

1. General

1.1 DOCUMENTS

- .1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Drawings include architectural, mechanical, and electrical drawings.

1.2 DESCRIPTION OF WORK INCLUDED

- .1 Provide all labour, materials, equipment and services to supply, design, and erect structural steel required and/or indicated on the drawings or specified herein, including the supply of plates and/or angles for support of masonry, embedded steel parts, headed stud and deformed bar anchors, wedge anchors, and epoxy anchors which will form the connection between the structural steel, open web steel joists and masonry or concrete; and reinforcement of steel deck openings larger than 400 mm (16"). Report any discrepancies between structural, mechanical, electrical and architectural drawings to the Consultant and Structural Engineer immediately.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 04200 - Unit Masonry
- .3 Section 05000 - Testing of Structural Steel, Open Web Steel Joists and Deck
- .4 Section 05200 - Open Web Steel Joists
- .5 Section 05300 - Steel Deck
- .6 Section 05500 - Metal Fabrications
- .7 Section 05510 - Metal Stairs
- .8 Section 07800 - Fireproofing
- .9 Section 09900 - Painting

1.4 REFERENCE STANDARDS

- .1 Structural steel shall conform to the requirements of the following Standards unless otherwise required by the specification:
 - .1 Building Code
 - .1 Ontario Building Code – 2012
 - .2 Reference Standards
 - .1 CSA S16 - Limits States Design of Steel Structures.
 - .2 CSA S136 - North American Specification for the Design of Cold-Formed Steel Structural Members
 - .3 CSA W47.1 - Certification of Companies for Fusion Welding of Steel

Structures.

- .4 CSA W59 - Welded Steel Construction (Metal Arc Welding) (Metric version).
 - .5 CSA G40.20 - General Requirements for Rolled or Welded Structural Quality Steel.
 - .6 CSA G40.21 - Structural Quality Steel.
 - .7 CSA G30.18 - Billet Steel Bars for Concrete Reinforcement.
 - .8 CSA W186 - Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .9 ASTM F1554 Standard Specification for 36, 55 and 105 ksi yield strength Steel Anchor Bolts.
 - .10 ASTM A193 – Standard Specification for Alloy-Steel Bolting Materials for Special Purpose Applications.
 - .11 ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated 120 / 105 ksi Minimum Tensile Strength.
 - .12 ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated 150 ksi Minimum Tensile Strength.
 - .13 ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - .14 CISC / CPMA Standard 1-73a - A Quick-Drying One-Coat Paint for Use on Structural Steel.
 - .15 SSPC SP-6 - Commercial Blast Cleaning
- .2 Where the Standard is referenced in this specification it shall mean the documents specified in clause 1.4.1.2, as specified in the Building Code noted in clause 1.4.1.1, and their referenced documents.

1.5 DEFINITIONS FOR THIS SECTION

- .1 “Owner”, “Contractor” and “Consultant” as per the General Conditions and Definitions.
- .2 “Structural Engineer” shall mean a representative of Read Jones Christoffersen Ltd.
- .3 “Specialty Structural Engineer” is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.
- .4 “Testing Agency” shall mean the testing agency responsible to the Owner.
- .5 “Standard” and “Standards” shall mean the reference standards listed under “Reference Standards” in this section.

1.6 QUALIFICATIONS

- .1 Structural steel fabricator shall have not less than five (5) years experience in the fabrication of structural steel.
- .2 Erector shall not have less than five (5) years experience in the erection of structural steel.
- .3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.
- .4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

1.7 EXAMINATIONS

- .1 All dimensions shall be taken from the drawings and verified by field measurement. Be responsible for the correctness of such measurements and report to the Consultant and Structural Engineer in writing all discrepancies between measurements in the field and those shown on drawings prior to commencing work. Verify location of anchor bolts and embedded steel and ensure that work prepared by other trades is at a proper elevation, on line, level and true.

