SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Refer to other Divisions of these specifications to determine the type and extent of work therein affecting the work of this trade, whether or not such work is specifically mentioned in this Section.

1.2 SUMMARY

A. The Work includes labor, materials, equipment, and services required for completion of Work under this section as shown on drawings and as specified here.

B. This Section includes the following:

1. Structural steel.
2. Steel deck support angles.
3. Column base plate leveling nuts and/or shim packs.
4. Architecturally exposed structural steel.
5. Field-installed headed shear studs.
6. Grout.
7. Hot-dip galvanizing of steel material.
8. Shop priming of steel material.
9. Color-galvanizing of steel material.
10. Other items shown on drawings.

C. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 1 Section “Submittals” for general submittal procedures.
3. Division 5 Section “Architecturally Exposed Structural Steel.”
4. Division 5 Section "Steel Deck" for field installation of shear connectors.
5. Division 5 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
6. Division 9 Painting Sections and Division 9 Section "High-Performance Coatings" for surface preparation and priming requirements.

D. Work furnished under this Section and installed under other Sections:
1. Division 3 Section “Cast-In-Place Concrete:” Installation of structural shapes, bolts, angles, plates, and inserts embedded in new concrete.

E. The Contractor has sole responsibility for site safety. The fabricator and Erector shall review the contract documents and if the structure, as shown on those documents, is in conflict with the requirements of any safety regulations, the Fabricator shall notify the Architect before commencing production of shop drawings. If the Fabricator and/or Erector fail to notify the Architect, as stated above, they shall become responsible for all costs for correcting such conflicts with the requirements of any and all safety regulations.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel (AESS) in the Contract Documents.

C. Special Inspector: Personnel performing Owner provided testing and inspection as specified and as required by 2009 International Building Code.

D. Fabricator's Engineer: Professional Structural Engineer licensed in the State where the Work will be erected permanently, responsible for the structural design of connections.

1.4 PERFORMANCE REQUIREMENTS

A. Detailing: Detail structural members, connections, accessories, and temporary components required for transportation and erection.

1. Refer to Architectural details for miscellaneous items, tolerances, and provisions to be made for the attachment of other materials.
2. Where indicated as requiring coordination, refer to approved mechanical shop drawings for exact location and dimensions of supports for mechanical equipment and penetrations.

B. Connections: Design and detail all connections to withstand loads indicated and comply with concepts, prescriptions, and restrictions indicated.

1. Where appropriate, select and complete connections using schematic details indicated and AISC Steel Construction Manual Thirteenth Edition, LRFD.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

C. Construction: Type FR, fully restrained.

1.5 SUBMITTALS

A. Make electronic submittals in compliance with Division 1 Section "Submittals".

B. Sustainability (LEED) Submittals:

1. Recycled Content Submittal: Provide documentation for all structural steel materials demonstrating the cost of all structural steel materials and the pre-consumer recycled content and post-consumer recycled content as percentages of the total weight of the structural steel materials.

C. Product Data: For each type of product indicated including but not limited to the following:

1. Expansion anchors.
2. Adhesive anchors.
3. Welding filler metals and fluxes.
4. Shop primer, including VOC content.
5. Galvanizing repair paint.
6. Slide bearing material.

