

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 1 Specification Sections apply to this section.

1.2 SECTION INCLUDES

- A. Structural Metals.

1.3 RELATED WORK

- A. Remaining metal work covered by Division 5.
- B. Concrete construction for the project is included in other subcontracts. Coordinate all details of structural metal fabrication and erection with the work of other Contractors.

1.4 QUALITY ASSURANCE

- A. Fabricator/Erector's Qualifications: Must have facilities and personnel sufficient to fabricate and erect structural metal framing as indicated on drawings; must have minimum of 5 years experience and be able, upon request, to show framing of similar size materials and scope of work of this contract; must be approved by the Structural Engineer.
- B. Material: Provide only structural steel certified as conforming with specified requirements and fabricated especially to the requirements of this contract.
- C. Tolerances: Unless otherwise noted on drawings or specified, provide structural steel work in accordance with the following minimum tolerances:
 - 1. Fabrication Tolerances: In accordance with requirements of AISC Specifications.
 - 2. Erection Tolerances: Maximum deviation from plumb level and alignment shall not exceed AISC Specifications.
- D. Inspection: All tests and inspections required for shop and field quality control shall be performed by an inspection agency.
- E. Welders: Certified and qualified in accordance with requirements of the American Welding Society, for the particular materials and methods being used. The welder's certification papers shall be available on the first trip by the inspector.
- F. Welding Materials and Methods: For fabrication and erection shall be in accordance with the requirements of the American Welding Society.
- G. 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, Fabrications, and Erection of Structural Steel for Buildings" includes "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 Riveted and Bolted Structural Joints of the Engineering Foundation.
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".

1.5 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. American Institute of Steel Construction (AISC): "Manual of Steel Construction"
 1. Load and Resistance Factor Design (LRFD) - Third Edition
- C. Steel Structures Paint Council (SSPC): "Steel Structures Paint Manual, Volume 1 and Volume 2, Systems and Specifications, by Steel Structures Painting Council.

1.6 SUBMITTALS

- A. Shop Drawings: Submit prior to commencing any fabrication of structural metal; show dimensions, connections with adjoining materials and construction, finishes, welds, bolts, and fasteners, anchoring all fabrication or erection accessories required; show field welds, cuts, holes and fasteners; verify all dimensions and correlate with adjoining construction and materials; indicate size, type and grade of all members.
 1. Prior to the commencement of steel erection, the erector shall carefully inspect all anchor bolts and leveling plates installed under other subcontracts and shall notify the general contractor of defects. If the anchor bolt, leveling plate and base plate placement are acceptable to him he shall notify the general contractor of the same and proceed with erection of the structural steel.
 2. The approval of the shop drawings is limited to design intent only. No responsibility for a detailed check of member length, size, spacing, or similar detail information is assumed by the Structural Engineer by virtue of such approval.
- B. Shop drawings shall not be a reproduction of the contract drawings. Corrections or revisions to the shop drawings required to coordinate them with the contract documents and other shop drawings shall be made at no additional cost. **Please note that the Contract Documents in CADD format will not be made available to the contractor for their use in the preparation of the shop drawings, unless a release is signed, and a fee is paid for each cadd file requested.**
- C. All steel connection design shall be completed by a design professional hired by the contractor, and satisfy the load requirements specified in the contract documents. Prior to submission of steel shop drawings, the steel fabricator shall submit sample calculations (prepared by a registered structural engineer) for all typical beam to beam and beam to

column connections, which are proposed to be used on this project. After these typical calculations and connections are accepted, the fabricator shall prepare and submit the shop drawings for this project. Only these typical sample calculations are required to be sealed by a registered structural engineer. The material necessary for the fabrication of all connections shall be the responsibility of the contractor.

