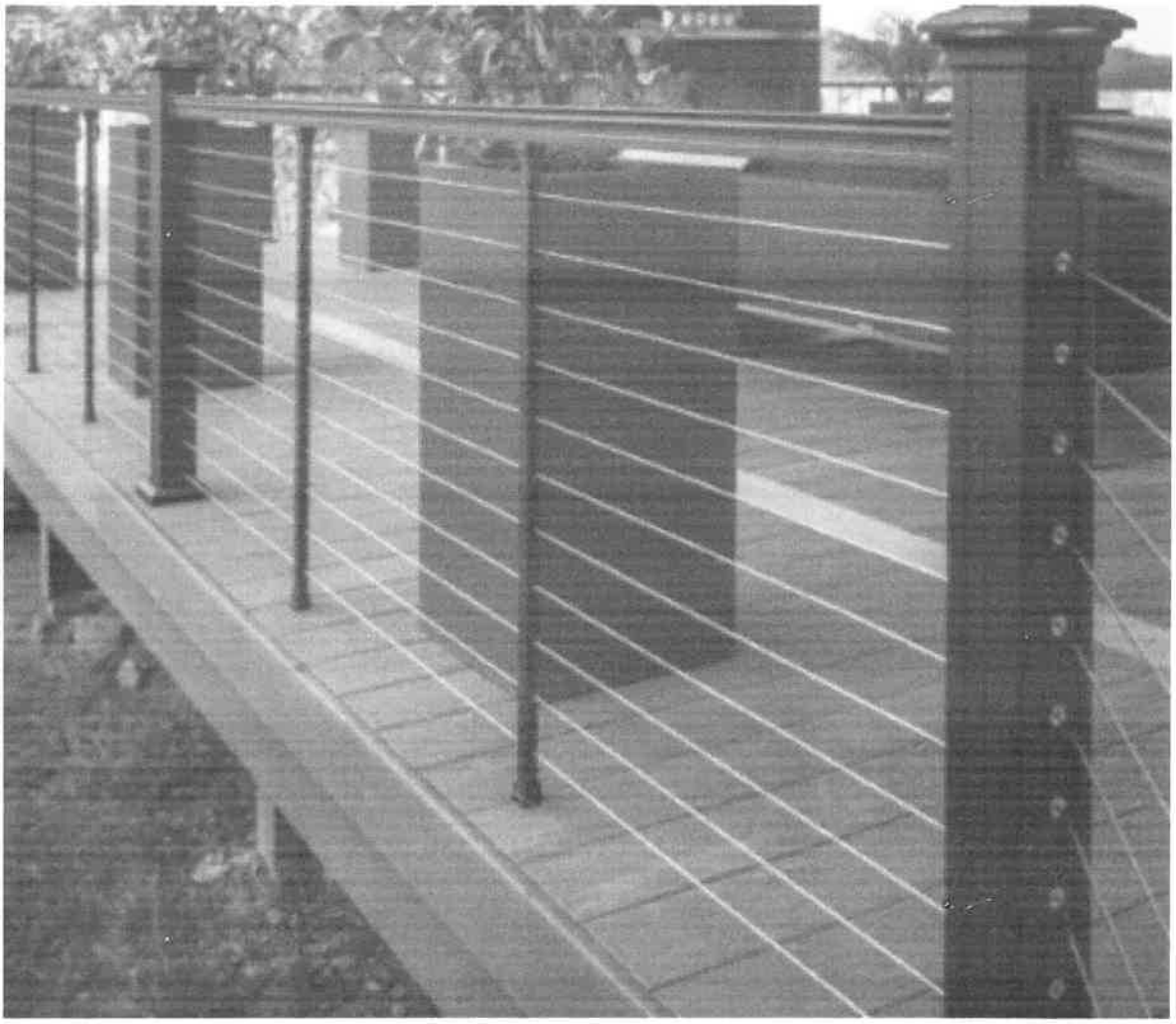


sample installations

example manufacturer's pictures, KeyLink railing

Molimo
Architectural Product Testing

RECEIVED
FEB 9 2024
KP

TEST REPORT

File No. R124·019·010
Exhibit E
Date 2.9.24
Initials KP

REPORT NO.: 12306.04-110-23

RENDERED TO: SUPERIOR PLASTIC PRODUCTS
New Holland, Pennsylvania

PRODUCT TYPE: American Level Railing with Horizontal Cable Infill

SERIES / MODEL: American Level Railing 84" x 36"

This report contains in its entirety:
Cover Page: 1 page
Body of Report: 20 pages
Photographs: 3 pages
Drawings: 14 pages

STATE OF MARYLAND
MICHAEL D. STREMMEL
NO. 32619
REGISTERED
PROFESSIONAL ENGINEER

2023.07.20 14:20:33 -04'00'

Test Date: 4/13/2023
Report Date: 7/19/2023

TABLE OF CONTENTS:

CLIENT INFORMATION: SUPERIOR PLASTIC PRODUCTS
260 Jalyn Drive
New Holland, Pennsylvania 17557

TEST LABORATORY: Molimo, LLC
1410 Eden Road
York, Pennsylvania 17402
717-916-6300

PROJECT SUMMARY:

PRODUCT TYPE: American Level Railing with Horizontal Cable Infill

SERIES / MODEL: American Level Railing 84" x 36"

PROJECT SUMMARY:

Molimo, LLC was contracted to perform structural testing in accordance with the 2021 IRC on the above referenced product. The results are tested values and were secured by using the designated test methods.

All testing was performed by representatives of Superior Plastic Products at the Superior Plastic Products test facility in New Holland, Pennsylvania. All test specimen construction, installation, and testing was witnessed by a representative of Molimo. The calibration of all equipment utilized for testing was verified prior to the start of testing.

The purpose of the testing is to prove that the product tested meets the code requirements listed in the appropriate version of the Building Code. Testing was not performed for use in conjunction with a Code Compliance evaluation report. All testing was performed in accordance with the following criteria:

ICC-ES™ AC273 (approved June, 2017), *Acceptance Criteria for Handrails and Guards*

2021 international Residential Code®, International Code Council

SUMMARY OF RESULTS:

The specimens tested met the 2021 IRC design load performance requirements for all mounting conditions, limited to use in One- and Two-family Dwellings (IRC).

PROJECT DETAILS:

Test Dates: 4/13/2023

Test Record Retention End Date: 4/13/2027

GENERAL INFORMATION:

LIMITATIONS:

All tests performed were to evaluate the structural performance of the railing assembly to carry and transfer imposed loads to the supports (posts). The test specimens evaluated included the balusters, rails, rail brackets and attachment to the supporting structure. The support posts were conventional construction and not within the scope of the evaluation. Posts were therefore not a tested component and were included in the test specimen only to facilitate anchorage of the rail bracket.

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

QUALIFICATIONS:

Molimo, LLC in York, Pennsylvania has demonstrated compliance with ISO/IEC International standard 17025 and is consequently accredited as a Testing Laboratory (TL-678) by International Accreditation Service, Inc. (IAS). Molimo is accredited to perform all testing reported herein.

PRODUCT DESCRIPTION:

The aluminum railing systems are comprised of aluminum rails and posts produced by an extrusion process. Horizontal wire cable balusters were attached to the adjacent posts. The railing systems consist of all Keylink color offerings including but not limited to textured black, white, bronze and gloss black, white, bronze, beige, kona, hunter green, speckled walnut, brownstone, redwood, silver. As the color of the aluminum does not have effect on the performance of the product, the black color product was selected for testing.

Drawings are included in Appendix B to verify the overall dimensions and other pertinent information for the tested product, its components, and any construction assemblies.

GENERAL INFORMATION: (Continued)

PRODUCT SAMPLING:

Sampling of the test specimens was not performed as the testing was not requested to be used for Code Compliance Evaluation Report. All test specimens were selected by Superior Plastic Products personnel.

WITNESSES:

The following representatives witnessed all or part of the testing.

Name	Company
Mike Alexander	Superior Plastic Products
Michael D. Stremmel, P.E.	Molimo, LLC
Robert J. Beatty	Molimo, LLC

CONDITIONS OF TESTING:

Unless otherwise indicated, all testing reported herein was conducted in a laboratory set to maintain temperature in the range of 68 ± 4°F and humidity in the range of 50 ± 5% RH. All test specimen materials were stored in the laboratory environment for no less than 40 hours prior to testing.

REFERENCED STANDARDS:

ASTM E 935-13, *Standard Test Methods for Performance of Permanent Metal Railing System and Rail for Buildings*

ASTM E 985-00(06), *Standard Specification for Permanent Metal Railing Systems and Rails for Buildings*

2021 international Residential Code®, International Code Council

TEST SPECIMEN DESCRIPTION:

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 ridged steel test frame. High strength steel cables, nylon straps, and load distribution beams were used to impose test loads on the specimen. The 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.

RAILING ASSEMBLY DESCRIPTION:

The guardrail systems consisted of extruded aluminum top rails with spaced steel horizontal cables between the rail members. Top rails were attached to 2-1/2" square aluminum posts via cast aluminum brackets. Component details, description, and a fastening schedule for connection details can be found in the following tables. See photographs in Appendix A and drawings in Appendix B for additional details.

COMPONENT DESCRIPTIONS:

The scope of testing performed and reported herein was intended to evaluate the American Series Level Rail system consisting of the following components, (Reference Appendix B for drawings).

Top Rail	Two-piece, snap-fit assembly measuring 1-3/4" wide by 1-7/8" high overall, with an internal PVC insert.
Balusters	1/8" diameter horizontal stainless-steel wire cable, spaced 2-7/8" on center with 3/4" square aluminum tube vertical supports spaced a maximum of 30" on center. The vertical supports utilized a clip at the bottom that was secured to the simulated deck surface.
Rail Connection Condition	Cast aluminum socket brackets contoured to accept the top or bottom rail. Connection details found in Fastening Schedule Section of this report.
Support Post	2-1/2" x 2-1/2" x 3/16" thick square extruded aluminum post with welded base plate

TEST SPECIMEN DESCRIPTION: (Continued)

FASTENING SCHEDULE:

Connection	Fastener
Top Rail Bracket to Post	Four - #12 x 1" pan head, self-drilling, square driver, stainless steel screws
Top Rail Bracket to top rail	Two - #10-16 x 3/4" (0.142" minor diameter) pan head, self-drilling, square driver, stainless steel screws
Horizontal Cables	Each post utilized a cable tensioner for each horizontal cable.
Vertical Support to Test Deck	One - #10 x 1-1/2" pan head wood screw
Post to Test Frame	Four – 3/8" diameter bolts with nuts and washers

TEST PROCEDURE:

TEST SETUP:

The railing assembly was installed and tested as a single railing section by directly securing the 2-1/2" square aluminum posts to a rigid test frame, which rigidly restrained the rail system. The 2-1/2" square aluminum posts were included only to facilitate anchorage of the test specimen and were not tested components. 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, (reference photographs in Appendix A).

TEST PROCEDURE:

The test specimen was inspected prior to testing to verify size and general condition of the material, assembly, and installation. No potentially compromising defects were observed. One specimen was used for all load tests which were performed in 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 at a steady, uniform rate. The load shall be achieved in no less than ten seconds.
3. Record the testing time of load application from the application of the load until the specified test load was achieved.
4. All test loads were maintained for a duration of 1 minute prior to releasing the test load.
5. If required, deflection of the railing was measured as a component displacement relative to their endpoints.

TEST EQUIPMENT:

The specimens 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 ridged steel test frame. High strength steel cables and nylon straps were used to impose test loads on the specimen. The 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.

The railings were secured to 12" structural steel "C" Channels. The structural steel "C" Channels were secured to the steel test frame with 1/2" bolts.

The following table lists the equipment used for testing:

Equipment	Calibration Due
Load Cell (3000 lb)	11/2023
Computer Acquisition System	Calibrated as part of the load cell and transducers
50" Linear Transducer (502-50 by TE)	Verified Prior to Testing
50" Linear Transducer (502-50 by TE)	Verified Prior to Testing
50" Linear Transducer (502-50 by TE)	Verified Prior to Testing
Test Fixture	--

GUARDRAIL END-USE ADJUSTMENTS:

The direction of all loads and displacement measurements are listed for each test. The test results apply only to the railing assembly between supports and anchorage to the support. The test loads adjustment factor was 2.5 x design load for all test loads.

STRUCTURAL PERFORMANCE TEST RESULTS:

84" by 36", American Aluminum Level Guardrail
(In-line Application) with Horizontal Cable
IRC – All Use Groups / ICC-ES AC273

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 the anchorage to the support.

Key to Test Results Table

- Load Level: Target test load
- Test Load: Actual applied load at the designated load level (target)
- Elapsed Time (E.T.): The amount of time into the test with zero established at the beginning of the loading procedure.

Allowable Deflection Criteria (for all tests)

Allowable Deflection Criteria (per ICC ES AC273)
Horizontal Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875"$
Vertical Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875"$

***General Note**: All center deflections were measured at the point of load application in the direction of the applied load. All end deflections were measured at the center of the support. The Net Deflection is the rail deflection at the load application point relative to the support.*

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 1:

Test No. 1 – Infill Load Test Test Date: 4/13/2023 Design Load: 50 lb / 1 Square Ft. of Infill				
Load Location	**Load Level**	**Test Load**	**E.T. (min:sec)**	**Result**
Center of Cables	125 lb (2.5 x D.L.)	131 lb	00:12	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Uniform Load Test (Horizontal) Test Date: 4/13/2023 Design Load: 20 lb / Ft. Uniform Load on Top Rail (20plf x (84 in ÷ 12 in/ft) = 140lb)						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
140 lb (Design Load)	148 lb	00:18	0.16	0.45	0.14	0.30"
350 lb (2.50 x D.L.)	364 lb	01:42	No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.30"$ $\therefore$ *meets requirement*						

Note 1: Horizontal uniform load was simulated with quarter point loading.

Test No. 3 – Uniform Load Test (Vertical) Test Date: 4/13/2023 Design Load: 20 lb / Ft. Uniform Load on Top Rail (20plf x (84 in ÷ 12 in/ft) = 140 lb)						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
140 lb (Design Load)	158 lb	00:21	--	0.10	--	0.10"
350 lb (2.50 x D.L.)	369 lb	01:39	No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.10"$ $\therefore$ *meets requirement*						

Note 2: Vertical uniform load was simulated with quarter point loading.

