SECTION 05 73 00.50

DECORATIVE METAL RAILINGS - INTERNA RAIL 2-LINE

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\*\* NOTE TO SPECIFIER \*\* Hollaender Mfg. Co.; decorative metal railings.  
This section is based on the products of Hollaender Mfg. Co., which is located at:10285 Wayne Ave., P. O. Box 156399Cincinnati, OH 45215-6399Toll Free Tel: 800-772-8800Tel: 513-772-8800Fax: 800-772-8806Email: [request info (sales@hollaender.com)](https://arcat.com/rfi?action=email&company=Hollaender%252BMfg.%252BCo.&message=RE%253A%2520Spec%2520Question%2520(05725hol)%253A%2520&coid=33096&spec=05725hol&rep=&fax=800-772-8806)  
Web: <https://architecturalhandrail.hollaender.com> | <https://www.hollaender.com>   
 [ [Click Here](https://arcat.com/company/hollaender-mfg-co-33096) ] for additional information.  
With more than 75 years of American-made experience and superior manufacturing technology has resulted in the most reliable, durable, and high-quality products hand railing systems.  
Our pipe fittings and handrail systems today can be found all over the world. From rocket launch pads to oil rigs, from Hollywood movie studios and modern amusement parks to the fixtures in your favorite retail stores, and from water treatment plants to powergen facilities around the globe.  
Why? The reasons are simple:  
- We manufacture handrail systems to meet any application.  
- Our slip-on fittings are cost effective, easy to install, and reusable.  
- We are vertically integrated: all our design, casting, and manufacturing is under one roof.  
- Aluminum-magnesium alloy is strong, corrosion resistant, and usable with any metal pipe.  
- We pursue innovative ideas in-house.

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Aluminum decorative 2-line railing system.
    2. Infill system for pipe and tube railings including:
       1. Glass panels.
       2. Stainless steel wire mesh infill.
       3. Steel wire mesh infill.
       4. Picket infill.
       5. Mid rail infill.
       6. Perforated steel panels.
       7. Perforated stainless steel panels.
  1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 05 73 00.10 - Decorative Metal Railings - KLEAR.
    2. Section 05 73 00.20 - Decorative Metal Railings - VUE
    3. Section 05 73 00.30 - Decorative Metal Railings - VISION.
    4. Section 05 73 00.40 - Decorative Metal Railings - INTERNA RAIL 3-LINE.
    5. Section 05 73 00.60 - Decorative Metal Railings - SPEED RAIL.
    6. Section 05 73 00.70 - Decorative Metal Railings - Structural Glass
    7. Section 05 73 00.80 - Decorative Metal Railings - Button Glass.
    8. Section 08 80 00 - Glazing: Glass panels for Infill Panels.
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. American Architectural Manufacturers Association (AAMA):
       1. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
    2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
    3. ASTM International (ASTM):
       1. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
       2. ASTM B 26 - Standard Specification for Aluminum-Alloy Sand Castings.
       3. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
       4. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
       5. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
       6. ASTM B 247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
       7. ASTM B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
       8. ASTM C 1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
       9. ASTM D 1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
       10. ASTM E 935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
    4. Code of Federal Regulations (CFR):
       1. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
    5. International Building code (IBC).
  1. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's data sheets on each product to be used, including:
        1. Railing, grout, anchoring cement and paint products.
        2. Preparation instructions and recommendations.
        3. Storage and handling requirements and recommendations.
        4. Installation methods.
     3. Shop Drawings: Prior to fabrication submitted which include the following:
        1. Plan views showing location of handrail required for the project with all necessary dimensions.
        2. Detail drawings which show standard handrail elevations, typical railing connections, anchoring systems and expansion joints.
        3. Drawings shall be signed and sealed by a structural engineer indicating compliance with design loads specified.
     4. Samples for Initial Selection: For products involving selection of color, texture, or design.
     5. Verification Samples: For each finish product specified, two samples, minimum size 6 inch (152 mm) square, representing actual product, color, and patterns.
     6. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
     7. Qualification Data: For professional engineer.
     8. Product Test Reports: Supplier shall submit calculations and test reports for complete system. Test Data perASTM E 935.
  2. QUALITY ASSURANCE
     1. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.
     2. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
     3. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

\*\* NOTE TO SPECIFIER \*\* Include mock-up if the project size or quality warrant the expense. The following is one example of how a mock-up on might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project.

