

## **1. General**

### **1.1 PRICING AND PAYMENT PROCEDURE**

- .1 Measure structural steel for building in kilograms, computed from mass of steel elements indicated on structural documents. Structural steel includes any component of steel frame not specifically designated in another section – steel joists or joist girders and steel decking will be measured separately.
  - .1 Pricing shall include materials and erection as well as computation, materials and installation of connecting elements.
  - .2 Supply and installation of all elements needed to realize structural steel works will not be measured and are considered part of structural steel works.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A 36/A 36M-14, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A 108-13, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
  - .3 ASTM A 123/A 123M-13, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Product.
  - .4 ASTM A 193/A 193M-14a, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service or High Pressure Service and Other Special Purpose Application.
  - .5 ASTM A 194/A 194M-14a, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - .6 ASTM A 325-10, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .7 ASTM A 325M-13, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric).
  - .8 ASTM A 490-14a, Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
  - .9 ASTM A 490M-14a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
  - .10 ASTM A 500/A 500M-13, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - .11 ASTM A 563-07a(2014), Standard Specification for Carbons and Alloy Steel Nuts.
  - .12 ASTM A 563M-07(2013), Standard Specification for Carbons and Alloy Steel Nuts, Metric.
  - .13 ASTM A 572/A 572M-13a, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

- .14 ASTM A 780/A 780M-09 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- .15 ASTM A 913/A 913M-14a, Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process.
- .16 ASTM A 992/A 992M-11, Standard Specification for Structural Steel Shapes.
- .17 ASTM A 1011/A 1011M-14, 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.
- .18 ASTM A 1085-13, Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
- .19 ASTM D 6386-10, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
- .20 ASTM F 436-11, Standard Specification for Hardened Steel Washers.
- .21 ASTM F 436M-11, Standard Specification for Hardened Steel Washers (Metric).
- .22 ASTM F 959-13, Standard Specification for Compressible-Washer- Type Direct Tension Indicators for Use with Structural Fasteners.
- .23 ASTM F 959M-13, Standard Specification for Compressible-Washer- Type Direct Tension Indicators for Use with Structural Fasteners (metric).
- .24 ASTM F 1136/F 1136M-11, Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners.
- .25 ASTM F 1554-07ae1, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.
- .26 ASTM F 1852-11, Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
- .27 ASTM F 2280-12, Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
- .2 Canadian Standards Association (CSA)/CSA International.
  - .1 CSA B167-08(R2014), Overhead travelling cranes - Design, inspection, testing, maintenance, and safe operation.
  - .2 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement;
  - .3 CSA G40.20/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .4 CSA S16-14, Design of Steel Structures.

- .5 CAN/CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2009), Update No. 2 (2010).
- .6 CSA W47.1-09, Certification of companies for fusion welding of steel.
- .7 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .8 CSA W55.3-08(R2013), Certification of companies for resistance welding of steel and aluminium.
- .9 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .3 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB 1.40-97, Anticorrosive Steel Alkyd Primer.
  - .2 CAN/CGSB 1.105-M91, Quick-drying Primer.
  - .3 CAN/CGSB 1.181-99, Ready-mix Organic Zinc-Rich Coating.
  - .4 CAN/CGSB 31-GP-108MA, Inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
  - .5 CAN/CGSB 85.10-99, Protective Coatings for Metals.
  - .6 CAN/CGSB 85.100-93, Painting.
- .4 Canadian Institute of Steel Construction (CISC) / Canadian Paint and Coatings Association (formerly known as Canadian Paint Manufacturers Association – CPMA).
  - .1 Handbook of Steel Construction, 10<sup>th</sup> Edition.
  - .2 Code of Standard Practice, 7<sup>th</sup> Edition, 2009.
  - .3 Guide for Specifying Architecturally Exposed Structural Steel, 2<sup>nd</sup> Edition, March 2012.
  - .4 CISC/CPMA 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
  - .5 CISC/CPMA 2-75, A Quick-drying Primer for Use on Structural Steel.
- .5 Master Painters Institute.
  - .1 Architectural Painting Specification Manual.
  - .2 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.
  - .3 MPI EXT 5.1-08, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International.
  - .1 SSPC SP 1-04, Solvent Cleaning.
  - .2 SSPC SP 2-04, Hand Tool Cleaning.
  - .3 SSPC SP 6/NACE No. 3-06, Commercial Blast Cleaning.
  - .4 SSPC SP 7/NACE No. 4-07, Brush-Off Blast Cleaning.

