

SECTION 05100

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Perform all work required to complete the Structural Steel work indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Test and Laboratory Control - Division 1
- B. Steel Joists and Joist Girders - Section 05210
- C. Metal Decking - Section 05300
- D. Miscellaneous Metal – Section 05500
- E. Metal Stairs – Section 05510

1.3 QUALITY ASSURANCE

- A. The testing laboratory approved by the Architect shall inspect high-strength bolted connections and welds and perform all tests in the shop and in the field and submit test reports to the Architect as hereinafter specified. The testing laboratory shall be responsible for conducting and interpreting the test, shall state in each report whether or not test specimens conform to all requirements of the Contract Documents, and shall specifically note any deviations therefrom. Corrective measures, including additional testing, which result from these tests, shall be the Contractor's responsibility.
- B. The testing agency shall furnish to the Architect five (5) certified copies of all test reports.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. Building Code shall mean Current Local Building Code.
- B. AISC Specifications for Structural Steel shall mean AISC Specification for Structural Steel Buildings, March 9, 2005.
- C. Specification for Structural Joints shall mean "Specifications for Structural Joints using ASTM A325 or A490 Bolts" June 30, 2004.
- D. AWS Building Code shall mean AWS "Code for Welding in Building Construction", latest edition.
- E. ASTM shall mean the appropriate specification of the American Society of Testing and Materials.
- F. Code of Standard Practice shall mean AISC Code of Standard Practice for Steel Buildings and Bridges, latest edition.

1.5 QUALIFICATIONS

- A. Steel Fabricator: Fabricator shall have not less than 10 years experience in the fabrication of structural steel.
- B. Steel Erector: Erector shall have not less than 10 years experience in the erection of structural steel.
- C. Welding procedures, welders, welding operations and tackers shall be qualified in accordance with the AWS Building Code. Certification of welders by the testing laboratory shall not be more than six months old at the time of welding in the erection period.

1.6 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit shop drawings, indicating all shop and erection details, including cuts, copes, connections, holes, threaded fasteners, rivets, and welds.
 - 2. Schedule and submit shop drawings in a timely manner that allows the Architect and

Engineer adequate time for review of the submittals. Refer to Division 1 for schedule and submittal requirements.

3. Shop drawings shall not be made by using reproductions of contract drawings. This restriction also prohibits using electronic files or reproductions of electronic files of the contract documents.
 4. Dimensions to existing construction are based on the original construction documents and/or approximate field measurements. They are to be used for bid purposes only and not for shop drawing preparation or construction. The Contractor shall provide all field measurements required for proper fit up of members framing to and around existing construction.
 5. All welds, both shop and field, shall be indicated by AWS Welding Symbols.
 6. Highlight, encircle or otherwise identify deviations from the contract documents on submittals.
 7. Divide or subdivide work into packages of reasonable size, sequence, and order. Each package shall be complete, including dimensioned plans with piece marks, and all pertinent framing and erection details, fabrication drawings of individual pieces, and bills of materials. Clearly identify each submittal package. Highlight, encircle or otherwise identify portions of the work that have been omitted and are to be included in other submittals.
 8. Shop drawings shall be fully reviewed by the Contractor for completeness and conformance with the contract documents prior to submitting to the Architect. All submittals shall be stamped, initialed and dated by the Contractor. Submittals that have not been reviewed by the Contractor may be rejected without review.
 9. Submittals that do not include all of the specified information may be rejected without review.
 10. The Contractor shall fully coordinate the work of the fabricator with all other trades including the steel joist manufacturer. Provide joist placing drawings and lists to the steel fabricator for coordination of work prior to submittal of shop drawings to the Architect.
 11. When re-submittals are required, highlight, encircle or otherwise clearly identify all changes, revisions, additions, or deletions of information since the previous submittal. Re-submittals shall be numbered, dated and descriptively identified in the title block of each revised sheet.
 12. Any fabrication of material before approval of drawings will be at the risk of the Contractor.
 13. Failure to comply with submittal and re-submittal requirements will be cause for rejection.
- B. Erection Procedure: Submit descriptive data to illustrate the structural steel erection procedure, including sequence of erection and temporary staying and bracing.
- C. Welding Procedure: Submit qualification of flux-cored arc welding procedures in accordance with Article 502, AWS D1-1.
- D. Proof of Compliance for Materials:
1. Report of ladle analysis of all steel.
 2. Report of tensile properties for;
 - a. Steel shapes
 - b. Steel bars
 - c. Steel plates
 3. Mill Certifications.

1.7 PROPOSED SUBSTITUTIONS

- A. Substitutions of sections or modification of details, if proposed by the Contractor, shall be submitted for approval in sketch form prior to submission of shop drawings, and such substitutions shall be made only when approved by the Architect and Engineer. Refer to

Division 1 for substitution submittal requirements.

