HANSEN ARCHITECTURAL SYSTEMS, INC.
WORLD-CLASS ALUMINUM RAILING

SECTION 05 73 16

CABLE RAILING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Division 01 - General Requirements, and other applicable specification sections in the Project Manual apply to the work specified in this Section.5

1.2 SUMMARY

A. Scope: Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for cable railing systems as required for the complete performance of the work, and as shown on the Drawings and as herein specified.

B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:

Edit list below to suit the Project.

1. Decorative stainless steel cable railings.
2. Miscellaneous handrails, rails, posts, fittings, fasteners, etc., as required for a complete system.

C. Related Sections:
1. Section 05 52 00 - Aluminum Handrails and Railings: Aluminum handrails and railings.
2. Section 05 70 00 - Decorative Metal: Adjacent or adjoining handrails and railings fabricated from steel pipe and tube components.

1.3 REFERENCES

A. 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.

B. Aluminum Association, Inc. (AA):
1. AA SAS-30, "Specifications for Aluminum Structures."

C. American Architectural Manufacturers Association (AAMA):
1. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum (Revised)."

2. AAMA 2604, "Voluntary Specification, Performance Requirements, and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels."
3. AAMA 2605, "Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

D. American Society of Civil Engineers (ASCE):
1. ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."

E. American Welding Society (AWS):
1. AWS D1.2, "Structural Welding Code – Aluminum."
2. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. ASTM International (ASTM):
1. ASTM A312/A312M, "Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes."
2. ASTM A492, "Specification for Stainless Steel Rope Wire."
3. ASTM A554, "Standard Specification for Welded Stainless Steel Mechanical Tubing."
4. ASTM A666, "Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar."
5. ASTM A743/A743M, "Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Applications."
6. ASTM B26/B26M," Standard Specification for Aluminum-Alloy Sand Castings."
7. ASTM B209/B209M," Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
8. ASTM B210/B210M, "Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes."
9. ASTM B221/B221M, "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."
10. ASTM B247/B247M, "Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings."
11. ASTM B429/B429M, "Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube."
12. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic Cement Grout (Non-Shrink)."
13. ASTM E488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements."
14. ASTM E985, "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings."

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

1.4 DEFINITIONS

Below defines terms that can be useful in identifying railings relative to structural performance.

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

1.5 PERFORMANCE REQUIREMENTS

A. General: Cable railing systems shall withstand structural loading as determined by allowable design working stresses of materials based on the following standards.
1. Aluminum: AA SAS-30.
2. Stainless Steel: ASCE 8.

B. Structural Performance: Provide cable railing systems 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 (890 N) applied at any point and in any direction.
      b. Uniform load of 50 lbf per foot (730 N/m) applied horizontally or vertically downward.
      c. Concentrated and uniform loads above need not be assumed to act concurrently.
   2. Handrails not Serving as Top Rails: Shall withstanding the following loads:
      a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
      b. Uniform load of 50 lbf per foot (730 N/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 50 lbf (222 N) applied to 1 square foot (0.09 m^2) 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.

Retain below for exterior cable railing systems.

C. Thermal Movements: Cable railing systems shall allow for movements resulting from 120 degree F (49 degree C) changes in ambient and 180 degree F (82 degree 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.

1.6 SUBMITTALS

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

B. Product Data:
   1. Submit manufacturer’s data sheets on each product to be used, including, but not limited to, the following:
      a. Preparation instructions and recommendations.
      b. Storage and handling requirements and recommendations.
      c. Installation methods.
   2. Submit product data for manufacturers product lines of cable railing systems assembled from standard components, including, but not limited to, the following:
      a. Grout, anchoring cements and paint products.

C. Shop Drawings: Submit shop drawings showing fabrication and installation of cable railing systems. Include plans, elevations, sections, details, and attachments to other work.

D. 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.

E. Quality Control Submittals:

1. Design Data: For installed cable 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. Qualification Data: Submit documentation demonstrating capability and experience in performing installations of the same type and scope as specified by this Section. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

Retain below if required for the Project.

3. Certificates: Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

Retain below for Project requiring LEED certification.

F. 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.

Above applies to Credit MR 4. Below applies to Credit MR 5.

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.

1.7 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of cable railing systems of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 15 years.
2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing cable railing systems similar in type and scope to that required for this Project.

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. Mock-Ups: Prior to installation of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of work. Locate mock-ups on site in location and of size indicated or, if not indicated, as directed by the Architect. Demonstrate the proposed range of aesthetic effects and workmanship to be expected in the completed work. Obtain the Architect's acceptance of mock-ups before start of final unit of work. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of work.
1. When directed, demolish and remove mock-ups from the Project site.

