SECTION 05 05 23

WELDING-QUALITY ASSURANCE

PART 1 GENERAL

1.1 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. Canadian Standard Association CSA:
      a. W47.1, Certification of Companies for Fusion Welding of Steel.
      b. W47.2, Certification of Companies for Fusion Welding of Aluminum.
      c. W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum
      d. W59, Welded Steel Construction (Metal Arc Welding).
      e. W59.2, Welded Aluminum Construction.
      f. W178.2, Certification of Welding Inspectors.
      g. W186, Welding of Reinforcing Bar in Reinforced Concrete Construction.
   2. American Welding Society (AWS):
      a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
      b. A3.0, Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermal Spraying.
      c. D1.1, Structural Welding Code – Steel.
      d. D1.6, Structural Welding Code – Stainless Steel.
      e. QC1, Specification for AWS Certification of Welding Inspectors.
   3. American Society of Mechanical Engineers (ASME):
      a. BPVC SECTION IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators Welding and Brazing Qualifications.

1.2 DEFINITIONS

A. Class W47.1 welding positions flat (F) horizontal (H); vertical (V) overhead (O).

B. CJP: Complete Joint Penetration.

C. CWB: Canadian Welding Bureau.

D. CWI: Certified Welding Inspector.

E. GTSM: Gauge to Sound Metal.

F. MT: Magnetic Particle Testing.

G. NDE: Nondestructive Examination.

H. NDT: Nondestructive Testing.

I. PJP: Partial Joint Penetration.

J. PQR: Procedure Qualification Record.

K. PT: Liquid Penetrant Testing.

L. RT: Radiographic Testing.

M. UT: Ultrasonic Testing.

N. VT: Visual Testing.

O. WPQ: Welding Personnel Performance Qualification.

P. WPS: Welding Procedure Specification.

Q. WPDS: Welding Procedure Data Sheets.

R. WQR: Welder Qualification Record.

S. Contractor's inspection:

T. Verification Inspection:

1.3 SUBMITTALS

A. Shop and Field Drawings:
   1. Welding Data (Shop and Field):
      a. Show on a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tail of welding symbol.
      b. Distinguish between shop and field welds.
      c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
      d. Fillet weld symbols shall show fillet size and length.
      e. Groove weld symbols shall indicate CJP or PJP or GTSM in the tail of the symbol, as applicable.
      f. For pipe fittings, provide a joint weld beveling diagram.
      g. Welding and NDE symbols shall be in accordance with AWS A2.4.
      h. Welding terms and definitions shall be in accordance with AWS A3.0.
      i. Submit welding data together with Shop Drawings as a complete package.

B. Informational Submittals:
   1. When CAN/CSA applies, WPS's and related WPDS's shall be submitted for all joints prequalified in accordance with W59. Similar documentation is required for non prequalified joints accompanied by PQR's for the non-prequalified joints. All such documentation shall be affixed with the CWB acceptance stamp.

2. When AWS applies, WPS's standard formats shall be submitted for all prequalified and non prequalified joints. In addition, PQR's shall be submitted for non-prequalified joints.
3. When the BPVC applies, WPS's and PQR's shall be submitted in accordance with ASME SECT. IX approved by the authority having jurisdiction.
4. When CAN/CSA W55.3 applies, documentation of resistance welded joint qualification accepted by the CWB shall be submitted.

1.4 QUALIFICATIONS

A. Structural fabricators and erectors shall be certified in accordance with CAN/CSA W47.1-03 and/or W47.2.

B. BPVC fabricators shall be qualified in accordance with ASME Section IX.

C. Welding personnel shall be qualified in accordance with the appropriate codes – CAN/CSA W47.1 or W47.2; AWS D1.1; D1.2; D1.6; ASME Section IX.

D. CWI shall be qualified in accordance with CAN/CSA W178.2 or AWS QC1 and shall have prior experience with the welding codes specified.

E. Non-destructive inspection personnel shall be qualified in accordance with the appropriate CAN/CGSB requirements or NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.5 SEQUENCING AND SCHEDULING

A. Unless otherwise specified, all Submittals required in this Section shall be submitted and approved prior to commencement of welding operations.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 GENERAL

A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

3.2 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

A. Contractor's Inspection Criteria:
   1. Selection of Welds to be Tested: Unless 100 percent NDT is specified herein, as agreed upon between Contract Administrator and Contractor.
   2. Unless otherwise specified, perform NDT of welds at a frequency as shown in the attached NDT table in accordance with the referenced welding codes. Perform UT on CJP groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply.

B. Weld Acceptance criteria for Contractor's inspection shall be based on the acceptance criteria as per the governing welding codes listed in the NDT table.

3.3 SOURCE AND FIELD QUALITY CONTROL

A. Contractor Inspection:
   1. The W178.2 (or QC1-96) CWI, employed by the Contractor, shall be present whenever shop or field welding is to be performed. The CWI shall perform inspection prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in referenced welding codes and as follows:
      a. Verifying conformance of specified job material and proper storage.
      b. Monitoring conformance with approved WPS.
      c. Monitoring conformance of WPQ.
      d. Inspecting weld joint fit-up and in-process inspection.
      e. Providing 100 percent visual inspection of all welds.
      f. Supervising nondestructive testing personnel and evaluating test results.
      g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

B. Verification Inspection:
   1. An independent testing agency will be retained by the City to perform verification inspection and testing of welds.

3.4 WELD DEFECT REPAIR

A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

B. Repair and retest rejected weld defects to meet the design, plans and specifications.

C. Retesting shall be performed with the same NDT method used for initial tests and to the same frequency of testing.

3.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification.
   1. Welding and Nondestructive Testing Table.

END OF SECTION

WELDING AND NONDESTRUCTIVE TESTING						
Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
03 21 00 Reinforcing Steel	CAN/CSA W186, Welding of Reinforced Bar in Reinforced Concrete Construction	Yes	Yes	Yes	No	100% MT of all rebar splices; see Section 03 21 00
03 40 00 Precast Concrete	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding)and CAN/CSA W186, Welding of Reinforced Bar in Reinforced Concrete Construction	Yes	Yes	Yes	Yes	100% VT; see Section 03 40 00
05 12 00 Structural Steel Framing	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding)	Yes	Yes	Yes	Yes	10% UT or RT of all groove-and-butt joint welds; 10% MT of all fillet welds; see Section 05 12 00
05 50 00 Metal Fabrications (Basic)	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding)or CAN/CSA W59.2, Welded Aluminum Construction	No	No	Yes	No	100% VT; see Section 05 50 00
05 52 00 Aluminum Guards and Handrails	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding) or CAN/CSA W59.2, Welded Aluminum Construction	No	No	No	No	100% VT; see Section 05 52 00

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 GENERAL

A. Requirements for the 66 kV Substation, refer to Section 05 12 00-01, Structural Steel Framing.

1.2 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. Canadian Standard Association (CSA):
      a. CAN/CSA-G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
      b. CAN/CSA-S16 Design of Steel Structures.
   2. Canadian Institute of Steel Construction (CISC):
      a. Code of Standard Practice for Structural Steel.
      b. Handbook of Steel Construction
      c. Standardized Shear Connections.
   3. ASTM International (ASTM):
      a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Steel Piling.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
      d. A490, Standard Specification for High Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
      e. A563, Standard Specification for Carbon and Alloy Steel Nuts.
      f. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      g. A1011, 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.
      h. F436, Standard Specification for Hardened Steel Washers.
      i. F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
      j. F1852, Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   4. American Welding Society (AWS):
      a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.

1.3 DESIGN REQUIREMENTS

A. Framing Design:
   1. Structural Steel Framing System has been designed on the basis of steel sections shown. It is the intent of Contract that indicated steel sizes, shapes, thicknesses, arrangements and grades of material be used.
   2. If for any reasons sections shown are not available, substitute sections may be proposed for the use and must be accepted in writing by the Contract Administrator prior to use. Contract Administrator may consider such substitutions only if proposed members provide equal or greater strength with deflection compatible with adjacent construction, and do not interfere in any way with the architectural construction or the installation of mechanical and electrical utilities. No increase in payment will be made because of substitutions.

B. Connections – General:
   1. Design in accordance with CAN/CSA-S16, Clause 21. - Connections.
   2. Connections may be bolted or welded.
   3. Design connections for end reactions from torsion, bending moment, shear, and axial load where indicated.
   4. Where no end reaction is indicated, design connection on the basis of simple construction 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 Standardized Shear Connections published by Canadian Institute of Steel Construction (CISC).
   5. For beams with intersecting bracing members, design connections for beam reaction plus reaction from the bracing members.

C. Bolted Connections:
   1. Unless noted otherwise, use bearing-type connections with snug-tightened bolts.
   2. Use pre-tension bearing type bolts in accordance with CAN/CSA-S16 for: Bracing connections, moment connections.
   3. Where indicated, use slip-critical connections.
   4. Use high-strength bolts in accordance with CAN/CSA-S16, Clause 22. – Design and Detailing of Bolted Connections.
   5. Use pre-tensioned bolts in accordance with CAN/CSA-S16, Clause 22.2.2 - Use of Pretensioned High-Strength Bolts for:
      a. Slip-critical connections.
      b. Connections of members resisting crane loads.
      c. Connections supporting running machines or other live loads that produce impact or cyclic loads.
      d. Connections where bolts are subject to tensile axial loads or stress reversal.
      e. Connections using oversize or slotted holes, unless designed to accommodate movement.
   6. Use clipped double connections where beams of similar size are bolted to both sides of a column at a common location.

D. For bracing and other tension and compression members, design connections, if not finished to bear, to develop the force due to full factored loads where indicated. Otherwise, design for

minimum of 50 percent of strength of the member in tension or 100 percent of strength of the member in compression, whichever governs.

E. Design splices for the full strength of the member in torsion, bending, shear, and axial load unless noted otherwise.

F. Provide welded stiffener plates on both sides of the web of beams or girders at points of concentrated loads including beams supporting columns, hangers or running over tops of columns, monorails, other beams and equipment supports. Minimum stiffener plates thickness shall be 10 mm or flange thickness of columns (hangers)/(beam webs) above or below. Minimum size of weld shall be 5 mm double fillet weld, or shall be sufficient to develop the full strength of the stiffener, whichever is greater.

1.4 SUBMITTALS

A. Action Submittals:
   1. Provide Shop Drawing details showing:
      a. Submit fabrication and erection documents. Include connection design details, shop details, erection diagrams and erection procedures.
      b. Submit connection design details and calculations bearing seal and signature of a Professional Engineer registered in the Province of Manitoba for review and approval prior to submitting shop details.
      c. Indicate fabrication details including cuts, copes, connections, bolt tension, holes, bearing plates, threaded fasteners, shop coatings, galvanizing, or other surface treatments, and welds on shop details. Indicate welds using American Welding Society (AWS) welding symbols in accordance with AWS A2.4.
      d. On erection diagrams, mark each member with a number corresponding to the Drawing containing the shop details of the member.
      e. Submit shop details and erection diagrams together for each structure or part of structure.
      f. Shop Drawings will be reviewed for general arrangement and material specifications.
      g. Shop Drawings bearing seal and signature of a professional engineer will not be reviewed for structural adequacy.
      h. Dimension Shop Drawings in units same as Contract Drawings.

B. Informational Submittals:
   1. Mill Certificates of tests made in accordance with ASTM A6.
   2. High-Strength Bolts (Plain Non coated and Hot-Dip Galvanized):
      a. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
      b. Manufacturer’s inspection test report results for production lot(s) furnished, to include:
         1) Tensile strength.
         2) Yield strength.
         3) Reduction of area.
         4) Elongation and hardness.

c. Certified Mill Test Reports for Bolts and Nuts:
   1) Name and address of Manufacturer.
   2) Bolts correctly marked.
   3) Marked bolts and nuts used in required mill tests and Manufacturer's inspection tests.

3. Direct Tension Indicators (DTIs): Furnish Manufacturer's test report meeting requirements of ASTM F959.
4. Tension Control (TC) Bolts: Furnish Manufacturer's test report meeting requirements of ASTM A325 and ASTM F1852.
5. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding-Quality Assurance.
6. Diagrams/Templates: Anchor bolt diagrams and/or templates for anchor bolt locations, in accordance with installing trade's schedule requirements.

1.5 QUALITY ASSURANCE

A. Identification:
   1. Marking:
      a. Heat number, producer's name or brand mark materials to comply with CAN/CSA-G40.20-M.
      b. For member identification do not use die stamping.
      c. Shop mark all members for fit and match.
      d. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
      e. Mark galvanized materials with a stamp or wire-on tag indicating the name of the galvanizer, the applicable code, and the weight of zinc coating.

B. Welding Qualifications: As specified in Section 05 05 23, Welding-Quality Assurance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.
   2. Deliver structural members to Project Site in protective manner that snow, road salt, dirt, etc. will not cause discoloring or damage to steel protective coating.

