

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members, support members, suspension cables, sag rods, and struts.
- B. Embedded anchor shapes, plates, angles, and bars.
- C. Base plates and shear stud connectors.
- D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 05 21 00 - Steel Joist Framing.
- B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2011.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2010.
- C. AISC S360 - Specification for Structural Steel Buildings, American Institute of Steel Construction, Inc., 2010.
- D. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, 2014.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- G. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- I. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- L. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- M. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- N. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- O. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.
- P. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2012.
- Q. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2014.
- R. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- S. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2013.
- T. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

- U. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2011.
- V. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength; 2015.
- W. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- X. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- Y. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.
- Z. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. All shop drawings shall be reviewed and approved by the Contractor before submitting to the Architect/Engineer.
- C. Shop Drawings, including complete details, schedules and diagrams for fabrication and assembly of structural steel members
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections. Design of connections shall be performed by the fabricator under the supervision of a registered engineer and shall conform to AISC specifications.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
 - 5. Reproduction of structural construction documents for shop drawing submittals will not be allowed.
- D. Anchor Bolts and Other Anchorages: Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
- E. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- F. Mill Test Reports: Indicate structural strength, chemical and physical properties, destructive test analysis and non-destructive test analysis.
- G. Product Data for Primer Paint: Submit producer's or manufacturer's specifications and installation instructions. Include data to show compliance with specifications and specified standards.

1.05 STORAGE AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- B. 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.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles, Plates, Channels, and Bars: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B, Finish black and galvanized, as indicated.
- E. Pipe: ASTM A53/A53M, Grade B, Finish black and galvanized, as indicated.
- F. Shear Stud Connectors: Made from ASTM A108, Fu = 65 ksi.
- G. Suspension Cable: 7 strand wire rope minimum as indicated on drawings.

- H. Sag Rods: ASTM A36/A36M.
- I. Erection Bolts and Nuts: Carbon steel, ASTM A307, Grade A .
- J. High-Strength Structural Bolts, Nuts, and Washers: F3125, Grade A325 or A325M, Type 1, medium carbon, plain, with matching compatible ASTM A563 or A563M nuts and ASTM F436 washers.
- K. Tension Control Bolts: Twist-off type; ASTM F1852.
- L. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436 Type 1 washers.
- M. Load Indicator Washers: Provide washers complying with ASTM F959 at all slip-critical connections requiring high-strength bolts.
- N. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
 - 1. For high-strength, low-alloy steel, provide electrodes, welding rods and filler metals equal in strength and compatible in appearance with parent metal joined.
- O. Grout: Non-shrink, non-metallic aggregate type, complying with 1 and capable of developing a minimum compressive strength of 7,000 psi at 28 days.
 - 1. Products:
 - a. NS Grout; Euclid Chemical Company
 - b. Crystex; L&M Construction Chemicals
 - c. Masterflow 713; Master Builders
 - d. Five Star Grout; U.S. Grout Corporation
- P. Shop and Touch-Up Primer: Fabricator's standard rust-inhibiting primer, complying with VOC limitations of authorities having jurisdiction.
- Q. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Properly mark and match-mark materials for field assembly.
- C. Fabricate connections for bolt, nut, and washer connectors.
 - 1. All permanent bolts shall be ASTM A-325.
 - 2. Erection bolts may be ASTM A-307.
 - 3. Field connections shall be bolted, except where welded connections or other connections are indicated.
- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- E. Develop required camber for members, where specified in the Drawings.
- F. Splice members only where indicated on structural drawings.
- 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 approved 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 by burning. Drill holes in bearing plates.
- H. Embedded members: Shear stud connectors shall be automatically end-welded with equipment and procedures as recommended by the manufacturer. All welding must comply with AISC 360 Section M2, Item 4 and AWS D1.1.

2.03 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
 - 1. After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits.