D. Mill test reports - see paragraph 3.4.A.

1.7 PRODUCT HANDLING AND STORAGE

- A. Deliver to the project site materials to be installed by other contractors in time to be installed before the start of work by trade affected. Specifically, anchor bolts and other anchorage devices, which are embedded in cast-in-place concrete or masonry construction. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.
- B. Store all steel in such manner as to prevent distortion to the members and injury to the paint, and supported free from the ground and kept clean. Where shop coat becomes damaged during handling, touch up paint. In the event that the shop coat of paint is damaged or rusted due to storage, repaint steel prior to erection with same paint used as shop coat.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plates, Angles, Channels, Bars, and rolled S, M, and HP shapes: ASTM A-36.
- B. Rolled Wide Flange Shapes: ASTM A-992, Grade 50.
- C. Cold-Formed Steel Tubing: ASTM A-500, Grade B.
- D. Hot-Formed Steel Tubing: ASTM A-501.
- E. Steel Pipe: ASTM A-53, Type E or S, Grade B.
- F. Anchor Bolts:
 - 1. ASTM F-1554 (hooked, headed, and threaded & nutted anchor rods including weldability supplement S1 conforming to grade 36).
- G. Bolts & Nuts:
 - 1. High-Strength Bolts, Nuts, and Washers: ASTM A-325 and A-490 bolts, with ASTM A-563 nuts and ASTM F-436 washers.
- H. Electrodes for Welding: Comply with AWS Code.
 - 1. Covered mild steel electrodes complying with AWS Code and ASTM A-233, Series E70. Use E70 Series, Grade SAW-1 for welding ASTM A-36 steel. Use E70 Low Hydrogen

Series, Grade SAW-2 for welding ASTM A-992, Grade 50 steel.

2. All electrodes having low hydrogen type coverings shall be dried for at least 2 hours between 450 degrees F. and 500 degrees F. before they are used. Electrodes may be stored immediately after drying in storage ovens held at a temperature of at least 250 degrees F. Electrodes that are not used within 4 hours after removal from a drying or storage oven shall be redried before use. Electrodes which have been wet shall not be used.
- I. Structural Steel Primer Paint: Use one of the following:
1. For interior building steel not receiving fireproofing
 - a. No. 769 Grey Primer manufactured by Rust-Oleum Corporation.
 - b. No. 99 Grey Primer manufactured by Tnemec Company.
 - c. Wetsall Primer manufactured by Farboil Company.
 - d. Or approved equal
- J. Structural Steel Protective Coating: All structural steel exposed to the weather or embedded in exterior walls shall be hot-dip galvanized in accordance with ASTM A123-84.
- K. Non-Shrink Grout: CRD C-588, factory pre-mixed grout. Products are subject to compliance with requirements, provide one of the following Type D, Non-metallic grouts:
1. "Masterflow 713"; Master Builders
 2. "SonogROUT"; Sonneborn - Contect.
 3. "Euco-NS"; Euclid Chemical Company.
 4. "Five Star Grout"; U.S. Grout Company
 5. "DuragROUT"; L & M Construction Chemical Company
- O. Diamond Steel Plate by Lucas or approved equal.

2.2 FABRICATION

- A. General: Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the final shop drawings. Properly mark and matchmark all materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling. Provide camber in structural members where indicated.
- B. Temporary Field Connections: Temporary erection connections shall consist of at least one clip angle and two 3/4" diameter bolts, remote from or compatible with the field welded connections. The Contractor shall be responsible for the design, function and use of all temporary erection connections. Remove temporary connections if they interfere with architectural finishes.
- C. Permanent Field Connections: High-strength bolts, for use in permanent slip-critical or bearing type connections with threads in shear planes, shall conform to ASTM A-325.
1. Shear web connections: "Double angle connections" as described in Table 10-1, 10-2, & 10-3 of AISC Steel Construction Manual, LRFD Third Edition, with shop welds and permanent field high strength bolts. However, in no case shall the shear web connections

be designed for less than the beam reactions shown in paragraphs 2.2.C.5 and 2.2.C.6 below, or as shown on the contract documents.

