Code Compliance Research Report CCRR-0167

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1.0 Subject

Superior Plastic Products Systems:

200 Series Professional Rail

1000 Series T-Rail

3000 Series Newport Rail

Beveled T-Rail

2 x 3.5 Rectangular Rail

Cardinal Building Products Systems:

Sonic Beveled-S,R,T

Sonic 24-S,R,T

2.0 Research Scope

2.1 Building Codes:

2012 International Building Code (IBC)

2012 International Residential Code (IRC)

2.2 Properties:

Structural Performance

Durability

Surface Burning

3.0 Description

3.1 General – The Superior Plastic Products vinyl guardrail systems identified in Section 1.0 are guardrails (guards) under the definitions of the referenced codes and are intended for use on elevated walking areas of buildings and walkways as required by the referenced codes.

3.2 Guardrail Assemblies – Railing systems are provided as level guards for level walking areas such as decks, balconies, and porches. Guards are provided in lengths up to 120 inches between supports and overall installed height of 36 inches to 42 inches. See Figure 1, Table 1, and Table 2.

3.3 Materials and Processes - Railings are an assemblage of co-extruded and molded components utilizing Poly Vinyl Chloride (PVC) material, and aluminum reinforcements. The *3000 Series PVC components are produced in five colors: White, Tan, Clay, Almond and Black.* The *1000 Series* PVC components are produced in four colors: White, Tan, Clay, and Almond. The *200 Series* PVC components are produced in three colors: White, Clay and Black. The Sonic Beveled-S,R,T Railing, Sonic 24-S.R.T Railing, Beveled S,R,T-Rail, and 2x3.5 Rectangular rails are produced in four colors: White, Black, Clay and Almond. The systems consist of the following components:

3.3.1 The *200 Series Professional Rail* top rail is a co-extruded PVC "T" profile with overall dimensions of 3.16 inches wide at the top and 1.75 inches wide at the bottom by 2 inches tall with a nominal 0.085 inch wall thickness. See Figure 2.

3.3.2 The *1000 Series T-Rail* top rail is a co-extruded PVC "T" profile with overall dimensions of 3.0 inches wide at the top and 1.75 inches wide at the bottom by 3.5 inches tall with a nominal 0.110 inch wall thickness. See Figure 4.

3.3.3 The *3000 Series Newport Rail* top rail is a co-extruded PVC contoured profile with overall dimensions of 3.0 inches wide at the top by 3.22 inches tall with a nominal 0.110 inch wall thickness. See Figure 5.

3.3.4 The Beveled S,R,T-Rail and *Sonic Beveled-T* top rail is a co-extruded PVC contoured profile with overall dimensions of 3.50 inches wide at the top by 3.50 inches tall with a nominal 0.110 inch wall thickness. See Figure 6.

3.3.5 The *200 Series Professional Rail* bottom rail is a co-extruded PVC rectangular profile with overall dimensions of 1.775 inches wide by 2.775 inches tall with a nominal 0.075 inch wall thickness. See Figure 3.

3.3.6 The *1000 Series T-Rail* and *3000 Series Newport Rail* bottom rail is a co-extruded PVC rectangular profile with overall dimensions of 1.75 inches wide by 3.5 inches tall with a nominal 0.110 inch wall thickness. See Figure 8.

3.3.7 The 2 x 3.5 Rectangular Rail and Sonic 24-S series bottom rail is a co-extruded PVC rectangular profile with overall dimensions of 2.00 inches wide by 3.50 inches tall with a nominal thickness of 0.11 inches. See Figure 7.

3.3.8 Baluster Styles and applicable systems can be found in Table 1, Table 2 and Table 3.

3.3.9 An extruded 6005-T5 aluminum "A"-shaped insert with an inner web thickness of 0.135 inch is used to provide reinforcement for the *1000 Series* and *3000 Series* PVC top rails. See Figure 20.

3.3.10 An extruded 6005-T5 aluminum inverted "A"-shaped insert with an inner web thickness of 0.070 inch is used to provide reinforcement for the *1000 Series* and *3000 Series* PVC bottom rails. See Figure 20.

3.3.11 An extruded 6063-T5 aluminum "A"-shaped insert with an inner rib thickness of 0.105 inch is used to provide reinforcement for the *200 Series* PVC top rails. See Figure 19.

3.3.12 An extruded 6063-T5 aluminum inverted "H"-shaped insert with a wall thickness of 0.070 inch is used to provide reinforcement for the *200 Series* PVC bottom rails. See Figure 19.

3.3.13 An extruded 6005-T5 aluminum "P"-oriented and shaped insert with a wall thickness of 0.070 inch is used to provide reinforcement for the Beveled S,R,T-Rail and *Sonic Beveled-S,R,T Series* PVC top rails. See Figure 21.

3.3.14 An extruded 6005-T5 aluminum "b"-oriented and shaped insert with a wall thickness of 0.070 inch is used to provide reinforcement for the 2 x 3.5 Rectangular Rail and the Sonic 24-S,R,T *Series* PVC bottom rails. See Figure 21.

3.3.15 Top and bottom rails are connected to posts using molded PVC brackets secured to the posts with stainless steel screws. See Figure 22 through 27 and Table 4.

3.3.16 Railing systems are attached to conventional wood supports which are outside the scope of this report. A 4 inch square with a nominal wall thickness of 0.150 inch co-extruded PVC post sleeve is used to sleeve a conventional 4x4 wood post. See Figure 22.

4.0 Performance Characteristics

4.1 The guardrail systems described in this report have demonstrated the capacity to resist the design loadings specified in Chapter 16 of the IBC and Section R301 of the IRC when tested in accordance with ICC-ES AC174.

4.2 Structural performance has been demonstrated for a temperature range from -20°F to 125°F.

4.3 Materials used are deemed equivalent to preservative treated or naturally durable wood for resistance to weathering effects, decay, and attack from Formosan termites.

4.4 The PVC material used in the guardrail system has a flame spread index less than 200 when tested in accordance with ASTM E 84.

5.0 Installation

The guard system shall be installed in accordance with the manufacturer's installation instructions and this report. Where differences occur between this report and the manufacturer's installation instructions, this report shall govern.

5.1 The baluster connections to the top and bottom rails are made by inserting the balusters into the routed openings in both rails.

5.2 The top and bottom rails are attached directly to structural supports utilizing molded PVC mounting brackets. See Figure 22 through Figure 27.

5.3 The top and bottom rails may be attached to conventional wood supports. The wood in the supporting structure, including conventional posts, shall have a specific gravity of 0.50 (southern yellow pine) or greater.

