SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Features:

1. Structural steel fabrication and erection required for completion of the work.
2. Architectural exposed structural steel fabrication and erection required for completion of the work, where indicated.

B. Related Sections:

1. 013300 – Submittal Procedures
2. 014500 – Structural Testing, Inspection, and Quality Assurance
3. 017100 – Construction Tolerance
4. 051213 – Architecturally Exposed Structural Steel Framing
5. 053100 – Steel Decking
6. 078100 – Applied Fireproofing
7. 099600 – High Performance Coatings

1.3 REFERENCE STANDARDS

A. General: Comply with the provisions of the latest versions of the publications listed below except as otherwise shown or specified.

B. American Institute of Steel Construction (AISC):

1.	AISC	Steel Construction Manual
2.	AISC 303	Code of Standard Practice for Steel Buildings and Bridges, as modified herein
3.	AISC 341	Seismic Provisions for Structural Steel Buildings.
4.	AISC 360	Specifications for Structural Steel Buildings

C. American Society for Testing and Materials (ASTM):

1.	ASTM A6	Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars
2.	ASTM A36	Standard Specification for Carbon Structural Steel
3.	ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4.	ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip
5.	ASTM A307	Carbon Steel Externally and Internally Threaded Standard Fasteners
6.	ASTM A435	Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates
7.	ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

8.	ASTM A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
9.	ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
10.	ASTM A588	High-Strength Low-Alloy Structural Steel with 50,000 PSI Minimum Yield Point to 4-Inch Thickness
11.	ASTM A706	Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
12.	ASTM A898	Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes
13.	ASTM A913	High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by the Quenching and Self-Tempering Process (QST)
14.	ASTM A992	Standard Specifications for Steel for Structural Shapes for Use in Building Framing
15.	ASTM F959	Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
16.	ASTM F3125	Standard Specifications for High-Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

D. American Welding Society (AWS):

1.	AWS A2.4	Welding Symbols
2.	AWS A3.0	Terms and Definitions
3.	AWS A5.1	Specifications for Carbon Steel Electrodes for Shielded Metal Arc Welding
4.	AWS A5.5	Specification for Low-Alloy Electrodes for Shielded Metal Arc Welding
5.	AWS A5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
6.	AWS A5.20	Specification for Carbon Steel Electrodes for Flux Cored Arc Welding
7.	AWS A5.23	Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
8.	AWS A5.29	Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding
9.	AWS D1.1	Structural Welding Code - Steel
10.	AWS D1.4	Reinforcing Steel Welding Code, including Metal Inserts and Connections in Reinforced Concrete
11.	AWS D1.8	Structural Welding Code - Seismic Supplement

E. Research Council on Structural Connections (RCSC):

1.	RCSC	Specification for Structural Joints Using High-Strength Bolts

1.4 STRUCTURAL DRAWINGS

A. The Contract Documents are complementary. The Structural Drawings shall not be considered a stand-alone document. The Contractor shall use the Structural Drawings in conjunction with all of the Contract Documents, including but not limited to the Architectural, Civil, Mechanical, and Electrical Drawings. Locations and geometry of steel members not provided in the Structural Drawings shall be determined from these other Drawings.

B. Delete Sections 2.1 and 2.2 from AISC 303 and replace with the following:

2.1 Definition of Structural Steel
Structural Steel shall consist of the elements of the structural frame that are shown and sized in the structural Design Drawings.

2.2 Other Steel, Iron, or Metal Items
Structural Steel shall not include other steel, iron, or metal items that are not shown and sized in the structural Design Drawings.

C. Section 3.1 and 3.2 from AISC 303 pertaining to the accurate dimensioning of structural steel shall be subject to the following additional requirements:

1. Dimensions and locations of steel framing shall be determined from the Structural Drawings as well as all other construction documents, including but not limited to the Architectural and MEP Drawings. It shall be the Contractor's responsibility to coordinate the dimensions of the structural steel between all of the construction documents.

D. Section 4.4 from AISC 303 pertaining to Approval shall be subject to the following additional requirements:

1. The review of submitted shop erection drawings will be in accordance with Division 1.
2. Submitted shop and erection drawings may not necessarily be individually annotated as approved or subject to corrections. The submittal as a whole will be noted by the Structural Engineer as "No Exceptions Taken," "Make Corrections Noted," "Revise and Resubmit," or "Not Reviewed." Correction notations specific to each piece will be noted.

