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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 13, 2009 | Modified ‘Related Section’ and approved suppliers |
| 3 | March 15, 2011 | Minor changes from Legal |
| 4 | April 18,2011 | Modified “2.1 Approved Suppliers” |
| 5 | June 5, 2012 | Added References and Replacement Parts Sections |
| 6 | July 3, 2012 | Reformatted to Remove White Space |
| 7 | April 22, 2015 | General formatting |
| 8 | April 8, 2016 | Phase 1 Update (AV) |
| 9 | February 1, 2017 | Corrected typos (AV) |
| 10 | February 15, 2017 | Updated standards. Revised the listed manufacturers. Performance specification and standards were added to those products in which all named manufacturers were removed. (AV) |

NOTE:

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**The on-line copy is the current version of the document.**

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## Related Sections

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 05120 – Structural Steel

#### Section 05502 – Metal Fabrications – Structural.

#### Section 05503 – Metal Fabrications – Mechanical

#### Section 05510 – Metal Stairs

#### Section 05512 – Metal Handrails

#### Section 09900 – Painting and Protective Coatings

#### Section 09960 – Interior and Exterior Coating of Steel Water Tanks and Appurtenances

#### Section 11700 – Elevated Water Storage Tank

## References

### Comply with the latest edition of the following statutes codes and standards and all amendments thereto.

#### ANSI/ASME B36.10M-2015, Welded and Seamless Wrought Steel Pipe.

#### ANSI/NAAMM MBG 531-09, Metal Bar Grating Manual.

#### American Society for Testing and Materials (ASTM)

##### ASTM A1008/A1008M-21, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, Bake Hardenable.

##### ASTM A1011/A1011M-18a, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

##### ASTM A123/A123M-17 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel products

##### ASTM A153/A153M-16a; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

##### ASTM A193/A193M-20; Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

##### ASTM A194/A194M-20a; Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

##### ASTM A307-21; Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

##### ASTM A312/A312M-21; Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

##### ASTM F3125/F3125M-19e2, 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.

##### ASTM A36/A36M-19; Standard Specification for Carbon Structural Steel.

##### ASTM A48/A48M-03(2021); Standard Specification for Gray Iron Castings.

##### ASTM A511/A511M-20, Standard Specification for Seamless Stainless Steel Mechanical Tubing.

##### ASTM A53/A53M-20; Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

##### ASTM A563-15/ A563M-21a, Standard Specification for Carbon and Alloy Steel Nuts.

##### ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

##### ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

##### ASTM A743/A743M-21, Standard Specification for Castings, Iron-Chromium, Iron-Chromium- Nickel, Corrosion Resistant for General Application.

##### ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

##### ASTM B209-21, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

##### ASTM B211-19, Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.

##### ASTM B221-20, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

##### ASTM B241/B241M-16, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

##### ASTM B26/B26M-18e1, Standard Specification for Aluminum-Alloy Sand Castings.

##### ASTM B316/B316M-20, Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.

##### ASTM B468-10 (2020), Standard Specification for Welded UNS N08020 Alloy Tubes.

##### ASTM B632/B632M-18, Standard Specification for Aluminum-Alloy Rolled Tread Plate.

##### ASTM B766-86(2015),Standard Specification for Electrodeposited Coatings of Cadmium.

##### ASTM C1107/C1107M-20, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

##### ASTM F1136/F1136M-11(2019), Standard Specification for Zinc/Aluminum Corrosion Protective Coating for Fasteners.

##### ASTM F436/F436M-19, Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

##### ASTM F467-13(2018), Standard Specification for Nonferrous Nuts for General Use.

##### ASTM F468-16,Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.

#### Canadian Standards Association (CSA)

##### CAN/CSA G40.21/G40.21-13 General Requirements for rolled or welded structural quality steel/ Structural quality steel.