.5 SSPC SP 11-12, Power Tool Cleaning to Bare Metal.

### 1.3 DESIGN CRITERIA

- .1 Design details and connections in accordance with requirements of CSA S16 and CAN/CSA S136 to resist forces, moments, shears and allow for movements indicated.
- .2 Beam assemblies shall have a depth equal to at least 50% of its depth.
- .3 Shop assemblies shall be welded. Field assemblies shall be bolted, using at least two (2) high-strength bolts per assembly.
- .4 Refer to an established manual recognized within the industry for connections design, such as the *Handbook of Steel Construction*.
- .5 Additional forces into connecting elements:
  - .1 Design connections as to not generate additional forces into connected elements.
  - .2 Connections generating torsion or flexure into connected elements are prohibited and will not be accepted by the Representative of the Ministry.
  - .3 Any modifications to details and connections due to changes requested by the Engineer shall be made free of charge.
- .6 Unless otherwise indicated, design connections to withstand the following loads:

Elements	Loads
Element loaded in bending (beam, column)	Maximum of support reaction considering the uniform load corresponding to the member strength in bending or 50% of the member strength in shear.
Element resisting significant point loads.	Member strength in shear.
Columns	Compressive resistance and shear resistance of member.
Joist girders	Tensile strength of member.

- .7 Splices in gravity columns shall have a minimum factored shear resistance equal to the sum of  $0.2 \cdot Z \cdot F_y / h_s$  of the column above and below in both orthogonal axis as indicated in article 27.1.4 of CSA S16 standard.

- .8 For non-standard connections, submit sketches and design calculations stamped and signed by qualified professional engineer member of the Ordre des Ingénieurs du Québec (OIQ).
- .9 For braces connections, submit sketches and design calculations stamped and signed by qualified professional engineer member of the Ordre des Ingénieurs du Québec (OIQ).
- .10 All works related to cranes, monorail and lifting equipment shall be in accordance with manufacturer's recommendations and specifications of CSA B167 standard.

#### **1.4 CONTRACTOR INSTRUCTION FOR MECHANICAL ANCHORING OF THE ROOF GRID**

- .1 Contractor shall be responsible for the design of the assembly and anchoring of the grid to the steel roof elements so that they can withstand an overload equal to the steel grid breakage limit.
- .2 Contractor shall supply materials, equipment and labor necessary to prepare shop drawings and to proceed to construction.
- .3 Shop drawings must have the seal of a qualified professional engineer who is a member of the Ordre des ingénieurs du Québec and must be presented to the Representative of the Ministry for the annotation and examination before the start of the works.
- .4 Workshop drawings shall clearly indicate the loads considered and the dimensions of the assemblies and anchors.
- .5 All joining and anchoring components shall be made of galvanized steel.
- .6 The maximum overlap between two (2) grid panels is 100 millimeters and shall face a structural member to secure it.
- .7 All bolts must be heavy-duty and resist loosening under vibration and torque.
- .8 Guide bolts out of safe course.
- .9 Stretch grid to provide tension recommended by manufacturer.
- .10 Grid must be securely attached to the steel structure and do not allow space between them.

#### **1.5 SHOP DRAWINGS**

- .1 Submit shop drawings, including fabrication and erection drawings, as well as list of materials used in accordance with section 01 33 00 – Submittal Procedures.
- .2 Submit erection drawings indicating 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.
- .3 Ensure that drawings submitted for connections, including all members and connection components designed by the fabricator are stamped and signed by a qualified engineer recognized by the OIQ. A letter stamped and signed by the engineer listing all drawings with applicable revisions and stating that the connections have been designed and reviewed under the engineer's guidance may be provided rather than stamping and signing each individual shop drawing.
- .4 Refer to articles 4.2 and 4.3 of CSA S16 standard for information that must be indicated on shop and erection drawings. Include locations and dimensions of the protected zones as well as a complete description of the fabrication operation that are prohibited in those zones.
- .5 If the Representative of the Ministry considers that significant or numerous revisions are required on drawings, they shall be returned without annotations to be submitted again. If more than two revisions are required to drawings, the Contractor is liable for the cost associated with any further review.
- .6 Contractor remains sole responsible for the exactness of drawings. No charge may be added for costs incurred by delays occurring due to mistakes uncovered on the Contractor's drawings on the work site, regardless of whether the drawings have been or have not been examined by the Representative of the Ministry, no charges.
- .7 Unless special authorization by Representative of the Ministry, structural steel fabrication shall not begin before approval of shop and erection drawings.

