

**SECTION 05100**  
**STRUCTURAL STEEL**

**05100.01 GENERAL**

**A. Description**

Structural steel shall include, but not necessarily be limited to, furnishing and erecting structural steel in accordance with the Contract Documents, or as directed by the County Engineer. Structural steel shall be fabricated and erected in accordance with the AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" and the "Code of Standard Practice for Steel Buildings and Bridges."

**B. Related Work Included Elsewhere**

Painting; Section 09900.

**C. Quality Assurance**

1. The County Engineer will inspect all materials and work to ensure compliance with the Contract Documents.
2. Shop and field welds may be inspected in accordance with AWS D 1.1. Welds requiring repairs will be reinspected after repairs are made.
3. Field assembled bolted construction may be inspected in accordance with AISC "Specifications for Structural Joints Using A325 or A490 Bolts."

**D. Submittals**

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for all structural steel. The shop drawings shall include the following information:

- a. Complete information necessary for the fabrication of the component parts of the structure or structures, including location, type and size of all bolts and shop welds. Welds shall be indicated by standard AWS welding symbols.
- b. Erection plans and details indicating required sequence of construction and temporary bracing where applicable.
- c. Surface finishes, shop paint system or other coating as specified in Section 05100.03 and/or 09900.03.

**2. Certificates of Compliance**

Certificates of compliance shall be submitted as specified in the "General Provisions" for all structural steel stating that the material furnished meets the requirements specified in Section 05100.02.

**05100.02 MATERIALS****A. Materials Furnished by the County**

The County will not furnish any structural steel.

**B. Contractor's Options**

Not applicable.

**C. Detailed Material Requirements****1. Structural Steel**

Carbon steel plates, shapes, and bars shall conform to requirements of ASTM A 36 unless otherwise noted on the Plans.

**2. Bolts, nuts, and washers shall meet requirements of ANSI B18.2.1 and B18.2.2 and the following:**

- a. Low carbon steel bolts and nuts shall conform to requirements of ASTM A 307.
- b. High strength carbon steel bolts, nuts, and washers for structural joints shall conform to requirements of ASTM A 325 only.
- c. Round washers other than those in contact with high strength bolt heads and nuts shall conform to requirements of ANSI B27.3, Type B.
- d. Beveled washers shall be square, smooth, and sloped to make contact surfaces of bolt head and nut parallel.

**3. Structural steel tubing in round, square, or rectangular tube shapes shall conform to requirements of ASTM A 501. Round pipe shall conform to the requirements of ASTM A 55, Grade B.****05100.03 EXECUTION****A. Design Criteria**

Design of connections not shown on the Plans shall be in accordance with requirements of "Specifications for the Design, Fabrication & Erection of Structural Steel for Buildings" of the AISC for the full strength of the member.

**B. Fabrications**

1. Fabricate and shop assemble work in accordance with AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," "Specifications for Architecturally Exposed Structural Steel," "Specification for Structural Joints using ASTM A 325 or A 490 Bolts."
2. Straighten rolled material, if necessary, before it is laid out for fabrication in a manner conforming to the mill tolerances provided in ASTM A 6, and by a process and in a manner which will not injure the material. Sharp kinks and bends will be cause for rejection of the material. Heat shrinking of low-alloy structural steel will not be permitted.
3. Perform shearing, flame cutting, and chipping carefully and accurately. Cut flame-cut edges of members by a mechanically guided torch or by hand, and remove all nicks. The radii of reentrant gas-cut fillets shall be not less than 3/4 inch and as much larger as practicable. Perform flame cutting in such a manner that metal being cut is not carrying stress. Finish exposed edge flame-cut by grinding.
4. Provide holes for connection of the work of other trades.
5. Weld in accordance with requirements of AWS D1.1. All welding shall be performed by welders who possess a current, valid AWS certificate. Shop connections may be bolted or welded. Field connections shall be made with high strength carbon steel bolts unless otherwise noted on the Plans.
6. All structural steel, except zinc coated surfaces, surfaces to be embedded in concrete or mortar, or steel for temporary construction shall be shop painted in accordance with Section 09900.03.

