

**SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

1.1 SECTION INCLUDES:

- A. Structural steel framing members.

1.2 RELATED REQUIREMENTS:

- A. Section 03 30 00 - Cast-in-Place Concrete: Grouting of column bases and placement of anchor bolts, assemblies and embeds.
- B. Metal Fabrications: Section 05 50 00.
- C. Painting: Section 09 91 00, PAINTING

1.3 REFERENCE STANDARDS (Editions adopted by current governing California Building Code):

- A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.
- B. AISC 341 - Seismic Provisions for Structural Steel Buildings; American Institute of Steel Construction, Inc.
- C. AISC 348 (RCSC) - Specification for Structural Joints Using ASTM A325 or A490 Bolts; American Institute of Steel Construction, Inc.
- D. AISC 360 - Specification for Structural Steel Buildings; 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 on Iron and Steel Products.
- I. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- J. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- K. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- L. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
- M. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs.

- N. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated.
- O. ASTM A 449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
- P. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated.
- Q. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- R. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
- S. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- T. ASTM A 588 - Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi Minimum Yield Point with Atmospheric Corrosion Resistance.
- U. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- V. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- W. ASTM A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
- X. ASTM A992 - Standard Specification for Structural Steel Shapes.
- Y. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
- Z. ASTM F436 - Standard Specification for Hardened Steel Washers.
- AA. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- AB. ASTM F594 - Standard Specification for Stainless Steel Nuts.
- AC. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
- AD. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
- AE. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- AF. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt /Nut /Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- AG. AWS D1.1 - Structural Welding Code - Steel; American Welding Society.
- AH. AWS D1.6 - Structural Welding Code - Stainless Steel; American Welding Society.

AI. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings.

1.4 SUBMITTALS:

- A. See Section 01 33 23 - Shop Drawings, Product Data and Samples, for submittal procedures.
- B. Shop Drawings
 - 1. Shop drawings for steel fabrications 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 Material
 - 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. 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. Laboratory Test Reports

1. 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.
2. 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.

1.5 QUALITY ASSURANCE:

- A. Codes and Standards: 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.

B. 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.

- C. 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.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel Angles and Channels: ASTM A36.
- B. Steel W Shapes and WT Tees: ASTM A992.
- C. Steel Plates, and Bars: ASTM A36 or ASTM A572, Grade 50.
- D. Structural Tubing: ASTM A500, Grade B.
- E. Pipe: ASTM A53, Type E or S, Grade B, with sulphur not exceeding 0.05%, std. ($F_y=35$ ksi and $F_u=60$ ksi)
- F. 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.
- G. 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.
- H. High-Strength Structural Bolts and Nuts:
 - 1. Conventional Bolts: ASTM A325 or A490, 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.
- I. 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 and under both the head and the nut for ASTM A490 bolts. Washers over oversized or slotted holes shall also comply with RCSC Specification section 6.
- J. 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 have a minimum CVN value of 20 ft-lbs at 0° F. Exceptions: Metal deck welding, stair and handrail welding, and light gage steel welding.

K. Stainless Steel:

1. Anchor Rods, Bolts and Nuts: ASTM F593 CW1(316) for diameters between 1/4 inch to 5/8 inch and ASTM F593 CW2(316) for diameters between 3/4 inch to 1-1/2 inch with ASTM F594 nuts. Nuts shall be the same alloy group as the bolt. Threaded parts except the length embedded in concrete shall be lubricated with Neolube or approved equal prior to assembly.
2. Bars, Shapes and Headed Stud: ASTM A276, Type 304L or 316L.
3. Plates: ASTM A240, Type 304L or 316L.
4. Washers: ASTM A240.

L. Paint System: Paint system shall consist of Corothane I Galvapac Zinc Primer and Fast Clad Urethane topcoat or approved equal. Prepare surfaces and apply coatings according to manufacturer's specifications.

2.2 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. Tack welds, air-arc gouging and flame cutting shall not be performed without adequate preheat or incorporation into the final weld.
 2. 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 backgouging and backwelding.
- E. High Strength Bolting: All high strength bolted connections shall be Slip Critical type connections unless noted otherwise.

2.3 FINISH:

- A. Galvanizing:
1. Galvanize all structural steel exposed to weather that are not primed, in contact with preservative-treated wood and fire-retardant-treated wood, or where shown on the drawings.
 2. Galvanizing of products fabricated from rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick or thicker, shall conform to ASTM A123.
 3. Galvanizing of standard pipe shall conform to ASTM A53.

4. Galvanizing of iron and steel hardware and nuts and bolts shall conform to ASTM A153 class C, except whenever threaded studs, bolts, nuts, and washers are specified to conform to ASTM A307, A325, A449, A563, or F436 and zinc coating is required, they shall be hot-dip zinc coated per ASTM A153 or mechanically zinc coated per ASTM B695 class 55 or greater. Unless otherwise specified, galvanizing shall be performed after fabrication. Components of bolted assemblies shall be galvanized separately before assembly.
5. Nuts to be used on bolts/rods/studs before hot-dip galvanizing, and then hot-dip galvanized in accordance with ASTM A153 class C, shall be tapped oversize after coating and shall conform to thread dimension and overlapping allowances in ASTM A563.
6. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing loose and cracked coating, after which the cleaned areas shall be painted with 2 applications of unthinned zinc-rich primer containing not less than 94% zinc dust by weight according to ASTM A780. Aerosol cans shall not be used.

B. Painting:

1. Steel that is exposed to view and/or weather shall be painted except where noted on the drawings shall be galvanized. Do not paint surfaces that will be fireproofed or 2 inches around the faying surface of slip critical connections and 2 inches around areas where field welding will occur. Painting shall consist of a prime coat followed by finish coats as specified by the architect. Touch-up painting is required at field weld locations.
 - a. Primer and finish paint shall be delivered in original sealed containers marked with manufacturer's name and brand identification.
 - b. Use primer and finish paint as prepared by the manufacturer without thinning or other admixture unless so stated by the manufacturer. Do not do any painting in temperatures lower than 45 °F.

PART 3 - EXECUTION

3.1 ERECTION:

- A. The Contractor will be responsible to erect the complete structural frame plumb and true to line and grade, in conformance with the AISC 303.
- B. Temporary Bracing and Shoring:
 1. The Contractor shall temporarily brace the frame in both directions and shall maintain columns plumb until the final connections of the framework and construction of diaphragms are complete.
 2. The Contractor shall provide such temporary shoring and additional bracing of steel frame as required to adequately and safely support any or all loads imposed upon the structure during construction.
- C. After erection, where the member is galvanized or painted, field welds, abrasions or scratched surfaces, and surfaces not shop primed or galvanized, shall be primed if

member is painted or painted if member is galvanized, except surfaces to be in contact with concrete. The entire work shall be left in a neat, clean and acceptable condition.

3.2 FIELD QUALITY CONTROL:

- A. The Contractor shall provide field quality control inspections for welding and bolting operation; and reduced beam sections, where exist, per AISC 341 Appendix Q section Q5.
- B. The Contractor shall hire the Engineer responsible for the design of temporary bracing and shoring to inspect the work as detailed on the reviewed shop drawings.
- C. The Engineer responsible for design, temporary bracing and shoring shall write a letter to the Architect certifying construction of temporary bracing and shoring is in accordance with the reviewed shop drawings, prior to start of construction requiring temporary bracing or shoring.

E N D OF SECTION 05 12 00