SECTION 055119 - METAL GRATING STAIRS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Industrial Class stairs with steel-grating treads.

Steel railings and guards attached to metal stairs.

Steel handrails attached to walls adjacent to metal stairs.

* + - 1. COORDINATION
				1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
				2. Coordinate installation of anchorages for metal stairs**[, railings, and guards]**.

Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts,**[ blocking for attachment of wall-mounted handrails,]** and items with integral anchors, that are to be embedded in concrete or masonry.

Deliver such items to Project site in time for installation.

* + - * 1. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

Retain paragraph below if railings and guards are specified in this Section.

* + - * 1. Schedule installation of railings and guards so wall attachments are made only to completed walls.

Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For metal grating stairs and the following:

Gratings.

Woven-wire mesh.

Welded-wire mesh.

Shop primer products.

Grout.

* + - * 1. Sustainable Design Submittals:
				2. Shop Drawings:

Include plans, elevations, sections, details, attachment to other work, and welding procedure specifications (WPS).

Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.

Include plan at each level.

Retain subparagraph below if railings and guards are specified in this Section.

Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For stairs**[, railings, and guards]**, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of New York, responsible for their preparation.

Coordinate "Qualification Data" Paragraph below with qualification requirements in "Quality Assurance" Article.

* + - * 1. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed and registered in the State of New York.

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Consider retaining "Paint Compatibility Certificates" Paragraph below if primers are fully specified in this Section rather than in painting Sections.

* + - * 1. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

Retain "Source quality-control reports" Paragraph below if Contractor is responsible for source quality-control testing and inspecting.

* + - * 1. Source quality-control reports.

Use subparagraph below for projects over $100,000. See Article 1.4. below.

Documentation to confirm compliance

* + - 1. QUALITY ASSURANCE
				1. Installer Qualifications: Fabricator of products.

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

Use paragraph below for projects over $100,000. Paragraph is taken from Article 25.4 of the General Conditions.

* + - * 1. If the value of the contract exceeds $100,000 all structural steel, reinforcing steel and other major steel items to be incorporated in the Work of this Contract shall be produced and made in whole or substantial part in the United States, its territories or possessions.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Store materials to permit easy access for inspection and identification.

Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.

Protect steel members and packaged materials from corrosion and deterioration.

Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

Repair or replace damaged materials or structures as directed.

* + - * 1. Store and handle galvanized steel members per the recommendations of the American Galvanized Association.
1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional engineer, licensed and registered to practice in the State of New York, to design stairs**[, railings, and guards]**, including attachment to building construction.
				2. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

First three subparagraphs below are based on the NYSBC; revise to suit Project and to comply with requirements of authorities having jurisdiction.

Uniform Load: 100 lbf/sq. ft..

Concentrated Load: 300 lbf applied on an area of 4 sq. in..

Uniform and concentrated loads need not be assumed to act concurrently.

Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.

Retain option in subparagraph below or insert another requirement. The NYSBC limits deflection of floor members to L/360.

Limit deflection of treads, platforms, and framing members to L/360.

Retain "Structural Performance of Railings and Guards" Paragraph below if railings and guards are specified in this Section. See the Evaluations in Section 055213 "Pipe and Tube Railings" for information about performance requirements for railings.

* + - * 1. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

"Handrails and Top Rails of Guards" and "Infill of Guards" subparagraphs below are examples only and are based on the NYSBC; revise to suit Project and to comply with requirements of authorities having jurisdiction. For some occupancy categories under certain circumstances, less-stringent provisions may apply.

Handrails and Top Rails of Guards:

Uniform load of 50 lbf/ft. applied in any direction.

Concentrated load of 200 lbf applied in any direction.

Uniform and concentrated loads need not be assumed to act concurrently.

Infill of Guards:

Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..

Infill load and other loads need not be assumed to act concurrently.

Delete "Thermal Movements" Subparagraph below if only interior railings and guards are required.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

Differential values in "Temperature Change" Subparagraph below (for aluminum in particular) are suitable for most of the U.S.

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

Retain "Seismic Performance of Stairs" Paragraph below for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

* + - * 1. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

Component Importance Factor:  Per design parameters indicated.

