

**SECTION 055000 - METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Rough hardware.
- B. Ladders (including roof ladders).
- C. Steel guardrails. (Including “Omega Rails”)
- D. Loose bearing and leveling plates.
- E. Loose steel lintels.
- F. Miscellaneous Framing and Supports for the Following:
  - 1. Overhead coiling doors.
  - 2. Security grilles.
  - 3. Roof openings.
  - 4. Applications where framing and supports are not specified in other sections.
- G. Miscellaneous Steel Trim, Including the Following:
  - 1. Steel angle corner guards.
  - 2. Edgings.
  - 3. Loading dock edge angles.
- H. Structural steel door frames and structural steel doors.
- I. Pipe bollards.
- J. Protection Enclosures.

**1.02 RELATED SECTIONS**

- A. Section 051200 - Structural Steel Framing: Structural steel framing system components.

**1.03 REFERENCES**

- A. ASTM A27/A27M - Steel Castings, Carbon, for General Application.
- B. ASTM A36 - Structural Steel.
- C. ASTM A47 - Ferritic Malleable Iron Castings.
- D. ASTM A48 - Gray Iron Castings.
- E. ASTM A53 - Hot-Dipped, Zinc-Coated Welded and Seamless Steel Pipe.
- F. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

- G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- H. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- I. ASTM A563 - Carbon and Alloy Steel Nuts.
- J. ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel.
- K. ASTM C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- L. ASTM E488 - Strength of Anchors in Concrete and Masonry Elements.
- M. ASTM F568 - Carbon and Alloy Steel externally Threaded Metric Fasteners.
- N. AWS A2.0 - Standard Welding Symbols.
- O. AWS D1.1 - Structural Welding Code.
- P. SSPC - Steel Structures Painting Council.

#### 1.04 SUBMITTALS

- A. General: Submit in accordance with Section 013300.
- B. See Section 013310 for Submittal Schedule.

#### 1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications 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.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," 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 re-certification.

#### 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 delaying the Work.
  - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed

dimensions. Allow for trimming and fitting.

## PART 2 - PRODUCTS

### 2.01 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications 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, or roughness.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/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. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
  - 1. Black finish, unless otherwise indicated.
  - 2. Galvanized finish for exterior installations and where indicated.
- E. Gray-Iron Castings: ASTM A 48, Class 30.
- F. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
- G. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- H. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

### 2.02 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 Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

### 2.03 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electro-deposited 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 bolts, 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.
- D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).
- E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.
- F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).
- G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly 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).
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.
- J. Chemical Anchors: Two-part epoxy systems with impacted bolt, rod or anchor as follows:
  - 1. Concrete anchor: Epoxy capsule system similar to Hilti HVA Adhesive Anchor System, Ramset Chemset anchor system, or approved equal.
  - 2. Masonry anchors: Epoxy injection system similar to Hilti HIT C-100 System.

#### 2.04 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.
  - 1. Sure-grip High Performance Grout; Dayton Superior Corp.
  - 2. Euco N-S Grout; Euclid Chemical Co.
  - 3. Five Star Grout; Five Star Products.
  - 4. Crystex; L & M Construction Chemicals, Inc.
  - 5. Masterflow 928 and 713; Master Builders Technologies, Inc.
  - 6. Sealtight 588 Grout; W. R. Meadows, Inc.
  - 7. SonogROUT 14; Sonneborn Building Products - ChemRex, Inc.

#### 2.05 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements of Section 03300 -

"Cast-in-Place Concrete".

## 2.06 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. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
  - 1. Temperature Change (Range): 100EF (55.5EC).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. 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.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. 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 contour of welded surface matches those adjacent.
- H. 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.
- I. 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.
- J. Shop Assembly: Preassemble 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.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws,

and similar items.

- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

#### 2.07 ROUGH HARDWARE

- A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

#### 2.08 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. Siderails: Continuous, steel channels, 3/8-by-2-1/2-inch (9-by-64-mm) flat bars, with eased edges, spaced 24 inches (600mm) apart.
- C. Bar Rungs: 3/4-inch- (19-mm-) diameter steel bars, spaced 12 inches (300 mm) 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 feet (1.5 m) o.c. with 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 (180 mm).
  - 2. Extend side rails 42 inches (1.1 m) 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.

