



Code Compliance Research Report

CCRR-0106

Subject to Renewal: 05/19/11
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1.0 Subject

Kroy Vinyl Railing Systems:

Kroy Performance Vinyl Railing

Assurance Outdoor Solutions™

Kroy Express Outdoor Solutions™

2.0 Research Scope

2.1. Building codes:

2009 International Building Code (IBC)

2009 International Residential Code (IRC)

2006 International Building Code (IBC)

2006 International Residential Code (IRC)

2.2. Properties:

Structural performance

Durability

Surface Burning

3.0 Description

3.1. General – Kroy Vinyl Railing Systems are guards under the definitions of the referenced codes intended for use on elevated walking areas in buildings and walkways as required by the codes.

3.2. Guard Assemblies - Railing systems are provided as level guards for level walking areas such as decks, balconies and porches, and sloped guards for open sides of stairways.

3.2.1. Level guards with a 36-inch overall installed height are provided in lengths up to 10 feet (120-inches). Guards with a 42-inch overall installed height are provided in lengths up to 10 feet (120-inches). See Table 1 - Maximum Railing System Size and Code Recognition.

3.2.2. Stair guards are provided in lengths up to 8 feet (96 inches) sloping length with a height up to that corresponding to a 42 inch level rail. See Table 1 - Maximum Railing System Size and Code Recognition.

3.3. Materials and Processes - Railings are an assemblage of extruded and molded components utilizing Poly Vinyl Chloride (PVC) material and aluminum reinforcements. Vinyl components are produced in four colors: white, sandstone, khaki, and laguna dune. All systems consist of the following components:

3.3.1. The top and bottom rails are extruded PVC profiles of various styles.

3.3.2. Balusters are extruded PVC profiles in various dimensions. Some extrusions are reshaped by a thermoform process to simulate a turned spindle design. See Table 4 for styles.

3.3.3. An extruded aluminum (6105-T5 or 6005-T5) insert provides reinforcement for the top and bottom rails. Bottom rail reinforcement is utilized only in level rail lengths exceeding 8-feet and all stair rails (See Table 2 and Table 3).

3.3.4. Top and bottom rails are connected to posts with molded plastic brackets (See Figures 9 & 10) that are secured to the supports with stainless steel screws. Screws are Hawk Fastener Corp. Square Drive Pan Head "Hi-Lo" thread Sharp Point 410 Stainless Steel.

3.4. Supports - Railing systems can be attached to conventional wood supports or a structural PVC post installed with a steel post-mount tower.

3.4.1. Two 4"x4" PVC posts are available for use (4x4 STD and 4x4 RW). Either can be installed with the steel post-mount tower or used as a non-structural cladding over conventional 4x4 wood posts.

3.4.2. Railing systems include a bottom rail intermediate support located beneath the rail at mid-span (See Figure 13). Exceptions: The following systems do not require intermediate supports:

1. Systems with aluminum inserts in the bottom rail.
2. Stair rails

4.0 Performance Characteristics

4.1. Kroy vinyl railing systems have demonstrated the capacity to resist the design loadings specified in Chapter 16 of the IBC 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 termites.

4.4. The PVC materials used have a flame spread index of 40 when tested according to ASTM E 84. The referenced criteria, AC174, requires a flame spread index not exceeding 200.

5.0 Installation

Installation shall be 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. Railing assemblies consist of top and bottom rails with pre-routed holes to receive balusters. Aluminum railing reinforcements are inserted in the rails during assembly as specified for the type and length of railing (See Table 2 and Table 3).

5.2. Railings attached to wood supports with molded PVC brackets utilize stainless steel "Hi-Lo" wood screws for anchorage. The wood in the supporting structure shall have a specific gravity of 0.50 or greater (Southern Yellow Pine or better) and a minimum thickness to allow full penetration of the bracket mounting screws. Bracket attachment shall be in accordance with Table 7.

5.3. The Steel Post Mount system shown in Figure 14 may be used for surface mount installations as permitted by Table 5. The Steel Post Mount is attached to the supporting structure using four (4) 0.375 inch diameter anchoring bolts with flat washers. The type and length of anchor bolts is dependant upon the material and condition of the supporting structure and is not within the scope of this report.

5.4. Where required by the building official, engineering calculations and details shall be provided. The calculations shall verify that the anchorage complies with the building code for the type and condition of the supporting construction.

5.5. Compatibility of fasteners and other installation hardware with the supporting construction including treated wood is not within the scope of this report.

6.0 Supporting Evidence

6.1. Manufacturer's drawings and installation instructions.

6.2. Reports of testing and engineering analysis demonstrating compliance with the performance requirements of ICC-ES Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails), AC174 effective June 1, 2009.

6.3. Quality control manual in accordance with ICC-ES Acceptance Criteria for Quality Control Manuals, AC10.

7.0 Conditions of Use

The guardrail 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. Conventional wood guardrail supports 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.

7.2. Compatibility of fasteners, post mount brackets, and other metallic components with the supporting structure, including chemically treated wood, is not within the scope of this report.

7.3. Kroy Vinyl Railing Systems are manufactured in Fair Bluff, North Carolina or York, Nebraska in accordance with the manufacturer's approved quality control system with inspections by Architectural Testing, Inc. (IAS AA-676).

8.0 Identification

The vinyl guardrail assemblies produced by Kroy Building Products, Inc. and identified in this report shall be identified with labeling on the individual components or the packaging that includes the name and/or trademark of the manufacturer, the identifying mark of the independent inspection agency, Architectural Testing, Inc. (IAS AA-676) and, the ATI Code Compliance Research Report Number (CCRR-0106).

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 ATI.

