter holes located on two opposite faces with the first hole located 2-3/4 in on-center from the deck surface and all other holes spaced 2-7/8 in on center apart.
- 1/2 in diameter solid stainless steel extrusion

Support Block:

Outlook Series: "Y"-shaped component comprised of a 5/8 in square by 2-7/16 in long solid 6063-T6 aluminum extrusion and a 3/4 in high by 1-1/4 in wide 6063-T6 aluminum extrusion U-section

Keystone, American and Arabian Series: "Y"-shaped component comprised of a 3/4 in square by 2-3/8 in long solid 6063-T6 aluminum extrusion and a 1-1/8 in high by 1-7/16 in wide 6063-T6 aluminum extrusion U-section

Post: 3-1/4 in square by 0.12 in wall 6105-T6 hollow aluminum extrusion with 1-5/8 in wide grooves located on all four sides. Posts utilized in the guardrail systems consisting of horizontal cable infill contained 1/2 in diameter holes centered in two opposite faces for *Easy Rail* cable receivers with the first hole located 2-3/4 in on-center from the deck surface and all other holes spaced 2-7/8 in on center apart.

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

4.4 Fastening Schedule

Connection	Fastener
Top / Bottom Rail Bracket to Post	Four #12-14 by 1" (0.155 in minor diameter) flat-head, square drive, self-drilling, coated carbon steel screws
Top Rail Bracket to Post <i>(American Series Rails with Deck Board Cap)</i>	Two #12-14 by 1" (0.155 in minor diameter) flat-head, square drive, self-drilling, coated carbon steel screws (bottom side of bracket) and Two #10-16 by 1" (0.135 in minor diameter) flat-head, square drive, self-drilling, coated carbon steel screws (top side of bracket)
Top / Bottom Rail Bracket to Rail	Two #10-16 by 3/4" (0.137 in minor diameter) pan-head, square drive, self-drilling, coated carbon steel screws
Square Baluster to Top / Bottom Rail	Compression Fit - no mechanical connector
Horizontal Cable Infill to Post Mount	<i>Easy Rail</i> cable receiver
Vertical Cable Infill to Top / Bottom Rail	5/16"-24 threaded connector with nut
Square Intermediate Support Baluster Bracket to Top Rail / Deck Surface	One #10-16 x 1" (0.135 in minor diameter) flat-head, square drive, self-drilling, coated carbon steel screw
Square Intermediate Support Baluster Bracket to Support Baluster	Slip fit - no mechanical connections
Round Intermediate Support Baluster to Top / Bottom Rail	Slip fit - no mechanical connections
Support Block to Bottom Rail	Compression Fit - no mechanical connector

4.5 Test Setup

The railing assembly was installed and tested as a single railing section by directly securing (surface-mounting) the base of the post mounts to a rigid steel test frame. 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.

4.6 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.

4.7 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.

4.7 Test Results (Continued)

Test Series No. 1
72 in by 42 in Outlook Series with 5/8 in Square Pickets
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	127 - 133	00:47 - 01:56	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 129	00:11 - 01:19	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (72 in ÷ 12 in/ft) = 300 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
750 lb (2.50 x D.L.)	750 - 765	00:46 - 01:54	Sustained load equal to or greater than 750 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads

4.7 Test Results (Continued)

Test Series No. 1 (Continued)

Test No. 4 - Test Date: 01/05/16						
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.)	206	00:14	0.02	1.01	0.02	0.99
500 lb (2.50 x D.L.)	501 - 510	00:28 - 01:34	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 206 lb = 0.99 in on a 6 ft rail (72 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{72}{96}\right) = 2.25" > 0.99" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 0.99" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	1002 - 1020	00:26 - 01:33	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 2
96-1/4 in by 42 in Arabian Series with Horizontal Cable Rail Infill and
Two 3/4 in Square Intermediate Support Balusters
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	125 - 134	00:17 - 01:30	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Support Balusters			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
250 lb (2.50 x D.L.) x 2	251 - 255	00:19 - 01:28	Sustained load equal to or greater than 125 lb per baluster for one full minute without failure

¹ Load was imposed on both intermediate balusters using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	996 - 1015	00:48 - 01:57	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

² Test load dropped below 1003 lbs for a total of 10 seconds during the one minute hold period.

Note: During the initial uniform load test, the top rail bracket cracked upon reaching the test load. The specimen was able to hold the load for the prescribed 1 minute period however. The cracked bracket was replaced with a new bracket which was revised to include larger holes for the bracket to rail fasteners. The uniform load test was repeated with no signs of cracking/failure and the results are reported in the table above.

4.7 Test Results (Continued)

Test Series No. 2 (Continued)

Test No. 4 - Test Date: 01/05/16						
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.)	201	00:23	0.01	1.65	0.02	1.64
500 lb (2.50 x D.L.)	501 - 511	00:37 - 01:45	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
Deflection Evaluation:						
Maximum rail deflection at 201 lb = 1.64 in on an 8 ft rail (96-1/4 in)						
Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.64" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.64" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	1001 - 1016	00:23 - 01:34	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 3
96-1/4 in by 42 in Arabian Series (Scranton) with 3/4 in Square Pickets
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
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.)	129 - 134	00:13 - 01:21	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 135	00:11 - 01:18	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	1000 - 1033	00:24 - 01:34	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads

² Test load dropped below 1003 lbs for a total of 6 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 3 (Continued)

Test No. 4 - Test Date: 01/05/16						
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.)	201	00:16	0.02	1.47	0.02	1.45
500 lb (2.50 x D.L.)	500 - 510	00:29 - 01:36	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 201 lb = 1.45 in on an 8 ft rail (96-1/4 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.45" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.45" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	1001 - 1026	00:21 - 01:29	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 4
96-1/4 in by 42 in American Series - Scranton with
3/4 in Square Pickets and No Deck Board Cap
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/04/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 133	00:15 - 01:34	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/04/16			
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 - 129	00:18 - 01:25	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/04/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	1000 - 1024	00:55 - 02:04	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

² Test load dropped below 1003 lbs for a total of 12 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 4 (Continued)

Test No. 4 - Test Date: 01/04/16						
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	00:16	0.02	1.36	0.02	1.34
500 lb (2.50 x D.L.)	500 - 508	00:30 - 01:39	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u>						
Maximum rail deflection at 200 lb = 1.34 in on an 8 ft rail (96-1/4 in)						
Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.34" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.34" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/04/16			
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 (2.50 x D.L.) x 2	998 - 1029	01:08 - 02:17	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

² Test load dropped below 1000 lbs for a total of 2 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 5
96-1/4 in by 42 in American Series - Scranton with 3/4 in Square Pickets and
Deck Board Cap
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/04/16			
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.)	132 - 138	00:11 - 01:22	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/04/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	129 - 134	00:14 - 01:23	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/04/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	999 - 1024	00:38 - 01:46	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with quarter point loading

² Test load dropped below 1003 lbs for a total of 14 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 5 (Continued)

Test No. 4 - Test Date: 01/04/16						
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	00:28	0.02	1.31	0.02	1.29
500 lb (2.50 x D.L.)	500 - 516	00:40 - 01:50	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 200 lb = 1.29 in on an 8 ft rail (96-1/4 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.29" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.29" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/04/16			
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 (2.50 x D.L.) x 2	1002 - 1027	00:46 - 02:12	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 6
96-1/4 in by 42 in American Series with Horizontal Cable Rail Infill,
Two 3/4 in Square Intermediate Support Balusters and Deck Board Cap
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/04/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	125 - 129	00:13 - 01:25	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/04/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Support Balusters			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
250 lb (2.50 x D.L.) x 2	250 - 253	00:49 - 01:59	Sustained load equal to or greater than 125 lb per baluster for one full minute without failure

¹ Load was imposed on both intermediate balusters using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/04/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	982 - 1019	00:39 - 01:47	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

² Test load dropped below 1003 lbs for a total of 15 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 6 (Continued)

Test No. 4 - Test Date: 01/04/16						
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	00:20	0.02	1.48	0.02	1.46
500 lb (2.50 x D.L.)	500 - 516	00:30 - 01:39	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 200 lb = 1.46 in on an 8 ft rail (96-1/4 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.46" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.46" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/04/16			
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 (2.50 x D.L.) x 2	998 - 1021	00:26 - 01:57	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

² Test load dropped below 1000 lbs for a total of 3 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 7
96-1/4 in by 42 in American Series with Horizontal Cable Rail Infill and
Two 3/4 in Square Intermediate Support Balusters
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	134 - 150	00:09 - 01:18	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Support Balusters			
Load Level ¹	Test Load (lb)	E.T. (min:sec)	Result
250 lb (2.50 x D.L.) x 2	257 - 264	00:23 - 01:31	Sustained load equal to or greater than 125 lb per baluster for one full minute without failure

¹ Load was imposed on both intermediate balusters using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	998 - 1014	00:36 - 01:45	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

² Test load dropped below 1003 lbs for a total of 3 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 7 (Continued)

Test No. 4 - Test Date: 01/05/16						
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	00:17	0.02	1.59	0.02	1.57
500 lb (2.50 x D.L.)	501 - 512	00:32 - 01:41	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 200 lb = 1.57 in on an 8 ft rail (96-1/4 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.57" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.57" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	1000 - 1022	00:25 - 01:31	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 8
96-1/8 in by 42 in American Series with Vertical Cable Rail Infill and
Three 1/2 in Diameter Intermediate Support Balusters
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 137	00:47 - 01:56	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Baluster			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	127 – 130	01:32 - 02:40	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	128 - 131	00:12 - 01:20	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 4 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Baluster			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	125 – 131	00:12 - 01:19	Sustained load equal to or greater than 125 lb for one full minute without failure

4.7 Test Results (Continued)

Test Series No. 8 (Continued)

Test No. 5 - Test Date: 01/05/16 Design Load: 50 plf x (96-1/8 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	1001 - 1034	00:48 - 01:55	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

² Test load dropped below 1003 lbs for a total of 1 second during the one minute hold period.

Test No. 6 - Test Date: 01/05/16 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	00:20	0.02	1.67	0.01	1.66
500 lb (2.50 x D.L.)	501 - 507	00:31 - 01:39	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 200 lb = 1.66 in on an 8 ft rail (96-1/8 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.125}{96}\right) = 2.5" > 1.66" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.66" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 7 - Test Date: 01/05/16 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 (2.50 x D.L.) x 2	1000 - 1033	00:29 - 01:38	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 9
96-1/4 in by 42 in Keystone Series (Scranton) with 3/4 in Square Pickets
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/04/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	127 - 131	00:39 - 01:45	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/04/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Two Pickets			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 133	00:08 - 01:16	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	998 - 1039	00:31 - 01:54	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

² Test load dropped below 1003 lbs for a total of 5 seconds during the one minute hold period.

Note: During the initial uniform load test, the top rail bracket cracked upon reaching the test load. The specimen was able to hold the load for the prescribed 1 minute period however. The cracked bracket was replaced with a new bracket which was revised to include larger holes (19/64 in diameter) for the bracket to rail fasteners. The uniform load test was repeated with no signs of cracking/failure and the results are reported in the table above.

4.7 Test Results (Continued)

Test Series No. 9 (Continued)

Test No. 4 - Test Date: 01/05/16						
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.)	203	00:27	0.01	1.28	0.02	1.27
500 lb (2.50 x D.L.)	503 - 512	00:41 - 01:52	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 203 lb = 1.27 in on an 8 ft rail (96-1/4 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.27" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.27" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	987 - 1057	00:19 - 01:34	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

² Test load dropped below 1003 lbs for a total of 7 seconds during the one minute hold period.

4.7 Test Results (Continued)

Test Series No. 10
96-1/4 in by 42 in Keystone Series with Horizontal Cable Rail Infill and
Two 3/4 in Square Intermediate Support Balusters
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	131 - 142	00:18 - 01:25	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Support Balusters			
Load Level¹	Test Load (lb)	E.T. (min:sec)	Result
250 lb (2.50 x D.L.) x 2	253 - 259	00:31 - 01:38	Sustained load equal to or greater than 125 lb per baluster for one full minute without failure

¹ Load was imposed on both intermediate balusters using a spreader beam; therefore, loads were doubled.

