

SPECIFICATIONS FOR

**Department of Fisheries and Oceans
Institute of Ocean Sciences
Lift Station Upgrading**

**ISSUED FOR TENDER
2016/01/20**

Prepared by:

WSP Group

Reference No. 131-19104-12

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END OF SECTION



Part 1 General

1.1 RELATED REQUIREMENTS

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises renovation of an existing sewage lift station, located at the Institute of Ocean Sciences, located at :

- .1 9860 West Saanich Road
 P.O. Box 6000
 Sidney, British Columbia
 V8L 4B2.

1.3 CONTRACT METHOD

- .1 Construct Work under stipulated price contract.

1.4 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Consultant.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Consultant, in writing, any defects which may interfere with proper execution of Work.
- .3 Work of Project executed during Work of this Contract, and which is specifically excluded from this Contract:
 - .1 Temporary relocation of CRD electrical panel to permit construction.
- .4 Work of Project which will be executed after completion of Work of this Contract, and which is specifically excluded from this Contract:
 - .1 Installation of CRD electrical panel inside building upon completion as shown on electrical drawings..

1.5 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner during construction.
- .3 Required stages:
 - .1 Provision of temporary sewage pumping to accommodate the continued operation of facilities during demolition/construction.
 - .2 Removal of existing pumping station and equipment.
 - .1 Coordinate and allow for temporary relocation of the CRD electrical panel to permit construction.

- .2 Disconnection of all remaining electrical power to the sewage lift station.
- .3 Excavation and construction of concrete grade beam reinforcing of the concrete walls to allow for demolition of the slab.
- .4 Saw-cutting of concrete slab to lines shown on plan, including removal and disposal.
- .5 Construction of wood frame building to enclose the dry-well side of the sewage lift station.
- .6 Complete installation of new piping, pumps, valves, electrical, and controls as shown on drawings.
- .7 Complete electrical connections to existing DFO facilities in accordance with electrical drawings.
- .8 Start-up and commissioning of equipment.
- .9 Removal of temporary pumping equipment and final clean-up.
- .4 Maintain fire access/control.

1.6 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work to allow:
 - .1 Owner occupancy.
 - .2 Continued sewage pumping to existing sewage force main.
- .2 Co-ordinate use of premises under direction of Owner.
- .3 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.7 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.8 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING FACILITY

- .1 Execute work with least possible interference or disturbance to operations and normal use of premises. Arrange with Owner to facilitate execution of work.

1.9 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.

- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Owner submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data in SI Metric units.
- .4 Where items or information are not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Owner. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Owner, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Owner or Consultant's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Owner or Consultant review.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Where required, submit drawings stamped and signed by professional engineer registered or licensed in the Project Jurisdiction.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow ten days for review of each submission.
- .5 Adjustments made on shop drawings are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Owner prior to proceeding with Work.

- .6 Make changes in shop drawings as Owner or Consultant may require, consistent with Contract Documents. When resubmitting, notify Owner in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Contractor's name and address.
 - .3 Identification and quantity of each shop drawing, product data and sample.
 - .4 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .3 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .4 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Owner or Consultant may reasonably request. The required submittals need to be formally identified against the shop drawing requirements for document control purposes.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Owner or Consultant where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Delete or cross out information not applicable to project.
- .13 Supplement standard information to provide details applicable to project.

- .14 If upon review by Owner and Consultant, no errors or omissions are discovered or if only minor corrections are made, electronic file will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .15 The review of shop drawings by Owner and Consultant is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Owner approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 MANUFACTURERS INSTRUCTIONS

- .1 Submit electronic copies of manufacturers instructions for requirements requested in specifications. This will consist of pre-printed material describing installation of product, system or material, including special notices, Material Safety Data Sheets, electrical requirements, hazards and safety precautions.

1.4 OPERATIONS AND MAINTENANCE DATA

- .1 Submit electronic copies of Operation and Maintenance Data for requirements requested in specifications.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Reinforcing Steel 03 21 00
- .2 Cast-in-place Concrete 03 30 00

1.2 REFERENCE STANDARDS

- .1 CAN/CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.
- .3 CAN/CSA-S269.3-M92 (R2008) - Concrete Formwork.

Part 2 Products

2.1 FORMWORK MATERIALS

- .1 Formwork materials shall conform to CAN/CSA-A23.1 and be:
 - .1 Form plywood is to be exterior grade. Plywood is to be resin coated one side (in contact with concrete), and is to be free from defects, damage, residual concrete, etc.
 - .2 Exposed surface formwork are to be square edged, smooth panels of plywood, metal or plastic. The panels are to be square and made in a true plane, clean, free from holes, surface marking and defects.
 - .3 Tubular forms: Spirally wound, adhesive laminated fibre paper tube forms with diameters as required, with a minimum bursting pressure of 965 kN/m² (140psi) and internally treated with release agent.

2.2 ACCESSORIES

- .1 Form Release Agent: Proprietary, non-volatile material which will not stain the concrete or impair the application of finishes or coating to the surface.
- .2 Form Ties: Removable or snap-off metal ties, fixed or adjustable length, that act as both spreader and tie, and that may be broken back not less than 9mm (3/8") from the concrete surface, free of devices leaving holes larger than 25mm (1") diameter in concrete surface.
 - .1 For exposed concrete, use snap ties complete with plastic cone-shaped plugs and fillers of light grey concrete plugs, with a minimum diameter of 15mm (5/8") and a minimum depth of 25mm (1").
- .3 Form Accessories: Inserts, ties or hangers, shall be commercially manufactured. Size and type as indicated on drawings.
- .4 Chamfer Strips & Void formers: Wood or plastic type.

2.3 DESIGN

- .1 Contractor shall be responsible for the design of formwork and its construction including shoring and bracing to ensure stability for the anticipated construction, gravity, equipment, worker and lateral loads related to the rate of concrete placing.
- .2 Construct forms of wood, metal or other approved materials, to produce concrete conforming to the shape, lines and dimensions shown on the drawings and to prevent excessive mortar leakage.
- .3 For multiple use applications, maintain formwork in such condition that the original dimensions and standard of finish produced does not deteriorate.

Part 3 Execution

3.1 INSTALLATION OF FORMWORK

- .1 Erect and brace formwork plumb and true. Align form joints and make watertight. Keep form joints to a minimum.
- .2 Coordinate with all other trades locations for chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .3 Coordinate with all other trades placing of anchors, sleeves and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .4 Tolerances:
 - .1 Variations from plumb: 6mm (1/4") in 3.0m (10'-0"), 9mm (3/8") for longer dimensions.
 - .2 Variations in level: 6mm (1/4") in 3.0m (10'-0").
 - .3 Variations of the linear building lines and related position of columns, walls and partitions from plan: 6mm (1/4") in 6.0m (20'-0"), 12mm (1/2") for longer dimensions.
 - .4 Variation in size of openings: $\pm 12\text{mm}$ (1/2").
 - .5 Variation in cross-sectional dimension: 3mm (1/8") to 6mm (1/4").
 - .6 Variation in steps: rise $\pm 3\text{mm}$ (1/8"), tread $\pm 6\text{mm}$ (1/4").
- .5 Construct templates and supports as required to rigidly fix reinforcing dowels and anchor bolts in the forms prior to placing concrete.

3.2 PREPARATION OF FORMWORK SURFACES

- .1 Untreated forms shall be kept moist prior to the placing of concrete and wetted at the time of placing, in order to prevent concrete shrinkage.
- .2 Treated formwork shall have the approved form coating applied in accordance with the manufacturer's recommendations before reinforcement and cast-in items are placed. Remove any excess form coating.
- .3 Thoroughly clean and retreat forms before reusing.

3.3 REMOVAL OF FORMWORK

- .1 Do not remove forms, shores and bracing until the concrete has gained sufficient strength to carry its own weight and construction and design loads which are liable to be imposed on it. The strength of concrete is to be verified by compressive test results.
- .2 Remove falsework progressively so that no shock loads or unbalanced loads are imposed on the structure. In general, unless otherwise approved, load supporting forms may be removed when the concrete has attained 70% of the required design 28 day compressive strength if the construction is re-shored.
- .3 Forms not directly supporting the weight of concrete may be removed as soon as the stripping operation will not damage concrete.
- .4 The removal of form ties shall be done carefully to avoid marking the concrete and to allow for patching. Grout the bottom of form tie holes to prevent rust staining in exposed areas.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- | | | |
|----|----------------------------------|----------|
| .1 | Concrete Forming and Accessories | 03 10 00 |
| .2 | Cast-in-place Concrete | 03 30 00 |

1.2 REFERENCE STANDARDS

- .1 CAN/CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.
- .3 CAN/CSA-G30.18-09 – Carbon Steel Bars for Concrete Reinforcement.
- .4 CAN/CSA-W186-M1990 (R2012) - Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .5 American Concrete Institute (ACI) Detailing Manual 2004-(SP-66)
- .6 Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice, 28th Edition.

1.3 SUBMITTALS

- .1 Prepare and submit shop drawings, consisting of bending, cutting and placing drawings for all reinforcing steel.
- .2 Generally, placing to be in accordance with the ACI Manual of Standard Practice for Detailing Reinforcing Concrete Structures and the CRSI Manual of Standard Practice for Placing of Reinforcing Bars.
 - .1 Structural drawings take precedence over placement drawings and bar schedules.

1.4 INSPECTION

- .1 The consultant's general review are undertaken to inform the Owner of the Contractor's performance, and in no way shall augment the Contractor's quality control procedures or relieve him of his contractual responsibilities.
- .2 Advise the Consultant a minimum of 24 hours prior to placement of concrete. Failure to give adequate notice may cause Consultant to classify the work as defective.
- .3 Concrete shall not be placed until the reinforcement and its placement has been reviewed by the Consultant.
- .4 Correct defects and irregularities to the satisfaction of the Consultant, at no cost to the Owner.

Part 2 Products

2.1 MATERIALS

- .1 Reinforcing bars: billet steel deformed bars, Grade 400R 400MPa (60 ksi) yield strength, conforming to CAN/CSA-G30.18-M92 (R2007).
- .2 Weldable reinforcing bars: weldable low alloy steel deformed bars, Grade 400W 400MPa (60 ksi) yield strength, conforming to CAN/CSA-G30.18-M92 (R2007).
- .3 Welded steel wire fabric: sizes and gauges are to be as shown on the structural drawings, flat sheets only.
- .4 Supports: wire chairs, bolsters, hanger bars, spirals, stirrups and plastic spacers of size and strength to adequately support reinforcing in required position.
- .5 Tie wire: annealed wire, 1.5mm (16ga) or heavier.

2.2 FABRICATION

- .1 Fabricate reinforcing to CAN/CSA-A23.1/A23.2-04.
- .2 Reinforcing bars shall be cold bent. Reinforcing bars shall not be straightened or re-bent without written approval of the Consultant.
- .3 The location of reinforcement splices not shown on the drawings shall be approved by the Consultant and shall, for beams and slabs, be away from points of maximum stress in the steel.

2.3 DETAILING

- .1 Conform to CAN/CSA-A23.1-04 and CAN/CSA-A23.3-04 for all hooks, bends, laps and similar details not specifically noted.
- .2 Lap bottom bars at support locations and top bars at mid-spans, unless noted otherwise on drawings.
- .3 Provide (24") long (each leg) corner bars to match all horizontal bars at all wall and grade beam corners and intersections.
- .4 Provide 4 extra 15M diagonal corner bars around holes larger than 100 mm (4") in floor slabs and walls. Corner bars shall be 1.5 times length of shortest side of hole or minimum 750 mm (30") long.
- .5 Provide 15M bar each face for holes larger than 1000 mm (40") in walls.

Part 3 Execution

3.1 PLACING

- .1 Place reinforcement within a tolerance of 6 mm (1/4") for slab steel and 12 mm (1/2") for other steel. Locate bends and end of bars within 50 mm (2") of specified location.
- .2 Provide minimum concrete cover to reinforcing steel in accordance with CAN/CSA-A23.1-04 and as indicated herein or on drawings:

- .3 Cast against and permanently exposed to earth 76mm (3”).
- .4 Interior faces 40 mm (1 1/2”).
- .5 Where a structural concrete member is required to have a fire resistance rating, provide minimum concrete cover to reinforcing steel in accordance with Appendix D of the British Columbia Building Code, except where indicated otherwise on drawings.
- .6 Provide 10M "U" spacers at 3 m (10'-0”) on centre horizontally and 1.5 m (5'-0”) on centre vertically to hold wall reinforcing mats in position.
- .7 Provide non-corrosive and non-staining reinforcing steel supports at surfaces where concrete will be exposed.
- .8 Set all wall and column dowels prior to placing concrete so that each dowel is maintained in its correct position. Do not insert dowels in freshly placed concrete unless approved by the Consultant.

3.2 WELDING

- .1 Any welding of reinforcing steel shall be in accordance with CAN/CSA-W186-M1990 (R2007).
- .2 No welding of reinforcing steel shall occur without approval of the Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1	Concrete Forming and Accessories	03 10 00
.2	Reinforcing Steel	03 21 00
.3	Structural Steel Framing	05 12 00

1.2 REFERENCE STANDARDS

- .1 CAN/CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-A23.3-04 (R2010) - Design of Concrete Structures.
- .3 CAN/CSA-A3000-08 (Consolidation) - Cementitious Materials Compendium.
- .4 CAN/CGSB-51.33-M89 - Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

1.3 TESTING

- .1 Testing of concrete and concrete materials will be carried out by testing agency as approved by the Consultant. Provide access for such testing. Initial testing paid by Owner.
- .2 It is the Contractor's responsibility to call for the specified number of tests at the appropriate time. Provide and maintain facilities for the temporary storage of concrete test cylinders.
- .3 Any additional testing, or retesting, required as a result of materials not meeting the specifications is to be paid for by the Contractor.
- .4 Perform a complete test set for each 50 cubic meters (65 cubic yards) of concrete, or fraction thereof, and in any event, not less than one test set for each type of concrete each day it is used.
- .5 Each test set, conforming to CAN/CSA-A23.2, is to consist of:
 - .1 Slump test;
 - .2 Air content test;
 - .3 Temperature measurement and
 - .4 Not less than three (3) moulded specimens for compression testing. Test one (1) at seven (7) days and two (2) at 28 days.
- .6 Provide the Consultant with copies of all concrete test results at regular intervals. Reports are to include the following:
 - .1 Project name;
 - .2 Date of sampling;
 - .3 Air temperature at time of sampling;

- .4 Concrete temperature;
 - .5 Concrete supplier;
 - .6 Exact location on the structure at which the concrete test set is taken;
 - .7 Slump;
 - .8 Air content;
 - .9 Method of curing;
 - .10 Cylinder strength.
- .7 When air temperature is below 5°C (41°F) during placement, or is likely to fall below 5°C (41°F) within 24 hours after placement, make two (2) additional specimens for compression testing. Field cure those two (2) cylinders in a manner which simulates as closely as possible the curing of the placed concrete.