B. Storage:
   1. Protect structural steel members and packed materials from corrosion and deterioration.
   2. Store in dry area and not in direct contact with ground.
   3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.

C. Handle materials to avoid distortion or damage to members or supporting structures.

PART 2 PRODUCTS

2.1 MATERIALS

A. All material shall be new and shall conform to the following:
   1. W and H-Shapes:
      a. CAN/CSA-G40.20/G40.21 Grade 350W.
   2. Shapes Except W and H-Shapes, Rolled plates and Bars:
      a. CAN/CSA-G40.20/G40.21 Grade 300W.
   3. Steel Pipe: ASTM A53, Type E or S, Grade B.
   4. Hollow Structural Sections (HSS): CAN/CSA-G40.20/G40.21 Grade 350W Class C.
   5. Cold Formed Sections:
      a. ASTM A653 Grade 340 (Grade 50), Fy = 345 MPa for coated sections.
      b. ASTM A1011 Grade 340 (Grade 50), Fy = 345 MPa for uncoated sections.

2.2 FASTENERS

A. Anchor Bolts: As specified in Section 05 50 00, Metal Fabrications (Basic).

B. High-Strength Bolts: ASTM A325 or ASTM A490, bolt type 1, plain uncoated .

C. Direct Tension Indicators (DTIs) or Load Indicator Washers:
   1. ASTM F959, coating type to match bolt finish.
   2. Type A325 or A490, to match bolt type.
   3. Manufacturers and Products:
      a. TurnaSure LLC, Langhorne, PA; DTI's.
      b. Applied Bolting Technology Products, Ludlow, VT; DTI's, regular or Squirter type.

D. Tension Control (TC) Bolts:
   1. High-strength, ASTM A325 and F1852.

E. Nuts: ASTM A563, type to match bolt type and finish.

F. Hardened Steel Flat and Beveled Washers: ASTM F436, type to match bolt finish.

G. Welding Electrodes: See Section 05 05 23, Welding-Quality Assurance.

2.3 ANCILLARY MATERIALS

A. Grout: As specified in Section 03 60 00, Grouting.

2.4 FABRICATION

A. General:
   1. Fabricate as shown and in accordance with CAN/CSA-S16 and CISC Code of Standard Practice for Structural Steel.
   2. Columns shall be full length members without splices, unless shown otherwise.
   3. Mark and match mark materials for field assembly.

4. Complete assembly, including bolting and welding of units, before start of finishing operations.
5. Field measure before fabrication.
6. Provide camber as indicated on Drawings. Shop camber to produce parabolic profile. Field camber is not allowed.

B. Connections:
1. Shop Connections: Weld or bolt.
2. Meet requirements of CAN/CSA-S16.
3. Meet OSHA requirements for one independent bolt at beams framing in to column web connections.

C. Welded Construction:
1. As specified in Section 05 05 23, Welding-Quality Assurance.
2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

D. Interface With Other Work:
1. Holes:
   a. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.
   b. Cut holes and reinforce openings only where shown.
   c. No flame-cut holes will be permitted without prior approval of Contract Administrator. Cutting of holes in structural members in the field will not be permitted except with written approval of Contract Administrator.
   d. Prevent accumulation of water in tubular members or enclosed sections by providing drainage holes.
2. Weld threaded nuts to framing, and other specialty items where shown or required to receive other Work.

E. Shop Paint Primer:
1. Do not shop prime the following surfaces, unless indicated otherwise:
   a. Faying surfaces of slip critical bolted connections.
   b. Within 50 mm of field-welded connections.
   c. Steel members to be completely encased in reinforced concrete or coated with cementitious fireproofing.
2. Apply shop primer to top flange surfaces of composite steel beams unless indicated otherwise.

F. Slip Critical Bolted Connections:
1. Mask faying surfaces of slip critical (SC) bolted connections to be shop painted.

G. Beams:
1. Rolled sections and/or welded wide flange sections to be straight without camber, except where beams exceed 12 m in length, in which case, camber beams 3 mm per 3 m of length, unless noted on Drawings.

2.5 SOURCE QUALITY CONTROL

A. Welding:
   1. Visually inspect fabrication welds as specified in Section 05 05 23, Welding-Quality Assurance.
   2. An independent testing agency will be retained by the City to perform the following inspection and testing of fabrication welds as specified in Section 05 05 23, Welding-Quality Assurance.
      a. Groove welds:
         1) Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.
         2) Use RT only for butt joint groove welds.
      b. Fillet welds larger than 8 mm: Liquid penetrate (PT) or magnetic particle (MT) for 10 percent of randomly selected welds, unless otherwise indicated.
      c. All Welds: 100 percent visually inspected (VT).
   3. Repair and retest defective welds as specified in Section 05 05 23, Welding-Quality Assurance.

PART 3 EXECUTION

3.1 ERECTION

A. Meet requirements of CAN/CSA S16 and CISC Code of Standard Practice for Structural Steel.

B. Install Contractor-designed temporary construction bracing to provide necessary support until components are in place and construction is complete.

C. High-Strength Bolted Connections:
   1. Tighten in accordance with CAN/CSA S16 Clause 23 Installation and Inspection of Bolted Joints.
   2. Hardened Washers:
      a. Provide at locations required by use of washers section of CAN/CSA S16, to include slip critical connections using slotted or oversized holes or ASTM A490 bolts.
      b. Use beveled style and extra thickness where required by CISC Handbook of Steel Construction.
      c. Use square or rectangular beveled washers at inner flange surfaces of Canadian Standard beams and channels.
      d. Do not substitute DTIs for hardened flat washers required at slotted and oversize holes.
   3. For bearing-type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.

D. Fully Tensioned Bolted Connections:
   1. Use DTIs or TC bolts at slip critical (SC) and fully tensioned (FT) bearing-type connections.
   2. DTIs:
      a. Position within bolted assembly in accordance with ASTM F959.

b. Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until plies are in firm contact and fasteners are uniformly snug tight.

3. Final tighten bolts, beginning at most rigid part of bolted connection and progressing toward free edges, until final twist-off of TC bolts or until DTIs have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

E. Welded Connections:
1. As specified in Section 05 05 23, Welding-Quality Assurance.
2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

3.2 FIELD ASSEMBLY

A. Set structural frames accurately to lines and elevations shown.

B. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.

C. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.

D. Level and plumb individual members of structure within tolerances shown in CAN/CSA S16 Clause 29.3 Erection Tolerances.

E. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.

F. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.

G. Splice members only where indicated and accepted on Shop Drawings.

3.3 MISFITS AT BOLTED CONNECTIONS

A. Where misfits in erection bolting are encountered, immediately notify Contract Administrator for approval of one of the following methods of correction:
1. Ream holes that must be enlarged to admit bolts and use oversized bolts.
2. Plug weld misaligned holes and redrill holes to admit standard size bolts.
3. Drill additional holes in connection, conforming with CSA Standards for bolt spacing and end and edge distances, and add additional bolts.
4. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.
5. Field weld connections to provide equivalent strength of bolts with the approval of Contract Administrator.

B. Do not enlarge incorrectly sized or misaligned holes in members by burning or by use of drift pins.

3.4 GAS CUTTING

A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.

B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by Contract Administrator.

C. Finish flame-cut sections equivalent to sheared and punched appearance.

3.5 REPAIR AND CLEANING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.

B. Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.

C. Remove weld back-up bars and grind smooth.

D. Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application.

3.6 FIELD QUALITY CONTROL

A. High-Strength Bolted Connections:
   1. An independent testing agency will be retained by the City to perform the following inspection and testing in accordance with CAN/CSA S16:
      a. Marking identification and conformance to ASTM standards.
      b. Alignment of bolt holes.
      c. Placement, type, and thickness of hardened washers.
      d. Tightening of bolts.
   2. Bearing-Type Connections Not Fully Tensioned (N, X): Snug tight condition with plies of joint in firm contact.
   3. Fully Tensioned (FT) Bearing and Slip Critical (SC) Connections:
      a. Conduct preinstallation test.
      b. Monitor installation and tightening of DTIs or TC bolts.
      c. Monitor condition of faying surfaces for slip critical connections.
   4. Preinstallation Test:
      a. Conduct jobsite test prior to start of work using a bolt tension measuring device.
      b. Select representative sample of not less than three bolts of each diameter, length, and grade.
      c. Include DTIs and flat hardened washers as required to match actual connection assembly.
      d. Conduct test in accordance with Specification for Structural Joints Using ASTM A325 or A490 Bolts.
   5. Nondestructive Testing (NDT) Report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.

6. Defective Connections: Correct and reinspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.

B. Welded Connections:
   1. Visually inspect field welds in accordance with Section 05 05 23, Welding-Quality Assurance.
   2. An independent testing agency will be retained by the City to perform the following inspection and testing of field welds as specified in Section 05 05 23, Welding-Quality Assurance.
      a. Groove Welds:
         1) Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.
         2) Use RT only for butt joint groove welds.
      b. Fillet Welds Larger Than 8 mm: Liquid penetrant (PT) or magnetic particle (MT) for 10 percent of randomly selected welds, unless otherwise indicated.
      c. All Welds: 100 percent visually inspected (VT).
   3. Repair and retest defective welds as specified in Section 05 05 23, Welding-Quality Assurance.

END OF SECTION

SECTION 05 12 00-01

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 GENERAL

A. Requirements of this Section apply only for the 66 kV Substation.

1.2 RELATED REQUIREMENTS

A. Requirements specified within this section apply to all sections in Division 05 Metals that are applicable to the 66 kV Substation. This section supplements requirements of other Divisions.

1.3 REFERENCES

A. Work shall be in accordance with the National Building Code of Canada 2010 and as revised by the Manitoba Buildings and Mobile Homes Act (C.C.S.M c. B93), MR 118/214, Regulation 31/2011' as amended. This is the Manitoba Building Code. References shall be the current document specified including documents referenced therein. References stipulated in the Manitoba Building Code shall be the issue of the document stipulated, including documents referenced therein.

B. The Manitoba Building Code (MBC).

C. American Society for Testing and Materials International, (ASTM).
   1. ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   2. ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.
   3. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A143; Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   5. ASTM A153; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Hardware.
   6. ASTM A384; Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
   7. ASTM A385; Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip).
   8. ASTM A767; Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   9. ASTM A780; Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

D. Canadian General Standards Board (CGSB)
   1. CAN/CGSB-85.10, Protective Coatings for Metals.

E. Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
   1. Handbook of the Canadian Institute of Steel Construction.
   2. CISC Manual of Standard Practice

F. Canadian Standards Association (CSA International)
   1. CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
   2. CSA S16, Limit States Design of Steel Structures.
   3. CSA W47.1, Certification of Companies for Fusion Welding of Steel.
   4. CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
   5. CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
   6. CSA W59, Welded Steel Construction (Metal Arc Welding).

G. Master Painters Institute
   1. MPI-EXT 5.1, Structural Steel and Metal Fabrications.

H. The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
   1. NACE No. 3/SSPC SP-6, Commercial Blast Cleaning.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

B. Shop Drawings:
   1. Submit Shop Drawings in accordance with the General Notes stipulated on the Drawings.
   2. Shop Drawings shall bear stamp and signature of qualified Professional Engineer registered or in the Province of the Work.

C. Erection Drawings:
   1. Submit erection Drawings indicating details and information necessary for assembly and erection purposes including:
      a. Description of methods.
      b. Sequence of erection.
      c. Type of equipment used in erection.
      d. Temporary bracings.

D. Fabrication Drawings:
   1. Submit fabrication Drawings showing designed assemblies, components and connections are stamped and signed by qualified Professional Engineer licensed in the Province of the Work.

E. Source Quality Control Submittals:
   1. Upon request, submit mill test reports four (4) weeks prior to fabrication of structural steel.
      a. Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.

b. Provide mill test reports certified by metallurgists qualified to practice in the Province of the Work.

F. Fabricator Reports:
1. Upon request, provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in Manufacturer's original, undamaged containers with identification labels intact.

B. Packaging Waste Management: remove and recycle materials.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. A-Frame supplier is responsible to design and provide a structure that is sufficient to accommodate the equipment shown in the Construction Documents and in the Material Data Lists.

B. Design details and connections in accordance with requirements of CSA S16 to resist forces, moments, shears and allow for movements indicated.

C. Shear connections:
1. Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
2. Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

D. Submit sketches and design calculations stamped and signed by qualified Professional Engineer licensed in the Province of the Work for non standard connections.