- B. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating. All structural steel that is exposed to weather shall be galvanized unless indicated otherwise.
 - 1. Any damage to galvanic material, including field welding, shall be repaired in accordance with ASTM A780.
 - 2. The Contractor shall inform the galvanizer of steel to be painted or powder coated.
 - 3. Galvanized steel to be painted shall be prepared in accordance with ASTM D6386.
 - 4. Galvanized steel to be powder coated shall be prepared in accordance with ASTM D7803.
- C. Galvanize steel hardware to comply with ASTM A153.
- D. 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 effects.

2.04 TOLERANCES

- A. Fabrication tolerances shall be limited to the tolerances as specified in the AISC Code of Standard Practice.

2.05 SOURCE QUALITY CONTROL

- A. An independent testing agency may perform shop quality control tests, as specified in Section 01 40 00.
- B. High-Strength Bolted Connections: The Owner may require testing and verification of shop-bolted connections by the testing agency in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", consisting of at least 50 percent of bolts at each connection unless noted otherwise in the Drawings.
- C. Welded Connections: The Owner may require non-destructive weld tests performed by the testing agency, of any shop welded assembly at any time. This requirement supersedes AWS 6.6.4 and 6.6.5.
 - 1. Fabricator shall inform testing laboratory of the fabrication schedule of items that require testing and supervision with sufficient time to avoid delay in the work.
 - 2. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
 - 3. Testing of welded connections may consist of the following:
 - a. Visual inspection of at least 50 percent of single-pass fillet welds.
 - b. Unless noted otherwise on the Drawings, visual inspection and testing of 100 percent of complete and partial penetration groove welds and multipass fillet welds using one of the following:
 - 1) Ultrasonic testing performed in accordance with ASTM E164.
 - 2) Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 3) Magnetic particle inspection performed in accordance with ASTM E709.
 - 4. The Contractor shall be responsible for all associated costs where defective welds are disclosed, including handling, surface preparation, non-destructive testing and retesting of unacceptable welds and repair of defects.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Surveys: Employ a registered professional engineer or land surveyor, experienced in survey work, to establish permanent benchmarks as shown and as necessary for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.
- B. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting rods and other anchors accurately.

- C. Setting Base Plates and Bearing Plates:
 - 1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces.
 - 2. Clean bottom surface of base and bearing plates.
 - 3. Set loose bearing plates and attached base plates for structural members on wedges or other adjusting devices.
 - 4. Tighten anchor rods after supported members have been positioned and plumbed.
 - 5. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
- D. Erect structural steel in compliance with AISC S303 "Code of Standard Practice for Steel Buildings and Bridges".
 - 1. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances.
 - 2. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
 - 3. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- E. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- F. Field weld components and shear studs indicated on shop drawings.
 - 1. Shear stud connectors shall be automatically end-welded with equipment and procedures as recommended by the manufacturer. All welding must comply with AISC 360 Section M2, Item 4 and AWS D1.1.
- G. Field bolted connections:
 - 1. All permanent bolts shall be ASTM A-325 installed in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", unless ASTM A-307 bolts are specifically permitted on the Drawings.
 - 2. ASTM A-307 bolts may be used for erection bolts and where specifically permitted on the Drawings.
 - 3. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary members. Ream holes that must be enlarged to admit bolts.
- H. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts".
- I. Do not field cut or alter structural members without approval of Architect.
 - 1. Use of gas cutting torches in field for correcting fabrication errors in primary structural framing is not acceptable.
 - 2. Where acceptable to Architect, gas-cutting will be permitted only on secondary members which are not under stress. Finish gas-cut sections equal to a sheared appearance when permitted.
- J. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint immediately after erection. Apply paint to areas with same material as used for shop painting.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- K. Touch-Up Galvanizing: Any damage to galvanic material, including field welding, shall be repaired in accordance with ASTM A780.

3.03 TOLERANCES

- A. Erection tolerances shall be defined relative to member working points and working lines and limited to the tolerances as specified in the AISC Code of Standard Practice.

