

**DIVISION 05**

**METALS**

**Part 1            General**

**1.1                DESCRIPTION**

- .1            This section specifies requirements for supply, fabrication and installation of structural steel.
- .2            The work includes design, installation and removal of any bracing or other measures necessary to ensure stability of the steel framework during construction.

**1.2                RELATED WORK**

- .1            Miscellaneous Metal - Section 05 50 00
- .2            Painting - Section 09 91 00

**1.3                REFERENCE STANDARDS**

- .1            Steel Structures for Buildings - CSA-S16.1
- .2            Welded Steel Construction (Metal Arc Welding) - CSA-W59
- .3            Structural Quality Steels - CSA-G40.21

**1.4                DESIGN**

- .1            Design in accordance with Standards in Article 1.3.
- .2            Design all the temporary systems to maintain stability of the work at all phases of construction.
- .3            Design of all members and connections not detailed on the drawings shall be detailed on a shop drawing bearing the signature and seal of a Professional Engineer registered in the Province of Manitoba.

**1.5                SUBMITTALS**

- .1            Submit certificates for the material supplied as requested by the Contract Administrator.
- .2            Submit erection diagram and shop details for review by the Contract Administrator 14 days in advance of fabrication.
- .3            Complete shop fabrication and erection drawings shall be provided for all work and items.
- .4            Provide separate layout plans and setting details for all bearing and attachment devices supplied under this section.

- .5 Shop drawings shall include details of all temporary bracing systems required for stability during construction and shall show the extent of prior work that is required to be in place for the temporary bracing system.
- .6 Bracing and stability systems as shown on drawings are for stability of the completed structure and shall not be assumed as adequate for the various stages of construction.
- .7 Before the placing of material orders, the Contractor shall submit for review by the Contract Administrator sketch drawings showing the general description of the proposed fabrication scheme. This shall include the general arrangement of plates or shapes, the location of all shop and field splices and such other information as may be required by the Contract Administrator to permit an assessment of the acceptability of the proposal.
- .8 Shop drawings showing all details shall be prepared by the Contractor and submitted for review by the Contract Administrator prior to fabrication. Refer to Section 01 33 00 – Submittals.
- .9 Fabrication executed before review of the shop drawings shall be at the Contractor's own risk.
- .10 In addition to specific details, the shop drawings must include the following items:
  - .1 Drawings showing details of connections designed by the Contractor.
  - .2 All dimensions shall be correct at 20°C unless otherwise shown.
  - .3 Weld procedure identification shall be shown on the shop details.
  - .4 All material splice locations shall be shown on the drawings.

## **1.6 QUALITY CONTROL**

- .1 Refer to Section 01 45 00 – Quality Control.

## **Part 2 Products**

### **2.1 STRUCTURAL STEEL**

- .1 Unless noted otherwise, steel to conform to the following.
- .2 Wide flange sections: to CSA-G40.21-350 W.
- .3 Hollow Structural Sections: to CSA-G40.21-350W Class C.
- .4 Other Steel Sections and Plate: to CSA-G40.21-300W.

### **2.2 BOLTS**

- .1 Bolts: to ASTM-A325.
- .2 Anchor bolts: to ASTM-F1554, Grade36
- .3 Nuts: to ASTM A563.

.4 Washers: to ASTM F436.

.5 Studs: to ASTM A108.

### **2.3 WELDING**

.1 All welding material: to CSA-W59.

### **2.4 PRIMER**

.1 Shop paint primer to CGSB-1-GP-140 Red Lead, Iron Oxide, Oil Alkyd Type, unless specified in Section 09 91 00 - Painting.

### **2.5 HOT DIP GALVANIZING**

.1 To CSA-G164.

## **Part 3 Execution**

### **3.1 INSPECTION**

- .1 Notify the Contract Administrator in advance as required to allow inspection of fabrication (including welding) and erection.
- .2 Provide access to allow inspection of fit, welding, bolting and other aspects of the work.

### **3.2 SURFACE PREPARATION, PRIMING AND PAINTING**

- .1 Blastcleaning: Unless otherwise noted, all steel components shall be sandblast cleaned after fabrication in accordance with the Steel Structures Painting Council Standard (SSPC) No. SP6. Essentially this is a surface from which all oil, grease, dirt, rust, scale and foreign matter have been completely removed except for slight shadows, streaks, or discolorations caused by rust stain or mill scale oxide binder.
- .2 Painting: In accordance with Section 09 91 00.
- .3 Splice areas and areas in contact with concrete shall be blastcleaned but not painted and shall be kept free from overspray.
- .4 Application Conditions: In accordance with Section 09 91 00. Application of primer or paint must be at temperature of not less than 5°C for a period of not less than 12 hours to dry the paint. During primer application and curing, all necessary means shall be provided to assure that the members are protected against the effects of the weather. Primer shall not be applied upon damp or frosted surfaces.

### **3.3 FABRICATION**

- .1 Take field measurements as necessary to ensure that items fabricated in the shop will fit the structure.

- .2 Reinforce hanger holes or openings for pipes or ducts with steel plates sized and welded in place to restore member to original design strength.
- .3 Provide holes for attachment of other work only after obtaining Contract Administrator's approval.