* + - 1. METALS
				1. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

Retain material types, qualities, and grades in remaining paragraphs below that are indicated in the Specifications or on Drawings. Insert or delete items to suit Project.

* + - * 1. Steel Plates, Shapes, and Bars: ASTM A36.

"Rolled-Steel Floor Plate" Paragraph below specifies minimum yield point of 30 ksi; revise if higher strength is required.

* + - * 1. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.
				2. Steel Bars for Grating Treads: ASTM A36 or steel strip, ASTM A1011 or ASTM A1018.
				3. Steel Wire Rod for Grating Crossbars: ASTM A510.
				4. Aluminum Bars for Grating Treads: ASTM B221 extruded aluminum, alloys as follows:

6061-T6 or 6063-T6, for bearing bars of gratings and shapes.

6061-T1, for grating crossbars.

Retain "Steel Tubing for Railings and Guards" or "Steel Pipe for Railings and Guards" Paragraph below if steel railings and guards are specified in this Section. Usually allow fabricator to use either type of tubing in first paragraph unless structural engineer of record has designed railings and guards based on one tube type. If higher strength is required, consider specifying ASTM A513 Type 5 tubing or ASTM A513 tubing of a high-strength alloy, after verifying availability.

* + - * 1. Steel Tubing for Railings and Guards: **[ASTM A500 (cold formed)] [or] [ASTM A513]**.

Delete subparagraph below if railings are galvanized after fabrication or if not using galvanized railings.

Provide galvanized finish for exterior installations and where indicated.

Primary difference between round steel tubing and steel pipe is in outside dimensions. Pipe sizes are normally indicated by use of NPS designator and weight class or schedule number; for tubing, OD and wall thickness are used. See Section 055213 "Pipe and Tube Railings."

Type, grade, and weight in "Steel Pipe for Railings and Guards" Paragraph below are typical default requirements; revise to suit Project.

* + - * 1. Steel Pipe for Railings and Guards: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

Delete paragraph below if railings and guards are galvanized after fabrication or if not using galvanized railings and guards.

* + - * 1. Provide galvanized finish for exterior installations and where indicated.

Retain one of or both "Woven-Wire Mesh" paragraphs below when applicable. First paragraph is for steel material; second paragraph is for aluminum material. Revise pattern and wire size in both paragraphs if required.

* + - * 1. Woven-Wire Mesh: Intermediate-crimp, **[diamond] [square]** pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal-diameter steel wire complying with ASTM A510.
				2. Woven-Wire Mesh: Intermediate-crimp, **[diamond] [square]** pattern, 2-inch woven-wire mesh, made from 0.162-inch- diameter, aluminum wire complying with ASTM B211, Alloy 6061-T94.
				3. Welded-Wire Mesh: **[Diamond] [Square]** pattern, 2-inch welded-wire mesh, made from 0.236-inch nominal-diameter steel wire complying with ASTM A510.

Use the Article below for DOCCS projects where there is inmate contact.

* + - * 1. Welded-Wire Mesh: Intermediate-crimp or lock-crimp as indicated, Square pattern, 2-inch welded-wire mesh, made from 0.375-inch nominal-diameter steel wire complying with ASTM A510.

Use the Article below for DOCCS projects where non-climbing mesh is required and there is inmate contact.

* + - * 1. Welded-Wire Mesh: Intermediate-crimp or lock-crimp as indicated, 0.50-inch by 3-inch by 0.128 (10 ga) welded-wire mesh, complying with ASTM A510.
				2. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.
				3. Cast-Abrasive Nosings: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.
			1. FASTENERS
				1. General: Provide **[zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5] [Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5]** where built into exterior walls.

Select fasteners for type, grade, and class required.

Retain "Fasteners for Anchoring Railings and Guards to Other Construction" Paragraph below if railings and guards are specified in this Section.

* + - * 1. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated**[ and capable of withstanding design loads]**.
				2. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

Structural Steel Connections: ASTM F3125, Grade A325 Type 1.

* + - * 1. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for **[exterior stairs] [stairs indicated to be galvanized] [stairs indicated to be shop primed with zinc-rich primer]**.

If retaining "Post-Installed Anchors" Paragraph below, indicate loads on Drawings and verify safety factors with Project's structural engineer.

