**3D VIEW OF RAILING WITH TYPE 1 - PICKET INFILL PANEL**

*(42" Height shown, 48" Height Similar)*

### TABLE 1 - RAILING MEMBERS

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSION</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Rail</td>
<td>2½&quot; NPS (Sch. 40)</td>
<td>2.50&quot; x 1.50&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Post &quot;A&quot;</td>
<td>HSS 2½ x 1½ x ¾&quot;</td>
<td>2.50&quot; x 1.50&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Post &quot;B&quot;</td>
<td>HSS 2½ x 1½ x ¾&quot;</td>
<td>2.50&quot; x 1.50&quot;</td>
<td>0.100&quot;</td>
</tr>
<tr>
<td>End Hoops</td>
<td>HSS 3.000 x 0.120</td>
<td>3.000&quot;</td>
<td>0.120&quot;</td>
</tr>
<tr>
<td>Intermediate &amp; Bottom Rail</td>
<td>HSS 2 x 2 x ¾&quot;</td>
<td>2.000&quot; x 2.000&quot;</td>
<td>0.188&quot;</td>
</tr>
</tbody>
</table>

### TABLE 1 NOTES:

1. 0.125" wall thickness permitted for rails with post spacings less than 5'-8", except that Post Connection Sleeve must be 1½" NPS (Sch. 40).

### ADDITIONAL NOTES:

1. Shop Drawings are required; see Specification Section 515.
2. Materials:
   - A. Pipe Rails and Pickets: ASTM A500 Grade B, C or D, or ASTM A53 Grade B for standard weight pipe (Schedule 40) and ASTM A45 for bars.
   - B. Structural Tube: ASTM A500 Grade A, B, C, or D or ASTM A501.
   - C. Steel Plate: ASTM A36 or ASTM A709 Grade 36.
   - D. U-Channels and filler plates: ASTM A36 or ASTM A4011 (Grade 36).
   - E. Stainless steel (SS) screws: Type 316 or 18-8 Alloy.
   - F. Galvanized Steel Fasteners: coated in accordance with Specification Section 962.
   - G. For intermediate and bottom horizontal rails, the screwed joints shown may be substituted with alternate joints shown in detail "K".
2. Cut reinforcing steel is permitted for post installed anchors.

### INSTALLATION:

- Field splices are similar to the Expansion Joint Detail and may be approved by the Engineer to facilitate handling; but the top rail must be continuous across a minimum of two posts.
- For intermediate and bottom horizontal rails, the screwed joints shown may be substituted with alternate joints shown in detail "K".
- Make corners and changes in tangential longitudinal alignment with a 9" bend radius or terminate adjoining sections with mitered end sections when handrails are not required.
- For changes in tangential longitudinal alignment greater than 45°, position posts a maximum of 2'-0" each side of the corner but not at the corner apex.
- For curved longitudinal alignments, shop bend the top and bottom rails and handrails to match the alignment radius.
- Handrails are required and must be continuous at landings for:
   - Grades Steeper than 5%.
   - Three or more steps.
- For changes in tangential longitudinal alignment greater than 45°, position posts a maximum of 2'-0" each side of the corner but not at the corner apex.
- Installation: Cutting of reinforcing steel is permitted for post installed anchors.
Handrail required for ramps (Handrail continuous at landings between runs)

Infill Panel Type Varies, See Data Table in Plans (Pickets Shown)

3'-0" Min. ~ 5'-0" Max. (Typ.)

Top of Intermediate Rail

ELEVATION
(Showing Outside Face of Railing with Type "A" Posts)

Typical Railing Details & Railings on Grades 0% to 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

NOTES:
* Keyed construction joints in Index 6011 Gravity
Wall are not considered to be expansion joints.
** Contraction joints (Tooled or Saw Cut) in sidewalks do not require a 6" minimum offset.

Rail expansion joints to be located in panels above structure expansion joints * (35'-0" maximum spacing).

Expanded Elevation at Corners

Detail for Non-Continuous Railing at Corners

Ramp & Lading Requirements
(Showing Inside Face of Railing with Type "A" Posts)

Railings on Grades Steeper Than 5%
(Type 1 - Picket Railing Shown, Other Types Similar)
Railing Continuation Beyond Steps or Stairs (Bottom shown, Top similar)

Concrete sidewalk to extend 6" Min. behind rail.

Flatten handrail termination to 1½" Max. width.

Equal spacing 5'-0" Max. on Steps

Steel Handrail required for three or more steps

See "Typical Railing Details", Sheet 2 for post, rail & picket details

See Index 521 or Contract Plans for Step Details

Not considered an expansion joint for railing fabrication (Typ.)
**PICKET NOTES:**
* Picket Spacing of 6" centers is based on a 3/8" Ø Bar for standard applications. When shown in the Contract Plans a 4" picket spacing may be required. See Note 4 (Sheet 1).

