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| This guide specification was prepared utilizing 3-part format recommended by the Construction Specifications Institute (CSI), and generally incorporates recommendations from their SectionFormat/Page Format, and MasterFormat, latest Editions, insofar as practicable.  Carefully review and edit the text to meet the Project requirements and coordinate this Section with the remainder of the Specifications and the Drawings.  Where bracketed text is indicated, e.g. [text], make appropriate selection and delete the remainder of text within additional brackets, highlighting, and bold face type, if any.  Consult the manufacturer for assistance in editing this guide specification for specific Project applications where necessary.  This Specification was current at the time of publication but is subject to change. Please confirm the accuracy of these specifications with the manufacturer prior to use.    by |

**SECTION 05 73 00**

**PERFORATED ALUMINUM** **GUARDRAIL**

**PART 1 - GENERAL**

**1.01 SUMMARY**

A. Section Includes:

1. Prefabricated perforated aluminum Guardrail

2. Mounting components and accessories

3. Mechanical fasteners

B. Related Requirements:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

*SPECIFIER: Revise Section numbers and titles in paragraphs below per CSI MasterFormat and Project requirements.*

2. Section 01 33 00 - Submittal Procedures [**insert other title**]: For administrative and procedural requirements for processing of submittals during the construction phase.

3. Section 01 77 00 - Closeout Procedures [**insert other title**]: For administrative and procedural requirements for completion of the Work.

4. Section 05 05 13 - Shop-Applied Coatings for Metal: For coatings applied in the shop or factory.

5. Section 09 90 00 - Painting and Coating: For site finishing of railings.

**1.02 REFERENCES**

A. Reference Standards and Codes:

*SPECIFIER: Use care when indicating the edition date of the referenced standards; these standards are*

*subject to regular review, and updated accordingly.*

1. The Aluminum Association, Inc. (AA):

a. AA DAF-45, 2003(2009), Designation System for Aluminum Finishes

2. American Architectural Manufacturers Association (AAMA):

a. AAMA 611-14, Voluntary Specification for Anodized Architectural Aluminum

*SPECIFIER: Delete the subparagraph below if support posts are field-painted.*

b. AAMA 2605-17, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing High Performance Organic Coatings on Aluminum Extrusions and Panels

3. ASTM International (ASTM):

a. ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet

and Plate

b. ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

c. ASTM B429/B429M-10e1, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

d. ASTM B483/B483M-13e1, Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications

4. American Welding Society (AWS):

a. AWS D1.2/D1.2M-2014, Structural Welding Code - Aluminum

*SPECIFIER: Review and revise Codes indicated below, applicable to the location of the Project.*

5. International Building Code (IBC), 2012 Edition.

6. Minnesota State Building Code (MSBC), 2015 Edition

7. The Society for Protective Coatings (SSPC):

a. SSPC-Paint 15 (March 2004), Steel Joist Shop Primer/Metal Building Primer

b. SSPC-Paint 20 (November 2004), Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic)

**1.03 ADMINISTRATIVE REQUIREMENTS**

A. Coordination: Coordinate installation of anchorages for guardrail. 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. Deliver such items to Project site in time for installation.

**1.04 ACTION SUBMITTALS**

*SPECIFIER: Revise Section number in paragraph below per CSI MasterFormat and Project requirements.*

A. Submit in accordance with Section 01 33 00 [**insert other Section number**]:

1. Product Data: Material description and installation instructions for manufactured products.

2. Shop Drawings:

a. Include plans, elevations, sections, details, attachments, anchors, and size and type of fasteners, and accessories.

b. Indicate welded connections and details of welds.

3. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate delivery of such items to Project site.

4. Samples for Initial Selection: For products involving selection of color, texture, or design.

*SPECIFIER: Retain paragraph above if final finishes are not specified herein, or; retain paragraph below if final finishes are included in PART 2.*

5. Samples for Verification: For each type of exposed finish required.

a. Section of fence panel, including specified perforation design(s), in the finish specified.

1) Submit sample, minimum [**12**]x[**12**] inches.

**1.05 QUALITY ASSURANCE**

A. Comply with Standards and Codes listed in Article 1.02 REFERENCES.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, for aluminum.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Deliver, store and handle guardrail components in a manner that will prevent distortion or damage.

