

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data including manufacturer's product lines of mechanically connected railings, railing brackets, and accessory materials including but not limited to grout, anchoring cement, and paint products.
- B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
- C. Samples: Submit 24 inch (610 mm) sample of handrail showing bends, elbows, wall bracket, escutcheon, and end stop when requested by Architect for each type of exposed finish required.
- D. Delegated Design Submittal: Submit analysis data including structural design calculations for specified load requirements signed and sealed by the qualified professional engineer responsible for preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding Certificates: Submit current certificates for each welder certifying it had passed AWS qualifications testing for welding process.
- B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: Submit test reports performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935 for handrails and railings.
- E. Evaluation Reports: Submit ICC-ES report for post installed anchors, from ICC-ES.

1.4 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: Licensed to practice in state where project is located and is experienced in providing engineering services of the kind indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M Structural Welding Code - Steel.
 - 2. AWS D1.2/D1.2M Structural Welding Code - Aluminum.
 - 3. AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.
- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer experienced in the design of railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Pipe Railing Standard: Comply with applicable provisions of ANSI/NAAMM AMP 521 Pipe and Railing Systems Manual.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C, material surfaces).

2.2 MATERIALS

- A. Steel Pipe and Tube Railings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. VIVA Railings, LLC.
 - b. Wagner, R & B, Inc.

2.3 METALS

- A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2 inch (38 mm) clearance from inside face of handrail to finished wall surface.
- C. Steel and Iron:
1. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 2. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads. Provide galvanized finish for exterior installations and where indicated.
 3. Plates, Shapes, and Bars: ASTM A 36/A 36M.

4. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- D. Fasteners:
1. Ungalvanized Steel Railings: Type 304 stainless steel fasteners.
 2. Hot Dip Galvanized Railings: Type 304 stainless steel fasteners.
 3. Aluminum Railings: Type 304 stainless steel fasteners.
 4. Stainless Steel Railings: Type 304 stainless steel fasteners.
- E. Fasteners for Anchoring Railings to Other Construction: Type 304 stainless steel fasteners.
- F. Fasteners for Interconnecting Railing Components:
1. Provide concealed fasteners for interconnecting railing components and for attaching to other work, unless otherwise indicated.
 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 3. Provide tamper resistant flat head machine screws for exposed fasteners unless otherwise indicated.
- G. Post Installed Anchors: Torque controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- H. Miscellaneous Materials:
1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - a. For aluminum and stainless steel railings, provide type and alloy recommended by producer of metal to be welded and necessary for color match, strength, and compatibility in fabricated items.
 2. Etching Cleaner for Galvanized Metal: Solution of acid and detergents designed to remove grease and oil residue from metal surfaces resulting in clean, lightly etched surface promoting adhesion of coating system.
 3. Galvanizing Repair Paint: High zinc dust content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 4. Universal Shop Primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.

5. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
6. Epoxy Zinc Rich Primer: Zinc rich primer compatible with topcoat.
7. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
8. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.
9. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - J. Form Changes in Direction: By radius bends of radius indicated on drawings.
 - 1. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 - K. Close exposed ends of railing members with prefabricated end fittings.
 - L. Provide wall returns at ends of wall mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
 - M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
 - N. Provide inserts and anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
 - O. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
 - P. For removable railing posts, fabricate slip fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
 - Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open sided floors and platforms. Fabricate to dimensions and details indicated.
- 2.5 FINISHES
- A. Steel and Iron:
 - 1. Galvanized Railings:
 - a. Hot dip galvanize exterior and where indicated steel railings, including hardware, after fabrication.
 - b. Comply with ASTM A 123/A 123M for hot dip galvanized railings.
 - c. Comply with ASTM A 153/A 153M for hot dip galvanized hardware.
 - d. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

- e. Fill vent and drain holes that are exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - f. For galvanized railings, provide hot dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 - g. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
2. Nongalvanized Steel Railings: Provide nongalvanized ferrous metal fittings, brackets, and sleeves; provide stainless steel anchors to be embedded in exterior concrete or masonry.
 3. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning or SSPC-SP 3 Power Tool Cleaning requirements based on exposure and conditions of use:
 - a. Exterior Railings: SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
 - b. Railings Indicated to Receive Zinc Rich Primer: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
 - c. Railings Indicated to Receive Field Applied Primers: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
 - d. Other Railings: SSPC-SP 3 Power Tool Cleaning.
 4. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - a. Shop prime uncoated railings with universal shop primer.
 - b. Do not apply primer to galvanized surfaces.
 5. Shop Painted Finish: Comply with Sections 09 96 53 High Build Glazed Coatings for exterior galvanized pipe and tube railings and 09 91 23 Interior Field Painting for interior Pipe and Tube Railings unless otherwise indicated.
 - a. Colors: As selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine field conditions for acceptability and ready to receive work.
- B. Attached Railings: Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.
- C. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

- B. Furnish items necessary to cast into concrete, embedded in masonry, or placed in partitions with setting templates.

3.3 INSTALLATION

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in place construction.

3.4 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.5 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink,

nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

- B. Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- D. Leave anchorage joint exposed with anchoring material flush with adjacent surface.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as necessary for conditions, connected to posts and to metal supporting members:
 - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 - 2. For stainless steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- F. Install removable railing sections, where indicated, in slip fit metal sockets cast in concrete.

3.6 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections to meet Performance Requirements.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction:
 - 1. For concrete and solid masonry anchorage, use drilled in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel framed partitions, use hanger or lag bolts set into fire retardant treated wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel framed partitions, use self tapping screws fastened to steel framing or to concealed steel reinforcements.

6. For steel framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.7 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION