

**SECTION 05 52 00 - PIPE AND TUBE RAILINGS**

## 1.01 SECTION INCLUDES

- A. Section Includes:
  - 1. Aluminum Handrail
  - 2. Aluminum Stair Rail
  - 3. Aluminum Guard Rail

1.02 RELATED SECTIONS: All applicable Sections apply including, but not limited to, Division 05.

## 1.03 REFERENCES

- A. ASTM B108, Standard Specification for Aluminum-Alloy Permanent Mold Castings
- B. ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C. ASTM B221, Standard Specification for Aluminum-Alloy. Extruded Bars, Rods, Wire, Shapes, and Tubes
- D. ASTM B247, Standard Specification for Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
- E. ASTM B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes
- F. ASTM B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
- G. ADM-1, Aluminum Design Manual, current edition
- H. AWS D1.2, Structural Welding Code Aluminum
- I. U. S. Department of Labor, Occupational Safety and Health Administration (OSHA)

## 1.04 DEFINITIONS

- A. Guardrail: A system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.
- B. Handrail: A railing provided for grasping with the hand for support.

- C. Railing: A generic term referring to guardrail, handrail and/or stair rails.
- D. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

#### 1.05 SUBMITTALS

- A. Product Data: Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Fabrication and/or layout drawings:
  - 1. Erection plans and details of each piece including connection details:
    - a. Plan showing profile, location, sections and details of each railing
    - b. Type and details of anchorage
    - c. Location and type of expansion joints
    - d. Materials of construction, shop coatings and all third-party accessories.

#### 1.06 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

#### 1.07 SEQUENCING

- A. Coordinate work under provisions of Section 01 31 00.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS – ALUMINUM RAILING

- A. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
  - 1. ASTM B209 for sheets and plates.
  - 2. ASTM B221 and ASTM B308 for shapes - beams, channels, angles, tees, and zees
  - 3. ASTM B247 for forgings.
- B. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes:
- C. Cast Fittings: Aluminum, ASTM B108.

- D. Shims: Aluminum of same alloy as component being shimmed.
- E. Electrodes for Welding:
  - 1. Aluminum: AWS D1.2.
  - 2. Filler alloy 5356 or 4043. Use 5356 on members that will be anodized.

## 2.02 FABRICATION

- A. General:
  - 1. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
  - 2. Form exposed work with smooth, short radius bends, accurate angles and straight edges. Ease exposed edges to a radius of approximately 1/32". Form bent-metal comers to smallest radius possible without causing grain separation or otherwise impairing work. Drill or punch holes with smooth edges.
  - 3. Form exposed connections with flush, smooth, hairline joints, using stainless steel or aluminum splice locks to splice sections together or by welding. Top rail splices and expansion joints shall be located within 8" of post or other support. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.
  - 4. Provide for anchorage of type indicated on Drawings or as required by field conditions. Drill or punch holes with smooth edges.
  - 5. Design railing, supports, and anchorage system to withstand:
    - a. Handrails and guardrails shall be designed to resist a load of 50 PLF applied in any direction at the top of the handrail or guardrail and shall transfer that load through the supports to the structure.
    - b. Handrails and guardrails shall be designed to resist a single 200 lb. concentrated load applied at any point in any direction to top of rail system and to transfer this load through the supports to the structure. This load need not be assumed to act concurrently with the loads specified in 'a' above.