D. Shop Drawings: Show fabrication of structural-steel components.

1. Before submitting shop drawings to the Architect, precheck the shop drawings for conformity of details to the Contract Documents and as coordinated with other work. Include signature of Contractor's representative indicating that the drawings have been prechecked. The Contractor is wholly responsible for the conformity of dimensions and details of the shop drawings with the Contract Documents.
2. Submit Job Standard Connection details and calculations before detail drawings. Submit connection information in tabular form with:
   a. Weld sizes.
   b. Sizes and material of connecting elements.
   c. Number, size, and type of bolt.
   d. Material; minimum thickness of supporting member part.
   e. Material and minimum thickness of supported member part.
3. Submit erection plans before or with detail drawings.
4. Resubmitted Drawings:
   a. Clearly and individually identify changes in resubmitted shop drawings whether the change results from a review comment or not.
   b. Date and identify each shop drawing issue.
   c. Identify each shop drawing by the same drawing number throughout the duration of the project.
5. Submit detail drawings. Include:
   a. Details and dimensions of all pieces.
   b. Steel material designation.
   c. Surface preparation and finish.
   d. Details of cuts, connections, splices, camber, holes, welds, bolts and other pertinent data.
   e. Identification marks cross-referenced to erection plans.
   f. Copy of reviewing Structural Engineer of Record's (SER's) shop drawings review stamp.
6. Include anchor rod and embedment drawings.
7. Prepare details avoiding interference of steel connections, gussets, and bracing elements with architectural details, shaft openings, and wall openings.

8. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
9. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
10. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the Fabricator's Engineer responsible for their preparation The Fabricator's Engineer designing connections shall be a Professional Engineer licensed in the state where the project is located.
11. Approval of the shop drawings is for size and arrangement of principal and auxiliary members and conformance of connections. Approval does not relieve the Contractor's responsibility for dimensions, fabrications, and correct fitting of structural members.

E. Connection Design:

1. Immediately upon submission of Job Standard Connection details and/or erection drawings, submit an affidavit from the Fabricator's Engineer, whose registration number shall appear on the affidavit, stating the following: "All connections and details required to resist the loads and reactions shown on the Contract Drawings and as specified, excepting those completely designed and detailed on the Contract Documents, will be designed by me personally or by qualified personnel under my direct supervision."
2. At the completion of the work, the same Fabricator's Engineer shall submit an affidavit stating: "All connections and details required to resist the loads and reactions shown on the Contract Drawings and as specified, excepting those completely designed and detailed on the Contract Documents, have been designed by me personally or by qualified personnel under my direct supervision."

F. Forces imposed on base building structure by temporary attachments for bracing of cranes, hoists, or any other equipment imposing loads on the structure during construction.

1. Provide drawings and calculations for temporary bracing and other construction loads affecting the base building structure stamped and signed by a Professional Engineer licensed in the state of Maine.

G. Welding Procedure Specifications including Qualification Test Reports for welds qualified by test, for each class of weld to be incorporated in the work

H. Welding certificates.

I. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.

5. Shop primers.
6. Nonshrink grout.

J. Source quality-control test reports.

K. Galvanizing: Submit an original and two copies of the coating applicator's notarized Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements of ASTM A123 or A153 as applicable.

L. Fabrication and Erection Errors: Notify Engineer of fabrication or erection errors requiring field work. Before performing corrective work, submit for review and approval description of field work.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE.

1. The erector shall have a minimum of five years of experience in the satisfactory erection of structural steel on projects of this magnitude.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Cbd.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Galvanizing Applicators: Company specializing in hot-dip galvanizing after fabrications and following the procedures of the Quality Assurance Manual of the American Galvanizers Association.

E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

F. Comply with applicable provisions of the following specifications and documents as amended herein:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges" March 18, 2005 Edition.
   a. Section 3.1.2, replace every occurrence of "Fabricator to select and complete" to "Fabricator's Engineer to design".
   b. Section 3.3, second paragraph, delete first sentence and replace with: "When discrepancies exist between the Design Drawings and Specifications, the more restrictive requirement shall govern unless otherwise agreed to by the Architect subject to the general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections
   c. Section 4.1, first sentence: Delete "complete" and insert "showing in sufficient detail the scope of Work items" after "Specifications".

