

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; furnish and install, except as noted.
1. Safety cage at existing ladder.
 2. Loose steel lintels; furnish to masonry trade for installation.
 3. Elevator pit ladder.
 4. Miscellaneous framing and supports for the following:
 - a. Elevator door sills.
 - b. Applications where framing and supports are not specified in other sections.
- B. Related Work Specified in Other Sections:
1. Concrete fill for stair pans: Section 03310.
 2. Installation of loose lintels: Section 04810
 3. Structural steel framing system components; loose bearing and leveling plates; shelf or relieving angles attached to structural steel or structural concrete: Section 05120.
 4. Prefabricated metal stair, including railings and handrails: Section 05510, "Metal Stairs."
 5. Wood blocking in walls for support of wall-mounted items: Section 06100 - Rough Carpentry.
 6. Elevator guide rails including anchorages and brackets: Section 14240.
 7. 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. Provide railings, including anchors and connections, capable of withstanding structural loading conditions of Section 4.4 of ASCE 7-95, as summarized below, without exceeding the allowable design working stress of materials.
1. Guardrail system shall be designed to resist a load of 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.
 2. Guardrail systems shall be able to resist a single concentrated load of 200 lbf applied in any direction and at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building. This load need not be assumed to act concurrently with the load specified in subparagraph 1.

3. Intermediate rails, balusters, and panel fillers shall be designed to withstand a horizontally applied normal load of 50 lb (0.22 kN) on an area not to exceed 1 ft. square (305 mm square) including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of subparagraphs 1 and 2.

- B. 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. Samples: Color samples for selection and verification of shop-applied color coat on steel railings.
- C. 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. Metal railings.
 2. Miscellaneous framing and supports.
 3. Loose lintels.
 4. Elevator sill support angles.
 5. Elevator pit ladder.
 6. Ladder safety cage.
- D. Calculations: For the fabrications listed below, submit calculations prepared and signed by a Professional Engineer registered in the State of Maine, demonstrating that structural design, including connections to the building structure, complies with loading requirements and with other structural requirements, such as points of support, which may be shown in the contract documents. Indicate other loads such as moving loads and seismic loads which have been taken into account.
 1. Metal railings.
 2. Miscellaneous supports. Indicate assumptions made about size and weight of items being supported and support points.
- E. Samples: Submit representative samples of materials and finished products as may be requested by Architect.
- F. 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. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing structural design services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project.
- F. 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. Include description of scope of services provided, and quantity and itemized description of items processed.
 1. Visual Stamp: Require the galvanizer to mark each lot of material with a clearly visible stamp or tag stating the name of the galvanizer, the weight of the nickel-zinc coating, and the applicable ASTM specification numbers.
- G. Templates: Furnish templates for anchors and bolts specified for installation under other sections.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements.

Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.01 FERROUS METALS

- A. Metal Surfaces, General: For metal fabric ations 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, as follows: Carbon below 0.25%, silicon below 0.05%, phosphorous below 0.05%, and maganese below 1.35%. If steel does not comply with these requirements, notify galvanizer to determine suitability for processing.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- 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 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. Primer for Field Touch-Up: For touch-up, use same material applied in the shop.

2.03 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. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
- I. Expansion Anchors: Carbon-steel, zinc-plated to comply with ASTM B 633, Class Fe/Zn 5. Provide anchor bolt and sleeve assemblies with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.04 GROUT

- A. Nonshrink Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacture for interior and exterior applications. Furnish one of the following, or approved equal:
 - 1. "Euco N.S.," Euclid Chemical Co.
 - 2. "Masterflow 713," Master Builders Technologies, Inc.
 - 3. "SonogROUT 14," Sonneborn. Building Products - ChemRex, Inc.
 - 4. "Five Star Grout," Five Star Products, Inc.

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. 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 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 change (range) in ambient and surface temperatures without 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 Change (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: Comply with design recommendations of ASTM A 385, "Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)."
 - 1. 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.

2. Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

2.06 METAL FINISHES

- A. Hot-Dip Galvanizing: Galvanize items which are to be installed at exterior locations and in exterior walls, and galvanized other items as specified. Apply zinc-alloy coating by the hot-dip process, Duragalv® by Duncan Galvanizing or equal, by immersing in a galvanizing bath which contains high grade zinc and other earthly materials. Immediately before galvanizing, immerse the steel in a bath of zinc ammonium chloride. The use of wet kettle process is prohibited. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards.
- 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. Stripe 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 to items which are scheduled to receive field-applied painted finished.
 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 METAL LADDERS

- A. General: Comply with ANSI A14.3, except comply with ASME A17.1 for location and dimensions of ladder.
- B. Steel Ladders:
 1. Siderails: Continuous, 3/8-by-2-1/2-inch minimum steel flat bars, with eased edges.
 2. Rungs: Minimum 3/4-inch-diameter or 3/4-inch-square steel bars. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 3. Provide nonslip surfaces on top of each rung, by coating rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufactured rung filled with aluminum-oxide grout, or by coating with abrasive material metallically bonded to rung by a proprietary process.

4. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted brackets, made from same metal as ladder.

C. Metal Finish: Galvanize the elevator pit ladder, including brackets and fasteners.

2.08 LADDER SAFETY CAGE

A. General: Furnish a one-piece, welded safety cage assembly designed for attachment to the existing fixed ladder (interior location). Field measure the ladder, and make the cage long enough to begin 7' or 8' above the roof surface and extend to 42" above the landing surface. Flare bottom opening to facilitate entry.

B. Fabricate ladder safety cage in compliance with OSHA Standard 1910.27.

C. Components: As follows, or construction standard with manufacturer having equal strength:

1. Primary Hoops: 5/16-by-4-inch (8-by-100-mm) steel flat bar hoops. Provide at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c.
2. Secondary Intermediate Hoops: 5/16-by-2-inch (8-by-50-mm) steel flat bar hoops, spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
3. Vertical Bars: 5/16-by-2-inch (8-by-50-mm) steel flat bars secured to each hoop, spaced approximately 9 inches (230 mm) o.c.

D. Metal Finish: Manufacturer's standard powder coat finish. Furnish hot-dip galvanized fasteners for installation.

2.09 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.10 LOOSE STEEL LINTELS

A. Furnish loose steel lintels, fabricated from structural steel angles, for openings and recesses in masonry walls and partitions at locations indicated.

B. If sizes of loose steel lintels are not shown on Drawings, size lintels so that deflection due to dead plus live loads does not exceed 1/600 nor 0.3 inch (7.6 mm), but not less than the following minimum dimensions:

1. Steel thickness: 5/16" minimum.
2. Fabricate steel lintels from one angle for each 4" of wall thickness, with horizontal leg at least 3-1/2" long, to provide at least 3" bearing; height of vertical leg shall depend upon the width of the opening, as follows:

<u>Masonry Opening Width</u>	<u>Height of Vertical Leg</u>
Up to 3'-0"	3-1/2"
3'-1" to 4'-6"	4"
4'-7" to 6'-0"	5"
6'-1" to 8'-0"	6"

- C. Size loose lintels for not less than 8 inches bearing at each side of openings. For openings wider than 8'-0" provide an additional 1 inch of bearing each side for each foot or fraction of a foot additional width.
- D. Galvanize all loose steel lintels.

2.11 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. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - 2. Except as otherwise indicated, space anchors 24 inches o.c. 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 areas of high-humidity.

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.
- B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
- C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION, GENERAL

- 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 concrete and masonry inserts, 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. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. 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.
- E. 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.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.

3.03 SETTING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLATION OF ROOF GUARDRAIL

- A. Adjust guardrail prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure railing posts to structural steel as shown on Drawings.

3.05 FIELD QUALITY CONTROL

- A. Owner's Testing and Inspection Agency will inspect high-strength bolted connections 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 of the tests and inspections described in Section 05120 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.

3.06 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