SECTION 05521 - ALUMINUM RAILINGS

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing complete aluminum railings, guardrails and handrailing systems.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Cast-In-Place Structural Concrete
2. Section 05500 Miscellaneous Metalwork
3. Section 09800 Protective Coating

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Building Code
2. General Industrial Safety Order (Title 8) Cal-OSHA
3. State Building Code (Title 24) Requirements for Handicapped Persons

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	ASTM A320/A320M	Alloy-Steel Bolting Materials for Low-Temperature Service
2.	ASTM B241/B241M	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings showing details of railings.
2. Layout plan showing post location and spans, gate locations, and removable railing sections.

3. Engineering calculations for railings, handrail brackets, brackets, support flanges, and fasteners or anchors.

4. Samples of systems and samples of color.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Manufactured materials shall be delivered in original, unbroken packages, containers, or bundles bearing the label of the manufacturer.

B. **Storage:** All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements as required by the product manufacturer.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Railings shall comply with SSPWC Subsection 304-2.1 unless indicated otherwise.

B. The aluminum railings shall be [pipe railing system] [and] [rectangular tube and square picket railing system] [round pipe and round picket railing system] unless otherwise indicated. Railing system shall be [grout pocket] [deck base] [side bracket] mounted unless indicated otherwise.

C. Railing systems shall meet UBC and Cal-OSHA requirements.

D. Railings and handrail brackets shall be [designed for the two non-simultaneous] [capable of withstanding either of the following] loading conditions without exceeding the allowable working stress of the material and without permanent deformation: (1) a 200-pound concentrated load applied to any point in any direction (2) a 50-pound per linear foot loading applied perpendicular to the top rail.

E. The allowable working stress shall be 60 percent of the material yield stress for materials that are more than 3 inches from a weld and 40 percent of the yield stress for all materials within 3 inches of any weld.

F. Railings shown at curved structures, elements or other areas such as the following: tanks, retaining walls, stairs, process units and ramps shall be bent to the radius necessary to install where indicated.

2.2 MATERIALS

A. **Rail Section:** Railings and handrails shall be [rectangular tube and square picket] [round tube and round picket] and [round pipe] design railing system unless otherwise indicated.

B. **Rail Material:** Aluminum shall be U.S. Alloy 6063, T-5 or T-6. Aluminum pipe rail shall be not less than 1-1/2-inch diameter, Schedule 40 pipe.

C. **Welding Rods:** Aluminum welding rods shall be of type recommended by the aluminum manufacturer for anodized finished products.

D. **Protective Coating:** Electrolysis protective material shall comply with Section 09800.

E. **Sleeves:** Sleeves for grout pockets shall be formed with EZ type removable plastic insert

sleeves. Sleeves for removable posts shall be of 316 stainless steel. Sleeves for removable railings at indicated corrosive environment locations shall be fiberglass similar to the railing system used there. EZ type removable plastic insert sleeves shall be EZ Sleeves as manufactured by Auciello Iron Works, Inc., (508) 568-8382, or equal.

F. **Fasteners:** Fasteners, screws, and bolts shall be concealed and shall be of stainless steel (316 alloy) or aluminum. Handrail bracket fasteners and fasteners over water basins shall be of stainless steel (316 alloy).

G. **Brackets:** Handrail brackets shall be aluminum with a finish that matches the handrail or railing of which they are a part.

H. **Toeboards:** Toeboards shall match railing system and shall be fabricated of 3/16 inch (minimum) aluminum and not less than 4 inches in height. Toeboards for picket railings shall be a special extrusion if a snap-in centered type toeboard is not standard with the railing manufacturer. Toeboards for pipe railing shall be channel section for strength.

I. **Socket Grout:** Non-shrink grout for handrail post sockets shall consist of an inorganic, non-metallic, premixed grout with a minimum 28-day compressive strength of 4,000 psi.

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NTS: In the "Finishes" paragraph below, use M32 at locations where a fine architectural finish is needed such as Administration Building.

