

**PART - 1 GENERAL**

**1.1 SUMMARY**

.1 Section Includes:

.1 Labour, Products, equipment and services necessary to complete the work of this Section.

**1.2 REFERENCES**

.1 ASTM A53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

.2 ASTM A307: Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

.3 ASTM A325M: High-Strength Bolts for Structural Steel Joints

.4 ASTM A653/A653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

.5 ASTM F436: Hardened Steel Washers (for Use with High Strength Bolts)

.6 CSA-G40.20/G40.21-M: General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

.7 CAN/CGSB-1.181: Ready Mixed Organic Zinc Rich Coating

.8 CAN/CSA G164-M: Hot Dip Galvanizing of Irregularly Shaped Articles

.9 CAN/CSA-S16.1: Limit States Design of Steel Structures

.10 CSA W47.1: Certification of Companies for Fusion Welding of Steel Structures

.11 CSA W48 Series: Electrodes

.12 CSA W59-M: Welded Steel Construction (Metal Arc Welding)

.13 CSA-W117.2: Safety in Welding, Cutting and Allied Processes

.14 CGSB 85-GP-16M: Painting Galvanized Steel

.15 CISC/CPMA 2.75: Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association "A Quick-Drying Primer for Use on Structural Steel"

.16 CISC: Canadian Institute of Steel Construction, "Code of Standard Practice"

.17 SSPC: Steel Structures Painting Council, "Steel Structures Painting Manual, Vol. 2"

**1.3 SUBMITTALS**

.1 Shop Drawings

.1 Submit shop drawings for each item showing:

.1 Product and material identification, thicknesses, gauges, finishes.

.2 Dimensions and jointing details.

.3 Cuts and drilled holes.

.4 Anchorage and securement systems.

.5 Interfaces with the work of other Sections.

.2 Where structural or miscellaneous metal shapes and sizes, including shapes and sizes of hangers, bracing and anchors, are indicated on Architectural drawings it is the responsibility of the Metal Fabrications Subcontractor's structural engineer to

review these shapes and sizes and confirm that they are adequate to support the loads anticipated. Consult with the Consultant regarding loading allowed by building structure. Subcontractor's structural engineer shall stamp and sign each shop drawing ensuring that the assemblies are provided in accordance with the engineer's design.

- .3 Clearly show and describe all items; sections, dimensions, erection details, anchors and fastenings, connection and jointing details.
- .4 Clearly indicate any deviation from the specifications or drawings.
- .2 Test Reports: Provide certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.
- .4 Samples: Duplicate samples of 300 mm square sheet, 300 mm long members of each finished metal work. Show each combination of mechanical and chemical treatments to be used on alloy. Prepare samples on metal of same alloy and gauge to be used for work. Show typical welds, fasteners, screws, mitres, and anticipated joints for compatible finish.

#### 1.4 **QUALITY ASSURANCE**

- .1 Employ a professional structural engineer registered in the province of Place of the Work to review components and supporting systems for the Work of this Section requiring structural performance, to be responsible for determining sizes, joint spacing to allow thermal movement, and loading of components in accordance with applicable codes and regulations, and to consult with the Project structural Consultant regarding loading allowed by building structure.
- .2 It is imperative that the Metal Fabrications Subcontractor's structural engineer review and coordinate shop drawings with respective Subcontractors specified to ensure proper interface of Work between both Subcontracts.
- .3 Employ welding operators licensed per CSA W47.1 for types of welding required by the Work.

#### 1.5 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, covered storage locations. Do not load areas beyond the designed limits.
- .2 Handle and store metal materials at job site in a manner to prevent damage to other materials, to existing buildings or property.
- .3 Handle components with care, and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.
- .4 Use strippable coatings or wrappings to protect exposed surfaces of prefinished metal work which does not receive site finishing. Use materials recommended by finishers or manufacturers of metals, to ensure that method is sufficiently protective, easily removed, and harmless to the finish.
- .5 Prevent the formation of wet storage stain on galvanized articles by complying with the following measures:
  - .1 Stack articles or bundle to allow air between the galvanized surfaces during transport from supplier. Load materials in such a manner that continuous drainage could occur.

