

PART 1 GENERAL

1.1 REFERENCES

- .1 American Association of State and Highway Transportation Officials (AASHTO)
 - .1 AASHTO M 300-03(2017), Standard Specification for Inorganic Zinc-Rich Primer.
- .2 ASTM International (ASTM)
 - .1 ASTM A53/A53M 12, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
 - .2 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A153/A153M-16A, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM A307 14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .5 ASTM A780/A780M-09(R2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .6 ASTM F3125/F3125M-15A, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- .3 Canadian Institute of Steel Construction (CISC)
 - .1 Code of Standard Practice for Structural Steel, 2010.
 - .2 Guide for Specifying Architecturally Exposed Steel, 2nd Edition.
 - .3 Handbook of Steel Construction - 11th Edition.
 - .4 Limit States Design in Structural Steel, 9th Edition.
 - .5 Steel Fabrication Quality Systems Guideline, 2nd Edition with Commentary.
- .4 CSA Group (CSA)
 - .1 CAN/CSA G40.20/G40.21 13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16-14, Design of steel structures, Includes Update No. 1 (2010), Update No. 2 (2010), Update No. 3 (2013).
 - .3 CSA W47.1-09 (R2014), Certification of companies for fusion welding of steel.
 - .4 CSA W48-14, Filler metals and allied materials for metal arc welding.
 - .5 CSA W55.3-08(R2013), Certification of companies for resistance welding of steel and aluminum.
 - .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
 - .7 CSA W178.2-14, Certification of Welding Inspectors.
- .5 National Association of Architectural Metal Manufacturers (NAAMM)
 - .1 NAAMM AMP 555-92, Code of Standard Practice for the Architectural Metal Industry.).

- .6 National Ornamental & Miscellaneous Metals Association (NOMMA)
 - .1 NOMMA Guideline 1: Joint Finishes, 1994.

1.2 ITEMS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 Supply following products for installation under other Sections:
 - .1 Anchor bolts, bearing plates, sleeves and other inserts to be built into concrete and masonry elements and required for anchorage and support of fabricated steel components.
 - .2 Fabricated steel components to be built into concrete and masonry.
- .2 Supply instructions and templates as required for accurate setting of inserts and components.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Division 01: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
- .2 Submit shop drawings in accordance with Division 01: Submittal Procedures:
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
 - .2 For items where design is delegated to fabricator, provide shop drawings signed and sealed by Professional Engineer licenced to practice in Province of Nova Scotia who responsible for the design.

1.4 QUALITY ASSURANCE

- .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 555.
- .4 Perform Work to the highest standard of modern shop and field practice, by personnel experienced in this Work. Accurately fit joints and intersecting members in true planes with adequate fastening. Build and erect the Work plumb, true, square, straight, level, accurate to the sizes shown, and free from distortion or defects.
- .5 Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- .6 Welding: Qualify procedures and personnel according to the following:
 - .1 Welders shall be qualified by Canadian Welding Bureau for classification of work being performed.
 - .2 The fabricator shall be certified to CSA W47.1, Division 1 or 2.1.
 - .3 Welding shall be inspected by inspectors certified to inspection to CSA W178.2.
 - .4 Resistance welding: to CSA W55.3.

.5 Fusion welding: to CSA W59.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Exercise due care in storing, handling and erecting all materials and support all materials properly at all times so that no piece will be bent, twisted or otherwise damage structurally or visibly.
- .2 Correct damaged material and where the Departmental Representative deems damage irreparable, replace the affected items at no additional expense to the Departmental Representative.
- .3 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed.
- .4 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

1.6 JOB CONDITIONS

- .1 Coordinate this Work with the remainder of the Work and exercise the necessary scheduling to ensure that all Work is carried out and all items incorporated during the appropriate construction phase.
- .2 Provide instructions and drawings to other trades for setting bearing plates, anchors bolts, and other members that are built in to work of other trades.
- .3 Protect other Sections of the Work from damage by this Section of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA G40.20/G40.21, Grade 300W.
- .2 Hollow structural sections: to CAN/CSA G40.20/G40.21, Grade 350W, Class C.
- .3 Steel pipe: to ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads, galvanized finish.
- .4 Steel tubing: to ASTM A500, shapes and configuration as indicated, 6 mm wall thickness unless another thickness is indicated or required by structural loads, galvanized finish.
- .5 Floor Plate: Steel safety plate meeting ASTM A786, 5 mm thickness, checkered pattern 45° to edge of steel plate, raised 28 mm x 8 mm elongated pips at 90° to each other, 22 mm offset x 45 mm on centre.
- .6 Welding materials: to CSA W59.
- .7 Welding electrodes: to CSA W48 Series.