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. High-Strength Bolted Connections: The Owner will require testing and verification of field-bolted connections by the testing agency in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", consisting of at least 50 percent of bolts at each connection unless noted otherwise in the Drawings.
- C. Welded Connections: The Owner will require non-destructive weld tests performed by the testing agency, of any field welded assembly at any time. This requirement supersedes AWS 6.6.4 and 6.6.5.
 - 1. Fabricator shall inform testing laboratory of the erection schedule of items that require testing and supervision with sufficient time to avoid delay in the work.
 - 2. Provide access for testing agency to perform the required inspection and testing.
 - 3. Testing of welded connections may consist of the following:
 - a. Visually inspect at least 50 percent of single-pass fillet welds.
 - b. Unless noted otherwise on the Drawings, visually inspect and test 100 percent of complete and partial penetration groove welds and multipass fillet welds using one of the following:
 - 1) Ultrasonic testing performed in accordance with ASTM E164.
 - 2) Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 3) Magnetic particle inspection performed in accordance with ASTM E709.
 - 4. The Contractor shall be responsible for all associated costs where defective welds are disclosed, including handling, surface preparation, non-destructive testing and retesting of unacceptable welds and repair of defects.

END OF SECTION

SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Open web steel joists, with bridging, attached seats and anchors.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors for casting into concrete.
- B. Section 03 47 13 - Tilt-Up Concrete: Placement of anchors for casting into tilt-up concrete.
- C. Section 04 27 31 - Reinforced Unit Masonry: Placement of anchors for embedding into masonry.
- D. Section 05 12 00 - Structural Steel Framing[] Superstructure framing, bearing plates and angles.
- E. Section 05 31 00 - Steel Decking: Support framing for openings in decking.
- F. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

- A. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.
- B. AISC 360 - Specification for Structural Steel Buildings; 2010.
- C. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- D. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.
- E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
- G. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.
- H. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2012.
- I. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2014.
- J. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- K. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength; 2015.
- L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- N. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.
- P. SJI (SPEC) - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.
- Q. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- S. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- T. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, attachments, and special connections, jointing, and accessories.
 - 1. Submit manufacturer's specifications and installation instructions for each type of joist and accessories.
 - 2. Include manufacturer's certification that joists and joist girders comply with SJI Standard Specifications (SPEC), including material testing and inspection as specified by SJI Standard Specifications (SPEC).

1.05 QUALITY ASSURANCE

- A. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications (SPEC) and SJI Technical Digest No.9.
- C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 10 years documented experience.
- D. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.
- E. Welder Qualifications: Qualify welding processes and operators in accordance with AWS "Standard Qualification Procedure." Verify AWS qualification within the previous 12 months. Operators shall carry proof of qualification on their person.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements. Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Joists:
 - 1. Nucor-Vulcraft Group: www.vulcraft.com.
 - 2. New Millennium Building Systems; www.newmill.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Open Web Joists: SJI Type K Joists:
 - 1. Provide bottom chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
 - 3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
 - 4. Finish: Shop primed.
- B. Open Web Joists: SJI (SPEC) Type LH Joists:
 - 1. Provide bottom chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
 - 3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
 - 4. Finish: Shop primed.
- C. Open Web Joists: SJI (SPEC) Type DLH Joists:
 - 1. Provide bottom chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
 - 3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
 - 4. Finish: Shop primed.
- D. Open Web Joists: SJI (SPEC) Joist Girders:
 - 1. Provide bottom chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.

3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
4. Finish: Shop primed.
- E. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 or ASTM A325M, Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436 washers.
- F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125, Grade A325 or A325M, Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or A563M nuts and ASTM F436 washers.
- G. Structural Steel For Supplementary Framing and Joist Leg Extensions:
 1. Steel Angles, Plates, Channels, and Bars: ASTM A36/A36M.
 2. Steel W Shapes and Tees: ASTM A992/A992M.
 3. Rolled Steel Structural Shapes: ASTM A992/A992M.
 4. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B, Finish black and galvanized, as indicated.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

- A. Fabricate steel joists and joist girders in accordance with SJI Standard Specifications (SPEC).
- B. Bridging: Provide horizontal or diagonal type bridging for open web joists complying with the SJI Standard Specifications (SPEC) unless shown otherwise. Provide bridging anchors for ends of bridging lines terminating at walls or beams.
- C. Header units: Provide header units to support joists and openings in roof system not framed with steel shapes.

