

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The work of this section consists of furnishing, installing, and connecting all structural steel members, complete with required studs, braces, connection plates, welds, washers, bolts, nuts, shims, anchor bolts, templates, field welding, and adjusting for plumb and level.
- B. Products Furnished but Not Installed Under this Section: Anchor Bolts, Bearing Plates, Angles, etc.
- C. Related Requirements:
 - 1. Section 03300: Cast-in-Place Concrete.

1.02 REFERENCES

- A. Work performed and materials supplied under this Section shall conform to the requirements of the following specifications, latest edition. Requirements specifically enumerated in this Section or shown on the Drawings supersede the reference specifications. In case of a disagreement between specifications, the more stringent requirement shall govern unless a written clarification is issued.
- B. Design, Detailing, Fabrication and Erection: Meet requirements of AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building", and AISC "Code of Standard Practice for Steel Buildings and Bridges", latest editions.
- C. AISC Specifications for Structural Steel Buildings.
- D. AISC Specifications for Structural Joints using ASTM A325 or A490 Bolts.
- E. AISC Code of Standard Practice for Steel Building and Bridges.
- F. ASTM A36 - Standard Specification for Carbon Structural Steel.
- G. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- H. ASTM A108 - Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished, Standard Quality.
- I. ASTM A123 - Standard Specification for Zinc Coatings on Iron and Steel Products.

- J. ASTM A153 - Standard Specification for Zinc Coating on Iron and Steel Hardware.
- K. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
- L. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- M. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- N. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- O. ASTM A992 - Standard Specification for Structural Steel Shapes.
- P. ASTM F436 - Standard Specification for Hardened Steel Washers.
- Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- R. AWS D1.1 Structural Welding Code - Steel.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum three years experience in fabrication of structural steel for similar projects.
- B. Welder Qualifications: Currently qualified according to AWS D1.1.
- C. Erector Qualifications: Minimum of three years experience in erection of structural steel of similar complexity.
- D. The Owner will employ and pay for independent field inspection and testing of steel erection. Contractor will coordinate scheduling, and provide necessary means to assure cooperation with the inspection and testing firm. Work and/or materials which are defective shall be repaired and re-tested at the Contractor's expense. Shop welding at the fabrication plant shall be part of the Contractor and Subcontractor Quality Control plan.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. All shop drawings shall be original drawings and shall not be reproductions of the contract documents.

2. Clearly indicate profiles, sizes, and locations of structural members, connections, attachments, studs, anchorages, framed openings, size and type of fasteners, cambers and clearances. Indicate welded connections using standard AWS welding symbols. Clearly indicate net weld lengths, sizes and welding sequences.
- B. Quality Control Submittals:
1. Design Data: Submit design calculations, bearing the seal and signature of a professional engineer, employed by the Contractor and registered in the State of Colorado for the following:
 - a. Connections not completely detailed on the structural drawings.
 - b. Requests for substitution of member sizes or material grades, or alteration of framing details.
 2. Certificates:
 - a. Welder Qualifications: Submit copies of welder's certifications.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Materials to be Installed by Others:
1. Deliver anchor bolts and other items which are embedded in cast-in-place concrete or masonry construction to project site in time to be installed before start of cast-in-place concrete operations or masonry work.
 2. Provide setting drawings, templates and directions for installation of anchor bolts and other embedded items.
- B. Delivery and Storage
1. Steel: Store members above ground on platforms, skids, or other supports, and store upright to prevent twisting. Protect steel from corrosion.
 2. Other Materials: Store in weathertight and dry place until ready for use. Store packaged materials in their original unbroken package or containers.
- C. Protect painted coatings and hot-dip galvanized finishes from damage due to metal banding and rough handling. Use padded slings and straps where necessary.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wide Flange Shapes: ASTM A992.
- B. Channels, Bars, Plates, and miscellaneous Shapes: ASTM A36.
- C. Welded and Seamless Steel Pipe: ASTM A53, Type E or S, Grade B.
- D. Square and Rectangular Hollow Structural Sections (HSS): ASTM A500, Grade B.

- E. Bolts, Nuts, Washers:
1. Anchor Bolts: ASTM F1554, Grade 36, unless noted otherwise.
 2. All other Bolts: ASTM A325.
 3. Nuts: ASTM A563, Grade C or DH, Heavy Hex.
 4. Washers: ASTM F436, Type 1.

F. Filler Metal for Welding: Meet requirements of AWS D1.1, 70 series.

G. Headed Studs: ASTM A108, minimum yield strength 50,000 psi.

2.02 FABRICATION

A. General: Fabricate structural steel in accordance with AISC specifications.

B. Shop Painting:

1. Surface Preparation: After fabrication and shop assembly, clean off all loose rust, mill scale, weld spatter, slag, or flux deposits in accordance with SSPC procedures as follows:
 - a. Surfaces to be Concealed in the Completed Structure: SP-3 power tool cleaning.
 - b. Surfaces to be Exposed in the Completed Structure: SP-6 commercial blast cleaning.
2. Painting: Shop coat fabricated items with shop paint. Omit shop paint on parts to be galvanized, surfaces to be encased in concrete, surfaces to be welded, and surfaces to receive welded studs.

C. Galvanizing:

1. Hot-Dip galvanize steel members noted to be galvanized in accordance with ASTM A123. Oversize holes to account for zinc thickness.
2. Hot-Dip galvanize fasteners and hardware in accordance with ASTM A153. Shop assemble bolts, washers, and nuts with lubricant.

D. Marking: Mark members in protected plainly visible locations in accordance with reference numbers on setting diagrams.

E. Finished Work: Finish work in accordance with accepted shop drawings. Finished work shall be true and free from twists, kinks, buckles, open joints and other defects.

F. Welding: Comply with AISC Specifications and AWS D1.1. Welds not specified shall be 3/16" continuous fillet but not less than AISC minimum based on thickness of parts joined.

G. Splices: Splicing of members to obtain required lengths not allowed without prior written acceptance of Engineer.

- H. Substitutions: Where exact sizes and weights called for are not readily available, secure Engineer's written acceptance suitable sizes in time to obviate any delay due to such substitutions.
- I. Headed Stud Connectors: Automatically end weld according to AWS D1.1. Shop weld where possible. Thoroughly clean surface where stud is to be attached. Remove scale by grinding or sandblasting where it is sufficiently thick to interfere with proper welding.

2.03 ANCHORS

- A. Provide anchors for beams, as indicated on drawings and required. Locate as indicated on accepted shop drawings.
- B. Anchor Bolts: Size and length as shown on drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Embeds: Prior to start of erection of steel, check location of embedded anchor bolts and report deviations from anchor bolts setting plan to Contractor in writing with copy to Engineer. Do not proceed until all unacceptable conditions are corrected.

3.02 PREPARATION

- A. Protection: Protect adjacent materials or areas below from damage due to weld spatter or sparks during field welding.
- B. Shoring and Bracing: Provide temporary shoring and bracing as required to maintain work in safe and stable condition during erection. Provide temporary guy lines as required to properly align members before welding.
- C. Field Measurements: Take measurements on site as required for correct fabrication and installation. Contractor shall be responsible for errors in fabrication and for correct fit of all structural steel.

3.03 ERECTION

- A. General: Erect structural steel in accordance with AISC specifications with additional requirements of this section.
- B. Field Assembly: Assemble structural steel to lines and elevations indicated within specified erection tolerances.
 - 1. Unless noted otherwise, elevations and horizontal locations shall be within 1/8" of elevations and locations shown on the drawings.

2. Dimensions shall be based on a mean temperature of 65 degrees Fahrenheit. Compensation shall be made for temperature at time of erection.
- C. Bolting: Unless indicated otherwise, tighten to snug tight condition. Use hardened washers over slotted or oversize holes.
- D. Field Modifications:
1. Contractor shall be responsible for errors in fabrication and for correct fit in field.
 2. Do not correct serious defects in field but call to the attention of Engineer for decision as to method or procedure for correcting.
 3. Using cutting torch for field modification or refabrication of structural steel not allowed without written acceptance of the Engineer.

3.04 REPAIR AND CLEANING

- A. Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint.
- B. Remove and grind smooth tack welds, fit-up-lugs and weld runoff tabs.
- C. Remove weld back-up bars and grind smooth where indicated on drawings.
- D. Repaint, or repair galvanizing as appropriate.

3.05 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Testing Service: Perform duties in such way that neither fabrication nor erection is unnecessarily delayed or impeded. Inspector will not recommend or prescribe method of repair of defect.
- B. Field Inspection: Include examination of erected steel for alignment.
- C. Bolted Connections:
1. Verify grade marks on bolts and proper installation of washers.
 2. Verify snug tight condition with all plies in firm contact.
- D. Welding and Materials:
1. Inspection of welding shall assure that work conforms to specified requirements and will include:
 - a. Ascertainment that electrodes used for manual shielded metal arc welding and electrodes and flux used for submerged arc welding conform to requirements of this section.
 - b. Ascertainment that specified welding procedure and specified welding sequence are followed without deviation.
 2. The Testing Service shall perform the following tests in the fabricator shop:
 - a. All Welds: 100% visual.

- b. All Full Penetration Welds: 100% ultrasonic.
3. The Testing Service will perform the following tests of field welds:
 - a. All Welds: 100% visual.
 - b. Full Penetration Welds: 20% magnetic particle or ultrasonic.
4. Additional testing will be required if more than 10% of tested welds are rejected, then 100% of welds will be tested using same method.
5. Testing Service will have authority to reject weldments. Such rejection may be based on visual inspection where in their opinion weldment would not pass more detailed investigation.

END OF SECTION