**C. Coating and Painting**

1. Galvanizing
  - a. Products fabricated from rolled, dressed, and forged steel shapes, plates, and strip shall conform to requirements of ASTM A 123.
  - b. Iron and steel hardware shall conform to requirements of ASTM A 153.
  - c. Hot dip coating on assembled steel products shall conform to requirements of ASTM A 386.
  - d. Prime coat for galvanized surfaces shall conform to requirements of FSS TT-P-641, Type I.
2. Painting shall be in accordance with Section 09900.03.

**D. Delivery and Storage**

1. Material shall be handled, shipped, and stored in a manner that will prevent distortion or other damage. Material shall be stored in a clean, properly drained location out of contact with the ground. Damaged material shall be replaced or repaired in an approved manner at no cost to the County.

2. Mark orientation on all members as well as piece mark.
3. Match mark all shop prefitted members.

**E. Erection**

1. General
  - a. Erection shall be in accordance with the AISC "Manual of Steel Construction" as modified herein. Erect steel members true and plumbing following match marks. Thoroughly clean surfaces to be joined.
  - b. Assemble joints using high strength steel bolts, unless otherwise indicated, in accordance with the AISC "Specifications for structural Joints using ASTM A 325 or A 490 Bolts."
  - c. Perform field welding in accordance with AWS D1.1.
  - d. Do not make or enlarge holes by burning.
  - e. Provide temporary bracing sufficient to handle construction loads.
2. Field Assembly
  - a. Splice only where indicated.
  - b. Align and adjust members forming parts of a complete assembly after assembly and before fastening. Should parts not fit, notify the County Engineer immediately.
3. Field paint exposed surfaces of steel work in accordance with requirements specified in Section 09900.

**05100.04 METHOD OF MEASUREMENT**

RESERVED FOR FUTURE USE

**05100.05 BASIS OF PAYMENT**

RESERVED FOR FUTURE USE

## SECTION 05500

### MISCELLANEOUS METALS

#### 05500.01 GENERAL

##### A. Description

Miscellaneous metals shall include, but not necessarily be limited to, furnishing and installing anchors, fasteners, hardware, castings, grating, railing, stairs, utility specialities, and other miscellaneous metal items in accordance with the Contract Documents or as directed by the County Engineer.

##### B. Related Work Included Elsewhere

Painting; Section 09900.

##### C. Quality Assurance

The County Engineer will inspect all materials and work to ensure compliance with the Contract Documents. All miscellaneous metal items and fabrications shall be anchored firm and tight, in true alignment with neat fits, and without distortions, unsightly fastenings, raw edges, or protrusions.

##### D. Submittals

###### 1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for all miscellaneous metal items. The shop drawings shall include the following information:

- a. Sizes; finishes; all materials, locations, attached hardware, and fittings; and detail for all items including fabricated metal work, threaded fasteners, and welds. Indicate all welds, both shop and field, by AWS standards symbols.
- b. Furnish setting diagrams, erection plans, templates, and directions for the installation of backing plates, anchors, and other items.
- c. Submit catalogue descriptions of manufacturers' standard items.

###### 2. Certificates of Compliance

Certificates of Compliance shall be submitted as specified in the "General Provisions" for all utility castings stating that the material furnished meets the requirements specified in Section 05500.02.

**05500.02 MATERIALS****A. Materials Furnished by the County**

The County will not furnish any miscellaneous metals.

**B. Contractor's Options**

Not applicable.

**C. Detailed Material Requirements**

1. Whenever practicable, items shall be standard products, meeting the requirements specified herein, of a manufacturer regularly engaged in production of such items.
2. All fasteners, hangers, or other miscellaneous connections or accessories shall be of the same material or compatible with the item being fastened or hung.
3. Shapes and Bars
  - a. Mild steel shall conform to requirements of ASTM A 36.
  - b. Stainless steel shall conform to requirements of ASTM A 276, Type 304.
  - c. Aluminum shall conform to requirements of ASTM B 221, Alloy 6061-T6.
4. Plate, Sheet, Strip
  - a. Mild steel shall conform to requirements of ASTM A 36, or A 283, Grade C.
  - b. High strength steel shall conform to requirements of ASTM A 242.
  - c. Corrosion resistant steel shall conform to requirements of ASTM A 242; 0.25 to 0.75 percent copper.
  - d. Stainless steel shall conform to requirements of ASTM A 240, Type 304.
  - e. Aluminum shall conform to requirements of ASTM B 209, Alloy 6061-T6.
5. Mild steel forgings shall conform to requirements of ASTM A 668, Class F.
6. Castings
  - a. Grey iron shall conform to requirements of AASHTO M 105, Class 35 B.
  - b. Malleable iron shall conform to requirements of ASTM A 47, Grade 35018.
  - c. Ductile iron shall conform to requirements of ASTM A 536, Grade 60-40-18.