- .8 Stainless steel fasteners, washers and nuts: to ASTM F593, type 316 austenitic stainless steel, sized as required for purpose intended, or as otherwise indicated. Cold Finished Materials: Condition B, cold worked, to ASTM A276. Exposed Fasteners: Stainless steel countersunk screws or bolts, consistent with design intent.
 - .1 Anchors shall be fabricated from stainless steel with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing to ASTM E488.
- .9 Steel fasteners: bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws, and machine bolts.
 - .1 Unfinished fasteners: In areas not exposed to public, use unfinished bolts conforming to ASTM A307, Grade A, with hexagon heads and nuts. Supply bolts of lengths required to suit the thickness of the material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
 - .2 Finished fasteners:
 - .1 In areas exposed to public use, bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts to be hot dip galvanized in accordance with ASTM A153/A153M.
 - .2 Structural bolts: to ASTM F3125.
- .10 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours; \geq 40 MPa at 28 days.
- .11 Miscellaneous Fabrications for Pumphouse:
 - .1 Posts (Schedule 40), 1370 mm long, 48 mm O.D., and eye hooks welded to posts for attachment of chains; assemblies hot dipped galvanized after fabrication. Supply in quantity required.
 - .2 Sleeves: fabricate of minimum 3 mm thick steel, open at top, capped at bottom, at least 200 mm deep unless otherwise shown, and sized to provide 8 mm grout space around perimeter of insert; hot dipped galvanized after fabrication. Supply in quantity required.
 - .3 Hot dipped galvanized landscape chain, links 6.35 mm (1/4-inch) diameter. Supply chain as required with quick release links at either end for attachment to eye hooks; quick release links to match diameter of chain and be hot dipped galvanized. Supply in quantity required.
 - .4 Steel angles as indicated, hot dipped galvanized after fabrication.
 - .5 Cover Plate: steel safety plate (checker plate) pit covers as indicated, hot dipped galvanized after fabrication; include two recessed steel rings for manual removal of cover plate to permit access to each pit. Supply in quantities required, complete with gas tight gasket at full perimeter of pit.
 - .6 Supply SAE type 316L fasteners and bolts as required to suit general design concept and job conditions.
 - .7 All exposed steel to be prime coated and finish painted safety yellow with a commercial grade metal paint after fabrication and galvanizing.

2.2 FABRICATION

- .1 Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
 - .1 Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss. Temperature change (Range): 100 deg F (38 deg C).
- .3 Shear and punch metals cleanly and accurately. Remove burrs.
- .4 Ease exposed edges to a radius of approximately 0.794 mm (1/32 inch), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- .5 Remove sharp or rough areas on exposed traffic surfaces.
- .6 Weld corners and seams continuously to comply with American Welding Society (AWS) recommendations, and the following:
 - .1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - .2 Obtain fusion without undercut or overlap.
 - .3 Remove welding flux immediately.
 - .4 At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- .7 Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- .8 Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- .9 Shop Assembly: preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- .10 Cut, reinforce, drill and tap miscellaneous metalwork as indicated to receive finish hardware, screws, and similar items.
- .11 Ensure exposed welds are continuous for length of each joint.

- .12 Grind or file exposed welds and steel sections smooth and flush with adjacent surfaces. Weld locations not to be visible after application of paint finishes.
- .13 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- .14 Accurately form connections with exposed faces flush; mitres and joints tight.
- .15 Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- .16 All welding is to be performed by CWB Certified Welders.
- .17 Welded joints: Finish #1, to NOMMA Guideline 1: Joint Finishes.

2.3 MISCELLANEOUS FABRICATIONS

- .1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.
- .2 Sleeves:
 - .1 Supply pipe sleeves to respective trade for building in. Where required install pipe sleeves as they pass through walls, floors and ceilings.
 - .2 Size sleeves to clear insulated surfaces, pipes and conduits with 13 mm minimum, unless noted otherwise.
 - .3 Terminate sleeves flush with surfaces of walls and ceiling and extend 38 mm above floors, unless noted otherwise.
 - .4 Seal and make waterproof and watertight sleeves of type suitable for application after installation of conduit or conductors.
 - .5 For sleeves, other than waterproofed sleeves seal or pack void between sleeve and pipe, conduit, or penetrations in accordance with ULC requirements for hourly rating of surface being penetrated.
- .3 Anchors and Fastening:
 - .1 Provide all anchor bolts and expansion bolts or other means of anchorage required for building into floors, walls and ceilings, where necessary to secure metal and wood to concrete, masonry or steel work, other than anchorages specified under other Sections. Fasten all components and items securely. Provide adequate reinforcing to ensure safe rigid installation. Set anchor bolts in locations indicated and spaced as shown or, if not shown, as may be required for properly securing Work.
 - .2 Use weld studs of size not larger than 10 mm for attaching miscellaneous materials and equipment to building steel. If weight of item requires larger fasteners use clips or brackets and secure by welding or through bolting.