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	1003 - 1020	00:29 - 01:39	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with four equal point loads.

4.7 Test Results (Continued)

Test Series No. 10 (Continued)

Test No. 4 - Test Date: 01/05/16						
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.)	205	00:18	0.02	1.36	0.02	1.34
500 lb (2.50 x D.L.)	502 - 513	00:30 - 01:39	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u> Maximum rail deflection at 205 lb = 1.34 in on an 8 ft rail (96-1/4 in) Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.34" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.34" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 5 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	997 - 1033	00:19 - 01:27	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

² Test load dropped below 1000 lbs for a total of 1 second during the one minute hold period.

Test No. 6 - Test Date: 01/05/16		
Concentrated Load at Center of Cable Infill to Failure		
Ultimate Load (lb)	E.T. (min:sec)	Mode of Failure
1020	01:26	Top rail brackets began to crack and intermediate support baluster bracket fastener began to withdraw

4.7 Test Results (Continued)

Test Series No. 11
96-1/8 in by 42 in *Keystone Series* with Vertical Cable Rail Infill and
Three 1/2 in Diameter Intermediate Support Balusters
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Cable Infill			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 130	00:13 - 01:21	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Intermediate Support Baluster			
Load Level¹	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	125 - 131	00:16 - 01:26	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Intermediate Support Baluster			
Load Level¹	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	130 - 134	00:16 - 01:25	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 4 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Cable Infill			
Load Level¹	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	127 - 131	00:10 - 01:18	Sustained load equal to or greater than 125 lb for one full minute without failure

4.7 Test Results (Continued)

Test Series No. 11 (Continued)

Test No. 5 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/8 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load ² (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	1001 - 1018	00:30 - 01:39	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with quarter point loading

² Test load dropped below 1003 lbs for a total of 5 seconds during the one minute hold period.

Test No. 6 - Test Date: 01/05/16						
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.)	203	00:15	0.02	1.57	0.01	1.56
500 lb (2.50 x D.L.)	501 - 507	00:25 - 01:35	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			

Deflection Evaluation:

Maximum rail deflection at 203 lb = 1.56 in on an 8 ft rail (96-1/8 in)

Limits per AC273 ²: $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.125}{96}\right) = 2.5" > 1.56" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.56" \therefore \text{ok}$

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 7 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	1000 - 1036	00:25 - 01:33	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.7 Test Results (Continued)

Test Series No. 12
96-1/4 in by 42 in *Keystone Series (3-Rail)* with 3/4 in Square Pickets
IBC – All Use Groups / ICC-ES™ AC273

Test No. 1 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Center of Balusters			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	129 - 133	00:11 - 01:20	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 2 - Test Date: 01/05/16			
Design Load: 50 lb / 1 Square ft of In-Fill at Bottom of Balusters			
Load Level¹	Test Load (lb)	E.T. (min:sec)	Result
125 lb (2.50 x D.L.)	126 - 132	00:18 - 01:25	Sustained load equal to or greater than 125 lb for one full minute without failure

Test No. 3 - Test Date: 01/05/16			
Design Load: 50 plf x (96-1/4 in ÷ 12 in/ft) = 401 lb Uniform Load at 45° from Horizontal on Top Rail ¹			
Load Level	Test Load (lb)	E.T. (min:sec)	Result
1003 lb (2.50 x D.L.)	1001 - 1026	00:38 - 01:45	Sustained load equal to or greater than 1003 lb for one full minute without failure

¹ Uniform load was simulated with quarter point loading

4.7 Test Results (Continued)

Test Series No. 12

Test No. 4 - Test Date: 01/05/16						
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.)	203	00:19	0.01	1.04	0.05	1.01
500 lb (2.50 x D.L.)	500 - 513	00:27 - 01:36	Result: Withstood load equal to or greater than 500 lb for one full minute without failure			
<u>Deflection Evaluation:</u>						
Maximum rail deflection at 203 lb = 1.01 in on an 8 ft rail (96-1/4 in)						
Limits per AC273 ² : $\left(\frac{h}{24} + \frac{l}{96}\right) = \left(\frac{36}{24} + \frac{96.25}{96}\right) = 2.5" > 1.01" \therefore \text{ok}$ and $\frac{h}{12} = \frac{36}{12} = 3.0" > 1.01" \therefore \text{ok}$						

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

² Deflection limit calculation based on worse case 36" railing height to satisfy One- and Two-Family Dwelling requirements.

Test No. 7 - Test Date: 01/05/16			
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 (2.50 x D.L.) x 2	1000 - 1033	00:24 - 01:32	Each end withstood load equal to or greater than 500 lb for one full minute without failure.

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

4.8 Summary and Conclusions

The railing assemblies reported herein meet the structural performance requirements of Section 4.2 of ICC-ES™ AC273 for use in IBC- All Use Groups Applications as installed between adequate supports with guardrail details and Occupancy Classification as shown in the following table:

Guardrail System	Guardrail Type	Rail Length ¹ and Height ²	Infill	No. of Support Blocks	No. of Intermediate Balusters	Code Occupancy
<i>Outlook</i>	Level; In-Line	72 in by 40-1/8	5/8 in Square Picket	1	N/A	IBC – All Use Groups
<i>Arabian</i>		96-1/4 in by 39-3/4 in	Horizontal Cable	N/A	(2) 3/4 in Square	
<i>Arabian (Scranton)</i>		96-1/4 in by 40 in	3/4 in Square Pickets	1	N/A	
<i>American (Scranton)</i>		96-1/4 in by 40 in		1	N/A	
		96-1/4 in by 40 in		1	N/A	
<i>American</i>		96-1/4 in by 39-1/4 in	Horizontal Cable	N/A	(2) 3/4 in Square	
		96-1/4 in by 39-1/4 in				
		96-1/8 in by 40 in	Vertical Cable	N/A	(3) 1/2 in Diameter	
<i>Keystone (Scranton)</i>		96-1/4 in by 40 in	3/4 in Square Pickets	1	N/A	
<i>Keystone</i>		96-1/4 in by 39-3/4 in	Horizontal Cable	N/A	(2) 3/4 in Square	
		96-1/8 in by 40 in	Vertical Cable		(3) 1/2 in Diameter	
<i>Keystone (3 Rail)</i>		96-1/4 in by 39-3/4 in	3/4 in Square Pickets	1	N/A	

¹ Overall top rail length (inside of post to inside of post)

² Overall rail height (bottom of bottom rail or cable to top of top rail)

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 conducted and reported herein was for the purpose of preliminary (research and development) purposes only. Additional testing is required in order to specify the products as ICC-ES™ AC273 compliant.

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:

Adam J. Schrum
Lead Technician

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

AJS:vtm/jas

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A - Drawings (30)

Appendix B - Photographs (12)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	07/05/16	N/A	Original report issue



F3320.01-119-19

APPENDIX A

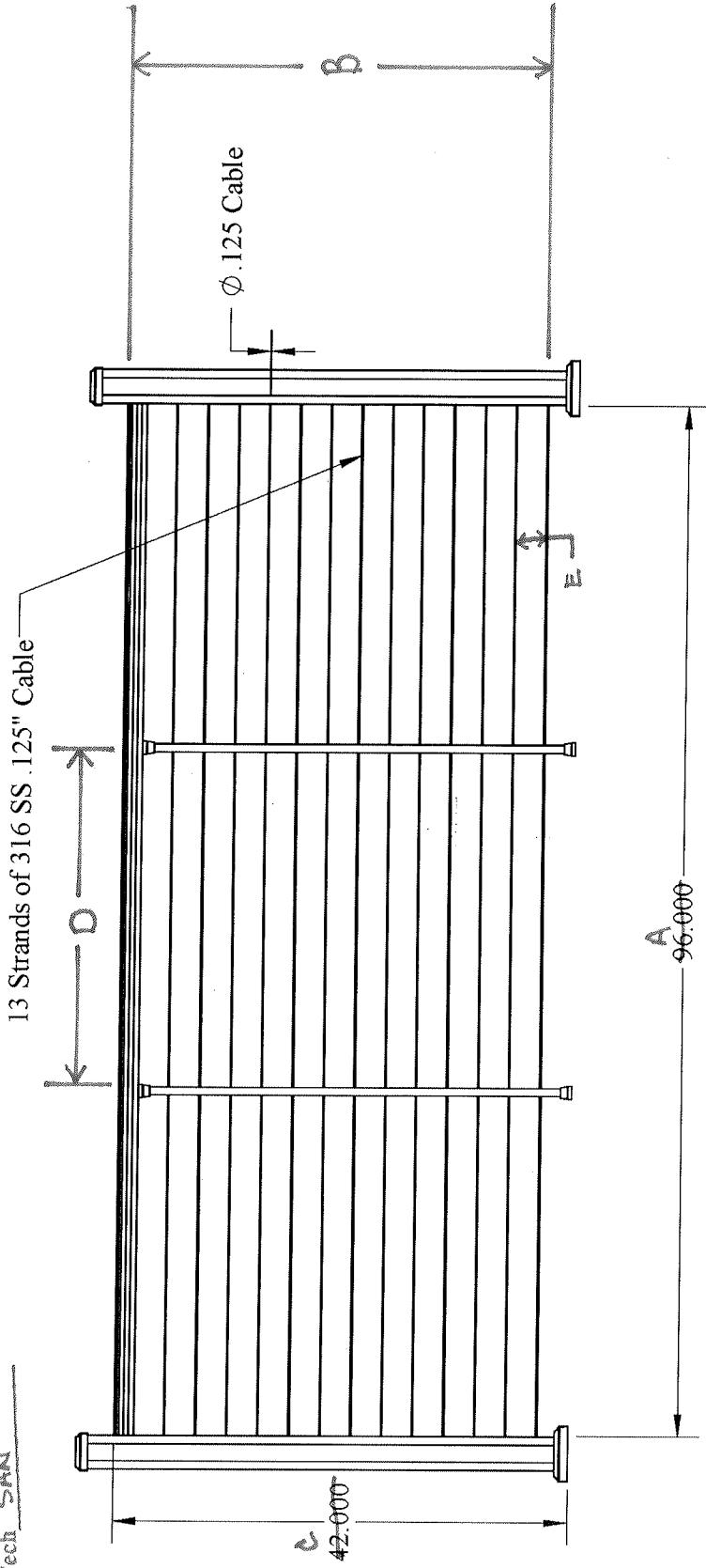
Drawings



Test sample complies with these details.
Deviations are noted.

