



SECTION 05 73 00
ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-Assembled Steel and Stainless Steel Railing System. (Cable Railing)

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 03 50 00 - Cast Decks and Underlayment.
- C. Section 05 52 17 - Roof Fall Protection.
- D. Section 05 75 00 - Decorative Formed Metal.
- E. Section 06 10 00 - Rough Carpentry.
- F. Section 09 01 20.91 - Plaster Restoration.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI 1264.1 Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A123/A123M-13 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A 307-14 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rods 60,000 psi Tensile Strength.
 - 3. ASTM A500/A500m-13 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 4. ASTM A555/A555m-05(2014) - Specifications for General Requirements for Stainless Steel Wire and Wire Rods.
 - 5. ASTM A580/A580M-14 Standards Specifications for Stainless Steel Wire.
 - 6. ASTM A751-14a Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.
 - 7. ASTM B117-11 Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 8. ASTM E8/8M-13a Standard Test Methods for Tension Testing of Metallic Materials.
 - 9. ASTM E488/E488M-10 Standard Test Method for Strength of Anchors in Concrete Elements.
 - 10. ASTM E894-88 (2010) Standard Test Method for Anchorage of Permanent Metal

- Railing Systems and Rails for Buildings.
 - 11. ASTM E935-13e1 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
 - 12. ASTM E1481-00a(2014)e1 - Standard Terminology of Railing Systems and Rails for Buildings
 - 13. ASTM E2349-12 Standard Practice for Safety Requirements in Metal Casting Operations and Sand Preparation; Molding and Core Making; Melting and Pouring; and Cleaning and Finishing.
 - 14. ASTM F593-13a Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - 15. ASTM F594-09e1 Standard Specifications for Stainless Steel Nuts
 - 16. ASTM F606/F606M-14a Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators and Rivets
 - 17. ASTM F879-12 Standard Specification for Stainless Steel Socket Button and Flat Countersunk head Cap Screws
- C. International Code Council (ICC):
- 1. ICC-ES AC174 - Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)
 - 2. ICC-ES AC273 - Handrails and Guards
 - 3. International Building Code (IBC)
 - 4. International Residential Code (IRC)
- D. International Conference of Building Officials (ICBO):
- 1. ICBO UBC - Uniform Building Code.
- E. Military Specification:
- 1. MIL-DTL-53084B: Primer, Cathodic Electrodeposition, Chemical Agent Resistant.

1.4 DEFINITIONS

- A. Railings: Guards, Handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Railings shall be engineered to withstand structural loads indicated. Determine allowable design working stresses of railing materials.
- B. Structural Performance: Provide railings capable of withstanding test loads in accordance with ICC-ES AC273.
 - 1. Structural Performance of Top Rails and Supports:
 - a. Concentrated Load Test: In Accordance with Section 4.23 of AC273. Two separate tests on each specimen shall be conducted, where a test load of 500 lbf/ft (2.22 kN) is applied at the midspan of the top rail and at the top of a single post in an outward direction. In both cases the load shall be continuously applied horizontally and normal to the top rail at the maximum guard and handrail system height.
 - b. Uniform Load Test: In accordance with Section 4.2.3 of AC273. The top rail of the guard and handrail test specimens shall be subjected to a single test where a maximum uniform load of 125 lbf/ft (1.82 kN/m) is applied vertically and in an outward direction at an angle of 45 degrees from horizontal.
 - c. Design need not provide for both concentrated and uniform loads to be applied concurrently.
 - 2. Structural Performance of Guardrail Infill:
 - a. In-Fill Load Test: In accordance with Section 4.2.2 of AC273. The test

- specimens shall be tested and shall be capable of satisfactorily resisting a load of 125 lbf (556 N) applied over a 1-square-foot (0.1 m²) area normal to the infill. In-Fill is defined to include panels, intermediate rails, balusters and other elements.
- b. Design need not provide for infill loads to be applied concurrently with top rail loads.

1.6 SUBMITTALS

- A. General: Submit under provisions of Section 01 30 00 - Administrative Requirements
- B. Product Data: Manufacturer's printed product information indicating material compliance and specified options are to be submitted prior to installation. Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's product lines of railings assembled from standard components
 - 2. Rail finish
- C. Shop Drawings: Layout of railings components with dimensions, details, and finishes shall be submitted for approval and shall be approved prior to installation. Include plans, elevations, sections, details, and attachments to other work.
- D. Design Data: Submit design data to verify compliance design loads specified in Performance Requirements Article. Design data shall be signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Samples:
 - 1. Submit Samples for initial color selection. Submit samples of each specific finish. Submit Samples in form of Manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full range of variations expected.
 - 2. Submit Samples for verifications purposes. Samples shall be submitted prior to removal. Submit samples for the following:
 - a. For each type of exposed finish required.
 - b. Of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 1) Each type of railing panel required.
 - 2) Fittings and Brackets.
 - 3) Welded Connections.
 - 4) Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- F. Qualification Data: For Professional Engineer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified inspecting and testing agency; according to ASTM E894-88 (2010) and ASTM E935-13e1 and in accordance with testing standards set forth in ICC-ES AC273 Guidelines.
- H. Closeout Submittals: Operation and Maintenance Data.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Company engineering and fabrication of custom railing systems for a minimum of 10 years.
 - 2. Installer Qualifications: Company experienced in manufacturer's products for a minimum of 5 years. The Contractor shall provide trained laborers with prior