5.3.1 For attachment to wood supports, see Table 4 for fastening methods of the guardrail system components.

5.3.2 4x4 conventional wood posts may be covered by a 4 inch square non-structural PVC post sleeve with decorative caps and moldings.

6.0 Supporting Evidence

6.1 Drawings and installation instructions submitted by the manufacturer.

6.2 The reports of testing and engineering analysis demonstrating compliance with the performance requirements of ICC-ES AC174, Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails), approved January 2012, and ASTM D 7032-07, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails). Within the scope of this report, ASTM D 7032-07 has been deemed equivalent to ASTM D 7032-08.

6.3 Documentation of an Intertek approved quality control system for the manufacturing of products recognized in this report.

7.0 Conditions of Use

The guard assemblies identified in this report are deemed to comply with the intent of the provisions of the referenced building codes subject to the following conditions:

7.1 Guardrail systems recognized in this report may be used in One- and Two-Family Dwellings regulated by the IRC and all construction types regulated by the IBC in accordance with IBC Section 1406.3, Exception 2. Guardrails less than 42 inches high are limited to use in One- and Two-Family Dwellings (IRC). See Tables 1 and 2 for additional restrictions based upon Use and Occupancy classification.

7.2 Conventional wood supports for guards are not within the scope of this report and are subject to evaluation and approval by the building official. Supports must satisfy the design load requirements specified in Chapter 16 of the IBC and must provide suitable material for anchorage of the rail brackets. Where required by the building official, engineering calculations and details shall be provided.

7.3 Compatibility of fasteners and other metallic components with the supporting structure, including chemically treated wood, is not within the scope of this report. Only those types of fasteners and fastening methods described in this report have been evaluated for the installation of the vinyl guardrail systems; other methods of attachment are outside the scope of this report.

7.4 The vinyl guardrail systems reported herein are manufactured by Superior Plastic Products, Inc. in New Holland, Pennsylvania. Manufacturing is in accordance with an approved quality control system and inspections by Architectural Testing (IAS AA-676).

8.0 Identification

The vinyl guardrail assemblies produced by Superior Plastic Products, Inc. identified in this report shall be identified with labeling on the individual components or the packaging that includes:

8.1 Name and/or trademark of Superior Plastic Products, Inc.;

8.2 Architectural Testing Code Compliance Research Report mark and number (CCRR-0167); and

8.3 The following statement: "See CCRR-0167 at www.ati-es.com for uses and performance levels." For guardrail systems recognized in Table 2, the label shall also include the phrase, “For Use in One- and Two-Family Dwellings Only.”

9.0 Code Compliance Research Report Use

9.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

9.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Architectural Testing.

9.3 Reference to the Architectural Testing internet web site address at www.ati-es.com is recommended to ascertain the current version and status of this report.

Table 1 - Guardrail Systems for Use in IBC / All Use Group Classifications

Guardrail System	Type	Maximum Rail Dimensions (length by height) [1]	Baluster(s) (described in Table 3)
1000 Series & 3000 Series	Level	96 inches by 42 inches	Heritage, Kinzer, Madison, Model, Traditional, Victorian, and York
200 Series	Level	72 inches by 42 inches	Model and York
2 x 3.5 Rectangular Rail & Beveled T-Rail	Level	96 inches by 42 inches	Portland, Excel and York
Sonic 24-S,R,T & Sonic Beveled-S.R.T	Level	96 inches by 42 inches	Turned(T), Round Aluminum (R) and Square (S)

[1] Length is clear space between supports.

Table 2 - Guardrail Systems for Use in IRC / One- and Two-Family Dwellings [1]

Guardrail System	Type	Maximum Rail Dimensions (length by height) [2]	Baluster(s) (described in Table 3)
1000 Series & 3000 Series	Level	96 inches by 42 inches	Heritage, Kinzer, Madison, Model, Traditional, Victorian, and York
	Level	120 inches by 36 inches	Heritage, Kinzer, Madison, Model, Traditional, Victorian and York
200 Series	Level	120 inches by 42 inches	Model and York
2 x 3.5 Rectangular Rail & Beveled T-Rail	Level	120 inches by 36 inches	Portland, Excel and York
Sonic 24 S,R,T & Sonic Beveled-S,R,T	Level	120 inches by 36 inches	Turned(T), Round Aluminum (R) and Square (S)

[1] The use of this product shall be limited to exterior use as a guard system for balconies and porches for one- and two-family dwellings of Type V-B (IBC) construction and structures constructed in accordance with the IRC.

[2] Length is clear space between supports.

Table 3 – Baluster Styles

Baluster Style	Description	Cross-Reference
Heritage	1.3 inch square-ended thermoformed PVC spindle with an 0.08 inch wall thickness measured at its ends	Figure 9
Kinzer		Figure 12
Madison		Figure 13
Model	1.3 inch square PVC baluster with an 0.06 inch wall thickness	Figure 14
Traditional	1.5 inches by 0.875 inch rectangular-ended thermoformed PVC spindle with an 0.08 inch wall thickness measured at its ends	Figure 10
Victorian	1.5 inches by 0.875 inch rectangular-ended PVC baluster with an 0.08 inch wall thickness	Figure 16
York	Round, painted 6063-T6 aluminum picket with a 0.75 inch outside diameter with 0.055 inch wall thickness	Figure 11
Portland and Square	1.5 inch square PVC baluster with 0.06 inch wall thickness	Figure 16
Excel and Turned	1.5 inch square ended hollow thermoformed PVC spindles with 0.06 inch wall thickness measured at its ends.	Figure 17
York and Round Aluminum	0.75 inch diameter round baluster with 0.055 wall thickness	Figure 18

Table 4 – Fastening Schedule

System	Connection	Fastener	Qty.
200 Series Professional Rail	Top Rail Bracket to Post	#14 x 1-1/2 in self-starting pan-head stainless steel screws	4
	Top Rail Bracket to Rail	#8 x 1 in self-starting pan-head stainless steel screws	2
	Bottom Rail Bracket to Post	#14 x 1-1/2 in self-starting pan-head stainless steel screws	4
	Bottom Rail Bracket to Rail	#8 x 1 in self-starting pan-head stainless steel screw	1
1000 Series T-Rail	Top Rail Bracket to Post	#8 x 1 in self-starting pan-head stainless steel screws	6
	Top Rail Bracket to Rail	#8 x 1 in self-starting pan-head stainless steel screws	2
	Bottom Rail Bracket to Post	#8 x 1 in self-starting pan-head stainless steel screws	6
	Bottom Rail Bracket to Rail	#8 x 1 in self-starting pan-head stainless steel screw	1
3000 Series Newport Rail	Top Rail Bracket to Post	#14 x 1-1/2 in self-starting pan-head stainless steel screws	4
	Top Rail Bracket to Rail	#8 x 1 in self-starting pan-head stainless steel screws	2
	Bottom Rail Bracket to Post	#8 x 1 in self-starting pan-head stainless steel screws	6
	Bottom Rail Bracket to Rail	#8 x 1 in self-starting pan-head stainless steel screw	1
Beveled T-Rail, 2 x 3.5 Rectangular Rail, *Sonic Beveled-T*, & *Sonic 24-S*	Top Rail Bracket to Post	#8 x 1-1/2 in self-starting pan head stainless steel screws	4
	Bottom Rail Bracket to Post	#8 x 1-1/2 in self-starting pan head stainless steel screws	4
	Top and Bottom Rail Bracket to Rail	#10 x ¾ in self-starting pan head stainless steel screws	3