M12 should be used at most locations within wastewater treatment plants.

Hardcoat finish shall be marine type hardcoat and should be used at marine environments and semi-corrosive environments.

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2.3 FINISHES

A. **Pipe Railing System:** Pipe railing system including handrails, railings, tube caps, and other miscellaneous parts of rails shall be provided with a 0.7-mil [clear anodized finish, AA-[M32] [M12]-C22-A[41] [marine type hardcoat]] [dark bronze anodized finish, AA-[M32] [M12]-C22-A[42] [marine type hardcoat]].

B. **Picket Railing System:** Picket railing system including handrails, railings, tube caps, gates, and other miscellaneous parts of railing shall be provided with a 0.7-mil [clear anodized finish AA-[M32] [M12]-C22-A[41] [marine type hardcoat]] [dark bronze anodized finish AA-[M32] [M12]-C22-A[42] [marine type hardcoat]].

C. **Marine Type Hardcoat**: Marine type hardcoat anodizing shall conform to MIL-A-8625C, Type III, Class 1, with 0.0020" minimum coating thickness.

2.4 SUB-ASSEMBLIES

A. **Height Requirements:** Top of upper railing shall be 42 inches above the working surface or finish grade. Toeboards shall be installed not more than 1/4-inch off the working surface and shall be provided where indicated and/or required by codes or standards. Handrail heights shall be per standards.

B. **Rectangular Sections:** Rectangular picket railing posts shall be not less than 1-1/2-inch

square, evenly spaced at not less than 4 feet nor more than 6 feet on centers. Field conditions may require some adjustment of spacing. Pickets shall be not less than 3/4-inch square and spaced not more than 6-1/2 inches on centers. Top rails and railings shall be not less than 2-1/2-inch by 1-1/8-inch and shall be provided with bottom enclosures. Bottom rails shall be not less than 1-3/8 inch by 1-inch and shall be provided with bottom enclosures. Top railings shall be as long as possible and the posts shall not project through the top rails. Toe board of picket rails shall function as a bottom rail enclosure. Handrails at stairs shall have both picket rails and round 1-1/2-inch diameter handrails.

C. **Round Sections:** Round tube and round picket railing posts shall be not less than 1-1/2-inch diameter, Schedule 40 pipe or 1-1/2-inch x 2-inches oval section. The posts shall be evenly spaced at not less than 4 feet nor more than 6 feet on centers. Field conditions may require some adjustment of spacing. Pickets shall be not less than 5/8-inch OD pickets, spaced at 4-1/2 inches on center; or 3/4-inch OD pickets, spaced at 6 inches on centers. Top rails and railings shall be not less than 1-1/2-inch OD pipe or 2-inch oval section. Rails may be type with bottom enclosures. Bottom rails shall be not less than 1-1/2-inch OD pipe or 1-7/8-inch diameter extrusion with bottom enclosures. The top railings shall be as long as possible and the post shall not project through the top rails. Toeboard of picket rails shall be a specially extruded, snap-in bottom rail enclosure with toeboard or special extruded centered toeboard that is screw applied to bottom of the bottom rail.

D. **Round Pipe Railing System (Guardrails):** Railing guardrail systems shall have rails spaced equally with equal open spaces between rails (and toeboard where required) with no open space larger than the following:

1. Public use areas, tour route, and Administration and Operations Buildings shall have no spaces larger than 6 inches per UBC requirements.

2. Industrial use areas, such as process and maintenance buildings and exit ways, shall have no spaces larger than 12 inches per UBC requirements.

3. Work areas and surfaces, such as rails around tanks, bridges to equipment and walkways at process units (not used as exit ways from any building), shall have no spaces larger than 15 inches. The railing shall be not less than a three railing system meeting Cal-OSHA requirements.

2.5 MANUFACTURERS OF RAILING SUB-ASSEMBLIES

A. Railing systems shall be manufactured by one of the following (or equal):

1. Round Pipe Railings:

"C-V Pipe Rail" by CraneVeyor Corp.
Moultrie Manufacturing Co., "Wesrail"

2. Rectangular Tube and Square Picket Railings:

Aluminum Tube Railing Co.
"Railtec 400" vertical bar railing by CraneVeyor Corp.

