

## SECTION 05510 - METAL STAIRS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:

- 1. Steel-framed stairs with concrete-filled treads.

- B. Related Sections: The following Sections contain requirements that relate to this Section.

- 1. Division 5 Section "Pipe and Tube Railings" (**Refer to this section for stair guards and railing information**)
- 2. Division 5 Section "Metal Fabrications"
- 3. Division 9 Section "Painting" for finish painting by General Construction Contractor.
- 4. Division 10 Section "Signage" for providing stairway tactile exit signs.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and install steel stairs to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of steel stairs.

- 1. Treads and Platforms of Steel Stairs: Capable of withstanding a uniform load of **100 lbf per sq. ft. (4.8 kN/sq. m)** or a concentrated load of **300 lbf (1.35 kN)** on a area of **4 sq. inches (26 sq. cm)** located in the center of the tread, whichever produces the greater stress.
- 2. Stair Framing: Capable of withstanding stresses resulting from loads specified above as well as stresses resulting from railing system loads.
- 3. Limit deflections of treads, platforms and framing members to L/360 or ¼ inch, whichever is less.

- B. Structural Performance: Engineer, fabricate, and install handrails and guard railing system to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication.

- 1. Top Rails of Guards:
  - a. Concentrated load of **200 lbf** applied in any direction.
  - b. Uniform load of **50 lbf per linear foot** applied in any direction.
  - c. Concentrated and uniform loads above need not be assumed to act concurrently.
- 2. Handrails:
  - a. Concentrated load of **200 lbf** applied in any direction.
  - b. Uniform load of **50 lbf per linear foot** applied in any direction.

- c. Concentrated and uniform loads need not be assumed to act concurrently.
  - 3. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
- C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to 2015 International Building Code Requirements.

#### 1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for metal stairs, prefilled metal pan stair treads, nonslip aggregates and nonslip aggregate surface finishes, cast nosings, extruded nosings, steel floor plate, paint products, and grout.
- C. Shop drawings detailing fabrication and installation of steel stairs. Include plans, elevations, sections, and details of steel stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
  - 1. For installed steel stairs indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
- D. Signed and sealed calculations prepared by professional engineer (licensed in the state of New Jersey) for the stair framing for review by the architect.
- E. Samples for initial selection of the following products, in the form of manufacturer's color charts or sections of units showing the full range of colors and patterns.
- F. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, and other information specified.

#### 1.5 QUALITY ASSURANCE

- A. Standards: Comply with the following: E119 fire tests of building construction and materials.
- B. Fabricator Qualifications: Firm experienced in producing steel stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.
- C. Installer Qualifications: Arrange for steel stair installation specified in this Section by the same firm that fabricated them.
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
  - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering preassembled stair units that may be incorporated in the Work include, but are not limited to, the following:
1. American Stair Corp., Inc.
  2. The Sharon Companies, Ltd.
  3. Local Iron Works
  4. Or Approved Equal

### 2.2 FERROUS METALS

- A. Metal Surfaces, General: For surfaces exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, roughness, or, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: [ASTM A 36](#) ([ASTM A 36M](#)).
- C. Steel Tubing: Product type (manufacturing method) and as follows:
1. Cold-Formed Steel Tubing: ASTM A 500.
  2. Hot-Formed Steel Tubing: ASTM A 501.
    - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
- D. Rolled Steel Floor Plate: [ASTM A 786](#) ([ASTM A 786M](#)).
- E. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade as follows:
1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
    - a. Grade A, unless otherwise indicated or required by design loading.
  2. Hot-Rolled Structural Steel Sheet: [ASTM A 570](#) ([ASTM A 570M](#)), grade as follows:
    - a. Grade 30, unless otherwise indicated or required by design loading.
- F. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:
1. Cold-Rolled Steel Sheet: [ASTM A 366](#) ([ASTM A 366M](#)).
  2. Hot-Rolled Steel Sheet: [ASTM A 569](#) ([ASTM A 569M](#)).
- G. Galvanized Steel Sheet: Quality as follows:
1. Structural Quality: [ASTM A 446](#); [Grade A, G 90](#) ([ASTM A 446M](#)); [Grade A, Z 275](#)) coating, unless otherwise indicated, or unless another grade is required for design loading.
  2. Commercial Quality: [ASTM A 526](#) ([ASTM A 526M](#)), [G 90 \(Z 275\)](#) coating designation, unless otherwise indicated.

- I. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.
- J. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

## 2.3 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head type, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.
- C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).
- D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).
- E. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).
- F. Lock Washers: Helical, spring type, carbon steel, ANSI B 18.21.1.
- G. Expansion Anchors: Anchor bolt and sleeve assemblies of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
  - 1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

## 2.4 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

## 2.5 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- C. Products: Subject to compliance with requirements, provide one of the following:

1. Nonshrink, Nonmetallic Grouts:
  - a. Euco N-S Grout; Euclid Chemical Co.
  - b. Five Star Grout; Five Star Products.
  - c. Crystex; L&M Construction Chemicals, Inc.
  - d. Masterflow 928 and 713; Master Builders Technologies, Inc.
  - e. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
  - f. Or approved equal.

## 2.6 CONCRETE FILL AND REINFORCING MATERIALS

- A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 2,500 psi, unless higher strengths indicated.
- B. Nonslip Aggregate Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rust-proof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- C. Concrete fill for metal pan treads and platforms shall be installed by the General Construction Contractor.

## 2.7 FABRICATION, GENERAL

- A. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Shear and punch metals cleanly and accurately.
- D. Remove sharp or rough areas on exposed surfaces.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Weld corners and seams continuously to comply with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

- H. Shop Assembly: Preassemble in shop to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces. Clearly mark units for field assembly and coordinated installation.

## 2.8 STEEL-FRAMED STAIRS

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, guard railing system, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
  - 1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.
    - a. Commercial class, unless otherwise indicated.
  - 2. Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.
- B. Stair Framing: Fabricate stringers of structural steel channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.
  - 1. Where masonry walls support steel stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Risers, Subtreads, and Subplatforms: Shape metal pans for risers and subtreads to conform to configuration shown. Provide thicknesses of structural steel sheet for metal pans indicated, but not less than that required, to support total design loading.
  - 1. Form metal pans of uncoated cold-rolled steel sheet, unless otherwise indicated.
  - 2. Form metal pans of uncoated hot-rolled steel sheet, unless otherwise indicated.
  - 3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
  - 4. Shape metal pans to include nosing integral with riser.
  - 5. At Contractor's option, provide prefabricated stair assemblies with prefilled treads consisting of prepoured reinforced concrete fill, with nonslip aggregate finish, in welded sheet metal pan, attached to installed stringers using manufacturer's standard connection detail.
  - 6. Provide reinforced concrete (2,500 psi) treads with slip-resistant, abrasive surface.
  - 7. Provide subplatforms of configuration and construction indicated; if not indicated, of same metal as risers and subtreads, in thicknesses required to support design loading. Attach subplatform to platform framing members with welds.
    - a. Smooth Soffit Construction: Construct subplatforms with smooth soffits.

## 2.9 FINISHES

- A. General: Finish metal stairs after assembly.
  - 1. Comply with NAAMM "Metal Finishes Manual" for recommendations on application and designations of finishes.

- B. Galvanizing: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:
  - 1. Fill vent and drain holes that will be exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed units:
  - 1. Exteriors (SSPC Zone 1B): SSPC SP 6 "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC SP 3 "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces, except those with galvanized finish or those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, weld plates, and anchor bolts. Coordinate delivery of such items to Project site.

### 3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Install steel stairs by welding stair framing to steel structure or to weld plates cast into concrete, except where otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted field connections.
- F. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with concrete or dissimilar metals with a heavy coat of bituminous paint.

### 3.3 INSTALLING STEEL STAIRS WITH GROUTED BASE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base plates.
- B. Set steel stair base plates on wedges or other adjustable devices. After the stairs have been positioned and aligned, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
  1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
  2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.4 ADJUSTING AND CLEANING

- A. 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 requirements for touching up field-painted surfaces.
  1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on steel stairs are specified in Division 9 Section "Painting."
- C. For galvanized surfaces, clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

**END OF SECTION 05510**