2. Single angle connections may be used in the webs of beams, provided that the connection is designed for the eccentric load, except as otherwise noted on the drawings.
 3. Connections: Made with at least 3/4" diameter high strength bolts in slip-critical, pre-tension, or snug-tightened connections with threads in shear planes. All high-strength bolts shall be installed in accordance with Section 8.1 for snug-tightened connections, and section 8.2 for pre-tensioned and slip-critical connections of the AISC Specifications for Structural Joints Using ASTM A-325 or A-490 bolts, as approved by the Research Council on Structural Connections dated 06/30/2004. At all slip-critical connections, faying surfaces shall meet the requirements of section 3.2.2. All pre-tensioned bolts shall be twist-off type tension control bolt assemblies.
 4. Unless otherwise specified in the contract documents, all beam, joist, joist girder and column connections shall be as follows:
 - a. Beam to Beam Connections: Snug-tightened joints.
 - b. Beam to Column Connections: Snug-tightened joints.
 - c. Joist to Column Connections: Snug-tightened joints.
 - d. Connections Subjected to Stress Reversal Conditions (Braced Frames, Moment Frames, etc.):
 - 1) Bolts In Standard Holes: Pre-tensioned joints.
 - 2) Bolts In Oversized or Slotted Holes: Slip-critical joints.
 5. All shear connections shall develop the end reaction (Ultimate LRFD Load) $\phi_b W_c / 2L$, where " $\phi_b W_c$ " is the uniform load constant in kip-foot, and where "L" is the span in feet, as shown in the tables "Uniform Load Constants for Beams" (laterally supported) for given shape and steel specified, LRFD Manual 3rd Edition, unless otherwise specified.
 6. All seated beam connections shall be designed so that the stiffener is clear of the finished ceiling and column encasement. The width of the stiffened seat shall not exceed 9". Beam web stiffeners shall be added as necessary to satisfy web yielding and web crippling code requirements.
- D. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for the passage of other work through steel framing members as indicated. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.
1. 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 SHOP PAINTING

- A. General: Shop paint all structural steel work, except members or portions of members to be embedded in concrete, mortar, or sprayed on fireproofing. Paint embedded steel on exposed portions and initial 2" of embedded areas only.
1. Do not paint contact surfaces which are to be welded or high-strength bolted.
 2. Apply a minimum of 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. Comply with Steel Structures Painting Council (SSPC) as follows:
1. SP-1 "Solvent Cleaning" for removing oil, grease and similar contaminants.
 2. SP-2 "Hand Tool Cleaning" for general cleaning.
 3. SP-3 "Power Tool Cleaning" for general cleaning.
- C. Application:
1. Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a uniform minimum dry film thickness of 2.0 mils. Use painting methods which will result in full coverage of joints, corners, edges, and all exposed surfaces.
 2. Provide a one-coat shop applied paint system complying with Steel Structures Painting Council (SSPC)-Paint System Guide No. 7.00.
 3. Immediately after surface preparation, apply the hot-dip galvanizing in accordance with ASTM A123-84 at the coating weight required by Table 1 to provide a uniform mil dry film thickness of 3.4 mils. Use galvanized methods which will result in full coverage of joints, corners, edges and all exposed surfaces.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Erector must examine the areas and conditions under which structural steel work is to be installed including all anchor bolts and leveling plates installed under other contracts, and notify the Owner in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified. Maintain work in a safe and stable condition during erection.
1. Structural steel with finished topcoat paint and galvanized steel shall be handled using nylon slings and wood dunnage to minimize damage.
- B. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
- C. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
1. Refer to Division 3 sections for anchor bolts installation in concrete.

D. Setting Leveling Plates:

1. Clean concrete bearing surfaces and roughen to improve bond. Clean the bottom surface of leveling plates.
2. Set loose leveling plates for structural members on wedges, or other adjusting devices.
3. Tighten anchor bolts after the plates have been positioned and leveled to proper elevation. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base plate prior to packing with grout.
4. 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.

E. Temporary Shoring and Bracing: Provide, as required, 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 the structures as erections proceeds.

1. Provide temporary planking and working platforms as necessary to effectively complete the work.

F. Field Assembly: Set structural members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Splice members only where indicated.
2. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
3. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress as acceptable to the Structural Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.

G. Touch-Up Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide the minimum dry film thickness as previously specified.
2. Steel which is abraded and rusty shall have primer and topcoat reapplied. Steel which is only abraded shall have topcoat reapplied.
3. Immediately after erection, clean field welds, bolted connections, and abraded areas of the hot-dip galvanized coating, and coat all exposed areas per ASTM A780-80. Apply coating to provide a minimum dry film thickness of 3.4 mils as previously specified.

3.3 SHOP AND FIELD WELDING

- A. Welding: Where structural joints are made by welding, the details of all joints, the technique of welding employed, the appearance and quality of welds made and the methods used in correcting defective work shall conform to requirements of the AISC Specification for the

Design, Fabrication and Erection of Structural Steel for Buildings and the Structural Welding Code D1.1 of the American Welding Society. In addition welds shall be made only by operators who have been previously qualified by tests as prescribed in the Standard Qualification Procedure of the American Welding Society, to perform the type of work required. The Contractor shall pay all costs for the qualification of welders. All welding equipment shall be direct current reverse polarity type.

