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SECTION 05520 - RAILINGS AND HANDRAILS

**PART 1 GENERAL**

1.01 SUMMARY

A. Section Includes: Handrails and railings of various types, including:

1. Galvanized steel stair railings and handrails.
2. Glass Railing System – N/A
3. Steel railings and ladders.
4. Fences and Gates.

B. Related Sections:

1. 03100 - Concrete Formwork
2. 03300 - Cast-In-Place Concrete
3. 04000 - Unit Masonry System
4. 05120 – Structural Steel
5. 05500 – Miscellaneous Metals
6. 05510 – Metal Stairs
7. 09900 - Painting

1.02 SYSTEM DESCRIPTION

A. Structural Performance: Railing systems shall be designed and constructed to withstand the following structural loads required by the BOCA Building Code, latest Edition, without exceeding the allowable design working stress of the materials. Loading conditions listed below shall not be applied simultaneously, but each shall be applied to produce the maximum stress in each of the respective components or any of the supporting components.

1. Handrail:

- a. Concentrated load of 200 lb. applied at any point and in any direction.
- b. Uniform load of 50 lb. per linear foot applied in any direction.

2. Guardrail System:

- a. Concentrated load of 200 lb. applied at any point and in any direction.
- b. Uniform load of 50 lb. per linear foot applied horizontally at the required guardrail height and simultaneous load of 100 lb. per linear foot applied vertically downward at the top of the guardrail.
- c. Infill Area: Concentrated horizontal load of 200 lb. Applied on a 1 sq.ft. area at any point in the system including intermediate rails or other elements serving this purpose; or wind loads prescribed by code, whichever is

greater.

### 1.03 REFERENCE STANDARDS

A. Except as otherwise specified herein or shown on the Drawings, comply with the latest editions of all applicable codes and regulations including the applicable requirements of the following reference Standards and Codes which are hereby made a part of this Section, as they relate to the railings and handrails.

1. BOCA Building Code, 2003 Edition.
2. The Occupational Health and Safety Administration (OSHA) Code of Federal Regulations(CFR), Volume 29.
3. American Society for Testing and Materials (ASTM):
  - a. A36 - Structural Steel.
  - b. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated and Seamless.
  - c. A167 - Stainless and Heat-Resisting Chromium-Nichel Steel Plate, Sheet and Strip.
  - d. A269 - Seamless and Welded Austenitic Steel Tubing for General Service. Stainless
  - e. A307 - Carbon Steel Externally and Internally Threaded Standard Fasteners.
  - f. A312 - Seamless and Welded Austenitic Steel Pipe. Stainless
  - g. A500 - Cold Formed and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - h. B209 - Aluminum-Alloy Sheet and Plate.
  - i. B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
  - j. B308 - Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded.
  - k. B429 - Aluminum-Alloy Extruded Structural Pipe and Tube.
  - l. F468 - Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
  - m. B483 - Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
4. American Iron and Steel Institute - Finishes for Stainless Steel.
5. AWS: D1.1 Structural Welding Code – Steel.
6. NAAMM: Metal-Finishes Manual.

### 1.04 SUBMITTALS

- A. Product Data: Manufacturer's technical data for products and processes not covered in shop drawings, installation instructions, finishes and grout.
- B. Shop Drawings: Show fabrication and installation details for each type and material. Include plans, elevations, sections, profiles of rails, fittings, connections, and anchors.
  - 1. Provide templates for anchors and bolts installed by other trades.
  - 2. Include structural computations or test results signed and sealed by a Maine Registered Professional Engineer, evidencing compliance with required design loadings.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
- B. Design Responsibility: Maine Registered Professional Engineer to prepare structural computations for handrail and railing systems to determine compliance with structural performance requirements.

**PART 2 PRODUCTS**

2.01 MATERIALS

- A. General: Comply with standards indicated. Provide railings and handrails and other metalwork composed of metals of the forms and types which comply with requirements of the Drawings and referenced standards, and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning," stains, discolorations or other imperfections on finished units are not acceptable.
- B. Aluminum: Alloy and temper recommended by producer or finisher for type of use and finish indicated, with not less than the strength and durability properties of the alloy and temper designated below:
  - 1. Extruded Bar and Shapes: ASTM B 221, 6063-T6.
  - 2. Extruded Pipe and Tube: ASTM B 429, 6063-T6, Schedule 40.
  - 3. Drawn Seamless Tube: ASTM B 483, 6063-T832.
  - 4. Plate and Sheet: ASTM B 209, 6061-T6.
  - 5. Finish for Exposed Surfaces (unless otherwise noted): Electrostatically applied acrylic or polyester enamel (ESP), minimum 1.0 mil dry thickness, specular gloss value approximately 20, applied over a buffed and etched surface (AAMA M22C22), color to be selected. Comply with AAMA 603.8-85 standards. Coordinate shade of selected color to match finish on other items specified

elsewhere. Submit color samples for approval.