- d. Nodular iron shall conform to requirements of ASTM A 220, Grade 45008.
  - e. Steel shall conform to requirements of ASTM A 27, Grade 65-35.  
  
The supplementary requirements of ASTM A 27 for tolerances and deviations shall also apply.
  - f. Chromium alloy-steel castings shall conform to the requirements of ASTM A 743, A 744, and A 297. The grade shall be as specified in the "Special Provisions" for the particular use requirement of the casting.
  - g. Aluminum shall conform to requirements of ASTM B 108, Alloy ANSI 356.0, T6.
7. Pipe and Tube
- a. Mild Steel
    - 1) For welding, shall conform to requirements of ASTM A 53, Type S, Grade B, Schedule 40, black. Provide Schedule 80 for handrail posts.
    - 2) For screwed connections, shall conform to requirements of ASTM A 120 or ASTM A 53, Type E or S, Grade B, Schedule 40. Provide Schedule 80 for handrail posts.
  - b. Stainless
    - 1) For welding, shall conform to requirements of ASTM A 312, Grade TP 304 L, Schedule 10 S minimum.
    - 2) For screwed connections, shall conform to requirements of ASTM A 312, Grade TP 304, Schedule 40S.
    - 3) For press fits, shall conform to requirements of ASTM A 312, Grade TP 304, Schedule 5S minimum.
  - c. Aluminum shall conform to requirements of ASTM B 221, Alloy 6061, T6.
8. Bolts, nuts, washers
- a. General
    - 1) Provide galvanized for use with galvanized material.
    - 2) Provide stainless for use with corrosion resistant metals and stainless material.
    - 3) Provide cadmium plated for use with all other materials.
  - b. Stainless
    - 1) Bolts shall conform to requirements of ASTM A 320, Type 304.

- 2) Nuts shall conform to requirements of ASTM A 194, Grade 8.
  - 3) Washers shall be Type 304.
  - c. Expansion bolts shall be the metal shield type.
  - d. Steel drive bolts shall be the split shank type.
  - e. Headed steel anchors shall be fabricated from cold finished carbon steel conforming to requirements of ASTM A 108.
  - f. Cast washers, ogee washers and special cast washers shall meet the requirements of ASTM A 47. Cast washers shall be mechanically or hot-dip galvanized. The coating shall meet the thickness, adherence, and quality requirements of ASTM A 153.
  - g. Bronze bolts, nuts, and washers shall meet the requirements of ASTM B 21, UNS No. C46400.
9. Hardware
- Spikes, wood screws, staples, brads, lag screws, carriage bolts, and other parts coming under the general heading of "Hardware" shall be composed of carbon steel and shall meet the requirements of FSS FF-N-105.
10. Checkered safety plate
- a. Steel shall conform to requirements of FSS QQ-F-461, Class 1, flat back, standard four-way raised pattern, rolled from ASTM A 36, Grade A.
  - b. Aluminum shall conform to requirements of ASTM B 221, Alloy 6063, T6.
11. Safety treads and stair nosings
- a. Safety treads shall conform to requirements of FSS RR-T-650, Type C.
  - b. Safety nosings shall conform to requirements of FSS RR-T-650.
12. Grating
- a. Steel shall conform to requirements of ASTM A 36.
  - b. Expanded metal shall be standard diamond.
  - c. Aluminum bar shall conform to requirements of FSS RR-G-661, Type 1.
  - d. Aluminum plank shall conform to requirements of FSS RR-G-1602, Type 1.

**05500.03 EXECUTION****A. Fabrication**



1. General
  - a. Fabricate all work true to shape, size and tolerances as indicated in the Contract Documents and on approved Shop Drawings; with straight lines, square corners, or smooth bends; free from twists, kinks, warps, dents, and other imperfections. Straighten work bent by shearing or punching.
  - b. Thickness of the metal and details of assembly and support shall provide sufficient strength and stiffness to resist distortion during shipment, handling, installation, and under severe service conditions. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded. Construct connections and joints exposed to weather to exclude water.
  - c. Provide sufficient quantity and size of anchors for the proper fastening of the work.
2. Fabricated Products
  - a. Pipe sleeves in concrete construction shall be standard weight, black steel pipe, with anchors welded to exterior, size as required to accommodate passage of conduits, pipes, ducts, and similar items with proper clearance.
  - b. Railings
    - 1) Fabricate railings and handrails as indicated to conform to OSHA regulations from aluminum alloy, steel-hot dip galvanized after fabrication, or stainless steel.
    - 2) Fabricated pipe handrail with all intersections and joints neatly fitted, fully welded, and ground smooth and flush. Aluminum members shall be shop welded only in accordance with AWS D1.2. Field welding of Aluminum will not be permitted. Heat and bend smoothly, without distortion. Fabricate posts and stand-offs for pipe railing of the same material as the railing, evenly spaced as shown, with anchor flanges. Handrails along walls shall return to the wall at ends with quarter round bends and welded flanges.
    - 3) Fabricate flanges for posts from aluminum 3/8-inch thick plate, and for stand-offs from not less than 3/16-inch thick plate.
    - 4) For fastening aluminum pipe railing and handrails, use stainless steel bolts with heavy aluminum washers and nuts. For fastening steel pipe railing and handrail, use galvanized bolts, nuts, and washers.
  - c. Trench covers

Provide checkered safety plate not less than 1/4-inch thick, having accurately formed steel angle frames, with provisions for firm anchorage to structural floor or curb. Cut plates to convenient lengths for handling, and provide finger holes for lifting.

- d. Metal stair systems, ladders, and cages
- 1) For metal stairs at angles greater than 45 degrees, provide open riser type with open grating type treads.
  - 2) For galvanized metal stair systems, provide solid treads of checkered safety plate and landing kick plates of 4 inches high by 1/4-inch thick plate.
  - 3) For permanent fixed-type ladders, all steel and all welded construction shall be galvanized, designed, fabricated, and installed in accordance with OSHA (1910.27) 31:4815-7 requirements for fixed ladders.
- e. Stair nosings
- Form abrasive safety nosing for concrete stair treads and landings from nonskid tread, 3 inches wide by 8 inches less than the concrete width, with suitable approved anchoring devices. Provide bolted-on nonskid treads for all plain metal stair treads.
- f. Gratings
- 1) Provide gratings of the type and size indicated. Provide bearing bars not less than 3/16 inch thick. Provide structural supports for gratings, of the shapes indicated, fastened to the structure with anchors. Unless otherwise indicated, provide gratings which are removable but with locking lugs and means of bolting in place. Grating shall be designed for a live load of 100 pounds per square foot with a deflection less than 1/4 inch.
  - 2) Provide serrated edges on the top of the grating bars, or other means to provide non-skid surface. Provide solid perimeter banding.
  - 3) Fabricate walkway grating by the electro-pressure welding method to form a sound welded joint at intersections of all bars, with the top surfaces of all bars in the same plane or in accordance with the manufacturer's standard practice.
- g. Hatch Doors
- Provide hatch doors of the sizes indicated on the Plans. Hatch doors shall be fabricated as specified in Section 02553.02.
- h. Connections
- 1) Shop connections in weldable materials, not designed for service removal, shall be welded. All welding shall conform to AWS D1.1 requirements. Grind all exposed welds smooth. Remove weld, brazing, and solder spatter, flux, slag, and oxides from finished surfaces. Use sheet metal lock seams only when indicated on the Plans or approved shop and working drawings.

- 2) Complete all provisions for bolted field connections in the shop unless otherwise indicated.
- 3) Match exposed work to produce continuity of line and design. Fabricate and fasten metal work so that the work will not be distorted, the finish impaired, nor the fasteners overstressed from the expansion and contraction of the metal.

