NOTES

PIPE RAILING & POSTS:
Structural Tube, Pipe and Bar shall be in accordance with ASTM B221 or ASTM B429, Alloy 6061-T6. End Rail 90° bends and corner bends with maximum 4'-0" post spacing, may be Alloy 6063-T6. Posts and End Rails shall be fabricated and installed plumb. ±1/2 tolerance when measured at 9'-6" above the foundation. Corners and changes in tangential longitudinal alignment, may be made continuous with a 9" bend radius or terminated at adjoining sections with a standard end hood when handrails are not required. For changes in tangential longitudinal alignment greater than 45°, posts shall be positioned at a maximum distance of 2'-0" each side of the corner and shall not be located at the corner apex. For curved longitudinal alignments the top and bottom rails and handrails shall be shop bent to match the alignment radius.

**RAILING MEMBER DIMENSIONS TABLE**

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSION</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Rails</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1 1/2&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Handrails Joint/Splice Sleeves</td>
<td>1&quot; NPS (Sch. 40)</td>
<td>1.315&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Handrails</td>
<td>1 1/2&quot; Ø Round Bar</td>
<td>1.900&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1 1/2&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.125&quot;</td>
</tr>
</tbody>
</table>

BASE PLATES:
Base Plates shall be in accordance with ASTM B209, Alloy 6061-T6.

SHIM PLATES:
Shim Plates shall be bonded in accordance with ASTM B209, Alloy 6061 or 6063. Shim plates shall be used for foundation height adjustments greater than ½" between 2 posts and localized irregularities greater than ½" beneath base plates. Field trim shim plates when necessary to match the contours of the foundation. Beveled shim plates may be used in lieu of trimmed flat shim plates shown. Stacked shim plates must be bonded together with adhesive bonding material and limited to a maximum total thickness of ½", unless longer anchor bolts are provided for the exposed thread length.

COATINGS:
The aluminum railing shall be mill finish unless otherwise noted in the Contract Documents. All nuts, bolts and washers shall be hot-dip galvanized in accordance with Section 967 of the Specifications.

ANCHOR BOLTS:
Anchor bolts shall be in accordance with ASTM F1554 Grade 36. Headless anchor bolts for Adhesive Anchors shall be threaded full length. Cutting of confining zones is permitted for drilled hole installation. All anchor bolts shall have single self-locking hex nuts. Tack welding of the nut to the anchor bolt may be conducted in lieu of anti-thru bolt washers. All nuts shall be in accordance with ASTM A563 or ASTM A194. Plate Washers shall be in accordance with ASTM F436 and Plate Washers (for long slotted holes only), shall be in accordance with ASTM A58 or ASTM A537 Grade 36. After the nuts have been snug tightened, the anchor bolt threads shall be distorted to prevent removal of the nuts. Distorted threads and lock washers shall be coated with a galvanizing compound in accordance with the Specifications.

RESILIENT AND NEOPRENE PADS:
Resilient and Neoprene pads shall be in accordance with Specification Section 932, except that testing of the finished pads shall not be required. Neoprene pads shall be durometer hardness 60 or 70.

JOINTS:
All fixed joints are to be welded all around and ground smooth. Expansion Joints shall be spaced at a maximum of 30'-0". Field splices similar to the expansion joint detail may be approved by the Engineer to facilitate shipping and handling, but rails must be continuous across a minimum of two posts. Only the Continuity Field Splice (Detail "E") is to be used. Over 35'-0" apart, expansion joints shall be spaced at a 9" bend radius or terminated at adjoining sections with a standard end hood when handrails are not required. For changes in tangential longitudinal alignment greater than 45°, posts shall be positioned at a maximum distance of 2'-0" each side of the corner and shall not be located at the corner apex.

WELDING:
All welding shall be in accordance with the American Welding Society Structural Welding Code (Aluminum) ANSI/WES 14.1.2, 14.1.3 and 14.1.4. Filler metal shall be either ER5183, ER5356 or ER5556. Nondestructive testing of welds is not required.

SHOP DRAWINGS:
Details addressing project specific geometry (line & grade) showing post and expansion joint locations must be submitted by the Contractor for the Engineer's approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.