Part 2 Products

2.1 CONCRETE MATERIALS

- .1 Portland Cement: conforming to CAN/CSA-A3000-03 (Consolidation), type as per Concrete Mix Schedule.
- .2 Water: conforming to CAN/CSA-A23.1.
- .3 Aggregates: conforming to CAN/CSA-A23.1, containing no shale, sizes as per Concrete Mix Schedule.
- .4 Air Entraining Admixture: conforming to CAN/CSA-A23.1, percentage as per Concrete Mix Schedule.
- .5 Chemical Admixtures: Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 ACCESSORY MATERIALS

- .1 Concrete Bonding Agent: Approved proprietary material to be applied directly to concrete or mixed with cement and sand before application.
- .2 Concrete Curing Agent: conforming to CAN/CSA-A23.1.
- .3 Polyethylene Vapour Barrier: 150 micrometre (6mil) polyethylene film, Type 1, conforming to CAN/CGSB-51.33.
- .4 PVC Waterstops: extruded polyvinylchloride with ribbed flanges, 150 mm (6") x 5 m (16'-0") unless noted otherwise.
- .5 Edge Joint Filler: Bituminous impregnated fibreboard, 12mm (1/2") thick, conforming to ASTM D1751.
- .6 Grout: Non-shrink, non-metallic dry pack or flowable, 35MPa (5 ksi) compressive strength at 28 days.
- .7 Control Joint Sealant: Cold-applied rubberized-asphalt sealer, 'W.R. Meadows' #158, or equivalent.

2.3 MIX DESIGN

- .1 Use ready-mix concrete conforming to CAN/CSA-A23.1 and these specifications. Site-mix concrete is permitted for placements not exceeding 1 cubic metre (1.5 cubic yards) and for core-filling masonry and bond beams.
- .2 Concrete shall be Normal Weight with a unit weight of 23.6 kN/m³ (150 pcf).
- .3 No Calcium Chloride, in any form, is permitted in any concrete mix without the written approval of the Engineer.
- .4 Cement: Concrete Type and Strength for concrete in contact with soil are to be confirmed with Geotechnical Engineer.
 - .1 Type HS: High Sulphate.
- .5 Curing: Concrete Placing and Curing shall not be carried out in temperatures lower than 5°C (40°F) without protective measures.
- .6 The variation of minimum 28 day compressive strength shall be within 15%.
- .7 Tolerance in slump shall be 20mm (3/4") for specified slumps less than 75mm (3"), and 30mm (1-1/8") for slumps of 75mm (3") and greater.

2.4 CONCRETE MIX SCHEDULE

Component	Min. Comp. Strength *	Type	Maximum Aggregate Size	Water/Cement Ratio	Slump	Air Content	Curing Type	Exposure Class
Pile Caps, Grade Beams &/or Foundation Walls	32 MPa	HS	20mm	0.45	80mm	4-7%	1	-
Structural Slab & Beams	30 MPa	GU	20mm	0.55	70mm	None	1	-
Parking Structural Slab	35 MPa	GU	20mm	0.40	70mm	5-8%	2	C-1
Concrete Topping (Q-Deck)	25 MPa	GU	20mm	0.55	50mm	None	1	-

* Strength at 28 days

Part 3 Execution

3.1 EXAMINATION AND PREPARATION

- .1 No flooding water is permitted on foundation beds and skim coats where footings and other concrete work is to be placed. Place concrete only on frost-free ground. Remove previously frozen bearing surfaces.
- .2 Ensure that foundations bear on undisturbed soil. If bearing surfaces are rejected because conditions do not meet those anticipated during the design, make adjustments only as directed. No extra payment will be made for adjustments made necessary because of damage to bearing surfaces caused by weather, traffic or removal of frozen material.
- .3 Ensure that compacted fill has been placed to meet specified requirements, and that underground services have been installed, inspected, tested and approved.

- .4 Keep excavations dry while placing concrete.
- .5 Before concrete is placed, all reinforcing steel, accessories and hangers, inserts, conduits, sleeves, outlets, etc. must be securely tied in place and reviewed.
- .6 All dirt, clips, sawdust, water, snow, ice and other foreign matter must be removed from forms and reinforcing steel.
- .7 When experience or weather records indicate adverse temperatures are probable, plan for protecting all concrete at early ages is to be established and the necessary special equipment and materials are available on site before adverse temperatures occur.

3.2 CONDUITS, PIPES, OPENINGS AND INSERTS

- .1 Electrical conduit and other pipes embedded in the concrete are not to be of a material harmful to the concrete and are to:
 - .1 Not be a larger outside diameter than one-third (1/3) the thickness of the slab in which they are embedded;
 - .2 Not be spaced closer than 3 diameters on centre unless otherwise shown on the Drawings;
 - .3 Have a concrete covering of not less than 25mm (1").
 - .4 Be so installed that it will not require cutting, bending or displacement of the reinforcement or impair the structural strength of the system.
- .2 Provide and cast in all sleeves, frame-outs, inserts, and fastening devices, including reglets and nailing strips, unless otherwise specified.
- .3 Anchor bolts, nuts and washers for structural steel and precast concrete shall be supplied and installed by the Contractor. Anchor bolts shall be set before concrete placement in accordance with approved shop drawings. Other anchoring devices for structural steel shall be supplied by the steel trades and installed by the Contractor in accordance with approved shop drawings.
- .4 The Contractor shall cooperate with all trades who are placing inserts, bolts, sleeves, hangers, conduits, reglets, nailers, etc.. Contractor shall notify other trades sufficiently in advance to ensure that provision is made for openings, inserts and fastenings.
- .5 Costs for cutting, coring & inserts in concrete for installation of sleeves, inserts, bolts, conduits, etc. not installed prior to concrete placement shall be at the cost of the Trade requiring the sleeves, inserts, bolts, conduits, etc..
- .6 Contractor shall grout all openings or sleeves in the concrete after the completion of work by other Trades.

3.3 PLACING CONCRETE

- .1 Place concrete in conformance with the requirements of CAN/CSA-A23.1.
- .2 The time lapse between the introduction of cement into the concrete mixes and final placement of the concrete into the forms shall not exceed 120 minutes (2 hours).
- .3 Conveying and placing equipment is to be such that when concreting has started, the depositing of concrete will be at such a rate and of such sequence that the concrete is at all times sufficiently plastic to ensure proper bonding of successive layers or panels.

- .4 Equipment and tools are to be kept free from hardened concrete and foreign material and is to be cleaned at frequent intervals.
- .5 Concrete is to be placed in the forms as close as it is practical to its final position to avoid segregation due to re-handling or flowing.
- .6 To prevent segregation, the vertical height of free fall of concrete is not to exceed 1.5m (5'-0"). For falls of greater than 1.5m (5'-0"), or if segregation occurs, chutes and spouts designed to prevent segregation of concrete are to be used.
- .7 While concrete is being placed it is to be consolidated thoroughly and uniformly by means of tamping, hand tools, vibrators or finishing machines to secure a dense, homogeneous structure, close bond with reinforcement and with smooth formed surfaces. Internal vibrators are to be used whenever practical.
- .8 Internal vibrators are to be applied at the point of deposit in the areas of freshly placed concrete, allowed to sink by their own weight in the concrete until they penetrate into the previous layer of concrete. They are to be withdrawn immediately at the same speed at which they sank, moved about 300mm (12") to a new location and the process repeated. Extreme care is to be taken to ensure that internal type vibrators do not disturb the reinforcing steel or the forms.
- .9 Place concrete as a continuous operation stopping only at construction joints indicated on the drawings or as follows: At centre of span of suspended slabs, beams and joists; in walls and columns immediately above or below floor construction; at centre of steel beam that supports concrete slab. The Consultant must approve all construction joint locations and may, at his discretion, require keys, mortises or extra reinforcing to be provided by the Contractor at construction joints not shown on the drawings.

3.4 SLAB CONSTRUCTION

- .1 The tops of all floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated of the Drawings and steel trowel finished to a tolerance of 12mm (1/2") in 3.0m (10'-0") dimension and ± 12 mm (1/2") overall.
- .2 Maintain topping slab thickness as indicated on Drawings. Thickness of topping are not be modified to facilitate finishing to specified tolerances, or to compensate for cambers in supporting structural members.

3.5 COLD WEATHER PROTECTION REQUIREMENTS

- .1 Cold weather protection requirements shall be as per CAN/CSA-A23.1, except that the following minimum requirements must also be met:
 - .1 Protection Against Early Frost Damage: Effective means is to be provided for maintaining the temperature of the concrete in place above 10°C (50°F) for a minimum period of 3 days or until sufficient hydration has occurred to protect the concrete from frost damage.
 - .2 Protection for Structural Safety: If, subsequent to the above period of protection, the ambient conditions are not likely to be favourable for continuous strength development, the protection period is to be extended until the concrete has achieved sufficient strength for structural safety.

- .3 Protection for Strength and Durability: When subsequent ambient conditions are not conducive to continued curing and strength development, the protection period is to be extended until a total period of 7 days at temperatures above 10°C (50°F) has been attained.
- .4 Concrete Temperature: When the air temperature is at or below 5°C (40°F) or when there is a probability of its falling to that limit within 24 hours of placing, the temperature of the concrete as placed is to be between 10°C (50°F) and 30°C (85°F).
- .5 Placing: Concrete is not to be placed against any surface that is at a temperature of less than 5°C (40°F) or will lower the temperature of the concrete once placed to below 10°C (50°F).
- .6 Cold Weather Protection: Protection is to be provided for newly placed concrete by means of suitable enclosures, coverings and/or adequate insulation as follows:
 - .1 For temperatures from 0°C (32°F) to 5°C (40°F), suitable covering plus adequate insulation.
 - .2 For temperatures below 0°C (32°F), suitable enclosure plus supplementary heat or adequate insulation.
- .7 Heating of Enclosures: At the time of placing and during placing, concrete surfaces are to be protected by formwork or an impermeable membrane from direct exposure to the combustion gasses of heaters.
- .8 Protection by Insulation: The amount of insulation required to properly cure concrete in cold weather is to be determined on the basis of the expected air temperatures and wind velocity (wind chill), the size and shape of the concrete structure and the amount of cement in the mix.
- .9 Cooling After Protection: To avoid cracking of the concrete due to sudden temperature change near the end of the curing period, the protection is not to be completely removed until the concrete has cooled to the temperature differential of 15°C (60°F)

3.6 HOT WEATHER PROTECTION REQUIREMENTS

- .1 Hot weather protection requirements shall be as per CAN/CSA-A23.1, except that the following minimum requirements must also be met:
 - .1 Job Preparation: Facilities are to be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. In extremely hot weather, the formwork, reinforcement and concreting equipment is to be protected from the direct rays of the sun, or cooled by fogging or evaporation.
 - .2 Concrete Temperature: When the air temperature is at or above 25°C (75°F) or when there is a probability of it rising to this temperature during the placing, special effort is to be made to maintain the temperature of the concrete as low as practical, and in no case more than 30°C (85°F).
 - .3 Protection From Drying: When the rate of surface moisture evaporation exceeds 0.75 kg/m²/hr, concrete shall be protected according to one or more of the following measures:
 - .1 dampening the subgrade prior to placing the concrete;
 - .2 erecting sunshades over the concrete during finishing operations;

- .3 lowering the concrete temperature;
- .4 covering the concrete surface with white polyethylene sheeting between the various finishing operations;
- .5 beginning the concrete curing immediately after trowelling; or
- .6 placing and finishing at night.

3.7 CURING

- .1 Curing of concrete shall be as per CAN/CSA-A23.1, except that the following minimum requirements must also be met:
 - .1 All equipment needed for curing and protection of the concrete is to be on hand and ready for use before actual placing is started.
 - .2 The water used for curing is to be clean and free from any materials that will stain or discolour the concrete.
 - .3 A liquid, membrane forming curing compound may be used under circumstances where application of such compounds will not jeopardize the appearance of the concrete or the bonding of floor finishes.
 - .4 Wheeling, handling, piling or storing of any material over or on slabs is prohibited during the first 7 days after placing concrete.
 - .5 Initial Curing: Keep concrete surface continuously moist for minimum 24 hours after placement.
 - .6 Final Curing:
 - .1 Type 1 (Basic): Immediately following Initial Curing and before the concrete has dried; All exposed, non-formed surfaces are to be cured for a period of at least 3 consecutive days, at which time the temperature of the air in contact with the concrete is to be above 10°C (50°F) or for a time necessary to attain 40% of the specified strength.
 - .2 Type 2 (Additional): Immediately following Initial Curing and before the concrete has dried; All exposed, non-formed surfaces are to be cured for a period of at least 7 consecutive days, at which time the temperature of the air in contact with the concrete is to be above 10°C (50°F) or for a time necessary to attain 70% of the specified strength.
 - .3 Type 3 (Extended): Immediately following Initial Curing and before the concrete has dried; All exposed, non-formed surfaces are to be wet cured for a period of at least 7 consecutive days. The Acceptable Wet Curing Methods Are:
 - .1 Ponding or continuous sprinkling.
 - .2 Absorptive mat or fabric kept continuously wet.
 - .3 Continuous steam vapour mist bath not exceeding 65°C (150°F).
 - .4 Polyethylene sheet covering, min. 300mm (12") lapped and edges weighted.

3.8 ACCEPTANCE

- .1 Where material or workmanship fails to meet the requirements of the specifications and tests, the work may be rejected by the Consultant. Rejected work shall be replaced or repaired to the Consultant's approval at no cost to the Owner.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Work of this section includes, but not limited to;
 - .1 Supply and installation of all metal fabrications complete with anchoring, fastenings and hardware.
 - .2 Miscellaneous steel and iron sections not specified in other sections or in design details.