d. Section 4.1, delete the second sentence.
e. Section 4.3, second sentence, after "following conditions" add: "as amended and/or superseded by the agreement with the Owner's Designated Representative for Design".
f. Section 4.3, replace every occurrence of "CAD" with "digital."
g. Section 4.4, delete the second and third sentences.
h. Section 4.4.2, delete this section in its entirety and replace with "Comments and markings or lack thereof on shop drawings or submissions do not constitute an express or implied change to the Contract Documents".
i. Section 6.5, insert before the first sentence:" Unless otherwise noted on the Contract Documents".
j. Section 7.10.3, delete the second sentence of the first paragraph and replace it with: "The Erector shall have the sole responsibility for determining the means and methods used to properly and adequately temporarily brace the framing during erection."
k. Section 7.11.1, delete second sentence and replace it with: "The erector shall coordinate with the General Contractor the installation and removal of all safety protection".
l. Section 7.14, delete in its entirety.
m. Section 9.1.1, delete "completely".
n. Section 9.3, delete in its entirety.
o. Section 10.2.5, delete in its entirety.
p. Section 10.2.8, delete in its entirety.
q. Appendix A, delete in its entirety.

2. AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings."
3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
5. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts", 2000 Edition.
6. AWS's "Structural Welding Code – Steel."
7. SSPC's "Society for Protective Coatings: Steel Structures Painting Manual, Vol. 2."
8. AGA's "Inspection of Products Hot-Dip Galvanized After Fabrication"
9. 2009 International Building Code

G. The Owner shall employ a Special Inspector to oversee and administer, and an independent Testing Agency(s) to perform, a Program of Structural Tests and Inspections for compliance with Chapter 17 of the 2009 International Building Code. The Structural Engineer of Record (SER) shall prepare a statement of structural tests and inspections specifying the program tests and inspections to be performed throughout the construction of this project. Submission and approval of this statement must be complete prior to beginning construction. The statement and program are contained in Section 01 46 00 Quality Control and Testing Services.

1. The Special Inspector will organize and direct the test and inspection program. All inspection and test reports shall be submitted to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER. The

Contractor shall be responsible for understanding the test and inspection program and notifying the Testing Agency and the Special Inspector when work is ready for tests and/or inspections. The Contractor will provide access to the Testing Agency, Special Inspector, and the SER. Inspections and tests of the Structural Tests and Inspection Program will not relieve the Contractor of responsibility for supervision, testing, and inspection for quality control of the work.

2. The Testing Agency and Special Inspector shall submit written reports to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER within two business days of all inspections that describe any construction that does not conform to the contract documents. The Special Inspector shall re-inspect all non-conforming construction after the Contractor has corrected the non-conforming construction and prepare a written report of the re-inspection within two business days of the re-inspection.

3. The Owner's Representative will provide testing and inspection reports to the local building official when requested by the local building official. Upon completion of the construction, the independent Special Inspector will make a final report on the satisfactory completion of the Program for Structural Tests and Inspection to the building official and to the Owner's Representative.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
3. Load and store galvanized articles in accordance with accepted industry standards.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.9 PREINSTALLATION CONFERENCES

A. Hold one conference at least 30 days before the start of shop drawings and one at least 30 days before start of erection.

B. Pre shop-drawing conference:
   1. Agenda to cover but not be limited to the following:
      a. Connection calculations.
      b. Procedures for review of submissions.
      c. Detailing procedures and preferences.
      d. Connection details.
      e. Welding procedures.
      f. Submission procedures.
      g. RFI procedures.
      h. Fabrication procedures and preferences.
      i. Specification and design drawing requirements.
   2. Pre shop drawing conference attendees include but are not limited to:
      a. Contractor.
      b. Contractor's Superintendent.
      c. Contractor's Assistant Superintendent or equivalent responsible for the structural steel.
      d. Fabricator's representative.
      e. Representative of Professional Engineer performing connection calculations.
      f. Architect.
      g. Structural Engineer of Record.
      h. Owner's representative.

