SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the construction of all structural metal framing, including columns, beams, lintels attached to steel columns, lintels, masonry bearing plates, connectors, shelf angles, primer, and grout.

B. Contractor shall provide all labor, materials, equipment, and services necessary to design, fabricate, deliver, and install all structural metal framing work, as indicated on the Drawings, in accordance with local codes and standards, or as specified herein. This work shall include but not be limited to fabricating, delivering, and erecting structural metal framing, cutting, fitting, welding, cleaning, painting, providing temporary supports, and removing all temporary steel elements necessary for erection of structural metal.

C. Coordinate delivery with other work to avoid delay. All work shall be coordinated with other sections.

1. Related Sections:
   a. Section 05500, "Metal Fabrications" for furnishing steel lintels for unit masonry.
   b. Section 07620, "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.

1.02 SUBMITTALS

A. Submittals shall be provided in accordance with Sections 01330

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

C. Shop Drawings:

1. For structural metal framing: Base drawings on Construction Documents, and details.
2. Shop drawings shall clearly show plans, elevations, sections, details, and attachments to other work, location, fastening and anchorage details, and materials required.
3. Submit complete shop fabrication details and erection diagrams. Such shop details and erection diagrams shall give all pertinent information of construction methods proposed, together with all required dimensions for the proper fitting for the connection with other work and materials.
4. Show, in detail, fabrication of all structural metal components included in the Contract.

D. Material certificates for each type of product indicated. Include statements of material properties indicating compliance with requirements, standards, and type designations within standards. Include material test reports, substantiating compliance with requirements.

E. Welding certificates.

F. Mill test reports.

G. Qualification Data.

H. Source quality control test reports.

I. Substitutions shall be requested in accordance with Sections 01630

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Experience in performing work of this section, specializing in installation of work similar to that required for this project, employing workers who are skilled in this area of work, and whose projects have a record of successful in-service performance.

1. Welding: qualified procedures and personnel according to AWS D1.1, "Structural Welding Code".

B. Manufacturers shall meet the industry standards and codes for the materials identified on the Drawings and in the Specifications herein, including but not limited to:

1. American Institute of Steel Construction
   a. Specifications for the Design, Fabrication and Erection of Steel for Buildings.
   b. Code of Standard Practice
   c. Manual of Steel Construction
2. American Welding Society: Code for Welding in Building Construction AWS D1.0
3. Latest edition of each of above governing standards shall apply.
4. Fabricate in accordance with the AISC Quality Certification Program.

C. Certification: Product certificates signed by manufacturer, certifying materials comply with specified performance characteristics, criteria, and physical requirements.

D. Manufacturer's instructions for installation shall be delivered and stored with the materials.

E. Testing: As required by the latest industry codes and standards.

1. Field tests: Where a welded splice is fabricated in beams or columns, other than those detailed, the fabricator shall have the splice connection tested using one of the following methods:
   a. magnetic particle
   b. radiographic
   c. ultrasonic.
2. The testing shall be conducted by an independent testing laboratory and a report submitted to the Architect and Owner Representative.
3. The costs of this testing shall be borne by the fabricator.

F. Performance requirements:

1. Provide assemblies capable of withstanding design loads within limits and under conditions indicated on the Drawings.
2. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service and LRFD loads indicated, and comply with other information and restrictions indicated.
3. Select and complete connections using schematic details indicated, and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9.

G. Tolerances shall conform to industry codes and standards, except as otherwise noted.

H. Warranty:

1. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

2. Warranty Period: two (2) years commencing on Date of Certificate of Occupancy.
3. Additional requirements for product warranties are included in Section 01788

1.04 DELIVERY, STORAGE AND HANDLING

A. Transport and handle all materials in such a manner as to prevent damage. Dumping on the ground is not permitted.

B. Locate storage piles, stacks, or bins to avoid or protect material from heavy and unnecessary traffic.

C. Furnish temporary protection for all exposed edges and corners.

D. Deliver all packaged materials in original, unopened, undamaged containers, with identification labels intact, and bearing the name of the manufacturer and brand.

E. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

F. Store all steel materials off the ground, and protect materials from corrosion and deterioration. Store fasteners in a protected location. Clean and lubricate bolts and nuts that become dry or rusty before use.

G. Protect materials from exposure to harmful weather conditions, and at temperature and humidity conditions recommended by manufacturer. Some materials may need to be stored in protected enclosures, and handled by methods which avoid exposure to moisture. Store materials off the ground, under cover, and in a dry location. Additional requirements for product delivery, storage and handling are in Section 01600.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. Structural steel shapes, plates and bars shall conform to ASTM A36 (FY = 36,000 PSI), ASTM A572 (Fy=50,000 PSI)

B. Steel pipe columns shall conform to ASTM A53, Grade B.

C. Steel tube columns shall conform to ASTM A500, Grade B.

D. Anchor rods, bolts and nuts and machine bolts shall conform to ASTM A307, unless otherwise indicated.

E. Welding rods shall conform to AWS A5.0, E70 series, low hydrogen type.

F. Expansion bolts shall be Hilti anchors with a 360° expansion steel wedging action, unless noted otherwise.

G. Sections shall be of dimensions, weight and design as indicated, assembled complete at the shop, with base plates and other detailed materials attached. Furnish 1/4" thick leveling plates at all columns where base plates are shop fabricated to columns.

H. All material must be new, of uniform quality, suitable and without defects affecting the strength of service of the structure.

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

J. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M, [ASTM A 572/A 572M, Grade 50.

2.02 PRIMER

A. All metals shall be shop primed per SATM standards unless indicated otherwise.

B. Metal primer shall conform to FS TT-P-636.

2.03 GROUT

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

2.04 FABRICATION

A. All workmanship, details of construction, etc., except as otherwise indicated or specified, shall conform with AISC "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings", AISC "Code of Standard Practice", and applicable building codes.

B. Shop fabricate, and assemble steel to the greatest extent possible prior to delivery to site.

C. Make connections as indicated or detailed, on the Drawings, and the approved shop and erection drawings.

D. Mark materials for field assembly. Arrange fabrication order for most efficient delivery sequence for field assembly.

E. All exposed steel shall have smooth, clean surfaces with no identifying trademarks, names, etc., exposed to view.

1. Leave in condition for finish painting.

F. Machine bolts shall have proper length shanks with no bearing on threaded portions.

G. Erect all work to the proper lines and levels, plumb and true, and in correct relation to other work.

1. Secure all parts in a rigid and substantial manner during construction.

H. Bolted connections shall be as detailed or shall conform to AISC standard bolted connections with maximum number of 3/4" diameter bolts.

1. See Framed Beam Connections Table I, II, III, or IV of AISC Manual of Steel Construction.

I. No slotted holes permitted at steel connections unless approved by Architect.

J. Where bolt holes in steel members are enlarged to more than 1/16" diameter oversize, provide 3/16" X 2-1/2" x 2-1/2" plate washers with proper diameter hole.

1. Weld plate washers to steel members with 1/8" fillet weld all around.

K. Structural Steel: Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design, or Load and Resistance Factor Design Specification for Structural Steel Buildings", as required.

L. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

M. No heat cutting.

2.05 WELDING

A. Make welds by the electric-arc process.

B. Welders shall be duly qualified (test passed in the preceding 12 months) for the position in which they are to weld. Qualifications and specifications for workmanship shall comply with the AWS requirements "AWS Structural Welding Code-Steel".

C. Grind all exposed welds smooth.

D. Where weld size is not indicated, it shall develop full strength of member and connection.

2.06 PAINTING – SHOP COAT

A. Items of steel and ironwork indicated or specified to be encased in concrete or receive spray fireproofing shall not be painted.

B. Clean all steel work by wire brushing, or by other means selected by the fabricator, of loose mill scale, loose rust, accessible weld slag or, flux deposit, dirt and other foreign matter.

1. Remove oil and grease deposits by solvent.

C. After cleaning, give all steel work one coat of metal primer.

1. Apply primer thoroughly and evenly to dry surfaces, by brush, spray, roller coating, flow coating or dipping at the selection of the fabricator.
2. Apply primer at a rate of 350 sq. ft. per gallon to provide a wet film of 4.5 mils.

D. Paint erection marks on painted surfaces.

E. Touch-up all surfaces where welding, grinding of welds, joints, etc., are done in the field.

F. Paint shall be thoroughly dry before the members are handled or loaded.

2.07 SOURCE QUALITY CONTROL

A. Comply with testing and inspection requirements of Section 01450

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

C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify all anchor bolt locations, grouting and elevation of base and setting plates and other material set by other trades, etc., before commencing work.

B. Notify the Architect of any work set by others if out of tolerances specified, and do not erect any material upon such work until it has been corrected satisfactorily.

C. Starting work implies acceptance of the work of other trades affecting erection of the structural frame.

D. Final results are the entire responsibility of the Contractor.

3.02 ERECTION

A. Erect material plumb and level and maintain this condition to completion.

B. Connect members temporarily and align completely before making permanent connections.

C. Temporary conditions shall consist of bolts in no less than one-third of the holes and in no case less than 3 bolts in any single connection.

D. Surfaces in contact shall be thoroughly clean when assembled.

E. Provide necessary temporary bracing and guying to align the structure properly for permanent connections, and safely resist all erection, dead load and wind stress.

F. Take particular care to have the work plumb and level (maximum tolerance 1 to 500 for interior members, 1 to 1000 for exterior members) before making permanent connections.

1. Remove bracing and guys only after permanent alignment, and assembly and structure is capable of completely sustaining design and temporary construction loads.

G. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

H. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges", and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design, and Load and Resistance Factor Design Specification for Structural Steel Buildings" as applicable.

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

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
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 base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surface. Protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

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

3.03 CONNECTIONS

A. Machine Bolting:

1. Fair-up holes with pins to align holes before bolting.
2. Ream unfair holes to obtain alignment or drill new holes.
3. Enlargement of holes with drift pins or burning of new holes is not permitted.
4. Draw bolts up tight after members are aligned and leveled, and set or deform threads to prevent loosening.

B. Welding:

1. Weld by shielded arc method per AWS standard code for arc and gas welding in building construction.
2. Submit certification that welders have passed AWS code qualification tests.
3. Certification must be dated no earlier than 3 months prior to beginning of project.
4. Refer to shop drawings for weld size and dimensions.
5. Close all joints exposed to weathering with continuous 1/8" weather welds.
6. Grind smooth all exposed welds, but grinding shall not reduce weld strength or required cross section.
7. Protect all finish material from damage due to welding.
8. Remove unsatisfactory welds by chipping or arc air method.

C. Field Painting:

1. Spot paint all abrasions, field bolts and field welds with same paint used for shop coat.
2. Remove all temporary guys, bracing and bracing clips and grind flush all burrs remaining, before painting.
3. Remove all welding slag, spatter, rust and burnt paint and wire brush clean all welds before touch-up.

D. 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.

E. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design, or Load and Resistance Factor Design Specification for Structural Steel Buildings" as required for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.04 FIELD QUALITY CONTROL

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

B. Contractor is responsible for quality control of all materials and workmanship including the workmanship and materials furnished by subcontractors and suppliers.

C. Ensure alignments and elevations are correct prior to welding or permanently fastening components together.

D. 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."

E. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

F. Remove temporary shoring, bracing, and guy lines.

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

END OF SECTION 05120