

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the fabrication and installation of structural steel and related work, complete, in accordance with the Drawings and as specified herein. For structural steel related to the Seismic Force Resisting System, see Section 051210.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Concrete Reinforcement and Embedded Assemblies	Section 032000
Cast-In-Place Concrete	Section 033000
Steel Deck	Section 053000
Metal Fabrication	Section 055000
Metal Stairs	Section 055100
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9

1.4 CODES AND STANDARDS

A. Building Code: Structural steel work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. American Institute of Steel Construction (ANSI/AISC 360-10)
"Specification for Structural Steel Buildings"
2. American Institute of Steel Construction (AISC 303-10), "Code of Standard Practice", April 14, 2010, shall apply except:
 - a) In item 3.1.2 delete all references to item 4.4 and replace with the requirements of the project Specification.

- b) Item 3.6 shall be deleted.
- c) Item 4.4 shall be deleted, and replaced with the requirements of the project Specification.
- d) The second paragraph of item 7.10.3 shall be revised from "... owner's designated representatives for design and construction" to "owner's designated representative for construction or as indicated in the Contract Documents"
- e) The last sentence of items 8.5.2 and 8.5.4 shall be deleted.
- f) Item 8.5.3 shall be deleted. Where a conflict exists between the Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.

- 3. American Welding Society, AWS D1.1-2010, "Structural Welding Code".
- 4. Research Council on Structural Connections (RCSC) - "Specification for Structural Joints Using ASTM A325 or A490 Bolts", (December 31, 2009).
- 5. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein, latest edition.
- 6. The Society for Protective Coatings (formerly Steel Structures Painting Council, "SSPC") "Steel Structures Painting Manual", (2005).

C. Definitions:

- 1. The term "Contract Documents" in this Specification is defined as the design Drawings and the Specifications.
- 2. The term "SER" in this Specification is defined as the Structural Engineer of Record for the structure in its final condition.
- 3. The term "Design Professionals" in this Specification is defined as the Owner's Architect and SER.
- 4. The term "Contractor" in this Specification is defined to include any of the following: General Contractor and their sub-contractors, Construction Manager, Structural Steel Fabricator or Structural Steel Erector.
- 5. The term "Heavy Shapes" in this Specification is defined to include hot rolled steel shapes with flanges exceeding 2 inches (50mm) in thickness and built up cross sections with plates exceeding 2 inches (50mm) in total thickness.
- 6. The term "High Restraint Weld" describes welds in which there is almost no freedom of movement for members joined due to geometry or material thickness.
- 7. The term "Testing Agency" in this Specification is defined as an independent testing and inspection service engaged by the Owner for quality assurance observation and testing of steel construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
- 8. The terms "for record" and "submit for record" in this Specification are defined as Contractor submittals that do not require a response from the Design Professionals.
- 9. Working Days: Monday through Friday, except for federal or state holidays.
- 10. Nondestructive Testing: Nondestructive testing (NDT) includes magnetic particle testing (MT), penetrating testing (PT), radiographic testing (RT),

and ultrasonic testing (UT). The terms nondestructive examination (NDE) and nondestructive testing (NDT) are synonymous.

1.5 CONTRACTOR QUALIFICATIONS

- A. The term Structural Steel Contractor refers to any or all of the following parties, regardless of their contractual relationships: Structural Steel Fabricator, Structural Steel Detailer, Structural Steel Erector and Contractor's Engineer.
- B. Qualification Data: Submit qualification data (personnel and firm resumes, and project lists with references) for the Structural Steel Fabricator ("Fabricator"), Structural Steel Detailer ("Detailer"), Contractor's Engineer(s) and Structural Steel Erector ("Erector").
- C. The Fabricator shall have 10 years of comparable experience in installations of this type and shall employ labor and supervisory personnel familiar with the type of installation, experienced in fabrication and erection of structural steel for projects of similar size and complexity. At the time of bid the Fabricator shall be AISC certified to the Standard for Steel Building Structures (STD) and must submit proof of these qualifications. The Fabricator's qualifications shall be subject to review by the Design Professionals and Owner.
- D. The Detailer shall have 10 years experience preparing detailed steel shop drawings for structures of this type and complexity. The detailer's qualifications shall be subject to review by the Design Professionals and Owner.
- E. The Contractor's Engineer(s) shall be qualified to perform the type of work required by the project. The Engineer(s) shall be a Licensed Structural Engineer(s) in California. The Contractor's Engineer(s) shall have 10 years of experience being in responsible charge of work of this nature. The proposed Engineer(s) shall be subject to approval of Design Professionals and Owner.
- F. The Erector shall have 10 years of successful experience erecting structural steel for structures of this type and complexity in the region of the project. At the time of bid the Erector shall be an AISC Certified Steel Erector (CSE) and must submit documentation of this qualification.
- G. Welding: Welders shall have a valid Welding Performance Qualification Record (WPQR) for each welding procedure to be performed. Qualify the welding procedures, shop welders, field welders, welding operators and tackers in accordance with AWS D1.1 and for the following periods of effectiveness of certification:
 - 1. Certification and qualification, including period of effectiveness of welding personnel shall be as specified by AWS D1.1. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified, unless welders fail to perform acceptable welding, as determined by the Owner's Testing Agency. Certification and re-certification of welding personnel is subject to verification by the Testing Agency. Re-testing for re-certification will be the Contractor's responsibility.

1.6 SUBMITTALS

- A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

- (1) Submittal Schedule
- (2) Calculations, Shop Drawings and Erection Drawings
- (3) Pre-construction Survey
- (4) Quality Control Program
- (5) Product Data
- (6) Samples
- (7) Welding Procedures Specification (WPS)
- (8) Welder Certifications
- (9) Mill Reports
- (10) LEED Submittals

1. Submittal Schedule: The contractor shall submit for approval a shop drawing submission schedule at least twenty (20) working days prior to commencing submission of connection design calculations and shop drawings.
 - a) This schedule shall include a list, in order of date to be submitted, of all drawings and other required submittal items scheduled to be submitted. The schedule shall list the proposed submittals for each week, including but not limited to the number of erection drawings, and piece drawings, as well as their formats. Once shop drawing submissions have commenced any modification or addition to this schedule must be submitted for approval at least twenty (20) working days before the modification or addition is proposed to take place.
 - b) If at any time the total number of erection drawings and shop drawings received in any one week period exceeds the amount in the approved schedule by more than 10% for that week, the Design Professionals have the right to add two days to the average turnaround time for each 20% increment in excess of the scheduled quantity for that week's submissions. For example if the weekly total exceeds the schedule by 10% to 20%, two days may be added; if it is exceeded by 21% to 40%, four days may be added. The return dates for subsequent submittals may be extended based on the additional review time stated above.
 - c) For the purposes of developing a schedule, assume the following review rates:
Shop drawings – 300 pieces per week
2. Shop Drawings and Erection Drawings (including Field Work drawings): Submit for approval required connection calculations, shop drawings and erection drawings for all structural steel indicated on the Contract Documents.