##### CAN/CSA S157-17); Strength Design in Aluminum.

##### CAN/CSA S16-14, Design of Steel Structures.

##### CAN/CSA W47.1-19; Certification of Companies for Fusion Welding of Steel.

##### CAN/CSA W47.2-11 (R2015); Certification of Companies for Fusion Welding of Aluminum.

##### CAN/CSA W55.3-08 (R2018); Certification of Companies for Resistance Welding of Steel and Aluminum.

##### CAN/CSA W59.2-M1991-18; Welded Aluminum Construction.

##### CAN/CSA W59-13 UP4; Welded Steel Construction (Metal Arc Welding).

#### CISC/CPMA 2 75, A Quick-drying Primer for Use on Structural Steel.

#### Ontario Building Code (2012) including all subsequent amendment to-date

#### The Society for Protective Coatings

##### SSPC SP1, Solvent Cleaning Design Requirements

#### American Architectural Manufacturers Association (AAMA)

##### AAMA 2605; Voluntary Specification Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

## Measurement and Payment

### All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

## Design Requirements

### Design miscellaneous metal items in accordance with above referenced standards for the loadings as required by the Ontario Building Code.

### Design Work covered of this Section, which will support other items or will be required to support structural loads of any nature, should be carried out by a Professional Structural Engineer. Affix professional seal and signature to shop drawings for such items. Provide Building Code Identification Number (BCIN)

### Design connections and splices using high strength bolts or welds. Use bearing type bolts for bolted connections.

### Design structural steel connections for the moments, shears and axial loads in accordance with CAN/CSA S16 requirements for Simple construction. Design connection for greater than half the shear capacity of the member unless indicated otherwise.

### Design End connections and/or splices in bracing members for the full axial compression strength of the member or 50% of tensile strength, the most stringent shall govern.

### Where no end reaction is indicated, design connection on basis of simple connection (unless indicated otherwise) for the end reaction of a laterally supported beam of a given span under a uniformly distributed factored load that has attained its maximum moment capacity in accordance with Standard Shear Connection published by Canadian Institute of Steel Construction(CISC).

### Design connections for hollow structural sections to develop the full strength of member in tension or compression.

### Unless design loads are indicated, design splices for the full strength of the member in bending, shear and axial load.

### Unless design loads are indicated, design end connections and/or splices in bracing members for the full axial strength of the member.

### Where overlapping or contacting surfaces cannot be avoided, completely seal weld these surfaces. Where there is any evidence of rusting or deterioration of finish in such areas, carry out remedial seal welding and refinishing.

### Design aluminum work to CAN/CSA S157-05 (R2015) and CAN/CSA W59.2-M1991 (R2013).

### Design equipment, anchorage and support systems for vertical, lateral and environmental loading in accordance with the Ontario Building Code.

## Submittals

### Shop Drawings: Submit shop drawings before fabrication commences for each metal fabrication item, showing in large scale fabrication details, thickness, anchors, location, dimensions erection details, connections and jointing details and finishes.

### Submit a welding procedure specification for each type of material.

### Submit sample of aluminium railing including a welded joint to the Consultant for acceptance, Commence fabrication only after acceptance has been obtained.

### Samples: Submit two samples of each finish.

### Submit written certification from a Professional Engineer stating that support systems, anchorage and equipment have been designed according to the requirements of OBC for post-disaster structures.

## Quality Assurance

### Ensure that workmanship is of the highest quality throughout by employing only metal workers that have demonstrated the highest skills in this type of work and qualified welders certified to weld the materials used in fabrication of the miscellaneous metals.

### Welding Procedure for Steel and Stainless Steel:

#### Submit certification that the companies which will be welding structural steel and stainless steel are CSA accepted.

#### Comply with CSA W47.1-11 and W59-13.

### Welding Procedure for Aluminum:

#### Submit certification that companies which will be welding aluminum are CSA accepted.

#### Comply with CSA W47.2-11, W59-13 and CSA W59.2-M1991 (R2013).

## Delivery, Storage and Handling

### Provide a protective coating on all stainless steel and aluminum items.

### Coordinate deliveries with construction schedule and arrange ahead for off the ground, covered storage locations.

### Handle and store materials at job site to prevent damage to other materials, existing buildings, structure, finishes or property.

### 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 removable coatings or wrappings to protect exposed surfaces of pre-finished metal work which does not receive site finishing. Use materials recommended by finishers or manufacturers to ensure that method is sufficiently protective, easily removed and harmless to the finish.

### Prevent the formation of wet storage stain on galvanized members with the following measures:

#### Stack members or bundle to allow air between the galvanized surfaces during transport from supplier. Load materials in position so that continuous drainage can occur.

