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DIVISION: 05 00 00 – METALS
Section: 05 14 00 – Structural Aluminum
Section: 05 25 00 – Aluminum Joist Framing

REPORT HOLDER:
SigmaDek Limited
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REPORT SUBJECT:
SigmaDek System

1.0 SCOPE OF EVALUATION

1.1. This research report addresses compliance with the following Codes:

- 2015 *International Building Code*® (IBC)
- 2015 *International Residential Code*® (IRC)

1.2. SigmaDek System has been evaluated for the following properties (TABLE 1):

- Structural Performance

1.3. The SigmaDek System has been evaluated for exterior use for one- and two-family dwellings of Type V-B (IBC) construction and dwellings constructed in accordance with the IRC.

2.0 STATEMENT OF COMPLIANCE

The SigmaDek System complies with the Codes listed in Section 1.1, for the properties stated in Section 1.2 and uses stated in Section 1.3, when installed as described in this report, including the Conditions of Use stated in Section 6.

3.0 DESCRIPTION

3.1. The SigmaDek System is a prefabricated guardrail, deck and stair system consisting of an assemblage of aluminum, steel, and plastic components.

3.2. Guardrail assemblies include handrails, vertical balusters, newel posts, and connecting brackets. See Figure 2 and Figure 3 for guardrail components and connectors.

3.2.1. Handrails (level and stair) are extruded aluminum, and are routed to accept aluminum pickets described in Section 3.2.2 for the guardrail assemblies installed in the SigmaDek System.

3.2.2. Pickets are extruded aluminum in various lengths, and are inserted into pre-routed holes of handrails, fascia, tread supports, and finishing joists with plastic picket connectors. Corner pickets are utilized in corner conditions.

3.2.3. Newel posts are extruded aluminum in various profiles, with a nominal wall thickness of 0.10" and lengths of 36" or 42". The SigmaDek System includes two types of newel posts:

3.2.3.1. Upper newel posts are utilized as supporting posts at the top of the stairs.

3.2.3.2. Lower newel posts are utilized as supporting posts at the bottom of the stairs.

3.3. Deck framing system includes joists, beams, fascia, ledger boards, deck boards, support posts, post beam connectors and other brackets. See Figures 3 through 7 for deck system components and connectors.

3.3.1. Joists are manufactured of extruded aluminum, provided in two profiles; finishing and interior joists. Interior joists span the length of the deck system and are spaced no greater than 12" on center. Finishing joists run parallel to the interior joists along the perimeter of the deck system framing. Finishing joists are pre-routed to accept aluminum pickets. Ends of interior or finishing joists are attached to the ledger board and fascia.

3.3.2. Fascia are manufactured of extruded aluminum and span the width of the deck system along the perimeter of the deck system framing. Fascia are pre-routed to accept aluminum pickets.



3.3.3. Beams are manufactured of extruded aluminum and span the width of the deck system. Beams support the joists and transfer the load to the supporting posts.

3.3.4. Ledger boards are manufactured of extruded aluminum and provide a connection between the joists and the adjacent building structure.

3.3.5. Deck boards, termination boards, and stair treads are an extruded aluminum profile, attached to the top surface of the joists to provide a floor for the deck. Ceramic boards are installed on the top surface of the boards and treads for aesthetic purposes, and is not within the scope of this report.

3.3.6. Post beam connectors consist of various aluminum and steel components, and provide a connection between beams and supporting posts.

3.3.7. Support columns are manufactured of extruded aluminum and provide support to the deck system by attachment to the deck framing system with post beam connectors and aluminum post plates.

3.4. Stair system includes stair stringers, tread supports, toe kicks and connectors. See Figure 9 for stair system components and connectors.

3.4.1. Stair stringers (starter and intermediate) are manufactured of cast aluminum. Stair assemblies with multiple intermediate stringers are preassembled by the manufacturer.

3.4.2. Cast aluminum tread supports (left and right) are installed on the top surface of the stair stringers and assist in securing the guardrail pickets to the stair substructure.

3.4.3. Cast aluminum stringer connectors and steel stringer connector rods attach stair framing assemblies to the deck framing system. See Figure 22.

3.4.4. Lower newel post brackets are manufactured of extruded aluminum, and provide a connection between the lower newel posts and stair stringers.

3.4.5. Stair stringer toe kicks are manufactured of aluminum sheet metal, and snap into place on the front face of the stair stringers.

4.0 PERFORMANCE CHARACTERISTICS

4.1. SigmaDek aluminum newel posts recognized in this report are designed to resist a concentrated load as specified in IRC Table R301.5 for up to 42" high rail posts.

4.2. The SigmaDek deck boards and aluminum deck framing system are rated for a uniform live load of 100 lb/ft.² when constructed with joists spacing up to 12" on center and installation details as described in Table 2. Joists have maximum allowable spans of up to 9' for multiple joist spans with a 2' cantilever, or 12' single joist span with a 2' cantilever. Joists are supported by deck beams running the entire width of the deck perpendicular to the joists, supported by aluminum columns spaced no greater than 12' on center. Each SigmaDek supporting aluminum column and post beam connector assembly is designed for an allowable vertical (downward) load of 8,480 lb, for a maximum column height of 12'.

4.3. For lateral racking performance due to wind and seismic loading, the SigmaDek deck system has an allowable shear strength design load of 300 lb_r/ft., when tested in accordance with ASTM E 455, using a safety factor of 2.5. The deck system is installed as described in this report, with the joists spaced at 12" on center and the aluminum deck boards attached to the top surface of the joists. Dimensions of the deck system is limited to a 1:1, width to length ratio.

4.4. SigmaDek stair assemblies consisting of up to fourteen stair treads, supported by stair stringers spaced 24" on center (two stair tread spans), meet the 40 lb/ft.² live load requirement for stairs in one- and two-family dwelling applications. Stair assemblies are only permitted for installations to the fascia side of the deck system only. Where the stair assembly is installed, the deck system is limited to a maximum one foot cantilever and with the deck beam supported by two aluminum columns spaced maximum 4' on center. See Table 2 for installation descriptions. Stair tread profiles are rated for the code-prescribed concentrated load equal to 300 lb when installed with a maximum 24" support span. Stair tread profiles shall be installed in a minimum two-span condition.



4.5. The SigmaDek guardrail assemblies described in this report have demonstrated the capacity to resist the design loadings specified in Section R301 of the IRC when tested in accordance with ICC-ES AC273. Guardrails may be installed up to 16 feet in length, measured clear space between corner pickets. Stair guardrails may be installed up to 13 feet in length, measured sloping length of rail between upper and lower newel posts.

4.6. Deck boards have a wind uplift resistance rating of 243 lb/ft.² when fastened with one #10-16 x 1" long stainless steel self-drilling screw at every joist, spaced 12" on center. The allowable wind uplift design loads identified in Table 3 shall be used by a registered design professional for determining the wind uplift capacity for the deck system per project specifics.

5.0 INSTALLATION

SigmaDek System must be installed in accordance with the manufacturer's published installation instructions, the applicable Code and this Research Report. The manufacturer's published installation instructions and this Research Report must be strictly adhered to, and a copy of the instructions must be available on the jobsite during installation.

5.1. Installation must comply with this Research Report, the manufacturer's published installation instructions and the applicable Code. In the event of a conflict between the manufacturer's instructions and this report, this report governs.

5.2. See Table 2 for SigmaDek guardrail, deck and stair systems fastening schedule.

5.3. Splicing of joists, fascia, and handrails are outside the scope of this report.

5.4. Deck framing anchorage to the primary structure is not within the scope of this report shall comply with IRC Sections R507.1 and R507.2.4, and IBC Section 1604.8.3 for lateral load. See paragraph **6.4**.

6.0 CONDITION OF USE

The SigmaDek System described in this Research Report complies with, or is a suitable alternative to, what is specified in those Codes listed in Sections 1.0 and 2.0 of this report, subject to the following conditions:

6.1. The use of the SigmaDek System shall be limited to exterior use for balconies and porches for one- and two-family dwellings of Type V-B (IBC) construction and dwellings constructed in accordance with the IRC.

6.2. The SigmaDek System has not been evaluated for drift limits applicable to earthquake loading, and is outside the scope this report. The system and its members shall be designed in accordance with IBC Section 1604.3.

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

6.4. Additional design and construction are required for anchorage of lateral loads to the primary building structure in accordance with Sections R507.1 and R507.2.4 of the IRC and Section 1604.8.3 of the IBC.