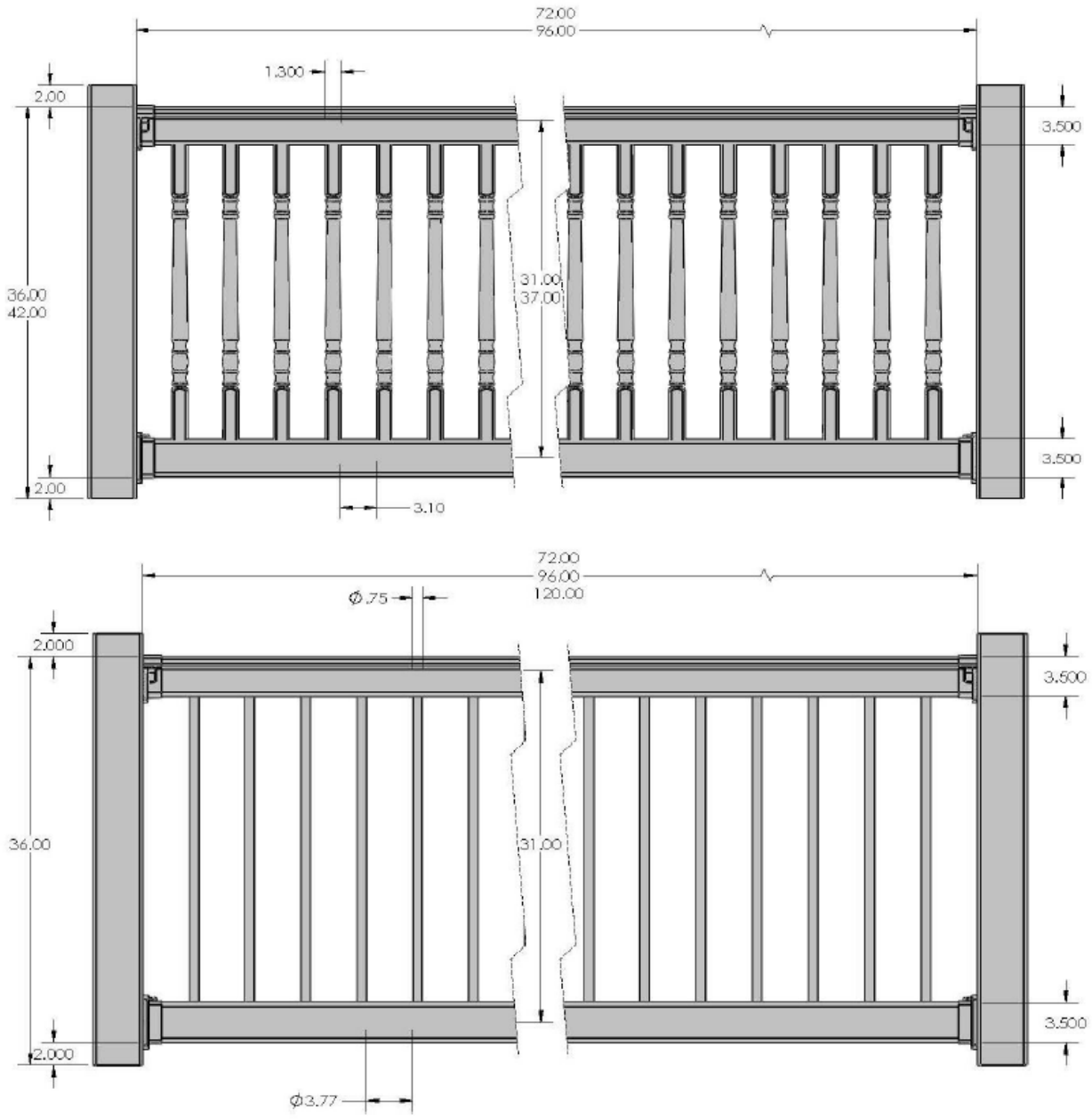


Figure 1 – Vinyl Railing Systems

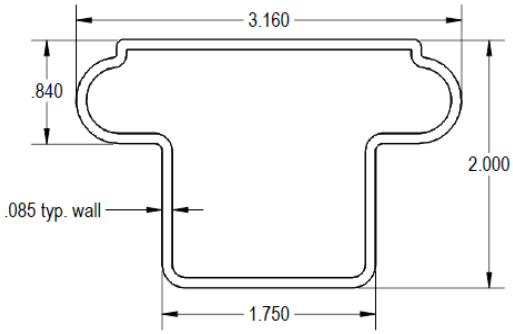


Figure 2 – *200 Series Professional Rail* Top Rail

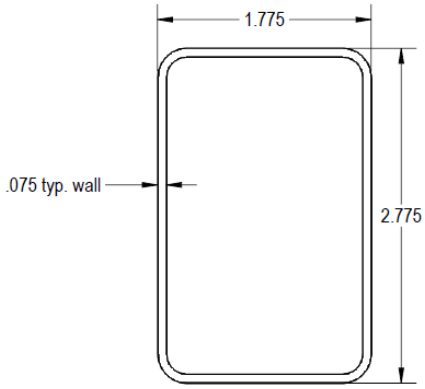


Figure 3 – *200 Series Professional Rail* Bottom Rail

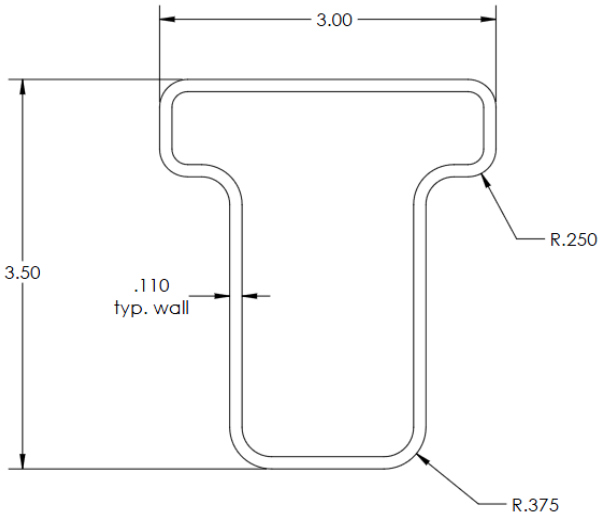


Figure 4 – *1000 Series T-Rail* Top Rail

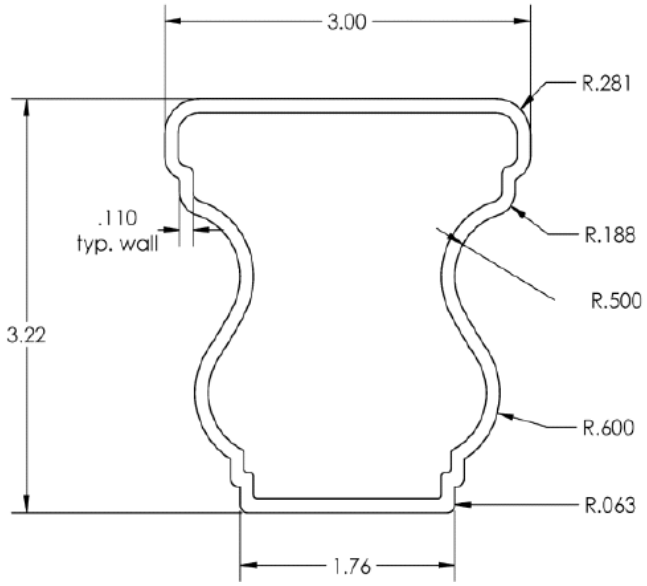


