SECTION 05120

STRUCTURAL STEEL

PART 1—GENERAL

1.1 SUMMARY

A. Section Includes:

1. Scope: The Contract Drawings, including schedules, notes and details, show size and location of members, typical connections, and type of steel required. This Section includes all structural steel work as defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as shown on Drawings.

B. Related Sections:

1. Section 01450—Testing Laboratory Services
2. Section 03300—Cast-In-Place Concrete

C. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated. Unless otherwise noted on the Drawings, all connections for noncomposite beams (beams not utilizing weld studs) shall develop one-half of the total allowable uniform load capacity of the beam for the given span in the AISC Manual of Steel Construction Beam Tables. Connections for composite beams (beams utilizing weld studs) shall develop three quarters of the total uniform load for each beam. Greater loadings will be shown on the drawings.

1. The design adequacy of any detail configuration of connections developed by the fabricator as part of the preparation of Shop Drawings and fabrication of material is not the responsibility of the Owner, Architect, or Architect's consultants.
2. Paragraph 4.2.1 of the AISC "Code of Standard Practice" referenced herein is hereby amended accordingly to eliminate the acceptance of this responsibility by the Owner, the Architect, and the Architect's consultants as a result of the review and approval of Shop Drawings.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Section 01300.

B. Product Data: Producer's or manufacturer's specifications, installation instructions, laboratory test reports and other data to show compliance with specifications (including specified standards) for following products:

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washers.
3. Structural steel primer paint.
4. Shrinkage-resistant grout.

C. Shop Drawings: Complete details and schedules for fabrication and assembly of structural steel members.

1. Include details of cuts, connections, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols. Show size, length, and type of each weld.
3. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other Sections.
4. Submit calculations of all steel connections, excluding connections fully detailed on the Drawings, stamped by a Louisiana Registered Engineer.

D. **All connections** not specifically detailed on the drawing, including standard connections shall be designed by a Registered Louisiana Engineer retained and compensated by the contractor.

1.3 QUALITY ASSURANCE

A. **Codes and Standards:** Comply with provisions of following, except as otherwise indicated:
1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
3. AISC "Specifications for Architecturally Exposed Structural Steel."
4. AISC "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 processes and welding operators in accordance with AWS "Standard Qualification Procedure."
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. **Source Quality Control:** Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by inspection agency specified in Section 01410. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. Promptly remove and replace materials or fabricated components which do not comply.

1.4 DELIVERY, STORAGE AND HANDLING

A. **Delivery Schedule and Sequence:**
1. Deliver materials to site at such intervals to insure uninterrupted progress of work.
2. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.

B. **Storage and Handling:** Comply with applicable requirements of Section 01600 and the following.
1. Store materials to permit easy access for inspection and identification.
2. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.
4. Handle materials to avoid damage to materials and other construction.

PART 2—PRODUCTS

2.1 MATERIALS

A. **General:** For work which will be exposed to view, use only materials which 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 application of surface finishes. All steel shall be produced and fabricated from sources in the United States.

B. **Structural Steel Shapes, Plates and Bars:** ASTM A572 Grade 50 as noted on the Drawings.

C. **Cold-Formed Steel Tubing:** ASTM A 500, Grade C.

D. **Hot-Formed Steel Tubing:** ASTM A 501.

E. **Steel Pipe:** ASTM A 53, Type E or S, Grade B; or ASTM A 501. Black finish, except where indicated to be galvanized.

F. **Anchor Bolts:** ASTM A 307, nonheaded type unless otherwise indicated.

G. **Unfinished Threaded Fasteners:** ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide either hexagonal or square, heads and nuts, except use only hexagonal units for exposed connections.

H. **High-Strength Threaded Fasteners:** Quenched and tempered medium-carbon steel heavy hexagon structural bolts, heavy hexagon nuts and hardened washers, complying with ASTM A 325.

1. Where indicated to be galvanized, provide bolts, nuts and washers zinc coated by hot-dip galvanizing (ASTM A 153) or by mechanical depositing (ASTM B 695, Class 50).

I. **Electrodes for Welding:** Comply with AWS Code.

J. **Structural Steel Primer Paint:**

1. SSPC - Paint 13 at all steel not exposed to view in the final structure and not scheduled to receive spray applied fireproofing.

K. **Cement Grout:** Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement of hydration.

L. **Non-Metallic Shrinkage-Resistant Grout:**

1. Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.
2. Subject to compliance with requirements, products which may be used include, but are not limited to, the following:
   a. Euco N. S.; Euclid Chemical Company.
   b. Crystex; L & M Construction Chemicals.
   c. Masterflow 713; Master Builders.

d. Sonogrout G.P.; Sonneborn Building Products.
e. Five Star Grout; U. S. Grout Corp.

2.2 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 which will expedite erection and minimize field handling of materials.
2. Where shop painting or galvanizing is required, complete assembly, including welding of units, before start of surface preparation for painting or galvanizing.
3. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Bolt field connections, except where welded connections or other connections are indicated.
2. Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.

C. 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."

D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

E. 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.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.3 PROTECTIVE COATINGS

A. General: Shop paint structural steel, except galvanized items and those members portions of members to be embedded in concrete or mortar and members to receive sprayed on fire proofing. Paint steel which is partially embedded on exposed portions and initial 2" of embedded areas only.

1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
2. Apply two (2) coats of paint to surfaces which 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 steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with the following Steel Structures Painting Council (SSPC) specifications:

1. Nuts and bolts are to be cleaned in accordance with SSPC-SP1 prior to shop painting to completely remove all oil, dirt, grease and all other soluble surface contaminants.

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 1.5 mils for SSPC-Paint 13. Use painting methods that will result in full coverage of joints, corners, edges and exposed surfaces.

D. Galvanizing: ASTM A123/123M and ASTM A153/153M for threaded fasteners. Galvanizing repair compound shall be a two-component zinc-rich paint, ASTM A 780.

PART 3—EXECUTION

3.1 ERECTION

A. Examination: Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds. 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. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces; remove bond-reducing materials and roughen to improve bond. Clean contact surfaces of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base 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. For proprietary grout materials, comply with manufacturer's instructions.

D. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust members before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Level and plumb individual members of structure within specified AISC tolerances.
3. 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.
4. Splice members only where indicated and accepted on shop drawings.

E. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

F. Bolted Connections: Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

G. 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 which are not under stress, as acceptable to Architect. Finish gas-cut sections, when permitted, equal to a sheared appearance.

H. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas.

1. Apply paint to exposed areas of shop primed items, using same material as used for shop painting, by brush or spray to provide a minimum dry film thickness of 1.5 mils.

3.2 QUALITY CONTROL

A. Testing Laboratory: Independent testing and inspection agency specified in Section 01450 shall inspect high-strength bolted and welded connections, perform tests, and submit test reports.

1. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
2. 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.
3. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

B. Contractor's Responsibilities: Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any noncompliance of original work, and as may be necessary to show compliance of corrected work.

C. Shop Bolted Connections: Testing laboratory shall inspect in accordance with AISC specifications. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.

D. Shop Welding: Testing laboratory shall inspect and test during fabrication of structural steel assemblies, 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. Perform visual inspections of all welds.
3. Perform tests on random 10% of full-strength welds as follows: Inspection procedures listed are to be used at Laboratory's option.
    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 109; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
    c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
    d. Ultrasonic Inspection: ASTM E 164.

E. Field Bolted Connections: Testing Laboratory shall inspect in accordance with AISC Specifications. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.

F. Field Welding: Testing Laboratory shall 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. Perform visual inspection of all welds.
3. Perform tests on random 10% of full strength welds and other welds as required by AISC, as follows:
   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 109; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
   c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
   d. Ultrasonic Inspection: ASTM E 164.

END OF SECTION