6.5. SigmaDek Limited manufactures the products recognized in this report in La Baie, Quebec in accordance with an approved quality control system that includes independent third party inspections by Intertek.

7.0 SUPPORTING EVIDENCE

7.1. Drawings and installation instructions submitted by SigmaDek Limited.

7.2. Reports of testing in accordance with ASTM E 455, demonstrating compliance with IBC Chapter 17 for static racking performance.

7.3. Reports of testing in accordance with ASTM E 72, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

7.4. Reports of testing demonstrating compliance with the strength and deflection requirements of IBC Section 1709 for the SigmaDek deck and stair substructure assemblies.

7.5. Reports of engineering analysis and testing in accordance with the 2015 Aluminum Design Manual (ADM).

7.6. Reports of testing demonstrating compliance with the performance requirements of ICC-ES AC273, Acceptance Criteria for Handrails and Guards, revised March 2016.



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

8.0 IDENTIFICATION

The SigmaDek aluminum framing and guardrail systems described in this Research Report are identified by a marking bearing:

- 8.1. The Intertek report holder's name (SigmaDek Limited)
- 8.2. The phrase: "For Use in One- and Two-Family Dwellings Only"
- 8.3. The Intertek Code Compliance Research Report mark and number (CCRR-0244)



9.0 OTHER CODES

This section is not applicable.

10.0 CODE COMPLIANCE RESEARCH REPORT

10.1. 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.

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

10.3. Reference to the <https://bpdirectory.intertek.com> is recommended to ascertain the current version and status of this report.

TABLE 1 – Properties Evaluated

| PROPERTY | 2015 IBC SECTION | 2015 IRC SECTION |
|------------------------|------------------|------------------|
| Structural Performance | 1709 | R301.5 |

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Table 2 – Component Fastening Schedule

| Connection | | Description |
|----------------------------|--|--|
| Deck Boards (Figure 10) | | <p>Aluminum deck boards are fastened with one #10-16 x 1" long stainless steel self-drilling screw at every joist.</p> <p>At the ledger board, termination deck boards are secured at every joist utilizing a "T" bracket and 3/16" diameter aluminum blind rivet. The "T" bracket is inserted in the channel on the underside of the termination deck board, and the rivet fastens the "T" bracket to the joist.</p> <p>For stair treads, for each span three 3/16" diameter aluminum blind rivets are fasten the tread in the front, and two 3/16" diameter aluminum blind rivets fasten the tread through the backside of the toe kicks.</p> |
| Pickets | | <p>Aluminum pickets are inserted into pre-routed holes in the aluminum handrails and finishing joists or fascia, and are secured with plastic picket barrels and stainless steel rivets.</p> <p>Aluminum corner pickets are inserted into routed holes of the fascia and finishing joists, and are secured with stainless steel rivets.</p> |
| Ledger Board | To building structure | Aluminum ledger boards are secured to two layers of 2x10 wood ledgers (specific gravity, G=0.55) with two 2-1/2" long TIMBERLOK® screws (7 TPI, 0.30" major dia., 0.204" minor dia., 0.230" shank dia., 0.622" dia. washer head) evenly spaced between each joist. |
| Finishing Joists | To ledger boards (Figure 12) | <p>Finishing joists are attached to aluminum ledger boards by locking the joist ends into the ledger board starter/termination brackets, each fastened with two #10-16 x 1" long, hex washer head self-drilling stainless steel self-drilling screws; located on the side (outermost side of the deck) of the starter/termination bracket, one at 2" down from the top of the bracket and the other 3" down from the top of the bracket with both located 1" from the end of the bracket. Additionally, one #10-16 x 1" long, hex washer head self-drilling stainless steel self-drilling screw located at the top of the finishing joist, 1/2" from end of joist member, fastened through the joist and into the starter/termination bracket.</p> <p>Ledger board starter and termination brackets shall be fastened to the building structure (two layers of 2x10 wood ledgers, specific gravity of 0.55) with two 2-1/2" long TIMBERLOK® screws (7 TPI, 0.30" major dia., 0.204" minor dia., 0.230" shank dia., 0.622" dia. washer head) located in the two pre-drilled holes of the starter and termination brackets. Use of other anchors or substrates are outside the scope of this report and must be designed by a registered design professional. Anchors must be stainless steel, aluminum, or other approved material compatible with the aluminum framing system.</p> |
| | To beams (Figure 13) | <p>Two 1/2"-13 x 5" hex head, partially threaded stainless steel bolts with lock washer and nut are used to attach the first part of the finishing joist to beam bracket to the box beam; the finishing joist then locks in the bracket.</p> <p>The second part of the finishing joist to beam bracket locks into a tab and is bolted to the first part using two 1/4"-20 x 3/4" hex head stainless steel bolts with lock washers, flat washers and nuts. Two 3/16" x 5/8" aluminum blind rivets are then used to attach the bracket on one side of the finishing joist.</p> |
| | To fascia (Figure 14) | Fascia brackets are utilized to fasten the finishing joists to the fascia. Four 3/16" multi-grip stainless steel blind rivets secure the bracket to the joist and four 3/16" multi-grip stainless steel blind rivets fasten the bracket to the fascia. |
| | To ledger of building structure (Figure 12) | <p>Two 2-1/2" long TIMBERLOK® screws (7 TPI, 0.30" major dia., 0.204" minor dia., 0.230" shank dia., 0.622" dia. washer head) and located in the two pre-drilled holes of the steel mounting bracket into two layers of 2x10 wood ledgers (specific gravity, G=0.55). Use of other anchors or substrates are outside the scope of this report and must be designed by a registered design professional. Anchors must be stainless steel, aluminum, or other approved material compatible with the aluminum framing system.</p> <p>Two #10-16 x 1" hex washer head, self-drilling stainless steel screws fasten the mounting bracket to the bottom of the finishing joist.</p> |

(Table 2 continued on next page)



Table 2 (continued)

| | | |
|-------------------|--|---|
| Interior Joists | To ledger board (Figure 15) | One #10-16 x 1" hex washer head stainless steel self-drilling screw located at the top; one #10-16 x 1" hex washer head stainless steel self-drilling screw used to fasten a 7/16" wide by 1-1/4" long by 0.100" thick aluminum retainer tab to the underside of the interior joist which engaged into a groove on the ledger board. |
| | To beam (Figure 16) | Attachment via joist beam connectors, which slide onto the bottom edge of the joist and are snap fitted onto the beam, and mechanically fastened on each side of the beam with one 3/16" diameter aluminum body with steel mandrel blind rivet. |
| | To fascia (Figure 17) | One 3/16" multi-grip stainless steel blind rivet through the underside of the joist. |
| Upper Newel Posts | To handrails (Figure 18) | Attachment via threaded plates, pinch brackets, and rail brackets. Two 8-32 UNC stainless steel machine screws fasten the plates and brackets to the post. |
| | To fascia or finishing joists (Figure 19) | Attachment via newel post brackets. Four 1/4"-20 x 2-3/4" long, round head, carriage bolts with lock nuts fasten the newel posts to the newel post brackets. The newel post brackets are secured to fascia or finishing joists with one 3/8"-16 x 3" long round head, carriage bolt and lock nut. |
| Lower Newel Posts | To handrails (Figure 20) | Attachment via threaded plates and pinch brackets. Two #10 x 1" long stainless steel self-drilling screws fasten the plates and brackets to the post. |
| | To stair starter stringers (Figure 21) | Attachment via tread supports and newel post brackets. Four 1/4"-20 x 3/4" long, round head, carriage bolts with washers and lock nuts fasten the newel posts to the newel post brackets. Two 3/8"-16 x 3" long, round head, stainless steel carriage bolts with lock nuts inserted through the newel post bracket, tread support and starter stringer to secure the post. |
| Stair Assembly | To deck (Figure 22) | Stair substructures are secured to the deck substructure via stringer connectors and joist to stringer brackets. One 1/2" diameter x 3" long stainless steel bolt is inserted through the joist to stringer bracket, which is slid onto the bottom edge of the interior joists. The stringer connectors are then secured to the bracket/bolt assembly via a stringer connector rod. A second stringer connector is then attached to the bottom of the stringer and fastened to the stringer connector rod with a 1/2" diameter x 3" long stainless steel bolt. |
| | Stringers (Figure 22) | Intermediate and starter stringers are interlocked together. |
| Support Post | To beam (Figure 23) | A Post Beam Connector assembly is utilized to attach the aluminum beams to aluminum support posts using one aluminum post plate and two aluminum support post brackets. The inserted through the slots of the post beam connector base extrusion and fastened to the aluminum post with two 3/16" multi-grip stainless steel blind rivets for each bracket. |
| | To footer (Figure 23) | An aluminum post plate is attached to the aluminum support post with two 3/8" x 5" stainless steel bolts that are inserted through the aluminum post and secured with lock nuts. A minimum of four anchor bolts must be used and located in the four pre-drilled holes in the post plate. Anchors must be stainless steel, aluminum, or other approved material compatible with the aluminum framing system. Anchor bolts must have a minimum diameter of 5/16". The type and length of the anchor bolts are dependent upon the material and condition of the footer and is not within the scope of this report. |
| Beam | To beam (Figure 11) | A Beam to Beam Connector is utilized to attach the ends of two beams with four 1/2" diameter x 4-1/2" stainless steel bolts and nuts. The beam splice must be centered directly over a supporting column. |

(1) All self-drilling screws utilized for connections of aluminum members must be of 300 series stainless steel.