2.2 MATERIALS

A. Structural steel: to CSA G40.20/G40.21 Grade 350W or as indicated.

B. Anchor bolts: as indicated in the Drawing General Notes.

C. Bolts, nuts and washers: as indicated in the Drawing General Notes.

D. Welding materials: to CSA W48 Series and CSA W59 and certified by Canadian Welding Bureau.

E. Coatings: as indicated in the Drawing General Notes.

F. Hot dip galvanizing: as indicated in the Drawing General Notes.

2.3 FABRICATION

A. Fabricate structural steel in accordance with CSA S16 and in accordance with reviewed Shop Drawings.

B. Continuously seal members by continuous welds where indicated. Grind smooth.

2.4 SHOP PAINTING

A. Clean, prepare surfaces and coat structural steel in accordance with the Drawing General Notes.

PART 3 EXECUTION

3.1 APPLICATION

A. Manufacturer's Instructions: comply with Manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

A. Structural steel work: in accordance with CSA S16.

B. Welding: in accordance with CSA W59.

C. Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 MARKING

A. 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.

B. Match marking: shop mark for fit and match.

3.4 ERECTION

A. Erect structural steel, as indicated and in accordance with CSA S16 and in accordance with reviewed erection Drawings.

B. Field cutting or altering structural members: to approval of Contract Administrator.

C. Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

D. Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD QUALITY CONTROL

A. Inspection and testing is to be carried out as stipulated.

B. Provide safe access and working areas for testing on site, as required by testing agency and as authorized by the Contract Administrator.

C. Submit test reports to the Contract Administrator within one (1) weeks of completion of inspection.

D. The Contractor shall pay for all required testing.

3.6 FIELD PAINTING

A. Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

3.7 CLEANING

A. Keep work place clean and tidy.

B. Waste Management: separate waste materials for recycling.

END OF SECTION

SECTION 05 21 19

OPEN WEB STEEL JOIST FRAMING

PART 1 GENERAL

1.1 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. ASTM Standards:
      a. ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
      b. ASTM A325, Standard Specification for Structural Bolts, Steel, Heated Treated, 120/105 ksi Minimum Tensile Strength.
      c. ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.
      d. A992, Standard Specification for Structural Steel Shapes.
   2. Canadian General Standards Board (CGSB):
      a. CAN/CGSB-1.184, Coal Tar-Epoxy Coating.
   3. Canadian Standards Association (CSA):
      a. CSA-S16, Design of Steel Structures.
      b. CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
   4. Steel Joist Institute (SJI):
      a. Standard Specifications and Load Tables:
         1) Open-Web Steel Joists, K-Series.
         2) Long Span Steel Joists, LH-Series, and Deep Long Span Steel Joists, DLH-Series.
         3) Super Longspan Steel Joists, SLH-Series.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Plan view layout of joists and bridging.
   2. Elevation view of each type of joist showing configuration, chord and web member sizes, panel point dimensions, and chord extensions.
   3. Connection and bearing details between joists and to supporting steels, concrete, etc.
   4. Special joist reinforcing and connections for supported items, such as monorails and mechanical equipment.
   5. Bridging member sizes and connection details.
   6. Complete design, including stress and deflection calculations, for joists, joist members, and connections for design load and equipment weight as indicated, plus any construction loads applied by Contractor's operations.
   7. Include check of joist chord bending stresses for concentrated loads applied between panel points.
   8. Licensed Professional Engineer's stamp, valid in Province of Manitoba, on design drawings and stress calculations.

9. Procedure for handling, erection, and bracing of steel joists.

B. Information Submittals:
1. Joist Manufacturer's installation requirements.
2. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding-Quality Assurance.

1.3 QUALITY ASSURANCE

A. General: Design and fabricate steel joists and bridging to meet requirements of SJI Standard Specifications and Load Tables.

B. Certification: SJI Membership, with certification for joist types as indicated on Drawings.

C. Qualifications for Field Welding: As specified in Section 05 05 23, Welding-Quality Assurance.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Protect joist paint system from abrasion at steel bands and other joists.

C. Store joists and bridging off ground on wood sleepers.

D. Support joists so there is no danger of tipping, sliding, rolling, shifting or material damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Shapes, Plates, Etc.: ASTM A992, Grade 50 ksi, Grade 350W for W and H shapes, and CSA-G40.20/G40.21 Grade 300W for other shapes, and plates.

B. Hollow Structural Sections: CSA-G40.20/G40.21, Grade 350W, Class C.

C. Welding Electrodes: As specified in Section 05 05 23, Welding-Quality Assurance.

D. High Strength Bolts, Nuts and Washers: ASTM A325, with each type and size of bolt and nut of same Manufacture and of same lot.
1. Bolts: Heavy, hexagon head high strength structural bolts.
2. Nuts: Heavy hexagon semi-finished nuts per ASTM A563.
3. Washers: Flat and smooth hardened washers, quenched and tempered.
4. Machine Bolts and Anchor Bolts: Unfinished bolts conforming with ASTM A307, Grade A, with hexagon heads and nuts where exposed in the finished work. Furnish 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. Furnish anchor bolts of lengths noted, but projecting not less than 13 mm beyond nut unless otherwise noted.

2.2 STEEL JOISTS AND BRIDGING

A. Provide type of joist, chord configuration, and depth as indicated on Drawings.

B. Design and Manufacture:
   1. In accordance with the applicable SJI Standard Specifications.
   2. Chord Members: Rolled double angle sections only.
   3. Provide the following where indicated, in accordance with SJI Standard Specifications and Load Tables:
      a. Bottom chord bracing and end anchorage for uplift design criteria.
      b. Ceiling extension to within 25 mm of finished wall surface, unless otherwise indicated.
      c. Top chord extension, S type, unless otherwise indicated.
      d. Bottom chord extension and stabilizer plates for joist girders.
      e. Full camber, unless otherwise indicated.

C. Joist Bridging:
   1. In accordance with applicable SJI Standard Specifications for type of joist.
   2. Furnish bridging of minimum size and type as indicated.
   3. Provide anchorage connection to walls and girders at bridging lines as indicated.

2.3 SHOP PRIMER

A. Surface Preparation and Primer: As specified in Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel joists.

3.2 INSTALLATION

A. Erection:
   1. Erect joints and associated work in accordance with CAN/CSA S16, SJI Standard Specifications and approved Shop Drawings.
   2. Set steel accurately to the lines and elevations shown.
   3. Do not cut structural members unless approved by the Contract Administrator in writing.
   4. Take full responsibility for correct alignment and setting of joists; guys, braces, etc., necessary to maintain the Work secure during erection.
   5. Only light drifting to draw parts together will be permitted. Enlarge holes by rearing with twist drill only.
   6. Setting and Anchoring:
      a. Set joists accurately and true to line. Anchor joists securely to supports with a minimum of 40 mm welds at each side of supporting members and/or bolt to supporting members.
      b. Weld joist to weld plates having anchor to masonry.

c. Tie joists on all column lines in both directions.
d. Erect bridging and secure in place.
e. Set and secure in place, extensions from joists to adjacent structure.

7. Bracing: Provide temporary bracing as necessary for all erection purposes. Remove all temporary bracing after steel is plumb and in true alignment.

B. Welded Connections: As specified in Section 05 05 23, Welding-Quality Assurance.

C. High-Strength Bolted Connections: Install as specified in Section 05 12 00, Structural Steel Framing.

3.3 TOUCHUP PAINTING

A. Immediately following erection, remove debris from completed installation.

B. Clean field welds, bolted connections, rust spots, and abraded areas.

C. Repair damaged painted surfaces as specified in Section 09 90 00, Painting and Coating.

3.4 FIELD QUALITY CONTROL

A. Welding:
1. An independent testing agency will be retained by the City to visually inspect field welded connections in accordance with applicable standards, and as specified in Section 05 05 23, Welding-Quality Assurance.
2. Repair defective welds as specified in Section 05 05 23, Welding-Quality Assurance.

B. High-Strength Bolted Connections:
1. An independent testing agency will be retained by the City to perform inspection and testing.
2. Inspect and test as specified in Section 05 12 00, Structural Steel Framing.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
   1. Canadian Standards Association (CSA):
      a. S16 Design of Steel Structures.
      b. S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. American Society for Testing and Materials (ASTM):
      a. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
      c. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   3. American Welding Society (AWS) D1.3 Structural Welding Code – Sheet Steel.
   4. Canadian Sheet Steel Building Institute (CSSBI): CSSBI B13 Design of Steel Deck Diaphragms.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Plan view layout of decking showing type and section properties of deck panels, reinforcing channels, pans, special jointing, and accessories.
   2. Location of openings, deck laps, and deck attachment details.
   3. Location of temporary shoring for placement of concrete topping.
   4. Drawings to bear seal and signature of a Professional Engineer registered in the Province of Manitoba.

B. Information Submittals:
   1. Decking Manufacturer's installation requirements.
   2. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding-Quality Assurance.
   3. Operation manuals for mechanical fastener installation tools.
   4. Manufacturer’s Certificate of Compliance, in accordance with Section 01 33 00, Submittal Procedures.

1.3 QUALITY ASSURANCE

A. General: For metal decking section properties, meet requirements of CAN/CSA-S136 North American Specification for the Design of Cold-formed Steel Structural Members.

B. Qualifications for Field Welding: As specified in Section 05 05 23, Welding-Quality Assurance.

C. Substitutions
   1. Substitutions of steel decking of different profiles or thickness than those specified may be accepted by the Contract Administrator providing the proposed substitutions satisfies the following requirements.
      a. Load carrying capacity and deflections equal to that of the specified profiles.
      b. Will not affect the overall structural design, such as reducing the effective depth of slabs cast on the proposed decking profile and composite action.
      c. Will not cause modification of structural steel layout.
      d. Will accommodate the specified number of field welded, through the decking, shear connectors and will meet the requirements of CSA-S16 with respect to composite construction.
   2. Any cost incurred by Contract Administrator to redesign the structural steel layout, or details to suit the substituted decking profile may be deducted from the monies due to the Contractor.

1.4 DESIGN CRITERIA

A. Base design on CSA S136.

B. Refer to structural Drawings for loadings, and related data. Minimum base steel thickness of all deck is as shown on Drawings.

C. Unit stress under full live and dead loads not to exceed 138 MPa (20,000 psi) and live load deflection (of metal roof deck) not to exceed L/240th of the span.

D. Design deck such that deflection under a 136 kg concentrated load at mid-span will be within L/240 of the span distance under a two span loading condition.

E. Roof deck to be designed to act as a diaphragm to resist wind loads.

F. Floor deck to be designed to support construction loads during concreting.

G. Design metal deck to generally span over 3 or more supports. For 1 or 2 span conditions, heavier gauge deck may be required.

H. Design connections of steel decking to supporting member unless shown on Drawings. Coordinate any attachment requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store deck bundles on platforms or pallets, with one end elevated to provide drainage.

C. Protect bundles against condensation with a ventilated waterproof covering.

D. Stack bundles so there is no danger of tipping, sliding, rolling, shifting or material damage.

E. Appropriately package and protect architecturally exposed deck to prevent damage during shipment.

1.6 SITE CONDITIONS

A. Field Measurements
1. Verify dimensions on Site.
2. Promptly notify the Contract Administrator if apparent discrepancies are found.

PART 2 PRODUCTS

2.1 METAL DECKING

A. Materials and Finishes:
1. Galvanized Deck:
a. Sheet steel for galvanized deck and accessories in accordance with ASTM A653M Structural Quality Grade 33 or higher, as shown in Steel Deck Schedule.
b. Galvanizing in accordance with ASTM A924M with coating class of ZF75 or Z275 as defined in ASTM A653M and as shown in Steel Deck Schedule.

B. Manufacturers:
1. VicWest.
2. The Roll Form Group.
3. Flynn Canada Ltd.
4. Canam Group.

2.2 SHOP PRIMER

A. Clean and coat with shop paint primer where shown in Finish Schedule.

B. Surface Preparation and Primer: As specified in Section 09 90 00, Painting and Coating.

2.3 ACCESSORIES

A. Provide pour stops, column closures, end closures, cover plates, girder fillers, ridge and valley plates, finish strips, reinforcing channels, and other accessories as indicated for complete installation.

B. Accessories to comply with requirements of CSSBI and deck Manufacturer.

2.4 MECHANICAL FASTENERS

A. Self-Drilling Screws:
1. Self-drilling, self-tapping screws with hexagonal washer head and corrosion-resistant finish.

2. Manufacturers and Products:
   a. ITW Buildex, Itasca, IL; ICH Traxx Self-Drilling Fasteners with Climaseal Coating and Autotraxx Standup Installation Tool.
   b. Hilti, Canada; Kwik-Pro HWH Self-Drilling Screws with Kwik-Cote Treatment and Kwik-Tapper Screwdriver.

B. Power Driven Fasteners:
   1. Knurled shank, minimum 12 mm diameter steel washer, corrosion-resistant coating.
   2. Pin diameter and length to suit deck type and flange thickness of steel support member.
   3. Manufacturers and Products:
      a. Hilti, Canada; ENP-series fasteners with electroplated zinc coating and DX-750 Installation Tool.

