

SECTION 05500  
METAL FABRICATIONS

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.

1.02 SUMMARY

- A. Work includes the following metal fabrications:
1. Miscellaneous framing and supports.
  2. Roof ladders.
  3. Ductwork bridge on roof.
  4. Railings, guardrails and gates.
- B. Related Work Specified in Other Sections:
1. Wood blocking in walls and above ceilings for support of wall- and ceiling-mounted items: Section 06100 - Rough Carpentry.
  2. Magnetic gate hold-open device: Section 08710 for device and Division 13 section for connection to fire-alarm system for release.
  3. Sleeves for pipes and conduits; light iron racks and support framing for mechanical and electrical equipment: Division 15 and 16 sections.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. Ladders: Comply with ANSI A14.3.
- B. Ductwork Bridge: Fabricate the bridge assembly, including gratings, supports, access stair or ladder, and connections capable of withstanding structural loading conditions as summarized below, without exceeding the allowable design working stress of steel materials, anchors and connections.
1. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and of a uniform load of 60 lbf/sq. ft. or a concentrated load of 300 lbf applied at midspan, whichever produces the greater stress.
  2. Limit deflection to L/360 or 1/4 inch, whichever is less.
- C. Provide handrails and guardrails, including anchors and connections, capable of withstanding structural loading conditions as summarized below, without exceeding the allowable design working stress of materials.
1. Guardrails:
    - a. Uniform Load: 50 lbf/ft. (pound-force per linear foot) applied in any direction at the top and to transfer this load through the supports to the structure.

- b. Concentrated Load: 200 lbf applied in any direction and at any point along the top. Provide attachment devices and supporting structure capable of transferring this loading to appropriate structural elements of the building.
  - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Intermediate rails, balusters, and panel fillers: Designed to withstand a horizontally applied normal load of 50 lb on an area not to exceed 1 ft. square, including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of subparagraph 1, above.
- D. Miscellaneous Supports: Design, fabricate and install miscellaneous supports to withstand applicable dead and live 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 respective component of each metal fabrication.

#### 1.04 SUBMITTALS

- A. Product data: Submit manufacturer's specifications and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.
- B. Shop drawings: Prepare and submit detailed fabrication and erection drawings for the metal fabrications listed below. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - 1. Ladders.
  - 2. Ductwork bridge.
  - 3. Miscellaneous framing and supports.
  - 4. Grillage framing.
- C. Samples: Submit representative samples of materials and finished products as may be requested by Architect.
- D. Quality Assurance Submittals: Submit data substantiating qualification of firms and persons specified in "Quality Assurance" article.
  - 1. Fabricator and Installer: List of completed projects with project name, brief description, addresses, names of Architects and Owners. Submit additional information which demonstrates capabilities and experience if requested by Architect.
  - 2. Welders: Certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
  - 3. Professional Engineer: Evidence of registration or licensing; list of similar projects and experience.

#### 1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

- B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
  - C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," 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.
  - D. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
  - E. Certificate of Compliance for Galvanizing: Submit notarized Certificate of Compliance signed by galvanizer, stating that products furnished for installation in this project comply with requirements of the specifications with respect to zinc hot-dip coatings.
  - F. Templates: Furnish templates for anchors and bolts specified for installation under other sections.
- 1.06 PROJECT CONDITIONS
- A. Field Measurements: Verify actual locations of walls, ducts, structural supports for metal fabrications, rooftop HVAC equipment, and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.01 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
  - 1. For steel which is to be hot-dip galvanized, provide steel chemically suitable for galvanizing complying with the recommendations of ASTM A 358.
- B. Steel Plates, Angles, Channels, and Bars: ASTM A 36/A 36M.
- C. Steel Shapes: ASTM A 992 Grade 50.
- D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- E. Malleable Iron Castings: ASTM A 47, grade 32510 (ASTM A 47M, Grade 22010).
- F. Gray Iron Castings: ASTM A 48, Class 30 (ASTM A 48M, Class 200), unless another class is indicated or required by structural loads.

- G. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

## 2.02 STEEL GRATING

- A. Welded Steel Grating, General: Furnish welded steel bar grating, with bearing and crossbars of dimensions and spacing as required to meeting structural performance requirements, but not less than that specified below:
- B. For platform, stairs and treads:
  - 1. Bearing Bar Spacing: 1-3/16 inches o.c.
  - 2. Bearing Bar Depth and Thickness: Not less than 1 inch deep and 1/8 inch thick.
  - 3. Crossbar Spacing: 4 inches o.c. maximum.
  - 4. Traffic Surface: Serrated.
  - 5. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.
- C. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.

## 2.03 PAINTS

- A. Alkyd Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in 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 specified in Section 09900 (if applicable) despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Primers and Paints for Field Touch-Up: For touch-up, use same materials applied in the shop.

## 2.04 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

## 2.05 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated.
- B. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Shear and punch metals cleanly and accurately. Remove burrs.
- D. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- I. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Range: 120°F (67°C), ambient; 180°F (100°C), material surfaces.
- J. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- K. Remove sharp or rough areas on exposed traffic surfaces.