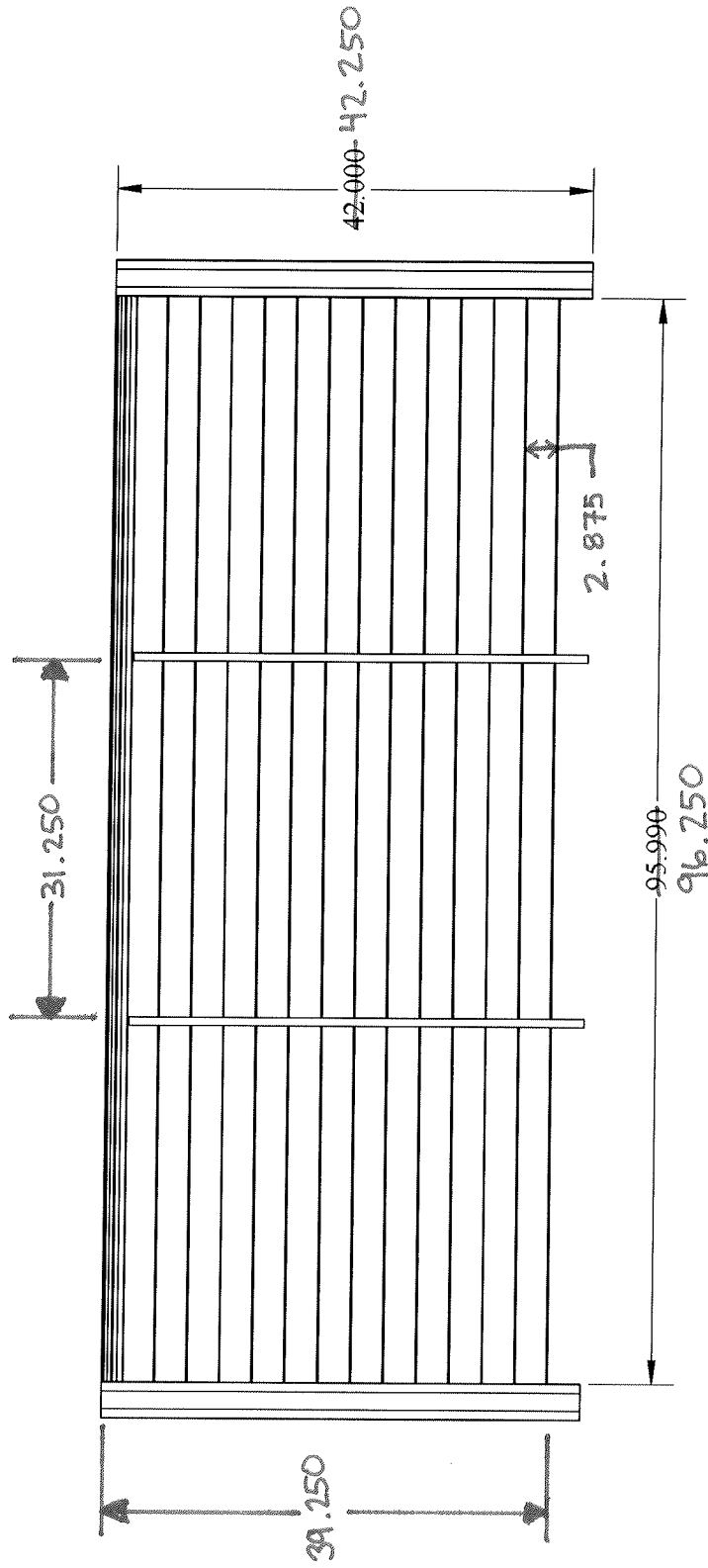
Report # F3320.01-119-19

Date 5/3/16 Tech SAM



SYSTEM	DIMENSIONS				
	A	B	C	D	E
KEYSTONE	96.250	39.750	42.50	32.00	2.875
AMERICAN	96.250	39.250	42.25	31.25	2.875
ARABIAN	96.250	39.750	42.50	32.00	2.875

 www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Cable Railing	
PART OR ASSEM: Keystone, American, & Arabian		SIZE: A
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SCALE: 1:16	WT: lbs	BY:
		SHEET 1 OF 25




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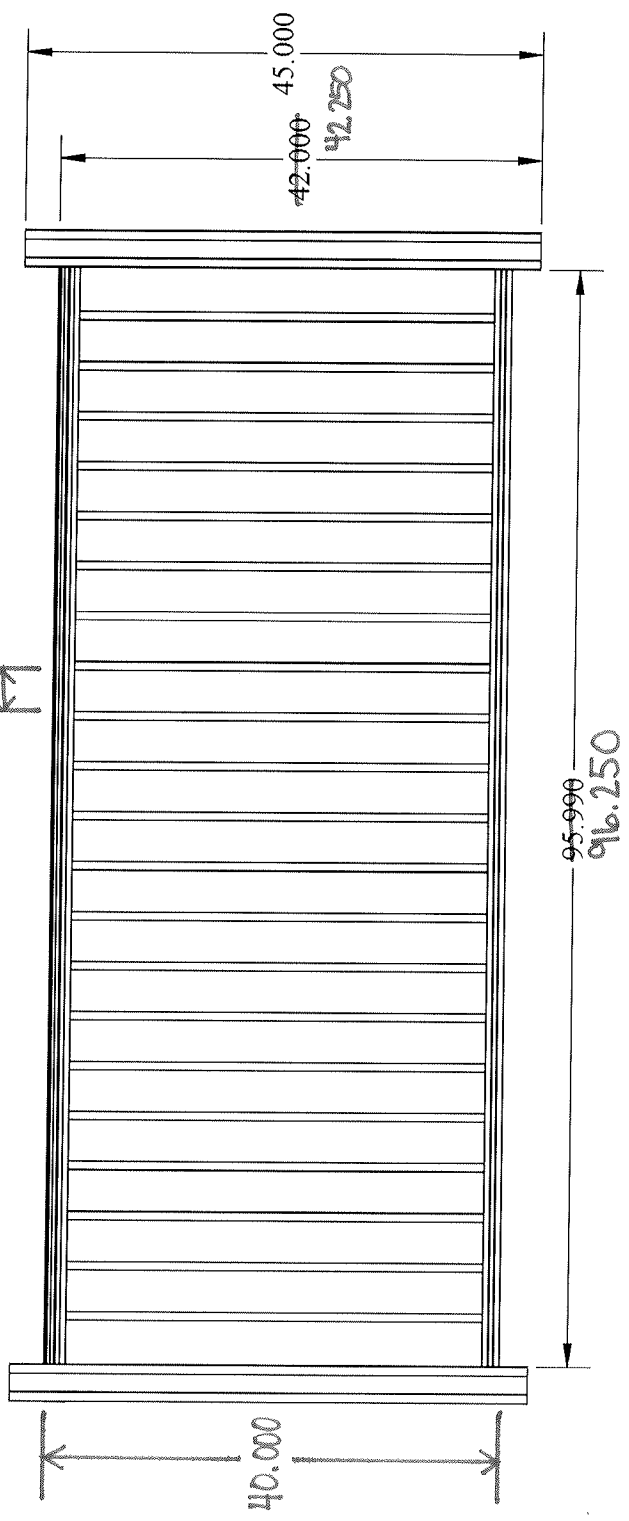
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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: 8'x42" Cable Rail Deck Board Cap	
PART OR ASSEM: Keystone, American, & Arabiant[®]	
SIZE A	PART NUMBER: REV
SCALE: 1:16	WT: lbs BY:
SHEET 2 OF 25	

Architectural Testing
 Test sample complies with these details.
 Deviations are noted.

Report # F3320.01-119-19
 Date 5/3/16 Tech SAN


3.625



Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

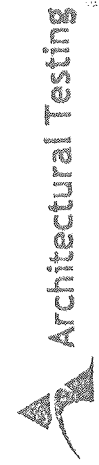
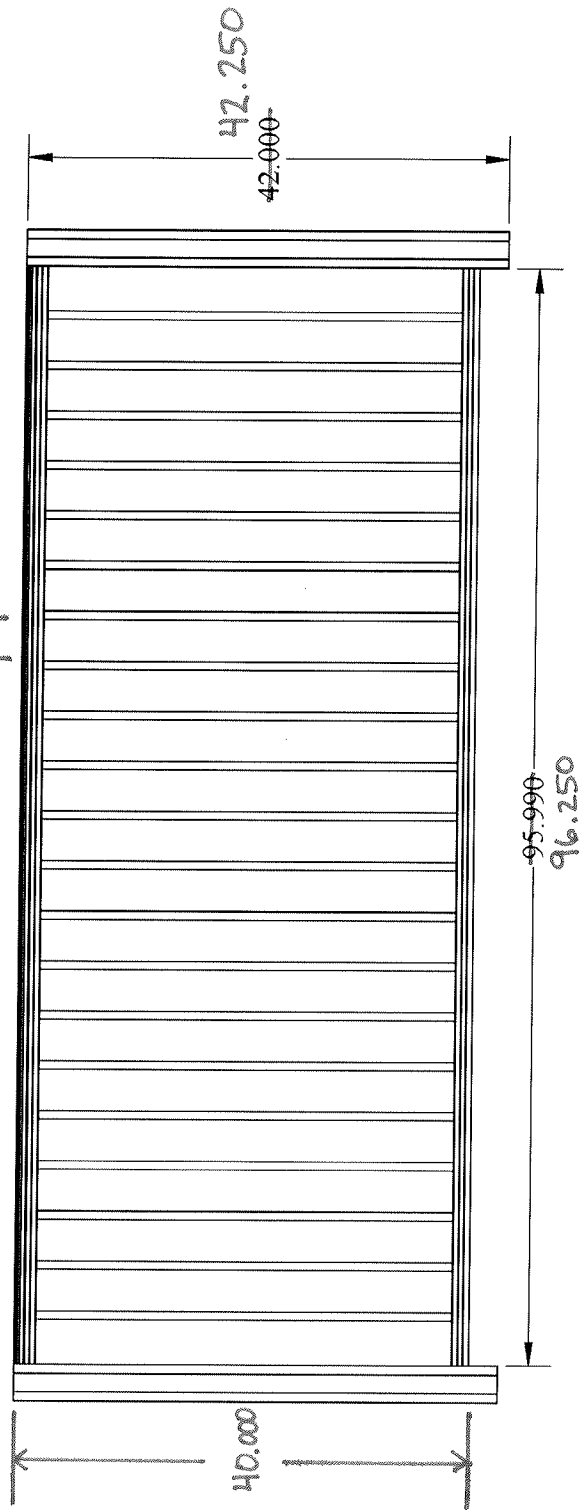
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TITLE: 8'x42" Railing	
PART OR ASSEM: Keystone, American, & Arabian	REV
SIZE: A	PART NUMBER:
SCALE: 1:16	WT: lbs
BY:	SHEET 3 OF 25

3.625



Test sample complies with these details.
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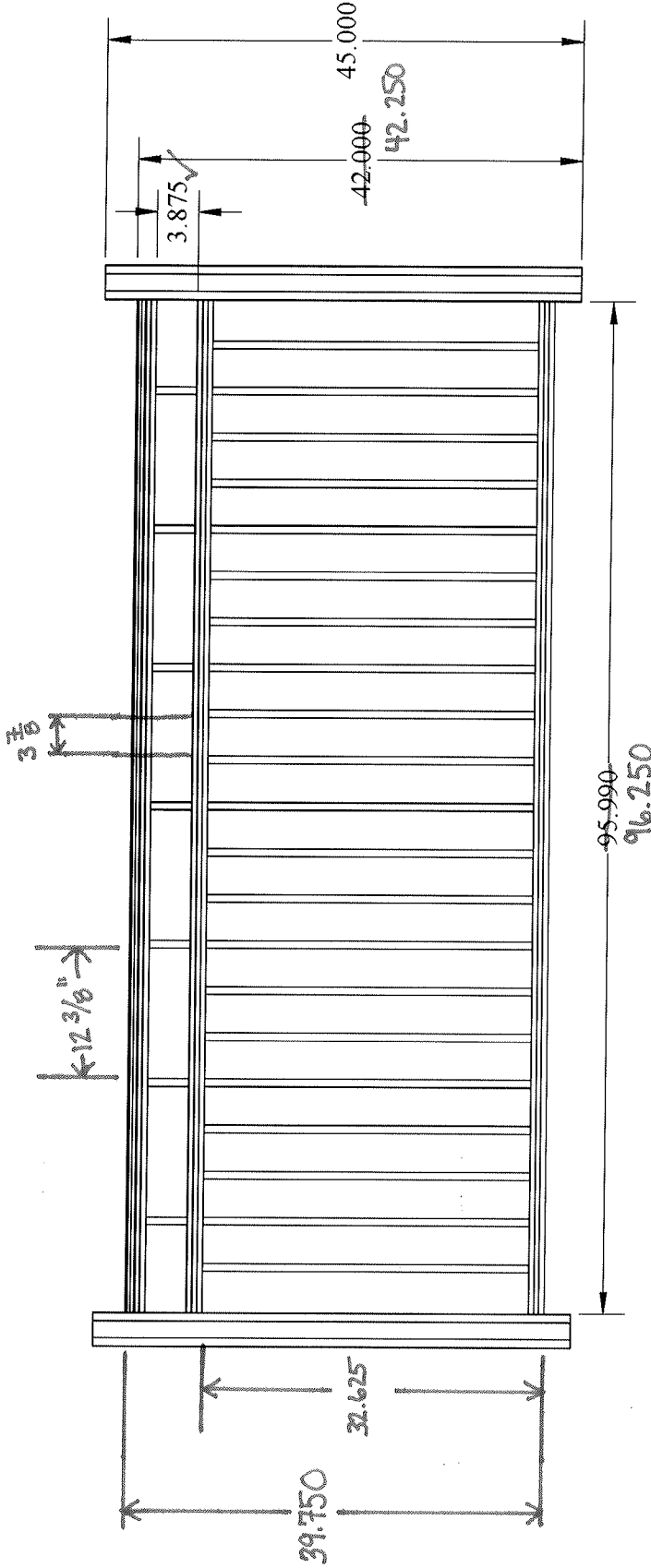
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TITLE: 8'x42" Rail with Deck Board Cap	
PART OR ASSEM: Keystone ; American, & Arabian	REV
SIZE A	PART NUMBER:
SCALE: 1:16	WT: lbs
BY:	SHEET 4 OF 25