1.2 RELATED SECTIONS

- .1 Submittal Procedures Section 01 33 00
- .2 Structural Steel Framing Section 05 12 00
- .3 Exterior Painting and Finishing Section 09 90 13

1.3 REFERENCE STANDARDS

- .1 CAN/CSA-S16-09 - Design of Steel Structures.
- .2 CAN/CSA-G40.20-04/G40.21-04 (R2009) - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 CAN/CSA-G164-M92 (R2003) - Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 CSA-W47.1-09 - Certification of Companies for Fusion Welding of Steel.
- .5 CSA-W55.3-08 - Certification of companies for resistance welding of steel and aluminum.
- .6 CSA-W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).
- .7 CAN/CSA-W117.2-06 (R2011) - Safety in Welding, Cutting and Allied Processes.
- .8 CAN/CGSB-1.105-M91 "Quick-Drying Primer"
- .9 CAN/CGSB-1.181-99 "Ready-Mixed Organic Zinc-Rich Coating"
- .10 ASTM A53/A53M-12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .11 CSA-W48-06 (2011) - Filler Metals and Allied Materials for Metal Arc Welding.
- .12 ASTM A307-10 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- .13 ASTM A108-07 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

1.4 SUBMITTALS

- .1 Comply with the requirements of Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings and product data prior to commencement of fabrication.

- .3 Shop Drawings shall include, though not limited to, materials, construction details, size of sections, core thickness of metal, finishes, connections, joints, methods of anchorage, number of anchors, supports, reinforcement, shop and erection details, cuts, copes, holes, threaded fasteners, rivets and welds. Shop Drawings shall be prepared under the supervision of, signed and sealed by a Professional Engineer registered in BC.
- .4 All steel connections and splices not shown on structural drawings shall be designed, signed and sealed by a Professional Engineer currently registered in BC and clearly shown on shop drawings for review by the Consultant.
- .5 The submission is required for the Consultant's review for compliance with the general design concept only, and shall in no way relieve the Contractor of his responsibility for the correct design, details, dimensions and site conditions.

1.5 FABRICATOR AND ERECTOR QUALIFICATIONS

- .1 The fabricator will be fully qualified to meet all requirements of CAN/CSA-S16, CSA-W59 and shall be certified to all conditions of CSA-W47.1 and CSA-W55.3. Fabricator shall be certified by the Canadian Welding Bureau and shall submit verification of same at time of bid.
- .2 Field and shop welding Work shall be performed throughout by certified welders.

1.6 COORDINATION

- .1 Where metal fabrications are scheduled to be finish painted, ensure that shop paint primer is compatible with painting coats specified in Section 09 90 13 - Interior Painting and Finishing and Section 09 90 23 - Exterior Painting and Finishing.
- .2 Give to the other Sections all necessary cooperation, directions and information regarding items supplied under this Section and in particular, but not limited to, the following:
 - .1 Details regarding the setting of anchor bolts, strap anchors, bearing plates and other members built into the work of other Sections.
- .3 Exchange shop drawings with regard to the details noted above with relevant Sections to ensure coordination of same. Do not cut holes through steel members in the field for any reason until their location has been individually approved by the Consultant. All approved field cutting shall be done as part of the work of this Section.

1.7 PROTECTION

- .1 Take all necessary precautions to protect existing or previously erected components at the time erection commences.
- .2 Exercise due care in storing, handling and erecting fabrications at all times so that no piece will be bent, twisted, or otherwise damaged. Damaged items shall be corrected at the Contractor's expense. Where damage is deemed irreparable by the Owner or Consultant, the affected item shall be replaced.
- .3 Protect architecturally exposed steel during fabrication, handling, shipping, storage and erection to prevent damage to surfaces by marking, bending, denting and soiling with grease, oil, weld, flux and other foreign materials.

Part 2 Products

2.1 MATERIALS

- .1 Provide steel to CAN/CSA-G40.20/G40.21 with the following grades:
 - .1 Rolled Structural Steel Sections: grade 300W.
 - .2 Rolled Structural Steel 'W-Sections': Grade 350W.
 - .3 Hollow Structural Steel Sections: Grade 350W, Class C.
 - .4 Structural Bars and Plates: Grade 300W.
 - .5 Pipe: Standard weight, Grade B, conforming to ASTM A53.
- .2 Welding materials: shall conform to CSA-W48.
- .3 Fasteners: Non-corrosive (stainless steel or hot-dipped galvanized steel) of same material, colour and finish as the metal to which they are applied unless otherwise noted and of sizes and types to suit application as specified on shop drawings.
 - .1 Screws: flat head countersunk of length adequate to penetrate no less than 3 fully exposed threads beyond joined materials.
 - .2 Bolts: Hexagonal head bolts and nuts shall conform to the requirements of ASTM A307. Hot-dip galvanized complete with washers.
 - .3 Shear Stud Connectors: to ASTM A108, minimum tensile strength of 400MPa (8350psf).
 - .4 Expansion Bolts: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers conforming to ASTM A307.
 - .5 Epoxy Anchors: Hilti HAS Rods and RE 500 Adhesive, complete with required nuts and washers conforming to ASTM A307.
- .4 Galvanizing:
 - .1 Exposed Exterior Application: Hot-dipped according to CAN/CSA-G164-M92 (R2003), minimum coating 600g/m² (2oz/ft²).
 - .2 Protected Exterior Application: Hot-dipped according to CAN/CSA-G164-M92 (R2003), minimum coating 180g/m² (0.6oz/ft²).
 - .3 Protected Interior Application: Hot-dipped according to CAN/CSA-G164-M92 (R2003), minimum coating 75g/m² (0.25oz/ft²).
- .5 Touch up Galvanizing: ready-mixed, organic, zinc-rich coating to CAN/CGSB-1.181-99.
- .6 Shop Primer: to CAN/CGSB 1.40-97, steel alkyd primer.
- .7 Grating: Fisher and Ludlow Type 19-4 with Bearing Bar size 32mm x 3mm
- .8 Isolation Coating: non-staining alkali resistant bituminous paint.

2.2 FABRICATION

- .1 Verify all dimensions on site prior to proceeding with shop fabrication.
- .2 Shop fabricated components where possible in largest practical sections for delivery to site.

- .3 Fabricate components square, straight, true, free from warpage and other defects. Accurately cut, machine, file and fit joints, corners, copes and mitres.
- .4 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Exposed connections to be of same material, colour and finish as base material on which they occur.
- .5 Exposed welds are to be continuous for length of each joint. File or grind exposed welds smooth and flush.
- .6 Supply all components required for anchoring to concrete or masonry, bolting or welding to structural framing or standing free or resting in frames or sockets.
- .7 All steel shall be thoroughly cleaned of all loose mill scale, loose rust, oil or dirt.
- .8 Remove all marks and surface imperfections from architectural finish surfaces exposed to view and refinish to match surrounding surfaces.

2.3 SURFACE PREPARATION AND SHOP PRIMING

- .1 Where steel fabrication is scheduled to be shop primed, clean surfaces of dirt and other foreign matter in accordance with SSPC-SP3 – Power Tool Cleaning.
- .2 Where steel fabrication is scheduled to be shop primed and finish painted, clean surfaces of dirt and other foreign matter in accordance with SSPC-SP6 – Commercial Blast Cleaning.
- .3 Clean welds by wire brushing and wash down with clean water to remove the chemical residues left by the electrodes.
- .4 Apply shop paint primer in accordance with CAN/CSA-S16 to a dry film thickness of 50 to 75 micrometers, grey colour. Ensure compatibility of primer with architectural finishes for exposed structural steel.
 - .1 Shop primer shall be applied to:
 - .1 Members exposed to outside conditions,
 - .2 Members inside building shell,
 - .3 Members penetrating slabs-on-grade,
 - .4 Members to receive finish painting.
 - .2 Do not prime paint the following surfaces:
 - .1 Surfaces and edges to be field welded,
 - .2 Steel to receive fireproofing.
 - .3 After erection and connections are complete, provide a field touch-up coat of paint to all surfaces that have been scraped, chipped, cut or welded.

2.4 COMPONENT DESIGN

- .1 Provide all necessary anchors, bolts and plates as required for connecting components to the structure.
- .2 Install components plumb and true in exact locations, using welded connections wherever possible to provide a rigid structure. Ensure alignment with adjacent construction.

- .3 Mount brackets to wall and/or blocking plumb and true with anchors appropriate to wall construction.
- .4 Touch-up and make good any damage to priming coat.
- .5 Coordinate with related work to ensure no interruption in installation.
- .6 Refer to design details for all design requirements, components and geometry and additional requirements as noted here;
 - .1 Stairs:
 - .1 All stairs and landing sections, attachments and connections, except where members are specifically sized on the drawings shall be designed to support a minimum live load of 4.8 kN/m² (100psf).
 - .2 Interior stairs shall be shop prime coated for paint finish. Exterior stairs to be hot dip galvanized after fabrication for paint finish.
 - .2 Handrails and Guardrails:
 - .1 All stair and landing handrail and guardrail components, attachment and connections, except where members are specifically sized on the drawings shall be designed to support the greater of; a lateral load of 0.75 kN/m (51 lb/ft) or a concentrated load of 1.0kN (225lb) applied at any point.
 - .2 Cap exposed ends of pipe railings.
 - .3 Terminate stair handrails and guardrails at abutting walls with end flanges.
 - .4 Interior handrails and guardrails shall be shop prime coated for paint finish. Exterior handrails and guardrails shall be hot dipped galvanized after fabrication for paint finish.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine areas and conditions under which work is to be performed and notify the Consultant of conditions detrimental to the proper and timely completion of the work.
- .2 Do not proceed with the work until unsatisfactory conditions have been corrected to the satisfaction of the installer.
- .3 Commencement of installation will indicate acceptance of the site conditions and, thereafter, the Contractor shall be fully responsible for satisfactory work as specified.

3.2 INSTALLATION

- .1 Install components square, straight, true to line, accurately fitted with tight joints and intersections. Apply isolation coating to contact surfaces for dissimilar metal materials.
- .2 Securely anchor components in place. Unless otherwise indicated, anchor components as follows:
 - .1 To concrete and solid masonry with expansion shields and bolts.

- .2 To hollow construction with toggle bolts.
- .3 To thin metal with screws or bolts.
- .4 To thick metal with bolts or by welding.
- .5 To wood with bolts for heavy and medium duty fastenings; with screws for light duty fastenings.
- .3 Supply items for casting into concrete or building into masonry to appropriate trades together with setting templates. Apply isolation coating to contact surfaces for components in contact with cementitious materials for exterior components.
- .4 Make provision for erection stresses and supply temporary bracing to keep work in alignment until completion of erection.
- .5 The Consultant may reject at any time during the progress of the work a component which he may find defective regardless of previous inspection. Components so rejected will be removed and replaced by the Contractor, at no expense to the Owner, and shall also be responsible for all delays caused by the rejection.
- .6 After installation, site clean and refinish damaged finishes, welds, bolt heads and nuts. Refinish with primer or zinc rich paint to match original finish.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

.1 CSA International

- .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .2 CSA O121-08, Douglas Fir Plywood.
- .3 CSA O141-05(R2009), Softwood Lumber.
- .4 CSA O151-09, Canadian Softwood Plywood.
- .5 CAN/CSA-O325.0-07, Construction Sheathing.

.2 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber 2010.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:

- .1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate

1.5 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

.4 Each piece of lumber and plywood as specified preserved wood to be identified by CSA O322 certified stamp.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Storage and Handling Requirements:

- .1 Store materials off ground 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

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.
- .3 Panel Materials:
 - .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
- .4 Preservative: to CSA-O80 Series, chemical, oil-borne for clear finish.

2.2 ACCESSORIES

- .1 Fasteners: to CAN/CSA-G164, for exterior work, interior highly humid areas, and pressure-preservative treated lumber.
- .2 Nails, spikes and staples: to CSA B111.
- .3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

Part 3 Execution

3.1 APPLICATION: PRESERVATIVE

- .1 Treat all specified pressure treated wood framing in contact with concrete to CSA O80.
 - .1 Use Category is UC4.2.
 - .2 Acceptable preservatives are ACZA, CCA, or CR.
- .2 Treat all surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

- .3 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.

3.2 INSTALLATION

- .1 Comply with requirements of NBC, supplemented by the following paragraphs.
- .2 All sill plates, and other wood in direct contact with concrete is to be pressure treated to Use Category UC4.2.
- .3 All plywood on both interior and exterior of structure within 1200 mm of the concrete is to be pressure treated to Use Category UC4.2.
- .4 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .5 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .6 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .7 Install sleepers as indicated.
- .8 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .9 Countersink bolts where necessary to provide clearance for other work.

3.3 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 62 00 – Sheet Metal Flashing and Trim.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B18.6.3-2011, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.
 - .3 CAN/CGSB-93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.
- .3 CSA International
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal siding and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal siding from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS

- .1 Strip siding: to CAN/CGSB-93.4, vertical,
 - .1 Finish coating: Class F2S.
 - .2 Colour: Heron Blue .
 - .3 Gloss: medium
 - .4 Thickness: 0.457 mm base metal thickness.
 - .5 Profile: 17 mm deep, preformed interlocking joints,
 - .6 Standard of Acceptance:
 - .1 Westman Steel, Tough Rib, Grade 550, 26 gauge.
- .2 Soffit: to CAN/CGSB-93.4, :
 - .1 Finish coating: Class F2S.
 - .2 Colour: White.
 - .3 Gloss: medium.
 - .4 Profile: flat sheet 'V' crimped for stiffness, preformed with elongated slits and small perforations.
- .3 Fascia facings and exposed trim: to CAN/CGSB-93.4, :
 - .1 Finish coating: Class F2S.
 - .2 Colour: White.
 - .3 Gloss: medium .
 - .4 Profile: manufacturer's standard as indicated.

2.2 FASTENERS

- .1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made, cadmium plated steel.

2.3 CAULKING

- .1 Sealants: in accordance with manufacturers recommendations.

2.4 SHEATHING PAPER

- .1 Exterior wall sheathing paper: to CAN/CGSB-51.32, spunbond olefin type coated

2.5 ACCESSORIES

- .1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour gloss as cladding.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied .

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions.
- .2 Install one layer exterior wall sheathing paper horizontally by stapling lapping edges 150 mm.
- .3 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.
- .4 Install outside corners, fillers and closure strips with carefully formed and profiled work.
- .5 Install soffit and fascia cladding as indicated.
- .6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .7 Attach components in manner not restricting thermal movement.
- .8 Caulk junctions with adjoining work with sealant. .