* + 1. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
       1. Unless indicated otherwise on the Drawings, approximate size of mockup shall be 25 to 50 percent of full size required, using full size components.
       2. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
       3. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
       4. Retain mock-up during construction as a standard for comparison with completed work.
       5. Do not alter or remove mock-up until work is completed or removal is authorized.
       6. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  1. PRE-INSTALLATION CONFERENCE
     1. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.
  2. DELIVERY, STORAGE, AND HANDLING
     1. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
     2. Protect from damage due to weather, excessive temperature, and construction operations.
  3. PROJECT CONDITIONS
     1. 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 recommended limits.
     2. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
     3. 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.
  4. COORDINATION AND SCHEDULING
     1. 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.
     2. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.
  5. WARRANTY
     1. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: Hollaender Mfg. Co., which is located at:10285 Wayne Ave., P. O. Box 156399Cincinnati, OH 45215-6399Toll Free Tel: 800-772-8800Tel: 513-772-8800Fax: 800-772-8806Email: [request info (sales@hollaender.com)](https://arcat.com/rfi?action=email&company=Hollaender%252BMfg.%252BCo.&message=RE%253A%2520Spec%2520Question%2520(05725hol)%253A%2520&coid=33096&spec=05725hol&rep=&fax=800-772-8806);Web: <https://architecturalhandrail.hollaender.com> | <https://www.hollaender.com>

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
  1. PERFORMANCE REQUIREMENTS

\*\* NOTE TO SPECIFIER \*\* Verify requirements and update as required to comply with building code.

* + 1. Railing must conform to apply to pertinent sections of the following codes:
       1. Applicable state and local building codes, including IBC.
       2. ADAAG.
    2. Handrail for Ramps and Stairs:
       1. Ramps with a rise greater than 6 inch (152 mm) shall have handrails on both sides.
       2. Handrail Height: Installed height of 34 to 38 inch (864 to 965 mm) above ramp surface.
       3. A curb, rail, wall, or barrier shall be provided to serve as edge protection.
          1. Curb: 4 inch (102 mm) minimum height.
          2. Barrier: Constructed to prevent the passage of a 4 inch (102 mm) diameter sphere above ramp grade level.
       4. Circular Cross Section Handrails: Gripping surface diameter between 1-1/2 inch (38 mm) and 2 inch (51 mm).
       5. Clearance between Wall or Post Surface and Handrail: 1-1/2 inch (38 mm) minimum.
       6. At the top and bottoms of handrail sections that stop at a landing, handrail shall extend 12 inch (305 mm) horizontally beyond the top riser and 12 inch (305 mm) horizontally beyond the bottom tread.
       7. Ramps with 30 inch (762 mm) or more drop off to grade shall require guards.
       8. Handrail shall be continuous, without interruption by newel posts or other obstructions.
       9. Handrails shall return to a wall, guard or walking surface.
    3. Structural Performance: Railings capable of withstanding effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
       1. Handrails:
          1. Uniform load of 50 lbf per ft (729.7 N per m) applied in any direction.
          2. Concentrated load of 200 lbf (889.6 N) applied in any direction.
          3. Uniform and concentrated loads need not be assumed to act concurrently.
       2. Top Rails of Guards:
          1. Uniform load of 50 lbf per ft (729.7 N per m) applied in any direction.
          2. Concentrated load of 200 lbf (889.6 N) applied in any direction.
          3. Uniform and concentrated loads need not be assumed to act concurrently.
       3. Infill Area of Guards:
          1. Horizontal concentrated load of 50 lbf per sq ft (2394 N per sq m)
          2. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.
          3. Glass infill panels shall have a safety factor of 4 included in the calculation.
    4. Thermal Movement: Exterior railings shall allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
       1. Temperature Change (Range): 120 degrees F (48.9 degrees C), ambient; 180 degrees F (82.2 degrees C), material surfaces.
    5. Corrosion Control: Prevent galvanic action and other corrosion types. Insulate metals and other materials from direct contact with incompatible materials.
  1. ALUMINUM HANDRAIL SYSTEM
     1. Basis of Design: INTERNA-RAIL Aluminum Component Railing as manufactured and assembled by Hollaender Manufacturing.
     2. Metals, General:
        1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
        2. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
     3. Aluminum:
        1. Aluminum, General: Provide 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 alloy and temper designated below for each aluminum form required.
        2. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52, 6005-T5.
        3. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6061-T6. Provide 1.90 inch (48 mm) OD Standard Weight, Schedule 40 pipe for rails, Schedule 80 for posts, Schedule 10 for pickets, unless otherwise indicated.
        4. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832
        5. Plate and Sheet: ASTM B 209, Alloy 6061-T6
        6. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6
        7. Base Flange Castings: ASTM B 26/B 26M, Alloy Almag 535
        8. Structural Fittings and Panel Clips: Alloy 6063-T6.
     4. Railing Configuration: 2-line, with infill panel running to top rail.

