

SPECIAL SPECIFICATION

SECTION 05120S

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.

Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges" and as otherwise shown on drawings.

- B. Related Sections: Refer to the following sections for related work:

1. Division 3, Section "Cast-In-Place Concrete" for anchor bolt and reinforcing steel installation in concrete.
2. Division 5, Section "Cold-Formed Metal Framing for light-gauge, load-bearing metal framing.
3. Division 5, Section "Metal Fabrications" for miscellaneous metal fabrications.

1.02 ENVIRONMENTAL OBJECTIVES

- A. As described in section 01805 "Environmental Objectives", the owner has determined that this project must be rated by LEED™ Version 2.0 green building rating system, which was issued in March 2000 by the U.S. Green Building Council, 1015 18th Street, NW, Suite 805, Washington, DC 20036. Phone: 202/ 82-USGBC (828-7422) Fax: 202/ 828-5110.
- B. While these goals and implementation strategies are incorporated within the Contract Documents, suggestions and input from the contractor for implementing these goals are encouraged. A team approach is encouraged.
- C. Manufacturer/ Fabricator to supply documentation of level of compliance or non-compliance with the following requirements before consideration as an "Acceptable Manufacturer".

1. The Design Team has determined that the following be mandatory requirements:

Structural Steel

- a. The product(s) supplied is manufactured/fabricated within a radius of 500 miles from the project site and/or the manufactured/fabricated product(s) are extracted, harvested, or recovered within 500 miles of the project site.
 - b. The product(s) supplied is to have a minimum weighted average of 20% post consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material.
 - c. Comply with the requirements of section 01505S “Construction Waste Management”
 - d. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
- D. Products that conform to the Environmental Objectives yet do not fully meet other requirements of this section may still be considered at the sole discretion of the Sandia and Engineer.

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM)

1. A6 Specification for General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use
2. A27 Specification for Steel Castings, Carbon, for General Application
3. A36 Specification for Structural Steel
4. A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
5. A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
6. A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7. A307 Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
8. A325 Specification for High-Strength Bolts for Structural Steel Joints
9. A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
10. A501 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

11. B695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
12. C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
13. E94 Guide for Radiographic Testing
14. E142 Method for Controlling Quality of Radiographic Testing
15. E164 Practice for Ultrasonic Contact Examination of Weldments
16. E165 Practice for Liquid Penetrant Inspection Method
17. E709 Practice for Magnetic Particle Examination
18. F959 Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

B. American Welding Society (AWS)

1. D1.1 Structural Welding Code – Steel

C. Corps of Engineers (CE)

1. CRD C621 Specification for Nonshrink Grout

D. Federal Specification (FS)

1. TT-P-664 Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant

E. National Fire Protection Assoc. (NFPA)

1. 51B Standard for Fire Prevention in Use of Cutting and Welding Processes

F. Steel Structures Painting Council (SSPC)

1. SP-1 Solvent Cleaning
2. SP-2 Hand-Tool Cleaning
3. SP-3 Power-Tool Cleaning

1.04 SUBMITTALS

- A. Environmental Objectives Documentation: signed by the manufactures/ fabricators stating level of compliance for the requirements and objectives in Environmental Objectives in section.
- B. General: Submit the following in accordance with conditions of Contract and Division 1, Section "Descriptive Submittals".
- C. Product Data: Submit product data or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
 2. Anchor bolts.
 3. Unfinished threaded fasteners.
 4. High-strength bolts (each type), including nuts and washers; include direct tension indicators if used.
 5. Structural steel primer paint.
 6. Nonmetallic shrinkage-resistant grout.
- D. Material Safety Data Sheets (MSDS): Submit MSDS for structural steel (each type), anchor bolts, unfinished threaded fasteners, high-strength bolts (each type) including nuts and washers, structural steel primer paint and nonmetallic shrinkage-resistant grout.
- E. Shop drawings: Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
1. Include details of cuts, connections, cambers, holes and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
 2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
- F. Welder Certifications: Provide certification that welders to be employed in work have satisfactorily passed qualification tests in accordance with AWS D1.1.

If recertification of welders is required, retesting will be Contractor's responsibility.

- G. Test reports: Submit test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:
1. AISC "Code of Standard Practice for Steel Buildings and Bridges" with paragraph 4.2.1 modified by deletion of the following sentence:

"This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings."
 2. AISC "Specifications for Structural Steel Buildings" including the "Commentary", later referred to as "AISC Specifications".
 3. "Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Structural Connections.
 4. AWS D1.1
 5. ASTM A6
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with the requirements of AWS D1.1.
- C. All materials used shall not contain asbestos fibers.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time so that work will not be delayed.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. If bolts and nuts become dry or rusty, clean and lubricate before use.

