SECTION 05 5200
ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work specified in this Section includes, but shall not be limited to, the following:
   1. Aluminum handrails.
   2. Aluminum railings.

B. Related Sections:
   1. Section 05 70 00 - Ornamental Metal: Adjacent or adjoining handrails and railings fabricated from steel pipe and tube components.

1.2 REFERENCES


B. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

C. Aluminum Association, Inc. (AA):

D. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum (Revised)."
   4. AAMA Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

E. American Iron and Steel Institute (AISI):
   1. AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

F. American Welding Society (AWS):
   1. AWS D1.2, "Structural Welding Code – Aluminum."

G. ASTM (ASTM):


I. National Association of Architectural Metal Manufacturers (NAAMM):
   1. NAAMM MFM, "Metal Finishes Manual."

1.3 DEFINITIONS
A. See definitions in ASTM E985 for railing-related terms that apply to this Section.

1.4 PERFORMANCE REQUIREMENTS
A. General: Handrails and railings shall withstand structural loading as determined by allowable design working stresses of materials based on the following standards.
   2. Cold-Formed Structural Steel: AISI SG-673, Part I.
   3. Glass: Fully tempered glass in glass-supported handrails and railings require a design with a safety factor of three applied to the applicable modulus of rupture listed in "Mechanical Properties" in AAMA Aluminum Curtain Wall Series No. 12.

B. Structural Performance: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
   1. Top Rail: Shall withstand the following loads:
      a. Concentrated load of 200 lbf (0.89 kN) applied at any point and in any direction.
      b. Uniform load of 50 lbf-ft. (0.07 kN-m) applied horizontally and concurrently with uniform load of 100 lbf-ft. (0.14 kN-m) applied vertically downward.
      c. Concentrated and uniform loads above need not be assumed to act concurrently.
   2. Handrails Not Serving As Top Rails: Shall withstand the following loads:
      a. Concentrated load of 200 lbf (0.89 kN) applied at any point and in any direction.
      b. Uniform load of 50 lbf-ft. (0.07 kN-m) applied in any direction.
      c. Concentrated and uniform loads above need not be assumed to act concurrently.
   3. Guard Infill Area: Shall withstand the following loads:
      a. Concentrated horizontal load of 200 lbf (0.89 kN) applied to 1 square foot (0.09 m²) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Loads need not be assumed to act concurrently with loads on top rails in determining stress on guard.

C. Thermal Movements: Handrails and railings shall allow for movements resulting from 120 deg F (49 deg C) changes in ambient and 180 deg F (82 deg C) surface temperatures. Base engineering
calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

1.5 SUBMITTALS

A. General: Submit under provisions of Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer’s data sheets on each product to be used, including, but not limited to, the following:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Product Data: Submit product data for manufacturers product lines of handrails and railings assembled from standard components, including, but not limited to, the following:
   1. Grout, anchoring cements and paint products.

D. Shop Drawings: Submit shop drawings showing fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other work.

E. Samples:
   1. Color Selection: Submit manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
   2. Finish Selection: Provide sections of railing or flat sheet metal which depict available mechanical surface finishes.
   3. Verification Samples: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
      a. 6 inch (152 mm) long sections of each different linear railing member, including handrails and top rails.

F. Quality Control Submittals:
   1. Design Data: For installed handrails and railing systems indicated to comply with certain design loadings, include structural analysis data signed and sealed by the professional engineer who was responsible for their preparation.
   2. Certificates: Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

G. LEED Submittals: Submittals that are required to comply with requirements for LEED certification include, but shall not be limited to, the following:
   1. Recycled Content: Provide product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
   2. Regional Materials: Provide product data for regional materials indicating location and distance from the Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Distance shall be within 500 miles (805 Km) of the Project Site.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of aluminum handrails and railings of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 10 years.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Welding Standards: Comply with applicable provisions of AWS D1.2.

D. Supply sample submittals to demonstrate aesthetic effects as well as qualities of materials and execution.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. General: See Section 01 77 00 - Closeout Procedures.