\*\* NOTE TO SPECIFIER \*\* Delete if not required.

* + 1. Post Mounting at Parapets:

\*\* NOTE TO SPECIFIER \*\* Delete options not required.

* + - 1. Core Mounting: Contractor to use non shrink grout, outside diameter of 3 inches (76 mm).
      2. Top Mounting: 45 SBC-8 external top mount flange.
      3. Side Mounting: 52E-8 side mount flange.

\*\* NOTE TO SPECIFIER \*\* Delete steel option if not required.

* + 1. Steel: Perforated Sheet: ASTM A1008.
    2. Bituminous Paint: Cold-applied asphalt emulsion complying withASTM D 1187.
  1. INFILL PANELS

\*\* NOTE TO SPECIFIER \*\* Delete infill options not required.

* + 1. Glass Infill Panels for Railings:
       1. Tempered Glass: ASTM C 1048, Fully Tempered, Condition A, Type 1, Quality Q3.
          1. 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 to16 CFR 1201for category 2 materials.
          2. Glass Type: 3/8 inch (10 mm) tempered.
    2. Stainless Steel Mesh Infill for Railings:
       1. Type 304 Stainless Steel Welded Wire Mesh Infill Panel: Minimum 0.118 inch (3.00 mm) wire diameter stainless steel
       2. Pattern: 2 inch (51 mm) square.
       3. Frame: Steel U-channel, minimum 14 ga, corners welded and ground smooth. To assure minimum maintenance and allow for water to escape, drain holes in the bottom side and corners of the infill panel shall be provided.
       4. Finish: Frame of panel to be electro-polished, thus ensuring maximum corrosion protection. Wire brush finish will not be accepted.
       5. Panels to be attached to railing using Hollaender #145 panel retainers and 1/4 - 20 screws, with appropriate slot width for panel thickness, and set screw for final tightening of panel within retainer slot.
    3. Steel Mesh Infill for Railings:
       1. Welded Wire Mesh Infill Panel: Minimum 0.118 inch (3.00 mm) wire diameter steel
       2. Pattern: 2 inch (51 mm) square.
       3. Frame: Steel U-channel, minimum 14 ga, corners welded and ground smooth. To assure minimum maintenance and allow for water to escape, drain holes in the bottom side and corners of the infill panel shall be provided.
       4. Corrosion Protection:
          1. Entire panel to be electro-coated. Electro-coating to be PPG Powercron 8000 or equivalent, and shall cover all exposed surfaces, especially interior of U channel. Electro-coating to be applied in four steps: Pre-treatment, electro-coat, post rinse and bake oven.
          2. Entire panel shall then be powder coated with TGIC Polyester, minimum AAMA 2604.

\*\* NOTE TO SPECIFIER \*\* Delete color options not required.

Color: Silver.

Color: To be selected by Architect.

Color: As indicated on Drawings.

Color: \_\_\_\_\_.