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 1: (Continued)

Test No. 4 –Concentrated Load Test (Midspan of Top Rail) (Horizontal) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
200 lb (Design Load)	212 lb	00:17	0.23	1.00	0.24	0.77"
500 lb (2.50 x D.L.)	507 lb	01:40	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.77"$ $\therefore$ *meets requirement*						

Note #3: End deflections were measured at the center of the support. The Net Deflection is the rail deflection relative to the support.

Test No. 5 –Concentrated Load Test (Midspan of Top Rail) (Vertical) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
200 lb (Design Load)	224 lb	00:18	--	0.10	--	0.10"
500 lb (2.50 x D.L.)	520 lb	01:38	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.10"$ $\therefore$ *meets requirement*						

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 1: (Continued)

Test No. 6 –Concentrated Load Test (Both Ends of Top Rail) (Horizontal) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Both Ends of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
400 lb (Design Load)	412 lb	00:21	0.52	0.59	0.51	0.08"
1000 lb (2.50 x D.L.)	1007 lb	01:39	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.08" \ \therefore \ meets\ requirement$						

Note #4: Load was imposed on both ends of the rail using a spreader beam; therefore, the load was doubled.

Test No. 7 –Concentrated Load Test (Both Ends of Top Rail) (Vertical) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Both Ends of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
400 lb (Design Load)	418 lb	00:22	--	0.01	--	0.01"
1000 lb (2.50 x D.L.)	1014 lb	01:45	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.01" \ \therefore \ meets\ requirement$						

Note #5: Load was imposed on both ends of the rail using a spreader beam; therefore, the load was doubled.

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 2:

Test No. 1 – Infill Load Test Test Date: 4/13/2023 Design Load: 50 lb / 1 Square Ft. of Infill				
Load Location	**Load Level**	**Test Load**	**E.T. (min:sec)**	**Result**
Center of cables	125 lb (2.5 x D.L.)	130 lb	00:12	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Uniform Load Test (Horizontal) Test Date: 4/13/2023 Design Load: 20 lb / Ft. Uniform Load on Top Rail (20plf x (84 in ÷ 12 in/ft) = 140 lb)						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
140 lb (Design Load)	146 lb	00:19	0.17	0.49	0.12	0.35"
350 lb (2.50 x D.L.)	359 lb	01:41	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.35"$ $\therefore$ *meets requirement*						

Note 1: Horizontal uniform load was simulated with quarter point loading.

Test No. 3 – Uniform Load Test (Vertical) Test Date: 4/13/2023 Design Load: 20 lb / Ft. Uniform Load on Top Rail (20plf x (84 in ÷ 12 in/ft) = 140 lb)						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
140 lb (Design Load)	156 lb	00:21	--	0.07	--	0.07"
350 lb (2.50 x D.L.)	370 lb	01:48	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.07"$ $\therefore$ *meets requirement*						

Note 2: Vertical uniform load was simulated with quarter point loading.

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 2: (Continued)

Test No. 4 –Concentrated Load Test (Midspan of Top Rail) (Horizontal) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
200 lb (Design Load)	212 lb	00:19	0.24	1.06	0.25	0.82"
500 lb (2.50 x D.L.)	507 lb	01:41	**Result**: No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.82"$ $\therefore$ *meets requirement*						

Note #3: End deflections were measured at the center of the support. The Net Deflection is the rail deflection relative to the support.

Test No. 5 –Concentrated Load Test (Midspan of Top Rail) (Vertical) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
200 lb (Design Load)	222 lb	00:18	--	0.10	--	0.10"
500 lb (2.50 x D.L.)	518 lb	01:36	**Result**: No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.10"$ $\therefore$ *meets requirement*						

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 2: (Continued)

Test No. 6 –Concentrated Load Test (Both Ends of Top Rail) (Horizontal) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Both Ends of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
400 lb (Design Load)	413 lb	00:21	0.51	0.61	0.52	0.10"
1000 lb (2.50 x D.L.)	1005 lb	01:42	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.10"$ $\therefore$ *meets requirement*						

Note #4: Load was imposed on both ends of the rail using a spreader beam; therefore, the load was doubled.

Test No. 7 –Concentrated Load Test (Both Ends of Top Rail) (Vertical) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Both Ends of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
400 lb (Design Load)	423 lb	00:22	--	0.01	--	0.01"
1000 lb (2.50 x D.L.)	1012 lb	01:38	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.01"$ $\therefore$ *meets requirement*						

Note #5: Load was imposed on both ends of the rail using a spreader beam; therefore, the load was doubled.

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 3:

Test No. 1 – Infill Load Test Test Date: 4/13/2023 Design Load: 50 lb / 1 Square Ft. of Infill				
Load Location	**Load Level**	**Test Load**	**E.T. (min:sec)**	**Result**
Center of cables	125 lb (2.5 x D.L.)	129 lb	00:11	Withstood load equal to or greater than 125 lb without failure

Test No. 2 – Uniform Load Test (Horizontal) Test Date: 4/13/2023 Design Load: 20 lb / Ft. Uniform Load on Top Rail (20plf x (84 in ÷ 12 in/ft) = 140 lb)						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
140 lb (Design Load)	148 lb	00:19	0.17	0.50	0.26	0.46"
350 lb (2.50 x D.L.)	359 lb	01:31	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.46"$ $\therefore$ *meets requirement*						

Note 1: Horizontal uniform load was simulated with quarter point loading.

Test No. 3 – Uniform Load Test (Vertical) Test Date: 4/13/2023 Design Load: 20 lb / Ft. Uniform Load on Top Rail (20plf x (84 in ÷ 12 in/ft) = 140 lb)						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
140 lb (Design Load)	158 lb	00:21	--	0.10	--	0.10"
350 lb (2.50 x D.L.)	372 lb	01:41	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.10"$ $\therefore$ *meets requirement*						

Note 2: Vertical uniform load was simulated with quarter point loading.

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 3: (Continued)

Test No. 4 –Concentrated Load Test (Midspan of Top Rail) (Horizontal) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
200 lb (Design Load)	212 lb	00:19	0.25	1.03	0.18	0.82"
500 lb (2.50 x D.L.)	507 lb	01:35	**Result**: No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.82"$ $\therefore$ *meets requirement*						

Note #3: End deflections were measured at the center of the support. The Net Deflection is the rail deflection relative to the support.

Test No. 5 –Concentrated Load Test (Midspan of Top Rail) (Vertical) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Midspan of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
200 lb (Design Load)	222 lb	00:22	--	0.09	--	0.09"
500 lb (2.50 x D.L.)	519 lb	01:42	**Result**: No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.09"$ $\therefore$ *meets requirement*						

STRUCTURAL PERFORMANCE TEST RESULTS: (Continued)

Test Specimen No. 3: (Continued)

Test No. 6 –Concentrated Load Test (Both Ends of Top Rail) (Horizontal) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Both Ends of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
400 lb (Design Load)	412 lb	00:24	0.51	0.58	0.49	0.08"
1000 lb (2.50 x D.L.)	1006 lb	01:49	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.08"$ $\therefore$ *meets requirement*						

Note #4: Load was imposed on both ends of the rail using a spreader beam; therefore, the load was doubled.

Test No. 7 –Concentrated Load Test (Both Ends of Top Rail) (Vertical) Test Date: 4/13/2023 Design Load: 200 lb Concentrated Load at Both Ends of Top Rail						
Load Level	**Test Load**	**E.T. (min:sec)**	**Deflection (inches)**			
			Left	**Center**	**Right**	**Net**
400 lb (Design Load)	423 lb	00:19	--	0.05	--	0.05"
1000 lb (2.50 x D.L.)	1015 lb	01:38	**Result:** No Damage to Railing System			
Deflection Evaluation: Deflection Limit per AC273: $\left(\frac{l}{96}\right) = \left(\frac{84}{96}\right) = 0.875" \geq 0.05"$ $\therefore$ *meets requirement*						

Note #5: Load was imposed on both ends of the rail using a spreader beam; therefore, the load was doubled.

ASSEMBLY FASTENER TESTING:

GENERAL:

The purpose of this testing was to simulate a 90° bracket loading condition for the in-line application, which addresses a situation when the guardrail system is to be installed with the top rails in a corner condition.

TEST SPECIMENS:

Short sections of the top rail were attached in accordance with Key-Link installation instructions to short sections of posts. Specimens were assembled by a Molimo technician. The rail brackets were attached to the aluminum posts as described in the Test Specimen Description – Fastening Schedule section of this test report, unless otherwise noted.

TEST SETUP:

For all specimens, the test machine was fitted with the post section secured to the base plate and a second post section secured to the machine's crosshead to accommodate anchorage of the rail and brackets. A rail section, approximately 8" – 12" long was secured to each post section using a backet at each post section. The bottom post section was rigidly secured to the base of the test machine and the top post section was rigidly secured to the crosshead of the test machine. Using this test setup, two bracket assemblies were tested at the same time. Reference Photographs in Appendix A for test setup.

TEST PROCEDURE:

Testing was performed in accordance with ASTM D1761 using a computer-monitored and controlled Test Resources, Model 312, Universal Testing Machine. Tests were run at a crosshead speed of 0.10 in/min. All specimens were tested in tension to its ultimate load capacity.

ASSEMBLY FASTENER TESTING: (Continued)

TEST RESULTS: Assembly fastener testing was previously conducted and reported in Molimo Report No. 2871.02-106-12 and is summarized below.

American Series Top Rail Assembly Fastener Test Results

Test Specimen	Ultimate Load (lb)	Deviation from Average	Mode of Failure
1	1102.24	-13.09%	Bracket Failure
2	1245.38	-1.80%	Bracket Failure
3	1456.96	14.88%	Bracket Failure
Average	**1268.19**		
Allowable Capacity [1]	**422.7**	≥ 200 lb ∴ OK [2]	

[1] *Average Ultimate Load divided by a Factor of Safety of three (3.0).*

[2] *Acceptance Criteria determined from the concentrated load test: 200 lb.*

SUMMARY AND CONCLUSIONS:

The maximum design load rating required for guardrail systems for use in IRC – One- and Two-Family Dwellings for guardrails up to 7 ft is 200 lbs. Therefore, fasteners / connectors reported herein meet the performance requirements of ICC-ES™ AC273 for use in corner conditions.

CONCLUSION:

The railing assemblies reported herein meet the structural performance requirements of Section 4.2 of ICC-ES™ AC273 as installed between adequate supports with guardrail details for use in One- and Two-family Dwellings as listed in the 2021 IRC.

The railing supports were not included within the scope of this testing and these conclusions would apply only for a railing that is provided with adequate supports that provide equal or better substrate material for the fasteners used to anchor the rail brackets.

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

A copy of this report, detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Molimo, LLC for the entire test record retention period. At the end of this retention period, the service life of this report will expire.

Results obtained are tested values and were secured by using the designated test methods. This test 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 specimen(s) tested. This report may not be reproduced, except in full, without the written permission of Molimo, LLC.

For MOLIMO, LLC:

Robert J. Beatty
Project Manager

Michael D. Stremmel, P.E.
Senior Project Engineer

MDS:alb

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Photographs (3)
Appendix-B: Drawings (14)

Appendix A

Photographs

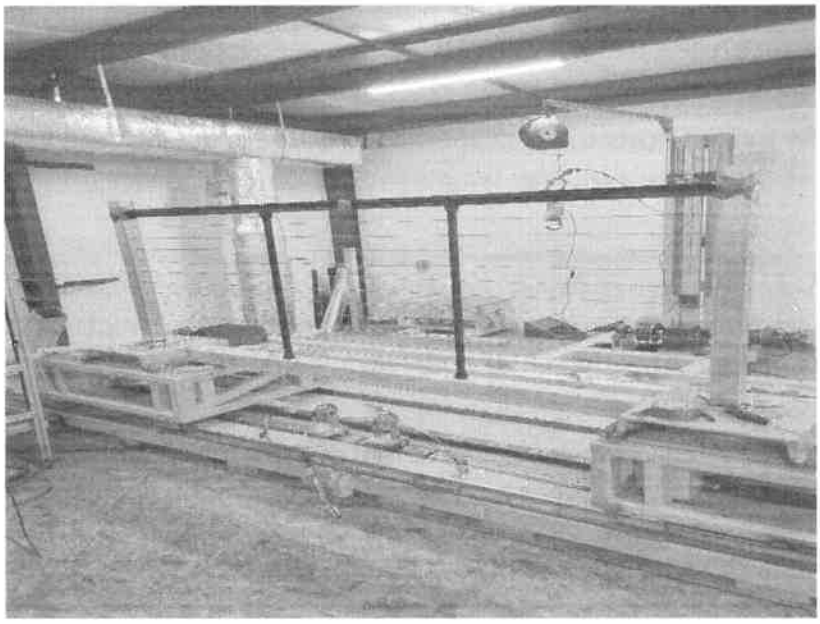


Photo No. 1
Test Specimen

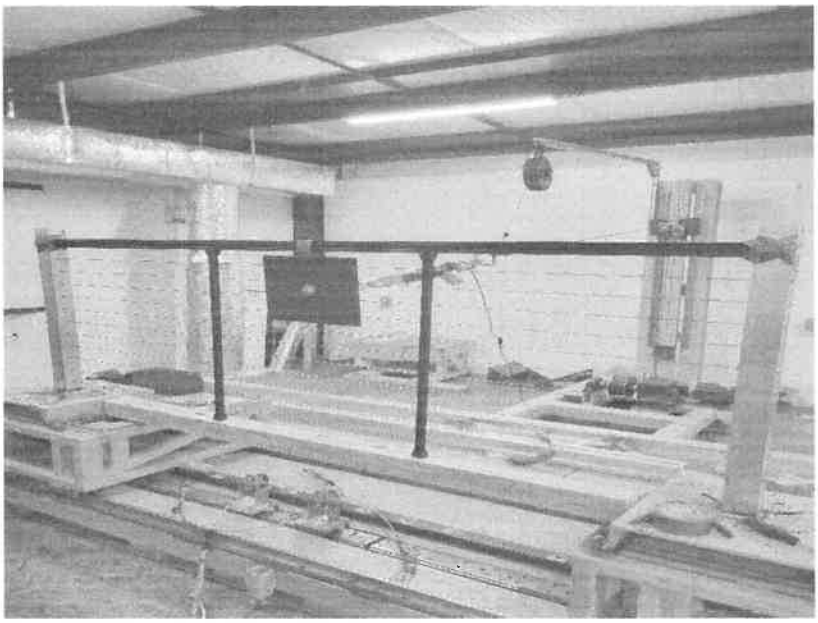


Photo No. 2
Test No. 1 – Infill Load Test (Top)