Figure 5 – *3000 Series Newport Rail* Top Rail

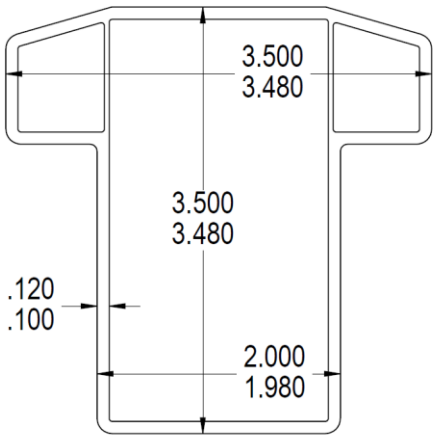


Figure 6 – *Beveled T-Rail and Sonic Beveled-T Top Rail*

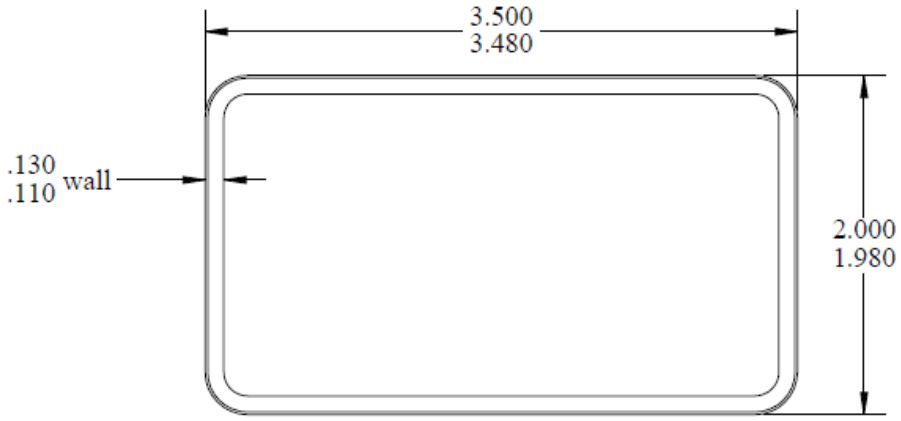


Figure 7 – *2 x 3.5 Rectangular Rail and Sonic 24-S*

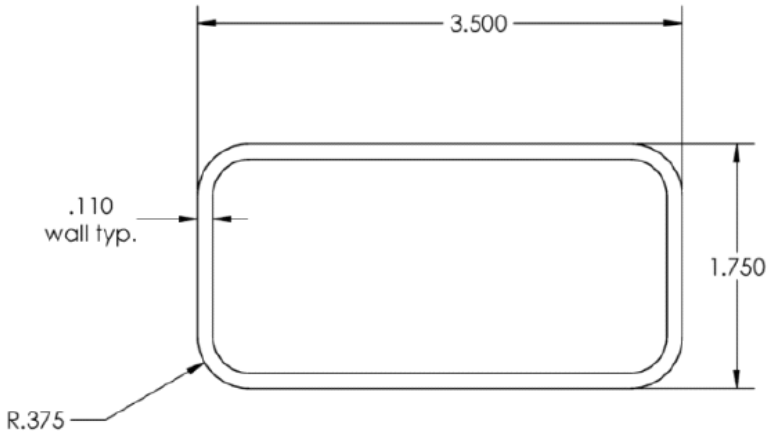


Figure 8 – *1000 Series* and *3000 Series* Bottom Rail

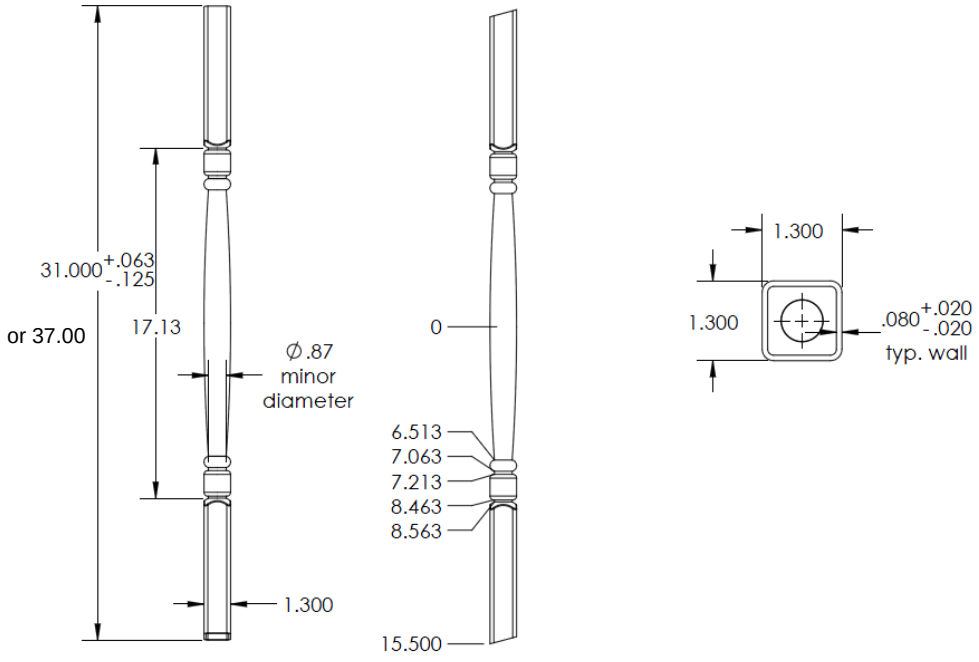


Figure 9 –*Heritage* PVC Spindle