experience in the type of construction involved as well as experience installing the materials and techniques specified.

3. Qualified Professional Engineer: A professional engineer licensed in the state of the Project location and who is qualified to design the portion of the work described in this Section.

- B. Regulatory Requirements: Completed installations shall meet ICC standards, applicable requirements of ADA Accessibility Guidelines along with any local amendments and/or modifications. Completed installations shall also conform to state, regional, and local codes and regulations.
- C. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles and dimensional requirements of railings and are based on the specific system indicated. Refer to section 01 60 00 - Product Requirements0-Product Requirements.
- E. Modifications: Do not modify intended aesthetic effects as judged solely by the Architect, except with the Architects' approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.
- F. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M:2010
- G. Mock-Ups: Build mock-ups to verify selections made under samples submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation. Build mock-ups for each form and finishes of railing consisting of two posts, top rail, infill area, and anchorage systems components that are full height and area not less than 24 inches (610 mm) in length.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store components in a dry, sheltered location away from uncured concrete, masonry, mortar, and stucco; and a safe distance away from any sanding, blasting, welding and/or painting operations.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on shop drawings. Provide allowance for trimming and fitting as site.

1.10 COORDINATION AND SCHEDULING

- A. 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 and masonry. Deliver such items to the project site in time for installation
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by means that do not satisfy structural performance requirements.

1.11 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty from the date of purchase, for defects, in material and workmanship, including protection against cracking, peeling, blistering, and corrosion (rusting) of metal parts supplied by the manufacturer.
1. Pre-Assembled Steel and Stainless Steel Railing System (Cable Railing): 15 years

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Fortress Railing Products, which is located at: 1720 N. First Street; Garland, TX 75040; Tel: 844-909-2999; Fax: 972-372-0924; Email: commercialdesign@fortressrailing.com; Web: www.fortressrailing.com
- B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PRE-ASSEMBLED STEEL AND STAINLESS STEEL CABLE RAILING SYSTEM

- A. Cable Railing.
1. Product: provide "Horizontal Cable Railing" as manufactured by Fortress Railing Products.
 2. Materials:
 - a. Rails and Reinforcement Channel: Grade A cold-rolled steel formed and welded tubing conforming to ASTM A500/ A500M-13 with G-60 zinc coating (0.60 oz/ft² or 0.27 kf/M²) on both inside and outside surfaces in accordance with ASTM A123/A123M-13 hot dipped electroplating process.
 - b. Cable Infill: Type 316 grade stainless steel wire with factory assembled and installed connectors in accordance with ASTM A492-95(2013), A580/A580M-14, and F594-09e1.
 - c. Tests: Tested in accordance with ASTM E935-13e1 (Methods A, B, C, and D) and load testing in accordance with ICC-ES AC273.
 3. Components:
 - a. Rails: 9 gauge (4 mm), formed galvanized steel channel, 1.22 inch (31 mm) width by 1.22 inch (31 mm) height with powder-coated factory finish.
 - b. Vertical Upright: 8 gauge (4.34 mm), formed and welded galvanized steel channel, 1.22 inch (31 mm) x 1.97 inch (50 mm) depth with powder-coated factory finish.
 - c. Vertical Upright Reinforcement Channel: 14 gauge (2 mm), formed and welded galvanized steel channel, 0.85 inch (21.50 mm) width by 0.47 inch (12 mm) height with powder-coated factory finish.
 - d. Vertical Upright Cover: 12 gauge (2.78 mm) plate width 1.22 inch (31 mm) with powder-coated factory finish.
 - e. Cable: 0.125 inch (3.2 mm) diameter, 1x19 strand construction, type 316 grade stainless steel, polished finish, dry grade cable with fitting factory installed as specified.
 - 1) Cable Fittings:
 - a) Compression Swage Fitting: 1.26 inch (32 mm), type 316 grade stainless steel factory-installed fitting pressed fit to cable.
 - b) Adjustable Swage Fitting: 1.20 inch (31 mm), type 316 grade stainless steel factory-installed fitting pressed fit to cable.
 - 2) Nut: 0.51 inch (13 mm), type 316 grade stainless steel hex nut with nylon insert installed onto threaded swage cable fitting.
 - f. Cable Midspan Support: 0.5 inch (12.70 mm) square galvanized steel tube, 31.50 inches (800 mm) or 37.50 inches (952.50 mm), with factory applied powder-coated finish.
 - g. Bolt: M8 by 1.25 inch (31.7 mm) thread by 1.18 inch (30 mm), type 316 grade stainless steel bolt.