C. Pre-erection conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
   1. Agenda to cover but not be limited to the following:
      a. Anchor bolt conditions.
      b. Welding procedures and welder qualifications.
      c. Bolting procedures.
      d. Methods, equipment, and sequencing of erection.
      e. Inspection.
      f. Metal deck and stud installation.
      g. Corrective measures in field.
   2. Pre-erection conference attendees include but are not limited to:
      a. Contractor.
      b. Contractor's Superintendent.
      c. Contractors steel assistant superintendent or equivalent.
      d. Fabricator's representative.
      e. Metal deck erectors representative (if different from steel erector).
      f. Architect.
      g. Structural Engineer of Record.
      h. Inspection and Testing Agency
      i. Owner's Representative.

D. Contractor to record, type, and distribute minutes of meeting to all attendees. Contractor shall update meeting minutes based on comments from attendees and redistribute to all attendees.

E. Notify attendees at least ten days before the scheduled date of the conference.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide structural steel products with a minimum post-consumer recycled content of 80% and a minimum pre-consumer recycled content of 10% by weight.

B. W-Shapes: ASTM A992.

C. Channels, Angles: ASTM A36.

D. Plate and Bar: ASTM A36.

E. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.

F. Steel Pipe: ASTM A53, Type E, Grade B.

G. Welding electrodes for all complete joint penetration welds: shall be rated as providing minimum Charpy V-Notch toughness of 20 ft-lbs at -20°F.

H. Other Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A490, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers, plain.

1. Finish: Plain except at galvanized steel use hot-dip zinc coating, ASTM A153, Class C.

2. Tap nuts after galvanizing to minimum diametral amounts in ASTM A563.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, heavy hex or round head steel structural bolts with splined ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Finish: Plain except at galvanized steel use mechanically deposited zinc coating, ASTM B695, Class 50.

C. Shop Installed Shear Connectors: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 55 and Grade 105 with weldability supplement.

1. Configuration: Straight.

2. Nuts: ASTM A 563 hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A 153, Class C.

E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.

1. Nuts: ASTM A 563 hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153, Class C.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain unless otherwise noted.

G. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 EXPANSION ANCHORS

A. Available Products: Subject to compliance with requirements, provide one of the following:
1. Hilti Kwik Bolt 3.
2. ITW Ramset/Red Head Trubolt Wedge.
3. Powers Power-Stud.

B. Finish: as indicated.

2.4 ADHESIVE ANCHORS

A. Available Products: Subject to compliance with requirements, provide one of the following:
1. Hilti HY 150 MAX System.
2. Hilti HIT-RE 500 System
3. Hilti HY 20 System.
4. Redhead Epcon C6.
5. Powers AC100 Plus.

B. Rods: as indicated.

C. Nuts and Washers: Match rod material.

2.5 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer, maximum VOC 250 g/L.

B. Galvanizing Repair Paint:
   1. ZRC Cold Galvanizing Compound.
   2. Brite Zinc by Brite Products.

2.6 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. Compressive strength per ASTM C 109: 8,000 psi.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."

   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
   2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: as indicated.

2. Do not reuse high-strength bolts.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Where backing or runoff tabs are removed, back gouge, and grind steel smooth, and reweld as required to establish specified profile.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.9 CLEANING AND SURFACE PREPARATION

A. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. Members indicated to receive galvanized finish: prepare per SSPC-SP6 / NACE No. 3, "Commercial Blast Cleaning."
   2. Members indicated to receive zinc-rich paint: prepare per SSPC-SP3 "Power Tool Cleaning."
   3. Members that are to be designated to receive sprayed fire-resistive materials or to remain unpainted: prepare per SSPC-SP 2, "Hand Tool Cleaning."
   4. Members not one of the above: prepare per SSPC-SP3 "Power Tool Cleaning" and prime with primer compatible with intermediate and top coats as specified in Division 9 Section "Interior Painting."

