

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rough hardware.
 - 2. Metal ladders.
 - 3. Steel framing and supports for mechanical and electrical equipment.
 - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 5. Shelf angles.
 - 6. Loose bearing and leveling plates.
 - 7. Miscellaneous steel trim including steel edgings.
 - 8. Loose steel lintels.
 - 9. Steel grating and frame at elevator sump pit
 - 10. Steel metal pan stairs.
 - 11. Steel pipe handrails.
- B. Related Work of Other Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Division 04 Section "Exterior Stone Cladding" for installing loose lintels, anchor bolts, and other items built into unit stone masonry.
 - 4. Division 05 Section "Structural Steel Framing."

1.3 DESIGN/PERFORMANCE REQUIREMENTS

- A. Prefabricated Metal Framing and Braces for Ceiling Mounted Equipment: Capable of supporting a minimum 200 lbf (90.7 kg-f) at each connection, unless heavier loads are indicated or required to be supported. Limit deflection in support framing to L/240 or 1/4-inch (6-mm), whichever is less. Provide direct connection to structural supports or provide drilled in expansion anchor attachment devices sized for not less than 5x design loads involved as determined by testing (ASTM E 488) conducted by a qualified independent testing agency. Indicate load at each connection and drilled in anchor for structural engineers review.
- B. Fabrication Workmanship: Provide the following classes of workmanship for miscellaneous metal fabrication items indicated or required.
 - 1. Class 1 Workmanship: Items that are exposed to view in finished spaces in completed Work.
 - a. Exposed Surfaces: Sandblast surfaces smooth; grind off mill marks; fill nicks and scratches so that defects do not show when painted. Remove sharp corners and edges.

- b. Welds: Conceal welds where possible. Where exposed, grind welds to small radius with uniform sized cove. When painted, welds shall be undetectable.
 - c. Bolts: Use only flat head countersunk bolts in exposed locations.
 - d. Straightness: Distortions visible to the eye will be rejected.
 - e. Joints: Fit joints to hairline finish.
2. Class 2 Workmanship: Items that are exposed to view in utility areas of the completed Work.
- a. Exposed Surfaces: Moderate irregularities not visible at 30-feet may remain. Mill marks may remain. Remove sharp corners and edges.
 - b. Welds: Provide neat welds of uniform size. Remove splatter and protrusions.
 - c. Bolts: Use only flat or oval head, countersunk bolts where exposed to view.
 - d. Straightness: Minor distortions not exceeding 1/8-inch in 8'-0" will be permitted.
 - e. Joints: Provide maximum gap of 1/16-inch.
3. Class 3 Workmanship: Items that are concealed from view in the completed Work.
- a. Exposed Surfaces: Mill finish with surface preparation for galvanizing or priming.
 - b. Welds: Grinding not required.
 - c. Bolts: Exposed bolts permitted.

1.4 SUBMITTALS

- A. Product Data: For materials indicated.
- B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Refer to Division 9 Painting.

2.4 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; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Plain Washers: Round, carbon steel, ASME B18.22.1.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below 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.
 - 1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 FABRICATION, GENERAL

- A. 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.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. 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.

- D. 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.
- E. 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.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive fasteners and similar items.
- G. 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 Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- H. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- C. Prefabricated Metal Framing and Support Bracing: Equivalent to Unistrut hot-dip galvanized P1000H3 with P3016-1420 nuts, HHCS205075EG hex head cap screws, P1026 ninety-degree angle fittings, (2) P1358 mounting brackets near lower corners of frame, and (4) P2398S beam clamps, unless heavier sections are required to support and brace loads indicated or required by structural calculations. Provide clips of required size for direct attachment to structural steel framing members.

2.7 MISCELLANEOUS STEEL TRIM

- A. Fabricate units from structural-steel shapes of profiles shown with mitered corners, continuously welded joints, and smooth exposed edges.
- B. Galvanize miscellaneous steel trim at exterior locations.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches on center, unless otherwise indicated.
- B. Galvanize shelf angles to be installed in exterior walls.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.
- C. Prime plates with zinc-rich primer.

2.10 ROUGH HARDWARE

- A. Furnish custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes in the sizes, shapes and dimensions required for framing and supporting and anchoring rough carpentry. Hot-dip galvanize where exposed to atmosphere or embedded into concrete. Furnish malleable iron washers for bolt heads and nuts that bear on wood connections; elsewhere furnish steel washers.

2.11 LADDERS

- A. General: Fabricate fixed ladders for the locations shown with dimensions, spacings, details, and anchorages as required to comply with the requirements indicated and ANSI A 14.3.
- B. Fabrication: Provide 1/2" (13 mm) x 2-1/2" (63 mm) continuous steel flat bar side rails with eased edges spaced 18" apart with 3/4" diameter solid structural steel bar rungs spaced 12" (300 mm) o.c. along the center of rails. Plug-weld rungs and grind welds smooth. Provide anti-slip surfacing on top 120° of each rung. Extend side rails minimum 42" (1050 mm) above top rung, except where safety extension posts are provided.
- C. Fixed Ladder Supports: Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" (1.5 m) o.c. Use welded or bolted steel brackets designed for adequate support and anchorage and to hold ladder rungs 7" (175 mm) clear of the wall surface and other obstructions.