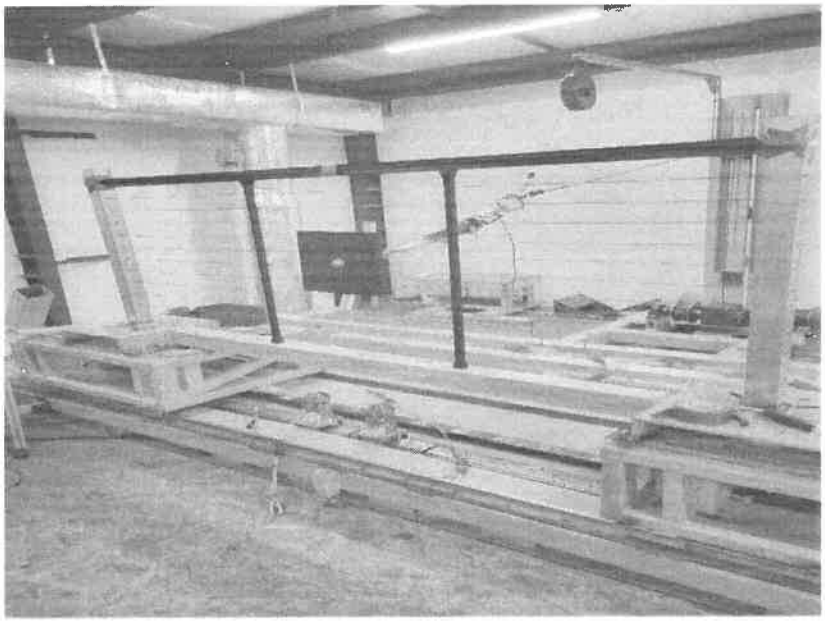


Photo No. 3
Test No. 1a – Infill Load Test (Center)

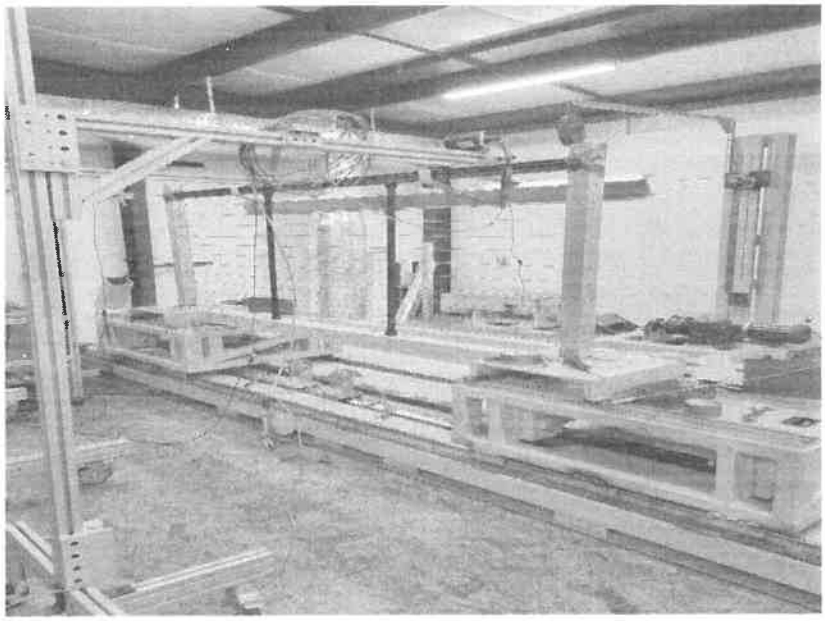


Photo No. 4
Test No. 2 – Uniform Load Test (Horizontal)

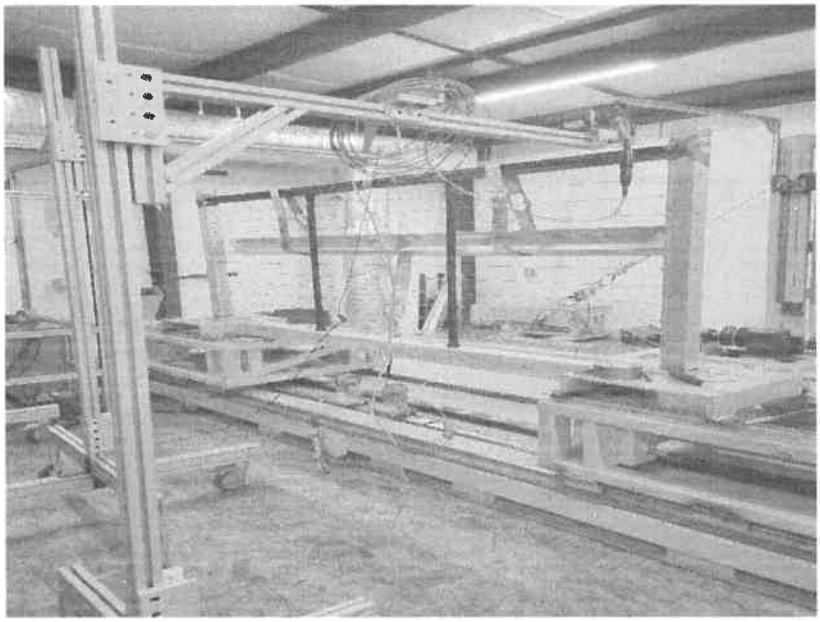


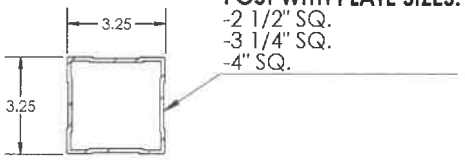
Photo No. 5
Test No. 3 – Uniform Load Test (Vertical)

Appendix B

Drawings

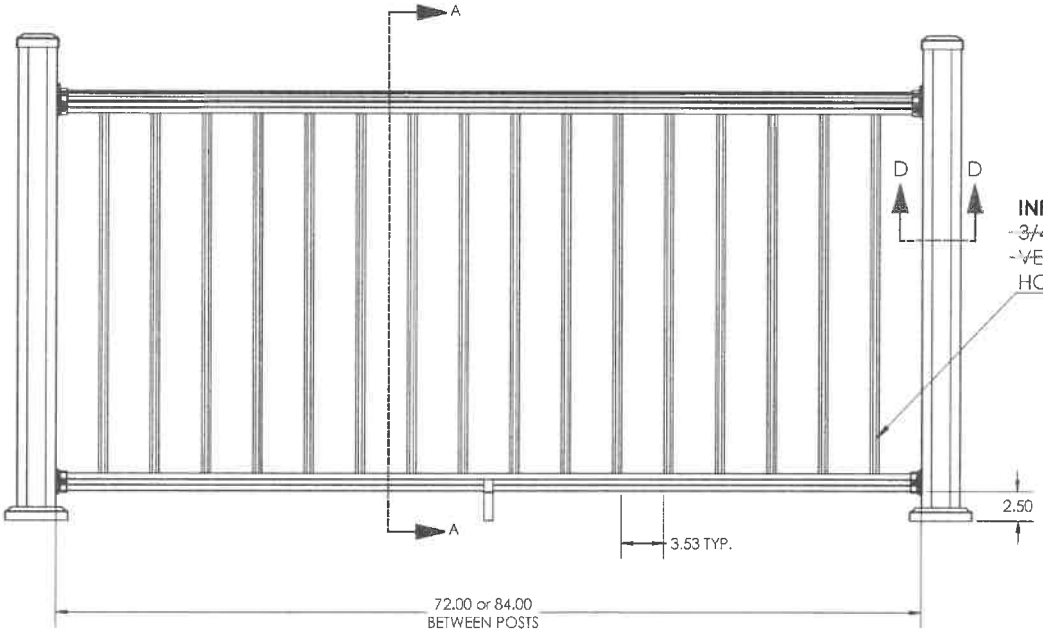
IN DESIGN

REVISIONS			
REV.	DESCRIPTION	DATE	BY
		4/20/2023	

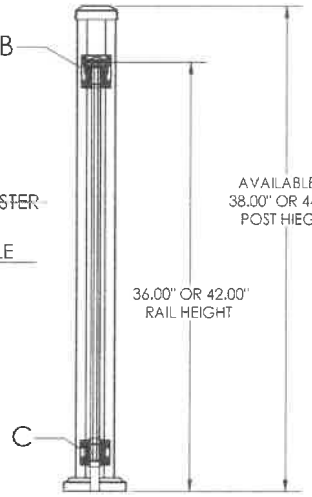


POST WITH PLATE SIZES:
-2 1/2" SQ.
-3 1/4" SQ.
-4" SQ.

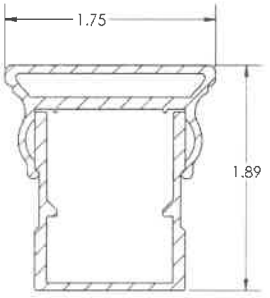
SECTION D
SCALE 1 : 4



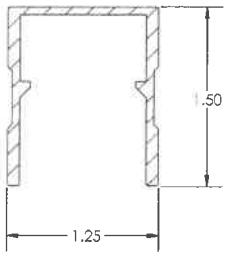
INFILL OPTIONS:
~~- 3/4" SQUARE BALUSTER~~
~~- VERTICAL CABLE~~
HORIZONTAL CABLE



SECTION A-A
SCALE 1 : 10



DETAIL B
SCALE 1 : 1



DETAIL C
SCALE 1 : 1

Molimo
Architectural Product Testing
Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

		NAME	DATE
EBMS #:	MODELED BY	A Sheika	04.20.2023
LAST SAVE DATE	DRAWN BY	A Sheika	04.20.2023
4/20/2023	APPROVED BY	D.Kinsey	04.20.2023

PROPRIETARY AND CONFIDENTIAL

THE INFORMATION CONTAINED IN THIS DRAWING IS THE PROPERTY OF **SUPERIOR PLASTIC PRODUCTS**. ANY REPRODUCTION IN PART OR IN WHOLE WITHOUT THE WRITTEN PERMISSION OF **SUPERIOR PLASTIC PRODUCTS** IS PROHIBITED.

PROJECTION

DO NOT SCALE DRAWING

FINISH: N/A

MATERIAL: SEE BILL OF MATERIALS

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR:MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

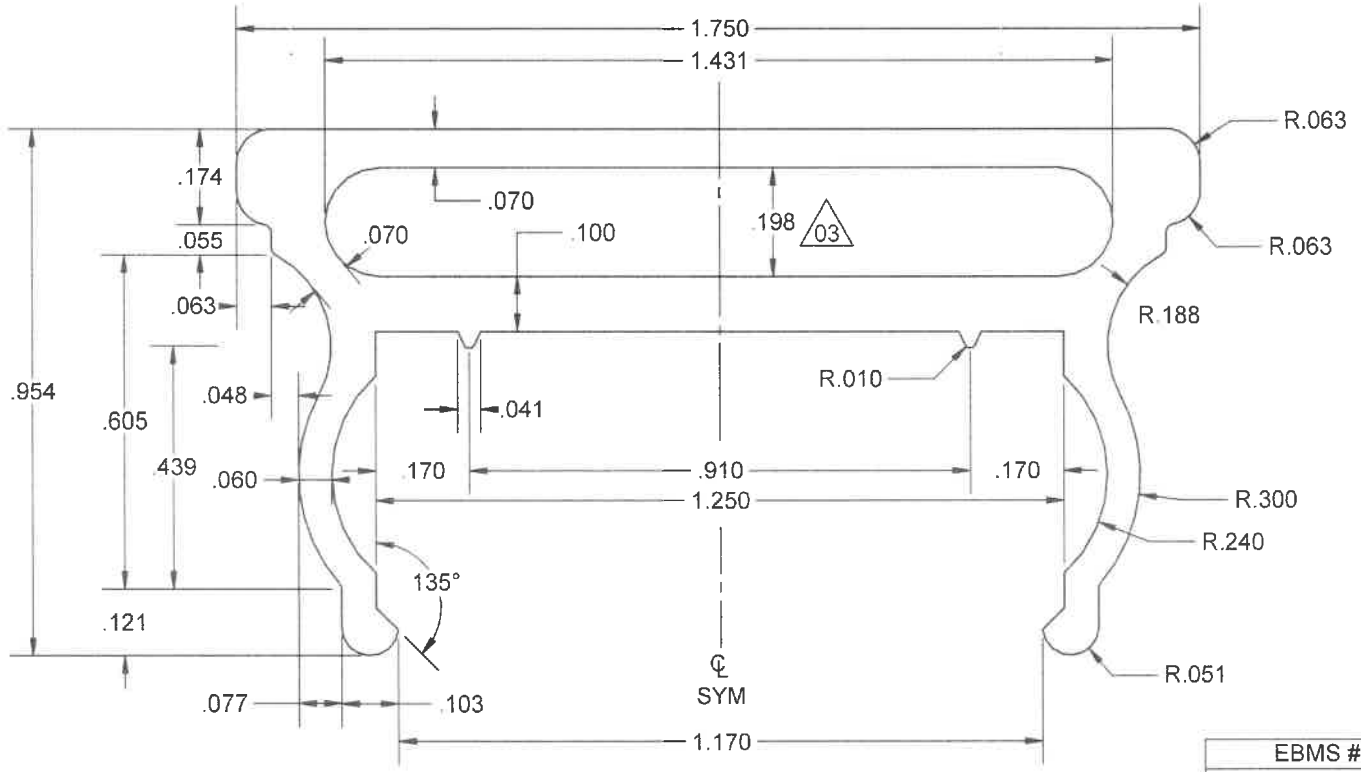
Key-Link Fencing and Railing
110 Peters Road, New Holland, Pa 17557