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

Table 1 - Maximum Railing System Size and Code Recognition

<i>Kroy Performance Vinyl Railing</i>	Code Recognition Maximum Railing Size (Length x Height)¹	
	IBC	IRC
2" x 3-1/2" STD Rail	8' x 42" Level 87-1/2" x 42". Stair	10' x 42" Level 87-1/2" x 42". Stair
3-1/2" x 3-1/2" T-Rail	8' x 42" Level 87-1/2" x 42". Stair	10' x 42" Level 87-1/2" x 42". Stair
2" x 3-1/2" RW Rail	8' x 42" Level 87-1/2" x 42". Stair	8' x 42" Level 87-1/2" x 42". Stair
2-3/4" x 3-1/4" Contoured Rail	8' x 42" Level 87-1/2" x 42". Stair	10' x 42" Level 87-1/2" x 42". Stair

¹ Railing lengths are clear length between supports. Railing height is installed height from walking surface to top of top rail. Minimum bottom rail clearance is 2-1/2"

Table 2 – Level Railing System Descriptions

<i>Kroy Performance Vinyl Railing</i>	Level Railing System Components (See Table 4 for available balusters)	
	Rails	Brackets
2" x 3-1/2" STD Rail	Top: 2x3-1/2" STD Rail with Alum "H" channel Btm: 2x3-1/2" STD Rail (Alum "H" Channel in lengths exceeding 8 feet.)	Top: OEM ,MOD, or LMT Btm: OEM, MOD, or LMT
3-1/2" x 3-1/2" T-Rail	Top: T-Rail with Alum "H" channel Btm: 2x3-1/2" STD Rail (Alum "H" Channel in lengths exceeding 8 feet.)	Top: OEM or LMT Btm: OEM, MOD, or LMT
2" x 3-1/2" RW Rail	Top: 2x3-1/2" RW Rail with Alum "P" channel Btm: 2x3-1/2" RW Rail	Top: OEM , MOD, or LMT Btm: OEM, MOD, or LMT
2-3/4" x 3-1/4" Contoured Rail	Top: Contoured with Contoured Rail Alum Insert Btm: 2x3-1/2" STD Open (Alum "H" Channel in lengths exceeding 8 feet.)	Top: Contoured Bracket Btm: OEM or MOD

Table 3 – Stair Railing System Descriptions

<i>Kroy Performance Vinyl Railing</i>	Stair Railing System Components (See Table 4 for available balusters)	
	Stair Rails	Stair Brackets
2" x 3-1/2" STD Rail	Top: 2x3-1/2" STD Rail with Alum "H" channel Btm: 2x3-1/2" STD Rail with Alum "H" Channel	Top & Btm: OEM or LMT
3-1/2" x 3-1/2" T-Rail	Top: T-Rail with Alum "H" channel Btm: 2x3-1/2" STD Rail with Alum "H" Channel	Top: T-Rail Stair Bracket or LMT Btm: OEM or LMT
2" x 3-1/2" RW Rail	Top: 2x3-1/2" RW Rail with Alum "P" channel Btm: 2x3-1/2" RW Rail with Alum "P" channel	Top & Btm: OEM or LMT
2-3/4" x 3-1/4" Contoured Rail	Top: Contoured with Contoured Rail Alum Insert Btm: 2x3-1/2" STD Rail with Alum "H" Channel	Top: Contoured Stair Bracket Btm: OEM

Table 4 - Balusters

Baluster Style	
3/4" x 1-1/2" PVC Picket	1" x 2" PVC Picket
1-1/2" Square PVC Picket	1-3/8" Colonial Spindle
1-1/2" Classic Spindle	1-1/2" Colonial Spindle
1-3/8" Square PVC Picket	

Table 5 – Post Mounts

<i>Post Mounting System</i>	Code Recognition	
	Maximum Supported Railing Length and Height	
	IBC	IRC
Steel Post Mount (See Figure 14)	8-ft Length 42" Height	10-ft. Length 42" Height

¹ Railing lengths are clear length between supports. Railing height is installed height from walking surface to top of top rail.
Minimum bottom rail clearance is 2-1/2"

Table 6 - Alternate Railing System Identifications ¹

<i>Kroy Performance Vinyl Railing</i>	<i>Assurance Outdoor Solutions™</i>	<i>Kroy Express Outdoor Solutions™</i>
2" x 3-1/2" Open STD	2" x 3-1/2" Standard Rail Kit	2" x 3-1/2" Standard Rail Kit
3-1/2" x 3-1/2" T-Rail	3-1/2" x 3-1/2" T-Rail Kit	3-1/2" x 3-1/2" T-Rail Kit

¹ Each row represents an identical railing system and its identification under the product series name given in the column heading.

Table 7 – Rail Bracket Fastening Schedule

Rail – Bracket Combination	Bracket to Post	Rail to Bracket
2" x 3-1/2" STD Rail with OEM Bracket	(4) #12 x 1-1/4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
2" x 3-1/2" STD Rail with LMT Bracket	(4) #10 x 1-1/4" Pan-head, Plated Steel Screws	(2) #10 x 1" Pan-head, Plated Steel Screws
2" x 3-1/2" STD Rail with MOD Bracket	(6) #12 x 1-1/4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
3-1/2" x 3-1/2" T-Rail with OEM Bracket	(4) #12 x 1-1/4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
3-1/2" x 3-1/2" T-Rail with LMT Bracket	(6) #10 x 1-1/4" Pan-head, Plated Steel Screws	(2) #10 x 1" Pan-head, Plated Steel Screws
3-1/2" x 3-1/2" T-Rail with LMT Stair Bracket	(6) #10 x 1-1/4" Pan-head, Plated Steel Screws	(2) #10 x 1" Pan-head, Plated Steel Screws
3-1/2" x 3-1/2" T-Rail with T-Rail Stair Bracket	(2) #10 x 4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
2" x 3-1/2" RW Rail with OEM Bracket	(4) #12 x 1-1/4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
2" x 3-1/2" RW Rail with LMT Bracket	(4) #10 x 1-1/4" Pan-head, Plated Steel Screws	(2) #10 x 1" Pan-head, Plated Steel Screws
2" x 3-1/2" RW Rail with MOD Bracket	(6) #12 x 1-1/4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
2-3/4" x 3-1/4" Open Contoured Rail with Contoured Bracket	(4) #12 x 1-1/4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws
2-3/4" x 3-1/4" Open Contoured Rail with Contoured Stair Bracket	(4) #10 x 4" Stainless Steel Screws	(2) #8 x 3/4" self-tapping screws