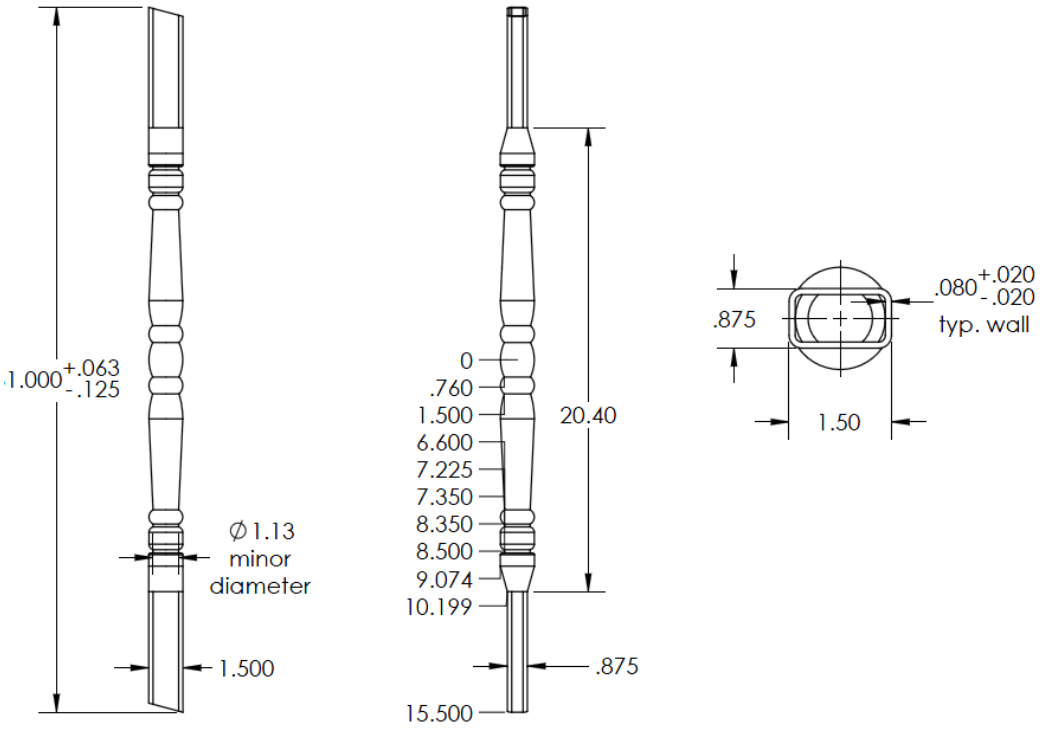


Figure 10 – *Traditional* PVC Spindle

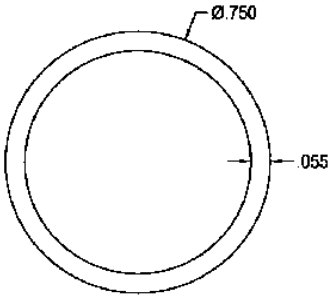


Figure 11 – *York* 6063-T6 Aluminum Round Tube Picket

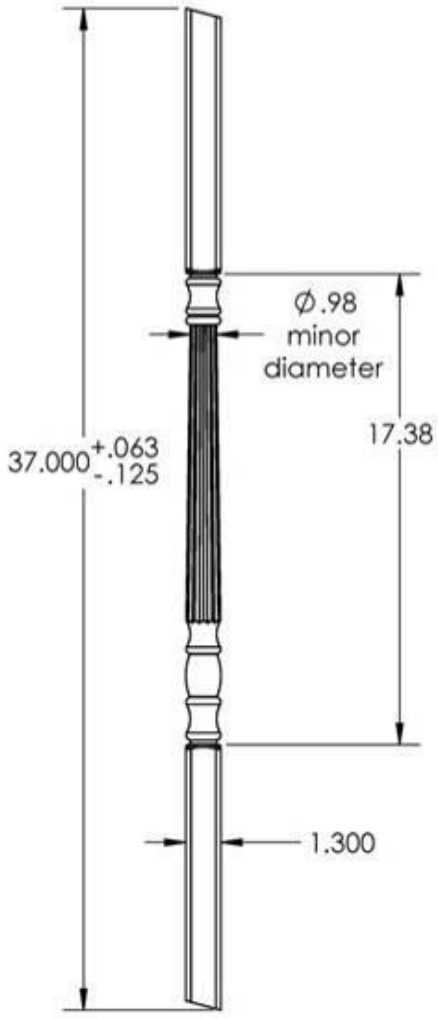


Figure 12 – ***Kinzer*** **PVC Spindle**

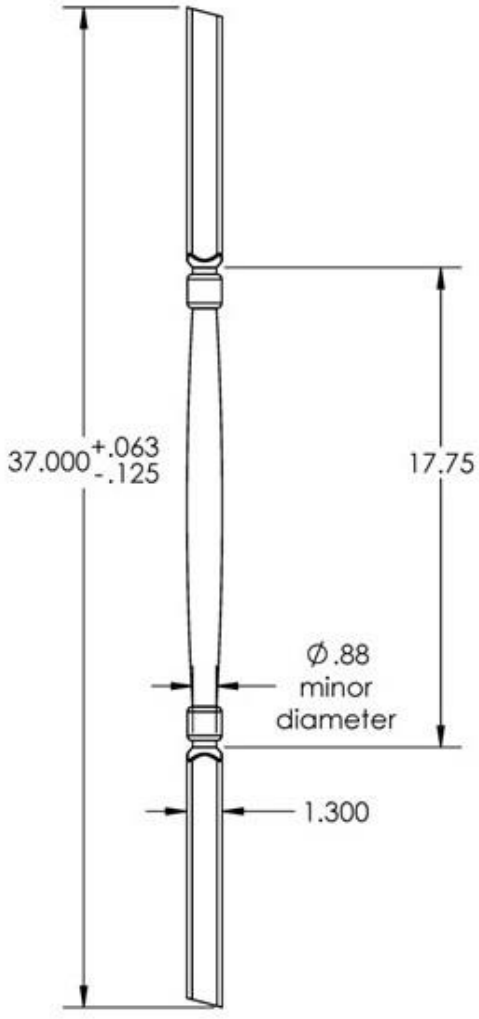


Figure 13 - *Madison* **PVC Spindle**

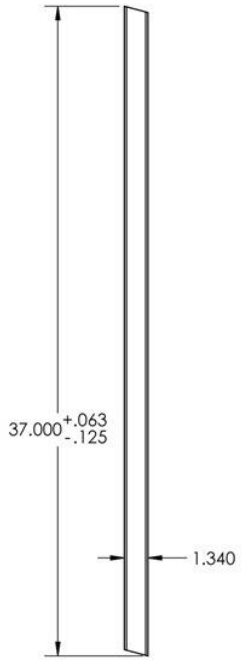


Figure 14 – *Model* PVC Baluster