1.8 PRODUCT HANDLING

- A. Delivery of materials to be installed under other sections:
 - 1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
 - 2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.
 - 3. The General Contractor shall check the correct positioning of anchor bolts before concrete is placed. Subsequent displacement of the anchor bolts will be the responsibility of the General Contractor.
- B. Storage of materials:
 - 1. Structural steel members which are stored at the project site shall be above ground on platforms, skids, or other supports.
 - 2. Steel shall be protected from corrosion.
 - 3. Other materials shall be stored in a weather-tight and dry place, until ready for use in the work.
 - 4. Packaged material shall be stored in their original unbroken package or container.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Shapes, Bars and Plates:
 - 1. W shapes shall conform to ASTM A992.
 - 2. All other steel shapes, bars and plates conform to ASTM A36.
- B. Pipes and Tubes:
 - 1. Structural Steel Pipe shall conform to ASTM A501 or ASTM A53, Types E or S, Grade B.
 - 2. Structural Steel Tube shall conform to ASTM A500, Grade B.
- C. Headed Stud Type Shear Connectors:
 - 1. Cold finished carbon steel, ASTM A108.
 - 2. Dimensions of shear connectors shall conform to Figure M-1 of AWS Building Code.
- D. Anchor Rods – provide material as indicated on drawings:
 - 1. Conform to Section 1c of ASTM A307 for J bent rods.
 - 2. ASTM A449 where indicated in drawings.
 - 3. ASTM F1554, grade as noted in drawings.
- E. High-Strength Threaded Fasteners: ASTM A325 or ASTM A490.
- F. Filler Metal for Welding:
 - 1. Shielded metal - arc welding - AWS A5.1 or A5.5.
 - 2. Submerged - arc welding - AWS A5.17.
 - 3. Flux-cored arc welding - AWS A5.20.
- E. Grout: Non-shrink grout "Embeco Pre-mixed Grout" by Master Builders or approved equal. The material shall be ready-to-use metallic aggregate product requiring only the addition of water at the job site, and shall produce a flowable grouting material having no drying shrinkage at any age. Compressive strength of grout (2"x2" cubes) shall be not less than 5000 psi at 7 days and 7500 psi at 28 days.
- F. Paint: Fabricators standard rust inhibiting primer conforming to SSPC Specifications.
 - 1. Standard interior protected conditions (SSPC Zone 1A): Fabricators standard rust inhibiting primer conforming to SSPC Specifications.
 - 2. Exterior exposures (all exterior exposures shall be treated as SSPC Zone 2A): Provide primer compatible with paint system and topcoats specified in Division 9, and SSPC Specifications.
 - 3. Crawl space exposures (all steel within the building crawl space): All steel within the

building crawl space shall be treated as exterior exposure SSPC Zone 1B. Provide primer and top coat (apply both coats at the shop) complying with SSPC Specifications, System A or B and as follows:

- a) For SSPC System A, Waterborne Acrylics: Provide two-coat waterborne acrylic latex (maintenance grade latex with at least 3 years documented service life, (e.g. SSPC Painting System 24.00).
- b) For SSPC System B, Alkyd: Provide zinc-oxide alkyd primer (e.g. SSPC – Paint 25) plus alkyd or silicone-alkyd topcoat.

4. Architecturally Exposed Structural Steel (AESS): Treat AESS as having exterior exposure as noted above.

G. Galvanizing: Conform to ASTM A123/A123M

2.2 FABRICATION

A. Fabricate Structural Steel in accordance with the AISC Specification for Structural Steel.

1. All work shall be shop-assembled in so far as possible and delivered to the site ready for erection. Trusses shall be shop fabricated with field splices allowed only as indicated on the drawings or as approved in the substitution process. Material shall be properly marked and match-marked where field assembly is required. The sequence of shipments shall be such as to expedite erection and minimize field handling of material.

2. Members to be milled shall be completely assembled before milling.

3. Beams, girders, and trusses shall be cambered as indicated on the drawings. Specified camber shall be within a tolerance of minus zero to plus 1/8 inch per 10 feet of beam length. Members without specified camber shall be fabricated so that after erection any minor camber due to rolling or fabrication shall be upward.

B. Shop connections shall be high-strength bolted or welded, as indicated on the structural drawings or as required.

C. Field connections shall be high-strength bolted or welded, as indicated on the structural drawings or as required.

D. High-strength Bolted Construction Assembly: Tightening shall be done by the calibrated wrench method or the turn-of-the-nut method in accordance with Section 8 (d) of the Specifications for Structural Joints for all friction connections. For all bearing type bolted connections, bolts shall be installed to a snug tight fit with all plies in a joint in firm contact.

E. Welded Construction

1. All welding done in accordance with AWS D1.1.

2. Welding process shall be limited to one or more of the following:

- a. Manual shielded-arc.
- b. Submerged-arc.
- c. Flux-cored arc.

3. Preheat and interpass temperature shall conform to Table 4.2, AWS D1.1.

4. Welds not specified shall be continuous fillet welds, using minimum fillet as specified by AWS D1.1.

5. Remove slag from welds and wire brush clean.

F. No combination of bolts and welds shall be used for stress transmission in the same faying face of any connections.

G. Bearing Plates:

1. Bearing plates shall be provided under beams, girders, and trusses resting on footings, piers, and walls.

2. Bearing plates shall be either attached or loose.

H. Elements identified on the drawings as AESS are Architecturally Exposed Structural Steel. Fabrication of these elements shall comply with the Code of Standard Practice for Architecturally Exposed Structural Steel including the more restrictive tolerances for fabrication and appearance and with criteria noted on the drawings.

I. Shop Painting:

1. Apply shop coat of paint on steel surfaces except:

- (a) Surfaces of members to be field welded, in immediate area of welds.

- (b) Surfaces of members to receive sprayed-on fireproofing.
 - 2. Surface preparation to be as follows:
 - (a) For standard interior protected uses: SP3 – Power Tool Cleaning.
 - (b) For exterior exposures: SP6 – Commercial Blast Cleaning.
 - (c) For crawl space exposures: SP6 – Commercial Blast Cleaning.
 - (d) For Architecturally Exposed Structural Steel (AESS): SP6 – Commercial Blast Cleaning.
 - 3. Repairing steel defects for both exterior exposures and for Architecturally Exposed Structural Steel: Weld spatter and other steel defects (e.g., scabs, burns, and slivers) that become visible after blast cleaning should be removed by sanding or grinding. All sharp edges or rough surfaces should be ground to a smooth contour (normally a 1/8 inch radius). Repaired areas should be restored to the original cleanliness and profile. This may be accomplished by spot air blast cleaning or vacuum blasting the damaged area or by use of profile producing power tools.
- J. Galvanizing: Hot dip galvanize per ASTM A123/A 123M. Straighten steel after galvanizing to achieve specified tolerances.