1.5 QUALITY CONTROL

A. Fabricator/Erector:

1. Must have plant, facilities, and personnel sufficient to fabricate and/or erect structural steel indicated on the drawings. Must have minimum of 5 years' experience with a record of successful in-service performance and be able, upon request, to show framing of size, materials, and scope similar to work of this contract. Must demonstrate sufficient production capacity to provide structural steel indicated on the drawings.
2. Must have a Quality Control Plan established in accordance with AISC 360 Chapter N and AISC 341 Chapter J; quality control procedures shall be established and maintained in accordance with these requirements.

B. Material: Provide only structural steel certified as conforming with specified requirements and fabricate specifically to the requirements of this contract. Material that does not conform to the requirements of this contract may be rejected at any time.

C. Charpy V-Notch Testing: Testing shall be in accordance with ASTM A6, Supplement S5 or S30, where this testing is specifically required.

D. Allowable Tolerances: Unless otherwise specified or noted on drawings or in Section 017100, "Construction Tolerance," provide structural steel work in accordance with the following minimum tolerances:

1. Fabrication Tolerances: In accordance with requirements of AISC specification unless noted otherwise and as required to maintain the erection tolerances specified herein.
2. Erection Tolerances: In accordance with requirements of AISC. The Contractor alone shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure. Any adjustment necessary in the steel frame because of discrepancies in elevations and alignment shall be the responsibility of the Contractor.

E. Connection Identification: Each person installing connections shall be assigned an identifying symbol or mark, and all shop and field connections shall be so identified so that the Owner's Testing Agency can refer to the person making the connection.

F. Testing and Inspections: Work is subject to special testing and inspection in accordance with the Building Code, AISC 360 Chapter N, and AISC 341 Chapter J. Refer to Section 014500,

"Structural Testing, Inspection, and Quality Assurance." The Fabricator/Erector shall provide the Owner's Testing Agency and the Architect/Engineer access to places where material is being fabricated/erected. Notice shall be given for joints requiring inspection for proper end preparation, root opening, etc., prior to welding.

G. Welder Qualifications: Each welder performing work on this project shall be qualified before commencement of welding on this project in accordance with the American Welding Society, AWS D1.1 and AWS D1.8. Copies of each welder's qualification records shall be made available to the Architect and Owner's Testing Agency for review.

H. Inspections: A qualified inspector under the requirements of the building code shall continuously inspect field welds.

I. Bolting Quality Assurance: The bolt supplier shall visit the project site or fabrication plant if bolt installation is to be performed during the bolting start-up to demonstrate proper installation procedures and verify inspection procedure with the Contractor, Erector, and the Owner's Testing Agency. The Contractor shall distribute written verification of the visit to the attending parties, Owner, Architect, and Owner's Structural Engineer.

J. Shop Testing by Contractor: The Contractor shall perform ultrasonic testing and visual inspection for discontinuities of all plate material and rolled sections greater than 1-1/2 inches in thickness and located at welded connections where the base metal is subjected to through-thickness weld shrinkage strains prior to fabrication. The test area is defined as a zone up to 6 inches away from the weld in the connection. These tests shall be in addition to the ultrasonic testing of all complete joint penetration welds and base metal that will be performed by the Owner's Testing Agency after joint completion. The Contractor's testing shall be submitted to the Architect/Engineer and Owner's Testing Agency. All costs associated with this testing shall be borne by the Contractor.

    1. Ultrasonic Testing of Plate Material: Conduct in accordance with ASTM A435 and the following modifications and supplementary requirements:
        a. Supplementary Requirements S1, requiring 100% scanning of the test area, are to be included.
        b. Section 5.2, Acceptance Standards, is supplemented with the following provision: "The fabricator, insofar as practical, may reposition a rejected plate so that rejectable defects are not located in a test area."
    2. Ultrasonic Testing of Wide Flange Material: Conduct in accordance with ASTM A898, Level I acceptance standard.

K. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

Pre-Construction Conference: Schedule a job conference to review the Structural Documents prior to development of shop drawings. The conference shall be attended by all pertinent parties, which is, at a minimum, to include the Fabricator, Erector, Contractor, Owner's Testing Agency, and Structural Engineer.

1.6 SUBMITTALS

A. Submit the following in accordance with Section 013300, "Submittal Procedures."

B. Shop Drawings: Submit shop drawings for review prior to commencing any fabrication of structural steel.

1. Show framing layout, dimensions, connections with adjoining materials and construction, finishes, welds, bolts and fasteners, anchoring, and all fabrication or erection accessories required.
2. Specify field welds, cuts, holes, and fasteners.
3. Verify all dimensions and correlate with adjoining construction and materials.
4. Indicate size, type, and grade of all members.
5. Include with each detail shown on the shop drawings a reference to the Architect's and Engineer's drawings and details, where applicable.
6. Prior to shop drawing submittal, the Contractor and Fabricator shall review the drawings for obvious drafting and detailing errors.

C. One month prior to commencing fabrication, submit Fabricator's quality control procedures to the Architect, Engineer, Owner, and Owner's Testing Agency.

D. Indicate welded connections on shop drawings using standard AWS welding symbols. Show all welded connections with details showing size, length, location, and type of welds.

E. Mill Reports: Submit three copies of certified mill reports indicating heat and melt numbers of steel. Mill reports are to be submitted for record only and will not be reviewed:

1. If test reports are not submitted or test reports cannot be identified with material proposed for use in the work, then secure and perform structural tests on 5% of all such unidentified steel.
2. Contractor shall furnish all such material for testing and pay for all such tests.
3. Furnish Owner, Architect, and Structural Engineer certified copies and Fabricator one certified copy of all test reports.

F. Inspection Test Reports: Upon request, submit to Architect copies of Contractor's ultrasonic testing reports.

G. Placement Plans: Submit placement plans and details as required for the satisfactory placing, connection, and anchorage of all structural members.

H. Survey Reports: Promptly submit an accurate survey of actual elevations and locations of base plates and anchor rods, and alignments as well as elevations of all steel as noted on the drawings. The report shall specify that the location of the structural steel is acceptable for plumbness, level, and alignment within the specified tolerances.

I. Certification: Submit manufacturer's certified test reports on compressible washer-type direct tension indicators and/or tension control bolts on at least three samples from each heat supplied to conform to tolerance range.

J. Welding Procedures: For welded joints prequalified and non-prequalified by AWS D1.1 and D1.8, submit a Welding Procedure Specification a minimum of one month prior to use. Furnish joint welding procedure qualification tests as required by AWS D1.1 and D1.8 for non-prequalified welded joints. Welding procedures shall be reviewed by the Owner's Testing Agency, and an approved copy shall be forwarded to the Structural Engineer.

K. Manufacturer's Certification is required as follows:

1. Bolts, Nuts and Washers: Furnish complete manufacturer's mill test reports conforming to ASTM F3125 Grade A325, F1852, A490, or F2280. Markings and chemistry must also comply with the specification. Certification numbers must appear on product containers and correspond to certification numbers on mill test report to be accepted. Mill test report must be supplied to both purchaser and Owner's Testing Agency.
2. Filler material for welding.

L. Product Data: For shop primers, include manufacturer's technical information including basic materials analysis and application instructions.

M. Structural Calculations: Submit structural calculations for connections that are designed by the Contractor as required in the construction documents. These calculations shall be prepared by an engineer licensed to perform the work in the jurisdiction where the project is located.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of the general conditions and of ASTM A6, including the following.

B. Store materials in a manner to permit easy access for inspection and identification.

1. Keep steel members off the ground, using pallets, platforms, or other supports.
2. Protect steel members and packaged materials from corrosion and deterioration.

C. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures at no additional cost to the Owner.

D. Columns, beams, girders, and other members that are to receive sprayed-on fireproofing shall be free of loose rust, heavy mill scale, oil, dirt, or other foreign substances prior to application of fireproofing materials.

E. All fasteners shall be stored and protected in accordance with the current requirements of the "Specification for Structural Joints Using High-Strength Bolts."

