
Part 1 GENERAL

1.1 Work Included

- .1 This Section specifies the requirements for supply, fabricating and erecting all structural steel. This Section also specifies the requirement for the fabricator to design and detail all connections not specifically defined on the Drawings.

1.2 Related Sections

- .1 Section 01 33 00 – Submissions and Shop Drawings.
- .2 Section 05 50 00 – Metal Fabrication.

1.3 References

- .1 National Building Code of Canada 2015, Volumes 1 and 2 and Structural Commentaries.
 - .2 CSA S6:19, Canadian Highway Bridge Design Code.
 - .3 CSA G40.20/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CSA G164-18, Hot dip galvanizing of irregularly shaped articles.
 - .5 CSA S16:19, Design of Steel Structures.
 - .6 CSA S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .7 CSA W47.1-19 Certification of Companies for Fusion Welding of Steel.
 - .8 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .9 CSA W55.3-08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .10 CSA W59-18, Welded Steel Construction.
 - .11 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless.
 - .12 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
 - .13 ASTM A153/A153M-16a, Standard Specification for Zinc Coatings (Hot-Dip) on Iron and Steel Hardware.
 - .14 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
 - .15 ASTM C881/C881M-20a, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - .16 ASTM F3125/F3125M-19e2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
 - .17 ASTM A500/A500M-21a, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
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- .18 ASTM A572/A572M-21e1, Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel.
- .19 ASTM A992/A992M-20, Standard Specification for Structural Steel Shapes.
- .20 ASTM A1011/A1011M-18a, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .21 ASTM F593-17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- .22 ASTM F1554-20, Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 – ksi Yield Strength.

1.4 Design Requirements

- .1 Design details and connections in accordance with requirements of CSA S16 to resist axial forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 Where axial bracing forces are not indicated, design and detail the connection based on 75% of the tensile resistance of the bracing members.
- .4 For non-standard connections, submit sketches and design calculations stamped and signed by a qualified Professional engineer registered or licensed to practice in the Province of Prince Edward Island.
- .5 For standard connections, select details from CISC Handbook of Steel Construction to ensure structural adequacy. Submit all standard connections for each structural steel member size. Connections shall be stamped and signed by a qualified Professional engineer registered or licensed to practice in the Province of Prince Edward Island.

1.5 Shop Drawings

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 – Submissions and Shop Drawings.
- .2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
 - .5 Member size and mark number.
 - .6 Elevations and dimensions.
 - .7 Bolt and weld requirements.
 - .8 Details of all standard and non-standard connections.
 - .9 Location of all non-standard connections.

- .3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified Professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.
- .4 Indicate welds by welding symbols as defined in CSA W59.

1.6 Samples

- .1 If requested, submit material samples in accordance with 01 33 00 – Submissions and Shop Drawings

1.7 Quality Assurance

- .1 If requested, submit four (4) copies of mill test reports two (2) weeks prior to fabrication of structural steel.
 - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
 - .2 Provide mill test reports certified by metallurgists qualified to practice in the Province of Prince Edward Island, Canada.
- .2 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.
- .3 Fabricator, as practicably as possible (preferably 90% or greater), to maximize amount of recycled content for all structural steel. Provide certification stating breakdown of the pre-consumer, post-industrial and post-consumer contents percentages of the steel.

Part 2 PRODUCTS

2.1 Materials

- .1 Structural steel: Hot-rolled structural steel conforming to CSA G40.20/G40.21, Grade 350W (Fy = 350 MPa) or alternatively ASTM A992, Grade 50W (Fy = 345 MPa) for wide flange shapes, channels, plates, and angles. Hollow Structural Sections (HSS) shall be Class C, Grade 350W (Fy = 350 MPa) or alternatively ASTM A500, Grade C (Fy = 345 MPa).
- .2 Anchor bolts (rods): to ASTM A307, ASTM F1554 (Grade 36ksi/248MPa Yield Strength) and ASTM F593 (AISI Type 316 stainless steel), unless noted otherwise.
- .3 Bolts, nuts and washers: to ASTM F3125/F3125M.
- .4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau; Electrodes: E49XX.
- .5 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123 or CSA G164 for all fabricated assemblies, minimum zinc coating of 705 g/m²; ASTM A153/A153M for all hardware (average zinc coating of 381g/m²).
- .6 Adhesive anchor bolts: high strength epoxy to ASTM C881, Type IV, and Grade 3. Provide adhesive anchor installation, including drilling of holes, preparation, storage, usage and curing in accordance with the written instructions and training as approved by the manufacturer.