## **1.6 SAMPLES**

- .1 Submit samples in accordance with section 01 33 00 – Submittal Procedures.
- .2 Refer to architectural drawings for type of finish and approbation criteria of connections. Samples will be submitted to Representative of the Ministry for approval.

## **1.7 QUALITY CONTROL**

- .1 Submit an electronic copy of mill test reports fourteen (14) days prior to fabrication of structural steel. Include following information:
  - .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 Quebec. Reports shall state that tests were made in accordance with CSA G40.20/G40.21.

- .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.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate packaging materials for recycling, in accordance with waste management plan.
- .3 Divert unused metal products to a metal recycling facility approved by the Representative of the Ministry.
- .4 Divert unused paints material from landfill to an official hazardous material collections site as approved by the Representative of the Ministry.
- .5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

## **1.9 ACCEPTABLE MATERIALS**

- .1 Where materials are specified by trade name refer to the Instructions to Tenderers for a procedure to be followed in applying for approval of alternatives

# **2. Products**

## **2.1 MATERIALS**

- .1 Structural steel: unless otherwise indicated, use:
  - .1 W-, WT-, HP-, M- and S-sections: to ASTM A 913/A 913M or ASTM A 992/A 992M, grade 50;
  - .2 Square and rectangular hollow structural section (HSS): to ASTM A 500/A 500M class C, grade C (50 ksi);
    - .1 HSS to CSA G40.20/G40.21 350W class C or H or to ASTM A 1085 may be used **except** as braces or as beam or column acting as moment-resisting frame that are part of the seismic force resisting system (SFRS).
  - .3 Round hollow structural section (HSS): to ASTM A 500/A 500M class C, grade B (46 ksi) ou ASTM A 1085;
  - .4 Angle (L-) and channels (C-): to CSA G40.20/G40.21 300W;
  - .5 Plates 65 mm thick or less: to CSA G40.20/G40.21 350W, yield strength of 350 MPa or to ASTM A 572/A 572M grade 50 (345 MPa);

- .6 Plates 66 mm to 100 mm thick: to CSA G40.20/G40.21 300W, yield strength of 320 MPa or ASTM A 572/A 572M grade 50 (345 MPa);
- .7 Plates 101 mm to 150 mm thick: to ASTM A 572/A 572M grade 42 (290 MPa);
- .8 Plates 150 mm thick or more: to ASTM A 36/A 36M grade 36 (248 MPa).
- .2 Cold-formed steel: to ASTM A 1011/A 1011M.
- .3 Anchor rods: as indicated on drawings and as follows:
  - .1 Reinforcing bars: to CSA G30.18, grade 400W or 500W;
  - .2 Anchor rods: to ASTM A 36/A 36M;
  - .3 High strength anchor rods: to ASTM A 193/A 193M, type B7 or ASTM F 1554 grade 105.
- .4 Structural bolts: to ASTM A 325/ ASTM A 325M/ ASTM A 490/ ASTM A 490M, unless otherwise indicated. Use type 1 bolts, except for weathering steel for which type 3 bolts shall be used.
  - .1 For zinc/aluminium coated bolt, coating shall be in accordance with ASTM F 1136/F 1136M.
- .5 Nuts: to ASTM A 563 (imperial) or ASTM A 563M (metric):
  - .1 For imperial bolts, use recommended nuts to article 3.2.1 of ASTM A 325 or ASTM A 490. Nuts to ASTM A 194/A 194M Gr. 2H may be used as substitute for type 1 bolts in accordance with article 3.2.2 of ASTM A 325 or ASTM A 490.
  - .2 For metric bolts, utiliser les correspondances spécifiées à l'article 1.3 de la norme ASTM A 325M ou ASTM A 490M.
  - .3 For high-strength anchor rods, use grade D (38 mm diameter or less) or DH (more than 38 mm diameter) ASTM A 563 nuts.
- .6 Washers: to ASTM F 436 (imperial) or ASTM F 436M (metric).
- .7 Compressible washer: to ASTM F 959 (imperial) or ASTM F 959M (metric).
- .8 Tension control structural bolt, nut and washer: to ASTM F 1852 or ASTM F 2280.
- .9 Welding material: to CSA W48 and CSA W59 certified by the Canadian Welding Bureau (CWB).
  - .1 Welding material shall be in accordance to article 27.1.5.3 of CSA S16 as well where appropriate.
- .10 Hot-dipped galvanizing: as indicated, galvanized steel to ASTM A 123/A 123M.
- .11 Shear studs: to CSA W59, appendix H, type B and article 5.5.6 of this standard. Material used for studs shall be to ASTM A 108, grade 1010 to 1020 (inclusively).
- .12 Conditioner and rust remover: to CAN/CGSB 31-GP-108MA.