3.4 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by preformed metal siding installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 62 00 – Sheet Metal Flashing and Trim.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-51.32- M77, Sheathing, Membrane, Breather Type.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 550 with Z275 coating, regular surface, prefinish as specified in 2.2, 0.457 mm base metal thickness.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied polyvinyl chloride.
 - .1 Class F2S.
 - .2 White colour from manufacturer's standard range.
 - .3 Coating thickness: 200 micrometres minimum.
 - .4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D822 as follows:
 - .1 Outdoor exposure period 5000 hours minimum.
 - .2 Humidity resistance exposure period 5000 hours minimum.
 - .5 Standard of Acceptance:
 - .1 Westman Steel, Tough Rib, Grade 550, 26 gauge, White

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Underlay: ASTM D226, Type II
 - .1 Standard of Acceptance:
 - .1 Westman Steel, Feltex Underlay
- .4 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.
- .5 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
- .6 Fasteners: exposed.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.4 FABRICATION

- .1 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.
- .2 Hem exposed edges on underside 12 mm, mitre and seal.
- .3 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .4 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Include underlay under sheet metal roofing.
 - .1 Secure in place and lap joints 100 mm minimum.
- .2 Install sheet metal roof panels.
- .3 Stagger Align transverse seams in adjacent panels.
- .4 Flash roof penetrations with material matching roof panels, and make watertight.
- .5 Form seams in direction of water-flow and make watertight.

3.3 CLEANING

- .1 Progress Cleaning.
 - .1 Leave Work area clean at end of each day.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 1997.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: 0.457 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied polyvinyl chloride.
 - .1 Class F2S.
 - .2 White colour from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
 - .4 Coating thickness: not less than 200 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D822 as follows:
 - .1 Outdoor exposure period 5000 hours.
 - .2 Humidity resistance exposure period 5000 hours.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
- .3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32
- .4 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .6 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
- .2 Form pieces in 2400 mm maximum lengths.
 - .1 Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm.
 - .1 Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 EAVES TROUGHS AND DOWNPIPES

- .1 Form eaves troughs and downpipes from prefinished sheet metal.
- .2 Sizes and profiles to match adjoining structures.
- .3 Provide goosenecks,, strainer baskets and necessary fastenings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install sheet metal work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction as detailed CRCA FL series details, FL ____.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal.
 - .1 Secure in place and lap joints 100 mm.

- .4 Lock end joints and caulk with sealant.

3.3 EAVES TROUGHS AND DOWNPIPES

- .1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.
 - .1 Slope eaves troughs to downpipes as indicated.
 - .2 Seal joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
 - .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.
 - .2 Connect downpipes to drainage system and seal joint with plastic cement.

3.4 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-[06a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-[84], Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-[04]/G40.21-[04], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-[03], Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, [2000].
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, [1990].
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S704-[03], Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Steel doors and frames: Commercial Grade.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Stiffened: face sheets welded insulated core.
 - .1 Fibreglass: to CAN/ULC-S702, semi-rigid, density 24 kg/m³.

2.3 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

2.4 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Conceal fastenings except where exposed fastenings are indicated.
- .6 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .7 Insulate exterior frame components with polyurethane insulation.

2.5 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

2.6 FRAMES: SLIP-ON TYPE

- .1 Ship slip-on type frames unassembled.
- .2 Provide frames with mechanical joints which inter-lock securely and provide functionally satisfactory performance when installed in accordance with CSDMA Recommended Installation Guide for Steel Doors and Frames and manufacturers' instructions.
- .3 Provide slip-on frames with manufacturers' proprietary design of wall anchorage comprising single, adjustable tension type per jamb and provision for secure attachment of each jamb base to stud runners.

2.7 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush.
- .2 Exterior doors: hollow steel construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: visible grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

2.8 HOLLOW STEEL CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel.
- .2 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.
- .3 Fill voids between stiffeners of exterior doors with fibreglass core.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

- .1 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section [08 71 00 - Door Hardware].
- .2 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2001, Exit Devices.
 - .4 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
 - .5 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Locks and latches:
 - .1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, series 2000 preassembled lock, grade 2 designed for function and keyed as stated in Hardware Schedule.
 - .2 3 point latching, surface mounted
 - .3 Normal strikes: lip projection not beyond jamb.
 - .4 Cylinders: key into keying system as directed.
- .2 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, 4 sets per door, Non Removable Pins, 114 x 101 mm, stainless steel.
- .3 Exit devices: to ANSI/BHMA A156.3, Panic Hardware, Surface mount, touchpad style, complete with dogging by key cylinder, grade 2, Stainless steel finish.
- .4 Architectural door trim: to ANSI/BHMA A156.6, as listed below.
 - .1 Pull units: stainless steel, 150mm, .
- .5 Auxiliary hardware: to ANSI/BHMA A156.16, as listed below, .
 - .1 Skeleton bolts top and bottom on non-active door, surface mount, 450 mm long, offset bolt, 50 mm throw, Brass, Satin Chrome Finish, visible fixing, complete with floor plate and top guide.
 - .2 Chain door guard on both doors, stainless steel
- .6 Door bottom seal: heavy duty, recessed in door bottom closed ends, adjustable automatic retract mechanism when door is open,
- .7 Thresholds: 125 mm wide x full width of door opening, stainless steel, serrated surface, with lip
- .8 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Adhesive backed vinyl covered foam material.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.

- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Doors to be keyed differently and master keyed as directed. Prepare keying schedule in conjunction with Departmental Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply construction cores.

Part 3 Execution

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .5 Use only manufacturer's supplied fasteners.
- .6 Remove construction cores when directed by Departmental Representative.
 - .1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Maintenance Repainting Manual - current edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store painting materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.

1.4 SITE CONDITIONS

- .1 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
 - .2 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

Part 2 Products

2.1 MATERIALS

- .1 Supply paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work including preparation and priming.

- .3 Materials in accordance with MPI - Architectural Painting Specification Manual MPI - Maintenance Repainting Manual "Approved Product" listing.
- .4 Colours:
 - .1 Submit proposed Colour Schedule to Departmental Representative.
 - .2 Base colour schedule on selection of 1 base colours and 1 accent colours.
- .5 Mixing and tinting:
 - .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations..
 - .2 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .6 Interior painting:
 - .1 Galvanized Metal: high contact/high traffic areas, doors, frames, railings and handrails.
 - .1 INT 5.3C – Alkyd gloss finish.
 - .2 Interior Wood: Interior plywood, panel backing boards.:
 - .1 INT 6.3A - Latex semi-gloss finish.

Part 3 Execution

3.1 GENERAL

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual MPI - Maintenance Repainting Manual except where specified otherwise.

3.2 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative .

- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
 - .3 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
 - .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
 - .6 Touch up of shop primers with primer as specified.

3.4 APPLICATION

- .1 Paint only after prepared surfaces have been accepted by Departmental Representative
- .2 Use method of application approved by Departmental Representative .
 - .1 Conform to manufacturer's application recommendations.
- .3 Apply coats of paint in continuous film of uniform thickness.
 - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .5 Sand and dust between coats to remove visible defects.
- .6 Mechanical/Electrical Equipment:
 - .1 Paint conduits, hangers, ductwork and other electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
 - .2 Do not paint over nameplates.
 - .3 Paint both sides and edges of backboards for telephone and electrical equipment before installation.
 - .1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A182/A182M-11a, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - .2 ASTM A193/A193M-11a, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
 - .3 ASTM A194/A194M-11, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High Temperature Service, or Both.
 - .4 ASTM A312-11, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - .5 ASTM A351/A351M-10, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - .6 ASTM A380-06, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
 - .7 ASTM A403/A403M-11, Standard Specification for Wrought Austenitic Stainless Steel Pipe Fittings.
 - .8 ASTM A774/A774M-09, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
 - .9 ASTM A778-01(2009), Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
 - .10 ASTM A967-05e2, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
 - .11 ASTM F1476-07, Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI/B1.20.1-1983(R2001), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B31.3-04, Process Piping.
 - .3 ANSI/MSS SP-58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
- .3 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C220-07, Stainless-Steel Pipe, 1/2 In. (13mm) and Larger.
 - .2 ANSI/AWWA C226-06, AWWA Standard for Stainless-Steel Fittings for Waterworks Service, Sizes ½ In. Through 72 In. (13mm Through 1,800mm).
 - .3 ANSI/AWWA C228-08, AWWA Standard for Stainless Steel Pipe Flanges for Water Service-Sizes 2 In. Through 72 In. (50mm Through 1,800mm)

- .4 ANSI/AWWA C606-11, AWWA Standard for Grooved and Shouldered Joints.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Include plans, elevations, sections and piping isometrics and construction, including:
 - .1 Prefabricated sections with field connection points.
 - .2 Branch connections,
 - .3 Equipment connections,
 - .4 Pipe supports.
 - .2 Scale of plans, elevations, sections:
 - .1 To be minimum 1:50
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual.
 - .2 Record Drawings: provide following information:
 - .1 Valve data.
 - .2 Existing services uncovered during installation.
 - .3 Existing services known to exist within 3 m of installation.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.4 SYSTEM START-UP

- .1 Provide continuous supervision during start-up.
- .2 Upon start-up, bring mains up to pressure slowly.
- .3 After system is in operation and under maximum pressures:
 - .1 Tighten bolts on flanges, using torque wrench;
 - .2 Check operation of valves.
- .4 Pipe supports:
 - .1 Monitor at all times during start-up and commissioning to ensure operation as designed.
 - .2 Adjust pipe supports.

- .5 Full scale tests: upon completion, conduct full scale tests at maximum design flow rates, operating pressures for continuous consecutive period of 4 hours to demonstrate full compliance with design requirements.

1.5 COMMISSIONING

- .1 Do commissioning in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.
- .2 Provide three (3) days written notice to Client Representative of intention to start up, test and adjust.
- .3 Start-up systems only after written approval of installation from Client Representative.

1.6 MAINTENANCE

- .1 Furnish special tools for maintenance of systems and equipment.
- .2 Extra Materials: furnish following spare parts:
 - .1 Grooved Mechanical Couplings: one (1) for every twenty (20) of each type and size supplied. Minimum: two (1) of each size and type.
 - .2 Grooved Mechanical Coupling Gaskets: one (1) for every twenty (20) of each type and size supplied. Minimum: two (1) of each size and type.
 - .3 Flange gaskets: one (1) for every ten (10) flanged joints of each size. Minimum: one (1).

Part 2 Products

2.1 SEWAGE, LOW TEMPERATURE (30 DEGREES C MAXIMUM)

- .1 Piping: to ASTM A778-01(2009), Type 304L.
 - .1 NPS 1/2 to 1-1/2: Sch. 40, seamless, screwed or plain ends.
 - .2 NPS 2 to 10: Sch.10, seamless, plain ends.
- .2 Fittings: to ASTM A182/A182M-11a, Type 304.
 - .1 NPS 1/2 to 1-1/2: Class 3000, 20 MPa, forged stainless steel, screwed ends.
 - .2 NPS 2 to 12: Sch.10, forged stainless steel, grooved ends to ASTM F1476-07.
- .3 Grooved Mechanical Couplings: to ASTM F1476-07 and ANSI/AWWA C606, Ductile Iron conforming to ASTM a-536, grade 65-45-12, Hot dipped galvanized.
 - .1 NPS 3 to 10: Piping to Piping, Piping to Straight Fittings: Rigid Style, Rated for working pressure of minimum 850 kPa with Schedule 10S rolled groove piping.
 - .1 Victaulic® Style 89
 - .2 Gruvlok® Style 7401
 - .3 Grinnell® Style 577

- .2 NPS 3 to 10: Piping to Elbows, Elbows to Elbows, Expansion Joints: Flexible Style, Rated for working pressure of minimum 850 kPa with Schedule 10S rolled groove piping.
 - .1 Victaulic® Style 77
 - .2 Gruvlok® Style 7001
 - .3 Grinnell® Style 705
- .4 Grooved Mechanical Coupling Gaskets: to ASTM F1476-07 and ANSI/AWWA C606, EPDM Gasket, standard seal style, compatible with Coupling, pipe, and fittings.
- .5 Nipples for drains, vents, pressure gauges: to ASTM A778-01(2009), Type 304.
 - .1 NPS 1/2 to 3/4: Sch.160, screwed.
- .6 Unions: to ASTM A182/A182M-11a, Type 304.
 - .1 NPS 1/2 to 1-1/2: Class 3000, 20 MPa, screwed ends, forged stainless steel, steel-to-steel ground joints.
- .7 Flanges: to ASTM A182/A182M-11a, Type 304L.
 - .1 NPS 1/2 to 1-1/2: Class 150, 1 MPa, full faced, screwed.
 - .2 NPS 2 to 12: Class 150, 1 MPa, full faced, weld neck, bored to suit pipe.
- .8 Bolts and nuts:
 - .1 Stud bolts, B7, to ASTM A193/A193M-11a, Zinc Plated.
 - .2 Heavy Hex Nuts, 2H, to ASTM A194/A194M-11, Zinc Plated
- .9 Pipe supports:
 - .1 All materials to be zinc plated.
 - .2 Bases:
 - .1 Adjustable pipe stanchions, bolted to concrete floor
 - .1 Anvil Figure 63, 1 1/2", Type P
 - .3 Supports
 - .1 For pipe, Pipe saddler with U bolt
 - .1 Anvil Figure 191
 - .2 For valves, Adjustable pipe saddles
 - .1 Anvil Figure 192

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

- .1 Lay out work in accordance with lines and grades as indicated.
- .2 Verify ground profiles, grades, lines, levels, dimensions as indicated against established benchmarks. Report discrepancies to Client Representative and obtain written instruction.
- .3 When required by Client Representative, provide drawings showing relative locations of various services.

3.3 FABRICATION OF PIPING

- .1 Do work in accordance with ANSI/ASME B31.3.
- .2 Joints:
 - .1 Accessible locations: grooved mechanical couplings, or flanged to match piping specification.
 - .2 Screwed joints: to ANSI/B1.20.1.
 - .1 Provide clean machine-cut threads.
 - .2 Use fluoropolymer resin tape or paste on male threads.

3.4 INSTALLATION OF PIPING

- .1 Maintain clearances between pipes as indicated.
- .2 Maintain clearance between pipes and structures for O&M as indicated, as directed and to manufacturer's recommendations.
- .3 Cap open ends of piping during installation. Remove foreign material from inside piping.
- .4 Remove burrs from piping.
- .5 Flanges: tighten bolts evenly with torque wrench.
 - .1 Retighten bolts with torque wrench after system is in operation.
- .6 Revisions to location of piping require written approval of Client Representative.

3.5 COLD SPRINGING

- .1 Except where cold springing is indicated or specified, do not force pipes into position.