- a) Material shall not be fabricated or delivered before the shop and erection drawings have been approved or approved as noted by the Design Professionals and returned to the Contractor.
 - b) Structural Steel Shop Drawings: Submitted shop drawings shall include layouts and details for each member showing the steel type and grade, size, connections, cuts, copes, holes, bolts, welds, surface treatments (cleaning, shop paint, etc.) and provisions for the connection of other work. Steel type, grade and size for all attached elements shall also be shown.
 - c) Shop and erection drawings shall contain complete dimensional and geometric information, based on established dimensions shown on Contract Documents, and shall not be scaled from Contract Documents. The shop drawings shall clearly distinguish between shop and field welds and bolts, identify pretensioned high strength bolts and identify surface preparation requirements at slip critical connections.
 - d) Welds: All welds shall be indicated by standard welding symbols in the "Standard Code for Arc and Gas Welding in Building Construction" or as accepted by the SER. Shop and erection drawings shall show the size, length, and type of each weld, including the electrode type to be used.
 - e) Bolts: Details for bolt assemblies shall indicate bolt size, length, type and the presence, type and location of washers where required as part of the assembly; distinguish between N and X bolts, distinguish between slip-critical and bearing bolts; and distinguish between shop and field bolts. Also, indicate bolt orientation where required by the Contract Documents.
 - f) Erection Drawings: The erection drawings shall include plans showing exact locations of base and bearing plates, and/or anchor rods and other embedded items. All field connections not specifically shown on shop drawings shall be shown on erection drawings, including field bolt size, type, number, location and any special installation requirements, and field weld size, type, length and location.
3. **Preconstruction Survey:** Submit for record. Where interface with existing construction occurs, before related shop drawings are prepared survey the existing construction and submit the survey prepared by a professional surveyor employed by the Contractor to the Design Professionals. For all steel construction, before steel erection commences, perform and submit to the Design Professionals a complete survey for position and alignment at all points where construction by other trades will support steel elements, including but not limited to pockets, embedded plates, anchor rods and base plates. Include plan location positions relative to the building gridlines, and elevations of bearing surfaces and tops of bolts relative to building Datum elevation.
4. **Quality Control Program:** Submit for record complete details of the Contractor's quality control program including the names of the personnel responsible for this work.

5. **Product Data:** Submit manufacturers' specifications, test reports and applicable standards for all products listed under Part 2: Products. Standard literature shall be edited to suit job conditions.
6. **Samples:** Material samples shall be provided as requested by the Owner's Testing Agency.
7. **Welding Procedures Specification (WPS):** Submit for approval written welding procedures for all AWS D1.1 prequalified joints, and qualification procedures for all joints not prequalified by Section 3 of AWS D1.1. Submit supporting Procedure Qualification Record (PQR) as required by AWS D1.1. Submit written welding procedures developed by Contractor's welding consultant for heavy shapes and High Restraint Welds described in this Specification. Use the forms in AWS D1.1, Annex N. Submit weld sequence procedures indicating field welding sequence for each type of connection with multiple field-welded joints, and the sequence of such connections to be field welded at each level. Where shrinkage is likely to cause distortion or other problems, submit a mitigation plan. Submit all welding and qualification procedures to the Owner's Testing Agency for approval before submitting to the Design Professionals.
8. **Welder Certification:** Submit for record certification that the welders have passed qualification tests acceptable to the governing authority using AWS procedures.
 - a) A certification shall be submitted in standard AWS format.
 - b) Each certification shall state that the welder has been doing satisfactory welding of the required type within the six-month period prior to the subject work.

For any welder whose period of certification effectiveness has lapsed or whose workmanship is subject to question in the opinion of the Design Professionals or Testing Agency, immediate testing for recertification will be required. Tests, when required, shall be conducted at the sole expense of the Contractor.

9. **Mill Reports:** Submit for record certified copies of all mill reports, two (2) to the Design Professionals and one (1) to the Testing Agency, covering the chemical and physical properties of all structural steel and accessories (as defined in this Specification) for the project. Where required on the Contract Documents or by the AISC Code, reports shall include results of Charpy V-notch tests.
 - a) Such certificates shall be obtained from the mills producing the steel and shall certify in a cover letter submitted with the certificates, that the steel meets the minimum requirements as to physical properties, inspection, marking and tests for structural steel as defined by the current edition of the relevant ASTM Standard Specifications. Any steel that does not meet the ASTM requirements must be clearly identified in a cover letter submitted with the certificates.
 - b) Prior to commencing steel erection, the contractor shall deliver certificates to the Owner in number and form as may be required by the local Building Department or other local and State agencies having jurisdiction.

10. **As-Built Surveys:** Execute and submit for record a comprehensive survey of steel structure at each level adequate to assess if the structure has been built within the tolerances specified in the Contract Documents. Each certified survey, performed by a professional surveyor employed by the Contractor, shall be submitted to the Contractor's Engineer for their approval before proceeding to the next stage of erection. If deviations from the tolerances are discovered, the Contractor shall present corrective measures to the Design Professionals within 48 hours of completion of that stage of erection. Upon completion of steel erection, submit the complete package of steel surveys for record to the Design Professionals and the Owner.

B. Submittal Process

1. Submittal of shop and erection drawings and other submittals by the Contractor shall constitute Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other Drawings and other trades. The Contractor shall place their shop drawing stamp on all submittals confirming the above.
2. Shop and erection drawings: Submit in complete packages so that individual parts and the assembled unit may be reviewed together. This Specification Section and the applicable drawings used in the development of the shop and erection drawings shall be referenced on each shop and erection drawing to facilitate checking. Unless the piece marks are self-indexing, furnish index sheets with the shop drawings, relating piece marks for all beam, girder and column details to the sheet numbers on which they are located.
3. The Contractor shall submit to the Design Professionals for shop drawing review. If the Contractor and Design Team agree to process shop drawings electronically, Contractor shall submit one hardcopy and one electronic copy to the SER. The naming convention of each drawing must follow the submittal numbering system and include the submittal #, specification #, revision # and drawing # in the prefix of the drawing name.
4. The Contractor shall allow at least ten (10) working days between receipt and release by the SER for the review of shop and erection drawings.
5. All modifications or revisions to submittals, shop drawings and erection drawings must be clouded, with an appropriate revision number clearly indicated. The following shall automatically be considered cause for rejection of the modification or revision whether or not the drawing has been approved by the Design Professionals:
 - a) Failure to specifically cloud modifications
 - b) Unapproved revisions to previous submittals
 - c) Unapproved departure from Contract Documents
6. The Contractor shall deliver to the Design Professionals at the completion of the job two (2) electronic versions of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Professionals.

7. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal.
8. Resubmittals Compensation: The Contractor shall compensate the Design Professionals for submittals that must be reviewed more than twice due to contractors' errors. The Contractor shall compensate the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%.

C. SER Submittal Review

1. The review and approval of shop and erection drawings and other submittals by the Design Professionals shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from:
 - a) Responsibility for all required detailing.
 - b) Responsibility for the proper fitting of construction work in strict conformance with the contract requirements.
 - c) The necessity of furnishing material and workmanship required by contract Drawings and Specifications which may not be indicated on the shop and erection drawings.
 - d) Conforming to the Contract Documents.
 - e) Coordination with other trades.
 - f) Control or charge of construction means, methods, techniques, sequences or procedures, for safety precautions and programs in connection with the work.
2. TYPE 1 Stamp - For shop drawings for building elements designed by the SER, the responses on the shop drawing review stamp used by the SER require the following actions:
 - a) APPROVED indicates that the SER has found that the information presented on the shop or erection drawing appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
 - b) APPROVED AS NOTED indicates that the SER requires the shop or erection drawing to be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected shop or erection drawing for record.
 - c) REVISE and RESUBMIT indicates that the SER requires resubmission of the shop or erection drawing after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed

until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

- d) NOT APPROVED indicates that the shop or erection drawing does not conform to the Contract Documents and must be extensively revised before re-submittal. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

- 3. TYPE 2 Stamp - For submittals for building elements which are not designed by the SER but are performance specified, for items that do not form part of the completed structural system but impose loads on the structure, and for construction items or activities which have an effect on the final structure, a second stamp will be used. The responses on the stamp used by the SER require the following actions:

- a) NO EXCEPTIONS indicates that the SER has found that the information presented on the submittal appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
- b) EXCEPTIONS NOTED indicates that the SER requires the submittal be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected document for record.
- c) REJECTED indicates that the SER requires resubmission of the submittal after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed. Contractor to revise and resubmit until SER response of No Exceptions or Exceptions Noted is received.

D. Substitution Request

- 1. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Professionals, prior to receipt of submittals.
- 2. All substitutions must be requested using the structural substitution request form included at the end of this section. Acceptance using the structural substitution request form indicates acceptability of the structural concept only. Contractor must submit shop drawings reflecting accepted substitutions for review in accordance with this Specification. The structural substitution request form, even if accepted, does not constitute a change order.
- 3. Such substitutions or modifications, if acceptable to the Design Professionals shall be coordinated and incorporated in the work at the sole expense of the Contractor.

4. The acceptance by the Design Professionals of a specific and isolated request by the contractor to deviate from these requirements does not constitute a waiving of that requirement for other elements of, or locations in the project, unless specifically addressed as such and permitted by the Design Professionals in writing.
5. Compensation for Additional Services: Should additional work by Design Professionals such as design, drafting, meetings and/or visits be required which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work performed by the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.
6. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

E. Request for Information (RFI)

1. RFI shall originate with the Contractor. RFI submitted by entities other than that Contractor will be returned with no response.
2. Limit RFI to one subject.
3. Submit RFI immediately upon discovery of the need for interpretation or clarification of the Contract Documents. Submit RFI within timeframe so as not to delay the Construction Schedule while allowing the full response time described below.
4. The response time for answering an RFI depends on the category in which it is assigned.
 - a) Upon receipt by the SER, each RFI will be assigned to one of the following categories:
 - i. Category 1: No cost clarification
 - ii. Category 2: Shown in Contract Documents
 - iii. Category 3: Change to be issued in future bulletin
 - iv. Category 4: Previously answered
 - v. Category 5: Information needs to be provided by others.
 - vi. Category 6: Request for corrective field work
 - vii. Category 7: Request for substitution
 - b) RFIs in categories 1, 2, 3, 4 and 5 will be turned around by the SER on average of five (5) working days.
 - c) RFIs in categories 6 and 7 will be rejected and must be submitted as submittals or requests for substitution.

1.7 TEMPORARY SUPPORT OF STRUCTURAL STEEL FRAME

The structure as shown on the Contract Documents is designed to withstand the design loads only when all structural elements are installed and fully connected. The contractor shall be responsible for the analysis of all components and assemblies for stresses and displacements that may be imposed by fabrication, shipping, handling, erection,

temporary conditions, construction loads, etc. The analysis of such shall be performed by the Contractor's Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Unload all structural steel promptly upon arrival and store in an area designated and approved by the Owner at the site of the work. The Contractor shall be responsible for any charges from failure to unload material promptly.
- B. Storage: Store structural steel to drain properly. Provide weep holes and clean out as required to keep steel free from water. Provide adequate protection and shoring to prevent distortion and other damage. Store structural steel on timber; do not lay on mud, directly on ground or cinders, or otherwise handle in a manner that damages finishes. Stored sections shall be readily accessible for inspection.
- C. Store fasteners in a protected place.
- D. Welding materials to be in moisture resistant, undamaged package. Maintain packages effectively sealed until electrode is required for use. Storage and handling shall be per AWS D1.1.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

- A. Quality assurance is testing and inspection to assist the Owner in evaluating the Contractor's performance in the fabrication shop and field. It is not a substitute for the testing and inspection which is required as part of the Contractor's quality control program (see the following section on quality control).
- B. Cost: Except as specifically noted otherwise, the testing agencies for quality assurance shall be engaged and paid by the Owner.
- C. The Owner has negotiated inspection services based upon the assumption that all fabrication work shall be performed at one single fabrication shop. Costs associated with work being performed in additional shops will require reimbursement to the Owner.
- D. Coordination with Owner's Testing Agency: The Contractor shall have sole responsibility for coordinating their work with the testing agency to assure that all test and inspection procedures required by the Contract Documents and Public Agencies are provided. The Contractor shall cooperate fully with the Owners testing agencies in the performance of their work and shall provide the following:
 - 1. Information as to time and place of starting shop fabrication and a field construction and erection schedule, one week prior to the beginning of the work.
 - 2. Site File: At least one copy of each approved shop drawing shall be kept available in the contractor's field office and the drawings not bearing evidence of approval and release for construction by the Design Professionals shall not be kept on the job. Provide drawings for the work to be performed in the shop or field one week prior to the start of work.
 - 3. Representative sample pieces requested by the inspection agency for testing, if necessary.