- .13 Zinc-rich coating:
  - .1 Use zinc-rich coating to CAN/CGSB 1.181 and ASTM A 780/A 780M containing at least 92 % of metallic zinc in dried coat, brush applied.
  - .2 Approved products such as :
    - .1 Zinc-paste 70-40 by Metaflux;
    - .2 ZRC Galvilite by Meta-Plus;
    - .3 Rust-anode by Galvatech (distributor).
    - .4 Alternative Materials: Approved by addendum in accordance with Instructions to Tenderers.

## **2.2 SHOP PAINTING**

- .1 Unpainted steel shall be used for structural steel on the interior of building not exposed to view. Take special precautions to minimize outside storage of unpainted elements. Refer to section 2.4 Storage.
- .2 The following surfaces shall not be painted:
  - .1 Surfaces to be encased in concrete.
  - .2 Surfaces to receive field installed stud shear connectors and steel decks.
  - .3 Surfaces and edges to be field welded.
  - .4 Faying surfaces of friction-type connections.
  - .5 Below grade surfaces in contact with soil.
- .3 Shop paint primer:
  - .1 To CISC/CPMA 1 and CAN/CGSB 1.105 for structural steel on the interior of building, exposed to view and without topcoat.
  - .2 To CISC/CPMA 2 and CAN/CGSB 1.40 for any other use of structural steel. Primer shall be compatible with topcoats.
- .4 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16, CAN/CSA S136, MPI INT 5.1/MPI EXT 5.1 except where members are to be encased in concrete.
- .5 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to:
  - .1 SSPC SP 2 for structural steel on the interior of building, exposed to view and without topcoat;
  - .2 SSPC SP 7 for structural steel on the interior of building, exposed to view where topcoat will be applied;
  - .3 SSPC SP 6/ NACE No 3 for structural steel on the exterior of building.
- .6 Apply one coat to steel surfaces to achieve dry film thickness of 1.5 to 2.0 mils (37 to 50 µm) for all painted steel surfaces.

- .7 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .8 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .9 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.
- .10 Unless otherwise indicated, do not apply primer on steel elements to be fireproofed. If, upon approval, primers are used, products shall be compatible with fireproofing product.

### **2.3 GALVANIZATION**

- .1 All steel in contact or that may be in contact with aluminium, even if no indication are given on drawings, shall be galvanized. All steel exposed to outside conditions shall be galvanized as well.
- .2 Galvanization of structural steel shall be hot-dip galvanizing.
- .3 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.
- .4 Minimum zinc coating thickness shall be in accordance to table 1 and 2 of ASTM A 123/A 123M. In general, zinc-coating shall be a minimum of 705 g /m<sup>2</sup>.
- .5 Realize quality control to ASTM A 123/A 123M.
- .6 Galvanized bolted elements prior to assembly.
- .7 When galvanized steel need be painted after galvanizing, surface preparation shall be in accordance with ASTM D 6386. In general, use the following method:
  - .1 Do not passivate after galvanizing;
  - .2 Use light manual sanding for surface preparation after galvanizing;
  - .3 Clean surface with a metal conditioner and rust remover;
  - .4 Rinse with pressurized clean water;
  - .5 Paint shall be applied immediately following cleaning.
- .8 When, due to delay that do not result from the actions of the Specialized Contractor, it becomes impossible to realize hot-dip galvanizing without affecting work schedule, the Contractor shall, conditional to the approval of the Representative of the Ministry, apply zinc-rich paint as described in the following articles:
  - .1 Steel shall be cleaned and prepared in accordance with SSPC SP-6 / NACE No. 3-06;
  - .2 Use zinc-rich coating in accordance with section 2.1.13. The sole method of application shall be by brush;

- .3 Apply one coat of zinc-rich paint to steel surfaces to achieve dry film thickness of at least 2.0 mils (50 µm) for all steel surfaces;
- .4 Allow a minimum of 24 hours for drying;
- .5 Apply a second coat of zinc-rich paint to steel surfaces to achieve dry film thickness of an additional 2.0 mils (50 µm) for all steel surfaces;
- .6 Allow a minimum of 24 hours prior to transporting steel;
- .7 During painting and drying, maintain dry condition and 5 degrees Celsius minimum temperature.

## **2.4 STORAGE**

- .1 Store materials off ground over wood studs or indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area as to prevent rusting.
- .2 Protect structural steel if stored over a long period.
- .3 Replace defective or damaged materials with new.

## **3. Execution**

### **3.1 GENERAL**

- .1 Structural steel work: in accordance with CSA S16 and CAN/CSA S136.
- .2 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 or both as applicable. Part of the work may be sublet to a division 3 fabricator or erector; however, the Division 1 or 2 fabricator or erector shall retain responsibility for the sublet work.
- .4 Submit certification that welded joints are qualified by Canadian Welding Bureau (CWB).
- .5 Provide to trade responsible for these works templates and steel elements to be embedded into concrete or masonry.
- .6 Ensure galvanic separation (galvanization, neoprene, other) between any steel and aluminium element.

### **3.2 FABRICATION**

- .1 Fabricate structural steel in accordance with CSA S16 and CAN/CSA S136 and in accordance with reviewed shop drawings. Structural steel shall be brand-new, free of loose mill scale, rust, oil, dirt and foreign matter.
- .2 Do not substitute members without written approval from Representative of the Ministry.
- .3 Structural bolt holes shall be drilled or punched. Do not use thermally cut holes. Fastener holes shall be made in accordance with article 28.4 of CSA S16.
- .4 Steel fabrication shall be done in accordance with CSA S16 article 28 tolerances, especially article 28.6.
- .5 Do not splice steel elements in tension or in the middle third of elements subjected to bending.
- .6 Reinforce openings so as to maintain the original strength of the element.
- .7 For all structural steel exposed to weather conditions, or where indicated on drawings, continuously seal members by continuous welds where indicated. Grind smooth.
- .8 When base plates required on drawings are thicker than 100 mm, top of plates shall be machine-cut to obtain the required flatness. Thickness on drawings is the final thickness.
- .9 Install shear studs in accordance with CSA W59. Unless otherwise indicated, use 19.1 mm diameter and 152 mm long studs.
- .10 Provide holes in top flanges. Weld threaded studs to top flanges for attachment of wood nailers.

### **3.3 CONNECTION TO EXISTING WORK**

- .1 When connecting to existing work, prior to preparing shop drawings, verify dimensions and condition of existing work, report discrepancies and potential problem areas to Representative of the Ministry for direction before commencing fabrication. Dimensions of steel elements shall be modified to adapt for the existing conditions and modifications shall be submitted to Representative of the Ministry for approval.
- .2 For plates anchored to an existing reinforced concrete or masonry element, use the following procedure, under the sole responsibility of the specialized steel contractor:
  - .1 Detect existing reinforcement bars prior to drilling to locate anchors;
  - .2 Use manual percussion drilling to drill anchor loads and protect existing reinforcement.

- .3 Measure anchor location on site after drilling prior to fabricating steel plates and adapt dimensions as needed without charge.
- .3 For plates anchored to an existing unreinforced masonry element, use diamond drilling to drill anchor as to protect the existing work. The contractor may use a different mean of drilling only if he is able to demonstrate that no damage will occur to the existing work due to drilling. If the contractor uses an alternative mean of drilling, any damage occurring to the existing work following drilling shall be automatically considered his responsibility.

