SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.1 PURPOSE

A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 LESSONS LEARNED AND DESIGN CONSIDERATIONS

A. X

1.3 REFERENCED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this Section.

1.4 DESCRIPTION OF WORK

A. Work Included: Furnish all labor, materials, services, equipment and appliances required in conjunction with or properly incidental to furnishing, fabrication, delivery, and erection of structural steel complete, including, but not limited to, the following:
   1. Structural steel columns, girders, beams, angles, rigid frames, trusses, shelf angles, angle frames for openings in floors and roofs, galvanized cooling tower grillage, steel supports for elevator machines, steel hoist beams for elevator equipment, steel supports for elevator guide rails, steel plates, miscellaneous deck support angles, shop welded shear studs, connections and component parts.
   2. Qualification of welders.
   3. Shop prime coat of paint and field-touch painting.
   4. Temporary construction bracing.
   5. Fabrication/erection inspection and testing.

B. Extent of structural steel work is shown on Drawings including schedules, notes and details to show sizes and locations of members, typical connections and types of steel required.

C. Include all supplementary parts and members necessary to complete structural steel work, regardless of whether all such parts are definitely shown or specified and furnish all such bolts, gussets, plates, etc., as may be required for proper assembly of all items. Include miscellaneous deck support angles as required for proper support of metal floor deck around columns, gussets, openings, and obstructions.

D. Connection Design:
   1. All typical beam to column and beam to beam connections are detailed and shown on the Construction Documents. The Contractor is to comply with these details.
   2. Where indicated, truss, bracing connections and special or non-typical structural steel beam connections shall be designed by the fabricator, in accordance with criteria on Drawings. Fabricator-designed connections shall be submitted together with complete calculations for review for acceptability by the Architect.

E. Substitutions:
   1. Proposed substitutions of sections or modification of details, and reasons therefor, shall be submitted with shop drawings for review. Submitted substitutions must be clearly identified and noted as such. Approved substitutions, modifications, and necessary changes in related portions of work shall be coordinated by fabricator and shall be accomplished at no additional cost to Owner.
   2. Substitutions to the beam to column and beam to beam connections shown on the drawings will be reviewed for acceptability if submitted with calculations prepared by a licensed professional engineer.

F. Responsibility for Errors: Fabricator shall be responsible for all errors of detailing, fabrications, and for correct fitting of structural steel members.

G. Templates: Shall be furnished by fabricator with instructions for setting of anchor bolts and bearing plates.

H. Related Work Specified in Other Sections:
   1. Testing laboratory services for verification of quality: Division 01.

2. Cold-formed metal framing: Section 05 40 00.
3. Metal fabrications: Section 05 50 00.
4. Painting and Coating: Section 09 90 00.

1.5 QUALITY CONTROL

A. Latest adopted edition of all standards referenced in this Section shall apply, unless noted otherwise. In case of conflict between Contract Documents and a referenced standard, Contract Documents shall govern. In case of conflict between Contract Documents and Building Code, more stringent shall govern.

B. Contractor shall furnish fabrication/erection inspection and testing of all welds in accordance with AWS D1.1, Chapter 6. Submit records of inspections and tests to Owner's testing laboratory for their review.

C. Fabricator shall have developed a detailed fabrication procedural manual reflecting key quality control procedures used in fabrication process and shall provide a copy of the manual for examination by Owner's testing laboratory.

D. Fabricator shall employ a competent technician, engineer or independent testing laboratory to inspect fabrication work to ensure compliance with Contract Documents and shall identify such inspector to Owner's testing laboratory. Inspector shall examine in the shop all welding, bolting, shear studs, painting, galvanizing, and straightness and alignment of fabricated members.

E. Testing Laboratory Services for Verification of Quality: Refer to Division 01.

F. All materials, fabrication procedures, and field erection are subject to verification inspection and testing by Owner's testing laboratory, in both shop and field. Such inspections and tests will not relieve Contractor of his responsibility for providing materials and fabrication procedures in compliance with specified requirements. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1. Promptly remove and replace materials or fabricated components which do not comply.