2.04 FINISH

- A. Shop prime joists as specified.
 1. Do not prime surfaces that will be fireproofed.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Place and secure steel joists in accordance with SJI Standard Specifications (SPEC), final shop drawings, and as herein specified.
- B. Erect joists in a manner that avoids excessive stresses and deformation of members.
- C. Erect joists with correct bearing on supports in accordance with SJI Standard Specifications (SPEC).
- D. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- E. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- F. Install supplementary framing for roof openings greater than 24 inches.
- G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- H. Do not field cut or alter structural members without approval of joist manufacturer.
- I. After erection, prime bolt heads, nuts, abraded or rusty surfaces, welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.
- J. Do not suspend any equipment piping ducting, etc. from joist bridging. Provide additional angle framing members for this purpose if required.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. High-Strength Bolted Connections: The Owner will require testing and verification of field-bolted connections by the testing agency in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", consisting of at least 50 percent of bolts at each connection unless noted otherwise in the Drawings.
- C. Welded Connections: The Owner will require non-destructive weld tests performed by the testing agency, of any field welded assembly at any time. This requirement supersedes AWS 6.6.4 and 6.6.5.
 - 1. Fabricator shall inform testing laboratory of the erection schedule of items that require testing and supervision with sufficient time to avoid delay in the work.
 - 2. Provide access for testing agency to perform the required inspection and testing.
 - 3. Testing of welded connections may consist of the following:
 - a. Visually inspect at least 50 percent of single-pass fillet welds.
 - b. Unless noted otherwise on the Drawings, visually inspect and test 100 percent of complete and partial penetration groove welds and multipass fillet welds using one of the following:
 - 1) Ultrasonic testing performed in accordance with ASTM E164.
 - 2) Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 3) Magnetic particle inspection performed in accordance with ASTM E709.
 - 4. The Contractor shall be responsible for all associated costs where defective welds are disclosed, including handling, surface preparation, non-destructive testing and retesting of unacceptable welds and repair of defects.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof deck.
- B. Composite floor deck.
- C. Metal form deck.
- D. Supplementary framing for openings up to and including 24 inches.
- E. Bearing plates and angles.
- F. Stud shear connectors.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping over metal deck.
- C. Section 04 27 31 - Reinforced Unit Masonry: Placement of anchors for bearing plates embedded in reinforced unit masonry.
- D. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete, support framing for openings larger than 24 inches, shear stud connectors, and steel angle concrete stops at deck edges.
- E. Section 05 21 00 - Steel Joist Framing: Support framing for openings larger than 24 inches and shear stud connectors.
- F. Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.

1.03 REFERENCE STANDARDS

- A. AISC 360 - Specification for Structural Steel Buildings; 2010.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- G. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- H. FM DS 1-28 - Wind Design; 2007.
- I. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.
- J. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- K. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; ICC Evaluation Service, Inc; 2010 (R2013).
- L. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc; 2013.
- M. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- N. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Certificates: Certify that products furnished meet or exceed specified requirements.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Manufacturer must be a member of the Steel Deck Institute.
- B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.
- C. Welder Qualifications: Qualify welding processes and operators in accordance with AWS "Standard Qualification Procedure." Verify AWS qualification within the previous 12 months. Operators shall carry proof of qualification on their person.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Store deck on dry wood sleepers; slope for positive drainage.
- C. Protect decking panels from moisture or mechanical damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Deck:
 - 1. Nucor-Vulcraft Group: www.vulcraft.com.
 - 2. New Millennium Building Systems; www.newmill.com.