Test sample compiles with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/3/16 Tech SAW

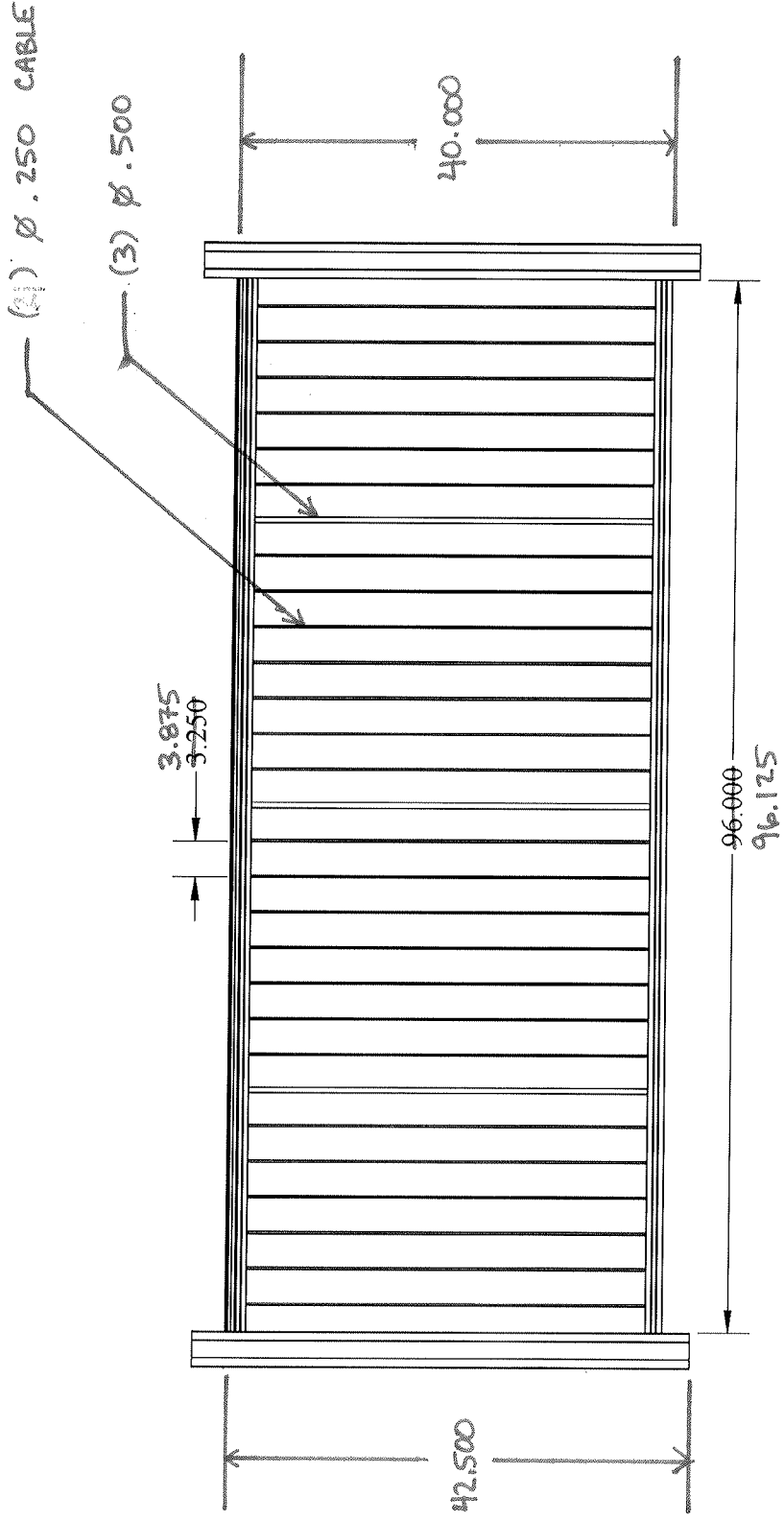




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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: 8"x42" 3 Rail	
PART OR ASSEM: Keystone	
SIZE: A	PART NUMBER: REV
SCALE: 1:16	WT: lbs
BY:	SHEET 5 OF 25




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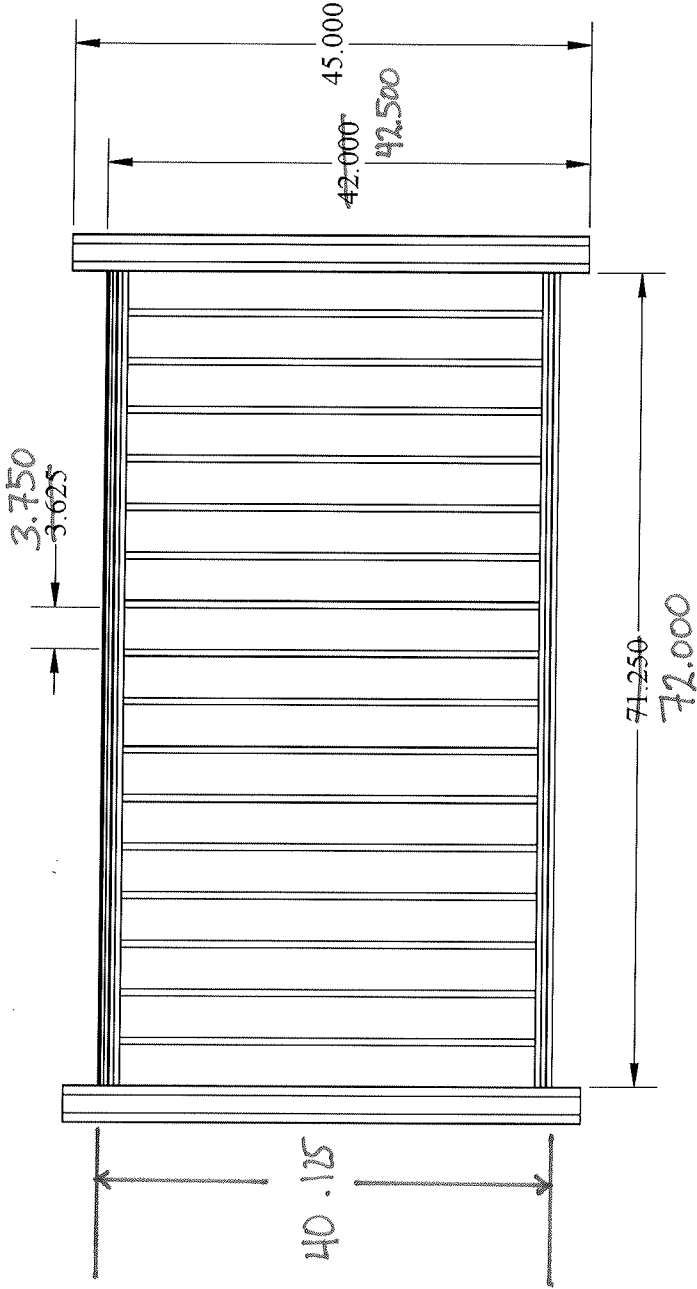
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TITLE: 8'x42" Vertical Cable Railing	
PART OR ASSEM: American	
SIZE A	PART NUMBER: REV
SCALE: 1:16	WT: lbs BY:
SHEET 6 OF 25	


Architectural Testing
 Test sample complies with these details.
 Deviations are noted.
 Report # F3320.01-119-19
 Date 5/3/16 Tech SAN

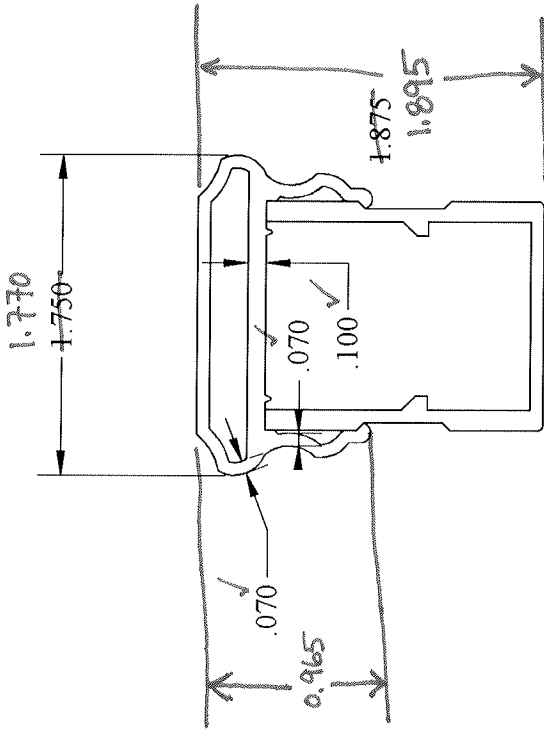
Test sample complies with these details.
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	TITLE: 6"x42" Railing		
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	SIZE A	PART NUMBER:	
SCALE: 1:16	WT: lbs	BY:	SHEET 8 OF 25



Test sample complies with these details.
 Deviations are noted.

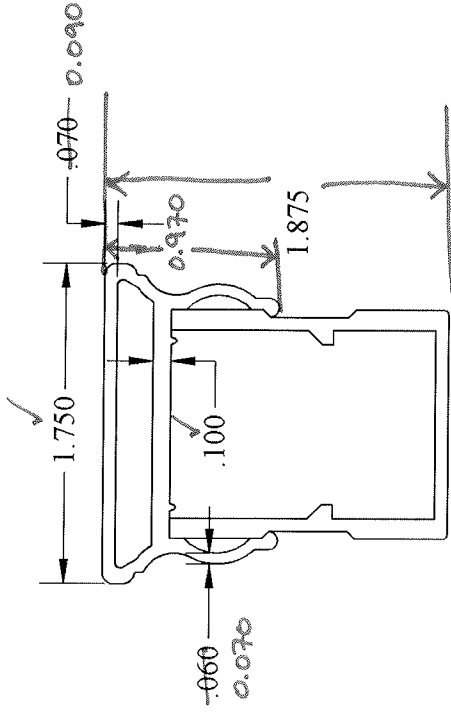
Report # F3320.01-119-19

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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: Keystone Rail	
PART OR ASSEM:	
SIZE	PART NUMBER:
A	REV
SCALE: 1:1	WT: lbs
	BY:
	SHEET 21 OF 25

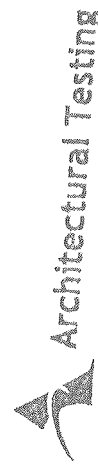


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Report # F3320.01-119-19

Date 5/2/16 Tech SAN

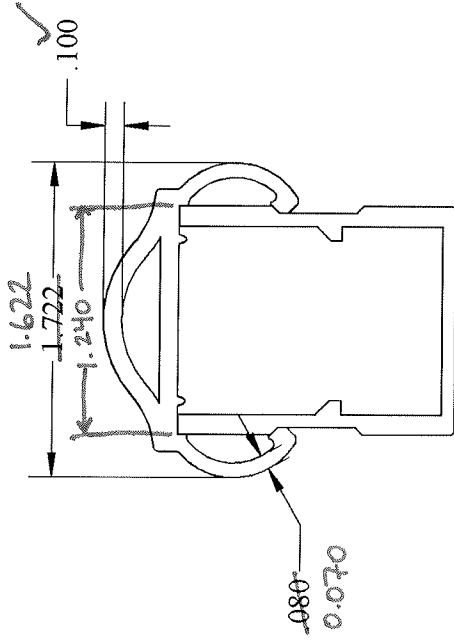
 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: American Rail	
PART OR ASSEM:		
MATERIAL: 6105-T6	SIZE: A	PART NUMBER: REV
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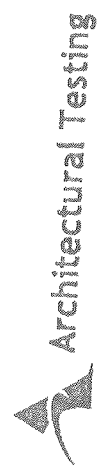
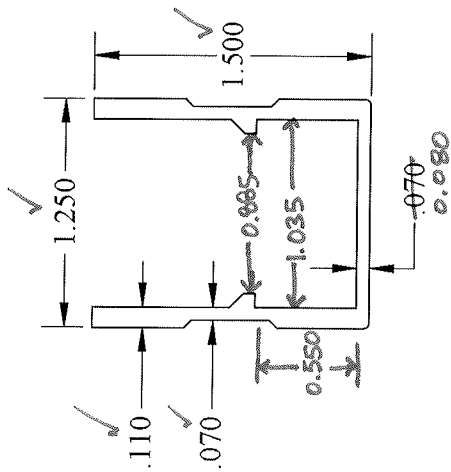
Test sample complies with these details.
Deviations are noted.