4. Full and ample means of assistance for testing and inspection of material.
 5. Proper facilities, including scaffolding, temporary work platforms, safety equipment etc., for inspection of the work in shop and field.
- E. Duties of the Owner's Testing Agencies:
1. Reports: The Testing Agency shall prepare daily reports of the structural steel work including progress and description/area of work, tests made and results. Reports of inspection of welding shall include deficiencies noted and corrections made, and other items pertinent to acceptance or rejection of the work. The reports shall state whether specimens comply with or deviate from contract requirements. The daily reports shall be collected and delivered to the Design Professionals, Contractor and Owner weekly.
 2. Rejection: The Owner's Testing Agency has the right to reject any material, at any time, when it is determined that the material or workmanship does not conform to the Contract Documents. The Testing Agency shall report deficiencies to Owner, Design Professionals, and Contractor immediately.
 3. Structural steel work and general testing requirements: The Testing Agency shall perform the following shop and field inspections in addition to any other inspections enumerated above or specified on the Contract Documents:
 - a) Shop inspection of steel shall include alignment and straightness of members, camber, preparation for connections, dimensional checks, testing of shop bolts, witnessing of welding procedures, testing of cuts, weld access holes and copes of heavy shapes as defined in this Specification, examination and testing of completed welds, headed studs and deformed bar anchors, cutting of heavy shapes, finishing of column ends, cleaning, painting and storage of material. All shop fabrication shall be inspected in the shop. Camber shall be verified in a minimum of 10% of all members requiring camber. If, in the opinion of the SER and Testing Agency this testing discloses a large ratio (10% or more) of unacceptable cambers, the required percentage of tested cambers may be increased by the SER to 100% at no expense to the Owner.
 - b) Field inspection of steel shall include connections, proper tensioning of bolts, levelness, plumbness and alignment of the frame, conformance to AWS welding methods, examination of surface before welding, examination and testing of completed welds, headed studs and deformed bar anchors and field painting, including touch-up.
 - c) Check qualifications of the following:
 - i. Shop welding procedures and personnel
 - ii. Shop stud welding setup and operators
 - iii. Shop bolting procedure and crew

- d) Where testing is required for less than 100% of locations, select test locations at random and throughout the project.
 - e) Review mill certifications for compliance with the Contract Documents. Where certification is questionable, test material.
 - f) Visually inspect seam welds of tube and pipe for evidence of cracking or lack of fusion. At each end piece of tube or pipe, inspect interior face of seam weld for evidence of cracking, lack of fusion, or less than full flashing.
4. High Strength Bolting: The Testing Agency inspector shall inspect high strength bolted construction in accordance with RCSC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts," including but not limited to:
- a) Surface preparation and bolt type conforms to plans and Specifications prior to start of bolting operations.
 - b) Proper bolt storage and handling procedures per codes and standards referenced by this Specification are being followed.
 - c) Visually inspect all bolted connections.
 - d) For all bolted connections that are indicated as snug tight, connections are properly compacted and brought to the snug tight condition progressing outward from the most rigid part.
 - e) For all bolted connections that are indicated as pretensioned or slip critical, pre-installation verification testing is performed by the inspector in cooperation with the contractor in accordance with RCSC section 9.2 and section 7.
 - f) For all bolted connections that are indicated as pretensioned or slip critical, through routine observation, as defined in RCSC 9.2.1, 9.2.3 or 9.2.4, that the pretensioning methods of RCSC 8.2.1, 8.2.3, or 8.2.4, as appropriate, are performed.
 - i. "Routine observation" is defined as observation of 10 bolts for every 100 bolts with a minimum of 2 bolts per connection.
 - g) Retest bolted connections that fail initial inspection after correction by the Fabricator or Erector.
5. Welding:
- a) Review of submittals: Welding procedures including prequalification, qualifications test and, for heavy shapes and high restraint welds, the welding procedure prepared by the Contractor's Engineer or Welding Consultant.
 - b) Complete joint penetration welds: Test all complete joint penetration welds for soundness by means of either radiographic or ultrasonic testing in accordance with AWS D1.1 and ASTM E164 procedures. For all complete joint penetration welds at top flange of cantilever beams and splices in beam flanges, test for soundness by means of ultrasonic testing and magnetic particle testing. All flaws in plate or flange material revealed during such

tests shall be repaired by the Contractor at the Contractor's expense.

- c) Partial penetration welds: Test all partial penetration welds for soundness by means of visual and magnetic particle inspection, unless other methods are specified in the Contract Documents. All flaws in plate or flange material revealed during such tests shall be repaired by the Contractor at the Contractor's expense.
- d) Testing of welds at heavy shapes and high restraint welds shall be performed not less than 24 hours after the weld has been completed.
- e) Fillet welds: Visually inspect all fillet welds. For all fillet welds at top flange of cantilever beams and splices in beam flanges, test for soundness by means of magnetic particle testing. In addition test ten percent (10%) of all fillet welds at other location using a non-destructive method, such as dye penetrant or magnetic particle. Select test locations randomly throughout the structure, but test at least one weld in each location with 6 or more welds per connection. If, in the opinion of the SER and Testing Agency this testing discloses a large ratio (10% or more) of unacceptable welds, the required percentage of tested welds may be increased by the SER to 100%, all at the Contractor's expense.
- f) Inspection and Testing by the Testing Agency of high restraint welds and where Heavy Shapes are to be joined by partial or full penetration welds in tension:
 - i. Joint Preparation: Monitor fit up and joint preparation (bevel angle, etc.) for conformance to the submitted welding procedures including preheat and interpass temperature. Monitor base metal temperature during welding operations.
 - ii. Test Full Penetration Welds in accordance to the requirements of this Specification section, ultrasonically in accordance with AWS D1.1 procedures. On T or corner joints, pay careful attention to the heat affected zone and base metal where the weld shrinkage stresses are in the through thickness direction.
 - iii. Test Partial Penetration Butt Joints in accordance with this Specification section by the magnetic particle method. At T or corner joints, in addition to the magnetic particle testing, ultrasonically scan the heat affected zone and adjacent base metal from face "C" per AWS D1.1 Table 6.7 and Annex K-7 to detect lamellar tears and shall be done with a compression wave. The Testing Agency shall submit a testing procedure that includes evaluation (acceptance criterion) procedures to the Design Professionals for review.
- g) Inspect Heavy Sections:
 - i. Heavy Section flanges shall be ultrasonically examined at locations to be groove-welded, for evidence of laminations,

- ii. For plates, ultrasonically examine in accordance with ASTM A435, Straight Beam Ultrasonic Examination of Steel Plates.
- iii. Any discontinuity causing a total loss of back reflection that cannot be contained within a circle with a diameter of the greater of 3" or one-half the plate or flange thickness, shall be cause for rejection.