PAYMENT:
Guiderails shall be paid for under the contract unit price for Pipe Guiderail (Aluminum). Will be plan quantity measured as the length along the center line of the top rail, and includes rails, posts, rail splice assembly, base plates, anchor bolts, nuts, washers, resilient or neoprene pads and all incidental materials and labor required to complete installation of the Guiderail.
NOTES:
NPS = Nominal Pipe Size
* Keyed construction joints in Index No. 6011 Gravity Structures Expansion Joints
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* Keyed construction joints in Index No. 6011 Gravity Structures Expansion Joints

CROSS REFERENCE:
For Details "C", "D" and "E", see Sheet 4.
GUIDERAIL ON STEPS & STAIRS

ALUMINUM PIPE GUARDERAIL

ELEVATION
(At-Grade Steps)

RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

Concrete sidewalk to extend 6" min. behind Handrail

Aluminum Handrail, required for three or more steps
(Handrail and cheekwalls continuous at landings)
Handrail ~ 1½" NPS (Sch. 40)

Handrail Continuous at Landing

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

See Index No. 521 or Contract Plans for Step Details

GUIDERAIL ON STEPS & STAIRS

ALUMINUM PIPE GUARDERAIL

ELEVATION
(At-Grade Steps)
SECTION B-B
(Handrail Connection)

SECTION C-C
BASE PLATE DETAIL
(2-Bolt Anchorage)

BASE PLATE DETAIL
(4-Bolt Anchorage)

SHIM PLATE DETAIL
(2-Bolt Anchorage)

SHIM PLATE DETAIL
(4-Bolt Anchorage)

PLATE WASHER
DETAIL

ALTERNATE BASE
PLATE DETAIL
(Recommended for Steep Slopes)

DETAIL "D" - EXPANSION JOINT
(FIELD SPlice SLIP JOINT SIMILAR)

DETAIL "E" - CONTINUITY
FIELD SPlice

DETAIL "C" - RAIL CONNECTIONS
(Handrail and 4-Bolt Anchorage Not Shown)

DETAIL "B" - RAIL AND HANDRAIL
(Showing Sloped Condition for Ramps with 2-Bolt Anchorage)

CROSS REFERENCE:
For locations of Details "C", "D" and "E", see Sheet 2.
**Guiderail & Anchor Bolts**

Optional 4-Bolt Anchorage (Shown Dashed)

4" Sidewalk with Thickened Edge

Slope 2% Max. (away from drop-off)

TYPICAL SECTION ON CONCRETE SIDEWALK

**Guiderail & Anchor Bolts**

Base Plate with Shim plates (as required) (Typ.)

1/8" Thick Resilient or Neoprene Pad (Typ.)

0" Standard 2" for Ramps

Slope 2% Max. (away from drop-off)

TYPICAL SECTION ON GRAVITY WALL

(Other Retaining Walls Similar)

**Guiderail & Anchor Bolts**

Base Plate with Shim plates (as required) (Typ.)

1/8" Thick Resilient or Neoprene Pad (Typ.)

0" Standard 2" for Ramps

Slope 2% Max. (away from drop-off)

TYPICAL SECTION ON STEPS & STAIRS

4-Bolt Anchorage or 4" for 4-Bolt Anchorage.

**Guiderail & Anchor Bolts**

Base Plate with Shim plates (as required) (Typ.)

1/8" Thick Resilient or Neoprene Pad (Typ.)

0" Standard 2" for Ramps

Slope 2% Max. (away from drop-off)

**Post**

Epoxy Mortar (Type F) in accordance with Specification Section 926

2" Min. Embedment

3" Ø Core Drilled Hole (1½"), clean hole in accordance with Specification Section 416

Seal base of hole (Option 2 & 3) and end of post (Option 2) prior to epoxy filling to prevent leakage

6" Foundation embedment permitted (Option 3)

**Notes:**

2 - 1/8" Ø x 8" or 4 - 1/8" Ø x 6" Steel Anchors:

Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Permitted (C-I-P), Galvanized Adhesive Anchors Permitted (C-I-P); Expansion Anchors Not Permitted.

*** Adhesive anchors shall be fully threaded headless anchor bolts set in drilled holes (manufacturer recommended diameter) with minimum embedment of 6" and installed in accordance with Specification Section 937 and installed in accordance with Specification Section 416. The minimum embedment is 6" for 2-Bolt Anchorage or 4" for 4-Bolt Anchorage.