### **3.4 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.

### **3.5 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CSA S16 and CAN/CSA S136 and in accordance with reviewed erection drawings.
- .2 Steel structure erection and dismantling work shall be done in accordance with Quebec's *Safety Code for the construction industry*, article 3.24 *Steel structure erection or dismantling work*.
- .3 Erection shall be done in accordance with CSA S16 article 29 tolerances, especially article 29.3.
- .4 Field cutting or altering structural members: to approval of Representative of the Ministry.
- .5 Protect galvanized steel against any damage, be it from manipulation, storage, contact with lifting equipment or others. Damaged galvanized elements due to welds, impacts, etc. shall be galvanized anew to article 2.1.7. If approved by Representative of the Ministry, surfaces may be repaired in accordance with ASTM A 780/A 780M.
- .6 Any defect shall be submitted to Representative of the Ministry as quickly as possible. Representative of the Ministry will determine corrections needed.
- .7 During erection, brace structure to ensure stability and lateral load resistance. Contractor shall use temporary bracing wherever necessary to maintain work integrity and ensure workers safety. Contractor is the sole responsible for determining erection methods and means of temporary bracing.
- .8 Once the structural steel frame has been set in place, adjusted and aligned, tighten bolts and put in place non-shrink grout under the columns as indicated on drawings.

- .9 The only mean of tightening structural bolts authorized is the turn-of-nut method. Refer to article 23.7 of CSA S16.
- .10 Twist-off structural bolts to ASTM F 1852 may be used where ASTM A 325 structural bolts are specified (or ASTM F 2280 for ASTM A 490 bolts) except for slip-critical assemblies where twist-off structural bolts shall never be used.
- .11 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

### **3.6 FIELD QUALITY CONTROL**

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Representative of the Ministry. Inspectors shall be certified as "Metal Products Inspector".
- .2 The following non-exhaustive list presents elements likely to be inspected:
  - .1 Origin of structural steel;
  - .2 Certification of the erector and welders;
  - .3 Braces connections and details: all braces assemblies will be inspected;
  - .4 Bolted connections: tension, type, diameter and grade;
  - .5 Welded connections: workmanship quality, conformity to drawings and shop drawings requirements, welding quality;
  - .6 Plumbness (verticality) of columns;
  - .7 Studs;
  - .8 Steel deck fasteners;
  - .9 General workmanship.
- .3 Origin of the steel;
  - 1. The inspection has to allow the verification of the origin of the structural steel and its conformity with the standards used as reference in this specification.
- .4 Certification of the erector and the welders:
  - 1. The inspector must validate the certifications of the erector and the welders and annexe copies of the worker's competence cards to his inspection report.
- .5 Bolted connections:
  - .1 Inspection will be done to validate respect to requirements of table 7 and 8 of CSA S16 standard.
- .6 Welded connections:
  - .1 Non-destructive testing may be done upon request by the Representative of the Ministry.

- .2 Where required, non-destructive tests shall be carried out by mean of: magnetic particle, radiography or ultrasonic testing. Representative of the Ministry will determine the method of testing.
- .7 Plumbness (verticality) of columns:
  - .1 Inspection will determine conformity to requirements of CSA S16 standard article 29.3.3.
- .8 Studs:
  - .1 Inspection of studs shall be done in accordance with article 5.5.6.6 of CSA W59 standard, except that at least one in every 100 (rather than 150) stud shall be tested.
- .9 General workmanship:
  - .1 General workmanship and conformity to drawings and specifications requirements will be reviewed. Evaluation by visual inspection will determine any non-conformity, with special attention to connections, presence of slotted holes not specifically required, presence of reinforcing members for holes and quality of coatings (paints, galvanization) including touch up.
- .10 The Contractor shall cooperate freely to allow testing by providing all the necessary assistance on site required by the testing laboratory. If an item (welding or bolted connection, column, etc.) is deemed defective by the Representative of the Ministry, another inspection will be performed on the elements immediately preceding and following the defective item. The Contractor will assume costs of additional testing. All corrective work required shall be performed, without charge, to the satisfaction of the Representative of the Ministry.
- .11 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Representative of the Ministry.
- .12 Submit test reports to Representative of the Ministry within three (3) days of completion of inspection.
- .13 Any element determined non-compliant shall be corrected and inspected again. When additional inspections are required to validate corrections on non-compliant elements, the Contractor shall assume the cost of inspection.
- .14 The Ministry will pay costs of tests.

**END OF SECTION**





## **PART 1 - GENERAL**

### **1.1 SCOPE OF WORK**

- .1 Galvanized steel railing and handrails.

### **1.2 RELATED WORK**

- .1 Concrete
  - .2 Self-Adhesive Sheet Waterproofing
  - .3 Performed metal siding
  - .4 Joint Sealants
- See engineering specifications and plans.  
Section 07 13 52.  
Section 07 46 13.  
Section 07 92 10.