#### 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 the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize paint after fabrication, for exterior exposed locations.

#### 2.10 LOOSE STEEL LINTELS

- A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Weld adjoining members together to form a single unit where indicated.

- C. Size loose lintels for equal bearing of 1 inch per foot (85 mm per meter) of clear span but not less than 8 inches (200 mm) bearing at each side of openings, unless otherwise indicated.
- D. Galvanize paint loose steel lintels located in exterior walls.

#### 2.11 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent 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.
    - a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.
- C. Fabricate support for suspended toilet partitions as follows:
  - 1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hangers, but use not less than C8 by 11.5 (C200 by 17.1) channels or another shape with equivalent structural properties.
  - 2. Hangers: Steel rods, 1/2-inch (13-mm) minimum diameter, spaced not more than 36 inches (900 mm) o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge-shaped washers for full bearing on sloping flanges of support beam.
  - 3. Braces and Angles: Steel angles of size required for rigid support of beam and for secure anchorage.

#### 2.12 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

#### 2.13 STRUCTURAL STEEL DOOR FRAMES AND STRUCTURAL STEEL DOORS

- A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Reinforce frames and drill and tap as required to accept finish hardware.
- B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using

1/8 x 2 inch (3 x 50 mm) straps of the length required for a minimum 8 inch (200 mm) embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches (300 mm) from both bottom and head of frame and space anchors not more than 30 inches (750 mm) apart.

- C. Construct structural steel doors to detail using 1/4 inch thick steel plate. Provide full surface plain bearing hinges attached to frame and door with threaded fasteners. Drill and tap to receive door hardware specified in Section 08700.
- D. Provide steel strap anchors for securing door frames to steel framing.
- E. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

#### 2.14 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Fill bollards with concrete, free of voids. See drawings for additional requirements.

#### 2.15 GUARD RAILS

- A. Rails shall be as manufactured by Omega Industrial Products.
- B. Rail sections shall be constructed from hot rolled; cold formed 11-gauge steel and shall meet the requirements of ASTM Grade E steel, modified to a minimum yield of 50 K.S.I. Rails shall be a minimum of 1.75" wide X 12" high X required length, no greater than 120" in length, with a (2) rib design.
- C. Mounting posts shall be a minimum 4" X 4" T.S. with a 10" X 10" X 0.50" base plate, constructed from cold formed structural steel tubing, that meets the requirements of ASTM Grade B, with a minimum yield of 46 K.S.I.
  - 1. See drawings for dimensions and details.
- D. Standard finish shall be a heat cured, polyester based powder coating with sea spray and ultraviolet enhancements and shall be custom color RD-Yellow, available through Omega Industrial Products. . All components shall be installed per manufacturer's approved installation instructions.

#### 2.16 MISCELLANEOUS FABRICATIONS

- A. Protection Enclosures: Fabricate to configuration and details indicated. Provide 3 hinges per door leaf. Shop prime and topcoat with DTM coating.

#### 2.17 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
- B. Finish metal fabrications after assembly.

## 2.18 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
  - 1. ASTM A 153 for galvanizing iron and steel hardware.
  - 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.
- B. 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 metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or 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

### 3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing 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. 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 installing 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 that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

- E. 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 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.
- G. Caulk around fasteners at floor angles bolted down on top of resilient sheet flooring (Altro) to prevent water migration under sheet flooring.

### 3.03 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, 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 nonshrink, nonmetallic grout, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.04 INSTALLING STRUCTURAL STEEL DOOR FRAMES

- A. Set door frames plumb, level and square. Diagonal measurement from square shall not exceed 3/16".
- B. Set door frame head elevation at scheduled height from finish floor with a maximum variation of +1/4".

### 3.05 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- B. Fill bollards solidly with concrete, mounding top surface.

### 3.06 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 shop-painted surfaces.
  - 1. Apply by brush or spray to provide a 2.0 mil (0.05 mm) minimum dry film thickness.

**END OF SECTION 055000**