2.5 SHEAR CONNECTORS FOR COMPOSITE DECK

A. Studs: Size and spacing as indicated on Drawings. Material as specified in Section 05 50 00, Metal Fabrication (Basic). Stud welding and testing as specified in Section 05 05 23, Welding-Quality Assurance.

2.6 WELD ATTACHMENT

A. Fusion welds as specified in Section 05 05 23, Welding-Quality Assurance.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 INSTALLATION

A. Locate deck bundles to prevent overloading of support framing members.

B. Install at right angles to supporting members, unless shown otherwise, and in accordance with specifications and Manufacturer's installation recommendation.

C. Bearing: 38 mm, minimum.

D. Endlaps: Minimum of 50 mm and located over supports.

E. Do not stretch sidelaps.

F. Closure Plates:
   1. Install closure and cover plate accessories as recommended by CSSBI.

2. Floor Deck and Form Deck Closures:
   a. Fasten column closures, cell closures, and zee closures to deck to provide tight fitting closures at open ends of ribs and sides of decking.
   b. Fasten cell closures at changes of direction of deck units unless otherwise indicated.

G. Holes and Openings
1. Cut and fit around roof openings and other work projecting through or adjacent to decking.
2. Locate holes and openings as shown to clear structural framing and bracing members.
3. Reinforcement around openings:
   a. Roof Deck: For hole sizes of at least 150 mm across, but not more than 300 mm across in roof deck, reinforce with L 38 by 38 by 4.0, painted or galvanized to match deck coating. Extend angles at least 300 mm or 2 deck flute beyond opening perpendicular to the flute direction and attach to top of roof deck with No. 10 self-drilling screws at 150 mm spacing and at all corners.
   b. For roof openings larger than 300 mm across, see Section 05 12 00, Structural Steel Framing for reinforcing roof deck with framing as shown on Drawings.
   c. Floor Deck: For openings less than or equal to 150 mm, reinforce with L 51 by 51 by 4.0, painted or galvanized to match deck coating. Extend angles at least 300 mm beyond opening perpendicular to the deck flute direction and attach to top of floor deck with No. 10 self-drilling screws or 19 mm diameter fusion weld at 150 mm spacing and at all corners.
   d. For floor openings larger than 150 mm across, see Section 05 12 00, Structural Steel Framing for reinforcing floor deck with framing as shown on Drawings.

H. Protect deck areas from heavy concentrated loads or wheel traffic with planking or other approved means.

I. Install temporary shoring, if required, to meet strength and deflection limitations, before placing any concrete topping on deck panels.

J. Completed Deck: Free from buckles and irregularities.

3.3 DECK ATTACHMENT

A. Fasten panels as shown on Drawings.

B. Welded Connections: Weld deck sidelaps, attachment to framing, and accessories in accordance with AWS D1.3 and as specified in Section 05 05 23, Welding-Quality Assurance.

C. Mechanical Fasteners:
1. Self-Drilling Screws:
   a. Install screws in accordance with Manufacturer’s written instructions and with special installation tool. Do not over-torque.
   b. Remove and redrive screws at sidelaps where upper sheet is not drawn tightly against lower sheet.
2. Power Driven Fasteners:
   a. Install fasteners in accordance with Manufacturer’s written instructions and with special installation tool.

b. Minimum Sidelap Edge Distance: 10 mm.
c. Minimum End/End Lap Distance: 25 mm.
d. Head Projection: As specified by Manufacturer for correct penetration into flange of steel support member.

3.4 TOUCHUP PAINTING

A. Immediately following erection, remove unused deck edge trimmings, screws, fasteners, welding washers, butt ends of welding rods, and debris from completed installation.

B. Clean field welds, bolted connections, rust spots, and abraded areas and touchup with galvanize paint.

C. Repair damaged painted surfaces as specified in Section 09 90 00, Painting and Coating.

D. Repair damaged galvanized surfaces with zinc-rich spray paint in accordance with ASTM A780; color to match galvanized deck.

E. Use magnetic gauge to determine that thickness of repair is equal to or greater than base painted or galvanized coating.

3.5 FIELD QUALITY CONTROL

A. An independent testing agencyto be retained by Contractor and approved by Contract Administrator to perform following inspections.
1. Welded Connections: Visually inspect in accordance with AWS D1.3, and as specified in Section 05 05 23, Welding-Quality Assurance.
2. Mechanical Fasteners: Visually inspect, in accordance with Manufacturer’s instructions, for each type of fastener.

B. Repair or replace defective welds and fasteners.

C. Stud Welding: Inspect and test as specified in Section 05 05 23, Welding-Quality Assurance.

END OF SECTION

SECTION 05 41 20

STRUCTURAL METAL STUD FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Division 1, General Requirements.

B. Section Includes:
1. Materials and application of Wind-Load bearing steel stud systems.

C. Related Sections:
1. Section 09 29 00, Gypsum Board.
2. Section 05 31 00, Steel Decking.

1.2 REFERENCES

A. American Society for Testing and Materials International (ASTM):
1. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
3. ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

B. Canadian Standards Association (CSA):
1. CSA W47.1, Certification of Companies for Fusion Welding of Steel.
2. CSA W59, Welded Steel Construction (Metal Arc Welding).
3. CSA-S136-12 PACKAGE: Consists of S136.12 - North American Specification for the Design of Cold-Formed Steel Structural Members and S136.1-12 - Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Canadian Sheet Steel Building Institute (CSSBI):
1. CSSBI 51, Lightweight Steel Framing Design Manual.
2. CSSBI Fact Sheet #3-February 2006, Care and Maintenance of Prefinished Sheet Steel Building Products.
3. CSSBI Technical Bulletin Vol. 7, No. 2-September 2011, Standard Thicknesses for Canadian Lightweight Steel Framing Applications.

D. National Building Code of Canada 2010 with 2011 Manitoba Amendments (NBC).

1.3 SUBMITTALS

A. Submit engineering calculations or data verifying the capacity of members to meet design requirements.

B. Shop Drawings:
   1. Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
   2. Indicate locations, dimensions, openings and requirements of related work.
   3. Provide details for attachment and support of composite metal decking and guardrails above where applicable.
   4. Indicate welds by welding symbols as defined in CSA W59.
   5. Installation and erection instructions, including sequence of operations and requirements for temporary bracing and bridging.
   6. Shop Drawings shall bear the seal and signature of a Professional Structural Engineer licensed in the Province of Manitoba.

C. Submit samples of framing components and fasteners to the Contract Administrator.

D. Prior to beginning Work, submit: two certified copies of mill reports covering material properties.

E. Submit to the Contract Administrator Manufacturer's written report, within 7 days of review, verifying compliance of Work, as described in Part 3 - Field Quality Control

1.4 QUALITY ASSURANCE

A. Site Meetings: as part of Manufacturer's Services as described in Part 3 - Field Quality Control, schedule site visits, to review Work, at stages listed:
   1. After delivery and storage of products, and when preparatory Work is complete but before installation begins.
   2. Twice during progress of Work at 25 percent and 60 percent complete.
   3. Upon completion of Work, after cleaning is carried out.

B. Subcontractor Qualifications: Performed by tradesmen experienced and competent in the installation of lightweight steel framing system. Submit documented proof of compliance to this requirement.

C. Qualifications for Welding: As specified in Section 05 05 23, Welding-Quality Assurance.

1.5 WARRANTY

A. Submit a two-year extended warranty for the work of this Section against defects in materials, products and workmanship.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel studs during transportation, site storage and installation in accordance with CSSBI Fact Sheet #3.

B. Deliver to Site in bundles marked with name of Manufacturer, section type, thickness, grade of material, and length.

C. Handle and protect galvanized materials from damage to zinc coating.

1.7 DESIGN CRITERIA

A. Design to be based on Limit States Design principles using factored loads and resistances.

B. Loads, resistances; and load and resistance factors to be in accordance with CSA-S136 and NBC for post-disaster structures. Base reference velocity pressure on a 1 in 50 probability of being exceeded in any one year for strength and deflection design.

C. Design for loads shown on Contract Drawings.

D. Conform to requirements of ULC and authorities having jurisdiction for fire-rated assemblies.

E. Maximum deflections for wall studs to be L/480.

F. Design connections between framing members.

G. Design slotted connections to allow for roof or floor deflection where required.

H. Stud sizes are shown on the Drawings. Adjust stud material thicknesses and spacings as required by the engineering design criteria. Do not change stud size unless approved by the Contract Administrator.

I. Space wall studs at spacing indicated on Contract Drawings. Use smaller spacing if required by the design criteria.

J. Structural steel studs in RDT Room shall be designed to resist loads transferred from composite concrete deck and attached guardrail above. Structural steel stud designer to coordinate, design and submit attachment details as part of Shop Drawing review.

K. Structural steel studs in Walkway A of Secondary Clarifiers and in Walkway B and UV Storage Room of UV Building shall be designed to resist loads transferred from roof deck above. Structural steel stud designer to coordinate decking attachment details as part of Shop Drawing review.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel: CSA S136, fabricated from ASTM A653/A653M, Grade 340 steel.

B. Zinc coated steel sheet: ASTM A653/A653M, with Z275 designation coating.

C. Aluminum zinc alloy coated steel sheet: ASTM A792/A792M, with AZM150 designation coating.

D. Welding materials: CSAW59 and certified by Canadian Welding Bureau.

E. Welding electrodes: 480 MPa minimum tensile strength sieves.

F. Screws: pan head, self drilling, self tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm.

G. Anchors: concrete expansion anchors or other suitable drilled type fasteners.

H. Bolts, nuts, washers: hot dipped galvanized to ASTM A153, 380 g/m^2 zinc coating.

I. Touch up primer: zinc rich, CAN/CGSB 1 GP 181 MPI #18.

J. Steel-to-Steel Fastenings: As follows:
   1. Electrodes for Welding: Comply with CSA W59.
   2. Self-Drilling, Self-Tapping Screws and Bolts: Size, type and finish as required in reviewed design drawings complete with required nuts and washers.

K. Steel-to-Concrete Anchors: Ramset "Mega" or Hilti "HSL" heavy-duty anchors installed in accordance with Manufacturer's directions, to sizes shown. Load capacity when embedded in 25 MPa concrete shall not be less than:

Diameter	Pullout kN	Shear kN
8 mm	30.0	36.0
10 mm	43.6	57.2
12 mm	53.6	82.8
16 mm	83.6	149.6
20 mm	119.6	205.6

2.2 STEEL STUD DESIGNATIONS

A. Colour code: to CSSBI Technical Bulletin Vol. 7, No. 2.

2.3 METAL FRAMING

A. Steel studs: CSA S136, fabricated from metallic coated steel, depth as indicated.
   1. Minimum steel thickness of 1.52 mm.

B. Stud tracks: fabricated from same material and finish as steel studs, depth to suit.
   1. Bottom track: single piece.
   2. Top track: two piece telescoping.

C. Bridging: fabricated from same material and finish as studs, 38 by 12 by 1.09 mm minimum thickness.

D. Bracing: Fabricated from same material and finish as studs, sizes and gauges shown on reviewed Shop Drawings.

E. Angle clips: fabricated from same material and finish as studs, thickness as designed by framing system Manufacturer for use intended; Manufacturer’s standard shapes but not less then 38 by 38 mm by depth of steel stud, 1.37 mm minimum thickness.

F. Tension straps and accessories: as recommended by Manufacturer.

2.4 SOURCE QUALITY CONTROL

A. Ensure mill reports covering material properties are reviewed by the Contract Administrator.

2.5 FABRICATION

A. Fabricate members with cut-outs to accommodate services. Unreinforced cut-outs in accordance with CSSBI-51.

B. Fabrication Tolerances
1. Member Depth (A): plus 2.4 mm, minus 1 mm.
2. Flange Width (B): plus 2.4 mm, minus 1 mm, except with gypsum board minimum 31 mm width.
3. Lip Length (C): plus 4 mm, minus 0 mm.
4. Thickness (T): minus 0 mm.
5. Corner Angles: plus/minus 3 degrees.
6. Length: plus/minus 1.5 mm.

C. Mark each member for steel thickness exclusive of coating by colour coding.

PART 3 EXECUTION

3.1 GENERAL

A. Do welding in accordance with Section 05 05 23, Welding-Quality Assurance.

B. Certification of companies: CSA W47.1 for fusion welding.

3.2 INSPECTION OF JOB CONDITIONS

A. Examine surfaces to assure they are free from conditions that will adversely affect execution, permanence, or quality of work.

B. Do not proceed with the work until unsatisfactory conditions are corrected.

3.3 ERECTION

A. Erect components to requirements of reviewed Shop Drawings.

B. Anchor tracks securely to structure at 800 mm on centre maximum, unless lesser spacing prescribed on Shop Drawings.

C. Erect studs plumb, aligned and securely attached with screws or welded in accordance with Manufacturer's recommendations.