2.12 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 to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.
- D. Galvanize loose steel lintels located in exterior walls.

2.13 STEEL FRAMED STAIRS

- A. General: Construct stairs to conform to sizes and arrangements indicated. Provide metal framing, hangers, struts, clips, brackets, bearing plates, and other components as required for the support of stairs and platforms. Construct stair work to line, plumb, square, and true with runs registering level with floor and platform levels. Fabricate units so that bolts and other fastenings do not appear on finish surfaces. Make joints true and tight and make connections between parts lightproof tight. Provide continuous welds ground smooth where exposed.
- B. Stair Framing: Fabricate stringers of structural steel channels or plates or a combination thereof. Provide 1/4" thick plate closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members.
- C. Metal Pan Units: Form metal pans of minimum 0.0966" (2.3 mm) thick hot-rolled steel sheet. Shape pans to conform to the configuration shown. Construct riser and subtread metal pans with steel angle supporting brackets welded to stringers. Weld metal pans to brackets. Weld sub platform metal pans to platform frames.
- D. Steel Floor Plate Risers, Treads, and Platforms: Form risers, tread, and platforms from floor plate of thickness required to support specified loads, but not less than 1/8" thick. Shape floor plate to conform to the configuration shown. Construct riser and trade floor plate with steel angle supporting brackets welded to stringers. Weld floor plate to brackets. Plug weld platform floor plate to platform frames and stiffeners.

2.14 STEEL RAILINGS

- A. Fabricate railings, handrails and guardrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, tubing, bars, post spacing, and anchorage, but not less than that required to support structural loads.
- B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option.
- C. At tee and cross intersections, notch ends of intersecting members to fit contour of member to which end is joined and weld all around.
- D. Form changes in direction of railing members by prefabricated elbow fittings, mandrel bends of radius indicated, mitering members, maintaining cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required;
- F. Provide wall returns at ends of wall-mounted handrails.
- G. Fabricate wire rope infill with fittings in arrangements indicated. Install wire rope and termination end swage fittings to develop maximum load carrying capacity in accordance with fitting manufacturer's instructions. Install fittings to secure wire rope to conform to design/performance requirements and to provide a balanced uniform arrangement of end fittings. Trim excess threaded rod from swage end fittings and install acorn nuts to provide required tension without overstressing or creating sag in adjacent wire ropes.

- H. Close exposed ends of pipe by welding 3/16" (5 mm) thick steel plate in place or by use of pre-fabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4" (6 mm) or less.
- I. Brackets, Flanges, Fittings, Inserts and Anchoring Devices: Provide for interconnections of pipe and attachment of railings and handrails to other work.
- J. For railing posts set in concrete, fabricate sleeves from steel pipe not less than 6" (150 mm) long and with an inside diameter not less than 1/2" (19 mm) greater than the outside diameter of post, with steel plate closure welded to bottom of sleeve.
- K. Fabricate steel exterior railings, handrails and guard rails fittings, brackets, sleeves and fasteners with galvanized finish. Fabricate interior railings with non-galvanized finish.
- L. De-burr all exposed sharp edges and corners.

2.15 GRATINGS

- A. Provide banded metal bar grating as shown on the Drawings, complying with the NAAMM "Metal Bar Grating Manual" and as specified herein. Furnish grating units complete with angle frames where indicated on the Drawings. Frames and fastening devices shall be of same material and finish as grating supported. Provide removable grating sections with end-bearing bars, 4 saddle clip anchors designed to fit over 2 bearing bars, and 4 stud bolts with washers and nuts. Notching of bearing bars at supports to maintain elevations is not acceptable. Subject to compliance with requirements, provide units produced by Borden Metal Products, IKG Industries or Reliance Steel Products.
 - 1. Furnish grating units complete with angle frames where indicated on the Drawings. Frames and fastening devices shall be of same material and finish as grating supported.
 - 2. Pressure-Locked Plain Surfaced Rectangular Steel Bar Grating: Provide I. K. G. Borden Type B pressure-locked grating with 1-1/4" (31 mm) x 3/16" (5 mm) bearing bars at 1-3/16" o.c. and crossbars at 4" (100 mm) on center, or equivalent.
 - 3. Hot-dip galvanize completed assemblies after fabrication.

2.16 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- 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/NACE No. 3, "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 and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. **Fastening to In-Place Construction:** Provide anchorage devices and fasteners where necessary for securing 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.
- B. **Cutting, Fitting, and Placement:** Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- D. **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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

3.3 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 the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.4 PROTECTION

- A. Protect finishes from damage during construction period. Remove protective coverings at time of Substantial Completion.

- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work.

END OF SECTION 05 50 00