

STANDARD SPECIFICATIONS  
SECTION 05500  
METAL FABRICATIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section includes requirements for providing metal fabricated items like castings, gratings, hatchways, ladders, stairs, floor plates, handrail, and railings including all anchors, fasteners, hardware, and accessories necessary to complete the work.

1.2 SUBMITTALS

- A. Submit following Section 01330.
  - 1. Shop Drawings.
    - a. Show sizes, finishes, locations, required hardware and accessories, and details for all fabricated metal work, threaded fasteners and welds.
    - b. Indicate welds, both shop and field, by symbols conforming to AWS Standards.
    - c. Shop drawings for continually furnished items will be waived provided Contractor submits a letter naming manufacturer to furnish these items who has on file with Engineer a certified standard drawing containing approved required information.
  - 2. Setting diagrams, erection plans, templates, and directions for installation of backing plates, anchors, and other items.
  - 3. Catalog descriptions of manufacturers' items.
  - 4. Working Drawings and calculations for Contractor designed hatches and gratings.
- B. Submit following Section 01450.
  - 1. Certificate of Compliance for Railings.
  - 2. Manufacturers' test results of identical railings tested by manufacturer.

1.3 DELIVERY, HANDLING, AND STORAGE

- A. Identify and match mark, if applicable, materials, items, and fabrications for installation or field assembly.
- B. Wherever practicable, deliver items to Contract site as complete units, ready for installation with anchors, hangers, fasteners, and miscellaneous metal items.
- C. Provide storage facilities at Contract site for protection and storage of delivered materials.
  - 1. Handle and store so as not to damage factory finishes.
  - 2. Repair damaged finishes, at no cost to the Commission.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### A. Shapes and Bars:

1. Mild Steel: ASTM A36, unless otherwise shown on Drawings.
2. Atmosphere Corrosion Resistant Steel: ASTM A242.
3. Stainless Steel: ASTM A276, type 316.
4. Aluminum:
  - a. ASTM B221 with alloy and temper of 6061-T6.
  - b. Aluminum structural members rolled or extruded: ASTM B308 with alloy and temper of 6061-T6.
  - c. Handrail that is standard manufacturer's product may be alloy 6061 or 6063 temper, as furnished by manufacturer.

#### B. Plate, Sheet, and Strip:

1. Mild Steel: ASTM A36.
2. High Strength Steel: ASTM A242.
3. Atmosphere Corrosion Resistant Steel: ASTM A242.
4. Stainless Steel: ASTM A264 and ASTM A240, type 316.
5. Aluminum: ASTM B209 with alloy and temper of 6061-T6.

#### C. Mild Steel Forgings: ASTM A668, Class F.

#### D. Castings:

1. Gray Iron: ASTM A48, grade 25 for all castings except valve and curb boxes, and minimum class 20 for valves and curb boxes.
2. Malleable Iron: ASTM A47, grade 35018.
3. Ductile Iron: ASTM A536, grade 60-40-18.
4. Steel: ASTM A27, grade 65-35.
5. Aluminum: ASTM B108 with alloy and temper of 356.0, T6.

#### E. Pipe And Tube:

1. Mild Steel.
  - a. For Welding:
    - 1) ASTM A53, type S, Grade B, schedule 40, black.
    - 2) Handrail posts: Schedule 80.
  - b. For Screwed Connections:
    - 1) ASTM A53, type E or S, grade B, schedule 40.
    - 2) Handrail posts: Schedule 80.
2. Stainless: ASTM A312, grade TP 316L.
3. Aluminum: ASTM B221 with alloy and temper of 6061-T6.

- a. Wall Thickness: Schedule 80, following ANSI H35.2, unless otherwise shown on Drawings.
- F. Steel Bolts, Nuts, Washers.
1. General.
    - a. Galvanized for use with galvanized material.
    - b. Stainless for use with stainless and aluminum materials.
    - c. Cadmium plated for use with other materials.
  2. Stainless.
    - a. Bolts: ASTM A193, grade B8M.
    - b. Nuts: ASTM A194, grade 8M.
    - c. Washers: ANSI B18.22.1 and of same material as bolts and nuts.
  3. Expansion/Adhesive Anchors.
    - a. Manufacturer's shear and tensile strength tests: ASTM E488.
    - b. Fastener assemblies working strength: See manufacturer's recommendations.
  4. Headed Steel Anchors: Fabricated from cold finished carbon steel meeting requirements of ASTM A108 and fabricated following Drawings.
- G. Checkered Safety Plate:
1. Aluminum: ASTM B221, with alloy and temper of 6061-T6, thickness and span 16 ksi maximum fiber stress.
- H. Safety Treads: FS RR-T-650, type C.
- I. Grating:
1. Aluminum: ASTM B221 with alloy and temper of 6063-T6, mechanically locked, with fluted non-skid surface.
- J. Hatches:
1. Hatch Door and Framing: Aluminum following Drawings.
    - a. Design.
      - 1) Maximum deflection not to exceed 1/150 of span.
      - 2) Minimum live load of 300 pounds per square foot, unless otherwise specified.
      - 3) H-20 loading with 30 percent impact following AASHTO Standard Specifications for Highway Bridges when shown on Drawings as H-20 or located on sidewalk, driveway, or parking lot.
- K. Fall Prevention System:
1. Ladders.
    - a. Fabricate of aluminum shapes and bars following Standard Detail M/16.0.
    - b. Adjust length of bent plates, except top pair, to make vertical alignment.
    - c. Place bottom angles no closer than 6 inches from edge of channel.
  2. Safety Extension: Follow Standard Detail M/16.1, unless top slab is used.