* + - * 1. Post-Installed Anchors: **[Torque-controlled expansion anchors] [or] [chemical 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 E488, conducted by a qualified independent testing agency.

Material in "Material for Interior Locations" Subparagraph below protects against corrosion in an indoor atmosphere.

Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

Alloy Group 1 (A1) refers to Type 304 and similar alloys, and Alloy Group 2 (A4) refers to Type 316 and similar alloys.

Material for Interior Locations Where Stainless Steel Is Indicated: Alloy **[Group 1] [Group 2]** stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

Material for Exterior Locations: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

* + - 1. MISCELLANEOUS MATERIALS
				1. Welding Electrodes: Comply with AWS requirements and welding procedure specification.

Retain one or more of "Shop Primers," "Universal Shop Primer," "Zinc-Rich Primer," and "Shop Primer for Galvanized Steel" paragraphs below. "Universal Shop Primer" Paragraph specifies a typical primer for painted finishes that provides minimum protection to steel. "Zinc-Rich Primer" and "Shop Primer for Galvanized Steel" paragraphs specify primers suitable for high-performance coatings.

* + - * 1. Shop Primers: Provide primers that comply with **[Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]**
				2. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

In "Zinc-Rich Primer" Paragraph below, Type II, Level 2 is common.

* + - * 1. Zinc-Rich Primer: Comply with SSPC-Paint 20, **[Type I-A] [Type I-B] [Type I-C] [Type II]**, Level **[1] [2] [3]**, and compatible with topcoat.
				2. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
				3. Galvanizing Repair Paint: High-zinc-dust-content paint complying with **[SSPC-Paint 20] [ASTM A780]** and compatible with paints specified to be used over it.

Retain "Nonmetallic, Shrinkage-Resistant Grout" Paragraph below for stairs having stringers or supports with grouted baseplates.

* + - * 1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for **[interior] [exterior]** use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
			1. FABRICATION, GENERAL
				1. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

Join components by welding or bolting unless otherwise indicated.

Use connections that maintain structural value of joined pieces.

* + - * 1. Assemble stairs**[, railings, and guards]** in shop to greatest extent possible.

Disassemble units only as necessary for shipping and handling limitations.

Clearly mark units for reassembly and coordinated installation.

* + - * 1. Cut, drill, and punch metals cleanly and accurately.

Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.

Remove sharp or rough areas on exposed surfaces.

* + - * 1. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
				2. Form exposed work with accurate angles and surfaces and straight edges.
				3. Weld connections to comply with the following:

Comply with AWS requirements and approved welding procedure specifications.

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

Delete first subparagraph below if appearance is not important or if economy is more important.

Weld exposed corners and seams continuously unless otherwise indicated.

At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish # 3 - Partially dressed weld with spatter removed] [Finish #4 - Good quality, uniform undressed weld with minimal splatter]**.

* + - * 1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

On DOCCS projects delete the first option below and retain the second option.

Where exposed fasteners are required, use **[Phillips flat-head (countersunk)][Security Torx style fastener head ]**screws or bolts unless otherwise indicated.

Locate joints where least conspicuous.

Fabricate joints that are exposed to weather in a manner to exclude water.

Provide weep holes where water may accumulate internally.

* + - 1. FABRICATION OF STEEL-FRAMED STAIRS

NAAMM standard in "NAAMM Stair Standard" Paragraph below includes only minimal requirements.

* + - * 1. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.
				2. Stair Framing:

Steel plate stringers are less expensive than channels, except for longer spans, and allow railing posts to be welded to face of stringer. Allowing either plates or channels gives fabricator maximum flexibility.

Fabricate stringers of steel **[plates] [or] [channels]**.

Stringer Size: **[As required to comply with "Performance Requirements" Article] [As indicated on Drawings]**.

Provide closures for exposed ends of channel stringers.

Finish: **[Shop primed] [Painted] [Galvanized]**.

Construct platforms and tread supports of steel **[plate] [or] [channel]** headers and miscellaneous framing members as **[required to comply with "Performance Requirements" Article] [indicated on Drawings]**.

Provide closures for exposed ends of channel framing.