1.8 SUBMITTALS

- .1 The Contractor shall submit, with the tender, written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements.
- .2 The Contractor shall submit, with the tender, written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186.
- .3 When requested, submit copies of mill test reports properly correlated to the materials used on the project.
- .4 Provide a schedule of fabrication to the Consultant, Structural Engineer and Testing Agency prior to the commencement of the fabrication.

1.9 SHOP DRAWINGS

- .1 Submit shop drawings prepared under direction of the Specialty Structural Engineer. Drawings of components and connections designed by the Contractor shall be sealed and signed by this Specialty Structural Engineer or a letter shall be submitted at the end of the project signed and sealed by this Specialty Structural Engineer. The letter shall identify what was designed by the Specialty Structural Engineer and list the final shop drawings by number with dates and revision numbers.
- .2 Shop drawings shall show complete shop and erection details necessary for fabrication and erection of the component parts of the structure, including cuts, copes, connections, holes, threaded fasteners, splices and location, type, size and extent of all welds. Splices not shown on the shop drawings will be rejected. All welds, both shop and field, shall be indicated by AWS Welding Symbols as specified in the CSA W59

Appendix D and E.

- .3 Provide a shop drawing clearly locating all anchor bolts, embedded plates, baseplates, etc.
- .4 Provide setting drawings, templates and directions for the installation of anchor bolts, plates and other devices.
- .5 Prior to starting erection work, submit a description of the methods, sequence of erection and type of equipment proposed for use in erecting structural steel for review of the effects of construction loads on the remainder of the structure.
- .6 Review of the shop drawings by the Structural Engineer is intended as an assistance to the Contractor and does not relieve the Contractor of his responsibility for the completeness or accuracy of his work and its conformance with the contract documents.
- .7 Fabrication that commences prior to shop drawing review by the Structural Engineer is at the risk of the Contractor.
- .8 Clearly identify on the shop drawing all revisions, changes, or modifications.
- .9 Resubmit reviewed shop drawings where noted in the Read Jones Christoffersen Ltd.'s review stamp, or when the Contractor makes revisions for his own purposes.
- .10 Allow at least two (2) weeks for shop drawing review by the Structural Engineer.
- .11 Structural drawings are not prepared to be used as erection or shop drawings. However, electronic files or sepias may be used by the Contractor under the following conditions:
 - .1 Copyright remains with Read Jones Christoffersen Ltd.
 - .2 The drawings will only be used for shop drawings for this project and not be put to any other use.
 - .3 Read Jones Christoffersen Ltd. assumes no liability for errors or omissions in the drawings. The Contractor assumes all risk and expenses associated with the use of structural drawings in the production of his work.
 - .4 References to Read Jones Christoffersen Ltd. must be deleted from the title block.
 - .5 The Contractor signs a release available from Read Jones Christoffersen Ltd. that addresses the above items in more detail.

1.10 SUPPLY OF ALTERNATE PRODUCTS

- .1 Should the rolled sections shown on the drawings not be procurable, or should substitution for those sections be desired, sections of equivalent strength, may be substituted if approved by the Consultant. In such cases full particulars, thereof must be submitted prior to the closing of Bid. Material substitutions after the closing of Bid, if accepted, will be at the Contractor's cost.

1.11 TESTING AND FIELD REVIEW

- .1 The Specialty Structural Engineer responsible for shop drawings, or the Specialty Structural Engineer's representative, shall visit the site to review in place the connections and components designed by that Specialty Structural Engineer. The Specialty Structural Engineer shall be satisfied or take steps to ensure that these connections and components substantially comply with the Specialty Structural Engineer's design. The Specialty Structural Engineer shall then provide a sealed and signed letter to the Consultant and Structural Engineer to this effect.
- .2 Prior to the commencement of work provide a schedule of shop fabrication to the Testing Agency.
- .3 If requested, submit certified mill tests in accordance with the Standards.
- .4 The Contractor shall advise the Testing Agency of the scheduling of all shop and field work pertaining to this Project. The Contractor shall permit the testing agency full access to the fabrication shop and the site, for the purpose of carrying out his work and he shall provide assistance required to aid in the performance of the inspection and testing.

1.12 STORAGE AND HANDLING

- .1 The Contractor shall be responsible for the protection of all steelwork during fabrication, shipping, storage and construction. All small bends and damage shall be reported to the Structural Engineer for instructions. Steel work which is bent, broken or otherwise damaged, shall be repaired or replaced by the Contractor prior to erection to the satisfaction of the Structural Engineer at no cost to the Owner.
- .2 The Contractor shall be responsible for proper scheduling of delivery and erection for the structural steel in accordance with the construction schedule.
- .3 Store structural steel members at the site above ground on platforms, skids or other devices so that ground dampness will not affect the bottom members of the stacks.
- .4 Steel, which is stored outdoors after fabrication, shall be protected from accumulations of standing water.
- .5 Other materials shall be stored in a weather tight and dry place until ready for use in the Work.
- .6 Packaged materials shall be stored in their original unbroken packages or containers.

1.13 COORDINATION WITH OTHER TRADES

- .1 Supply all necessary instructions and drawings to other trades for setting bearing plates, anchor bolts, and other members that are built in with the work of other trades. Provide punched holes for the convenience of other trades in attaching wood blocking or other materials. Coordinate with drawings of other disciplines for locations and details. Supply the necessary material in accordance to the construction schedule.

2. Products

2.1 MATERIALS

- .1 All steel shall be new unless otherwise indicated and be of sizes and shapes listed in the current CISC Handbook or AISC Handbook and as indicated on the drawings.
- .2 Rolled shapes, except wide flanges, and rolled plate shall be to CSA G40.21 - grade 300W or equal.
- .3 Wide flange rolled shapes and welded wide flange sections shall be to CSA G40.21 - grade 350W or equal.
- .4 Hollow structural sections shall be to CSA G40.21 - grade 350W, Class H or C.
- .5 High strength bolts shall be to ASTM A325 or A490, as required by the drawings.
- .6 Standard anchor rods shall be to ASTM F1554, 36ksi. High strength anchor rods shall be to ASTM A193, grade B7, see drawings for locations, if required.
- .7 Bolts and nuts shall be to ASTM A307.
- .8 Primer for interior exposure not to receive a shop or field paint finish shall be to CISC / CPMA Standard 1-73a or other pre-approved, unless noted otherwise.
- .9 Brick support angles and related framing materials exposed to weather, shall be galvanized to CSA G164.
- .10 Headed shear stud connectors shall be Nelson anchors with fluxed ends or other pre-approved equal conforming to ASTM A108. Studs to be automatically end welded with suitable stud welding equipment or shop fillet welded to develop full strength of the stud. Field fillet welded studs will be rejected.
- .11 Bar anchors shall be Nelson deformed bar anchors or pre-approved equal conforming to ASTM A496.
- .12 Welding consumables for all processes shall be fully approved by the Canadian Welding Bureau and certified by the manufacturers as complying with the requirements of this specification. Such certificates shall be not more than two (2) years old.
- .13 Electrode strengths to be equal to E49XX (E70XX) or better.
- .14 Grout for column bases shall be non-metallic, non-expanding and non-shrink type with a minimum strength of 35 MPa at 28 days, unless noted otherwise. Grout may be place in a dry pack or flowable consistency.

2.2 DESIGN

- .1 Unless otherwise noted connections and trusses shall be designed by the Contractor to the reference Standards by the Specialty Structural Engineer.
- .2 Where connections are detailed, use connection of the type and detail shown on the drawings. Modifications to the specified connection types and details will not be

permitted without prior approval from the Structural Engineer.