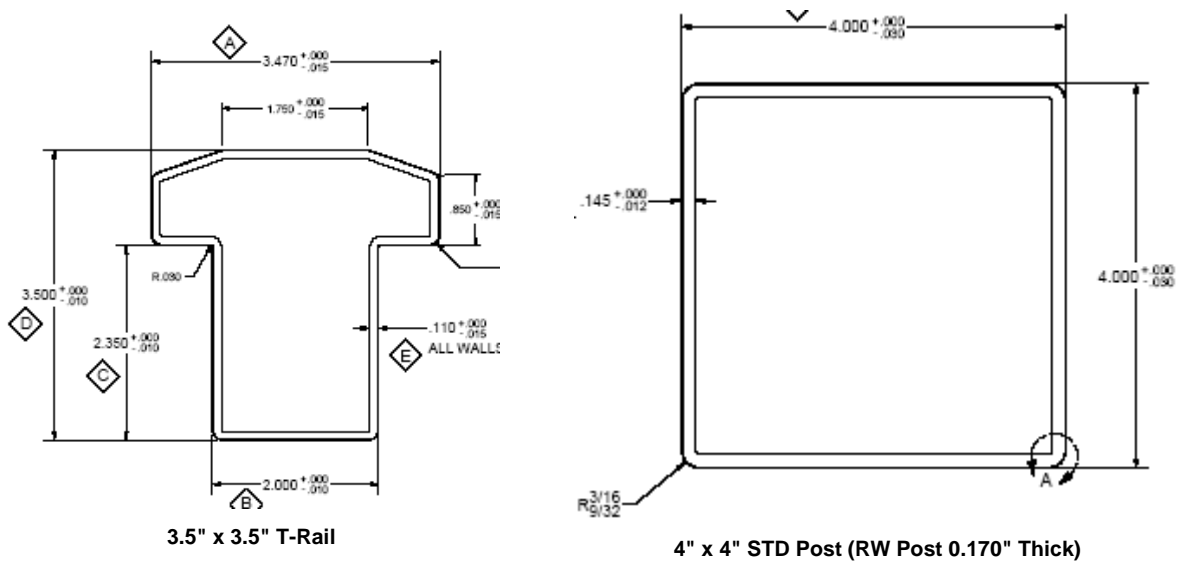
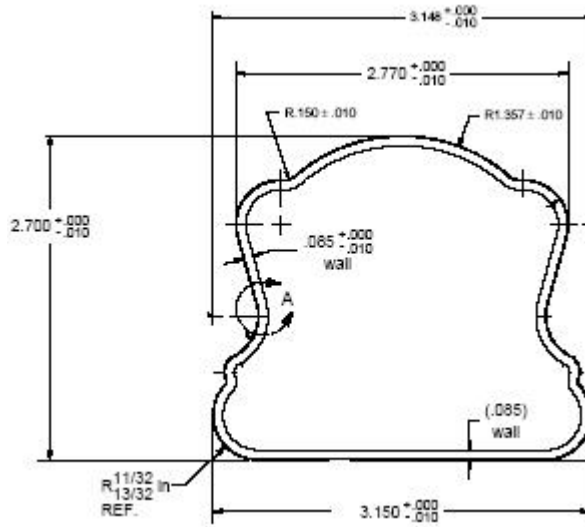
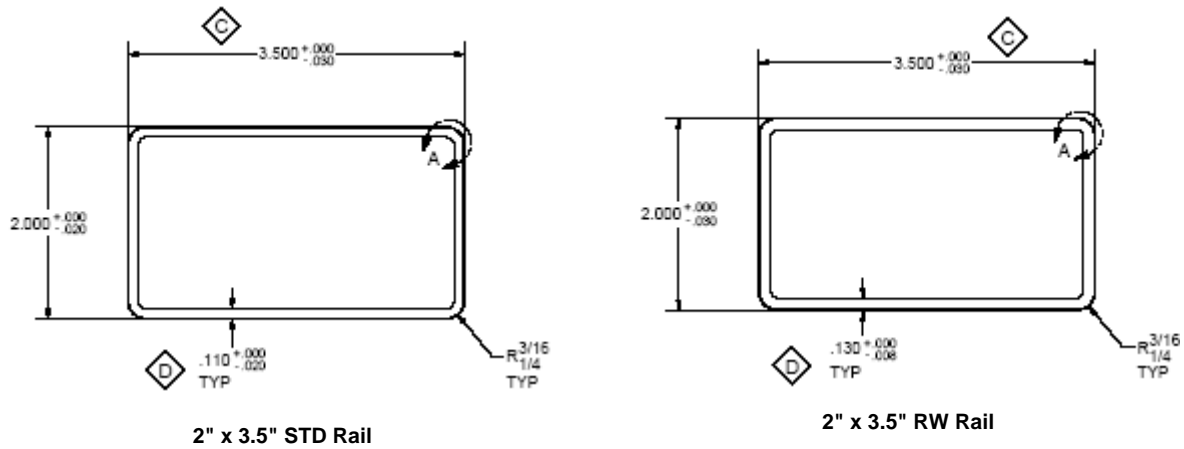