Finish: **[Shop primed] [Painted] [Galvanized]**.

Weld**[ or bolt]** stringers to headers; weld**[ or bolt]** framing members to stringers and headers.

Where stairs are enclosed by gypsum board**[ shaft-wall]** assemblies, provide hanger rods or struts to support landings from floor construction above or below.

Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

Options in first subparagraph below are examples only. Retain second subparagraph to allow fabricator to size for loads given in Part 1. Floor openings in areas required to be accessible to people with disabilities are limited to 1/2 inch in width by the ADA-ABA Accessibility Guidelines and UNIFORM CODE A117.1. This spacing is not close enough to support some high-heeled shoes.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Fabricate treads and platforms from **[welded steel] [or] [pressure-locked steel] [pressure-locked aluminum]** grating with **[1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c.] [1-by-3/16-inch bearing bars at 11/16 inch o.c.] [1-by-1/8-inch bearing bars at 7/16 inch o.c.]** and crossbars at 4 inches o.c.

Fabricate treads and platforms from **[welded steel] [or] [pressure-locked steel] [pressure-locked aluminum]** grating with openings in gratings no more than **[5/16 inch] [1/2 inch] [3/4 inch] [1 inch]** in least dimension.

Surface: **[Plain] [Serrated]**.

Finish: **[Shop primed] [Painted] [Galvanized] [Mill]**.

Fabricate grating treads with **[rolled-steel floor plate] [cast-abrasive]** nosing and with steel angle or steel plate carrier at each end for stringer connections.

Secure treads to stringers with bolts.

Fabricate grating platforms with nosing matching that on grating treads.

Secure grating to platform framing **[by welding] [with bolts]**.

Retain one of two options in "Risers" Paragraph below.

* + - * 1. Risers: **[Open] [Solid]**.

Retain "Toe Plates" Paragraph below if required for protection against objects falling over edge of traffic surfaces.

* + - * 1. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.

Material and Finish: Steel plate to match finish of other steel items.

Fabricate to dimensions and details indicated.

* + - 1. FABRICATION OF STAIR RAILINGS AND GUARDS

Retain first paragraph below and delete remainder of this article if Section 055213 specifies railings and guards for metal grating stairs.

* + - * 1. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
				2. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

Rails and Posts: Minimum 1/4-inch wall thickness **[1-5/8-inch- diameter] [1-1/2-inch- square]** top and bottom rails and 1-1/2-inch- square posts.

Retain one infill configuration from three subparagraphs below or revise depending on style of railing used and code requirements. See NYSBC for exceptions to passage of 4-inch diameter sphere requirement. Delete all if configuration is indicated on Drawings.

Picket Infill: **[1/2-inch-] [3/4-inch] [round] [square]** pickets spaced to prohibit the passage of a 4-inch diameter sphere.

Coordinate selection in "Mesh Infill" Subparagraph below with retained wire mesh pattern.

Mesh Infill: **[Woven] [Welded]**-wire mesh **[crimped] [welded]** into 1-by-1/2-by-1/8-inch steel channel frames. Orient wire mesh with **[diamonds vertical] [wires perpendicular and parallel to top rail] [wires horizontal and vertical]**.

The NYSBC allows configurations in "Intermediate Rails Infill" Subparagraph below only for certain occupancies and applications. Verify required rail spacing before retaining.

Intermediate Rails Infill: **[1-5/8-inch- diameter] [1-1/2-inch- square]** intermediate rails spaced less than **[12 inches] [21 inches]** clear.

* + - * 1. Welded Connections: Fabricate railings and guards with welded connections.

Fabricate connections that are exposed to weather in a manner that excludes water.

Provide weep holes where water may accumulate internally.

Cope components at connections to provide close fit, or use fittings designed for this purpose.

Weld all around at connections, including at fittings.

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove flux immediately.

Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #3 - Partially dressed weld with spatter removed] [Finish #4 - Good quality, uniform undressed weld with minimal splatter]** as shown in NAAMM AMP 521.

* + - * 1. Form changes in direction of railings and guards as follows:

Retain one of five subparagraphs below.

As detailed.

