
Part 1 General

1.1 RELATED REQUIREMENTS

- .1 The list of work sections in this division is indicative and non-exhaustive. It does not exclude the works described in the other specification sections, shown in the drawings or necessary for the execution of the works in keeping with overall intent of the plans.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 61 00 – Common Product Requirements.
- .4 Section 01 74 11 – Cleaning.
- .5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.2 SCOPE OF WORK

- .1 Section Provide the labour, equipment and materials required to fabricate and install on site all of the structural steel shown on the plans and/or described in these specifications.
- .2 Make and reinforce as required all of the openings shown and/or necessary in the structural steel, as required.
- .3 Shop paint the structural steel and touch up as required on site. For paint specifications, refer to architectural documents.
- .4 Provide anchor bolts, expansive anchors, plates, angles and their anchors (weldable rods or other) to be embedded in concrete and required by this specification and/or shown on the plans.
- .5 Temporarily brace the structural steel.
- .6 Hot dip galvanize all steel elements identified as galvanized on drawings.
- .7 Provide and place non-shrink grout under steel column base plates or other plates or beams in contact with concrete. Provide heating during placing and curing, if necessary.
- .8 On site, survey all of the measurements and site conditions/hindrances/information required to fabricate the structural steel.

1.3 REFERENCE CODES AND STANDARDS

- .1 Unless otherwise indicated, the most recent editions of all reference standards must be used.
- .2 Unless otherwise specified, perform structural steel work in compliance with S16.09 standard.

- .3 Unless otherwise indicated, perform welding work in compliance with W59 standard.
- .4 Unless otherwise indicated, all painting work to be performed according to standards of « Steel Structures Painting Manual, volume 1 – Good Painting Practice ».

1.4 CONTRACTOR QUALIFICATIONS

- .1 The Contractor must qualify based on the provisions of the W47.1 standard « **Certification of companies for fusion welding of steel** ». The Contractor, as well as all his staff assigned to the execution of welding work, must be certified with regard to divisions 1 or 2 of the Canadian Welding Bureau.

1.5 INSPECTION CERTIFICATE

- .1 Upon request from the Departmental Representative, submit two (2) certified copies of steel mill test reports pertaining to the chemical and physical characteristics of the steel to be used in the execution of the project.
- .2 Upon request, provide Departmental Representative with two (2) certified copies of Charpy V notch resilience test reports.
- .3 Also provide an affidavit from the steel fabrication company confirming that the material used for this project complies with the relevant standards pertaining to products and materials specified.

1.6 CONNECTION DESIGN

- .1 Upon request, provide the Departmental Representative with one (1) copy of the calculations for all connections. The responsibility to provide adequate connections in terms of dimensions, capacity and general layout remains that of the Contractor's, notwithstanding any indication to the contrary which could be included in provisions from standards mentioned above.
- .2 Unless otherwise indicated by the Departmental Representative or when member configuration results in additional loads, design all of the assemblies based on the following minimum loads and criteria :
 - .1 Beams
 - .1 100 % of the shear load under a uniformly distributed load corresponding to the beam's flexion capacity when supported laterally. In case of composite beams, assume that the beam is 100% composite and calculate flexion capacity accordingly.
 - .2 For beams for which axial loads must be included in connection design, two(2) additional load cases must be considered, being : 70 % of shear load as described above, combined with axial load (C_f or T_f) shown on plans.

- .2 Braces
 - .1 Factored traction load corresponding to A_g , R_y , F_y , where R_y F_y is at least equal to 460 MPa.
 - .2 A factored compression load corresponding to 2.0 times C_r but no greater than load from point « .1 ». C_r is the brace compressive resistance using 90 % of its smallest unrestrained length.
 - .3 Brace connections must be designed according to clause 27.5.4.2 of CSA S16.09 standard.
- .3 Columns
 - .1 In addition to having sufficient resistance for axial loads (C_r or T_f), column splices must be designed as to offer shear and flexural resistance for bending moments equal to $0.3 \sum F_y$ applied in each direction separately at both ends of columns; same way (simple curvature) or opposite ways (double curvature).
 - .2 Welded column splices with partial penetration groove joints that are subject to traction loads must comply with clause 27.5.5.3 of CSA S16.09 standard .
- .3 Provide web stiffeners for beams sitting on columns or other beams. Web stiffeners must also be provided for suspended beams.
- .4 Unless otherwise previously indicated by the Departmental Representative, splices are prohibited for elements subjected to bending or traction. When authorized by the Department Representative, the splices must be shown on the shop drawings. X-ray tests must be conducted at Contractor's expense.
- .5 When a connection exceeds the footprint of the connected elements, verification must be made with the architect to avoid any conflict or interference.
- .6 Bolted assemblies must comply with clause [27.1.6] of the CAN/CSA-S16-09 standard.