Figure 1 – PVC Profile Drawings

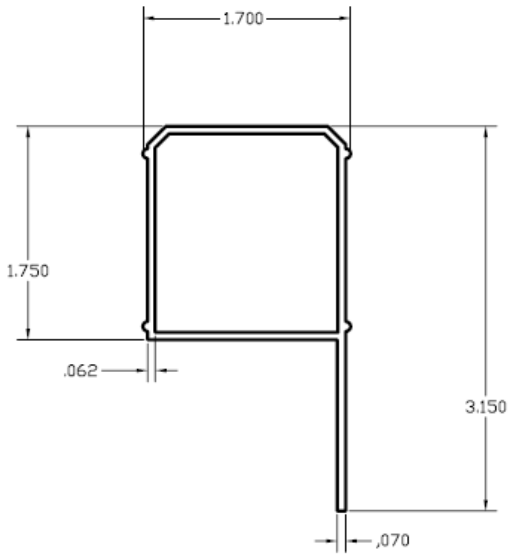


Figure 2 – Aluminum P-channel Insert

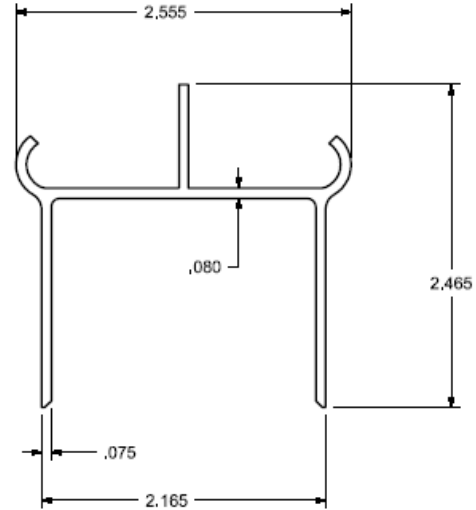


Figure 3 – Contoured Rail Aluminum Insert

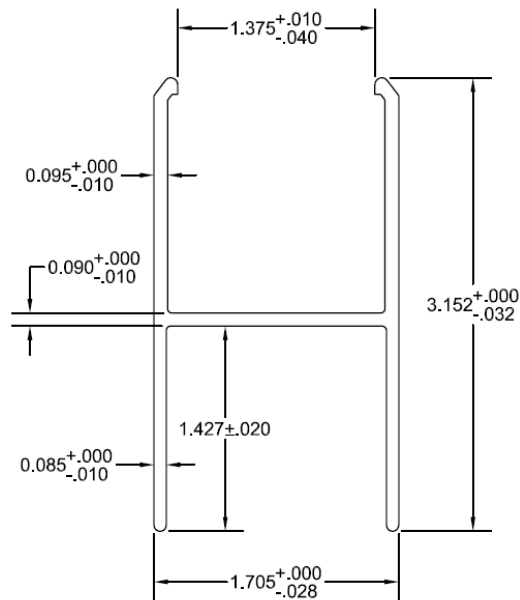


Figure 4 - Aluminum H-Channel Insert

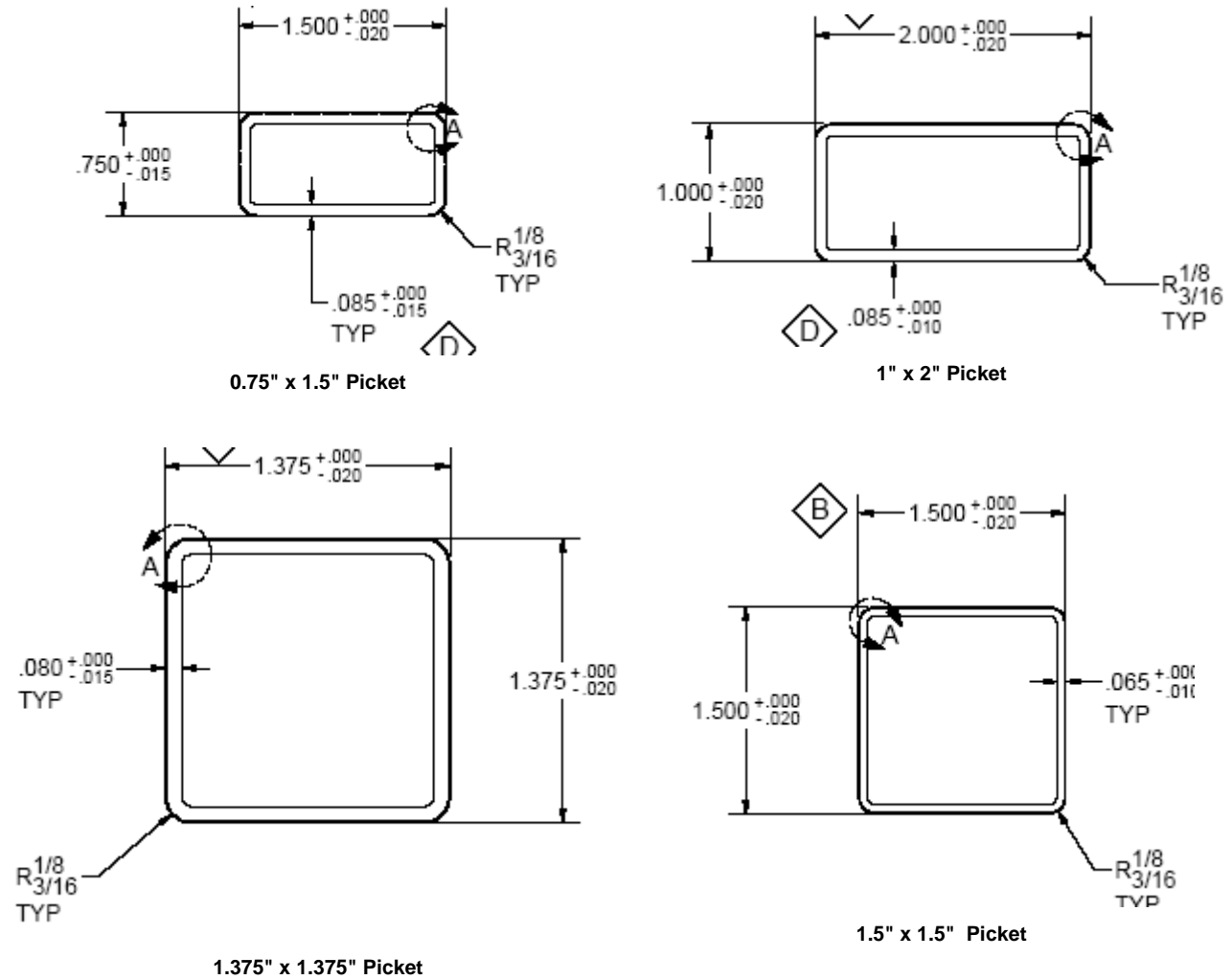
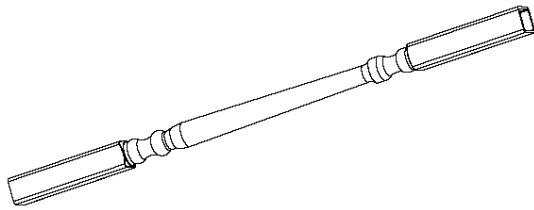
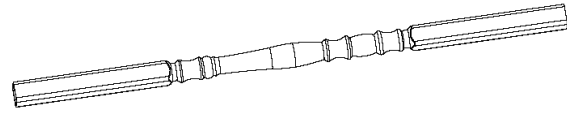