C. Miscellaneous Materials:

1. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.
2. Fasteners: Of same basic metal and alloy as fastened metal and parts being joined unless otherwise indicated. Do not use metals which are corrosive or otherwise incompatible with metals joined.
  - a. Provide concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method.
  - b. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
  - c. Provide stainless steel fasteners at aluminum connections and at stainless steel connections.
3. Anchoring Cement: Nonshrink nonmetallic hydraulic controlled expansion cement grout equal to Por-Rok manufactured by Minwax Construction Products Division. Pre-mixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.
4. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior locations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
5. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).
6. Accessory Materials: Provide highest quality as required for the complete work.
7. Shop Coating for Ferrous Steel: Provide one of the following, or equivalent as approved by Resident.
  - a. Tnemec No. 99QD Red Metal Primer, by Tnemec Co., Inc.
  - b. Rust-Oleum 678 Quick Dry Red Bare Metal Primer or No. 7086 Quick Dry Gray Zinc Chromate Primer, by Rust-Oleum Corp.
  - c. No.SR-50 or SR-51 Steelcote Universal Primer, by Steelcote Manufacturing Co.
  - d. Zinc Chromate Primer No. 13800 by Devoe Paint Co.
  - e. Heavy Duty RIP Primer No. 1-0900 or No. 1-0969, by Southern Coatings & Chemical Co., Inc.

2.02 FABRICATION, GENERAL

- A. Form ornamental metalwork to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural performance.
- B. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature, in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.
  - 1. Temperature Change (Range): 100 deg F,(55.5 deg C).
  - 2. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible.
  - 3. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux, and dress on all exposed and contact surfaces.
  - 4. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
  - 5. Provide castings that are sound and free of warp or defects which impair strength and appearance.
  - 6. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.
  - 7. Preassemble items in shop 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.

#### 2.03 FABRICATION OF RAILINGS, FENCES AND GATES

- A. Fabricate systems for interconnection of members by means of concealed internal welds and fittings which eliminate surface grinding. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- B. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of members to other work.
  - 1. Furnish inserts and other anchorage devices for connecting systems to concrete or masonry work.
  - 2. Fabricate anchorage devices which are capable of withstanding loadings imposed by systems. Coordinate anchorage devices with supporting structure.
- C. Swing Gates: Comply with ASTM F 900.
  - 1. Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:

- a. Hinges: Size and material to suite gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.
  - b. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.
  - c. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.
  - d. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete, and designed to engage a center drop rod of plunger bar. Include a locking device and padlock eyes as an integral part of the latch, permitting both gate leaves to be locked with a single padlock.
- D. Sliding Gates: Comply with ASTM F 1184.
- 1. Cantilever: Manufacturer's standard top rail gate incorporating a track for the top roller. Brace frame to prevent sagging and apply fabric to entire gate. Provide external rollers with accessible grease fittings, a safety enclosure, and guide posts to keep the gate on the rollers.

#### 2.04 ALUMINUM PIPE RAILINGS AND HANDRAILS

- A. Pipe Railings: 1-1/2" diameter pipe and 3/4" diameter pipe fabricated to configurations shown on Drawings and approved shop drawings, smooth welded connections, AAMA M22C22 finish to receive coating specified.
- B. Handrails: Match free standing railings in construction and finish, fabricated to configurations shown on Drawings and approved shop drawings.
  - 1. Brackets for Wall Handrails: Cast aluminum, equal to J. G. Braun No. 4498.

#### 2.05 GALVANIZED STEEL PIPE RAILINGS AND HANDRAILS.

- A. Standard weight galvanized steel, ASTM A53, smooth welded construction with welds ground smooth and coated with galvanizing paint, fabricated to the configurations shown on the drawings, ready for field painting. Shop coated with primer as specified in Section 05500. Provide fittings for anchoring to concrete as shown on details.
- B. Handrails: Match free standing railings in construction and finish, fabricated to configurations shown on Drawings and approved shop drawings.
  - 1. Brackets for Wall Handrails: Galvanized steel ASTM A53, equal to J. G. Braun No. 4595.

#### 2.06 STAINLESS STEEL PIPE RAILINGS

- A. ASTM A312 Type 304 with No. 4 finish, 1-1/2 in. O.D. Schedule 40, .145 in. wall thickness, unless noted otherwise.

