

SECTIONS 05715 & 05720

MONUMENTAL STAIRS

CUSTOM RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Ornamental railings fabricated from custom shapes.
 - 2. Glass railing systems
 - 3. Monumental Stairs

- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 5 Section "Metal Fabrications" for metal fabrications made from heavy-gage ferrous metal for nonornamental purposes.
 - 2. Division 5 Section "Sheet Metal Fabrications" for metal fabrications made from sheet metal.
 - 3. Division 5 Section "Ornamental Handrails and Railings" for ornamental metal handrails fabricated from stock components.

1.2 PERFORMANCE REQUIREMENTS FOR HANDRAIL AND RAILING SYSTEMS

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: AA "Specifications of Aluminum Structures."
 - 2. Copper Alloys: Use a safety factor of 1.65 applied to minimum yield strength of alloy, as published in CDA "Standards Handbook, Part 2—Alloy Data, Wrought Copper and Copper Alloy Mill Products."
 - 3. Stainless Steel: ASCE "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
 - 4. Cold-Formed Structural Steel: AISI "Specification for the Design of Cold-Formed Steel Structural Members."
 - 5. For fully tempered glass in glass-supported railing systems, use a safety factor of 4.0 applied to the applicable modulus of rupture listed under "Mechanical Properties" in AAMA Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

- B. Structural Performance of Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed according to ASTM E 894 and E 935.

- C. Structural Performance of Handrails and Railing Systems: Engineer, fabricate and install handrails and railing systems to withstand the following structural loads without

exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.

1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated.
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sp. M) at any point in the system, including panels, intermediate rails, balusters, or other elements composing the infill area.
 - a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress of guard.
 4. Glass-Supported Railing Systems: Capable of withstanding loads indicated for top rails and infill areas of guardrail systems, with each section of top rails supported by a minimum of 3 glass panels or by another means so that it remains in place should any 1 panel fail.
- D. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 PERFORMANCE REQUIREMENTS FOR MONUMENTAL STAIRCASES

- A. General: In engineering monumental staircase to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. Hot formed structural steel: AISI "Specification for the design of hot-formed steel structural members."
- B. Structural performance of Monumental Staircase: Design, engineer, fabricate and install monumental staircase to comply with NAAMM recommended live load of 100 pounds per square foot or alternatively 300 pound minimum concentrated load.
- C. Structural performance of building: Provide engineering calculations of top and bottom moment connections to enable "Building Engineer" to properly design structural reinforcement for the building to carry the loads of the monumental staircase structure.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each product used in ornamental metalwork, including finishing materials and methods.
- C. Prepare handrail and railing systems shop drawings under the supervision of a qualified professional engineer. Shop drawings shall show fabrication and installation of ornamental metalwork including plans, elevations, details of components, and attachments to other units of Work. Indicate materials and profiles of each ornamental metalwork member, fitting, joinery, finishes, fasteners, anchorages, and accessory items.
 - 1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unite of Work of other sections.
 - 2. For installed products indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparations.
- D. Prepare monumental stair shop drawings under the supervision of a qualified professional engineer. Shop drawings shall show fabrication and installation of monumental staircase including plans, elevations, details of materials, and attachments to building structural. Indicate materials and profiles of each member including welding type.
 - 1. Include setting drawings, and directions for installation of anchor bolts and other anchorages to be installed to support the stair structure.
 - 2. Include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
 - 3. Include analysis data of top and bottom moment connections sealed and signed by the qualified professional engineer who was responsible for their preparation.
- D. Patterns, models or plaster castings made from proposed patterns for each design of custom casting required.

