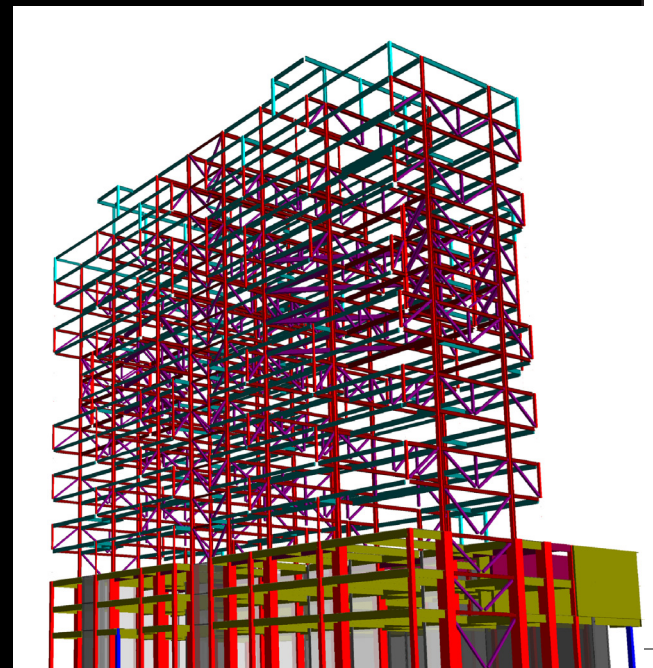
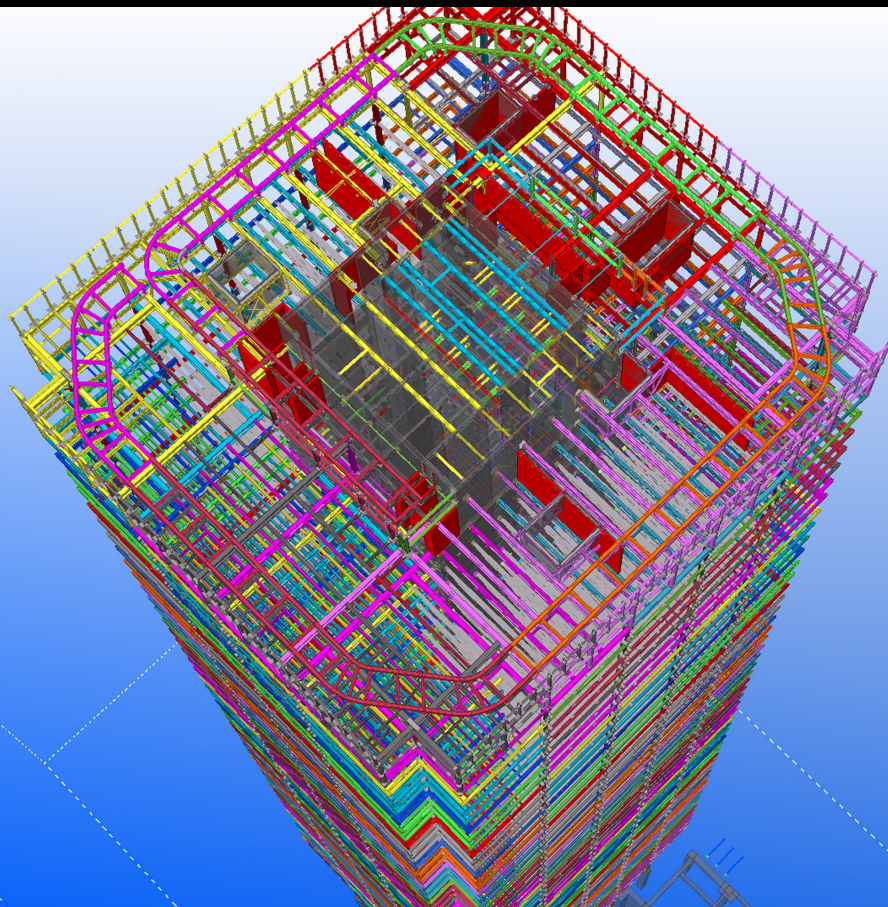


Division 5 Standard
Specification for
Structural Steel



CISC Ontario Division 5 Specification

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PART 0 INTRODUCTION

Refer to the following standard specification as published by CISC, dated June 2013 and its modifications as outlined in the Appendix.