TITLE:
AMERICAN SERIES, 36'/42' HT. X 6'/7' W. LEVEL RAILING SECTION

SIZE	DWG. NO.	REV
B	142637	-

SCALE: 1:16 | WEIGHT: 15.14 | SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	BY
01	Changed material from 6061-T6 to 6105-T6	11/5/2020	GE
02	UPDATED MATERIAL FROM 6105-T6 TO 6005-T5	11/6/2020	GE
03	UPDATED HOLLOW SECTION TO ROUNDED CORNERS	4/1/2022	JC



EBMS #	CUT LENGTH TOL.
COAMSTC6RW	+/- .010"
COAMSTC8RW	+/-.010"

LAST SAVE DATE		NAME	DATE
4/4/2022	MODELED BY	E.Hunt	8/4/2020
	DRAWN BY	E.Hunt	8/4/2020
	APPROVED BY	A.Nace	04/04/2022

PROJECTION

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR:MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH: N/A

MATERIAL: 6005-T5 Aluminum

Key-Link Fencing and Railing
110 Peters Road, New Holland, Pa 17557

TITLE: RAILING, AMERICAN SERIES, SNAP TOP COVER, 1.75" X .9544" X .06-.10w

SIZE	DWG. NO.	REV
A	110029	03

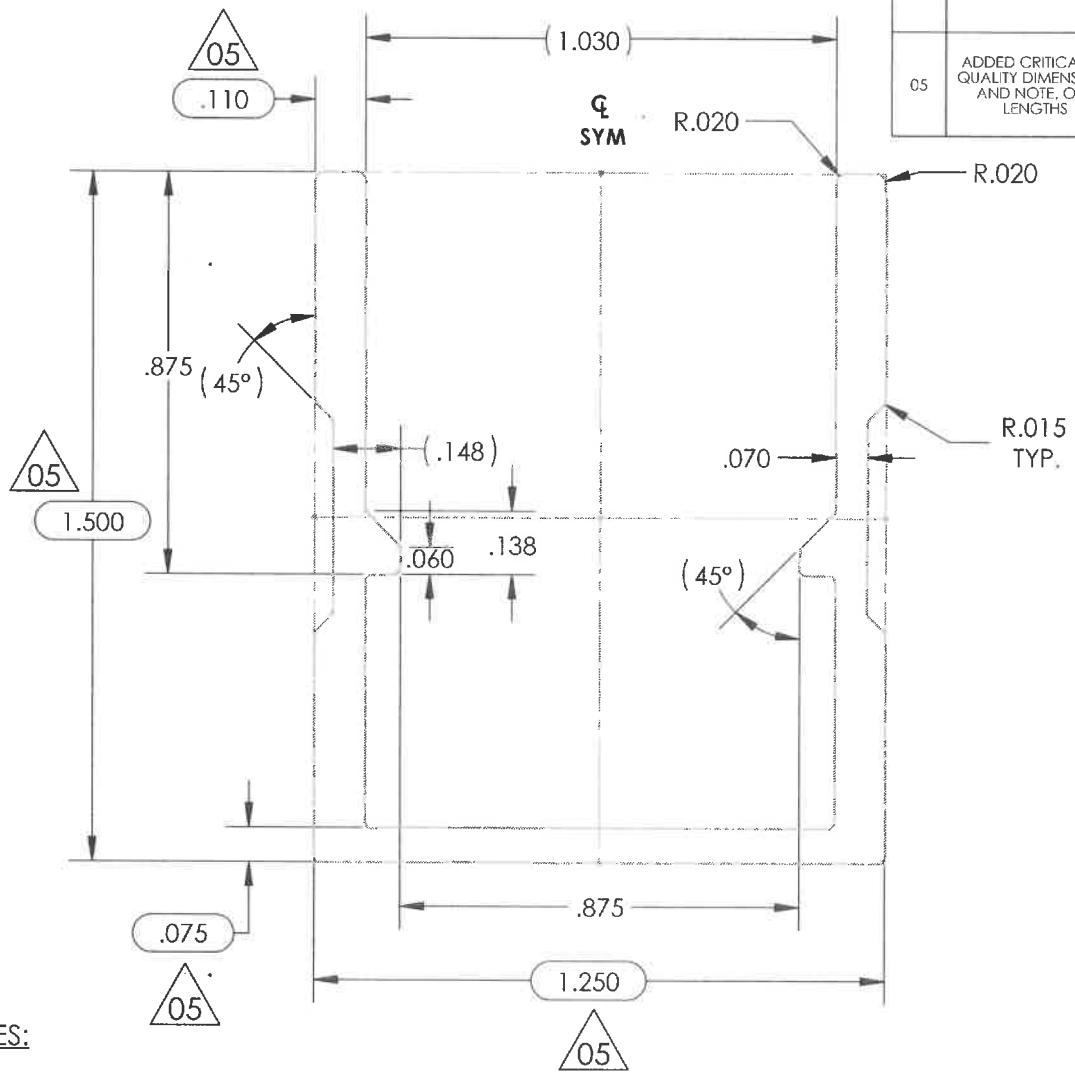
SCALE: 1:4 | WEIGHT: 0.47408 | SHEET 1 OF 1

Molimo
Architectural Product Testing

Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

Molimo® Architectural Product Testing	
Report #:	12306.04-110-23
Date:	7/19/2023
By:	M. Stremmel, P.E.

REVISIONS			
REV.	DESCRIPTION	DATE	BY
01	INITIAL RELEASE	1/18/2019	F. T.
02	ADD CUT LENGTH TOL.	5/29/2019	F. T.
03	.110" WALL WAS .100", & .075" WALL WAS .060". DID NOT MATCH VENDOR DWG	11/16/2021	EH
04	Moved Fencing 4000 to end of description	6/14/2022	JH
05	ADDED CRITICAL TO QUALITY DIMENSIONS AND NOTE, OAL LENGTHS	2/23/2023	BA



NOTES:

1. BREAK ALL SHARP EDGES
2. ALL RADIUS R.010" EXCEPT WHERE SPECIFIED
3. CRITICAL TO QUALITY DIMENSIONS

05

05

EBMS #	OAL	CUT LENGTH TOL.
COARBR8RW	8'	+1/8" / -0"

PROJECTION

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5-2009

MATERIAL: 6063-T6

FINISH: N/A

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN BY	F.Torres	05/16/2019
MODELED BY	F.Torres	05/16/2019
CHECKED BY		02/23/2023
APPROVED BY		02/23/2023

COMMENTS:

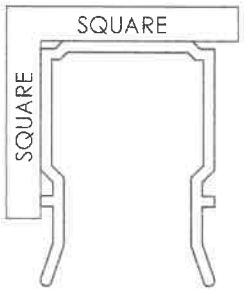
Key-Link Fencing & Railing, Inc
150 Orlan Road, New Holland, PA 17557

TITLE:
RAILING (AM/AR/KS), STD, 1.50" X 1.25" X .075"w FENCING (4000)

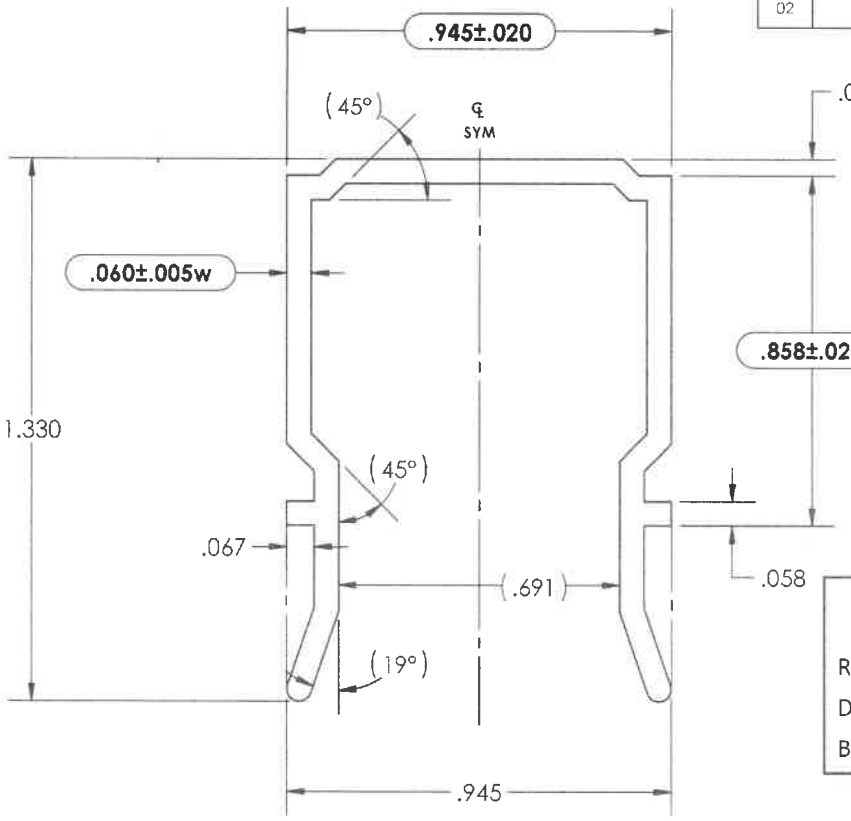
SIZE	DWG. NO.	REV
A	081101	05

SCALE: 2.5:1 | WEIGHT: 0.000 | SHEET 1 OF 1

INFORMATION OF PROFILE	
TOTAL WEIGHT PER FOOT	0.137668 lbs
TOTAL AREA OF PROFILE	0.21795 sq. in
THICKNESS OF CAP	.06 in
AREA OF CAP	0.21795 sq. in
WEIGHT PER FOOT OF CAP	0.137668 lbs
PERCENT OF CAP	100 %
THICKNESS OF SUB	0 in
PERCENT OF SUB	0 %
AREA OF SUB	0 sq. in
WEIGHT PER FOOT OF SUB	0 lbs



SCALE 1:1
REF. NOTE # 3



REVISIONS			
REV.	DESCRIPTION	DATE	BY
01	CUT LENGTH TOL. WAS +1/8"/ -0"	10/3/2019	F. T.
02	ADDED NOTE 4	3/19/2020	EH

Molimo Architectural Product Testing
Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

01

1. **CRITICAL DIMENSIONS** ⬭
2. ***REPRESENTS KFR COLOR CODE
3. USE A SQUARE TO CHECK FLATNESS ON TOP & BOTH SIDES INCLUDING TABS.
4. EVERY INSERT RAILING MUST HAVE AT LEAST 2 WEEP HOLES

SP #	EBMS#	CUT LENGTH TOL.
SP-1063	PLKFRCOARRI***	±1/8"

	NAME	DATE
DRAWN BY	F.Torres	07/25/2019
MODELED BY	F.Torres	07/25/2019
APPROVED BY	E.Hunt	10/10/2019

Superior Plastic Products Inc.
260 Jalyn Dr. New Holland, Pa 17557

PROJECTION

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR:MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH: N/A

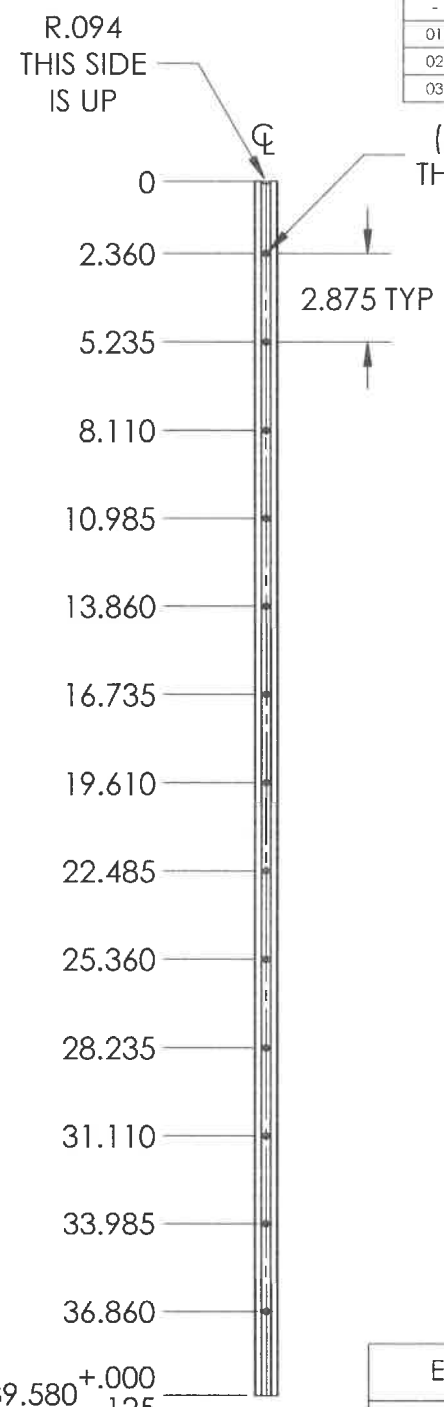
MATERIAL: SUPERIOR PVC

TITLE:
RAILING, AM/AR/KS, INSERT, 1.330" X .945" X .06w

SIZE	DWG. NO.	REV
A	097115	02

SCALE: 2:1 | WEIGHT: 0.138 | SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	MADE OWN DWG. WAS A PART OF 076481	6/25/2020	EH
01	UDATED DESCRIPTION IN DATA CARD	3/27/2023	EH
02	UPDATED TOLERANCE AMOUNT	3/27/2023	CL
03	UPDATED SHEET TO REFLECT IQC STANDARD	4/11/2023	C



Molimo™ Architectural Product Testing

Report #: 12306.04-110-23

Date: 7/19/2023

By: M. Stremmel, P.E.