6. Headed Studs, Threaded Studs and Deformed Bar Anchors: Visually inspect all headed studs and deformed bar anchors for complete fusion and full 360-degree weld flash (or fillet).

b) For production studs and anchors, visually inspect all head studs and deformed bar anchors for complete fusion and full 360 degree weld flash (or fillet) per AWS D1.1. Check all studs and anchors with incomplete fusion or which have been repaired by welding, by bending to an angle of 15 degrees from its original axis (away from any missing flash). Torque test all threaded studs with incomplete fusion. If more than twenty percent of studs fail on one member, check all studs or anchors on member.

d) Contractor to replace any studs that crack or break. Contractor to only straighten studs that would foul other work or have less than 1 inch (25mm) cover in bent position.

a) Prior to shop painting, examine all fabricated pieces to verify proper cleaning in accordance with this Specification.

- b) Examine all shop painting to verify conformance with this Specification.
 - c) Examine loading and unloading of steel to visually observe that damage does not occur during shipping and handling.
- 8. Remedial Work: The Testing Agency shall indicate to the Contractor where remedial work must be performed and will maintain a current list of work not in compliance with the Contract Documents. This list shall be submitted to the Design Professionals and Owner on a weekly basis.
- 9. Certification: When all work has been approved by the Testing Agency, the Testing Agency shall certify in a letter to the Design Professionals and Owner that the installation is in accordance with the design and Specification requirements (including applicable codes).

1.10 QUALITY CONTROL BY CONTRACTOR

- A. The Contractor shall provide a program of quality control to ensure that the minimum standards specified herein are attained.
- B. Structural Steel shall be identified in accordance with the requirements contained in AISC 360.
- C. The Contractor shall immediately report to the Design Professionals any deficiencies in the work which are departures from the Contract Documents which may occur during construction. The Contractor shall propose corrective actions and their recommendations in writing and submit them for review by the Design Professionals. After proposed corrective action is accepted by the Design Professionals and Owner, the Contractor shall correct the deficiency at no cost to the Owner.
- D. The Owner's general review during construction and activities of the Owner's Testing Agency are undertaken to inform the Owner of performance by the Contractor but shall in no way replace or augment the Contractor's quality control program or relieve the Contractor of total responsibility for quality control.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

- A. Review: The Design Professionals will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.
- B. Compensation for Additional Services: Should additional work by Design Professionals such as design, drafting, meetings and/or visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents, the Contractor is responsible for paying for additional work performed by the Design Professionals at their standard firm-wide billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

1.12 PERMITS AND WARRANTY

- A. Permits: The Contractor shall apply for, procure, renew, maintain, and pay for all permits required by City, State, or other governing authorities, necessary to execute work under this Contract. Contractor shall furnish copies of all permits to the Owner and Design Professionals.
- B. Structural Steel shall be identified in accordance with requirements contained in AISC 360.
- C. Warranty: Upon completion of all work to be performed under this Contract, the Contractor shall execute and deliver in a satisfactory form a warranty that all workmanship and materials used in the performance of this Contract shall remain free from defects for a period of one (1) year from the date of execution of the Warranty.

PART 2 - PRODUCTS**2.1 STRUCTURAL STEEL**

- A. Structural steel shall conform to the requirements listed on the Structural General Notes.

2.2 SHOP COATINGS

- A. Standard Primer: Rust inhibitive, universal phenolic alkyd metal primer 2-4mls . Color to be determined by Architect. Primer shall be compatible with, and from the same manufacturer as, top coats specified in Division 9 specification.
- B. Zinc Rich Primer: SSPC-Paint 20, Type I or Type II, Zinc rich primer utilizing either an organic or inorganic binder with a minimum zinc content of 80 percent by weight in the dry film. The primer shall provide a surface meeting AISC Slip Critical Class B (slip coefficient =0.50 min) requirements. Color to be determined by Architect. Primer shall be compatible with, and from the same manufacturer as, top coats specified in Division 9 specification.
- C. Hot Dip Galvanizing: ASTM A123, weight of coating shall average not less than 2.3 oz per square foot (0.70 kg/ m²), with no individual thickness less than 2.0 oz per square foot (0.61 kg/m²).
- D. Galvanizing Repair Paint: ZRC Cold Galvanizing Compound, or other complying with SSPC-Paint 20.

2.3 ACCESSORIES

- A. High Strength Bolts: Conform to the provisions of the Research Council on Structural Connections (RCSC) "Specifications for Structural Joints using ASTM A325 or A490 Bolts" except that nuts shall be ASTM A563 Grades DH or DH3 (hardened) for both A325 and A490 bolts. Twist off type bolts (Tension Control bolts) shall additionally conform to ASTM F1852 or ASTM F2280.

- B. All bolts shall be new, and not re-used.
- C. Where A325 galvanized bolts nuts and washers are required, they shall be in accordance with ASTM F2329 and ASTM A153, Class C. Where A588 steel is used, bolts, nuts and washers shall be Type 3.
- D. Direct Tension Indicators: Meet requirements of ASTM F959.
- E. Anchor Rods: Per structural General Notes.
- F. Washers:
 - 1. Round washers shall conform to American Standard B 27.2 type b
 - 2. Washers in contact with high-strength bolt heads and nuts shall be hardened in accordance with ASTM Standard F436.
 - 3. Beveled washers shall be square, smooth and sloped so that contact surfaces of the bolt head and nut are parallel.
 - 4. The diameter of the hole of square beveled washers shall be 1/16 inch (1.5mm) greater than the bolt size for bolts smaller than one inch (25mm), and shall be 1/8 inch (3.0mm) greater than the bolt size for bolts larger than one inch (25mm).
 - 5. Comply with requirements of RCSC for all washers including thickness, size and hardness, depending on connection details.
- G. Welding Electrodes: Electrodes shall be low hydrogen and shall be selected from Table 4.1.1 of AWS D1.1.
 - 1. Shielded Metal-Arc Welding: Welding electrodes for manual shielded metal-arc welding shall conform to the specification for Mild Steel Covered Arc-Welding Electrodes, AWS A5.1 E70 or 80, or the specification for Low-Alloy Steel Covered Arc-Welding Electrode, AWS A5.5.
 - 2. Submerged-Arc Welding: Bare electrodes and granular flux used in submerged-arc welding shall conform to F70 or F80 AWS flux classifications of the specification for Mild Steel Electrodes and Fluxes for submerged-arc Welding, AWS A5.17.
- H. Headed Studs (shear connectors) shall be per Structural General Notes.
- I. Deformed Bar Anchors shall be as specified in Structural General Notes.
- J. Steel Castings shall conform to ASTM A27, Grade 65-35, medium strength carbon steel.
- K. Grout: Refer to 03 3000 Specification.
- L. Post-installed Anchors shall be per Structural General Notes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Work by Others: Examine all work prepared by others to receive work of this Section and report any defects affecting installation to Design Professionals. Commencement of work will be construed as complete acceptance of preparatory work by others. The Contractor alone shall be responsible for checking the dimensions and coordination of the structural steel work with other trades.
- B. Anchor Rods: Anchor rods shall be set in conformance with Section 7.5 of AISC 303. At least 20 working days prior to the start of the structural steel erection, the Contractor shall ascertain by accurate survey the existing location, alignment, and elevation of the anchor rods embedded in the concrete by others. The Contractor shall immediately bring to the attention of the Design Professionals any discrepancies observed between the Contract Documents and the as-built conditions. Steel erection shall not start until corrective measures, if required, have been performed.

