GUIDE SPECIFICATIONS: These guide specifications are intended to be used as the basis for developing job specifications and **must be edited** to fit specific job requirements. Inapplicable provisions should be deleted, appropriate information should be provided in the blank spaces, and provisions applicable to the job should be added as necessary. Items, which represent an option or choice, are enclosed in brackets [ ] or braces { }. Notes to specifiers are given in *Italics*.

SECTION 05720 - ALUMINUM PIPE RAILING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install Component type aluminum handrails, guardrails, and railing systems, including connectors, fasteners, and system required accessories.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish [anchors] [fabrications] to be cast in concrete to Section [03000 – Concrete] [03300 - Cast-in-Place Concrete].
B. Furnish [anchors] [fabrications] for embedding in masonry to Section [04200 - Masonry Unit System] [_____]
C. Furnish anchors for placement in [_____] walls to Section [_____ - _____].

1.03 RELATED WORK

A. Section 03000 - Concrete:
B. Section 03300 - Cast-in-Place Concrete:
C. Section 04200 - Unit Masonry Systems: Grout
D. Section 05030 - Metal Finishes:
E. Section 05510 - Metal Stairs: Handrailing at Stairs
F. Section 06100 - Rough Carpentry:
G. Section 08800 - Glazing: Glass; Plastic Glazing; Glazing Accessories
H. Section 09900 - Painting: Paint Finish

1.04 REFERENCES

Include only reference standards that are to be indicated within the text of this section. Edit the following, adding and deleting as required for project and product selection.

A. Aluminum Association (AA)
   1. ASD-1 Aluminum Standards and Data
   2. DAF-45 Designation System for Aluminum Finishes
B. American Architectural Manufacturers Association (AAMA)
   1. AAMA 2605-98: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 2604-98: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2603-98: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
C. American National Standards Institute (ANSI)
   1. A21 .1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.
   2. A58.1 Minimum Design Loads in Buildings and Other Structures.

3. AI 17.1 Accessible and Usable Buildings and Facilities.

D. American Society for Testing and Materials (ASTM)
   1. B 221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.
   2. B 429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
   3. D 1730 Recommended Practices for Preparation of Aluminum and Aluminum Alloy Surfaces for Painting.
   4. E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
   5. E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
   6. E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings.

E. Military Specifications (MIL)
   1. MIL-A-46104 Aluminum Alloy Extruded Rod, Bar, and Shapes, 7001.
   2. MIL-P-1144 Pipe, Corrosion Resistant, Stainless Steel, Seamless or Welded.
   3. MIL-P-25995 Pipe, Aluminum Alloy, Drawn or Extruded.
   4. MIL-R-36516 Rail, Restraint.

F. National Association of Architectural Metal Manufacturers (NAAMM)
   1. Metal Finishes Manual
   2. Pipe Railing Manual
   3. Stair Manual

G. National Ornamental and Miscellaneous Metals Association (NOMMA)
   1. Metal Rail Manual

1.05 PERFORMANCE REQUIREMENTS

Check governing codes for requirements.

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 for Aluminum Structures."

B. 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. Toprail of Guardrail System: Capable of withstanding the following loads applied as indicated:
      a. Uniform load of [20] [50] pounds per lineal foot applied horizontally at right angles to the top rail.
   2. Infill Area of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
      a. Concentrated load of 25 pounds per square foot applied horizontally at right angles over the entire tributary area, including openings and spaces between rails.
      b. Reactions due to the above load need not be combined with those loads on the toprail of guardrail system.
   3. Handrails: The mounting of handrails shall be such that the completed handrail and supporting structure are capable of withstanding the following loads applied as indicated:
      a. Concentrated load of 200 pounds applied in any direction at any point on the handrail.
      b. These loads shall not be assumed to act cumulatively with those loads on the infill area of guardrail system.

C. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculations on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
   1. Temperature Change (Range): 120 deg. F ambient; 180 deg. F material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section [01300] [01340].
B. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.
C. Submit manufacturer's installation instructions under provisions of Section [01300] [01340].