D. Seat studs into bottom tracks and single piece top track.

E. Install 50.0 mm minimum telescoping track at top of walls where required to accommodate vertical deflection.
   1. Nest top track into deflection channel minimum of 30.0 mm and maximum of 40.0 mm.
   2. Do not fasten tracks together.
   3. Stagger joints.

F. Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

G. Brace steel studs with horizontal internal bridging as required by design, but at 1200 mm maximum.
   1. Fasten bridging to steel clips fastened to steel studs with screws or by welding.

H. Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on Shop Drawings.

I. Touch up welds with coat of zinc rich primer.

J. Provide temporary bracing for support of all construction loads until framing system is installed complete with sheathing or decking.

K. All structural framing members shall be full-length without splices.

L. Cut ends of framing members with saw or shear to bear uniformly against abutting members. Flame cutting is not permitted.

3.4 ERECTION TOLERANCES

A. Plumb: not to exceed 1/500th of member length.

B. Camber: not to exceed 1/1000th of member length.

C. Spacing: not more than plus or minus 3.0 mm from design spacing.

D. Gap between end of stud and track web: not more than 4.0 mm.

3.5 CUTOUTS

A. Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

B. Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Obtain written report from Manufacturer's verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Part 1 - Submittals.
   2. Provide Manufacturer's field services consisting of product use recommendations and periodic Site visits for inspection of product installation in accordance with Manufacturer's instructions.
   3. Schedule Site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
   4. Inspection:
      a. Perform periodic field review by the professional engineer responsible for the engineering design and production of the Shop Drawings during construction and shall submit reports. Field review shall include:
         1) Mill test reports are correlated to materials.
         2) Sampling fabrication and erection procedures to conform design requirements.
         3) Connections to structural elements.
         4) Check welded and screwed connections.
         5) Check member sizes, shapes, thicknesses, coating thicknesses and erection tolerances.
         6) Visual inspection of all welded connections including sample checking of joint preparation and fit-up.
         7) Check screwed and bolted joints.
         8) Check erection tolerances.
         9) Additional inspection and testing of welded connections as required by CSA W59.
         10) Inspection of field cutting and alterations required by other Sections.

B. The cost of this field review shall be paid for by the Contractor.

C. Submit reports to the Contract Administrator covering the work inspected with details of deficiencies discovered.

D. Materials or workmanship not conforming to the requirements of the Contract will be rejected at any time during the progress of the work. Replace rejected work at no extra cost to the City even if the Contractor has to destroy and rebuild other work as a result.

3.7 INDEPENDENT INSPECTION

A. Additional inspection and testing of materials and workmanship may be carried out by a qualified Independent Inspection Agency appointed by the City.

B. The cost of this independent inspection shall be paid for by the City except that any testing or inspection required by the Contract Administrator because of an error by the Contractor or due to departure from the Contract Documents by the Contractor, shall be paid for by the Contractor.

C. The Contractor shall provide the necessary co-operation and access to insure that the inspection can proceed.

D. The additional inspection does not relieve the Contractor of its responsibility for the performance of the Contract. The Contractor is solely responsible for quality control and implementation of its own supervisory and quality control procedures.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS (BASIC)

PART 1 GENERAL

1.1 SUMMARY

A. Requirements for the 66 kV Substation, refer to Section 05 50 00-01, Metal Fabrications.

B. Comply with Division 1, General Requirements.

C. Metal Fabrications (Structural): Refer to Section 05 50 02, Metal Fabrications (Structural).

D. Welding (Quality Assurance) Refer to Section 05 05 23, Welding-Quality Assurance.

1.2 REFERENCES

A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
1. CAN/CSA-S16 Design of Steel Structures.
2. CAN/CSA G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
3. CSA S157/S157.1 Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.
4. CSA W47.1 Certification of Companies for Fusion Welding of Steel.
5. CSA W47.2-M Certification of Companies for Fusion Welding of Aluminum.
6. CSA W55.3 Certification of Companies for Resistance Welding of Steel and Aluminum.
7. CSA W59 Welded Steel Construction (Metal Arc Welding).
8. CSA W59.2-M Welded Aluminum Construction.
9. ASTM A36 Standard Specification for Carbon Structural Steel.
10. ASTM A48 Standard Specification for Gray Iron Castings.
11. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
12. ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
13. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
14. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
15. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High-Temperature or High Pressure Service and Other Special Purpose Applications.
16. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
17. ASTM A240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
18. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes.
19. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 psi Tensile Strength.

20. ASTM A312 Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes.
21. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
22. ASTM A511 Standard Specification for Seamless Stainless Steel Mechanical Tubing.
23. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts.
24. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
25. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
26. ASTM A743 Standard Specification for Castings, Iron-Chromium, Iron-Chromium - Nickel, Corrosion-Resistant, for General Application.
27. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
28. ASTM A786 Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
29. ASTM A793 Standard Specification for Rolled Floor Plate, Stainless Steel.
30. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
31. ASTM A1011 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.
32. ASTM B26 Standard Specification for Aluminum-Alloy Sand Castings.
33. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
34. ASTM B221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
35. ASTM B241 Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
36. ASTM B308 Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
37. ASTM B316 Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.
38. ASTM B468 Standard Specification for Welded UNS N08020 Alloy Tubes.
39. ASTM B632 Standard Specification for Aluminum-Alloy Rolled Tread Plate.
40. ASTM B766 Standard Specification for Electrodeposited Coatings of Cadmium.
41. ASTM F436 Standard Specification for Hardened Steel Washers.
42. ASTM F467 Standard Specification for Nonferrous Nuts for General Use.
43. ASTM F468 Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.
44. ASTM F1136 Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners.
45. ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
46. ANSI B36.10 Pipe, Steel.
47. ANSI/NAAMM MBG 531-88/NAAMM Metal Bar Grating Material.
48. CISC/CPMA 2-75a A Quick-Drying Primer for use on Structural Steel.
49. National Building Code 2010 with 2011 Manitoba Amendments (NBC).

50. SSPC SP1 Solvent Cleaning.

1.3 SYSTEM DESCRIPTION

A. Design Requirements
1. Design miscellaneous metal items in accordance with applicable standards.
2. Design work of this Section, which will support other items or will be required to support structural loads of any nature, by a Professional Structural Engineer licensed in the Province of Manitoba. Affix professional seal and signature to Shop Drawings for such items.
3. Design connections and splices using high-strength bolts or welds. Use bearing type bolts for bolted connections.
4. Design structural steel connections for 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.
5. Design splices for the full strength of the member in bending, shear and axial load.
6. Design end connections and/or splices in bracing members for the full axial strength of the member.
7. 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.
8. Design aluminum work to CSA S157/S157.1 and CSA W59.2-M.
9. Design equipment, anchorage, and support systems for vertical and lateral loading in accordance with NBC.

1.4 SUBMITTALS

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

B. Submit welding procedure specification for each type of material.

C. Submit sample of aluminum railing including a welded joint to the Contract Administrator for acceptance. Commence fabrication only after acceptance has been obtained.

D. Samples: Submit two samples of each finish.

E. Submit written certification from Professional Engineer licensed in the Province of Manitoba stating that support systems, anchorage, and equipment have been designed according to requirements of the NBC for post-disaster structures.

1.5 QUALITY ASSURANCE

A. Ensure workmanship 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. Comply with Section 05 05 23, Welding-Quality Assurance.

B. Welding Procedure for Steel, aluminum and Stainless Steel:
   1. Comply with Section 05 05 23, Welding-Quality Assurance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Provide protective coating on stainless steel and aluminum items.

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

C. Handle and store metal materials at job Site to prevent damage to other materials, existing buildings, structure, finishes or property.

D. 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.

E. Use removable coatings or wrappings to protect exposed surfaces of prefinished 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.

F. Prevent the formation of wet storage stain on galvanized members with the following measures:
   1. Stack members or bundle to allow air between the galvanized surfaces during transport from supplier. Load materials in position that continuous drainage could occur.
   2. 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.
   3. Handle galvanized members in such a manner as to avoid any mechanical damage and to prevent distortion.

1.7 COORDINATION

A. 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.

1.8 WARRANTY

A. Submit a 5-year warranty for prefinished aluminum work against defects in materials and workmanship including but not limited to fading or non-uniformity of color, cracking, peeling or other corrosion.

PART 2 PRODUCTS

2.1 MATERIALS

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

B. Structural Steel:
   1. W and H-Shapes:
      a. CAN/CSA-G40.20/G40.21 Grade 350W.
   2. Shapes Except W and H-Shapes, Rolled plates and Bars:
      a. CAN/CSA-G40.20/G40.21 Grade 300W.
   3. Steel Pipe: ASTM A53, Type E or S, Grade B.
   4. Hollow Structural Sections (HSS): CAN/CSA-G40.20/G40.21 Grade 350W Class C.
   5. Cold Formed Sections:
      a. ASTM A653 Grade 340 (Grade 50), Fy = 345 MPa for coated sections.
      b. ASTM A1011 Grade 340 (Grade 50), Fy = 345 MPa for uncoated sections.

C. Welding Electrode: Comply with requirements of applicable welding codes. Refer to Section 05 05 23, Welding-Quality Assurance for applicable codes.

D. Structural Steel Connections:
   1. High strength Bolts:
      a. For structural connections at platforms, support frames and similar items; use ASTM A325 carbon steel high strength bolts with nuts and washers.
      b. Where such structural connections will be normally exposed to atmospheric conditions use ASTM A325 carbon steel bolts hot-dip galvanized to ASTM A153.
   2. Nuts: ASTM A563 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.
   3. Washers: Bolted connections - hardened steel washers conforming to ASTM F436. Hot-dip galvanized washers with galvanized bolts.

E. Cast In Place Anchor Bolts and Anchor Bolt Sleeves:
   1. Cast-In-Place Anchor Bolts:
      a. Carbon Steel: ASTM F1554, Grade 55 with weldability supplement S1.
      b. Stainless Steel: ASTM F593, AISI Type 316, Condition CW.
      c. Headed type, unless otherwise shown on Drawings.
      d. Material type and protective coating as shown in Fastener Schedule at end of this Section.
   2. Anchor Bolt Sleeves:
      a. Plastic:
         1) Single unit construction with corrugated sleeve.
         2) Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
         3) Material: High density polyethylene.
      b. Fabricated Steel: ASTM A36/A36M.

F. Concrete and Masonry Drilled Anchors:
   1. General:
      a. Material and Protective coating as shown in Fastener Schedule at end of this section.
   2. Wedge Anchors:
      a. Hilti Kwik-Bolt-3 (KB-3) Anchor.
      b. ITW Construction Products; Ramset/Red Head; Trubolt Wedge Anchor.
   3. Drop in Expansion Anchors:
      a. Hilti HDI Drop-In Anchor.
      b. ITW Construction Products; Ramset/Red Head; Multi-Set II Drop-In and Self Drill Anchor.
   4. Undercut Anchors:
      a. Hilti HDA Undercut Anchor.
      b. USP Structural Connectors; DUC Undercut Anchor.
   5. Heavy Duty Sleeve Anchors:
      a. Hilti HSL-3 Heavy Duty Sleeve Anchor.
      b. ITW Construction Products; Ramset/Red Head; Dynabolt Hex Nut Sleeve Anchor.
   6. Adhesive Anchors:
      a. Threaded Rod:
         1) ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.
         2) Length as required, to provide minimum depth of embedment.
         3) Clean and free of grease, oil, or other deleterious material.
         4) For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
      b. Adhesive:
         1) Two-component, designed to be used in adverse freeze/thaw environments, with gray color after mixing.
         2) Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
         3) Non sag, with selected viscosity base on installation temperature and overhead application where applicable.
         4) Manufacturers and Products:
            a) Hilti HIT HY 200 Adhesive Anchor System, (use HIT HY 20 for hollow masonry).
            b) ITW Construction Products; Ramset/Red Head; C6 Adhesive Anchor System or A7 Adhesive Anchor System. (Use A7 Adhesive Anchor System for hollow masonry.)
   7. Adhesive Threaded Inserts:
      a. Stainless steel, internally threaded insert.
      b. Manufacturer and Product: Hilti HIS-R Insert with HIT HY 200 adhesive.