* + - 1. Panels to be attached to railing using Hollaender #146 panel connectors with button head cap screws and 5/16 inch (8 mm) rivet nut.
    1. Picket Infill for Railings:
       1. Picket infill shall be 3/4 inch (19 mm) IPS, Sch 10, 6063-T6 aluminum pickets, attached to top and bottom rails by 156-85 aluminum component tees.
       2. Spacing to be 4 inches (102 mm) on center.
       3. Picket tees to be attached to top and bottom rails with threaded self tapping machine screws, size 1/4 - 20 x 1. Picket tees to be attached to pickets by friction fit through the use of mechanical or hydraulic pressure.
       4. Top and bottom rail to be 1-1/2 inch (38 mm) IPS, Sch 40, 6063-T6 aluminum
       5. Pickets to be installed such that no welding or tool marks will be needed or visible, and pickets will be firmly fixed with no movement allowed.
       6. Individual picket tees to have notches allowing escape of any water build up in the pickets.
    2. Mid Rail Infill for Railings: For use at parapet wall.
       1. Multiple mid rails of 6063-T5, Schedule 40 pipe.
       2. Spacing: Maximum spacing between mid rails to be 3.75 inches (95 mm).
       3. Height to Top of Railing: 42 inches (1067 mm) above walking surface.
       4. Finish: Clear anodized.
    3. Perforated Steel Infill for Railings:
       1. Perforated Steel Sheet: Gage as necessary to withstand loads indicated

\*\* NOTE TO SPECIFIER \*\* Delete gauge option not required.

* + - * 1. Minimum: 11 gauge (3.0 mm).
        2. Minimum: 14 gauge (2.0 mm).
      1. Margins: Minimum 1 inch (25 mm) on all sides.

\*\* NOTE TO SPECIFIER \*\* Delete pattern options not required.

* + - 1. Pattern: 1/2 inch (13 mm) diameter holes spaced at 11/16 inch (17 mm) on center.
      2. Pattern: As indicated on Drawings.
      3. Pattern: To be selected by Architect.
      4. Pattern: \_\_\_\_\_.
      5. Frame:

\*\* NOTE TO SPECIFIER \*\* Delete gauge option not required.

* + - * 1. Steel U-channel, minimum 11 gauge (3.0 mm).
        2. Steel U-channel, minimum 14 gauge (2.0 mm).
        3. Corners welded and ground smooth. To assure minimum maintenance and maximum corrosion protection, bottom channel of frame shall be open, in order to evacuate all water.
      1. Corrosion Protection
         1. Entire panel to be electro-coated. Electro-coating to be PPG Powercron 8000 or equivalent, and shall cover all exposed surfaces, especially interior of U channel. Electro-coating to be applied in four steps: pre-treatment, electro-coat, post rinse and bake oven.
         2. Entire panel shall then be powder coated with Silver powder coat, or equivalent powder coat color of architect's choice. Powder to be TGIC Polyester, minimum AAMA 2604.
    1. Perforated Stainless Steel Infill for Railings:
       1. Perforated Stainless Steel Sheet: Gage as necessary to withstand loads indicated
          1. Minimum: 14 gauge (2.0 mm).

\*\* NOTE TO SPECIFIER \*\* Type 304 is recommended for interior applications. Type 316 is recommended for exterior applications. Delete type option not required.

* + - * 1. Grade: 304.
        2. Grade: 316.

\*\* NOTE TO SPECIFIER \*\* Delete pattern options not required.

* + - 1. Pattern: 1/2 inch (13 mm) diameter holes spaced at 11/16 inch (17 mm) on center.
      2. Pattern: As indicated on Drawings.
      3. Pattern: To be selected by Architect.
      4. Pattern: \_\_\_\_\_.
      5. Frame:
         1. Steel U-channel, minimum 11 gauge (3.0 mm).
         2. Corners welded and ground smooth. To assure minimum maintenance and evacuation of water, 3 drain holes shall be punched in bottom of hem.

\*\* NOTE TO SPECIFIER \*\* Electropolish finish is shiny, almost chrome. Delete finish option not required.