PART 1 GENERAL**1.1 General Requirements**

- .1 Conform to the CSA Standard S16-09, CISC Code of Standard Practice and the applicable construction safety act.
- .2 Cooperate with Consultants, independent inspection and testing agencies.

1.2 Quality Assurance

- .1 Execute work of this Section only by a structural steel fabricator who is a current member of the Canadian Institute of Steel Construction.
- .2 Any organization undertaking to weld under this contract shall be certified by the Canadian Welding Bureau to the requirements of CSA W47.1, Division 1 or 2.
- .3 Engage a Professional Engineer, licensed to practice in the province of Ontario, to design and /or review all connections related to structural steelwork. When requested by the Consultant, submit calculations signed and sealed by the Engineer responsible for the connections.
- .4 Submit a certified copy of Mill Test Certificates or provide an affidavit (based on material testing) stating that the materials and products that have been used in fabrication conform to the applicable material or product standards and are new materials.
- .5 General Review by the Consultant is undertaken so that the owner may be informed as to the quality of the Contractor's performance and for the protection of the Owner. This does not relieve the fabricator of their responsibility for the performance of the Contract and they shall implement their own supervisory and quality control procedures.

1.3 Reference Standards - Materials, fabrication, installation and inspection are to be in accordance with the following reference standards and as specified in the Appendix.

- .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
- .2 CSA G189-1966, (R2003) Sprayed Metal Coatings for Atmospheric Corrosion Protection
- .3 CSA S16-09, Design of Steel Structures
- .4 CAN/CSA S136-13, North American Specification for the Design of Cold-Formed Steel Structural Members
- .5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel
- .6 CSA W48-06 (R2011), Filler Metals and Allied Materials for Metal Arc Welding
- .7 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum
- .8 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding)
- .9 CSA W178.1-08, Certification of Welding Inspection Organizations
- .10 CSA W178.2-08, Certification of Welding Inspections
- .11 CAN/CGSB-1-GP171-98, Inorganic Zinc Coating
- .12 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .13 CISC/CPMA 1-73a (1975) A Quick-drying One-coat Paint for Use on Structural Steel
- .14 CISC/CPMA 2-75 (1975) A Quick-drying Primer for Use on Structural Steel.
- .15 CISC Code of Standard Practice for Structural Steel, June 2008

- .16 ANSI/NAAMM MBG 531-09, Metal Bar Grating Manual
- .17 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
- .18 ASTM A108-07, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- .19 ASTM A123/A123M-12, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .20 ASTM A 307-12, Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60 000 PSI Tensile Strength
- .21 ASTM A325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric)
- .22 ASTM A325-10, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
- .23 ASTM A570-79, Standard Specification for Hot Rolled Carbon Steel Sheet and Strip, Structural Quality
- .24 ASTM A653/A653M-11 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .25 ASTM A780/A780M-09 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- .26 ASTM A992/A992M-11, Standard Specification for Structural Steel Shapes
- .27 ASTM F1554-07ae1, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- .28 SSPC, Standards of the Society for Protective Coatings (see http://www.sspc.org/standards_techcommittee_updateyear/)

1.4 Related Sections

1.4.1 Related Work Specified Elsewhere

General Contractor shall coordinate the work of this section with all related sections.