3. Round Tube and Round Picket Railings:

Oval-Tube Railing "IJ" (w/bottom fillers) by Aluminum Tube Railing Co.
"Baluster Railing", by CraneVeyor Corp.

PART 3 -- EXECUTION

3.1 COMPONENT SYSTEMS

A. Unless otherwise indicated, aluminum handrails and railings shall be component systems, installed complete and ready for use with all sleeves, grout, sealants, anchors, attachments, balusters, brackets, caps, fasteners, gates, posts, sleeves, trim, and all other related items required or necessary for the complete installation.

3.2 CRAFTSMANSHIP

A. WORK shall be performed by craftsmen experienced in the fabrication of architectural metal work. Exposed surfaces shall be free from defects or other surface blemishes. All dimensions and conditions shall be verified in the field in advance. All joints, junctions, miters, and butting sections shall be precision-fitted, with no gaps occurring between sections, and all surfaces shall be flush and aligned.

3.3 ALIGNMENT

A. Extruded, case, molded, or bent work shall be straight and with true edges. Railings and handrails shall be installed with continuous top rails, without post projections or other obstructions.

3.4 FABRICATION

A. Pipe cuts shall be clean, straight, square and accurate for minimum 1/8-inch joint gap. WORK shall be done in conformance with the handrail manufacturer's instructions. WORK shall be free from blemishes, defects, and misfits of any type which can affect durability, strength, or appearance.

B. Railing and handrail brackets shall be connected by screws or bolts. Holes shall be punched 1/16-inch larger than the nominal size of the fasteners, unless otherwise indicated. Wherever needed because of the thickness of the metal, holes shall be subpunched and reamed or drilled. Handrail components with mismatched holes shall be replaced. No drifting of bolts nor enlargement of holes will be allowed to correct misalignment.

C. Aluminum items in contact with concrete or steel or embedded in concrete shall be provided with an electrolysis protective material. The protective material shall be applied to the aluminum surface which will be in contact with the dissimilar material. Protection material shall be pressure tapes, coatings, or isolators.

D. Metal to be embedded in concrete shall be placed accurately and held in correct position while the grout is placed. Railing post shall not be installed until after concrete has attained its design strength.

E. Posts, except for removable railings, shall be provided with weep holes for condensation drainage within 3/16-inch of the finish deck.

3.5 WELD FINISH

A. Exposed welds shall be ground smooth and flush and shall be polished and anodized. Discoloration of exposed aluminum surfaces, whether or not due to welding, shall constitute a basis for rejection of the entire assembly.

3.6 EXPANSION/CONTRACTION

A. Exterior railing systems shall provide for 1/4-inch expansion and contraction per 20 linear feet of railing. Interior railing systems shall provide for 1/8-inch expansion or contraction per 20 linear feet of railing.

3.7 FASTENER FINISH

A. Stainless steel fasteners shall be painted to match adjacent aluminum finishes, except fasteners at clear anodized railings or elements shall not be painted.

3.8 RAILING CONTINUITY AND END TREATMENT

A. Handrails and railings shall be designed to form a continuous run system with elbow turns and bends that do not have interferences with hand movement. Handrails shall be continuous for the full length of the stairs and landings. The handrail shall extend no less than 12 inches beyond the top riser and one tread plus 12 inches wherever possible. At work areas and surfaces, handrail extensions need only meet the Cal-OSHA requirements where extensions cannot be provided as a straight run. The ends of handrails shall be returned to wall or shall be terminated in newel posts or safety terminals.

3.9 GATES AND REMOVABLE SECTIONS

A. Gates shall be provided with self-closing hinges and self-closing latch bolts. Removable handrail sections shall be provided where indicated. The gate and removable railing hardware's color shall match that of the railing system of which it is a part.

END OF SECTION