- a. Approved manufacturers:
  - 1) Washington Aluminum Company, Inc.
  - 2) Or equal.
- 3. Extension Poles:
  - a. Extruded: Aluminum following ASTM B221 with alloy and temper of 6061-T6.
  - b. Casting: Aluminum alloy following ASTM B108 with alloy and temper of 356, T6.
  - c. Required hardware: Stainless steel, furnished with safety extension for mounting to ladder.
  - d. Finish: Standard mill.
- 4. Safety Rails: Aluminum SAF-T-NOTCH.
  - a. Provide rail with a removable aluminum extension kit secured to top ladder rung with stainless steel strap and galvanized steel hook.
  - b. Provide necessary aluminum hardware and clamps to mount rail and extension kit.
  - c. Do not provide sleeve and belt.
  - d. Top of mandrel attached on top of fixed rail: 6 inches below manhole cover and extend bottom of rail within 30 inches of bottom most portion of ladder.
  - e. Safety rail and extension kit: Follow manufacturer's catalog cut.
  - f. Approved manufacturers:
    - 1) North Specialty Products.
    - 2) Or equal if rails and extension kits are aluminum and are compatible with the specified system.

L. Safety Chains And Accessories:

- 1. Safety Chains:
  - a. Stainless steel 9/32 inch with minimum working load limit of 2000 pounds, Type 316.
  - b. Aluminum alloy 17/64 inch or 9/32 inch with minimum working load of 550 pounds.
- 2. Links: Wide jaw quick 1/4-inch with 9/16 inch jaw opening and minimum working load limit of 1280 pounds.
- 3. Locking Pin: 5/16 inch spring loaded snap type with snap opening of 3/8 inch.
- 4. Hooks: Minimum tensile load limit of 1200 pounds.
- 5. Eye Bolts: Shoulder type, drop forged with UNC-2 right-hand threads and heavy duty hexagonal nuts, 1/4 inch by 2 inch or 1/4 inch by 4 inch with working load limit of 460 pounds, and Type 316 stainless steel accessories.

M. Fabrication:

- 1. General: Fabricate items following Contract Documents and approved Contractor's submittals.
  - a. Straighten work bent by shearing or punching.
  - b. Press exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded.
  - c. Construct connections and joints exposed to weather to exclude water.

- d. Quantity and size of anchors: Sufficient for proper fastening of work.
- 2. Fabricated Products:
  - a. Pipe sleeves in concrete construction: Standard weight, black steel pipe, with anchors welded to exterior, size to accommodate passage of conduits, pipes, ducts, and similar items.
  - b. Railings: ANSI A.12.1 “American National Standard Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.”
    - 1) Pipe handrails intersections and joints: Neatly fitted, fully welded and ground smooth and flush.
      - a) Heat and bend smoothly, without distortion.
      - b) Posts and stand-offs for pipe railing: Same material as railing evenly spaced as shown, with anchor flanges.
      - c) Handrails along walls: Return to wall at ends with quarter round bends and welded flanges.
      - d) Members: Coped and continuously welded or mechanically connected at all junctions.
      - e) Run top rails continuously over posts.
    - 2) Flanges for posts: 3/8 inch minimum thickness plate, and for stand-offs from not less than 3/16 inch thickness plate.
      - a) Use stainless steel stud bolts, nuts, and washers for fastening aluminum pipe railing and handrails.
      - b) Use galvanized high tensile strength stud bolts, nuts, and washers for fastening steel pipe railing and handrail.
  - c. Gratings: Removable with locking legs and means of bolting in place unless otherwise shown on Drawings.
    - 1) Bearing bars not less than 3/16 inch thick of flat stock or equivalent I-bars with center to center spacing of not more than 1-3/16 inches.
    - 2) Structural supports for gratings, of shapes indicated: Fastened to structure with anchors.
    - 3) Cross supports: Allowable maximum deflection in span length, in inches, divided by 360 or 1/4 inch whichever is smaller.
    - 4) Non-skid Surface: Serrated edges on top of grating bars, or other equivalent means.
    - 5) Perimeter banding: Solid.
    - 6) Aluminum grating: Mechanically locked at intersections of all bars.
  - d. Hatch Door for Vaults: Channel frame with full anchor flange around perimeter.
    - 1) Aluminum covers: Mill finish.
    - 2) Covers with forged brass hinges with stainless steel pins.
      - a) Hinges: Through-bolted to cover and frame with tamperproof stainless steel bolts and lock nuts.
      - b) Covers: Equipped with stainless steel snap latch to hold in closed position mounted on underside of covers and provided with removable latch release handle.
        - (1) Latch release: Protected by flush mounted removable non-ferrous screw plug.