**TYPE 1 - PICKET INFILL PANEL**

**TYPE 2 - CHAIN-LINK (Continuous Infill Panel)**

**NOTES:**
1. See Plans for Infill Panel option required.

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**TABLE 2 - CHAIN-LINK PANEL COMPONENT MATERIALS**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASTM</th>
<th>COMPONENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain-Link Fence Fabric (2&quot; mesh with twisted bottom and knuckled top selvage)</td>
<td>A 392</td>
<td>Zinc-Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating</td>
</tr>
<tr>
<td>Chain-Link Fence Fabric (2&quot; mesh with twisted bottom and knuckled top selvage)</td>
<td>A 491</td>
<td>Aluminum-Coated Steel - No. 9 gage (coated wire diameter)</td>
</tr>
<tr>
<td>Polystyrene (PVCP) Coated Steel - No. 9 gage Zinc-Coated Wire (metallic-coated core wire diameter)</td>
<td>F 668</td>
<td>See Plans for specified color of PVC</td>
</tr>
<tr>
<td>Tie Wires</td>
<td>F 626</td>
<td>Zinc-Coated Steel Wire - No. 9 gage with coating to match Chain-Link Fence Fabric</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>F 626</td>
<td>(Min. thickness) x 3/8&quot; (Min. width) x 2'-3&quot; (Min. height) Steel Bars</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
<td>F 626</td>
<td>Zinc-Coated Steel</td>
</tr>
</tbody>
</table>

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**CHAIN-LINK PANEL NOTE:**
Chain-Link Fence Fabric shall be continuous along limits of railing. Splicing of Chain-Link panels using Tension Bars at 20'-0" minimum increments is permitted.
TYPE 3 - SUNSHINE INFILL PANEL

* Arc, Rays and Sun Segment may be formed in a single panel from 3/8 steel plate pattern cut with laser or plasma CNC, welded to a 1x1x3/8 Angle Border or the 3/8x3/8 Channel Border shown.

TYPE 4 - BROADWAY INFILL PANEL

NOTES:
1. See Plans for Infill Panel Option required.
REPEATING PATTERN DETAIL FOR PERFORATED PANEL

SECTION A-A
Seal welding mitered corners is permitted

DETAIL "5A"
PANEL/RAIL CONNECTION
(Top Shown, Bottom Similar)

DETAIL "5B"
PANEL/END CONNECTION
(Expansion Joint Shown, Sides Similar)

NOTES:
1. See Plans for Infill Panel Type required.

TYPE 5 - PERFORATED INFILL PANEL

STEEL PEDESTRIAN/BICYCLE RAILING
**REVISION NO.** 0

**INDEX NO.** 1

**DESCRIPTION:**

**REVISION OF DESIGN STANDARDS** FY 2017-18

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**TYPICAL SECTION ON CONCRETE SIDEWALK** (Case I)

**TYPICAL SECTION ON RETAINING WALL** (Case II)

**TYPICAL SECTION ON STEPS & STAIRS** (Case III)

**TYPICAL SECTION FOR 4-BOLT ANCHORAGE** (Case IV)

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**ANCHOR BOLT TABLE**

<table>
<thead>
<tr>
<th>CASE</th>
<th>STRUCTURE TYPE</th>
<th>DIMENSIONS</th>
<th>ANCHOR LENGTH</th>
<th>ANCHOR SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Unreinforced Concrete</td>
<td>6&quot; 1&quot;-2&quot; 9&quot; 10½&quot; 11&quot;</td>
<td>½ ½ ½ ½</td>
<td></td>
</tr>
<tr>
<td>iiA</td>
<td>Reinforced Concrete</td>
<td>4&quot; 4&quot; 9&quot; 10½&quot; 11&quot;</td>
<td>½ ½ ½ ½</td>
<td></td>
</tr>
<tr>
<td>iiB</td>
<td>Gravity Wall Index 6011</td>
<td>4½&quot; 3½&quot; 1-0&quot; 1-½&quot; 1-½&quot;</td>
<td>½ ½ ½ ½</td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>Step Cheekwall</td>
<td>4½&quot; 4½&quot; 9&quot; 10½&quot; 11&quot;</td>
<td>½ ½ ½ ½</td>
<td></td>
</tr>
<tr>
<td>iv</td>
<td>Varies</td>
<td>5&quot; 5&quot; 5&quot; 6½&quot; 7&quot;</td>
<td>½ ½ ½ ½</td>
<td></td>
</tr>
</tbody>
</table>

* Embedment length "C" may be reduced to 9" for the 42" height railings for Case iiB, when the post spacing does not exceed 5'-0".

**When required; measured from top of sidewalk.**

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**DETAIL "D" (OPTIONAL SHIMMING DETAIL FOR CROSS SLOPE CORRECTION)**

(Used in lieu of Beveled Shim Plates)

**DETAIL "C"**

(Cast-in-Place Anchor Bolts shown, Adhesive Anchors similar)

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**NOTE:**

1. **Post & Anchor Bolts**
   - Place Anchor Bolts perpendicular to Base for Grades ≤ 8.33% (Ramps) with flat washer. Place anchor bolts plumb for Grades > 8.33° (Stairs) with flat washer & beveled washer, or leveling channel.
   - Place anchor bolts plumb for Grades > 8.33° (Stairs) with flat washer & beveled washer, or leveling channel.

2. **Shim Plates as required**
   - Full size Shim Plates when required for height adjustment.
   - Inside Face of Concrete Structure or Sidewalk (See Concrete Structure Plans for actual dimensions and reinforcing details).

3. **Adhesive Anchor Bolts**
   - 1-½ ø C-I-P Hex Head Anchor Bolt, or 1-½ ø Adhesive Anchor with hex nut & washer. Place anchor bolts (perpendicular to Base) for Grades ≤ 8.33° (Ramps) with flat washer.
   - Place anchor bolts plumb for Grades > 8.33° (Stairs) with flat washer & beveled washer, or leveling channel.

4. **Note:**
   - Embedment length "C" may be reduced to 9" for the 42" height railings for Case iiB, when the post spacing does not exceed 5'-0".

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**NOTE:**

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