NOTES:

1. **BREAK ALL SHARP EDGES**
2. **ALL TOLERANCES: +/-.010"**

EBMS ID	OAL:	Cut Length Tolerance:
COCRCBL3958RW	39.580"	+.000 -.125

PROJECTION

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5-2009

MATERIAL 6063-T6

FINISH POWDER COAT PER KFR STD

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN BY	F. Torres	6/25/2020
MODELED BY	E.Hunt	06/25/2020
CHECKED BY		04/12/2023
APPROVED BY		04/12/2023

COMMENTS:

Key-Link Fencing & Railing, Inc
150 Orlan Road, New Holland, PA 17557

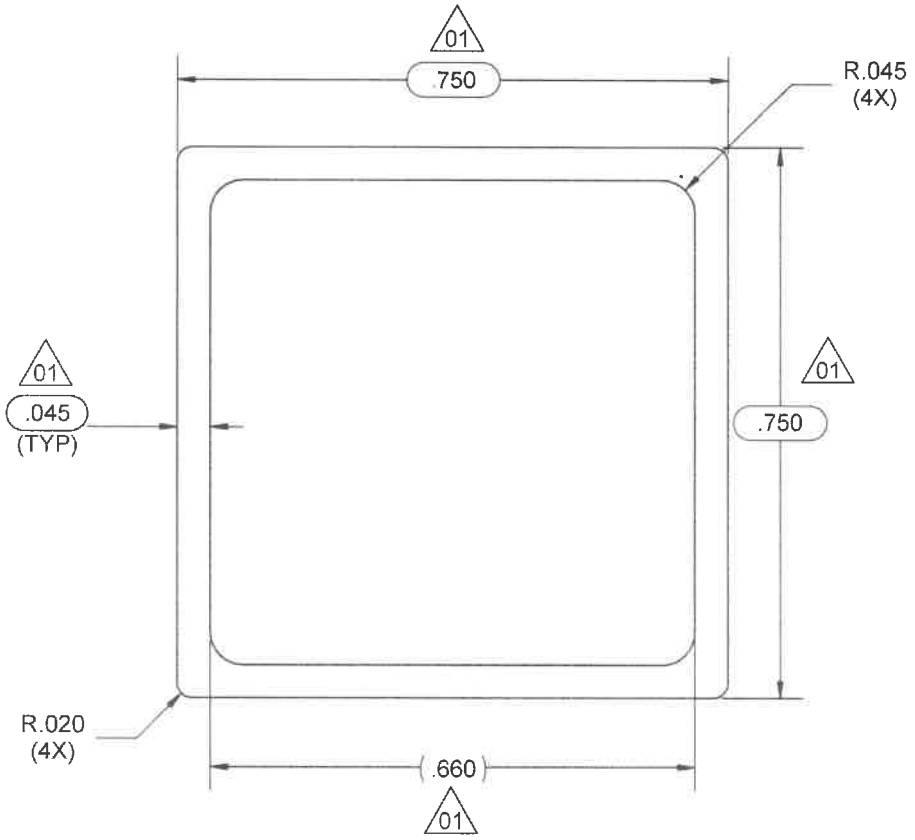
TITLE:

3/4" SQ. X 39" LEVEL BALUSTER (FOR 42" HT. RAILING)

SIZE	DWG. NO.	REV
A	108959	3

SCALE: 1:5 | WEIGHT: 0.598 | SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	INITIAL RELEASE	8/5/2020	IS
01	ADDED CRITICAL TO QUALITY DIMENSIONS AND NOTE, OAL LENGTHS	2/22/2023	M.A.



Molimo
Architectural Product Testing

Report #: 12306.04-110-23

Date: 7/19/2023

By: M. Stremmel, P.E.

01

NOTE:

1. CRITICAL TO QUALITY DIMENSIONS

01

EBMS #	OAL	CUT LENGTH TOL.
COARSP46RW	46"	+/- .010"
COARSP39RW	39"	+/- .010"
COARSP35RW	35"	+/- .010"
COARSP33RW	33"	+/- .010"
COARSP31RW	31"	+/- .010"
COARSP29RW	29"	+/- .010"

LAST SAVE DATE		NAME	DATE
2/22/2023	MODELED BY	F.Torres	01/20/2020
	DRAWN BY	F.Torres	01/20/2020
	APPROVED BY	J.Detweiler	02/22/2023

PROJECTION

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR:MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH: N/A

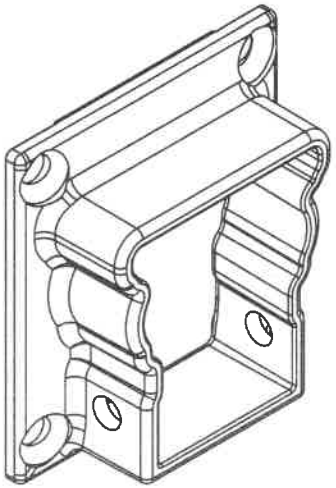
MATERIAL: 6063-T6

Key-Link Fencing and Railing
110 Peters Road, New Holland, Pa 17557

TITLE:
RAILING, BALUSTER, THIN, 0.75" SQ. X .045w

SIZE	DWG. NO.	REV
A	102834	01

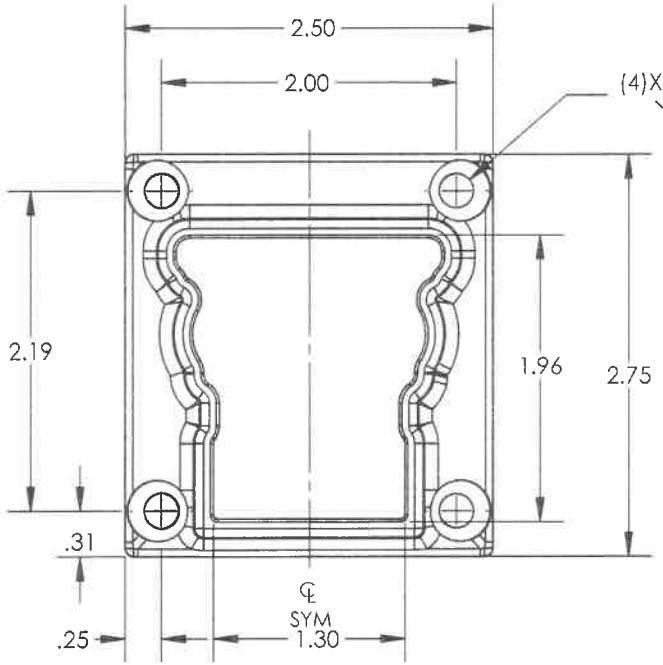
SCALE: 4:1 | WEIGHT: 0.1502 | SHEET 1 OF 1

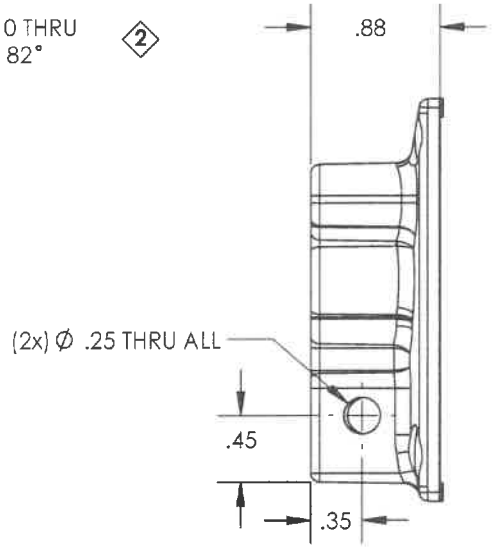


Molimo
Architectural Product Testing

Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	See 076815 SHEET 1	-	-





NOTES:

1. BREAK ALL SHARP EDGES

2. HOLES MUST BE CHECKED WITH #12 FHMS, THE SCREW MUST SIT FLUSH OR SLIGHTLY BELOW SURFACE

3. REF. DWG CAD #076815 FOR DIE CAST DIM.

PROJECTION

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5-2009
MATERIAL: A360-1 Die Cast
FINISH: N/A
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN BY	J.Coon	01/27/2022
MODELED BY	J.Coon	01/27/2022
CHECKED BY		
APPROVED BY	J.Coon	

COMMENTS:

EBMS# COAMLBTRW

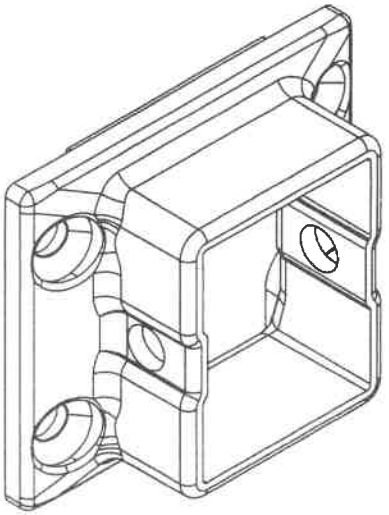
Key-Link Fencing & Railing, Inc
150 Orlan Road, New Holland, PA 1755

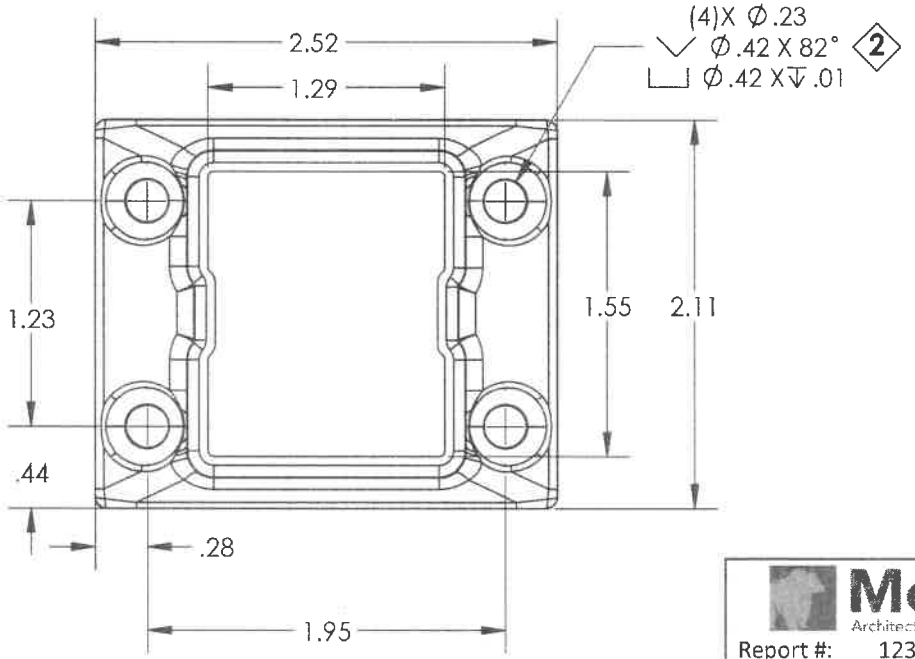
TITLE:
AMERICAN SERIES MOUNTING BRACKET, TOP, LEVEL

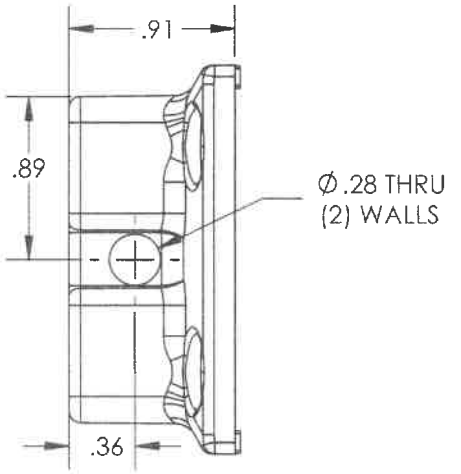
SIZE	DWG. NO.	REV
A	078161	

SCALE: 4:5 | WEIGHT: 0.114 | SHEET 2 OF 2

REVISIONS			
REV.	DESCRIPTION	DATE	BY
01	INITIAL RELEASE	9/21/2018	F. T.
02	EBMS ID WAS INCORRECT, UPDATED DESCR.	12/21/2018	EH
03	CHANGE MAT'L FROM A380 TO A360-1	2/8/2022	JC







NOTES:

1. BREAK ALL SHARP EDGES

2. HOLES MUST BE CHECKED WITH #12 FHMS, THE SCREW MUST SIT FLUSH OR SLIGHTLY BELOW SURFACE

3. REF. DWG CAD #076833 FOR DIE CAST DIM.

Molimo Architectural Product Testing

Report #:	12306.04-110-23
Date:	7/19/2023
By:	M. Stremmel, P.E.

EBMS# COARLBBRW

PROJECTION

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/64'
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5-2009

MATERIAL: A360-1 Die Cast (03)

FINISH: N/A

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN BY	E.Hunt	9/26/18
MODELED BY	E.Hunt	9/26/18
CHECKED BY	M. Alexander	8/4/2020
APPROVED BY	A. Rodriguez	8/4/2020

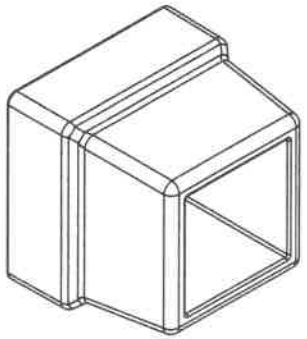
COMMENTS:

Key-Link Fencing & Railing, Inc
150 Orlan Road, New Holland, PA 1755

TITLE: MOUNTING BRACKET BOTTOM, LEVEL (AM/AR/KS) (DRILLED)

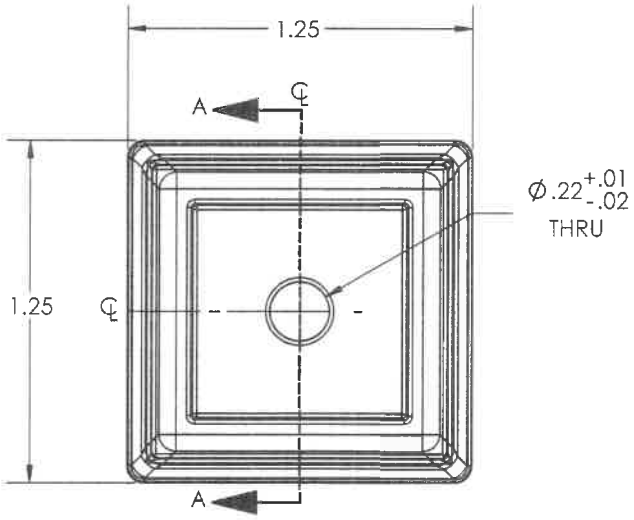
SIZE	DWG. NO.	REV
A	079359	03

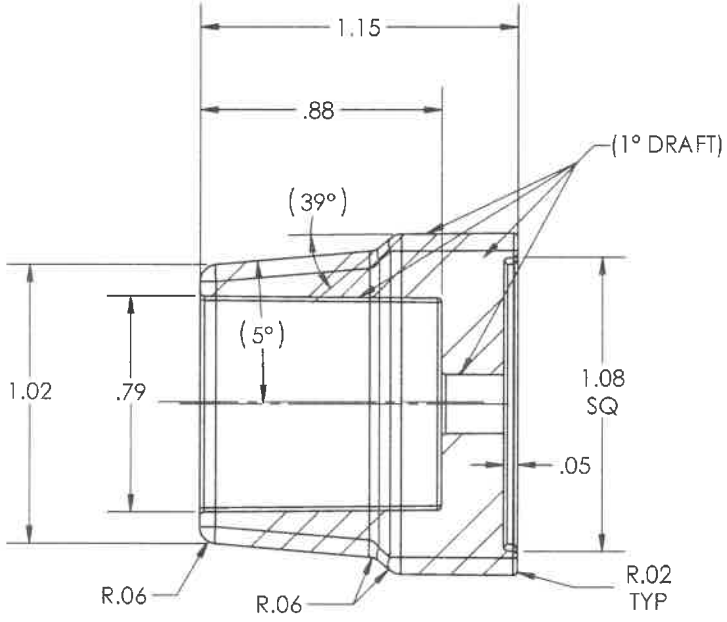
SCALE: 1:1 | WEIGHT: 0.093 | SHEET 1 OF 1



Molimo Architectural Product Testing	
Report #:	12306.04-110-23
Date:	7/19/2023
By:	M. Stremmel, P.E.