B. Store clear of the ground and protect from moisture and the elements.

C. Deliver items required to be built into concrete promptly to the site so they may be built in as the work progresses.

D. Do not install damaged and otherwise unsuitable material.

**1.07 FIELD CONDITIONS**

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1. Indicate field measurements on final shop drawings.

2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements.

3. Coordinate construction with work of other trades to ensure that actual dimensions correspond to guaranteed dimensions.

**1.08 WARRANTY**

*SPECIFIER: The paragraphs below designate a shop-applied anodized finish and a high-performance coating for guardrail; edit or choose below as required.*

A. Special Finish Warranty (Anodized Coating): Applicator's standard form in which applicator agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 1yr

B. Special Finish Warranty (High-Performance Organic Coatings): Applicator's standard form in which applicator agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

*SPECIFIER: Select Manufacturer or Fabricator in Article heading below.*

**2.01 ACCEPTABLE [MANUFACTURERS] [FABRICATORS]**

A. Astro Metal Craft

11059 Lamont Avenue NE

Hanover, MN 55341

(763)777-8087

www.astrometalcraft.com

*SPECIFIER: When the first paragraph below is selected, you may add additional requirements specific to this portion of the Work.*

B. Substitutions: Manufacturers seeking approval of their products are required to comply with [**Section 01 25 00**] [**insert other Section number**] [**the Owner's Instructions to Bidders, generally contained in the Project Manual**] [**and the following:**

**1.** ].

*SPECIFIER: Select paragraph B above if substitutions will be allowed during the bidding process, or;*

*Select paragraph B below for a proprietary specification when substitutions are NOT allowed.*

B. No substitutions are allowed.

**2.02 PERFORMANCE CRITERIA**

A. 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.

*SPECIFIER: Differential values in paragraph below (for aluminum in particular) are suitable for most of the United States.*

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

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

**2.03 MATERIALS**

A. General:

1. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2. Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper specified below.

3. Component Sizes: Unless otherwise specified herein, sizes are indicated on Drawings.

B. Perforated Guardrail Panels:

1. Aluminum Plate: ASTM B209, 5052 alloy; anodizing quality aluminum plate, 0.125-inch thick.

2. Panel Dimensions:

*SPECIFIER: Indicate perforation shape (shapes if more than one), perforation dimension (dimensions if more than one; each must EXCEED the thickness of the aluminum plate), perforation center-to-center dimensions, and other dimensional characteristics required to describe perforations, including distance between perforations (NOT less than the thickness of the aluminum plate).*

*NOT more than 10 different sizes and shapes of perforations are allowed.*

*MAXIMUM size of any perforation cannot exceed 2-1/2 inches.*

3. Perforations:

a. Shape(s): [**Square**] [**Round**] [**Insert other shape(s)**] holes, with [**insert size**] solid gaps between holes and 1-inch minimum solid edges.

b. Size(s):

1) Round Perforations: [**1-inch**] [**Insert other size(s)**] diameter.

2) Hole Centers: 2-inch c-c for 1-inch perforations [**Insert other size(s) for other size holes**].

*SPECIFIER: Indicate desired pattern below.*

a. Pattern: [**Straight pattern**] [**Straight pattern with custom voids as shown on the Drawings**] [**Insert other pattern**].

*SPECIFIER: Select subparagraph 3 above for perforations guidelines and specifications if other than design indicated below.*

3. Perforations: Round holes, 1-inch (2-inch c-c), and 1-inch minimum solid edges.

4. CAD file will be provided at manufacturer’s written request.

C. Aluminum Tube Posts: ASTM B221, 6061-T6 alloy, extruded tubing, 0.250-inch wall thickness.

D. Aluminum Tube Horizontals: ASTM B209, 5052 alloy; aluminum plate, 0.125-inch thick.

E. Exposed Fasteners: Button head screws or bolts, consistent with design of fence.

F. Welding Electrodes: Comply with AWS requirements in D1.1 and D1.2.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

G. Fasteners, Anchors and Inserts:

1. Aluminum Component Fasteners: Type 304 stainless‑steel fasteners.

2. Fasteners for Anchoring Support Posts to Concrete: Select fasteners of type, grade, and class required to produce connections suitable for anchoring posts to surface as indicated on Drawings and capable of withstanding design loads.