Select above or below.

2. Accepted mock-ups in undisturbed condition at time of Substantial Completion may become part of completed unit of work.

D. Single Source Responsibility: Obtain cable railing systems from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work.

1.8 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.

1.9 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.

1.10 WARRANTY

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

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

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.

1.11 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.

2.2 MATERIALS

Retain below for Project requiring LEED Certification.

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.

Above applies to Credit MR 4. Select applicable percentage, five percent will allow the Project to achieve one point, 10 percent will allow the Project to achieve two points. Below applies to Credit MR 5. Select applicable percentage, five percent will allow the Project to achieve one point, 10 percent will allow the Project to achieve two points.

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. Basis of Design: “Series 200X Cable Railing System” and “Series 300X Cable Railing System”, Hansen Architectural Systems, Inc.; 5500 SE Alexander Street, Hillsboro, OR 97123; Toll Free Tel: 800-599-2965, Fax: 503-356-8478; Email: info@aluminumrailing.com; Web: www.aluminumrailing.com.

C. 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.
      a. Extruded Bar and Tube: ASTM B221/B221M, Alloy 6063-T5/T52.
      b. Extruded Structural Pipe and Tube: ASTM B429/B429M, Alloy 6063-T832.
      c. Drawn Seamless Tube: ASTM B210/B210M, Alloy 6063-T832.
      d. Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
      e. Die and Hand Forgings: ASTM B247/B247M, Alloy 6061-T6.
      f. Castings: ASTM B26/B26M, Alloy A356-T6.
   2. Stainless Steel: Provide grade and type designated below for each form required:
      a. Castings: ASTM A743/A743M, Grade CF 8M.
      b. Plate: ASTM A666, Type 316L.
      c. Wire Rope: 1-by-19 cable conforming to ASTM A492, Type 316.
   3. 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.
   4. Wire Rope Fittings: Provide connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to the minimum breaking strength of the wire rope with which they are used.

D. 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) wide with a 0.765 inch (19.43 mm) wide pocket on the top and an open bottom.
      c. 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.

2. Condensation Insert: Provide rigid plastic post insert to evacuate entrapped water in hollow sections of railing members, 2-3/8 inches (60 mm) by 2-3/8 inches (60 mm) by 4-1/8 inches (105 mm) high.
   a. Basis of Design: “Dri-Post System,” Hansen Architectural Systems, Inc.

E. Fasteners:
1. Handrail Anchors: Select fasteners of type, grade and class required to produce connections suitable for anchoring cable railing systems 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.

Select anchor types required. Delete others not required for this Project.

---

   a. Cast-in-place anchors.
   b. Chemical anchors.
   c. Expansion anchors.

F. 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 cable railing systems 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. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of cable railing system members as shown on the Drawings.

C. Fabricate cable railing systems 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 cable railing system members to other construction.

E. Provide inserts and other anchorage devices to connect cable railing systems to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by cable railing systems. Coordinate anchorage devices with supporting structure.

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

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

H. Close exposed ends of cable railing system members with prefabricated end fittings.

I. 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.

Retain finishes below which are applicable to the Project.

   1. Powder Coat Finish: AA-C12-C42-R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply manufacturer's standard baked powder coat finish. Comply with coating manufacturer's written instructions for cleaning, surface preparation, pretreatment, and application.
      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, provide one of the following products:
         1) “1PC-406 Series,” Forrest Paint Co.
         2) “Series 38,” TIGER Drylac U.S.A., Inc.

Select above or below. Products below, which comply with AAMA 2605, are a superior performing, more expensive, finish.

      b. Material: Polyester powder coating, 3.0 mil (0.076 mm). Comply with AAMA 2605, including, but not limited to, average film thickness. Subject to compliance with requirements, provide one of the following products:
         1) “1PC-440 Series,” Forrest Paint Co.
         2) “Series 75,” TIGER Drylac U.S.A., Inc.

Insert color and gloss below.

      c. Color: [_____].
      d. 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.

C. Stainless Steel Finishes: As fabricated mill finish.

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 cable railing systems 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 cable railing system 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.

Select one of two subparagraphs above, both, or neither, for posts in concrete, to suit the Project. Select one of the following two sub-subparagraphs if retaining either or both of the post anchorage methods above.

1) Cover anchorage joint with a round steel flange attached to post by set screws.
2) Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch (3 mm) buildup, sloped away from post.

3. Corrosion Protection: Provide separation as recommended by manufacturer on concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals.
4. Adjusting: Adjust cable railing systems 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 cable railing systems 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.

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 cable railing systems shall be without damage at time of Substantial Completion.

B. Protect finishes of cable railing systems 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