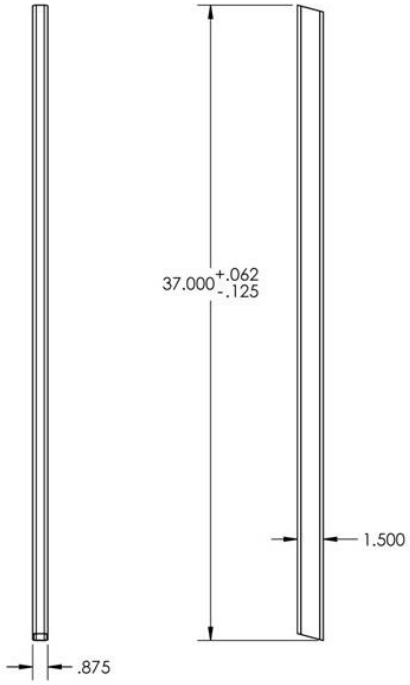


Figure 15 – *Victorian* PVC Baluster

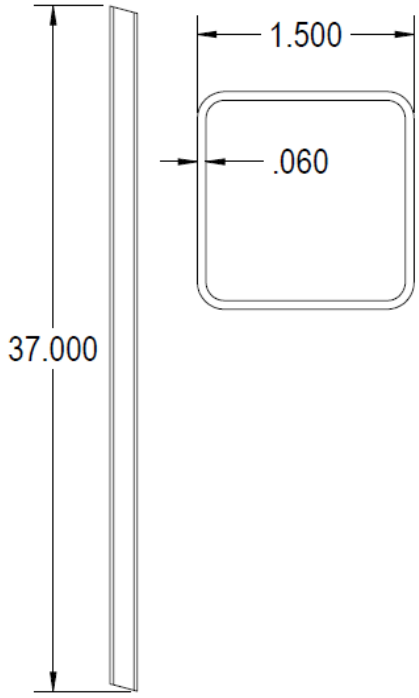


Figure 16 – *Portland PVC Baluster Spindle and Square Baluster (S)*

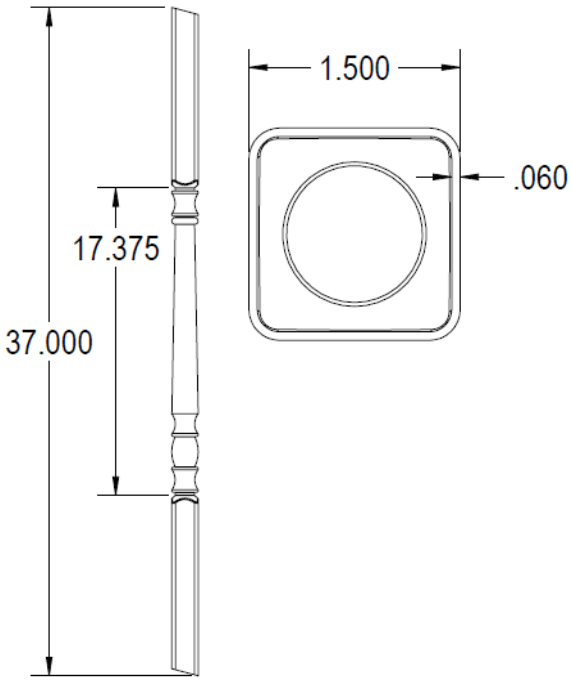


Figure 17 – *Excel PVC Spindle and Turned (T)*

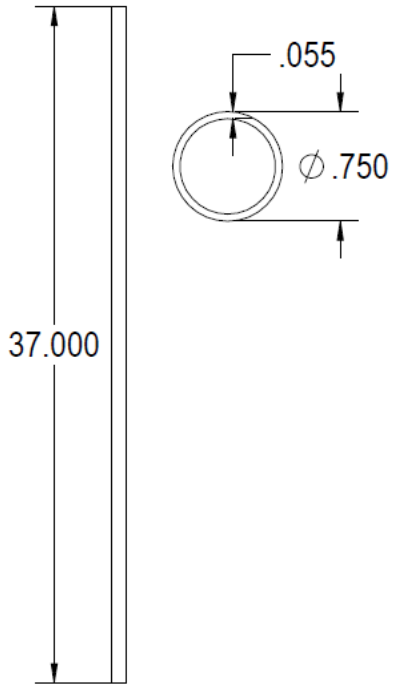
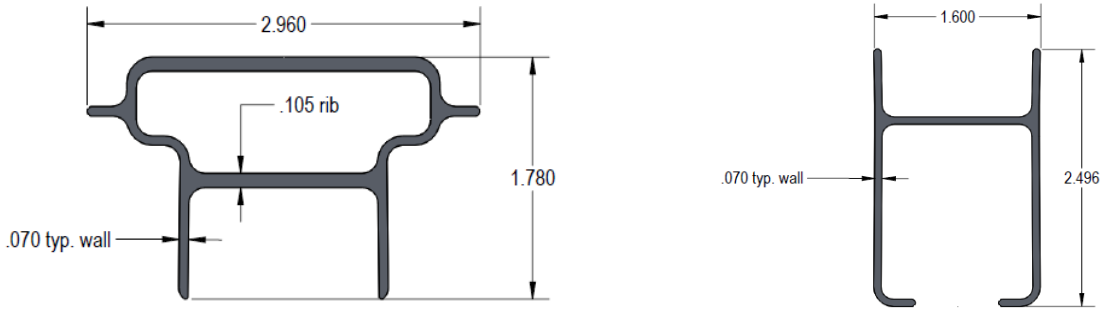
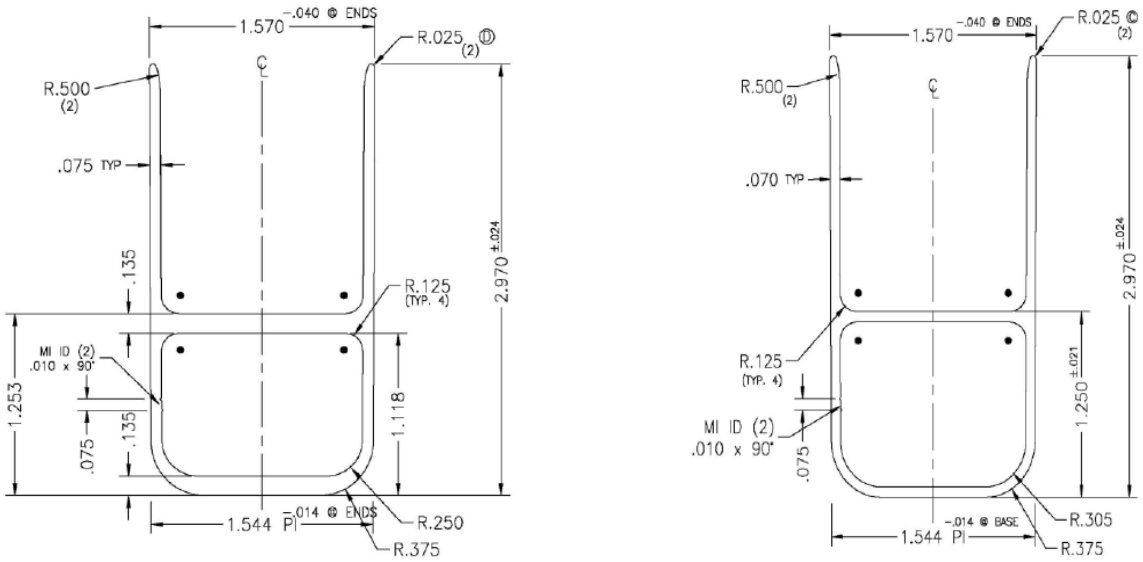