Table 3 – Allowable Uplift Design Loads for Connections

| Connection | Detail | Allowable Uplift Design Load |
|---|-----------|------------------------------|
| Finishing Joist to Ledger | Figure 12 | 892 lb |
| Finishing Joist to Beam | Figure 13 | 1,002 lb |
| Interior Joist to Ledger | Figure 15 | 1,236 lb |
| Interior Joist to Beam | Figure 16 | 337 lb |
| Support Post to Beam | Figure 23 | 445 lb |
| Support Post to Post Plate ⁽¹⁾ | Figure 23 | 3,122 lb |

⁽¹⁾ Concrete anchors and anchoring systems for use with SigmaDek assembly are not within the scope of this report and are subject to evaluation and approval by the building official. Anchors must satisfy the design load requirements specified in Chapter 16 of the building code.

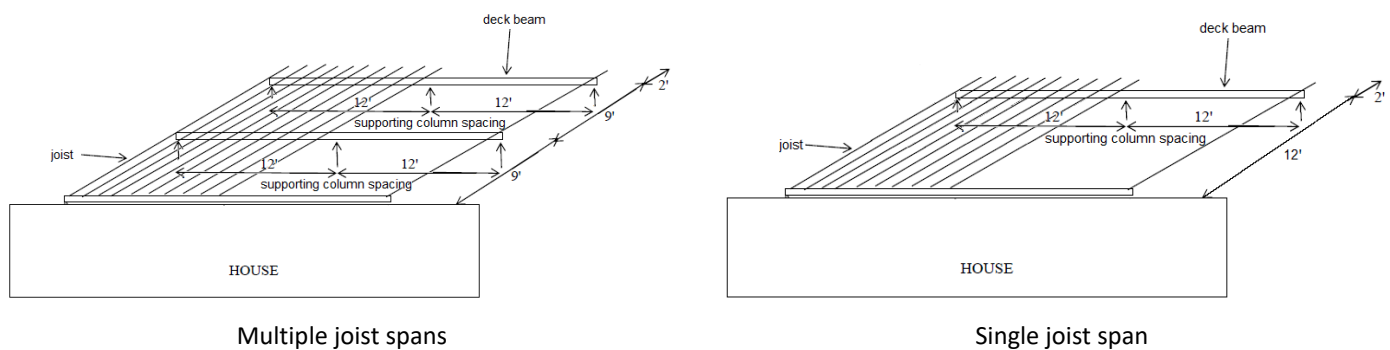


Figure 1 – Sigmadek Deck System Diagram

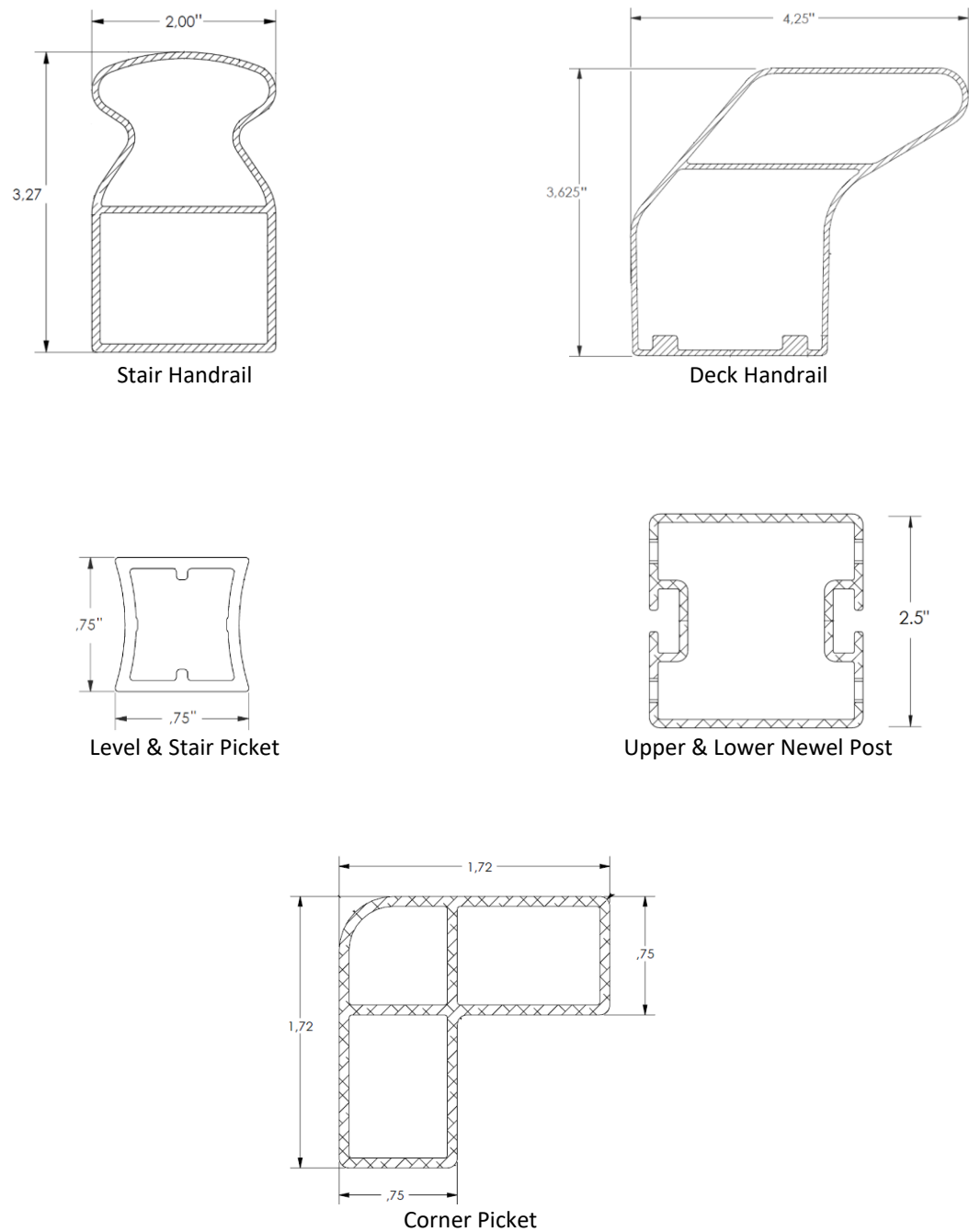


Figure 2 – Guardrail Assembly Components

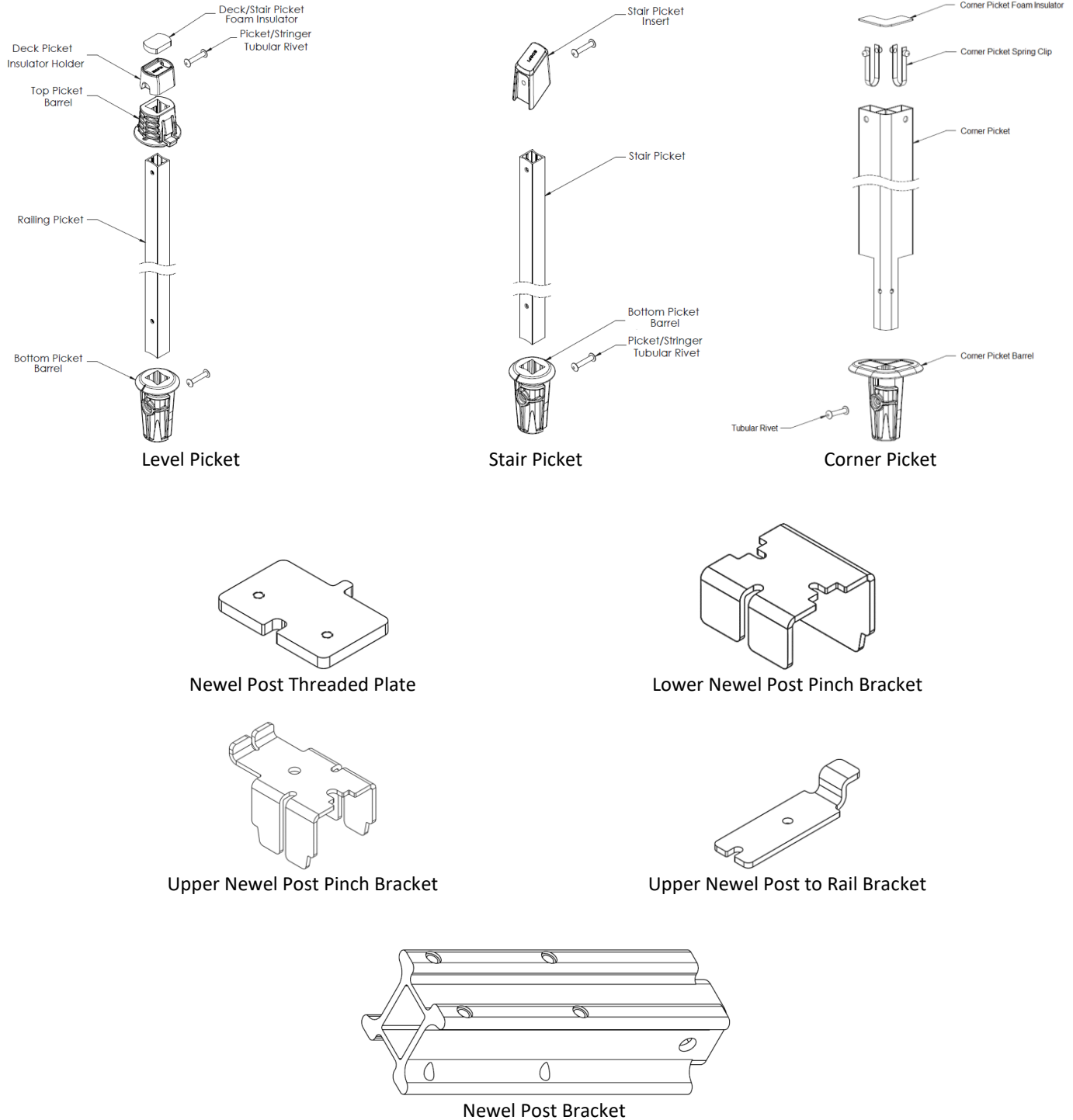


Figure 3 – Guardrail Assembly Components, Connectors, and Brackets

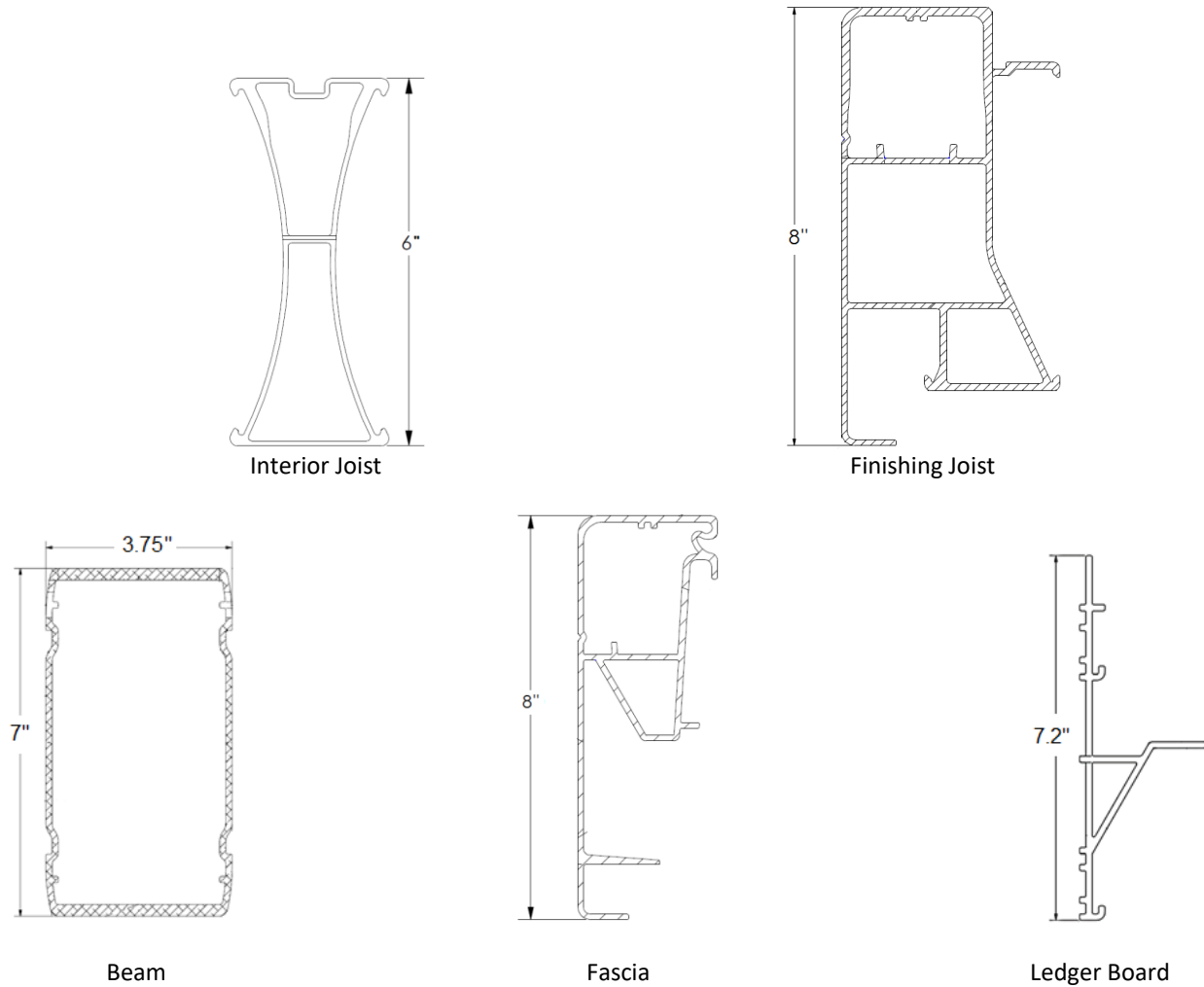


Figure 4 – Deck Framing Components

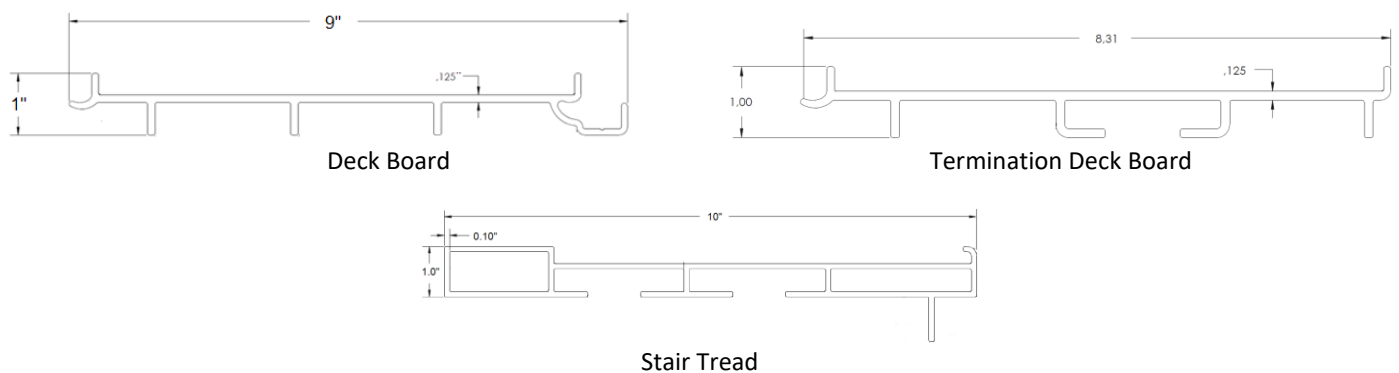


Figure 5 – Deck Boards and Stair Treads

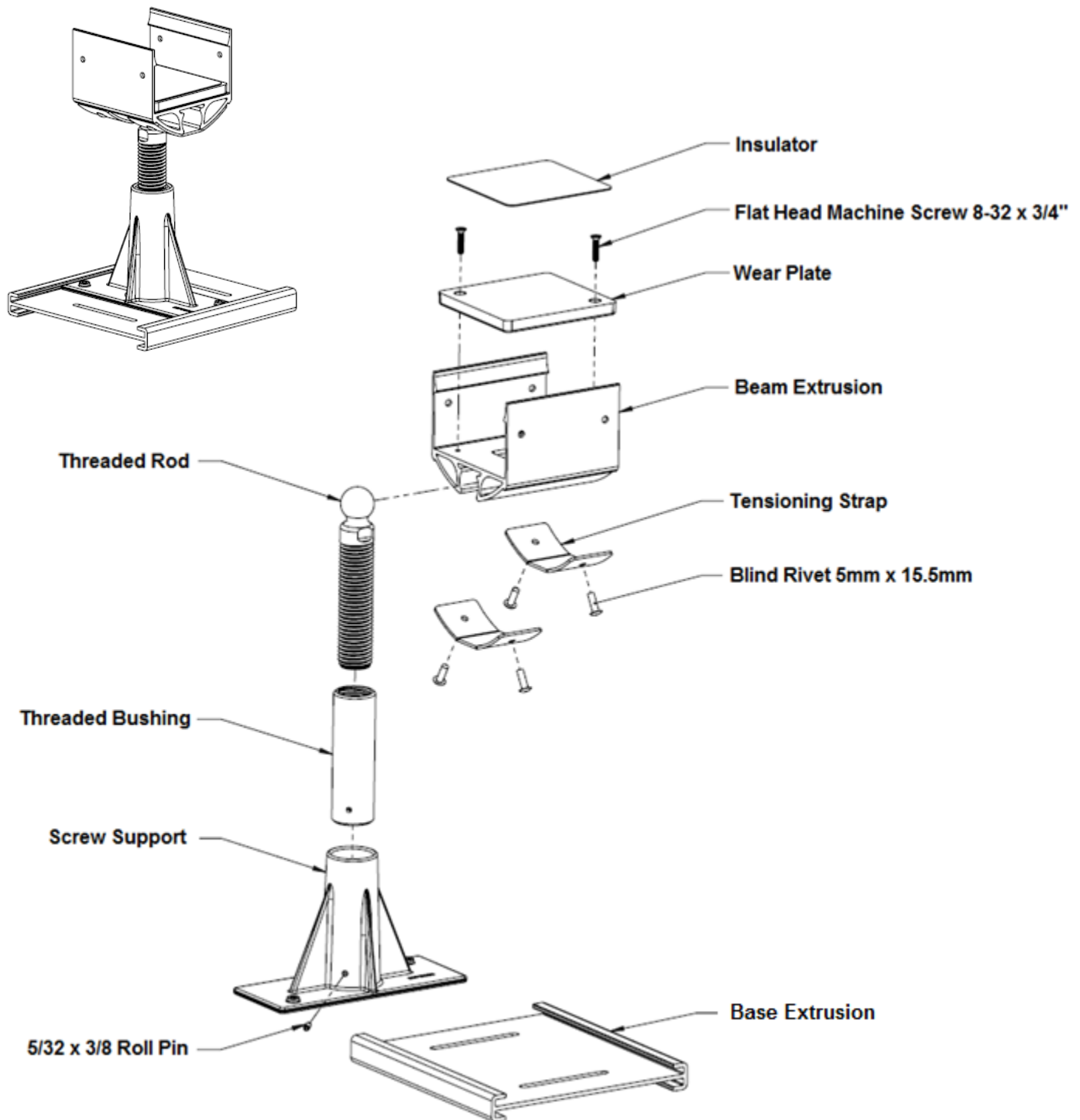
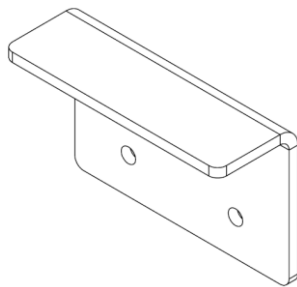
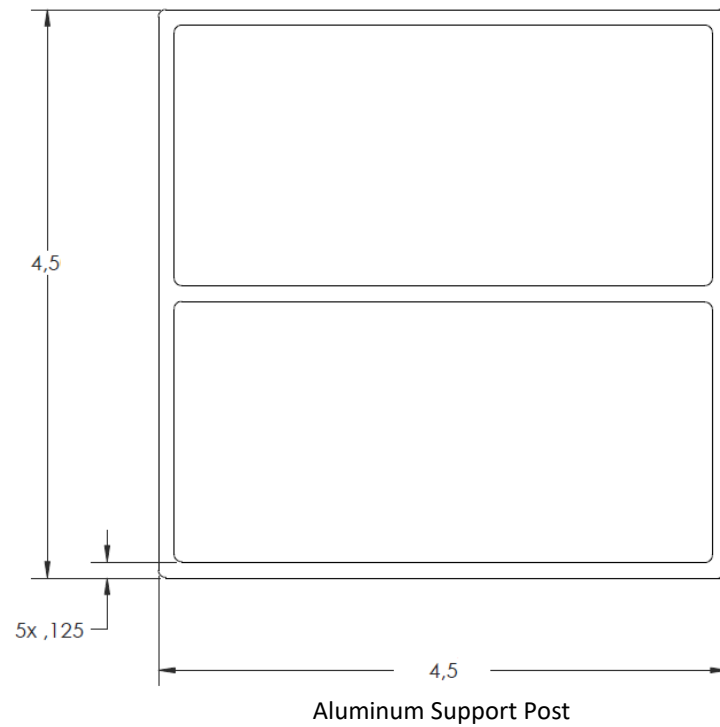
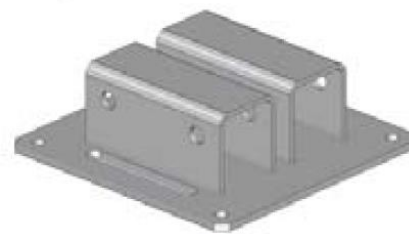


Figure 6 – Post Beam Connector Assembly