G. Pipe Sleeves: As specified in Section 40 27 01, Process Piping Specialties.

H. Galvanized steel sheet: ASTM A653- Class Z275 zinc coating.

I. Hot rolled steel sheet: ASTM A1011.

J. Cold rolled steel sheet: ASTM A1008.

K. Steel Pipe: ASTM A53 - Type S Grade A or ANSI B36.10.

L. Neoprene: Premium grade Durometer A 40.

M. Fasteners: 19 mm diameter minimum.

N. Stainless Steel: Alloy 316.

Item	ASTM	UNA Designations
Structural	A666	S31600 or S31603
Architectural	A666	S31600 or S31603
Plates, Sheets and Strips	A240	S31600 or S31603
		Grade
Fasteners	A193	B8A
Castings	A743	CF-8M

O. Aluminum:

Item	ASTM	UNA Designations
Extruded Shapes - Structural	B211	A96351-T6
Extruded Shapes - Architectural	B221	A96063-T6
Smooth Plates and Sheets	B209	A93003-H16
Checkered or Tread Plates	B632	A96061-T6
Gratings	B221	A96061-T6
Rivets	B316	A96061-T6
Castings	B26	A03560-T6 or A05350-F
Tubing & Pipe	B241	A96061-T6
Fasteners - Bolts	F468	A96061-T6
- Nuts	F467	A96061-T6

P. Primer: CISC/CPMA 2-75a unless otherwise noted.

Q. Isolation coating: Coal Tar-Epoxy Coating.

R. Grouting: As specified in Section 03 60 00, Grouting.

2.2 FINISHES

A. Rough Edges and Mill Scale:
   1. Following completion of fabrication of any item, grind rough edges straight and finish smooth. Remove mill scale and rust.

B. Electrolytic Corrosion:
   1. Back paint metal surfaces in contact with dissimilar metal or concrete or masonry, with coal tar-epoxy coating, 1.0 mm (40 mils) DFT minimum.
   2. Paint galvanized metal surfaces to be in contact with or encased in concrete with rust inhibitive epoxy coating ICI Devoe Coating: Devran 201. Prepare surfaces to SSPC SP1, apply coating to 125 microns DFT.

C. Aluminum:
   1. Restore aluminum to original mill finish after fabrication. Buff and brighten exposed aluminum surfaces, which have been damaged during construction.
   2. Paint the surfaces to be in contact with aluminum with coloured coal tar-epoxy coating where aluminum is intended to be in contact with dissimilar metals, concrete, or masonry.
   3. Use anodizing quality aluminum where anodizing is required or where aluminum is to be painted.

D. Carbon Steel:
   1. Hot dip galvanize metal fabrications where carbon steel is intended to be exposed to atmospheric conditions or sewage.
   2. Hot dip galvanize the surfaces to be in such contact where carbon steel is intended to be in contact with either concrete, brick or mortar.

E. Galvanizing:
   1. Hot-dip galvanized items after fabrication. Galvanize steel scheduled for exposure to exterior conditions or corrosive materials.
   2. Clean surfaces to be galvanized of slag and impurities immediately before being galvanized or cadmium plated.
   3. Where specified or detailed, galvanize plates and other structural shapes in accordance with ASTM A123. Where fabrications are too large to be hot-dipped, employ zinc metallizing.
   4. Repair of Damaged Galvanized Surfaces:
      a. Repair hot-dip galvanized coatings damaged by welding, cutting, rough handling during shipping or erection or otherwise, in accordance with ASTM A780 using organic zinc-rich primer. Dry film thickness on repairs to exceed original coating thickness by 25 percent.

F. Shop Finishes:
   1. Aluminum Finish:
      a. Where shop finishing is specified or indicated, after fabrication or forming, prepare surfaces, shop prime, and factory finish in accordance with PPG specifications for the Manufacturer's Duranar two-coat fluoropolymer enamel system for aluminum. Shop finishing: Performed by an accepted applicator. Minimum dry film thickness – 30 microns (1.2 mil).
      b. Color : To be determined by the Contract Administrator.
      c. After installation, touch-up shop finished surfaces damaged during construction.
      d. 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.

G. Stainless Steel:
   1. Remove rust and postweld discoloration from stainless steel by grinding, using only stainless steel tools.
   2. Passivate stainless steel, which was cleaned by grinding, with a solution of 12-15 percent nitric acid and 3 percent hydroflouric acid.
   3. During finishing ensure no carbon steel gets into contact with the stainless steel surfaces.
   4. Finishes: 2B mill finish.

H. Steel Finish:
   1. Where shop finishing is specified or indicated, after fabrication or forming, prepare surfaces, shop prime, and factory finish in Stelcolor 8,000 Series.
   2. Shop finishing: Performed by an accepted applicator. Minimum dry film thickness – 30 microns (1.2 mil).
   3. After installation, touch-up shop finished surfaces damaged during construction

2.3 FABRICATION - GENERAL

A. 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 Project Site in the largest practical sections.

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

C. Assume responsibility for the correctness of the actual detailed dimensions used in fabrication and carefully check the same, by field measurement.

D. Variations from suggested details are subject to acceptance in writing by the Contract Administrator. Such acceptance does not in any way waive the above mentioned responsibility.

E. 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.

F. Fabricate the work true to dimensions and square. Accurately fit members with hairline joints, and join using adequate fastening. Assemble members without twists or open joints.

G. Construct finished work free from distortion and defects detrimental to appearance and performance.

H. Stainless steel grain direction: One direction throughout.

I. 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 Contract Administrator in writing. Brighten and buff aluminum and stainless steel welds to match appearance of adjacent surface.
   1. Remove weld spatter and slag. After finish grinding and smoothening welds, passivate welds with pickling paste.

J. 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.

K. 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.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Install work of this Section using skilled craftsmen and in accordance with Manufacturer's recommendations where applicable.

B. 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 Contract Administrator.

C. Perform drilling of steel, concrete or masonry to fasten the work of this Section.

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

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

F. Touch-up galvanized steel where galvanizing is damaged during installation with zinc rich primer.

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

H. Where items are specified to be installed by other Sections, fabricate items to the appropriate trade with necessary instructions and templates required for proper installation. Include required fastenings, such as screws, bolts, expansion shields and similar items.

I. Tolerances: CAN/CSA S16.

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

3.2 INSTALLATION - ANCHORS AND FASTENERS

A. Use anchor bolts of sufficient length to embed into concrete to develop full strength of the anchor or 200 mm minimum, the maximum governs, and project the threaded portion a minimum of 50 mm for the installation of the nuts.

B. Do not offset bolts by deformation.

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

3.3 FASTENER SCHEDULE

A. Unless indicated otherwise on the Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings		
Interior Dry Areas	Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise.	
Exterior and Interior Wet Areas	Stainless steel headed anchor bolts.	
Submerged and Corrosive Areas	Stainless steel headed anchor bolts	
2. Anchor Bolts Cast Into Concrete for Equipment Bases		
Interior Dry Areas	Hot dip galvanized carbon steel headed anchor bolts, unless otherwise specified with equipment	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor bolts, unless otherwise specified with equipment	
3. Drilled Anchors for Metal Components to Cast-in-Place Concrete (e.g., Ladders, Handrail Posts, Electrical Panels, and Equipment)		
Interior Dry Areas	Stainless steel wedge or drop in expansion anchors	Use undercut anchors for overhead and ceiling installations.
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel Adhesive anchors or Stainless heavy duty sleeve anchor	Use undercut anchors for overhead and ceiling installations.
4. Anchors in Grout-Filled Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Hot-dip galvanized steel headed anchor bolts, or stainless steel heavy duty sleeve anchors, or stainless steel adhesive anchors	
5. Anchors in Hollow Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Stainless steel adhesive anchors with screen tube	

Service Use and Location	Product	Remarks
6. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members and for Exterior areas
7. Connections for Steel Fabrications and Wood Components		
Exterior and Interior Wet and Dry Areas	Hot-dip galvanized carbon steel bolted connections	
8. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment	
9. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel fasteners	

B. Anti-seizing Lubricant: Use on all stainless steel threads.

C. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 49 degrees C.

END OF SECTION

SECTION 05 50 00-01

METAL FABRICATIONS

PART 1 GENERAL

1.1 GENERAL

A. Requirements of this Section apply only for the 66 kV Substation.

1.2 RELATED REQUIREMENTS

A. Requirements specified within this section apply to all sections in Division 05 Metals that are applicable to the 66 kV Substation. This section supplements requirements of other Divisions.

1.3 REFERENCES

A. Work shall be in accordance with the National Building Code of Canada 2010 and as revised by the Manitoba Buildings and Mobile Homes Act (C.C.S.M c. B93), MR 118/214, Regulation 31/2011' as amended. This is the Manitoba Building Code. References shall be the current document specified including documents referenced therein. References stipulated in the Manitoba Building Code shall be the issue of the document stipulated, including documents referenced therein.

B. The Manitoba Building Code (MBC).

C. American Society for Testing and Materials International, (ASTM).
   1. ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   2. ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   3. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   4. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   5. ASTM A143; Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   6. ASTM A153; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Hardware.
   7. ASTM A384; Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
   8. ASTM A385; Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip).
   9. ASTM A767; Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   10. ASTM A780; Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

D. CSA International
   1. CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
   2. CSA S16, Design of Steel Structures.
   3. CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
   4. CSA W59, Welded Steel Construction (Metal Arc Welding).

E. Health Canada / Workplace Hazardous Materials Information System (WHMIS)
   1. Material Safety Data Sheets (MSDS).

F. The Master Painters Institute (MPI)
   1. Architectural Painting Specification Manual.

G. Shop Drawings:
   1. Submit Drawings stamped and signed by Professional Engineer registered or licensed in the province of the Work.
   2. Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

A. Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

B. Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with Section 01 61 00, Common Product Requirements and with manufacturer's written instructions.

B. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

C. Storage and Handling Requirements:
   1. Store materials off ground, in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
   2. Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel sections: to CSA G40.20/G40.21, Grade 350W.

B. Steel plates and BAR stock: to CSA G40.20/G40.21, Grade 300W minimum

C. Welding materials: to CSA W59.

D. Welding electrodes: to CSA W48 Series.

E. Bolts: to ASTM A325.

F. Anchor rods: in accordance with the Drawing General Notes.

G. Grout: in accordance with the Drawing General Notes.

2.2 FABRICATION

A. Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

B. Where possible, fit and shop assemble work, ready for erection.

C. Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

A. Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to ASTM A123.

2.4 SHOP PAINTING

A. Coating: in accordance with the Drawing General Notes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
   1. Visually inspect substrate in presence of the Contract Administrator.
   2. Inform Contract Administrator of unacceptable conditions immediately upon discovery.
   3. Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

A. Do welding work in accordance with CSA W59 unless specified otherwise.

B. Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

C. Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

D. Exposed fastening devices to match finish and be compatible with material through which they pass.

E. Supply components for work by other trades in accordance with Shop Drawings and schedule.

F. Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

G. Touch-up damaged galvanized surfaces with zinc rich primer.

3.3 CLEANING

A. Progress Cleaning: leave work area clean at end of each day.

B. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

C. Waste Management: separate waste materials for recycling.
   1. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

A. Protect installed products and components from damage during construction.

B. Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

SECTION 05 50 01

METAL FABRICATIONS (ARCHITECTURAL)

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.2 REFERENCES

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.3 SUBMITTALS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.4 QUALITY ASSURANCE

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.6 WARRANTY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

2.2 FINISHES

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

2.3 ANCHORS AND FASTENERS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

2.4 FABRICATION - GENERAL

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

2.5 FABRICATION - ALUMINUM ANGLE AND BENT PLATE

A. Unless different thickness indicated otherwise, fabricate aluminum angle and bent plate of 6 mm thick aluminum
   1. Architectural Class I Anodic Coating, AA-C22A41, clear.

2.6 FABRICATION - ALUMINUM CLOSURES

A. Fabricate aluminum closures where indicated and as detailed.

B. Shop finish closures in accordance with Finishes as per Section 05 50 00, Metal Fabrications (Basic).

2.7 FABRICATION - ALUMINUM CHECKER PLATE THRESHOLD

A. Fabricate in locations shown on the Drawings, one-piece thresholds of 5 mm thick 6061-T6 aluminum checker plate formed to profiles shown.

2.8 FABRICATION - STEEL BOLLARDS

A. Fabricate bollards of Schedule 40, hot-dip galvanized steel pipe.

2.9 ABRASIVE NOSING INSERTS

A. Abrasive Nosing Inserts (Cast-in-Place Concrete Stair): Extruded aluminum Type 3501 by American Safety Tread Co. Inc. distributed by Safety Stair Products, 75 mm wide, 6 mm thick with 5 abrasive filled ribs, length as indicated, complete with protective tape. Color of abrasive ribs: to later selection.

B. Fastenings: Stainless steel countersunk screws and metal plugs.

2.10 FLOOR DOORS (ACCESS HATCHES)

A. Refer to Section 10 80 00, Miscellaneous Specialties.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

3.2 INSTALLATION - ANCHORS AND FASTENERS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

3.3 INSTALLATION – ANGLES, BENT PLATES, CLOSURES, PROTECTIVE ANGLE CHANNEL

A. Install aluminum and steel angles, bent plates, closures and protective angle as required and as detailed.

3.4 INSTALLATION - BOLLARDS

A. Set bollard into concrete encasement as indicated.

B. Fill posts with 25 Mpa concrete rounded at the top.

3.5 INSTALLATION – STAINLESS STEEL FACING

A. Install stainless steel facing as required and as detailed.

3.6 INSTALLATION - CHECKER PLATE THRESHOLD

A. Notch thresholds neatly as required to fit jamb profiles. Co-ordinate installation with threshold grouting under Section 03 30 00, Cast-in-Place Concrete and the setting of edges of waterproof membranes and metal flashings.