### **1.3 REFERENCES**

- .1 Standards:
  - .1 CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-G164-FM92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16-09, Limit States Design of Steel Structures.
  - .4 CSA W59-F03 (C2008), Structural Welding Code - Steel.
  - .5 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
  - .6 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .7 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
  - .8 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .9 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.
  - .10 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .11 ASTM A325-10, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .12 ASTM A269-10, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .13 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes.
  - .14 "Systems and Specifications Manual, Volume 2," de Steel Structures Painting Council (SSPC).

### **1.4 SITE VISIT**

- .1 Before the start of work, the Contractor shall examine the work of other Contractors and services associated with the work as well as site conditions affecting the work of this section. It is the Contractor's responsibility to note any error or defect that could impede flawless execution of the work and to notify the Departmental Representative immediately.
- .2 Do not start work before such errors and defects have been corrected.
- .3 Start of work indicates acceptance of conditions of existing work and site conditions.

### **1.5 SHOP DRAWINGS**

- .1 Submit shop drawings, data sheets and samples.
- .2 Indicate construction details and sizes of steel profiles, and thickness of steel plate.
- .3 Submit drawings stamped and signed by professional engineer, member of the Quebec Order of Departmental Representatives, registered or licensed in province of Quebec, Canada.
- .4 Perform work in strict accordance with the shop drawings submitted to the Departmental Representative and Structural Departmental Representative for verification. Shop drawings shall indicate, in appropriate scale, dimensions, methods of assembly, installation or erection, construction details and quantities, in compliance with the architectural drawings and these technical specifications
- .5 Do not, under any circumstances, start work before shop drawings have been checked. However, verification is limited to model, shape, overall dimensions and finish of materials, and in no way relieves the Contractor of its responsibility for the accuracy of dimensions and the stability of structures.

## **1.6 STANDARDS AND DESIGN CALCULATIONS**

- .1 In general, materials, calculations and erectability conditions shall comply with the standards specified in this section. In addition, all work, calculations, assembly methods and test reports shall meet the requirements of the National Building Code, latest edition, for the structural stresses imposed and required for the intended purpose.

## **1.7 COOPERATION**

- .1 The Contractor shall cooperate closely with the other Contractors; such collaboration is essential to proper execution of the work and the Departmental Representative will not tolerate any defect in execution of the work caused by a lack of cooperation.

## **1.8 WARRANTY AND CERTIFICATE**

- .1 Prior to installation, submit purchase order for galvanization of steel structures. Include name of company, name of person responsible for galvanizing, date, project name, a note stating, "Work performed and delivered to the customer on \_\_\_\_\_," galvanization method and any other relevant technical data.
- .2 Provide a signed, written warranty in the Owner's name guaranteeing all metal structures against any defects relating to quality of materials and finishes or installation for a period of one year from date of PRELIMINARY ACCEPTANCE of the entire project.

# **PART 2 - PRODUCTS**

## **2.1 MATERIALS**

- .1 Profiles
  - .1 Smooth, serrated, ribbed and expanded metal profiles and plates as needed: to CSA G40.21-98 300W G-40-8.
- .2 Stainless steel
  - .1 ASTM-A-312, Type 304, No. 4 finish on one side, cold rolled annealed, gauge 12
  - .2 Ribbed steel or as needed.
- .3 Welding materials
  - .1 To CSA W59-1982.
- .4 Bolts and anchor bolts
  - .1 To ASTM A307-82a depending on use and expected loads.
- .5 High strength bolts
  - .1 To ASTM A325-78A.
- .6 Galvanization of steel structures
  - .1 Hot dip galvanizing with minimum zinc coating 600 g/m<sup>2</sup>, to CSA G164-FM92 (R2003) ASTM 123-59, for all non-stainless steel structures.
  - .2 Galvanization is required for all interior and exterior structures.
- .7 Shop-applied primer
  - .1 To CAN/CGSB 1-GP-40d.
- .8 Galvanizing primer
  - .1 Rich in zinc, ready mix, to CGSB 1-GP-181M.
- .9 Sulphur
  - .1 Commercial grade for installation of metal studs.
- .10 Welding
  - .1 To CSA W47, W48, W55 and W59.
- .11 Bolts

- .1 Decorative flat head, chosen by the Departmental Representative for exposed decorative elements, stairways, handrails, etc.
- .2 Galvanized steel for galvanized structures.