3.2 FABRICATION

- A. Fabricate and assemble structural steel in the shop to the greatest extent possible.
- B. Tolerances:
 - 1. Conform to the tolerances of the AISC "Code of Standard Practice," compensate for the difference between the temperature at time of fabrication and the mean temperature in service.
 - 2. Elevator shafts used for temporary hoists shall conform to the detailed requirements of the hoist manufacturer.
 - 3. Conform to the tolerances of the AISC "Code of Standard Practice", Section 10 (AECS) for architecturally exposed structural steel as indicated as "AECS" on the Drawings.
- C. Holes: Holes shall be provided in members to permit connections to the work of other trades or contracts, and for passage through the member of work of other trades. All holes shall be accurately drilled or punched at right angles to the surface of the metal in accordance with AISC Specifications. Holes shall not be made or enlarged by burning. Burning or drifting unfair holes will not be permitted. Holes that must be enlarged shall be reamed, but only up to the next larger bolt size. Where unfairness exceeds the maximum, weld hole in base material solid and drill hole of proper size. Drift pins will be allowed only to bring together the several parts for connection. Holes in base plates shall be drilled. Holes shall be clean-cut without torn or ragged edges. Outside burrs resulting from drilling operations shall be removed with a suitable tool.
- D. Camber: Provide camber as indicated on the Contract Documents. Where no camber is indicated, provide natural camber up.

- E. Cutting: Manual gas-cutting in the shop may be used only if automatic or semi-automatic methods are not possible. If manual shop cutting is required, it shall be done only with a mechanically guided torch, except that an unguided torch may be used where the cut is more than 1/2 inch (12mm) from the finished dimension and final removal is completed by means such as chipping or grinding to produce a gouge-free surface of quality equal to that of the base metal. At restrained joints and as indicated elsewhere, weld access holes shall be ground smooth.
- F. Cutting of Heavy Shapes: Where "Heavy Shapes" as defined in this Specification are to be joined by partial or full penetration welds in tension, preheating shall be required for all thermal cutting operations. Preheat shall be sufficient to prevent cracking but in no case less than 150 degrees F (65°C). Weld access holes and copes shall be ground to a smooth radius after cutting and tested for cracks by the magnetic particle method. All cut edges shall be free of sharp notches and gouges.
- G. Anchor Rods: Rigid steel templates and anchor rods shall be furnished, labeled and shipped in sets indicating sizes and locations of columns, together with instructions for setting of anchor rods. Plate washers per Typical Details shall be provided.
- H. Bolting: Bolts shall be driven accurately into the holes without damaging the threads. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing under the head or nut.
- I. Bolts indicated as "finger tight" on the Contract Documents shall be prevented from backing off by using lock nuts, thread compound or deformed threads.
- J. Installation of High Strength Bolts:
 - 1. Except where "snug tight" installation is specifically permitted on design Drawings, all high strength bolts shall be installed with full pretension using Turn-of-Nut Pretensioning, Twist-Off Type Tension Control Bolt Pretensioning or Direct-Tension-Indicator (DTI) Pretensioning in accordance with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts". Calibrated Wrench Pretensioning shall only be used where specifically approved by the SER.
 - 2. Comply with special washer requirements of the RCSC, such as those related to slotted and oversize holes, and tapered flanges. DTI "washers" shall not be substituted for such required washers.
 - 3. All high strength bolt assemblies (including Tension Control bolts and DTI's) used in pretensioned connections shall be verified in accordance with the Pre-Installation Verification section of the RCSC.
 - 4. Clean and re-lubricate bolts and nuts that become dry or rusty before use, except Tension Control bolts must be re-lubricated by manufacturer.
- K. Welding of Structural Steel:

1. Pre-Weld Inspection: The surface to be welded and the filler material to be used shall be subject to inspection before welding is performed.
2. Welds indicated on the Contract Documents or the approved shop or erection drawings shall be created by electric arc welding processes that comply in all respects with the codes and specifications herein noted covering the design, fabrication, and inspection of welded structures and the qualifications of welders and supervisors. Control the heat input, weld length, weld sequence and cooling process to prevent distortion of the completed assembly.
3. Each welder's work shall be traceable.
4. Special Requirements: For high restraint welds and welds at heavy shapes, follow approved welding procedures for weld process, sequence, pre-heating and cooling. Use stress relieving techniques where shown in the approved procedure developed by the Contractor's Welding Consultant.
 - a) Special Procedures: Prior to the start of production welding, the contractor shall demonstrate to the Testing Agency that preheat can be maintained without relying on heat from the arc. For field welding, the contractor shall provide a shelter to protect each joint from inclement weather (rain, snow, etc.), from start until completion of the joint.
 - b) Preheat and Postheat: Preheat shall be sufficient to prevent cracking, but in no case less than required by AWS D1.1. For high-restraint welds, minimum preheat shall be 225 degrees F (105°C). The preheat shall be maintained throughout the thickness of the material for a distance equal to twice the material thickness on both sides of the joint at a minimum. Where different thicknesses of steel are being joined, the greater thickness shall govern. Preheat shall be measured on the face opposite the side of the heat application. Preheat shall be applied uniformly in a manner that does not harm the surface of the material nor cause surface temperatures to exceed 1100 degrees F (600°C). Should stress relief heat treatment be required, the contractor shall submit a written procedure.
 - c) Prior to heat treatment on a production weld, prepare and treat a test sample per the contractor's written procedure for tests in accordance with ASTM requirements.
5. Supplemental Welding Requirements:
 - a) Nonfusible Backing: The use of nonfusible backing materials, including ceramic and copper, is permitted only with satisfactory welder qualification testing performed using the type of backing proposed for use and using the test plate shown in AWS D1.1, Figure 4.21, except that groove dimensions shall be as provided in WPS and PQR. For nonfusible weld tabs and short segments of nonfusible weld backing used at the ends of welds between shear plates and column faces, or at the ends of continuity plate welds, special welding personnel and welding procedure qualification testing is not required.

