SECTION 05 52 00

METAL RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

Paragraph	Title
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B. Scope

1. The Work covered under this section includes furnishing all labor, materials, and equipment to supply, erect, and install railing systems as shown on the drawings and/or specified herein.

1.2 REFERENCES

A. Definitions

1. Handrails: Synonymous with terms; i.e., guardrail system, railing system, ramp-rail system, and stair-rail system. Handrails are comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.
2. ICC Evaluation Services Report for concrete anchor manufacturers.
3. Special Inspection: As governed by the ICC IBC.
4. Toeboards: Vertical barrier at floor level usually erected on handrails along exposed edges of floor or wall openings, platforms, ramps, or stairs to prevent miscellaneous items from falling through.

B. Reference Standards

1. Aluminum Association, Incorporated (AA): DAF45, Designation System for Aluminum Finishes.

2. American Iron and Steel Institute (AISI)
3. ASTM International (ASTM)
   a. A36/A36M – Standard Specification for Carbon Structural Steel
   b. A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   c. A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   d. A167 – Standard Specification for Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   e. A193/A193M – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
   f. A194/A194M – Standard Specification for Carbon and Alloy Steel Nuts and Bolts for High Pressure or High Temperature Service, or Both
   g. A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   h. A554 – Standard Specification for Welded Stainless Steel Mechanical Tubing
   i. E985 – Standard Specification for Permanent Metal Railing Systems and Rails for Buildings
4. International Code Council (ICC): International Building Code (IBC).
5. Occupational Safety and Health Act (OSHA): 29 CFR 1910, Code of Federal Regulations.
6. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

A. Action Submittals/Informational Submittals

1. Shop Drawings
   a. Indicate handrail profiles, sizes, connections, anchorage, size and type of fasteners, and accessories. Project-specific scale plans and elevations of handrails.
   b. Manufacturer’s Literature and catalog data of handrail and components.
   c. Design Data: Calculations or test data using design performance loads and include the following:
      1) Bending stress in, and deflection of, posts in accordance with ASTM E985.
      2) Stress in post base connection.
      3) Calculation of anchorage forces and comparison of these forces to ICC IBC recommendations regarding safe allowable design loads of anchorages.
      4) For concrete anchor spacing less than 12 anchor diameters and edge distances less than six anchor diameters, make reduction in allowable pullout and shear values. Provide independent laboratory inspection service for ICC Evaluation Services Report values with Special Inspection.
2. Samples

a. Railing sections, 6 inches long showing different connections and proposed finish.

b. Each fitting including wall brackets, castings, toeboard fittings, and rail expansion joints.

3. Certificates

a. Manufacturer's Certificate of Proper Installation in accordance with Section 01 91 13 – Equipment Testing and Facility Startup.

4. Test and Evaluation Reports

a. Test data may supplement load calculations providing data covers the complete handrail system, including anchorage.

b. Test data for handrail and components showing load and deflection due to load, in enough detail to prove handrail is strong enough and satisfies national, state, and local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:

1) Railing and post connections.

2) Railing wall connections.

3) Post and base connections.

4) Railing expansion joint connections.

5) Railing gate assembly, including latch and gate stop. Both gate latch and stop support required loads applied independent of each other.

6) Railing gate hinges.

c. Deflection Criteria: In accordance with ASTM E985 and design loads specified.

d. Aluminum Rail Piping: Test data showing yield strength of pipe as-delivered equals or exceeds values specified in this section.

e. Concrete Anchors: Calculations and test data for review prior to use, on anchors other than those specified.

5. Manufacturer's Instructions

a. Manufacturer's assembly and installation instructions.

b. Manufacturer's written recommendation describing procedures for maintaining handrails including cleaning material, application methods, and precautions to be taken in the use of cleaning materials.

c. Special Inspection:

1) Manufacturer's instructions for special inspection of concrete anchors.

2) Special inspection report in accordance with Article Tests and Inspections.

1.4 QUALITY ASSURANCE

A. Completely coordinate the work of this with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. Qualifications

1. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1, welding of aluminum shall conform to AWS D1.2, and welding of stainless steel shall conform to AWS D1.6.
2. Suppliers/Fabricators
    a. Minimum of five (5) years' experience in the manufacturing and fabrication of handrail systems of similar size and configuration as those required on this Project.
3. Licensed Professionals
    a. Calculations required for design data stamped by a registered civil or structural engineer licensed in the State of Georgia.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements
1. Handrails adequately packaged and wrapped to prevent scratching and denting during shipment, storage, and installation. Maintain protective wrapping until railing is completely installed.
2. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.
3. Insofar as practical, factory assemble items specified herein. Assemblies that due to necessity have to be shipped unassembled shall be packaged and tagged in a manner that will protect materials from damage and will facilitate identification and field assembly. Deliver toeboards loose for field assembly.
4. Repair items which have become damaged or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

B. Storage and Handling Requirements
1. Store fabricated items in dry area, not in direct contact with ground.

1.6 FIELD CONDITIONS

A. Environmental Requirements
1. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of handrails to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.
    a. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surface.