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 03 41 00 Precast Structural Concrete
- .3 Section 04 22 00 Concrete Unit Masonry
- .4 Section 05 21 00 Steel Joist Framing
- .5 Section 05 31 00 Steel Decking
- .6 Section 05 41 00 Structural Metal Stud Framing
- .7 Section 05 50 00 Metal Fabrications
- .8 Section 07 81 00 Applied Fireproofing
- .9 Section 09 91 00 Painting
- .10 Section 23 05 00 Common Work Results for HVAC

1.5 Co-operation

- .1 Co-operate with all engaged on the Project. When requested submit shop detail or erection diagrams to the General Contractor to assist with their co-ordination and schedule with other trades.
- .2 Provide where shown on structural design drawings, holes and copes for connections and clearance for the work of other trades. These shall be shown on erection diagrams before submitting for review.

1.6 Work Supplied but Installed by Others

- .1 Anchor rods and leveling plates
- .2 Connection assemblies set in concrete.
- .3 Provide loose steel lintels that bear on concrete or masonry. (Steel lintels not quantified and shown on structural design drawings to be provided by others).
- .4 Shelf angles, wall and deck plates/angles that bear on or are attached to concrete or masonry and are specifically located on the Structural Design drawings.

.5 Masonry anchors.

.6 Masonry wall bearing hoist beams, where shown and sized on structural design drawings.

1.7 Work Excluded

.1 Not included unless specified in the attached Appendix – Non-load bearing masonry top lateral wall ties and braces, Door jambs in pre-cast, Grouting, Steel Deck, Reinforcing bars, Welded Wire Fabric, Dock Angles, Drilling of concrete, precast or masonry and steel items not shown specifically on Structural Design Drawings. Refer to section 2.3 in the CISC Code of Standard Practice for a comprehensive list of Items Supplied by Others.

1.8 Connections

.1 All connections shall conform to CSA S16-09.

.2 Retain a Professional Engineer to be responsible for the design of connections not specifically designed and detailed by the Consultant.

.3 For all framed beam shear connections, use end plate (shop welded), single angle or double angle header connections (shop bolted or welded) or shear tabs where practical.

.3.1 Framed beam shear connections shall not be less than one half of the depth of the connected member.

.3.2 All connections shall be designed and detailed to resist connection forces provided on the Structural Drawings. Where these forces are not provided or unless shown otherwise on the Structural drawings, connect all simply supported non-composite flexural members (beams, channels, etc.) at each end for one half of the total uniformly distributed factored load of the laterally supported beam. For composite beams, increase connection load at each end to 75 % of the total uniformly distributed factored load on the steel section only.

.3.3 Connect for the factored moment where shown on the structural design drawings. Design connections for eccentricities where shown on the structural design drawings.

.3.4 For spandrel beams, provide full depth web connection or top and bottom flange clips where detailed and shown on structural design drawings.

.3.5 Provide reinforcement of unconnected sides of HSS members, where detailed and shown on the structural design drawings.

.3.6 Bolted connections shall be bearing-type unless otherwise shown on the structural design drawings. Use of oversize holes shall be subject to approval and such connections shall be detailed as slip-critical.

.3.7 Vertical and Horizontal Bracings

Connect all tension and compression members for the axial force shown on the drawings plus the shear force due to direct member loading, if applicable.

.3.8 Prior to erection diagram review, the fabricator is to be provided the necessary information to locate punched or drilled holes from 14 mm (9/16") to 24mm (15/16") diameter for other trades to attach blocking or other material where shown on structural design drawings.

.3.9 Provide holes for pipes and ducts as indicated on structural design drawings and reinforce only those as detailed and shown on the structural design drawings. Cutting of holes in any structural steel member in the field is not permitted without the written approval of the Consultant.

.3.10 Structural steel members shall not be spliced unless approved by the Consultant in writing. Except for splices shown on structural design drawings, do not splice vertical and horizontal members unless necessary to accommodate shipping lengths or material availability. Ensure that splice connections develop the factored load at the splice location of the member unless otherwise indicated on the drawings.

1.9 Drawings

1.9.1 Preparation of Drawings

.1 "Drawings" means erection diagrams and shop details.