- .2 Raise articles from the ground and separate with strip spacers to provide free access of air to most parts of the surface. Incline in a manner which will allow continuous drainage. Do not lay galvanized steel on cinders, clinkers, wet soil or decaying vegetation.
  - .3 Handle galvanized articles in such a manner as to avoid any mechanical damage and to prevent distortion.
  - .6 Tag metal fabrications, including associated anchor bolts, sleeves, and bases, or otherwise mark for ease of identification at project site.
- 1.6 **COORDINATION**
- .1 Supply to other Sections, materials requiring setting and/or building-in in concrete, masonry or other trades. This includes inserts, anchors, frames, sleeves, etc. Verify locations of said materials.
- 1.7 **PROJECT CONDITIONS**
- .1 Field Measurements: Take measurements at the building to assure proper fitting, fabrication, and erection of the work. Check dimensions in the field, whether or not shown, upon which the accurate fitting together and building-in of the metal fabrication work may depend or which affects the proper installation of the work of others.
- PART - 2 PRODUCTS**
- 2.1 **MATERIALS**
- .1 Metals - General: free from defects which impair strength or durability, or which are visible; new, of best quality and free from rust, waves or buckles, and clean, straight throughout entire length, of sharply defined profiles and true in web and flange.
  - .2 Steel - General:
    - .1 Structural Shapes, Plates: New material conforming to CSA-G40.20/G40.21-M, Grade 350W for W and H shapes, and Grade 300W for other shapes, and plates.
    - .2 Hollow Structural Sections: New material conforming to CSA-G40.20/G40.21-M Grade 350W, Class H.
    - .3 Steel Pipe: Conforming to ASTM A53, Type "S", bare, Schedule 40, Grade A steel pipe.
  - .3 Stainless Steel - General
    - .1 Stainless Steel Shapes: to ASTM A276, Type 304 for interior use; to AISI No. 4 (2B) finish.
    - .2 Stainless Steel Plate: to ASTM A167, Type 304 for interior use; to AISI No. 4 (2B) finish.
    - .3 Stainless Steel Sheet: to ASTM A167, Type 304 for interior use; to AISI No. 4 (2B) finish.
    - .4 Stainless Steel Fasteners: Type 304 or Type 316 to suit
  - .4 Galvanizing, steel shapes: CSA G164 Table 1, hot dip galvanized and passivated after fabrication of individual components.
  - .5 Galvanizing, sheet steel: commercial quality to ASTM A653/A653M, Grade A, with zinc coating designation Z275, minimized spangle, in accordance with CSSBI Technical Bulletin No. 6. Galvanized sheets temper rolled and unpassivated zinc coating where required to receive paint or other applied finish.

- .6 Slotted Channel Framing: Cold-formed metal box channels (struts), complying with MFMA-4.
  - .1 Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with Z275 (G90) coating; minimum 1.6mm (0.064") nominal thickness.
  - .2 Size of Channels: As indicated.
- .7 Welding Materials: Conforming to CSA W48.1-M and CSA W59-M.
- .8 High Strength Bolts with Bolts, Nuts and Washers (for structural connections): Conforming to ASTM A325M with each type and size of bolt and nut sourced from same manufacture and of same lot. Use hot dipped galvanized where used in exterior connections or in unheated areas inside the building.
  - .1 Bolts: Heavy, hexagon head high strength structural bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
  - .2 Nuts: Heavy hexagon semi-finished nuts.
  - .3 Washers: Flat and smooth hardened washers, quenched and tempered per ASTM F436.
- .9 Common or Ordinary Bolts and Anchor Bolts (for general applications): Unfinished bolts conforming with ASTM A307, Grade A, with hexagon heads and nuts where exposed in the finish work. Use hot dipped galvanized where used in exterior connections or in unheated areas inside the building.
  - .1 Common bolts: of lengths required to suit thickness of material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
  - .2 Anchor bolts: of lengths noted, but projecting not less than 13 mm beyond nut unless otherwise noted.
- .10 Galvanized Primer: Zinc rich conforming to CAN/CGSB-1.181 for new galvanized metal in compliance with CGSB 85-GP-16M. For galvanized fabrications touch-up to remain unpainted in finished work, use W.R. Meadows of Canada Ltd. "Galvafruid" or Kerry Industries "Z.R.C." or Niagara Paint Inc. "PL052898" zinc rich coating.

## 2.2 **FABRICATION**

- .1 Fabricate the work true to dimensions, square, plumb and level. Joints and intersecting members shall be accurately fitted with adequate fastenings.
- .2 Finished work shall be free from distortion and defects detrimental to appearance and performance.
- .3 Unless otherwise specified, noted or approved, all connections shall be welded.
- .4 Where not possible connections shall be bolted or secured in an approved manner. Exposed fastenings shall be countersunk, bolts cut off flush with nuts and made as inconspicuous as possible. Exposed fastenings where approved shall be of the same material, colour and finishes as the base metal on which they occur.
- .5 Shop and field connections shall comply with CSA S16.
- .6 Connections to structural steel members shall be welded. No bolting or drilling of holes shall be done unless approved in writing by the Consultant.
- .7 Fabricate items that are to be built into masonry or concrete and deliver to project site for setting; furnish items complete with bolts, anchors, clips, etc., ready to set. Furnish, completely install and connect other items. Erect items to proper lines and levels, plumb and true, and in correct relation to adjoining work. Secure parts in a rigid and substantial manner using concealed connections where practicable.