B. Take field measurements at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

1.7 WARRANTY

A. Manufacturer Warranty
1. Provide a 3 year limited warranty on all aluminum handrail products against defects in

materials and workmanship.

PART 2 PRODUCTS

2.1 ALUMINUM HANDRAILS

A. Manufacturers

1. Thompson Fabricating Co.
2. Moultrie Manufacturing.
3. Engineer approved equal.

B. Description

1. Furnish pre-engineered and prefabricated two picket handrails with a top rail height of 42 inches and mid rail height of 21 inches above the finished floor surface.
2. O-ring, pop rivet, and glued railing construction not permitted.

C. Performance/Design Criteria

1. Structural Performance of Handrails: Design, test, fabricate, and install handrails to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress deflection in each of the respective components comprising the handrails.
   a. Top Rail: Capable of withstanding the following load cases applied:
      1) Concentrated load of 200 pounds applied at any point and in any direction in accordance with ICC IBC.
      2) Uniform load of 50 pounds per linear foot applied in any direction in accordance with ICC IBC.
      3) Concentrated load need not be assumed to act concurrently with uniform loads in accordance with ICC IBC.
   b. In-Fill Area of Railing Systems:
      1) Capable of withstanding a horizontally applied normal load of 50 pounds applied to one (1) square foot at any point in the system including panels, intermediate rails, balusters, and openings and space between railings.
      2) Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of handrails.
   c. Mid-rails with corner returns to withstand a 300-pound concentrated vertical load applied at any point or direction without damage and loosening of pipe, fittings, or attachment hardware.
   d. Concrete Anchors for Handrail Wall Brackets: Anchors with a strength required by calculations with concrete strength assumed at 4,000 psi and in conformance with ICC IBC.
   e. Concrete Anchors: In accordance with ICC IBC for size, length, embedment, spacing, and edge distance to match required loads shown in calcualtions.

D. Materials

1. Rails, Posts, and Formed Elbows: Extruded Alloy 6105-T5 or 6061-T6, minimum tensile strength of 38,000 psi and minimum yield strength of 35,000 psi.

a. Miscellaneous Aluminum Parts: 6063-T6 or 6061-T6 extruded aluminum of adequate strength for all loads.

b. Post and Railing: Nominal 1-1/2-inch diameter.

1) Rails: 1.900-inch O.D. by 0.145-inch wall thickness, Schedule 40.

2) Posts: 1.900-inch O.D. by 0.200-inch wall thickness, Schedule 80.

3) Solid dowel interconnectors of 6105-T5 or 6061-T6 aluminum.

2. Fittings:

a. Handrail and Post Fittings: Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements. Match color to color of pipe in handrails. Sand cast parts not permitted.

b. Concrete Top Mount Post Base: Four holes in base for concrete anchors. For narrow walls or curbs, furnish two holes in base for concrete anchors with required edge distance.

c. Concrete Side Mounted Handrail Bracket: Extruded aluminum, Alloy 6063-T6 with four holes for bolts or concrete anchors.

d. Concrete Anchors for Securing Bases and Brackets to Concrete: Type 316 stainless steel, ½-inch concrete anchors.

e. Handrail Connections for Metal Stairway Stringers or Beams: Extruded aluminum bracket, Alloy 6063-T6 with Type 316 stainless steel ½-inch diameter bolts.

f. Handrail Wall Brackets: Adjustable wall fitting with provision for three 3/8-inch Type 316 stainless steel bolts or concrete anchors.

3. Handrail Gate: 6063-T6, 6105-T5, or 6061-T6 extruded aluminum.

4. Toeborads and Accessories: Molded or extruded 6063 or 6061 aluminum.

5. Castings for Handrails:

a. Cast Al-mag with sufficient strength to meet load and test requirements.

b. Anodizable grade finish with excellent resistance to corrosion when subject to exposure of sodium chloride solution intermittent spray and immersion.