3.6 PIPE SUPPORTS

- .1 Stanchions:
 - .1 Provide adjustable pipe stanchions as required to support pipes as shown on drawings.
 - .1 After all piping is completed and adjusted, bolt stanchions to floor with epoxy set type 304 stainless bolts and nuts.
 - .2 Provide adjustable pipe saddles as appropriate
 - .3 For vertical risers, provide welded dummy leg elbow support suitable for adjustable pipe stanchions, complete with stud and double nuts for adjustment.

3.7 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
 - .1 Verify suitability of valve for application by inspection of identification tag.
 - .2 Handle valve with care so as to prevent damage to disc and seat faces.
 - .3 Valves in horizontal pipe lines should be installed with stem in vertical position.
 - .4 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.
- .2 Install isolating valves at as indicated.
- .3 Grooved mechanical couplings and flanged valves to be accessible for maintenance without removing adjacent piping.

3.8 PRESSURE TESTS

- .1 Pressure test piping after installation and before concealing in any way to 175 psi for a minimum of 15 minutes, inspecting visually for any leaks at all joints and flanges.

3.9 FIELD QUALITY CONTROL

- .1 Inspections: leave joints in piping systems uncovered until tests are completed and system inspected and approved by Client Representative.
- .2 Paint hangers, supports, exposed steelwork with 2 coats of rust inhibitive primer.

3.10 SPARE PARTS

- .1 Furnish specified spare parts.

3.11 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 11 18.01 - Distribution Piping-Stainless Steel.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures
- .2 Provide operation and maintenance data for incorporation into manual.

1.3 MAINTENANCE

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.

Part 2 Products

2.1 PRODUCT QUALIFICATION

- .1 Standard of Acceptance means that the item named and specified by manufacturer and/or model or catalogue number forms part of the specification and sets standards regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.
- .2 The product indicated Standard of Acceptance was used in preparing the design. Tenders must be based on the Standard of Acceptance
- .3 Where multiple manufacturers and or models are named but no single one is indicated as Standard of Acceptance, any one of those named shall be acceptable provided they meet the specified requirements.
- .4 Where any product other than the Standard of Acceptance is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Re-design drawings shall be to scale and of a standard equal to the Project Drawings.
- .5 Install and test all equipment and material in accordance with the detailed instructions and recommendations of the manufacturer.
- .6 A visible nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

2.2 MATERIALS

- .1 Gaskets:
 - .1 Flanges: EPDM, 1.6 mm thick, full face, to ANSI/AWWA C111/A21.11.
- .2 Knife Gate Valve
 - .1 NPS 2 to 12: 1.0 MPa WOG, flanged end Class 125, cast stainless 304 body, ASME 150 UNC Tapping for Threads, resilient seated, bi-directional, PTFE packing, Stainless 304 Gate, EPDM Seat, rising stem, Handwheel Actuator.
 - .1 Standard of Acceptance
 - .1 Dezurik KGN-x-RSB-F1-S1-MSP-S1-EPDM-MN-HDx-S1
- .3 Plug Valve
 - .1 NPS 2-1/2 to NPS 4: 1.2 MPa WOG, flanged end Class 125, ASTM A-126 Class B cast iron body, Electroless nickel plated cast iron plug, Plug Seal Grade RS51 (BUNA), Baked on thermoplastic coated Seat, Upper/Lower Bearing ASTM B30 Bronze, O-ring stem seal (BUNA), Adjustable Memory stop on Actuator.
 - .1 Standard of Acceptance
 - .1 Homestead Eccentric Plug valve, Series 300, Figure 312-1-RS51-3"-Memory Stop
- .4 Check Valves:
 - .1 NPS 2 to NPS 8: 1.4 MPa WOG, flanged end Class 125, ASTM A-536 Grade 65-45-12 Ductile Iron Body, internal body and seat fully encapsulated with epoxy, Buna-N coated steel disc, Manually operated backflow device factory installed.
 - .1 Standard of Acceptance
 - .1 Flowmatic Flo-Flex Swing Check Valve, Model 745 BF

Part 3 Execution

3.1 PLUG AND CHECK VALVES

- .1 Contractor is responsible to provide adequate mechanical supports for all above ground valves
 - .1 Orient hand wheel operators for easy access and visibility.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A312-11, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - .2 ASTM A380-06, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
 - .3 ASTM A778-01(2009), Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
 - .4 ASTM A967-05e2, Standard Practice for Chemical Passivation Treatments for Stainless Steel Parts.
- .2 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.3-2006, Process Piping.
 - .2 ANSI/ASME Boiler and Pressure Vessel Code-2007:
 - .1 BPVC 2007 Section V: Non-destructive Examination.
 - .2 BPVC 2007 Section IX: Welding and Brazing Qualifications.
- .3 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.
 - .2 ANSI/AWWA C220-07, Stainless-Steel Pipe, 1/2 In. (13 mm) and Larger.
 - .3 ANSI/AWWA C226-06, AWWA Standard for Stainless-Steel Fittings for Waterworks Service, Sizes ½ In. Through 72 In. (13 mm Through 1,800 mm).
 - .4 AWWA M11, Steel Water Pipe: A Guide for Design and Installation (M11), Fourth Edition
- .4 American Welding Society (AWS)
 - .1 AWS C1.1M/C1.1-2000(R2006), Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
 - .3 AWS W1-2000, Welding Inspection Handbook.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-03(R2007), Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.

.6 CSA W178.2-2008, Certification of Welding Inspectors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit valid Welders Performance Qualification Record (WPQR) book issued under the authority of the Provincial Boiler and Pressure Vessel Safety Program to Client Representative.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

.4 Welders Performance Qualification Record (WPQR) book issued under the authority of the Provincial Boiler and Pressure Vessel Safety Program.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 NOT APPLICABLE

Part 3 Execution

3.1 APPLICATION

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

3.2 QUALITY OF WORK

- .1 Welding: in accordance with ANSI/ASME B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.3 WELDER PROCEDURES

- .1 All welding of the root passé of austenitic stainless steel shall be done using the Gas Tungsten Arc Weld (GTAW) process.
 - .1 Backside of the weld shall have shielding gas protection to reduce oxygen content and prevent granulation.
 - .2 Where tape is used for back purging gas, tape shall use an adhesive backing allowing complete removal and residual adhesive removal by suitable solvent or abrasive.

3.4 SHOP FABRICATION

- .1 Fabrication shall be in an approved fabrication shop set up to handle, fabricate and weld stainless steel pipe using handling procedures to eliminate carbon and/or iron contamination of the stainless steel.
 - .1 Welds shall be prepared by using only stainless steel tools.
 - .2 Tools used on previous carbon steel products are not permitted.
 - .3 Wire brushes and wheels shall be 300 series for use on austenitic and nickel alloys.

3.5 FIELD WELDING

- .1 Field welding is only permitted with prior consent of the Client Representative.
 - .1 When authorized, welding procedures shall include all necessary shelters, shields, and protection required for weld quality control.
 - .2 No field welding is permitted below 0 degrees C.
 - .3 Pipe shall be clean, dry, and free of any foreign contamination.
 - .4 Pre-weld zone of 50 mm on either side of weld shall be cleaned with alcohol or acetone immediately prior to welding.

3.6 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.

- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.7 POST WELD CLEANING

- .1 All welds shall be pickled and passivated in accordance with ANSI/AWWA C220, ASTM A380, and ASTM A967. All Pickling solutions and pastes shall be certified under NSF 61.
 - .1 Small assemblies shall be immersed in a liquid bath of pickling solution.
 - .2 Large fabrications shall be cleaned with a pickling paste.
 - .3 Any discolouration on the pipes shall be removed by pickling.
- .2 After completion of pickling, the passivated surface shall be cleaned of all acids by thoroughly washing the pipe with potable water.

3.8 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Client Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in cooperation with Client Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.9 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Client Representative.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect minimum fifty (50%) percent of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination.
- .2 Hydrostatically test welds to ANSI/ASME B31.3.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of more than five (5%) percent of welds by visual examination, perform additional testing as directed by Client Representative of total of up to ten (10%) percent of welds, selected at random by Client Representative by radiographic tests.

- .5 Radiographic tests for piping systems.
 - .1 Radiographic film:
 - .1 Identify each radiographic film with date, location, name of welder, and submit to Client Representative. Replace film if rejected because of poor quality.
 - .2 Interpretation of radiographic films:
 - .1 By qualified radiographer.
 - .3 Failure of radiographic tests:
 - .1 Extend tests to welds by welder responsible when those welds fails tests.

3.10 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.3 and ANSI/ASME Boiler and Pressure Vessels Code.
- .2 In addition, water systems below 1000 kPa:
 - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
 - .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
 - .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
 - .5 Poor weld fit-up.
 - .6 Excessive arc strikes or weld spatter.
 - .7 Insufficient heat tint removal.
 - .8 Repair cracks and defects in excess of 0.8 mm in depth.
 - .9 Repair defects whose depth cannot be determined accurately on basis of visual examination.

3.11 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.3-07, Process Piping.
- .2 ASTM International
 - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.
 - .2 Submit shop drawings for:
 - .1 Bases, hangers and supports.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.3 or MSS SP58.
 - .3 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Provide supplementary structural steelwork where structural bearings do not exist.

3.3 HANGER OR SLIDE SPACING

- .1 Plumbing piping: to Canadian Plumbing Code.
- .2 Grooved mechanical coupling and roll groove pipe: in accordance with table below for steel, but not less than one hanger or support per three joints. Table listings for straight runs without concentrated loads.

Maximum Pipe Size NPS	Maximum Spacing Steel
1	2.4 m
1-1/2	3.0 m
2	3.0 m
2-1/2	3.7 m
3	3.7 m
3-1/2	3.7 m
4	3.7 m
5	4.3 m
6	4.3 m
8	4.3 m
10	4.9 m
12	4.9 m

- .3 Pipework greater than NPS 12: to MSS SP69.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS & SUMMARY

- .1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.
- .2 Reference to "Electrical Divisions" shall mean all sections of Divisions 26, 27, 28, 33 & 34 in the Master Format or the Canadian Master Specifications.
- .3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
- .4 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and the delivery of a fully commissioned installation.
- .5 The most stringent requirements of this and other electrical sections shall govern.
- .6 All work shall be in accordance with the PROJECT Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
- .7 Provide seismic restraints for all required fixtures, devices, equipment, pathway, and wiring systems as required by the BC Building Code.
- .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories
- .9 "Consultant" shall mean WSP Canada Inc..

1.2 CODES AND STANDARDS

- .1 Comply with all laws, ordinances, rules, regulations and codes of all authorities having jurisdiction relative to this project.
- .2 The project will be constructed to the current adopted edition of applicable standards, including:
- .3 CSA C22.1, Canadian Electrical Code (CEC)
- .4 British Columbia Building Code (BCBC)
- .5 National Fire Code of Canada (NFCC)
- .6 CSA 282 Emergency Electrical Power Supply for Buildings
- .7 ASHRAE 90.1, Standard for Energy Efficient Design of New Buildings
- .8 Provincial Fire Marshall Regulations

- .9 WorkSafe BC Regulations
- .10 Applicable NFPA Regulations

1.3 REFERENCES

- .1 Install in accordance with CSA C22.1 (current adopted edition) – except where specified otherwise.
- .2 Refer to CSA C22.1 Appendix A “Safety Standards for Electrical Equipment” for applicable codes and the related revisions
- .3 Refer to CSA C22.1 Pages xxix – xxxii for related ‘Reference Publications’
- .4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.
- .5 Comply with Local Electrical Bulletins and by-laws relating to the Authority having Jurisdiction.
- .6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) – except where specified otherwise.
- .7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition)

1.4 PERMITS

- .1 Submit to the Electrical Inspection Authority having jurisdiction the necessary number of drawings and specifications for review and approval prior to commencement of the project.
- .2 Pay all associated fees and obtain all permits, licenses etc. to complete the project.
- .3 Obtain a Certificated of Acceptance from the Inspection Authority having jurisdiction upon completion of the project and include in the O&M manual.

1.5 SCOPE OF WORK

- .1 Scheduling of all work will be co-ordinated with the Departmental Representative.
 - .1 All shutdowns will be arranged in advance with the Departmental Representative. The contractor shall allow 1 week notice for all shutdowns.
- .2 The project comprises the removal of existing services and equipment, installation of power supplies to feed new pumps, installation of a new electrical panel, lighting and low voltage power outlets.
- .3 All controls and ancillary devices associated with the new pumps will be installed by the Contractor
- .4 The contractor shall install, test and commission the equipment in accordance with the tender drawings.
- .5 Upon completion of the works the contractor will provide record drawings, labelling, operation and maintenance manuals and will provide a one year warranty for the equipment and installation.

1.6 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235- current edition
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 All electrical work to be installed with common work practices and methods

1.7 SUBMITTALS

- .1 Shop Drawings:
 - .1 The term “shop drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the contractor to illustrate details of a portion of the work.
 - .2 Prior to submitting the shop drawings to the Consultant, the contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.
 - .3 Submit shop drawings, product data and samples for all electrical equipment and materials. .
 - .4 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .5 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.
 - .6 Manufacturer of products shall conform to revised shop drawings.
- .2 Content
 - .1 Shop drawings submitted title sheet.
 - .2 Data shall be specific and technical.
 - .3 Identify each piece of equipment including specific options selected for each type to be included in the project.
 - .4 Information shall include all scheduled data.
 - .5 Advertising literature will be rejected.
 - .6 The project and equipment designations shall be identified on each document.
 - .7 The shop drawings/product data shall include:
 - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
 - .2 Mounting arrangements.
 - .3 Control explanation and internal wiring diagrams for packaged equipment.
 - .4 A written description of control sequences relating to the schematic diagrams.
 - .5 Copies of factory tests, where applicable.

- .3 Format
 - .1 Shop Drawings to be submitted in PDF format; larger submittals may be submitted on flash drives or uploaded to an FTP site set up the contractor.
- .4 Coordination
 - .1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Consultants.
- .5 Keep one 1 copy of shop drawings and product data, on site, available for reference.
- .6 Quality Control:
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, the electrical "load balance" report.
- .7 Permits and Fees:
 - .1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.
 - .2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.8 QUALITY ASSURANCE

- .1 Quality Assurance:
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial and/or Territorial Act.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
 - .1 Site Meetings: as part of Manufacturer's Field Services: schedule site visits, to review Work, at stages listed below:
 - .1 At time of initial shop drawing submission to confirm any existing conditions and to coordinate with the project schedule and any cross discipline requirements.
 - .2 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .3 During progress of Work at key schedule points as determined.

- .4 At commissioning.
- .5 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and owners requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .4 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .5 Store and protect equipment and materials from nicks, scratches, and damage. Protect from dust where applicable.
- .6 Replace defective or damaged materials with new.

1.10 SYSTEM START-UP

- .1 Instruct Consultant and operating personnel in the operation, care and maintenance of equipment.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.11 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.13 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings.
- .2 Site measure all buildings, rooms and existing cable routes prior to ordering any materials.
- .3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.
- .4 Where imperial units have been indicated in brackets following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

1.14 PROJECT COORDINATION

- .1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant's written approval.
- .2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.
- .3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Architect and Consultant and all affected parties.
- .4 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before installing any material or equipment. Demonstrate to the Consultant on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.15 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

- .1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.
- .2 Where contract documents don't clearly indicate the future expansion requirements, but known services are required, provide written "request for information" to the consultant before making assumptions as to intent.

1.16 SPRINKLER PROOF REQUIREMENTS

- .1 All equipment and wiring systems shall be sprinkler proof standard where sprinkler fire protection systems are installed.
- .2 In rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible driphoods, shields, and gasketed doors as applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors. Top entry to be avoided where possible
- .3 In particular all unit substations, transformers, switchgear, motor control and panelboard shop drawings shall be certified 'sprinkler proof' design.

1.17 PHASED CONSTRUCTION

- .1 Make all allowances to phase the work in accordance with the project phasing.
- .2 All trades in this Division shall make allowance for the implications of having to totally complete all work on the exterior generator before proceeding with work on the interior generator.

1.18 WARRANTY

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period.
- .2 Take note of any extended warranties specified in other sections of this Division or in Division 27.
- .3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance and include in O&M manual.
- .4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.19 TENDER INQUIRIES

- .1 All contractor queries during the tender period shall be made in writing to the Consultant. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the Consultant's office during tender. All tender queries may be emailed, mailed or couriered to the Consultant's office. No telephone questions will be answered.

1.20 RESPONSIBILITIES

- .1 Provide temporary lighting, power and systems for construction services and remove after construction is complete.
- .2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.
- .4 Protect equipment and material from the weather, moisture, dust and physical damage.
- .5 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Owner.
- .6 Refinish damaged or marred factory finish to factory finish.
- .7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Consultant.

1.21 STANDARD OF ACCEPTANCE

- .1 Standard of Acceptance means that the item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.
- .2 Where a manufacturer's equipment is listed, the manufacturer's listed equipment was used in preparing the base design. Tenders may be based on the listed equipment or preapproved alternate manufacturer's equivalent products, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.
- .3 Where other than the listed manufacturer's equipment is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.
- .4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.
- .5 All materials shall be new, of the quality specified and shall confirm to the standards of the Canadian Standards Association. Where equipment or materials are specified by technical description only, they shall be of the best quality for the listed application in which it is to be installed.

- .6 All work shall be executed in a neat and workmanlike manner by qualified tradespersons. Electrical contractor shall keep a competent foreman and necessary assistants all satisfactory to the consultant on the project during the progress of the work.

1.22 PROJECT CLOSE-OUT REQUIREMENTS

- .1 Refer to detailed specifications in each section for detailed requirements. Record drawings to be submitted to Consultant and all life safety systems must be operational, verified and tested and demonstrated to Consultant prior to issuance of Schedule C.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment as follows.
- .2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
- .3 Where equipment or materials are specified by technical description only, they are to be of the best quality available for the application for which it is to be installed.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.
- .2 Bond all motors to conduit system with separate bonding conductor in flexible conduit or bonding conductor in the flexible conduit.
- .3 Connections shall be made with watertight flexible conduit with watertight connectors.
- .4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Section 26 24 21 – Mechanical Equipment Controls and the Mechanical Divisions for scope of work and particular details.

2.3 WARNING SIGNS

- .1 Provide warning signs, as specified or to meet the requirements of Inspection Department, Authority having Jurisdiction, Engineer and Architect.
- .2 Use decal signs, minimum 175 x 250 mm 7" x 10" size

2.4 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.
- .3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.

- .4 Paint outdoor electrical equipment "equipment green" finish.
- .5 Paint indoor switchgear and distribution enclosures light gray unless otherwise indicated in particular specification sections for specialised or emergency power equipment.

2.5 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other Divisions.

2.6 FASTENING TO BUILDING STRUCTURE

- .1 General:
 - .1 Do not use inserts in base material with a compressive strength less than 13.79 MPa 2000 psi.
 - .2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.
- .2 Types:
 - .1 Cast-in-place type:
 - .1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.
 - .2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm 8" pipe size.
 - .3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm 8" pipe size.
 - .2 Drilled, mechanical expansion type:
 - .1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa 2840 psi.
 - .2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).
 - .3 Hilti HDI or UCAN IPA drop-in anchor for concrete.
 - .4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.
 - .5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.
 - .3 Drilled, adhesive type:
 - .1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.
 - .2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.
 - .3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.
 - .4 Rod assemblies shall extend a minimum of 50 mm 2" into the concrete slab below the housekeeping bases.
- .3 Note:

- .1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.
- .2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.
- .3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

2.7 EQUIPMENT SUPPORTS

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.
- .3 Concrete bases shall be a minimum of 100 mm 4" thick, or as noted and shall project at least 150 mm 6" outside the equipment base, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.
- .4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm 1" above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.
- .5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.
- .6 Support ceiling hung equipment with rod hangers and/or structural steel.

2.8 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:
 - .1 Support of equipment.
 - .2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.
 - .3 Earthquake restraint devices - refer also to "Seismic Restraint" sections
 - .4 Bridle rings - secure to structure or steel supports.
- .2 All steel work shall be prime and undercoat painted ready for finish under the related Division.

2.9 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data as follows.
- .2 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

- .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .3 Include in the manual the following major sections:
- .1 Title page (in plastic cover).
 - .2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.
 - .3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and troubleshooting instructions.
 - .4 Local source of supply for each item of equipment.
 - .5 Wiring and control diagrams.
 - .6 Spare parts list.
 - .7 Copies of guarantees and certificates.
 - .8 Manufacturer's maintenance brochures and shop drawings.

2.10 PROJECT RECORD DRAWINGS

- .1 Provide project record documents
- .2 The contractor shall keep a complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the contractor shall clearly record in Red all as-built conditions which deviate from the original contract documents. Record drawings to include cable runs (complete with number of cables and ID number) and locations of all telecommunications equipment.
- .3 Prior to substantial performance, the Contractor shall submit completed red-line record drawings to the Consultant. The Contractor shall certify, in writing that the as-built record drawings are complete and that they accurately indicate all electrical services and electrical pathway, including exposed as well as concealed items.
- .4 Preparation of record drawings in AutoCAD shall be performed by the Contractor based on the red-line record drawings submitted by the Contractor.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm 2”.
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation. Install roof stand offs where conduit or teck is installed on roof.
- .4 All cables and conduits to be installed concealed in finished areas.

3.4 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm 16” horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm 10”- 0” and information is given before installation.
- .3 Locate light switches on latch side of doors unless otherwise indicated.
- .4 Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.5 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to the required values and settings to provide a fully coordinated system. Adjust and modify the protective devices to the recommendations of the Analysis to minimize available incident energy in arc flash situations and maximize the coordination of the protective devices.

3.6 FIELD QUALITY CONTROL

- .1 Load and Balance:
 - .1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase and neutral currents to dry-core transformers and motor control centres, operating under normal load,
 - .3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .2 Conduct and pay for the following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 4 hour generator run test. Contractor to provide suitable load bank for testing.

- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Provide Consultant with at least one week's notice prior to testing.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Reports:
 - .1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.7 CLEANING

- .1 Do final cleaning in accordance with Division 01.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.
- .5 Clean Communication Rooms and equipment located therein with vacuum or similar compressed air/pressurized duster system.

3.8 WORKMANSHIP

- .1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Consultant and the Trade.
- .2 The Consultant shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.
- .3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Consultant.

3.9 PROTECTION OF WORK

- .1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.
- .2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.

- .3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.
- .4 Refinish damaged or marred factory finish.
- .5 All communication rooms shall be dust free at the time of installation of cabling and equipment. Communication rooms shall remain dust free during construction.

3.10 PROTECTION OF ELECTRICAL EQUIPMENT

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.11 CONCEALMENT

- .1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.
- .2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.12 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

- .1 All fire stopping materials shall be of one manufacturer; pre-approved manufactures are Hilti and STI.
- .2 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building Code in effect.
- .3 Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- .4 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system; installer to be FM 4991 Approved Contractor, UL Approved Contractor or Hilti Accredited Fire Stop Specialty Contractor.
- .5 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number during shop drawing stage.
- .6 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be re-penetrated.
- .7 All penetrations for communication cabling are to be firestopped using re-penetrable EZ Path System (Specified Technologies Inc. - STI) or re-penetrable Hilti Firestop Systems designated and installed for each specific application.
- .8 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks (if applicable).

- .9 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B & C-B signed by a BC registered Professional Engineer. Submit a letter certifying that all work is complete and in accordance with this specification.
- .10 A manufacturer's direct representative (account manager, fire protection specialist, not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details. Manufacturer's fire protection specialist to work with consultant to determine frequency of site walk-throughs to be submitted to construction manager and consultant.
- .11 Inspection of through-penetration firestopping by the manufacturer shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard and a field report shall be issued by the manufacturer to the consultant.
- .12 Electrical Contractor to provide for a 10% deconstruction test by the Engineer during walk-through.

3.13 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.14 CONDUIT SLEEVES

- .1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.
- .3 Conduit sleeves shall extend 50 mm 2" above floors in unfinished areas and wet areas and 6 mm 1/4" above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm 1" on each side of walls in unfinished areas and 6 mm 1/4" in finished areas.
- .5 Conduit sleeves shall extend 25mm 1" beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm 1/2" clearance all around, between sleeve and conduit or wiring.
- .7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.
- .8 Packing of Sleeves:
 - .1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.
 - .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

3.15 ACCESSIBILITY AND ACCESS PANELS

- .1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.
- .2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Consultant.
- .3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.
- .4 Access panels shall be painted with a primer coat if applicable and then with a finish coat, colour and type to the Consultant's approval.
- .5 Locate equipment and junction boxes in service areas wherever possible.

3.16 EQUIPMENT INSTALLATION

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.

3.17 CUTTING, PATCHING, DIGGING, CANNING, CORING & CONCRETE

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.
- .2 The Electrical Contractor shall be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.
- .3 The Electrical Contractor shall be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.
- .4 Verify the location of existing and planned service runs and structural components within concrete floor and walls prior to core drilling and/or cutting.
- .5 Openings through structural members of the building shall not be made without the approval of the Structural Consultant.
- .6 Openings in Concrete:
 - .1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.
 - .2 All openings shall be core drilled or diamond saw cut.
 - .3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.
 - .4 Refer to structural drawings for locations of steel reinforcing.
 - .5 Be responsible for repairing any damage to steel reinforcing.
- .7 Openings in building surfaces other than concrete:
 - .1 Lay out all openings required.
- .8 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.

- .9 Precast concrete items such as transformer pad bases, pull boxes and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.
- .10 Excavation and backfilling will be provided by other Divisions. This Division to supervise the work and provide all layouts and parameters.

3.18 PAINTING

- .1 Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.
- .2 Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.
- .3 Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

1.2 REGULATORY REQUIREMENTS

- .1 The contractor shall hire a suitably qualified seismic engineer to design equipment mounting and support details.
- .2 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.
- .3 The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Electrical Consultant. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC and VBBL requirements.
- .4 The Contractors' Seismic Consultant shall submit original signed BC Building Code "Letters of Assurance" "Schedules B and C-B" to the Prime Consultant or Electrical Consultant.
- .5 Project shall comply with the local bylaw where applicable.
- .6 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE

- .1 It is the responsibility of the contractor to ensure equipment manufacturers design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components.
- .3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.
- .4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

- .5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.
- .6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.
- .7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.
- .8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.
- .9 Include all costs associated with the Seismic installation and certification in the base tender.

Part 2 Products

2.1 SLACK CABLE SYSTEMS

- .1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control or equal.
- .2 Slack cable restraints shall be provided on suspended and shelf mounted transformers along with associated equipment and assemblies connected to them at the points of vertical support (4 points). The restraint wires shall be oriented at approximately 90 degrees to each other (in plan), and tied back to the ceiling slab or its structure at approximately 45 degrees to the slab or basic structure. The restraints shall be selected for a 1 g earthquake loading, i.e. each wire shall have a working load capacity equal to the weight of the transformer. The anchors in the structure shall be selected for a load equal to the weight of the transformers at a 45 degree pull.
- .3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.
- .4 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

- .1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

3.2 CONDUITS

- .1 Provide restraint installation information and details on conduit and equipment as indicated below:
- .2 Vertical Conduit:

- .1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.
- .2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m.
- .3 Riser joints shall be braced or stabilized between floors.
- .4 Horizontal Conduits:
 - .1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
 - .2 EMT tubing - tubing shall be supported at approximately 1.2 m 4 ft intervals for tubing.
- .5 Do not brace conduit runs against each other. Use separate support and restraint system.
- .6 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.
- .7 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.
- .8 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
- .9 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .10 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to consultants for their reference.

3.3 FLOOR MOUNTED EQUIPMENT

- .1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.
- .2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section of the specification forms part of the Contract Document and is to be read, interpreted and coordinated with all other parts.