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

1.07 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which steel framing must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- B. All wide flange shapes and tees, Type ASTM A992 Grade 50. Use 100% recycled steel.
- C. All angles, Use 100% recycled steel.
- D. Miscellaneous Steel Member Sand Bars: ASTM A36, All plates ASTM A572 Grade 50.
- E. Cold-Formed Steel Tubing: ASTM A500, Grade B. Use 100% recycled steel.
- F. Hot-Formed Steel Tubing: ASTM A501.
- G. Steel Pipe: ASTM A53, Type E or S, Grade B: or ASTM A501. Use 100% recycled steel.
- H. Finish: Black, except where indicated to be galvanized.
- I. Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.
- J. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications.
- K. Anchor Bolts: ASTM A307, nonheaded type unless otherwise indicated.
- L. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts; provide hexagonal heads and nuts for all connections.
- M. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325.
 2. Where indicated as galvanized, provide units that are zinc-coated, either mechanically deposited complying with ASTM B695, Class 50, or hot-dip galvanized complying with ASTM A153.
- N. Direct Tension Indicators: ASTM F959, type as required; use at Contractor's option.
- O. Electrodes for Welding: Comply with AWS Code.
- P. Structural Steel Primer Paint: Red oxide, lead- and cadmium-free, corrosion-inhibiting primer complying with performance requirements of FS TT-P-664.
- Q. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107 (formerly referenced as CE CRD C621).

Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

100 Non-Shrink Grout (Non-Metallic) - Conspec, Inc.
Crystex - L & M Construction Chemicals, Inc.
Euco N-S Grout - Euclid Chemical Co.
Kemset - Chem-Masters Corp.
SonogROUT - Sonneborn Building Products Div., Rexnord Chemical Products, Inc.

Supreme Grout - Cormix, Inc.
Sure-Grip High Performance Grout - Dayton Superior
Vibropruf #11 - Lambert Corp.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Connections: Weld or bolt shop connections, as indicated.
1. Bolt field connections, except where welded connections or other connections are indicated.
 2. Provide high-strength threaded fasteners, unless otherwise indicated.
- C. High-Strength Bolted Connections: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".
- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.
- F. Steel Wall Framing: Select members that are true and straight for fabrication of steel wall framing. Straighten as required to provide uniform, square, and true members in complete wall framing.
- Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (25 cm) o.c., unless otherwise indicated.
- G. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.
1. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING

- A. General: Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches (51 mm) of embedded areas only.
1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
 2. Apply 2 coats of paint to surfaces that 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 steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with SSPC as follows:
- SP-1 "Solvent Cleaning"
SP-2 "Hand-Tool Cleaning"
SP-3 "Power-Tool Cleaning"
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 3.0 mils. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.04 SOURCE QUALITY CONTROL

- A. Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. Promptly remove and replace materials or fabricated components that do not comply.

PART 3 - EXECUTION

3.01 ERECTION

- A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- B. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

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

- C. Setting Bases and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 2. Tighten anchor bolts 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 prior to packing with grout.
 3. Pack grout solidly between bearing surfaces and bases or plates to insure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 4. For proprietary grout materials, comply with manufacturer's instructions.
- D. Field Assembly: Set structural frames accurately to lines and elevations indicated and in accordance with AISC Specifications. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structures within specified AISC tolerances.
 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
 3. Splice members only where indicated and accepted on shop drawings.
 4. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 5. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

- E. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to the SDR. Finish gas-cut sections equal to a sheared appearance when permitted. Comply with NFPA 51B for cutting processes.
- F. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

Apply by brush or spray to provide minimum dry film thickness of 3.0 mils.

3.02 QUALITY CONTROL

- A. Sandia National Laboratories (SNL) may engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
 - 1. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
 - 2. Provide access for testing agency to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.
 - 3. Testing agency may inspect structural steel at plant before shipment. SNL reserves the right, at any time before final acceptance, to reject materials not complying with specified requirements.
- B. Correct Deficiencies in structural steel work that inspections and laboratory test reports have indicated are not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.
- C. Shop-Bolted and Field-Bolted Connections: Inspect or test in accordance with AISC Specifications.

Verify that gaps of installed direct tension indicators are less than gaps specified in ASTM F959, Table 2.
- D. Shop Welding and Field Welding: Inspect and test during fabrication for shop welding and during erection for field welding, of structural steel assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.
3. Perform tests up to and including 100% of welds at SNL's option. Inspection procedures may include the following:
 - a. Liquid Penetrant Inspection: ASTM E165.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not acceptable.
 - c. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T".
 - d. Ultrasonic Inspection: ASTM E164.
4. Acceptance criteria shall be as specified in AWS D1.1.

END OF SECTION