2.3 SOURCE QUALITY CONTROL: The Steel fabricator shall provide certification of the following to the Testing Agency for their review:

- A. Check steel plates and shapes for conformance to specifications.
- B. Check High-strength threaded fasteners for conformance to the specifications
- C. Check filler metal for conformance to the specifications.
- D. Determine chemical composition of all steel.
- E. Determine mechanical properties, in accordance with ASTM A370, of the following materials:
 - 1. Steel shapes.
 - 2. Bars and plates.
 - 3. Headed stud type shear connectors.
 - 4. Anchor bolts.
 - 5. High-strength threaded fasteners.
 - 6. Filler metal for welding.
- F. Qualification of shop bolting, welding, and stud welding and personnel.
- G. Inspection of shop welds shall be in accordance with Section 6 of AWS Building Code and as follows:
 - 1. Visual inspection of all shop welds in accordance with Article 605.
 - 2. Ultrasonic testing in accordance with ASTM E164 of all penetration welds.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect structural steel in accordance with the AISC Specifications for Structural Steel, and the Code of Standard Practice for Steel Buildings and Bridges.
- B. Selection of construction means, methods, techniques, sequences and/or procedures, as well as safety precautions and programs in connection with the Work, are solely the Contractor's rights and responsibilities. As such, any required construction engineering and/or design resulting from these selections is the responsibility of the Contractor.
 - 1. Temporary supports, such as temporary guys, braces, falsework, cribbing or other elements required for the erection operation will be determined, furnished, and installed by the erector. These temporary supports shall be capable of securing the steel framing, or any partly assembled steel framing, against loads comparable in intensity to those for which the structure was designed, resulting from wind, seismic forces and erection operations.
 - 2. The lifting and erection of pre-assembled elements such as trusses or pre-fabricated framing are considered special erection conditions. The selection of lift points, and erection techniques are the responsibility of the Contractor. Locate and provide sufficient lift points to prevent overstress and/or distortion of any components within the assembly.

- Provide temporary strong-backs, stiffeners and/or lifting devices as required.
3. Temporary supports of existing framing required to complete modifications and additions as shown in the drawings, are the responsibility of the Contractor. Provide shoring, braces, jacks, etc. as required to complete the work. Engineering and design of the temporary supports shall be performed by a professional engineer, engaged by the Contractor, and registered in the state of the project, with experience in the design of these elements.
- C. Column Bases and Bearing Plates:
1. Attached column bases and bearing plates for beams and similar structural members shall be aligned with wedges and shims.
 2. Loose column bases which are too heavy to be placed without a derrick or crane shall be set and wedged or shimmed or as noted on the structural drawings.
- D. Erection Tolerances:
1. Individual pieces shall be erected so that deviation from plumb, level and alignment shall not exceed that specified in the AISC Code of Standard Practice, nor the following:
 - a. The displacement of the centerline of columns adjacent to elevator shaft, from the established column line, shall be not more than 1 inch at any point.
 - b. The displacement of the centerline of exterior columns, from the established column line, shall be not more than 1 inch toward, nor 2 inches away from the building line at any point.
 2. Elements identified on the drawings as AESS are Architecturally Exposed Structural Steel. Erection of these elements shall comply with the Code of Standard Practice for Architecturally Exposed Structural Steel (AESS) including the more restrictive tolerances for erection and appearance and with criteria noted on the drawings.
- E. Field Assembly:
1. Structural steel frames shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerances.
 2. The Various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
 3. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.
 4. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
 5. Splices shall be permitted only where indicated.
 6. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged to admit bolts shall be reamed. Burning and drifting may be used to align unfair holes in secondary members only upon approval of the Architect.
 7. Erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.
 8. Perform bolting and welding operations as specified in 2.02 Fabrication.
- F. Gas Cutting: Field correcting of fabrication by gas cutting shall not be permitted on any major member in the structural framing without prior approval of the Architect.
- G. Grouting of Base Plates and Bearing Plates: Plates shall be set and anchored to the proper line and elevation. Metal wedges, shims, and/or setting nuts shall be used for leveling and plumbing the structural members, including plumbing of columns. Concrete surfaces shall be rough, and shall be clean and free of oil, grease, and rust. The addition of water and mixing shall be in conformance with the material manufacturer's instructions. Grout shall be mixed by using a mortar mixer. Batches shall be of size to allow continuous placement of freshly mixed grout. Placing shall be quick and continuous. Exposed surfaces shall have smooth, dense finish.
- H. Field Touch-up Painting: After erection of structural steel, touch-up field welds and abrasions in shop paint coating with same paint used for shop painting. Touch up welds in galvanized steel with a zinc rich paint.