.2 Prepare erection diagrams and shop details which conform to the requirement of the CSA S16-09, and as specified herein.

.3 Show the size, spacing and location of structural steel members, connections, attachments, reinforcing and

anchorage. Include necessary plans, elevations and details; indicate size and type of fastening, and for weld connections use welding symbols in accordance with Appendix D of CSA Standard W59 and clearly indicate net weld lengths.

.4 Submit connections for review by the consultant when requested.

.5 Supply necessary information for setting items of structural steel supplied under this Section that are to be built or drilled into the work of other Sections, as and where shown on structural design drawings. Show orientation of bearing plates on erection diagrams.

.6 Indicate on Erection diagrams, steel lintels and other structural shapes, which are embedded in masonry or cast-in-place concrete and not connected to structural steel.

.7 Provide necessary information for setting leveling and bearing plates, anchor rods, etc. installed by other sections.

.8 Show existing steel modifications with sufficient details to clarify the work required.

.9 Submit fieldwork details with complete information for modifying fabricated members.

1.10 Submittals

.1 Submit for review before fabrication, 4 white prints or transmit via digital pdf format of erection diagrams. Leave room on drawings for the stamps of the Consultant and the General Contractor. The first submission of the erection diagrams is to include a materials specification indicating steel grades, paints, etc. Shop fabrication drawings need not be submitted for approval.

.2 The fabricator shall include in his delivery schedule one week for the review of erection diagrams by the Consultant.

.3 Review of erection diagrams by the Consultant will not absolve the fabricator from his responsibility of providing materials and equipment to complete and finish his work in accordance with the structural design drawings. Departures or differences from the referenced drawings shall be approved, in writing, by the Consultant.

.4 Submit, if requested, details of all moment connections and other non-standard connections not covered by standard details, signed and sealed by a Professional Engineer for approval prior to fabrication.

.5 Submit, if requested, a signed and sealed letter to the Consultant stating that all shop fabrication drawings have been prepared and reviewed under the connection Design Engineer's supervision (PEO Guideline, item 6.5, Shop Drawings).

.6 If noted in the appendix, one copy of the shop fabrication drawings will be provided to the consultant for his use.

PART 2 PRODUCTS

Materials to be new, unless specified otherwise, free from defects impairing strength and durability in accordance with reference standards and quality as listed below and as shown on the structural drawings.

2.1 Materials

.1 Wide flange: CSA G40.20/G40.21, Grade 350W, ASTM A992 grade 50

.2 Welded wide flange: CSA G40.20/G40.21, Grade 350W

.3 Hollow structural sections: CSA G40.20/G40.21, Grade 350W - Class C or Class H where noted on structural design drawings.

.4 Channels, angles and plates: CSA G40.20/G40.21, Grade 300W

.5 Steel, sheet and strip, carbon, hot-rolled, structural quality: ASTM A570

.6 Cold formed shapes (coated): ASTM A653/A653M Grade 50

.7 Standard I beams: ASTM A992/A992M, Grade 350

.8 Structural pipe: ASTM A53, Grade B

.9 Arc welding electrodes and equipment: CSA W48 Electrode Classification Series 490 MPa low hydrogen type dry welding electrodes

.10 High-strength bolts: Minimum ASTM A325 Type 1

.11 Machine bolts: ASTM A307

- .12 Anchor rods: CSA G40.20/G40.21 300W or ASTM F1554
- .13 Joint filler for exposed steelwork: Epoxy resin
- .14 Shop primer paint for steel receiving finish coat of paint on site: CISC/CPMA 2-75. (lead-based paints not permitted)
- .15 Shop paint for steel without finish coat: CISC/CPMA 1-73a. (lead-based paints not permitted)
- .16 Zinc-rich primer and touch-up paint – inorganic: CAN/CGSB-1-GP171, organic, ready mixed: CAN/CGSB-1.181
- .17 Galvanizing: ASTM A123/123M
- .18 Expansion or adhesive anchors as shown on the structural design drawings.
- .19 Stud Shear Connectors to ASTM A108 in the size, quantities and pattern as shown on the Drawings.
- .20 Shear Connectors (Direct Fastened, No Welding) in size, quantities and patterns as shown on the structural drawings.
- .21 Checkered Floor Plate – Raised pattern plate, commercial quality.
- .22 Grating to be in accordance with ANSI/NAAMM MBG 531, Metal Bar Grating Manual.