- .8 Where necessary to secure work to the structure by means of expansion bolts, cinch anchors, and similar connections, lay out the work and install such connections, install the work and bolt up, unless otherwise noted.
- .9 Provide bolts, shims, blocks, nuts, washers, wedging pieces, etc., required for complete installation, unless otherwise noted.
- .10 Drill field holes for bolts or rivets. Do not burn holes.
- .11 Furnish fitting-up bolts, drift pins, other tools and equipment and do necessary reaming of unfair holes found in field connections. New holes or enlargement of unfair holes by use of cutting torch is cause for rejection of the entire member. Replacement shall be made at Contractor's expense.
- .12 Mill joints to a tight, hairline fit; cope or miter corners. Form joints exposed to weather to exclude water.
- .13 Remove burrs from all exposed cut edges.
- .14 Accurately cut, machine and fit joints so that finished work presents a neat appearance.
- .15 Assemble members without twists or open joints.
- .16 Drill properly sized holes for connecting the work of other trades where such can be determined prior to fabrication. Where possible, show such holes on shop drawings. Place holes so not to cause an appreciable reduction in strength of member.
- .17 Metal members shall be isolated where necessary in an approved manner to prevent corrosion due to metal to metal contact, or contact between masonry and concrete and metal.

### 2.3 **WELDING**

- .1 Execute welding to avoid damage or distortion to the Work. Should there be, in the opinion of Consultant or Inspection and Testing company, doubt as to adequacy of welds, such welds shall be tested for efficiency and any work not meeting specified Standards shall be removed and replaced with new work satisfactory to Consultant. Execute welding in accordance with the following standards:
  - .1 CSA W48: for Electrodes. If rods are used, only coated rods are allowed.
  - .2 CSA W59: for design of connections and workmanship.
  - .3 CAN/CSA-W117.2: for safety.
- .2 Welding shall be done by a fabricator fully approved by the Canadian Welding Bureau under the requirements of CSA W47.1.
- .3 Thoroughly clean welded joints and expose steel for a sufficient space to perform welding operations. Neatly finish welds. Where exposed to view and finish painted, apply weld continuously and grind to a uniformly smooth finish.

### 2.4 **GALVANIZING**

- .1 Unless otherwise specified galvanize exterior ferrous metals including members exposed to exterior elements when in final location; members embedded on the exterior side of exterior walls; members built into roof construction; members imbedded in concrete; members specified in this Section or noted on Drawings.
- .2 Hot-dip galvanize steel, in accordance with CSA G164 coating weight as prescribed for type of article, or ASTM A525M coating weight of 380 g/sq.m. as applicable. Galvanize after fabrication where possible. Follow recommended precautions to avoid embrittlement of the base metal by overpickling, overheating or during galvanizing.

- .3 Perform hot dip galvanizing after fabrication. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with galvanize primer in accordance with manufacturer's printed directions.
- .4 Where the specification requires that material be zinc-coated it shall be zinc-coated after fabrication and in accordance with CGSB1-GP-181M (or) 1-GP-183M.
- .5 Wet Storage Stain: Remove wet storage stain that may have developed in the coating before installation so that premature failure of the coating does not occur. Remove wet storage stain in accordance with galvanizer's recommendations.
- .6 Repair of Galvanized Items: Repair coatings damaged by welding, cutting, or during handling, transport or erection using cold galvanizing compound specified, and as follows:
  - .1 Ensure surface is clean, dry, and free of oil, grease and corrosion.
  - .2 Power clean surface to near white metal condition, extending into undamaged galvanized coating.
  - .3 Apply touch up material to a dry film thickness of 0.203 mm (8 mils) minimum. If touched up work is to remain exposed in the finished work, apply a finish coat of aluminum paint to provide a colour blend with the surrounding galvanizing.
  - .4 Coating shall be continuous, adherent, as smooth and evenly distributed.

2.5 **FINISHES**

- .1 Where stainless steel is specified in subsequent articles of this section it shall have an AISI No. 4 finish, unless another finish is specified in the particular article.

**PART - 3 EXECUTION**

3.1 **EXAMINATION**

- .1 Examine substrate surfaces to receive the work of this Section and ensure that work done as part of the work of other Sections is complete and that there are no conditions which will adversely affect the performance of this work.
- .2 Verify the accuracy and alignment of structural framing to which work of this Section is connected.
- .3 Do not proceed with work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of surfaces and conditions.