6. Welded Joint Details:

- a) Welding Backing: The use of weld backing shall be in accordance with AWS D1.1. Weld backing shall be removed where required by the Contract Documents or for the WPS by AWS D1.1
 - i. If groove weld backing is permitted to remain, the backing shall not exceed 3/8" thickness.
 - ii. Heavy Section Splices Requiring Removal of Weld Backing: All welded splices of Heavy Sections, shall have the weld backing removed. Where fusible backing material is used, the root pass area shall be backgouged after backing bar removal, backwelded until flush or with slight reinforcement. The surface shall then be ground Extra Smooth.
- b) Weld Tabs:
 - i. Use of Weld Tabs: Welds shall be terminated at the end of a joint in a manner that will ensure sound welds. Whenever necessary, this shall be done by use of weld tabs.
 - (1) Weld tabs shall extend beyond the edge of the joining a distance equal to a minimum of the part thickness, but not less than 1".
 - (2) Weld tabs shall be oriented parallel to the joint preparation and to the weld direction.
 - (3) Nonfusible weld tabs may be used in applications and locations where qualified in accordance with AWS D1.1, Section 4.
 - ii. Heavy Section Joint Weld Tab Removal and Finish: All welded tension splices in Heavy Sections, shall have the weld tabs removed and ground smooth.
- c) Weld toes: Weld toes, whether groove welds or fillet welds, shall provide a smooth transition between the weld and base metal. The as-welded profile is adequate provided it satisfies the criteria of AWS D1.1, Section 5.24.
- d) Weld access holes:
 - i. Weld access holes shall meet the dimensional, surface finish, and testing requirements of AISC 360 Chapter J1.6 and AWS D1.1, except as otherwise required by the Contract Documents.
 - ii. Where the height of the weld access hole exceeds the quantity $k-tf+1\frac{1}{2}"$ or where the length of the weld access hole exceeds 4 tf (where k and tf are defined in AISC 360), welded reinforcement is required. Notify the Design Professionals for specific instruction.

- e) Welding for Moment Connections shall be sequenced so as to minimize residual stresses in the joint.
- 7. Deficient Welds: Welds found deficient in dimensions but not in quality may be enlarged by additional welding. Any weld found deficient in quality shall be removed and repaired in accordance with AWS D1.1, Section 5.26.
- L. Heavy Sections:
 - 1. General: See AISC 360 Chapter A3.1c for materials requirements.
 - 2. Applicability of Provisions: All requirements of AISC 360 for Group 4 and 5 shapes shall apply to Heavy Sections as defined in this Specification.
 - 3. Access Hole Requirements: Access holes shall conform to the requirements of AISC 360, Chapter J1.6. Weld access holes must be preheated to a minimum of 150° prior to thermal cutting, ground to an Extra Smooth finish. Inspect holes for cracks using either penetrant testing (PT) or magnetic particle testing (MT). Optionally, weld access holes may be made by drilling and saw-cutting without grinding, but PT or MT of the cut surface is still required.
 - 4. Welding: The minimum preheat and interpass temperature shall be as specified by AISC 360, Chapter J2.8 Weld tabs and weld backing shall be removed, ground to an Extra Smooth finish, with reinforcement not to exceed 1/8", at a transition slope not to exceed 1:10. See AISC 360, J2.8 for preheat requirements and J1.5 for weld tab and backing bar removal requirements.
 - 5. Splices shall conform to the requirements of AISC 360, Chapter J1.5.
- M. Surface Finish
 - 1. Flush Surfaces: Welds in butt joints required to be flush shall be finished so as to not reduce the thickness of the thinner base metal or weld metal by more than 1/16," or 5% of the material thickness, whichever is less. Remaining reinforcement shall not exceed 1/32" in height. However, all reinforcement shall be removed where the weld forms part of a faying or contact surface. All reinforcement shall blend smoothly into the plate surfaces with the transition areas free from undercut.
 - 2. Finish Methods and Values: Chipping and gouging may be used, provided these methods are followed by grinding. Where surface finishing is required, surface shall be Extra Smooth, unless otherwise noted or specified in this document. Measurement of surface finish values by visual appearance or tactile comparison is acceptable.
- N. Repair of Gouges: Gouges are not permitted in areas requiring and Extra Smooth finish surface, or where specifically prohibited by AWS D1.1 or this Specification. Repair of gouges shall meet the following requirements, unless otherwise noted:
 - 1. Shallow Gouges: Gouges up to 3/16" deep shall be removed by grinding as per D1.1, or to a radius of not less than 3/8".

2. Deep Gouges: Gouges deeper than 3/16" shall be repaired by welding. Prior to welding, gouges shall be ground to provide an Extra Smooth contour with a radius not less than 3/8". The repair area shall be preheated to a temperature between 400° F and 550°F, measured at the point of welding approximately one minute after removal of the heating source, or shall be preheated in accordance with AWS D1.1 Annex I for high restraint. A written repair WPS for the application shall be followed. Following completion of welding, the area shall be ground Extra Smooth, with fairing of the welded surface to adjoining surfaces where applicable, and shall be inspected using magnetic particle testing (MT).
 3. The transitional slope after gouge removal shall not exceed 1:5.
- O. Bearing:
1. Bearing ends of columns shall be milled or sawn square perpendicular to axis of the column.
 2. Finish bearing areas of base plates per AISC M2.8.
- P. Stiffeners: Fitted stiffeners shall be ground to fit closely against flanges.
- Q. Cleaning and Preparation of Steel Surfaces:
1. Clean all steel work in accordance with the Steel Structures Painting Council (SSPC). Method specified herein that corresponds to its location and exposure. Steel work to be painted shall be painted within the same day that it is cleaned.
 - a) Interior, Not Exposed to View (above suspended ceilings, under sprayed-on fireproofing, steel to be encased in concrete): SSPC-SP-2, Hand Tool Cleaning.
 - b) Interior, Exposed in the Finished Building: SSPC-SP-6, Commercial Blast Cleaning, unless noted otherwise on the Drawings.
 - c) Exterior (exposed to weather or in unconditioned space): SSPC-SP-6, Commercial Blast Cleaning, unless noted otherwise on the Drawings.
 - d) Architecturally Exposed Structural Steel where indicated on the Contract Documents as "AESS": SSPC-SP-10, Near White Blast.
 - e) Members to be Hot Dipped Galvanized: SSPC-SP3, Power Tool Cleaning, before galvanizing.
- R. Shop Coating:
1. Where painting is specified, paint all steel work in accordance with the Steel Structures Painting Council (SSPC) Method specified herein that corresponds to its location and exposure and in accordance with manufacturer's written instructions. Paint steel work the same day that it is cleaned.
 - a) Interior, Not Exposed to View (above suspended ceilings, under sprayed-on fireproofing, steel to be encased in concrete): No Paint.