2.2 Fabrication

- .1 Fabricate structural steel in accordance with CSA S16, W47.1 (Division 1 or 2), W59 and in accordance with approved shop drawings.

- .2 Confirm exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush where indicated without compromising design weld profile or size.
- .3 Provide weep holes to suit hot dip galvanizing where required.

Part 3 EXECUTION

3.1 General

- .1 Do structural steel work in accordance with CSA S16.
- .2 Do welding in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.
- .4 When required by the *Departmental Representative*, provide certification that all welded joints are qualified by the Canadian Welding Bureau.

3.2 Connection to Existing Work

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to the *Departmental Representative* for direction before commencing fabrication.

3.3 Marking

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. If 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.

3.4 Erection

- .1 All construction activities including the erection, use, moving and dismantling of approved and certified staging must be by qualified and experienced personnel and shall conform to all safe work practices, procedures and regulations of the applicable regulatory authorities.
- .2 Erect structural steel, as indicated and in accordance with CSA S16 and in accordance with approved erection drawings.
- .3 Obtain written permission and approval of the *Departmental Representative* prior to field cutting or altering of structural members.
- .4 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .5 Continuously seal members by continuous welds where indicated. Grind smooth.
- .6 Assume full responsibility for the integrity of structure during erection. Make necessary provision for all erection loads and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of necessary permanent bracing and frames.
- .7 Set base plates and loose bearing plates with steel shims to proper elevation, true and level, ready for grouting-in.
- .8 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes and without distorting, kinking or sharply bending metal of any unit. If, in the opinion of

the *Departmental Representative*, holes must be enlarged to admit bolts, they are to be reamed and larger size bolts used. Reamed holes not to exceed size of bolt used by more than 2mm.

3.5 Field Quality Control

- .1 If requested, inspection and testing of materials and workmanship will be carried out by testing laboratory designated by the *Departmental Representative*.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by the *Departmental Representative*.
- .3 Submit test reports to the *Departmental Representative* within two (2) weeks of completion of inspection.
- .4 Testing laboratory may use ultra-sonic testing procedures to verify soundness of some representative shop and field welds. In principal structural members, shop and field welds will be X-rayed. Representative bolted connections will be checked with torque wrench. The *Departmental Representative* will determine location and extent of all testing.

END OF SECTION

Part 1 GENERAL

1.1 Reference Standards

- .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
- .3 ASTM F3125/F3125M-19e2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- .4 ASTM A240/A240M-20a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .5 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
- .6 ASTM F393-17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- .7 ASTM F594-09(2020), Standard Specification for Stainless Steel Nuts.
- .8 ANSI AWS D1.6/D1.6M:2017, Structural Welding Code – Stainless Steel.
- .9 CSA G40.20-13 / G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
- .10 CSA S16:19, Design of Steel Structures.
- .11 CSA W59-18, Welded Steel Construction.
- .12 CSA S157/S157.1-17, Strength Design in Aluminum/Commentary on S157-17, Strength Design in Aluminum.
- .13 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
- .14 CSA W47.2-11 (R2020), Certification of Companies for Fusion Welding of Aluminum.
- .15 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .16 CSA W55.3-08 (R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.