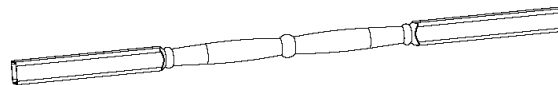
Figure 5 – Picket Profiles



1.5" Colonial Spindle

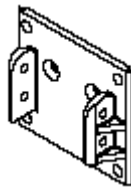


1-3/8" Colonial Spindle

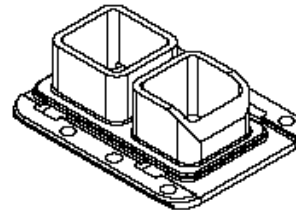


1.5" Classic Spindle

Figure 6 - Spindles and Balusters



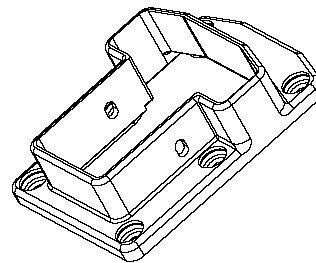
2" x 3.5" OEM Base



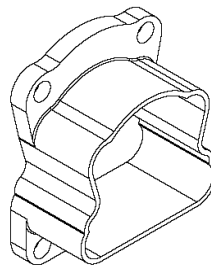
2" x 3.5" MOD Base



LMT 2" x 3.5" Bracket

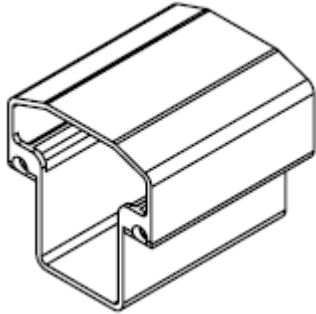


LMT T-Rail

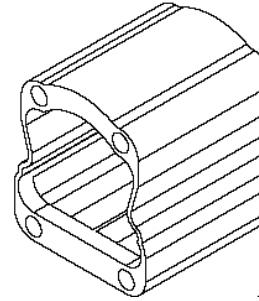


Contoured Rail

Figure 7 – Straight Rail Brackets

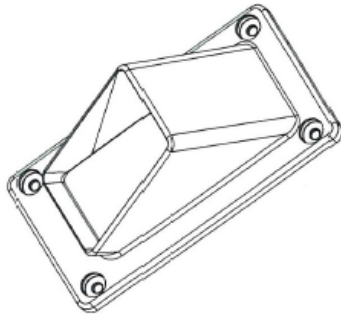


T-Rail Stair Bracket ⁽¹⁾

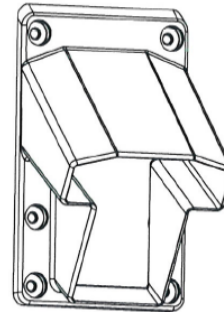


Contoured Stair Bracket ⁽¹⁾

⁽¹⁾ Note: T-Rail and Contoured stair brackets are field cut for a flush fit to the supporting surface with an angle corresponding to the stair slope. The end cut shall be limited to providing the required angle and shall not reduce the overall length of the bracket.



LMT 2 x 3.5 Stair Bracket



LMT T-Rail Stair Bracket

Figure 8 – Stair Rail Brackets

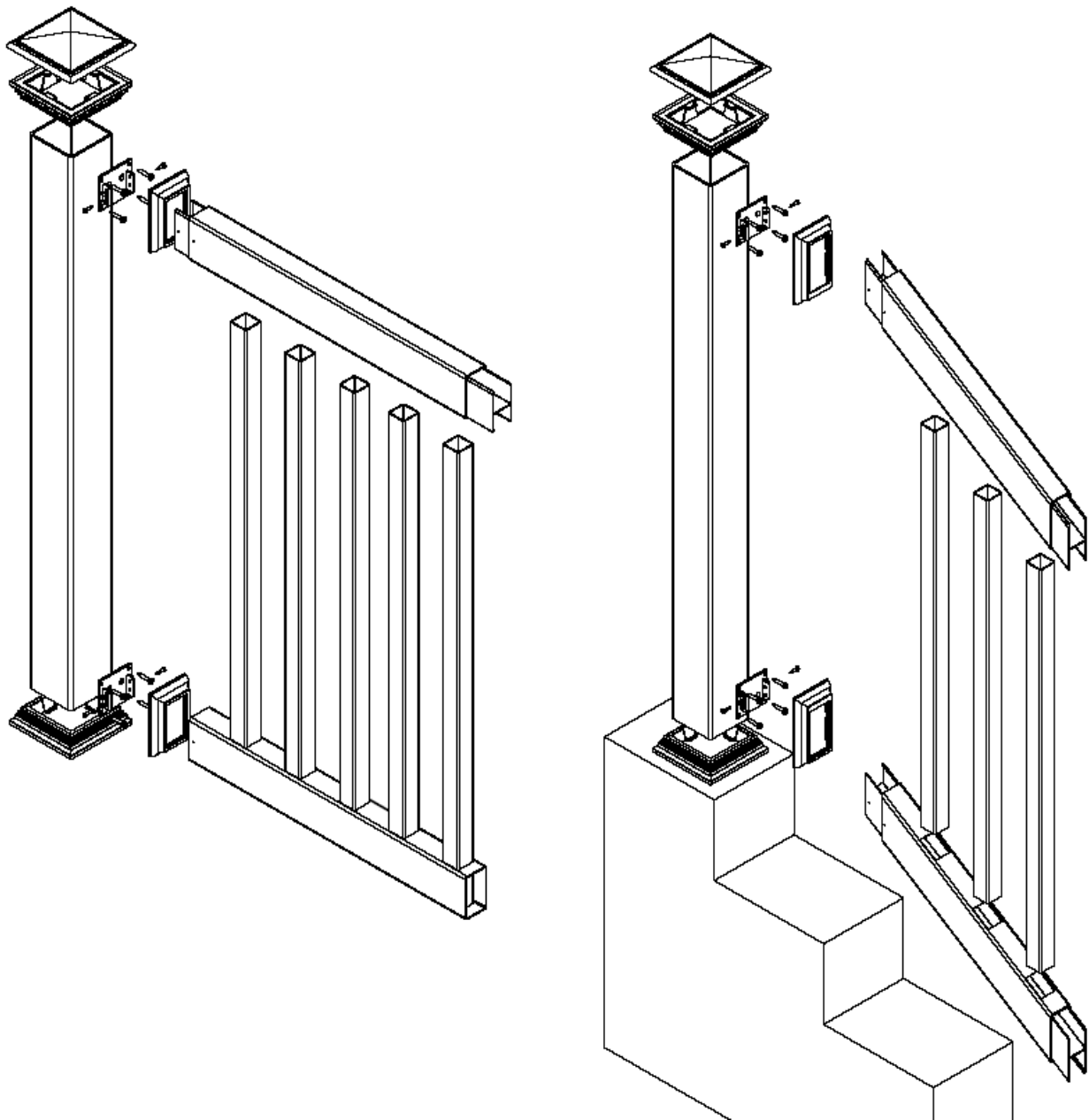


Figure 9 – 2 x 3-1/2 STD Rail (Level and Stair)

Bottom rail reinforcement not shown for level rail. See Table 2 for requirement.