3.7 INSTALLATION – ABRASIVE NOSING INSERTS

A. Install abrasive nosing inserts and strips where indicated on Drawings and as detailed.

END OF SECTION

SECTION 05 50 02

METAL FABRICATIONS (STRUCTURAL)

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.2 REFERENCES

A. Refer to Section 05 50 00, Metal Fabrications (Basic).

PART 2 PRODUCTS

2.1 STEEL LINTELS AND SHELF ANGLES

A. CSA G40.20/21 – 300W hot-dip galvanized after fabrication.

B. Where lintel or shelf angle size is not shown, design lintels to NBC 9.20.5.2 Lintels or Arches.

C. Provide adjustable lintel anchors where indicated and detailed.

2.2 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, A276, AISI Type 316, unless indicated otherwise.

B. Provide stainless steel welded anchors for stainless steel support frames.

2.3 CHECKERED FLOOR PLATE

A. Design Requirements:
   1. Floor plate shall have regular pattern of raised diamond or lines on top surface for better grip.
   2. Design floor plates and frames.
   3. Subdivide floor plates with side larger than 1000 mm by reinforcing each subdivision with stiffeners.
   4. Limit deflection under a concentrated midspan load of 5.0 kN to 1/360th of the span, and under superimposed 15 kN/m^2 uniformly distributed load, 6 mm maximum.
   5. Provide handles or lifting holes as detailed.
      a. Lifting holes or handles on process and sanitary sumps shall be gas tight.
   6. Provide hinges as indicated and hold down fasteners.

B. Fabricate angle frames and border bars with the following features:
   1. Corners neatly fitted, welded, mitred.

2. Shop welded border bars.
3. Weld strap anchors to angle frames for casting into concrete.
4. Size angle frames to fit floor plate with clearances between frames and floor plate not exceeding 3 mm on any side.

C. Fabricate floor plates on process and sanitary sumps with the following features:
1. Gastight.
2. Hinged.
3. Hold open assembly.
4. 3 mm full face neoprene border gasket secured in place with a suitable adhesive.
5. Gastight lifting handles.
6. Countersunk stainless steel screws to fasten plate down.

D. Where indicated, fabricate checkered floor plate with 50 mm thick styrofoam SM insulation and 1.3 mm thick galvanized backpan secured to underside of checkered plate.

E. Material:
1. Aluminum: ASTM B632/B632M, Alloy 6061-T6.

F. Minimum Thickness:
1. Aluminum: 10 mm, unless shown otherwise on Drawings.

G. Surface shall be raised-lug pattern or diamond tread, unless shown otherwise on Drawings.

H. Slip-Resistant Surface:
1. Provide for all exterior checkered floor plates and where indicated on Drawings.
2. Manufacturers and Products:
a. IKG/Borden, MEBAC 2.
b. W.S. Molnar Co., SLIPNOT Grade 2-Medium.

2.4 STAIRS

A. Material:
1. Aluminum: ASTM B632, Alloy 6060-T6.

B. Fabricate stairs as detailed on Drawings and install using stainless steel anchor bolts.

C. For railing requirements, refer to Section 05 52 00, Aluminum Guards and Handrails.

D. Fabricate stairs with open grating treads of welded grating with slip-resistant, 32 mm cross hatch solid nosing.
1. Manufacturers:
a. Borden Metal Products Ltd.
b. Fisher & Ludlow Ltd.

2.5 ALUMINUM LADDERS

A. Fabricate aluminum ladders of the lengths required as indicated on Drawings.

B. Flat Stringer Ladder
   1. Fabricate ladders with the following features:
      a. Welded construction with 50 mm schedule 80 pipe and 25 mm wide by 19 mm deep top-fluted rungs.
      b. Stringers spaced 500 mm apart and rungs equally spaced at 300 mm centers.
      c. Locate the bottom rung 300 mm above the finished floor, roof or platform.
      d. Fabricate attachment brackets to space ladder 175 mm clear from finished architectural wall.
      e. Weld attachment brackets to the stringers. Locate within 300 mm of the top and bottom of each ladder and at intermediate points spaced not more than 1200 mm o.c.
      f. Reinforce stringer extensions above the top rung to provide rigid support for the personnel using the ladder.
      g. Grind welds smooth.
      h. Finish: Architectural Class I Anodic Coating, AA-C22A41 clear.

2.6 LIFTING HOOKS

A. Design hooks to withstand loads imposed with a minimum safety factory of 3.

B. Material: 316 Stainless Steel.

C. Cast hooks into concrete slab or beams at location shown.

2.7 METAL GRATING

A. Design:
   1. Design metal grating to support loads indicated on Drawings but not less than 4.8 kPa (100 psf) or 4.5 kN (1000 lbs) concentrate loads apply to mid span.
   2. Grating deflection shall not exceed L/180.

B. Product:
   1. Grating shall be aluminum, unless noted otherwise on Drawings.
   2. Grating shall be serrated.

C. Installation:
   1. Anchor grating to supporting members with clips and bolts with spring as indicated or at 300 mm centre to centre minimum.
   2. Grating supporting equipment shall be weld to supporting members with 5 mm fillet welds, at 300 mm centre to centre, 50 mm long.
   3. Use stainless steel bolts for aluminum construction.

2.8 PLATFORMS

A. Design’s Qualification: Calculations and Shop Drawings required for Contractor design must be stamped by a registered engineer, licensed in Province of Manitoba.

B. Design Criteria:
   1. Comply with the requirements of NBC.
   2. Serrated open grating.

3. Uniform Live Load: 4.8 kPa minimum.
4. Uniform Collateral Dead Load (not including self-weight): 0.5 kPa minimum. Design platforms to accommodate small piping or conduits hanging from underside.
5. Maximum Deflection: 6 mm or L/240.
6. For support points, locate to suit. Point loads at all support points are 12 kN maximum.
7. Do not use existing building framing or walls as part of lateral load resisting system. Anchor directly to concrete slab only.
8. Design platforms to accommodate openings for piping, ducting, and electrical services as shown on Drawings.
9. Design platforms for additional requirements indicated on Drawings.

C. Design and provide other items such as grating, stairs, bolts, welds, anchors, etc. in compliance with the requirements of this section.

D. Provide railing in compliance with the requirements of Section 05 52 00, Aluminum Guards and Handrails.

E. Field measure areas around equipment prior to fabrication. Design platforms and grating so that gaps around perimeter of equipment do not exceed 75 mm clearance.

F. Material:
1. Aluminum: ASTM B632/B632M, Alloy 6061-T6.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Clean off dirt on installed miscellaneous metal surfaces.

END OF SECTION

SECTION 05 50 03

METAL FABRICATIONS (MECHANICAL)

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. As specified in Section 40 27 01, Process Piping Specialties.

2.2 U-CHANNEL CONCRETE INSERTS

A. Rolled ASTM A240/A240M, AISI Type 316 stainless steel, 3 mm thick, 40 mm wide by 35 mm deep, with stainless steel anchors at 250 mm maximum spacing, styrofoam fillers, and end caps.

B. Nut and Bolts Hardware: Type 316 stainless steel, 16 mm minimum diameter unless indicated otherwise, Manufacturer's standard to match insert.

C. Manufacturers and Products:
   1. Power-Strut; PS 349 Series.
   2. B-Line Systems, Inc.; B32 Series.
   3. Halfen Anchoring Systems; Channel Type 4141 HTA.

2.3 T-HANDLED OPERATING WRENCHES

A. Galvanized operating wrenches, 1.2 m total length, No. A-2461 as manufactured by Mueller.

2.4 VALVE OPERATOR ACCESS BOX

A. Cast iron, 200 mm by 100 mm, as manufactured by Zurn; No. ZN-1930-K.

2.5 SAMPLING SINKS

A. Fabricate sampling sinks as detailed.

B. Fabricate sampling sinks with the following features:
   1. Fabricated from 2 mm thick Type 304 stainless steel.
   2. Continuous welds for joints.
   3. Bowls 600 mm diameter by 340 mm deep with conical bottoms and 75 mm drains.
   4. Anti-splash guard rims.

5. Flushing spray rings.
6. 1000 mm flushing hose with hand gun type spray nozzle.
7. Piping connections of Type 304L stainless steel quick-disconnect couplings by Tri-Canada Ltd.

PART 3 EXECUTION

3.1 U-CHANNEL CONCRETE INSERTS

A. Provide as indicated for pipe supports and where otherwise shown on Drawings.

B. Except for interior dry areas, use plastic clips or similar dielectric material to isolate channel anchors from concrete reinforcing steel.

3.2 MANHOLES

A. During concrete placement, brace the manhole thimbles internally to prevent deformation.

B. Install bolts before concrete placement.

C. Ensure that surfaces in contact with concrete are full of paint, oil, and grease before concrete placement.

3.3 BULKHEAD AND STOPLOG GUIDES

A. Set frames plumb and vertical in concrete forms so that no jamming will occur during installation or removal of stoplogs or bulkheads.

B. During concrete placement, brace the frame internally and externally to prevent deformation of the guide frame alignment.

3.4 SAMPLING SINKS

A. After mounting sampling sink and hood on sampling sink, seal joints.

END OF SECTION

SECTION 05 50 10

METAL FABRICATIONS – A-FRAME

PART 1 GENERAL

1.1 GENERAL

A. Requirements of this Section apply only for the 66 kV Substation.

1.2 RELATED REQUIREMENTS

A. Requirements specified within this section apply to all sections in Division 05, Metals and Division 26, Electrical. This section supplements requirements of other Divisions.

1.3 REFERENCES

A. Work shall be in accordance with the National Building Code of Canada in effect at the time of Contract, and as revised by the Manitoba Buildings and Mobile Homes Act (C.C.S.M c. B93), MR 118/214, Regulation 31/2011' as amended. This is the Manitoba Building Code. References shall be the current document specified including documents referenced therein. References stipulated in the Manitoba Building Code shall be the issue of the document stipulated, including documents referenced therein at the time of Contract signing.

B. The Manitoba Building Code (MBC).

C. Canadian Standards Association (CSA)
   1. CSA S16; Design of Steel Structures
   2. CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
   3. CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
   4. CSA W59, Welded Steel Construction (Metal Arc Welding).

D. Canadian Welding Bureau (CWB)

E. American Institute of Steel Construction (AISC)

F. American National Standards Institute (ANSI)

G. American Society of Mechanical Engineers (ASME)

H. American Society for Testing and Materials International (ASTM)
   1. ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   2. ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

3. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
4. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A143; Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
6. ASTM A153; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Hardware.
7. ASTM A384; Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
8. ASTM A385; Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip).
9. ASTM A767; Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement.
10. ASTM A780; Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

I. American Welding Society (AWS)
   1. D1.1; Structural welding Code – Steel

J. American Iron and Steel Institute (AISI)
   1. AISI 316L Stainless Steel

K. International Organization for Standardization (ISO)

L. Health Canada / Workplace Hazardous Materials Information System (WHMIS)
   1. Material Safety Data Sheets (MSDS).

1.4 APPROVED MANUFACTURERS AND STANDARD OF ACCEPTANCE

A. Approved equipment manufacturer:
   1. SLACAN Industries Inc., or approved equal in accordance with B8.

B. The equipment layouts, details, wiring, and dimensions depicted on the Drawings are based upon specific equipment types and manufacturers that are defined on the Drawings, in the Specification and on the Data Sheet. Work to be coordinated with the circuit switching supplier.

C. Use of alternative equipment other than the “Standard Of Acceptance” defined in this Specification is permitted. However, use of alternative equipment by the Contractor is subject to the Contractor having received formal " approved equal" status, formalized by a PCN, for the equipment in question from the Contract Administrator. Any changes to layouts, details, wiring and dimensions including all associated costs arising from the use of "Approved Equal" materials and equipment is and are the sole responsibility of the Contractor. Use of "Approved Equal" equipment shall result in a fully functional installation in accordance with the requirements and intent of the design documents.

1.5 SHOP DRAWINGS:

A. Submit Drawings stamped and signed by registered professional engineer.

B. Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.6 QUALITY ASSURANCE

A. Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

B. Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

C. Design the equipment to provide continuous, long term service under the ambient and environmental conditions that will prevail on the site as indicated for the geographic, seismic and climate for the area.

D. Provide materials in accordance with this Specification and the manufacturer’s recommendation for the conditions specified.