Report # F 3320-01-119-19

Date 5/2/16 Tech SAN



 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Arabian Rail	
PART OR ASSEM:		
MATERIAL: 6105-T6	SIZE: A	PART NUMBER: REV
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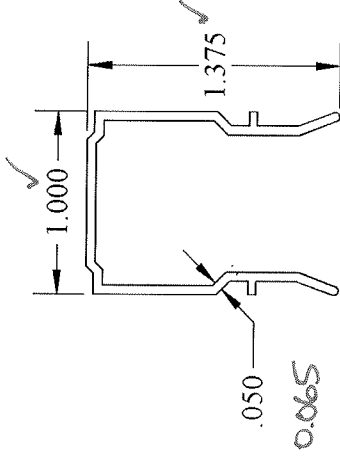


Test sample complies with these details.
Deviations are noted.

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Date 5/2/16 Tech SAN

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Bottom Rail	
PART OR ASSEM: Keystone, Arabian, & American		
MATERIAL: 6105-T6	SIZE: A	PART NUMBER: REV
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		SHEET 24 OF 25




Architectural Testing

Test sample complies with these details.
Deviations are noted.

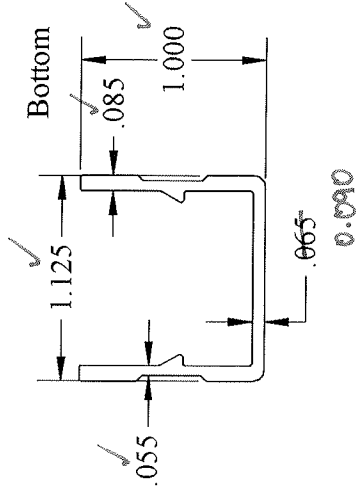
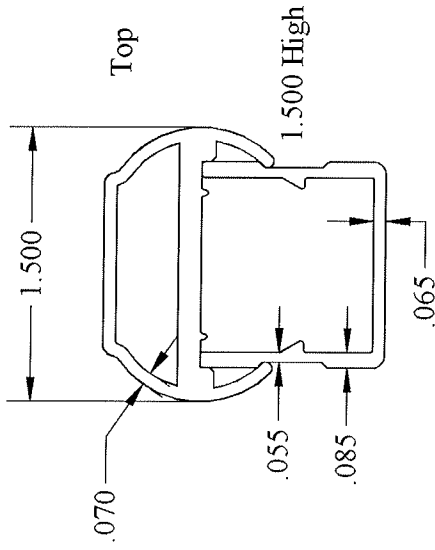
Report # F3320.01-119-19

Date 5/24/16 Tech SAN


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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: Keystone, Arabian, American Rail Channel	
PART OR ASSEM:	
SIZE A	PART NUMBER: REV
SCALE: 1:1	WT: lbs BY: SHEET 29 OF 31

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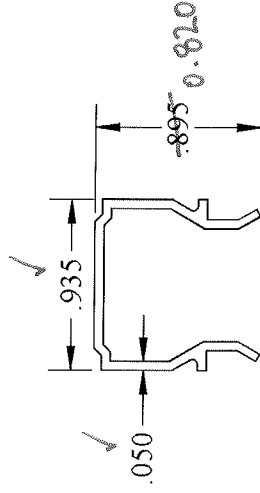
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # F3320.01-19-19

Date 5/24/16 Tech SAN

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Outlook Rail	
PART OR ASSEM:		
MATERIAL: 6105-T6	SIZE: A	PART NUMBER:
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SCALE: 1:1	WT: lbs	BY:
		SHEET 21 OF 31



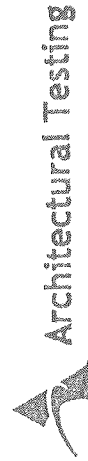
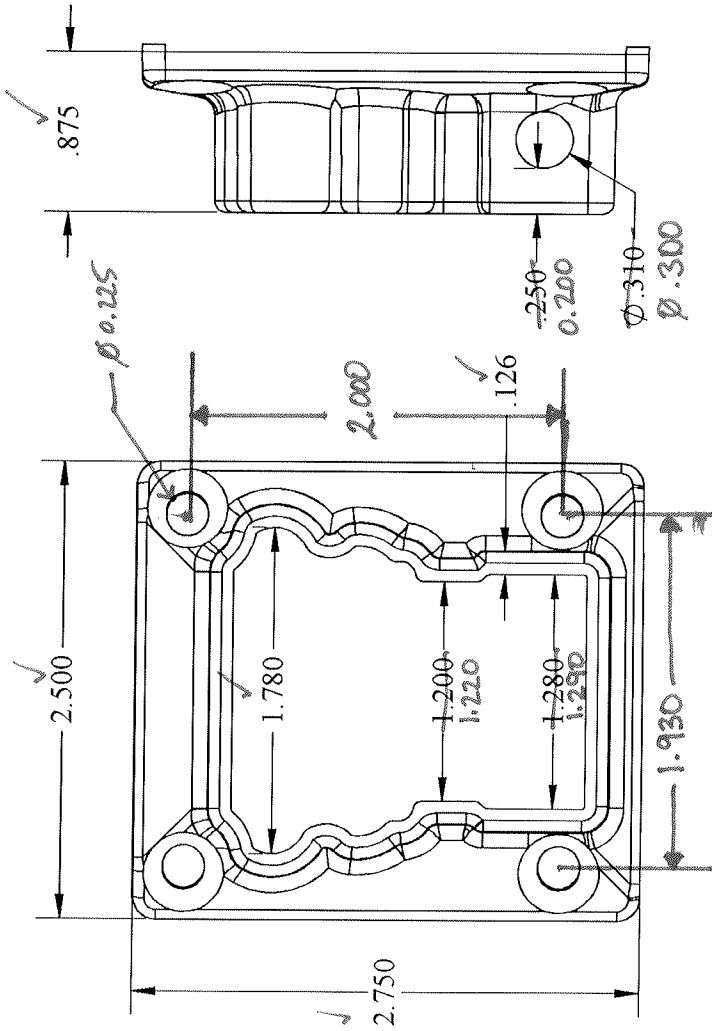
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/24/16 Tech SAU

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Outlook Rail Channel	
PART OR ASSEM:		
MATERIAL: PVC	SIZE: A	PART NUMBER: REV
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Report # F3320.01-119-19

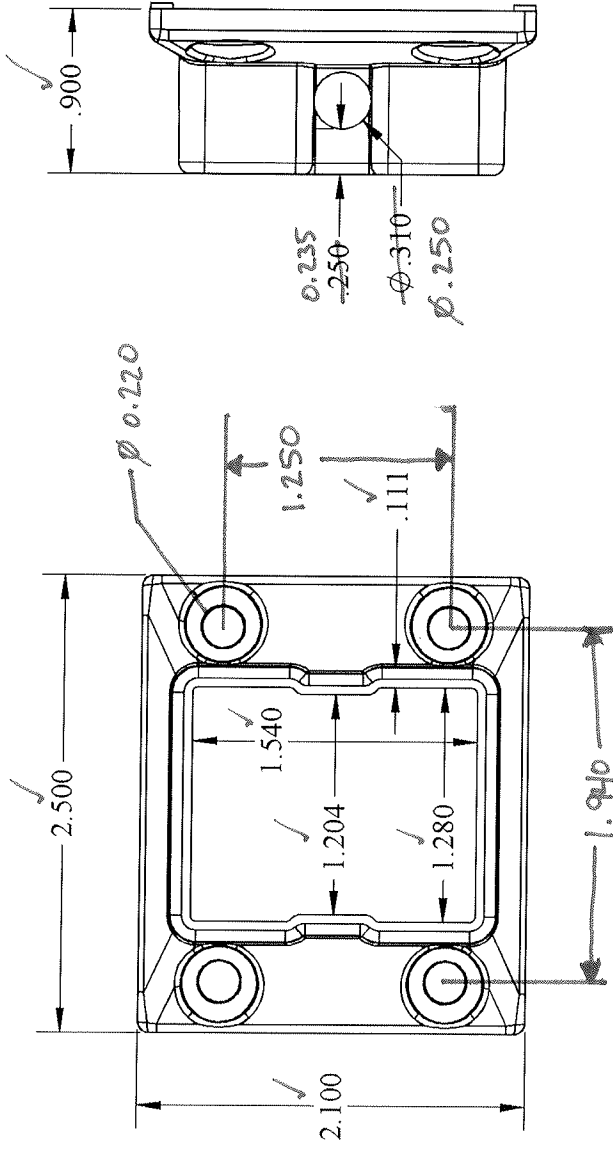
Date 5/2/16 Tech SAN



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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557		TITLE: Top Straight Bracket	
PART OR ASSEM: Keystone		PART NUMBER: 04	
SIZE A	WT: lbs	BY: Benueel Kauffman	SHEET 15 OF 25
SCALE: 1:1	REV	BY: Benueel Kauffman	

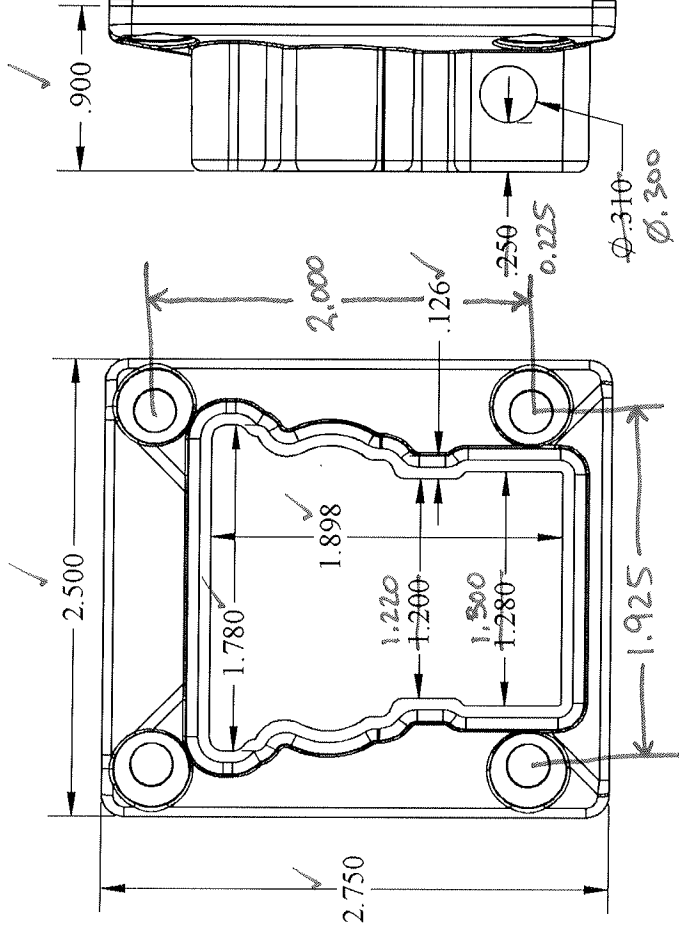


Test sample complies with these details.
Deviations are noted.