1.7 BRACE SYSTEM PROTECTED ZONES

- .1 All diagonal members between ground level and roof are part of the brace system.
- .2 The protected zone for diagonals includes the total length of the diagonal, as well as elements that join the diagonal to beams and columns. Protected zones must meet clause [27.1.9] of CSA / CAN-S16-09, and its supplement.
- .3 Protected zones must be clearly indicated on shop drawings.
- .4 Clearly identify protected zones with a different color paint or primer, all in compliance with paint specifications contained in architectural documents. Apply labels to at least two (2) faces of the members which are part of protected zone; coordinating with appearance required.
- .5 Do not modify, make cuts or attach anything on members which are part of protected zones. In the event, members shall be repaired at Contractor's expense and certified by

steel fabricator's Engineer as meeting CSA / CAN-S16-09 requirements. The Engineer is the one responsible for sealing and stamping the fabricator's structural steel shop drawings.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - *Submittal Procedures*.
- .2 Shop drawings :
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec of Canada.
 - .2 On each detailed drawing for a given element, specify the location of the item and identify the plan number, as well as the reference grid lines adjacent to the item.
 - .3 Shop drawings must include all of the details pertaining to fabrication and erection, including cuts, notches, connections, perforations, threaded anchors and welds. Use symbols from the Canadian Welding Bureau to show welds.
 - .4 The shop drawings review process merely aims to allow the Departmental Representative to familiarize himself with the general conformity of the structure versus the contractual provisions. The comments and/or corrections made to the drawings do not relieve the Contractor from his obligation to comply with all of the contractual requirements, nor do they constitute a commitment or approval should there be a deviation from the requirements.
 - .5 Submit the welding procedures in the following cases :
 - .1 Continuous weld.
 - .2 Rail welding.
- .3 Erection drawings :
 - .1 Submitted erection drawings must show the details and information required for assembling and erecting elements, specifically :
 - .1 Work methods.
 - .2 The installation sequence.
 - .3 The type of equipment use for erecting.
 - .4 The temporary bracing devices.
 - .2 At all times, the Contractor remains solely responsible for the construction methods, equipment and work execution mode.
- .4 Fabrication drawings :
 - .1 Submitted shop fabrication drawings showing connections, components and assemblies designed by fabricator must be stamped and signed by qualified professional engineer licensed in the Province of Quebec of Canada.

- .5 Samples :
 - .1 Provide samples specified in the Part 4 in this section.
- .6 Fabricator Reports :
 - .1 Provide structural steel fabricator's affidavit stating that materials and products used in the fabrication conform to applicable material and products standards specified and indicated.

1.9 CERTIFICATES OF CONFORMITY – C.S.S.T.

- .1 The Contractor shall provide the “Commission de santé et sécurité du travail du Québec” or CSST with all of the certificates required by the latter as specified in the “Code de sécurité pour les travaux de construction” (safety code for construction work) or in the “Loi sur la santé et la sécurité du travail” (law on health and safety in the workplace), including the documents requiring the signature and seal of an engineer certified by the “Ordre des Ingénieurs du Québec”, specifically the anchor bolt plan as well as installation procedures for columns with less than four (4) anchor rods (ref.: Articles 3.24.11 and 3.24.12 of the “Modifications réglementaires au Code de sécurité pour les travaux de construction et Règlement sur la santé et la sécurité du travail” (regulatory modifications to the safety code for construction work and the regulation on health and safety in the workplace)).

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - *Common Product Requirements* and manufacturer’s instructions.
- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.
- .3 Packaging Waste Management: reuse of packaging materials in accordance with Section 01 74 21 - *Construction/Demolition Waste Management and Disposal*.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel : Unless otherwise indicated on the plans, comply with the G40.21 standard, grade 350W for regular « I » shaped sections, 300W for C shapes, angles and plates, ASTM A500 Gr. C ($F_y = 317$ MPa min.) for round tubular sections, ASTM A500 Gr. C for square or rectangular tubular sections and ASTM A-307 for anchor bolts.
- .2 Bolts, nuts and washers : to ASTM A 325.
- .3 Welding material : Shall comply with CSA W59 and certified by the Canadian Welding Bureau.