2.02 STEEL DECK

- A. Roof Deck: Non-composite type, fluted steel sheet. Size, type, and gauge as indicated on the Drawings.
 - 1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
 - a. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
 - 2. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating for permanently exposed exterior conditions and where indicated in the Drawings.
- B. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete. Size, type, and gauge as indicated on the Drawings:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with galvanized coating:
 - a. Interior elevated floors: G60/Z180 galvanized coating.
 - b. Elevated floors permanently exposed to the exterior: G90/Z275 galvanized coating.
 - c. First floor deck above a crawlspace: G90/Z275 galvanized coating
- C. Metal Form Deck: Corrugated sheet steel. Size, type, and gauge as indicated on the Drawings.
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating for permanently exposed exterior conditions and where indicated in the Drawings.
- D. Metal Deck for Awnings: Size, type, and gauge as indicated on the Drawings.

2.03 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.
- B. Stud Shear Connectors: Made from ASTM A108, Fu = 65 ksi.
- C. Welding Materials: AWS D1.1/D1.1M.

- D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.
 - 1. Exposed Roof Deck Applications: Provide manufacturer's standard stainless steel sealing caps with bonded neoprene washer over each fastener.
 - 2. Products:
 - a. Hilti, Inc.; www.us.hilti.com.
- E. Mechanical Sidelap Connectors: Steel; hex washer head undercut with reverse serrations and self-piercing or stitch point at center.
 - 1. Corrosion Resistance:
 - a. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B 633, SC1, Type III zinc electroplate.
 - b. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, as indicated on Drawings, minimum 20 gage, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- B. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level. Do not stretch or contract side lap interlocks.
- C. On concrete and masonry surfaces provide minimum 4 inch bearing.
- D. On steel supports provide minimum 1-1/2 inch bearing.
- E. Fasten deck to steel support members at ends, at intermediate supports, and parallel with the deck flutes as indicated in the Drawings.
- F. At mechanically fastened male/female side laps, fasten as indicated on the Drawings.
- G. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- H. Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.
- I. At roof deck openings from 6 inches to 24 inches in size, provide 2 by 2 by 3/16 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum four flutes beyond each side of opening and fusion weld to deck at each flute.
- J. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete as indicated in the Drawings. Where not indicated, provide stops of sufficient strength to remain stationary without distortion.
- K. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- L. Provide a finished surface for the application of insulation and roofing. Provide all required edge reinforcing channels or angles, closures, plates and other accessories which must be attached directly to the steel deck.
- M. Weld stud shear connectors through steel deck to structural members below.

- N. Immediately after welding deck and other metal components in position, repair welds, burned areas, and areas with damaged surface coating.
 - 1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
 - 2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.
- O. Suspension of any mechanical or electrical equipment, such as ducts, piping, etc., from main roof deck is not permitted.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.
- B. Exterior wall sheathing.
- C. Formed steel joist and purlin framing and bridging.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Lightweight, interior non-load bearing metal stud framing.
- B. Section 09 22 16 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- E. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 DESIGN RESPONSIBILITIES

- A. Floor joists, load-bearing and exterior wall studs, and all other cold formed metal framing shall be as indicated in the drawings.
- B. For exterior wall studs, the Contractor may submit, as an alternate, the complete design and details for the exterior wall studs, signed and sealed by an engineer registered in the state in which the project is located. The alternative design shall comply with the criteria specified on the Contract Documents.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members and factory-made framing connectors; describe materials and finish, product criteria, limitations.
- C. Shop Drawings: Indicate component details, framed openings, anchorage, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud, floor joist, ceiling joist, roof joist, roof rafter, and roof truss layout.

2. Provide details for securing studs to tracks and for bolted framing connections.
 3. When the Contractor provides both the design and the details of the exterior wall studs:
 - a. The shop drawings shall be signed and sealed by an engineer registered in the state in which the project is located.
 - b. Structural calculations shall be provided and shall be signed and sealed by an engineer registered in the state in which the project is located.
- D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 2. The Steel Network, Inc: www.SteelNetwork.com.
 3. Current member of SSMA: www.ssma.com
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Framing Connectors and Accessories:
 1. Same manufacturer as metal framing.
 2. Simpson Strong Tie; ____: www.strongtie.com.
 3. The Steel Network, Inc: www.SteelNetwork.com.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Design Criteria: Where the Contractor provides the design for the exterior wall studs as described in PART 1 - DESIGN RESPONSIBILITIES section, provide completed framing system having the following characteristics:
 1. Design cold-formed steel framing members according to AISI S100-12.
 2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for the project conditions specified on the Contract Documents.
 3. Framing Connectors: Maintain load and movement capacity in accordance with AISI S100-12.
 4. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 5. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