G. Qualifications for Welding Work: Contractor shall be responsible for qualifying welding operators in accordance with AWS "Standard Qualification Procedure." Provide certification, to Owner's testing laboratory, that welders to be employed in work have satisfactorily passed AWS qualification tests and are currently qualified. Welders who have changed employers or who have not performed the designated weld for a period of 6 months or longer since the last qualification shall be retested. If requalification of welders is required, retesting will be Contractor's responsibility.

H. Qualifications of Welding Procedures: Contractor shall provide testing laboratory with welding procedures which are to be used in executing this work. Welding procedures shall be qualified prior to use in accordance with AWS D1.1, Part B.

I. Comply with Provisions of the Following Codes, Specifications and Standards, in Addition to Building Code:
   1. AISC, "Code of Standard Practice for Steel Buildings and Bridges."
   2. AISC, "Specification for Structural Steel Buildings," including "Commentary" and Supplements thereto, as issued.
   3. AISC, "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts," approved by the Research Council on Structural Connections of the Engineering Foundation.
   4. AISC, "Specification for Architecturally Exposed Structural Steel."
   5. AWS D1.1, "Structural Welding Code."
   6. ASTM A 6, "Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling."
   7. Industrial Fasteners Institute, "Handbook on Bolt, Nut, and Rivet Standards."
   8. Steel structure painting council:
      a. Painting manual, vol. 1, Good Painting Practice.
      b. Painting manual, vol. 2, Systems Specifications.

J. QUALIFICATIONS
   1. Structural steel fabricator shall comply with one of the following:
      a. Structural steel fabricator shall have not less than 10 years' experience in fabrication of structural steel for buildings and shall be currently certified under the AISC Certification Standard for Steel Building Structures. Submit proof of certification with bid.
      b. An otherwise qualified fabricator who is not a member of the AISC Quality Certification Program may be acceptable if satisfactory evidence of qualifications is submitted prior to contract award. For non-certified fabricators, Contractor shall submit, for consideration, a resume describing plant size, equipment, quality control procedures and personnel, and experience on comparable work in the last 3 years. Final acceptability shall be subject to approval of the Architect.

2. Structural steel erector shall have not less than 10 years' experience in erection of comparable structures and shall be currently certified under the AISC Advanced Certified Steel Erector (ACSE) category.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions, including laboratory test reports and other data, to show compliance with Specifications for the following products.

B. Mill Certificates: Submit for Architect's record certificates of mill analysis showing compliance with Specifications for the following products.

C. Shop Drawings:

1. Indicate Structural steel primer paint.
2. Shrinkage-resistant grout.
3. Shear studs.
4. Structural steel (each type).
5. High-strength bolts (each type), including nuts and washers.
6. Shear studs.
7. All typical beam to column and beam to beam connections are detailed and shown on the Contract Documents. The Contractor is to comply with these connection details. If the Contractor would like to substitute a connection, it shall be submitted in accordance with the specified procedure for substitutions, with calculations prepared by a licensed professional engineer.
8. Submit shop drawings of all structural steel, including complete details and schedules for fabrication and shop assembly of members, erection plans and details, procedures, and diagrams showing sequence of erection. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
9. Submit design calculations for the non-typical beam, truss and bracing connections that are designed by the fabricator. Calculations shall bear seal of a Licensed Professional Engineer, licensed in the State of Texas. Calculations shall show applied loads and reference applicable piece mark from the shop drawings as well as location or mark from structural drawings.
10. Structural steel members for which shop drawings have not been reviewed shall not be fabricated. Architect's review shall cover general locations, spacings, and details of design.
11. Omission from shop drawings of any materials required by Contract Documents shall not relieve Contractor of responsibility of furnishing and installing such materials, even though such shop drawings may have been reviewed and returned.
12. Submit setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by other trades.