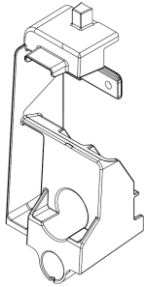


Aluminum Support Post Bracket

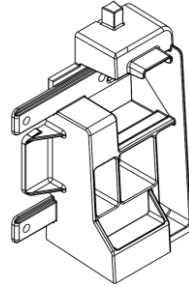


Post Plate

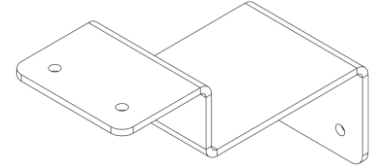
Figure 7 – Support Post, Brackets and Connectors



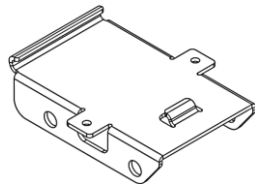
Ledger Board Starter Bracket



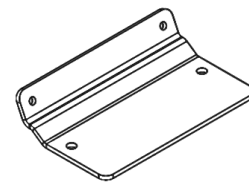
Ledger Board Termination Bracket



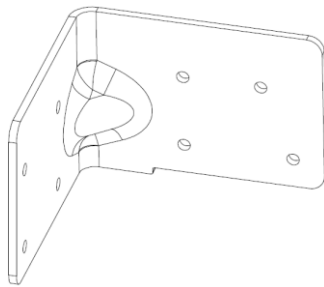
Steel Mounting Bracket



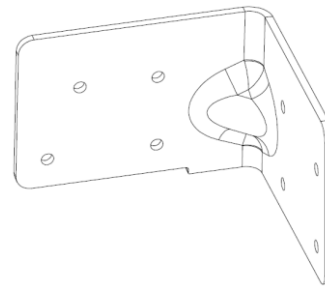
Finishing Joist to Beam Bracket



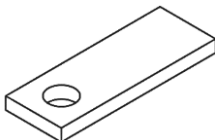
Finishing Joist to Second Beam Bracket



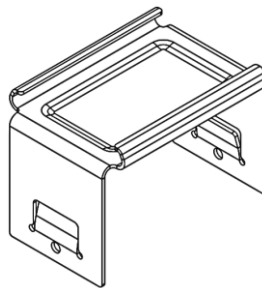
Finishing Joist to Fascia Bracket (Right)