Retain one of first three subparagraphs below if bending is used. First subparagraph allows fabricator to choose radius of bends. Second is for flush (zero-radius) bends. Third is for radii that are indicated on Drawings.

By bending**[ or by inserting prefabricated elbow fittings]**.

By flush bends**[ or by inserting prefabricated flush-elbow fittings]**.

By radius bends of radius indicated**[ or by inserting prefabricated elbow fittings of radius indicated]**.

Retain subparagraph and one of three options below if bending is not used. First option allows fabricator to choose radius of fittings. Second is for flush (zero-radius) fittings. Third is for radii that are indicated on Drawings.

By inserting prefabricated **[elbow fittings] [flush-elbow fittings] [elbow fittings of radius indicated]**.

Retain first paragraph below unless all bends are made with standard elbow fittings.

* + - * 1. For changes in direction made by bending, use 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.

* + - * 1. Close exposed ends of railing and guard members with prefabricated end fittings.
				2. 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 or less.

* + - * 1. Connect posts to stair framing by direct welding unless otherwise indicated.
				2. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

Delete inapplicable requirements in subparagraphs below or revise to suit Project.

For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

Provide type of bracket **[with flange tapped for concealed anchorage to threaded hanger bolt] [with predrilled hole for exposed bolt anchorage]** and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

Retain "Fillers" Paragraph below if railings are supported from plaster or gypsum board walls.

* + - * 1. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

* + - 1. FINISHES
				1. Finish metal stairs after assembly.
				2. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.

Retain first subparagraph below if galvanized items are painted.

Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

Generally, retain subparagraph below for railings and guards hot-dip galvanized after fabrication.

Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

* + - * 1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."] [SSPC-SP 3, "Power Tool Cleaning."] [minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:]**

Retain one or more of three subparagraphs below to suit Project service conditions of installed work. Insert other exposures and preparation requirements where applicable. See SSPC's painting manual.

Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Retain first "Interior Stairs" Subparagraph below for stairs that are to receive zinc-rich primer or primer specified in Section 099600 "High-Performance Coatings."

Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."

* + - * 1. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

Stripe painting adds cost but helps ensure that hard-to-reach areas, such as crevices, inside corners, and welds, are thoroughly coated and that sharp edges (which are vulnerable to chipping and are where the film may be thinner due to surface tension) receive adequate coverage.

Stripe paint corners, crevices, bolts, welds, and sharp edges.

1. EXECUTION
	* + 1. EXAMINATION
				1. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

* + - * 1. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. INSTALLATION OF METAL STAIRS

This article generally applies to set on concrete floors or pavements.

* + - * 1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

* + - * 1. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
				2. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

Retain subparagraph below where stair vertical supports are supported on concrete or masonry.

Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.

Clean bottom surface of baseplates.

Set steel-stair baseplates on wedges, shims, or leveling nuts.

After stairs have been positioned and aligned, tighten anchor bolts.

Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.

Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

Neatly finish exposed surfaces; protect grout and allow to cure.

Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

* + - * 1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
				2. Fit exposed connections accurately together to form hairline joints.

Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Comply with requirements for welding in "Fabrication, General" Article.

* + - 1. INSTALLATION OF RAILINGS AND GUARDS

Retain this article for railings and guards specified in this Section.

* + - * 1. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

Space posts at spacing indicated or, if not indicated, as required by design loads.

Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.

Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.

Secure posts, rail ends, and guard ends to building construction as follows:

Anchor posts to steel by **[welding] [or] [bolting]** to steel supporting members.

Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

* + - * 1. Attach handrails to wall with wall brackets.

Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

Secure wall brackets to building construction as**[ required to comply with performance requirements.][ follows:]**

For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

For hollow masonry anchorage, use toggle bolts.

For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

Retain one of two subparagraphs below if using steel studs.

For steel-framed partitions, use hanger or lag bolts set into **[fire-retardant-treated ]**wood backing between studs. Coordinate with stud installation to locate backing members.

For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

* + - 1. REPAIR

Retain first "Touchup Painting" Paragraph below if touchup painting is included in this Section.

* + - * 1. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

Retain "Touchup Painting" Paragraph below if touchup painting is specified in Section 099123 "Interior Painting."

* + - * 1. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in **[Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]**
				2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 055119