2.07 GLASS RAILING SYSTEM – N/A

- A. Point supported rail system as detailed in Drawings and as manufactured by Livers Bronze Co., Kansas City, MO. or approved equal.
  - 1. Guardrail: 42 in. high guardrail post of stainless steel at 4'-0" o.c. maximum as detailed in Drawings.
  - 2. Handrail: 2 in. diameter stainless steel handrail.
  - 3. Glass: 1/2 in. thick fully tempered plate glass with polished edges on all four sides, furnished by Livers Bronze for field attaching to post with stainless steel point supports. Kinetic energy impact loading of the glass shall comply with ANSI Z07.1-1984 using a 400 ft.-lb. (542 N-m) energy impact, as tested by an accredited laboratory.
  - 4. Finish: As selected by Resident from manufacturer's standard color charts.

2.08 SPECIFIC ITEMS

- A. Those items which are of standard or stock design or which are sufficiently detailed or described on the Drawings to permit their fabrication and installation are not described in detail herein.

**PART 3 EXECUTION**

3.01 INSPECTION

- A. Examine surfaces for conditions that will adversely affect execution, performance and quality of work.
- B. Correct unsatisfactory conditions before proceeding with the work.

3.02 FABRICATION

- A. Fabricate work to field measurements whenever possible. When fabrication must precede construction and field measurements are not practical, make sure construction conforms to fabricated dimensions. Ill-fitting work due to failure to coordinate will not be accepted.
- B. Joints: Close fitting, uniform, designed and assembled to be as strong and rigid as adjoining sections. Locate in symmetrical patterns and inconspicuous places whenever possible. Do not make joints in straight runs unless the available stock length is shorter than the run.
  - 1. Provide caps or flush matching profile fittings at exposed ends. Finish to match ending member.

- C. Railing Ends at Walls: Provide concealed fittings unless otherwise approved by Owner.
  - 1. For concrete or solid masonry: Expansion shields.
  - 2. For hollow masonry: Toggle bolts.
- D. Assemble railings at the shop in as large sections as possible. Make field joints by welding whenever possible. Mechanical fasteners will not be permitted unless shown and approved in shop drawings, in concealed locations. Grind welds smooth and flush.
- E. Aesthetics: Fabricate all work to accurately express the character and detail indicated on the Drawings and approved shop drawings.
- F. Formed work: Form metal work to the required dimensions, shapes and sizes, with true curves, lines and angles. Provide necessary rebates, lugs, flanges, covers and brackets for assembly of units. Use concealed fasteners wherever possible.
- G. Welding: Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of the exposed side. Clean exposed welded joints.
  - 1. Unless specified, detailed, or approved otherwise on shop drawings, weld all shop connections and all field connections.
  - 2. Unless otherwise approved, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- H. Fit-up: Mill joints to a tight, hairline fit. Cope or miter corner joints.
- I. Castings: Provide castings that are sound and free of warp or defects which impair strength and appearance. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.
- J. Anchorage: Provide brackets and anchors for joining and securing rails. Furnish inserts and sleeves as required for anchorage to concrete, and structural supports.

### 3.03 INSTALLATION

- A. Install manufactured items in accord with manufacturer's instructions and approved shop drawings.
- B. Set all work accurately to lines and levels, plumb and secure.
- C. Install members, bolts, anchors, and inserts to be covered, inserted or built-in, as the work progresses.
- D. Perform all cutting, drilling and fitting required for the installation of work specified.



- E. Where cutting, welding and grinding are required for proper fitting and jointing of the work, restore finishes to match original shop applied finish.
  - F. Set posts in 2" diameter drilled holes not less than 3" deep, but not more than 4" deep. Clean holes of loose material and fill with anchoring cement flush with the surface of the slab. Do not leave a recess where water may collect.
  - G. Fit work to existing structural supports with close uniform joints. Secure rigidly, without movement, level and plumb. Top rail shall present a straight level appearance, without waves in any direction.
  - H. Where field welding is required and approved, conform to requirements of AWS.
  - I. Corrosion Protection: Coat concealed surfaces of aluminum, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.
  - J. Upon completion of the work, touch up minor abrasions and defects. Work damaged or defaced to the extent that in the opinion of the RESIDENT constitutes an unsightly condition may not be corrected by field touching up. Invisible field repair, removal and shop refinishing, or replacement will be required.
- 3.04 CLEANING AND ADJUSTMENT
- A. Protect work after installation use temporary covers. Before final acceptance, clean work, adjust fastenings and anchors that have worked loose, restore finishes soiled, damaged, or defaced during construction.

\*\*\*END OF SECTION\*\*\*