- 3.2 FIELD QUALITY CONTROL: Testing agency shall perform the following:
- A. Check bracing.
 - B. Check location and set of anchor bolts and other inserts.
 - C. Prior to attaching steel, check adjustments to fit accuracies.
 - D. Qualification of field bolting, welding, and stud welding procedures and personnel.
 - E. Inspection of the erected structural framework for conformance with the requirements specified, including alignment, plumb, camber, etc.
 - F. Inspection of Field Welds shall be in accordance with Section 6 of the AWS Building Code as follows:
 - 1. Visual inspection of all welds in accordance with Article 605, of AWS.
 - 2. All column-to-base plate field welds shall be inspected by ultrasonic testing in accordance with ASTM E164.
 - 3. All welds that fail shall be re-welded and retested until they pass the test. The cost of the initial test and all further testing on welds that fail shall be borne by the Contractor. All initial weld tests that pass will be paid by the Owner.
 - 4. All full and partial penetration welds shall be tested by ultrasonic testing.
 - G. Inspection of high-strength bolted construction shall be in accordance with Section 9, AISC Specifications for Structural Joints, and as follows:
 - 1. Friction Connections
 - a. All high-strength bolted connections shall be visually inspected.
 - b. At least two bolts of every third connection between floor beams and girders shall be checked with a calibrated torque wrench for proper torque.
 - c. At least two bolts of every connection between girders and columns shall be checked as above.
 - d. All bolted connections that fail shall be corrected and all bolts in that connection tests that fail shall be paid by the Owner. The cost of retests on connections that fail shall be borne by the contractor.
 - 2. Bearing Connections
 - a. All high-strength bolted connections shall be visually inspected to ensure that all plies of the connected elements have been brought into snug contact.
 - H. Field testing of welded stud shear connectors shall be in accordance with sections 4.29 and 4.30 of the AWS Structural Welding Code, and as follows:
 - 1. Visual inspection shall be made for all studs for proper number and quality of welds. Any studs that do not have a full 360 degree fillet weld shall be tested.
 - 2. In addition to defective studs visually observed, a prescribed pattern of selecting studs for testing shall be followed.
 - a. Any member having more than 20 studs shall have at least two studs tested.
 - b. Members having less than 20 studs shall be tested as a group. Select two studs randomly from each sample of 100 studs to be tested.
 - 3. Testing shall consist of bending the stud to an angle of 30 degrees from its original axis by striking the stud with a hammer.
 - 4. If failure occurs during testing, inspector shall test adjacent studs as required to determine extent of poor welding.
 - 5. Stud replacement or repair shall be in accordance with AWS Structural Welding Code sections 4.29 and 4.30.

END OF SECTION

SECTION 05210

STEEL JOISTS AND JOIST GIRDERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide Steel Joist and Joist Girders work indicated by the Contract Documents including supplementary items necessary for its proper installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Quality Control – Division 1.
- B. Cast-in-Place Concrete – Section 03300.
- C. Unit Masonry – Section 04200.
- D. Structural Steel – Section 05100.
- E. Metal Decking – Section 05300.

1.3 REFERENCES

- A. The term "Standard Specifications" as used herein shall refer to Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, Latest Edition, as adopted by the Steel Joist Institute and American Institute of Steel Construction.

1.4 PLACING DRAWINGS AND SUBMITTALS

- A. The Contractor shall be fully, and solely responsible for the coordination of production, review, submittal and distribution of placing drawings and lists. Regardless of the method or source of production used for placing drawings and lists, the Contractor will be responsible for the completeness and accuracy of each submittal.
- B. The Contractor shall provide appropriate parties with the construction documents necessary for the production of drawings and lists. The Contractor shall provide all field measurements required for proper fit up of members framing to and around existing construction.
- C. Placing drawings and lists shall include framing plans, sections and details of construction, bill of materials, and lists or diagrams of special loading and design criteria. Drawings and lists shall indicate that the manufacturer is a member of the Steel Joist Institute. Submittals that do not include all of the specified information will be rejected without review.
- D. Drawings and lists shall show the mark, number, type, location and spacing of all joists and joist girders. Show bridging type, mark, method of attachment to the joists and anchorage at the ends. Indicate type of paint. Show and detail all accessories required for proper installation of joists and joists girders.
- E. Placing drawings and lists shall be fully reviewed by the Contractor for completeness and conformance with the contract documents prior to submitting to the Architect. Submittals to the Architect shall be in conformance with Division 1. All submittals shall be stamped, initialed and dated by the Contractor. Submittals that have not been reviewed by the Contractor will be rejected without review.
- F. The Contractor shall fully coordinate the work of the manufacturer with the steel fabricator. Provide placing drawings and lists to the steel fabricator for coordination of work.
- G. Upon request, submit design calculations sealed by an engineer registered in the state of the project.

1.5 QUALIFICATIONS

- A. The manufacturer shall be a member of the Steel Joist Institute.
- B. Unless otherwise noted on the drawings or herein specified, the work shall conform to the Standard Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Joists and Joist Girders: Conform to the standard specifications and the following:
 - 1. Special joist and joist girders: Comply with the Standard Specifications and special design criteria as noted on the drawings. Special design criteria may include loading, end moments, wind uplift, deflection limits, maximum widths, special bridging, bottom chord bracing, chord stiffeners, bearing conditions, special seats, special chord configurations, clearance for ducts through members, etc. Provide all accessories required to comply with the Standard Specifications and the design criteria.
- B. Identify each member with its mark.
- C. Extended Ends: To comply with the Standard Specification and have a uniform load carrying capacity of the joist unless special design criteria are shown on the drawings.
- D. Bridging: Provide manufacturers standard complying with the Standard Specifications and with the following, unless otherwise indicated on the drawings.
 - 1. K and LH (for spans up to and including 60 feet) series Joists:
 - a. Provide standard horizontal bridging complying with the Standard Specifications.
 - b. Provide bolted diagonal bridging for erection stability as required by the Standard Specifications, the governing building code or OSHA.
 - 2. LH (for spans exceeding 60 feet) and DLH series Joists:
 - a. Provide bolted diagonal bridging for all rows.
 - 3. Joist Girders: Provide and install bottom chord bracing as required to prevent the bottom chord l/r ratio from exceeding the specified criteria in the Standard Specifications. Provide and install additional bottom chord bracing as required by the design of special joist girders with end moments or uplift as indicated on the drawings.
 - 4. Number of rows of bridging shall comply with the Standard Specifications.
 - 5. Where uplift forces due to wind are specified on the drawings and are a controlling factor in the design, provide bridging to comply with the Standard Specifications including a single line of bottom chord bridging near the first bottom chord panel point, at each end of the joist.
 - 6. Where end moments are indicated on the drawings, provide bottom chord bracing at the first bottom chord panel point at each end of the joist.
 - 7. Provide and install special bridging complying with the Standard Specifications as noted on the drawings.
 - 8. Provide and install sag rods complying with Manufacturer's standard as required for erection of joists.
 - 9. Provide positive anchorage at the ends of each bridging row at top and bottom chords.
- E. Shop Paint: Manufacturer's Standard - conforming to the performance requirements of the Standard Specifications.
- F. Outriggers, Headers, Bottom Chord Struts, Ceiling Extensions and other accessories: Manufacturer's standard complying with the Standard Specifications and any special design criteria shown on the drawings.
- G. Design of all members and accessories shall be performed under the direction of an engineer registered in the state of the project.