* + - 1. Finish: Electropolish finish.
      2. Finish: Satin No. 4.
  1. FASTENERS
     1. Alloy steel fasteners with JS-600 zinc plating.
     2. Fasteners Anchoring Railings 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.
     3. Structural Fasteners for Interconnecting Railing Components:
        1. Rails shall be attached to posts by means of tee fittings equipped with anodized aluminum, tubular rivet nut and stainless steel socket head cap screw.
        2. All structural fasteners such as tee fittings shall be machined from 6063-T6 aluminum alloy.
        3. The fitting shall be internally connected to the rail by means of an internal dual tang that is expanded with a stainless steel, internal /external, reverse knurl, cup point socket head set screw. This combination shall prevent any loosening of the system due to changes in temperature or vibration.
        4. Systems using pop rivets or adhesives will not be accepted.
     4. Fasten infill panels to rails and posts with Hollaender model 145 panel clips, machined from 6063-T6 aluminum alloy.
        1. Secure the infill panels in the panel clips with reverse-knurl cup-point set screws.
        2. Fasten panel clips to rails and posts with 1/4 - 20 sheet metal screws.
     5. Anchors: Provide concrete adhesive anchors where indicated or necessary.
  2. FABRICATION
     1. 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.
     2. 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.
     3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.79 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
     4. Form work true to line and level with accurate angles and surfaces.
     5. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
     6. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
     7. Connections: Fabricate railings with nonwelded connections, unless otherwise indicated.
     8. Nonwelded Connections:
        1. Connect members with concealed mechanical fasteners and fittings.
        2. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
        3. Fittings to be of the internal double tang type activated by a reverse knurl cup point set screw. Reverse knurl is required to ensure that screw does not come loose under vibration. Plain cup point screws will not be accepted. Fittings to be fastened to pipe by means of a 5/16 inch (7.9 mm) tubular rivet nut and socket head cap screw.
     9. Form Changes in Direction as Follows: By flush bends or by inserting prefabricated flush-elbow fittings.
     10. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
     11. Close exposed ends of railing members with prefabricated end fittings.
     12. 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 (6.4 mm) or less.
     13. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated. Flanges to be sand cast from aluminum alloy 535 with anodized finish and fastened directly to the post by means of two reverse knurl cup point set screws.
     14. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
  3. FINISHES
     1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
     2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
     3. Appearance of Finished Work:
        1. Acceptable Variations: Appearance of abutting or adjacent pieces must be within one-half of the range of approved samples.
           1. 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.
        2. Noticeable Variations: In same piece is not acceptable.
        3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

\*\* NOTE TO SPECIFIER \*\* Delete finish types not required on this project.

* + 1. Aluminum:
       1. Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.
       2. Aluminum Pipe Finish: Anodize to AA-M10C22A41, Architectural class, 0.7 mil (0.02 mm) thickness or greater, unless indicated otherwise.
    2. Steel:
       1. Primer: Approximately 0.04 inch (1 mm) coating provided by minimum 4 step electrocoat process.
       2. Finish: Powdercoat.

\*\* NOTE TO SPECIFIER \*\* Delete color options not required.

* + - * 1. Color: As selected by Architect from manufacturer's full line.
        2. Color: As indicated on Drawings.
        3. Color: \_\_\_\_\_.

1. EXECUTION
   1. EXAMINATION
      1. 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.
      2. Do not begin installation until substrates have been properly constructed and prepared.
      3. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.
   2. PREPARATION
      1. Clean surfaces thoroughly prior to installation.
      2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   3. INSTALLATION
      1. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.
      2. Fit exposed connections together to form tight, hairline joints.
      3. 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 (1.6 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 (6 mm in 3.6 m).
      4. 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.
      5. Adjust railings before anchoring to ensure matching alignment at abutting joints.
      6. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
      7. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2 inch (38 mm) clearance from inside face of handrail and finished wall surface.
      8. Once installed, all handrails must be in compliance with the requirements of applicable federal, state and local building codes.
      9. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.
      10. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.
      11. Anchoring Railing Ends:
          1. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
          2. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.
      12. Attaching Handrails to Walls:
          1. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2 inch (38 mm) clearance from inside face of handrail and finished wall surface.
          2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
          3. Secure wall brackets to building construction as indicated, or if not indicated, as follows:
             1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
             2. For hollow masonry anchorage, use toggle bolts.
             3. Provide blocking between studs in stud wall construction.
   4. CLEANING AND PROTECTION
      1. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
      2. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer.
      3. Remove protective coverings at time of Substantial Completion.
      4. 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