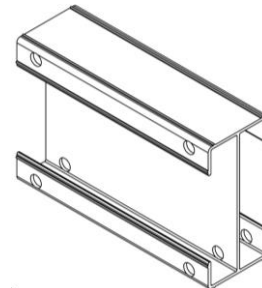
Finishing Joist to Fascia Bracket (Left)



Interior Joist Retainer Tab

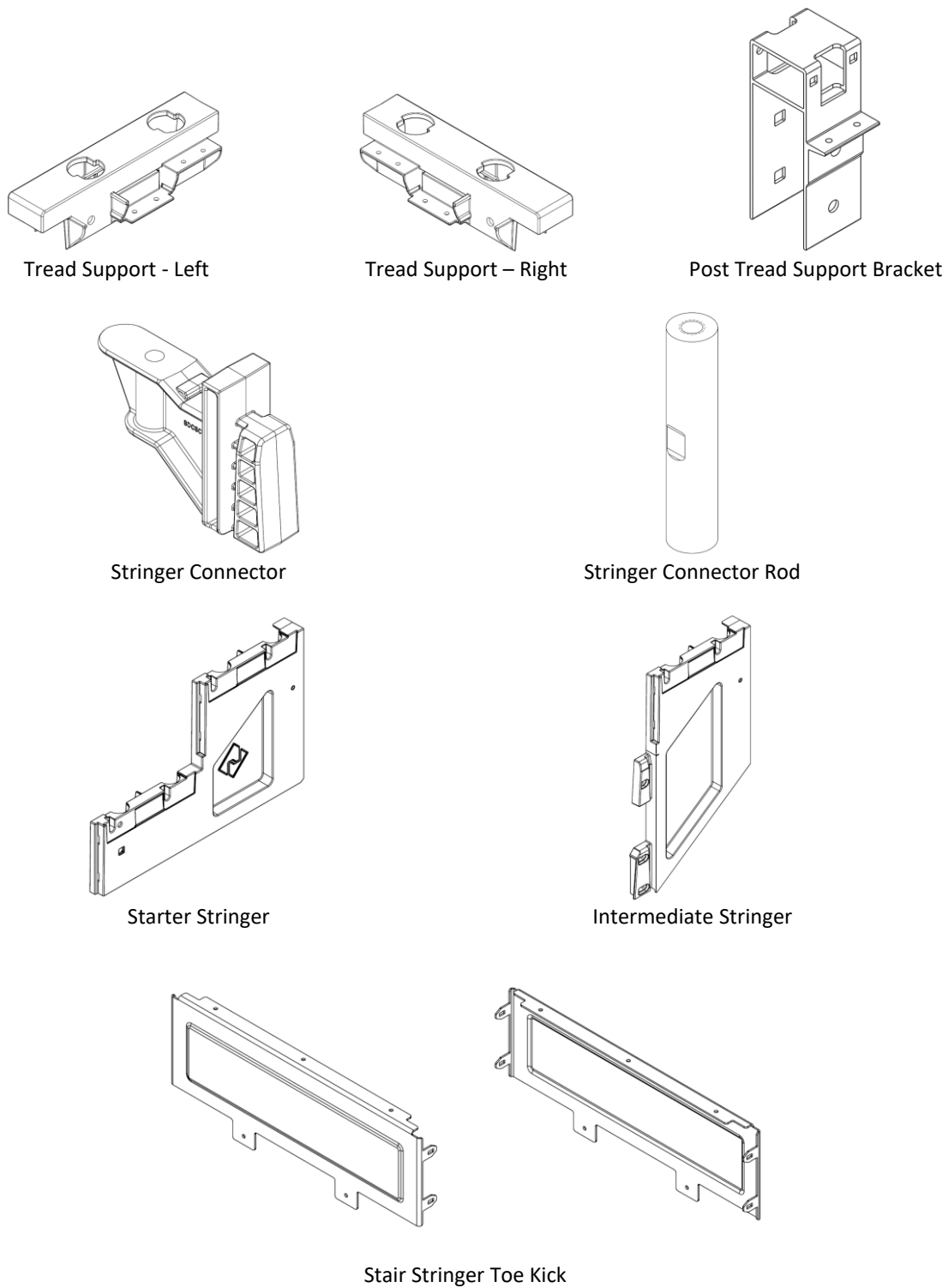


Interior Joist to Beam Bracket



Beam to Beam Connector

Figure 8 – Deck Framing Connectors and Brackets

**Figure 9 – Stair Stringer Assembly Components**

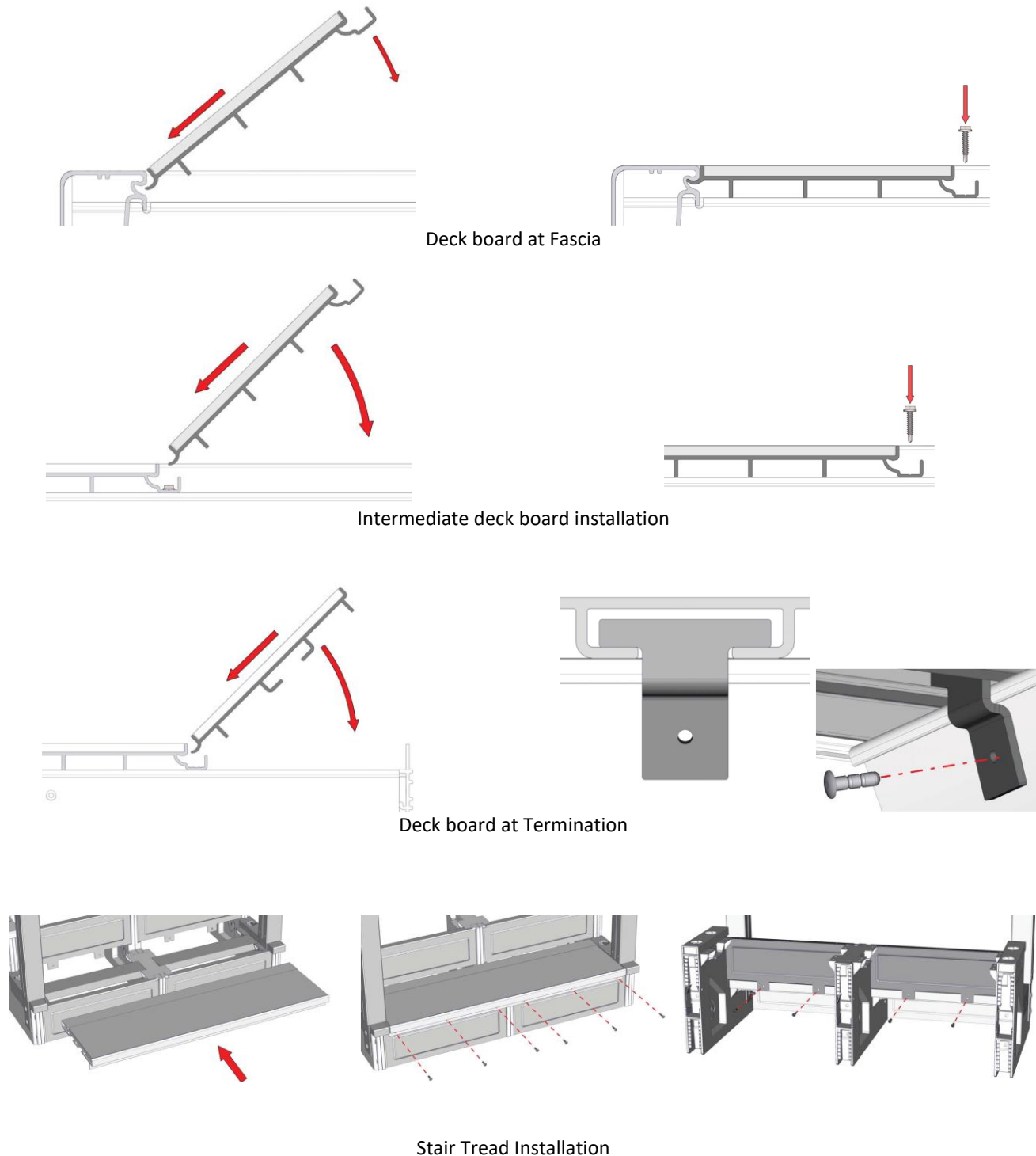


Figure 10 – Aluminum Deck Board Attachment



Figure 11 – Beam to Beam Connection

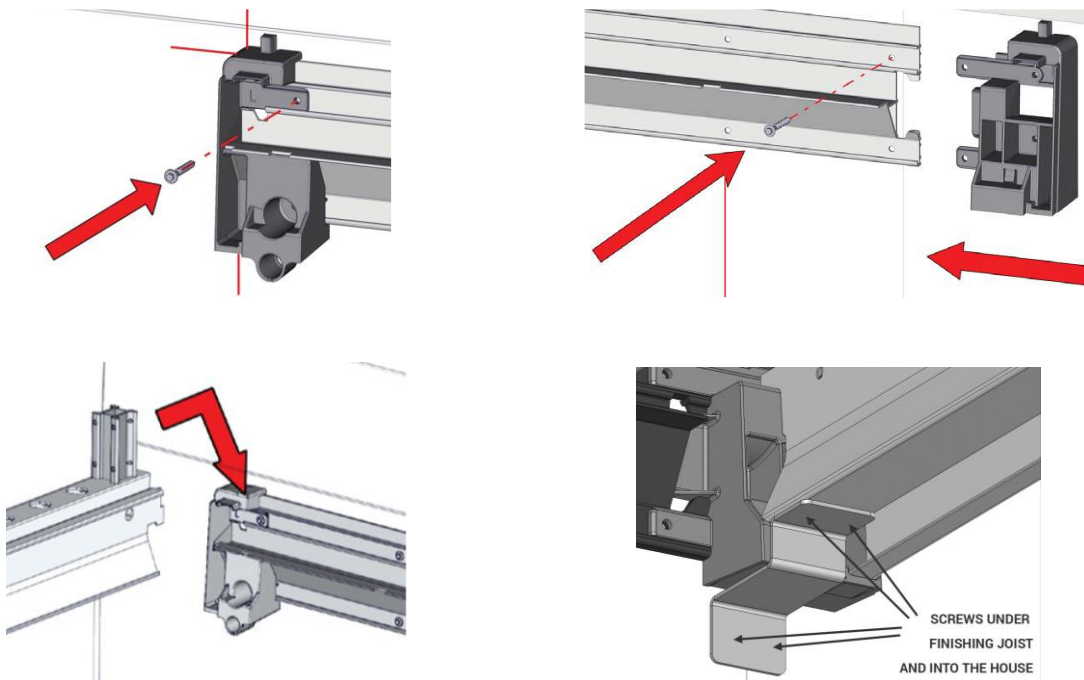
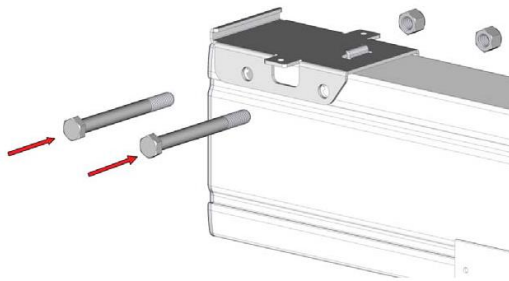