REVISIONS			
REV.	DESCRIPTION	DATE	BY
01	INITIAL RELEASE	3/26/2019	F. T.
02	MEASUREMENT DESCRIPTION UPDATE	8/5/2022	DC





SECTION A-A

NOTES:

1. BREAK ALL SHARP EDGES

EBMS#
COARRBMRW

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES	DRAWN BY	F. Torres	5/1/2019
TOLERANCES:	MODELED BY	C. Weaver	8/4/2018
FRACTIONAL ± 1/64"	CHECKED BY		
ANGULAR: MACH ±1.0° BEND ±1.0°	APPROVED BY		
TWO PLACE DECIMAL ±0.01"	COMMENTS:		
THREE PLACE DECIMAL ±0.005"			
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5-2009			
MATERIAL: A360-1 Die Cast			
FINISH: N/A			
DO NOT SCALE DRAWING			

PROJECTION

Key-Link Fencing & Railing; Inc
150 Orlan Road, New Holland, PA 1755

TITLE:

.75" SQ. BALUSTER MOUNT, LEVEL

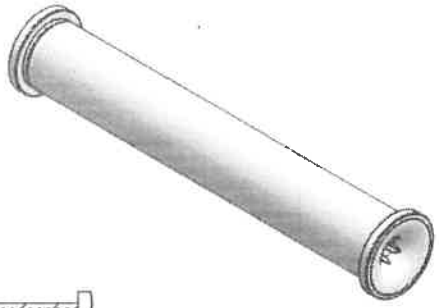
SIZE	DWG. NO.	REV
A	082432	02
SCALE: 3:2	WEIGHT:	SHEET 1 OF 1

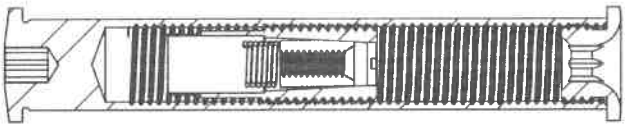
BOM TABLE			
ITEM NO.	CAD NUMBER	DESCRIPTION	QTY.
1	075350	CABLE PULL LOCK CARTRIDGE	1
2	075596	3.25" END POST RECEIVER (HORZ. CABLE)	1
3	075362	CABLE PULL LOCK WEDGE	2
4	111827	PULL LOCK CARTRIDGE SPRING	1
5	075881	END POST RECEIVER CAP (HORZ. CABLE)	1

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	INITIAL RELEASE	1/31/2023	EH
01	REMOVED OBSOLETE CARTRIDGE CAP	1/31/2023	DN

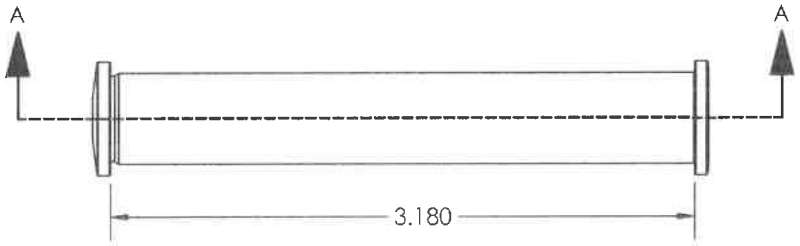
Molimo
Architectural Product Testing

Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

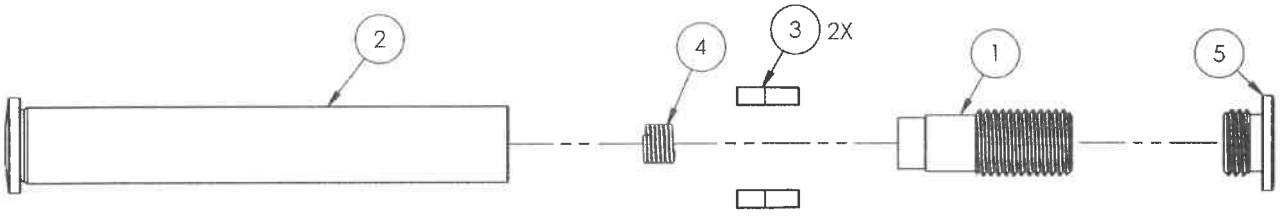




SECTION A-A



EXPLODED VIEW



	NAME	DATE
DRAWN BY	E.Hunt	11/9/2020
MODELED BY	E.Hunt	11/9/2020
APPROVED BY	E.Wenger	02/01/2023

PROJECTION

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH: N/A

MATERIAL: SEE BILL OF MATERIALS

EBMS ID: CRPFKE314X1

Key-Link Fencing & Railing, Inc
150 Orlan Road, New Holland, PA 17557

TITLE:
HORIZONTAL CABLE END POST RECIEVER, ASSY

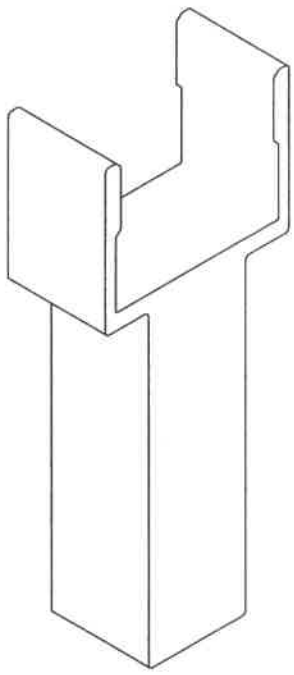
SIZE	DWG. NO.	REV
A	111709	01

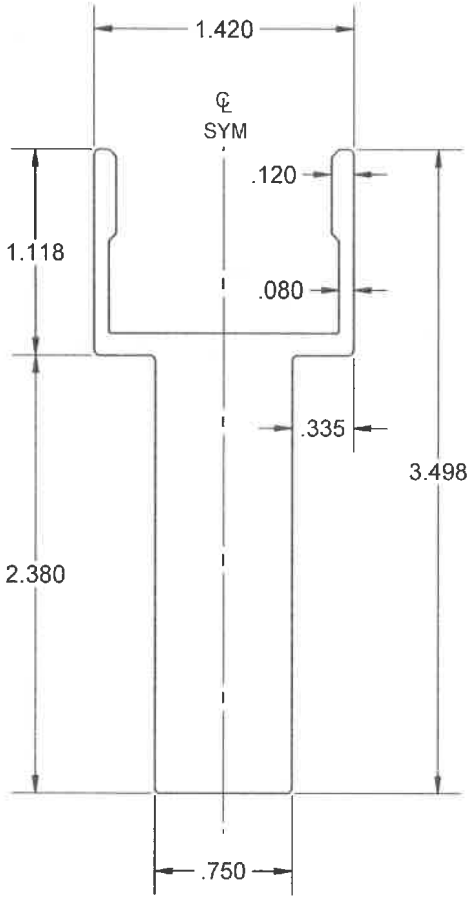
SCALE: 1:1 | WEIGHT: 0.105 | SHEET 1 OF 1

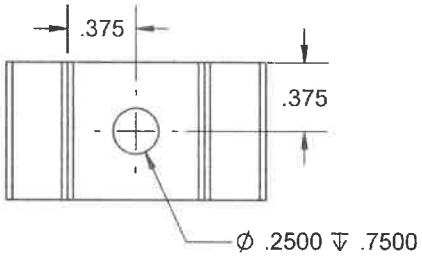
Molimo
Architectural Product Testing

Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	INITIAL RELEASE	8/6/2020	IS







EBMS #
COARSOSSRW

LAST SAVE DATE		NAME	DATE
6/7/2021	MODELED BY	E.Hunt	10/29/2019
	DRAWN BY	I.Shenk	10/29/2019
	APPROVED BY	E.Hunt	08/07/2020

Superior Plastic Products, Inc.
260 Jalyn Dr, New Holland, PA 17557

TITLE:
SNAP ON SECTION SUPPORT, AM/AR/KS

PROJECTION

DO NOT SCALE DRAWING

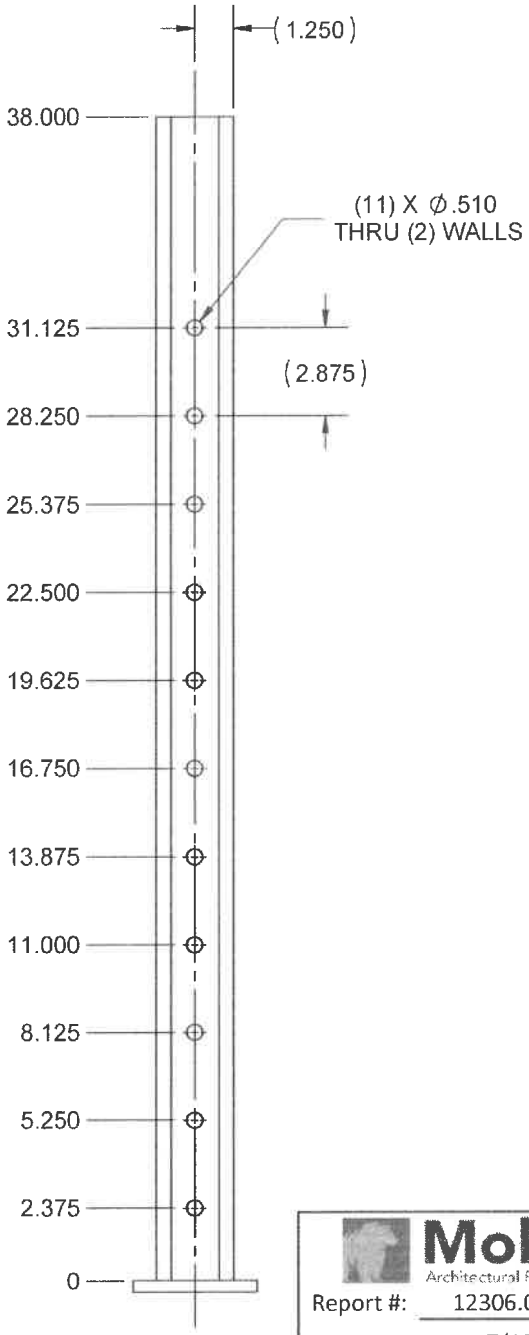
UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

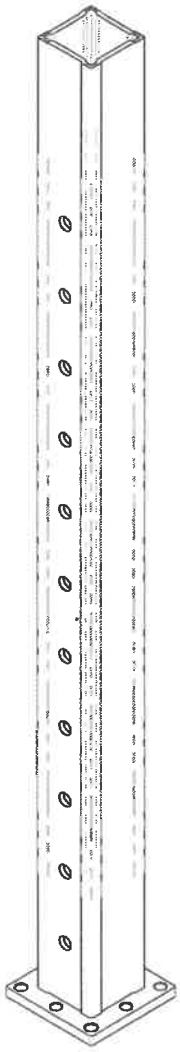
FINISH	MATERIAL
N/A	6063-T6

SIZE	DWG. NO.	REV
A	100664	-

SCALE: 1:1 | WEIGHT: 0.15363 | SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	INITIAL RELEASE	3/23/2023	JM





Molimo
Architectural Product Testing

Report #: 12306.04-110-23

Date: 7/19/2023

By: M. Stremmel, P.E.