PART 3 - EXECUTION

3.1 HANDLING AND ERECTION

- A. Handling and erection shall be in accordance with Standard Specifications. Protect joists and joist girders and accessories from harmful elements when stored at the job site. Store above the ground on platforms, pallets or other supports. Keep joists and joist girders free of dirt and other foreign matter.

3.2 FIELD REPAIRS

- A. Damaged materials will be rejected. The Contractor will be responsible for the repair or replacement of all damaged material. Evaluation and repairs shall conform to the Standard Specifications and the following:
 - 1. The manufacturer shall be engaged to evaluate the damage and determine if joists may be repaired or must be replaced.
 - 2. Any evaluation of damaged material that concludes that the material is acceptable for use shall be accompanied by a written certification from the manufacturer that the material conforms with the Standard Specifications. The certification shall be sealed by the manufacturer's engineer.
 - 3. When repairs are recommended, they shall be designed by the manufacturer. Drawings and/or written instructions for the repairs shall be sealed by the manufacturer's engineer and submitted to the Architect.
 - 4. After completion of the repair work, the Manufacturer shall inspect the work and provide written documentation that the material has been installed correctly and that the repaired member conforms to the Standard Specifications.

3.3 FIELD QUALITY CONTROL

- A. The testing laboratory shall perform the following:
 - 1. Inspection of Field Welds shall be in accordance with Section 6 of the AWS Building Code as follows:
 - a. Perform a visual inspection of all welds at anchorage to the supporting structure in accordance with Article 605.
 - b. All welds that fail shall be re-welded and re-tested until they pass.
 - 2. Inspection of high-strength bolted construction shall be in accordance with Section 9, AISC Specifications for Structural Joints, and as follows:
 - a. All high-strength bolted connections shall be visually inspected to ensure that all plies of the connected elements have been brought into snug contact.

END OF SECTION

SECTION 05300

METAL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide Metal Decking work as indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

1.2 REFERENCES

- A. The work described in this section, unless otherwise noted on the drawings or herein specified shall be governed by the following codes or specifications.
 - 1. "Specifications for the Design of Cold-Formed Steel Structural Members": -AISI.
 - 2. "Code for Welding in Building Construction": - American Welding Society. AWS D1.1.
 - 3. "Basic Design Specifications": - Steel Deck Institute.
- B. These specifications shall be supplemented by the requirements of the Uniform Building Code.

1.3 QUALIFICATIONS

- A. Qualifications of welders and welding operators, filler metal, welding techniques and procedures shall be in accordance with AISC specification for the Design, Fabrication and Erection of Structural Steel for Buildings, and AWS Code for Welding in Building Construction.
- B. All field welders shall be certified by a testing laboratory employed by the Contractor. Certifications shall be no more than six (6) months old during the time of welding in the erection period.

1.4 SUBMITTALS

- A. Shop drawings including erection sequences, procedures, diagrams, schedules and complete details shall be submitted to the Architect for review. Any fabrication of material before review of drawings will be at the risk of the contractor.

1.5 STORAGE OF MATERIAL

- A. Sheets shall be protected from the elements in transit. When stored at site, they shall be raised off the ground, and be provided with weatherproof covering. The Architect reserves the right to reject any material that has become damaged because of improper storage.

PART 2 - PRODUCTS

2.1 METAL DECK MATERIAL

- A. Shall conform to the requirements of ASTM A611, Grade C, D, or E.
- B. Type, gauge, depth and finish shall be as specified on the Drawings.
- C. Welding electrodes shall conform to ASTM A233 "Tentative Specifications for Iron and Steel air-Welding Electrodes", and AWS A 5.1.
- D. Finish: Field welds shall be touched-up as approved using a prime coat conforming to TT-P-64 1D, Type 1.
- E. Accessories: Provide all accessories necessary to complete the entire installation, including cover plates required to cover all gaps where deck units abut or change direction, around columns, and to cover access holes used for welding.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- A. Metal deck shall be installed in accordance with the manufacturers recommendations. Refer to drawings for welding and attachment requirements.
- 3.2 OPENINGS
- A. Openings shall be provided where shown on the Drawings, along with any reinforcing required to strengthen the metal deck.
- B. Other openings and reinforcing not shown on Drawings, will be made and reinforced by other trades and are subject to Architect's approval.
- C. The Architect shall be immediately notified of any openings where supplemental framing is required but is not provided.
- 3.3 HANGING LOADS
- A. Ceilings, mechanical equipment or other loads shall not be hung from metal deck unless shown on the drawings or approved by the Architect. Method of attachment subject to approval.
- 3.4 FIELD QUALITY CONTROL
- A. The testing agency shall visually inspect the welding and screw attachment pattern for conformance to the Contract Documents.