- E. Samples for initial selection in the form of manufacturer's color charts consisting of actual units or sections of units showing the range of colors expected and other finish characteristics available for each item indicated below.
 - 1. Ornamental metal work composed of color-or acid etched components.
 - 2. Ornamental metalwork items with a based-enamel coating.
 - 3. Ornamental metalwork items with a high-performance coating.
- F. Samples for verification of each profile and pattern of fabricated metal and each type of metal finish required, prepared on metal of same thickness and alloy indicated for final unit of Work. Where finished materials involve normal color and texture variations, include sample sets composed of two or more units showing the expected range of variations.
 - 1. Include 6-inch- (150-mm-) long samples of linear shapes.
 - 2. Include 6-inch- (150-mm-) square samples of plates.
 - 3. Include full-size samples of castings and forgings.
 - a. For custom castings, submit samples of previous work to show quality of finish, ability to reproduce detail, and color of cast metal.
- G. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm with five years experience in successfully producing ornamental metalwork and monumental staircases similar to that indicated for this Project and with sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for installation of ornamental metalwork specified in this Section by the same firm that fabricated it. Arrange for fabrication and installation of any monumental stairs and monumental stair railings by the same company.
- C. Organic-Coating Applicator Qualifications: Firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions and equipped with the following:
 - 1. A multistage cleaning and pretreatment system capable of complying with test requirements of AAMA standard referenced for type of coating indicated.
 - 2. Spray equipment required to apply a uniform coating.
 - 3. A preventive-maintenance program and good record-keeping.
- D. Anodic Finisher Qualifications: Firm experienced in successfully applying anodic finishes of type indicated, employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel" and AWS D1.2 "Structural Welding Code—Aluminum."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and , if pertinent, has undergone recertification.
- F. Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of assemblies similar to this Project in material, design, and extent and that have a record of successful in-service performance.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store ornamental metalwork inside a conditioned area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Delivery and store cast metal products in wooden crates with sufficient excelsior to ensure that they will not be cracked or otherwise damaged.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where ornamental metalwork or monumental staircase is indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Where field measurements cannot be made without delaying the Work, General Contractor will guarantee dimensions and Ornamental Metal/Monumental Stair Fabricator will proceed with fabricating ornamental metalwork without field measurements. General Contractor will coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Pre-Approved Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:
- B. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
1. Custom Railings:
 - a. Big D Metalworks of Texas -Phillip Hoppman (800) 299-9767 or (214) 638-8753
 2. Monumental Stairs:

- a. Big D Metalworks of Texas - Phillip Hoppman (800) 299-9767 or (214) 638-8753

2.2 METALS

- A. General: Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required:
 1. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), 6063-T6.
 2. Extruded Pipe and Tubes: ASTM B 429, 6063-T6.
 3. Drawn Seamless Tubes: ASTM B 483 (ASTM B 483M), 6063-T832.
 4. Plate and Sheet: ASTM B 209 (ASTM B 209M), 6061-T6.
 5. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), 6061-T6.
 6. Castings: ASTM B 26/B 26M, A356-T6.
- C. Copper Alloys, Bronze,: Provide copper alloy of type and form indicated to comply with the following requirements.
 1. Extruded Shapes: ASTM B 455, alloy UNS No. C38500 (Architectural bronze).
 2. Plate and Bars: ASTM B 36/B, alloy UNS NO. C28000 (Muntz metal, 60 percent copper.)
 3. Seamless Pipe: ASTM B 43, alloy UNS No. C23000 (red brass, 85 percent copper).
 4. Seamless Tubes: ASTM B 135 (ASTM B 135M), alloy UNS No. C23000 (red brass, 85 percent copper).
 5. Composition Bronze Castings: ASTM B 62, alloy UNS No. C83600 (85-5-5-5 or composition bronze).
 6. Sand Castings: ASTM B 584, alloy UNS No. C86500 (No. 1 manganese bronze).
- D. Copper Alloys, Brass: Provide copper alloy of type and form indicated to comply with the following requirements:
 1. Extruded Shapes: ASTM B 249 (ASTM B 249M), alloy UNS C36000 (free-cutting brass).
 2. Plate and Bars: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).
 3. Seamless Tubes: ASTM B 135 (ASTM B 135M), alloy UNS No. C26000 (Cartridge brass, 70 percent copper).
 4. Sand Castings: ASTM B 584, alloy UNS No. 85200 (high copper yellow brass).
- E. Stainless Steel: Grade and type designated below for each form required:
 1. Tubing: ASTM A 554, grade as follows:
 - a. Grade MT 304.
 - b. Grade MT 316.