## **2.2 FABRICATION**

- .1 Work to be plumb, square and true-to-line, accurately sized, with close-fitted and secure joints.
- .2 Unless otherwise indicated, use steel.
- .3 Where possible, fit and shop-assemble work, ready for erection.
- .4 Exposed welds to be continuous over length of joint. File or grind exposed welds.
- .5 Use bolted connections where assemblies have to be produced in sub-modules sized to suit available galvanizing baths.
- .6 Exposed welds to be continuous, filed or ground and polished. Welds to be smooth and flush.

## **2.3 SHOP-APPLIED PRIMER**

- .1 Apply one shop coat of primer to galvanized parts.
- .2 Use unadulterated primer, as prepared by the manufacturer. Apply to dry surfaces, free from rust, scale and grease. Do not paint at temperatures below 7°C.
- .3 Clean surfaces to be field welded; do not paint.

# **PART 3 - EXECUTION**

## **3.1 MOUNTING**

- .1 Unless otherwise indicated, perform welding to CSA W59-F03 (C2008). Install structures as specified in the approved shop drawings.
- .2 Welding companies to be certified either under the provisions of Division 1, or under Section 2.1 of CSA W47.1-09 for fusion welding or CSA W55.3-F08 for resistance welding.
- .3 Provide proof that all welds are certified by Canadian Welding Bureau.
- .4 Exposed fastening devices, as specified in the drawings, to match finish and be compatible with material through which they pass or to which they are attached. The preceding indications notwithstanding, exterior anchoring devices must be protected against corrosion, hot-dip galvanized or stainless steel, type 304 or 316.

## **3.2 INSTALLATION**

- .1 Mount metalwork plumb, square and true-to-line, accurately fitted with tight joints and intersections.
- .2 Provide appropriate and acceptable anchoring devices such as dowels, clips, rods, bolts, expansion bolts and toggle bolts.
- .3 Make field connections with high strength bolts or welds, to CSA S16.1-94, CSA S16S1-1975 and CSA W59-F03 (C2008).  
Deliver to appropriate discipline items for casting into concrete or building into masonry together with setting templates.
- .5 Touch up rivets, field welds, bolts and burnt or scratched surfaces.
- .6 Favour bolt assembly to minimize field welding and prevent burns on galvanized items. Favour galvanizing following shop-assembly.
- .7 Touch-up galvanized surfaces with zinc primer where burnt by field welding.

## **3.3 PAINTED GALVANIZED STEEL RAILINGS**

- .1 Fabricate railings where required and as described in the plans (use galvanized steel for handrails).
- .2 Shop-assemble structures in sections as long as possible.
- .3 Railings: painted, Tubular galvanized steel profiles, 38 mm diameter, forming a rigid frame with vertical sections fastened to concrete landings and ramps.
- .4 Handrails: tubular, galvanized steel profiles, 38 mm diameter, fastened to walls, according to details.

- .5 For handrails installed on walls, weld to flat steel rods, 38 mm x 12 mm, welded to each other and to square steel wall plates, 90 mm x 90 mm x 6 mm. Attach plates to walls with four 6 mm diameter X 65 mm screws and lead studs (see plans for details).
- .6 See cross-sections in plans and details.

### **3.4 GENERAL INSTALLATION**

- .1 Unless otherwise indicated, all structures referred to in these specifications and shown in the plans to be shop-produced for installation on-site.

### **3.5 COORDINATION**

- .1 Coordinate production of support and anchoring systems according to the needs and constraints of the components requiring support.
- .2 See relevant sections of the specifications.

### **3.6 APPEARANCE OF GALVANIZED STEEL STRUCTURES**

- .1 Exposed galvanized steel structures visible to users of the facility to present a uniform appearance. Field touch-ups with zinc coating to be kept to a minimum.
- .2 The Departmental Representative reserves the right to refuse parts of galvanized metalwork deemed unaesthetic, touch-ups showing poor-quality workmanship at the factory and poor quality surface finishes. The Departmental Representative reserves the right to require replacement of such work.

### **3.7 CLEANING**

- .1 Clean metal work following installation to remove construction and accumulated environmental dirt.
- .2 Once installation is complete, remove surplus materials, rubbish, tools and equipment barriers.

### **END OF SECTION**