- L. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- M. Items to be Galvanized: To the extent possible, design fabrications which are indicated to be hot-dip galvanized in accordance with the following:
  - 1. Comply with design recommendations of ASTM A 385, "Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)."
  - 2. Design fabrications so that they will not have to be field-welded unless field welding is specifically required by the Drawings or Specifications. For example connect railings by slip-fit method and connect other fabrications by bolted connections wherever possible.
  - 3. Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

## 2.06 STEEL AND IRON FINISHES

- A. Galvanizing: Galvanize items which are to be installed at exterior locations and in exterior walls, unless otherwise indicated, and galvanize interior items which are indicated to be galvanized. Apply galvanizing coating to meet the following standards, and without flux inclusions on the surface.
  - 1. Apply zinc alloy coating by the dry-kettle hot-dip process.
  - 2. ASTM A 153 for galvanizing iron and steel hardware.
  - 3. ASTM A 123 for galvanizing iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Shop Priming of Steel, General: Shop prime steel items except those which are shown or specified as galvanized, and those which are entirely embedded in concrete or masonry or covered by sprayed-on fireproofing.
  - 1. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting. Prime paint edges, corners, crevices, bolts, welds, and sharp edges.
  - 2. Prepare metal surfaces, mix and apply primers in accordance with paint manufacturer's recommendations, using brush or spray.
- C. Corrosion Resistant Alkyd Primer: Apply to items which are indicated to be primed, and which are scheduled to be field finished with alkyd or latex paint, or to receive no finish coat.
  - 1. Preparation: Prepare metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
    - a. Exterior (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
    - b. Interior (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning:"

## 2.07 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3.
- B. Side Rails: Continuous steel flat bars, 1/2 inch x 2-1/2 inches, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: Round steel bars, 3/4 inch diameter, with non-slip surface provided either by coating the rung with aluminum oxide granules set in epoxy resin adhesive or by using a type of manufactured rung which is filled with aluminum oxide grout. Space rungs 12 inches o.c.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" o.c. by means of welded or bolted steel brackets.
  - 1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.
  - 2. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.
- F. Galvanize ladders and ladder fasteners.

## 2.08 DUCTWORK BRIDGE

- A. General: Fabricate bridge assembly, including access stairs or ladders, platform, supports, and guard rails for the location shown, with dimensions, spacings, details and anchorages as indicated. To the extent such information is not indicated on Drawings, option is the Comply with structural performance requirements specified in the Quality Assurance Article.
- B. Supporting Structure: Fabricate from ASTM A36 structural steel shapes or tubing. Design substructure so that it rests on or is hung from the pair of beams that are being traversed. Supports which rest on the roof deck or which require penetration of the roofing assembly will not be acceptable.
  - 1. Close exposed ends of tubing by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.
- C. Platform: Fabricate from hot-dip galvanized steel welded bar grating. Provide raised toe-guards at platform edges.
- D. Railings: Provide handrails at stairs, and provide guard rails at stairs and platform edges as required by applicable OSHA regulations and as required to support structural loads.

1. Guard rail is not required where there is no possibility of falling off the edge of stair or platform because there is an adjacent wall or solid structure.
  2. Interconnect railing and handrail members by butt-welding or welding with internal connectors. At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.
  3. Provide internal venting of hollow members as required for hot-dip galvanizing after fabrication.
  4. Bending Pipe: Unless preformed elbow fittings are used, bend pipe in jigs to produce uniform curvature and maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
  5. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.
- E. Finish: Hot-dip galvanize bridge assembly after fabrication. Galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

#### 2.09 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Unless otherwise indicated, provide for anchors spaced 24 inches o.c. maximum, and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.
- C. Galvanize miscellaneous framing and supports installed in exterior locations and in or above ceilings of toilet rooms. Shop prime other interior framing and supports.

#### 2.10 RAILING AND GATE

- A. Fabricate from steel shapes and perforated steel sheet, in configuration shown on Drawings.
1. Perforated Steel Sheet: 0.105 inch nominal thickness (12 gauge), with round perforations. Architect will specify perforation pattern if not shown on Drawings.
- B. Hardware: Provide self-closing hinges for hanging gate and latch.
- C. Metal Finish: Shop prime for field painting; at Contractor's option, gate and railing may be shop painted with paint system specified in Section 09900.



## PART 3 - EXECUTION

### 3.01 PREPARATION

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

### 3.02 INSTALLATION

- A. **Fastening to In-Place Construction:** Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. **Cutting, Fitting, and Placement:** Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication 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. 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 which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- D. **Field Welding:** Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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 contour of welded surface matches those adjacent.

### 3.03 FIELD QUALITY CONTROL

- A. Owner's Testing and Inspection Agency will inspect bolted and welded connections and perform tests and prepare test reports, including interpretations.
- B. Testing agency may inspect miscellaneous metal fabrications at plant before shipment. Provide access as requested by the testing agency so that testing and inspection can be accomplished.
- C. For fabrications which are required to meet specified structural strength or performance requirements, Testing and Inspection Agency may, at its discretion, perform any tests and inspections which are typically performed for structural steel fabrications.

- D. Correct deficiencies in metal fabrications that inspections and laboratory test reports have indicated to be not in compliance with requirements. Owner's Testing and Inspection Agency may perform additional tests as it deems necessary to confirm compliance of corrected work; Contractor shall pay for such additional testing.

3.04 ADJUSTING AND CLEANING

- A. Touch-Up 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 touch-up of field painted surfaces.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanizing Repair: For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500