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
B. Storage on site:
   1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way that will prevent bending.
   2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
C. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, provide handrails and railing systems by one of the following:
   1. Aluminum Ornamental Railing Systems:
      a. ALUMINUM TUBE RAILINGS manufactured by

         ATR Technologies, Inc.
         805 Towne Center Drive
         Pomona, CA 91767-5901

         Toll Free Phone: (800) 423-4148
         Fax: (909) 399-5834
         Website: www-ATR-Technologies.com
         Email: railings@ATR-Technologies.com
B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
C. Provide all handrails, guardrails, and railing systems from a single manufacturer.

2.02 METALS

A. General: Provide metal 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 Bar and Tube: ASTM B 221, Alloys 6005-T6, 6061-T6 and 6063-T6.
   2. Extruded Structural Pipe and Tube: ASTM 429, Alloy 6063-T6
   3. Drawn Seamless Tube: ASTM B 210, 6063-t832.
   4. Plate and Sheet: ASTM B 209, Alloys 6061-T6 and 6063-T6.
   5. Die and Hand Forging: ASTM B 247, 6061-T6.
   6. Castings: ASTM B 26, A356-T6.

2.03 RAILING SYSTEM

A. Material shall conform to 2.02 and be finished in accordance with 2.07.
B. Railing system shall be [permanently anchored] [removable].
C. Top Rails, Handrails and/or Griprails, Mid Rails and Posts
    1. Fabricate from [anodized] [painted] 1-1/2 inch Schedule 40 aluminum pipe.
    2. If required, provide post reinforcement to meet loading criteria.
D. Fittings and Fasteners: Same basic material and alloy as parts being joined, unless otherwise indicated. Do not use metals that will be corrosive or incompatible with materials being fastened; do not utilize cast fittings.
    1. Component Fittings: Machined from solid extruded 6063-T6 aluminum alloy and finished to match the pipe.
    2. Fasteners: Screws shall be fabricated from [cadmium plated] [galvanized] [type 304 stainless] [type 316 stainless] steel.
E. Transitions
    1. Formed with uniform radius bend within allowable tolerance of pipe size.
    2. If required, formed with mitered, non-welded, hair-line joints.
F. Connection Splices
    1. Internal mechanical connection splices shall be of extruded aluminum.
G. Base Flanges, Anchors, and Inserts:
    1. Manufacturer's standard machined socket bases from solid aluminum stock; no castings of any type allowed (die or sand).
    2. Anchors and inserts as required to support work specified, in accordance with approved shop drawings.
H. Mounting Wall Brackets
    1. Wall mounted brackets shall be of aluminum attached to bottom side of Handrail and/or Griprail by means of mechanical attachment.
    2. Fasteners: Screws shall be fabricated from [cadmium plated] [galvanized] [type 304 stainless] [type 316 stainless] steel.

2.04 FASTENERS

A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.
    1. For aluminum railings, provide fasteners fabricated from [cadmium plated] [galvanized] [type 304 stainless] [type 316 stainless] steel.
B. Fasteners for Interconnecting Railing Components: 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.
C. Cast-in-Place and Post-Installed Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, the loads determined by local code requirements.
    1. list anchors required

2.05 GROUT AND ANCHORING CEMENT

A. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-shrink, non-metallic, non-staining, non-corrosive grout. Provide grout specifically recommended by manufacturer for interior and exterior applications. Minimum 28 day compressive strength of _____ psi.
B. Products: Subject to compliance with requirements, provide one of the following:
    1. Erosion-Resistant Anchoring Cement:
        a. AnchoRoc by ThoRoc
        b. Quick-Rok by ThoRoc

2.06 FABRICATION

A. Fabricate handrails and railing systems with non-welded, internal and mechanical connections to comply with manufacturer's printed requirements, project design requirements, details, dimensions, finish and member sizes, including post spacing and anchorage, but not less than the structural requirements to support loading.
   1. Clearly mark component units for site assembly and installation.
   2. Use connections that maintain structural capacity of joined members.

B. Provide weep holes or other means to exit entrapped water from hollow sections of railing members exposed to exterior, condensation, or moisture from other sources.

C. Form all changes in rail direction by [mitered, hairline mechanical joints] [uniform radius bend within allowable tolerance of pipe size].

