

## SECTION 057300

### DECORATIVE METAL RAILINGS

#### PART 1 - GENERAL

##### 1.1 STIPULATIONS

- A. The specifications sections "General Conditions of the Construction Contract", "Special Conditions", and "Division 1 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Glass-supported railings.
- B. Related Sections:
  - 1. Section 044203 "Stone Masonry" for steel tube railings included with metal stairs.

##### 1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Copper Alloys: 60 percent of minimum yield strength.
  - 2. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Infill load and other loads need not be assumed to act concurrently.
  3. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 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.

## 1.5 SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's product lines of railings assembled from standard components.
  2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. For illuminated railings, include wiring diagrams and roughing-in details.
- C. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
  2. Each type of glass required.
  3. Fittings and brackets.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For qualified professional engineer.
- F. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- G. Welding certificates.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- I. Preconstruction test reports.

## 1.6 QUALITY CONTROL

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
  - 1. Do not modify intended aesthetic effects, as judged solely by Professional, except with Professional's approval. If modifications are proposed, submit comprehensive explanatory data to Professional for review.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. Refer to Section 016000 "Product Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Professional, except with Professional's approval. If modifications are proposed, submit comprehensive explanatory data to Professional for review.
- D. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC, the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockups for each form and finish of railing consisting of three glass panels and top rail, and anchorage system components that are full height.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.8 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent product as approved by the Professional:
  - 1. Glass- and Plastic-Supported Railings:
    - a. Architectural Metal Works.
    - b. Blum, Julius & Co., Inc.
    - c. Blumcraft of Pittsburgh.
    - d. Livers Bronze Co.
    - e. Newman Brothers, Inc.
    - f. TACO Metals Inc.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
  - 1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
  - 2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
  - 3. 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.
  - 4. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

### 2.3 COPPER ALLOYS

- A. Copper and Copper Alloys, General: Provide alloys indicated and with temper to suit application and forming methods, but with strength and stiffness not less than Temper H01 (quarter hard) for plate, sheet, strip, and bars and Temper H55 (light drawn) for tube and pipe.
- B. Extruded Shapes, Bronze: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
- C. Seamless Tube, Bronze: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).

### 2.4 GLASS AND GLAZING MATERIALS

- A. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
  - 1. Glass Color: Clear.
  - 2. Thickness for Structural Glass Balusters: 19.0 mm.

- B. Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and polyvinyl butyral interlayer not less than 0.060 inch (1.52 mm) thick.
  - 1. Kind: LA (laminated annealed), LHS (laminated heat strengthened) or LT (laminated tempered) as required by delegated design.
  - 2. Glass Color: Clear.
  - 3. Interlayer Color: Clear.
  - 4. Glass Plies for Structural Glass Balusters: Thickness required by structural loads, but not less than 8.0 mm thick, each.
- C. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
  - 1. Glazing Cement: Non-shrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.
- D. Glazing Gaskets for Glass Panels: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

## 2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Components: Type 304 stainless-steel fasteners.
  - 2. Copper-Alloy (Bronze) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed; muntz metal (Alloy 280) fasteners where exposed.
  - 3. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are clearly indicated on shop drawings.
  - 1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

## 2.6 MISCELLANEOUS MATERIALS

- A. Brazing Rods: For copper-alloy railings, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
- B. Lacquer for Copper Alloys: Clear acrylic lacquer specially developed for coating copper-alloy products.
- C. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Anchoring Cement: 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.

## 2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the 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.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with non-welded connections unless otherwise indicated.
- H. Brazed Connections: Connect copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.
  - 1. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
  - 2. Remove flux immediately.
  - 3. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.
- I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
1. By bending to smallest radius that will not result in distortion of railing member.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

## 2.8 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces
  2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.
- C. Structural Balusters: Provide tempered, laminated, heat-strengthened, or laminated, tempered glass panels per delegated design.

## 2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.10 COPPER-ALLOY FINISHES

- A. Finish designations for copper alloys comply with the system for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
- B. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear organic, air drying, as specified below).
  - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
  - 2. Match finish of existing railing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

### 3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- C. Corrosion Protection: Coat concealed surfaces of copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

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

### 3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

### 3.4 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
  1. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top rail channels in factory.
    - a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
  2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
  3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Professional and will comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.6 CLEANING

- A. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 057300