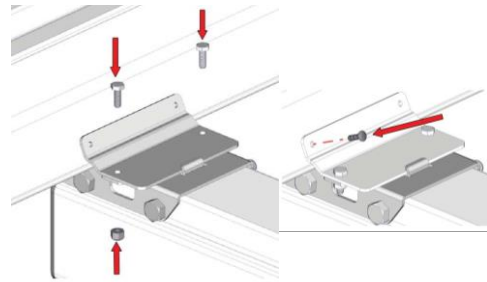


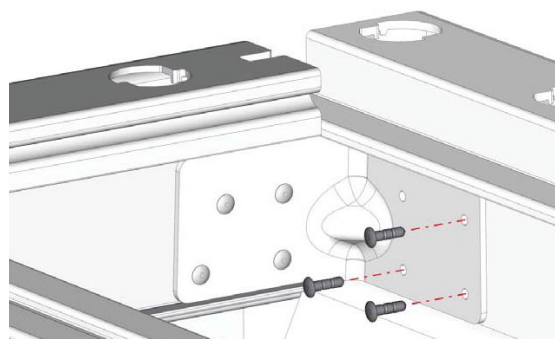
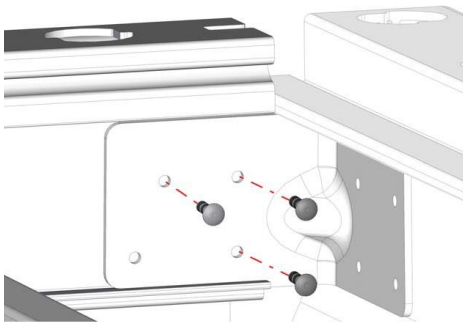
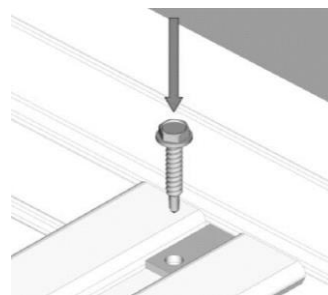
Figure 12 – Finishing Joist to Ledger Board



First Beam Bracket



Second Beam Bracket

Figure 13 – Finishing Joist to Beam**Figure 14 – Finishing Joist to Fascia**

Joist Retainer Tab

Figure 15 – Interior Joist to Ledger Board



Figure 16 – Interior Joist to Beam

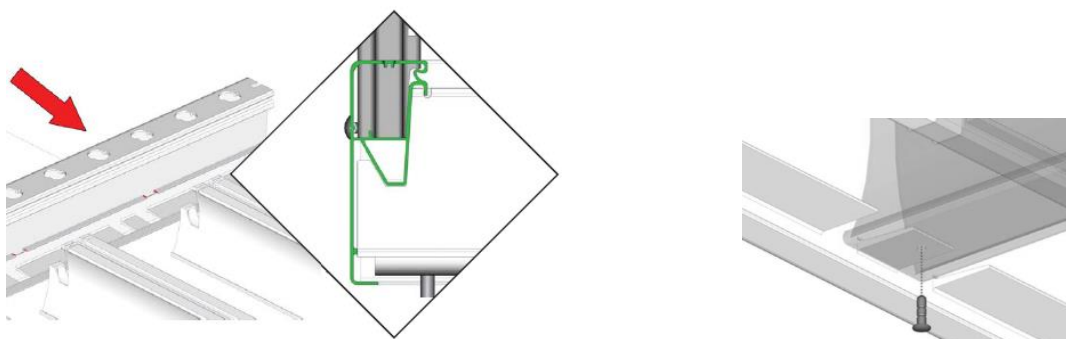
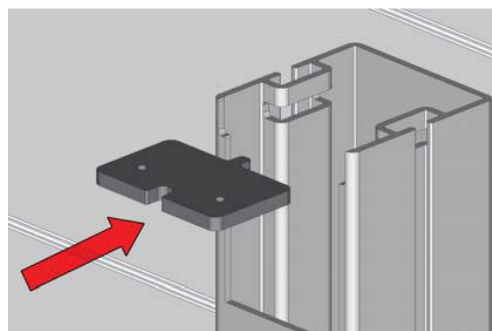
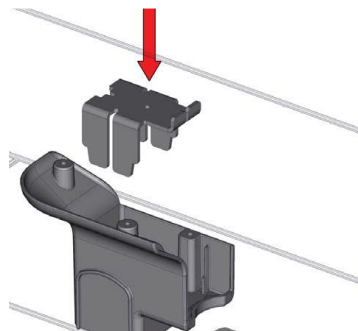