Figure 18 – ***York PVC Spindle and Round Aluminum Spindle (R)***



Top Rail **Bottom Rail**

Figure 19 – ***200 Series*** **Rail Aluminum Inserts**



Top Rail **Bottom Rail**

Figure 20 – *1000 Series* and *3000 Series* Rail Aluminum Inserts

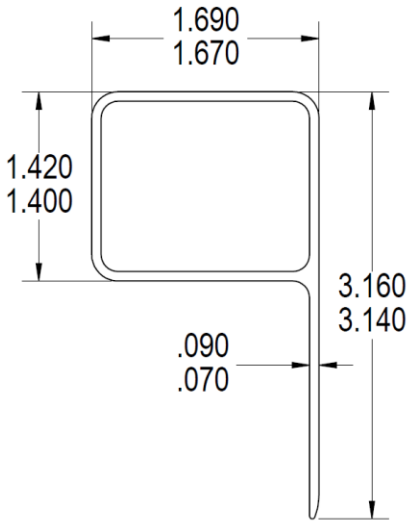


Figure 21 – *Beveled T-Rail and Sonic Beveled-T* Aluminum Inserts

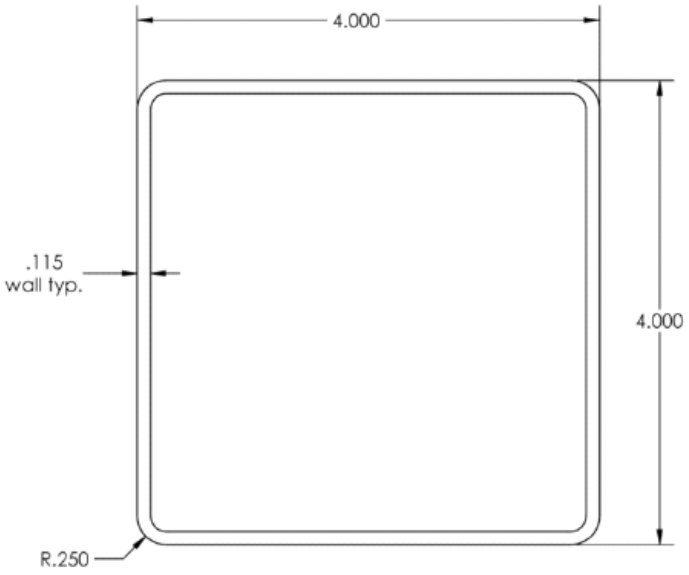


Figure 23 – PVC Post Sleeve

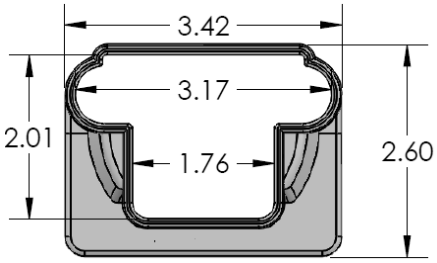


Figure 22 – *200 Series Professional Rail* Top Rail Mounting Bracket