#### Raise members 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.

#### Handle galvanized members in such a manner as to avoid any mechanical damage and to prevent distortion.

## Coordination

### Supply to concrete, masonry and/or 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 these materials on site before fabrication and erection.

## Warranty

### Submit a 5-year warranty to commence on the date of Total Performance of the work for prefinished aluminum work against defects in materials and workmanship including but not limited to fading or non uniformity of colour, cracking, peeling or other corrosion.

# PRODUCTS

## Materials

### Where anchors, lifting hooks, screws, bolts, nuts, washers, hangers and other fasteners are not specifically shown or specified in the Contract Documents, provide such items with at least the strength and corrosion resistance properties of the metal fabrication for which they are required.

### Structural Steel and Loose Lintels: CSA G40.21/G40.21-13, Grade 400W.

### Structural Steel for Hollow Sections: CSA G40.21/G40.21-13, Grade 350W, Class H.

### Steel - General Purpose: ASTM A36/A36M-14 Table 1 Material Specifications

### Steel anchors, studs, taps and bolts: ASTM A307-14, Grade B carbon steel.

### Cast Iron: ASTM A48/A48M-03(2016) Class 30, grey galvanized steel.

### Galvanized steel sheet: ASTM A653/A653M-20 , Z275 zinc coating class.

### Hot rolled steel sheet: ASTM A1011/A1011M-18a.

### Cold rolled steel sheet: ASTM A1008/A1008M-21.

### Steel Pipe: ASTM A53/A53M-12 Type S Grade A or ANSI/ASME B36.10M-2015.

### Neoprene: Premium grade Durometer A 40.

### Fasteners: ASTM F1136/F1136M-11, galvanized.

### Stainless Steel: Alloy 304.

| Item | ASTM | UNS Designations |
| --- | --- | --- |
| Structural | A666-15 | S30400 |
| Architectural | A666-15 | S30400 or S31600 |
| Plates, Sheets and Strips | \* | S30400 or S30403 |
|  |  |  |
|  |  | Grade |
| Fasteners | \*, F1136-11, | B8A |
|  | A193-16, A194-16a |  |
| Castings | A743-13ae1 | CF-8M |
| Tubing | A511-16 | MT-304 or |
|  | A511-16 | MT304L |
|  |  |  |

### Aluminum:

|  |  |  |
| --- | --- | --- |
| Item | ASTM | UNS Designations |
| Extruded Shapes - Structural | B211-12e1 | A96351-T6 |
| Extruded Shapes - Architectural | B221-12e1 | A96063-T6 |
| Smooth Plates and Sheets | B209-14 | A93003-H16 |
| Checkered or Tread Plates | B632M-15 | A96061-T6 |
| Gratings | B221-14 | A96061-T6 |
| Rivets | B316M-15 | A96061-T6 |
| Castings | B26M-14e1 | A03560-T6 or A05350-F |
| Tubing & Pipe | B241M-16 | A96061-T6 |
| Fasteners - Bolts | F468-16 | A96061-T6 |
| - Nuts | F467-13e2 | A96061-T6 |
|  |  |  |

### Primer: In accordance with CISC/CPMA 2-75a unless otherwise required for finish coating under Section 09900 – Painting and Protective Coatings and Section 09960 - Interior and Exterior Coating of Steel Water Tanks and Appurtenances.

### Isolation coating: quick drying asphalt utility enamel.

### Zinc rich primer:

#### In accordance with CAN/CGSB-1.181 Ready-Mixed Organic Zinc-Rich Coating

## Finishes

### Rough Edges and Mill Scale:

#### Following completion of fabrication of any item, grind rough edges straight and finish smooth. Remove mill scale and rust.

### Electrolytic Corrosion:

#### Back-paint any metal surfaces which are to come into contact with dissimilar metal or concrete or masonry, with bituminous paint, 1.0 mm (40 mil) DFT minimum.

#### Paint galvanized metal surfaces to be in contact with or encased in concrete with rust inhibitive epoxy coating. Prepare surfaces in accordance with SSPC SP1, apply paint to 125 microns DFT.

### Aluminum:

#### Restore aluminum to its original mill finish after fabrication. Buff and brighten exposed aluminum surfaces, which have been damaged during construction.