- c. Intermediate rails, balusters-picketts, and filler panels shall be designed to withstand a horizontally applied normal load of 50 lb. on an area not to exceed one square foot including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of 'a' or 'b' above.
  - d. 100 PLF vertical and 50 PLF horizontal uniform loads applied simultaneously to the top rail of the guardrail.
  - e. A load of 25 PSF applied horizontally at right angles over the entire tributary area including openings and spaces between rails.
  - f. Loading conditions need not act concurrently.
  - g. Maximum post spacing is six (6) feet.
6. Custom fabricate railings to dimensions and profiles as follows:
- a. Fabricate handrail and handrail posts using 1-1/4" or 1-1/2" nominal DIA Schedule 40 pipe (or heavier).
  - b. Fabricate all guardrail top and bottom rails using 2" or 2-1/2" nominal aluminum tubing.
  - c. Fabricate all guardrail vertical posts using 2" or 2-1/2" nominal aluminum tubing.
    - 1) Guardrail vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6063-T6.
  - d. All intermediate guard rails shall be fabricated using aluminum channel of a width to match top and bottom rail width.
  - e. All pickets to be 3/4" or 1" aluminum tubes or bars.
  - f. Base plate for vertical posts mounted to top of concrete surface:
    - 1) 3/8" (minimum) x 6 x 6" square plate.
    - 2) Predrilled to accept four anchors.
    - 3) Provide an 8" long solid aluminum bar welded to the base plate. Size bar to fit snug to inside of post tube.
    - 4) Fit the vertical post over the solid rod and weld the post to the base plate.
  - f. Base plate for vertical guardrail post mounted to flange of metal structure:
    - 1) 3/8x3x8" plate.
    - 2) Predrilled to accept two fasteners.
    - 3) Provide a 2" DIA x 8" long solid aluminum rod welded to the base plate.
    - 4) Fit the vertical post over the solid rod and weld the post to the base plate.
  - g. Mounting bracket for vertical guardrail post mounted to vertical concrete surface or web of metal structural member:
    - 1) Pair of 3/8" angles or bent plates.

- 2) Predrilled to accept two fasteners each.
  - 3) Weld angles or bent plates to vertical posts.
7. Fit exposed ends of guardrails and handrails with solid terminations.
    - a. Return ends of handrail to wall, but do not attach to wall.
    - b. Where guardrail terminates at a wall provide a vertical post located 4" off the wall to center of post.
  8. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.
- B. Finish: Aluminum Association Anodized Architectural Class I, A42, dark bronze color.
- C. Welded Railing Fabrication: All welding to be continuous in accordance with AWS C5.5 and AWS D1.2. All welded railing joints shall have full penetration welds unless noted otherwise. All exposed welds to be ground and buffed smooth and flush to match and blend with adjoining surfaces. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted. Finishing joints with filler is not acceptable.
- D. Install weeps to drain water from hollow sections of railing at exterior and high humidity conditions.
  1. Drill ¼" weep hole in railings closed at bottom:
    - a. 1" above walkway surface at bottom of posts set in concrete.
    - b. 1" above solid aluminum rod at posts having base plate.
    - c. At low point of intermediate rails.
  2. Do not drill weep holes in bottom of base plate.

E. Expansion and Construction Joints:
  1. Provide expansion joints at forty (40) foot maximum spacing and provide for ½ inch of movement.
  2. Joints in the top and bottom guard rails shall be accomplished using a solid aluminum bar fit snug inside rail and extending 8" minimum into each rail.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install handrails and guardrails to meet loading requirements of the International Building Code and as specified above.

- B. Install products in accordance with manufacturer's instructions.
- C. Set work accurately in location, alignment and elevation; plumb, level and true. Handrail slope to match slope of stairs. Guard Rails are to slope parallel to supporting surface. Measure from established lines and items which are to be built into concrete, masonry or similar construction.
- D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
  - 1. Space vertical posts as required by loading requirements but not more than 6 ft. on center.
  - 2. Space handrail brackets as required by loading requirements but not more than 4 ft. on center.
  - 3. Provide shims as required.
- E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
- F. Provide removable railing sections where indicated on Drawings.
- G. Attach handrails to walls or guardrail with brackets designed for condition:
  - 1. Provide brackets which provide a minimum 1-1/2" clearance between handrail and nearest obstruction.
  - 2. Handrails shall not project more than 3-1/2" into required stairway width.
  - 3. Anchor handrail brackets to concrete or masonry walls with 1/2" stainless steel adhesive anchors with stainless steel hex head bolts.
- H. Anchor railings to concrete with minimum 1/2" stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract Documents. Where exposed, bolts shall extend minimum 1/2" and maximum 3/4" above the top nut. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut. Bevel the top of the bolt after cutting to provide a smooth surface.
- J. Anchor railing to metal structure with minimum 3/4" stainless steel bolts, nuts and washers.

**END OF SECTION**