1.2 Related Work

- .1 Refer to other Specification Sections for related information.
- .2 Refer to Section 01 33 00 for Shop Drawing and Submission requirements.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submissions and Shop Drawings.
 - .2 Shop Drawings:
 - .1 Clearly indicate the following items:
 - .1 General arrangements, dimensions, clearance locations and directions of assemblies as installed on structures.
 - .2 Locations, sizes and installation tolerances of anchor bolts, eye bolts and embedded parts.
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- .3 Types of materials used, finishes and core thickness.
 - .4 All other pertinent details and accessories.
 - .5 Each drawing submission shall bear signature and stamp of a registered Professional Engineer licensed to practice in the Province of Prince Edward Island, for all assemblies, components, joint details and connections not shown on the drawings.
- .3 Test Results:
- .1 Provide test results for the galvanized items.

Part 2 PRODUCTS

2.1 Materials

- .1 Steel sections: to CSA G40.21, Grade 350W.
- .2 Hollow steel sections: to CSA G40.21, Class C Grade 350W.
- .3 Steel rod, plate, and angles: to CSA G40.21, Grade 350W.
- .4 Welding materials: to CSA W59.
- .5 Anchor bolts/rods: to ASTM A307.
- .6 Bolts, nuts and washer: to ASTM F3125/F3125M.
- .7 Galvanizing: hot dipped galvanizing with zinc coating 610 g/m² to ASTM A123. All hardware to be galvanized unless otherwise noted on the drawings.
- .8 Zinc primer: Zinc rich, ready mix to ASTM 123.
- .9 Do not use items manufactured or fabricated from scrap steel of unknown chemical composition or physical properties.
- .10 For adhesive anchors see Cast-in-Place concrete, Section 03 30 00.
- .11 Aluminum: to CSA HA-Series M, alloy 6061-T6.
- .12 Stainless steel: to ASTM A240/A240M or ASTM A276/A276M of type UNS S31603 (316L) for angles, plates, rods, and channels.
- .13 Welding of aluminum to be mig welding with 5356 filling alloy in accordance with CSA W47.2.
- .14 Polyethylene sheet: high density, white HDPE, thickness as indicated.
- .15 Aluminum deck: Perf-O Z Grip, size hole Plank – 5052 aluminum alloy, 305 mm width, Model No. P-620.125-A by Pacific Grating, or approved alternative.

2.2 Fabrication

- .1 Build work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
 - .2 Fabricate items from steel unless otherwise noted.
 - .3 Where possible, fit and shop assemble work, ready for installation.
 - .4 Ensure exposed welds are continuous for length.
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2.3 Gangway Fabrication

- .1 Fabricate metal components as indicated, in accordance with CSA S16, CSA S157, and reviewed shop drawings.
- .2 Minimum fillet weld size shall be 5 mm.
- .3 All welding operations and procedures used are to be qualified to CSA W47.2 for aluminum and W47.1 for steel.
- .4 All stainless steel welding to be in accordance with AWS D1.6/D1.6M.
- .5 Fabricate gangway structure square, plumb, straight, and true with all joints neatly and accurately aligned.
- .6 Remove burs from cut sections.
- .7 Make punched or drilled holes in components clean and accurately spaced without deformation to components.

2.4 Miscellaneous Metal Work Items

- .1 Miscellaneous anchors, bolts and inserts:
 - .1 Where size, spacing and the like are not indicated, provide as necessary for the purpose.
 - .2 Galvanize all miscellaneous anchors, bolts and inserts.
- .2 Miscellaneous Steel:
 - .1 Provide miscellaneous steel as required for guide units and the like to shape, size and details required.
 - .2 Galvanize all miscellaneous steel items.

Part 3 EXECUTION

3.1 Erection

- .1 Install metalwork square, plumb, straight and true, accurately fitted, with tight joints and intersections.
- .2 Make field connections with bolts to CSA S16, or weld.
- .3 Touch-up bolts and scratched surfaces after completion of erection with zinc primer.

3.2 Dissimilar Metals

- .1 Isolation between black reinforcing steel and galvanized anchor bolts is required, and is the responsibility of the contractor to avoid potential galvanic reaction. Isolation to be achieved by 30 mm clear spacing between black and galvanized steel or denso tape on black steel at contact areas if 30 mm clear spacing cannot be achieved.
- .2 Provide full isolation gaskets (4 mm neoprene) between aluminum electrical shrouds and galvanized anchor bolts as shown on drawings.

END OF SECTION