#### Where aluminum is intended to be in contact with either dissimilar metals, concrete, or masonry, paint the surfaces to be in such contact with aluminum coloured bituminous paint.

#### Use anodizing quality aluminum where anodizing is required.

### Carbon Steel:

#### Where carbon steel is intended to be exposed to atmospheric conditions or sewage, hot dip galvanizes the metal fabrications.

#### Where carbon steel is intended to be in contact with either concrete, brick or mortar, hot dip galvanizes the surfaces to be in such contact.

### Galvanizing:

#### Hot-dip galvanize items after fabrication. Galvanize all steel scheduled for exposure to exterior conditions or corrosive materials.

#### Clean surfaces which are to be galvanized of slag and impurities immediately before being galvanized or cadmium plated.

#### Where specified or detailed in the Contract Documents, galvanize plates and other structural shapes in accordance with ASTM A123/A123M-15. Where fabrications are too large to be hot dipped, employ zinc metalizing.

### Repair of Damaged Galvanized Surfaces:

#### Repair hot dip galvanized coatings damaged by welding, cutting, rough handling during shipping or erection or otherwise, in accordance with ASTM A780/A780M-09(2015) using organic zinc rich primer. The dry film thickness on repairs shall exceed the original coating thickness by 25 percent.

### Cadmium – Plating:

#### Clean surfaces which are to be cadmium plated, of slag and impurities immediately before being cadmium plated.

#### Where specified or detailed, cadmium plate metal fabrications and fasteners in accordance with ASTM B766-86(2015). Use coating thickness on threaded articles equivalent to Type TS. For surfaces other than threaded areas provide coating thickness equivalent to Type NS.

### Shop Finishes:

#### Aluminum finish: Where shop finishing is specified or indicated, after fabrication or forming, prepare surfaces, shop prime, and factory finish in accordance with AAMA 2605-05. The finishing material shall be a fluoropolymer coating with a minimum of 70% PVDR resin, by weight, for the colour and clear coats. Shop finishing: Performed by an accepted applicator. Minimum dry film thickness – 30 microns (1.2 mil).

#### After installation, touch up shop finished surfaces damaged during construction.

### Anodized finish: Anodizing Architectural Class I Anodic Coating 0.018 mm (0.7 mil) thickness, one hour coating 215 RI (AA C22A41 clear) preceded by a caustic etch.

### Stainless Steel:

#### Remove all rust and post-weld discolouration from stainless steel by grinding, using only stainless steel tools.

#### Passivate stainless steel, which was cleaned by grinding, with a solution of 12-15 percent nitric acid and 3 percent hydroflouric acid.

#### Finishes: No. 4 finish XL Blend S

### Steel Finish:

#### Where shop finishing is specified or indicated, after fabrication or forming, prepare surfaces, shop prime, and factory finish.

#### Shop finishing: Performed by an accepted applicator. Minimum dry film thickness – 30 microns (1.2 mil).

#### Colour: To later selection.

#### After installation, touch-up any shop finished surfaces damaged during construction.

## Anchors And Fasteners

### Anchors, Studs, Taps and Machine Bolts:

#### For structural connections at platforms, support frames and similar items, use ASTM F3125/F3125M-15a carbon steel bolts.

#### Where such structural connections will be normally exposed to atmospheric conditions use ASTM F3125/F3125M-15a carbon steel bolts hot-dip galvanized in accordance with ASTM A153/A153M-16a.

#### Unless otherwise specified or detailed use hot dip galvanized or stainless steel anchors and fasteners.

#### Railing anchors for side mounted railing on concrete stair: length to meet design requirements adhesive set anchors by Hilti Ltd. or Approved Equivalent.

#### Use corrosion resistant fasteners of stainless steel or aluminum for corrosion resistant items to be fastened.

### Nuts: In accordance with ASTM A563-15 and the recommended nut grade and style listed in Appendix X1, Table X1 thereof. Where connections will be normally exposed to atmospheric conditions use Grade C3 or DH3.

### Washers: Bolted connections hardened steel washers conforming to ASTM F436/F436M-16. Hot dip galvanized washers with galvanized or cadmium plated bolts.