3.4 INSPECTION AND TESTING

- A. Mill Inspection: The Contractor shall furnish Morabito Consultants, Inc. and the inspection agency a copy of the certified mill test reports of the chemical analysis and physical tests for each member and each beam number.
- B. Shop Inspection: The Owner shall employ an inspection agency approved by the Structural Engineer to inspect the steel in the shop. This inspection shall include the joining of parts, punching, bolting, welding painting, etc. The inspection agency shall submit to the Structural Engineer, prior to the delivery of the steel to the job site, certified reports showing the results of these inspections. The shop inspection shall include the type and manufacturer of the paint used.
- C. Field Inspection: The Owner shall employ an inspection agency approved by the Structural Engineer to inspect the erected steel in the field. This inspection shall include alignment, position of member, bolting, welding, painting, etc. The inspection agency shall also submit to the Structural Engineer, prior to the Contractor's request for payment for the erected steel, certified reports showing results of these inspections.
- D. Costs: The cost of all the tests and inspections are to be borne by the Owner.
- E. Shop Inspection shall include, but is not limited to:
 - 1. Examination of mill certificates in reference to material being fabricated.
 - 2. All welding procedures including certification of welders and electrode identification.
 - 3. All shop connections.
 - 4. Shop preparation for butt welds.
 - 5. Location of all clips, seats, holes and other accessories.
 - 6. Type and quality of shop paint and painting.
- F. Field Inspection shall include, but is not to be limited to:
 - 1. See that all steel is properly stored and protected.
 - 2. Vertical and horizontal alignment of all beams and columns before and after welding.
 - 3. Temporary guying of building.
 - 4. All joints, prior to welding, for required clearances and preparation.
 - 5. Type of material and equipment used to make connections.
 - 6. Preheat requirements due to type of steel and weather conditions.
 - 7. All welded and bolted field connections.
 - 8. Check field touch-up painting prior to covering by architectural materials.
 - 9. Inspection shall mark all connections when they are finally approved.
 - 10. Welding of steel floor deck.
 - 11. Welding and/or screwing of steel roof deck.

12. Perform visual inspection of all welds.
- G. Reports: Mill certificates shall be reviewed and approved by the Inspection Agency and Structural Engineer prior to fabrication.
1. Certified shop inspection reports indicating that the steel as fabricated meets all the requirements of the Contract Documents shall be submitted to the Structural Engineer prior to shipment.
 2. Certified field reports, indicated that the steel as erected meets all of the requirements of the Contract Documents, shall be submitted to the Structural Engineer prior to starting of other work preventing access for any possible repairs.
- H. Notification: It shall be the responsibility of the Contractor to see that the inspection agency is supplied with a complete set of Contract Drawings and Specifications and approved shop drawings before the work is started. It shall be the Contractor's responsibility to notify the inspection agency before the start of fabrication and before the start of erection of steel, a sufficient time before such work is started in order that the inspector may properly schedule the required inspections. If material is shipped prior to shop inspection, any additional costs of inspection and repair shall be borne by Contractor.

3.5 CONTRACTOR'S RESPONSIBILITY

- A. Acceptance of the shop and field inspection done by the testing agency pertaining to the structural steel does not relieve the Contractor of his responsibility to insure that the project has the proper sizes, strength, fabrication and erection procedures and any other requirements of the Contract Documents.
- B. If the installed structural steel is not erected in accordance with the contract documents and approved shop drawings, the contractor shall hire a professional engineer registered in the state of the project to prepare corrective calculations and details which shall be submitted to the engineer for approval prior to completing any corrections in the field. All costs incurred by the contractor to complete this corrective design and field repairs shall be paid by the contractor.
- C. Submit copies of all reports indicating conformance and exceptions to contract documents in a timely fashion to General Contractor for distribution to design consultants, owner, subcontractors and other interested parties.
- D. Final Report: The Inspection Agency shall prepare a written report that summarizes the work inspected during the course of the project, and certifies that the work meets the requirements of the contract documents, specifications, and all governing agencies.

END OF SECTION 051200