2. Pipe: ASTM A 312/A 312M, grade as follows:
 - a. Grade TP 304.
 - b. Grade TP 316.
 3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
 4. Castings: ASTM A 743/A 743M, Grade CF 8M.
 5. Plate: ASTM A 167, type as follows:
 - a. Type 304
 - b. Type 316.
 6. Bar Stock: ASTM A 276.
 - a. Type 304.
 - b. Type 316.
 7. Wire Rope: 1-by-19 cable made from wire conforming to ASTM A 492, Type 316.
 8. Wire Rope: Specially fabricated 1-by-19 cable that is drawn through a die after laying to produce a smooth outer surface; made from wire conforming to ASTM A 492, Type 316.
- F. Steel and Iron: Provide steel and iron in the form indicated complying with the following requirements.
1. Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 501.
 2. Steel Plate, Shapes and Bars: ASTM A 36/A 36M.
 3. Gray Iron Castings: ASTM A 48, Class 30.
 4. Malleable Iron Castings: ASTM A 47 (ASTM A 47M), grade as recommended by fabricator for type of use indicated.

2.3 MISCELLANEOUS MATERIALS

- A. 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.
- B. Fasteners: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 1. Provide concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other work, except where otherwise indicated.
 2. 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.
 3. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- C. Cast-in-Place and Post-Installed Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to

4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Cast-in-place anchors.
 2. Chemical anchors.
 3. Expansion anchors.
 4. Undercut anchors.
- D. Wire Rope Fittings: 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.
- E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Shop Primer for Ferrous Metal: Fast-curing, lead-free, universal modified-alkyd primer complying with performance requirements of FSTT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- G. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint 20.
- H. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.4 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. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners wherever possible.
- C. Comply with AWS for recommended practices in shop welding and brazing. Provide welds and brazes behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded and brazed joints of all flux, and dress all exposed and contact surfaces to #1 finish per NOMMA Guideline 1: Joint Finishes.
- D. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- E. Provide castings that are sound and free of warp, cracks, blow holes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff casting to remove seams, gatemarks, casting flash, and other casting marks.
- F. Finish exposed surfaces to smooth, sharp, well-defined lines and arises.
- G. Assemble items in the shop to the 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.

- H. Make up wire rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so that maximum amount is available for tensioning wire ropes. Tag wire rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

2.5 FABRICATING MONUMENTAL STAIRCASES

- A. Form structural members and stair pans 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. Provide necessary lugs, and brackets to assemble units and to attach to other work.
- C. Comply with AWS for recommended practices in shop and field welding.
- D. Assemble items in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for assembly and coordinated installation. Use connections and connecting welds that maintain structural value of joined pieces.

2.6 FABRICATING HANDRAILS AND RAILINGS

- A. Nonwelded Connections: Fabricate railing systems and handrails to interconnect members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- B. Welded Connections: Fabricate handrails and railing systems of materials indicated below to interconnect members by welding. Use welding method that is appropriate for metal and finish indicated and that develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces. Utilize #1 finish per NOMMA Guideline1: Joint Finishes, as guide to finishing quality.
 - 1. Provide welded connections for stainless-steel handrails and railing systems.
 - 2. Provide welded connections for ferrous handrails and railing systems.
- C. Welded Connections: Fabricate handrails and railing systems to interconnect members with concealed internal welds that eliminate surface grinding, using fittings designed and fabricated for this purpose.
- D. Form changes in direction of railing members as follows:
 - 1. As detailed.
 - 2. By radius bends of radius indicated.
 - 3. By flush radius bends.
 - 4. By bending.
 - 5. By mitering at elbow bends.
 - 6. By inserting prefabricated flush elbow fittings.

7. By any method indicated above applicable to change of direction involved.
- E. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of handrail and railing components.
- F. For handrails and railing systems with non welded connections that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or another means to drain water entrapped in hollow sections of railing members.
- G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated; close ends of returns.
- H. Close exposed ends of handrail and railing members with manufacturer's standard prefabricated end fittings.
- I. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.
 1. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work. Fabricate anchorage devices that are capable of withstanding load imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.
 2. For railing posts set in concrete, provide preset sleeves of steel, not less than 6 inches (150 mm) long and inside dimensions not less than ½ inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure. Or, drill holes on site and utilize non-shrink grout to secure posts.