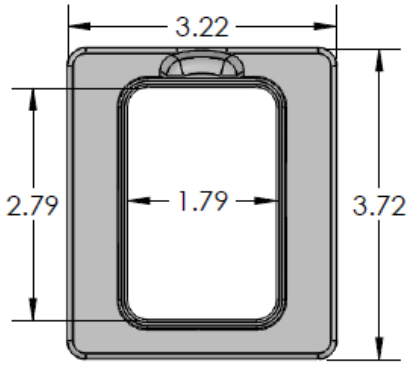


Figure 23 – *200 Series Professional Rail* Bottom Rail Mounting Bracket

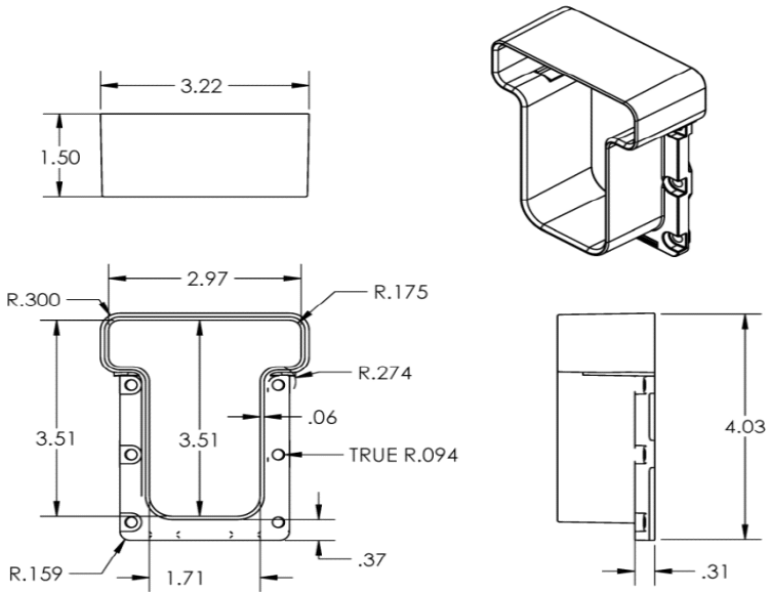


Figure 24 – *1000 Series T-Rail* Top Rail Mounting Bracket

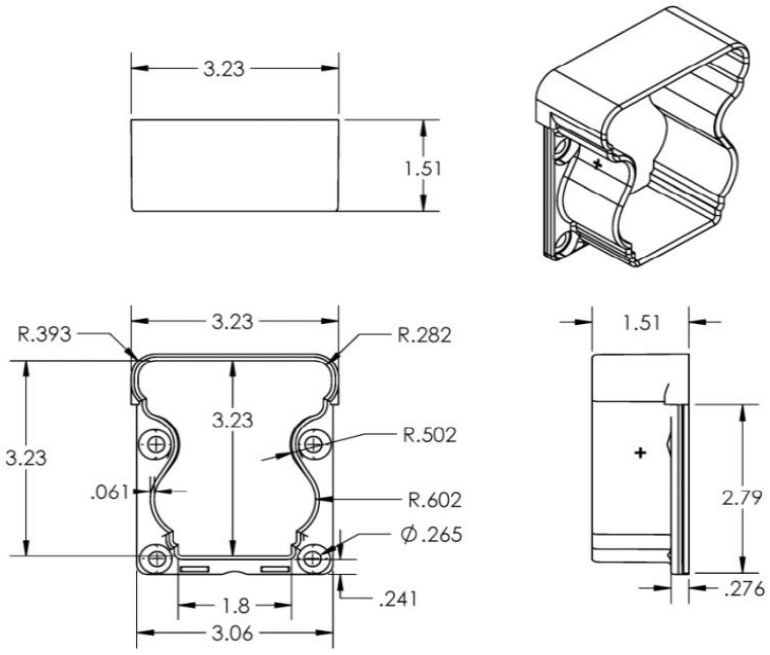


Figure 25 – *3000 Series Newport Rail* Top Rail Mounting Bracket

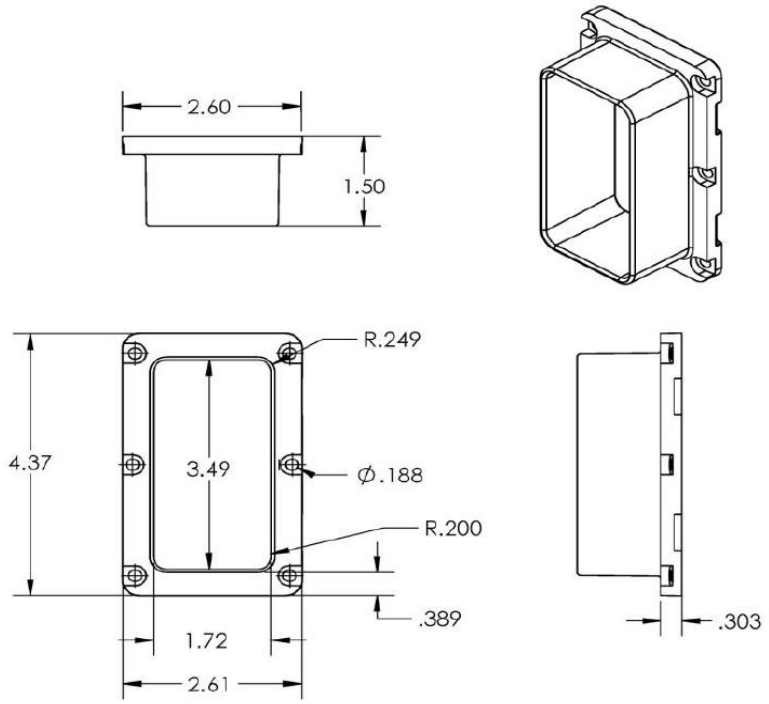


Figure 26 – *1000 Series* and *3000 Series* Bottom Rail Mounting Bracket

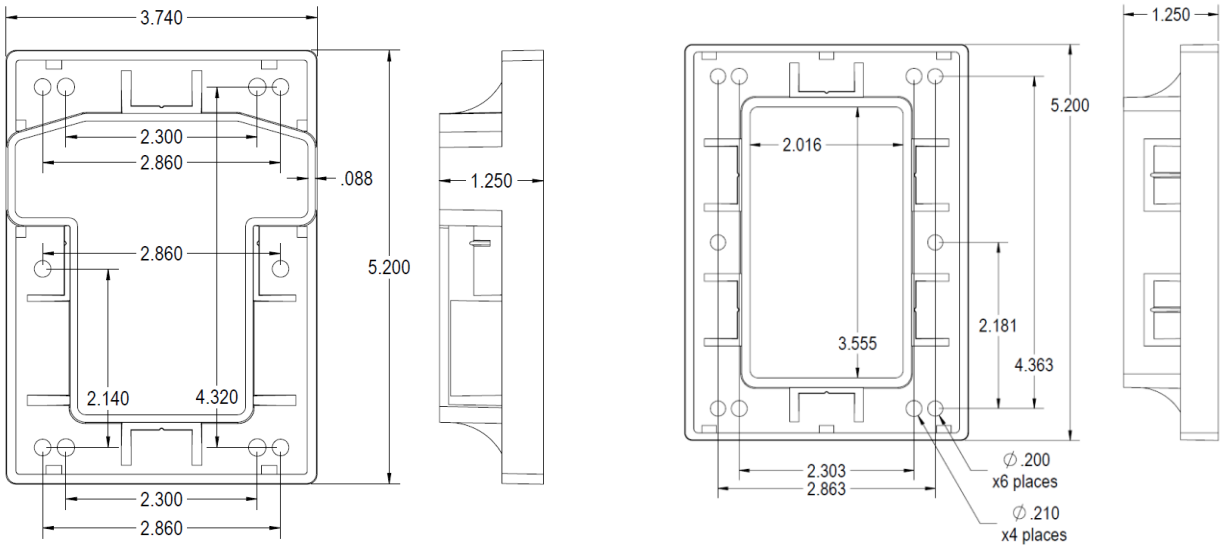


Figure 27 – Sonic Beveled-S,R,T and *Sonic 24-S,R,T Top and Bottom Rail Mounting Brackets*