B. Special Warranty: Provide manufacturer's standard form outlining the terms and conditions of their standard Limited Warranty:
   1. Surface Finish Warranty: Five year limited warranty.
   2. Material Integrity Warranty: One year.

C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.10 EXTRA MATERIALS

A. All supplemental materials not expressly specified in this section shall be approved by the Architect prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent.
A. LEED Requirements:
1. Recycled Content: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content shall constitute a minimum of [10 percent] [20 percent], based on cost, of the total value of materials in the Project.

2. Regional Materials: Provide a minimum of [10 percent] [20 percent], based on cost, of building materials that are regionally extracted, processed, and manufactured.

B. Application/Scope of Work:
1. Architectural railing.
2. Structural glass railing.
3. Fencing and pool surround.
4. Vehicle and pedestrian gate.
5. Glass wall system.

C. Basis of Design: C.R. Laurence Co., Inc. (CRL)
   Tel: (800) 421-6144 Fax: (800) 587-7501
   Email: railings@crlaurence.com
   www.crlaurence.com

D. Metals: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
1. Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.
   b. Extruded Structural Pipe and Tube: ASTM B429/B429M, Alloy 6063-T832.
   c. Drawn Seamless Tube: ASTM B210/B210M, Alloy 6063-T832.

2. Brackets, Flanges, and Anchors: Provide cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
   a. Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.
   b. Provide formed or cast brackets with predrilled hole for exposed bolt anchorage.
   c. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
   d. Provide brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

E. Railing Components:
1. Extruded Aluminum Components: Provide manufacturer’s standard extruded aluminum components as follows:
   a. Standard Post: 2.376 inches (60.35 mm) by 2.376 inches (60.35 mm) with radiused corner, 0.100 inch (2.54 mm) wall thickness.
   b. Bottom Rail: 1.6926 inches (42.99 mm) high by 1.676 inches (43.57 mm) high with a 0.765 inch (19.43 mm) wide pocket on the top and an open bottom.
   c. Picket: 0.750 inches (19.05 mm) by 0.750 inches (19.05 mm), 0.062 inch (1.57 mm) wall thickness.
d. Top Rail: Circular cross section, radius as indicated on the Drawings or, if not indicated, as selected by the Architect from the manufacturer’s standards with an open bottom, 0.0866 inch (2.20 mm) wall thickness.

F. Glass Products and Glazing Materials:

2. Glass: Provide fully tempered, uncoated, transparent flat glass meeting the requirements of ASTM C1048, Type FT, Condition A, Type 1, Quality q3. Products shall comply with properties indicated for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C1048 and for impact strength according to 16 CFR Part 1201 for Category II materials.
   a. Clear Glass: Class 1 (clear).
   b. Thickness: 1/4 inch (6 mm) except where noted.
   c. Manufacturing Process: By vertical (long-held) or horizontal (roller-hearth) process, at manufacturer’s option. Horizontal process shall be performed tongless. Glass shall be free of tong marks and other visual distortions.
   d. Marking: Subject to compliance with requirements, provide glass permanently marked with certification label of Safety Glazing Certification Council or other agency acceptable to authorities having jurisdiction.

3. Glazing Cement and Accessories: Provide glazing cement and related accessories recommended or supplied by railing manufacturer for bonding glass to metal subrails.

G. Fasteners:

1. Handrail Anchors: Select fasteners of type, grade and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

2. Handrail and Railing Component Anchors: Use fasteners fabricated from same basic metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   a. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.
   b. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

3. Cast-in-Place and Post Installed Anchors: Provide anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four items the load imposed when installed in concrete, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
   b. Chemical anchors.
   c. Expansion anchors.

H. Grout and Anchoring Cement:

1. Non-Shrink, Non-Metallic Grout: Provide premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2. Interior Anchoring Cement: Provide factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching and grouting compound. Use for interior applications only.

2.3 FABRICATION

A. Assemble handrails and railings in shop to greatest extent possible to minimize filed 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.
B. Form changes in direction of railing members as shown on the Drawings.

C. Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

D. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

E. Tempered glass shall be cut to final size and shape before heat treatment; provide for proper edge clearance and bite on glass. Provide thickness indicated on the Drawings, not less than required to support structural loads.

F. Provide inserts and other anchorage devices to connect handrails and railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

G. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

H. Cut, reinforce, drill, and tap components as indicated on the Drawings to receive finish hardware, screws, and similar items.

I. Close exposed ends of railing members with prefabricated end fittings.

J. Provide mounted handrail wall returns at wall ends unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

2.4 FINISHES

A. General: Comply with NAAMM MFM for recommendations for applying and designating finishes.
   1. Appearance of Finished Work:
      a. Variations in appearance of abutting or adjacent units are acceptable if they are within one-half of the range of final samples. Noticeable variations in the same unit are not acceptable.
      b. Variations in appearance of other components are acceptable if they are within the range of final samples and are assembled or installed to minimize contrast.

B. Aluminum Finish: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
      a. Material: Polyester powder coating, 3.0 mil (0.076 mm). Comply with AAMA 2604, including, but not limited to, average film thickness. Subject to compliance with requirements, provided by the following product:
         1) "ARC 2001™," Spraylat Powder Coatings
      b. Color: [______________].
      c. Gloss: [______________].
   2. Class I Clear Anodized Finish: AA-M12-C22-A41 (Mechanical Finish: as fabricated, non-specular; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear film thicker than 0.7 mil [0.018 mm]) complying with AAMA 611.
3. Class I Color Anodized Finish: AA-M21-C22-A42/A44 (Mechanical Finish: as fabricated, non-specular; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, film thicker than 0.7 mil [0.018 mm] with integral color or electrolytically deposited color) complying with AAMA 611. Provide color to match the Architect's sample, or, if no sample, as selected by the Architect from within full range of industry colors and color density range.

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 substrates to receive anchors verifying that locations of concealed reinforcements have been clearly marked for the Installer. Locate reinforcements and mark locations if not already done.
   2. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchors, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project site.

3.3 INSTALLATION

A. General:
   1. Fitting: Fit exposed connections together to form tight, hairline joints.
   2. Cutting and Placement: Set handrails and railings accurately in location, alignment, and elevation measured from established lines and levels and free from rack.
      a. Do not weld, cut, or abrade coated or finished surfaces of railing components that are intended for field connection by mechanical or other means without further cutting or fitting.
      b. Align rails so variations from level or parallel alignment do not exceed 1/4 inch in 12 feet (1.6 mm per m).
      c. Provide manufacturer's proprietary system to evacuate entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources, in order to prevent water from entering the concrete slab. In lieu of the manufacturer's proprietary system, if acceptable to the Architect, provide another means to evacuate the entrapped water, i.e., a weephole and epoxy fill system ("drill-and-fill").
      d. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.
      e. Anchor posts in concrete by forming or core drilling holes not less than 5 inches (127 mm) deep and 3/4 inch (19 mm) greater than outside diameter of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.
   1) Cover anchorage joint with a round steel flange attached to post by welding to post after placement of anchoring material.
2) Cover anchorage joint with a round steel flange attached to post by set screws.
3) Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch (3 mm) buildup, sloped away from post.

3. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

4. Adjusting: Adjust handrails and railings before anchoring to ensure alignment at abutting joint's space posts at interval indicated, but not less than required to achieve structural loads.

5. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

B. Non-Welded Railings Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

C. Installing Glass Panels in Glass Handrails and Railings: Install assembly to comply with railing manufacturer's written instructions. Attach base channel to building structure, then insert and connect factory-fabricated and factory-assembled glass panels.
   1. Erect glass handrails and railings under direct supervision of manufacturer's authorized technical personnel.

3.4 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and appoint exposed areas with same material.

B. Cleaning: 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.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer that shall ensure that the aluminum handrails and railings shall be without damage at time of Substantial Completion.

B. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

END OF SECTION