D. Cut materials square and remove burrs from all exposed edges, with no chamfer.

E. Make exposed joints butt tight and flush.

F. Close exposed visible ends of Top Rails and Handrails by use of [flat] [domed] end cap.

I. Verify dimensions on site prior to shop fabrication.

2.07 FINISHES, GENERAL

A. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage per manufacturer’s recommendations.

C. Appearance of Finished Work: *(add notes as required)*

2.08 ALUMINUM FINISH

Specifiers may use the following paragraphs "A" and "B" for anodized finishes.

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Anodized finish shall be Class I provided in accordance with [AA-M12 C22 A41 (*use for Clear)*] [AA-M12 C22 A43 *(use for Gold)*] [AA-M12 C22 A44 *(use for Bronze or Black)*].

Specifiers may use the following paragraph "A" for organic coatings (baked enamel and/or powder coat).

A. Finish designations prefixed AAMA conform to the system established by the American Architectural Manufacturers Association.

Specifiers may choose one of the following options for paragraph "B" for organic coatings (baked enamel and/or powder coat) and edit the choices accordingly.

OPTION #1

B. Painted finish shall be a baked enamel type that meets the requirements of AAMA 2605-98 (Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels). Finish shall be 70% Fluorocarbon Resin - Kynar 500 by Atochem North America or Hylar 5000 by Ausimont USA, Inc. applied over the manufacturer’s recommended inhibitive primer. Applicator must use a chrome chemical conversion coating pretreatment process in order to comply with AAMA 2605-98.

   [PPG Industries: [Duranar] [Duranar XL] [Duranar XLT] [Duranar XLTS] [Sunstorm]**]**
   [BASF: [Fluoroceram] [Fluoroceram CL] [Ultramet]**]**
   [Valspar Corp.: [Fluropon] [Fluropon Classic] [Fluropon Classic II]**]**
   [Lilly Industries: [Nubelar]**]**
   [Akzo-Nobel: [Trinar] [Tri-escent II]**]**
   [Duracoat Products: [DC290 Series PVDF]**]**

OPTION #2

B. Painted finish shall be a type that meets the requirements of AAMA 2604-98 (Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels). One of the following applications may be used:

1. Finish shall be a baked enamel containing 70% Fluorocarbon Resin - Kynar 500 by Atochem North America or Hylar 5000 by Ausimont USA, Inc. applied over the manufacturer's recommended inhibitive primer. The applicator may use a non-chrome chemical conversion coating pretreatment process in order to comply with AAMA 2604-98.

   [PPG Industries: [Duranar] [Duranar XL] [Duranar XLT] [Duranar XLTS] [Sunstorm]**]**
   [BASF: [Fluoroceram] [Fluoroceram CL] [Ultramet]**]**
   [Valspar Corp.: [Fluropon] [Fluropon Classic] [Fluropon Classic II]**]**
   [Akzo-Nobel: [Trinar] [Tri-escent II]**]**
   [Lilly Industries: [Nubelar]**]**
   [Duracoat Products: [DC290 Series PVDF]**]**

2. Finish shall be a baked enamel containing 50% Flourocarbon Resin Products or Silicone Polyester applied over the manufacturer's recommended primer. The applicator may use a chrome or a non-chrome chemical conversion coating pretreatment process in order to comply with AAMA 2604-98.

   [BASF: [Superl SP]**]**
   [Valspar Corp.: [Acroflur] [Acrodize]**]**

3. Finish shall be a High Performance power coating in order to comply with AAMA 2604-98.

   [Tiger Drylac: [Series 28 High Performance Powder]**]**
   [Other manufacturers with product information indicating compliance with AAMA 2604-98.**]**

OPTION #3

B. Painted finish shall be a type that meets the requirements of AAMA 2603-98 (Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels). One of the following applications may be used:

1. Finish shall be a baked enamel containing Polyester, Acrylic or High Solids applied in accordance with AAMA 2603-98.

   [PPG Industries: [Duracron (Acrylic)] [Polycron (High Solids)]**]**
   [BASF: [Polyester]**]**
   [Valspar Corp.: [Flurocryl Acrylic] [Valex High Solids Polyester] [Dynapon Polyester]**]**
   [Duracoat Products: [DC210 Series] [DC240 Polyester]**]**

2. Finish shall be an exterior quality power coating applied in accordance with AAMA 2603-98.

   [Tiger Drylac: [TGIC Polyester]**]**
   [Dupont Powder Coatings: [Polyester]**]**
   [Morton Powder Coatings: [Polyester]**]**
   [Spraylat: [Polyester]**]**
   [Other manufacturers with product information indicating compliance with AAMA 2603-98.**]**

Specifiers may use the following paragraph "C" to clarify the finish color selection.