E. Concrete Embedded Metal Anchorages: In accordance with Section 05 05 23 – Metal Fastenings.

F. Finishes:

1. Handrail Pipe and Posts: In accordance with AA DAF45, designation AA-M32-C22-A41.

2. Cast Fittings and Toeboards: In accordance with AA DAF45, designation AA-M10-C22-A41.

G. Fasteners: Stainless Steel.

H. Fabrication:

1. Shop Assembly:

a. Post Spacing: Maximum 5-foot horizontal spacing.

b. Railing Posts Bolted to Metal or Concrete:

1) In lieu of field cutting, provide approved fitting with sufficient post overlap,

containing provisions for vertical adjustment.

2) Field fit-up is required.

c. Free of burrs, nicks, and sharp edges when fabrication is complete.

d. Welding is not permitted.

2. Shop/Factory Finishing:

a. Use same alloy for uniform appearance throughout fabrication for railings.

b. Handrail and Post Fittings: Match fitting color of pipe in handrail.

c. Sand cast parts not permitted.

3. Tolerances:

a. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.

b. Fit dowels tightly inside posts.

PART 3 EXECUTION

3.1 GENERAL

A. Provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on the actual structure. Install railing with a base that provides ± ¼-inch vertical adjustment inside base fitting. If adjustment is required in the field and exceed ± ¼-inch, recue post length not to exceed beyond bottom of lowest set screw or bolt in base fitting.

B. Field Fabrication of aluminum railing systems not permitted.

C. Modification to structure not permitted where handrail is attached.

D. Mount handrails only on completed walls. Do not support handrails temporarily by means not satisfying structural performance requirements. Mount handrails only on gypsum board assemblies reinforced to receive anchors and where location of concealed anchor plates has been clearly marked for benefit of installer.

3.2 HANDRAIL INSTALLATION

A. Assembly and installation: Perform in accordance with manufacturer's written recommendations for installation.

B. Protection from Entrapped Water:

1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.

2. Post mounted in concrete, bends, and elbows occurring at low points drill weep holes of ¼-inch diameter at lowest possible elevation, one hole per post or rail. Drill hole in the plane of the rail.

C. Expansion Joints:

1. Maximum interval of 54 feet on center and at structural joints.

2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide ½-inch slip joint gap to allow for expansion.

3. Fasten to one side using 3/8-inch diameter set screw. Place screw at bottom of pipe.

4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.

D. Setting Posts:

1. Embedded:
   a. Clean dust and foreign matter from sleeves or blockouts.
   b. Moisten interior of hole and surrounding surface with clean water. Fill hole with nonshrink grout prior to installing post.
   c. Brace railing until grout sets.
   d. Post installed outside and exposed to freezing temperatures, drill weep hole through post approximately ½-inch above level of grout inside post and place in plane of rail to prevent entrapment and freezing of water inside post.
2. Surface Mounted:
   a. Bolt post baseplate connectors firmly in place.
   b. Shims, wedges, grout, and similar devices for handrail post alignment not permitted.

E. Posts and Rails:

1. Set posts plumb and aligned to within 1/8-inch in 12 feet.
2. Set rails horizontal or parallel to slope of steps to within 1/8-inch in 12 feet.
3. Install posts and rails in same plane. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail. Use offset rail for use on stairs and platforms if post is attached to web of stringer or structural platform supports.
4. Support 1-1/2-inch rails directly above stairway stringer with offset fitting.

F. Handrail Wall Bracket:

1. Support wall rails on brackets spaced maximum 5 feet on center for aluminum as measured on the horizontal projection.
2. Install wall anchor backplates on solid blocking in stud walls.

G. Toeboards:

1. Provide at handrails, except where 4-inch or higher concrete curbs are installed or at gates.
2. Accurately measure in field for correct length; after handrail post installation cut and secure to posts.
3. Dimension between bottom of toeboard and walking surface not to exceed ¼-inch.
4. Aluminum Toeboards: Provide expansion and contraction connections between each post.

H. Railing Gates: Install in accordance with manufacturer's installation instructions.

3.3 FIELD FINISHING

A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces as specified in Section 09 91 00 – Painting.

3.4 TESTS AND INSPECTIONS

A. Perform special inspection for anchors where ICC Evaluation Services Reports require them for anchor strength value used.

B. Provide an independent test laboratory to perform special inspections.

3.5 CLEANING

A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.

B. Do not use acid solution, steel wool, or other harsh abrasive.

C. If stain remains after washing, restore in accordance with manufacturer's recommendations or replace stained handrails.

END OF SECTION