EBMS#: PWP8CEL2X38TBL

	NAME	DATE
MODELED BY	J.Martin	1/17/2023
DRAWN BY	J.Martin	1/17/2023
APPROVED BY	J.Coon	03/23/2023

Key-Link Fencing and Railing
110 Peters Road, New Holland, Pa 17557

TITLE:
2.5" x 38" CABLE LEVEL END POST W/PLATE (FOR 36" HT. RAILING)

LAST SAVE DATE
3/23/2023

PROJECTION

DO NOT SCALE DRAWING

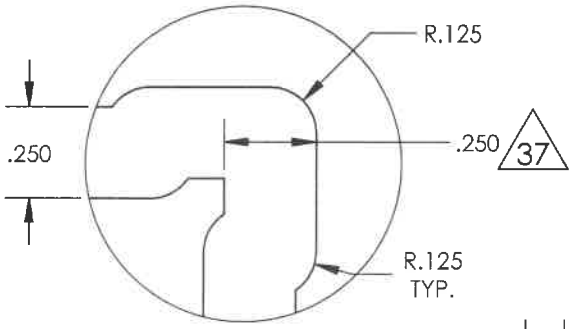
UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH: N/A

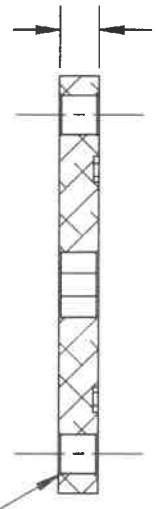
MATERIAL: SEE BILL OF MATERIALS

SIZE	DWG. NO.	REV
A	140001	-

SCALE: 1:8 | WEIGHT: 6.509 | SHEET 1 OF 1

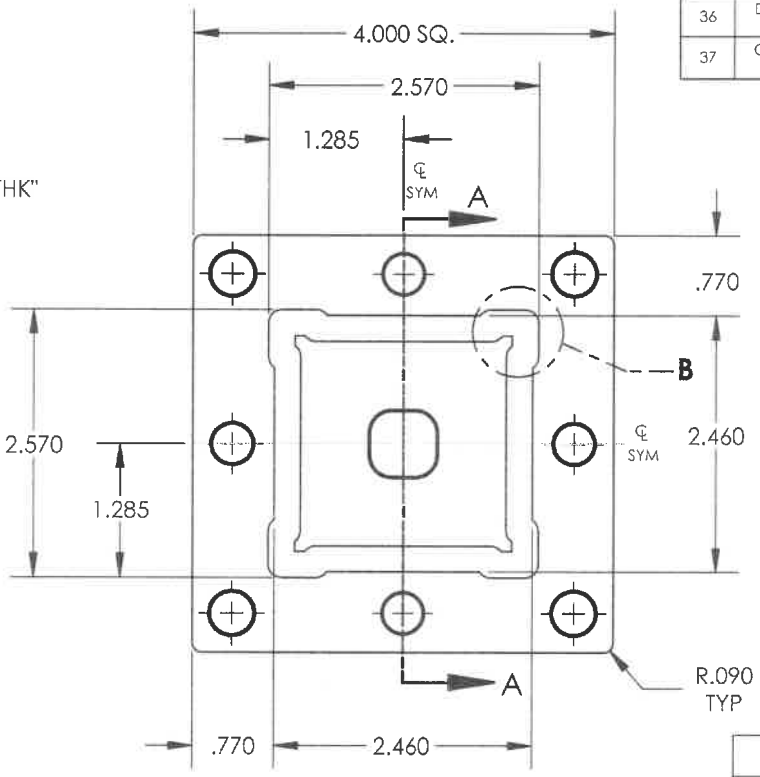


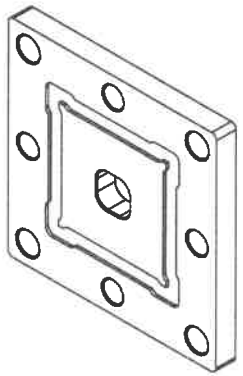
DETAIL B
SCALE 2 : 1
4-CORNERS



.02 X 45°
ALL HOLES & CTR SQ.
TOP & BOTTOM

SECTION A-A





REVISIONS			
REV.	DESCRIPTION	DATE	BY
33	DATA MIG. TO PROD. VAULT	9/6/2018	F. T.
34	WAS 3.88" SQ. IS NOW 4" SQ., WAS .31"IS NOW .38"	9/6/2018	F. T.
35	REVISED MILL PATH, ADDED DETAIL B	11/10/20 20	Prod_G W
36	DESCRIPTION FIELD SPELLING ERROR	12/14/20 20	EH
37	Changed moat to new 0.25" wide single tool path	8/24/202 2	JM

"THK"	EBMS#
0.38"	COARAPP38X4RW
0.50"	COARAPP12X4RW

EBMS #

NOTE:

1. BREAK ALL SHARP EDGES

Molimo
Architectural Product Testing

Report #:	12306.04-110-23
Date:	7/19/2023
By:	M. Stremmel, P.E.

LAST SAVE DATE		NAME	DATE
1/17/2023	MODELED BY		
	DRAWN BY	J.MARTIN	
	APPROVED BY	J.Coon	01/17/2023

PROJECTION

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES [MM]
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR:MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH	MATERIAL
N/A	6061 Alloy

Key-Link Fencing and Railing
110 Peters Road, New Holland, Pa 17557

TITLE:
.375"-.5" X 4" SQ. POST PLATE FOR 2.5" POST

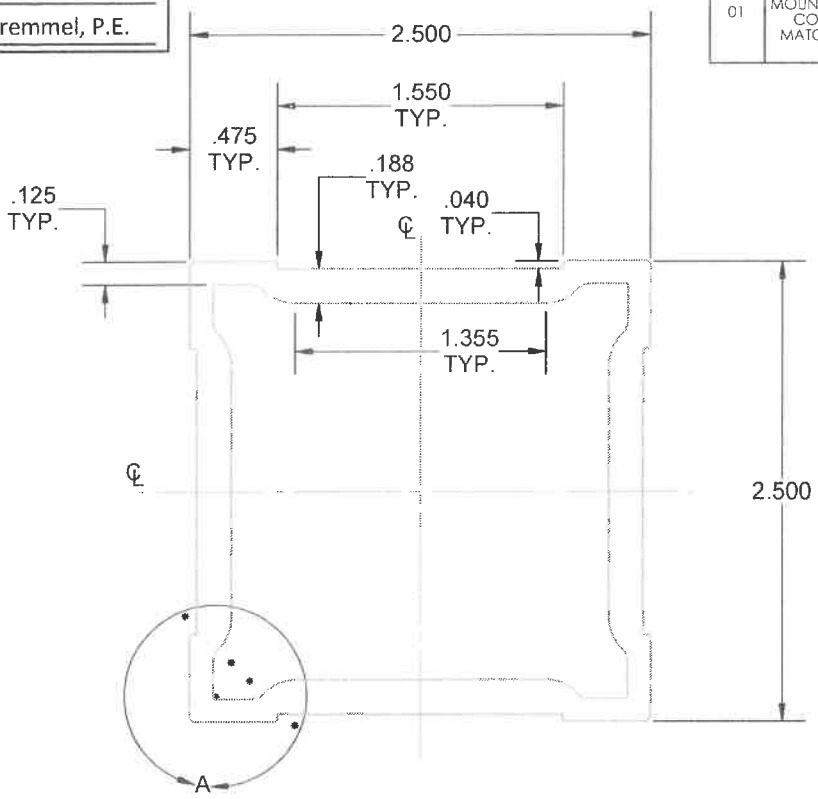
SIZE	DWG. NO.	REV
A	069808	37

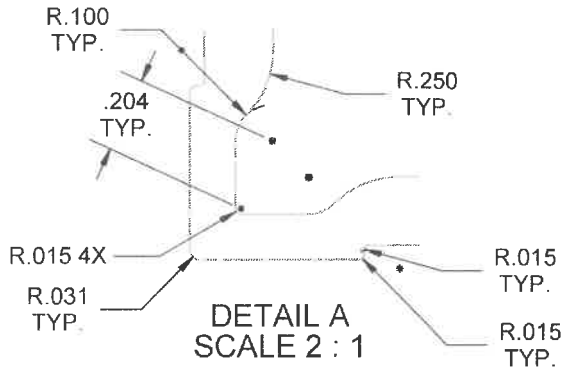
SCALE: 1:1.75 | WEIGHT: 0.525 lbs. | SHEET 1 OF 2

Molimo
Architectural Product Testing

Report #: 12306.04-110-23
Date: 7/19/2023
By: M. Stremmel, P.E.

REVISIONS			
REV.	DESCRIPTION	DATE	BY
-	INITIAL RELEASE FOR QUOTING	1/28/2022	JD
01	CHANGED INSIDE CORNER RADIUS TO FIT INTERNALLY MOUNTING CAPS. THE INSIDE CORNER RADIUS NOW MATCHES THE 0.125" WALL POST.	10/28/2022	JM





DETAIL A
SCALE 2 : 1

NOTES:

1. BREAK ALL SHARP EDGES

	NAME	DATE
MODELED BY	J.Detweiler	1/31/2022
DRAWN BY	J.Detweiler	1/31/2022
APPROVED BY	A.Nace	11/01/2022

PROJECTION

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED:
1. DIMENSIONS ARE IN INCHES
2. BREAK ALL SHARP EDGES
3. TOLERANCES:
FRACTIONAL ± 1/64"
ANGULAR: MACH ±1.0° BEND ±1.0°
TWO PLACE DECIMAL ±0.01"
THREE PLACE DECIMAL ±0.005"

FINISH: N/A
MATERIAL: 6063-T6

LAST SAVE DATE
11/1/2022

EBMS#:

Key-Link Fencing and Railing
110 Peters Road, New Holland, Pa 17557

TITLE:
RAILING, POST MOUNT, STD, 2.5" SQ. X .1875w

SIZE	DWG. NO.	REV
A	123845	01

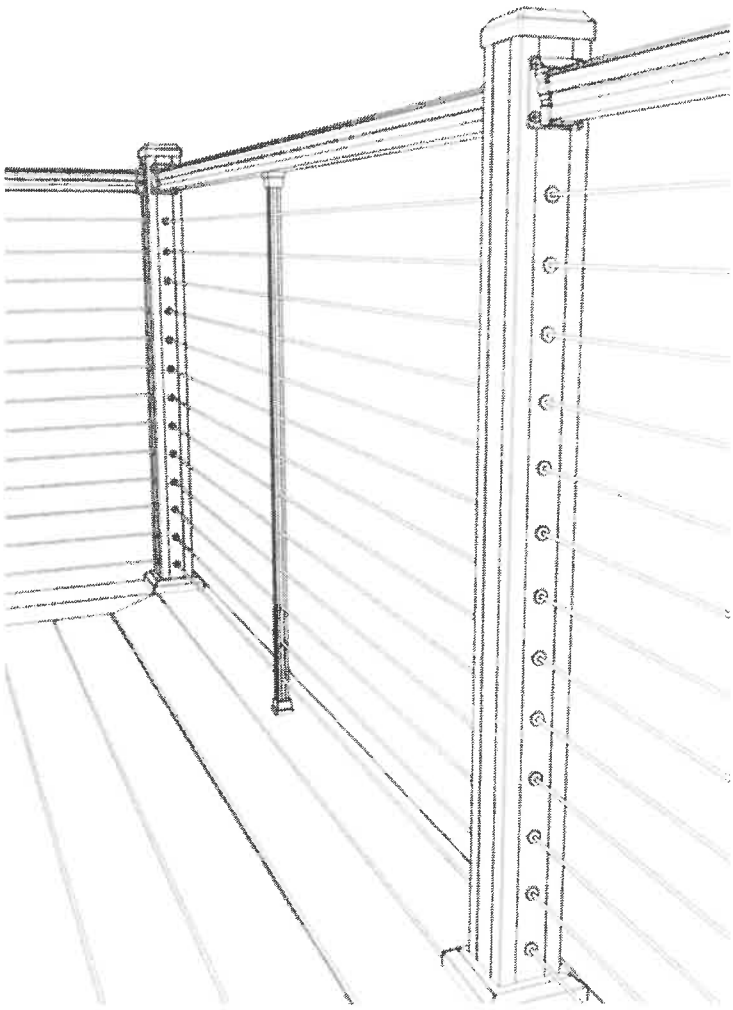
SCALE: 1:1 | WEIGHT: | SHEET 1 OF 1

Key-Link Fencing & Railing

HORIZONTAL CABLE INFILL

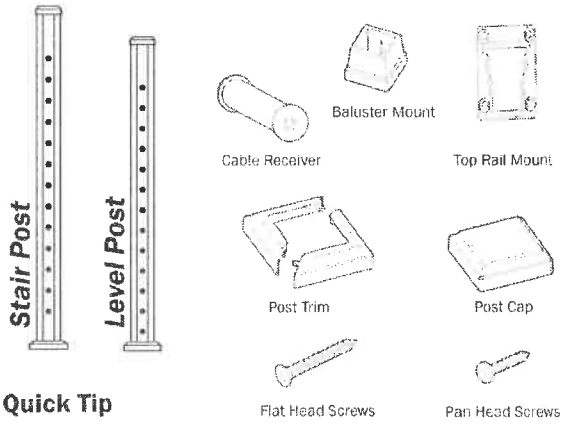
American & Arabian Series

**Reference Local Building Codes for Railing and Cable Installation requirements*



What's Included

- Top Rail & Baluster(s)
- Mounting Brackets & Screws
  (Predrilled Posts, Caps, & Trim packaged separate)
- Stainless Steel Cable Roll *(optional)*



Quick Tip

Wear clean, new gloves when handling stainless steel parts to prevent corrosion from oil and dirt.

Recommended Tools

- Safety Glasses
- Tape Measure & Pencil
- Level
- Drill & Bits (¼", 3⁄16", 17⁄32")
- Hammer Drill (if concrete)
- Circular Saw w/ Fine-Tooth Aluminum Cutting Blade
- Rubber Mallet

● Available from Key-Link

●Tension Gauge

●Cable Vise Grip

● Cable Release Key

●Cable Cutter

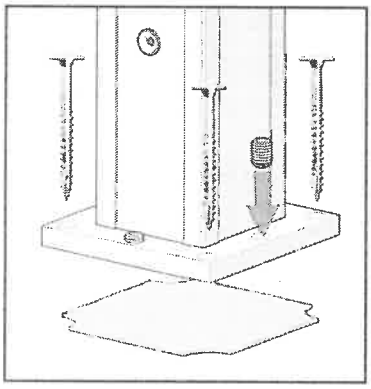
● Cable Needle

- *These directions are only a guide and may not address every situation.*
- *Always wear proper safety equipment while assembling and installing.*
- *The installer should obtain all required building permits and follow all installation procedures in accordance with applicable building code requirements.*
- *Key-Link Fencing and Railing Inc. shall not be held liable for improper or unsafe installations.*
- *Applying paint, other than Key-Link's touch up paint, will void your warranty.*
- *To ensure proper coverage by our warranty please visit our website and complete the warranty form and mail to: Key-Link Fencing & Railing, Inc., 150 Orlan Road, New Holland, PA 17557*

KFRIG161208

Post, Baluster, and Top Rail Installation

1 Install Railing Post & Post Trim

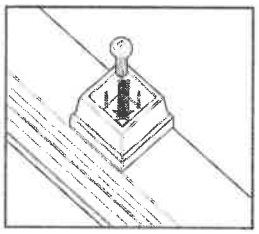


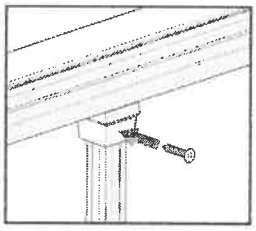
Space Posts according to *application and Top Rail length. A structural member must be placed between top of Posts to ensure proper cable tensioning. Place leveling plate (*highlighted*) between Post and mounting surface.