C. Color:
   for anodized finishes: [Clear] [Gold] {[Medium] [Dark] Bronze} [Black]
   for organic organic coatings (baked enamel and/or powder coat): [As selected from manufacturer's standard colors] [Custom color as selected by Architect] [To match *brand name,* color number *color number*]

PART 3- EXECUTION

3.01 EXAMINATION

A. Examine system components, substrate, and conditions where railing systems are to be installed.
B. Notify architect in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare surrounding construction to receive railing system installations to comply with manufacturer's requirements.
B. Review and coordinate setting drawings, shop drawings, templates, and instructions for assembly and installation of railing system and related items to be embedded in concrete and masonry. Supply items to be [cast in concrete] [embedded in masonry] [placed in partitions].

3.03 DISSIMILAR METALS

A. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with a heavy coat of a [two-part epoxy] [proper primer] [asphalt paint] or provide a heavy vinyl tape barrier.
B. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be separated by means of [asphaltic paint] [two-part epoxy] [heavy vinyl tape] or other approved method to prevent electrolytic action.

3.04 INSTALLATION

A. Install railing system and related components in strict accordance to shop drawings [and to manufacturer’s instructions].
B. Preassemble railing system, including posts, in easy to lift sections whenever possible.
    1. Align rails so that variations from level for horizontal members, and from parallel with rake of steps and ramps for sloping members, do not exceed 1/4 inch in 12 feet (6.3 mm in 3.657 m). Erect work free from distortion or defects detrimental to appearance or performance.
    2. Separate aluminum which might contact concrete, masonry, or other metals, by means of [asphaltic paint] [two-part epoxy] [heavy vinyl tape] or other approved method to prevent electrolytic action.
D. Adjust, level, and securely install railing system components.
    1. Avoid springing assembled components of system into place.
E. Install posts in concrete with pipe sleeves preset and anchored into concrete whenever possible, or by core drilling.
    1. After posts are inserted, solidly fill the remaining space between post and side of sleeve or hole, with nonshrink nonmetallic grout to approximately 1/2 inch (13 mm) below exposed surface.
    2. Install appropriate waterproof sealant as recommended by the manufacturer; slightly taper away from posts.
E. Provide for thermal expansion and contraction by use of expansion joints/gaps in top rails, 20 foot (6.096 m) maximum intervals.
    1. Strictly adhere to manufacturer's instructions for locations of expansion joints and fastening of expansion sleeves.
    2. Attach top rail to posts located at maximum 5 foot (1.524 m) on center spacings.
    3. Install bottom rails in unspliced lengths between posts.
    4. Install posts of continuous sections from mounting base to top rail.
F. Provide for water to drain from the railing system hollow sections by drilling weep holes at bottom locations or other approved methods.

3.05 CLEANING

A. As installation is completed, wash thoroughly using plain water containing a mild soap or detergent. When preferred, an anodized finish shall be cleaned with white gasoline, kerosene or distillate. Aluminum with a painted finish shall be cleaned with plain water containing a mild soap or detergent.
B. Do not use an acid solution, steel wool or other harsh abrasives.
C. If stains remain after washing, remove paint finish and restore in accordance with NAAMM Metal Finishes Manual. Finish must not be removed from anodized aluminum. Reanodizing can only be done by removing railing and returning it to the anodizer.

3.06 PROTECTION

A. Provide adequate protection for all surfaces of completed installations to prevent damage during remainder of construction activities.

3.06 REPAIR OF DEFECTIVE WORK

A. Remove stained or otherwise defective work and replace with material that meets specification requirements.