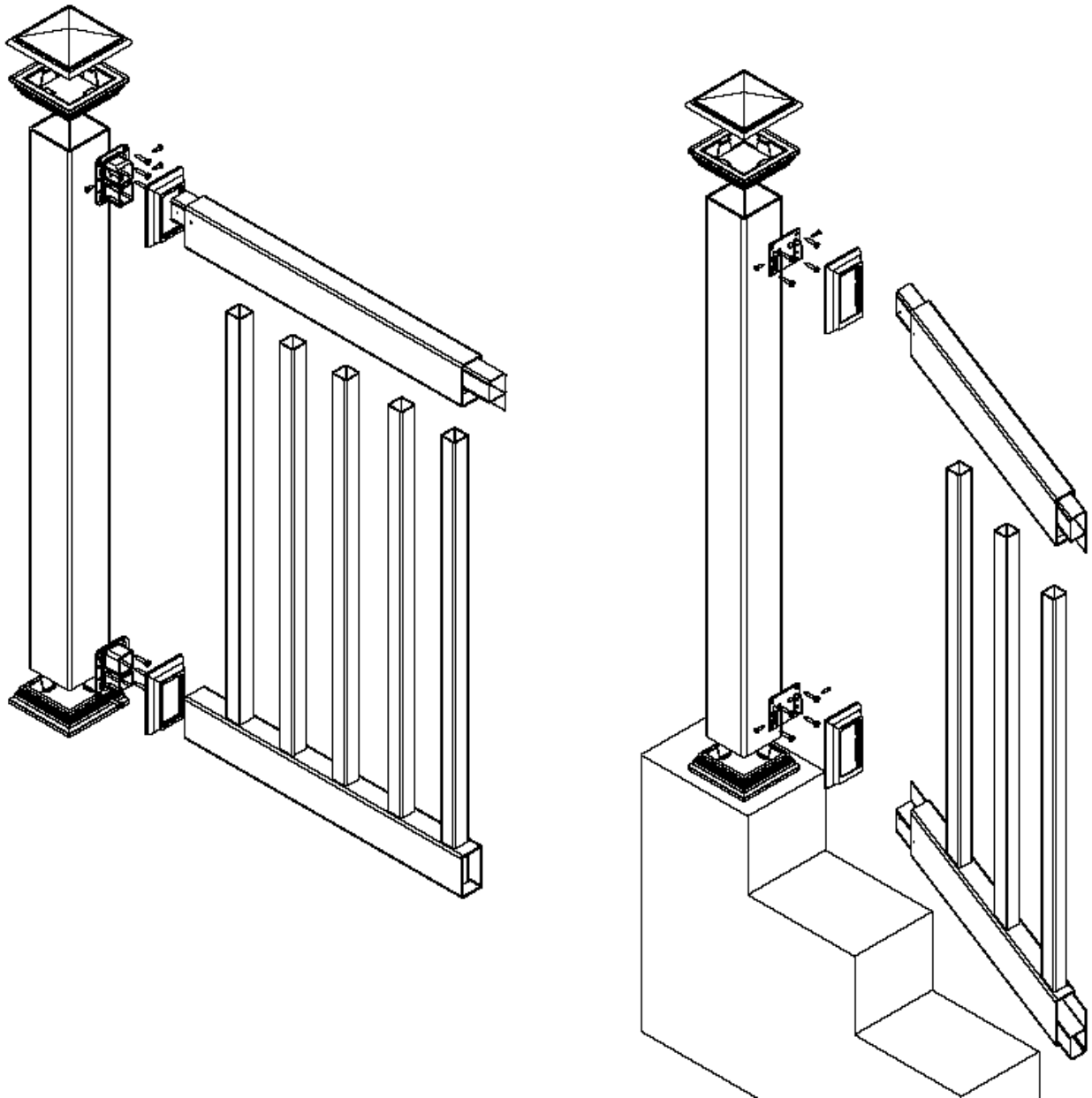


Figure 10 – 2 x 3-1/2 RW Rail
(Level and Stair)