### Bolts or Studs Used as Anchors: 75mm x 75mm x 10 mm steel plate welded to the bolt head or stud.

### Grout:

#### Meets ASTM C1107/C1107M-14a Grade Classification C.

#### 28-day compressive strength of at least [50 MPa].

### Drilled anchors:

#### Hilti Ltd.; stainless steel HVA, HSL, Kwik bolts as indicated in the Contract Documents

#### Approved Equivalent

### Anchor grout for submerged and exterior conditions:

#### Hilti Ltd.; Epoxy acrylate resin HVA

#### Or Equivalent

## Fabrication General

### Where possible, verify dimensions on Site before preparing shop drawings or proceeding with shop work. Fit and shop assemble insofar as possible various sections of the Work and deliver to the Site in the largest practical sections.

### The general dimensions and details of the metal fabrications are shown on the Contract Documents where practical. Such details and dimensions are suggested concepts for design.

### Contractor shall assume responsibility for the correctness of the actual detailed dimensions used in fabrication and carefully check the same, by field measurement.

### Variations from suggested details are subject to acceptance in writing by the Consultant. Such acceptance does not in any way relieve the Contractor from any of its responsibilities referred to above .

### Wherever overlapping or contacting surfaces cannot be avoided, completely seal weld these surfaces. Rusting or deterioration of finish in such areas will require remedial seal welding and refinishing.

### Fabricate the Work true to dimensions and square. Accurately fit members with hairline joints, and join using adequate fastening.

### Construct finished Work free from any distortion and defects which may be detrimental to appearance and performance.

### Stainless steel grain direction: One direction throughout.

### File or grind exposed welds smooth and flush. Finish to match adjacent surface finish. Do not leave grinding marks. Construct internal and external corners with sharp lines. Provide continuous welds unless otherwise accepted by the Consultant in writing. Brighten and buff aluminum and stainless steel welds to match appearance of the adjacent surface.

#### Remove weld spatter and slag. After finish grinding and smoothening welds, passivate welds with pickling paste.

#### Preheat members thicker than 19 mm before welding.

### Weld aluminum in accordance with CAN/CSA W47.2-11.

#### Use weld rod No. 5356 for clear anodized aluminum of 6063 T5 alloy.

### Fabricate metal Work complete with components required for anchoring to concrete; bolting or welding to structural steel frames; standing free; or resting in frames or sockets, in a safe and secure manner.

### Countersink exposed fastenings, where such are accepted in writing, and make as inconspicuous as possible with bolts cut off flush with nuts. Construct fastenings of the same material and finish as the base material on which they occur.

# EXECUTION

## Installation General

### Install the Work of this Section using skilled craftspeople and in accordance with the manufacturer's recommendations where applicable.

### Install metal fabrications in the correct locations and positions, plumb, level, structurally sound, securely fastened, free from defects detrimental to finished appearance and to acceptance of the Consultant.

### Perform all drilling of steel, concrete or masonry to fasten the Work of this Section.

### For aluminum and stainless steel items, and exterior locations, use stainless steel anchors.

### After installation, spot prime bolt heads and nuts, field rivets, field welds and any abrasions or damage to the shop coat of primer.

### Touch up galvanized steel where galvanizing is damaged during installation with zinc rich primer as specified in subsection 2.2.6.

### Apply isolation coating to surfaces between dissimilar metals, and between metal and concrete, mortar, grout or masonry.

### Where items are specified to be installed under other Sections, fabricate items and provide to the appropriate forces or Subcontractor(s) with the necessary instructions and templates required for their proper installation. Include required fastenings, such as screws, bolts, expansion shields and similar items.

### Tolerances: In accordance with CAN/CSA S16-14.

### Deliver items to be cast into concrete with instructions for setting.

## Installation – Anchors and Fasteners

### Arrange bolts with sufficient length to embed 100 mm in the structural floor slab and to project the threaded position a minimum of 50 mm above the proposed elevation of the base plate or mounting plate.

### Set anchor bolts accurately in holes in concrete using plywood templates prepared from the manufacturer's shop drawings. Set items in grout. Use anchor grout for submerged and exterior conditions.

### Do not offset bolts by deformation.

### Secure lateral support units for masonry walls at 600 mm o.c.

### For submerged conditions where bolts are used, use lock nuts or nuts with a lock washer.

**END OF SECTION**