3 Inserts: Furnish inserts to be set or otherwise secured to supporting Work.

a. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.

**2.04 FABRICATION**

A. General:

1. Fabricate fence components 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.

C. Joinery and Terminations:

1. Fabricate components to produce joints tightly fitted and secured.

2. Form curved sections, if any, by rolling to produce uniform curvature indicated without buckling, twisting, or otherwise deforming exposed surfaces of fence panels.

3. Close exposed ends of tube supports by welding cover plate in place or by use of prefabricated fittings.

B. Accurately form components to suit specific project conditions and for proper connection to other construction.

1. Panels:

a. Perforations: Punch metals cleanly and accurately. Remove burrs.

b. Exposed Edges: Ease exposed edges to a radius of approximately 1/32 inch unless otherwise indicated.

e. Apply finish specified, after fabrication.

C. Dissimilar Metals: Provide nylon or other manufacturer suggested gaskets at mounting flanges, and other areas where fence panels or posts are scheduled to attach to dissimilar metals or concrete. Cut gaskets to match profile of mounting flange.

**2.05 FINISHES**

*SPECIFIER: Retain the paragraph below when shop-applied finish coatings are specified elsewhere; edit Section number if necessary.*

A. Fence Panels:

1. Anodized Finish: Clear anodized to comply with AA-M12C22A41 for a Class I coating, complying with AAMA 611.

B. Fence Posts:

1. High‑Performance Organic Finish: Two‑coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color and Gloss: [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**] [**Insert color and gloss**].

*SPECIFIER: Retain the paragraph below when shop-applied finish coatings are specified elsewhere; edit Section number if necessary.*

C. Refer to Section 05 05 13 for shop-applied finish coatings performed by others.

*SPECIFIER: Retain the paragraph below when support posts are field finished and delete paragraphs B and C above; edit Section number if necessary.*

D. Refer to Section 09 90 00 - Painting and Coating: For site finishing of support posts.

E. Protect shop-applied finishes on surfaces exposed to view in the finished Work from damage, by applying a temporary protective covering or by other methods recommended by the coating applicator before shipment.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

*SPECIFIER: Select correct entity in paragraph below.*

A. Examine substrates, areas, and conditions, with installer present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Notify the [**Contractor**] [**Construction Manager**] of conditions detrimental to performance of the Work and recommended corrections. Where the installation and its completion may be delayed due to existing conditions, follow notification immediately with a written report. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 PREPARATION**

A. Coordinate post setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete construction. Coordinate delivery of such items to project site.

B. Apply one coat of bituminous paint to concealed aluminum, steel and stainless-steel surfaces that will be in contact with cementitious or dissimilar materials.

**3.03 INSTALLATION**

A. General:

*SPECIFIER: Select correct entity in subparagraph below.*

1. Install in accordance with [**manufacturer's**] [**fabricator's**] instructions anchored securely to supporting construction.

2. Fit panels together to form tight, hairline joints, free from distortion and other defects.

3. Perform cutting, drilling, and fitting required for installing fence panels. Set panels accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

a. Do not weld, cut, or abrade surfaces of fence 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.

4. Align panel tops so variations from level for horizontal members do not exceed 1/4 inch in 12 feet unless otherwise shown on the Drawings.

5. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with concrete or dissimilar metals, with a heavy coat of bituminous paint.

6. Conceal anchor bolts and screws whenever possible.

B. Guardrail Posts and Panels:

1. Posts: Space posts at spacing indicated on final shop drawings. Plumb posts in each direction.

2. Panels: Set panels in proper location. Adjust panels prior to anchoring to ensure matching alignment of abutting joints and continuity of patterns, if any.

**3.04 INSTALLATION TOLERANCES**

A. Maximum Variation from Plumb: 1/4 inch per floor level, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

D. Posts: 1/16 inch in 3 feet.

**3.05 ADJUSTING**

A. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop. Make required alterations and refinish affected area so that it is indistinguishable from adjacent undamaged areas. Provide new components where finishes cannot be restored to undamaged condition.

**3.06 PROTECTION**

A. Protect finishes of guardrail components from damage during construction period with temporary protective coverings approved by guardrail manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION