SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Sections:

1. Division 01 Section "Coordination Drawings" for requirements to coordinate the work of this Section with the construction elements indicated as "Coordination Drawing Content" and as required by the other Prime Contractors for the Project Coordination Drawings.
2. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
3. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 09 Section "Painting and Finishing" for exposed structural steel framing.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 ALLOWANCES

A. Work Included in Base Bid: The Contractor shall include in the space provided on the Bid Form, the allowances for work of this section itemized on the Bid Form. The cost of this work shall be computed based upon the scope indicated on the Drawings. The work listed is in addition to that required to complete the work of the Contract and, consequently, the sum therefore may be deducted from the Contract amount if the corresponding work is not required by actual conditions encountered.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer, fabricator, professional engineer, and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Source quality-control reports.

G. Field quality control and special inspection reports from testing agency.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who is thoroughly familiar with AISC's quality requirements for structural steel fabrication.

B. Installer Qualifications: A qualified installer who is thoroughly familiar with AISC requirements for steel erection and has completed no less than five (5) projects of similar size and scope within the last three years.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified to perform the testing indicated.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M and ASTM A 572/A 572M, Grade 50.

B. Channels, Angles**,** Shapes: ASTM A 36/A 36M and ASTM A 572/A 572M, Grade 50.

C. Plate and Bar: ASTM A 36/A 36M and ASTM A 572/A 572M, Grade 50.

D. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.

1. Location: Exterior.
2. Finish: Hot-dip zinc coating.

3. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

D. Anchor Receivers: Ties and receivers to be welded to beams and columns prior to shop prime painting.

1. Products: Subject to compliance with requirements, provide products by Hohman & Barnard, Inc.:

a. Masonry to Column Anchor Receivers: "359-C Weld on Ties."

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Co.; "Hi-Flow Grout."
b. L&M Construction Chemicals, Inc.; "Crystex."
c. Master Builders; "Masterflow 928."

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
6. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

1. Holes through columns or beams, larger than 2" diameter, are to be reinforced with steel plate each side to replace the strength.
2. All bolted connections are to be made using high strength bolts of min. ¾" diameter.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
4. Provide holes in beams for bolted field connections required to properly support wood nailers, wood blocking, angles, etc., of other trades.

G. Reinforcing: Provide the following reinforcing:

1. Provide a minimum of four web stiffeners in all beams supporting columns.
2. Angle hangers where required but not noted shall be a minimum of 3 x 3 x 3/8" angles.
3. Provide all necessary bent steel plate closures, clip angles, bolts, anchor bolts, etc., as shown or required to complete the job.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. All welds shall be ¼" minimum Fillet unless noted otherwise.
2. All welding shall be performed by an AWS-certified welder.
3. Provide all necessary erection bolts to properly support members for field welding. Remove temporary bolts if they interfere with the finished job.
4. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

C. Masonry Bearing Plates: Provide bearing plates and 2-1/2-in. on center anchor bolts under the ends of all beams bearing on masonry. Unless noted otherwise on structural drawings, bearing plates are to be 8 x 3/8 x 12 in.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 2.0 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize exterior lintels and shelf angles and attached to structural-steel frame and exposed exterior structural steel framing.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor shall engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected and 10%, or not less than two (2) bolts will be tested, according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection of all welds, 10% of shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Ultrasonic Inspection: ASTM E 164.

E. In addition to visual inspection of all shear connectors, 10% of shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Plates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Anchor Bolts: Furnish anchor bolts, steel plates, and other connectors required for securing structural steel to foundations, walls, and other in-place work.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

E. 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.

F. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

G. Splice members only where approved by Architect and Engineer.

H. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

I. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures:

    a. Ultrasonic Inspection: ASTM E 164.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents. Additional testing and inspection, at Contractor's expense, will be performed to determine compliance of deficient work.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 Section "Painting and Finishing."

END OF SECTION 05 12 00