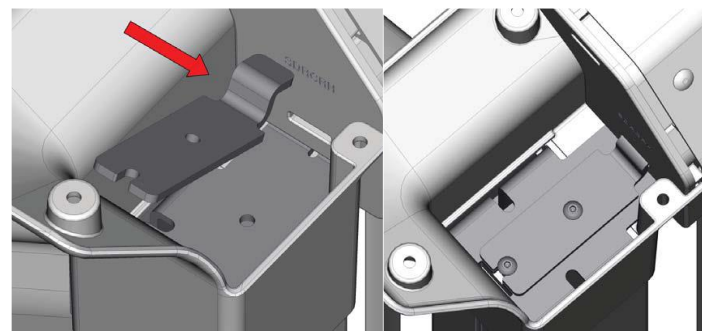
Figure 17 – Interior Joist to Fascia



Newel Post Threaded Plate

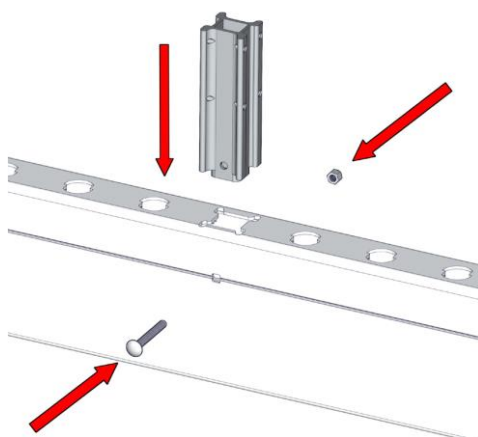


Upper Newel Post Pinch Bracket



Upper Newel Post to Rail Bracket

Figure 18 – Upper Newel Post to Handrail

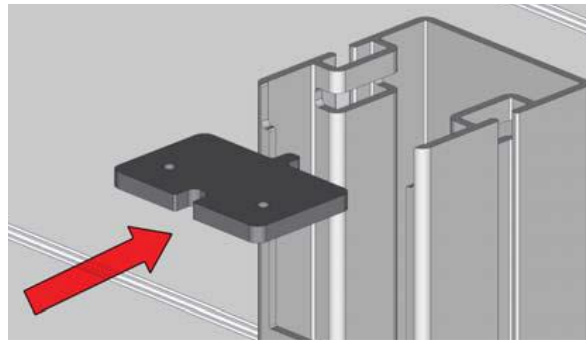


Post Bracket to Finishing Joist or Fascia

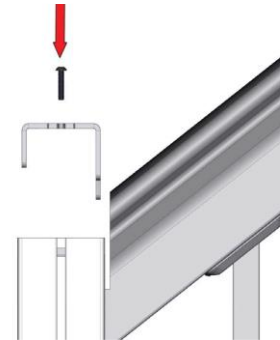


Post attachment to Post Bracket

Figure 19 – Upper Newel Post to Finishing Joist or Fascia

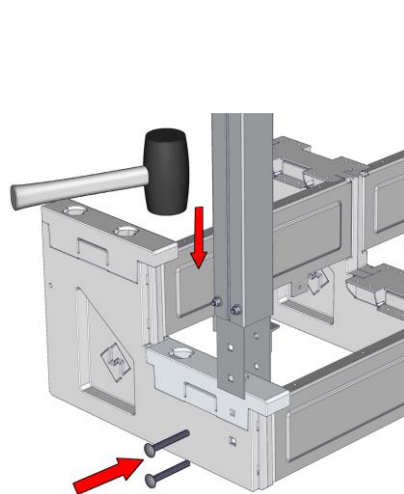


Newel Post Threaded Plate

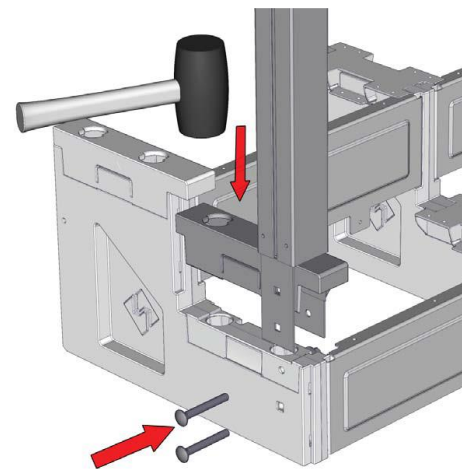


Lower Newel Post Pinch Bracket

Figure 20 – Lower Newel Post to Handrail



Post attachment to Tread Support



Attachment to Stringer

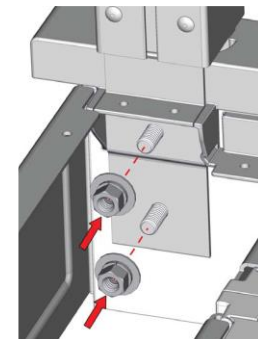


Figure 21 – Lower Newel Post to Tread Support



Attachment to Deck

Figure 22 – Stair Substructure Assembly

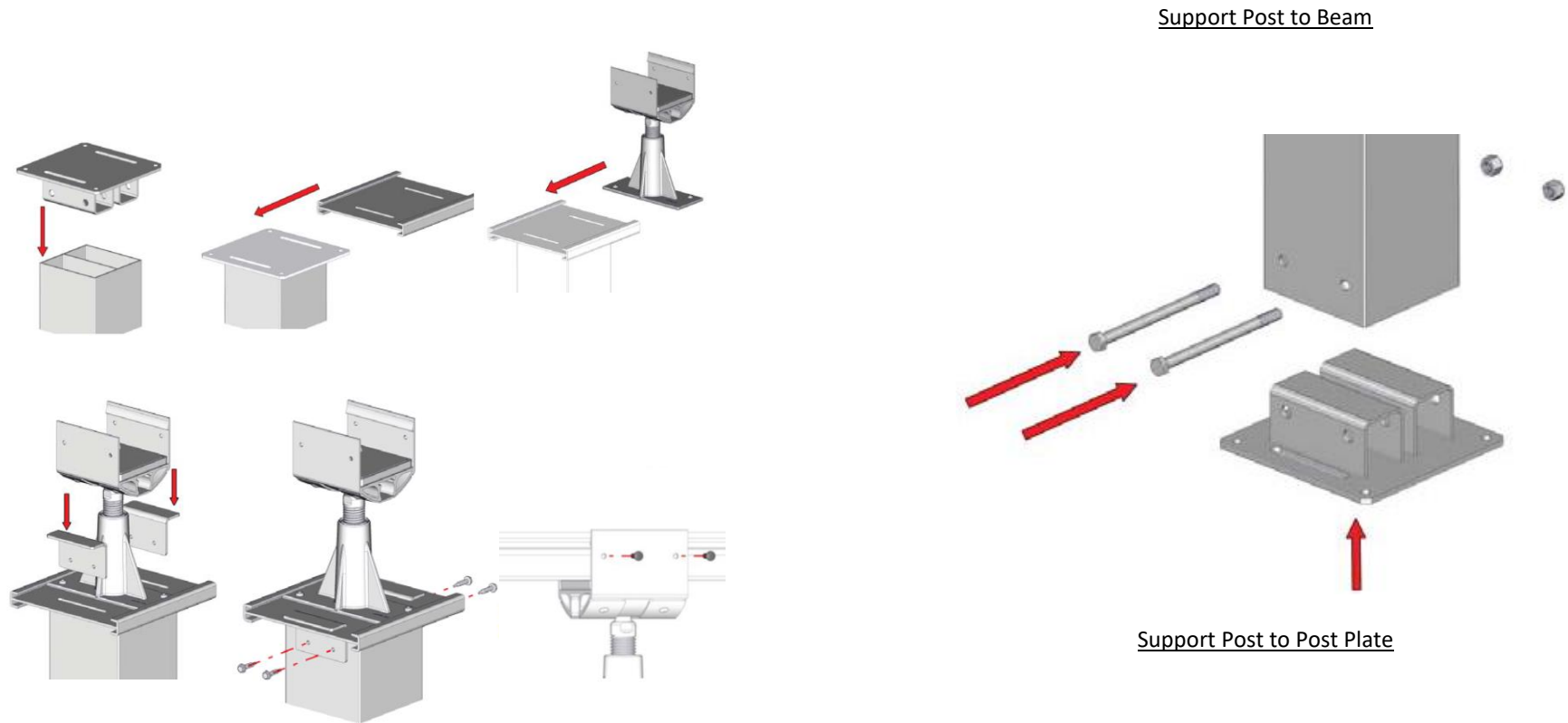


Figure 23 – Aluminum Support Post Beam Connector Attachment Details