D. Manufacturer's Certification: Submit evidence of current AISC plant certification (see "Qualifications").

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Designer Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.

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

C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

D. Support cambered members during shipment and handling in a manner which will not result in loss of camber.

1.8 JOB CONDITIONS

A. Coordinate erection of structural steel with work of other trades.

B. Do not install columns which have embeds or anchor bolts in concrete until concrete members have attained their 28 day compressive strengths.

PART 2 – PRODUCTS

2.1 GENERAL

A. All paints, coatings, adhesives, sealants, stains, caulk, firestopping, etc. applied inside the weatherproofing systems and on site only in this specification must comply with the VOC limits in Division 01. In submittal, include product data sheet or MSDS clearly showing VOC content of product in grams/Liter.

2.2 MATERIALS

A. Studs Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. Steel:
   1. Wide flange (W) shapes and tees: ASTM A 992 (50 ksi yield).
   2. Other rolled shapes, plates, and bars: ASTM A 36 (36 ksi yield).
   3. Hollow structural sections (HSS or TS): ASTM A 500, Grade B, (46,000 psi yield for square shapes and 42,000 psi for round shapes).
   4. Steel pipe: ASTM A 53, Type E or S, Grade B (35,000 psi yield).
   5. For ASTM A 6 Group 3 rolled shapes having flanges thicker than 1 1/2" and Groups 4 and 5 rolled shapes (spliced or otherwise) connected by full penetration welds, provide material with Charpy V-Notch testing in accordance with ASTM A 6, Supplementary Requirement S5. Impact test shall meet a minimum average value of 20 foot-pounds absorbed energy at 70° F. and shall be conducted in accordance with ASTM A 673 and AISC Specifications for Structural Steel Buildings.
   6. For plates exceeding 2" thickness used in built-up members, which are spliced or connected by full penetration welds, provide material with Charpy V-Notch testing in accordance with ASTM A 6, Supplementary Requirement S5. Impact test shall be conducted by producer in accordance with ASTM A 673, Frequency P and shall meet a minimum average value of 20 foot-pounds absorbed energy at 70° F.

C. Bolts and Washers:
   1. Anchor bolts: Anchor bolts (or anchor rods) for anchoring to concrete shall conform to ASTM F1554, 36 KSI yield strength, and to requirements for regular hexagon bolts and nuts of ANSI Standards B18.2.1 and B18.2.2. Washers for anchor bolts shall be oversize or plate washers as specified, with a hole 1/16 inch larger than the bolt diameter.
   2. All bolts for connections shall be high strength bolts conforming to ASTM A 325. Dimensions of bolt heads and nuts shall conform to requirements for heavy hexagon nuts of ANSI Standards B18.2.1 and B18.2.2. Nuts shall be ASTM A 563 material.
   3. Washers: Flat and smooth circular hardened washers conforming to requirements of ASTM F 436. Beveled washers for "S" shapes and channels shall be square or rectangular, taper in thickness, and smooth. Washers for use with high-strength bolts shall be hardened.
   4. Direct tension indicator washers for high-strength bolts in friction connections shall conform to ASTM F 959, Type A 325.
   5. Tension control (twist off) bolts may, at Contractor's option, be used in lieu of conventional high-strength bolts. Tension control bolts shall conform to ASTM F 1852 with A 325 marking.
   6. Drilled Expansion Bolts in Concrete Shall Be One of the Following, except where a specific product is specified on the drawings:
      a. Power-Stud+SD1, Powers Fasteners, Brewster, NY
      b. Kwik Bolt TZ, Hilti Fastening Systems, Tulsa, OK
   7. Drilled Screw Anchors for Structural Applications in Concrete Shall Be One of the Following, except where a specific product is specified on the drawings:
      a. Titen HD, Simpson Strong-Tie Co., Pleasanton, CA
      b. Wedge-Bolt+, Powers Fasteners, Brewster, NY
      c. Kwik HUS EZ, Hilti Fastening Systems, Tulsa, OK
   8. Drilled Adhesive Anchors in Concrete Shall Be One of the Following Anchoring Systems, except where a specific product is specified on the drawings:
      a. SET-XP Epoxy Anchoring System, Simpson Strong-Tie Co., Pleasanton, CA
      b. PE1000+ Standard Set Adhesive Anchoring System, Powers Fasteners, Brewster, NY
      c. HIT-HY150 MAX SD Adhesive Anchoring System, Hilti Fastening Systems, Tulsa, OK
      d. HIT-HY200 SAFE SET System, Hilti Fastening Systems, Tulsa, OK
      e. HIT-RE500-SD Adhesive Anchoring System, Hilti Fastening Systems, Tulsa, OK
      f. A manufacturer’s representative shall be present during initial installation to provide onsite training of installers.
      g. In the case of a cored hole, a wet hole, or a hole deeper than 18 inches, substitute a slow cure epoxy adhesive or other appropriate product recommended by the manufacturer for the special application.
   9. Drilled Expansion Bolts in Masonry Shall Be One of the Following, except where a specific product is