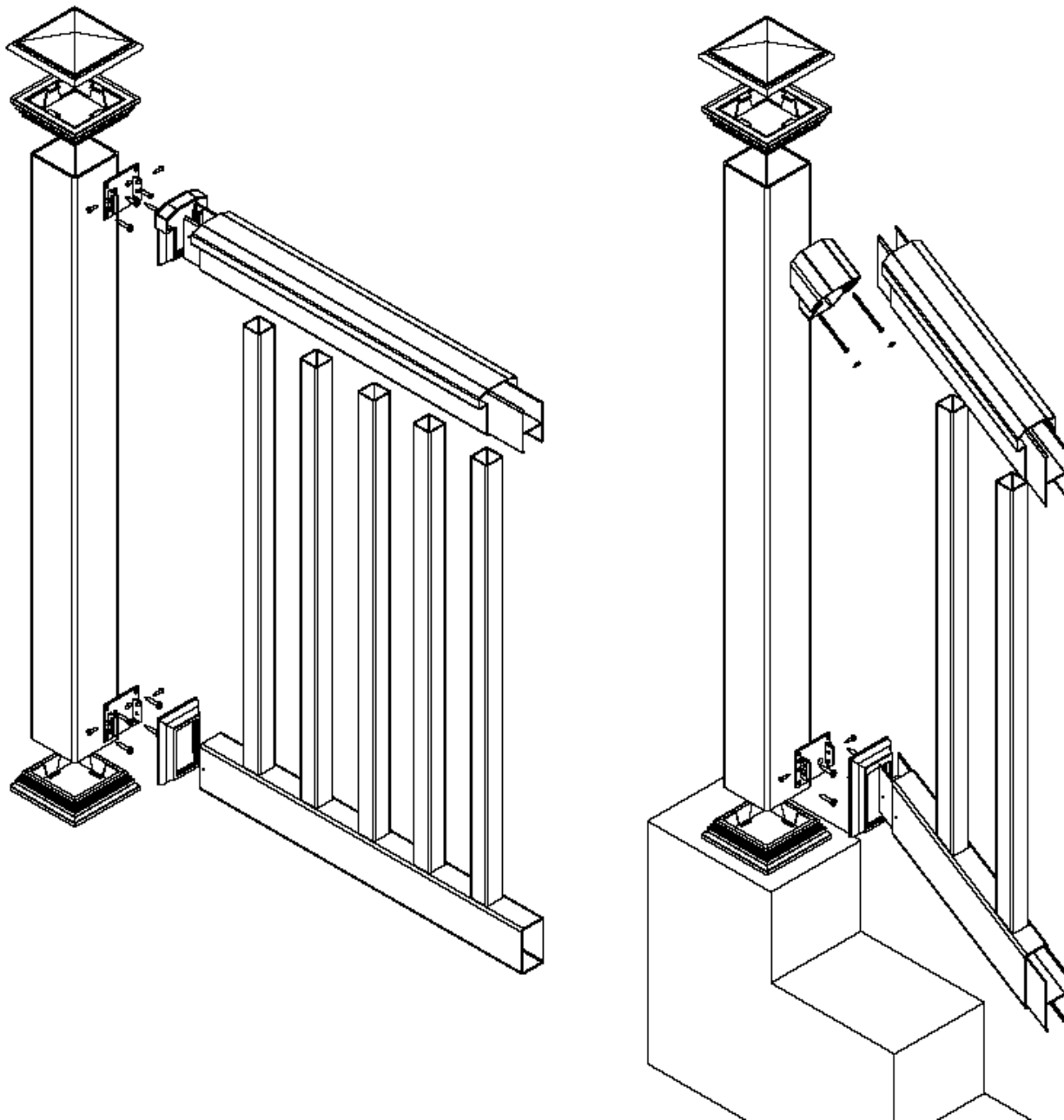


Figure 11 - T-Rail (Level and Stair)

Bottom rail reinforcement not shown for level rail. See Table 2 for requirement.

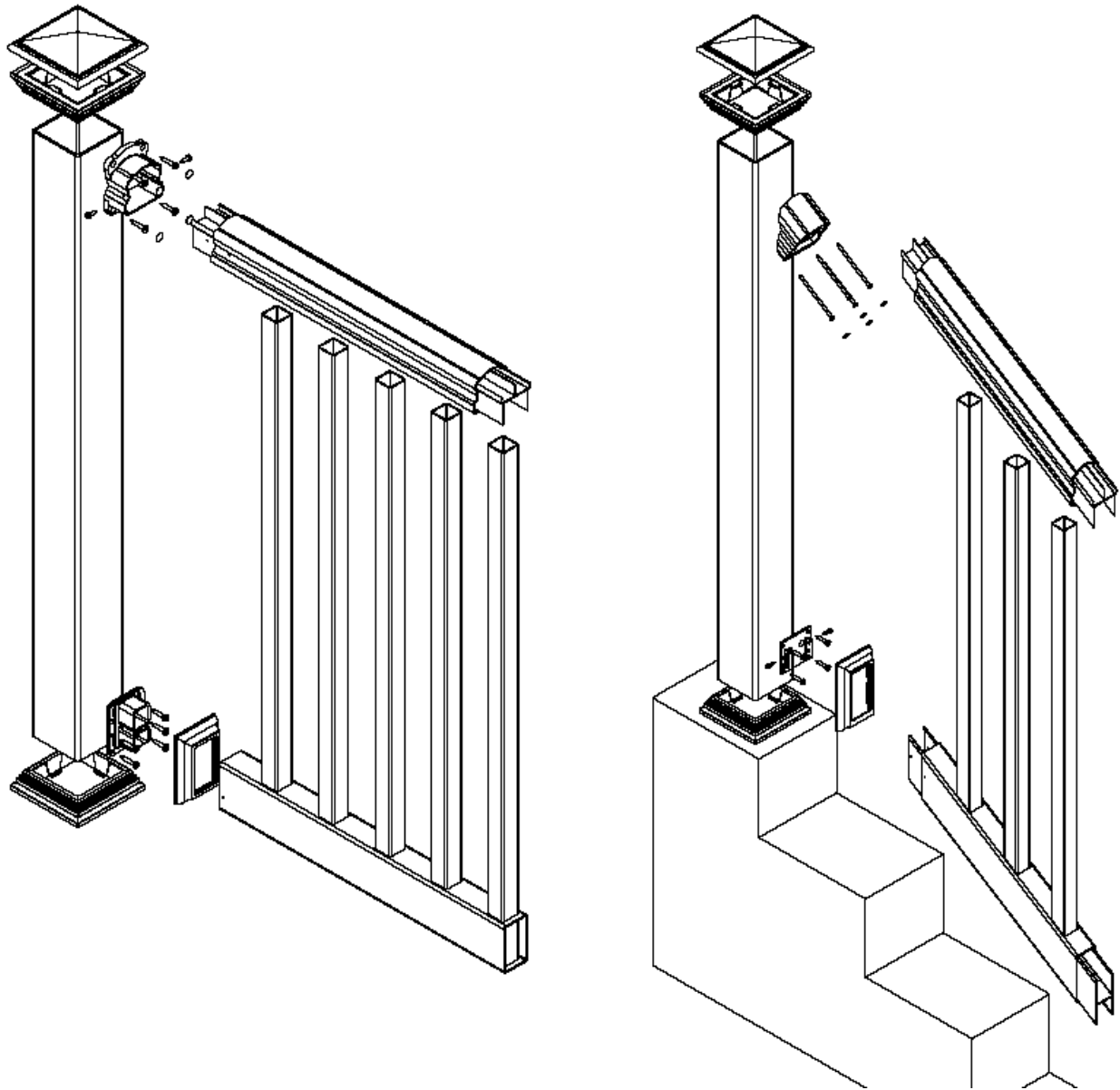


Figure 12 - Contoured Rail (Level and Stair)

Bottom rail reinforcement not shown for level rail. See Table 2 for requirement.