1.2 EXCAVATION AND BACKFILL

- .1 Check the drawings of other Divisions of the work for the existence of underground services, and report any serious interference before proceeding with the work. The services of Utility Authorities shall be engaged to accurately determine the location of any underground services prior to excavation.
- .2 Carefully coordinate duct bank location below building with the structure.
- .3 In the execution of this work, or any extra work in connection therewith, do not move any structure or services without the consent of the proper parties. In crossing or running parallel with said structures or services, secure same in place until the work is completed. Any damage to structures or services of this kind caused by neglect to attend to same shall be paid for by the Contractor.
- .4 Keep excavations dry at all times by bailing, pumping, or other means as is necessary.
- .5 Prove grades and the route of ductwork and conduits and the location of manholes far enough along the route in advance of forming and concrete pour so that any relocation or re-design necessitated by unforeseen obstacles may be carried out.
- .6 Grade the bottom of trenches for ducts, duct banks and conduit and level with pit-run gravel and sand, graded from coarse to fine with a maximum size of 38mm 1½". Where excavation is carried out to a depth greater than that required for the proper elevation for the ducts, duct bank, or conduit, backfill with carefully compacted and power-tamped sand and pit-run gravel as specified to the required grade.
- .7 Backfill trenches under building floor areas with sand placed in layers in an approved manner to achieve 95% modified Proctor compaction. Material from excavation shall not be used for backfilling.
- .8 In locations other than under building floor areas, thoroughly tamp same around and over ducts and conduits to a height of at least 300mm 12" above. Fill remainder of trench and consolidate on 450mm 18" layers with approved excavated materials, free from stone and foreign materials.
- .9 Except where beneath the building, supply and install polyethylene HIGH VOLTAGE marking tape over and along the full length of underground services at a depth of 300mm 12" below grade.
- .10 Backfill the top 150mm 6" of the excavation with pit-run gravel where the excavation is situated on a paved or travelled road; crushed rock screenings where the excavation is situated on a concrete sidewalk; black loam where the excavation is on a developed grass boulevard; and sand or earth free of clay, extraneous material, or rock no larger than 38mm 1½" in any dimensions elsewhere. All shall be thoroughly tamped. Where area

was originally grassed, rake loam clear of all stones and debris and leave ready for re-sodding.

- .11 Backfill as soon as possible, so that regular traffic in and around the work will not be inconvenienced.
- .12 Fill depressions to restore the correct grade after a period adequate to reveal settlement has passed. Restore all surfaces (paving, sidewalk, grass) to same quality as the surroundings. Assume responsibility for making good any subsequent settlement of such fill. Pay costs involved in making good pavement, surfacing lawns, curbs and all other surfaces damaged by such settlement and subsequent restoration.
- .13 Store materials excavated during the progress of the work in such locations as directed by the Consultant and in such a manner as to produce a minimum of inconvenience, damage or disfigurement of existing ground.
- .14 Remove and dispose of excess excavated material remaining on completion of the work and leave site clear and unencumbered.

1.3 WATERPROOFING/VAPOUR BARRIERS

- .1 Generally penetrations through waterproofing members and vapour barriers will not be permitted. However, where any work must pierce vapour barriers and waterproofing membranes including waterproofed concrete, the method of installation, colour of caulking material and location of penetration shall be as approved by the Consultant and as coordinated with the owner prior to proceeding with the work. Supply and install all necessary sleeves, caulking and flashing and make the penetrations watertight. For penetrations of vapour barrier, maintain integrity of the system. Restore penetrations through existing surfaces to match the surroundings.
- .2 Provide specified caulking around all exterior recessed lighting fixtures in concrete steps, walls, etc.
- .3 Provide clear silicon bead on top and down both sides of all exterior wall mounted devices (e.g. light fixtures and gongs) where devices are exposed to the weather.

1.4 EQUIPMENT FINISHES

- .1 Thoroughly degrease all metalwork and apply one overall coat of zinc chromate primer to all electrical equipment enclosures, supports, switchgear cubicles, bus ducts, gutters, panelboards, low tension and other cabinets. Unless otherwise directed, apply one overall coat of grey enamel and a second coat of gloss enamel. Paint all exposed surfaces Grey ASA #61 unless matching existing equipment in which case colour shall match existing.
- .2 Unless otherwise directed, paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint. Ensure that equipment finishes are not defaced during installation. Scratched or otherwise marred surfaces shall be refinished before the job will be accepted. Other surfaces shall be completely repaired to match original paint. Patching of damaged area will not be accepted.

- .4 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .5 Generally, equipment finishes shall be as outlined under applicable sections of the specifications.

1.5 VIBRATION AND NOISE CONTROL

- .1 Mounting
 - .1 Vibrating electrical equipment, such as transformers and standby diesel engine generators, shall be mounted using vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution of equipment so as to produce the manufacturers' recommended uniform deflection. Such equipment shall be restrained at each isolator pad using bolts into the floor slab with neoprene washers and clearance holes to prevent short circuiting.
- .2 Connections
 - .1 Connections to rotating, vibrating, or other noise-producing equipment such as motors, generators and transformers shall be by means of flexible conduit and flexible stranded conductors so as to minimize transmitted noise and vibration. Where equipment is mounted by means of resilient supports and is subject to physical displacement under such conditions as energizing a motor, the flexible conduit connections shall be formed into a loop of sufficient length to permit freedom of travel.
- .3 Vibration Isolators and Hangers
 - .1 For floor-mounted transformers, use Mason Industries bridge bearing quality neoprene "Super W" waffle pads Type SWMW, SWML, or SWM as appropriate, or approved equal, anchored to the structure through Mason hemispherical grommets.
 - .2 For transformers suspended from the ceiling, use hanger rod assemblies, fitted with Mason Industries Type 30N, or approved equal, vibration hangers with 30° misalignment capability.
 - .3 For dry type transformers 750kVA and larger, use Mason Industries SSLFH spring type vibration isolators.
- .4 General
 - .1 In other than Mechanical or Electrical Rooms or closets, electrically held relays, contactors and starters shall be provided with vibration isolation mounts and sound enclosures.
 - .2 All parts of all fluorescent lighting fixtures and remote ballast boxes or racks shall be securely fastened and, if necessary, fitted with neoprene spaces to minimize ballast noise amplification.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This section of the specification forms part of the Contract Document and is to be read, interpreted and coordinated with all other parts.

1.2 BRANCH WIRING

- .1 Adhere to the circuit numbers indicated on the drawings. Provide all branch circuit wiring using materials and methods described herein and in consultation with the Consultant.
- .2 Calculate volt drop of all feeders and branch circuit wiring and increase wire sizes based on actual wire run to meet the minimum requirements of the Canadian Electrical Code.
- .3 Install a green insulated bonding conductor in all conduits; do not rely on metallic conduit for bonding continuity. Size bonding conductor as per the Canadian Electrical Code.
- .4 Phase all panelboard buses throughout the building such that the left, centre, and right hand buses represent phase A, B, and C respectively. Identify all indicating meters to this sequence.
- .5 Provide all conduits and wiring including flexible connections, outlet boxes complete with wiring devices and surface raceways for all casework and millwork as shown on the drawings, unless otherwise noted. Arrange conduit so that it will be completely concealed along the entire run to the outlet.
- .6 Where wiring devices are indicated on free-standing benches or tables, locate conduit so that it will be concealed along the entire run to the outlet. Location of conduit floor penetrations shall be to the approval of the Consultant. Conduits will not be permitted to run in concrete floor or topping or below slab on grade.
- .7 Prior to cutting of millwork for outlets/devices, prepare a "mock-up" at each location using paper cutouts to indicate the outlet/device layout. The paper cutouts shall be of the same overall size as the outlet/device that they represent and be complete with identification. The Contractor shall attach the paper cutouts to the millwork such that they are easily removable and in positions that are as generally indicated on the drawings. After each piece of millwork has all paper cutouts mounted, advise the Owner and the Consultant and relocated as directed by the Consultant prior to performing cutting of millwork.
- .8 Wire to all electrical appliances indicated on the drawings. The word appliance is intended to include cooking equipment not of 'plug-in' nature, laundry equipment, stills, hot water tanks, and other special equipment throughout the building for which outlets are indicated on the drawings or noted in the equipment schedule. Use flexible conduit or liquid-tight flexible conduit for connection from outlets to appliances.
- .9 Unless otherwise noted, appliances will be supplied and set in place in the rooms by others. Check with the trades involved and with the Owner to determine correct

orientation of the appliances, the final and exact location and electrical requirements of each outlet (both control and supply) before proceeding with the installation.

- .10 Prior to rough-in of outlet boxes confirm final furniture layout with the Architect.
- .11 Prior to installation of switch outlets, confirm door swing on Architectural Drawings. Where switch cannot be located on latch side of door, install the outlet box a minimum of three feet from the door swing, do not install switch behind door.
- .12 Wiring circuits for electronic equipment, such as computers, printers and Communications equipment shall have a separate dedicated neutral for each and every circuit.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section of the Specifications forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts.

1.2 REFERENCES

- .1 CSA International – most recent version
 - .1 CAN/CSA-Z809, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC) – most recent version
 - .1 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.
- .3 Insulated Cable Engineers Association, Inc. (ICEA)
- .4 Sustainable Forestry Initiative (SFI) – most recent version
 - .1 SFI Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 CABLE PROTECTION

- .1 38 x 140mm planks pressure treated with coloured, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Cedar post type markers: to CAN/CSA-Z809 or FSC or SFI 89 x 89mm, 1.5m long, pressure treated with coloured copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.
 - .1 Nameplate: aluminum anodized 89 x 125mm, 1.5mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
 - .1 Inform Consultant of unacceptable conditions immediately upon discovery.

3.2 DIRECT BURIAL OF CABLES

- .1 After sand is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable.
 - .1 Do not pull cable into trench.
- .2 Include offsets for thermal action and minor earth movements.
 - .1 Offset cables 150mm minimum for each 60m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6m minimum of surplus cable in each direction.
 - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation:
 - .1 Maintain 75mm minimum separation between cables of different circuits.
 - .2 Maintain 300mm minimum horizontal separation between low and high voltage cables.
 - .3 When low voltage cables cross high voltage cables maintain 300mm vertical separation with low voltage cables in upper position.
 - .4 At crossover, maintain 75mm minimum vertical separation between low voltage cables and 150mm between high voltage cables.
 - .5 Maintain 300mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
 - .6 Install treated planks on lower cables 0.6m minimum in each direction at crossings.
- .7 After sand protective cover is in place, install continuous row of overlapping 38 x 140mm pressure treated planks as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

- .1 Mark cable every 150m along cable or duct runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install concrete cable markers within 180m from each side of runway centreline; 45m from each side of taxi way centreline; 50m from edge of taxi ramps or aprons.
- .5 Install cedar post type markers.
- .6 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50megohms.
- .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.

- .2 Ground shields, ground wires, metallic armour and conductors not under test.
- .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at original factory test voltage in accordance with manufacturer's recommendations.
- .4 Leakage Current Testing:
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
- .7 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.6 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 GENERAL DESCRIPTION

- .1 The Contractor shall furnish a pump and control panel package from a single supplier to ensure compatibility. All components and materials shall be in accordance with section 2.0 of this Product Specification.
- .2 Attention is directed to the fact that the drawings and overall system design are based on a particular piece of equipment from a particular manufacturer (Standard of Acceptance).
- .3 In the event that a bidder or supplier proposes an alternate to the specified equipment, the Engineer recognizes that it will be difficult to conform to all details of this Specification due to different manufacturing techniques and patents. Pre-approval of alternate equipment will NOT be provided, due to scheduling concerns. Award will be based on specified units. If the successful proponent wishes to propose an Alternate after award, the submission requirements will be as follows:
 - .1 The supplier must submit:
 - .1 A complete description of any changes that will be necessary to the system design,
 - .2 A system hydraulic analysis based on the proposed pump,
 - .3 A complete list of exceptions to this specification,
 - .4 If the equipment differs materially or differs from the dimensions given on the Drawings, the Proponent shall submit complete drawings showing elevations, dimensions, or any necessary changes to the Contract Documents for the proposed equipment and its installation,
 - .5 The cost savings or other benefit to the Owner as part of the proposed alternate.

1.2 OPERATING CONDITIONS

- .1 The pumps shall be sized to conform to the following design conditions. The pumps must be capable of operating at all points on the system curve without overloading the motors.

.1	Primary Design Capacity	300 GPM
.2	Primary Design Total Head	60 Ft
.3	Min. Shut-Off Head @ Primary Design Speed	71 Ft
.4	Max. NPSHR @ Primary Design	10 Ft
.5	Minimum efficiency at Design Point	71 %

Part 2 Products

2.1 PRODUCT QUALIFICATION

- .1 Standard of Acceptance means that the item named and specified by manufacturer and/or model or catalogue number forms part of the specification and sets standards regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.
- .2 The product indicated Standard of Acceptance was used in preparing the design. Tenders must be based on the Standard of Acceptance
- .3 Where multiple manufacturers and or models are named but no single one is indicated as Standard of Acceptance, any one of those named shall be acceptable provided they meet the specified requirements.
- .4 Where any product other than the Standard of Acceptance is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.
- .5 Install and test all equipment and material in accordance with the detailed instructions and recommendations of the manufacturer.
- .6 A visible nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

2.2 PUMP ASSEMBLY

- .1 The pump assembly shall be an end suction centrifugal pump, complete with a vertical close coupled motor and base elbow. Pumps shall be designed for continuous operating service. Warranty shall be for a minimum of 24 months after start-up, not to exceed 30 months from the date of shipment.
 - .1 Standard of Acceptance:
 - .1 Manufactured by CORNELL PUMP COMPANY of Portland, Oregon, USA
 - .2 Model 4NNT-VM-10-4

2.3 PUMP

- .1 The pump casing shall be tangential discharge, and of back pullout design allowing for removal of rotating element without disturbing piping connections. The casing shall be constructed of ASTM A48, Class 30 Cast Iron. All casing sections shall have heavy wall thickness to provide long life under abrasive and corrosive operating conditions. All mating surfaces shall have register fits to ensure proper alignment. Piping connections shall be ANSI 125# flat-face drilled flange. Flange face surface finish shall be a minimum of 250 micro-inch finish.
- .2 The pump shall be directly coupled to the motor. The keyed straight bore impeller shall be mounted directly to the motor shaft. The pump and motor shall be connected by an ASTM A48, Class 30 Cast Iron bracket with machined registers to assure proper alignment.

- .3 The pump backplate/bracket shall be constructed of ASTM A48, Class 30 Cast Iron, and be connected to the pump casing. All mating surfaces shall have register fits to ensure proper alignment.
- .4 Replaceable suction wear ring shall be provided. The ring shall be of the peripheral design requiring no axial adjustment and shall be press fit into the case and the backplate. The ring shall be constructed of ASTM A48, Class 30 Cast Iron.
- .5 The impeller shall be constructed of heavy section ASTM A48, Class 30 Cast Iron. The impeller will be a two-vane design for solids pumping. Impellers shall be capable of passing a 3" or smaller soft solid. Internal vane edges shall be well rounded to present smooth flow. Impeller shall have a straight non-tapered bore, be statically balanced, keyed to the shaft and further secured with a Stainless Steel washer and a Stainless Steel impeller lockscrew. The impeller shall be fixed at location with no expected or required adjustment.
- .6 The shaft shall be of high strength Steel. The shaft shall be accurately machined and polished and of sufficient size to transmit full driver output without excessive flexure or stressing. The shaft shall have a minimum diameter of 1.625 inches under the sleeve. All steps in the shaft shall have radiuses to reduce stress concentrations. Shaft deflection shall not exceed 0.003 inch measured at end of shaft when operating at specified design condition. A complete shaft stress analysis calculation shall be supplied by the pump manufacturer to illustrate conformance with this requirement.
- .7 The shaft shall be protected by a renewable shaft sleeve which extends through the stuffing box and under the gland. The sleeve shall have an O-ring fit to prevent leakage along the shaft and shall be positively locked to prevent rotation. The sleeve O.D. shall be a minimum of 0.375 inches wider than the shaft and constructed of 416 Stainless Steel.