2.10 SHOP PRIMING

A. Do not shop prime members that will be concealed and protected from moisture in the finished construction, nor as follows:

   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation: Prepare surfaces to be painted according to paint manufacturer's recommendations. Remove loose rust and mill scale and spatter, slag, or flux deposits.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.11 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

   1. Fabricate structural steel in accordance with Class 1 guidelines as described in AGA's "Recommended Details for Galvanized Structures."
   2. Fill all vent holes and grind smooth after fabricating.

3. Fabricate in accordance with the applicable portions of ASTM A 143, A 384, and A 385. Avoid fabrication techniques that could cause distortion and embrittlement of the steel.
4. The Fabricator shall consult with the Architect and hot-dip galvanizer regarding potential problems or potential handling problems during the galvanizing process that may require modification of design before fabrication begins.
5. Coordination between Fabricator and Galvanizer:
   a. Review approved shop drawings.
   b. Location of holes and lifting lugs for galvanizing.
   c. Avoiding using unsuitable marking paints, grease, oil paint, and other deleterious material.
   d. Removal of welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
   e. Removal of surface contaminants and coating that would not be removable by the normal chemical cleaning process in the galvanizing operation.
6. Galvanize structural steel such as lintels and shelf angles located in exterior walls. Galvanize structural steel that is in unconditioned space such as canopies and awnings.
7. Mask areas that will be field welded prior to galvanizing.
8. Inspection: Contractor's inspector to check coating mil thickness prior to shipment. Send a certification to the Architect stating that coating satisfies specified requirements.
9. Furnish Notarized Certificate of Compliance with ASTM Standards and Specifications listed here. The certificate must be signed by the galvanizer and contain a detailed description of the material processed. Include in the Certificate information as to the ASTM standard used for the coating.
10. Mark all material specified to be hot-dip galvanized after fabrication with a stamp. The stamp must clearly show the name of the galvanizer, the applicable ASTM specification number, and the number of ounces per square foot of zinc coating applied after fabrication.

B. Factory-Applied Architectural Finish with Clearcoat
   1. Where indicated, provide factory-applied architectural finish with clearcoat after hot-dip galvanizing.
      a. Apply primer within 12 hours after galvanizing at the same facility where the galvanizing is done in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
      b. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer.
      c. Coatings shall be certified VOC compliant and conform to applicable regulations and EPA standards.
      d. Apply the galvanizing, primer and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
      e. Blast cleaning of the galvanized surface is not acceptable.
   2. Quality Assurance for Factory-Applied Metal Coatings:

a. Factory-applied metal coatings shall be performed in a facility acceptable to the coating manufacturer.
b. Submit two 3-in. by 6-in. samples of factory-applied coatings and colors proposed for use for approval prior to coating application.
c. Engage the services of a galvanizer who has demonstrated a minimum of ten years experience in the successful performance of the processes outlined in this specification in within the same facility as outlined herein. The Architect has the right to inspect and the facility where the work is to be done and who will apply the galvanizing and coatings approve or reject the galvanizer/galvanizing facility.
d. Handle and install materials with factory-applied coatings as recommended by galvanizer and coating manufacturer to prevent damage to coatings prior to and after installation.
e. Touch-up factory-applied metal coatings as recommended by galvanizer and coating manufacturer.
f. Coatings not matching approved submittals shall be removed and replaced at no additional expense to the Owner.

2.12 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option and as indicated on Drawings:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other

surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type:
   a. Standard Shear Connections: Snug tightened
   b. Moment Frame or Braced Frame Connections: Pretensioned.

2. Do not reuse high strength bolts.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Where backing or runoff tabs are removed, gouge, and grind steel smooth, and reweld as necessary to meet specified profile.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
   c. Grind all galvanizing masking material before making field welds.

3.5 FIELD QUALITY CONTROL

A. Special Inspection and Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option and as specified on Drawings:

   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural steel, joists and accessories.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

3.7 CLEANING

A. Remove and dispose of away from the site: Erection bolts, erection attachments, temporary lifting lugs, safety barrier supports, and any other auxiliary or temporary steel components that interfere with other work.

END OF SECTION 05 12 00