Conceal fastenings whenever practicable. Use fastenings exposed to public view of the same color and appearance as the surrounding metal.

i. Castings and Forgings

- 1) Fabricate castings and forgings to the sizes and shapes indicated. Castings and forgings shall be uniform quality, true to pattern; strong, tough, of even grain; sound; smooth; without cold sheets, scabs, blisters and sand holes, cracks or other defects. Plugs, filled holes, and welding will not be allowed. Castings shall be of thickness and configurations shown on the Standard Details. Sand blast as required to remove scale and sand to achieve a uniform smooth clean surface. Paint with asphaltum or coal tar paint meeting requirements of AWWA C 203, where indicated. Provide raised letters where indicated.
- 2) Valve boxes shall be Class 30B, round head, sliding type consisting of snug fitting top, bottom sections, and sliding type extension. Lid shall be removable only by lifting straight up from the shaft shoulder.
- 3) Meter setting fittings, yokes, and appurtenances for 3/4 through 2-inch metered water supplies, and meter pit frames, lids, and covers shall be as specified on the Standard Details.
- 4) Manhole frames and covers, and inlet frames and grates, and grade rings shall be cast from material meeting the requirements of AASHTO M 105, Class 30B. Weights, configuration, and lettering shall be as shown on the Standard Details. Except sanitary sewer manhole frames and covers shall be cast from materials meeting AASHTO M105 Class 35.

j. Manhole Steps

- 1) Aluminum steps shall be fabricated from aluminum Alloy 6061, T6. Steps shall be of the drop-front design and shall incorporate two non-skid grooves in the tread as shown on the Standard Details.
- 2) Stainless steel steps shall be fabricated from Type 304 stainless steel. Step design shall be the same as for the aluminum steps.
- 3) Plastic coated steps shall be manufactured using a minimum 3/8-inch diameter steel reinforcing rod meeting the requirements of ASTM A 615, as a core. The plastic coating shall meet the

requirements of ASTM 2146, Type II, Grade 43758.

- k. Miscellaneous anchors, strap anchors, clip angles, and plates, hangers, etc., and other items, together with all miscellaneous structural shapes required for construction of the work shown on the Plans, shall be furnished in accordance with the requirements of the Plans.

## **B. Painting and Coatings**

1. Where indicated, shop and/or field paint miscellaneous metal items according to one of the paint systems specified in Section 09900.
2. Metal coatings
  - a. Galvanized sheet shall conform to requirements of ASTM A 446. All other galvanizing shall conform to requirements of ASTM A 123 or ASTM A 153 or both ASTM A 385 and ASTM A 386, as applicable.

Items to be shop painted which are fabricated without welding entirely from galvanized shapes, hardware, and sheet shall not be galvanized after fabrication. All other fabrications to be galvanized shall be hot-dipped after fabrication.
  - b. Cadmium shall conform to requirements of ASTM A 165, Type NS.
3. Galvanized touch up shall be zinc dust coating conforming to requirements of Military Specification P-26915.
4. Bituminous corrosion protection shall conform to requirements of Military Specification C-18480.
5. Coat aluminum accessories and items embedded in concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

## **C. Delivery, Handling, and Storage**

1. Identify, and match mark if applicable, all materials, items, and fabrications, for installation and field assembly.
2. Wherever practicable, deliver items to job site as complete units, ready for installation or erection, with all anchors, hangers, fasteners, and miscellaneous metal items required for installation.
3. Provide adequate storage facilities at the job site for the protection and storage of all delivered materials. Handle and store in such a manner as to not damage factory finishes. The Contractor shall repair damaged finishes at no cost to the County.

## **D. Erection and Installation**

1. Erection and installation of miscellaneous metal items shall be in accordance with requirements specified elsewhere in the Contract Documents.

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2. Miscellaneous metal items and fabrication shall be installed in their proper locations as shown or directed and shall be anchored, rigid and secure, plumb and level unless otherwise shown, and in true alignment with related and adjoining work.
3. The Contractor shall provide shims, washers, anchors, and such additional work as necessary to achieve a satisfactory installation.

**05500.04 METHOD OF MEASUREMENT**

RESERVED FOR FUTURE USE

**05500.05 BASIS OF PAYMENT**

RESERVED FOR FUTURE USE