SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Buildings and Bridges.

1.2 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Painting: Section 09 91 00, PAINTING.

C. Steel Decking: Section 05 31 00, STEEL DECKING.

D. Composite Steel Deck: Section 05 36 00, COMPOSITE STEEL DECKING

E. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

F. Concrete: Section 03 30 00, Cast-in-Place Concrete, Grouting of column bases and placement of anchor bolts, assemblies and embeds.

1.3 QUALITY ASSURANCE:

A. Fabricator and erector shall maintain a program of quality assurance in conformance with Section 8, Code of Standard Practice for Steel Buildings and Bridges.

B. Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide copy of this notification to the COR.

C. The fabrication, priming and erection of structural steel members shall comply with the current governing edition of CBC, AISC 360, AISC 303, AWS D1.1, AWS D1.6 and RCSC Specifications except where more stringent requirements are shown or specified.

D. Sampling, Testing, and Inspection:

1. General

a. If the special inspector, through oversight or otherwise has accepted material or work which is defective or contrary to

specifications, this material or work, regardless of state of completion, may be rejected.

2. Contractor

a. The Contractor shall cooperate with and notify Owner's agent at least 24 hours in advance of inspections required and shall supply samples, test pieces, and facilities for inspection without extra charge.

b. The Contractor shall identify and tag each lot of fabricated steel to be shipped to the site by heat numbers in such a manner that it can be accurately identified at the job site.

c. The Contractor shall remove all unidentified steel received at the site.

E. Qualifications: Welding processes and welding operators shall be qualified in accordance with AWS D1.1. Welders to be employed are to provide AWS certification for the type of welding necessary.

1.4 TOLERANCES:

A. Fabrication tolerances for structural steel shall be held within limits established by ASTM A6, by AISC 303, Sections 6 and 7, Code of Standard Practice for Buildings and Bridges, except as follows:

1. Elevation tolerance for closure plates at the building perimeter and at slab openings prior to concrete placement is 6 mm (1/4 inch).

1.5 DESIGN:

A. Connections: Use details consistent with the details shown on the Drawings.

1.6 REGULATORY REQUIREMENTS: (EDITIONS ADOPTED BY CURRENT GOVERNING CALIFORNIA BUILDING CODE)

A. AISC 360 - Specification for Structural Steel Buildings; American Institute of Steel Construction, Inc.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.

C. AISC 341 – Seismic Provisions for Structural Steel Buildings; American Institute of Steel Construction, Inc.

D. AISC 348 (RCSC) – Specification for Structural Joints Using ASTM A325 or A490 Bolts; American Institute of Steel Construction, Inc.

E. ASTM A36 – Standard Specification for Carbon Structural Steel.

F. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

G. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.

H. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings in Iron and Steel Products.

I. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

J. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs.

K. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated.

L. ASTM A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.

M. ASTM A490 – Standard Specification for Structural Bolts, Alloy Steel, Heat Treated.

N. ASTM A500 – Standard Specification for Cold-Formed welded ans seamless Carbon Steel Structural Tubing in Rounds and Shapes

O. ASTM A563 – Standard Specification for Carbon Alloy Steel Nuts.

P. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

Q. ASTM A992 – Standard Specification for Structural Steel Shapes.

R. ASTM A1085 – Standard Specification for Cold Formed Welded carbon steel Hollow Structural Sections (HSS).

S. ASTM F436 – Standard Specification for Hardened Steel Washers.

T. ASTM F844 – Standard Specification for Washers, Steel Plain (Flat) Unhardened for General Use.

U. ASTM F959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

V. ASTM F1554 – Standard Specification for Anchor bolts, Steel 36, 55 and 105 ksi Yield Strength.

W. ASTM F1852 – Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel Heat Treated, 120/105 kst Minimum Tensile Strength.

X. AWS D1.1 – Structural Welding Code Steel; American Welding Society.

1.7 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop and Erection Drawings:

1. Shop Drawings for steel fabrication shall show details of members, including connections, sizes, spacing of bolts and welds. They shall show the marking and position of each member, erection plans and the limits of paint applications. A complete anchor bolt/rod setting plan for the execution of the work shall be submitted.

2. Shop drawings and calculations for temporary shoring and bracing shall be submitted for review. The shop drawings shall show layout, size of members and connection details. Calculations shall show all stresses in members and connections, from dead, live, and lateral loads in accordance with the requirements of the CBC current governing edition. Shop drawings and calculations for temporary shoring and bracing shall be stamped and signed by a civil engineer registered in the state of California.