- .3 Use self-drilling expansion type concrete anchors for attaching to masonry and concrete.
- .4 Do not secure items to steel deck.
- .5 Use steel beam clamps of 2 bolt design to transmit load to beam web. Do not use 'C' and 'I' clamps.
- .4 Inserts and Hangers:
 - .1 Install inserts, hangers, and supports. Make inserts drilled lug or expansion type.
 - .2 Before openings are cut through structure, obtain Departmental Representative's written acceptance for procedures, locations and reinforcements required.
 - .3 Do not weld hangers to structural steel members or burn holes in structural steel.
 - .4 Do not suspend items from steel decking.
- .5 Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitred joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- .6 Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
- .7 Miscellaneous Steel Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination for assembly and installation with other work.

2.4 ROUGH HARDWARE

- .1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.

2.5 FINISHES

- .1 Prior to applying primer or other finishes, clean metal to equivalent of commercial sand blast SSPC SP6, remove sandblast in residue.
- .2 Galvanizing: hot-dip method with minimum zinc coating of 705 g/m² conforming to ASTM A123 for fabricated assemblies. ASTM A153/A153M for all hardware (average zinc coating of 381 g/m²).
 - .1 Hot-dip-galvanize all exterior metal fabrications and metal fabrications incorporated into the exterior wall and roof assemblies; hot-dip-galvanize after fabrication.
- .3 Touch-up galvanized surfaces with zinc rich coating, to ASTM A780: DOD-P-21035 zinc rich paint, minimum DFT 8 mils.
- .4 Galvanized primer: one-component, ready-mixed zinc rich primer, to AASHTO-M-300 or DOD-P-21035.

- .5 Isolation Coating: Apply an isolation coating to contact surfaces in contact with cementitious materials, wood materials and dissimilar metals.
- .6 Shop coat primer: to CAN/CGSB-1.40.
- .7 Finish paint finishes: to Section 09 91 00 - Painting, colours as determined by Departmental Representative.

2.6 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.7 SHOP PAINTING

- .1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2, minimum SSPC SP6.
- .2 Apply two coats of primer of different colours to parts inaccessible after final assembly.
- .3 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, and grease. Do not paint when temperature is below 7 degrees C.
- .4 Do not paint surfaces to be field welded.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Check and verify that no irregularities exist that would affect quality of execution of work specified.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

- .1 Install Work in accordance with manufacturer's or fabricator's (as applicable) written instructions, job-specific details, and Drawings.
- .2 Do welding work in accordance with CSA W59 unless specified otherwise.
- .3 Supply finished items to be built in to those trades along with instructions for proper installation.

- .4 Apply architectural metalwork using hidden mechanical fasteners. Installation shall be by skilled Architectural metalworkers experienced in highest quality work.
- .5 Fasteners to draw adjoining sections together in proper, true alignment, and are capable of field adjustment.
- .6 All fasteners, mountings to be non-loosening and installed so that they will be hidden at completion.
- .7 Install all Work to true, straight lines, accurate to profile, all properly aligned.
- .8 Isolate dissimilar metals in a manner approved by the Departmental Representative to prevent electrolytic action or corrosion.
- .9 Install finish hardware supplied under other Sections required for completion of components of this Section.
- .10 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .11 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .12 Make field connections with high tensile bolts to CSA S16 and weld to prevent loosening.
- .13 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .14 Touch up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .15 Repair galvanized areas damaged by welding, flame cutting or during handling, transport or erection in accordance with ASTM A780. Touch up with organic zinc rich paint to DOD-P-21035 zinc rich paint, minimum DFT 8 mils.

3.3 MISCELLANEOUS ITEMS

- .1 Supply and install miscellaneous metal fabrications as indicated or specified, or as otherwise required in accordance with the design intent of the project.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: Cleaning. Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

3.6 SCHEDULE

- .1 The schedule given hereunder shall not be considered to represent a complete schedule of all metal fabrications required in the Work. Thorough scrutiny of the complete Contract Documents is required to obtain a complete schedule of metal fabrications required in the Work.
- .2 Include miscellaneous framing and supports that are not included under work indicated on structural drawings.
- .3 Provide the following metal fabrications:
 - .1 Steel angle at perimeter of louvres.
 - .2 Miscellaneous sleeves, fastenings, anchors, inserts, hangers and supports for mechanical installations.
 - .3 Miscellaneous steel angles, plates, and lintels required but not included on structural Drawings.
 - .4 Miscellaneous metal fabrications, components and parts for pumphouse as indicated.
 - .5 Other metal fabrications indicated and not specifically covered in other Sections.

END OF SECTION