- .4 Paint : Shop-applied paint primer, with touch-up paint on site: Compliant with the ICCA/AFPC (CISC/CPMA) 1-73a standard. Colour : grey.
- .5 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².
- .6 « Nelson Stud » shear connector : Compliant with the ASTM A-108, minimum yield strength of 345 MPa, minimum ultimate strength 400 MPa. The connectors must be attached to the structure in compliance with the CSA W-59 standard, clause 5.5.6 and appendix H.
- .7 Non-shrink grout under columns or other plates in contact with concrete : Non-shrink cement-based mortar with a minimum compressive strength after one (1) day of 26 MPa and of 56 MPa after 28 days. Aggregate classification must comply with the ASTM C136 standard and must have a sieve size of 2.5 mm passing 100 %. Add aggregate, as recommended by the manufacturer, for use where thickness is more than 150 mm. Have non-shrink grout approved by the Departmental Representative prior to its use.
- .8 Acceptable materials or products : When materials or products are specified by their brand names, refer to bidders instructions for procedure on how to submit equivalent/substitution product or material for approval.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

- .1 Structural steel work : in accordance with CAN/CSA-S16-09.
- .2 Welding : in accordance with CSA W59.

3.3 FABRICATION

- .1 Fabricate steel elements in compliance with the S16-09 standard.
- .2 Punch holes 11 to 27 mm in diameter to connect with other elements. Refer to the drawings for execution details and locations.
- .3 Reinforce the openings in order to ensure the original strength.
- .4 Provide steel bars same size as grating bearing bars at perimeter of grating openings an edge of grating sections.

- .5 Fasten grating sections at 450 oc maximum. Provide a minimum of two (2) fasteners at each support.
- .6 Cut edges of plates and steel members must be smooth and free of crack or signs of breakage.
- .7 Joints must be sealed using a continuous weld where indicated. The welds must then be smoothed through grinding.
- .8 At any given beam cross section, no more than one hole must be made on top flange for joist seat connection.
- .9 Cold camber beams as indicated on drawings. Camber tolerances between values specified on drawings and those measured on site are – 0 mm and + 8 mm.

3.4 CONNECTION TO EXISTING WORK

- .1 Before beginning steel fabrication, verify the dimensions and conditions of the existing structure (including the elevations and dimensions indicated on the plans) prior to preparing shop drawings and/or fabricating. Notify the Departmental Representative of any discrepancy in size or eventual connection issue in order to obtain new instructions.
- .2 The information on the plans regarding existing structures may not be accurate or complete.
- .3 Inform Departmental Representative of any discrepancy or defect that may affect the work.
- .4 Support the base plates of the columns using steel shims to allow for placing of non-shrink grout.

3.5 SHOP-APPLIED PAINT

- .1 Clean, prepare and prime the steel in compliance with the S16-09 standard, with the exception of elements to be embedded in concrete, which must not be painted, as well as the surfaces of slip-critical connections.
- .2 Clean the steel using a phosphoric based cleaning and rust-removing product specifically designed to improve paint adhesion to metal and to delay rust under the coats of paint.
- .3 Elements must be free of slag, rust, oil, dirt and any other foreign substance :
 - .1 Prepare the surfaces in compliance with the requirements of the SSPC SP1 standard on brush stripping, with the exception of structural elements that will receive intumescent paint.
 - .2 For elements that will be protected by intumescent paint, prepare the surfaces in accordance with the SSPC SP6 / NACE # 2 standard “Commercial Blast Cleaning” with 2 to 3 mils angular profile.

- .3 A coat of paint primer must be shop-applied on all steel surfaces, with the exception of the following surfaces :
 - .1 Surfaces embedded in concrete.
 - .2 Surfaces where shear studs will be site installed.
 - .3 Surfaces and edges that must be welded on site.
 - .4 Surfaces of slip-critical connections.
 - .5 Surfaces located below ground and directly in contact with the ground.
 - .6 Surfaces sprayed with a cement-based fire-proof coating (for location, see Architect).
- .4 Obtain a dry film thickness of at least :
 - .1 1.5 to 2.0 mils except for structural elements that will receive intumescent paint.
 - .2 2.0 to 3.0 mils for structural elements that will receive intumescent paint.
- .4 The paint must be applied in a sheltered area, on dry surfaces, when the ambient temperature and the temperature of the primed surfaces are higher than 5 °C.
- .5 Painted elements must be kept dry and at a temperature of at least 5 °C until the paint is completely dry.
- .6 Paint on bolts, nuts, edges and angles must be removed before it dries.
- .7 Clearly indicate specified lifting capacity on hoist beams.
- .8 West wing: All spray-on fireproofed steel surfaces must be left bare metal, unpainted (refer to architectural documents for details and location).