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	TITLE: Bottom Straight Bracket	
PART OR ASSEM: Keystone, Arabian, & American Railing		
MATERIAL: A360-1 Die Cast	SIZE: A	PART NUMBER: 04
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SCALE: 1:1	WT: 0.08290lbs	BY: Chris Wenger
		SHEET 16 OF 25





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MATERIAL: A360-1 Die Cast

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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: Straight Mounting Bracket	
PART OR ASSEM: American Railing	
SIZE: A	PART NUMBER:
SCALE: 1:1	REV: 08
WT: 0.09230lbs	BY: Chris Wenger
WT: 0.09230lbs	SHEET 12 OF 25

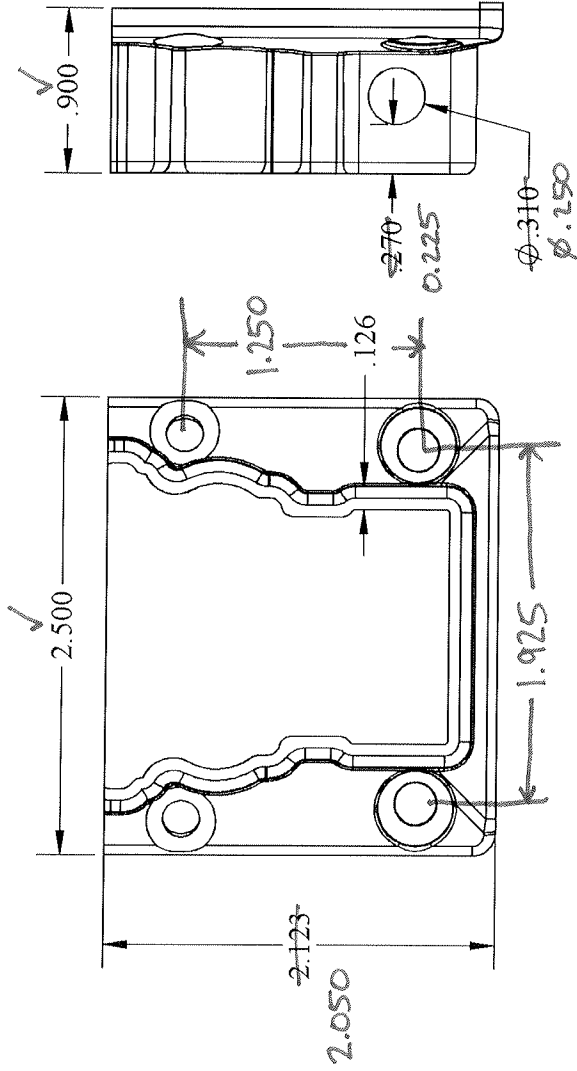

Architectural Testing

 Test sample complies with these details.

 Deviations are noted.

 Report # F3320.01-119-19

 Date 5/2/16 Tech SAN



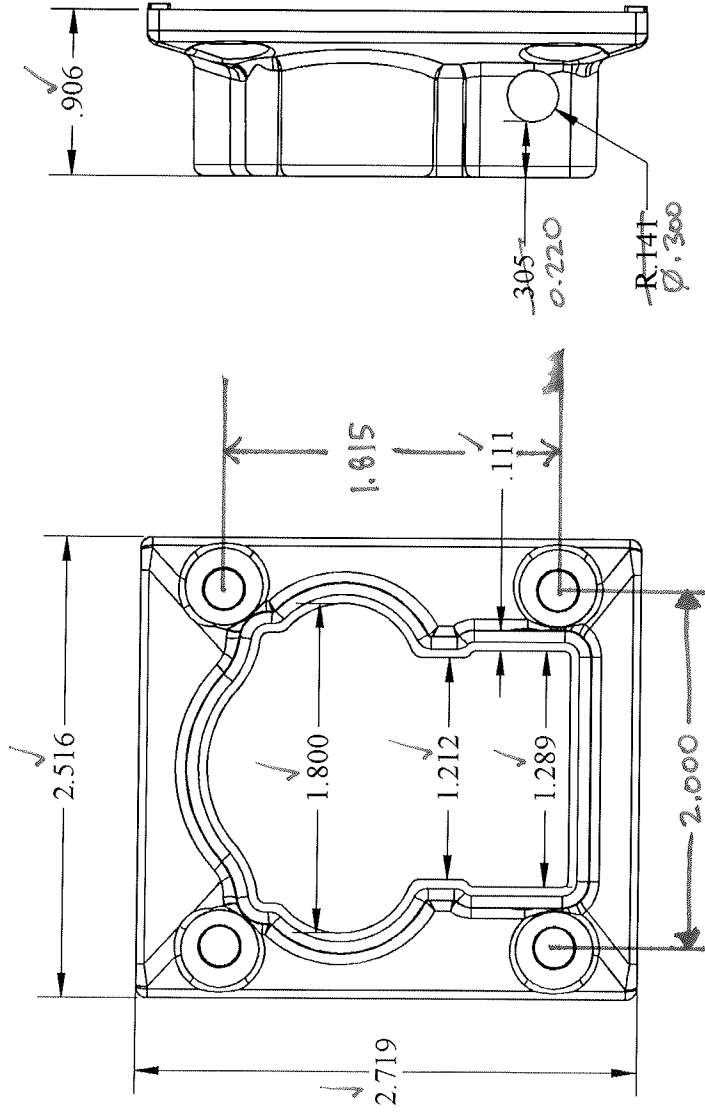
Test sample complies with these details.
Deviations are noted.

Report # F3720.01-119-19

Date 5/2/16 Tech SAN


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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: Straight Deck Cap Mounting Bracket	
PART OR ASSEM: American Railing	
SIZE A	PART NUMBER: 08
SCALE: 1:1	WT: 0.09230lbs BY: Chris Wenger
SHEET 13 OF 25	



Test sample complies with these details.
 Deviations are noted.

Report # F3320.01-119-19

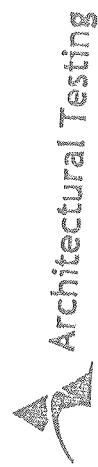
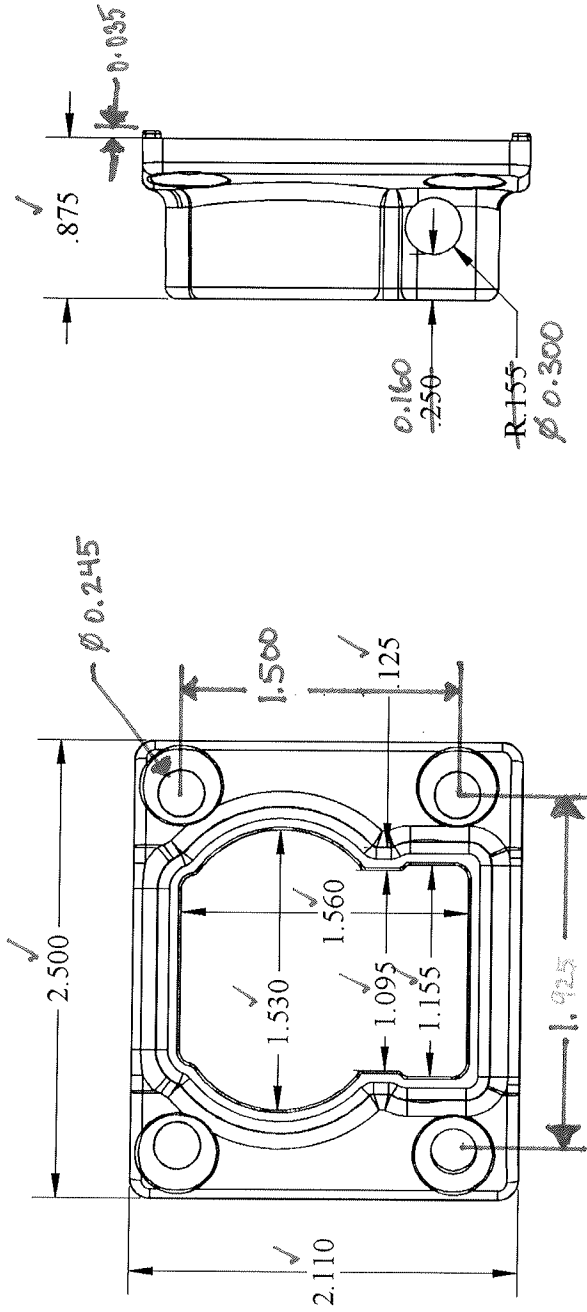
Date 5/2/16 Tech SAN



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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: Arabian Top Level Bracket	
PART OR ASSEM:	
SIZE A	PART NUMBER: 04
SCALE: 1:1	WT.: lbs BY: Benuel Kauffman
SHEET 14 OF 25	

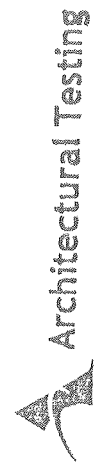
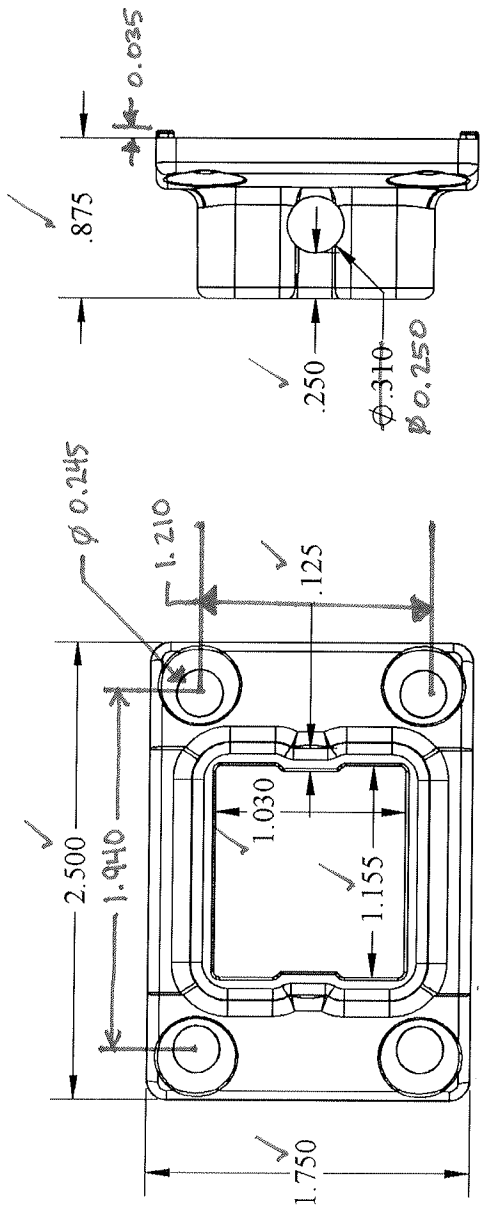


Test sample complies with these details.
Deviations are noted.

Report # F3320-01-119-19

Date 5/2/16 Tech SAW

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Outlook Top Straight Bracket	
PART OR ASSEM:		
MATERIAL: A360-1 Die Cast	SIZE: A	PART NUMBER: 0.03878
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		
SCALE: 1:1	WT: lbs	BY: Benuei Kauffman
		REV: 03
		SHEET 10 OF 25



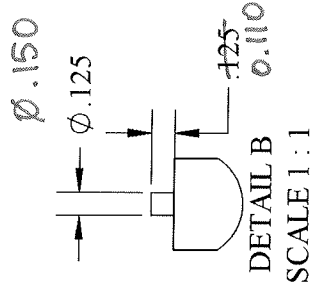
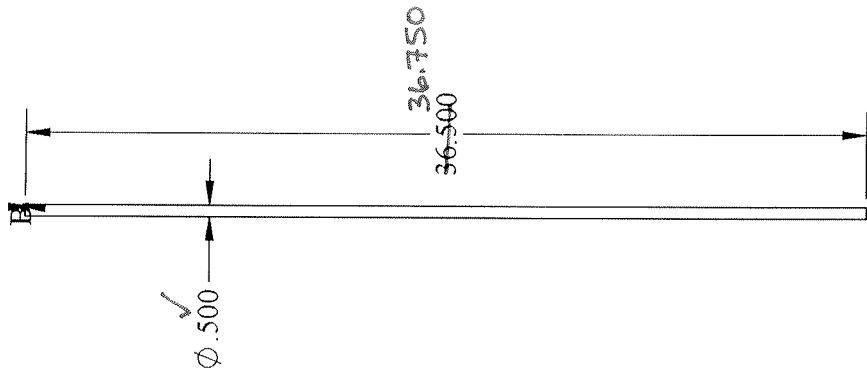
Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/2/16 Tech SAN.


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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE: Bottom Bracket	
PART OR ASSEM: Outlook	
SIZE: A	PART NUMBER: 02
SCALE: 1:1	WT: lbs
BY: Benueel Kauffman	
SHEET 11 OF 25	



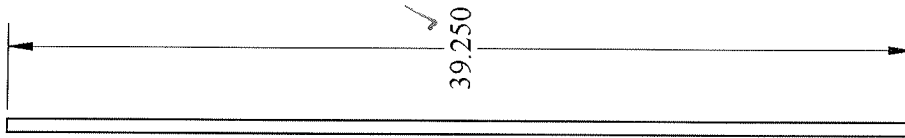
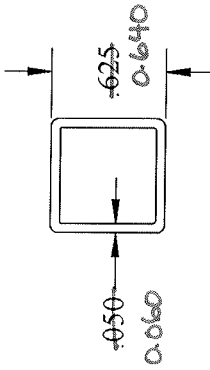
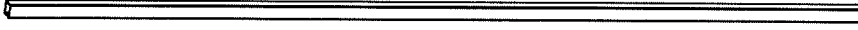
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/26/16 Tech SAN

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: AISI 316 Annealed Stainless Steel Bar (SS)	
PART OR ASSEM: PART OR ASSEM:		
MATERIAL:	SIZE A	PART NUMBER: 11
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		REV 11
SCALE: 1:8		BY: Chris Wenger
WT: lbs		SHEET 7 OF 31



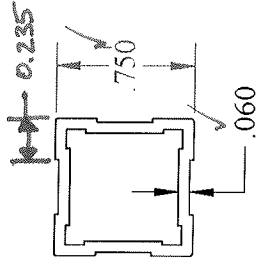
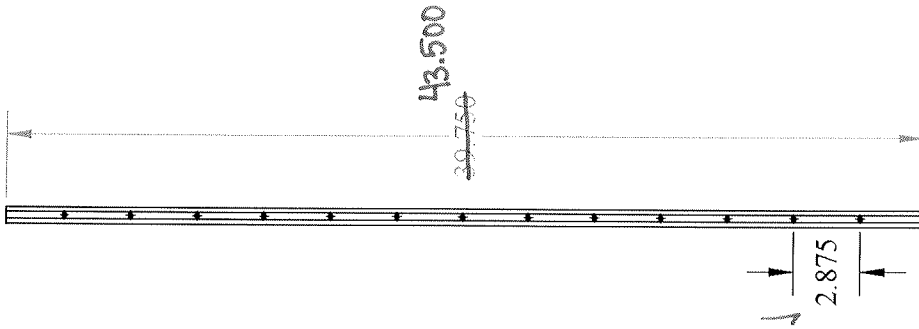
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # F3320.01-19-19

Date 5/24/16 Tech SAJ

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE:	
MATERIAL:		
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		
PART OR ASSEM: SIZE A	PART NUMBER: REV	WT: lbs BY:
SCALE: 1:8		SHEET 27 OF 31



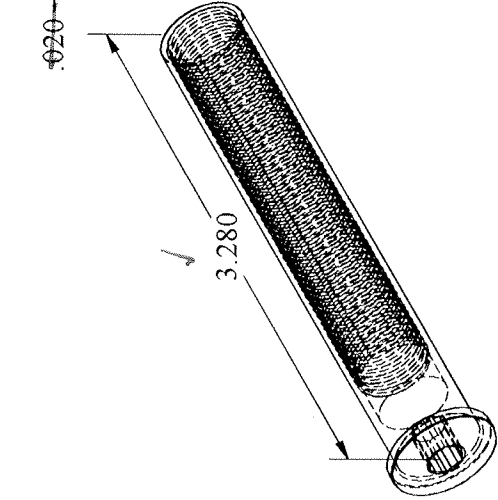
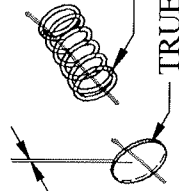
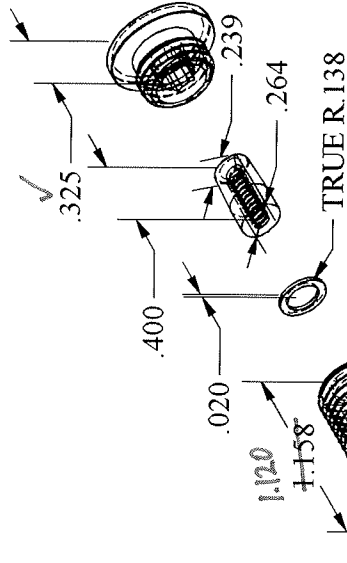
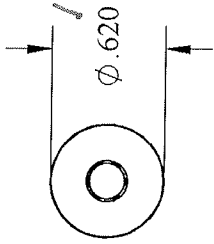
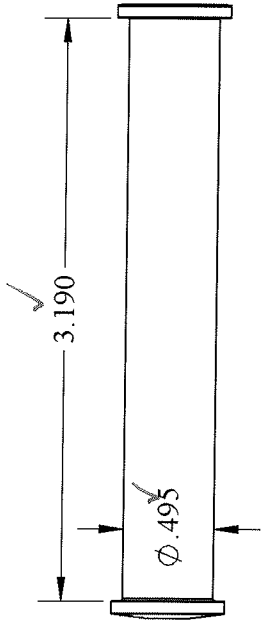
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/24/16 Tech SAW

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Cable Rail Baluster	
PART OR ASSEM:		
MATERIAL: 6063-T6	SIZE: A	PART NUMBER: REV
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		SCALE: 1:1 WT: lbs BY:
		SHEET 19 OF 31




Architectural Testing

Test sample complies with these details.
 Deviations are noted.

Report # F 3320.01-119-19

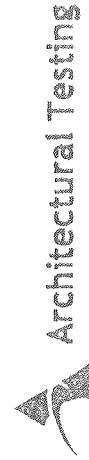
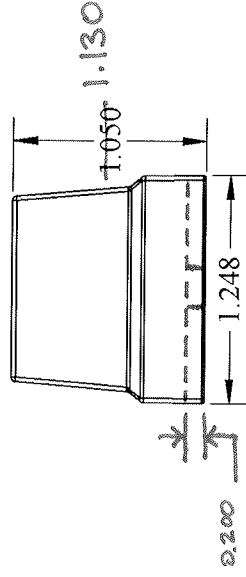
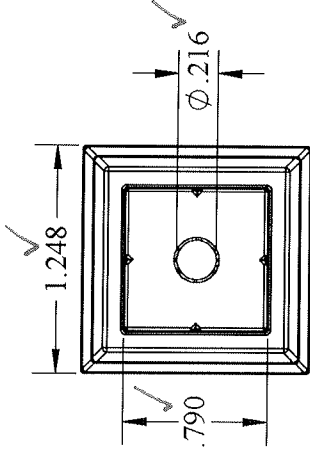
Date 5/24/16 Tech SAN


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 www.superiorplasticproducts.com

MATERIAL:

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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557		TITLE:
PART OR ASSEM:		REV
SIZE A	PART NUMBER:	29
SCALE: 1:1	WT: lbs	BY: Earl Wenger
		SHEET 18 OF 31

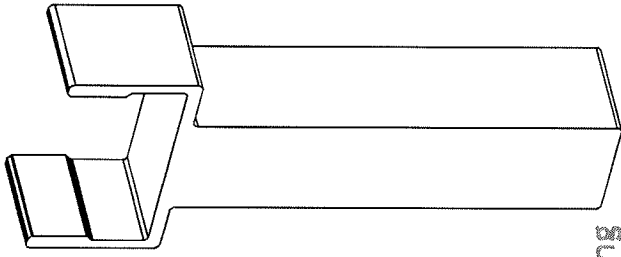


Test sample complies with these details.
Deviations are noted.

Report # F 3320.01-119-19

Date 5/2/16 Tech SAN

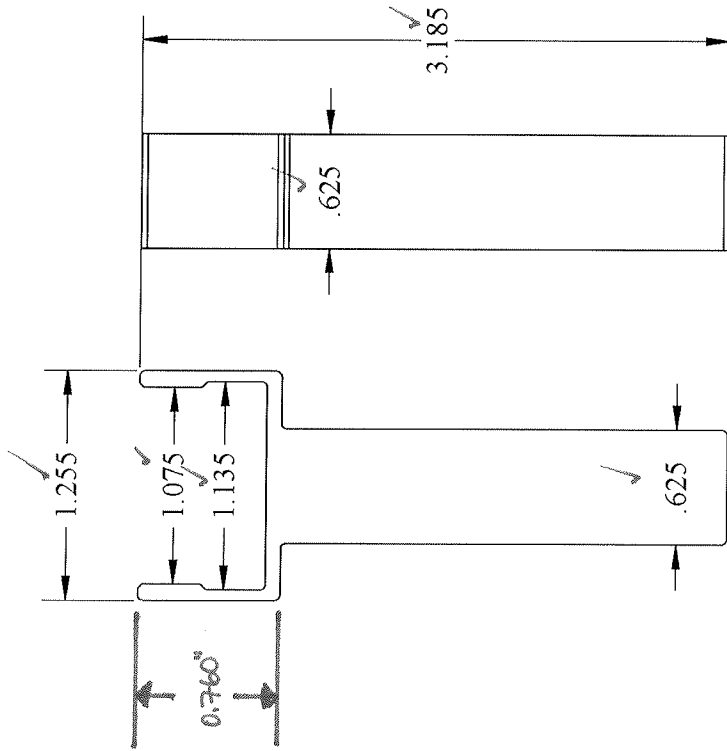
 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: Baluster Mount	
PART OR ASSEM:		
MATERIAL: A360-1	SIZE: A	PART NUMBER: 08
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		
SCALE: 1:1	WT: lbs	BY: Benueel Kauffman
		SHEET 19 OF 25



Test sample complies with these details.
Deviations are noted.