C. Certificates of Compliance:

1. Structural steel.

a. The contractor shall provide mill certificates for each grade of steel for each heat to be used on project and certify that products meet or exceed specified requirements.

b. Mill certificates shall include name of mill, date of rolling, date of shipping, ultimate tensile strength, yield strength, and percent of elongation.

c. Mill certificates shall be furnished with each lot of material shipped to the site and shall be signed by the contractor which will serve to certify that all structural steel materials installed comply with specified requirements.

2. Welding materials.

    a. The contractor shall provide manufacturer's certificates of compliance for all electrodes, fluxes and shielding gasses to be used and certify that the filler metal meets the supplemental notch toughness requirements, as applicable.

3. Bolts

    a. The contractor shall provide certificates of compliance for bolts and certify that products meet or exceed specified requirements.

4. Shop coat primer paint.

5. When Mill certificates cannot be provided or does not supply required supplemental certifications, the contractor shall hire a professional testing laboratory to verify compliance of each type of material to be used and provide laboratory test reports. The cost of testing shall be paid for by the contractor.

D. Test Reports:

1. Welders' qualifying tests.

2. Laboratory test reports shall show the name of testing agency, date of testing, types of tests performed and shall be signed by a principal of the testing agency who is a registered civil engineer in the State of California.

3. When required by other portions of these specifications, laboratory test reports shall be submitted for each type of steel for each heat to show compliance with appropriate ASTM Standards and these specifications.

E. Welding Procedure Specifications (WPS)

1. Welding procedure specifications for all prequalified joints shall be submitted per AWS D1.1, clause 3 and reviewed prior to beginning fabrication. Non-Prequalified joints shall be qualified per AWS requirements. WPS shall specify all applicable variables of AWS D1.1, power source information, and electrode manufacturer and trade name.

F. Record Surveys.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Institute of Steel Construction (AISC):

AISC 360-10 - Specification for Structural Steel Buildings

AISC 303-10 - Code of Standard Practice for Steel Buildings and Bridges

C. American National Standards Institute (ANSI):

B18.22.1-65(R2008) Plain Washers

B18.22M-81(R2000) Metric Plain Washers

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

A6/A6M-11.....Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

A36/A36M-08.....Standard Specification for Carbon Structural Steel

A53/A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123/A123M-09.....Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A242/A242M-04(R2009) Standard Specification for High-Strength Low-Alloy Structural Steel

A283/A283M-03(R2007) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

A307-10 .....Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

A325-10 .....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A490-12 .....Standard Specification for Heat-Treated Steel Structural Bolts 150 ksi Minimum Tensile Strength

A500/A500M-10a....Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A501-07 .....Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

A572/A572M-07.....Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

A992/A992M-11.....Standard Specification for Structural Steel Shapes

E. American Welding Society (AWS):

D1.1/D1.1M-10 .....Structural Welding Code-Steel

F. Research Council on Structural Connections (RCSC) of The Engineering Foundation:

Specification for Structural Joints Using ASTM A325 or A490 Bolts

G. Military Specifications (Mil. Spec.):

MIL-P-21035.....Paint, High Zinc Dust Content, Galvanizing, Repair

H. Occupational Safety and Health Administration (OSHA):

29 CFR Part 1926-2001 Safety Standards for Steel Erection

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel Angles and Channels: ASTM A36

B. Steel W shapes and WT Tees: ASTM A992

C. Steel M shape, S shape, MT tees and ST tees: ASTM A36

D. Steel HP shape: ASTM A572, Grade 50

E. Steel Plates, and Bars: ASTM A36 unless noted otherwise

F. Steel Plates, and Bars: ASTM A572, Grade 50 where shown on the structural drawings

G. Structural Tubing: ASTM A500, Grade B.

H. Steel Pipe: ASTM A53, Type E or S, Grade B with sulfur not exceeding 0.05%, STD.

I. Shear Stud Connectors: ASTM A108, Type B.

J. Machine Bolts and Nuts: Heavy Hex, carbon steel, ASTM A307, Manufactured to American standard bolt and nut dimensions with “Free Fit – Class 2” Threads with matching finish ASTM A563 nuts. All unfinished bolts shall have an approved lock washer under nut.

K. Threaded Rod and Nuts: Carbon Steel, ASTM A36, manufactured to American standard bolt and nut dimensions with “Free Fit – Class 2” threads. All unfinished bolts shall have an approved lock washer under nut. Rods embedded in concrete, grout or adhesive shall be galvanized or non-lubricated unless noted otherwise.

L. Smooth Rods: Smooth rods shall conform to ASTM A36.

M. Anchor Rods and Nuts: ASTM F1554 Grade 36 Class 2A with matching finish ASTM A563 Nuts. Rods embedded in concrete, grout or adhesive shall be galvanized or non-lubricated unless noted otherwise. Embedded Rods without a head, nut or hook for anchorage shall be threaded full length.