2.4 ELECTRIC MOTOR

- .1 The motor shall be of North American manufacture, vertical mount, close-coupled type. It shall be not less than 10 HP at 1800 RPM, TEFC enclosure.
 - .1 The motor will not be non-overloading exclusive of the service factor.
 - .2 The motor will be supplied with Class F insulation, and have a 1.15 SF.
 - .3 Motor supply power is 575 volt, 60 hertz, 3 phase.
 - .4 The motor bearings shall be selected to withstand thrust loads and have a minimum B-10 life of 20,000 hours.
 - .5 The motors shall be equipped with grease fittings and automatic grease reliefs.

2.5 MECHANICAL SEAL

- .1 A Cornell Cycloseal backplate with deflector vanes constructed of ASTM A48 Class 30 Cast Iron shall be provided, including a John Crane single mechanical seal, Tungsten Carbide vs Silicon Carbide seal face material, Buna-N elastomer, and 300 Series Stainless Steel hardware and spring. The design shall allow for continuous operation without the need for external flush water or venting.
 - .1 (** Cycloseal is a Registered Trademark of Cornell Pump Company, Patent Number 5,489,187 **)

2.6 BASE ELBOW

- .1 The pump shall be mounted on a 6" inlet by 4" outlet base elbow constructed of ASTM A48, Class 30 Cast Iron with an ASTM A48, Class 30 Cast Iron cradle/base, and have a cleanout handhole cover.

2.7 CONTROL PANEL

- .1 The control panel shall be a complete NEMA Type 4X stainless enclosure, complete with inner door, pump controller, switches, lights, and cutouts for the included combination starters for the provided pumps. Also included are pressure sensor and auxiliary float controls, which require field mounting and connection to panel.
- .2 Enclosure
 - .1 The enclosure shall be NEMA Type 4X rated stainless steel.
 - .1 The material to be 16 gauge Type 304 stainless steel.
 - .1 Seams to be continuously welded and ground smooth.
 - .2 The random dimensions of the enclosure should not be greater than 20" tall, 16" wide and 8" deep.
 - .3 The enclosure shall come with mounting feet to allow for wall mounting.
 - .4 Entry shall be via a quarter-turn latch.
 - .5 A hasp shall be installed to allow for the ability to padlock the enclosure.
- .3 Inner Door
 - .1 The enclosure shall be provided with aluminum Inner Door to provide mounting of the STATIONVIEW™ controller, HAND-OFF-AUTO switches, and SEAL FAIL lights. The door shall also provide cut-outs to allow access to the Combination Starter.
 - .2 The inner door shall be connected via an aluminum piano hinge.
 - .3 The inner door shall be provided with quarter turn latches to securely hold the door in a closed position against a doorstop.
- .4 Data Pocket
 - .1 The control panel shall be provided with a data pocket mounted to the inside surface of the enclosure door.
- .5 Alarm Light
 - .1 A Type 4X flashing Alarm Light shall be provided and should be mounted on the top center of the enclosure.
 - .2 The alarm light shall be a flashing 40watt Red light with an option of being Amber.
 - .3 Standard of Acceptance
 - .1 AC/DC Equipment Company, R40-XLS or A40-XLS

- .6 Audible Horn
 - .1 The Audible Horn shall be a piezo type that is rated Type 4X and should be mounted on the top left side of the enclosure.
 - .2 The horn shall be a minimum of 95dB sound output at two feet.
 - .3 Standard of Acceptance
 - .1 Ingram, PW120A-BLACK.
- .7 SILENCE/TEST pushbutton
 - .1 The SILENCE/TEST pushbutton should be Type 4X rated and mounted on the top left side of the enclosure below the Audible Alarm.
 - .2 The pushbutton should have an integrated printed label insert stating "SILENCE". The label shall be white with black lettering.
 - .3 Standard of Acceptance
 - .1 Square D, XB4BA21.
- .8 COMPONENT AND REQUIREMENTS
 - .1 Indicators and switches.
 - .1 Indicator to be 22 mm LED industrial devices.
 - .2 There shall be a Green pump running light to indicate the run status of each pump.
 - .3 There shall be three position switch for each pump. The positions shall be HAND-OFF-AUTO.
 - .4 All indicators and switches are to be labeled with a white legend plate with black lettering. Labels are to be mechanically fastened; labels with adhesive are not acceptable.
 - .5 Standard of Acceptance
 - .1 Square D, XB4 series.
- .9 Level Transmitter
 - .1 Stainless steel, non fouling submersible level transmitter, 4-40ma output, IP68 protection rating, Polyethylene coated cable 50ft, level range of 0 to 15 feet, complete with stabilizing weights, conduit fitting, and cable hanger.
 - .1 Standard of Acceptance:
 - .1 Keller America Inc, LevelRat.
- .10 Float Controls
 - .1 Mechanically activated low current float activated control switch, CSA certified, UL listed, narrow angle range, externally weighted, polypropylene float housing, SJOW 18 gauge 2 conductor water resistant CPE cable, 50 ft cable length.
 - .1 Standard of Acceptance:
 - .1 SJE Rhombus, Milliampmaster Series:
 - .1 50MANWENO, (normally open)
 - .2 50MANWENC, (normally closed)

- .11 Controller:
- .1 Standard of Acceptance:
 - .1 Primex STATIONVIEW™ controller, complete with optional battery backup and Ethernet Card.
 - .2 The STATIONVIEW™ controller shall be comprised of the following:
 - .1 LCD graphic display (128x64 pixels)
 - .2 LED backlight - Sunlight readable
 - .3 Modbus communications
 - .4 1 serial RS 232/RS485 port
 - .5 GSM & CDMA cellular communication support
 - .6 Ethernet communication card
 - .7 Motor Amps monitoring
 - .8 Two Pump control modes built in: Four float switches or level transmitter with two backup float switches
 - .9 Float status indication
 - .10 Flow monitoring when using level transmitter (Volumetric flow calculation)
 - .11 Alarm log with time and date stamp
 - .12 Data logging (pump run time, Starts, volume pumped, GPM)
 - .13 Password capable
 - .3 The I/O module shall have the following features:
 - .1 10 digital inputs
 - .2 8 relay outputs
 - .3 2 analog inputs
 - .4 The I/O shall be assigned as follows:

		DUPLEX TRANSDUCER BASED	DUPLEX FLOAT SWITCH BASED
INPUT	TYPE	DESCRIPTION	DESCRIPTION
I0	DIGITAL	ILLEGAL ENTRY	ILLEGAL ENTRY
I1	DIGITAL	PUMP1 IN AUTO MODE	PUMP1 IN AUTO MODE
I2	DIGITAL	PUMP2 IN AUTO MODE	PUMP2 IN AUTO MODE
I3	DIGITAL	PUMP1 RUNNING	PUMP1 RUNNING
I4	DIGITAL	PUMP2 RUNNING	PUMP2 RUNNING
I5	DIGITAL	POWER FAIL	POWER FAIL
I6	DIGITAL	LOW FLOAT (BACK UP)	STOP ALL PUMPS FLOAT
I7	DIGITAL		START LEAD PUMP FLOAT
I8	DIGITAL		START LAG PUMP FLOAT
I9	DIGITAL	HIGH FLOAT (BACK UP)	HIGH LEVEL FLOAT
AN1	4-20mA	LEVEL TRANSDUCER	NOT USED
AN0	4-20mA	MOTOR AMPS	MOTOR AMPS

GRND		GROUND	
0V		POWER SUPPLY 0V	
24V		POWER SUPPLY +24Vdc	

		DUPLEX TRANSDUCER BASED	DUPLEX FLOAT SWITCH BASED
OUTPUT	TYPE	DESCRIPTION	DESCRIPTION
O0	RELAY C	RUN PUMP1 IN AUTO	RUN PUMP1 IN AUTO
	RELAY NO		
O1	RELAY C	RUN PUMP2 IN AUTO	RUN PUMP2 IN AUTO
	RELAY NO		
O2	RELAY C	GENERAL ALARM (BEACON)	GENERAL ALARM (BEACON)
	RELAY NO		
O3	RELAY C	GENERAL ALARM	GENERAL ALARM
	RELAY NO		
O4	RELAY C	PUMP1 FAULT	PUMP1 FAULT
	RELAY NO		
O5	RELAY C	PUMP2 FAULT	PUMP2 FAULT
	RELAY NO		
O6	TRANSISTOR	HIGH LEVEL XCDR	NOT USED
O7	TRANSISTOR	LOW LEVEL (BACKUP FLOAT)	NOT USED

2.8 MODE OF OPERATION

- .1 The STATIONVIEW™ controller shall be able to use four floats switches or a submersible level transmitter with two float backup.
- .2 In float switch operation, four floats shall be required. The floats shall be designed for control voltages, non-mercury with 50 feet of cable. They shall have a cable weight and a stainless steel hanging bracket. Float switches shall be provided for the following functions:
 - .1 Pumps Off
 - .2 Lead pump on float
 - .3 Lag pump on float
 - .4 High level float
 - .5 The operation in float switch mode shall be as follows:
 - .1 When the HAND-OFF-AUTO switch is in the HAND position, the corresponding pump will run, bypassing the float control until the operator turns the switch to the OFF position. If the motor heat sensor is faulted or an overload is present, the motor will not be permitted to run.
 - .2 When the HAND-OFF-AUTO switch is in the OFF position, the corresponding pump will be off and not permitted to run.

- .3 When both HAND-OFF-AUTO switches are in “Auto” position, the pumps shall be controlled via floats. When the water level rises to the “Lead Pump On” float, the lead pump shall be called and shall run until the water level goes below the “Pumps Off Level” float. When the lead pump shuts down, the alternating relay shall index to the other pump for the next pumping cycle. If the water level continues to rise to the “Lag Pump On” float, the lag pump will be called, and after a time delay, will run along with the lead pump. Both pumps will run until the water level reaches the “Pumps Off Level” float. The “Lag Pump On” float shall override the “Lead Pump On” float in case of a lead float failure.
 - .4 If the pump motor heat sensor fault and/or an overload is present, the corresponding motor will not be permitted to run.
 - .5 If the water level rises to the “High Level” float, a flashing alarm beacon and audible alarm shall be activated. The beacon and audible alarm shall be active until the water level goes below the “High Level” float.
- .3 In level transmitter mode, a submersible pressure transmitter and two backup floats shall be required. The transmitter shall be designed with a 0-15 foot calibrated range. It shall be manufactured of stainless steel with a 50 foot vented cable. The two backup float switches shall be designed for control voltages, non-mercury with 50 feet of cable. They shall have a cable weight and a stainless steel hanging bracket.
- .1 Level transmitter (0-15 foot range; 50 foot cable)
 - .2 Low level backup float (50 foot cable)
 - .3 High level backup float (50 foot cable)
 - .4 The operation in level transmitter mode shall be as follows:
 - .1 When the HAND-OFF-AUTO switch is in the HAND position, the corresponding pump will run, bypassing the automatic control until the operator turns the switch to the OFF position. If the motor heat sensor is faulted or an overload is present, the motor will not be permitted to run.
 - .2 When the HAND-OFF-AUTO switch is in the OFF position, the corresponding pump will be off and not permitted to run.
 - .3 When both HAND-OFF-AUTO switches are in “Auto” position, the pumps shall be controlled via the controller. When the water level rises to the user adjustable “Lead Pump On” set point, the lead pump shall be called and shall run until the water level goes below the “Pumps Off Level” user adjustable set point. When the lead pump shuts down, the alternation logic shall index to the other pump for the next pumping cycle. If the water level continues to rise to the “Lag Pump On” set point, the lag pump will be called, after a time delay, to run along with the lead pump. Both pumps will run until the water level reaches the “Pumps Off Level” set point. The “Lag Pump On” set point shall override the “Lead Pump On” set point in case of a lead pump failure.
 - .4 If the pump motor heat sensor fault and/or an overload is present, the corresponding motor will not be permitted to run. The next pump shall be called to run an alarm message shall be displayed on the controller screen.

- .5 If the water level rises to the “High Level” set point, a flashing alarm beacon and audible alarm shall be activated. The beacon and audible alarm shall be active until the water level goes below the “High Level” set point.
 - .6 If the level rises above the “High Level Backup” float switch, both pump shall start, and the horn and beacon be ON. The pumps shall remain ON until the level drops below the “Low Level Backup” float switch.
 - .7 Should the level drop below the “Low Level Backup” float switch at any time during normal transmitter operation, the pumps will stop. The pumps will start again as the level rises above the “Lead Pump On” set point.
- .4 When the HAND-OFF-AUTO switch is in the HAND position, the corresponding pump will run, bypassing the float control until the operator turns the switch to the OFF position.
 - .5 There shall be an external “Silence/Test” pushbutton that will; when pressed when in normal condition will test the audible and alarm light, and when in a high level condition will silence the audible alarm.

Part 3 Execution

3.1 INSTALLATION

- .1 The electrical enclosure shall be furnished, installed and wired to the supply electrical power and the pumps by the Contractor.

3.2 START-UP AND FIELD TESTING

- .1 The Contractor shall provide the services of qualified factory trained technician who shall inspect the placement and wiring of the station, perform field tests, and instruct the Owner’s personnel in the operation and maintenance of the equipment before the stations are accepted by the Owner.
- .2 The services of a trained factory-authorized technician shall be provided for four (4) hours of commissioning.
- .3 Upon completion of the installation, the authorized factory technician will perform the following tests:
 - .1 Make certain the discharge shut-off valve in the station is fully open.
 - .2 Turn ON the alarm power circuit and verify the alarm is functioning properly.
 - .3 Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
 - .4 Consult the Manufacturer's Service Manual for detailed start-up procedures.
- .4 Upon completion of the start-up and testing, the Contractor shall submit to the Consultant the manufacturer's start-up authorization form describing the results of the tests performed for each pump .

END OF SECTION