1.8 JOB CONDITIONS

A. Temporary Bracing: Temporary bracing and guylines shall be provided to adequately protect all persons and property and to ensure proper alignment.

B. Temporary Floors: All temporary flooring, planking, and scaffolding necessary in connection with the erection of the structural steel or support of erection machinery shall be provided. The temporary floors or use of steel decking shall be as required by law and governing safety regulations. The reduced load capacity of members and assembly, especially the floor and roof beams and girders due to their unbraced condition prior to welding of steel deck and completion of concrete slabs, is hereby noted and shall be considered.

C. Holding and Protection: In assembling and during welding, the component parts shall be held with sufficient clamps or other adequate means to keep parts straight and in close contact. In welding, precautions shall be taken to minimize "lock-up" stress and distortion due to heat. In windy conditions, welding shall be done only after adequate wind protection is furnished and set up and as specified in the AWS.

1.9 CONDITION OF STEEL

A. Pre-Fireproofing Inspection: The Contractor, structural steel erector, sprayed-on fireproofing applicator, and the Owner's Testing Agency shall conduct a visual inspection of all structural steel prior to receiving fireproofing. The purpose of this inspection is to check for foreign substances on the surfaces, which could impair adhesion. Any cleaning that may be necessary as a result of this inspection shall be done at no additional cost to the Owner.

B. Application of the sprayed-on fireproofing will not commence until all steel surfaces have been accepted by the sprayed-on fireproofing subcontractor and material manufacturer. No additional compensation shall be granted to the Contractor, structural steel erector, or fireproofing applicator should it be determined at a later date that foreign substances, which were allowed to

remain on the steel surfaces, will have a detrimental effect in obtaining total adhesion in accordance with specification Section 078100, "Applied Fireproofing."

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Carbon Steel and High-Strength Low-Alloy Steel: Provide steel shapes, plates, and bars of structural quality, sizes, and standards noted on drawings for use in welded and bolted construction. Steel manufactured by the acid bessemer process shall not be used for structural purposes. Steel that, in the opinion of the Owner's Testing Agency, is badly corroded or physically damaged shall not be incorporated in the work until the Owner's representatives, Contractor, Erector, and Fabricator have agreed to allow the installation.

B. Primer: Fabricators standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer.

1. Weldable primers shall not be used.
2. Where other coatings (intumescent paint, architectural paint, etc.) are to be applied, use the appropriate primer as required per the architectural coatings specifications and as required to be compatible with these other coatings.

C. Standard Fasteners: Low-carbon steel externally and internally threaded fasteners conforming to requirements of ASTM A307, Grade A. Provide hexagonal heads and nuts for all connections. Include lock washers under nuts or self-locking nuts.

D. High-Strength Fasteners: Quenched and tempered steel bolts and nuts conforming to requirements of ASTM F3125.

1. Washers other than compressible washer type direct tension indicators shall be hardened steel.
2. Compressible washer type direct tension indicators, where used, shall conform to ASTM F959.
3. Any proposed substitutions must have documentation submitted for review and approval of the Structural Engineer one month prior to construction.

E. Weld Electrodes: See AWS D1.1 and AWS D1.8 for requirements.

F. Headed Shear Connector Studs, Deformed Bar Anchors: Refer to Section 053100, "Steel Decking," for specific requirements at composite floor deck.

1. Headed Shear Connector Studs: Shall be Type B in accordance with AWS D1.1 and comply with ASTM A29, Grade 1010 or 1020; of dimensions complying with AISC specifications and the contract drawings; through deck stud welded shear connectors. Install in such a manner as to provide complete fusion between the end of the stud and structural steel base material.
2. Deformed Bar Anchors: ASTM A496 of dimensions per plan. Install in such a manner as to provide complete fusion between anchor and base material.
3. All steel stud/anchors welded to steel beams or plates shall be "Tru-weld studs," Division of Tru-Fit Screw Products Corporation, Cleveland, Ohio; "Nelson Stud," Division of Gregory Industries, Inc., Lorain, Ohio; or approved equal. All stud anchors shall be automatically end-welded in shop or field with equipment recommended by manufacturer of studs and anchors.
4. All welded connectors are to be end welded in accordance with AWS D1.1 Clause 7. Base metal is to be clean, dry, and free of paint, rust, oil, scale, or other contaminants. Welding should not be done when the base metal temperature is below 0°F or when the surface is wet or exposed to falling rain or snow.

5. Where threaded studs are specified, the stud shall utilize a reduced weld base so that the weld flash will match the diameter of the fastener.

G. Drilled-in-Concrete Anchors: Refer to structural drawings.

H. Slab Edge/Deck Supports: Refer to Section 053100, "Steel Decking," for specific requirements at composite floor deck.

1. Provide additional structural steel support framing for steel deck where normal deck bearing is precluded by column flange plates or other framing members.
2. The Contractor shall make specific provisions to provide the necessary framing materials at slab and roof edge conditions. The Contractor shall provide and install all gage metal edge closures where required by the plans and specification and shall coordinate shoring requirements at composite slab edges. The Contractor shall provide and install all structural steel bent plate edge closures or structural steel edge materials and any corresponding bracing or shoring where required by the plans and specifications.

I. Grout: Refer to Structural General Notes.

J. Other Materials: Provide all incidental and accessory materials, tools, methods, and equipment required for fabrication and erection of structural steel framing as indicated on drawings. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

K. General: Miscellaneous materials or accessories not listed above shall be provided as specified herein under the various items of work and as indicated on the drawings or required for good construction practice.

2.2 FABRICATION

A. Fabricate all steel in accordance with requirements of AISC specifications and in accordance with details indicated on the drawings or as approved on shop drawings.

1. Identify all steel at mill showing ASTM standard grade.
2. Identify each piece with an erection mark corresponding to identifications noted on erection drawings.

B. Materials shall be properly identified with an erection mark corresponding to identifications noted on erection drawings and match-marked where field assembly requires. The sequence of shipments shall be such as to expedite erection and minimize the field handling of material.

C. Cutting: All holes and openings must be approved by the Owner's Structural Engineer.

1. Do no flame cutting by hand of openings greater than 1/2 the depth of the member, unless approved by the Engineer.
2. All flame-cut holes shall be smoothed by chipping, planing, or grinding members to required AISC tolerances.
3. Sharp bends or kinks will not be allowed.
4. Flame cutting by hand will not be allowed for holes at connections.

D. Milled Surfaces: All milled surfaces shall be completely assembled or welded before milling. Milled surfaces are to provide full contact bearing for the entire cross section.

E. Beams, girders, and trusses shall be upward cambered where indicated on the drawings. For beams, girders, and trusses without specified cambers, fabricate members so that after erection, any minor camber due to rolling or fabrication is upward.

F. Connections Designed on the Structural Drawings:

1. The Contractor shall not deviate from these designs unless approved by the Architect and Engineer.
2. Connections shown on the drawings may eliminate certain methods of erection.
3. If the Contractor elects a method of erection that requires a change of some of the connections, it must be approved by the Architect and Engineer.

G. Combination of bolts and welds shall not be used for stress transmission in the same faying face of any connection without prior approval by the Structural Engineer.

H. For stud anchor and deformed bar anchor welding, the area where the anchor is to be attached shall be made free of all foreign material such as rust, oil, grease, paint, galvanizing, etc.

1. When the mill scale is sufficiently thick to cause difficulty in obtaining proper welds, it shall be removed by grinding or sandblasting.
2. Use automatic end welding of headed stud shear connectors and deformed bar anchors in accordance with manufacturer's printed instructions.

I. Welding processes other than shielded metal arc, flux core arc, and submerged arc may be used, provided procedure qualification tests in accordance with the American Welding Society are made for the intended application of all such processes.

J. Built-up sections assembled by welding shall be free of warpage, and all faces shall have true alignment.

K. Types of Welds: Required weld types are indicated by symbols on drawings; characteristics of welds shall be in accordance with standard specifications or codes as applicable; each welder shall mark his identification symbol on his work.

L. Preparation of Steel Surfaces to be Welded: Prepare edges to be joined by welding as indicated on drawings and in accordance with AWS D1.1. All welds are to be made to sufficiently clean steel. Remove all coatings, galvanizing, grease, scale, rust, and other foreign matter at locations that are to be welded in accordance with AWS D1.1.