E. Fabricate each equipment assembly using only new materials of first grade quality, free from defects impairing strength, durability and appearance.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with Section 01 61 00, Common Product Requirements and with manufacturer's written instructions.

B. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

C. Storage and Handling Requirements:
   1. Store materials off ground, in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
   2. Replace defective or damaged materials with new.

1.8 DESIGN CRITERIA

A. Design to accommodate all loading shown in the documents or as shown on the equipment Data Sheets.

B. Provide adequate lifting points, lugs, angles, eye bolts, etc. for the safe handling, installation and servicing.

C. Provide adequate safety guards around all moving equipment and energised electrical equipment.

D. Provide A-frame type structure, free standing, dead-ending, with provisions for mounting disconnect switch, and terminations. All mounting brackets shall have pre-drilled holes.

E. Vertical legs and cross members shall be factory assembled, bolted sections.

F. Comply with design requirements of Inspection and Supply Authorities.

G. Design structure for the loads and design criteria stipulated on Data Sheets.

H. Design structural members for maximum loads. These shall include dead loads, wind loads, cable and equipment loads, ice loads, and seismic loads.

I. Space all mounting brackets and mounting holes to meet or exceed Supply Authority standard for overhead line and outdoor equipment installation, for the specified voltage.

J. Refer to the equipment Data Sheets for performance characteristics.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel sections: to CSA G40.20/G40.21, Grade 350W.

B. Steel plates and BAR stock: to CSA G40.20/G40.21, Grade 300W minimum

C. Welding materials: to CSA W59.

D. Welding electrodes: to CSA W48 Series.

E. Bolts: to ASTM A325.

F. Anchor rods: provide in accordance with the Drawing General Notes. “L” or “J” anchor rods shall not be used. To be designed as Headed Anchor Rods.

G. Grout: in accordance with the Drawing General Notes.

2.2 FABRICATION

A. Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

B. Where possible, fit and shop assemble work, ready for erection.

C. Ensure all plates and connections are coordinated with products in the equipment data sheets.

D. All miscellaneous loose support brackets and hardware shall conform to AISI 314L stainless steel. Provide isolation to prevent galvanic corrosion. Use silica bronze fasteners as required.

E. Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

A. Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to ASTM A123.

2.4 SHOP PAINTING

A. Coating: in accordance with the Drawing General Notes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for A-Frame, Dead End Structure installation in accordance with manufacturer's written instructions.
   1. Visually inspect supporting structure in presence of the Contract Administrator.
   2. Inform Contract Administrator of unacceptable conditions immediately upon discovery.
   3. Proceed with installation only after unacceptable conditions have been remedied.

3.2 SHOP FABRICATION

A. Fit and assemble work in the shop, where possible. Where final assembly in the shop is not possible, partly assemble in the shop and match-mark the component parts to ensure proper assembly on site.

B. Identify individual pieces in accordance with the identification schedule used on the Shop Drawings and bill of materials to clearly indicate their location in the work for installation. Provide the following lamacoid nameplates:
   1. A main identification nameplate for the A-Frame assembly, mounted centrally, 1” black lettering on a white background, riveted to the structure.

3.3 SHOP INSPECTION AND TESTING

A. Inspect all shop welds prior to shipment. Ensure that the inspection of welds complies with applicable American Welding Society (AWS), Canadian Welding Bureau (CWB) and American Society of Mechanical Engineers (ASME) standards and Specifications.

B. Submit copies of mill analyses and test reports of materials on request.

C. Submit a written statement that materials conform to the Drawings and Specifications.

D. Provide the Contract Administrator and/or the Contract Administrator with all reasonable access to the work whether it is in preparation or progress. Provide proper facilities for such access and for inspection.

E. Factory tests shall not constitute a waiver of field commissioning requirements and the requirement to pass field tests under the specified operating conditions.

F. Submit an Inspection and Test Plan in accordance with this Specification. Inspection and Test Plan shall be reviewed by the Contract Administrator and implemented in the shop and/or the field.

3.4 ERECTION

A. Do welding work in accordance with CSA W59 unless specified otherwise.

B. Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

C. Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

D. Exposed fastening devices to match finish and be compatible with material through which they pass.

E. Supply components for work by other trades in accordance with Shop Drawings and schedule.

F. Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

G. Touch-up damaged galvanized surfaces with zinc rich primer.

3.5 CLEANING

A. Leave Work area clean at end of each day.

B. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

C. Waste Management: separate waste materials for recycling.

D. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

A. Protect installed products and components from damage during construction.

B. Repair damage to adjacent materials caused by the A-Frame installation.

3.7 TECHNICAL DATA DRAWINGS AND MANUALS

A. Submit information as identified in Vendor Documentation.

B. Tenders not containing completed equipment data sheets will be rejected.

C. Ensure that drawings, design calculations and welding procedures submitted for review are sealed and signed by a registered Professional Engineer.

D. For Shop Drawings, include, but not necessarily limit to, design data such as size, dimensions, material thickness, materials, spacing and location of attachments, anchor bolt size, location and projection, reinforcement, welding, points of connection, etc., as applicable.

E. Provide detailed installation Drawings showing requirements for all field welds and all other necessary details of installation.

F. Provide Drawings and/or reports showing the necessary data for the design of the supporting steel structure or foundation. Include, but not necessarily limit to, the following:
   1. Magnitude and location of all equipment dead loads.
   2. Magnitude and location of all operating live loads with contents at maximum design density
   3. Any requirement to accommodate thermal and/or operating movements at support locations
   4. Impact factors to be applied to support reactions.

END OF SECTION

SECTION 05 52 00

ALUMINUM GUARDS AND HANDRAILS

PART 1 GENERAL

1.1 SUMMARY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.2 REFERENCES

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.3 DEFINITIONS

A. Guard: A protective barrier around openings in floors or at the sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations, capable of withstanding the loadings prescribed by codes.

B. Handrail: A horizontal or inclined rail at one or both sides of a stair or ramp, continuous and without interruptions, intended to be grasped by hand when ascending or descending and capable of withstanding the loadings prescribed by codes. A handrail may function as a guard on the open side of a stair.

C. Post: Supporting member for a guard or handrail, capable of transmitting the guard or handrail loadings prescribed by code to the supporting structure.

D. Railing: A horizontal or inclined rail supported by posts, acting as a guard at or below the minimum prescribed guard height.

E. Toeboard: Vertical barrier along exposed edges of platforms, ramps, landings or other floor openings preventing miscellaneous items from falling over the exposed edge.

1.4 SYSTEM DESCRIPTION

A. Fabrication Requirements
   1. Comply with Section 05 50 00, Metal Fabrications (Basic).
   2. Fabricate guard and handrail components in accordance with applicable Codes.

1.5 SUBMITTALS

A. Metal fabrication details for all guard and handrail assemblies.

B. Shop Drawings:
   1. Indicate guard and handrail profiles, connections, terminations, and accessories.
   2. Project specific plans, elevations, and details of guards and handrails.

C. Samples:
   1. Guard and post assembly minimum 300 mm long indicating connections and finish.
   2. Handrail assembly minimum 300 mm long indicating connections and finish.

D. Information Submittals:
   1. Manufacturer's assembly and installation instructions.
   2. Manufacturer's Certificate of Proper Installation in accordance with Section 01 43 33, Contractor Field Services.
   3. Manufacturer's written recommendation describing procedures for maintaining guards and handrails including cleaning materials, application methods, and precautions to be taken in the use of cleaning materials.

1.6 QUALITY ASSURANCE

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

1.8 WARRANTY

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B241, A96061-T6.

B. Stainless Steel: Type 304 with minimum yield strength of 350 MPa.

C. Stainless Steel Rods and Plates: Type 2205 with minimum yield strength of 450 MPa.

D. Stainless Steel Self Drilling Fasteners: Type 302 PFHUC, S-WD 12-14x25mm #3 bimetal flex by HILTI, or Type 302 EHE352, 14x25mm type AB self tapping, flat undercut head, ALLFLEX by ELCO.

2.2 FINISHES

A. Grind all welds and terminations smooth.

B. Restore aluminum to original mill finish after fabrication. Buff and brighten all aluminum surfaces.

C. Where aluminum is in contact with dissimilar metals, concrete, or masonry, paint contact surfaces with aluminum coloured bituminous paint.

2.3 ANCHORS AND FASTENERS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

2.4 FABRICATION – WELDED ALUMINUM GUARDS AND HANDRAILS

A. Comply with Section 05 05 23, Welding-Quality Assurance.

B. Provide guard and handrail systems in accordance with the National Building Code, and for additional requirements specified.

C. Fabricate posts of 40 mm nominal size 6061-T6 Schedule 80 aluminum pipe, 42.16 mm o.d., 4.83 mm wall thickness with shop welded connections.

D. Fabricate railings of 40 mm nominal size 6061-T6 Schedule 40 aluminum pipe, 42.16 mm o.d., 3.56 mm wall thickness with shop welded connections.

E. Fabricate guards, posts and railings with the following characteristics:
   1. Vertical posts and horizontal or inclined railings of identical outside diameter.
   2. Vertical posts spaced at maximum 1200 mm o.c.
   3. Handrail and guard not less than 1070 mm above the floor, landing or platform on which it is installed.
   4. Handrail and guard at stair flight not less than 920 mm above line drawn through the front of nosing of stair.
   5. Guard and handrail assembly design configuration:
      a. Two rails as indicated – for interior locations
      b. Three rails as indicated – for exterior locations
   6. All railings aluminum construction.
   7. All connections, except expansion connections, continuously welded using welding rod to achieve welds identical in appearance to railings.
   8. Fabricate Type 2205 stainless steel base plate assemblies with Type 2205 vertical stainless steel rod sized for friction fit within aluminum posts.
   9. Anchor Handrail System with:
      a. Exterior:
         1) Side mounted post bracket anchored to supporting structure as indicated. Anchor posts to rod with stainless steel self drilling fasteners in predrilled pilot holes.
         2) Top mounted post base plate anchored to supporting structure as indicated. Anchor posts to rod with stainless steel self drilling fasteners in predrilled pilot holes.
      b. Interior:
         1) Posts embedded into formed blockouts cast into slab.
      c. Connection as indicated.
   10. Formed elbows at changes of direction of rails and handrail.
   11. Expansion sleeves at location of building expansion joints and at 8000 mm o.c. maximum spacing. Locate expansion sleeves within 300 mm of post.
   12. Handrail turned back to wall, floor or post at end of run.
   13. Posts located maximum 300 mm each way from corner or point of change of direction. Space both posts equal distance from corner.

14. Welded aluminum end caps at railing terminations.
15. Aluminum toe-board 125 mm high, 6.0 mm thick aluminum plate.
16. Hairline joints at butt connections.
    a. Interior welds: concave profile.
    b. Exterior or butt welds: smooth profile.
    c. End caps, closure plates, exposed edges: pencil round.
17. Wall Brackets: Extruded aluminum Julius Blum Model 498. Hollaender Model 82A. Grind exposed edges pencil round.
18. Hardware: Stainless steel.
19. Finish assembly after fabrication.
20. Do not field weld.

F. Fabricate gates and hinged assemblies complete with all necessary hardware including but not limited to hinges, hasps, canebolts and receivers. All hardware to be stainless steel.

G. Fabricate safety chains of Type 304 stainless steel safety chain with links 34 mm long by 6 mm cross section, and stainless steel safety snap and eyebolt. Install eyebolt through handrail post and fasten with stainless steel nut and lock washer.

H. Finish: Architectural Class I Anodic Coating, AA-C22A41 clear.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

3.2 INSTALLATION - ANCHORS AND FASTENERS

A. Comply with Section 05 50 00, Metal Fabrications (Basic).

3.3 INSTALLATION – GUARDS AND RAILINGS

A. Install guards and handrails to meet design requirements.

B. Fasten posts to SST rod in predrilled pilot holes, sized as recommended by fastener Manufacturer.

C. Set posts into holes of post diameter plus 20 mm maximum, 100 mm deep. Side mount railing with brackets and anchors as shown.Top mount railing with brackets as shown.

D. Grout posts with epoxy grout, plumb and aligned.

3.4 INSTALLATION – WALL MOUNTED HANDRAILS

A. Install handrails to meet design requirements.

B. Anchor handrails to walls with wall brackets. Provide wall bracket filler for gypsum board application.

C. Anchor wall brackets with bolts. Exposed threads and nuts are not acceptable.

3.5 INSTALLATION – TOEBOARD

A. Provide continuous toeboard at all platforms, ramps, landings or other floor openings, except at gates or where 125 mm or higher curbs are installed.

B. Accurately measure in field for correct length, after handrail post installation, cut and secure to posts with stainless steel fasteners.

C. Dimension between bottom of toeboard and walking surface not to exceed 3.0 mm. Cope toeboard at baseplates.

D. Provide expansion and contraction connections at each post. Provide expansion sleeves at location of railing expansion sleeves.

END OF SECTION