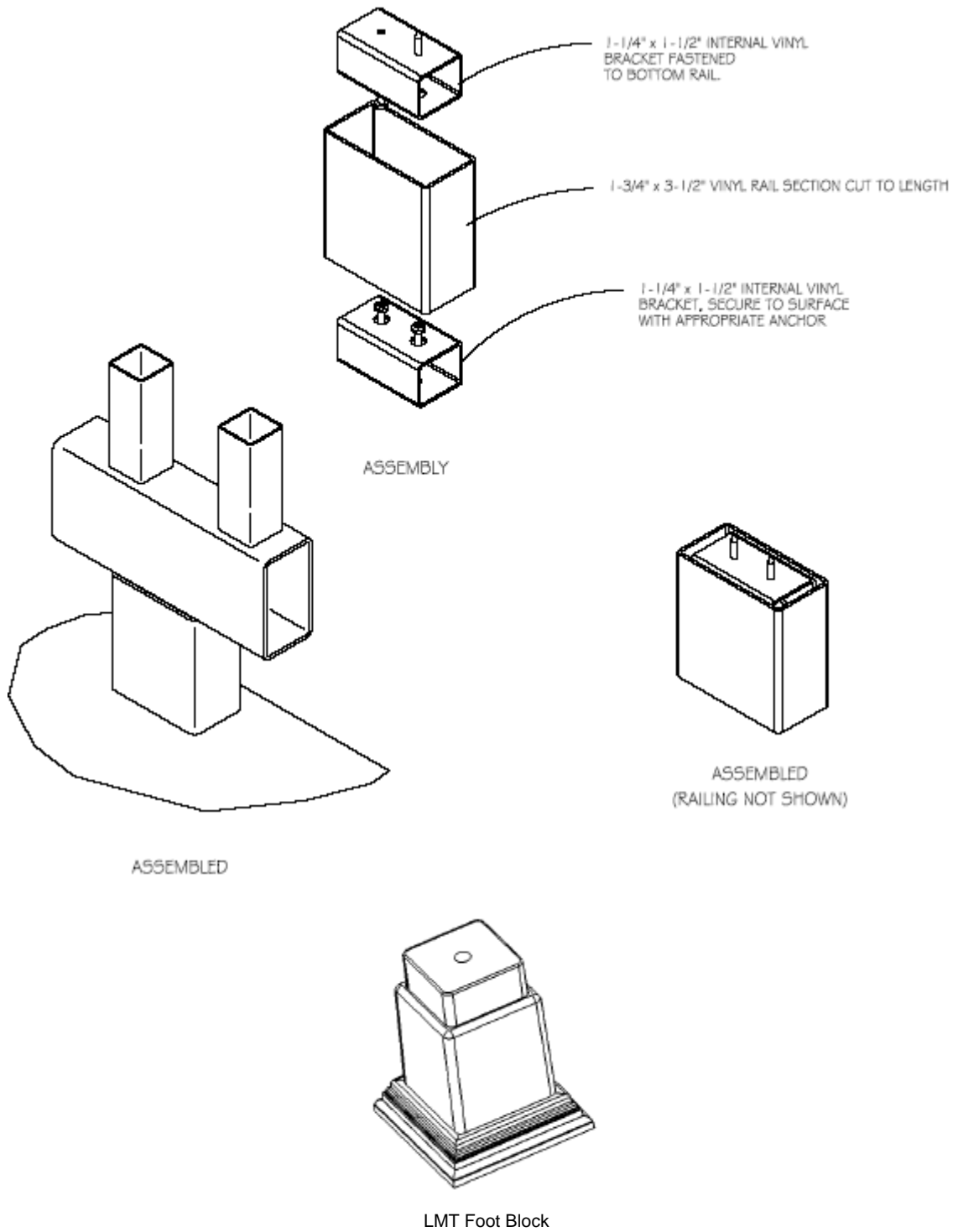


Figure 13 - Bottom Rail Intermediate Support (Foot Block)

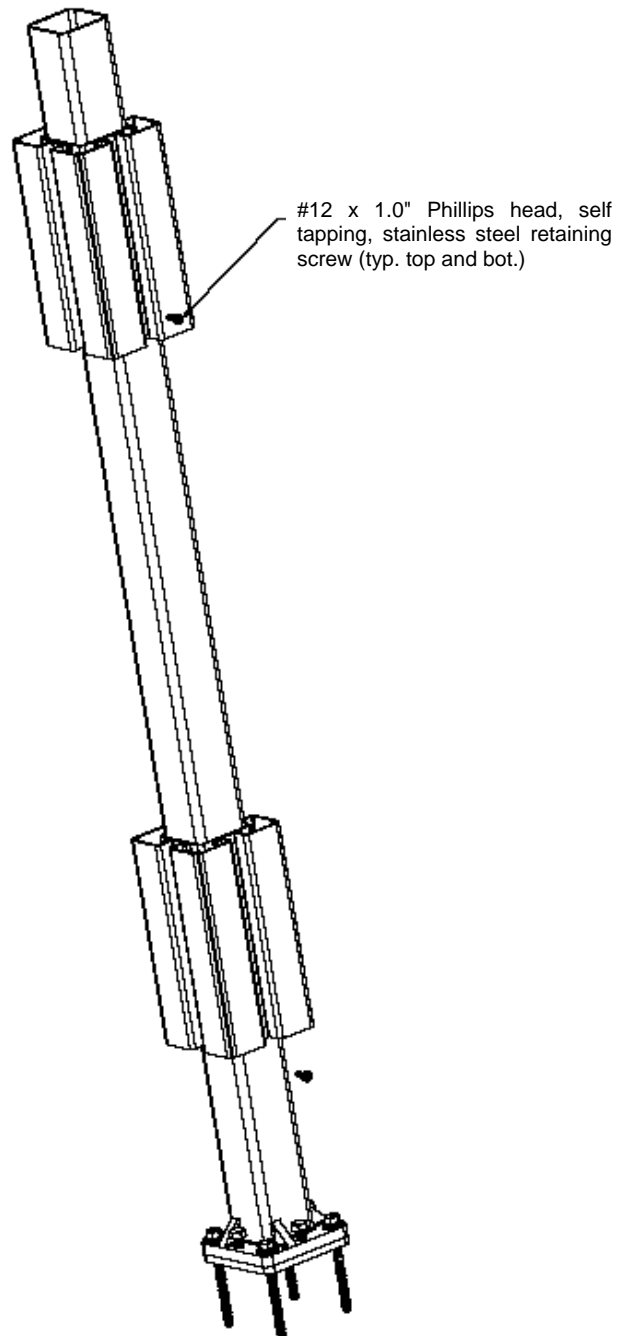


Figure 14 - Post Mount

Note: Anchorage and supporting structure are not within the scope of this report and must be designed and constructed in accordance with Chapter 16 of the IBC.

1. Minimum anchorage is (4) 3/8" Bolts. Length and type as appropriate for the type and condition of the supporting structure.
2. Molded PVC Guide Blocks are located at top and bottom rail bracket connection