- b) Interior, Exposed in the Finished Building: SSPC – Paint 25
 - c) Exterior (exposed to weather or in unconditioned space): SSPC – Paint 20
 - d) Architecturally Exposed Structural Steel (AESS) to receive a 2 or 3 coat paint system.
- 2. Protect finished bearing surfaces with a rust-inhibiting coating which is to be removed immediately prior to erection.
- 3. Do not paint:
 - a) Surfaces within six (6) inches (150mm) of field welds
 - b) Surfaces to be encased in concrete or to receive cementitious fireproofing
 - c) Contact surfaces of high-strength bolted Slip Critical connections (unless surface prep and paint has been specifically prequalified by the contractor or approved for use in this location by the SER)
 - d) Surfaces required for testing and preheat, until all testing and preheat has been performed
 - e) Finished bearing surfaces (use removable rust-inhibiting coating)
 - f) Top flange of the beam where steel deck or headed studs are to be attached
- 4. Paint shall be applied thoroughly and evenly to dry surfaces only when surface temperatures are above dew-point, in strict accordance with manufacturer's instructions.
- 5. Surfaces of exterior members which are inaccessible after assembly or erection shall receive their second coat of the approved paint, in a different shade, in the shop.
- 6. Hot-dip galvanize the following steel members:
 - a) All angles, steel plates and shims supporting exterior masonry or exposed to the weather, including shelf, arch and relieving angles
 - b) All connections between the above angles and steel plates and the supporting structural member, including clip angles and hardware
 - c) Any other steel members indicated as "Galvanized" on the Contract Documents.
 - d) All miscellaneous metal, angles, clips, etc. on exterior masonry walls.

3.3 ERECTION

- A. Tolerances: Erect all work plumb, square and true to lines and levels in strict accordance with the structural requirements of the building within tolerances of the AISC Code of Standard Practice, unless otherwise indicated on the Contract Documents. Compensate for the difference between the temperature at time of erection and the mean temperature in service.
- B. Bracing: Brace the frame during erection in accordance with the Contractor's erection procedure.

- C. Errors: Immediately report to the Design Professionals any errors in shop fabrication, deformations resulting from handling and transportation, and improper erection that affects the assembly and fitting of parts. Prepare details for corrective work and obtain approval of the method of correction. Approved corrections shall be made expeditiously at the sole expense of the Contractor.
- D. Column Base Plates: Support and align on steel shims or setting bolts. After the supported members have been plumbed and properly positioned, tighten anchor rod nuts in preparation for grouting. Cut off wedges and shims flush with edges of plates and leave in place. The use of leveling plates will not be permitted.
- E. Grouting: Refer to General Notes. Grout base plates immediately after the first tier of columns are plumbed. Do not proceed with steel erection above the first tier until base plates are grouted.
- F. Bolting and Welding of Structural Steel: See Section on "Fabrication".
- G. Bearing Surface: Clean bearing surfaces and surfaces that will be in permanent contact before the members are assembled.
- H. Splices: Splices will be permitted only where indicated on the Contract Drawings or the reviewed shop drawings. Fasten splices of compression members only after surfaces are cleaned and abutting surfaces have been brought completely into contact. Fill any remaining gaps with steel shims driven into place and cut flush. Tack weld shims to each other and to members. Use runoff tabs at bevel weld splices. Cut off runoff tabs and ground smooth after weld completion.
- I. Driftpins: Driftpins may be used only to bring together the several parts, and shall not be used in such a manner as to distort or damage the metal. Correct poor matching of holes by drilling to the next larger size and using a larger size bolt. Plug welding and redrilling will not be permitted, unless a specific instance arises and is approved by the SER.
- J. 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, remove erection bolts.
- K. Hammering: Hammering which may damage or distort the members will not be permitted.
- L. Do not use cutting torches in the field without the specific approval of the SER for each application. Where cutting torch use is permitted, all the requirements of the Section on "Fabrication" shall apply.
- M. Additional Material and Labor: If the Contractor furnishes additional material and labor for the purpose of erection or if the erection method requires that material be added to certain members, the required modifications shall be at the sole expense of the Contractor.
- N. Alignment: Following erection, accurately align, level, and adjust all members prior to final fastening. Conform to AISC standard tolerances unless otherwise noted in the Contract Documents.

- O. Touch-Up and Field Applied Paint: After erection, clean all damaged areas in the shop coat, exposed surfaces of bolts, bolt heads, nuts and washers and all field welds and unpainted areas adjacent to field welds according to manufacturers recommendations and paint with the same paint used for the shop coat. Match the touch up and field applied paint color to the as-built paint color. After touch up, at exterior (exposed to the weather or in unconditioned space) steel members apply a full coat of the specified paint in a different shade than the shop applied coat.
- P. After erection, clean all damaged galvanized areas, welds and areas adjacent to welds and paint with the specified galvanizing repair paint.
- Q. Clean all steel members of mud and debris and construction residue prior to erection.
- R. Headed Studs and Deformed Bar Anchors:
 - 1. End weld headed studs and deformed bar anchors with an automatic process in accordance with section 7 of AWS D1.1.
 - 2. Areas to which studs are to be attached must be free of foreign material, such as rust, oil, grease, paint etc. When mill scale is sufficiently thick to cause difficulty in obtaining proper welds, remove by grinding or sand blasting.
 - 3. Remove ceramic ferrules from studs and work after welding.

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Structural Substitution Request Form – to be completed by Contractor

Project:		Substitution Request #
Date:		
Requesting Contractor:		Pages Attached (including this form)

1. Description of Requested Substitution:

2. Related Drawings and Specification Sections:

3. Rationale or Benefit Anticipated:

4. Effect on Construction Schedule¹ (check one): ☐ NONE ☐ See Attached

5. Effect on Owner's Cost² attach data (check one): ☐ CREDIT TO OWNER ☐ EXTRA

6. Effect on Construction Documents³ (design work anticipated): ☐ NONE ☐ See Attached

7. Requesting Contractor Agrees to Pay for Design Changes (check): ☐ YES ☐ NO ☐ NOT APPLICABLE

8. Effect on Other Trades⁴:

9. Effect of Substitution on Manufacturer's Warranty (check): ☐ NONE ☐ See Attachment
Signature⁵: Date:

Company:

General Contractor Signature⁵: Date:

Notes:

- Contractor is responsible for means and methods and any problems that may arise from making the requested substitution.
- This is **NOT A CHANGE ORDER FORM**. A separate form is required to adjust costs and/or schedules.
- Contractor is responsible for any design impacts that may arise from this substitution, including redesign efforts.
- Contractor is responsible for effects on other trades from this substitution;
General Contractor must review and agree effects on other trades are fairly represented in items 4-9.
- Signature by a person having authority to legally bind his/her company to the above terms. Otherwise this request is void
- All items in form must be completed for substitution request to be considered.

Request Review Responses (completed by Architect and/or Engineer(s)):

ACCEPTED	ACCEPTED AS NOTED	REJECTED	INSUFFICIENT DATA TO SUPPORT REQUEST	ENGINEER / ARCH / MEP SIGNATURE	DATE

Engineer/Architect Comments:

END OF SECTION