### **3.4 WELDING**

- .1 Shop Qualifications: The Contractor shall be fully approved by the Canadian Welding Bureau (CWB) as per CSA-W47.1. Welding procedures shall be submitted for each type of weld used in the structure. The procedures shall bear the approval of the Canadian Welding bureau and must also be approved by the Contract Administrator prior to use on the structure.
- .2 Welder Qualifications: Only welders, welding operators and tackers approved by the Canadian Welding Bureau in the particular category may be permitted to perform weldments. Their qualifications must be current and be available for examination by the Contract Administrator.
- .3 Welding Code: Except as otherwise noted on the drawings, all welding, cutting and preparation shall be in accordance with the CSA-W59.
- .4 Cleaning: All weld areas must be clean and free of mill scale, dirt, grease, paint, etc., prior to welding.
- .5 Preheat material and enclose heated enclosures as required for all field welding or cutting to maintain the steel at temperatures above 10°C.
- .6 Filler Metals: Low hydrogen filler, fluxes and low hydrogen welding practices are to be used throughout. The low hydrogen covering and flux shall be protected and stored as specified by CSA-W59.
- .7 Automatic Welding Process: All flanges and web butt joints and all stiffener to web fillet welds shall be made by an approved semi or fully automatic submerged arc process. All webs to flange fillet welds shall be made by an approved fully automatic submerged process. These weld areas must be clean, free of mill scale, dirt, grease, etc., and be preheated as required, just prior to welding.
- .8 Tack and Temporary Welds: Tack and temporary welds are not allowed unless they are to be incorporated in the final weld.
- .9 Methods of Weld Repair: Repair procedures for unsatisfactory welds must be submitted for approval by the Contract Administrator prior to work commencing.
- .10 Arch Strikes: Arch strikes shall not be permitted. In the event of accidental arc strikes, the Contractor shall submit to the Contract Administrator for approval his/her proposed repair procedure. The repair procedure shall include the complete grinding out of the crater produced by the arc strike. These areas shall be examined by the Contract Administrator to ensure complete removal of the metal in the affected area.

- .11 Grinding of Welds: Welds at web members to chord members shall be ground flush in all locations exposed to view. All other welds ground to CSA-W59.

### **3.5 MATERIAL SPLICES**

- .1 Additional splices, other than those shown on the details, will require approval of the Contract Administrator. The Contractor shall bear the cost of inspection of these splices.

### **3.6 HANDLING AND STORAGE**

- .1 All lifting and handling shall be done using devices that do not mark damage, or distort the assemblies or members in any way. Girders shall be stored upright, supported on sufficient skids and safely shored to maintain the proper section without buckling, twisting or in any damage or misalign the material.

### **3.7 APPROVAL OF ERECTION SCHEME**

- .1 Before starting the work of erection, the Contractor shall inform the Contract Administrator fully in writing as to the method of erection he/she proposes to follow and the amount and character of equipment he/she proposes to use which shall be subject to the approval of the Contract Administrator. The Contract Administrator's approval shall not be considered as relieving the Contractor of the responsibility for the safety of his/her methods or equipment, nor from carrying out the work in full accordance with the plans and specifications. No work shall be done until such approval by the Contract Administrator has been obtained.
- .2 Erect to CSA-S16.1.
- .3 Touch up prime painting for complete coverage including all field connections.
- .4 Provide details of blocking for bearings, where necessary to restrain movements due to horizontal forces and/or gravity effects.
- .5 Provide details of grouting procedures including design mix and aggregate gradation of grout, or specifications for other materials, proposed for setting anchor bolts and/or constructing grout pads. Non-metallic non-shrink grout shall be used.
- .6 Carry out field measurements of the constructed substructure.
- .7 Bearing and Anchorage:
  - .1 Bearing plates shall not be placed upon bearing areas which are improperly finished, deformed, or irregular.
  - .2 Bearing plates shall be set level and in exact position.
  - .3 The Contractor shall accurately set anchor bolts, except where bolts are cast into concrete; he/she shall coordinate correct locations.
  - .4 When bearings are employed in conjunction with grout pockets in the substructure, bearings shall be set accurately on steel shims and grouted as detailed on the drawings after erection has been completed.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 03 30 00 - Cast-In-Place Concrete: setting inserts and anchors in concrete.
- .3 Section 04 05 00 - Common Work Results for Masonry: installation of steel lintels.
- .4 Section 05 12 00 - Structural Steel
- .5 Section 09 91 00 - Painting: field painting.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .3 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .4 ASTM A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .5 ASTM F1554, Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40, Anti-corrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-1.108, Bituminous Solvent Type Paint.
  - .3 CAN/CGSB-1.181, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA)
  - .1 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16.1, Limit States Design of Steel Structures.
  - .4 CSA W48 Series, Electrodes for Welding
  - .5 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .4 The Society for Protective Coatings (SSPC)
  - .1 SSPC Painting Manual, Volume 2, Systems and Specifications.
- .5 National Building Code of Canada (NBC)
- .6 Workplace Safety and Health Act and Regulations.
  - .1 Manitoba Regulation 217.