- (2) Lift handle: Designed to be flush with cover surface when not in use.
    - (3) Covers: Capable of operation with 1 hand with automatic hold open device which will not intrude into opening space enough to hinder ingress and egress and have conveniently positioned release handle for safe closing.
  - c) Cover operation:
    - (1) Compression springs: Enclosed in telescopic stainless steel tubes and operable with force not to exceed 30 pounds.
    - (2) Telescopic tube: Constructed so upper tube is outer tube.
- 3. Connections: Weld shop connections in weldable materials not designed for service removal.
  - a. Welding: AWS D1.1 requirements.
    - 1) Weld behind finished surfaces whenever possible.
    - 2) Grind all exposed welds smooth.
    - 3) Remove weld, brazing, and solder spatter, flux, slag, and oxides from finished surfaces.
  - b. Use sheet metal lock seams only when indicated on Drawings or approved shop and working drawings.
  - c. Complete provisions for bolted field connections in shop unless otherwise shown on Drawings.
  - d. Match exposed work to produce continuity of line and design.
    - 1) Fabricate and fasten metal work so that work will not be distorted, finish impaired, nor fasteners overstressed from expansion and contraction of metal.
    - 2) Conceal fastenings whenever practicable.
    - 3) Use fastenings exposed to public view of same color and appearance as surrounding metal.
- 4. Castings and Forgings: Fabricate.
  - a. Castings and Forgings:
    - 1) Uniform quality, true to pattern, strong, tough, of even grain, sound, smooth, without cold sheets, scabs, blisters, and sand holes, cracks, or other defects.
    - 2) Plugs, filled holes, and welding will not be allowed.
  - b. Castings thicknesses and configurations: Follow Standard Details.
    - 1) Sand blast to remove scale and sand to achieve uniform smooth clean surface.
    - 2) Markings: Raised letters where indicated.
  - c. Valve Boxes: Round head, sliding type consisting of snug-fitting top, bottom section and sliding type extension.
    - 1) Lid: Removable only by lifting straight up from shaft shoulder.
- 5. Galvanizing: Follow reference standards specified herein.
  - a. Items fabricated entirely from galvanized shapes, hardware, and sheet, without welding will not require galvanizing after fabrication.

N. Painting and Coatings:

1. Painting Metal Fabrications:
  - a. Shop paint following Drawings, or if not shown, use metal fabricator's standard shop paint.
  - b. Shop prime and field paint connecting ends after installation.
2. Metal Coatings:
  - a. Galvanized Sheet: ASTM A653.
  - b. Other Galvanizing: ASTM A123, ASTM A153, and ASTM A385.
  - c. Cadmium: ASTM B766, type NS.
3. Repair of Damaged Coatings:
  - a. Repair Damaged Areas: ASTM A780.
  - b. Minimum Thickness Requirements for Repair: ASTM A123.
  - c. Maximum Area to be Repaired: ASTM A123 and specified herein.
    - 1) If damaged area exceeds maximum defined, regalvanize item as stated herein.
4. Corrosion Protection for Contact Surfaces of Different Type Metals:
  - a. Carbolite Bitumastic 300M.
  - b. Or equal.
5. Corrosion Protection for Aluminum to be Embedded in Concrete: See Section 03300.

O. Source Quality Control:

1. Test Metal Railings:
  - a. ASTM E935, Standard Test Methods for performance of permanent metal railing systems and rails for buildings.
  - b. ASTM E894, Standard Testing Method for anchorage of permanent metal railing systems and rails for buildings.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Standards:

1. AISC Specification for Design, Fabrication, and Erection of Structural Steel for Buildings.
2. AISC Code of Standard Practice for Steel Buildings and Bridges, where applicable.

B. Add shims, washers, anchors, and corrective work to ensure that installation is firm, tight, anchored, in true alignment with neat fits, without distortions, unsightly fastenings, raw edges, or protrusions.

C. Touch Up:

1. Use compatible paint system for damaged painted areas and field coat at connecting ends.
2. Galvanized Items: ASTM A780.

D. Fall Prevention System:

1. Install fall prevention system following Standard Details and specified herein.
2. Minimum Inside Diameter of Manhole: 5 feet, except for top 4 feet transitioned for manhole opening.
3. Adjust manhole frame as necessary to assure fit of ladder extension.

E. Safety Chain:

1. Install quick links with anti-seize lubricant at mating threads.
2. Install eyebolts with load applied to plane of eye.
3. Do not use safety chains or accessories for overhead lifting or dynamic loading conditions.

PART 4 MEASUREMENT AND PAYMENT

- 4.1 Measurement of metal fabrication work for payment will not be made under this Section and is considered essential material required in construction of specific items of work that will be measured and paid for under various items in Bid Schedule.

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