- .3 The following connections, and any connections so noted on the structural drawings, shall be designed as slip critical and shall be pre-tensioned:
 - .1 Trusses.
 - .2 Elements resisting crane loads.
 - .3 Connections for supports of running machines or other live loads that produce impact or cyclic loads.
 - .4 Connections where bolts are subject to repeated tensile loads.
 - .5 Connections using slotted holes in the direction of the load or oversize holes unless specifically designed to accommodate movement.
- .4 Connections for wind or seismic lateral load-resisting elements, such as bracing and drag struts, and others so noted on the structural drawings may be designed as bearing connections but shall be pre-tensioned.
- .5 Other bolted connections may be snug tight.
- .6 Use standard connection types where connections are not detailed on the structural drawings.
- .7 Design shall be for the forces and loads shown on the drawings and shall allow for the effects of beam deflections. Provide a minimum of two (2) 19 mm (3/4") A325 bolts or an equivalent weld for all beam to girder and beam to column connections. If forces or loads are not given, the connection shall be designed for the maximum uniform distributed load that the member can carry for the span shown.
- .8 Structural steel members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Structural Engineer. The cost for such testing shall be borne by the Contractor.
- .9 Provide stiffeners in beam webs at all locations where beams pass over supports. Unless noted otherwise in the structural drawings, web stiffeners shall be 10 mm minimum.
- .10 Provide separators for all double members in accordance with CSA S16.

3. Execution

3.1 FABRICATION

- .1 Fabrication shall be to CSA S16 and reviewed shop drawings.
- .2 Welding shall be to CSA W59.
- .3 Structural steel work shall be executed by skilled and experienced workmen.
- .4 Fabricated units shall be straight and true and without sharp kinks or bends, accurate to sizes shown.

- .5 Fabricate rolled steel sections so that any camber and/or sweep resulting from manufacturing is positioned to create a hump up between the ends, not a sag down.
- .6 Flame cut steel columns shall have their ends milled. Steel base plates supporting columns shall be flat.
- .7 Unless noted otherwise, all hollow structural sections shall be dry inside and closed airtight with end plates sealed with welds.
- .8 Visually inspect all plates and shapes for laminations. Repair plates or shapes that contain laminations in a manner approved by the Structural Engineer.
- .9 Headed shear stud connectors and deformed bar anchors shall be applied in strict accordance with the manufacturer's instructions and the Standards or shop fillet welded as per the Standards. Procedural control to be in accordance with W59 as a minimum. Field fillet welds will be rejected.
- .10 Obtain Structural Engineer's approval for holes required through structural steel that are not shown on the drawings.
- .11 Refer to Architectural drawings for extent and location of Architecturally exposed steel elements.
- .12 Remove and replace any work which is not acceptable to the Consultant, when and as directed. Such operation shall not become an extra charge to the Owner.
- .13 Steel members spliced for ease of fabrication shall develop the full strength and stiffness of the member.
- .14 Where roof slopes exceed 5% and do not permit flush bearing of the steel deck on the beams, provide continuous 3mm bent plates to the pitch and necessary to ensure full bearing of the steel deck. Co-ordinate with the deck supplier the locations that will require these bent plates.

3.2 CLEANING AND PRIMING

- .1 All steel shall be thoroughly cleaned of all loose mill scale, loose rust, oil or dirt.
- .2 Architecturally exposed steel members, related framing and exterior steel shall be primed.
- .3 Steel, which will be encased in concrete, fireproofed, zinc coated or galvanized, welded, receive shear studs, faying surfaces of slip resistant connections and the underside of base plates and bearing plates steel shall not be primed.
- .4 Structural steel which will not receive a finish paint coat and is required to be primed for interior exposure shall be cleaned in accordance with CISC / CPMA Standard 1-73 (minimum).
- .5 Structural steel to be primed for exterior exposure shall be cleaned in accordance with SSPC SP6 "Commercial Blast Cleaning" as a minimum.
- .6 Apply primers in accordance with the manufacturer's instructions.

- .7 Use paint prepared by manufacturer without thinning or adding admixtures. Execute painting on dry surfaces, free from rust, scale, or grease. Do not paint in temperatures lower than 8°C.
- .8 Where finish painting to parts inaccessible for finish painting after final assembly is required, apply two coats of paint during fabrication. Apply paint of 2 different colours so that missed areas can be detected.
- .9 Provide the following touchup for steel in an exterior exposure or which has a finish paint coat. After erection and after connections are completed, provide a field touchup coat of primer to all surfaces that had no paint shop coat and have been chipped or scraped. Touch up with primer and paint all shop coat painted areas that have been chipped or scraped.
- .10 Provide the following touchup for galvanized steel. After erection and after connections are completed, provide a field touchup coat of zinc rich paint to all surfaces that have been chipped or scraped.

3.3 ERECTION

- .1 The erector is fully responsible for erection methods, equipment, workmanship and safety precautions.
- .2 Confirm the setting of anchor bolts and bearing plates and make an instrument survey to verify the setting prior to erection of steel members.
- .3 Cutting or burning of baseplates to accommodate anchor bolts shall be cause for rejection of baseplates.
- .4 Install all temporary bracing that is required to stabilize the work against wind, earthquake and construction loads. Keep structure true and plumb until completion of the building. Assume complete responsibility for the extent and timing of the removal of such bracing. The bracing members indicated on the drawings are required for the finished structure and shall not be considered as adequate for temporary bracing. Any failure to make proper and adequate provision for stresses occurring during the erection from any causes whatsoever shall be entirely the responsibility of the Contractor.
- .5 As erection progresses, the work shall be securely bolted up to take care of all loads including wind and seismic during erection. Any failure to make proper and adequate provisions for loads during erection shall be solely the responsibility of the Contractor.
- .6 The Contractor shall be responsible for the design of all hooks, erection connections and handling gear.
- .7 Whenever piles of materials, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from same. All construction loads shall be adequately distributed so as not to exceed the capacity of any member.
- .8 Structural steel shall be assembled and erected in accordance with the approved

erection drawings and specified reference Standards.

- .9 Structural steel work on concrete shall be carefully located at the proper grade and rigidly secured in place, using steel shims. Spaces under the steel shall then be filled with nonshrink premix grout as soon as possible, and before placing any concrete toppings or precast concrete units.
- .10 Plumb, level and align individual members of steel work as specified in CSA S16.
- .11 The various members forming parts of complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
- .12 Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
- .13 Temporary bolts, clips and angles etc. used to facilitate erection shall be removed unless noted otherwise on the drawings.

3.4 TEMPORARY FLOORING

- .1 Provide all temporary flooring, planking and scaffolding necessary in connection with erection of structural steel, or support of erection machinery in accordance with governing regulations and by-laws.

3.5 WELDING

- .1 Welding shall be done by the shielded metal-arc method in accordance with the requirements CSA W59. The welding operators shall be currently certified under CSA W47.1 for the work they are performing.
- .2 Submit, when requested, welding procedures prepared and sealed by a Specialty Structural Engineer for review.
- .3 Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter. Where weld material is deposited in two (2) or more layers, each layer shall be cleaned before the next layer is deposited. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by approved methods.
- .4 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA W59.
- .5 Welding of reinforcing bars to structural steel as per CSA W186.

3.6 COMPLETION

- .1 The Specialty Structural Engineer responsible for the sealed shop drawings, or his representative shall visit the site to review in place connections and components designed by that Specialty Structural Engineer to ensure substantial compliance with his sealed shop drawings. He shall then submit a sealed and signed letter of substantial compliance to the Consultant and Structural Engineer.
- .2 On completion of the work of this section, all protection erected in conjunction with

the structural steel work shall be removed, all damage to this work and adjoining work shall be made good and all surplus materials and debris and all tools, plant and equipment shall be removed from the site.

End of Section 05100