- h. Washer: M8 by 0.63 inch (16 mm) by 0.055 inch (1.4 mm), type 316 grade stainless steel washer.
 - i. Split Washer: M8 by 0.25 inch (6 mm) radius by 0.075 inch (1.90 mm), type 316 grade stainless steel split washer.
 - j. Posts: 13 gauge (2.5 mm) 2 inch (51 mm) or 15 gauge (1.8 mm) 3 inch (76 mm) square formed and welded galvanized steel tubing with welded base and powder-coated factory finish.
 - k. Brackets: Brackets shall come from same manufacturer as railings and posts. Brackets shall have powder-coated factory finish.
 - l. Fasteners: All nuts, bolts, sheet metal screws, wood screws and washers shall be stainless steel.
4. Fabrication:
- a. Metal rail sections shall comply with all requirements indicated for materials, thickness, design, and details for construction.
 - b. Welded connections shall comply with AWS D1.1/D1.1M:2010 standards for recommended practice in shop welding. Welds behind finished surfaces shall be without distortion or discoloration of exposed side.
 - c. Components shall be accurately cut, drilled, and/or tapped to receive hardware, fasteners, and accessories.
5. Finish:
- a. Horizontal Cable Railing:
 - 1) Metal parts shall be assembled and finished individually prior to shipment.
 - 2) Individual parts and welded assemblies shall be made from G60 pre-galvanized material.
 - 3) Galvanized steel railing components shall be cleaned with a non-petroleum solvent followed by the application of a sealing zinc phosphate coating.
 - 4) Following cleaning and pretreatment parts and welded assemblies shall be electro-coated.
 - 5) Electro coating of parts and welded assemblies shall be a two-component cathodic electrodeposition primer with high corrosion protection followed by a sealing and drying process.
 - 6) Immediately after sealing, a two-step powder finish coating shall be applied by the electrophoresis and electrostatic spray process.
 - 7) Electro coating and Powder Coating of parts and welded assemblies shall be done by a certified powder coater.
 - b. Fasteners:
 - 1) Fasteners used for mounting metal parts and welded assemblies shall be stainless steel as supplied by recommended railing supplier.
 - 2) Hexalobular Internal Drive, Flat Head Stainless Steel Thread Cutting Screw.
 - a) Immediately after cleaning and drying, a two-step coating shall be applied by the electrophoresis and electrostatic spray process. This consists of a thermosetting carboxyl polyester resin top coat with a minimum dry film thickness of 60 to 80 microns.
 - c. Color as selected by Architect from manufacturer's full range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

1. Examine gypsum board assemblies, where in forced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for installer. Locate reinforcements and mark locations if not already done.
2. Verify areas to receive railings are completed to previously established conditions as detailed in other sections.
3. Coordinate post setting diagrams, plans, templates, and drawings and verify the proper installation of any necessary anchorages as detailed in the Drawings.
4. Coordinate with appropriate entity to correct unsatisfactory conditions, if any exist.
5. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

- A. Stake Layout showing locations of posts as well as any gates.
- B. Note location of any affected underground utility lines, irrigation lines, or other subsurface structures, if applicable.
- C. Railings that require wall mounting, wood blocking shall be provided.

3.3 INSTALLATION

- A. Assemblies shall be installed based on manufacturer's written installation instructions and in accordance with authorities having jurisdiction.
- B. Mount posts in accordance with post mounting applications per manufacturer's written installation instructions and in accordance with authorities having jurisdiction.
- C. Install manufacturer-supplied brackets and mounting clips onto railing section and posts as indicated in manufacturer's printed instructions for specific railing material. Attach railing sections to brackets with approved fasteners and techniques to ensure that sections are horizontal and parallel to grade/slab or rake to within 0.25 inches (6 mm) in 12 feet (3658 mm).
- D. Verify that rails, posts, and other surfaces are clean and free of obstructions.
- E. Joints shall accommodate expansion and contraction of metal components without causing undue stress, buckling, joint fatigue, and/or distortion. Follow manufacturer's written installation instructions.

3.4 CLEANING

- A. Repair scratches and other installation-incurred damage on rails and posts. If damage is visible from a distance of 5 feet (1524 mm), component shall be replaced.
- B. Clean up debris and unused material, and remove from site.

3.5 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.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION