

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. This section includes the furnishing, fabrication and erection of structural steel, including the major items listed below:
 - 1. Base plates, setting plates and anchor rods for columns.
 - 2. Columns.
 - 3. Beams, girders, purlins, crane rails.
 - 4. Edge angles in roof system.
 - 5. Angle roof frames.
 - 6. Horizontal wall girts, sag rods.
 - 7. Bracing angles and rods.
 - 8. Lintels if connected to structural steel columns.
 - 9. Shelf angles.
 - 10. Shear stud connectors.
 - 11. Appurtenances, connections, bolts, plates for the above.
 - 12. All embedded items required for other portions of work.
 - 13. Other items as listed in Section 2.1 of AISC Code of Standard Practice for Steel Buildings and Bridges.
- B. Related sections include the following:
 - 1. Division 05 Section “Steel Joist Framing.”
 - 2. Division 05 Section “Metal Decking.”
 - 3. Division 05 Section “Metal Fabrications.”

1.3 REFERENCES

- A. Except as herein specified or as indicated on the Drawings, the work of this section shall comply with the following:

1. ASTM Standard Specifications:
 - a. A6 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.
 - b. A36 - Carbon Structural Steel.
 - c. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - d. A108 - Carbon Steel Bars, Cold Finished, Standard Quality.
 - e. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - f. A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - g. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - h. A325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi; Minimum Tensile Strength.
 - i. A490 - Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
 - j. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - k. A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - l. A563 - Carbon and Alloy Steel Nuts.
 - m. A572 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 - n. A780 - Standard Practice for Repair of Damaged and Uncoated Hot-Dip Galvanized Coatings.
 - o. A992 - Steel for Structural Shapes for Use in Building Framing.
 - p. F436 - Hardened Steel Washers.
 - q. F1554 - Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.
2. AISC:
 - a. Code of Standard Practice for Steel Buildings and Bridges.
 - b. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
 - c. Detailing for Steel Construction.
 - d. Manual of Steel Construction.

- e. Specification for Structural Joints Using ASTM A325 or A490 Bolts.
- 3. AWS - American Welding Society publications:
 - a. ANSI/AWS D1.1 - Structural Welding Code - Steel.
 - b. American Hot-Dip Galvanizers Association.

1.4 DEFINITIONS

- A. Fabricator: An individual, firm or corporation that assembles raw structural steel items into structural steel building members.

1.5 CONNECTION DESIGN REQUIREMENTS

- A. Fabricator:

- 1. Responsible for the selection of connections except those specifically noted on the Drawings as Engineer designed.
- 2. Responsible for the design of moment connections where indicated on the Drawings.
- 3. Coordinate type of connection (bolted or welded) with steel erector.

- B. General Types of Connections: Indicated on Drawings.

- C. Connections:

- 1. Equal to standard framing connections in accordance with AISC - Manual of Steel Construction.
- 2. Minimum Load Connection:
 - a. Two 3/4-inch diameter bolts, or
 - b. Welds with a total capacity of 6,000 pounds.
- 3. Beam connections shall be selected for a shear capacity equal to the greater of the following:
 - a. 1/2 the total allowable uniform load capacity of the beam according to the AISC Manual of Steel Construction, Section 2, or
 - b. The actual shear reaction due to combination of all loads as posted on the Drawings.
- 4. Connections: Bolted bearing type unless indicated otherwise on the Drawings.

1.6 SUBMITTALS

- A. Shop Drawings: For all members to be furnished to include:

1. Detail Drawings of Members and Connections:
 - a. In accordance with AISC - Detailing for Steel Construction.
 - b. Size, number and type of bolts.
 - c. Dimensions.
 - d. Connection angles and plates.
 - e. Camber.
 - f. Holes.
2. Erection Drawings:
 - a. Locate and identify members.
 - b. Clearly identify bolt installation requirements.
3. Welding: In accordance with AWS welding symbols.
4. Type of paint.
5. Steel sections which are not available, and suggested steel sections that are available.

B. Certification:

1. Proof of acceptable quality control program.
2. Bolts, Nuts and Washers: Manufacturer's certification that products supplied for this Project comply with this specification.
3. Weld Filler Materials: Manufacturer's certification that products supplied for this Project comply with this specification.

C. Mill Certification Tests: Submit in compliance with Michigan Building Code.

D. Provide setting Drawings, templates and directions for the installation of anchor rods and other devices.

1.7 QUALITY ASSURANCE

A. Fabrication and Erection Personnel Qualifications:

1. Trained and experienced in the type of work being performed.
2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Welders, Welding Operators and Tackers Qualifications:

1. Qualified by tests in accordance with Section 5 of AWS D1.1.
2. Qualification Papers:
 - a. Given by an independent testing laboratory.
 - b. Dated no earlier than 6 months prior to beginning of Project.
3. Engineer, at Engineer's discretion, may accept evidence of previous qualifications.

C. Steel Fabricators Qualifications:

1. Certified under the AISC Quality Certification Program for Category I - Conventional Steel or II - Complex Steel Building Structures, as applicable, or under other quality control program acceptable to building official in accordance with building code, prior to fabrication.
2. The quality control program shall permit work on fabricator's premises without special inspection.

D. Testing of Welds, Bolts and Shear Studs: In accordance with Division 01 Section "General Requirements – Quality Requirements," and the Michigan Building Code.

E. Inspection of Steel Fabrication and Erection: In accordance with Division 01 Section "General Requirements – Quality Requirements" and Michigan Building Code.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, unload, handle and store structural steel items in such manner as to not distort or otherwise damage the materials, and protect from corrosion and deterioration.

B. Reject damaged, deteriorated or distorted material and immediately remove from the site. Replace rejected materials with new material at no additional cost to Owner.

C. Embedded Items

1. Includes anchor rods and other anchorage devices which are to be embedded in cast-in-place concrete and masonry.
2. Deliver to the Project site before the start of cast-in-place concrete and masonry operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: All materials shall be subject to Engineer's review.

B. Structural Steel:

1. All Structural Steel Shapes:

- a. New, unused and perfect stock.
- b. Free from millscale, rust, flake, pitting and imperfections.
- c. Without bends, kinks and distortions.

2. Identified Steel Sizes:

- a. Review availability of specified steel sizes for delivery within the Project schedule.
- b. Submit to Engineer proposed alternative sizes, if specified sizes are unavailable.

- c. Be responsible for additional costs, if any, of steel size revisions required because of availability or Project schedule.
 3. Shop splicing of members will be permitted only if the member exceeds maximum mill length or if approved by Engineer and so indicated on the Shop Drawings.
 4. Yield Stresses and Types of Steel:
 - a. Wide Flange Shapes: ASTM A992.
 - b. HP-Shapes, M-Shapes, S-Shapes, Channels, Angles, Bars, Plates and Rods: ASTM A36, with yield stress of 36,000 psi.
 - c. Square and Rectangular Tubular Shapes: ASTM A500, Grade B, with yield stress of 46,000 psi.
 - d. Round Tubular Shapes: ASTM A53, Grade B, with yield stress of 35,000 psi, or ASTM A501, with yield stress of 36,000 psi.
- C. Bolted Connections:
 1. Bolts:
 - a. ASTM A325, 3/4-inch diameter or larger unless indicated otherwise on the Drawings.
 - b. ASTM A490, 3/4-inch diameter or larger, only if required by connection design.
 2. Nuts: ASTM A563, overtapped when used on galvanized bolts.
 3. Washers:
 - a. ASTM F436, Type I.
 - b. Circular, clipped, or beveled as required by the application.
- D. Welding:
 1. In Accordance With:
 - a. AISC Specification Section J.
 - b. AWS Structural Welding Codes D1.1.
 2. Filler Metal: As indicated in Table 4.1 of AWS D1.1.
- E. Prime Paint: As specified in Division 09.
- F. Shear Studs:
 1. Diameter and after-welded length as indicated on the Drawings.
 2. Headed.
 3. Conform To:

- a. ASTM A108.
- b. Table 7.3.1 of AWS D1.1.

G. Anchor Rods

1. ASTM F1554, Grade 36, or greater if indicated on the Drawings.
2. Remove oil, grease and dirt from anchor rods prior to shipping to the site.
3. Anchor Rod Washers:
 - a. 5/16-inch ASTM A36 plate.
 - b. With hole 1/16-inch larger than anchor rod diameter.

2.2 FABRICATION

A. Shop Assembly:

1. Assemble steel work in shop by bolting and welding, as indicated on Drawings and as herein specified.
2. Assemble components prior to shipping as much as is practical.
3. Camber steel beams to amounts indicated on the Drawings.
4. Fabricate and ship steel in sequence which minimizes rehandling of steel and expedites erection.
5. Accurately mill ends of columns and other members to be in direct bearing.

B. Fabrication:

1. Conform to Applicable Portions of AISC:
 - a. Specification for the Design, Fabrication, and Erection of Structural Steel for Building.
 - b. Code of Standard Practice.

C. Holes:

1. Provide required holes for attachment of the work of other trades.
2. Where conditions require, holes shall be slotted.
3. Do not flame cut holes or enlarge holes by burning.

D. Galvanizing:

1. Hot-dipped galvanize with 2 oz/ft² minimum after fabrication in accordance with ASTM A123, unless noted otherwise.
2. Hot-dip galvanize bolts, nuts, washers and anchor rods in accordance with ASTM A153, Class C.
3. Do not hot-dip galvanized cold bent items.

4. Galvanize the items so indicated on the Drawings.

E. Architecturally Exposed Structural Steel:

1. For items so indicated on the Drawings.
2. Fabricate with exposed surfaces smooth and free of pittings, rust, trade names or other stamped data, and other similar surface defects.
3. Remove or repair surface defects prior to shop painting.
4. Comply with AISC Code of Standard Practice for Architecturally Exposed Structural Steel.

2.3 SHOP PAINTING

A. Surface preparation and prime painting: As specified in Division 09.

B. Prime Paint:

1. Hold paint back on surfaces which are:
 - a. Enclosed in concrete.
 - b. Within 2 inches of field weld areas or slip-critical bolted connections.
 - c. To be spray fireproofed.
 - d. To be galvanized.
2. Surfaces not accessible after assembly shall be painted before assembly.
3. Work paint into all joints.
4. Thoroughly dry before shipment.
5. Smooth, even, free from skips and runs.
6. Suitable to receive field painting finish coats.

C. Identification: Paint each item in shop with identification mark in accordance with erection drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey:

1. Check elevations of bearing surfaces and locations of anchor rods and embedded connections.
2. Report discrepancies to Engineer.
3. Do not proceed with erection until Engineer has reviewed discrepancies and adjustments have been agreed upon.

3.2 ERECTION

A. Assembly:

1. Erect steel accurately to lines and elevations indicated.
2. Align and adjust framing as erection proceeds and before final fastening.
3. Splice members only where so indicated on the reviewed Shop Drawings.
4. Remove erection bolts and connections where required for exposed construction; plug weld holes and grind exposed surfaces smooth.
5. Remove mud, tags, and other foreign material from members prior to erection.

B. Plumbing:

1. Make allowances for thermal changes of length of members when plumbing columns and struts.
2. Generally:
 - a. Set columns at the center of building plumb.
 - b. Cant exterior columns in or out depending upon temperature at time of erection.

C. Temporary Bracing:

1. Provide temporary bracing and accessories required for complete erection.
2. Safety and adequacy of temporary bracing is the responsibility of Contractor.
3. Structure will not be stable until all beams, floors, roofs, shear walls and bracing are complete.

D. Burning of holes is prohibited.

E. Cutting:

1. Gas cutting is prohibited on major members.
2. On minor members not stressed: Obtain Engineer's prior approval.

F. Do cutting, fitting, drilling and tapping of materials as required for proper and complete installation of work of this section.

G. Tightening:

1. Tighten bolts snug-tight as defined by AISC, unless otherwise noted on the Drawings.
2. Tighten bolts in long and short slotted holes using AISC Turn-of-the-Nut Method, unless indicated otherwise on the Drawings; or approved by Engineer.

3. Where specifically indicated on the Drawings, finger-tighten nuts in connections where movement must be permitted, and tighten jam nut over finger-tightened nut, or peen bolt threads, to prevent nut backoff.

H. Welding: Field welding shall be performed to the same standards and requirements as shop welding.

I. Touch Up:

1. After erection is complete, touch up shop priming coats damaged during transportation and erection.
2. Prime field welds, bolt heads, nuts and abrasions using the priming paint specified for shop priming.
3. Touch up damaged galvanized areas with a zinc rich paint meeting ASTM A780.

J. Erection Tolerances:

1. Structural Steel: In accordance with AISC Code of Standard Practice.
2. Architecturally Exposed Structural Steel: In accordance with AISC Code of Standard Practice.

3.3 CLEANING

A. Prior to acceptance of the work of this section, thoroughly clean structural steel and related areas in accordance with Division 01 requirements.

END OF SECTION 051200