N. High Strength Anchor Rods and Nuts: ASTM F1554 Grade 105 Class 2A with matching finish ASTM A563 nuts. Rods embedded in concrete, grout or adhesive shall be galvanized or non-lubricated unless noted otherwise. Embedded rods without a head, nut or hook for anchorage shall be threaded full length.

O. High Strength Structural Bolts and Nuts:

1. Conventional Bolts: ASTM A325 Type 1

2. Twist-Off-Type Tension-Control Bolt Assembly: ASTM F1852. The use of these devices must conform to the requirements in the RCSC Specification.

3. Compressible-Washer-Type Direct-Tension Indicator: ASTM F959. The use of these devices must conform to the requirements in the RCSC Specification.

4. Nuts: ASTM A563. Finish shall match fastener.

P. Washers shall be flat circular, rectangular or square beveled washers and shall conform to ASTM F436 Type 1 for high strength bolts/rods and ASTM F844 for other bolts/rods. Washer finish shall match nut. Washers shall be installed under the element being turned for A325 bolts. Washers over oversized or slotted holes shall also comply with RCSC specification section 6.

Q. Raised Pattern Floor Plates: ASTM A786 commercial grade.

R. Forged Steel Structural Hardware:

1. Clevises and turnbuckles shall conform to AISI C1035.

2. Eye nuts and eye bolts shall conform to AISI C1030.

3. Sleeve nuts shall conform to AISI C1018 Grade 2.

S. Welding Filler Metal: Arc-Welding electrodes shall be E70 series electrodes for A36, A572 and A992 material. Electrodes shall be as recommended by their manufacturers for the positions and conditions of actual use.

1. Weld metal toughness shall be reported on the filler metal manufacturer's certificate of compliance. All filler metal shall be capable of welds with a minimum CVN value of 20 ft-lbs at 0^0 F. Exceptions: Metal deck welding, stair and handrail welding and light gage steel welding.

2. Demand Critical Welds (DCW) shall use filler metal with a minimum CVN value of 20 ft-lbs at -20^0 F and 40 ft-lbs at 70^0 F.

T. Zinc Coating: ASTM A123.

U. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035.

V. Paint System: Primer shall be compatible with the finish paint system specified by architect. Prepare surfaces and apply coatings according to manufacturer's specifications.

PART 3 - EXECUTION

3.1 CONNECTIONS (SHOP AND FIELD):

A. Welding: Welding in accordance with AWS D1.1. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.

B. High-Strength Bolts: Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

3.2 FABRICATION:

A. The fabricator shall provide quality control inspections for welding and bolting operation; and reduced beam sections, where exist, per AISC 341 Appendix Q Section Q5.

B. Shop Fabricate to greatest extent possible.

C. Locate concrete reinforcement and confirm final concrete anchor locations prior to fabricating plates, members or other steel assemblies attached with anchors.

D. Welding:

1. Connections and joints that are part of SFRS, shall be welded in accordance with AISC 341, Appendix W.

2. Tack welds, Air-arc gouging and flame cutting shall not be performed without adequate preheat or incorporation into the final weld.

3. The filler metal manufacturer's published recommendations shall be the basis for determining the allowable range of essential variables for a prequalified WPS. Unless noted otherwise on the plans, back-up bars for CJP welds shall be removed followed by back-gouging and back-welding.

4. Coatings and contaminates, including galvanizing must be removed 1" minimum clear from area to be welded.

E. High Strength Bolting: All high strength bolted connections shall be slip critical type connections unless noted otherwise.

F. Holes, notches, slots, etc are not allowed in steel members and attached plates unless shown on the structural drawings or requested and specifically accepted by the engineer.

3.3 SHOP PAINTING:

A. General: Shop paint steel with primer in accordance with AISC 303, Section 6.

B. Shop paint for steel surfaces is specified in Section 09 91 00, PAINTING.

C. Do not apply paint to following:

1. Surfaces within 50 mm (2 inches) of joints to be welded in field.

2. Surfaces which will be encased in concrete.

3. Surfaces which will receive sprayed on fireproofing.

4. Top flange of members which will have shear connector studs applied.

D. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting.

E. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication): Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.4 ERECTION:

A. General: Erection in accordance with AISC 303, Section 7B. Temporary Supports: Temporary support of structural steel frames during erection in accordance with AISC 303, Section 7

3.5 FIELD PAINTING:

A. After erection, touch-up steel surfaces specified to be shop painted. After welding is completed, clean and prime areas not painted due to field welding.

B. Finish painting of steel surfaces is specified in Section 09 91 00, PAINTING.

3.6 SURVEY:

A. Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to COR for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

END OF SECTION 05 12 00