END OF SECTION

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, specifications and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. It is the responsibility of the Contractor and all subcontractors to locate information pertaining to required items of work specified or indicated elsewhere in the Contract Documents.

1.2 SUMMARY

- A. This Section includes the following:
1. Exterior load-bearing wall framing.
 2. Interior load-bearing wall framing.
 3. Exterior non-load-bearing curtain-wall framing.
 4. Floor joist framing.
- This section does not include non-load bearing interior wall framing, gypsum board assemblies, shaft-wall assemblies, ceiling-suspension assemblies or insulation. Refer to Division 9 for these items.
- B. Related Sections include the following:
1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
 2. Division 6 Section "Rough Carpentry" for subflooring, wall sheathing, or roof sheathing using wood-based structural-use panels, particleboard, fibrous-felted board, and foam-plastic sheathing.
 3. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.
 4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 DEFINITIONS

- A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.
- B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads:
 - a. Dead Loads: 20 psf roof and mechanical mezzanine dead load.
 - b. Live Loads: 50 psf mechanical mezzanine live load.
 - c. Roof Loads: 20 psf typical roof live load. 40 psf in mechanical zones.
 - d. Snow Loads: 5 psf roof.
 - e. Wind Speed and Exposure: 90 mph. Exposure B.
 - f. Seismic Criteria: Design Class A.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of [1/600] of the wall height.
 - b. Interior Load-Bearing Wall Framing: Horizontal deflection of [1/240] of the wall height.
 - c. Exterior Non-Load-Bearing Curtain-Wall Framing: Horizontal deflection of [1/600] of the wall height.

- d. Floor Joist Framing: Total load vertical deflection of 1/360 of the span.
 - e. Roof Rafter Framing: Total load vertical deflection of 1/360 of the horizontally projected span.
 - f. Ceiling Joist Framing: Total load vertical deflection of 1/360 of the span.
3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and/or downward movement of 1 inch.
- B. Minimum Requirements: In addition to satisfying the strength and stiffness criteria noted above, framing shall meet the following minimum requirements:
1. Stud Web Depth and Maximum Stud Spacing: Provide studs with web depths as indicated in the drawings and at maximum spacings as indicated herein. Where special conditions require additional strength or stiffness, spacing may be decreased, gage may be increased or both. Stud web depth shall not be increased.
 2. Kickers/Braces: At the Contractor's discretion, and based on sound engineering principals, wall systems may be designed to span floor to floor without the aid of intermediate kickers/braces or may include kickers/braces above the ceiling line to limit the unbraced height of the stud. Design of kicker/brace systems shall comply with the following minimum requirements:
 - a. Kickers must not interfere with other building systems and must be located a minimum of 1'-0" above the ceiling line. It will be the Contractor's responsibility to fully coordinate the kicker/brace system with other trades.
 - b. All aspects of the kicker/brace system, including connections to the structure, shall be designed by the engineer responsible for the design of the cold-formed framing. The engineer shall take into consideration the flexibility and strength of the primary structural frame and provide reinforcement of the primary building frame where required.
 - c. Kicker braces may connect to concrete slabs and concrete slabs on metal deck, but shall not connect to any metal or wood roof decks.
 3. Wall Openings: Frame wall openings that are wider than the stud spacing as follows:
 - a. Frame wall openings with not less than two full height jamb studs at openings less than 4'-0" wide and with not less than three full height jamb studs at openings equal or greater than 4'-0" wide. Where cripple studs are used for header bearing/connection, they shall be in addition to the full height jamb studs.
 - b. Over all wall openings, provide box headers consisting of double studs with top and bottom tracks. Install a runner track over each header and anchor to header by welding or screws. Provide, space and align jack studs same as full height studs.
 - c. Below wall openings, install sill tracks or box header/sills as required by design. Sill tracks, if used, shall be a minimum of 16 gage. Anchor sill tracks or headers to jambs with clip angles, gusset plates or welding. Provide, space and align jack studs same as full height studs.
 - d. Individual elements of built up jambs, box headers and/or sills shall be fastened together to guarantee composite action.
 - e. Details of attachment, connections between jambs, headers or sills, and connections to structure shall be clearly shown in the Shop Drawings and constructed accordingly.
 4. Bridging: Provide bridging in compliance with AISI specifications. Where walls are scheduled not to receive sheathing, provide adequate bridging in compliance with SSMA and AISI standards. Refer to Architectural for locations where sheathing is to be omitted. Indicate bridging requirements on Shop Drawings.
 5. Alignment of Framing and Reinforcement of Tracks in Load-Bearing Systems: Align framing or provide track reinforcement to comply with the following minimum requirements:
 - a. Align studs vertically where wall-framing continuity is interrupted by floor

- framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
 - b. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
 - c. Track reinforcement shall be designed by the engineer responsible for the design of cold-formed metal framing regardless of what material the reinforcement consists of.
 - d. All costs associated with the reinforcement shall be included in the bid.
 - e. Indicate track reinforcement on the Shop Drawings.
6. Special Conditions: Provide supplemental reinforcement of cold-formed metal framing as required at special conditions. Supplemental reinforcement shall be designed by the engineer responsible for cold-formed metal framing regardless of what material the reinforcement consists of. All costs associated with the supplemental reinforcement shall be included in the bid. Indicate supplemental reinforcement on the Shop Drawings.
 7. Design exterior non-load-bearing curtain-wall framing to limit horizontal deflection without regard for contribution of sheathing materials.