2.2 Fabrication

2.2.1 Workmanship

- .1 Conform to CSA S16 and CSA W59.
- .2 Clearly mark pieces by stamping or painting to prevent obliteration during shipping and handling for identification of individual pieces, in accordance with identification schedules on the shop drawings, to clearly indicate the location of each piece in the Work for installation.
- .3 Shop welding shall conform to welding requirements as specified in CSA W59.
- .4 Do not fabricate steel members until erection diagrams have been returned. Any work done prior to return of erection diagrams will be at the fabricator's risk or at the contractor's written request and risk.
- .5 The minimum size of welds shall be as required in CSA W59: For cold-rolled steel a minimum of 3 mm (1/8"); for hot-rolled steel, a minimum of 5 mm (3/16") unless a larger size is required by CSA W59.
- .6 Do not splice steel members unless required and approved by the Consultant.
- .7 Complete welded shop connections prior to galvanizing when possible. Seal weld only where shown on drawings or noted in the Appendix.
- .8 Orientate straight beams which have cambers within allowable mill tolerances so that the resulting camber is up.
- .9 Provide 19 mm (3/4") diameter weep holes in HSS columns where shown on structural design drawings.
- .10 When shop inspection is required, the General Contractor is to coordinate inspection of material before it is shipped to the site.
- .11 Shop applied Stud Shear Connectors: Remove paint, rust, mill scale, dirt, sand, grease and other deleterious materials from the surface of the steel prior to welding. Weld in accordance with CSA W59. Determine the proper weld set-up as per CSA W59.

2.2.2 Coatings

- .1 Standard one coat paint
CISC/CPMA Standard 1-73a, A Quick-dry One-coat Paint for Use on Structural Steel
This paint is intended for use on structural steel which, with the exception of a short period of time during construction, will meet interior exposures of a normally dry nature.
- .1.1 Apply paint under cover. Keep painted members under cover until paint has dried to the touch. Steel shall be dry when painted and paint shall be dry before loading for shipment.
- .1.2 Prepare paint material in accordance with paint manufacturer's published instructions. Comply with paint manufacturer's recommendations relative to equipment and application techniques.
- .1.3 Apply one shop coat of paint, to a dry film thickness of 1.5 to 2.5 mils.
- .1.4 Thoroughly work paint into all joints and open surfaces.
- .1.5 For shop coat and field touch-up: Clean and prepare surfaces in accordance with CISC/CPMA Standard 1-73a.

- .1.6 Use power tool cleaning to SSPC-SP3 unless otherwise specified on steel exposed to view.
- .1.7 Do not paint:
 - .1.7.1 Contact surfaces of slip-critical connections.
 - .1.7.2 Portions of surfaces that are to receive field welds.
 - .1.7.3 Portions of steel members, which are to be encased in or in contact with cast-in-place concrete.
 - .1.7.4 Members that are to be galvanized.
 - .1.7.5 Members to receive sprayed-applied fire protection, unless paint is compatible.
 - .1.7.6 Members where special paints are to be applied.

2.2.3 Other Paint systems

Refer to Appendix as applicable.

2.2.4 Galvanizing

When specified on structural design drawings, fabricated members shall be zinc 'hot-dip' galvanized after fabrication in accordance with all pertinent ASTM standards and primarily ASTM A123/A123M. The minimum average zinc coating thickness is dictated in Table 1 of the ASTM A123/A123M standard and shall generally meet or exceed 85 microns. Where welding after galvanizing is necessary, the zinc shall be removed by grinding and the damage repaired in accordance with ASTM A780/A780M.