Attach to structural surface using bolts or lags (*not included*). Partially Tighten prior to levelling. Using 3/16" Allen wrench, turn set screws to level Post. Then fully tighten structural screws.

**Check your local building codes to determine structural mounting requirements for Post.*

2 Attach Baluster Mount

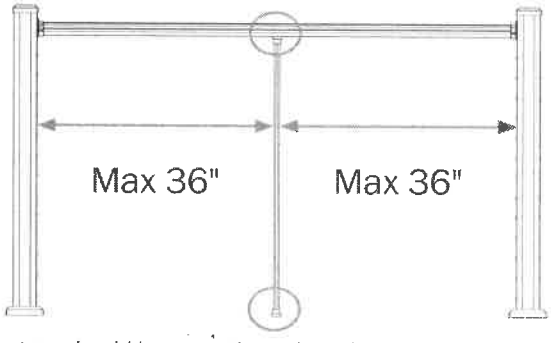




*(*If Needed*) Cut Rail to proper length

Attach a Baluster Mount (*circled*) centered on the bottom surface of the Top Rail and another to the deck aligned with the baluster mount on the Top Rail. Fasten the Baluster to the Mount.

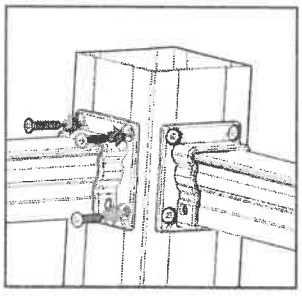
Baluster Spacing



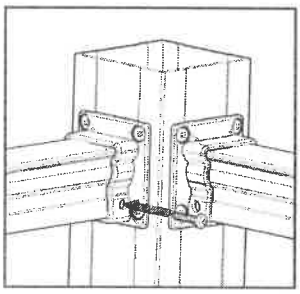
Balusters should be spaced evenly and no more than 36" apart

Cutting Tip

Be sure to use a **fine-tooth blade approved for cutting aluminum** and rest rails on a piece of **non-abrasive material** to protect from scratches.



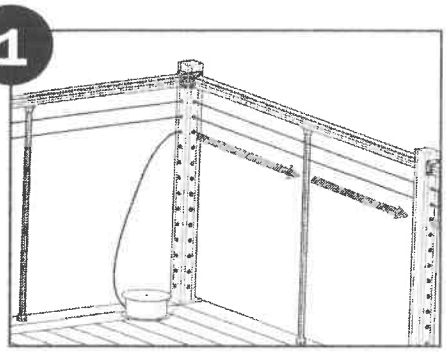
3 Attach Top Rail



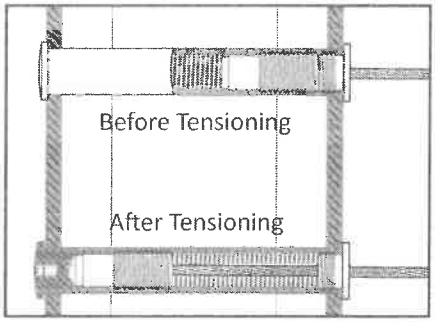
Slide the Bracket over the Rail, then put the Rail in place, and slide the self-centering Bracket against the Post. Fasten Bracket to Post using #12 screws, and secure Bracket to Rail using #10 pan-head screws.

Cable Rail Installation

1

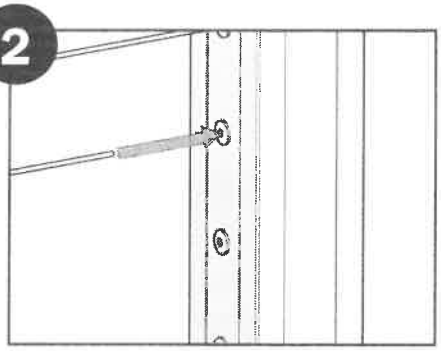


Thread the cable through all the Posts and balusters starting from one end Post to the next end Post.



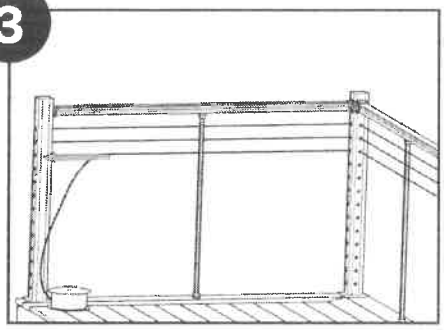
Check to make sure the Lock Jaw housing (*highlighted*) is threaded all the way out to the cap to maximize tensioning capacity.

2



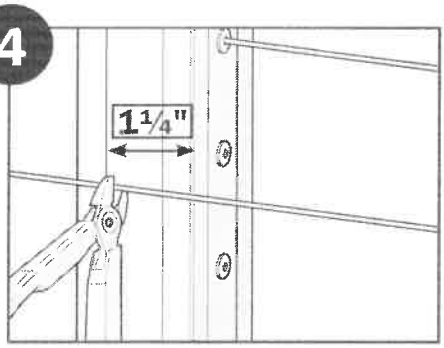
Insert the cable into the end Post Receiver as far as it will go. Gently twist clockwise on the cable to until it is secure.

3



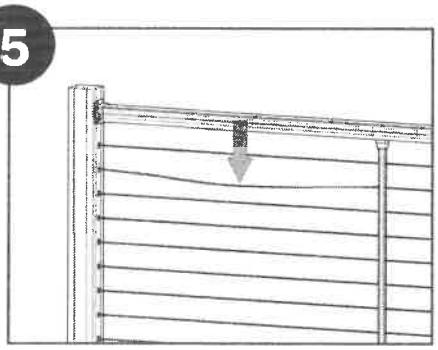
Unwind enough cable to reach to the opposite end Post and pull tight. Removing all slack from each section.

4



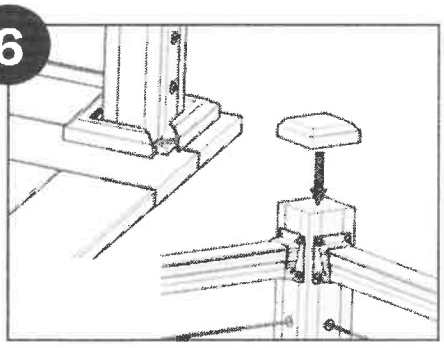
Remove Cable Slack and cut 1¼" longer than inside face of the end Post Receiver. Insert Cable into the Receiver by twisting in a clockwise direction. (*Optional use Cable Vice Grip Tool*)

5



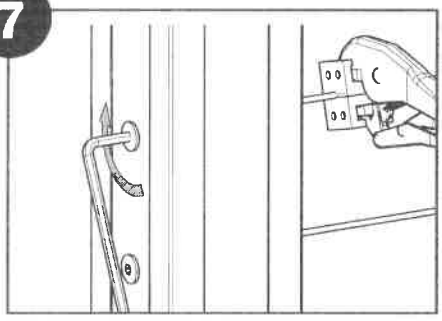
Once both cable ends have been inserted; place body weight onto each cable to set/ anchor them firmly inside Receivers. (*Before continuing to Step-7*) Repeat previous steps for the remaining Post and Baluster rows.

6



Place Post Cap on Post and use soft or rubber mallet to set in place. Snap the Post Trim halves together around the bottom of each Post.

7



Use a 3⁄16" Allen Wrench, to tighten

Tip: Tighten every other row first, working away from the center.

A Tension Gauge (*available from Key-Link*) can be used to tighten the cable to the desired tension.

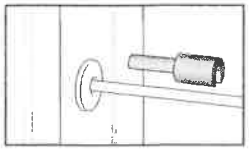
When tightening cable; watch to ensure the cable is not spinning which could indicate the receiver is fully tightened.

Do not overtighten!

Cable can release if over tightened

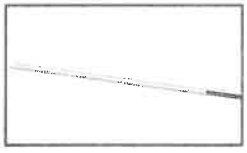
Check with your local building inspector about local codes regarding cable tension.

Cable Release Key

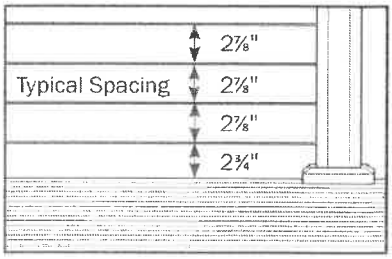


*To use the **Cable Release Key**, slide it over the cable into the receiver, and push to release the cable. For use before the cable is fully tightened.*

Cable Needle



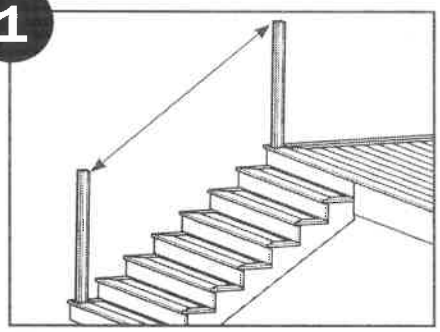
*The **Cable Needle** is used for threading the cable through balusters & posts that do not have fittings.*



Check with your local building inspector on how close the cables should be if drilling the Post yourself.

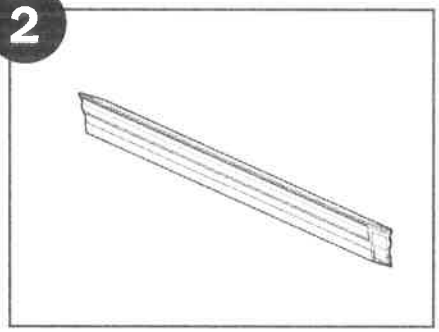
Stair Rail Installation

1



Measure from inside edge between Posts (then subtract ¼")

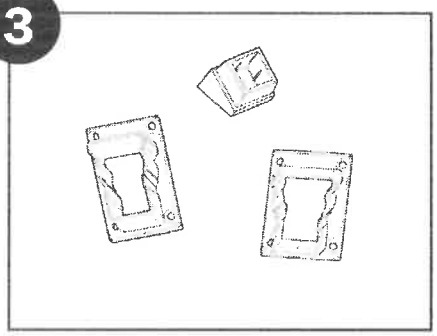
2



Cut Upper and Lower ends of Top rails at opposite angles. To ensure Rails align properly.

(Standard stair angle is 34°)

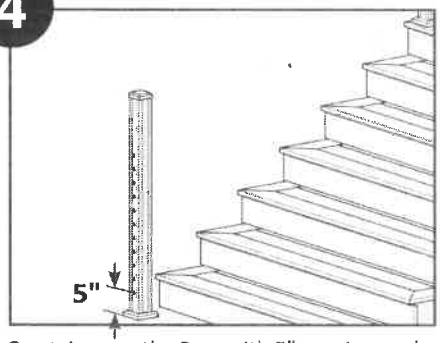
3



Attach both Baluster stair mounts, and Up and Down Top rail mount

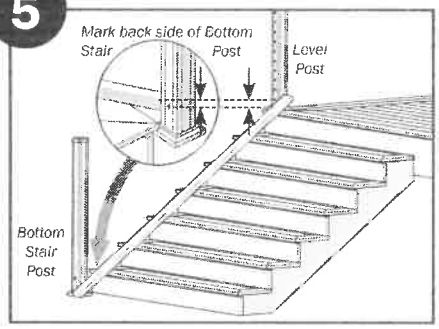
(Refer to pg.2 Step 2 & 3)

4



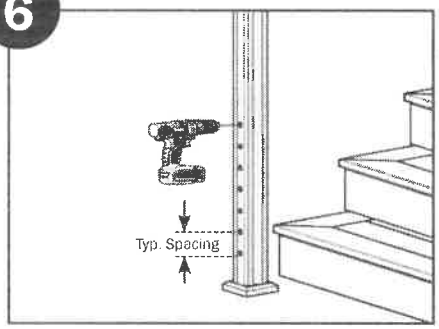
On stairs; use the Post with 5" spacing to the bottom receiver. Standard Posts can only be used on stairs when stair angle is 34°. For all other angles, blank Posts will need to be used and custom drilled.

5



To determine first hole placement; use a straight edge laid flat on the nose of the stairs, and measure off the surface to the first hole on the Level Post, and translate that measurement to each Post/ Baluster.

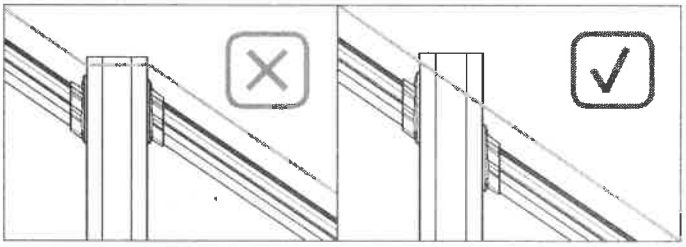
6

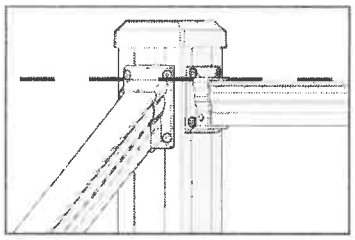


Use typical spacing (2⅞") to mark each additional hole on both sides of the Bottom Stair Post, and drill a 17/32" level hole at each mark.

Note: On a Line Post, or Baluster; 3/16" holes should be drilled at the appropriate stair angle.

! When doing stair sections, mount them as shown below:





Ensure that the stairs' Top Rail doesn't exceed the level rail height of the opposite Rail.

! NOTE: How to Loosen Stuck Jaws

In the event that the jaws of the post receiver become stuck.

Insert an Allen Wrench into the open end of the cable receiver, and press until you can feel the internal spring release.

Key-Link Fencing & Railing

150 Orlan Road • New Holland, PA 17557

KeyLinkOnline.com