specified on the drawings:
   a. Wedge-All, Simpson Strong-Tie Co., Pleasanton, CA
   b. Kwik Bolt 3, Hilti Fastening Systems, Tulsa, OK
10. Drilled Adhesive Anchors in Masonry Shall Be One of the Following Anchoring Systems, except where a specific product is specified on the drawings:
   a. SET Epoxy Tie, Simpson Strong-Tie Co., Pleasanton, CA
   b. Powers Standard Set Power-Fast+, Powers Fasteners, Brewster, NY
   c. HIT-HY 70 Adhesive Anchoring System, Hilti Fastening Systems, Tulsa, OK

D. Welding electrodes shall conform to requirements of Specifications of American Welding Society. Use E70 electrodes. For high-strength, low-alloy steel, provide electrodes, welding rods, and filler metals equal in strength and compatible in appearance with parent metal joined.

E. Shear studs shall be shear connectors with proper ferrules and accessories, especially designed to create composite deck action between concrete deck and supporting beam. Steel for studs shall conform to requirements of "Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished," ASTM A 108, Grades 1015-1020, with a minimum tensile strength of 60,000 psi. Studs shall be of uniform diameter, heads shall be concentric and normal to shaft and weld end shall be chamfered, welds shall be solid flux.

F. Primer Paint:
   1. Standard shop coat of primer, meeting requirements of "SSPC-Paint 15", Type I, applied to a dry film thickness of 2.0 mils.
   2. Primer Paint:
      a. Epoxy primer for steel - Tnemec "Hi-Build Epoxoline II Series L69" Primer or Carboline "Carbogard 890 VOC" applied to a dry film thickness of 4 to 6 mils. Selected product shall qualify as a low VOC material under LEED requirements.
      b. For architecturally exposed steel - Sherwin Williams Re-Coatable Epoxy Primer, gray.

G. Zinc-coating:
   1. For galvanized steel shall conform to ASTM A 123, threaded products shall conform to ASTM A 153, Class C and sheet steel shall conform to ASTM A 591.
   2. Cold Galvanizing Compound: "ZRC Zero VOC Cold Galvanizing Compound," by ZRC Chemical Products Co., Marshfield, MA.

H. Slide Bearings: Reinforced teflon, factory prebonded to steel plates with initial static coefficient of friction not exceeding 0.06 at interface, over a working stress range of 500 to 2000 psi. Bearing shall be one of the following:
   1. "Fluorogold" slide bearings, by Fluorocarbon Co., Pine Brook, N.J.
   2. "Con-Slide" slide bearings, by Con-Serv, Inc., Georgetown, SC.

2.3 FABRICATION

A. Shop Fabrication and Assembly:
   1. Fabricate and assemble structural assemblies in the shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.
   2. Provide camber in members where indicated. Specified camber applies at jobsite, just prior to erection, lying down flat so that member weight has no effect. Contractor shall take necessary precautions to prevent or compensate for camber loss during shipment. Measured camber in members up to 50'-0" long shall be within a tolerance of -0" to +1/2" from amount specified. For members greater than 50'-0" long, both positive and negative tolerance may increase 1/8" for every 10'-0" of length in excess of 50'-0". Members with a field measured camber outside of specified tolerance shall be returned to shop.
   3. If heat is used to camber steel beams, it shall be carefully controlled and applied in a manner which will not alter the material properties of the member, and only in the presence of the testing laboratory. Follow AISC recommendations for heat cambering.
   4. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
   5. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
   6. Splicing of structural steel members is prohibited without prior approval of Architect. Any member having a splice not shown and detailed on approved shop drawings shall be rejected.

7. Members in compression joints which depend on contact bearing shall have bearing surfaces milled to a common plane. Members to be milled shall be completely assembled before milling.
8. Plates shall be free of gross internal discontinuities such as ruptures and delaminations. Plates shall comply with ASTM A 578, Level 1.
9. Mill tolerances: Comply with ASTM A 6.
10. Fabrication tolerances: Comply with AISC Code of Standard Practice.

B. Connections:
1. Weld or bolt shop connections, as indicated on Drawings.
2. Bolt field connections, except where welded connections or other connections are indicated. Provide specified threaded fasteners for all principle bolted connections. Holes for bolted connections shall be drilled or punched at right angles to member. Slope of surfaces under bolt head and nut shall not exceed 1:20. Provide beveled washers where slopes exceed 1:20. Bolt holes shall have a diameter not greater than 1/16" larger than nominal bolt diameter. Do not flame cut holes or enlarge by burning. Provide washers over all slotted holes in an outer ply.
3. High-strength bolted construction: Install in accordance with AISC, "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts," (RCRBSJ).
4. Welded construction: Comply with AWS Structural Welding Code for procedures, appearance and quality of welds and methods used in correcting welding work. Assemble and weld built-up sections by methods which produce true alignment of axes without warp. Welds not specified shall be continuous fillet welds designed to develop full strength of member. No combination of bolts and welds shall be used for stress transmission at the same face of any connections.
5. Heavy shapes (ASTM A 6, groups 4 and 5, and built-up sections containing plates thicker than 2"): Comply with all special requirements for welding heavy shapes contained in the AISC Specification and in AWS Structural Welding Code.
6. Clean completed welds prior to inspection. Slag shall be removed from completed welds, and adjacent base metal shall be cleaned by brushing or other suitable means. Tightly adherent splatter remaining after cleaning is acceptable unless its removal is required for the purpose of nondestructive testing.
7. For high-strength, low-alloy steels follow welding procedures recommended by steel producer for exposed and concealed connections.
8. Base plates where exposed to view: Hole sizes for anchor bolts shall be as follows:
   a. Bolts 3/4" to 7/8" diameter - 5/16" oversize
   b. Bolts 1" to 2" diameter - 1/2" oversize
   c. Bolts over 2" diameter - 1" oversize
   d. Use circular oversize washers under nut at all oversized holes in base plates. Washers must be large enough to cover entire hole. Washer thickness shall be at least 1/6 of bolt diameter.
9. Base plates where not exposed to view: Hole sizes for anchor bolts may be oversized to facilitate erection as follows:

Anchor Bolt Diameter	Base Plate Hole Diameter	Min. Washer Diameter	Min. Washer Thickness
3/4	1 5/16	2	1/4
7/8	1 9/16	2 1/2	5/16
1	1 13/16	3	3/8
1 1/4	2 1/16	3	1/2
1 1/2	2 5/16	3 1/2	1/2
1 3/4	2 3/4	4	5/8
2	3 1/4	5	3/4
2 1/2	3 3/4	5 1/2	7/8
All sizes are in inches. Plates used as washers may be square ASTM A 36 plate with sides equal to given diameter. (Ref. Table 14-2, AISC LRFD 3rd Ed.)			

C. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, shaped as shown, to beams and girders in composite construction which does not support metal deck. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions. Apply before galvanizing where galvanized members are called for.
1. Installation of shear connectors: End weld in shop, in accordance with Article 31 of AWS Code and

Specifications of shear stud manufacturer. After installation, each ceramic ferrule shall be removed prior to placement of concrete. Adequate welding power must be available for studs being welded.

2. All areas to which studs are to be attached shall be cleaned of rust, oil, grease, and paint. When mill scale is sufficiently thick to cause difficulty in obtaining proper welds removed by grinding or sand blasting.

D. Steel Wall Framing: Select members which are true and straight for fabrication. Straighten as required to provide uniform, square, and true members in completed wall framing.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

F. Zinc-coating: Following Steel Shall be Galvanized:
1. Cooling tower grillage and supports, including fasteners.
2. Cooling tower screen support members and braces.
3. Masonry shelf angles.
4. Exposed railing.
5. Roof Screen Supports.

G. Architecturally Exposed Structural Steel: Applies to Portico Girts, North Entry Level 3 Girts and Columns, Clinical Entry Level 2 and Level 3 Girts, and Tower Level 5 Girts. Members shall be straight and true. Select or straighten members to meet permissible variations of ASTM A 6, subject to tolerances of AISC Code of Standard Practice, Section 10. Exposed surfaces shall be smooth, free of embedded scale, trademarks, roll imperfection marks and other irregularities. Fill any depressions with weld metal of the same composition as the parent metal. Grind welds and raised marks smooth and flush with adjacent surfaces.

2.4 SHOP PAINTING

A. General: Shop paint structural steel, except members or portions of members to receive a galvanized coating or members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
1. Do not paint surfaces which are to be welded.
2. Do not paint surfaces which are scheduled to receive sprayed-on fireproofing.
3. Do not paint surfaces of exposed high-strength, low-alloy steel members (weathering steel).
4. Do not paint top surface of beams which support composite metal floor deck.
5. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

B. Surface Preparation: After inspection and before shipping, clean steel to be painted. Remove loose rust, mill scale, spatter, and slag or flux deposits. Clean in accordance with Steel Structures Painting Council (SSPC) as follows:
1. SP-2 "Hand Tool Cleaning" or SP-3 “Power Tool Cleaning” on members in enclosed air conditioned spaces.
2. SP-6 "Commercial Blast Cleaning" for the following steel:
a. All members exposed to weather
b. Architecturally exposed members
c. All members in non-conditioned spaces
3. SP-10 "Near-White Blast Cleaning" for high-strength, low-alloy steel surfaces to avoid uneven oxidation.

C. Painting: Immediately after surface preparation apply structural steel primer paint in accordance with manufacturer's instructions, at a rate to provide a uniform dry film thickness as specified. Use painting methods which result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 – EXECUTION

3.1 INSPECTION

A. Erector must examine areas and conditions under which structural steel work is to be installed, and notify Contractor of conditions detrimental to proper and timely completion of work.

3.2 SURVEY

A. Employ a licensed professional engineer or public surveyor, experienced in survey work, to establish permanent bench marks as shown and as necessary for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds, report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

3.3 ERECTION

A. Maximum General: Comply with AISC Specifications and Code of Standard Practice, and as herein specified.

B. Temporary Shoring and Bracing:
   1. Maximum Variation of any Member from Plane: 1/8 inch.
   2. As erection progresses, make a sufficient number of permanent welded or bolted connections to withstand erection stresses and maintain stability.
   3. Design of temporary shoring and bracing shall be responsibility of Contractor.
      a. Contractor shall hire a Licensed Professional Engineer, licensed in the State of Texas, to design and detail temporary shoring and bracing.

C. Temporary Planking: Provide planking and working platforms, as necessary, to effectively complete work.

D. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors in accurate locations. Refer to Division 03 of these Specifications for anchor bolt installation requirements in concrete, and Division 04 for masonry installation.

E. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond- reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
   1. Set loose and attached base plates and bearing plates, for structural members, on leveling nuts, steel wedges or steel shims.
   2. Tighten anchor bolts after supported members are positioned and plumbed. Do not remove wedges or shims but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

F. Slide Bearings Plates: Shall be permanently affixed to member and support, respectively, by welding or bolting as indicated. Member faces shall be aligned and leveled so as to maintain full and level contact between surfaces before completing installation. Use tapered shims where required for leveling.

G. Field Assembly:
   1. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   2. Level and plumb individual members of structure within tolerances defined by AISC Code for Standard Practice, unless closer tolerances are required for proper fitting of adjoining or enclosing materials, in which case the most stringent shall apply.
   3. Set horizontal members with their natural camber (or specified camber) up.
   4. Exposed-to-view faces of members designated as architecturally exposed structural steel shall be plumbed, leveled and aligned to a tolerance not to exceed 1/2 the amount permitted for structural steel, unless adjoining materials dictate a tighter tolerance.
   5. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
   6. Splice members only where indicated and accepted on final shop drawing.
   7. Where parts cannot be assembled or fitted properly, as a result of errors in fabrication or of deformation due to handling or transportation, such condition shall be immediately reported to Architect, along with proposed method of correction. Straightening of bends or warps shall be done by approved methods. Bent or damaged heat-treated parts will be rejected.
   8. Fastening of splices in compression members shall be done after abutting surfaces have been brought completely into contact.

H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces. On non-exposed welded construction, erection bolts shall be tightened

securely and left in place, or if removed, holes shall be filled with plug welds.

I. Bolted Connections:
   1. High-strength bolts shall be installed in conformance with "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."
   2. A 307 bolts and high-strength (A 325 and A 490) bolts noted to be "snug-tight" shall be tightened using a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench, bringing plies into snug contact. Tension control bolts, if used, may be tightened to their full design tension.
   3. High-strength bolts which are not specifically designated to be "snug-tight" shall be tightened to provide at least the minimum tension shown in Table 4 of "Specification for Structural Joints using ASTM A 325 and A 490 Bolts." Tightening shall be done by turn-of- the-nut method, with direct tension indicators, or by properly calibrated wrenches. Torque control bolts shall be tightened with torque control wrench until spline twists off.
   4. Bolted parts shall fit solidly together when assembled. All joint surfaces shall be free of burrs, dirt and other foreign material that would prevent solid seating of parts.
   5. Faying surfaces of "slip-critical" connections, as defined in "Specification for Structural Joints" or on Drawings, shall have all paint removed by blast cleaning.
   6. Bolts tightened by calibrated wrench or torque control shall have a hardened washer under the element (nut or bolt head) turned in tightening.
   7. Hardened washers shall be placed over slotted holes in an outer ply. Hardened beveled washers shall be used where outer face of bolted parts has a slope greater than 1:20 with respect to bolt axis.

J. Field Welding: Comply with AWS Structural Welding Code and AISC Specification for Structural Steel Buildings. Pay particular attention to surface preparation, preheating, sequence, and continuity of welds. Where heavy shapes are to be welded, comply with all special requirements of AISC Specification and AWS Structural Welding Code.

K. Field Grinding of Exposed Welds: All visible field welds shall be ground smooth unless otherwise indicated.

L. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

M. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

N. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

O. Touch-up Painting: Immediately after erection clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same materials as used for shop painting. Apply by brush or spray, to provide a minimum dry film thickness of 2.5 mils for each coat.

P. Touch-up Cold Galvanizing: Immediately after erection, touch-up areas of hot-dip galvanized members where galvanizing has been abraded during shipping and erection and where it has been removed or damaged due to welding. Apply specified cold galvanizing compound by brush or spray in accordance with manufacturer's instructions, to a minimum dry film thickness of 2.5 to 3.5 mils.

3.4 CLEANUP

A. Clean up all debris caused by work of this Section, keeping the area clean and neat at all times.

END OF SECTION