2.2.5 Architecturally Exposed Structural Steel

- .1 Members that are to be treated as Architecturally Exposed Structural Steel are indicated on structural steel drawings.
- .2 Refer to Appendix for specific class of AESS required as per CISC Code of Standard Practice Appendix I.

PART 3 SCOPE

3.1 General

- .1 Erect structural steel indicated on the structural design drawings.
- .2 Detail connections of steel members so as not to interfere with architectural clearance lines or finishes that are shown on design drawings.
- .3 Provide special connections and /or splices specific to this contract where shown on the structural design drawings.
- .4 Do not field cut members without the Structural Consultant's prior approval .
- .5 Temporary bracing shall be in accordance with CSA S16 or this specification. Bracing members shown on structural design drawings are not to be assumed adequate for erection purposes.
- .6 Framing around openings. Provide structural steel members, where shown, at perimeter of openings through metal decking. Member sizes are as shown on the structural design drawings.
- .7 Web stiffeners where required by connection design or as shown on structural design drawings.
- .8 Soffit support angles. (Where shown on structural design drawings.)
- .9 Where structural steel members specified on the drawings are not available, contact the Structural Consultant for acceptance of any and all substitutions.

3.2 Examination

- .1 The General Contractor shall provide a survey of the position of anchor rods and surfaces and conditions upon which work of this section depends. Any deviations found from structural or architectural drawings are to be submitted to the Consultants for their written instructions.
- .2 Where new steel connects to existing steel, check that the information and dimensions shown on the drawings, are correct, by field measuring the existing steel, as necessary. The General Contractor shall provide access in a timely manner.

3.3 Rejected Work

.1 Do not deliver to the site materials which are known not to meet the requirements of the Specifications. If rejected after delivery, remove immediately from site.

3.4 Site Preparation, Handling and Storage

.1 The General Contractor is responsible for providing and maintaining an all weather surface suitable to allow passage for trucks, cranes and man lifts and is also to provide a clean, dry and solid area for storage of material. The General Contractor shall also provide safety measures as listed in the CISC Code of Standard Practice.

.2 The steel fabricator is responsible for maintaining cleanliness of steel until it is delivered onto the site.

.3 Store materials on site for as short a time as possible and such that members do not acquire permanent camber or deflection.

.4 Store steel on timbers, or other support clear of the ground.

.5 Store fastener components according to CSA S16.

3.5 Erection

.1 Erection of structural steel shall be in accordance with CSA S16, CISC Code of Standard Practice and the applicable provincial construction safety act and its regulations.

.2 Do not cut holes in the field unless sizes and locations are accepted by the Consultant in each case. Accepted field cutting and welding shall be undertaken by this section.

.3 All high-strength bolts are to be installed to a snug tight condition except as noted in Clause 1.8.3.6 or in the Appendix.

.4 Erect individual members of the structural steel to the tolerances given in CSA S16.

.5 Set column base plates on leveling plates which are to be set with grout at the required elevation by others and are to be level to within 1.5 mm (1/16") across the plate. Leveling plates are to be used under base plates when base plates are less than 0.26 square meters (400 square inches) in area. Set column base plates on leveling nuts / shims to the required elevation ready for grouting when base plate area exceeds the above.

.6 Do not make permanent connections until as much of the structure as will be stiffened thereby has been suitably aligned.

.7 Report ill-fitting connections to the Consultant before taking corrective measures.

.8 Remove paint from surfaces that are to receive primary welds. Secondary weld surfaces i.e. joist shoes or bridging need not have the paint removed.

.9 Do not weld in an ambient temperature below -10°C (14°F). Preheat according to CSA W59 requirements.

.10 Remove slag from all completed welds so that they may be visually inspected.

.11 Checkered Plate: Unless shown otherwise on the drawings, weld edge of checkered plate to supporting steel with 40 mm (1-9/16") long intermittent or 14 mm (9/16") plug welds at 450 mm (17-3/4") centres maximum.