3.2 **ERECTION**

- .1 Fit joints and intersecting members accurately. Make work in true planes with adequate fastenings. Build and erect work plumb, true, square, straight, level and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.
- .2 Fit door frames and jambs with temporary steel spreaders to prevent springing frames and jambs out of shape.
- .3 Weld as specified herein.
- .4 Take adequate care to prevent damage to any material such as weld burns, etc.
- .5 Include all cutting and patching of masonry walls where necessary. Obtain Contractor's approval of cut-outs in advance.
- .6 Insulate where necessary to prevent electrolysis due to dissimilar metal to metal contact, or metal to masonry and concrete. Use bituminous paint, butyl tape, building paper or other approved means.

- .7 Install materials in a good and workmanlike manner, cleaning and grinding all welding laitance and touching up primer where necessary.

### 3.3 **CONNECTIONS**

- .1 Weld or high strength bolt main member connections. Use CISC double angle header connections wherever possible. High strength bolted connections shall be bearing type using 19mm dia. bolts conforming to ASTM A325M. Secondary members may be bolted with machine bolts.
- .2 Perform high tensile bolted connections in accordance with CSA-S16.1. Accurately space holes of size 1.6 mm larger than the nominal diameter of the bolt. Install bearing type high tensile bolted connections unless shown otherwise on Drawings. Provide compressor or electrical equipment capable of supplying and maintaining required pressure at the wrench. Make connections without the use of erection bolts, some high tensile bolts will serve that purpose. Prevent nuts on bolts, except high tensile bolts, from becoming loose by burring bolt thread, by welding or by lock washers or lock nuts.
- .3 Execute welding as specified under shop welding in Part 2 and as follows:
  - .1 Provide continuous welds on exterior work to provide proper weathering.
  - .2 Take necessary safety precautions in accordance with CSA Standards when welding is carried out in cold weather.

### 3.4 **FIELD TOUCH-UP**

- .1 Paint bolt heads, washers, nuts, field welds and previously un-primed items. Touch up shop primer damaged during transit and installation with material to match shop primer or galvanize coating.
- .2 Clean off dirt on installed miscellaneous metal surfaces.

### 3.5 **SCHEDULE OF METAL FABRICATION ITEMS**

- .1 General
  - .1 Provide metal fabrication items specified herein and items not indicated to be supplied under other Sections.
  - .2 Refer to drawings for details of metal fabrication work and related items not specifically listed in this Section.
  - .3 Where work is required to be built into work of other Sections supply such members to respective Sections.
  - .4 Provide anchor bolts and expansion bolts or other means of anchorage required for building into floors, walls and ceilings, where it is necessary to secure metal and wood to concrete, masonry or steel work. Supply anchor bolts, nuts and similar hardware to the respective Sections for fastening.
- .2 Steel Sections
  - .1 Supply and install steel sections which are:
    - .1 Not shown on structural drawings.
    - .2 Shown in outline, but not identified on structural drawings.
    - .3 Not noted on drawings to be supplied by another section.
    - .4 Not specified to be supplied under another section.

- .2 Cutting of these steel sections in the field shall be done under this section and as directed. The cost of field cutting shall be borne by the trades requiring such cutting.
  - .3 Where sections are required to be built into masonry or concrete, supply such members to respective trades.
  - .4 This work shall include, without being limited to -
    - .1 Steel struts to support suspended lead shielding
    - .2 Steel posts to counters.
  - .3 **Stainless Steel Items**
    - .1 Supply and install stainless steel items indicated on drawings, complete with fastenings and other incidentals required and as detailed. Refer to 'Materials' articles for alloy.
    - .2 Stainless steel finish: as specified under 'Finishes' article of this section, unless specified otherwise below.
  - .4 **Concealed support elements and framing**
    - .1 Construct concealed support elements and framing from rolled steel sections assembled by welding.
    - .2 Design work to withstand, within acceptable deflection limitations, their own weight, the weight of the items to be supported, loads imposed by the motion of supported items, where applicable, and all live loads, static and dynamic which might be applied to the supported items in the course of their normal function. Design supports with a safety factor of 3. Design supports further as required to accommodate structural deflection.
    - .3 Provide accessories, inserts and fixings necessary for attachment of supports to building structure. Drill supports to receive attachment of supported items. Arrange supports to avoid conflicts with pipes, ducts, pre-cast concrete connections, thermal and air/vapour barrier construction, framing provided under other Sections, and such that supports and their fixings are fully concealed from view within the finished work.
    - .4 Paint all supports unless galvanizing is specified.
  - .5 **Steel Frames for Miscellaneous Openings**
    - .1 Connections: Connect built-up members of frames by means of plug welding. Miter or cope and join members with continuous welding beads.
- 3.6 **RECONSTRUCTION, ALTERATIONS AND MAKING GOOD**
- .1 Do all re-construction, alterations, fitting, patching and making good of the existing building and to join new work to existing.

END OF SECTION