Report # F3320-01-119-19

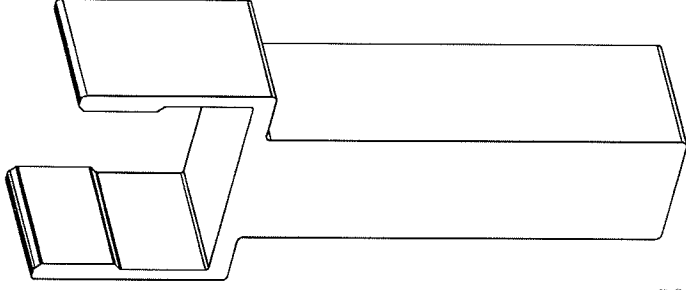
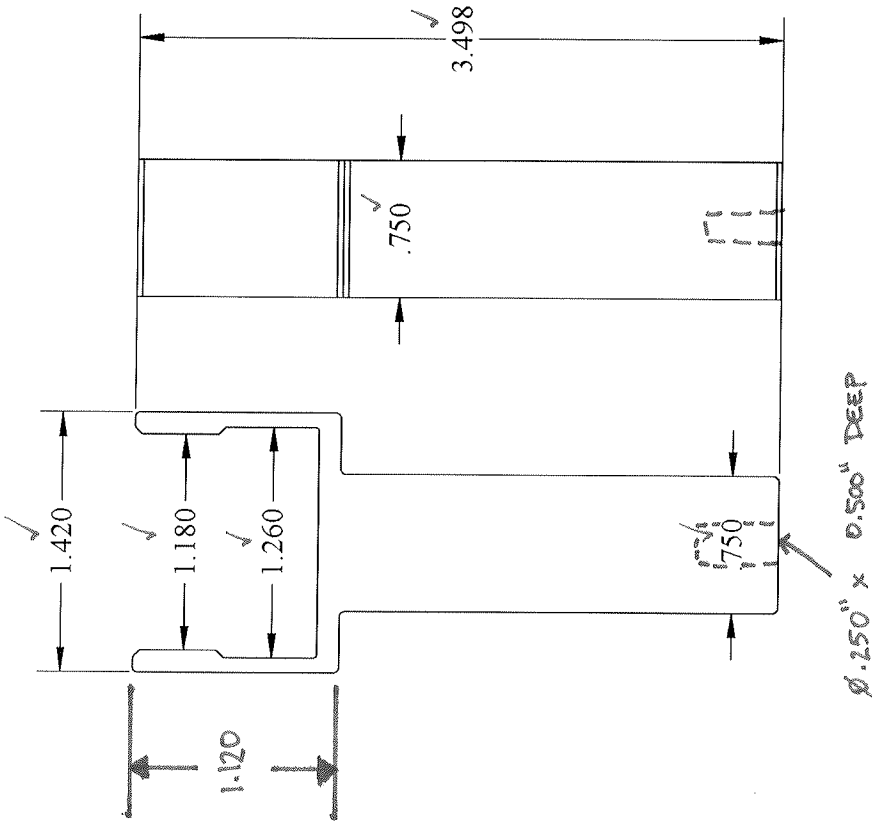
Date 5/24/16 Tech SAN





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 www.superiorplasticproducts.com
 MATERIAL: 6063-T6
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SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
TITLE:	
PART OR ASSEM:	
SIZE A	PART NUMBER: COARSSBRW
SCALE: 1:1	WT: lbs
	BY: Benue Kauffman
	REV 02
	SHEET 31 OF 31

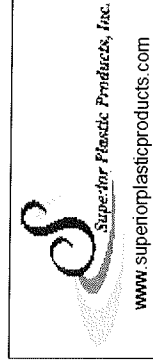


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/24/16 Tech SAN



MATERIAL: 6063-T6

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SUPERIOR PLASTIC PRODUCTS, INC.
260 JALYN DRIVE
NEW HOLLAND, PA 17557

TITLE:

PART OR ASSEM:

SIZE
A

PART NUMBER:
COARSOSSRW

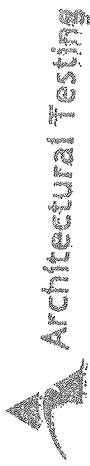
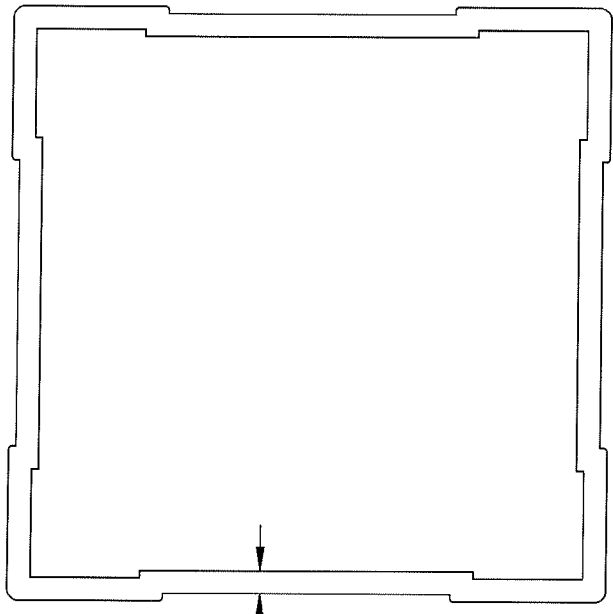
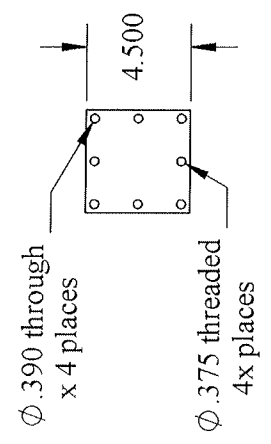
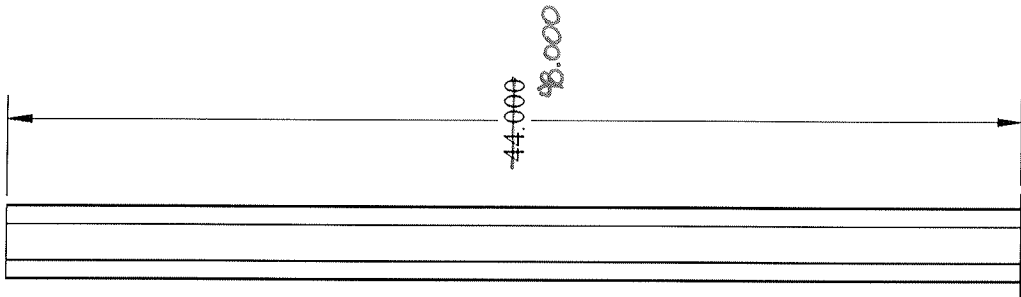
REV
10

SCALE: 1:1

WT: lbs

BY: Benue Kaufman

SHEET 30 OF 31



Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19
Date 5/24/16 Tech SAN

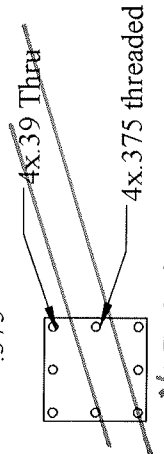
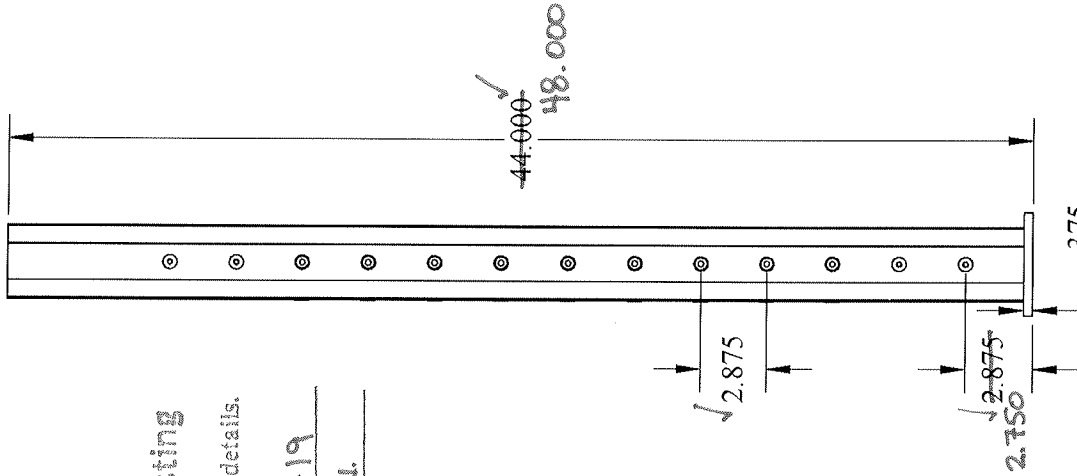
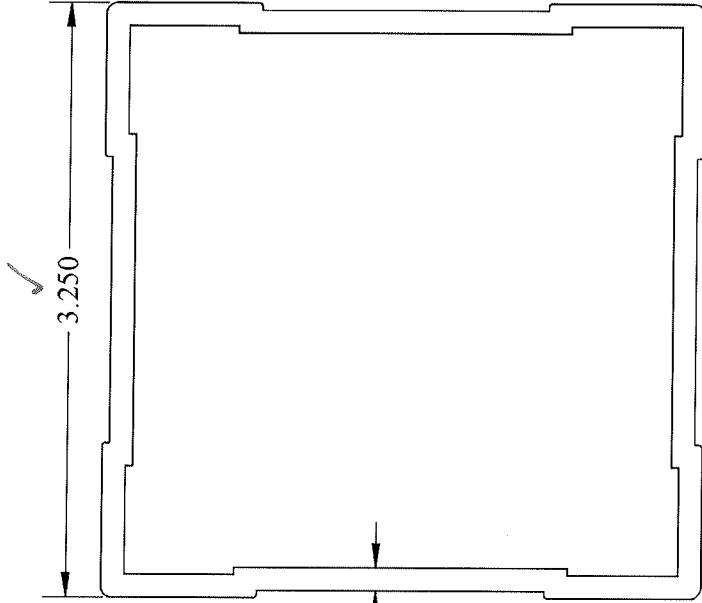
 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: 3.25 Square Post	
MATERIAL: 6105-T5		
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		
PART OR ASSEM:		
SIZE A	PART NUMBER:	REV
SCALE: 1:8	WT: lbs	BY:
		SHEET 9 OF 31



Test sample complies with these details.
Deviations are noted.

Report # F3320.01-119-19

Date 5/2/16 Tech SAN.



NOT EVALUATED

 Superior Plastic Products, Inc. www.superiorplasticproducts.com	SUPERIOR PLASTIC PRODUCTS, INC. 260 JALYN DRIVE NEW HOLLAND, PA 17557	
	TITLE: 3.25 Square Post	
PART OR ASSEM:		
MATERIAL: 6105-T5	SIZE: A	PART NUMBER: REV
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SUPERIOR PLASTIC PRODUCTS, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SUPERIOR PLASTIC PRODUCTS, INC. IS PROHIBITED.		SCALE: 1:8 WT.: lbs BY:
		SHEET 9 OF 25



F3320.01-119-19

APPENDIX B

Photographs



Photo No. 1
Assembly Fastener Test Setup



Photo No. 2
In-Fill Load Test at Center of Horizontal Cable Infill



Photo No. 3
In-Fill Load Test at Center of Vertical Cable Infill



Photo No. 4
In-Fill Load Test at Center of Intermediate Support Balusters



Photo No. 5
In-Fill Load Test at Center of Two Pickets



Photo No. 6
In-Fill Load Test at Bottom of Vertical Cable Infill



Photo No. 7
In-Fill Load Test at Bottom of Two Pickets



Photo No. 8
Uniform Load Test on Top Rail



Photo No. 9
Concentrated Load Test at Mid-Span of Top Rail



Photo No. 10
Concentrated Load Test at Ends of Rail (Brackets)



Photo No. 11

American Series - Top Rail Collar Bracket; Rail-Bracket-Post Connections



Photo No. 12

American Series - Top Rail Socket Bracket; Rail-Bracket-Post Connections



Photo No. 13

Keystone Series - Top Rail Socket Bracket; Rail-Bracket-Post Connections



Photo No. 14

Keystone Series (3-Rail) - Top and intermediate Rail Socket Bracket; Rail-Bracket-Post Connections



Photo No. 15

***Arabian Series* - Top Rail Socket Bracket; Rail-Bracket-Post Connections**



Photo No. 16

***Outlook Series* - Top Rail Socket Bracket; Rail-Bracket-Post Connections**



Photo No. 17
***American, Arabian and Keystone Series - Bottom Rail Socket Bracket;
Rail-Bracket-Post Connections***



Photo No. 18
Outlook Series - Bottom Rail Socket Bracket; Rail-Bracket-Post Connections



Photo No. 19
American, Arabian and Keystone Series - Bottom Rail Support Block



Photo No. 20
Outlook Series - Bottom Rail Support Block



Photo No. 21
Horizontal Cable Rail Infill to Post Connection



Photo No. 22
Intermediate Support Baluster Top Rail Socket Bracket



Photo No. 23
Intermediate Support Baluster Deck Board Socket Bracket