- A. Load-bearing Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 1. Mil thickness and depth: As indicated on the Drawings.
 2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.
 3. Load bearing studs shall be Structural studs. Nonstructural or "equivalent" studs are not acceptable.
- B. Non-load bearing Studs, Track, Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating; studs formed to "C" shape with punched web; U-shaped track in matching nominal width and compatible height.
 1. Base Metal: Structural Steel (SS), Grade as indicated on the Drawings.
 2. Mil thickness and Depth: As indicated on the Drawings.

3. Exterior studs shall be Structural studs. Nonstructural or "equivalent" studs are not acceptable.
- C. Joists and Purlins: Fabricated from ASTM A1008/A1008M, Designation SS (structural steel) sheet, shop painted.
 1. Mil thickness and Depth: As indicated on the drawings.
 2. Finish: Manufacturer's standard, rust-inhibitive paint.
- D. Framing Connectors: Factory-made, formed steel sheet.
 1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, unless indicated in the Drawings, and factory punched holes and slots.
 2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
 - a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical movement of slab without affecting studs; allow for minimum movement of 1 1/2 inches.
 - b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical movement of slab without affecting studs; allow for minimum movement of 1 1/2 inches.
 3. Fixed Connections: Provide non-movement connections to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, stiffeners, and where indicated on the Drawings.

2.04 WALL SHEATHING

- A. Wall Sheathing: As indicated on the Drawings.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Plates, Gussets, Clips: Formed Sheet Steel, thickness as indicated on the Drawings; finish to match framing components.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.06 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M, as indicated on the Drawings.
- B. Anchorage Devices: Powder actuated and Drilled expansion bolts, as indicated on the Drawings.
- C. Welding: In conformance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 16 inches on center, unless indicated otherwise on the Drawings. Coordinate installation of sealant with floor and ceiling tracks.

- C. Place studs at the spacing indicated on the Drawings; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs, unless indicated otherwise on the Drawings.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- J. Attach cross studs, backing plate, and furring channels to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- L. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 INSTALLATION OF JOISTS AND PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists at the spacing indicated on the Drawings; not more than 2 inches from abutting walls. Connect joists to supports using fastener method.
- D. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.
- E. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- F. Provide web stiffeners at all support points and concentrated loads when joist height-to-thickness ratio exceeds 200 and where indicated on the Drawings.
- G. Touch-up field welds and damaged primed surfaces with primer.

3.04 WALL SHEATHING

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

3.05 TOLERANCES

- A. Shall be in accordance with ASTM C1007.
 - 1. Vertical alignment (plumbness) of the studs shall be within 1/960 of the span (1/8 inch in 10 feet).
 - 2. Horizontal alignment (levelness) of walls shall be within 1/960 of their respective length (1/8 inch in 10 feet).

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop fabricated metal components.
 - 2. Guard rails and handrails.
 - 3. Ladders.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Welding Society (AWS) D1.1/D1.1M - Structural Welding Code - Steel.
- B. ASTM International (ASTM):
 - 1. A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. A108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - 3. A123/A123M - Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 - 4. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
 - 5. A307 - Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.
 - 6. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 7. A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - 8. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 9. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 10. E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
- C. Society for Protective Coatings (SSPC) - Painting Manual.

1.3 SYSTEM DESCRIPTION

- A. Minimum Design Loads:
 - 1. Guard rails and handrails:
 - a. 50 pounds per linear foot applied in any direction at top, transferred via attachments and supports to building structure.
 - b. Concentrated 200 pound load applied in any direction at any point along top, transferred via attachments and supports to building structure.
 - c. Maximum deflection under loading: $L/120$.
 - 2. Concentrated and uniform loads do not need to be applied simultaneously.
 - 3. Perform design under direct supervision of Professional Structural Engineer licensed in State in which Project is located, with minimum 2 years documented experience in work of this Section.
- B. Fabricate guard rails and handrails in accordance with ASTM E985.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show dimensions, metal thicknesses, finishes, joints, attachments, and relationship of work to adjacent construction.
 - 2. Samples: Perforated Metal.
- B. Quality Control Submittals:
 - 1. Certificate of Compliance from Professional Structural Engineer performing system design.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum 3 years documented experience in work of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store steel above ground on platforms, skids, or other supports; separate with wooden separators.
- B. Protect steel from corrosion.
- C. Prevent damage to prime coat and galvanized coatings.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Shapes: ASTM A36/A36M.
- B. Plate: ASTM A283.
- C. Sheet: ASTM A1008/A1008M.
- D. Pipe: ASTM A501.
- E. Tube: ASTM A500.
- F. Bars: ASTM A108.

2.2 ACCESSORIES

- A. Exposed Screws: Same material as metal being fastened; Phillips flat head, countersunk, unless noted otherwise.
- B. Bolts: ASTM A307, hexagonal head type.
- C. Primer Paint: SSPC Paint 15, Type 1, red oxide.
- D. Anchoring Cement: Non-shrink cementitious type.

2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Conceal fastenings where possible.
- G. Welding to conform to AWS D1.1/D1.1M.
 - 1. Use welds for permanent connections where possible. Grind exposed welds smooth.
 - 2. Tack welds prohibited on exposed surfaces.

2.4 FINISHES

- A. Handrails and Guardrails: Powder coated, Cardinal Metallics Black.
- B. Other Ferrous Metal:
 - 1. Exterior: Painted Steel to match surrounding exterior; ASTM A123/A123M, to 2.0 ounces per square foot.
 - 2. Interior:
 - a. Shop painted except steel to be encased in concrete and surfaces to be welded.
 - b. Surface preparation: SSPC SP2 - Hand Tool Cleaning or SP3 - Power Tool Cleaning.
 - c. Application: One coat; follow coating manufacturer's instructions.
 - d. Minimum dry film thickness: 2.0 mils.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install items in accordance with approved Shop Drawings.
- B. Install components plumb, level, and rigid.
- C. Welding: AWS D1.1/D1.1M. Grind and fill exposed welds; finish smooth and flush.
- D. Install sleeved components with anchoring cement.
- E. Prevent contact of exterior aluminum and dissimilar metals by use of zinc rich paint, bituminous coating, or non-absorptive gaskets.

3.2 ADJUSTING

- A. Clean and touch up damaged primer paint with same product as applied in shop.
- B. Clean and touch up painted coatings at welded and abraded surfaces in accordance with ASTM A780, Annex A2.

3.3 SCHEDULE

- A. This Schedule includes principal items only; refer to Drawings for additional items not listed.
- B. Guard Rails and Handrails:
 - 1. Fabricate from steel pipe of sizes and types indicated.
 - 2. Make bends uniform and free from buckles and other defects.
 - 3. Cut intersections square to within 2 degrees and to length within 1/8 inch. Remove burrs from cut ends.
 - 4. Miter and cope intersections within 2 degrees, fit to within 1/8 inch.
 - 5. Continuously weld connections.

6. Where length exceeds that suitable for shipping and handling, fabricate in sections with concealed internal sleeves forming slip joints. Extend sleeves minimum 2 inches on both sides of joint; field weld and grind smooth.
- C. Ladders:
1. Side rails: Continuous steel flat bars, 1/2 x 2-1/2 inches, eased edges, spaced 18 inches apart.
 2. Rungs: Round steel bars, 3/4 inch diameter, knurled or abrasive coated to ANSI A14.3, spaced 12 inches on center. Fit rungs in centerline of side rails and plug weld on outer rail face.
 3. Support ladders at top, bottom, and at intermediate points spaced maximum 5'-0" on center with steel brackets, welded or bolted to supports.

END OF SECTION