

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary Conditions and Division 1 - General Requirements, apply to this Section.

1.02 SUMMARY

- A. Work Included: This Section specifies fabrication and erection of structural steel work. Drawings show size and location of members, typical connections, and types of steel required.
- B. Definition: Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
- C. Related Work Specified in Other Sections:
 - 1. Anchor bolt installation in concrete: Section 03300.
 - 3. Steel Deck: Section 05310.
 - 4. Cold Formed Metal Framing: Section 05410.

1.03 REFERENCED STANDARDS

- A. American Institute of Steel Construction.
 - 1. Manual of Steel Construction.
 - 2. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design.
 - 3. Code of Standard Practice for Steel Buildings and Bridges.
- B. American Society for Testing and Materials (ASTM).
 - 1. ASTM A36: Standard Specification for Structural Steel.
 - 2. ASTM A108: Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - 3. ASTM A123: Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bar and Strip.
 - 4. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. ASTM A307: Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners.
 - 6. ASTM A325: Standard Specification for High-Strength Bolts for Structural Steel Joints, including Suitable Nuts and Plain Hardened Washers.
 - 7. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 8. ASTM A572: Grade 50, High-strength, Low Alloy, Columbium-Vanadium Steels of Structural Quality.

9. ASTM A992: Grade 50, High-strength, Low Alloy, Columbium-Vanadium Steels of Structural Quality.

C. American Welding Society (AWS).

1. AWS A5.1: Specification for Carbon Steel Covered Arc Welding Electrodes (including appendix).
2. AWS D1.1: Structural Welding Code.

D. Steel Structures Painting Council (SSPC), Steel Structures Painting Manual.

1.04 SUBMITTALS

A. Product Data : Manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel primer paint.
2. Non Shrink Grout.
3. Adhesive anchor bolts.
4. Galvanizing certificates of compliance.
5. Structural steel mill reports for all members used.
6. Anchor bolts.

B. Shop drawings prepared under supervision of a licensed Structural Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

C. Test reports conducted on shop-bolted and welded connections where requested by the Architect. Include data on type(s) of tests conducted and test results.

D. A comprehensive survey shall be performed of all existing conditions prior to the issuance of steel shop drawings for approval. Certified copies of each survey conducted by a licensed Land Surveyor, showing elevations and control locations of base plates, anchor bolts, and existing stub columns to receive new structural steel. Indicate discrepancies between the new construction and the actual in-situ conditions.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the latest edition of the following, except as otherwise indicated:

1. "BOCA National Building Code", 1999 Edition.
2. AISC "Code of Standard Practice for Steel Buildings and Bridges."

- a. Exception: Modify paragraph 4.2.1 of the AISC code by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings."
 - 3. AISC "Specifications for Structural Steel Buildings," including "Commentary."
 - 4. "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Structural Connections.
 - 5. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel."
 - 6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
- 1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
 - 2. If recertification of welders is required, retesting will be Contractor's responsibility.
- C. Testing: Owner's testing agency will inspect field-bolted and welded connections, and a copy of the test reports will be transmitted to the Contractor through the Architect.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
 - B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
 - C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.
 - D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

- B. High Strength Structural Steel Shapes: ASTM A 572, or ASTM A992 Grade 50.
- C. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501; black finish, except where indicated to be galvanized.
- E. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications.
- F. Anchor Bolts: ASTM A 307, headed type unless otherwise indicated.
- G. High Strength Anchor Bolts: ASTM A 449 or ASTM A325, headed type.
- H. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel, hexagonal head bolts and nuts.
- I. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325.
 - a. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.
- J. Epoxy Anchors: Hilti HVA or HIT adhesive, Simpson SET, Epcon C-6, or approved equal.
- K. Direct Tension Indicators: "TC" Bolts by the TC Bolt Corporation or equal, as required.
 - 1. Use on all field bolted connections, and at all shop or field bolted slip critical connections.
- L. Electrodes for Welding: Comply with AWS Code.
- M. Shop Primer Paint:
 - 1. Standard Shop Primer: Provide one of the following USM standard shop primers listed below, to all members not scheduled to have sprayed-on fire proofing. (Substitutions, are not allowed.)
 - a. Wilbur & Williams Primline #1703 Red.
 - b. Wilbur & Williams Primline #1704 Gray.
- N. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euco N.S.; Euclid Chemical Co.
 - b. Masterflow 713; Master Builders.
 - c. SonogROUT; Sonneborn.

- d. High Flow; Upcon.
- e. Five Star Grout; U.S. Grout Corp.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects, especially at architecturally exposed members.
- B. Connections: Weld or bolt shop connections, as indicated.
- C. Bolt field connections, except where welded connections or other connections are indicated.
 - 1. Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.
 - 2. Unfinished threaded fasteners may be used for connections of temporary bracing to facilitate erection.
- D. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."
- E. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- F. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.
- H. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.
- I. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.

- J. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
- K. Expansion Joints: Provide expansion joints in steel shelf angles when part of structural steel frame; locate at vertical brick expansion joints as indicated on drawings.

2.03 GALVANIZING

- A. Galvanizing: Galvanize items which are indicated on the Drawings or in these specifications to be galvanized. Galvanizing shall conform to the following standards, and zinc coating shall be without flux inclusions on the surface.
 - 1. Apply zinc alloy coating by the dry-kettle hot-dip process in a bath which contains high grade zinc and other earthly materials; Duncan Galvanizing "DeltaGalv" or approved equal. Immediately before galvanizing, immerse the steel in a bath of zinc ammonium chloride.
 - 2. ASTM A 153 for galvanizing iron and steel hardware.
 - 3. ASTM A 123 for galvanizing iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
 - 4. All member connections requiring field welding shall have all of the Galvanizing in the affected areas removed prior to welding.

2.04 SHOP PAINTING

- A. General: Shop-paint structural steel, except members to be galvanized.
 - 1. Do not paint surfaces to be welded (including shear connectors) or high-strength bolted with slip-critical type connections.
 - 2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.
 - 3. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. As a minimum, clean steel in accordance with Steel Structures Painting Council (SSPC) as follows; except clean to more stringent surface preparation standard if required by primer manufacturer:
 - 1. All Steel to be primed with alkyd primer: SP-3 "Power-Tool Cleaning."
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.05 SOURCE QUALITY CONTROL

- A. General: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
 - 1. Promptly remove and replace materials or fabricated components that do not comply.
- B. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
 - 1. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

PART 3 - EXECUTION

3.01 ERECTION

- A. Surveys: Employ a licensed land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.
- B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- D. Setting Leveling and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of leveling and bearing plates.
 - 1. Set loose and attached leveling plates and bearing plates for structural members on wedges or other adjusting devices.
 - 2. Grout under the plates after they have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of leveling or bearing plate prior to packing with grout.
 - 3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

4. For proprietary grout materials, comply with manufacturer's instructions.
- E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- F. Level and plumb individual members of structure within specified AISC tolerances.
- G. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- H. Splice members only where indicated and accepted on shop drawings.
- I. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
 1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. At galvanized members receiving field welded connections, clean welds and apply two coats of a zinc rich paint or cold galvanizing coating, ZRC or an approved equal product.
 1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.02 QUALITY CONTROL

- A. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
- B. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
- C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. Testing agency may inspect structural steel at plant before shipment.

- E. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.
- F. Field-Bolted Connections: Inspect in accordance with AISC specifications.
 - 1. For Direct Tension Indicators, "TC" Bolts, verify that splines have been severed and that all faying surfaces are in direct contact.
- G. Field Welding: Inspect and test during erection of structural steel as follows:
 - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. Inspect all welds visually for proper length, size, and quality. Repair all defects noted and re-inspect as required or directed by the Engineer of Record.
 - 3. Test all full penetration welds using Ultrasonic Testing Equipment. Repair all defects and re-test as required or directed by the Engineer of Record.

END OF SECTION 05120