.12 After erection, touch up paint with one (1) coat CISC/CPMA 1-73a one-coat paint to match shop coat to primary welds and major abrasions. Bolt assemblies and bridging welds do not require touch up.

.13 All welds on galvanized members, and where galvanizing has been damaged during erection and handling, are to be touched up with zinc rich paint.

3.6 Inspection and Testing

.1 A qualified independent inspection and testing company may be engaged by the Owner for this work. The inspection organization undertaking to inspect welding shall be qualified in accordance with the requirements of CSA W178.1, "Certification of Welding Inspection Organizations", and certified by the Canadian Welding Bureau. Alternatively, visual weld inspection may be performed by persons certified to Level 2 or 3 of CSA W178.2, "Certification of Welding Inspectors".

.2 The inspection shall cover shop work and field erection work to review for compliance with the CSA S16. Inspectors will randomly review materials to ensure conformance to the requirements of this specification.

- .3 The inspection agency will submit reports to the Consultants, Contractor, Steel Fabricator and Municipal Authorities covering the Work inspected and provide details of nonconformities or deficiencies observed.
- .4 Structural steel items to be cast into concrete / masonry shall be randomly inspected prior to concrete / grout placement.
- .5.1 Notify the Inspection Organization two weeks in advance of the date when the first work will be ready for inspection.
- .5.2 The inspector shall carry out visual inspection of at least 10% of all connections and 100% of butt joints that are loaded in direct tension.
- .5.3 The Inspection Organization to start field inspection as soon as each section of the work has commenced in the field.
- .5.4 In so far as possible, the fabricator and erector shall cooperate with the inspector, permitting access for inspection to all places where work is being done. The inspector shall cooperate in avoiding undue delay in the fabrication or erection of the steelwork.
- .5.5 The cost of independent inspection will be paid by the owner.
- .6 The scope of inspection may include:
1. Shop inspection of fabrication in the plant.
 2. Mill test reports (fabricator's affidavit will be accepted).
 3. Company certification is in accordance with CSA W47.1 Division 1 or 2.
 4. Welders' CWB Qualifications.
 5. Welding procedures are approved by the CWB in accordance with to CSA W47.1 and CSA W59.
 6. Splicing details and procedures.
 7. Overall dimensions.
 8. Fabricated members against specified member sections.
 9. Cambers and sweeps.
 10. Workmanship regarding layout, punching and drilling of holes.
 11. Shop and field inspection of bolt installation.
 12. Shop and field inspection of welded joints.
 13. General inspection of field cutting and alterations.
 14. General inspection of surface preparation, shop painting and field touch-up for structural steel.
 15. Review location of anchor rods and other embedded items. Tolerances for anchor rods location to be in accordance with CSA S16 and CISC Code of Standard Practice for Structural Steel – Item 7.7.
 16. Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.
 17. Installation of sliding bearings
 18. Galvanizing and field touch-up
 19. Grouting under base plates and bearing plates
 20. Sample checking of stud anchors
 21. Sample checking of drilled concrete and masonry anchors.
- .7 Installation of bolts shall conform to the requirements of CSA S16. Bolts to be snug tight unless as noted in Clause 1.8.3.6. The use of a torque wrench for random bolt inspection shall not be permitted unless otherwise approved by the Consultant and communicated to the Erector prior to erection. Any use of a torque wrench for inspection shall meet the requirements of CSA S16.
- .8 The inspector shall, as a minimum, visually examine all welded joints for inclusions, porosity, lack of fusion, penetration, contour, under-cuts and cracks.
- .9 Remove and replace non - conforming materials without delay and without extra cost.

3.7 Clean Up

- .1 Remove from the site any large excess materials, place other debris resulting from work of this Section in bins provided by the General Contractor / Owner.

3.8 APPENDIX

END OF SECTION

3.8 APPENDIX

3.8 APPENDIX

3.8 APPENDIX



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