1.5 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
 1. Submittals shall include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data. This engineer will be responsible for all aspects of the design including all lightgauge elements, supplemental reinforcement, strap bracing, accessories, fasteners and connections to the primary structure.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing specialty engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

1.8 BASIS FOR BIDS

- A. Bidders shall perform sufficient engineering design prior to submitting bid to insure that the bid include all costs associated with cold-formed metal framing as indicated in the construction documents. It is the bidders responsibility to review all the construction documents to locate pertinent information regarding the Work and its coordination with other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Manufacturers: The manufacturer shall be a current member of the Steel Stud Manufacturers Association (SSMA).
- B. Products: All members, accessories and components shall be as specified in "Product Technical Information" as published by the Steel Stud Manufacturers Association and in compliance with ICBO ER 4943-P.
- C. Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.
- D. Product Identification: Each stud/joist/rafter shall be identified using SSMA nomenclature for depth, style, flange width and material thickness and with the manufacturer's name, yield strength (if over 33 ksi), minimum base metal thickness, and the ICBO ES report number embossed or stamped on the web of each section at a maximum of 48 inches on center per ICBO ER 4943P requirements

2.2 MATERIALS

- A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 33 for minimum uncoated steel thickness of 0.0428 inch (18 gage) and less; 50, Class 1 or 3 for minimum uncoated steel thickness of 0.0538 inch (16 gage) and greater.
 - 2. Coating: G90 for all elements in an exterior wall system that backs up masonry. Provide G60 coating for all other conditions.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0428 inch (18 gage).
 - 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: Matching steel studs.
 - 2. Minimum Flange Width: 1-1/4 inches.

2.4 NON-LOAD-BEARING CURTAIN-WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0428 inch (18 gage).
 - 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: Matching steel studs.
 - 2. Minimum Flange Width: 1-1/4 inches.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0538 inch (16 gage).
 - 2. Flange Width: Appropriately size flange width to accommodate an upward or downward vertical deflection in the primary structure of 1inch.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges

designed to support horizontal and lateral loads, and as follows:

- a. Minimum Uncoated-Steel Thickness: 0.0538 inch (16 gage).
 - b. Flange Width: Appropriately size flange width, fully coordinated with inner track and fasteners, to accommodate and upward or downward vertical deflection in the primary structure of 1inch.
2. Inner Track: Of web depth indicated, and as follows:
- a. Minimum Uncoated-Steel Thickness: 0.0538 inch (16 gage).
 - b. Flange Width: Appropriately size flange width, fully coordinated with outer track and fasteners, to accommodate and upward or downward vertical deflection in the primary structure of 1inch.
- E. Vertical Deflection Clips: Provide bypass or head clips, as required by framing conditions, complete with special hardware, connectors, tracks, etc., capable of accommodating upward and downward vertical displacement of the primary structure of 1 inch.

2.5 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched or punched, with stiffened flanges, complying with ASTM C 955, and as follows:
1. Minimum Uncoated-Steel Thickness: 0.0428 inch (18 gage).
 2. Flange Width: 1-5/8 inches, minimum.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:
1. Minimum Uncoated-Steel Thickness: Matching steel joists.
 2. Flange Width: 1-5/8 inches, minimum.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. End clips.
 5. Foundation clips.
 6. Gusset plates.
 7. Stud kickers, knee braces, and girts.
 8. Joist hangers and end closures.
 9. Hole reinforcing plates.
 10. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20.

- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

2.9 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.03 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
- E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated in shop drawings.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: 16 inches maximum and as indicated in shop drawings. Where special conditions require additional strength or stiffness, stud spacing may be decreased, gage may be increased or both. Stud size shall not be increased.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations. At nonplumb conditions, miter cut studs and provide special tracks to insure that stud webs are uniformly seated against the track and that track legs adequately lap the stud flanges.
- D. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads as indicated in the Shop Drawings.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads as indicated in the Shop Drawings.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated in Shop Drawings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates. Provide multiple stud jambs, cripple studs, runner tracks, sill tracks, jack studs and connectors as indicated in the Shop Drawings.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced and of type as indicated on Shop Drawings.

- Fasten at each stud intersection.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure as indicated in the Shop Drawings.
 - K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated in shop drawings.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches maximum and as indicated in the shop drawings. Where special conditions require additional strength or stiffness, stud spacing may be decreased, gage may be increased or both. Stud size shall not be increased.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements. At nonplumb conditions, miter cut studs and provide special tracks to insure that stud webs are uniformly seated against the track and that track legs adequately lap the stud flanges.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support. Provide one of the following connection types as indicated in Shop Drawings:
 - 1. For in-fill curtain wall applications, install single deep-leg deflection tracks or vertical deflection head clips and anchor to building structure when the wall is to be stick built.
 - 2. For in-fill curtain wall applications, install double deep-leg deflection tracks and anchor outer track to building structure when the wall is to be installed in panels.
 - 3. For bypass curtain wall applications, connect vertical deflection clips to bypassing studs and anchor to primary building structure.
- E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings and as follows. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated in Shop Drawings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates. Provide multiple stud jambs, cripple studs, runner tracks, sill tracks, jack studs and connectors as indicated in the Shop Drawings.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

3.6 JOIST AND RAFTER INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
 - 1. Joist Spacing: As indicated in shop drawings.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists as indicated in shop drawings.

- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at each end of joists and at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

- A. Field Inspection by Contractor: The Contractor shall provide effective, full time quality control over all fabrication and erection. The Contractor shall inspect the completed work for conformance to the Shop Drawings and make any necessary repairs or modifications to bring the Work into compliance.
- B. Inspection and Testing: Owner will engage a qualified independent testing agency to perform field quality control inspection and testing as follows:
 - 1. Members, built up members, bridging, kickers/braces, headers, jambs, reinforcement and supplemental reinforcement shall be visually inspected for size, gage, spacing, alignment, configuration and placement.
 - 2. Connections between members and connections to structure shall be inspected as follows:
 - a. Field and shop welds shall be visually inspected for conformance to the Shop Drawings and AWS standards.
 - b. Screws, power actuated nails and other fasteners shall be visually inspected for type, size, number, placement and installation.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace Work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed cold-formed metal framing. Paint surfaces with galvanizing repair paint.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 SCOPE

- A. Provide Miscellaneous Metal work as indicated by the Contract Documents.
- B. Work, items and requirements specified elsewhere that apply and/or relate to this Section include:
 - 1. Structural Steel - Section 05100
 - 2. Steel Joists - Section 5210
 - 3. Metal Deck - Section 05300
 - 4. Metal Doors & Frames - Section 08110
 - 5. Painting - Section 09900

1.2 STANDARDS

- A. Meet requirements and recommendations of applicable portions of the Standards listed.
 - 1. Architectural Aluminum Manufacturers Assoc. AAMA
 - 2. American Hot Dip Galvanizers Assoc. AHDGA
 - 3. American Institute of Steel Construction AISC
 - 4. American Society for Testing and Materials ASTM
 - 5. American National Standards Institute ANSI
 - 6. American Welding Society AWS
 - 7. National Association of Architectural Metal Mfrs. NAAMM

1.3 SHOP DRAWINGS

- A. Refer to Section 01340 - Shop Drawings, Product Data and Samples.
- B. Meet requirements of applicable portions of "Structural Shop Drafting" by AISC.
- C. Indicate profiles, sections, and views of items especially manufactured for this work at a scale large enough to permit checking for design conformity.
- D. Show locations, markings, quantities, materials, sizes and shapes.
- E. Note and mark sufficiently to indicate compliance with requirements of these Specifications.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Structural Steel - ASTM A 36, and ASTM A 440.
- B. Cast Steel - ASTM A 27, Grade 65-35; and ASTM A 140, Grade 80-50.
- C. Steel Forgings - ASTM A 235, and ASTM A 237.
- D. Bolts - ASTM A 307, ASTM A 325 and ASTM A 195.
- E. Filler Metal - ASTM A 233, E60 or R70 series.
- F. Cast Iron - ASTM A 48, Class 30, min. 30,000 PSI tensile.
- G. Malleable Iron - ASTM A 47, and ASTM A 197.
- H. Paint - F.S. TT-P-636 Red Oxide.
- I. Galvanizing - ASTM A 123, and ASTM A 386.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Form materials to shapes indicated with straight lines, sharp angles, and smooth curves. Drill or punch holes and smooth edges.
- B. Weld permanent shop connections. Grind smooth, welds that will be exposed. Conceal fastenings where practicable.

- C. Punch or drill for temporary field connections and for attachment of work by other trades.
- D. Fabricate work in shop in as large assemblies as practicable.
- E. Meet requirements specified under Structural Steel for fabricating items of a structural nature or use.

3.2 ITEMS

- A. Furnish all bolts, nuts, clip angles, etc. as shown on Drawings and as required to complete the work.
- B. Pipe Handrails:
 - 1. Fabricate handrails of standard weight black steel pipe of sizes indicated.
 - 2. Form bends smooth without wrinkles, kinks, or flat spots.
 - 3. Weld all joints and grind smooth.
 - 4. Fabricate handrails of one continuous piece in each run with no joints within a stair run.
 - 5. Support handrails with wall supported brackets anchored into brick as detailed on Drawings. Brackets placed at a 5'-0" o.c. maximum.
 - 6. Secure handrails as detailed. Exterior handrails shall be galvanized after fabrication.
- C. Brick Lintel Supports: Steel brick lintel angle set in masonry for support of the brick parapet fascia. Sizes as indicated on drawings.

3.3 INSTALLATION

- A. Set metalwork level, true to a line, plumb, or as indicated. Shim bearing plates with metal, and grout solid.
- B. Weld field connections and grind smooth, where practicable. Conceal fastenings where practicle.
- C. Secure metal to wood with lag screws, of adequate size, with appropriate washers.
- D. Secure metal to masonry with embedded anchors, setting compound, lead caulking and sleeves, or cement-sand grouting.
- E. Expansion bolts, toggle bolts, and screws permitted for light duty service only.
- F. Meet requirements specified for structural steel for erecting items of structural nature or use.
- G. Metal work, in place, shall be approved before being covered.
- H. Do all work in accordance with the approved shop drawings and as indicated on the details.

3.4 PAINTING

- A. Clean ferrous metal of scale, rust, oil, moisture and dirt before applying paint.
- B. Apply one shop coat to ferrous metals after fabrication except metals that will be encased in concrete, and except surfaces that will be adjacent to field welds. Use asphalt paint on metals anchored into masonry, and concrete.
- C. Apply two shop coats to ferrous metals that will be inaccessible after erection.
- D. Retouch, in field, all scrapped, abraded and unpainted surfaces. Pointing as specified for shop coats.
- E. Painting specified here does not count as a coat for finish painting.
- F. Shop Painting will not be required for galvanized metal, stainless steel, aluminum, copper brass, bronze and metals to receive special coatings unless specifically mentioned.

3.5 CLEANING

- A. Refer to Section 01710 - Cleaning.
- B. Clean items prior to final inspection in accordance with the recommendations of the fabricator.

END OF SECTION