3.6 MARKING

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking : shop mark bearing assemblies and splices for fit and match.

3.7 ERECTION

- .1 Erect structural steel as indicated and in accordance with CAN/CSA-S16-09 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering of structural members must be by Departmental Representative before proceeding.
- .3 When erection is completed, clean with mechanical brush and touch up bolts, rivets, welds and primed surfaces that are burned, scratched or missing primer. The Contractor must remove grease from the structural bolts prior to the application of the paint finish.

- .4 If indicated on the drawings, seal continuously all of the steel members by section, with a continuous fillet weld and grind the welds.
- .5 Place non-shrink grout under the columns, as specified in the plans. Use adequate forms to execute the work.
- .6 When the lateral stability of the building is ensured by masonry or reinforced concrete walls, provide and install the required temporary braces until all of the walls are built.
- .7 Holes that have not been shop-perforated but are still required for assembly must be drilled mechanically. Holes must not be made with a torch.
- .8 Columns anchored to foundations by less than four (4) anchor rods must be subjected to appropriate measures to ensure their temporary stability during the erection of the structural steel. The same applies when the position of the anchors does not ensure the stability of the column in both directions. The Contractor must provide all of the certificates required in this regard as specified in Item 1.8.

3.8 FIELD AND SHOP QUALITY CONTROL

- .1 When required, or upon Departmental Representative's request, inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- .2 The Departmental Representative will pay for control tests except in case of a second inspection required due to deficient initial work, which will be at the Contractor's expense.
- .3 Tests will be non-destructive and conducted using one or the other of the following methods and a representative sample determined by the Departmental Representative :
 - .1 X-ray of the butt welds and groove welds.
 - .2 Magnetic particules test for fillet welds.
 - .3 Ultrasonic test for complete penetration welds.
 - .1 The Contractor must collaborate free of charge to the execution of these tests by providing the laboratory with all of the necessary assistance. If a weld is deemed defective by the Departmental Representative, an additional inspection at the expense of the Contractor will be carried out for the welds located on either side of the defective welds executed by the same welder. Any corrective work must be executed to the satisfaction of the Departmental Representative, at no cost to the Owner.
- .4 Allow and facilitate access to the plant and to the construction site for the Departmental Representative to verify, examine and supervise the quality of the material and execution and to take samples for testing and analysis purposes. If necessary, provide all of the assistance (labour, equipment and materials) required by the Departmental Representative, free of charge.
- .5 The laboratory may subject all of the welds to non-destructive tests.

- .6 Destructive tests may be required by the Departmental Representative with regard to **welder certification** and tension or flexion tests.
- .7 If requested by the Departmental Representative, any part specified will be kept at the plant until the Departmental Representative authorizes its shipment to the construction site.
- .8 Before making a new weld, chisel, melt and grind all of the welds deemed defective until all traces of imperfection are removed.
- .9 In the case of slip-critical bolted connections, the structure's bolts will be tightened and inspected by the Contractor using a torque wrench through the application of the torque required for inspection in the tightening direction.
 - .1 At least 10 % of the bolts must be verified, but no less than two (2) bolts in each connection. If no bolt or nut has turned when applying the torque required for inspection, this torque will be applied to all of the bolts of the connection. All of the bolts that will have moved will be tightened and inspected again. The tightening torque wrench must be calibrated at least twice daily.
- .10 For bearing type bolted connections, the bolts will be tightened until all of the surfaces involved are firmly in contact.
- .11 The Departmental Representative and/or laboratory may repeat the verification required in the previous paragraphs. If the bolt tightening has not been conducted as required, the expenses associated with the laboratory's verification will be paid by the Contractor.
- .12 **Shop or field welded shear studs** must be verified by the Contractor using the methods of pipes or hammer described in Article 5.5.6.5.5 of the W59 standard. Upon request, the Contractor must provide the Departmental Representative with a certificate confirming the tests, results and corrective actions taken, if applicable.
- .13 In the case of **hot dipped galvanized elements**, the interfaces of the elements in contact must be previously sealed with a continuous weld. In addition, the Contractor must notify the Departmental Representative five (5) days prior to the beginning of galvanization activities.
- .14 Welds on a galvanized element are prohibited unless expressly authorized by the Departmental Representative.

3.9 **CLEANING**

- .1 Leave all steel clean and in condition allowing work by other trades to be completed.
- .2 Once work is completed, remove from site all surplus material, tools, equipment and debris in order for work site to be left clean, all at Departmental Representative's satisfaction.

3.10 LOADS ON STRUCTURES

- .1 The Contractor must ensure that the structures in place or being installed are not overloaded and that the service load shown on plans are not exceeded.