M. Welding Environment: Welding shall not be done when the ambient temperature is lower than 0°F; when surfaces are wet or exposed to rain or snow; when exposed to high wind velocities; or when welding personnel are exposed to inclement weather.

N. Reinforcing Steel: Welding or tack welding of reinforcing bars to other bars or plates, angles, and similar shapes is prohibited, except where specifically shown on plans or approved by the Structural Engineer; where required, use electrodes in accordance with requirements of AWS D1.4 Clause 7.1 and the Structural General Notes. Welding of reinforcing bars shall only occur at bars conforming to ASTM A706, except where specifically approved by the Structural Engineer.

O. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.

P. Detailing of connections, welding sequences, and preheat methods shall be such as to minimize restraint and the accumulation and concentration of through thickness strains due to weld shrinkage.

Q. At welded joints that are not hidden by architectural finish materials, remove projecting ends of runoff tabs, backer bars, and any other erection aids, and grind flush with edges of plates.

R. Cleaning of Steel Surfaces: Clean all surfaces of oil, grease, loose rust, loose mill scale, and other foreign matter present in sufficient quantities to impair bond of spray fireproofing or other specified coatings.

S. Bolted Faying Surfaces at Slip Critical Connections: Surfaces are to be prepared such that faying surfaces satisfy the requirements for a Class A surface unless noted otherwise.

T. Steel Stud and Deformed Bar Anchors:

1. All anchors shall be automatically end-welded in the shop or field with equipment recommended by the manufacturer of the studs and by qualified welders. Steel stud material, welding, and inspection shall be in accordance with AWS D1.1 Clause 7. End-weld in such a manner as to provide complete fusion between the end of the stud and the plate. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate.
2. Tests and Inspections by the Contractor: Provide testing of deformed bar anchors and studs in accordance with AWS D1.1 Clause 7.
3. Refer to Section 053100, "Steel Decking," for specific requirements at composite floor deck.

U. Shop Priming: Prime steel as follows and as specified in Section 099600, "High Performance Coatings."

1. Shop prime steel surfaces except the following:
   a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   b. Within 2 inches of surfaces to be welded.
   c. Surfaces to receive sprayed-on fireproofing, unless surfaces will be exposed to moisture.
2. Surface Preparation: Clean surfaces to be primed. Remove loose rust, loose mill scale, and splatter, slag, or flux deposits. Prepare surfaces to SSPC specification as follows:
   a. SSPC SP3 "Power Tool Cleaning" to a minimum blast profile of 1.5 mils.
3. Priming: Immediately after surface preparation, apply primer according to the manufacturer's instruction and at the rate recommended by SSPC to provide a dry film thickness of not less than 3.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   b. Apply two coats of primer paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

V. Temperature Effects: Fabrication shall take into consideration all temperature effects relevant to the fabrication, erection, and final condition of the structural frame. Fabrication shall consider that the temperatures which the frame members are subjected to during fabrication, erection, and in their final condition may be significantly different and shall make any adjustments necessary to facilitate proper erection of the frame.

W. If the Contractor elects a method of erection that requires a change of some of the connections, or otherwise wishes to use alternate connections, the alternate connections must be reviewed and approved by the Architect. The design of all alternate connections is the responsibility of the Contractor. The Contractor shall retain an engineer licensed to perform the work in the jurisdiction where the project is located to prepare details and calculations, which shall be submitted for review and approval by the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 ERECTION

A. General: Erect structural steel framing in accordance with governing codes and specifications. Conform to configurations and connections as shown in the documents.

B. Shoring and Bracing: Provide temporary shoring and bracing members as required and according to the AISC Code of Standard Practice as well as any applicable Local, State, or Federal requirements. The design of the shoring and bracing is the responsibility of the Contractor. The determination of the timing of the installation and removal of the shoring and bracing elements is strictly the responsibility of the Contractor.

C. Column Base and Bearing Plates: Align attached column bases and bearing plates for beams and similar structural members. Set loose column bases and bearing plates. Grout solid with non-shrink grout as specified.

D. Field Assembly: Accurately assemble structural framing to lines and elevations indicated within specified or noted tolerances.

1. Align and adjust various members of framing system prior to fastening.
2. Prior to assembly, clean bearing surfaces and surfaces that will be in permanent contact.
3. Splice structural members only where indicated or where approved.
4. Cut holes by drilling only.
5. Fasten splices of compression members after bringing abutting surfaces completely into contact.
6. Make all field connections by high-strength bolting or welding, unless otherwise noted.
7. Unless noted otherwise, tighten and leave erection bolts in place after welding. Where high-strength bolts are required, provide identified and marked bolts.
8. Do not field cut or alter structural members without the written approval of the Structural Engineer.
9. Do not use gas-cutting torches for correcting fabrication errors in structural framing.
10. Finish gas-cut sections equal to a sheared appearance.

E. Furnish shim plates or develop fills where required to obtain proper fit and alignment.

F. Non-Fusible Backing Materials: The use of non-fusible backing materials, including ceramic and copper, in accordance with the structural notes, is permitted only with satisfactory welder qualification testing performed using the type of backing proposed for use, using the test plate shown in AWS D1.1, Figure 4.21, except that groove dimensions shall be as provided in the weld procedure specification. Welders using these backings shall be prequalified per AWS.

G. Composite Construction: This building utilizes composite (concrete and structural steel) construction for various beams and columns. Careful sequencing of steel erection and concrete placement is recommended.

H. Connections: No welding or bolting shall be done until as much of the structure as will be stiffened by the welding or bolting has been properly aligned.

I. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged shall be reamed up to a maximum of 1/16 inch larger to admit bolts. Burning, drifting, and reaming may be used to align unfair holes in members only after approval by the Owner's Structural Engineer.

J. Mutilate threads or use lock nuts for unfinished bolts to prevent nuts from backing off. Draw unfinished bolt heads and nuts tight against the work.

K. Establish required leveling and plumbing measurements on the mean operating temperature of the structure of 65°F unless noted otherwise. Make allowances for differences between

temperature at time of erection and mean temperature at which the structure will be maintained when completed and in service.

L. The steel erector shall leave the steel clean of oil or other contaminants as outlined under Part 2 of this Specification.

M. Touch-up Priming: Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop primer. Apply primer to exposed area with the same material as used for shop priming. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

3.3 ERECTION TOLERANCES AND SURVEY

A. Plumb, level, and align individual pieces in accordance with the requirements of the "AISC Code of Standard Practice for Steel Buildings and Bridges" and Section 01 71 00, "Construction Tolerance."

B. Field Survey: Make an accurate survey of alignments and elevations of all steel members as noted on the drawings.

1. During construction of the steel frame, the Contractor shall survey the column locations and splice elevations as each column tier is erected. Submit survey reports indicating this information within 24 hours for review prior to erecting the subsequent tiers.
2. Permanent benchmarks shall be established by an engineer licensed to perform the work in the jurisdiction where the project is located, employed by the Contractor in accordance with the requirements of contract documents.
3. Should locations vary beyond the allowable tolerances, notify the Architect/Engineer and take necessary corrective measures and modify details and/or procedures as required and approved.

3.4 HIGH-STRENGTH BOLT INSTALLATION

A. General: Supply and install all high-strength bolts, nuts, and washers in conformance with the requirements of the current edition of "Specification for Structural Joints Using High-Strength Bolts."

1. High-strength bolts in snug-tight connections, where allowed by the drawings, shall be installed in accordance with Section 8.1, "Snug-Tightened Joints."
2. All other high-strength bolts shall be installed in accordance with Section 8.2, "Pretensioned Joints and Slip-Critical Joints."
    a. Turn-of-nut pretensioning shall be in accordance with Section 8.2.1.
    b. Calibrated wrench pretensioning is not an acceptable pretensioning method.
    c. Twist-off-type tension-control bolt pretensioning shall be in accordance with Section 8.2.3. Tension control bolts shall be supplied and installed in accordance with the manufacturer's written procedures.
    d. Direct-tension-indicator pretensioning shall be in accordance with Section 8.2.4. Direct tension indicators shall be supplied and installed in accordance with the manufacturer's written procedures.

END OF SECTION