**1.3 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: indicate materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories. Indicate field measurements on shop drawings.

- .3 Submit shop drawing bearing stamp of a qualified professional engineer registered in Canada Province of Manitoba for:
  - .1 Metal ladders.
  - .2 Railings and guardrails.
  - .3 Additional items requested by Contract Administrator.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.
- .2 Steel pipe: to ASTM A53/A53M, Type S, Grade B, weight class and finish as specified by item, of sizes indicated.
- .3 Metal bar grating: to ANSI/NAAMM, as specified by item.
- .4 Safety grip ladder rungs: 13 gauge rolled steel channel with raise lug safety grip, 2 hole design, (32 mm (1.25") wide, fabricated of 13 gauge rolled steel, hot dip galvanized.
- .5 Stainless steel plates, sheet and strip: to ASTM A167, ASTM A240/A240M, Type 304 with AISI No.4 finish unless otherwise indicated.
- .6 Stainless steel tubing: to ASTM A269, Type 304 seamless welded of sizes indicated. Finish #180-grit polish equivalent to AISI No 4 finish, of diameters indicated, wall thickness 1.6 mm minimum.
- .7 Welding materials: to CSA W59.
- .8 Welding electrodes: to CSA W48 Series.
- .9 Bolts, washers and nuts: to ASTM A325.
- .10 Anchor bolts: to CAN/CSA-G40.20/G40.21, Grade 300W
- .11 Exposed fasteners: of same material, colour and finish as the metal to which applied, unless indicated otherwise.
- .12 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.
- .13 Epoxy grout: multi-component epoxy grout with high bond strength for anchoring bolts, pipes, base plates in concrete and masonry.

### **2.2 DESIGN CRITERIA**

- .1 Details and specifications are intended to indicate the general character and extent of metal fabrications and do not attempt to indicate all methods of construction.
- .2 Fabricate and install metal fabrications to withstand all stresses encountered in normal use. Unless specified or noted otherwise, all imposed live loads shall be in accordance with NBC.
- .3 Fabricate and install metal ladders in accordance with Manitoba Regulation 217, Part 13 - Entrances, Exits, Stairways and Ladders.

### **2.3 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

- .3 Where possible fit work and shop assemble ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .5 Remove and grind smooth burrs, filings, sharp protrusions, and other projections from metal fabrications to prevent possible injury. Correct dangerous or potentially harmful installations.

## **2.4 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with minimum zinc coating 600 g/m<sup>2</sup> (2.0 oz/ft<sup>2</sup>) to CAN/CSA-G164.
- .2 Shop coat primer: to CAN/CGSB-1.40.
- .3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .4 Bituminous paint: to CAN/CGSB-1.108.

## **2.5 SHOP PAINTING**

- .1 Clean surfaces in accordance with SSPC Painting Manual, Volume 2, minimum SP6.
- .2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, or grease. Do not paint when temperature is lower than 7°C.
- .4 Clean surfaces to be field welded; do not paint.

## **2.6 ANGLE LINTELS**

- .1 Steel angles: of sizes indicated for openings, hot dip galvanized. Provide minimum 150 mm bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles indicated.

## **2.7 STEEL PIPE RAILINGS**

- .1 Steel pipe: standard weight, galvanized for exterior, black for interior, of diameters indicated.
- .2 Formed to shapes and sizes indicated. Return pipe railing to walls at terminations.
- .3 Box open ends of railings with half-round welded cap.
- .4 Provide wall brackets at maximum 1200 mm on centre and not more than 300 mm from ends and corners.
- .5 Galvanize exterior railings after fabrication.
- .6 Prime paint interior railings after fabrication.

## **Part 3 Execution**

### **3.1 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork in accordance with reviewed shop drawings, square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

- .3 Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Secure wall mounted items securely and rigidly in place as follows:
  - .1 Stud walls: screws into solid backing. Do not use toggle bolts for stud walls.
  - .2 Hollow masonry: toggle bolts.
  - .3 Solid masonry, concrete, and stone: bolts and expansion anchors.
- .5 Grout under base plates with non-shrink grout.
- .6 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .7 Provide components for building by other sections in accordance with shop drawings and schedule.
- .8 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .9 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .10 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .11 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .12 Touch-up galvanized surfaces with zinc primer where scratched, ground off, or burned by field welding.

### **3.2 PIPE RAILINGS**

- .1 Install railings where indicated. Weld connections where assembled in sections. Grind welds smooth and make inconspicuous in final assembly. Remove burrs, weld spatter and other defects.
- .2 Install railings in accordance with following methods:
  - .1 Set railing standards in preformed holes in concrete. Grout with epoxy grout. Trowel surface smooth and flush with adjacent surfaces.
  - .2 Weld railing standards to base plates embedded in concrete. Continuously weld post to plate to seal joint.
  - .3 Bolt base plates to concrete with expansion anchors, bolts and lock washers. Fill under base plates with non-shrink grout to level uneven surfaces.
  - .4 Set railing standards over pipe sleeves embedded in concrete. Secure standards to pipe sleeves with through bolt or welding.
- .3 Provide removable railing sections where indicated.

**END OF SECTION**