3.11 FIELD PAINTING

- .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

Part 4 Architecturally exposed structural steel (AESS)

4.1 GENERAL

- .1 Summary
 - .1 In addition to the requirement of the sections above, this section includes requirements regarding the appearance, surface preparation and integration of Architecturally Exposed Structural Steel.
 - .2 In addition to the requirements of this sub-section, comply with the provisions of Appendix I "Exposed Steel") of the CISC Code of Standard Practice for Structural Steel.
 - .3 This Subsection applies to all exposed structural steel members noted on Structural Documents as AESS. followed by their category (1, 2, 3, 4 or C).
 - .4 For the definition of exposed steel categories (1, 2, 3, 4 and C), refer to Appendix I of the CISC Code of Standard Practice for Structural Steel.
- .2 Shop Drawings
 - .1 Shop Drawings detailing fabricating of AESS components must :
 - .1 Clearly indicate which members are considered as AESS members and their Category.
 - .2 Include notes and details that clearly identify all of the requirements listed in sub-section 4 "Exposed Steel".
 - .3 Include, when required, connections coherent with the concepts included in the plans and specifications.
 - .4 Indicate welds by standards CWB symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds.
 - .5 Indicate type of bolt and their finish. Indicate on which side of the connection bolt heads should be placed.
 - .6 Indicate any special tolerances and erection requirements.
 - .7 Be submitted to both the Architect and the Departmental Representative for approval.

.3 Quality Assurance

- .1 Fabricator Qualifications: In addition to those qualifications listed in other Subsections, hire a firm competent in fabricating AEES similar to that indicated for this Project with sufficient production capacity to fabricate the AEES elements.
- .2 Erector Qualifications : In addition to those qualifications listed in other Subsections, hire a competent Erector who has completed comparable AEES work.
- .3 Submit a typical brace sample, which will include the following :
 - .1 3-D rendering of specified element.
 - .2 First off inspection : First element fabricated for use in finished structure subject to alterations of subsequent pieces.

.4 Delivery, storage, and handling

- .1 Ensure that all items are properly prepared, handled and/or packaged for storage and shipping to prevent damage to product.
- .2 Erect finished pieces using nylon slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Architect.

.5 Fabrication

- .1 For the special fabrication characteristics, see Table 1 – AEES Category Matrix of CISC Code of standard practice.
- .2 Fabricate and assemble AEES in the shop to the greatest extent possible. Locate field joints in AEES assemblies at concealed locations or as approved by the Architect.
- .3 Fabricate AEES with surface quality consistent with the AEES Category and visual samples if applicable.

4.2 EXECUTION

.1 Examination at delivery

- .1 The Contractor and the Erector shall check all AEES members upon delivery for twist, kinks, gouges or other imperfections, which might result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

.2 Preparation

- .1 Provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using padded slings and/or other

protection required to maintain the appearance of the AESS through the process of erection.

.3 Erection

.1 In addition to the special care used to handle and erect AESS, employ the proper erection techniques to meet the requirements of the specified AESS Category :

- .1 AESS Erection tolerances : Erection tolerances shall meet the requirements of standard frame tolerances for structural steel per CSA S16.
- .2 Bolt Head Placement : all bolt heads shall be placed as indicated on the structural documents. Where not noted, the bolt heads in a given connections shall all be placed to same side.
- .3 Removal of temporary field connection : Welding backing bars, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure and grinded smooth. Holes for erection bolts shall be plug welded and ground smooth.
- .4 Filling of connection access holes : Filling shall be executed with proper procedures to match architectural profile.
- .5 Field Welding : Weld profile, quality, and finish shall be consistent with AESS Category and visual samples, if applicable, approved prior to fabrication.

.4 Connections

- .1 Bolted Connections : Provide bolt type and finish as specified and place bolt heads as indicated on the approve shop drawings.
- .2 Welded Connections : Appearance and quality of welds shall be consistent with the AESS Category and visual samples if applicable. Assemble and weld built-up sections by methods that will maintain alignment of members to the specified tolerance.
- .3 Assemble and weld built-up sections by methods that will maintain alignment of axes. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.

.5 Architectural Review

- .1 The Departmental Representative shall review the AESS steel in place and determine acceptability based on the Category and visual samples (if applicable). The Contractor will inform Departmental Representative of the schedule of the AESS Work.

.6 Adjusting and Cleaning

- .1 Touch up Painting : Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch-up work shall be done in accordance with Departmental Representative and manufacturer's instructions.

- .2 Galvanized Surfaces : Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION